UNCLASSIFIED

TECHNICAL MANUAL

for

LINEAR POWER AMPLIFIER MODEL PAL-350

THE TECHNICAL MATERIEL CORPORATION

MAMARONECK, N. Y. OTTAWA, ONTARIO

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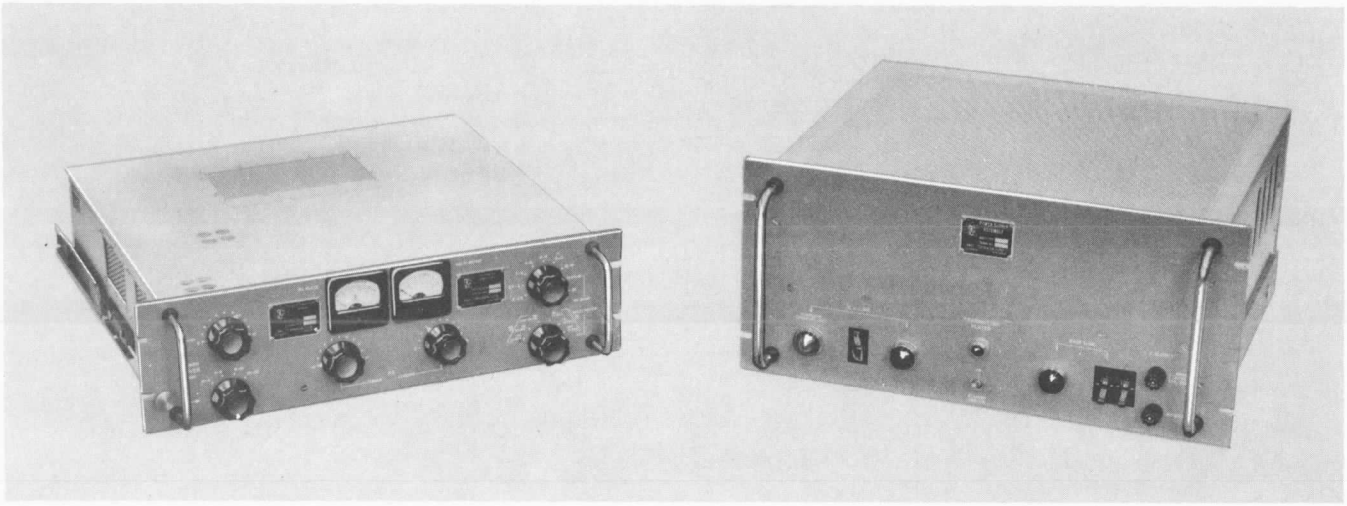


Figure 1-1. Power Amplifier Linear Model PAL-350

SECTION 1
GENERAL DESCRIPTION

1-1. INTRODUCTION. (See figure 1-1.)

The Power Amplifier Linear PAL-350, is a conservatively rated general purpose amplifier which provides 350 watts PEP output over the frequency range 2 to 32 megacycles.

The PAL-350 is composed of two small and compact units: the Linear Power Amplifier, RFA-1 (5-1/4 inch panel) and the Power Supply, PSP-350 (8-3/4 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. A pair of 4CX250B beam amplifier tubes in parallel with a pi network provide unbalanced output of from 50 to better than 600 ohms.

The combination of the Transmitting Mode Selector SBE, and the PAL-350 provides a compact transmitting system capable of producing single, double, or independent sideband signals with any degree of carrier insertion.

The PAL-350 has been carefully designed with no compromise in workmanship or component quality. Particular attention has been given to 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 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.

Commercial and military nomenclature for the PAL-350 are as follows:

Commercial	Military
Power Amplifier Linear, PAL-350	-
a. Amplifier Unit, RFA-1	AM-2867/GRT - 9
b. Power Supply Unit, PSP-350	PP-2839/GRT - 9

1-2. TECHNICAL SPECIFICATIONS.

Item	Characteristic
FREQUENCY RANGE	2 to 32 mc continuous, bandswitched.
OUTPUT POWER	At least 350 watts, PEP; 200 watts, CW or FSK.
OPERATING MODES	CW, MCW, SS, DSB, ISB, FSK.
TUNING	All tuning and bandswitching controls are on front panel (no plug-in components).
OUTPUT IMPEDANCE	Matches 30 to 1000 ohms at 0-degree angle. Matches 50 to 700 ohms at ± 45-degree angle. (All unbalanced to ground.)
INPUT IMPEDANCE	70 ohms coaxial.
OUTPUT CONNECTION	Type C coaxial.
INPUT REQUIREMENTS	100 mw produces full output.
INPUT CONNECTIONS	Type UHF coaxial.
SIGNAL TO DISTORTION RATIO	Better than 40 db down relative to PEP output.
HARMONIC SUPPRESSION	Second harmonic at least 40 db and all others at least 50 db down from PEP output.
ALDC	An automatic load and drive control is provided to limit distortion during high drive peaks or load changes.

Item	Characteristic
PRIMARY POWER REQUIREMENTS	115/230 volts, 50/60 cycle, single phase, 550 watts, under 350 watts PEP output conditions.
SAFETY	Full interlock protection. Full overload and fuse protection.
COOLING	Filtered, forced-air blower system of high capacity.
TEMPERATURE AND HUMIDITY	Designed to operate in any ambient temperature between the limits of 0°C and 50°C for any value of humidity.
RUGGEDNESS	The unit is designed for mobile applications with the addition of shock mounts.
MOUNTING	Standard 19-inch panel width.
SIZE	RFA-1 5-1/4 x 19 x 17 inches. PSP-350 8-3/4 x 19 x 13 inches.

Item	Characteristic
APPROXIMATE WEIGHT	Unit Unpacked Packed RFA-1 30 lb. 50 lb. PSF-350 60 lb. 90 lb.
COMPONENTS AND CONSTRUCTION	Equipment manufactured in accordance with JAN/MIL specification wherever practicable. All parts and assemblies meet or exceed the highest quality standards
TUBE COMPLEMENT	RFA-1; V201; 6CL6; RF-Amplifier. V202; 6146; Driver. V203; V204; 4CX250 B; PA. PSP-350; V101 5R4GY; LV Rectifier. V102; OA 2; Bias Volt. Reg. V103/V104; 886; HV Rectifier. V105; OA 2; Screen Grid Volt. Reg. V106; OB 2; Screen Grid Volt. Reg. V107; OB 2; Screen Grid Volt. Reg.

SECTION 2
INSTALLATION

2-1. UNPACKING AND HANDLING.

The PAL-350 has been designed for ease of installation and minimum effort in operation. The units are packed in individual shipping containers and should be carefully unpacked. Packing materials should be examined for loose items before discarding. Make a close visual inspection to determine any physical damage due to rough handling during shipment. If damage is found, notify carrier immediately.

Check all tubes for damage and correct seating in tube socket. Insert the two 866A rectifier tubes in their appropriate sockets in the PSP-350. Replace all covers.

2-2. POWER REQUIREMENTS AND DISTRIBUTIONS.

The unit is designed for operation from a 115-volt or 230-volt, 50-or-60-cycle source. Unless specifically ordered for a 230-volt source, the unit is shipped wired for 115-volt operation.

Wiring changes necessary to change the PAL-350 to 230-volt operation are shown in figures 8-1 and 8-2.

CAUTION

In changing from 115-volt to 230-volt operation and vice versa, use fuse capacities shown in figures 8-1 and 8-2.

2-3. INSTALLATION LAYOUT.

The PAL-350 can be mounted in any standard 19-inch relay rack. The front panel of the RFA-1 and the PSP-350, of which the PAL-350 is composed, are 5-1/4 and 8-3/4 inches high respectively. It is recommended that 1-3/4 inches of free space be allowed above the PSP-350 unit.

WARNING

For maximum life of the type 866A tubes in the PSP-350: mount the unit in such a way that the tubes are vertical with their bases down.

The PAL-350 is generally used in combination with other equipments as the linear amplifier of a 350-watt single sideband transmitter. The PAL-350's RFA-1 and PSP-350 units are provided with slides for convenient mounting in a 19-inch rack. The PAL-350 does not have a rack of its own.

2-4. INSTALLATION REQUIREMENTS.

a. As shown in figure 2-1, interconnect J102 and J201 using power cable assembly W101 (supplied).

b. Connect the AC power cable (supplied) to J101.

c. Connect a coaxial cable such as RF-8/U or RF-11/U depending upon antenna or lead, to OUTPUT connector (see figure 2-1).

d. Interconnect PAL-350's associated exciters' output to PAL-350's RFA-1 INPUT connector (see figure 2-1).

2-5. PRELIMINARY ADJUSTMENTS.

a. Before operation of the equipment in any NEW installation, it is necessary to allow a twenty-minute warm-up period to vaporize any liquid mercury which might have gathered on the rectifier tube elements. Proceed as follows:

(1) Make cable connections as shown in figure 2-1.

(2) Turn HV LINE breaker (CB102) to OFF.

(3) Turn TRANSMITTER PLATES switch (S103) to STANDBY.

(4) Turn MULTI METER switch (S203) to PA FIL (position 1).

(5) Turn MAIN LINE switch (CB101) to ON. Allow to remain ON for twenty minutes.

(6) MULTI METER (M202) should indicate 30 (equivalent to 6 volts).

If reading is not correct, use the FIL ADJ. control located on the rear of the RFA-1 chassis for adjustment.

(7) Rotate bias potentiometers R213 and R221 and the ALDC potentiometer R228 to the fully counter-clockwise position. All these controls are located on the rear of the RFA-1 unit.

b. To operate, proceed as follows:

(1) Carry out steps 6 through 20 in Table 3-1, Tune Up on Exciter's Carrier.

(2) Switch MULTI METER to read high voltage. Reading at this point will be 3000 volts approximately.

(3) Slowly adjust potentiometer R213 until V203 is drawing 90 m/a plate current, using the plate current meter as the indicator. Adjust R221 until total plate current, V203 and V204, is 160 m/a. The high voltage will now be 2000 volts approximately. Lock the adjustment potentiometers.

(4) Carry out steps 21 through 25 in Table 3-1, Tune Up on Exciter's Carrier.

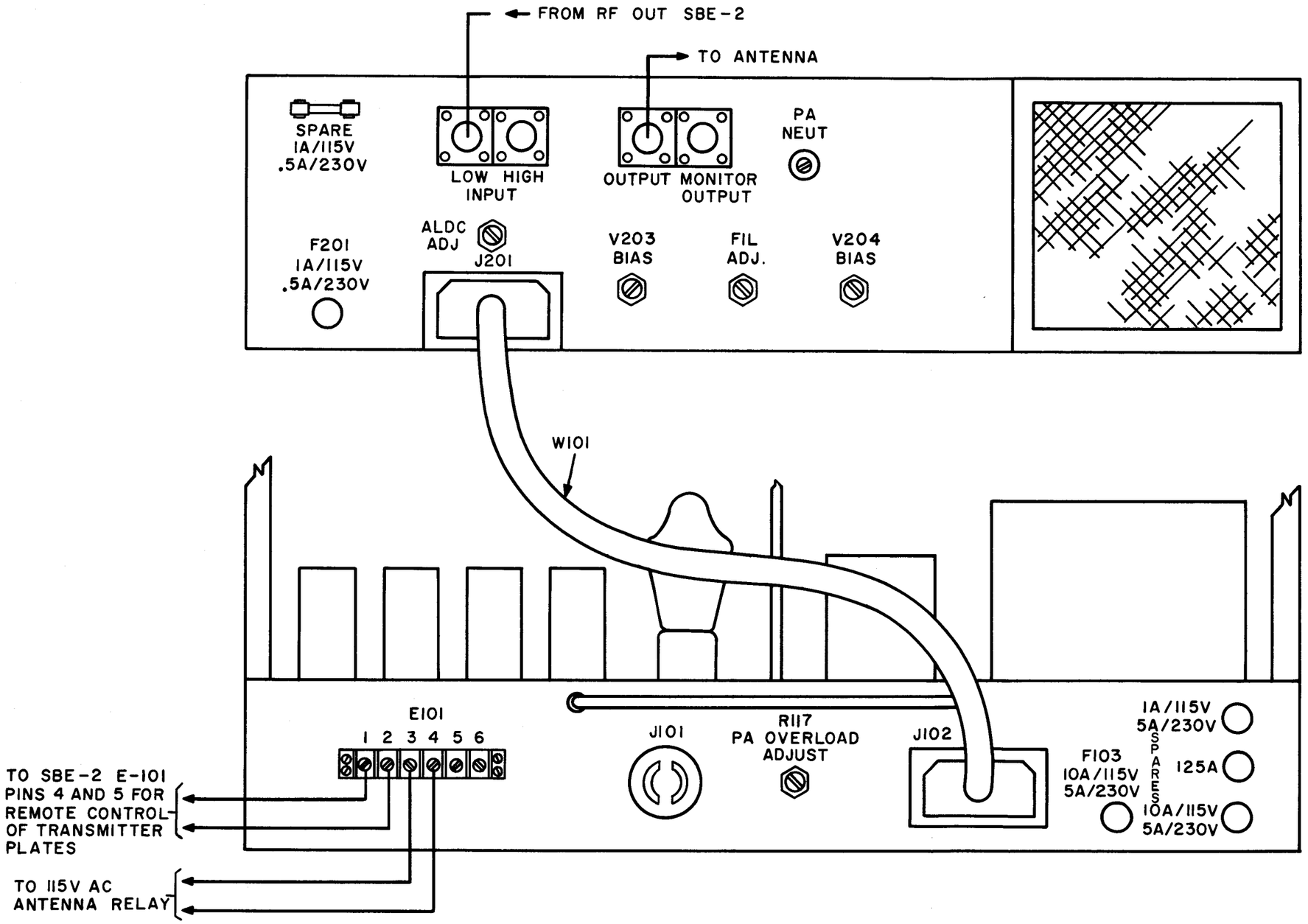


Figure 2-1. Interconnection Diagram, PAL-350

SECTION 3
OPERATOR'S SECTION

3-1. FUNCTIONAL OPERATION.

The PAL-350 accepts the output of an associated exciter and amplifies the signal to the 350-watt level for transmission.

3-2. DESCRIPTION OF CONTROLS.

a. LINEAR POWER AMPLIFIER, RFA-1. (See figure 3-1 and Table 3-2.)

(1) DRIVER/BAND switch (S201): Switches in and out various coils to change the resonate frequency of the driver plate tank.

(2) DRIVER/TUNING control (C205): Varies the driver tuning capacitors to resonate the circuit to the desired frequency.

(3) PA/BAND switch (S202): Sets the PA tank to the proper band by selecting the appropriate tap on the PA tank coil.

(4) PA/TUNING control (C213): Varies the main PA tuning capacitor to resonate the circuit to the desired frequency.

(5) PA/LOADING control (C276): Adjust the amount of coupling to the load.

(6) MULTI METER switch (S203): Permits selective indication of the PA filament voltage, the PA screen grid current, and the PA DC plate voltage: also, the RF voltage at the input and output of the PA, and the RF voltage at the PAL-350's output.

(7) PA PLATE meter (M201): This meter indicates PA plate current.

(8) MULTI METER (M202) indications:

Section	Item
PA	HV - PA DC plate voltage
	ISG - PA screen grid current
	FIL - PA filament voltage
RF	IN - RF PA plate voltage
	DR - RF drive to PA stage
	OUT - RF output voltage

b. POWER SUPPLY, PSP-350. (See figure 3-1 and Table 3-2.)

(1) MAIN LINE ON/OFF switch and circuit breaker (CB101): In the ON position, this switch applies 115-volt or 230-volt AC power to the transmitter and provides line overload protection.

(2) HV LINE ON/OFF switch and circuit breaker (CB102): When the TRANSMITTER PLATES switch is in the ON position, the HV LINE switch (ON position) applies voltage to the final plates. It also provides overload protection when tripped by excessive, PA or screen grid current.

(3) TRANSMITTER PLATES ON/STANDBY-REMOTE switch (S103): In the ON position this switch applies plate and screen voltages to the driver, ALDC and final plates (HV LINE switch in ON position). When the HV LINE switch is in the OFF position, this switch applies plate and screen voltages to the ALDC and driver stages only. The STANDBY REMOTE position permits remote control of these functions.

3-3. OPERATOR'S CHART. (See tables 3-1 and 3-2.)

a. GENERAL. - This section assumes that all units are in proper working condition and are capable of performing their normal conditions. Furthermore, it assumes that the installation procedures of Section 2, which include preliminary operational instructions, have been satisfactorily fulfilled.

b. OPERATING INSTRUCTIONS.

Table 3-1, Tune Up on Exciter's Carrier, presents an operating chart for the PAL-350. Table 3-2, Table of Equivalent Control Designation, provides reference designations for all operating controls.

c. OPERATOR'S MAINTENANCE.

The PAL-350 provides long-term trouble-free continuous operation. Maintenance of the equipment should be performed by a qualified maintenance technician only. Operators may perform the emergency maintenance discussed in following paragraphs when properly authorized.

(1) REPLACEMENT OF FUSE. - Fuse failure is indicated by failure of the indicator lamp to light when the POWER switch is ON, and when the filaments of the electron tubes do not light. Check fuse F100 at the rear of the chassis. Replace if defective with a fuse of equal rating.

(2) REPLACEMENT OF ELECTRON TUBES. - Electron tube failure may be indicated by failure of the tube filaments to light when the MAIN LINE switch is ON, and when the tubes do not heat. Check questionable tubes with a tube tester or by tube substitution method. Be certain to reinstall tube shields after testing or replacing tubes.

TABLE 3-1. TUNE UP ON EXCITER'S CARRIER

Step	Panel Serial Designation	Operation	Purpose
1	HV LINE (10)	OFF	No high voltage on RFA.
2	TRANSMITTER PLATES (13)	STANDBY	
3	MULTI METER (5)	PA FIL	Preparatory to steps 4, 5.
4	MAIN LINE (15)	ON	1/2-hour warmup.
5	MULTI METER (3)	Check 30 reading	Indicates 6 volts.
6	HV LINE (10)	OFF	No high voltage on RFA.
7	TRANSMITTER PLATES (13)	STANDBY	
8	PA/TUNING (7)	0	Reference tune up point.
9	PA/LOADING (6)	0	Reference loading point.
10	MAIN LINE (15)	ON	Applies low voltage to RFA.
11	MULTI METER (5)	PA FIL	Multimeter (3) should read 30.
12	DRIVER/BAND (8)	Turn to proper output band.	
13	PA BAND (4)	Turn to proper output band.	
14	MULTI METER (5)	RF DR Position	Preparatory to step 18.
15	Turn on associated exciter which should be tuned and set for proper mode of operation; adjust exciter for low output level.		
16	DRIVER/TUNING (1)	See table 3-3.	
17	TRANSMITTER PLATES (13)	ON	
18	DRIVER/TUNING (1)	Readjust step 16 until peak reading is obtained on MULTI METER (3). Keep peaks below 30 by operation of associated exciters output control.	
19	Do not readjust DRIVER/TUNING (1) unless another frequency is wanted; Reduce associated exciter output to 0. Check to make sure load or antenna is connected to J205.		
20	HV LINE (10)	ON	Place high voltages on RFA.
21	Increase associated exciters output slowly, observing PA PLATE meter (2). Meter should indicate idling current of 200 ma.		
22	Adjust PA/TUNING (7)	DIP MULTI METER (3) with MULTI METER (5) in RF DR position.	
23	Adjust PA/LOADING (6)	As follows:	
Observe the RF DR on the MULTI METER 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 chart #1 below, if a single tone is applied to the exciter input; chart #2 below, if two tones of equal levels are applied.			

TABLE 3-1. TUNE UP ON EXCITER'S CARRIER (Cont.)

Step	Panel Serial Designation	Operation	Purpose

CHART #1

Single Tone Input

MULTI METER:

Switch Position	Reading	Values
ISG	15	-5 ma
RF DR	18	18 v
RF PS	10	500 v
RF OUT	7	70 v

PA PLATE meter: PLATE CURRENT 240 ma

CHART #2

Two Tone Input

MULTI METER:

Switch Position	Reading	Values
ISG	12 to 10	-8 to -10 ma
RF DR	25 to 30	25 to 30 v
RF PL	18	800 v
RF OUT	14	140 v

PA PLATE meter: PLATE CURRENT 300 ma. Combinations that may be applied: speech and/or tones, etc. RF output measurements can indicate a wide range of voltages since the actual leading of an antenna may involve a great variety of impedance and reactances.

24	Readjust PA/TUNING (7) per step 22.
25	Use the OUTPUT CONTROL of the exciter to keep the RF PL reading on the MULTI METER from ever exceeding 800 volts. This must be done regardless of the various input combinations that may be applied.
26	If at any time during the tuning procedure the amplifier shows signs of instability of self-oscillation, it should be neutralized as described in maintenance section of this handbook.

TABLE 3–2. TABLE OF EQUIVALENT CONTROL DESIGNATION

Serial Designation (See figure 3-1)	Serial Designation (See figure 3-1)	Component Designation on Overall Schematic Diagrams (See figures 8-1 and 8-2)
1	DRIVER/TUNING	C205A, B
2	PA PLATE	M201
3	MULTI METER	M202
4	PA BAND	S202
5	MULTI METER	S203A, B
6	PA/LOADING	C276A, B
7	PA/TUNING	C213
8	DRIVER/BAND	S201A, B
9	HV LINE/OVERLOAD (Indicator)	I103
10	HV LINE ON/OFF	CB102
11	HV LINE (Indicator)	I102
12	TRANSMITTER PLATES (Indicator)	I104
13	TRANSMITTER PLATES (Switch)	S103
14	MAIN LINE (Indicator)	I101
15	MAIN LINE ON/OFF	CB101
16	LV SUPPLY MAIN	F101
17	LV SUPPLY B	F102

TABLE 3–3. DRIVER TUNING POSITIONS

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	5.55	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	*
*Beyond tuning range											

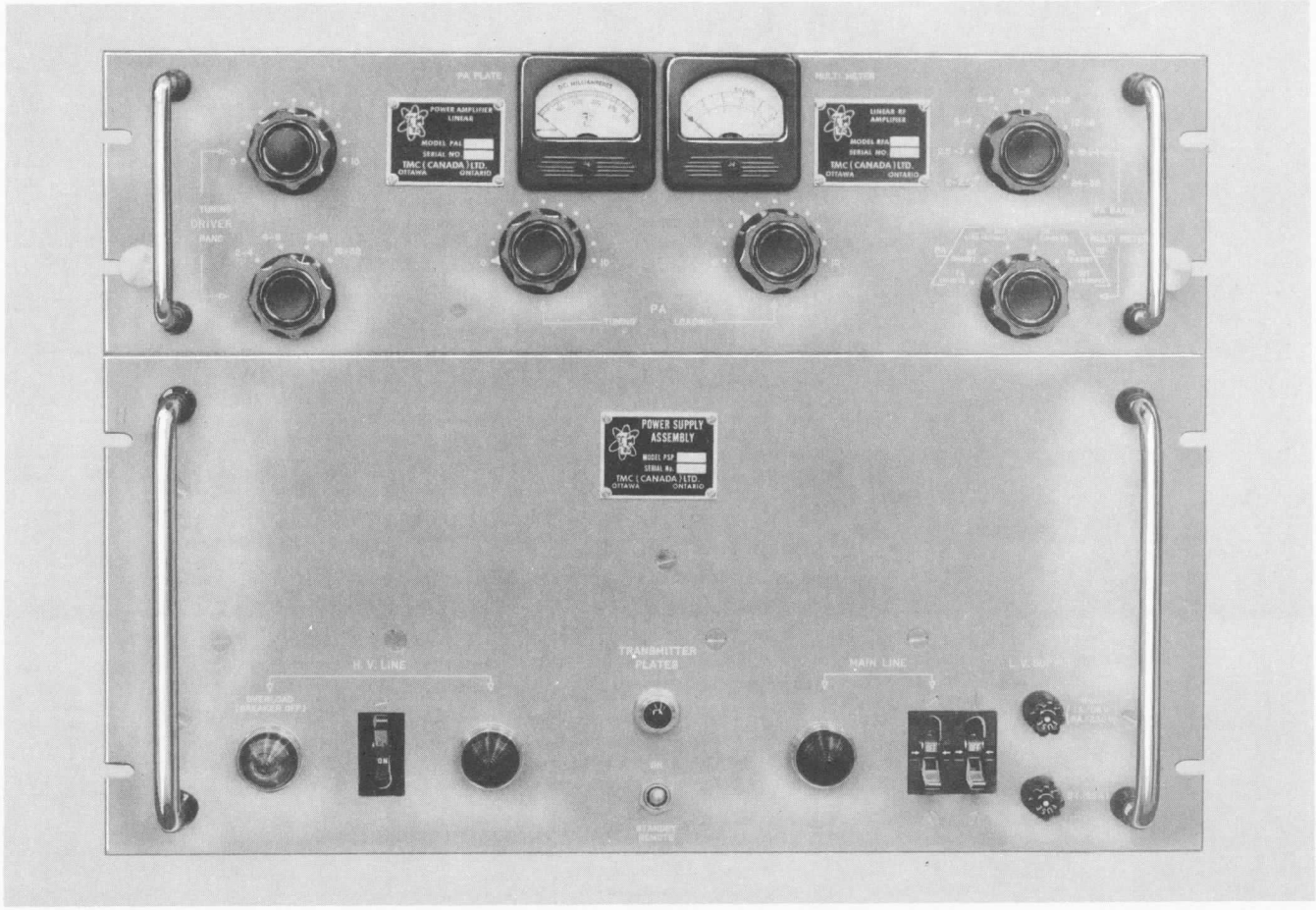


Figure 3-1-a. Front Panel Controls, PAL-350

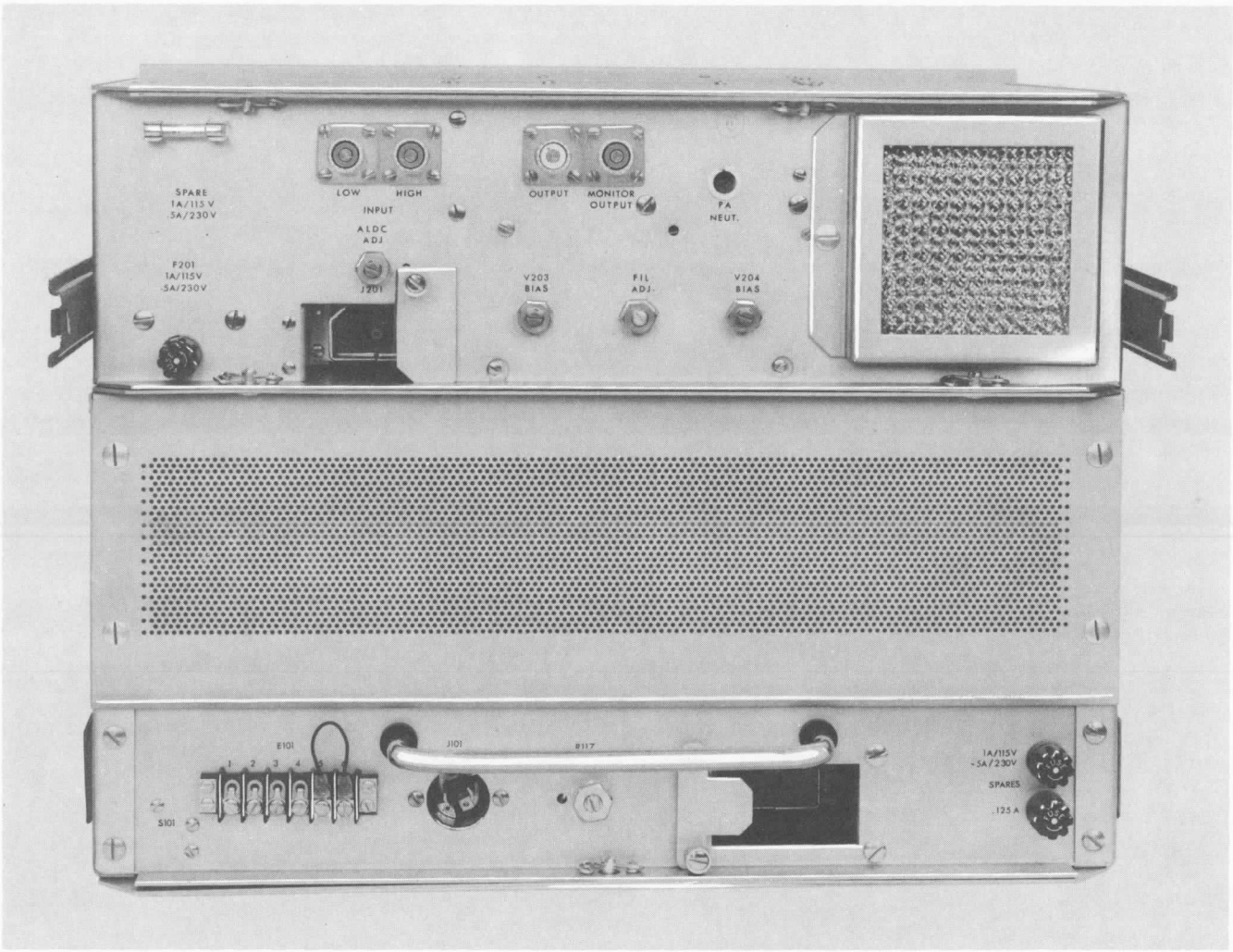


Figure 3-1-b. Rear Chassis Controls, PAL-350

SECTION 4
PRINCIPLES OF OPERATION

4–1. INTRODUCTION. (See figure 4-1.)

Figure 4-1 is a functional block diagram of the RFA-1 unit of the PAL-350. RF input from an exciter is injected into J202 (low wattage, 100 milliwatts approximately) or J203 (high wattage, less than 1 watt). 6CL6 (V201) RF amplifier is associated with bandswitch, tuning, and automatic load and drive control (ALDC) circuitry to provide class A1 amplification over the frequency range of 2 to 32 mc. Type 6146 (V202) driver amplifier is associated with bandswitch and tuning. Parallel 4CX250B beam power amplifiers provide output (with reserve) to a pi-network having an unbalanced impedance characteristic of 50 to 70 ohms. For simplicity, power-supply-voltage, metering, interlock, and ALDC, circuits are not shown on figure 4-1, but will be shown on following figures 4-2 through 4-10.

4–2. RF AMPLIFIER, RFA–1. (See figures 4-2 through 4-8.)

a. GENERAL. - This amplifier, consists of stages V201 (RF amplifier), V202 (driver), and V203/V204 (PA amplifier) plus the antenna tuning section in addition to accessory circuits, such as metering, power supply, and miscellaneous circuits.

b. RF STAGE, V201 AND ASSOCIATED CIRCUITS. (See figure 4-2.) - This figure shows that the associated exciter's input reaches control grid 2 of V201 then proceeds, via bandswitch S-201A, to control grid 5 of V202. Attention is called to the following features, whose functions are conventional.

(1) R, L, C networks: block RF from unwanted channels.

(2) Automatic load and drive control (ALDC): lowers V201's output on high peaks.

c. DRIVER STAGE, V202 AND ASSOCIATED CIRCUITS. (See figure 4-3.) - Signal flow proceeds from RF stage V201 to driver stage V202 and continues on to PA stage V203/V204. Attention is called to the following features whose functions are conventional.

(1) R, L, C networks: block RF from unwanted channels.

(2) Capacitors C205A, B provide driver tuning.

(3) C223: provides driver neutralization.

d. PA STAGE, V203/V204 AND ASSOCIATED CIRCUITS. (See figure 4-4.) - Signal flow proceeds from driver stage V202 to the antenna tuning section (composed of PA bandswitch S202, PA coil T208/ T209, and PA loading capacitor C276) via PA amplifier (V203/V204 and associated circuitry). This section features a number of items:

(1) PA TUNING capacitor C213, whose function is conventional.

(2) PA neutralization via C214, whose function is also conventional.

(3) Various metering circuits described more fully in following paragraph 4-2.f.

(4) Automatic load and drive control ALDC described more fully in following paragraph 4-2.g.

(5) RF feedback via C215 to improve RFA's linearity.

(6) As before, R, L, C networks block out RF flow from unwanted channels.

e. ANTENNA TUNING SECTION. (See figure 4-5.) Signal flow proceeds from PA stage V203/V204 to the antenna via pi-network composed of PA TUNING capacity C213, the tuning section coil and its associated bandswitch (T208/T209 and S202 respectively) and the PA LOADING capacitor C276. This is a conventional circuit arrangement. This section features a number of items:

(1) Nine position bandswitch, S202.

(2) PA neutralization via capacitor C214.

(3) Various metering circuits, described more fully in following paragraph 4-2.f.

(4) Output connections consist of two type C coaxial connectors, one of which provides full RF output, and the other provides 1/300th of the RF output for monitoring purposes. The monitoring output may be terminated on any resistive load of 70 ohms or higher.

f. METERING CIRCUITS. (See figure 4-6.) - Six quantities are metered as follows:

(1) MULTI METER switch S203, in position 1, indicates PA filament current (V203/V204) through MULTI METER M202.

(2) MULTI METER switch S203, in position 2, indicates PA DC high voltage (V203/V204) through MULTI METER M202.

(3) MULTI METER switch S203, in position 3, enables MULTI METER M202 to indicate PA screen grid d-c milliamperes.

(4) MULTI METER switch S203, in position 4, enables MULTI METER M202 to indicate driver RF output voltage.

(5) MULTI METER switch S203, in position 5, enables MULTI METER M202 to indicate PA (V203/V204) plate RF output voltage.

(6) MULTI METER switch S203, in position 6, enables MULTI METER M202 to indicate RFA-1's RF output voltage at J205.

(7) PA PLATE meter M201, 0-500 MA, is connected across 56-ohm resistor R106 in PSP-350 via pins 4 of J201 and J102.

g. AUTOMATIC LOAD AND DRIVE CONTROL (ALDC) CIRCUIT. (See figure 4-7.) The grid of V201 is biased by two voltage components:

(1) The grid receives DC voltage via pin 5 of J201, ALDC ADJ R228, CR202 and various R, L, C networks.

(2) The grid receives rectified AC voltages via CR202 and various R, L, C networks.

The ALDC limits the distortion produced by PAL-350 when high peaks or load changes occur.

h. INTERLOCK CIRCUIT. (See figure 4-8.) - A number of interlock switch circuits are located throughout the PAL-350. Unless all these microswitches are closed, the PAL-350 will not operate. Figure 4-8 indicates the various interlocks as well as their "series" circuit.

4-3. POWER SUPPLY PSP-350. (See figures 4-9 and 4-10.)

a. GENERAL. - This power supply consists of four sections as follows: high voltage, low voltage, AC input voltage, and control overload circuit.

b. HIGH VOLTAGE CIRCUIT. (See figure 4-9.)

This supply is of a conservative design containing mercury vapor, high voltage rectifiers (type 886A). Rectification is full wave and is followed by a choke input filter network providing a plate voltage of approximately +2000 volts to the plates, and a regulated screen voltage of +360 volts to the final RF stage. The percent of regulation is high because of the low internal impedance of the rectifier.

c. LOW VOLTAGE CIRCUIT. (See figure 4-10.) The low voltage power supply contains a high vacuum, full-wave, rectifier. This supply provides a voltage of +150 volts (unregulated) and -150 bias (regulated) voltage for the final amplifier, and screen voltage to the driver stage.

d. AC INPUT VOLTAGE. (See figure 8-3.) - The equipment is wired for operation on 115 V, 50/60 cycle power line supply. 230 V, 50/60 cycle operation may be had on a special order or by following the instructions provided on the RFA-1 and PSP-350 schematic diagrams (figures 8-1 and 8-2).

e. CONTROL OVERLOAD CIRCUIT. (See figure 8-2.) - The time delay relay prevents the application of high voltage to the mercury vapor rectifiers until their filaments have been allowed to warm up sufficiently for operation.

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

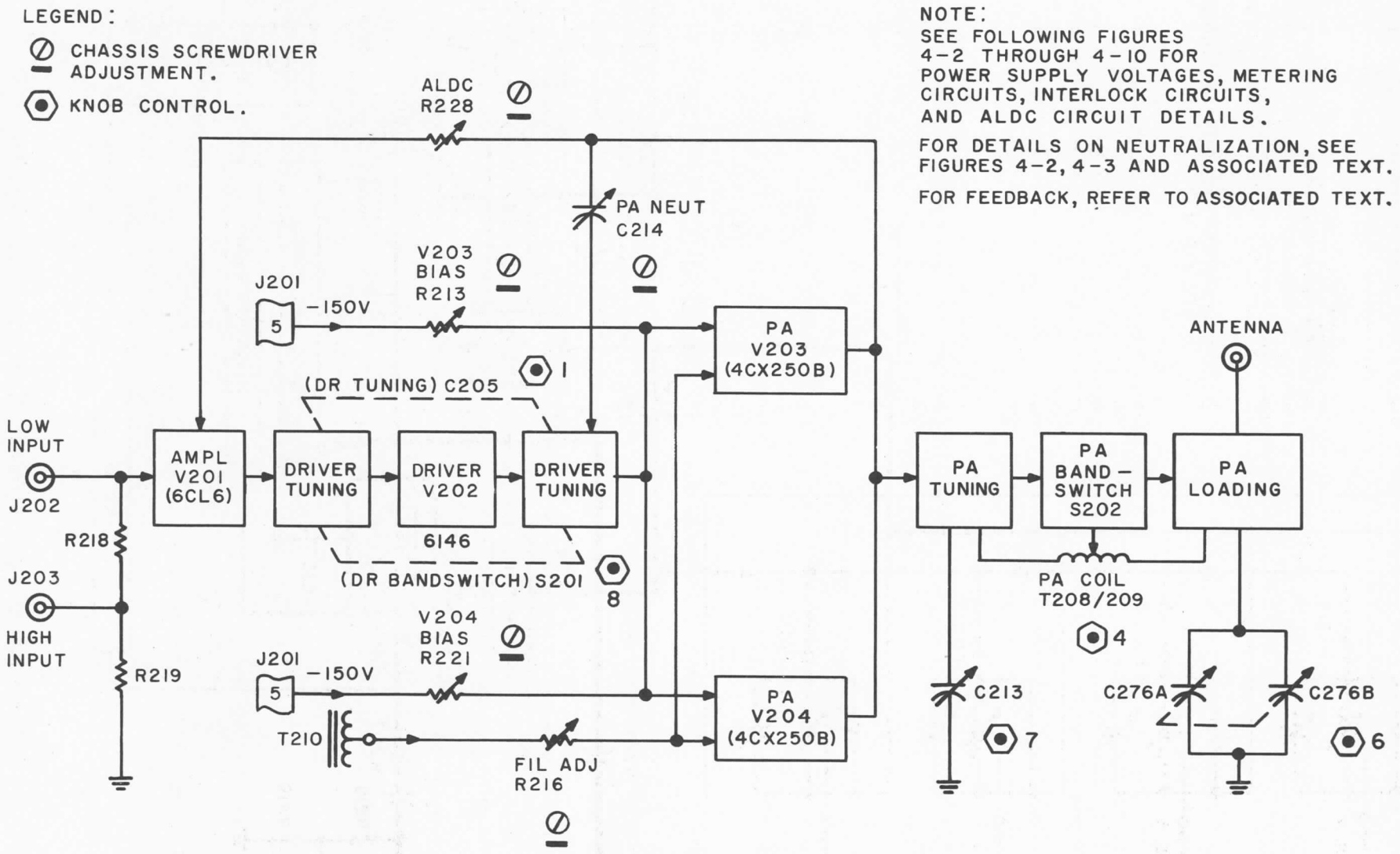


Figure 4-1. Block Diagram, RFA (Unit of PAL-350)

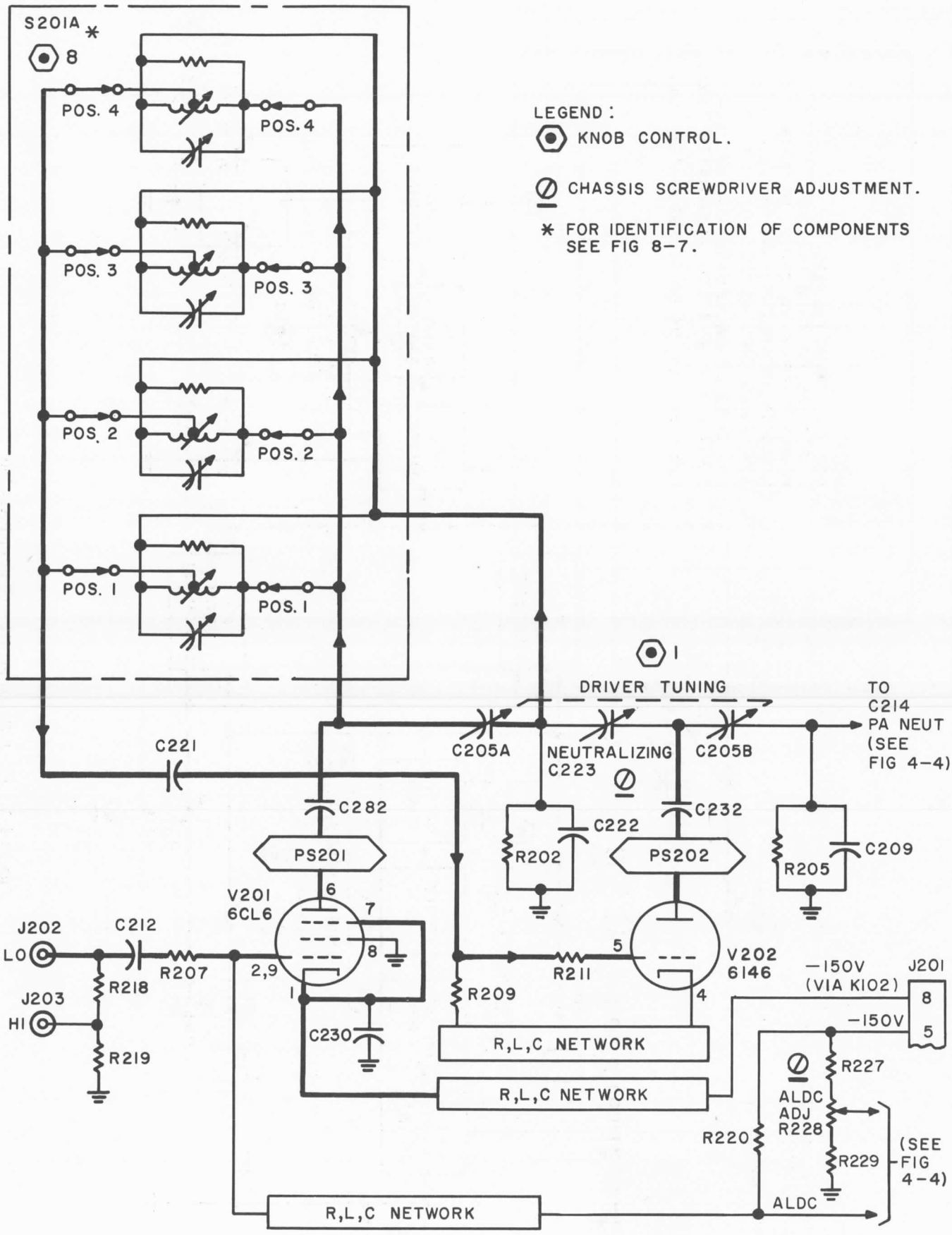


Figure 4-2. Simplified Schematic, RF Amplifier Stage, PAL-350

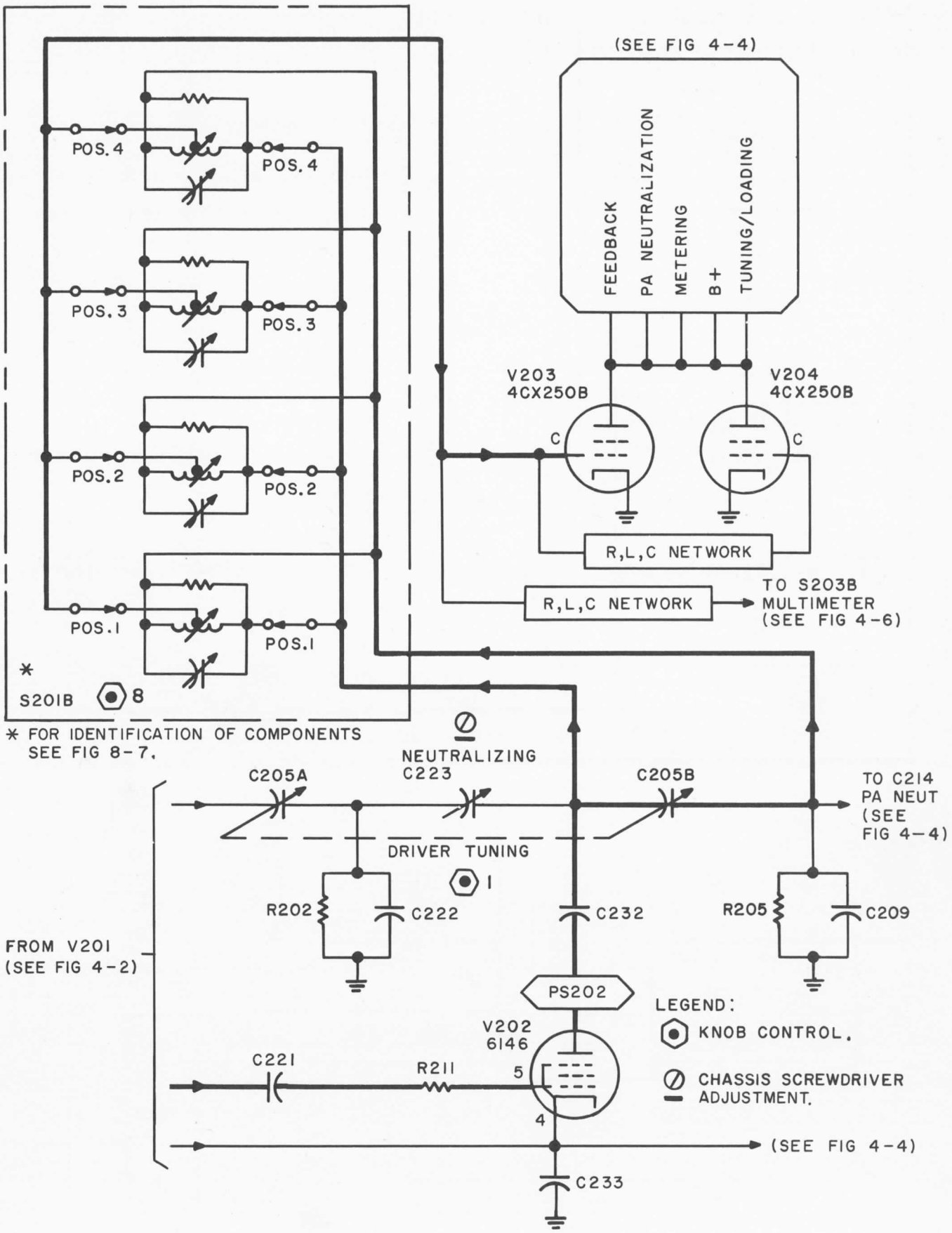


Figure 4-3. Simplified Schematic, Driver Stage, PAL-350

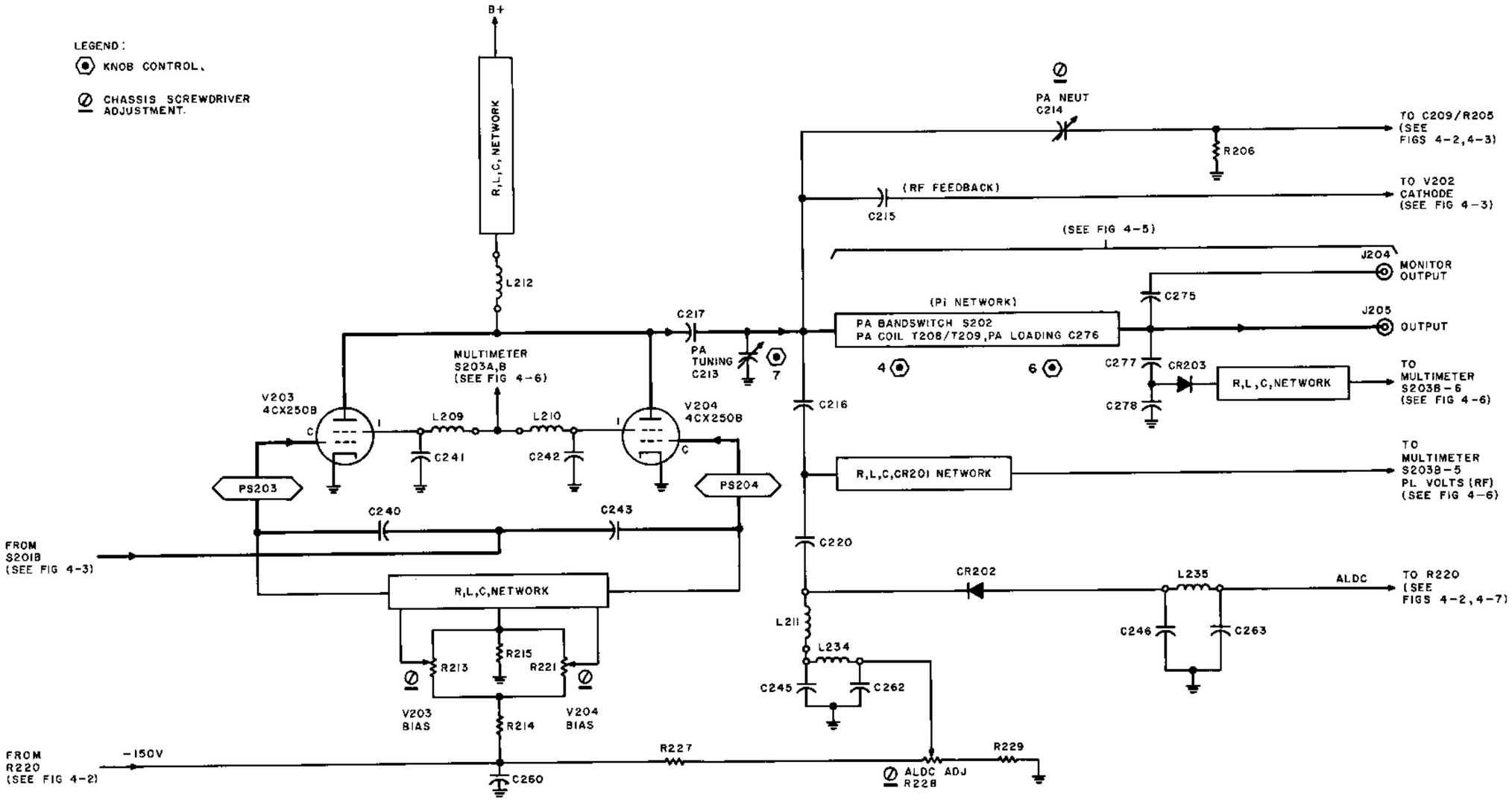


Figure 4-4. Simplified Schematic, PA Stage, PAL-350

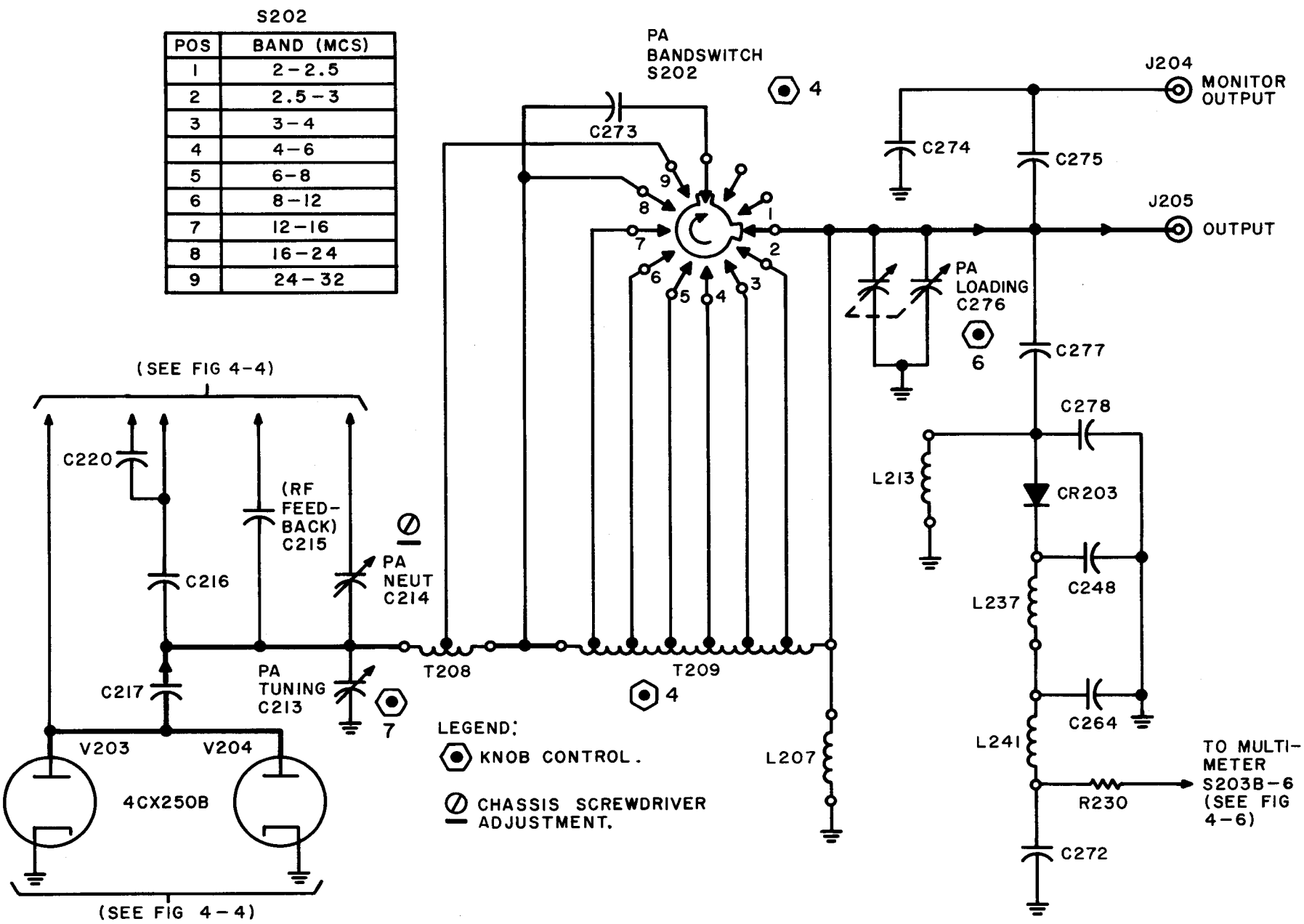


Figure 4-5. Simplified Schematic, Antenna Tuning Stage, PAL-350

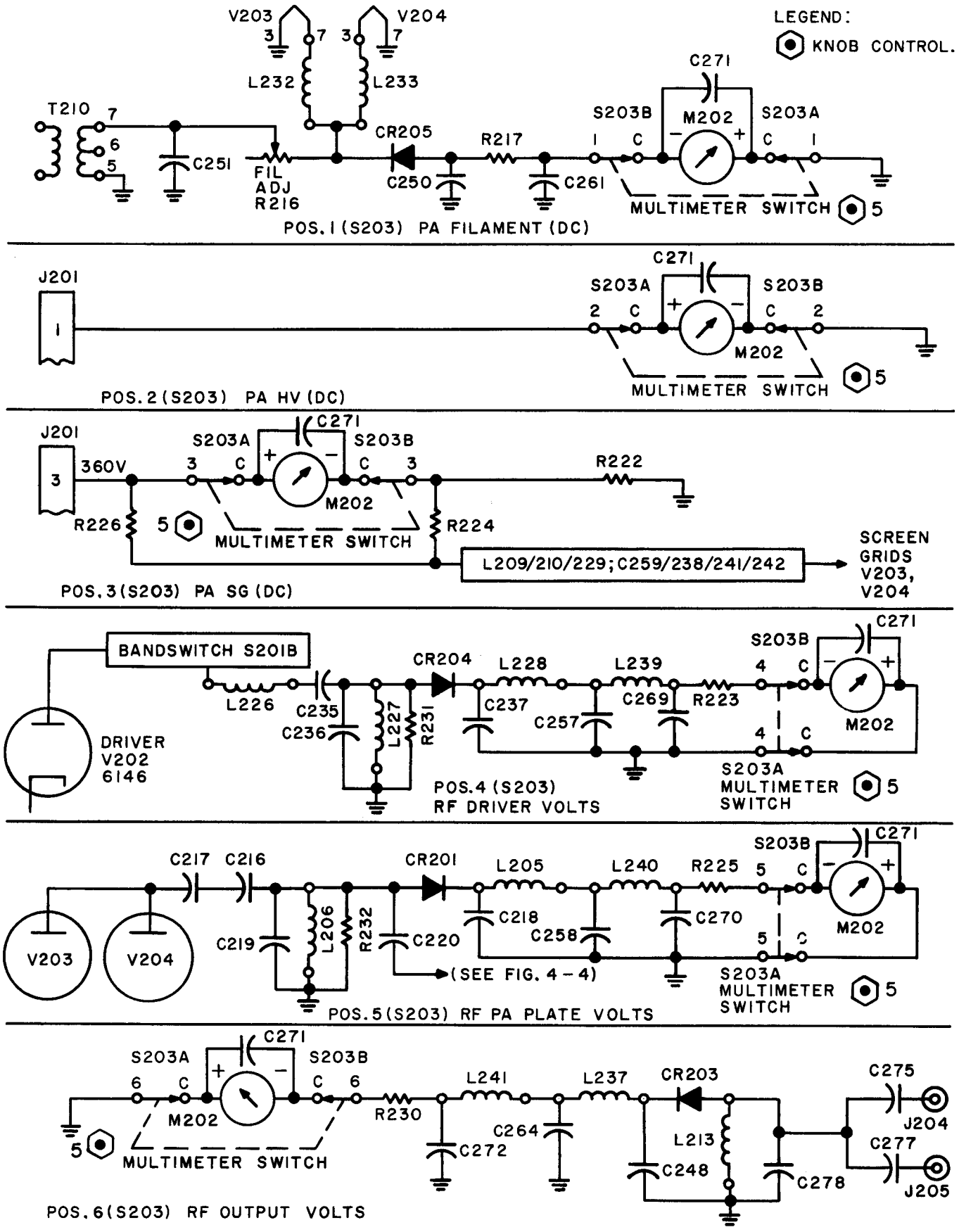


Figure 4-6. Simplified Schematic, Metering Circuits, PAL-350

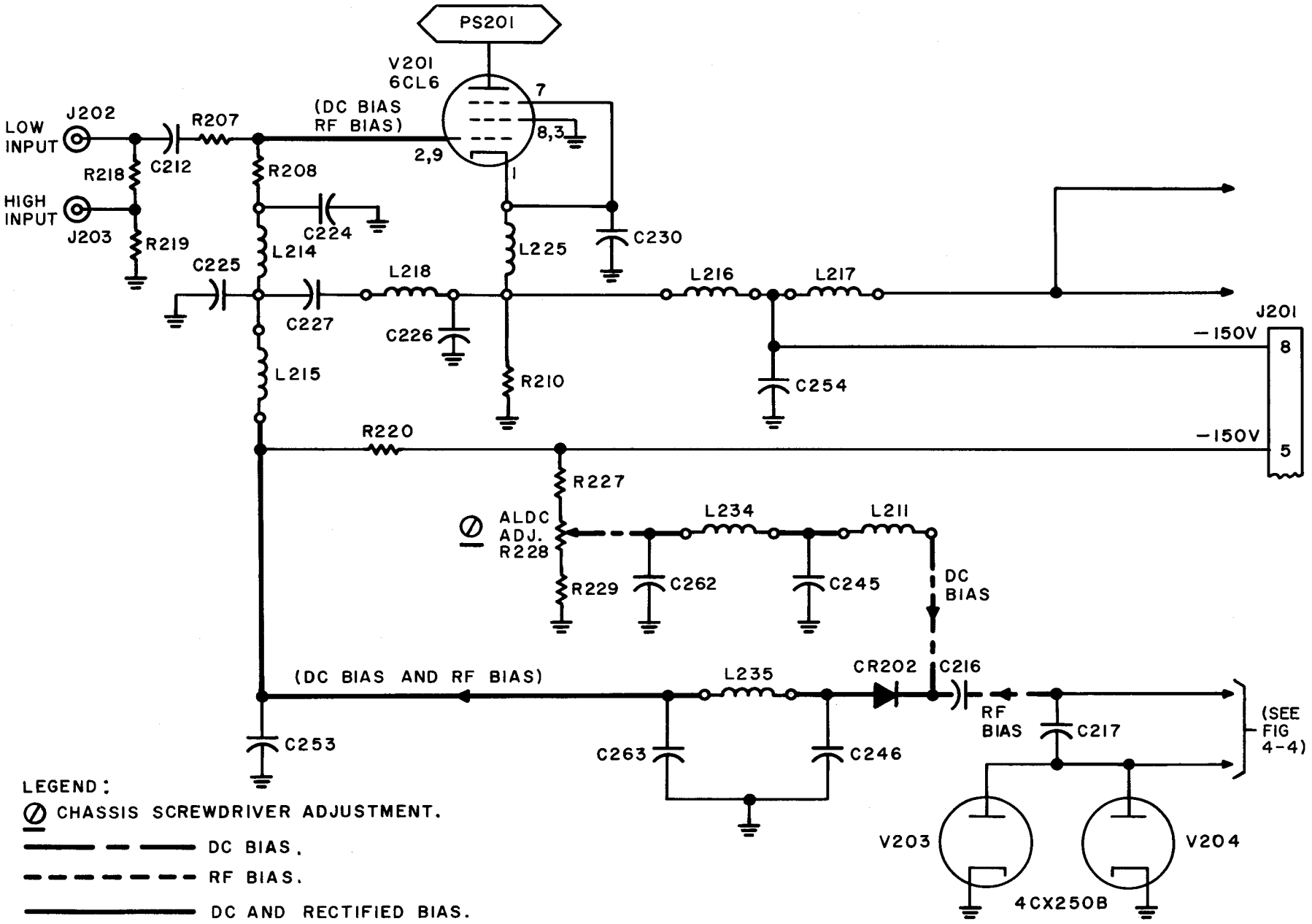


Figure 4-7. Simplified Schematic, ALDC Circuits, PAL-350

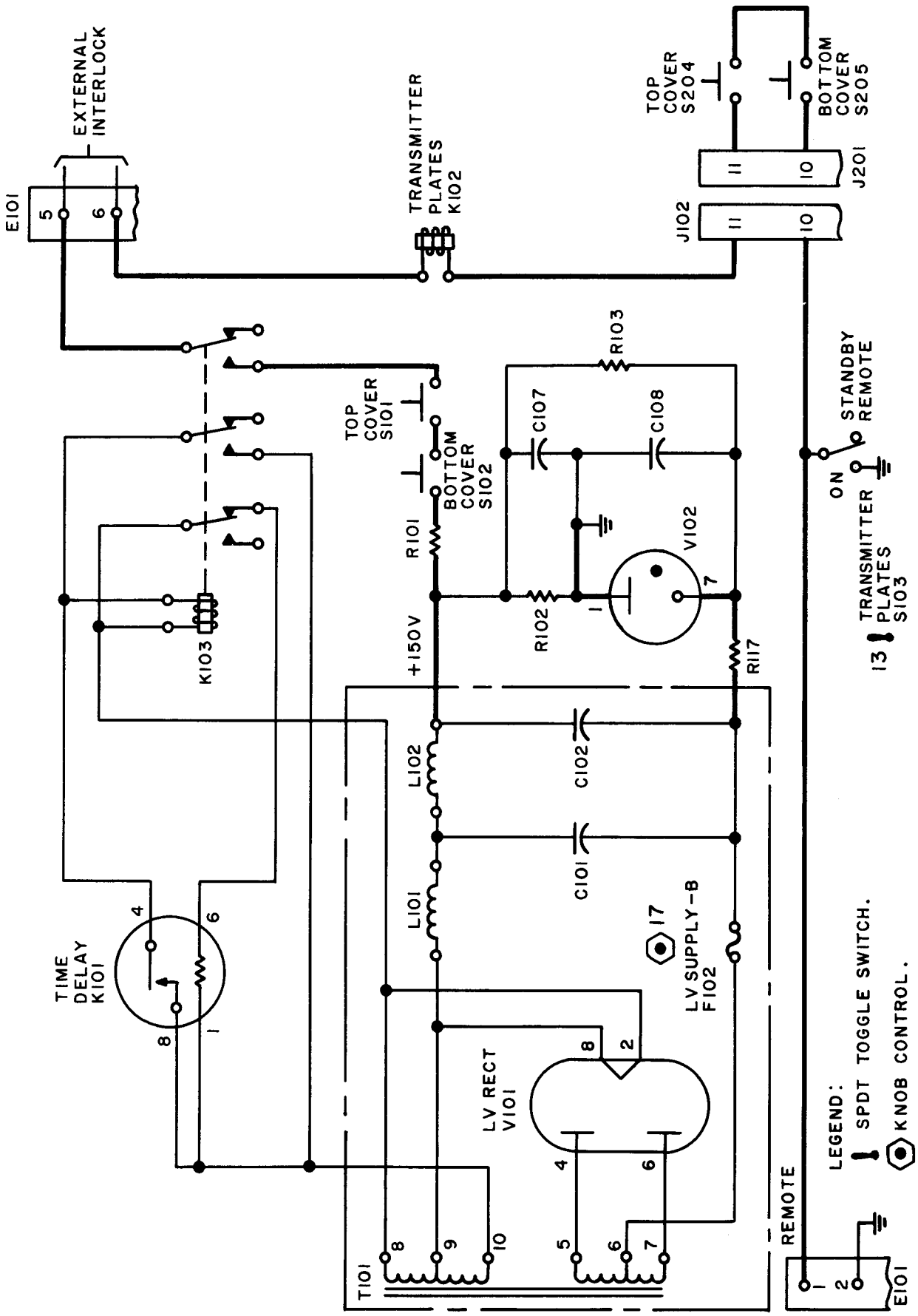


Figure 4-8. Simplified Schematic, Interlock Circuit, PAL-350

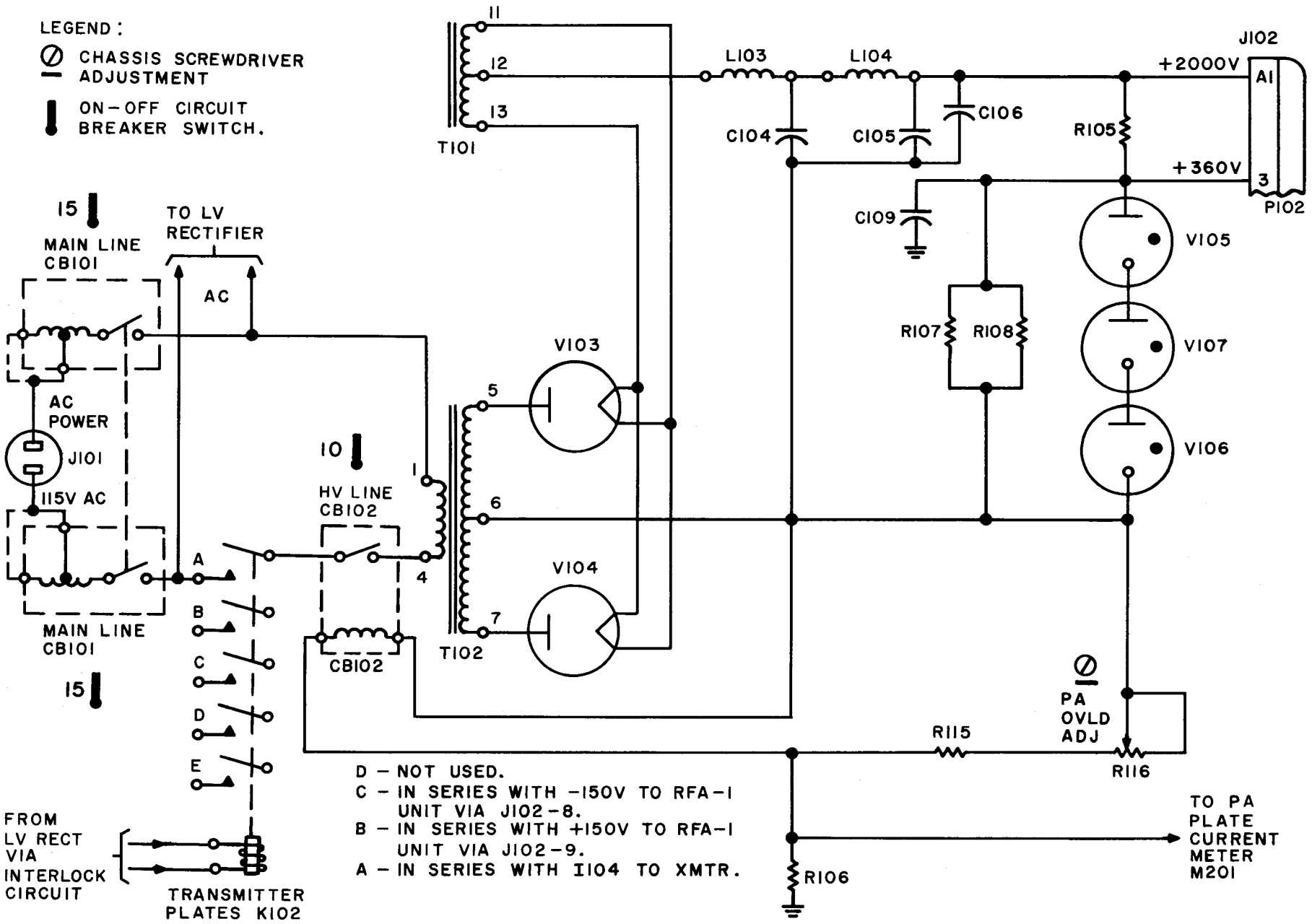


Figure 4-9. Simplified Schematic, High Voltage Power Supply Circuit, PAL-350

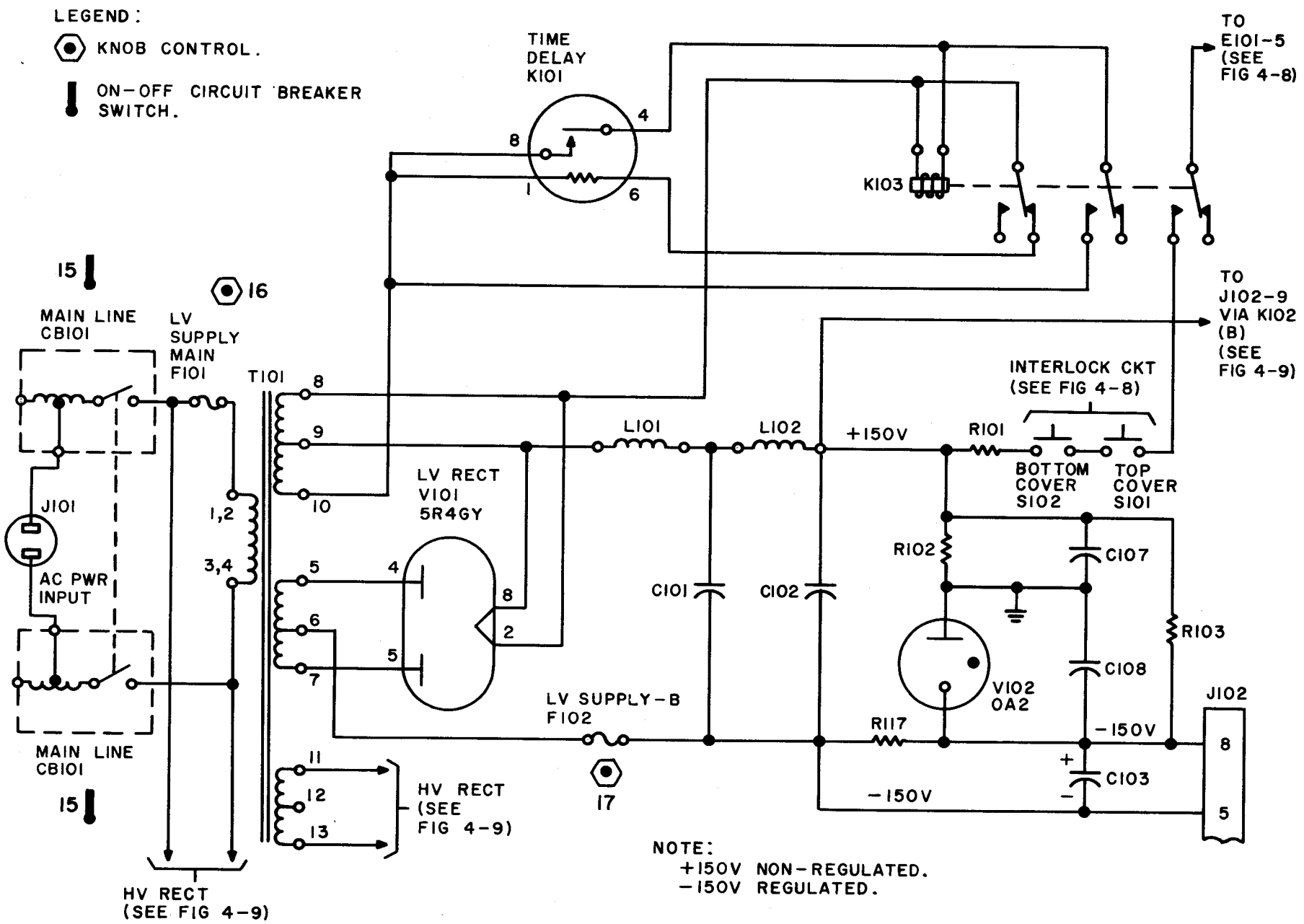


Figure 4-10. Simplified Schematic, Low Voltage Power Supply Circuit, PAL-350

SECTION 5
TROUBLESHOOTING

5-1. GENERAL.

Trouble-shooting is the art of locating and diagnosing equipment troubles and maladjustments; the information necessary to remedy the equipment troubles and maladjustments is reserved for Section 6 of this manual under the heading "Maintenance."

Trouble-shooting tools may, for convenience, be divided into the following six categories:

a. Accurate schematic diagrams.

b. Tables of voltage and resistance, waveform data.

c. Location data (photographs with call outs of the major electronic equipment elements).

d. Trouble-shooting techniques.

e. Trouble-shooting charts based on operating procedures.

f. Trouble-shooting procedures based on circuit sectionalization.

Trouble-shooting techniques are about the same for all types of electronic equipment and are covered briefly in the following paragraphs.

5-2. TROUBLE-SHOOTING TECHNIQUES.

a. GENERAL CONSIDERATIONS. - When a piece of equipment has been working satisfactorily and suddenly fails, the cause of failure may be apparent either because of circumstances occurring at the time of failure or because of symptoms analogous to past failures. In this case, it is unnecessary to follow a lengthy and orderly course of trouble-shooting in order to localize and isolate the faulty part.

A second short cut in trouble-shooting is to ascertain that all tubes are in proper working order; also that the equipment receives proper supply voltages. Many times this will eliminate further investigation.

A third short cut is to examine the equipment, section by section, for burned out elements, charring, corrosion, arcing, excessive heat, dirt, dampness etc.

It is important to recognize that defective elements may have become defective because of their own weakness or due to some contributing cause beyond their control.

b. TROUBLE-SHOOTING CHARTS BASED ON OPERATING PROCEDURES. - The general purpose of these charts is to narrow the area of trouble to one or more sections of the equipment in order to minimize the labor of locating the source of trouble. These charts present a prescribed order "to turn on" the equipment, indicate what to expect as each step is taken, and give clues as to possible "trouble areas" when some expectation is not realized.

c. TABLES OF VOLTAGE AND RESISTANCE; WAVE FORM DATA. - These tables give nominal values of voltage-to-frame and resistance-to-frame, generally at tube elements and sometimes at connectors and terminal board elements. Large deviations from the nominal values should be carefully investigated. During this process, accurate schematic diagrams and location data are highly essential. Schematic diagrams of all equipments will be found in Section 8.

An oscilloscope is a good trouble-shooting tool. It may be connected to a number of critical points along a circuit to detect extraneous voltages, distorted waveforms, and other symptoms of trouble.

d. TROUBLE-SHOOTING PROCEDURES BASED ON CIRCUIT SECTIONALIZATION. - Equipments usually consist of a number of subassemblies or sections. It is frequently helpful to treat these subassemblies or sections as independent entities. In so doing, however, they must be properly powered. Observations may then be made with VTVMs, CROs, or other test equipment at selected points under given types and magnitudes of injection voltages. Again, the subassemblies or sections may be examined for rated presence of extraneous grounds, for opens, or unusual voltages.

5-3. POWER AMPLIFIER LINEAR, PAL-350.

a. VOLTAGE AND RESISTANCE DIAGRAMS. - Tables 5-1 and 5-2 show voltage and resistance-to-chassis measurements at terminal strips and vacuum tube pins in the RF Amplifier (RFA-1) and the Power Supply (PSP-350) units of the PAL-350.

b. LOCATION DATA. Figures 5-1 through 5-5 are photographs with call outs showing the location of the major electronic equipment in the RFA-1 and PEP-350 units of the PAL-350.

c. TROUBLE-SHOOTING CHART BASED ON OPERATING PROCEDURES. - See Table 5-3.

d. TROUBLE-SHOOTING PROCEDURES BASED ON CIRCUIT SECTIONALIZATION. - As stated in preceding paragraph 5-1, the procedures given below deal with locating and diagnosing equipment troubles. The information necessary to remedy the equipment troubles and maladjustments is reserved for following Section 6 of the manual.

(1) GENERAL INSPECTION (RFA-1).

(a) Inspect the unit for obvious mechanical and electrical imperfections.

(b) Inspect all the relative positions of variable capacitors C205, C213 and C276 with respect to dial setting. The dials must read zero when capacitors are fully meshed (extreme counterclockwise position).

(c) Visually inspect the components in the pressurized compartment for "shorts" to ground as well as between the component parts. All RF connections must be as short as physically possible.

NOTE

Do not enclose the pressurized compartment until resistance check has been performed.

(d) Visually inspect the components in the driver chassis for "shorts" and make sure that all RF connections were kept as short as physically possible.

(e) Inspect all the RF wiring of S202, T208, T209, C213, C276 and C273.

(2) BLOWER WIRING (RFA-1). - Blower must be wired in accordance with figure 8-1. C268 must be 1 mfd. All connections are color coded.

NOTE

If power is applied, an improperly wired blower will be damaged.

(3) RESISTANCE CHECK (RFA-1). - See table 5-1.

(4) INITIAL POWER CHECK (RFA-1).

(a) Connect power supply unit, PSP-350, to unit under test.

(b) Close interlocks S204, S205 of RFA-1 by pulling their shafts outward.

(c) Be sure that TRANSMITTER PLATES switch and high voltage breaker are off.

(d) Turn MAIN LINE breaker to ON position and note if all filaments operate.

(e) Quickly go through all positions of metering switch observing MULTI METER. No meter readings should be seen except in filament position.

(f) Meter switch in filament position, reset filament adjust potentiometer R216 on the rear skirt of the RFA chassis to 6 V on multimeter.

(g) Set bias controls R213 and R221 to full counterclockwise position.

(h) Measure voltage to ground from pin C of V203; it must be 90 to 115 V.

(i) Measure voltage at pin 2 of V201; it must be 147 to 163 V.

(j) Turn TRANSMITTER PLATES switch to ON position; the TRANSMITTER PLATES indicator lamp must go on.

(5) VOLTAGE CHECK (RFA-1).

(a) With VTVM check following voltages:

From	To	Voltage
Plate Cap	Ground	90 to 150 V
Pin 6 of V201	Ground	90 to 150 V
Pin 3 of V202	Ground	40 to 70 V
Pin 4 of V202	Ground	-120 to -130V
Pin 5 of V202	Ground	-140 to -150V
Pin 2 of V201	Ground	-145 to -150V
Pin 1 of V201	Ground	-140 to -150V

(b) Turn off power and place cover on the bottom of pressurized compartment.

(6) GENERAL INSPECTION (PSP-350).

(a) Inspect total unit for obvious mechanical and electrical imperfections.

(b) Inspect the high voltages wiring at: J102, C106, C105, C104, L104, L103, T101, V103, V104, T102. It must be in accordance with figure 8-2.

(c) Inspect values and tolerances of: R109, R110, R111, R112, R113----20M ±5% R114----220K ±10%.

(7) RESISTANCE CHECK (PSP-350). - See table 5-1.

(8) INITIAL POWER CHECK (PSP-350).

NOTE

Be sure the HV Breaker (CB102) is OFF.

(a) Connect 115 V at 60 cps power (or 230 V if the unit is wired for 230 V) to J101.

(b) Turn on CB101, MAIN LINE; observe if pilot light "MAIN LINE" is on; observe if voltage regulator V102 operates, and HV rectifier filaments operate.

(c) Turn off the MAIN LINE circuit breaker.

(d) Load the PSP 350.

(e) Throw TRANSMITTER PLATES switch (S103) to ON position.

(f) Pull out plungers of interlock switches S102, S103.

(g) Turn on MAIN LINE circuit breaker. After approximately 60 seconds, TRANSMITTER PLATES relay K102 must go to energized position, and TRANSMITTER PLATES indicator I104 and overload "breaker OFF" indicator I103 must light.

(h) Throw TRANSMITTER PLATES switch (S103) to "stand-by remote" position. The I103 and I104 must go OFF. Return S103 to ON position.

(i) Check S101, by depressing plunger all the way. The I103 and I104 must light.

(j) Release plunger into test position and repeat steps (i) and (j), but with S102. Then pull out plunger and throw S103 to "stand-by remote" position.

(9) VOLTAGE TEST (PSP-350).

NOTE

When testing the high voltage, do not connect and disconnect instruments while voltage is on, and do not touch anything except main front panel switches. Do not allow anyone to stand by in vicinity.

(a) Turn TRANSMITTER PLATES switch S103 to ON position. (Leave the high voltage breaker in OFF position.)

(b) Measure following voltages at J102.

Pin	To	Volts
5	ground	-145 to -155
8	ground	-145 to -155
9	ground	120 to 180
5	8	5 to 6

(c) With AC VTVM measure pin 9 to ground. RMS voltage must not exceed 0.3 volt.

(d) Turn TRANSMITTER PLATES switch (S103) to OFF position.

(10) HV Test (PSP-350).

(a) Set Simpson model 260 voltmeter on 5000 VDC range and connect it across HV load.

(b) Place scope at junction of R105 and R107 and ground.

(c) Remove V105.

(d) Turn TRANSMITTER PLATES switch (S103) to ON position.

(e) Turn HV LINE ON/OFF breaker (CB102) to ON position. The associated indicator (I103) must go off.

(f) The DC voltmeter must now read 1800 to 2300 volts.

(g) The scope must now read AC ripple voltage of not more than 25 V peak-to-peak.

(h) Turn all power off.

(i) Replace V105, and disconnect all the equipment.

e. CABLING DIAGRAM. - Figures 5-6 and 5-7 present cabling diagrams of the RFA-1 and PEP-350 units of the PAL-350.

TABLE 5-1. RESISTANCE TO CHASSIS RFA-1 AND PSP-350

Tube	Resistance to Chassis									
	1	2	3	4	5	6	7	8	9	CAP
V201 (6CL6)	220K	50K	0	220K	220K	∞	220K	0	50K	
V202 (6146)	220K	220K	∞	220K	250K	220K	220K	0		∞
V203 (4Cx250B)	15meg	0	0	0	NC	0	0	0		∞
V204 (4Cx250B)	15meg	0	0	0	NC	0	0	0		∞
V101 (5R4GY)	NC	10K	NC	100K*	NC	100K*	NC	10K		
V102 (0A2)	0	NC	NC	NC	NC	NC	100K*			
V103 (866)	105K	∞	∞	150K						350
V104 (866)	150K	∞	∞	150K						350
V105 (0A2)	75K	∞	NC	NC	75K	NC	NC			
V106 (0B2)	∞	70	NC	NC	NC	NC	70			
V107 (0B2)	NC	NC	NC	∞	∞	NC	NC			
*Leakage resistance of C103										

NOTE: Units disconnected from one another.

J201 Pin#	Measured To	Ohms	Remarks
1	Ground	Short	S203 in HV Position.
2	Pin 7, J201	3 to 6	F201 must be in place.
3	Ground	14 to 16 meg	S203 in PA SG Position.
4	Ground	M201 will deflect	
5	Ground	20K to 38K	
6	No conn.		
7	Pin 2, J201	3 to 6	F201 must be in place.
8	Ground	190K to 250K	
9	Ground	Open	
10	Ground	Open	With S204 and S205 closed.
11	Pin 10, J201	Short	With S204 and S305 closed.
12	Ground	Short	
A-1	Ground	Open	

TABLE 5–2. D.C. VOLTAGES TO CHASSIS — PSP–350 CONNECTED TO RFA–1

TUBE	TYPE	PINS									CAP
		1	2	3	4	5	6	7	8	9	
PSP - 350 UNIT											
V101	5R4	NC	185	NC	-165	NC	-165	NC	185	X	X
V102	0A2	0	-150	X	-150	0		X	-150	X	X
V103	866*				SEE BELOW						
V104	866*										
V105	0A2*	370	210	X	210	370	X	210	X	X	X
V106	0B2*	105	0	X	0	105	X	0	X	X	X
V107	0B2*	210	105	X	105	210	X	105	X	X	X
*NOTE: PA HV can be read on RFA panel meter. Final Voltage ON for indicated readings.											
RFA-1 UNIT											
V201	6CL6	-150	-150	0	-150	-150	+120	-150	0	-150	X
V202	6146	-115	-150	+95	-115	-150	-115	-150	NC	X	-120
PA screen grid voltage, from C 259 to GND = 365 VOLTS.											
PA control grid bias, from C 260 to GND = (-) 150 VOLTS.											

TABLE 5–3. TROUBLE-SHOOTING CHART

(Steps refer to steps in Operating Table 3-1)

Step	Control Operated	Normal Indication	Remedy
1-11	MAIN LINE switch ON	MAIN LINE indicator lit. RFA blower is running.	Check 115-volt supply. Check fuse F101. Check MULTI METER for 6 volts on filament. Check lamp I101.
12-19	DRIVER/TUNING	TRANSMITTER PLATES indicator lit after 60-second time delay. OVER-LOAD indicator lit. Tune driver stage for peak reading on multimeter. Keep peaks below 30 by operation of associated exciters output control.	Check voltages on V201, V202. Check tube emission. Check driver band switch circuits for defective element.
20-22	HV LINE ON	HV indicator lit. OVER-LOAD indicator OUT XMTR PLATES indicator lit. Tune PA stage.	Check voltages on V203, V204 with PA PLATE meter. Check PA circuits with power OFF.
23-26	Load and retune amplifier	See Operating Table 3-1.	Check PA circuits with power OFF. Use resistance to chassis data in Table 5-1.

NOTE

Checking PA circuits with power OFF for resistance to chassis values per table 5-1, requires removing plate at bottom of PA tubes. This must be replaced after measurements BEFORE applying the plate power to V203, V204. Otherwise the tubes will not receive adequate air cooling and may burn out, particularly if poorly tuned/loaded.

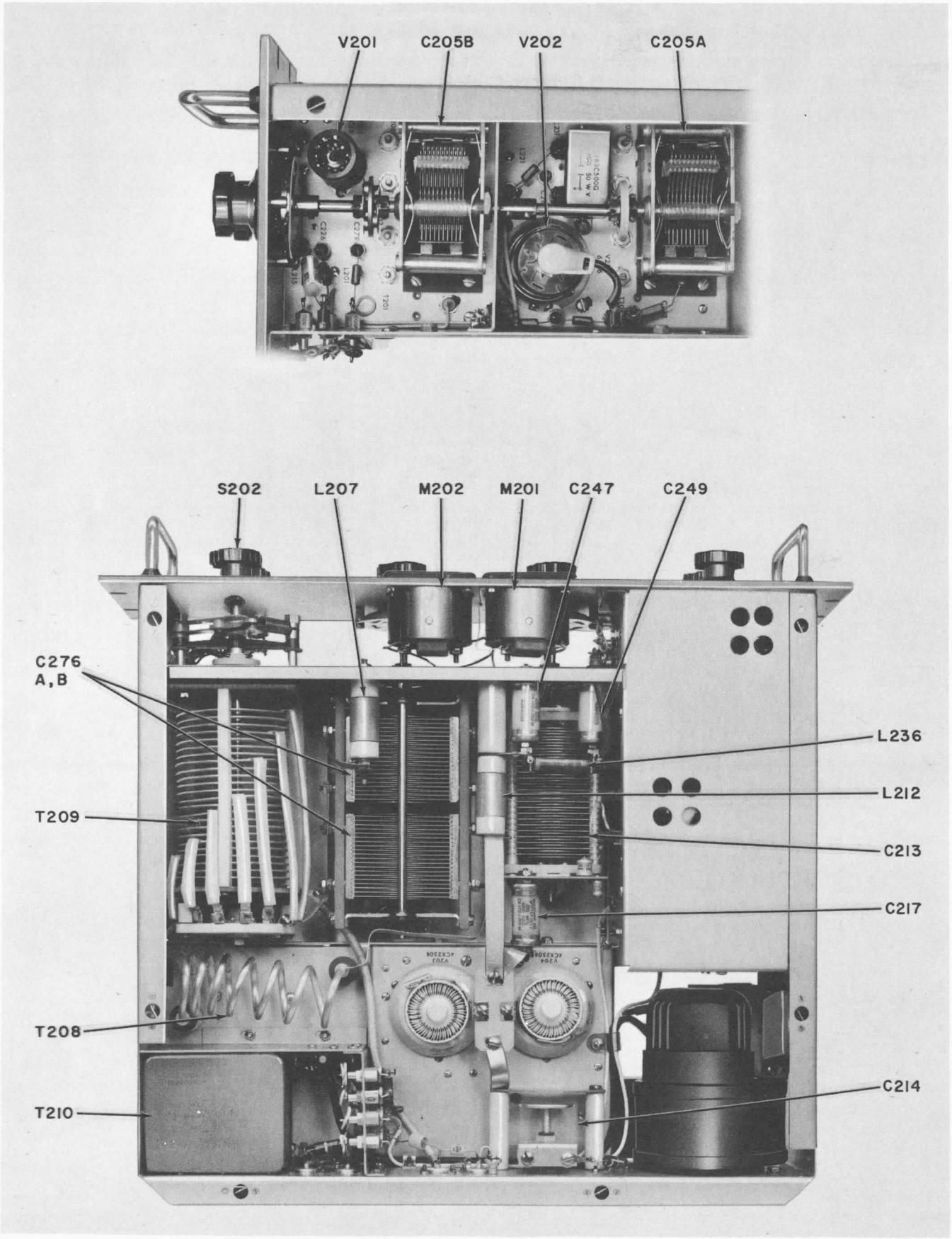


Figure 5-1. Top View of RFA (Unit of PAL-350)

Figure 5-2. Bottom View of RFA (Unit of PAL-350)

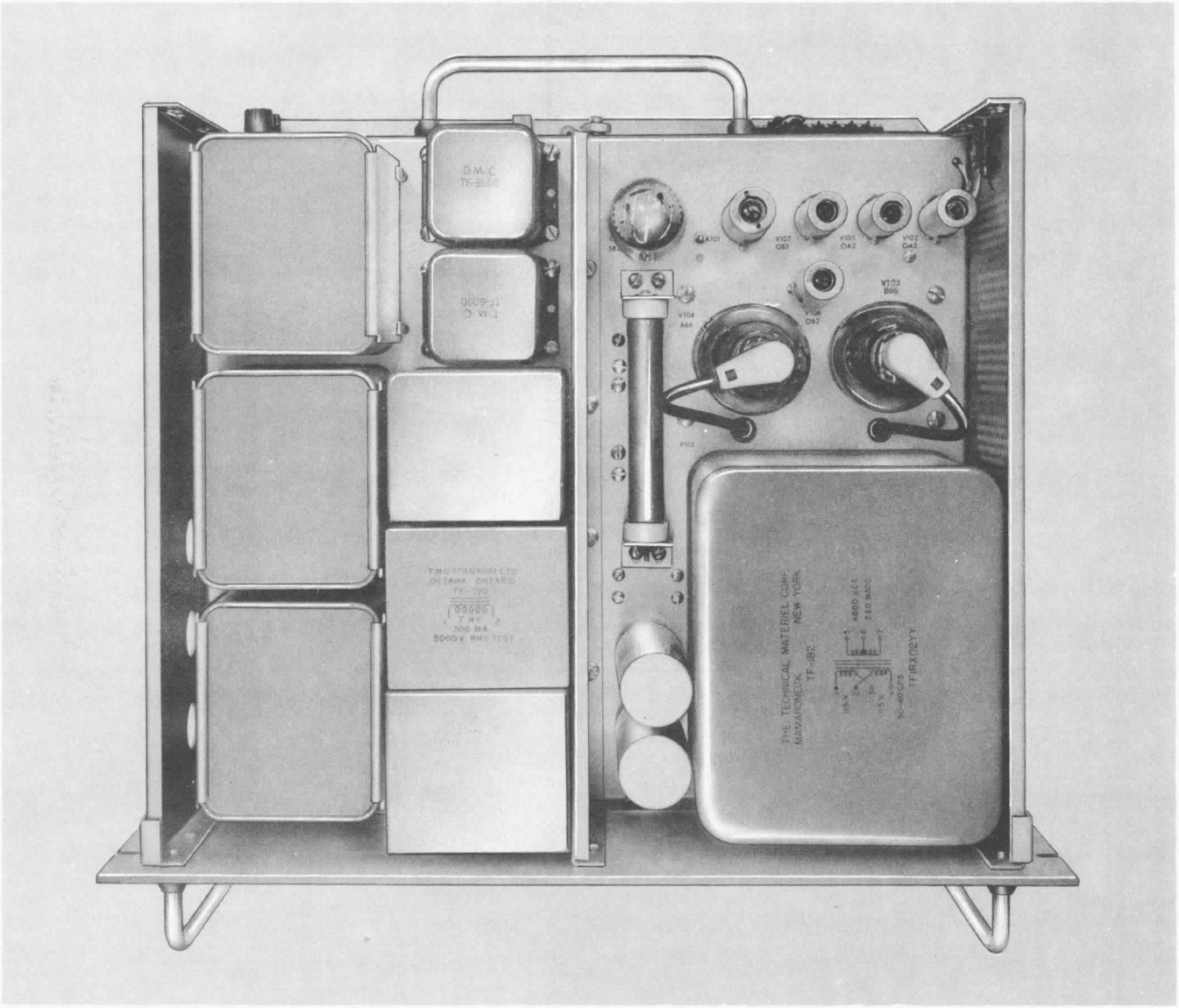


Figure 5-3. Top View of PSP-350 (Unit of PAL-350)

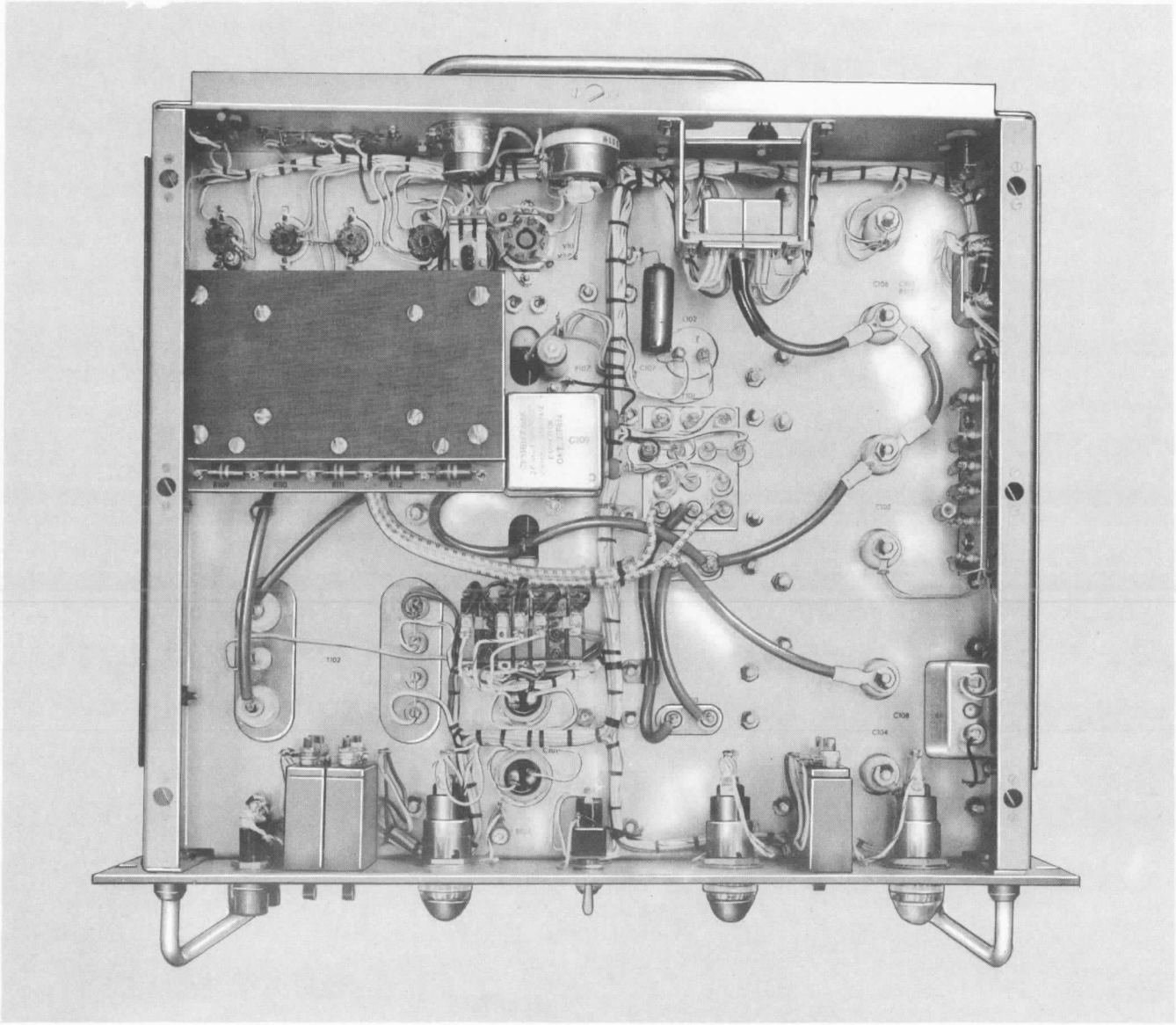


Figure 5-4. Bottom View of PSP-350 (Unit of PAL-350)

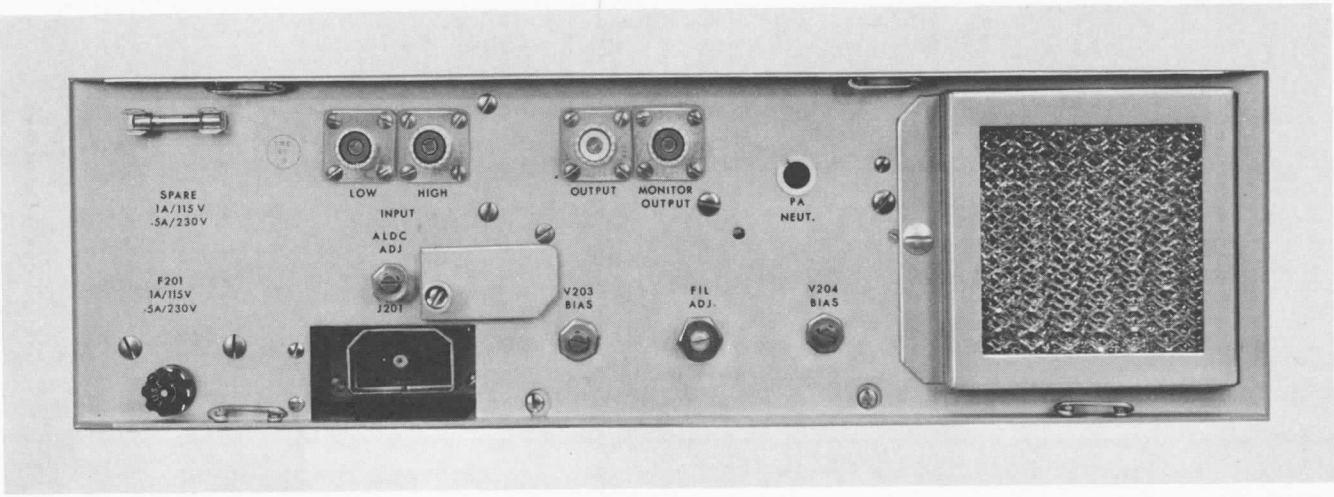
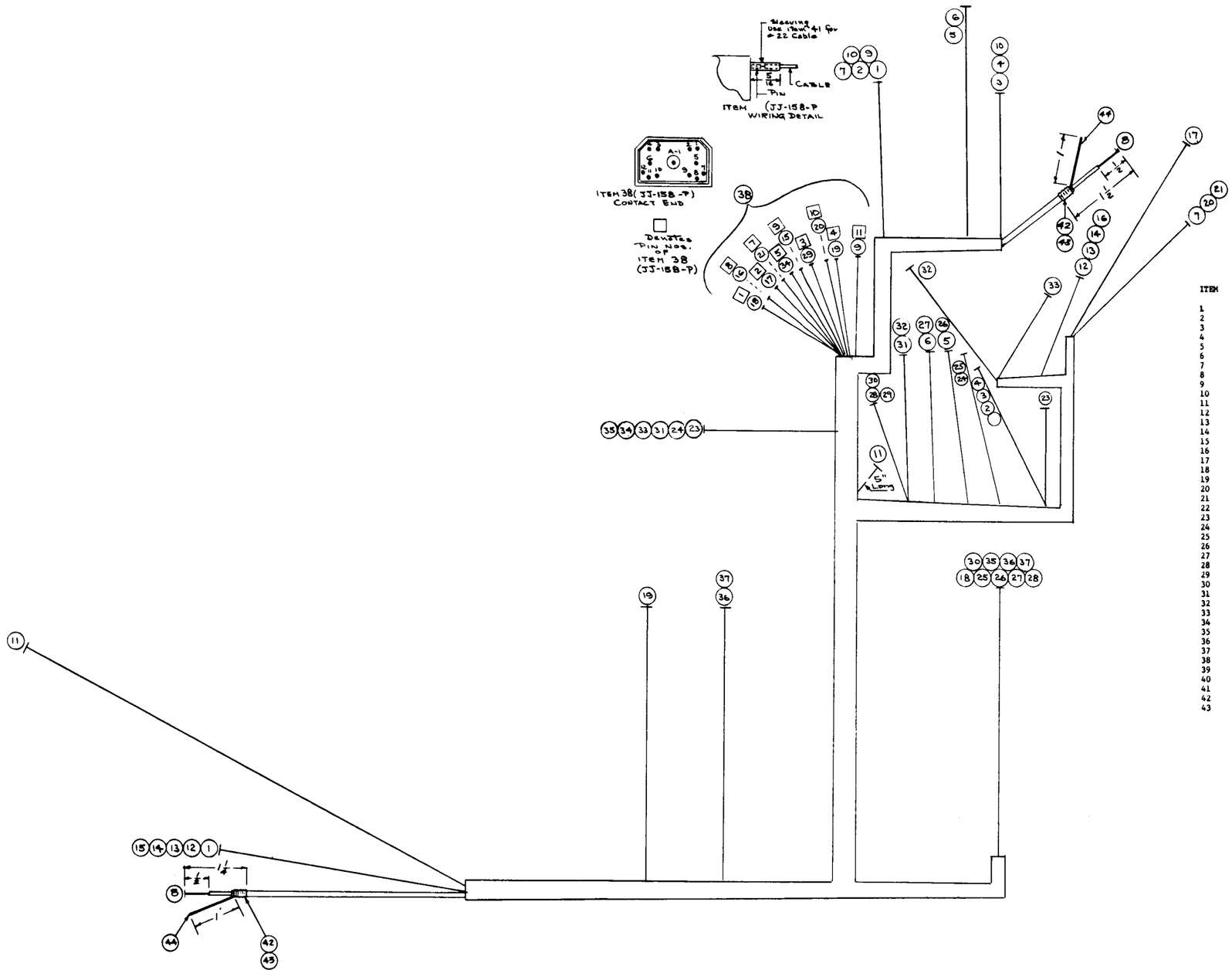
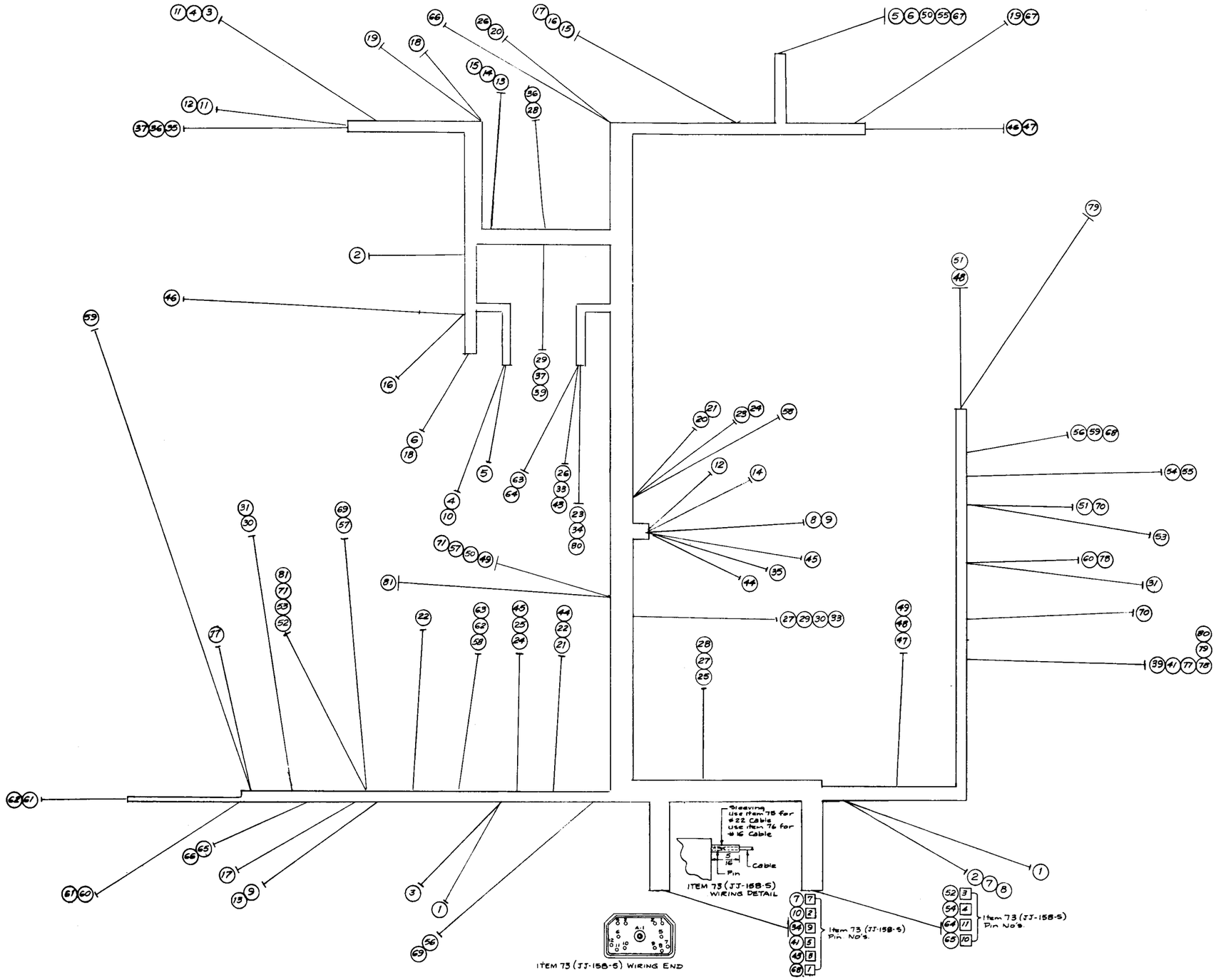


Figure 5-5. Rear View of PSP-350 (Unit of PAL-350)



ITEM	COLOR	LENGHT	WIRE CODE
1	(Wh. & Grey)	31	MWC22(7)U
2	(Wh. & Grey)	18	MWC22(7)U
3	(Blue)	20	MWC22(7)U
4	(Wh. & Blue)	20	MWC22(7)U
5	(Wh. & Or.)	19-1/4	MWC22(7)U
6	(Wh. & Brn.)	18-1/2	MWC22(7)U
7	(Orange)	21-3/4	MWC22(7)U
8		37-3/4	RG-188/U
9	(White)	9-3/4	RG-188/U
10	(Yellow)	10-1/4	MWC22(7)U
11		31	WI-126-1
12	(Yellow)	31-1/4	MWC22(7)U
13	(Wh. & Brn.)	31-1/2	MWC22(7)U
14	(White & Red)	31-1/2	MWC22(8)U
15	(Red)	26-3/4	MWC22(7)U
16	(Yellow)	16-1/4	MWC22(7)U
17	(Grey)	19	MWC22(7)U
18	(Pink)	23-3/4	MWC22(7)U
19	(Wh. & Grn.)	23-3/4	MWC22(7)U
20	(Brown)	17-1/2	MWC22(7)U
21	(Black)	17-3/4	MWC22(7)U
22		2-1/2	WL-103-1
23	(Wh. & Yel.)	12-1/4	MWC22(7)U
24	(Wh. & Grn.)	12-3/4	MWC22(7)U
25	(Green)	24-1/2	MWC22(7)U
26	(Orange)	23-1/2	MWC22(7)U
27	(Brown)	22-3/4	MWC22(7)U
28	(Wh. & Viol.)	1-1/4	MWC22(7)U
29	(Wh. & Viol.)	10-1/4	MWC22(7)U
30	(Violet)	21-1/2	MWC22(7)U
31	(Pink)	10-3/4	MWC22(7)U
32	(Black)	14-1/2	MWC22(7)U
33	(Grey)	16-1/2	MWC16(19)U
34	(Wh. & Yel.)	8-1/4	MWC22(7)U
35	(Wh. & Brn.)	23	MWC22(7)U
36	(Red)	18-3/4	MWC22(7)U
37	(Black)	18-3/4	MWC22(7)U
38		1	JJ-158-P
39		A/R	CD-101-1 MW
40		A/R	BS-100
41		A/R	FX-100-1-106
42		2	CU-101-9
43		2	CU-101-10

Figure 5-6. Cabling Diagram of RFA (Unit of PAL-350)



ITEM	COLOR	LENGTH	WIRE CODE
1	(Viol.)	31-1/8	MWC16(19)U
2	(White)	11-1/2	MWC16(19)U
3	(Grey)	31-1/8	MWC16(19)U
4	(Brown)	16-1/2	MWC16(19)U
5	(Viol.)	20-1/2	MWC16(19)U
6	(Green)	19-1/4	MWC16(19)U
7	(White)	29-1/2	MWC22(7)U
8	(White)	22-1/2	MWC22(7)U
9	(White)	20	MWC16(19)U
10	(Brown)	29	MWC22(7)U
11	(Brown)	9-1/2	MWC22(7)U
12	(Black)	21-1/2	MWC22(7)U
13	(White)	27-1/2	MWC22(7)U
14	(White & Black)	17	MWC22(7)U
15	(White)	16-1/4	MWC22(7)U
16	(White & Brn.)	17-1/2	MWC22(7)U
17	(White & Brn.)	31-1/2	MWC22(7)U
18	(Green)	11-1/8	MWC22(7)U
19	(White & Grn.)	21-1/4	MWC22(7)U
20	(White & Grey)	15-1/4	MWC22(7)U
21	(White & Grey)	14-1/2	MWC22(7)U
22	(White & Grey)	12	MWC22(7)U
23	(White & Viol.)	14-1/8	MWC22(7)U
24	(White & Viol.)	16-1/2	MWC22(7)U
25	(White & Viol.)	11-1/8	MWC22(7)U
26	(White & Blue)	13	MWC22(7)U
27	(White & Grn.)	12-1/4	MWC22(7)U
28	(White & Grn.)	21-1/2	MWC28(7)U
29	(White & Red)	17-1/2	MWC22(7)U
30	(White & Red)	21-3/4	MWC22(7)U
31	(White & Red)	30-1/8	MWC22(7)U
32			
33	(White & Red)	15-3/4	MWC22(7)U
34	(White & Or.)	22-3/4	MWC22(7)U
35	(White & Grn.)	22-5/8	MWC22(7)U
36	(Yellow)	14-5/8	MWC22(7)U
37	(Yellow)	14-1/4	MWC22(7)U
38			
39	(Yellow)	28	MWC22(7)U
40			
41	(Yellow)	20	MWC22(7)U
42			
43	(White & Yel.)	22	MWC22(7)U
44	(Blue)	14-1/2	MWC22(7)U
45	(White & Blue)	17	MWC22(7)U
46	(Orange)	23-1/2	MWC22(7)U
47	(Orange)	33	MWC22(7)U
48	(Orange)	17	MWC22(7)U
49	(Or.)	17-1/2	MWC22(7)U
50	(Or.)	21-3/4	MWC22(7)U
51	(Or.)	9-1/8	MWC22(7)U
52	(Blue)	20-1/2	MWC22(7)U
53	(Blue)	29-1/4	MWC22(7)U
54	(Red)	21	MWC22(7)U
55	(Red)	41-1/4	MWC22(8)U
56	(Wh. & OR.)	24-1/4	MWC22(7)U
57	(Or.)	19-1/2	MWC22(7)U
58	(Wh. & OR.)	18-1/2	MWC22(7)U
59	(Viol.)	38	MWC22(7)U
60	(Wh. & Yel.)	29-1/4	MWC22(7)U
61	(Wh. & Bl.)	10-1/4	MWC22(7)U
62	(Wh. & Brn.)	14-1/8	MWC22(7)U
63	(Red)	23	MWC22(7)U
64	(Pink)	25-3/4	MWC22(7)U
65	(Orange)	20-1/2	MWC22(7)U
66	(Orange)	30	MWC22(7)U
67	(Viol.)	11-1/2	MWC22(7)U
68	(Viol.)	23-1/4	MWC22(7)U
69	(pink)	17	MWC22(7)U
70	(Black)	10-1/2	MWC22(7)U
71	(Viol.)	18	MWC22(7)U
72	(Black)	X	CD-101-1-MW
73			JJ-158-S
74		X	BS-100
75	(Black)		FX-100-1-106
76	(Black)		FX-100-1-118
77	(Wh. & Grn.)	26	MWC22(7)U
78	(Wh. & Grn.)	9	MWC22(7)U
79	(Wh. & Grn.)	14	MWC22(7)U
80	(Wh. & Grn.)	29	MWC22(7)U
81	(Blue)	19	MWC22(7)U
82	(Grey)	13-1/2	

Figure 5-7. Cabling Diagram of PSP-350 (Unit of PAL-350).

SECTION 6
MAINTENANCE

6–1. GENERAL.

The PAL-350 is an assembly of many electrical and mechanical parts which may be maintained adequately by conventional preventive and corrective maintenance techniques as outlined in the following paragraphs. Long life and continual reliable operation of moving parts require especially good maintenance. When a component fails in a highly-precise frequency-sensitive assembly, it is generally more practical to replace the entire assembly than to attempt to repair it. Such assemblies may then be returned to the factory for repair and adjustment. The same is true of complicated mechanical assemblies. Fabrication of parts peculiar without suitable tools make the replacement of the entire assembly more practical than disassembly, fabrication, and reassembly. Pieces of PAL-350 equipment that fall into this category are band and load switches, blowers, contactors, relays, interlock switches, etc.

6–2. OPERATOR'S MAINTENANCE.

The PAL-350 units, provide long-term, trouble-free, continuous, operation. Maintenance of the equipment should be performed by a qualified maintenance technician. Operators may perform emergency maintenance as follows:

a. REPLACEMENT OF FUSES. - Fuse failures are indicated by glowing of the neon lamps contained in the fuse holder and by failure of the electron tubes to light. Check fuses in their holders on the front panel. Replace, if defective, with fuses of equal rating. If fuses blow immediately after replacement, do not replace again until the trouble has been corrected.

CAUTION

Be thoroughly familiar with PAL-350 units before trouble-shooting them in a POWER-ON condition.

b. RECORDS AND LOGS. - Operator's maintenance consists in not only maintaining optimum PAL-350 performance at all times but in keeping detailed record of readings as well as a log of events and happenings including climatic conditions. Large departures from normal values should be investigated.

6–3. PREVENTIVE MAINTENANCE.

Preventive maintenance is maintenance that detects and corrects trouble producing items before they become serious enough to affect equipment operation adversely. Some trouble producing items are dirt and grime, contact erosion, improper contact pressure, lack of proper lubrication, improper relay adjustment, dirty air filters, overheating, unstable power supplies, vacuum tubes with poor emission, loose parts (due to vibration), etc.

It may appear contradictory to state that good preventive maintenance means that one should not constantly poke around and tinker with an equipment that is performing excellently. Overzealous maintenance frequently causes trouble. Good preventive maintenance requires constant vigilance and good judgment of when, what, and how to apply remedial measures.

In order to prevent a failure of the equipment because of corrosion, dust, or other destructive elements, it is recommended that a schedule of preventive maintenance be established and followed.

a. ONCE EACH SHIFT DURING AN "ON THE AIR" PERIOD. - Check the operator's PAL-350 performance record for irregularities and possible sources of future trouble. Make minor adjustments of tuning controls to verify proper tuning. Observe all electrical quantities measurable with built-in meter and compare observations with established standards for irregularities. Observe indicator lights and rectifier tubes for abnormal color and signs of internal flashing.

b. 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 a vacuum cleaner if one is available. Remove dirt or grease from electrical parts with carbon tetrachloride.

WARNING

Carbon Tetrachloride ($CC1_4$) is a toxic substance. Do not inhale its fumes. Avoid contact with skin.

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.

6-4. CORRECTIVE MAINTENANCE.

a. GENERAL.

Corrective maintenance is an aftermath of trouble-shooting as discussed in Section 5, or preventive maintenance as discussed in the preceding paragraph. With the exception of those cases when components suddenly fail for no apparent reason or under extenuating circumstances, an intelligent program of preventive maintenance should produce minimum PAL-350 outage.

The PSP-350 power supply contains 6 protective devices. The action of one or more of these devices will disable all or part of the PAL-350 system. These protective devices are as follows:

Syn	Function
F101	LV SUPPLY MAIN FUSE
F102	LV SUPPLY B FUSE
CB101	MAIN LINE SWITCH (CIRCUIT BREAKER)
CB102	HV LINE SWITCH (CIRCUIT BREAKER)
S101	TOP COVER INTERLOCK
S102	BOTTOM COVER INTERLOCK

The RFA-1 contains three protective devices:

Syn	Function
S204	TOP COVER INTERLOCK
S205	BOTTOM COVER INTERLOCK
R201	FILAMENT FUSE

b. REPLACEMENT OF INDICATOR LAMPS.

In the event that any of the indicator lamps 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.

c. REPLACEMENT OF ELECTRON TUBES.

Electron tube failure may be indicated by failure of tube filaments to be lighted when the unit is connected to main power and when the tubes do not heat. Remove questionable tubes and test by substitution method or tube tester. Be certain to reinstall tube shields after testing or replacing tubes. In most instances where a failure is experienced but not accompanied by a blown fuse or open switch, a faulty tube will be responsible.

WARNING

The voltages used in the equipment are sufficiently high to endanger life. All personnel are advised to use utmost caution when trouble-shooting the PAL-350 with power turned on.

6-5. ALIGNMENT PROCEDURE.

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.

b. RESISTANCE CHECKS.

(1) Remove all power from equipment completely by disconnecting power line cord from its socket.

(2) Disconnect cable from PSP-350 to RFA-1.

(3) If checks are to be made in the PSP-350, remove both covers and short any charge remaining in the large capacitors. This will guard against mishap in the event that the bleeders have failed during operation.

(4) If checks are to be made in the RFA-1, place a bus wire across both terminals at the rear of multimeter M202 and remove red lead from positive terminal. This must be done to protect the micro-ammeter movement and as a test condition for the following tabulation of measurements.

c. ALIGNMENT OF DRIVER CHASSIS.

(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, and C223.

(2) Check that TRANSMITTER PLATES and HV LINE switches are OFF.

(3) Turn on MAIN LINE switch.

(4) After 60 seconds delay, turn on TRANSMITTER PLATES switch.

(5) Set MULTI METER switch to FIL position.

(6) Check 6 V PA filament voltage (reset R216 FIL ADJ if necessary).

(7) Set the MULTI METER switch to the RF DR position.

(8) Set the DRIVER/BAND switch to 2-4 mcs position.

(9) Set the DRIVER/TUNING control at point No. 1.

(10) Apply drive slowly at 2 mcs (single tone).

(11) Tune T201 and T204 to peak indication on MULTI METER, reducing drive to maintain 30 V on MULTI METER.

(12) Set DRIVER/TUNING control to position 9.

(13) Tune trimmers C201 and C207 to peak indication on MULTI METER; readjust drive to maintain 30 V on MULTI METER.

NOTE

Remove drive and if MULTI METER continues to read, readjust C223 and start from step (7) until there is no sustained reading when drive is removed.

(14) Repeat steps (9) through (13) several times until no further adjustment of coils and trimmers is necessary.

(15) Reduce the exciter output level temporarily to minimum.

(16) Set DRIVER/BAND switch of the RFA to 4-8 mcs position.

(17) Set DRIVER/TUNING control at point No. 1.

(18) Apply drive slowly at 4 mcs (single tone).

(19) Tune T202 and T205 to peak indication on MULTI METER while controlling the exciter output to keep meter readings below 30 V as before.

(20) Set DRIVER/TUNING control to position 9.

(21) Tune trimmers C202 and C208 to peak indication on MULTI METER. Maintain less than 30 V on the meter by use of the exciter output drive control.

(22) Remove drive. If MULTI METER continues to read, readjust C223 as before and repeat procedure starting with step 12.

(23) Repeat steps (17) through (22) several times until no further adjustment of coils and trimmers is necessary.

(24) Set DRIVER/BAND switch to 8-16 mcs position.

(25) Set DRIVER/TUNING control at point No. 1.

(26) Apply low level drive slowly at 8 mcs (single tone).

(27) Tune T203 and T206 to peak indication on MULTI METER while adjusting the drive to keep meter readings below 30 V.

(28) Turn DRIVER/TUNING control to point 9.

(29) Apply drive slowly at 16 mcs (single tone).

(30) Tune trimmer C204 and C211 to peak indication on MULTI METER; maintain a meter reading of less than 30 V by use of the exciter output drive control.

(31) Remove drive. If MULTI METER continues to read, readjust C223 and repeat procedure beginning with step 12 until there is no sustained reading when drive is removed.

(32) Repeat steps (24) through (31) several times until no further adjustment of coils and trimmers is necessary.

(33) Set DRIVER/BAND switch to 16-32 mcs (single tone).

(34) Set DRIVER/TUNING control at point No. 1.

(35) Apply drive slowly at 16 mcs (single tone).

(36) Tune L208 and T207 to peak indication on MULTI METER while controlling the exciter output drive to keep the meter readings below 30 V.

(37) Set DRIVER/TUNING control to position 9.

(38) Apply drive slowly at 32 mcs (single tone).

(39) Tune trimmers C203 and C210 to peak indication on MULTI METER while again keeping the reading below 30 V by use of the exciter output drive control.

(40) Remove drive. If MULTI METER continues to read, readjust C223 and repeat procedure beginning at step (12) until there is no sustained reading where drive is removed.

(41) Repeat steps (35) through (40) several times until no further adjustment of coils and trimmers is necessary.

(42) Lock all coils observing MULTI METER.

(43) Please cover driver chassis and tighten at least one screw.

NOTE

It is of the utmost importance that the driver chassis be aligned with great care. Inadequate gain in these stages will originate an appreciable amount of distortion.

(44) Turn off TRANSMITTER PLATES switch.

d. NEUTRALIZATION OF PA.

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-350 which require neutralizing, i.e, the driver stage V202 and the final stage V203/V204. The driver stage neutralizing is described fully in the section on driver alignment.

WARNING

Be certain that overload breaker stays in OFF position throughout neutralization process (removes B+ from PA). Remove load resistor.

(1) Turn ALDC Adj. to extreme counterclockwise position.

(2) Connect VTVM to plates of power amplifiers.

(3) Set PA loading at point No. 0. This operation maximizes plate voltage in absence of neutralization.

(4) Disconnect lead from C215 (feed back loop).

(5) Turn on TRANSMITTER PLATES switch. This operation provides B+ to V201, V202.

(6) Apply drive at 32 mc (single tone), tuning the driver stages to the peak meter indication in RF DR position. Adjust the drive control to 30 V on MULTI METER. This provides PA with adequate drive.

(7) Set PA BAND switch to 24-32 mcs position.

(8) Adjust PA TUNING (capacitor C213) to peak indication on RF DR position. This tunes PA plate tank.

(9) Adjust PA neutralizing capacitor C214 in small steps, each time retuning PA TUNING (capacitor C213) to peak RF DR position until the reading on VTVM is approximately 0.9 volt RMS.

(10) Adjust drive at 16 mcs and tune driver stages to peak indication in RF DR position. Adjust drive control until 30 V on MULTI METER is obtained.

(11) Set the PA/BAND switch to 16-24 mcs position.

(12) Tune PA TUNING (capacitor C213) to peak indication on RF VTVM; the reading must not exceed 1 V RMS.

(13) Set up the unit at 2 mcs. The reading on VTVM must not exceed 1 V RMS. If more than 1 V RMS, readjust the neutralizing capacitor C214 and recheck at 32 mcs.

(14) Disconnect VTVM and remove drive.

(15) Turn off TRANSMITTER PLATES switch.

(16) Connect feedback lead to C215.

e. ADJUSTMENT OF PA BIAS.

(1) Be certain that V203 bias and V204 bias control potentiometers are in extreme counterlockwise position.

(2) Disconnect exciter from J202.

(3) Turn on TRANSMITTER PLATES switch.

(4) Turn on high voltage breaker.

(5) Turn V204 bias control potentiometer R213 slowly clockwise until the PA plate current will read 90 ma and lock the potentiometer.

(6) Turn V204 bias control potentiometer R221 slowly clockwise until the PA plate current will read 160 ma and lock the potentiometer.

(7) Set MULTI METER switch to PA HV position; MULTI METER must read 2000 VDC approximately.

(8) Turn off TRANSMITTER PLATES switch.

f. SPURIOUS TEST.

NOTE

Do not connect a load and drive to the unit for this test.

(1) Turn on TRANSMITTER PLATES switch.

(2) Turn on high voltage breaker.

(3) Tune driver stages and PA at approximately 2 mcs; move tuning knobs slightly, observing PA plate current and RF DR.

(4) Continue to rotate driver tuning and PA tuning knob throughout the band, keeping driver tuning frequency and PA plate frequency approximately the same. Switch bands and check all frequencies until 32 mcs is reached.

NOTE

If there is a sudden jump in PA plate current and RF DR during the tests in steps (3) and (4), determine the parasitic frequency. If it is grid to plate oscillation, then the unit must be reneutralized.

g. PA PERFORMANCE AND INTERMODULATION.

(1) Set up unit for all operations, using two tone signal from exciter.

(2) Set band switches as per chart below; the voltage across the 52-ohm load must be 140 V as measured with Hewlett-Packard VTVM.

(3) The third and fifth order products may not be less than 40 db below fundamental tones. These products can only be measured with spectrum analyzer. No other method is practicable.

F	Driver Band	PA Band	
2	2 - 4	2.0 - 2.5	The MULTI METER reading must be as follows at each frequency:
2.5	2 - 4	2.5 - 3.0	
3.0	2 - 4	3.0 - 4.0	Sw, Pos. Value
4.0	4 - 8	4.0 - 6.0	
6.0	4 - 8	6.0 - 8.0	IS_G -8 to -10 ma
8.0	8 - 16	8.0 - 12	RF DR 25 to 30 V
12	8 - 16	12 - 16	RF PL approx. 800 V
16	16 - 32	16 - 24	RF OUT approx. 140 V
24	16 - 32	24 - 32	
32	16 - 32	24 - 32	

h. ALDC ADJUSTMENT.

(1) Unless operating on VOICE, this control should be fully counterclockwise. On VOICE, the control should be advanced as far clockwise as possible without introducing abvious distortion. It is suggested that this adjustment be made with a remote station monitoring the quality of transmission. Further suggestions follow.

(2) While unit is still fully tuned at some frequency, turn ALDC adjustment potentiometer slowly clockwise until output will just begin to drop off.

(3) Increase the drive from the exciter; output must increase only slightly.

(4) Turn off all power.

i. PLATE OVERLOAD.

The plate overload relay control adjustment (R116 in PSP-350) should be set to trip at 360 m/a plate current for all operating conditions. This current condition, for adjustment purposes, can be obtained by overdriving on single tone input.

SECTION 7
PARTS LIST

INTRODUCTION

Reference designations have been assigned to identify all maintenance parts of the equipment. They are used for marking the equipment (adjacent to the part they identify) and are included on drawings, diagrams, and the Parts List. The letters of a reference designation indicate the kind of part (generic group), such as resistor, amplifier, electron tubes, etc. The number differentiates between parts of the same generic group. Parts of the same first major unit are numbered from 1 to 199; parts of the second, 201 to 299. Two consecutive series of numbers have been assigned to major units in which there are more than 100 parts of the same generic group. Sockets associated with a particular plug-in device such as an electron tube or fuse, are identified by a reference designation which includes the reference designation of the plug-in device. For example, the socket for fuse F7 is designated XF7. The parts for each major unit are grouped together. Column 1 lists the reference series of each major unit, followed by the reference designations of the various parts in alphabetical and numerical order. Column 2 gives the name and describes the various parts. Major part assemblies are listed in their entirety; subparts of a major assembly are listed in alphabetical and numerical order with reference to its major assembly. Column 3 indicates how the part is used within a major component. Column 4 lists each Technical Materiel Corporation part number.

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SYM	DESCRIPTION	FUNCTION	TMC PART NO.
C101	CAPACITOR: fixed, paper, round case		CP41B1FF405K
C102	CAPACITOR: fixed, paper, round case		CP41B1FF405K
C103	CAPACITOR: fixed, electrolytic		CE63C500G
C104	CAPACITOR: fixed, paper		CP70E1F1405K
C105	CAPACITOR: fixed, paper		CP70E1F1405K
C106	CAPACITOR: fixed, paper		CP70E1F1405K
C107	CAPACITOR: fixed		CN-100-22
C108	CAPACITOR: fixed bathtub		CP53B1EF205K
C109	CAPACITOR: fixed bathtub		CP53B1EF205K
CB101	CIRCUIT BREAKER: A. C., Main Power		SW-216
CB101	CIRCUIT BREAKER: A. C., Main Power		SW-216
CB102	CIRCUIT BREAKER: Overload H. V.		SW-215
F101	FUSE: time lag, 1/2 amp., 230 V.		FU-102-.5
F101	FUSE: time lag, 1/2 amp., 230 V.	(Spare)	FU-102.5
F101	FUSE: time lag, 1 amp. 110 V.		FU102-1
F101	FUSE: time lag, 1 amp. 110 V.	(Spare)	FU-102-1
F102	FUSE: cartridge 1/8 amp.		FU-100-.125
F102	FUSE: cartridge 1/8 amp. (Spare)		FU-100-.125
I101	LAMP: incandescent, 3 W. 120 V.		BI-102-3
I102	LAMP: incandescent, 2 W. 120 V.		BI-102-3
I103	LAMP: incandescent, 2 W. 120 V.		BI-102-3
I104	LAMP: incandescent, 6-8 volts		BI-101-44
J101	CONNECTOR: receptacle, female		JJ-158-S
J102	RECEPTACLE: power		JJ-100
K101	RELAY: thermostatic delay 9 pin miniature		RL-111-6N060T
K102	RELAY: plate		RL-114
K103	RELAY: interlock		RL-116-AC-3C-00.63
L101	REACTOR: filter, 15 henries		TF-5000
L102	REACTOR: filter, 15 henries		TF-5000

POWER SUPPLY, MODEL PSP-350 (SYMBOL SERIES 100)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
L103	REACTOR: filter, 7 henries		TF-190
L104	REACTOR: filter, 7 henries		TF-190
P102	CONNECTOR: plug, male		PL-160-P
P103	CONNECTOR: plug, female		PL-160-S
R101	RESISTOR: fixed, comp. 2200 ohm, 2 watt		RC42GF222K
R102	RESISTOR: fixed, ww., 10K ohm, 10 watt		RW-109-34
R103	RESISTOR: fixed, composition, 100. 000 ohm, ± 10%, 2 watt		RC42GF104K
R104	RESISTOR: fixed, w. w., 45K ohm, 10 watt		RW-109-42
R105	RESISTOR: fixed, w. w., 80K ohm, 50 watt		RW-105-48
R106	RESISTOR: fixed, composition, 56 ohm, ± 10%, 2 watt		RC42GF560K
R107	RESISTOR: fixed, w. w., 100K ohm, 20 watt		RW-110-43
R108	RESISTOR: fixed, composition, 470. 000 ohm, ± 10%, 2 watt		RC42GF474K
R109	RESISTOR: fixed, composition, 20 megohm, ± 5%, 2 watt		RC42GF206J
R110	RESISTOR: fixed, composition, 20 megohm, ± 5%, 2 watt		RC42GF206J
R111	RESISTOR: fixed, composition, 20 megohm, ± 5%, 2 watt		RC42GF206J
R112	RESISTOR: fixed, composition, 20 megohm, ± 5%, 2 watt		RC42GF206J
R113	RESISTOR: fixed, composition, 20 megohm, ± 5%, 2 watt		RC42GF206J
R114	RESISTOR: fixed, composition, 220. 000 ohm, ± 10%, 2 watt		RC42GF224K
R115	RESISTOR: fixed, w. w., 20 ohm, 5 watt		RW-107-11
R116	RESISTOR: variable, w. w., 25 watt		RA75XA101AK25
R117	RESISTOR: fixed, composition, 43 ohm, ± 5%, 2 watt		RC42GF430J
S101	SWITCH: interlock		SW-219

POWER SUPPLY, MODEL PSP-350 (SYMBOL SERIES 100)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
S102	SWITCH: interlock		SW-219
S103	SWITCH: toggle		ST-12A
T101	TRANSFORMER: power		TF-181
T102	TRANSFORMER: power		TF-182
V101	TUBE: rectifier		5R4GY
V102	TUBE: voltage regulator		OA2
V103	TUBE: rectifier		866
V104	TUBE: rectifier		866
V105	TUBE: voltage regulator		OA2
V106	TUBE: voltage regulator		OB2
V107	TUBE: voltage regulator		OB2

LINEAR POWER AMPLIFIER, MODEL RFA-1 (SYMBOL SERIES 200)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
B201	BLOWER: air		BL-100
C201	CAPACITOR: trimmer 4-30 uuf		CV-11C300
C202	CAPACITOR: trimmer 4-30 uuf		CV-11C300
C203	CAPACITOR: trimmer 4-30 uuf		CF-11C300
C204	CAPACITOR: trimmer 4-30 uuf		CV-11C300
C205A	CAPACITOR: variable, air, 12.5 - 270 uuf		CB-139-1
C205B	CAPACITOR: variable, air, 12.5 - 270 uuf		CB-139-2
C206	CAPACITOR: fixed, feed thru		CK70A202M
C207	CAPACITOR: trimmer 4-30 uuf		CV-11C300
C208	CAPACITOR: trimmer 4-30 uuf		CV-11C300
C209	CAPACITOR: button mica		CB21QW102K
C210	CAPACITOR: trimmer 4-30 uuf		CV-11C300
C211	CAPACITOR: trimmer 4-30 uuf		CV-11C300
C212	CAPACITOR: mica		CM20D162G

LINEAR POWER AMPLIFIER, MODEL RFA-1 (SYMBOL SERIES 200)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
C213	CAPACITOR: variable air, 19-488 uuf		CB-138-3AN
C214			
C215	CAPACITOR: fixed, ceramic H. V.		CC-109-6
C216	CAPACITOR: fixed, ceramic H. V.		CC-109-2
C217	CAPACITOR: trylar		CX102J202M
C218	CAPACITOR: button mica		CB21QW102K
C219	CAPACITOR: button mica		CB21QW151K
C220	CAPACITOR: mica		CM20C102J
C221	CAPACITOR: mica		CM20C102J
C222	CAPACITOR: button mica		CB21QW471K
C223	CAPACITOR: trimmer 1.5 - 7 uuf		CV-11A070
C224	CAPACITOR: button mica		CB21QW102K
C225	CAPACITOR: fixed, feed thru		CK70A202M
C226	CAPACITOR: fixed, feed thru		CK70A202M
C227	CAPACITOR: mylar		CN108C1003J
C228	CAPACITOR: mica		CM35C103J
C229	CAPACITOR: fixed, feed thru		CK70A202M
C230	CAPACITOR: button mica		CB21QW102K
C231	CAPACITOR: fixed, electrolytic		CE63C500G
C232	CAPACITOR: mica		CM20C102J
C233	CAPACITOR: button mica		CB21QW102K
C234	CAPACITOR: mica		CM35C103J
C235	CAPACITOR: fixed, ceramic		CC21SL030C
C236	CAPACITOR: button mica		CB21QW151K
C237	CAPACITOR: button mica		CB21QW102K
C238	CAPACITOR: button mica		CB21QW102K
C239	CAPACITOR: button mica		CB21QW102K
C240	CAPACITOR: mica		CM20C102J
C243	CAPACITOR: mica		CM20C102J
C244	CAPACITOR: button mica		CB21QW102K

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
C245	CAPACITOR: button mica		CB21QW102K
C246	CAPACITOR: button mica		CB21QW102K
C247	CAPACITOR: trylar		CX102J202M
C248	CAPACITOR: button mica		CB21QW102K
C249	CAPACITOR: trylar		CX102J202M
C250	CAPACITOR: button mica		CB21QW102K
C251	CAPACITOR: mica		CM35C103J
C252	CAPACITOR: fixed, feed thru		CK70A202M
C253	CAPACITOR: fixed, feed thru		CK70A202M
C254	CAPACITOR: fixed, feed thru		CX70A202M
C255	CAPACITOR: fixed, feed thru		CK70A202M
C256	CAPACITOR: fixed, feed thru		CK70A202M
C257	CAPACITOR: fixed, feed thru		CK70A202M
C258	CAPACITOR: fixed, feed thru		CK70A202M
C259	CAPACITOR: fixed, feed thru		CK70A202M
C260	CAPACITOR: fixed, feed thru		CK70A202M
C261	CAPACITOR: fixed, feed thru		CK70A202M
C262	CAPACITOR: fixed, feed thru		CK70A202M
C263	CAPACITOR: fixed, feed thru		CK70A202M
C264	CAPACITOR: fixed, feed thru		CK70A202M
C267	CAPACITOR: mica		CM35C103J
C268	CAPACITOR: paper		CP69B1EF105K
C269	CAPACITOR: mylar		CN108C1003J
C270	CAPACITOR: mylar		CN108C1003J
C271	CAPACITOR: mica		CM35C103J
C272	CAPACITOR: mylar		CN108C1003J
C273	CAPACITOR: fixed, ceramic H. V.		CC-109-28
C274	CAPACITOR: button mica		CB21QW102K
C275	CAPACITOR: fixed, ceramic H. V.		CC-109-1
C276A-B	CAPACITOR: variable air, 30-950 uuf		CB-125-A-950X

LINEAR POWER AMPLIFIER, MODEL RFA-1 (SYMBOL SERIES 200)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
C277	CAPACITOR: fixed, ceramic H. V.		CC-109-5
C278	CAPACITOR: button mica		CB21QW151K
C279	CAPACITOR: fixed, feed thru		CK70A202M
C280	CAPACITOR: fixed, feed thru		CK70A202M
C281	CAPACITOR: mica		CM20D101G
C282	CAPACITOR: mica		CM20C102J
C283	CAPACITOR: button mica		CB21QW102K
CR-201	DIODE: silicon		IN-303
CR-202	DIODE: silicon		IN-303
CR-203	DIODE: silicon		IN-303
CR-204	DIODE: germanium		IN-67
CR-205	DIODE: germanium		IN-67
F201	FUSE: lamp (100V.)		FU-100-1
F201	FUSE: 1/2 amp. (230V.)		FU-100-.5
J201	CONNECTOR: receptacle male		JJ-158-P
J202	CONNECTOR: R. F.		SO-239
J203	CONNECTOR: R. F.		SO-239
J204	CONNECTOR: R. F.		SO-239
J205	CONNECTOR: R. F. teflon		SO-239-A
L201	INDUCTOR: RF, encapsulated, 120 uh		CL-10006-6
L202	INDUCTOR: RF, encapsulated, 120 uh		CL-10006-6
L203	INDUCTOR: RF, encapsulated, 120 uh		CL-10006-6
L204	INDUCTOR: RF, encapsulated, 120 uh		CL-10006-6
L205	INDUCTOR: RF, encapsulated, 120 uh		CL-10006-6
L206	INDUCTOR: RF, encapsulated, 680 uh		CL-10006-7
L207	COIL: RF, 50 uh		CL-10013
L208	COIL: tunable, 16-32 Mc/s driver		CL-10011-1
L209	INDUCTOR: RF, encapsulated, 120 uh		CL-10006-6
L210	INDUCTOR: RF, encapsulated, 27 uh		CL-10006-2
L211	INDUCTOR: RF, encapsulated, 680 uh		CL-10006-7

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
L212	COIL: RF, 50 uh	(double ins.)	CL-10012
L213	INDUCTOR: RF, encapsulated, 680 uh		CL-10006-7
L214	INDUCTOR: RF, encapsulated, 27 uh		CL-10006-2
L215	INDUCTOR: RF, encapsulated, 120 uh		CL-10006-6
L216	INDUCTOR: RF, encapsulated, 120 uh		CL-10006-6
L217	INDUCTOR: RF, encapsulated, 120 uh		CL-10006-6
L218	INDUCTOR: RF, encapsulated, 27 uh		CL-10006-2
L219	INDUCTOR: RF, encapsulated, 8.5 uh	(1 amp.)	CL-10023-2
L220	INDUCTOR: RF, encapsulated, 8.5 uh	(1 amp.)	CL-10023-2
L221	INDUCTOR: RF, encapsulated, 120 uh		CL-10006-6
L222	INDUCTOR: RF, encapsulated, 680 uh		CL-10006-7
L223	INDUCTOR: RF, encapsulated, 8.5 uh	(1 amp.)	CL-10023-2
L224	INDUCTOR: RF, encapsulated, 8.5 uh	(1 amp.)	CL-10023-2
L225	INDUCTOR, RF, encapsulated, 27 uh		CL-10006-2
L226	INDUCTOR: RF, encapsulated, 1.0 uh		CL-10006-3
L227	INDUCTOR: RF, encapsulated, 680 uh		CL-10006-7
L228	INDUCTOR: RF, encapsulated, 120 uh		CL-10006-6
L229	INDUCTOR: RF, encapsulated, 120 uh		CL-10006-6
L230	INDUCTOR: RF, encapsulated, 27 uh		CL-10006-2
L231	INDUCTOR: RF, encapsulated, 120 uh		CL-10006-6
L232	INDUCTOR: RF, encapsulated, 4.5 uh	(3 amp.)	CL-10023-1
L233	INDUCTOR: RF, encapsulated, 4.5 uh	(3 amp.)	CL-10023-1
L234	INDUCTOR: RF, encapsulated, 120 uh		CL-10006-6
L235	INDUCTOR: RF, encapsulated, 120 uh		CL-10006-6
L236	COIL: RF, 185 uh		A-1126
L237	INDUCTOR: RF, encapsulated, 120 uh		CL-10006-6
L239	INDUCTOR: RF, encapsulated, 27 uh		CL-10006-2
L240	INDUCTOR: RF, encapsulated, 27 uh		CL-10006-2
L241	INDUCTOR: RF, encapsulated, 27 uh		CL-10006-2
M201	MULTIMETER		MR-10002

LINEAR POWER AMPLIFIER, MODEL RFA-1 (SYMBOL SERIES 200)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
M202	METER: 500 ma		MR-10003
PS-201	SUPPRESSOR: parasitic		A-1543-2
PS-202	SUPPRESSOR: parasitic		A-1453
PS-203	SUPPRESSOR: parasitic		A-1546-1
PS-204	SUPPRESSOR: parasitic		A-1546-1
R201	RESISTOR: fixed, composition, 5600 ohm, ± 10%, 1/2 watt		RC20GF562K
R202	RESISTOR: fixed, composition, 2200 ohm, ± 10%, 1/2 watt		RC20GF222K
R203	RESISTOR: fixed, composition 8200 ohm, ± 10%, 1/2 watt		RC20GF822K
R204	RESISTOR: fixed, composition, 2700 ohm, ± 10%, 1/2 watt		RC20GF272K
R205	RESISTOR: fixed, composition, 2200 ohm, ± 10%, 1/2 watt		RC20GF222K
R206	RESISTOR: fixed, composition, 180 ohm, ± 10%, 2 watt		RC42GF181K
R207	RESISTOR: fixed, composition, 47 ohm, ± 10%, 1/2 watt		RC20GF470K
R208	RESISTOR: fixed, composition, 47 ohm, ± 10%, 1/2 watt		RC20GF470K
R209	RESISTOR: fixed, composition, 33,000 ohm, ± 10%, 1/2 watt		RC20GF333K
R210	RESISTOR: fixed, composition, 220,000 ohm, ± 10%, 1/2 watt		RC20GF224K
R211	RESISTOR: fixed, composition, 12 ohm, ± 10%, 1/2 watt		RC20GF120K
R212	RESISTOR: fixed, composition, 560 ohm, ± 10%, 2 watt		RC42GF561K
R213	RESISTOR: variable		RV4LAYSA503A
R214	RESISTOR: fixed, composition, 220,000 ohm, ± 10%, 1 watt		RC30GF223K
R215	RESISTOR: fixed, composition, 220,000 ohm, ± 10%, 1 watt		RC30GF223K
R216	RESISTOR: variable, wirewound	(fil. adjust)	RA75XAOR5AK 25
R217	RESISTOR: fixed, composition, 820,000 ohm, ± 10%, 1 watt		RC30GF823K

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
R218	RESISTOR: fixed, composition, 220 ohm, ± 10%, 2 watt		RC42GF221K
R219	RESISTOR: fixed, composition, 100 ohm, ± 10%, 2 watt		RC42GF101K
R220	RESISTOR: fixed, composition, 1 megohm, ± 10%, 1/2 watt		RC20GF104K
R221	RESISTOR: variable		RV4LAYSA 503A
R222	RESISTOR: fixed, composition, 15 megohm, ± 5%, 1/2 watt		RC20GF156J
R223	RESISTOR: fixed, composition, 13,000 ohm, ± 5%, 1/2 watt		RC20GF133J
R224	RESISTOR: fixed, composition, 8,200 ohm, ± 5%, 1/2 watt		RC20GF822J
R225	RESISTOR: fixed, composition, 1.2 megohm, ± 5%, 1/2 watt		RC20GF125J
R226	RESISTOR: fixed, composition, 10 ohm, ± 10%, 1/2 watt		RC20GF100K
R227	RESISTOR: fixed, composition, 2,200 ohm, ± 10%, 1/2 watt		RC20GF222K
R228	RESISTOR: variable		RV4LAYSA503A
R229	RESISTOR: fixed, composition, 47,000 ohm, ± 10%, 1/2 watt		RC20GF473K
R230	RESISTOR: fixed, composition, 750,000 ohm, ± 5%, 1/2 watt		RC20GF754J
R231	RESISTOR: fixed, composition, 2,200 ohm, ± 10%, 1/2 watt		RC20GF222K
R232	RESISTOR: fixed, composition, 3,300 ohm, ± 10%, 1/2 watt		RC20GF332K
R233	RESISTOR: fixed, composition, 15,000 ohm, ± 10%, 1 watt		RC30GF153K
R234	RESISTOR: fixed, composition, 8,200 ohm, ± 10%, 1/2 watt		RC20GF822K
S201A	WAFER: rotary switch		WS-101
S201B	WAFER: rotary switch	Drive Band Switch	WS-101
S202	SWITCH		SW-218
S203A-B	SWITCH: meter		SW-217
S204	SWITCH: micro		SW-219

LINEAR POWER AMPLIFIER, MODEL RFA-1 (SYMBOL SERIES 200)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
S205	SWITCH: micro		SW-219
T201	COIL: tunable 2-4 Mc/s driver		CL-10020
T202	COIL: tunable 4-8 Mc/s driver		CL-10021
T203	COIL: tunable 8-16 Mc/s driver		CL-10022
T204	COIL: tunable 2-4 Mc/s driver		CL-10020
T205	COIL: tunable 4-8 Mc/s driver		CL-10021
T206	COIL: tunable 8-16 Mc/s driver		CL-10022
T207	COIL: tunable 16-32 Mc/s driver tapped		CL-10011-2
T208	TRANSFORMER: RF, fixed, 16-32 Mc/s		TF-10020
T209	TRANSFORMER: RF, (Part of A-10298)		TF-10019
T210	TRANSFORMER: power (filament)		TF-180
V201	TUBE		6CL6
V202	TUBE: driver		6146
V203	TUBE: PA		4CX250B
V204	TUBE: PA		4CX250B
XV201	SOCKET: tube, 9 pin		TS-103-P01
XV202	SOCKET: tube, octal		TS-101-P01
XV203	SOCKET: tube		TS-132
XV204	SOCKET: tube		TS-132

SECTION 8
SCHEMATIC DIAGRAMS

PA BANDSWITCH S202

POS	BAND (MCS)
1	2-2.5
2	2.5-3
3	3-4
4	4-6
5	6-8
6	8-12
7	12-16
8	16-24
9	24-32

DRIVER BANDSWITCH
S201-A, B

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

UNLESS OTHERWISE SPECIFIED

1-ALL RESISTORS ARE IN OHMS 1/2 WATT.
2-ALL CAPACITORS ARE IN UUFD.
3-ALL COILS AND TRANSFORMERS ARE IN UHY.

CHANGES NECESSARY TO CONVERT TO 230 V OPERATION.
F201- CHANGE FROM 1 AMP TO .5 AMP.
T210- REMOVE JUMPERS MARKED ~~- x x x -~~ AND CONNECT A JUMPER BETWEEN TERMINALS 2 AND 3.

MISSING SYM COLUMN	LAST SYM COLUMN
L238	B201
	C283
	R234
	L241
	CR205
	E201
	F201
	J205
	M202
	S205
	T210
	V204
	PS204

MULTI-METER SWITCH
S203 A,B

POS.	METER READING	
1	FIL. 0-10 V	PA
2	HV. 0-5KV	PA
3	ISG. 20, +30MA	PA
4	DR. 0-50 V	PA
5	PL. 0-2.5KV	PA
6	OUT. 0-500V	RF

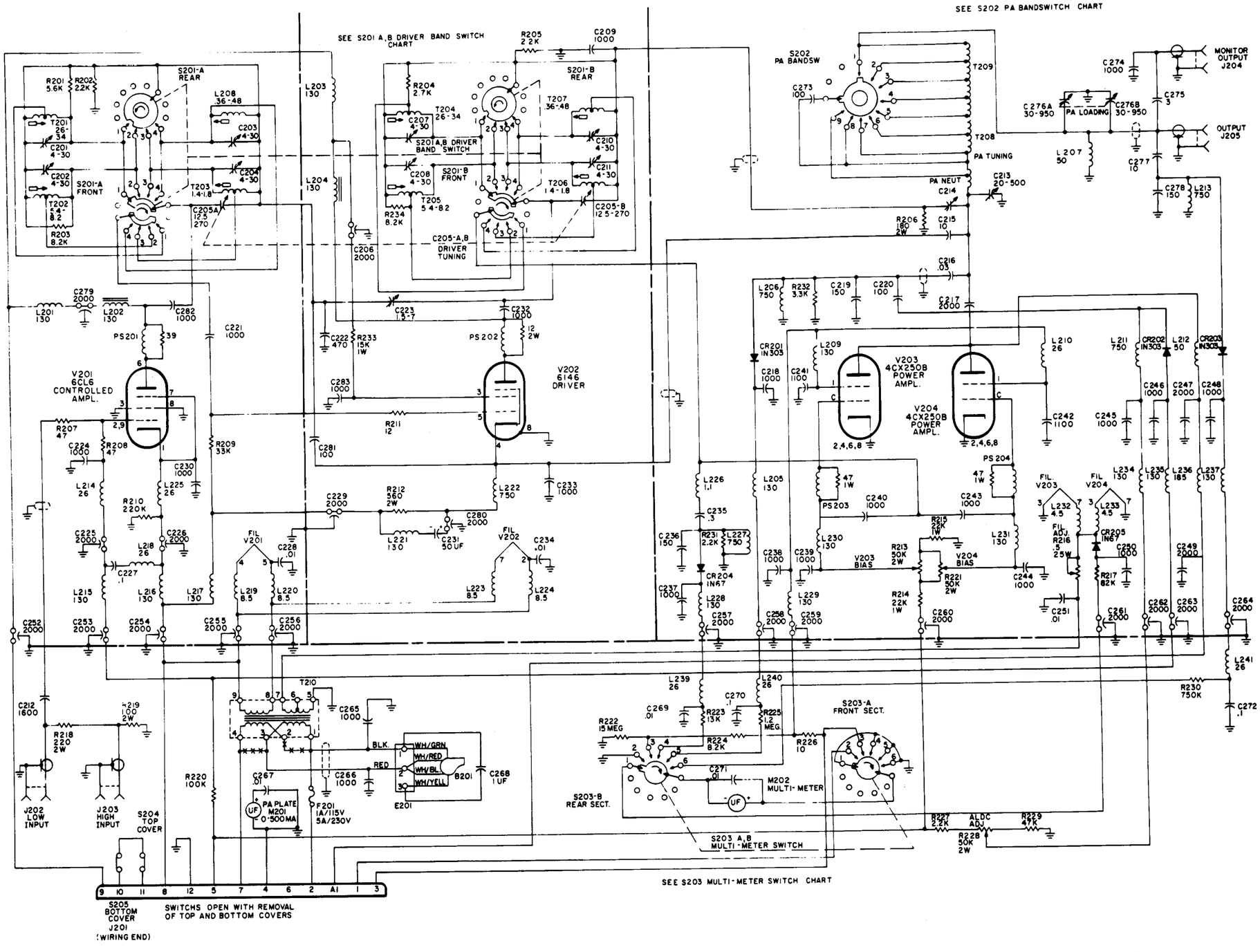


Figure 8-1. Schematic Diagram of RFA (Unit of PAL-350)

CHANGES NECESSARY TO CONVERT TO 230V OPERATION.

T101-REMOVE JUMPERS MARKED ~~***~~ FROM TERMINALS 1&2, 3&4,
ADD JUMPER MARKER ----- BETWEEN TERMS 2&3

T102-SAME AS T101.

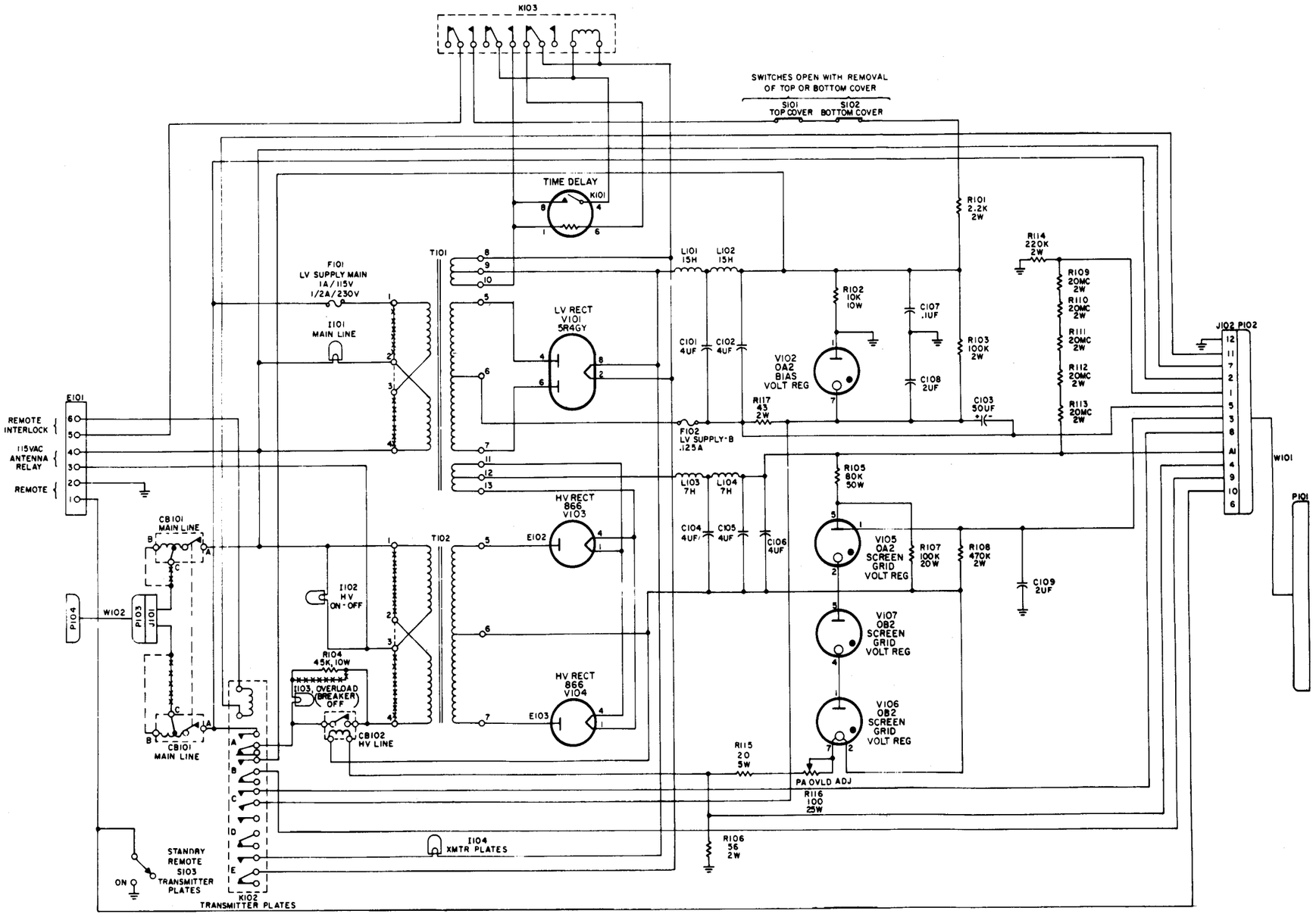
CB101-REMOVE LEAD MARKED ~~****~~ FROM TERMINAL C & CONNECT IT TO TERMINAL B

R104-REMOVE & DISCARD JUMPER MARKED ~~***~~ .

F101-CHANGE FROM 1 AMP TO 1/2 AMP.

F103-CHANGE FROM 10AMP TO 5AMP.

NOTES:
1- ALL FUSES ARE SLOW BLOW EXCEPT F102.
2- E101 # 5 & 6 NORMALLY JUMPERED UNLESS REMOTE INTERLOCKING IS REQUIRED.



WARNING: DO NOT OPERATE THIS UNIT WITH V102 AND/OR V105 AND/OR V106 REMOVED.

Figure 8-2. Schematic Diagram of PSP-350 (Unit of PAL-350)