UNCLASSIFIED

TECHNICAL MANUAL

for

LINEAR POWER AMPLIFIER MODEL PAL-1K(A) (AMPLIFIER POWER SUPPLY GROUP, AN/URA-36A)

THE TECHNICAL MATERIEL CORPORATION

MAMARONECK, N.Y. OTTAWA, ONTARIO

UNCLASSIFIED

TECHNICAL MANUAL

for

LINEAR POWER AMPLIFIER MODEL PAL-1K(A)

(AMPLIFIER POWER SUPPLY GROUP, AN/URA-36A)

THE TECHNICAL MATERIEL CORPORATION

MAMARONECK, N.Y. OTTAWA, ONTARIO

IN-523

Issue Date: 15 June 1962

WARNING

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

THE TECHNICAL MATERIEL CORPORATION
COMMUNICATIONS ENGINEERS
700 FENIMORE ROAD MAMARONECK, N. Y.

Warranty

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:

THE TECHNICAL MATERIEL CORPORATION
Engineering Services Department
700 Fenimore Road
Mamaroneck, New York

RECORD OF CORRECTIONS MADE

Change No.	Date of Change	Date Entered	Entered By

CHANGE NO. 3

INSTRUCTION BOOK CHANGE NOTICE

Date December 22, 1967

Manual affected: Linear Power Amplifier Model PAL-1KA IN - 523

Make the following corrections to the Schematic and Parts List.

a. Schematic Diagram Figure 8-2; change V706 to OA2 and R714 to 3500 ohms.

b. Parts List; Change the description and part numbers as follows:

PART	DESCRIPTION	PART NO.
R714	3.5K ohm	RW-110-48
V706	TUBE	OA2

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.

CHANGE NO. 2 PAL-1K(A)

INSTRUCTION BOOK CHANGE NOTICE

Date 4/5/65

Manual affected: Linear Power Amplifier, Model PAL-1K(A) IN -523

Page 1-1, paragraph 1-2.

Change 5th sentence to read:

"When specified on order, the RFD-1A and PS-4A units are supplied with chassis slides. The PS-5 always comes with the channel runners on the chassis bottom as shown in figure 1-3b."

Page 2-1, paragraph 2-5a.

Delete 3rd sentence: "All three units are provided with slides."

Page 2-4, paragraph 2-5c.

Change to read:

c. INSTALLATION OF UNITS. - Follow procedure outlined below for installing units equipped with chassis slides.

Page 7-15, SYMBOL XF701.

Revise TMC PART NO. to read: "FH-100-1."

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.

CHANGE NO. 1

INSTRUCTION BOOK CHANGE NOTICE

Date October 4, 1963

Manual affected: Linear Power Amplifier Model PAL-1K(A) IN -523

(a) page 3-4 Table 3-2 PAL-1KA Tuning Procedure
Step 1 Purpose should read "Sets level of ALDC (Automatic load and Drive Control) at its minimum voltage position."

(b) Page 3-6 Step 23 Purpose should read "Adjusts bias for ALDC operation."

(c) Page 3-6 Step 24 Change operation to read "Assume 1 kw PEP output: To check that ALDC is effective, increase the excitation slightly; the power output should be constant."

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.

TABLE OF CONTENTS

SECTION 1—GENERAL DESCRIPTION

SECTION 2—INSTALLATION

SECTION 3—OPERATOR'S SECTION

SECTION 4—PRINCIPLES OF OPERATION

SECTION 4—PRINCIPLES OF OPERATION (Cont.)

SECTION 5—TROUBLE-SHOOTING

SECTION 6—MAINTENANCE

SECTION 7—PARTS LIST

SECTION 8—SCHEMATIC DIAGRAMS

LIST OF ILLUSTRATIONS

SECTION 1—GENERAL DESCRIPTION

SECTION 2—INSTALLATION

SECTION 3—OPERATOR'S SECTION

SECTION 4—PRINCIPLES OF OPERATION

SECTION 4—PRINCIPLES OF OPERATION (Cont.)

SECTION 5—TROUBLE-SHOOTING

SECTION 8—SCHEMATIC DIAGRAMS

LIST OF TABLES

SECTION 1—GENERAL DESCRIPTION

SECTION 3—OPERATOR'S SECTION

SECTION 4—PRINCIPLES OF OPERATION

SECTION 5—TROUBLE-SHOOTING

SECTION 6—MAINTENANCE

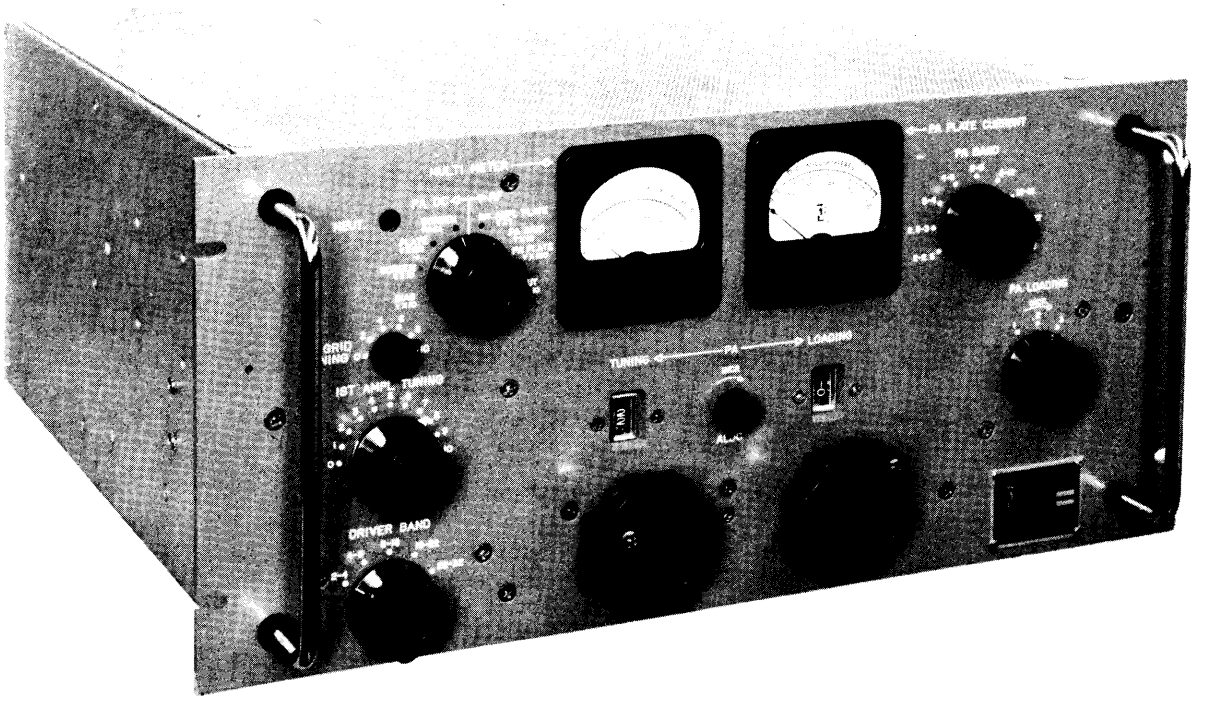


Figure 1-1a. Front Angle View, RFD-1A RF Linear Amplifier

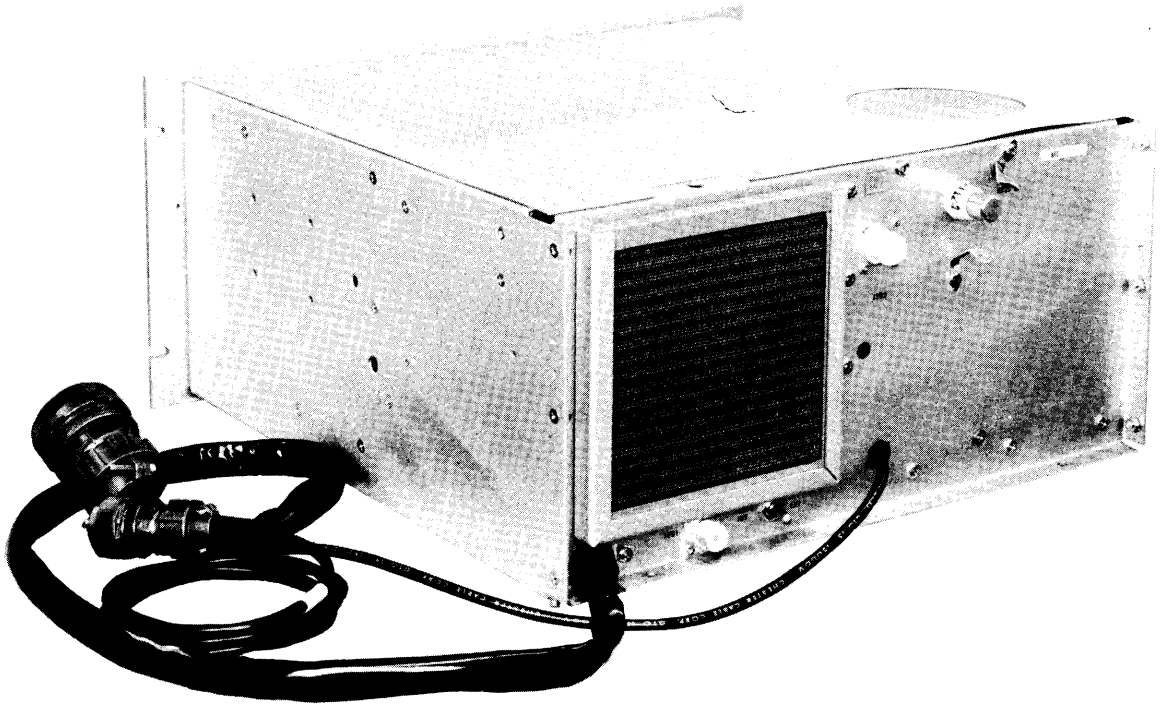


Figure 1-1b. Rear Angle View, RFD-1A Linear Amplifier

SECTION 1
GENERAL DESCRIPTION

1-1. PURPOSE AND BASIC PRINCIPLES.

Technical Materiel Corporation's Model PAL-1K(A) is a conservatively rated general purpose linear amplifier. It provides 1000 watts PEP (Peak Envelope Power) over the frequency range of 2 to 32 megacycles from a 100 milliwatt input.

Combined with a suitable exciter, the PAL-1K(A) forms a powerful and compact 1-kw transmitter for CW, MCW, AM, SSB, ISB, DSB, FSK and many other modes of emission. It is used as a modular unit in a large number of TMC's transmitter systems. It forms the r-f amplifier in the 1-kw transmitters; in the 10-kw and 40-kw transmitters it is utilized as an intermediate stage of amplification.

The PAL-1K(A) is composed of three units. The commercial and military nomenclatures of these units are as follows:

Commercial	Military
RFD-1A Amplifier	AM-2785A/URA-36 Amplifier, Radio Frequency
PS-4A Low Voltage Power Supply	PP-2765A/URA-36 Power Supply
PS-5 High Voltage Power Supply	PP-2766/URA-36 Power Supply

Front panel controls provide bandswitching, separate 1st. amplifier, driver and power amplifier output tuning controls together with output load matching controls. A multimeter with an 8-position switch provides a convenient front panel check for proper amplifier power supplies and output values during tuning. Complete overload protection is furnished by circuit breakers, ALDC (Automatic Load and Drive Control) and a PA plate current meter to warn operator when approaching overload conditions. A safety interlock system is included to protect personnel from shock hazards and prevent overheating of equipment due to blower failure. The final power amplifier tube is a ceramic beam pentode, forced-air cooled by a built-in exhaust blower in the RFD-1A unit. ALDC, neutralization and inverse feedback improve linearity and suppress unwanted transmission products. A time-delay relay prevents the PA tube from receiving high plate voltage supply before receiving bias supply.

1-2. DESCRIPTION OF UNITS.

The PAL-1K(A) system units, RFD-1A, PS-4A, and PS-5, are shown in figures 1-1 through 1-3. Together, they occupy a total of 35 inches vertically in any standard 19-inch relay rack. The deepest chassis, the RFD-1A unit, extends 17 1/4 inches behind its panel. All panels are 3/16-inch thick and are finished in TMC gray enamel. All units come provided with chassis slides. Exhaust blowers, filters, and baffles are built into the RFD-1A and PS-5 units for forced-air cooling of hot spots; the PAL-1K(A) requires no additional cooling device for operation.

The equipment is manufactured in accordance with JAN/MIL specifications whenever practicable. All parts and assemblies meet or exceed the highest quality standards.

The RFD-1A unit weighs 46 lbs., the PS-4A 64 lbs. and the PS-5 194 lbs.

1-3. REFERENCE DATA.

The PAL-1K(A) is shipped from the factory in two crates, the contents of which are described in paragraph 2-2. The gross shipping weights of the crates are as follows:

Crate No	Gross Shipping Weight
1	278 lbs.
2	209 lbs.

Tables 1-1 and 1-2 contain additional reference data.

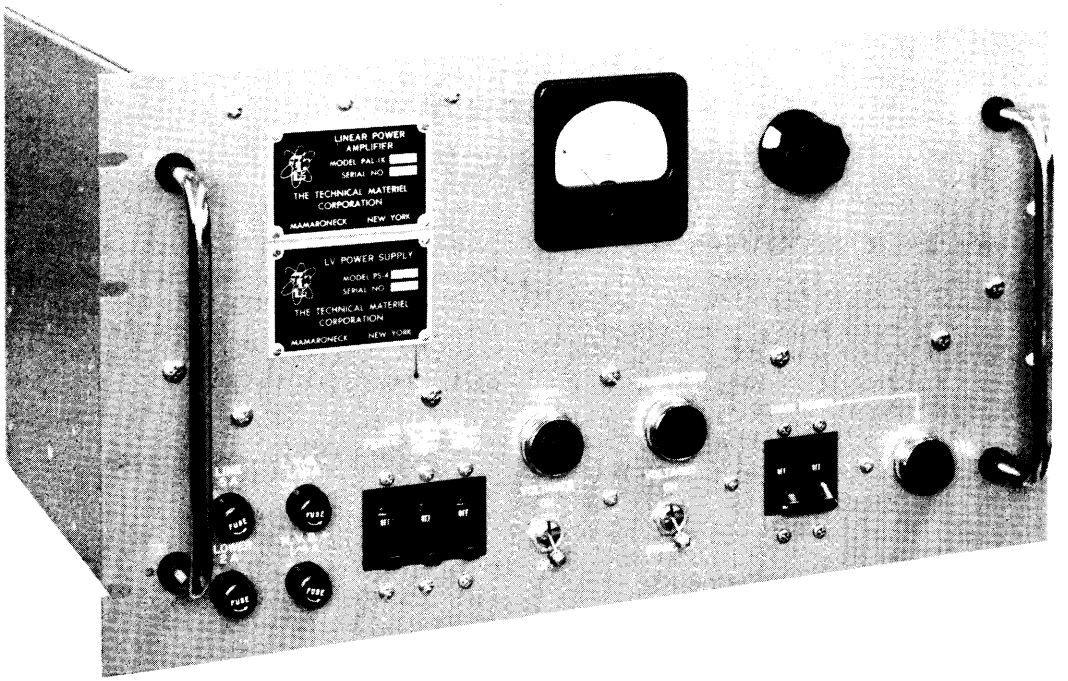


Figure 1-2a. Front Angle View, PS-4A Low Voltage Power Supply

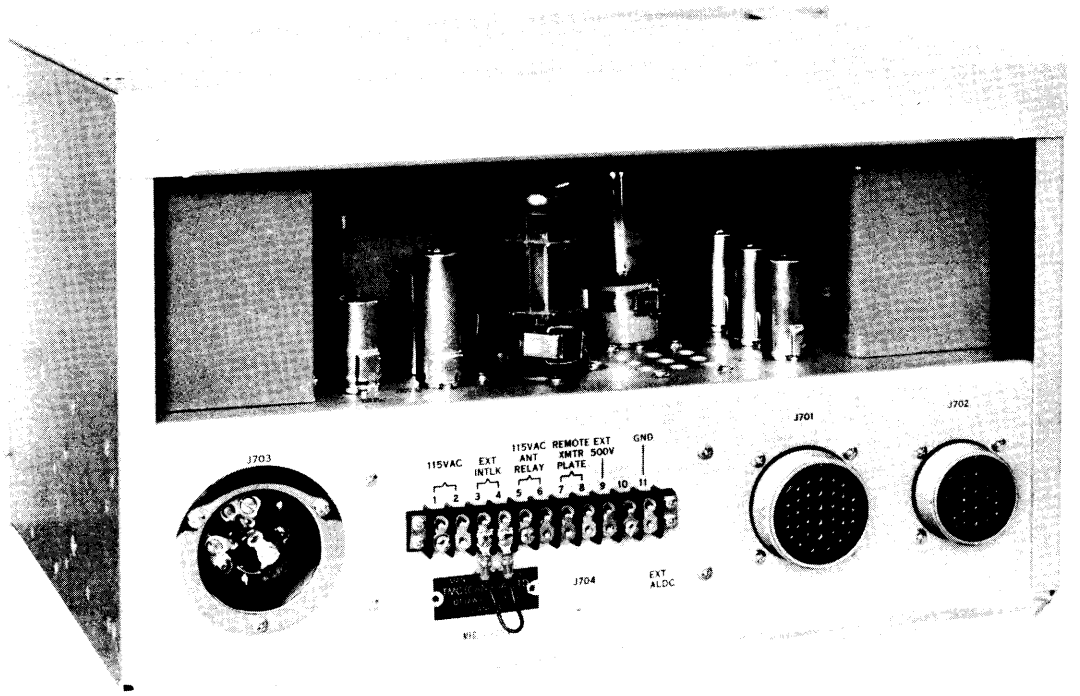


Figure 1-2b. Rear Angle View, PS-4A Low Voltage Power Supply

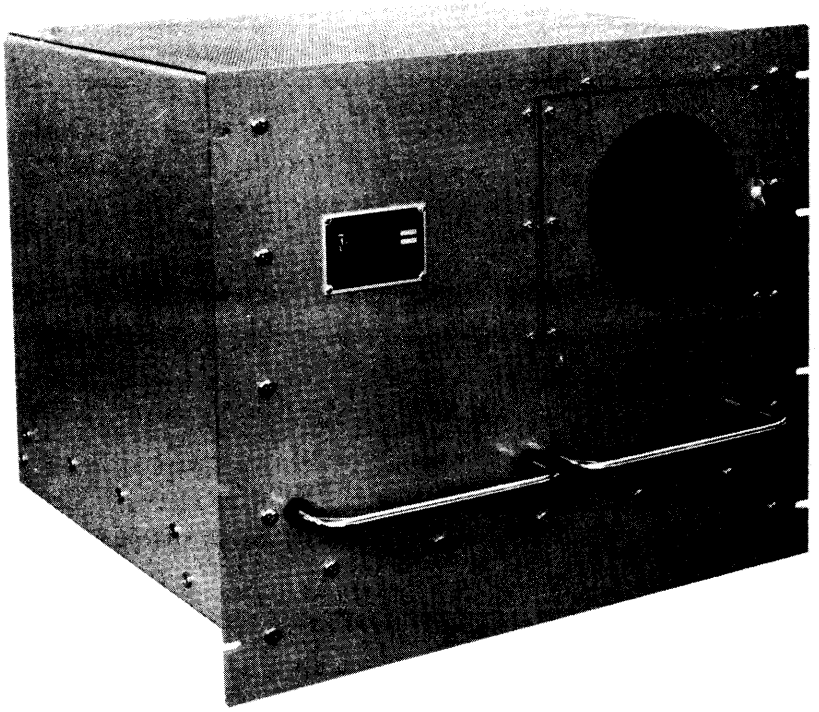


Figure 1-3a. Front Angle View, PS-5 High Voltage Power Supply

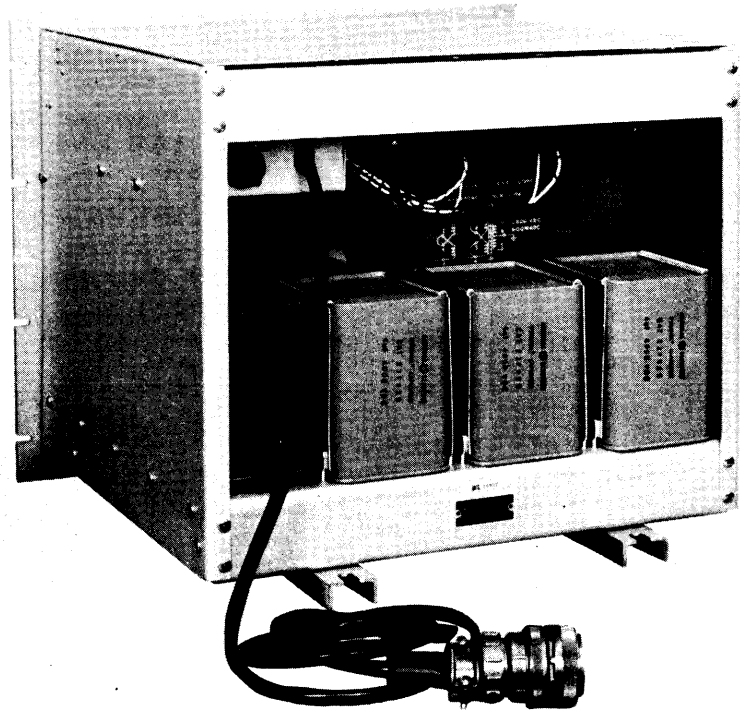


Figure 1-3b. Rear Angle View PS-5 High Voltage Power Supply

TABLE 1-1. ELECTRICAL CHARACTERISTICS, PAL-1K(A)

ITEM	CHARACTERISTICS
Frequency range:	2 to 32 mc continuous.
Output power:	At least 1000 watts PEP. 1000 watts CW and FS.
Input signal requirements:	100 milliwatts produces full output.
Primary power requirements:	115- or 230-volt single-phase 50- or 60-cycle AC, approximately 1900 watts.
Operating modes:	CW, MCW, AM, SSB, DSB, ISB, FSK.
Input connection:	Type UHF coaxial.
Output connection:	Type C coaxial.
Output impedance:	Panel controls output circuit to match any unbalanced load from 50. to 600-ohms at ±45 degrees.
Tuning:	All tuning and bandswitching controls are on front panel (no plug-in components).
Signal to distortion ratio:	Better than 40 db down relative to PEP output.
Harmonic suppression:	Second harmonic at least 40 db down 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.
Safety:	Full interlock protection. Full overload and fuse protection.
Cooling:	Built-in high capacity, filtered forced air cooling.
Temperature and Humidity:	Designed to operate in any ambient temperature between the limits of 0°C and 50°C for any value of humidity up to 90%.

TABLE 1-2. VACUUM TUBE COMPLEMENT, PAL-1K(A)

UNIT	SYMBOL	TYPE	FUNCTION
RFD-1A	V201	5763	1ST AMPLIFIER
	V202	6146	DRIVER
	V203	PL-172	POWER AMPLIFIER
PS-4A	V701	6X4	BIAS RECTIFIER
	V702	5R4GY	MID-VOLTAGE RECTIFIER
	V703	6336A	SERIES REGULATOR
	V704	6AU6	CONTROL AMPLIFIER
	V705	OA2	PA SCREEN REGULATOR
	V706	OB2	PA SCREEN REGULATOR
	V707	OA2	VOLTAGE REFERENCE
	V708	OB2	VOLTAGE REFERENCE
PS-5	V401	872A	RECTIFIER
	V402	872A	RECTIFIER

SECTION 2
INSTALLATION

2-1. INTRODUCTION.

Each PAL-1K(A) has been tested and calibrated before shipment. It is only necessary to unpack and install units and cables as outlined in the following paragraphs.

2-2. INITIAL INSPECTION.

The PAL-1K(A) is shipped in two crates. Crate #1 contains the PS-5 High Voltage Power Supply. Crate #2 contains the RFD-1A Amplifier, the PS-4A Low Voltage Power Supply and the loose items listed below.

Inspect each crate and its contents immediately for possible damage. Unpack the equipment carefully. Inspect the packing material for parts which may have been shipped as loose items. Although the carrier is liable for any damage in the equipment, Technical Materiel Corporation will assist in describing and providing for repair or replacement of damaged items. The equipment is shipped with all tubes and plug-in components installed. Check that all such components are properly seated in their sockets.

2-3. 115- VS. 230-VOLT LINE SUPPLY.

The PAL-1K(A) power supply circuitry is designed to work from a 115- or 230-volt, 50- or 60-cps single phase line: Unless specifically ordered for 230-volt operation, it is factory wired for 115-volts, 50- or 60-cps. If 230-volt, 50- or 60-cps, operation is required, minor changes may be made to the PS-4A and PS-5 Power Supplies as depicted in figure 2-1.

CAUTION

Do not change any fuse values; all fuses are independent of the primary source voltage.

2-4. INITIAL ADJUSTMENTS.

The PAL-1K(A) has been factory tested and adjusted. No initial adjustments of chassis mounted variable components are necessary before operation.

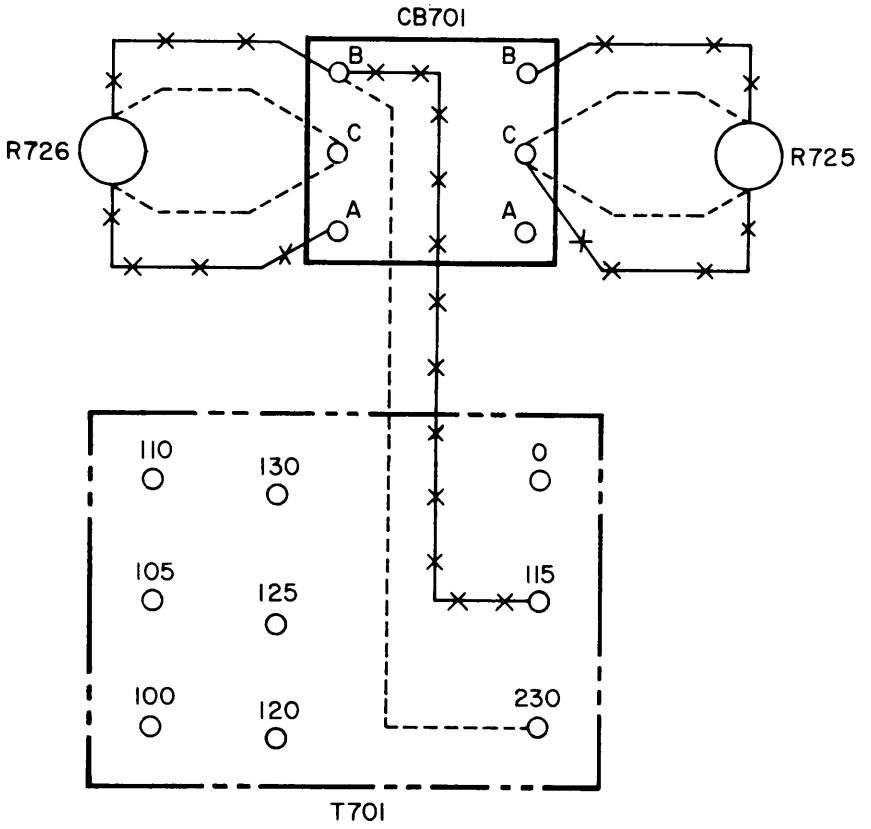
2-5. INSTALLATION PROCEDURE.

a. GENERAL. The PAL-1K(A) may be installed in any standard relay rack. For outline dimensions, see figure 2-2. All three units are provided with slides.

b. HEAT DISSIPATION. RFD-1A Amplifier and PS-5 High Voltage Power Supply are equipped with individual exhaust blowers. For good heat dissipation, mount RFD-1A Amplifier above the two power supplies in the rack with PS-5 below PS-4A. A vertical clearance of at least 13 inches in the area indicated in figure 2-2, should be left above the Amplifier. This will prevent back pressure at the exhaust outlet from impairing the cooling system. If the cooling air rate (cubic feet per minute) falls below a critical figure in the RFD-1A Amplifier across its PA tube, a safety interlock system shuts off the entire PAL-1K(A) system. If this should happen, during subsequent operation of the equipment, it may be due to restricted air movement through the rack and appropriate corrections should be made. Room air temperature should be kept below 50°C (122°F) for this cooling system to perform adequately.

LOOSE ITEMS IN CRATE NO. 2

QTY	TMC PART NO.	DESCRIPTION	FUNCTION
1	UG-646/U	Right Angle Adapter, Series UHF	Mates with J201 INPUT
1	PL-259	Plug, Series UHF	Mates with J201 INPUT
1	UG-59B/U	Plug, Series HN	Mates with J202 RF OUT
1	PL-134-NG	Plug, AC Power	Spare plug to mate with J703
2	IN-523	Technical Manual for PAL-1K(A)	
1		Tuning Chart	Guide figures to facilitate tuning PAL-1K(A)
1		Test Data	



LEGEND

—X—X—X— WIRE TO BE REMOVED

- - - - - - - - WIRE TO BE ADDED

Figure 2-1a. Modification for 230-V Line, PS-4A Low Voltage Power Supply

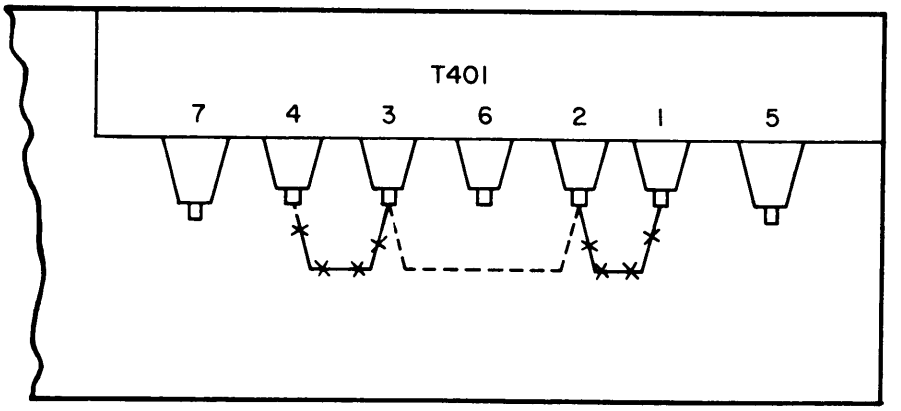
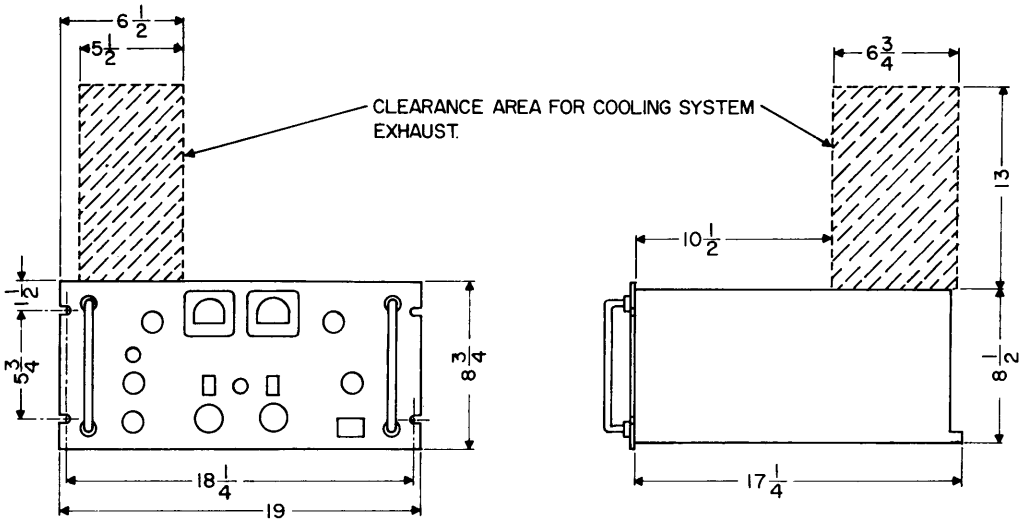
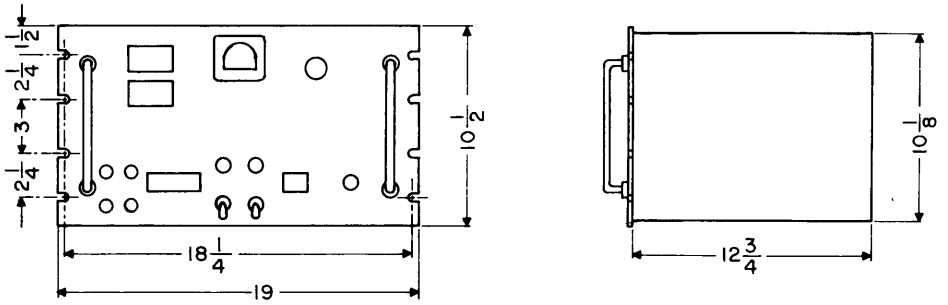


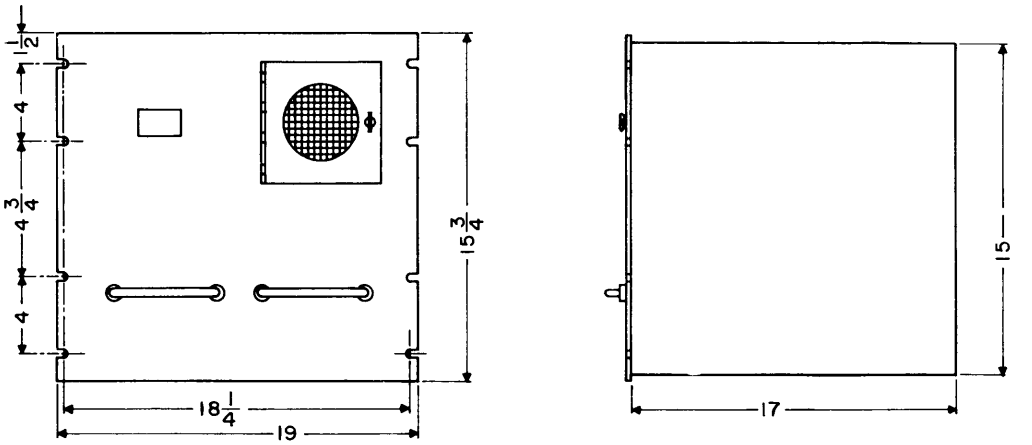
Figure 2-1b. Modification for 230-V Line, PS-5 High Voltage Power Supply



RFD-1A RF LINEAR AMPLIFIER



PS-4A LOW VOLTAGE POWER SUPPLY



PS-5 HIGH VOLTAGE POWER SUPPLY

Figure 2-2. Outline Dimensional Drawing, PAL-1K(A) System Units

c. INSTALLATION OF UNITS. When locations have been chosen for the three units in the rack, follow procedure outlined below for installing them.

(1) Install track portions of slides in rack.

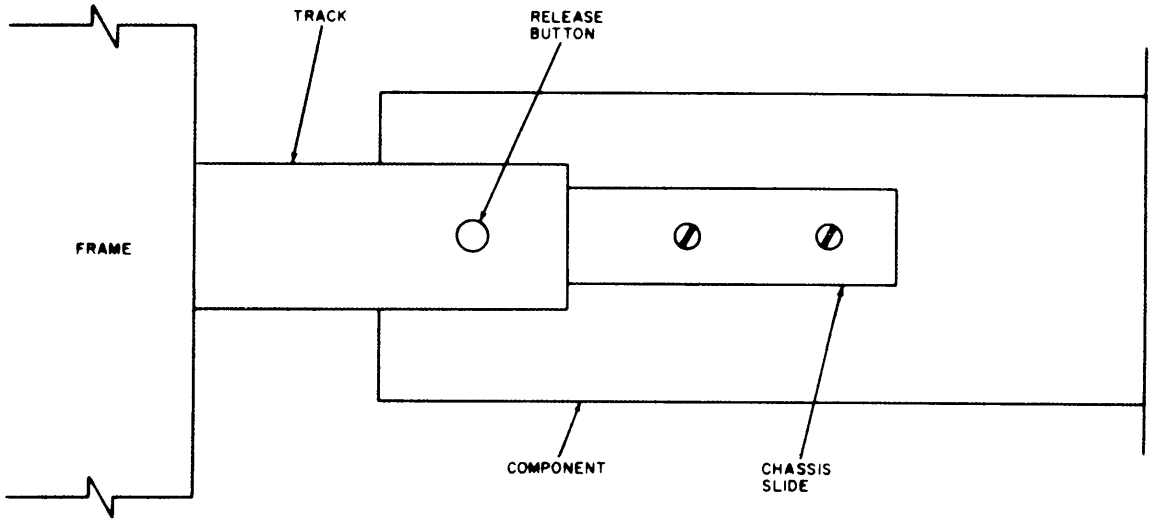
(2) Set the unit (with chassis slide attached) on the tracks as shown in figure 2-3.

(3) Slide the unit on the tracks until the release buttons catch.

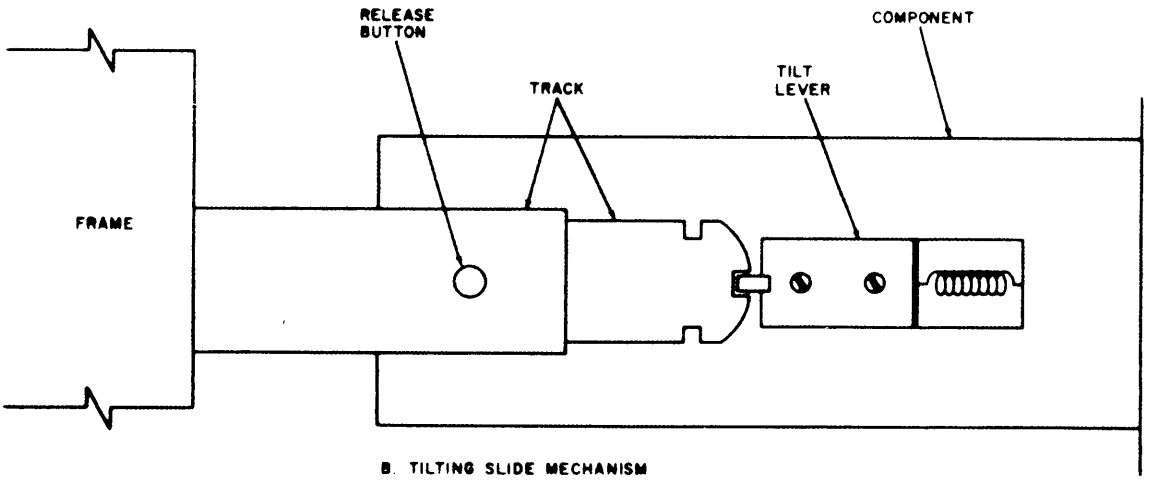
(4) Press the release buttons and push the unit into the rack until the release buttons engage the holes in the rack.

(5) Refer to figure 2-4 and paragraph 2-5d and make the necessary cable connections.

(6) When all units have been installed and cabled, press the release buttons and push the units into the rack. Care should be employed in positioning cables to prevent snagging or catching as units slide in and out of rack.



A. NON-TILTING SLIDE MECHANISM



B. TILTING SLIDE MECHANISM

Figure 2-3. Slide-mounting Details

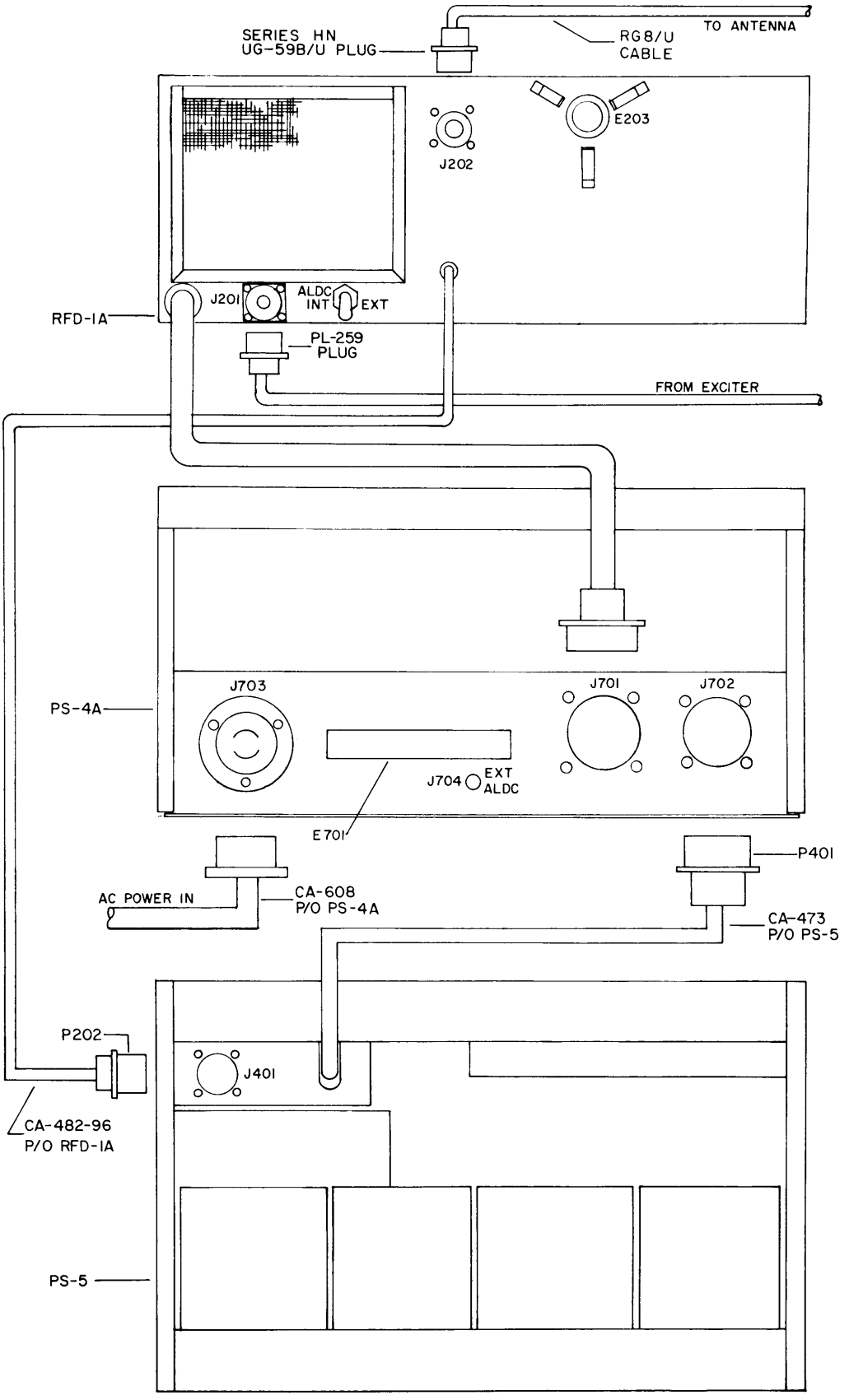


Figure 2-4. Pictorial Cabling Diagram, PAL-1K(A)

(7) Secure the front panels to the rack with screws.

d. INSTALLATION OF CABLES. Figure 2-4 is a pictorial cabling diagram for PAL-1K(A), for the standard arrangement of exciter input and antenna output.

CAUTION

Do not connect PAL-1K(A) to line voltage source in the process of installing cables. The prescribed "power-off" and "power on" procedure outlined in Section 3 (Operator's Section) should be followed, in order to prolong the PA tube's life.

PL-259 plug, supplied as a loose item, mates with J201; UG-646/U right angle adapter, in addition, may be used if required. Manufacture exciter input cable using PL-259 plug and RG-59/U coaxial cable. UG-59B/U plug, supplied as a loose item, mates with J202. Manufacture antenna output cable using this plug and RG-8/U coaxial cable for any unbalanced 50- through 600-ohm antenna load. Keep coaxial cables as short as possible for best performance.

e. AUXILIARY EXTERNAL CONNECTIONS, PAL-1K(A).

(1) GENERAL. Figure 2-5 is a diagram showing connections possible for wiring the PAL-1K(A) system into another system. All such external connections

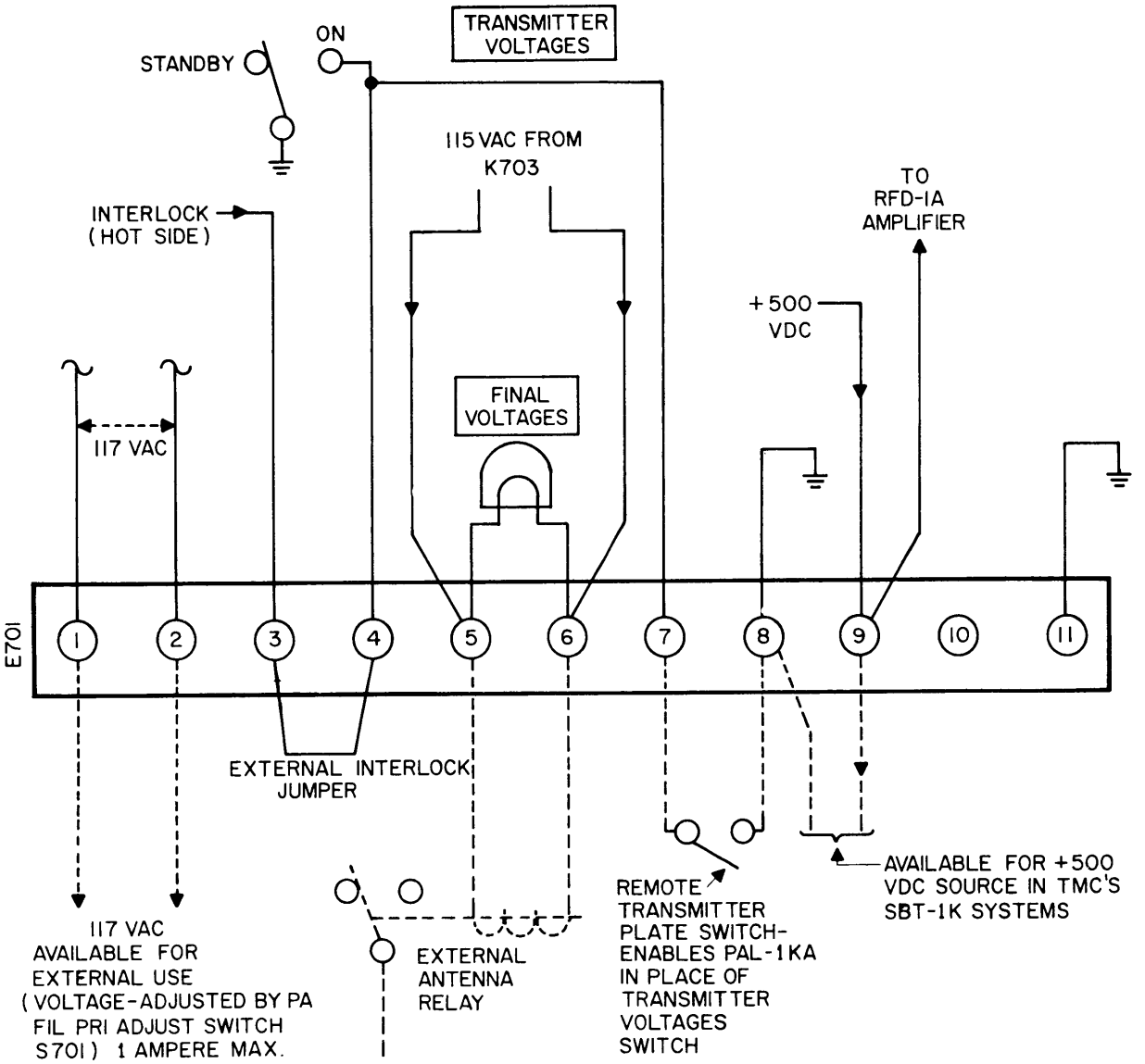


Figure 2-5. Auxiliary External Connections, PAL-1K(A)

are made at terminal board E701 on PS-4A Low Voltage Power Supply.

(2) AUXILIARY 115 VAC OUTPUT. The 115 VAC selected by PA FIL PRI ADJUST and applied to the primary of filament transformer T702, is also available at terminals 1 and 2 of E701. Any additional loads across this source, however, should be limited to draw a maximum current of 1 ampere.

(3) ADDITION SAFETY INTERLOCKS. If it is desired to have additional link or links into the safety interlock circuit (described in paragraph 4-5a), the jumper at terminals 3 and 4 may be removed and the links added here.

(4) EXTERNAL ANTENNA RELAY. As described in paragraph 4-3b, the a-c input section of PS-4A delivers 115 VAC to energize the PS-5 High Voltage Power Supply through a time delay system. This 115 VAC is also routed over to terminals 5 and 6 of E701. In some of TMC's transmitter systems, in which PAL-1K(A) is used, this 115 VAC is picked off terminals 5 and 6 of E701 to supply a sequential relay system controlling the antenna. This system switches the antenna into appropriate circuits so as to function as a transmitting antenna or receiving antenna.

(5) REMOTE CONTROL. If desired, an external push-to-talk switch may be installed to control on-off operation of PAL-1K(A) Amplifier, in lieu of the TRANSMITTER VOLTAGES-ON/STANDBY switch on the PS-4A unit. Such a switch is installed across terminals 7 and 8 of E701.

(6) AUXILIARY +500 VDC OUTPUT. Additional +500 VDC plate voltage is available from PS-4A across terminals 8 and 9 for use in TMC's SBT-1K transmitter systems.

(7) EXTRA TERMINALS. Terminal 10 on E701 is not used; terminal 11 serves as an extra ground point.

(8) EXTERNAL ALDC. If it is elected to use ALDC to control an external exciter output level instead of PAL-1K(A) first amplifier output, the ALDC signal may be routed to the exciter via J704 EXT ALDC jack. Use a series BNC connector to mate with J704 and an RG-55/U or RG-58/U coaxial cable. When using this arrangement, the EXT ALDC switch on the rear of the RFD-1A unit should be switched to EXT position.

SECTION 3
OPERATOR'S SECTION

3-1. PRELIMINARY CONSIDERATIONS.

Before proceeding to tune and operate PAL-1K(A), make sure that no line-voltage is connected. A brief visual check then should be made to ascertain that top and bottom covers are installed on RFD-1A Amplifier, and that the top cover and blower door on PS-5 High Voltage Power Supply is secured. If any of the conditions are not met, PAL-1K(A) will not operate, due to a safety interlock system, to protect the operator from shock.

WARNING

Extremely dangerous voltages exist in all units of the PAL-1K(A). Do not attempt to bypass or override the safety interlock system, described in table 4-1, in order to inspect the unit interiors, once line voltage has been applied.

Before connecting line-voltage to PAL-1K(A), follow procedures for preliminary power-off and power-on adjustments as outlined in paragraphs 3-3 and 3-4.

After tuning and operating PAL-1K(A) in accordance with paragraphs 3-5 and 3-6, paragraph 3-7 should be followed for shutdown procedure.

3-2. DESCRIPTION OF CONTROLS.

Figure 3-1 shows PAL-1K(A) panel controls and includes number designations for reference in the text of this manual. Table 3-1 describes the function of each control and a cross-reference to component designations appearing in figures 8-1 and 8-2.

3-3. PRELIMINARY POWER-OFF ADJUSTMENTS.

Place the following controls in the positions indicated before applying a-c power to the PAL-1K(A).

ASSOCIATED EXCITER

Control	Position
POWER ON/OFF	ON
OUTPUT LEVEL	OFF or MINIMUM

(Permit the exciter to warm up for the proper length of time before applying power to the PAL-1K(A).)

NOTE

All frequency determining elements of the exciter units should be given their proper warm-up times before attempting to transmit. Single sideband suppressed carrier transmission requires a high degree of frequency stability for maximum effectiveness, and a 24-hour warm-up period is recommended.

PS-4A

CONTROL	Fig. 3-1 No.	POSITION
PA FIL PRI ADJUST (knob)	16	Position 4 from fully counter-clockwise
FINAL VOLTAGES (switch)	25	OFF
TRANSMITTER VOLTAGES (switch)	27	STANDBY
PA OVERLOAD PLATE (circuit breaker)	21	OFF (down)
PA OVERLOAD SCRN GRID (circuit breaker)	22	OFF (down)
PA OVERLOAD CONTR GRID (circuit breaker)	23	OFF (down)
MAIN POWER (circuit breaker)	28	OFF (down)

3-4. PRELIMINARY POWER-ON ADJUSTMENTS.

a. Tune the associated exciter for the desired output frequency. Return output level to zero.

b. Connect line-voltage to PAL-1K(A) system.

c. Set MAIN POWER circuit breaker (28) to ON position (down); MAIN POWER light (29) should go on. If not, check to see that the previous steps have been performed properly.

d. Check the PA FIL PRI meter (15.) for a reading of 115 volts. Use PA FIL PRI ADJUST 7-position switch (16) to obtain a reading closest to 115 volts.

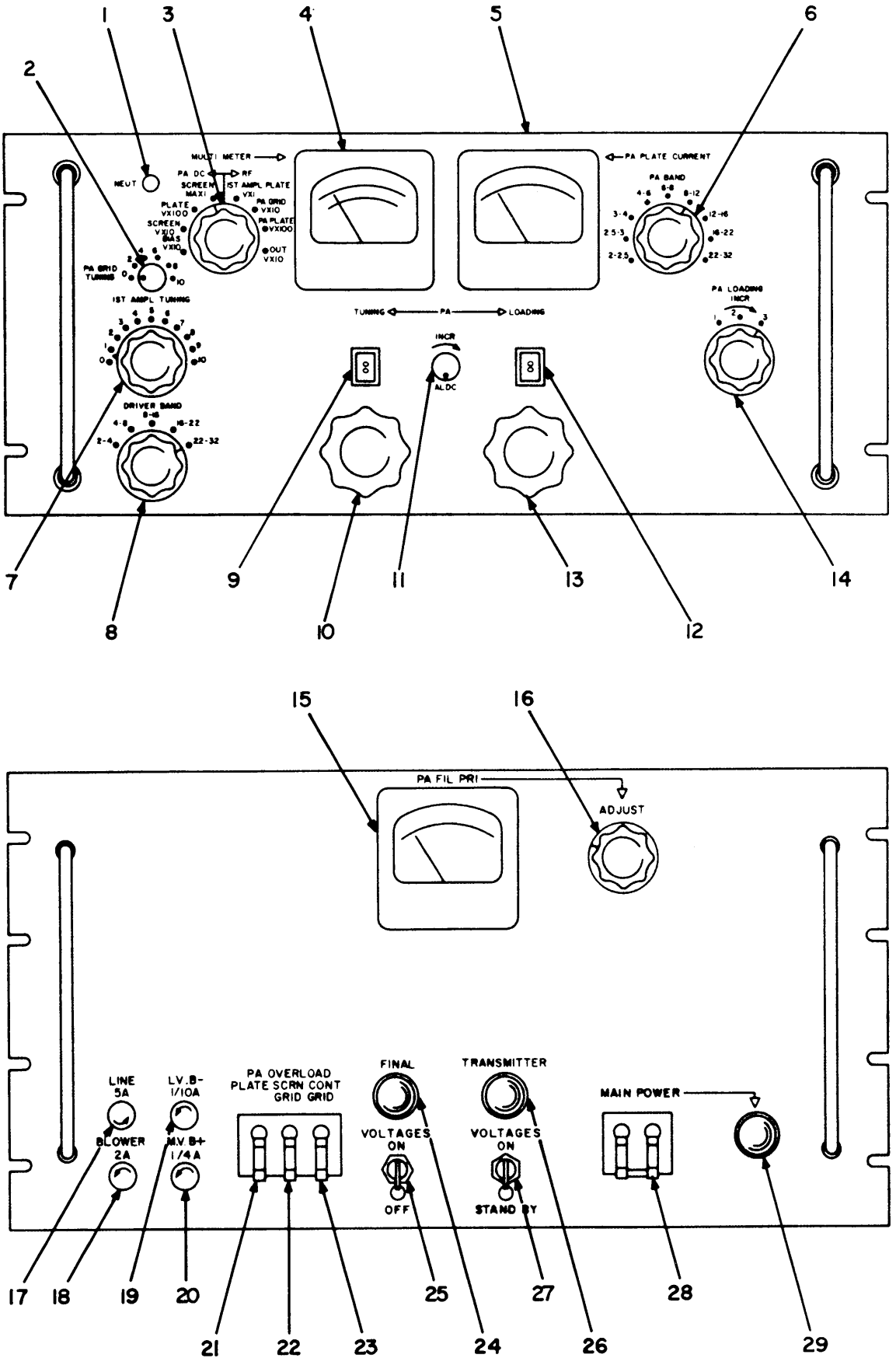


Figure 3-1. Panel Controls, PAL-1K(A)

TABLE 3-1. PANEL CONTROL FUNCTIONS, PAL-1K(A)

CONTROL NUMBER (Fig. 3-1)	COMPONENT DESIGNATION No.	COMPONENT DESIGNATION in Fig.	PANEL MARKING	FUNCTION
1	C255	8-1	NEUT	Modifies spurious feedback from PA.
2	C231	8-1	PA GRID TUNING	Fine-tunes PA stage input (or driver stage output).
3	S204	8-1	MULTIMETER (switch)	Selects circuits for measurement by M202 multimeter.
4	M202	8-1	MULTIMETER (meter)	Measures circuit selected by S204 switch.
5	M201	8-1	PA PLATE CURRENT (meter)	Monitors PA plate d-c current.
6	S202	8-1	PA BAND	Coarse - Tunes PA output
7	C203 C232	8-1	1ST AMPL TUNING	Fine - Tunes 1ST amplifier stage output.
8	S201	8-1	DRIVER BAND	Simultaneously coarse-tunes driver stage input and output
9	Mechanically linked with C254	8-1	PA TUNING (dial)	Provides calibrated position readings for C254 knob movement.
10	C254	8-1	PA TUNING (knob)	Fine-tunes PA output to match antenna.
11	R201	8-1	ALDC	Adjusts ALDC operating level.
12	Mechanically linked with C269	8-1	PA LOADING (dial)	Provides calibrated position readings for C269 knob movement.
13	C269	8-1	PA LOADING (knob)	Fine adjust for antenna impedance matching.
14	S203	8-1	PA LOADING (switch)	Coarse-adjust for antenna impedance matching.
15	M701	8-2	PA FIL PRI (meter)	Indicates voltage applied to primary of transformer supplying filament voltages to RFD-1A unit
16	S701	8-2	PA FIL PRI/ ADJUST (knob)	7-position switch. Adjusts voltage across primary of transformer supplying filament voltages to RFD-1A unit.
17	F701	8-2	LINE 5A	Fuse for mid-voltage, filament and bias supply transformer primary current
18	F703	8-2	BLOWER 2A	RFD-1A blower 115 VAC supply fuse.

TABLE 3-1. PANEL CONTROL FUNCTIONS, PAL-1K(A) (C nt.)

CONTROL NUMBER (Fig. 3-1)	COMPONENT DESIGNATION No.	COMPONENT DESIGNATION in Fig.	PANEL MARKING	FUNCTION
19	F702	8-2	L.V.B. - 1/10A	Fuse for bias supply to amplifier and interlock system.
20	F704	8-2	M.V.B. + 1/4A	Fuse for mid-voltage plate supply to RFD-1A.
21	CB704	8-2	PA OVERLOAD/ PLATE	Circuit breaker for PA output current.
22	CB703	8-2	PA OVERLOAD/ SCREEN GRID	Circuit breaker for PA screen grid current.
23	CB702	8-2	PA OVERLOAD/ CONT GRID	Circuit breaker for PA control grid current.
24	I703	8-2	FINAL VOLT-AGES (light)	Light indicates PS-5 High Voltage Power Supply is receiving energizing power from PS-4A Low Voltage Power Supply.
25	S703	8-2	FINAL VOLT-AGES ON/OFF (switch)	ON position of switch supplies high PA plate and screen grid voltages to RFD-1A.
26	I702	8-2	TRANSMITTER VOLTAGES (light)	Light indicates that RFD-1A Amplifier is receiving mid-voltage plate supply.
27	S702	8-2	TRANSMITTER VOLTAGES ON/ STANDBY (switch)	ON position of switch feeds mid-voltage plate supply to RFD-1A Amplifier; STANDBY position cuts off supply.
28	CB701	8-2	MAIN POWER (circuit breaker -left)	Dual circuit breaker for PAL-1K(A) system main line current supply, companion trip type.
29			MAIN POWER (light)	Light indicates that PS-4A is receiving main line supply.

e. Set PA OVERLOAD PLATE, SCRN GRID, and CONT GRID circuit breakers (21, 22 and 23) to ON positions (down).

f. Select the frequency range to be used by turning DRIVER BAND and PA BAND switches (8 and 6) to position of selected frequency.

3-5. PAL-1K(A) TUNING PROCEDURE.

Tune PAL-1K(A) as outlined in table 3-2.

The tuning chart referred to in the table is the tuning chart that is packed with each PAL-1K(A) shipment. Tuning charts will vary for each PAL-1K(A) (see figure 3-2 for sample chart). Control settings and meter readings on the chart are obtained with the PAL-1K(A) attached to a 50-ohm dummy load. The "Two Tone Test" settings and readings are intended to be used as a guide for best distortions-free output when transmitting a modulated signal. Reference to "SBE" is the associated TMC equipment used for PAL-1K(A) input signals. "1PA" is equivalent to "PA" markings on PAL-1K(A) panels. Figures in 1KW S/D DB column represent resulting distortion level below PEP at 1KW output in decibels. "Load Current" is current in amperes on ammeter connected in series with dummy load. In "CW Test" column, load, screen and plate currents represent normal readings to be expected when transmitting CW. Slightly different settings and readings may be obtained when equipment is in actual use, depending on location, antenna, associated equipment and environmental conditions. For maximum linearity and power output, a new tuning chart with settings for these conditions, should be followed. Such a chart can be made by observing operation of PAL-1K(A) under actual field usage.

TABLE 3-2. PAL-1K(A) TUNING PROCEDURE

Step	CONTROL NUMBER (See Fig. 3-1)	OPERATION	PURPOSE
1	11	Set ALDC/INCR knob (11) in the extreme counterclockwise position.	Sets level of ALDC (Automatic Load and Drive Control) at its maximum voltage position.
2	3 4	Set MULTIMETER switch (3) to PA DC BIAS V x 10 and observe MULTIMETER (4). Indication should be around 100 on red scale.	Checks bias supply to PA. Nominal value is -100 VDC.
3	27 26	Set TRANSMITTER VOLTAGES switch (27) to ON. TRANSMITTER VOLTAGES lamp (26) should light, if about 3 minutes have elapsed since MAIN POWER circuit breaker was switched ON.	Furnishes RFD-1A Amplifier with low plate voltages.
4	25 24	Set FINAL VOLTAGES switch (25) to ON. FINAL VOLTAGES lamp (24) should light.	Furnishes RFD-1A Amplifier with high plate and screen voltages.
5	3 4	Set MULTIMETER switch (3) to SCREEN V x 10 and observe MULTIMETER (4). Indication should be 500 on green scale.	Checks PA screen grid d-c supply. Nominal value is +500 VDC.
6	3 4	Set MULTIMETER switch (3) to PA DC PLATE V x 100 and observe MULTIMETER (4). Indication should be about 3000 on black scale.	Checks PA d-c plate supply. Nominal value is +3000 VDC.
7	5	Observe PA PLATE CURRENT meter (5). Indication should be around 220 milliamperes.	Checks "idling" value of PA plate d-c current (with no signal). Nominal value is 220 milliamperes.
8	25 24	Set FINAL VOLTAGES switch (25) to OFF. FINAL VOLTAGES lamp (24) should go out.	Shuts off high plate and screen voltages to RFD-1A Amplifier in preparation for first tuning phase.
9	3	Set MULTIMETER switch (3) to RF 1ST AMPL PLATE V x 1. Turn up output level on exciter to obtain 10 on MULTIMETER black scale. Adjust 1 st AMPL TUNING for peak on MULTIMETER.	Fine-tunes 1ST amplifier stage.
10	3 2 4	Set MULTIMETER switch (3) to RF PA GRID V x 10. Adjust output level on exciter to obtain 7 on MULTIMETER red scale. Adjust PA GRID TUNING knob (2) for peak on MULTIMETER (4).	Fine-tunes PA stage input.

TABLE 3-2. PAL-1K(A) TUNING PROCEDURE (Cont.)

STEP	CONTROL NUMBER (See Fig. 3-1)	OPERATION	PURPOSE
11		Turn down output level control on exciter to minimum output position.	Turns down exciter input in preparation for PAL-1K(A) output tuning and loading adjustments.
12	10 9	Set PA TUNING knob (10) to bring reading on PA TUNING dial (9) as shown in the tuning chart supplied with PAL-1K(A).	Coarse-tunes PA output and antenna.
13	14	Set PA LOADING switch (14) to position shown in the tuning chart supplied with PAL-1K(A).	Coarse-adjustment for antenna impedance match.
14	13 12	Set PA LOADING knob (13) to bring reading on PA LOADING dial (12) as shown in the tuning chart supplied with the PAL-1K(A).	Further adjustment for antenna impedance match.
15	25 24	Set FINAL VOLTAGES switch (25) to ON. FINAL VOLTAGES lamp (24) should light.	Furnishes RFD-1A Amplifier with high plate and screen voltages.
16	3	Set MULTIMETER switch (3) to RF OUT V x 10	Connects MULTIMETER (4) to indicate r-f voltage at PAL-1K(A) output for monitoring during final tuning.
17	5	Slowly increase exciter output until PA PLATE CURRENT meter (5) reads: Modulated Signal: 300 ma Unmodulated Signal: 220 ma Note reading on MULTIMETER (4).	Increases exciter output to suitable level for the beginning of final tuning.
18	10 5	Adjust PA TUNING knob (10) until a pronounced dip is produced on PA PLATE CURRENT meter (5).	First step in fine-tuning PA output circuit and antenna.
19	13 5	Adjust PA LOADING knob (13) until the reading on PA PLATE CURRENT meter (5) begins to rise.	First fine-adjustment for matching PAL-1K(A) output circuit with antenna load.
20	5 4	Decrease setting on exciter output control until reading on PA PLATE CURRENT meter (5) is the same as that in step 17. Reading on MULTIMETER (4) should rise slightly from that in step 17.	Backs off input from exciter as finer tuning progresses in order to prevent overloading of PA tube.
21	10 13 5	Repeat steps 18 through 20, observing PA PLATE CURRENT meter (5) and MULTIMETER (4). After each step 18	Fine-tunes PA output circuit to match antenna in steps to prevent over-

TABLE 3-2. PAL-1K(A) TUNING PROCEDURE (Cont.)

STEP	CONTROL NUMBER (See Fig. 3-1)	OPERATION	PURPOSE
21 (Cont)	4	and 19, decrease exciter output to bring PA PLATE CURRENT meter (5) reading back to the reading in step 17 (as in step 20). Upon each step 20 adjustment, MULTIMETER (4) reading will continue to increase. When point is reached where MULTIMETER (4) reading starts to fall (in step 20 adjustment) readjust controls back to previous step, as this is the step where ultimate tuning has been reached. ** ***	loading of PA tube.
22		Slowly increase exciter output level control, until desired power output is reached. * ** ***	To obtain desired power output.
23	11	Turn ALDC knob (11) slowly clockwise until MULTIMETER (4) reading begins to drop off.	Takes up slack in ALDC control.
24	11	If transmitting voice, turn ALDC knob (11) as far clockwise as possible without introducing obvious distortion. It is suggested that this adjustment be made with a remote station monitoring the quality of transmission.	

*NOTE

Output power is increased as RF OUT reading is increased (as indicated on MULTIMETER). PA PLATE CURRENT meter reading will also increase; it will indicate around 400 to 450 milliamperes when 1 kilowatt of output power is reached. However, actual output power at the antenna, in a transmitting system, depends on antenna load and degree of impedance match between PAL-1K(A) and antenna. A reading of the power output from the antenna can be obtained by multiplying the RF OUT reading on PAL-1K(A)'s MULTIMETER by the ampere reading on an ammeter connected in series with the antenna. For more accuracy, an SWR (Standing Wave Ratio) indicator, such as TMC's model SWR-1K, is usually employed to indicate the resistance presented by the antenna. This resistance, together with the RF OUT voltage read in PAL-1K(A)'s MULTIMETER can be used to calculate output watts.

**NOTE

In final adjustments, an occasional check should be made on PA screen grid current, by turning MULTIMETER switch (3) to PA DC SCREEN MAX I position and observing MULTIMETER (4) black scale. With a resistive load, it is usually under 35 to 40 ma. At no time should it exceed full scale.

***CAUTION

If PAL-1K(A) turns off automatically as a result of a PA overload (indicated by circuit breakers and TRANSMITTER VOLTAGES and FINAL VOLTAGES lights on PS-4A unit), reduce exciter output level before re-setting the associated circuit breakers.

SBE			TWO TONE TEST									CW TEST		
FREQ MCS	SBE BAND	VOX	IPA BAND	DRIVER BAND	IST AMP TUNING	IPA GRID TUNING	IPA TUNING	IPA LOADING	IPA LOAD POS	IPA PLATE CURRENT	LOAD CURRENT	IKW S/D DB	LOAD CURRENT	SCREEN CURRENT	PLATE CURRENT
2	2-4	2500	2-25	2-4	.5	1	022	019	2	370	3.1	45	4.45	46	550
3	2-4	3500	2.5-3	2-4	5	7	065	064	3	400	3.1	45	4.45	45	550
4	2-4	2250	3-4	2-4	9	9	082	108	3	360	3.1	45	4.45	45	520
4	4-8	2250	4-6	4-8	.5	1	077	071	2	360	3.1	45	4.45	45	550
6	4-8	3250	4-6	4-8	5	7	102	090	3	360	3.1	47	4.45	42	550
6	4-8	3250	6-8	4-8	5	7	080	057	2	400	3.1	49	4.45	45	550
8	4-8	2125	6-8	4-8	9	9	094	051	3	380	3.1	48	4.45	43	520
8	4-8	2125	8-12	8-16	.5	1	082	107	2	400	3.1	48	4.45	45	550
12	8-16	3125	8-12	8-16	5	7	108	069	3	360	3.1	45	4.45	41	510
12	8-16	3125	12-16	8-16	5	7	092	031	3	370	3.1	45	4.45	42	500
16	8-16	2062.5	12-16	8-16	9	10	169	073	3	320	3.1	40	4.45	38	500
16	16-32	2062.5	16-22	16-22	4.5	5	089	022	3	400	3.1	40	4.45	42	550
22	16-32	2812.5	16-22	16-22	7	7	114	087	3	400	3.1	40	4.45	42	530
22	16-32	2812.5	22-32	22-32	3.5	2	088	019	2	400	3.1	40	4.45	40	500
32	16-32	2031	22-32	22-32	9	9	115	104	3	390	3.1	35	4.45	43	520

SAMPLE

TEST CONDITIONS :

50Ω UNBAL

REMARKS :
ALDC OK
PLATE
OVERLOAD
SET AT
600 MA

DATE : _____
MFGR No. _____
SERIAL No. _____
TESTED BY _____
APPROVED BY _____

MODEL PAL-1K

THE TECHNICAL MATERIEL CORP.
MAMARONECK NEW YORK

CH-186

TMC FORM NO. 166

Figure 3-2. Sample Tuning Chart, PAL-1K(A)

3-6. PAL-1K(A) OPERATION.

PAL-1K(A) transmits while TRANSMITTER VOLTAGES switch is ON. Or it may be operated remotely through the external interlock connection described in paragraph 2-5e(3).

3-7. SHUTDOWN PROCEDURE.

a. GENERAL. The PAL-1K(A) may be placed in standby or completely turned off. Standby is recommended when using PAL-1K(A) in a system where frequency stability is critical.

b. STANDBY. To place PAL-1K(A) in standby operation, set switches as shown below:

Switch	Control Number	Position
FINAL VOLTAGES	25	OFF
TRANSMITTER VOLTAGES	27	STANDBY

c. NORMAL STOPPING. The normal stopping procedure for PAL-1K(A) is accomplished in steps as follows:

Step	Switch	Control Number	Position
1	FINAL VOLTAGES	25	OFF
2	TRANSMITTER VOLTAGES	27	STANDBY

CAUTION

Wait at least 5 minutes before proceeding to step 3. This delay will gradually cool the PA tube (PL-172) and prolong its life.

3	MAIN POWER	28	OFF

d. EMERGENCY STOPPING. To turn off the PAL-1K(A) in an emergency, set MAIN POWER circuit breaker (28) to OFF.

3-8. OPERATOR'S MAINTENANCE.

The operator should note general condition of panel switches, fuses and circuit breakers, and observe whether panel indicator lamps light properly. In general, the operator's maintenance should be restricted to replacement of such units accessible only from the front of the control panel (i.e.: lamp bulbs and fuses), due to the dangerous voltages existing within the units.

SECTION 4
PRINCIPLES OF OPERATION

4-1. INTRODUCTION.

The PAL-1K(A) consists of RFD-1A Amplifier, PS-4A Low Voltage Power Supply and PS-5 High Voltage Power Supply. An external exciter modulated by audio or keyed by a telegraph key provides r-f excitation for RFD-1A. RFD-1A amplifies the 100-mw signals and supplies a 1-kw output to the transmitting antenna. PS-4A provides bias, medium plate and screen voltages to the RFD-1A; PS-5 provides high plate voltage.

4-2. RF AMPLIFIER, RFD-1A.

a. GENERAL (See figure 4-1). Figure 4-1 is a functional block diagram of RFD-1A. A 100-milliwatt, 2-32 mc signal from an external exciter is amplified up to a 1000-watt level by V201, V202 and V203. A DRIVER BAND switch inserts two tuned circuits of the proper frequency range in the input and output of V202. A PA BAND selector switch and tuned circuit serve to match RFD-1A output impedance with antenna impedance.

ALDC (Automatic Load and Drive Control) is accomplished by a feedback from V203 to V201, when S209 is in INT. position. An increase in V203 output beyond a safe point cuts down V201 output. With S209 in EXT position, V203 feedback may be routed to one of the amplifier stages in the external exciter for ALDC, if preferred.

Power supply, metering, safety interlock and PA overload circuits are not depicted in figure 4-1 for simplicity. They are described, however, in following paragraphs.

The complete RFD-1A schematic wiring is shown in figure 8-1. Paragraphs 4-2b through 4-2f with accompanying figures 4-2 through 4-5 give a brief description of circuit action. In figures 4-2 through 4-5, heavy lines indicate path of signal. The function of each individual component may be found in Section 7 (Parts List).

b. RF AMPLIFIER STAGE V201 AND ASSOCIATED CIRCUITS (See figure 4-2).

(1) Amplification and Tuning. External exciter input is amplified at V201 (Class A) and proceeds, via a tuned circuit, to the control grid of V202. The tuned circuit consists of C202, C203 and a tapped inductor selected by S201 DRIVER BAND switch. Fine-tuning is accomplished by adjustment of 1ST AMPL TUNING capacitor C203.

(2) ALDC. Negative ALDC feedback from V203 (see paragraph 4-2d) is supplied to the grid return circuit through L242.

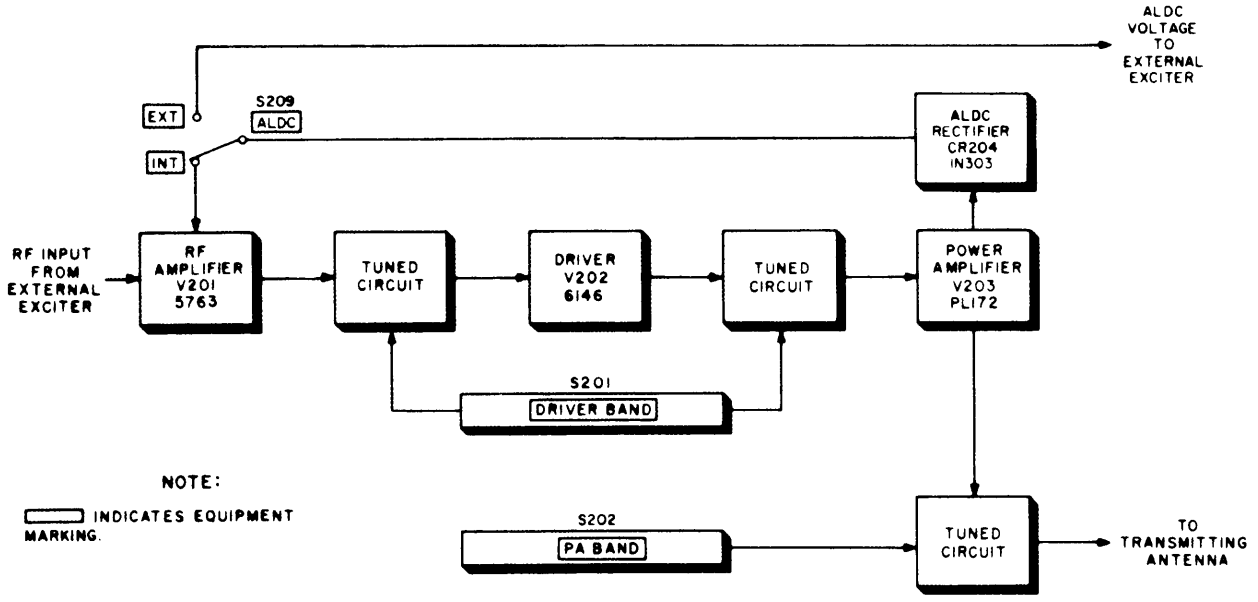


Figure 4-1. Functional Block Diagram, RFD-1A Amplifier

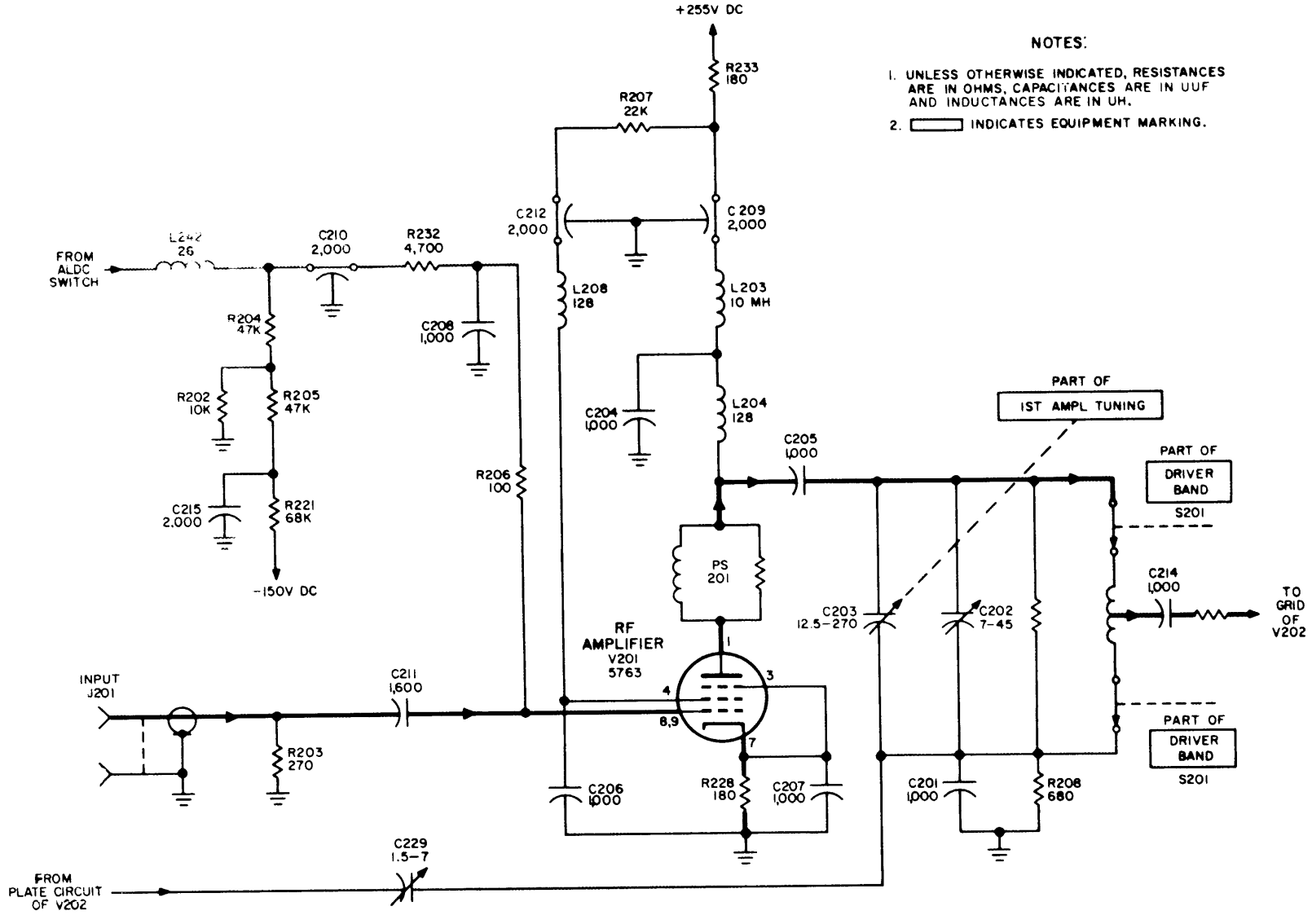


Figure 4-2. Simplified Schematic Diagram, V201 RF Amplifier, RFD-1A

c. DRIVER STAGE, V202 AND ASSOCIATED CIRCUITS (See figure 4-3).

(1) AMPLIFICATION AND TUNING. V201 tuned output is amplified at V202 (Class A) driver and proceeds, via a tuned circuit, to the control grid of V203 power amplifier. The tuned circuit consists of C231, C232 and a tapped inductor selected by S201 DRIVER BAND switch. Fine-tuning is accomplished by adjustment of C232, part of 1ST AMPL TUNING control.

(2) NEUTRALIZATION. Neutralizing voltage is developed from V202 plate voltage routed through neutralizing capacitor C229, developing voltage across C201 and R208 and applied to V202 grid via tap on tuned circuit inductance.

(3) METER SIGNALS. Samples representing V201 r-f plate voltage and V203 r-f grid voltage are routed through C216 and L227, respectively, to the meter circuit (paragraph 4-2e.).

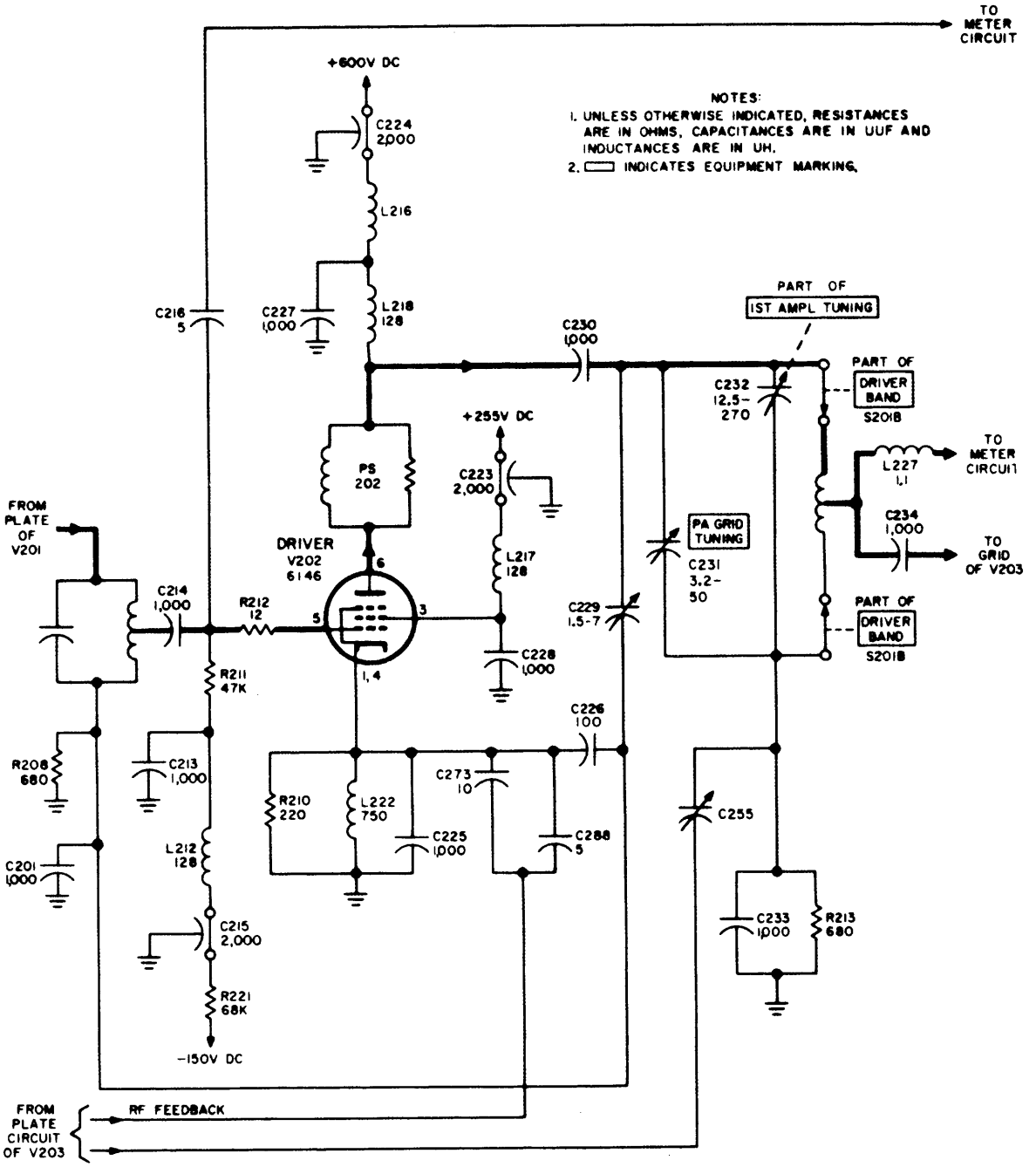


Figure 4-3. Simplified Schematic Diagram, V202 Driver, RFD-1A

(4) V203 FEEDBACK. An r-f feedback from the plate of V203 is applied to V202 cathode through capacitors C273 and C288. This feedback decreases third order distortion by another -10 db.

d. PA STAGE, V203 AND ASSOCIATED CIRCUITS (See figure 4-4).

(1) AMPLIFICATION. V202 tuned output is amplified at V203 (Class AB) power amplifier and proceeds, via PA TUNING, BAND, and LOADING control circuits to J202 r-f output jack and auxiliary output terminal E203.

(2) PA TUNING AND LOADING. The output tuning and loading circuit consists of tapped portions of L245 and L246 selected by S202 PA BAND switch, C254 PA TUNING capacitor, C269 PA LOADING capacitor, and combinations of C244, C272 and C274 selected by S203 PA LOADING switch. Referring to figure 8-1, it will be seen that S202 PA BAND switch has nine frequency band positions for tuning PA output and S203 PA LOADING switch has 3 positions for load conditions.

(3) NEUTRALIZATION. Neutralizing voltage is developed from V203 plate voltage routed through neutralizing capacitor C255, developing voltage across C233 and R213 and applied to V203 grid via tap on tuned circuit inductance.

(4) METER SIGNALS. Samples representing V203 control grid and screen grid d-c voltages are routed to the meter circuit via L247 and L231 respectively. R222 is a meter shunt resistor for measuring V203 screen grid d-c current as described in paragraph 4-2e. A sample representing V203 r-f plate voltage is routed to the meter circuit via C270 capacitor.

(5) ALDC. The r-f output of V203 is rectified and applied as a d-c signal to ALDC switch S209 via capacitors C257 and C252, diode CR204 and inductor L240. The r-f voltage is rectified by CR204, with a negative d-c voltage developed across C265 and filtered by L240 and C263. Referring to figure 8-1, ALDC d-c bias voltage is received from pin d of P201 and developed across resistors R233, R227, ALDC control R201, and resistor R226. A portion of this bias voltage is tapped off ALDC control R201 and applied through inductors L239 and L238 to the junction of CR204 and capacitor C252. Referring to figure 4-4, the negative voltage appearing across C265 is then a result of two sources, one from V203 output and the other from ALDC d-c bias. When S209 is in INT position, the combined negative d-c is sent to V201 control grid. When V203 output voltage extends beyond a certain amplitude, V201 negative grid bias, increases, decreasing V201 output voltage. When S209 is in EXT position, the combined negative d-c is sent to pin b of P201 plug from which point it may be cabled to the external exciter, if preferred.

e. METER CIRCUIT (See figure 4-5). Meter M202 is capable of measuring various voltages or currents as determined by settings of S204 switch. Table 4-1 describes measurements vs. switch positions.

Meter M201 continually monitors V203 d-c plate current. The negative return from PS-5 High Voltage Power Supply is connected to the negative terminal of M201 via pin H of P201.

f. INTER-UNIT CIRCUITS. Safety interlock, filament supply, and power amplifier overload circuits involve the functioning of RFD-1A, PS-4A and PS-5 units together and are described in paragraph 4-5.

4-3. LOW VOLTAGE POWER SUPPLY, PS-4A.

(See figures 4-6 through 4-9.)

a. GENERAL (See figure 4-6). PS-4A consists of a bias power supply, an a-c input section, and a mid-voltage power supply. The bias and mid-voltage power supplies generate the operating voltages for RFD-1A Amplifier. The a-c input section distributes a-c voltage to the two power supplies and to the PS-5 High Voltage Power Supply unit through time delay and control circuits.

Primary power, 115 VAC, is applied to the a-c input section. This voltage is routed directly to the bias power supply and to a timing circuit within the a-c input section. The -150 volts d-c output of the bias power supply is applied to the RFD-1A Amplifier and to the a-c input section. When applied to the a-c input section, this voltage energizes the timing and control circuits. After the time delay elapses, 115 VAC is applied to the mid-voltage power supply and to the PS-5 High Voltage Power Supply unit. The time delay and control circuits ensure that plate voltage is not applied to the RFD-1A Amplifier before bias voltage is applied to it.

The complete schematic for PS-4A is shown in figure 8-2. Simplified schematics for the a-c input section, mid-voltage power supply and bias power supply are shown in figures 4-7, 4-8 and 4-9, respectively, and are described in the following paragraphs. Refer to section 7 (Parts List) for functions of individual components.

b. AC INPUT SECTION (See figure 4-7).

(1) Primary power (115 VAC) is applied to the PS-4A unit through jack J703. With MAIN POWER circuit breaker CB701 closed, primary power is applied between terminals 115 and 0 of autotransformer T701. PA FIL PRI ADJUST switch S701 is set to that position which most closely produces 115 VAC from T701. The output of T701 supplies operating voltage to MAIN POWER lamp I701, to the bias power supply, and to filament transformer T702 through LINE 5A fuse F701. Operating voltage for a blower motor located in the RFD-1A Amplifier unit is routed through BLOWER 2A fuse F703 to pin F of J701 and from terminal 0 of T701 to pin K of J701. Filament voltage, developed across the secondary of T702, is applied to pins J, O, U, V, P, R and S of J701. A-c voltage is also tapped off the primary of T702 and applied to terminals 1 and 2 of E701 for external use.

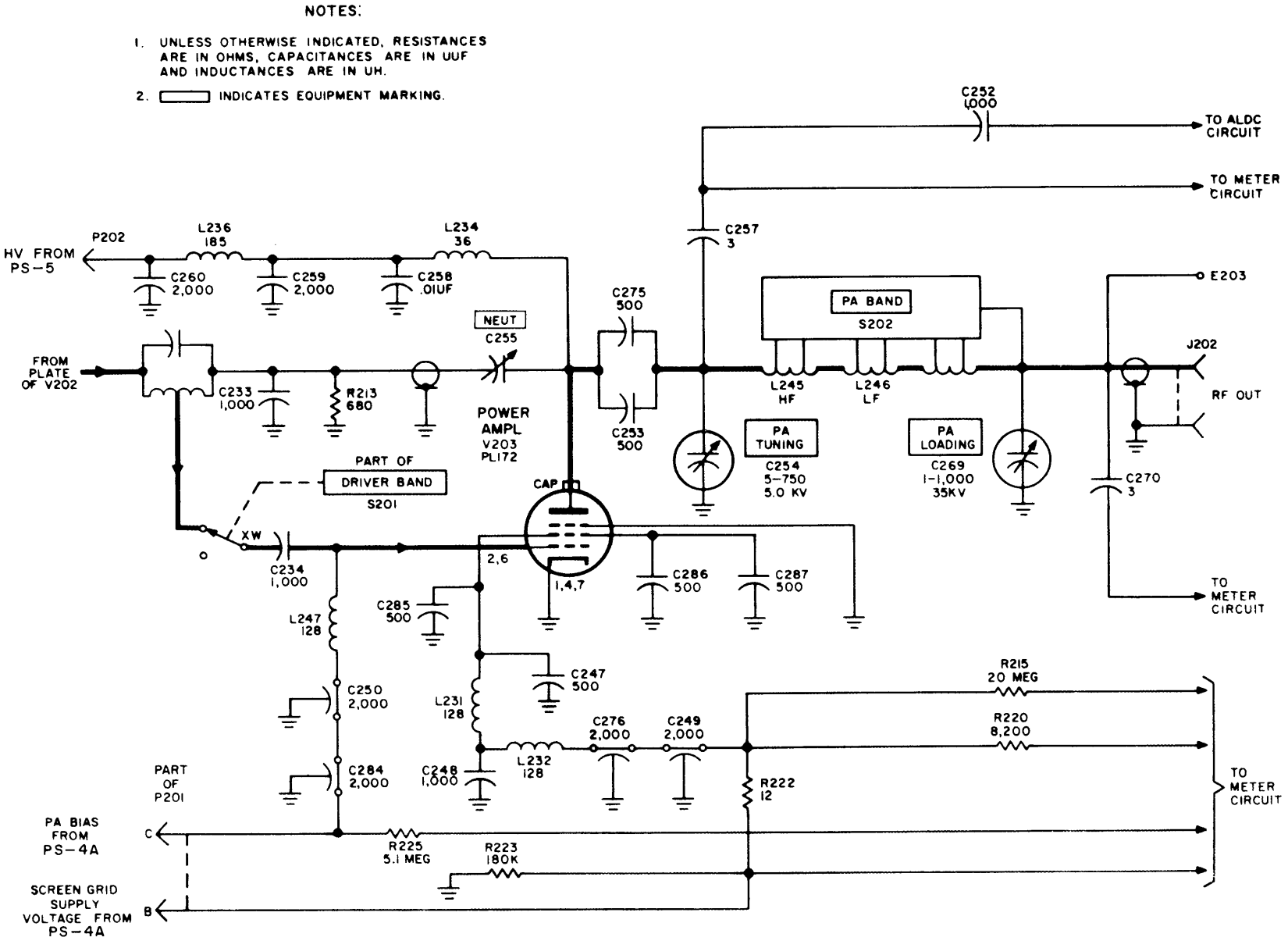


Figure 4-4. Simplified Schematic Diagram, V203 Power Amplifier, RFD-1A

(2) Operating voltage (115 VAC) is also applied across the heater element (terminals 2 and 3) of K701 time delay relay through S701, F701 and closed contacts 5 and 6 of de-energized relay K702. After a 3-minute time delay (during which time the bias supply is energized and grid bias is applied to RFD-1A Amplifier) contacts 5 and 7 of K701 close, grounding one end of K702 coil.

(3) With relay K701 energized and K702 coil grounded, the -150 VDC bias power supply energizes K702. Contacts 1 and 2 of K702 close to bypass relay K701. Contacts 5 and 6 of K702 open and remove energizing voltage from time delay relay K701. Contacts 4 and 5 close and apply operating voltage to the mid-voltage power supply through S701, F701 and contacts 4 and 5 of K702.

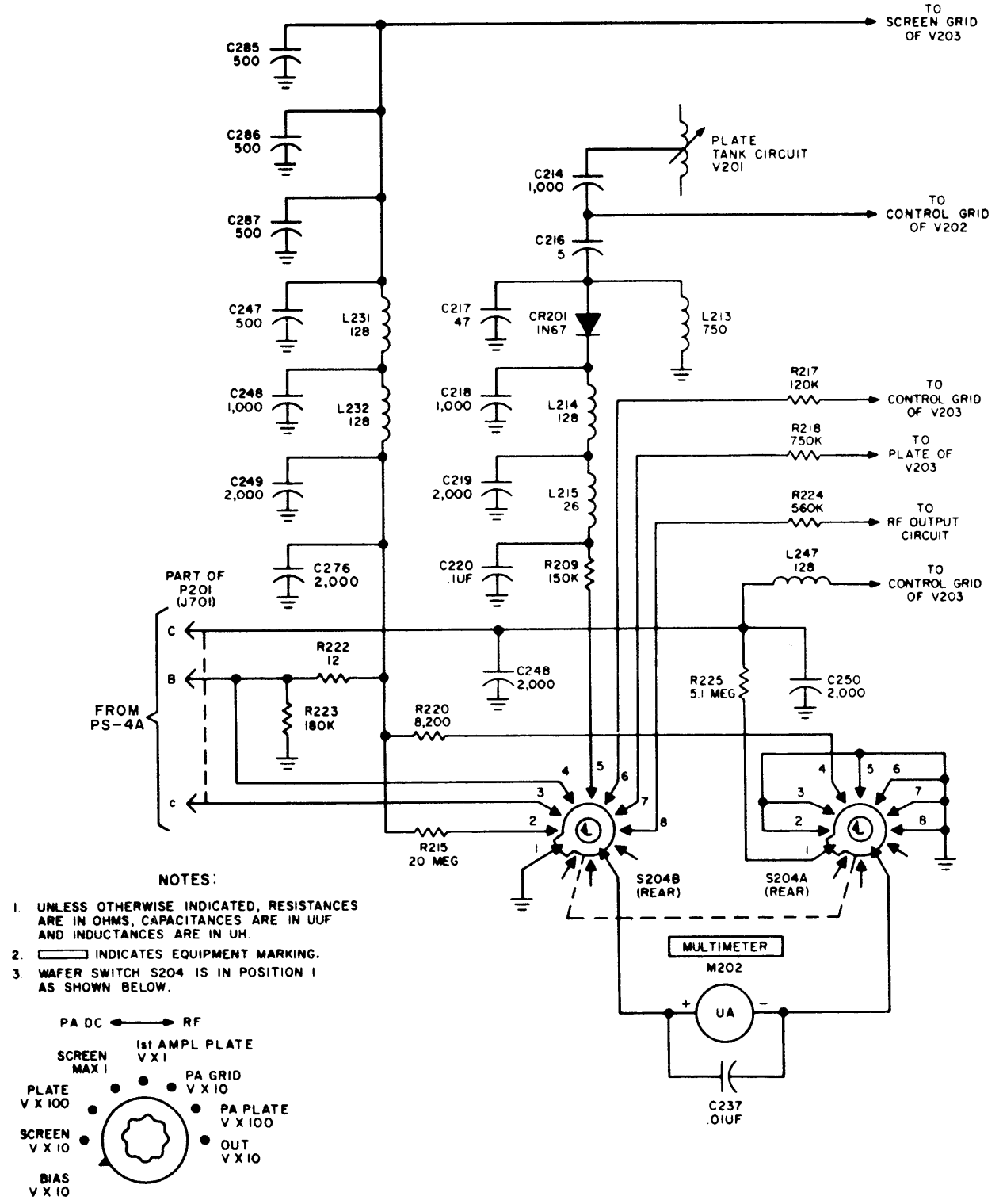


Figure 4-5. Simplified Schematic Diagram, Meter Circuit, RFD-1A

(4) With relay K702 energized, contacts 7 and 8 apply d-c voltage from the bias power supply to terminal 13 of transmitter plates relay K703. Since terminal 12 of K703 is grounded through PA OVERLOAD CONT GRID circuit breaker CB702 and the interlock circuit (paragraph 4-5a), relay K703 is energized.

(5) Primary a-c power (115 VAC) is routed to the PS-5 High Voltage Power Supply unit from the output of MAIN POWER circuit breaker CB701 and pins C and M of J702. When FINAL VOLTAGES switch S703 is set to ON, the voltage at pin C of J702 is routed to the PS-5 unit through closed contact pairs 8-9 and 10-11 of K703 and pin J of J702. This voltage is returned at pin E of J702, routed to terminal 5 of E701, and lights FINAL VOLTAGES lamp I703. The a-c voltage at pins 5 and 6 of E701 can be used for an external antenna relay, if desired.

c. MID-VOLTAGE POWER SUPPLY (See figure 4-8).

(1) A-c voltage is applied to the primary of transformer T704 from the a-c input section (figure 4-7). The voltage induced in the secondary of T704 (figure 4-8) is applied to the plates of mid-voltage rectifier V702. The rectified output of V702 (500 VDC) is applied to the plates of series regulator V703 through MV B+ 1/4A, fuse F704 and an LC filter network (L702 and C703). The rectified output of V702 is also applied to the plate and screen grid of control amplifier V704.

(2) During normal operation, the 500-volt output of V703 series regulator is taken from the cathodes and applied to pin d of jack J701 through R714 and closed contacts 6 and 7 of K703. The voltage on the output side of R714 is maintained at 225 VDC by PA

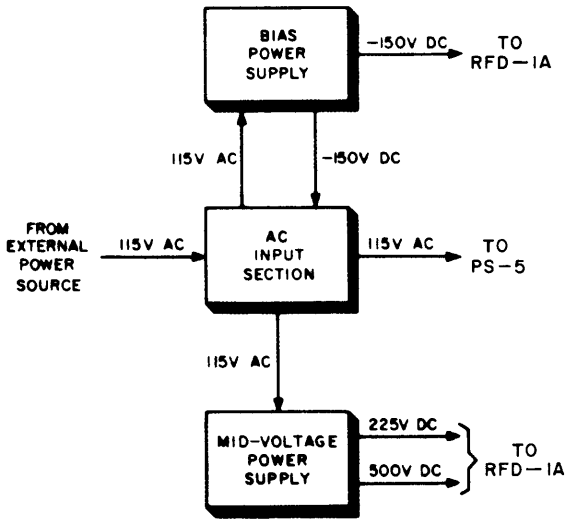


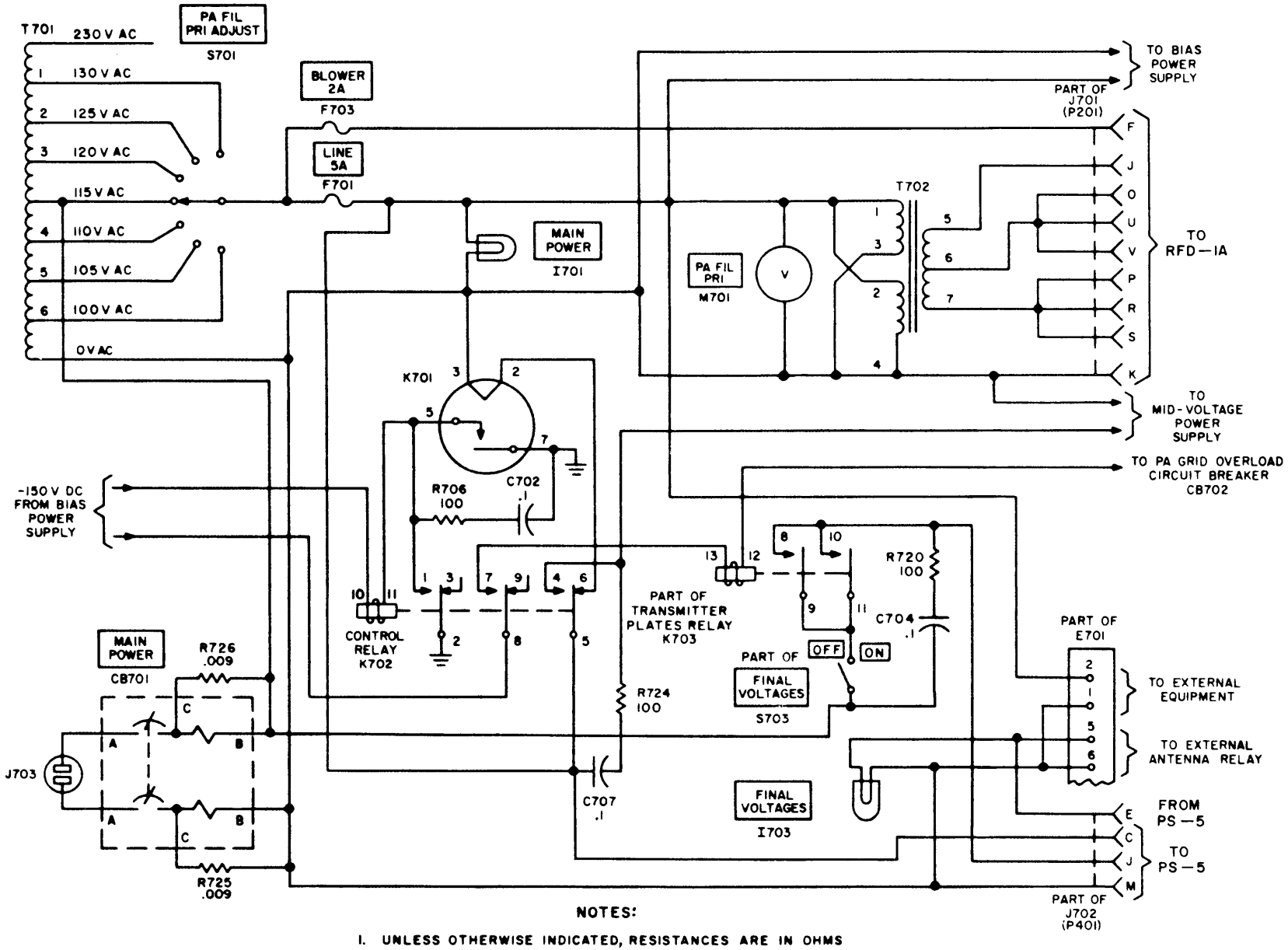
Figure 4-6. Functional Block Diagram PS-4A, Low Voltage Power Supply

screen grid regulators, V705 and V706. The 500 VDC output of V703 is also applied to pin E of J701 and to TRANSMITTER VOLTAGES lamp I702 via closed contacts 4 and 5 of K703. When FINAL VOLTAGES switch S703 is set to ON, this output is also applied to pin B of J701 through closed contacts 5 and 4 of K703 and PA OVERLOAD SCRN GRID circuit breaker CB703.

(3) The d-c output of V703 is also applied to a voltage divider network consisting of R715, MV ADJ potentiometer R716, and resistor R718. A portion of this voltage is picked off potentiometer R716 and

TABLE 4-1. MULTIMETER SWITCH POSITIONS VS. METER READINGS

S204 POSITION	PANEL MARKING	METER READING
1	PA DC BIAS V x 10	V203 d-c control grid bias voltage.
2	PA DC SCREEN V x 10	V203 d-c screen grid voltage
3	PA DC PLATE V x 100	V203 d-c plate voltage.
4	PA DC SCREEN MAX I	V203 d-c screen grid current.
5	RF 1ST AMPL PLATE V x 1	V201 r-f output voltage.
6	RF PA GRID V x 10	V203 r-f input voltage at grid.
7	RF PA PLATE V x 100	V203 r-f output voltage at plate.
8	RF OUT V x 10	PAL-1K(A) final r-f output voltage at J202 RF OUT jack.



NOTES:

1. UNLESS OTHERWISE INDICATED, RESISTANCES ARE IN OHMS AND CAPACITANCES ARE IN UF.
2. ▭ INDICATES EQUIPMENT MARKING.

Figure 4-7. Simplified Schematic Diagram, AC Input Section, PS-4A

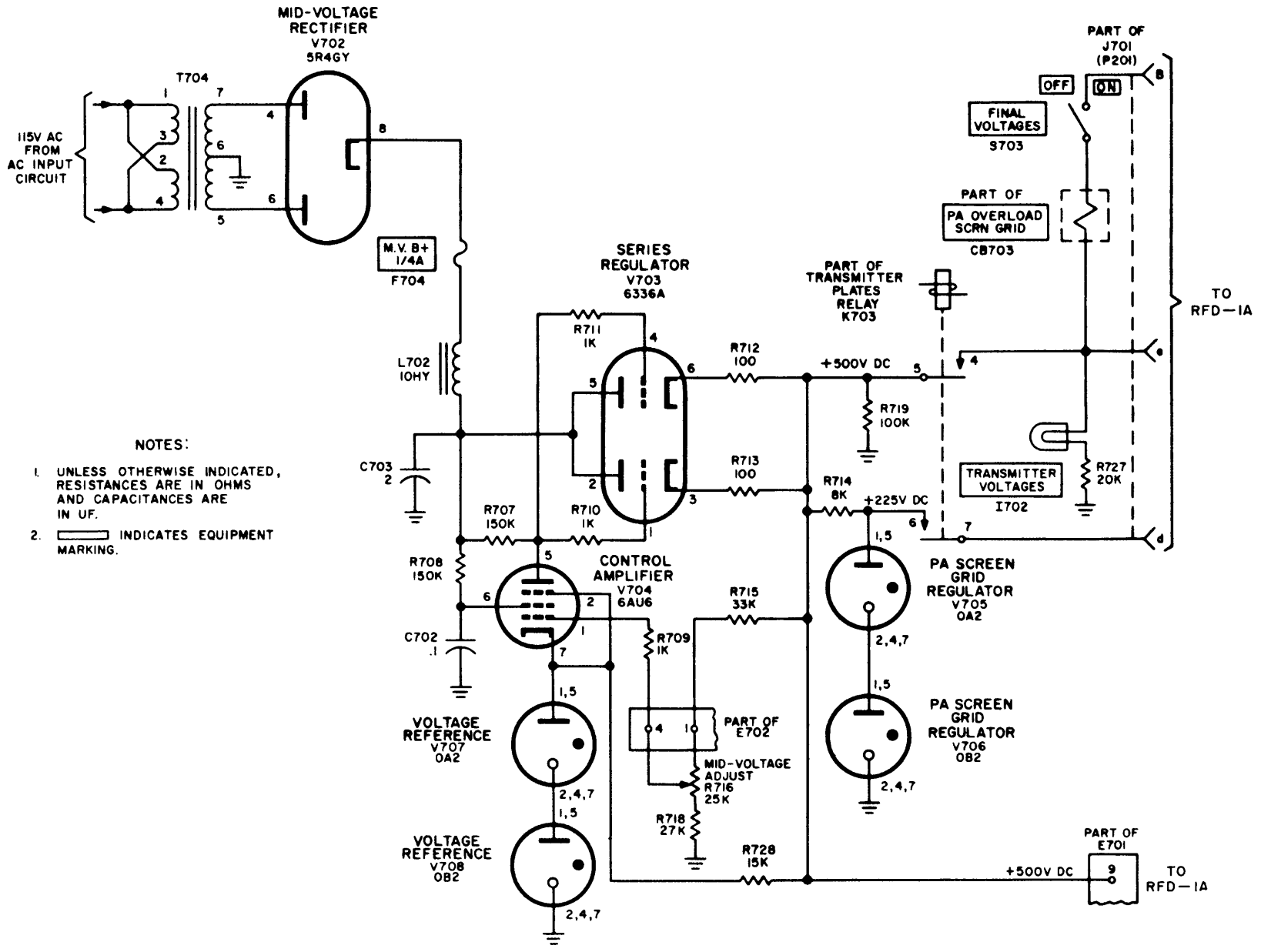


Figure 4-8. Simplified Schematic Diagram, Mid-Voltage Power Supply Section, PS-4A

applied to the control grid of V704. This voltage controls the conduction of V704, since the cathode is maintained at a fixed potential by voltage reference tubes V707 and V708. The output of V704, developed across resistor R707, is fed to the grids of V703 through current limiting resistors R710 and R711. This grid voltage controls the conduction of V703 and thereby controls the amplitude of the regulated d-c output voltage. The voltage level through which the mid-voltage regulator operates is set by potentiometer R716.

V703 is in series with the input and output voltages of the mid-voltage power supply section. If the output voltage of V703 tends to rise due to an increase in input voltage or a decrease in current drawn by the load, the increase in voltage will be felt across the voltage divider network (R715, R716 and R718); this increase in voltage is applied to the grid of V704. An increase in voltage at V704 grid causes that tube to conduct more and produces a greater voltage drop across plate load resistor R707. This increased voltage drop reduces the d-c voltage applied to the grids of V703. Conduction of V703 therefore decreases resulting in an increase in internal resistance. Since V703 is in series with the load, the effective increase in resistance causes a decrease in output voltage.

d. BIAS POWER SUPPLY (See figure 4-9).

(1) 115 VAC is applied to the primary of transformer T703 from the a-c input circuit (figure 4-7). The secondary of T703 has four windings; three windings provide filament voltage for the tubes in the mid-voltage power supply. The fourth winding provides plate voltage for bias rectifier V701 (figure 4-9).

(2) The rectified output of V701 is taken off pin 12 of T703 and applied, through LV B- 1/10A fuse F702, to an LC filter network (L701 and C701). The -150 VDC output of the filter network is applied to pin h of J701 jack through R701 and R705. Voltage is regulated by Zener diode CR701. A portion of this voltage is tapped off R703, PA BIAS ADJ resistor, and applied to pin C of J701 via the coil of PA OVERLOAD CONT GRID circuit breaker CB702.

(3) The -150 VDC output is also routed to the coil and contact 8 of relay K702 via resistors R702 and R717, respectively (see figure 4-7).

e. INTER-UNIT CIRCUITS. Interlock, blower motor and filament supply, and power amplifier overload circuits involve the functioning of RFD-1A, PS-4A and PS-5 together and are described in paragraph 4-5.

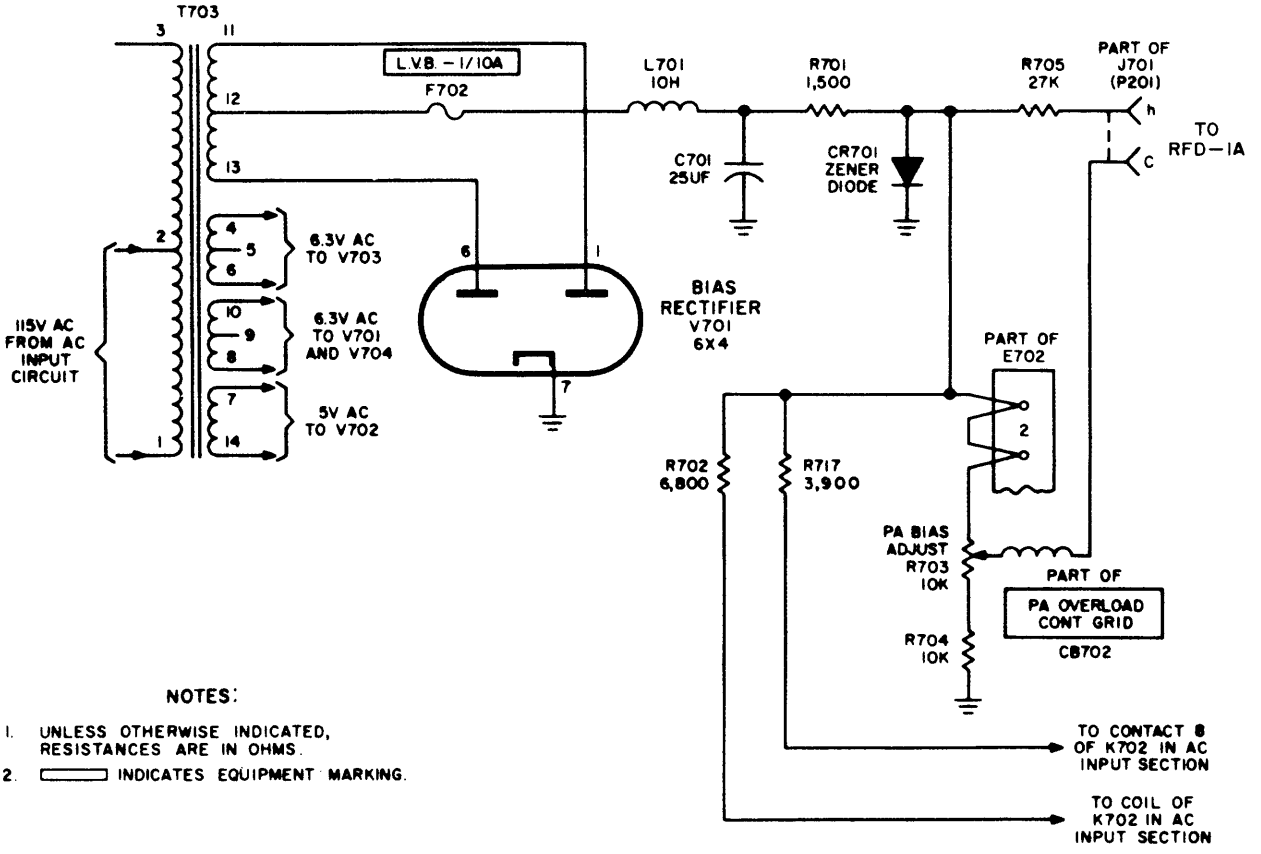


Figure 4-9. Simplified Schematic Diagram, Bias Power Supply Section, PS-4A

4-4. HIGH VOLTAGE POWER SUPPLY, PS-5.

(See figure 8-3.)

a. GENERAL. The PS-5 High Voltage Power Supply furnishes high voltage for RFD-1A Amplifier plates and sends sample voltages to the RFD-1A meters for measuring power amplifier plate voltage and plate current. A-c voltages for the PS-5 are received from the a-c input section of PS-4A.

b. MAIN CIRCUIT. The PS-5 consists of two transformers and a full-wave rectifier circuit. Primary power (115 VAC) is applied across the primary coils of T401 and T402 from pins M and C of P401. Secondary voltage of T401 is applied to V401 and V402 rectifier plates; secondary voltage of T402 is applied to V401 and V402 filaments. Full wave rectified output appears across resistor R401 and is filtered by capacitors C401, C402 and C403 and choke L401. The positive d-c output is routed to RFD-1A Amplifier through jack 401.

c. METER SIGNALS. The positive d-c output is also applied across a voltage divider network consisting of resistors R402 through R407. A portion of this voltage is applied through pin B of P401 and the PS-4A unit to a meter circuit in the RFD-1A Amplifier measuring PA plate voltage. The negative return of PS-5 is taken from pin 6 of T401 and routed through pin X of P401 and the PS-4A unit to a meter circuit in the RFD-1A measuring PA plate current.

d. INTER-UNIT CIRCUITS. Interlock, blower motor and filament supply, and power amplifier overload circuits involve the functioning of RFD-1A, PS-4A, and PS-5 together and are described in paragraph 4-5.

4-5. INTERUNIT CIRCUIT DETAILS.

(See figures 4-10 through 4-12.)

a. INTERLOCK CIRCUIT (See figure 4-10).

(1) GENERAL. The interlock circuit in the PAL-1K(A) consists of circuit breakers, protective switches, and relay contacts. This circuit prevents the distribution of plate voltages to the RFD-1A Amplifier unless all circuit breakers and switches are closed and all relays are in their normal operating positions. Basically, -150 VDC is applied across transmitter plates relay K703 through current limiting resistor R717 and series-connected interlocks (figure 4-10A). If all series-connected interlocks are closed, K703 is energized and plate voltages are applied to the RFD-1A Amplifier.

(2) POWER CONTROL AND PROTECTIVE CIRCUIT. Refer to figure 4-10B. Contact 13 of transmitter plates relay K703 is connected to -150 VDC through closed contacts 7 and 8 of control relay K702 and R717. Contact 12 of K703 is grounded through closed contacts of the series-connected interlocks in the PAL-1K(A) as follows:

(A) When TRANSMITTER VOLTAGES switch S702 is in the ON position, pin D of plug P401 is grounded through closed contacts of S702, terminal 4 of E701, a jumper wire (or external interlocks*), terminal 3 of E701, and pin D of jack J702. It is also possible to ground pin D of plug P401 by connecting a remote transmitter plate switch between terminal 7 of E701 and ground. When this remote switch is closed, TRANSMITTER VOLTAGES switch S702 is shunted and terminal 4 of E701 is grounded through terminal 8 of E701, the remote transmitter plate switch, and terminal 7 of E701.

(B) Table 4-2 lists all interlocks and circuit breakers connected between pin D of plug P401 and contact 12 of transmitter plates relay K703, the unit in which the component is contained, and the condition under which it closes.

(C) Capacitors C235, C236, C280 and C281 in the RFD-1A unit suppress any arcing which might be generated by the interlock contacts.

b. BLOWER MOTOR AND FILAMENT SUPPLY CIRCUITS (See figure 4-11).

(1) GENERAL. Besides functioning as described in paragraph 4-3, PS-4A Low Voltage Power Supply also supplies operating voltages for RFD-1A and PS-5 blower motors and RFD-1A tube filaments.

(2) RFD-1A BLOWER MOTOR AND TUBE FILAMENT SUPPLY. Primary power (115 VAC) is applied between the arm of PA FIL PRI ADJ switch S701 and common terminal 0 of autotransformer T701 through J703 and MAIN POWER circuit breaker CB701. This 115 VAC is routed through LINE 5A fuse F701 to the primary of transformer T702. Terminal 5 of T702 provides filament voltage for V201 and V202 in RFD-1A Amplifier; terminal 6 provides filament voltage for V203. Terminal 7 is grounded in RFD-1A.

The same primary power (115 VAC) appearing between S701 switch arm and terminal 0 of T701 is also applied to RFD-1A blower motor B201 through pins F and G of P201. C706 capacitor, connected across pins I and G of J701, is a starting capacitor for the motor.

(3) PS-5 BLOWER MOTOR SUPPLY. A-c voltage for the operation of the PS-5 High Voltage Power Supply unit is derived from the output of MAIN POWER circuit breaker CB701. Primary voltage for PS-5 filament transformer is received from the output of CB701 directly through pins M and C of jack J702 and plug P401. This voltage is also applied to blower motor B401 in PS-5 through door interlock S401. A-c voltage from CB701 is applied to one side of PS-5 plate transformer T401 primary directly from pin M of plug P401. The other side of T401 primary is connected to the other side of the a-c line through pin J of P401 and J702, closed contact pairs 8-9 and 10-11 of transmitter plates relay K703, and closed contacts of FINAL VOLTAGES switch S703. S703 and K703 action is described in paragraph 4-3b(5).

*External interlocks may be used if additional equipment is to be operated in conjunction with the PAL-1K(A) and the equipment interlocks are to be connected in series with PAL-1K(A) interlock circuit.

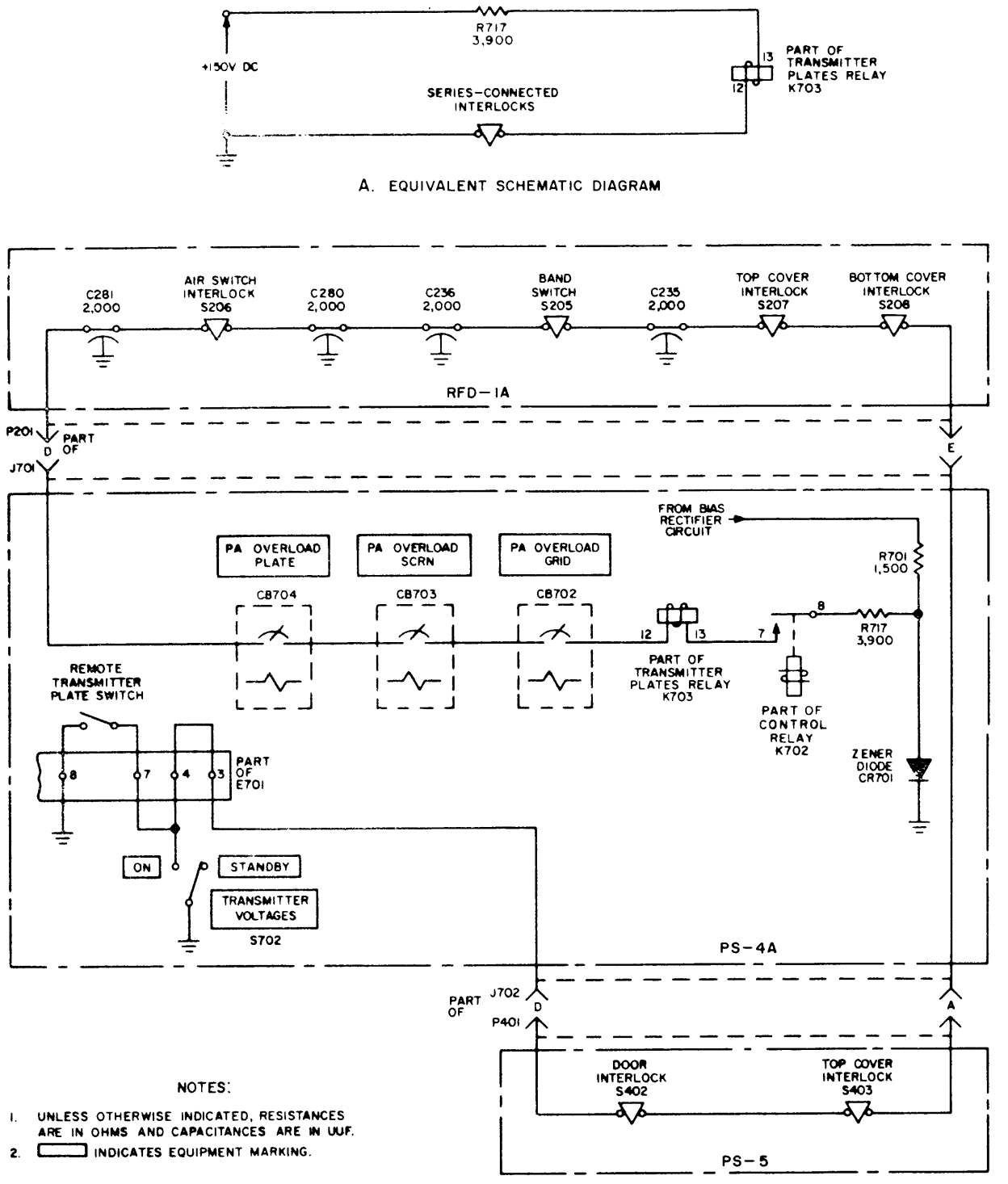


Figure 4-10. Simplified Schematic Diagram, Interlock Circuit, PAL-1K(A)

c. POWER AMPLIFIER OVERLOAD CIRCUIT (See figure 4-12).

(1) GENERAL. Excessive current in the RFD-1A PA tube plate will open CB704 circuit breaker, one of the series-connected interlock components in the interlock circuit described in paragraph 4-5a.

(2) NORMAL CONDITIONS. The negative return of the high voltage power supply in the PS-5 is routed to pin X of P401 and J702. The voltage at pin X of J702 is, in turn, connected to pin H of J701 through two parallel paths. One path consists of R723, terminal 3 of E702, and PA OVLD ADJ potentiometer R722. The second parallel path contains PA

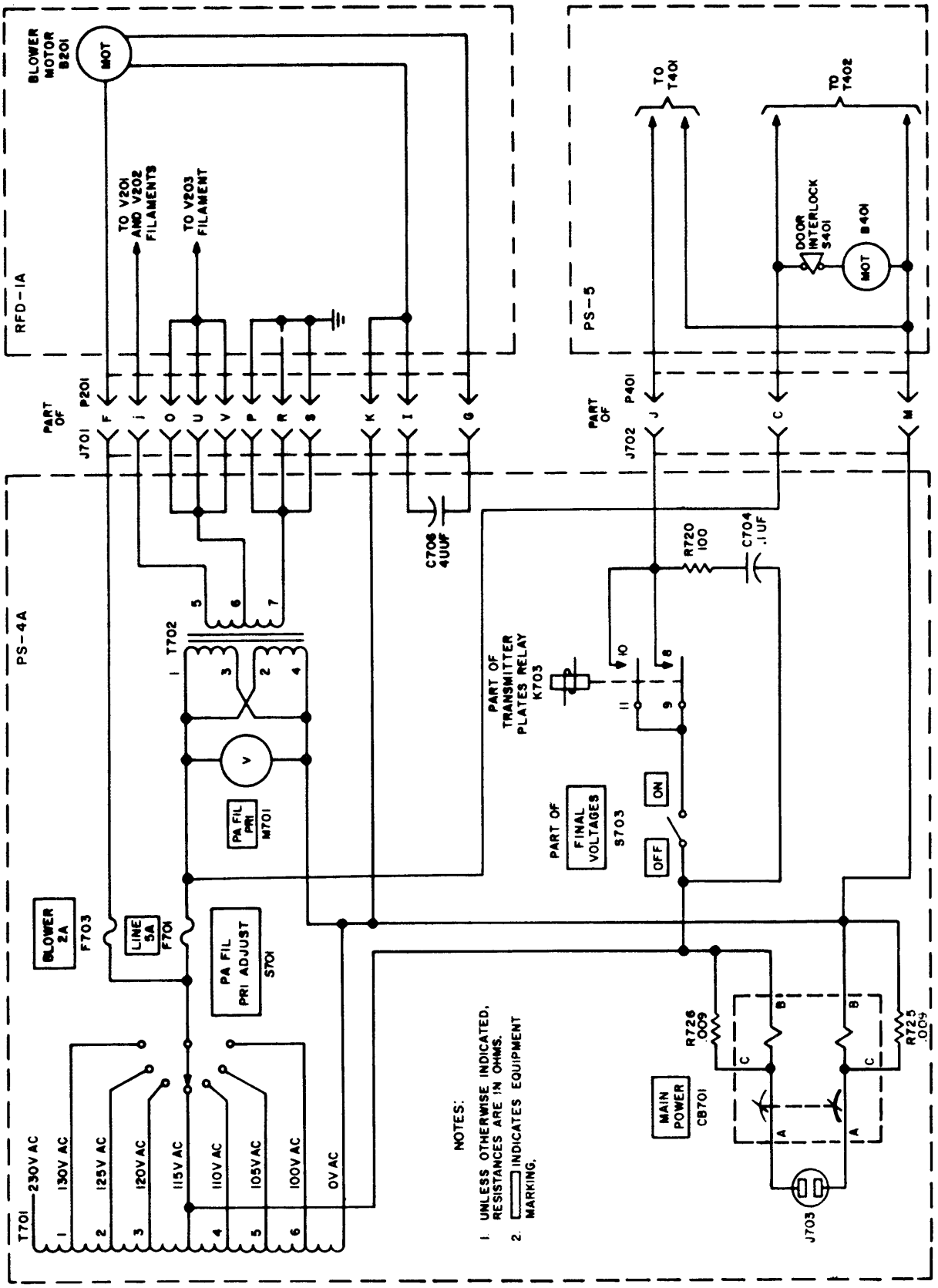


Figure 4-11. Simplified Schematic Diagram, Blower Motor and Filament Supply Circuits, PAL-1K(A)

TABLE 4-2. PAL-1K(A) INTERLOCK CIRCUIT COMPONENTS

UNIT	INTERLOCK OR CIRCUIT BREAKER	WHEN CLOSED
PS-5	Door interlock S402	When PS-5 is secured in the rack
PS-5	Top cover interlock S403	When the top cover of PS-5 is secured in position.
RFD-1A	Bottom cover interlock S208	When the bottom cover of the RFD-1A is secured in position.
RFD-1A	Top cover interlock S207	When the top cover of the RFD-1A is secured in position.
RFD-1A	Band switch S205	When PA BAND switch S202 is properly set in a detent.
RFD-1A	Air switch interlock S206	When blower motor B201 is operating normally.
PS-4A	PA OVERLOAD PLATE circuit breaker CB704	When no overload condition exists in the RFD-1A PA plate circuit.
PS-4A	PA OVERLOAD SCRN GRID circuit breaker CB703	When no overload condition exists in the RFD-1A PA screen grid circuit.
PS-4A	PA OVERLOAD CONT GRID circuit breaker CB702	When no overload condition exists in the RFD-1A PA grid circuit.

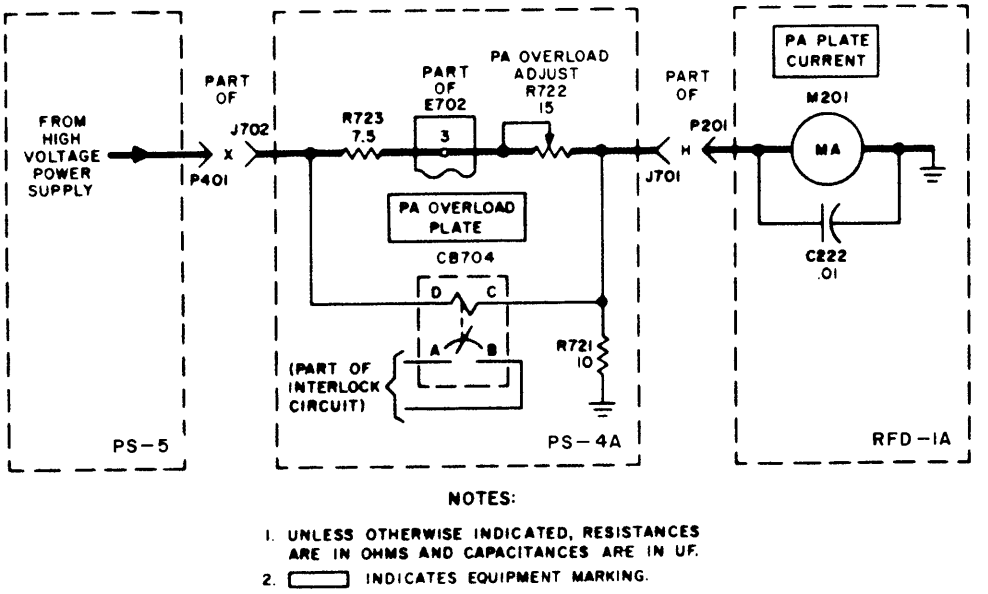


Figure 4-12. Simplifier Schematic Diagram, Power Amplifier Overload Circuit, PAL-1K(A)

OVERLOAD PLATE circuit breaker CB704. The output of the parallel circuit, connected at pin H of J701, is routed to PA PLATE CURRENT meter M201. C222 is an r-f bypass capacitor. During normal operation, PA OVLD ADJ potentiometer R722 is set so that current through CB704 is somewhat below its tripping value at normal high-level operation.

(3) OVERLOAD CONDITIONS. If excessive current is drawn from the PS-5 unit, an increase in the current which passes through CB704 causes it to open. Since CB704 is in series with the interlock circuit, this circuit is broken, as described in paragraph 4-5a, and plate voltages are removed from PS-5 High Voltage Amplifier.

SECTION 5
TROUBLE-SHOOTING

WARNING

PAL-1K(A) uses high voltages which are dangerous to life and present in all three units (RFD-1A, PS-4A and PS-5). Do not depend on safety interlock system but always throw MAIN POWER circuit breaker to OFF position and discharge high voltage capacitors before entering units for any purpose. Discharge any lingering voltage with a screwdriver to ground before touching a component.

5-1. INTRODUCTION.

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 the 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 callouts 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 paragraph.

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 and fuses are in proper working order; also that the equipment receives proper supply voltages. Many times this eliminates 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 due to their own weaknesses or to some contributing cause beyond their control.

In general, re-alignment of any electrical equipment should not be attempted unless, in the final analysis, it is concluded to be necessary. Section 6 describes the alignment of the PAL-1K(A).

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 "troubled areas" when some expectation is not realized.

c. TABLES OF VOLTAGE AND RESISTANCE WAVEFORM DATA. These tables give nominal values of voltage-to-frame and resistance to-frame, generally at tube elements and sometimes at connectors and terminal boards. 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 equipment are found in Section 8.

A good 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.

5-3. LINEAR POWER AMPLIFIER, PAL-1K(A).

a. PROCEDURE. If trouble occurs during tuning or operation of the PAL-1K(A), perform the general checking procedure outlined as follows:

(1) Perform a general check along the lines listed under paragraph 5-2a.

(2) If source of trouble is not revealed by (1), a performance check may be made per paragraph 5-3b(1) to reveal the troublesome area. This may be made with a signal generator and dummy load as described in 5-3b(1) or the original exciter and antenna may be used if it is more convenient. When area is discovered, single out faulty component by referring to VR charts (figures 5-2 and 5-3).

(3) If area is not revealed by (2), reference to paragraph 5-3b(2) may be helpful. This paragraph lists generalizations on some additional troubles that might occur during actual tuning and operation of PAL-1K(A) and their probable causes.

b. TROUBLE-SHOOTING BASED ON OPERATING PROCEDURES.

(1) PERFORMANCE CHECK. The following performance check on PAL-1K(A) is based on using an r-f signal generator as an input, a dummy load at the output, and the original tuning chart shipped with the PAL-1K(A). If the original tuning chart is not available and a subsequent chart has been made (see paragraph 3-5), use this chart together with exciter and antenna normally used with PAL-1K(A) in operation.

Position controls and make connections as listed below before proceeding with check as outlined in table 5-1.

Control Panel Marking	Figure 3-1 No.	Position
PA GRID TUNING	2	0
PA BAND	6	3-4
1ST AMPL TUNING	7	0
DRIVER BAND	8	2-4
PA TUNING (knob)	10	extreme ccw
ALDC	11	extreme ccw
PA LOADING (knob)	13	extreme ccw
PA OVERLOAD/ PLATE, SCRN GRID & CONT GRID	21,22,23	ON
FINAL VOLTAGES ON/OFF (switch)	25	OFF
TRANSMITTER VOLTAGES ON/ STANDBY (switch)	27	STANDBY
MAIN POWER (circuit breaker)	28	OFF

Connect PAL-1K(A) to line voltage and dummy load as shown in figure 5-1. Do not connect r-f signal generator until step 8 of table 5-1. Test equipment required is as follows:

R-f signal generator (Measurements Corp. Model 82 or equivalent)

Load resistor, 51.5 ohms, 2,500 watts (Termaline Model 82C or equivalent)

Tuning chart originally shipped with PAL-1K(A)

R-f ammeter (thermocouple type) 0-8 amperes (Simpson Model 39 or equivalent)

(2) TROUBLES OCCURRING DURING OPERATION. Table 5-2 lists generalized troubles and their probable sources.

5-4. VOLTAGE AND RESISTANCE CHARTS.

Figures 5-2 and 5-3 show nominal voltage and resistance-to-chassis measurements at vacuum tube pins and TB201 terminal block terminals in the RFD-1A Amplifier and at vacuum tube pins in the PS-4A Low Voltage Power Supply, respectively. Figures 5-4 through 5-9, are photographs showing locations of main components in these two units.

The PS-5 High Voltage Power Supply is a relatively simple circuit (see figure 8-3) and, due to the dangerously high voltages present in it, voltage/ resistance measurements are not practical for trouble shooting purposes. Therefore, no such diagram is presented in this manual.

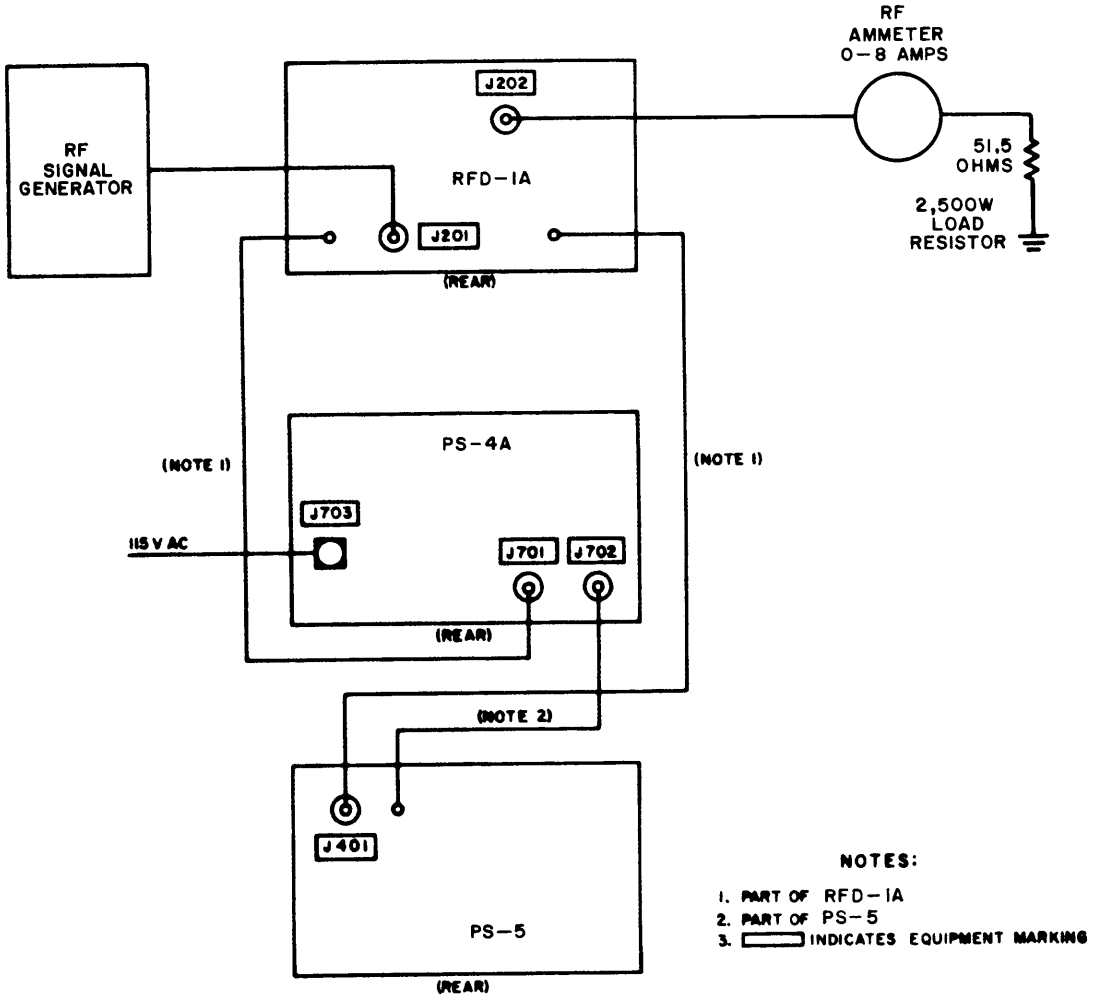


Figure 5-1. Test Setup for Trouble-Shooting PAL-1K(A)

TABLE 5-1. PAL-1K(A) PERFORMANCE CHECK

STEP	OPERATION	NORMAL INDICATION	PROBABLE TROUBLE
1	a. Make certain all doors and covers are properly secured in position.		
	b. Set MAIN POWER circuit breaker (28) to ON. Note time for reference in step 3.	MAIN POWER light (29) goes on and voltage indication appears on PA FIL PRI meter (15). Blowers in PS-5 and RFD-1A units go on. All tube filaments in RFD-1A glow.	If none of the indications occur, check a-c input connection and MAIN POWER circuit breaker (28). If only one indication does not occur, check appropriate item, i.e.: light, meter or blower.
2	Adjust PA FIL PRI ADJUST switch (16) for a position that will give a 117 volt reading on PA FIL PRI meter (15).	It is possible to obtain a 117 V reading on meter (red mark on dial) with one of the switch positions.	T701 transformer or PA FIL PRI ADJUST switch in PS-4A unit may be defective.
3	Set TRANSMITTER VOLTAGES switch (27) to ON. Allow about 3 minutes to elapse from time that MAIN POWER circuit breaker (28) was switched ON in step 1.	TRANSMITTER VOLTAGES light (26) goes on in 3 minutes ±40 seconds after MAIN POWER circuit breaker (28) is switched ON.	If timing is abnormal, check K701 time delay relay. If TRANSMITTER VOLTAGES light (26) fails to go on at all, K701, K702 or K703 is defective in PS-4A unit. If not relays, interlock circuitry continuity has been broken.
4	Set MULTIMETER switch (3) to PA DC BIAS V x 10.	MULTIMETER (4) reads 100 ±10 on red scale.	Bias rectifier tube V701, in PS-4A unit, may be defective or R310 potentiometer in RFD-1A may be misaligned.
5	Set FINAL VOLTAGES switch (25) to ON.	FINAL VOLTAGES light (24) goes on.	If light fails to go on, check T401 high-voltage plate transformer in PS-5 and FINAL VOLTAGES light (24) in PS-4A
6	Wait 15 minutes for equipment to warm up, then:		
	Set MULTIMETER switch (3) to PA DC SCREEN V x 10.	MULTIMETER (4) reads 500 ±5 on green scale.	Check T704 mid-voltage transformer, V702 rectifier tube, and V703 regulator tube in PS-4A unit. Check meter circuit in RFD-1A unit.
7	Set MULTIMETER switch (3) to PA DC PLATE V x 10.	MULTIMETER (4) reads 3000 ±100 on black scale.	Check T401 high voltage plate transformer

TABLE 5-1. PAL-1K(A) PERFORMANCE CHECK (C nt.)

STEP	OPERATION	NORMAL INDICATION	PROBABLE TROUBLE
7 (Cont.)			and associated components in PS-5 and meter circuit in RFD-1A unit.
8	Observe PA PLATE CURRENT meter (5).	Meter reads 220 ± 10 milliamperes.	Check V203 PA tube and PA PLATE CURRENT meter (5) in RFD-1A unit. Check V401 and V402 tubes in PS-5 unit. Check PA overload adjust potentiometer R722 in PS-4A for misalignment.
9	Set FINAL VOLTAGES switch (25) to OFF. Set MULTIMETER switch (3) to RF 1ST AMPL PLATE V x 1. Connect r-f signal generator to RFD-1A Amplifier input at J201. Set generator for 3-mc, zero output level and allow generator to warm up. Turn up level on the generator until a reading of "10" is obtained on MULTIMETER (4) on black scale. Rotate 1ST AMPL TUNING knob (7) until a peak reading is obtained on MULTIMETER (4) black scale.	 It is possible to obtain a reading of "10" with adjustment of generator. It is possible to peak meter with adjustment of 1ST AMPL TUNING knob (7).	 Check V201 tube and meter circuit in RFD-1A unit. Check DRIVER BAND switch (8) and 1ST AMPL TUNING capacitors (C203 and C232) in RFD-1A unit.
10	Set MULTIMETER switch (3) to RF PA GRID V x 10. Adjust output level on generator; obtain a reading of "7" on MULTIMETER (4) red scale. Adjust PA GRID TUNING knob (2) for a peak indication on MULTIMETER (4).	 It is possible to obtain a reading of "7" with adjustment of generator. It is possible to peak meter with adjustment of PA GRID TUNING knob.	 Check V202 tube and meter circuit in RFD-1A unit. Check DRIVER BAND switch (8) and PA GRID TUNING capacitor (C231) in RFD-1A unit.
11	Turn down output level control on generator to minimum output. Set PA TUNING knob (10) to bring reading on PA TUNING dial (9) as shown in the tuning chart.		

TABLE 5-1. PAL-1K(A) PERFORMANCE CHECK (C nt.)

STEP	OPERATION	NORMAL INDICATION	PROBABLE TROUBLE
11 (Cont.)	Set PA LOADING switch (14) to position shown in the tuning chart. Set PA LOADING knob (13) to bring reading on PA LOADING dial (12) as shown in the tuning chart. Set FINAL VOLTAGES switch (25) to ON. Slowly increase generator output until PA PLATE CURRENT meter (5) reads 220 milliamperes.	It is possible to bring meter reading to 220 from adjustment of generator.	If meter will not respond in this way, check V203 PA tube, PA TUNING capacitor C254, PA LOADING capacitor C269, PA BAND switch (6), PA LOADING switch (14) and meter circuit in RFD-1A unit.
12	a. Set MULTIMETER switch (3) to RF OUT V x 10 and note reading on MULTIMETER (4) green scale.		
	b. Adjust PA TUNING knob (10) until a pronounced dip is produced on PA PLATE CURRENT meter (5).	It is possible to produce dip in meter from adjustment of PA TUNING knob.	Check PA TUNING capacitor C254, PA BAND switch (6) and meter circuitry in RFD-1A unit.
	c. Adjust PA LOADING knob (13) until the reading on PA PLATE CURRENT meter (5) begins to rise.	It is possible to produce rise in meter from adjustment of PA LOADING knob.	Check PA LOADING capacitor (C269) PA BAND switch (6) and meter circuitry in RFD-1A unit.
	d. Slowly decrease the generator output until reading of 220 is restored on PA PLATE CURRENT meter (5).	It is possible to bring reading of 220 back with adjustment of generator. Reading on MULTIMETER (4) has increased from that in step 12a.	Check V203 PA tube in RFD-1A unit.
13	Repeat steps 12b, 12c and 12d, observing PA PLATE CURRENT meter (5) and MULTIMETER (4), until MULTIMETER (4) reading begins to fall off on step 12d adjustment. Then reset controls back to previous setting of 12b, 12c and 12d, to regain ultimate tuning point.	It is possible to obtain ultimate tuning point in manner described.	Check PA TUNING capacitor C254, PA BAND switch (6) and associated components, PA LOADING capacitor (C269) and meter circuits in RFD-1A unit.
14*	Slowly increase generator output until ammeter (in series		

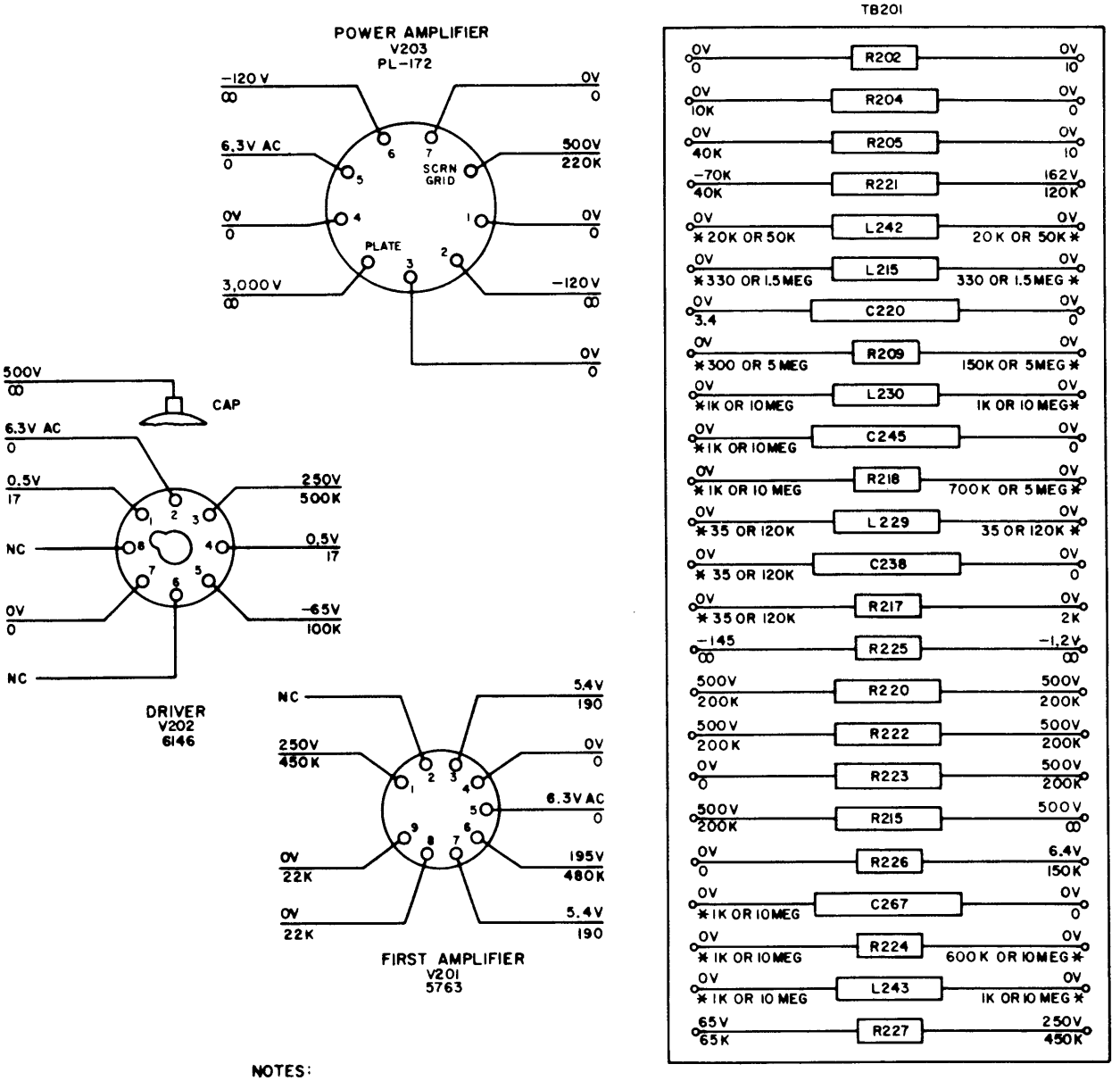
TABLE 5-1. PAL-1K(A) PERFORMANCE CHECK (Cont.)

STEP	OPERATION	NORMAL INDICATION	PROBABLE TROUBLE
14* (Cont.)	with dummy load) reads 4.4 amperes.		
	Observe PA PLATE CURRENT meter (5).	Nominal reading is 400 to 450 milliamperes.	Check V203 PA tube and PA PLATE CURRENT meter (5) in RFD-1A unit. Check PA overload adjust potentiometer R722 alignment in PS-4A unit.
	Observe MULTIMETER (4) (in RF OUT V x 10 position).	Nominal reading is 23.	Check capacitors in output section and meter circuit in RFD-1A unit.
	Set MULTIMETER switch (3) to PA DC SCREEN MAX I. Observe reading on MULTIMETER (4) black scale.	Reading is around 35 to 40.	Check V203 PA tube and meter circuit in RFD-1A unit. Check V703 regulator tube in PS-4A unit.
	Set MULTIMETER switch (3) to RF PA PLATE V x 100. Observe reading on MULTIMETER (4) red scale.	Nominal reading is 1,760 V (for 3 mc signal).	Check V203 PA tube and meter circuit in RFD-1A unit.
15	Set MULTIMETER switch (3) to RF OUT V x 10. Slowly turn ALDC knob (11) clockwise until reading on MULTIMETER (4) begins to drop off.	Meter reading can be made to drop from clockwise adjustment of ALDC knob.	Check ALDC potentiometer (11) and ALDC circuit in RFD-1A unit. Check PA bias adjust potentiometer (R703) alignment in PS-4A unit.

*If original antenna is used, generator output is increased to produce full rated output power, as indicated by RF OUT V x 10 on MULTIMETER and an ammeter in series with antenna or a SWR (Standing Wave Ratio) indicator. PA PLATE CURRENT should read around 400 to 450 ma and DC SCREEN MAX I should read around 35 to 40 ma.

TABLE 5-2. TROUBLES OCCURRING DURING OPERATION

INDICATION	PROBABLE TROUBLE
LINE 5A fuse (17) opens continually.	Mid-voltage rectifier tube V702 in PS-4A defective.
L.V.B. - 1/10A fuse (19) opens continually.	Transformer T702, T703, or T704 in PS-4A shorted.
M.V.B. + 1/4A fuse (20) opens continually.	Capacitor C703 in PS-4A shorted.
With MULTIMETER switch (3) set to RF 1ST AMPL PLATE V x 1 position, incorrect indications are observed on MULTIMETER (4) when operating at any frequency.	DRIVER BAND switch (8) defective. First amplifier stage defective. Meter filter circuit defective.
With MULTIMETER switch (3) set to RF PA GRID V x 10, incorrect indications are observed on MULTIMETER (4) when operating at any frequency.	DRIVER BAND switch (8) defective. Driver stage defective. Meter filter circuit defective. Capacitor C231 misaligned.
With MULTIMETER switch set to RF PA PLATE V x 100, incorrect indications are observed on MULTIMETER (4) when operating at any frequency.	Power amplifier stage defective. Meter filter circuit defective.
With MULTIMETER switch set to RF OUT V x 10, incorrect indications are observed on MULTIMETER (4) when operating at any frequency.	PA BAND switch (6) defective. PA LOADING switch (14) defective. Antenna tuning and loading circuit defective. NEUT capacitor C255 misaligned.
With MULTIMETER switch (3) set at various RF positions and with ALDC, INT/EXT switch (S209, on back of chassis) set at INT, incorrect indications are observed on MULTIMETER (4).	ALDC circuit misaligned or defective.
No indication is observed on MULTIMETER (4) with MULTIMETER switch (3) in any position. Indications on PA PLATE CURRENT meter (5) is correct.	MULTIMETER switch (3) defective. MULTIMETER meter (4) defective. Meter bypass capacitor C237 shorted or leaky.
No indication is observed on PA PLATE CURRENT meter (5). MULTIMETER (4) indications are correct for every position of MULTIMETER switch (3).	PA PLATE CURRENT meter defective. Meter bypass capacitor C222 shorted or leaky.



NOTES:

1. * DEPENDS ON WHICH OHMMETER PROBE IS GROUNDED.
2. ALL VOLTAGES ARE MEASURED WITH NO SIGNAL INPUT.
3. [MULTIMETER] SWITCH S204 SET TO [PA DC BIAS V X 10].
4. VOLTAGE READINGS ABOVE LINE. RESISTANCE READINGS BELOW LINE.
5. UNLESS OTHERWISE SHOWN, VOLTAGES AND RESISTANCES ARE MEASURED TO GROUND. DC VOLTAGE READINGS ARE TAKEN WITH A 20,000 OHMS-PER-VOLT METER.
6. NC INDICATES NO CONNECTION.

Figure 5-2. Voltage and Resistance Diagram, RFD-1A

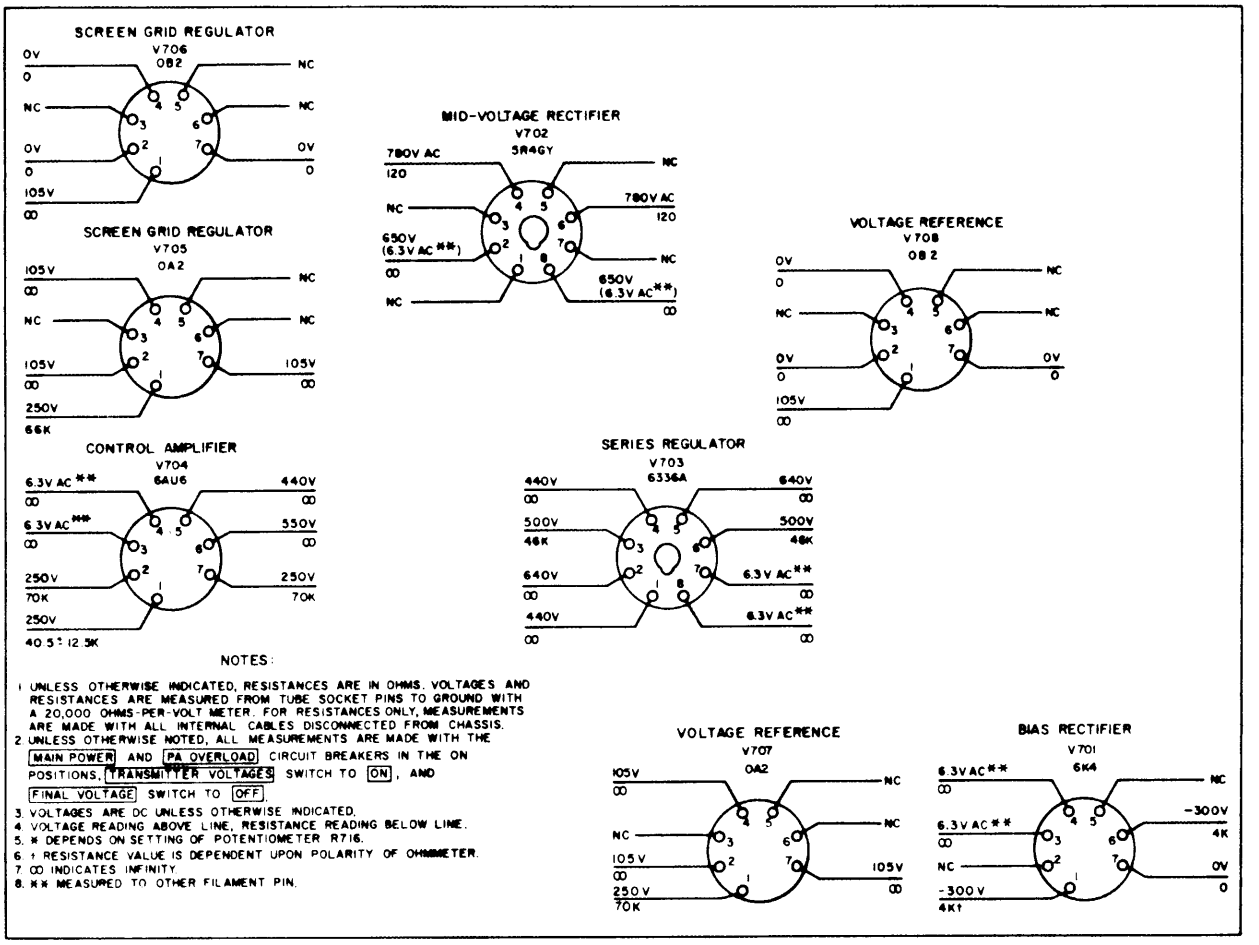


Figure 5-3. Voltage and Resistance Diagram, PS-4A

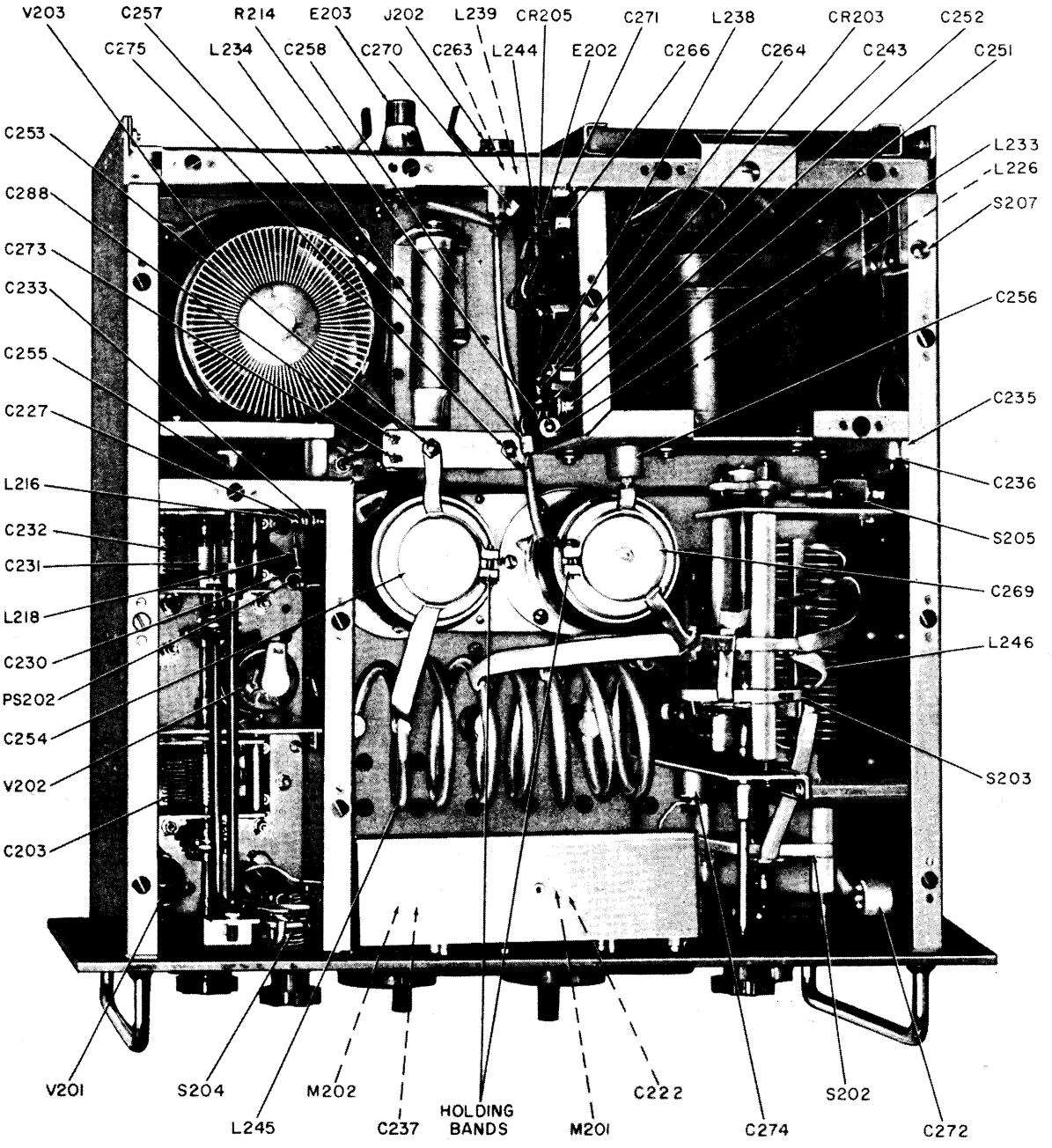


Figure 5-4. Location Diagram of Major Electronic Components, Top View, RFD-1A

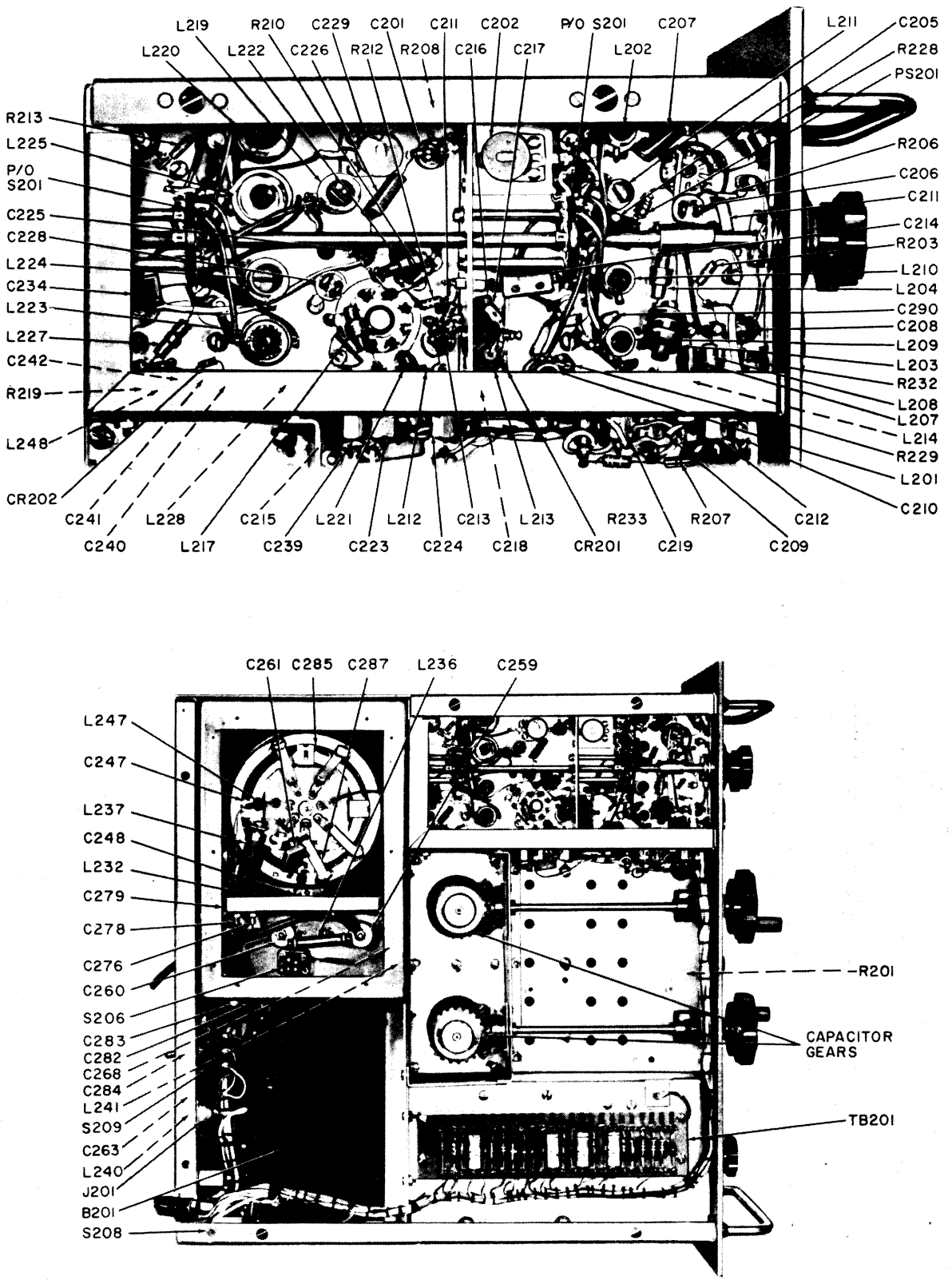


Figure 5-5. Location Diagram of Major Electronic Components, Bottom View, RFD-1A

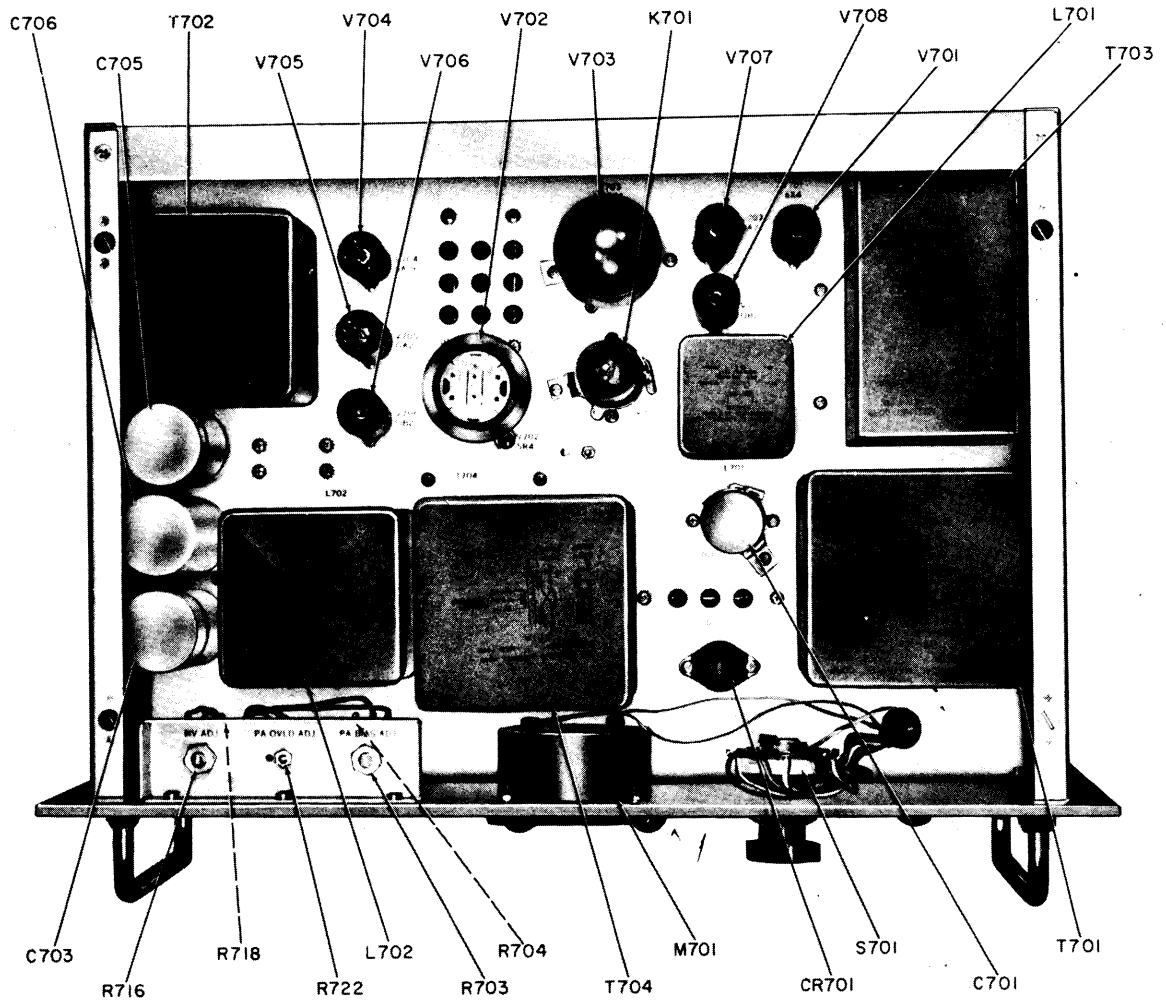


Figure 5-6. Location Diagram of Major Electronic Components, Top View, PS-4A

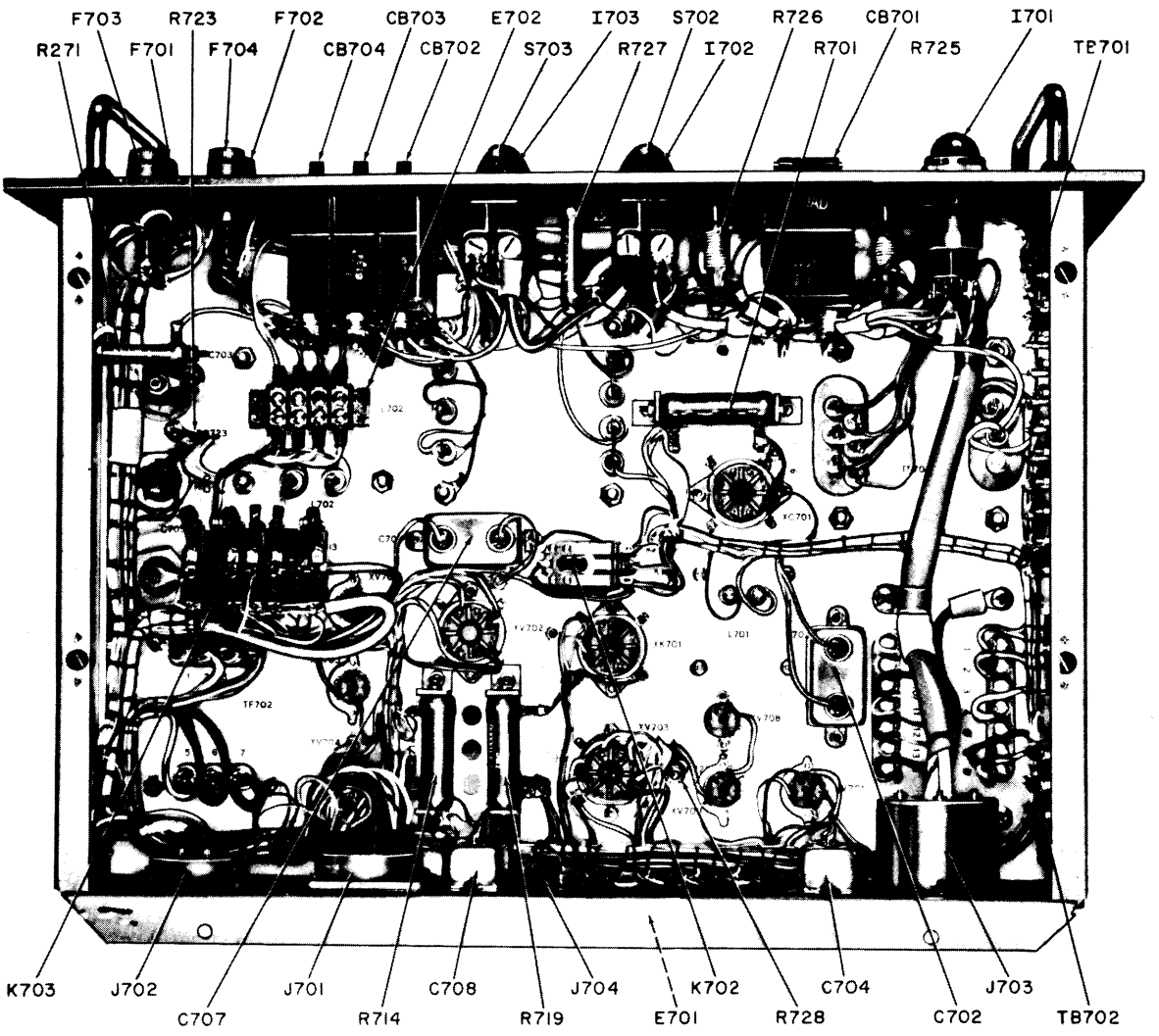


Figure 5-7. Location Diagram of Major Electronic Components, Bottom View, PS-4A

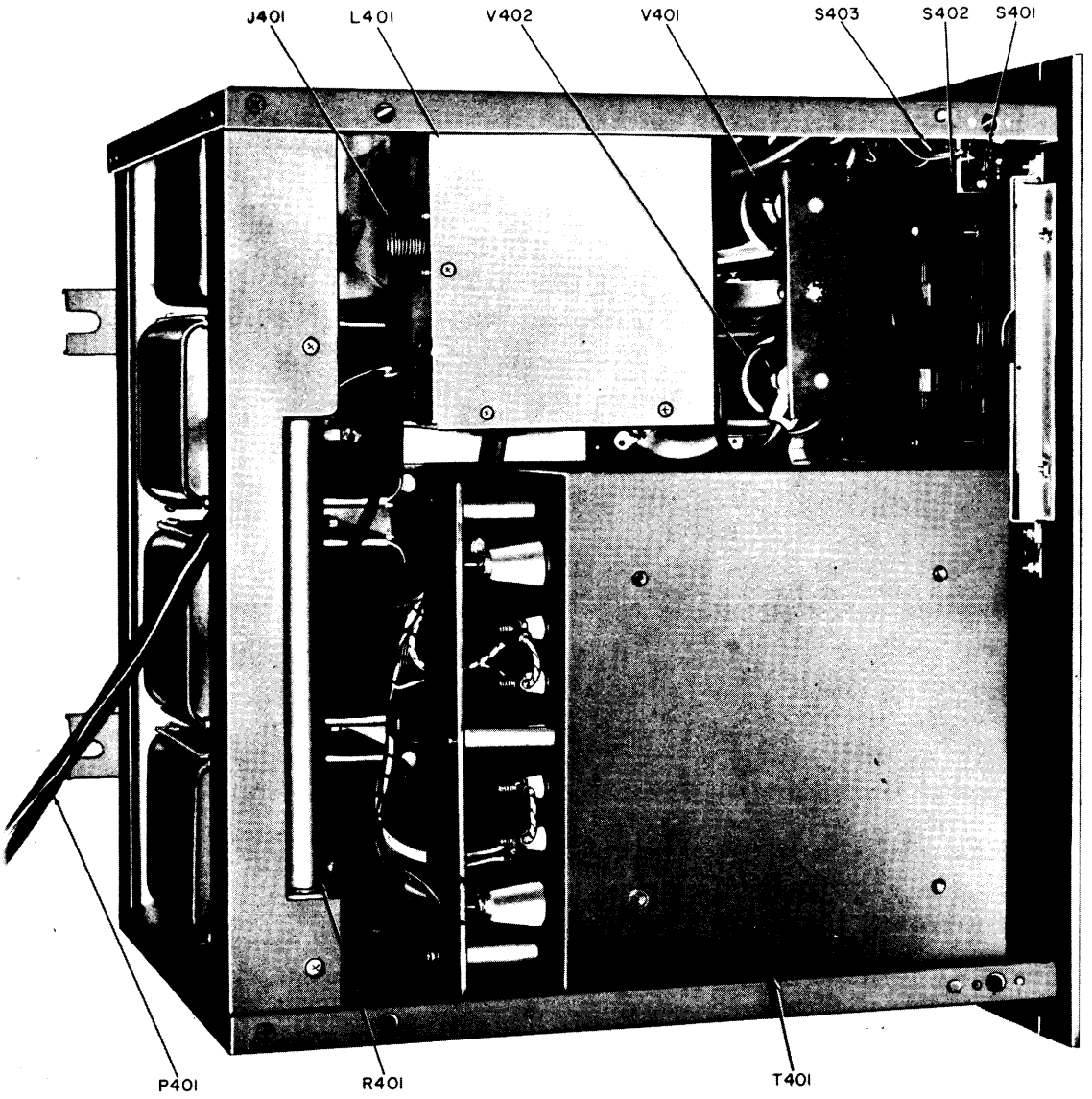


Figure 5-8. Location of Major Electronic Components, Top View, PS-5

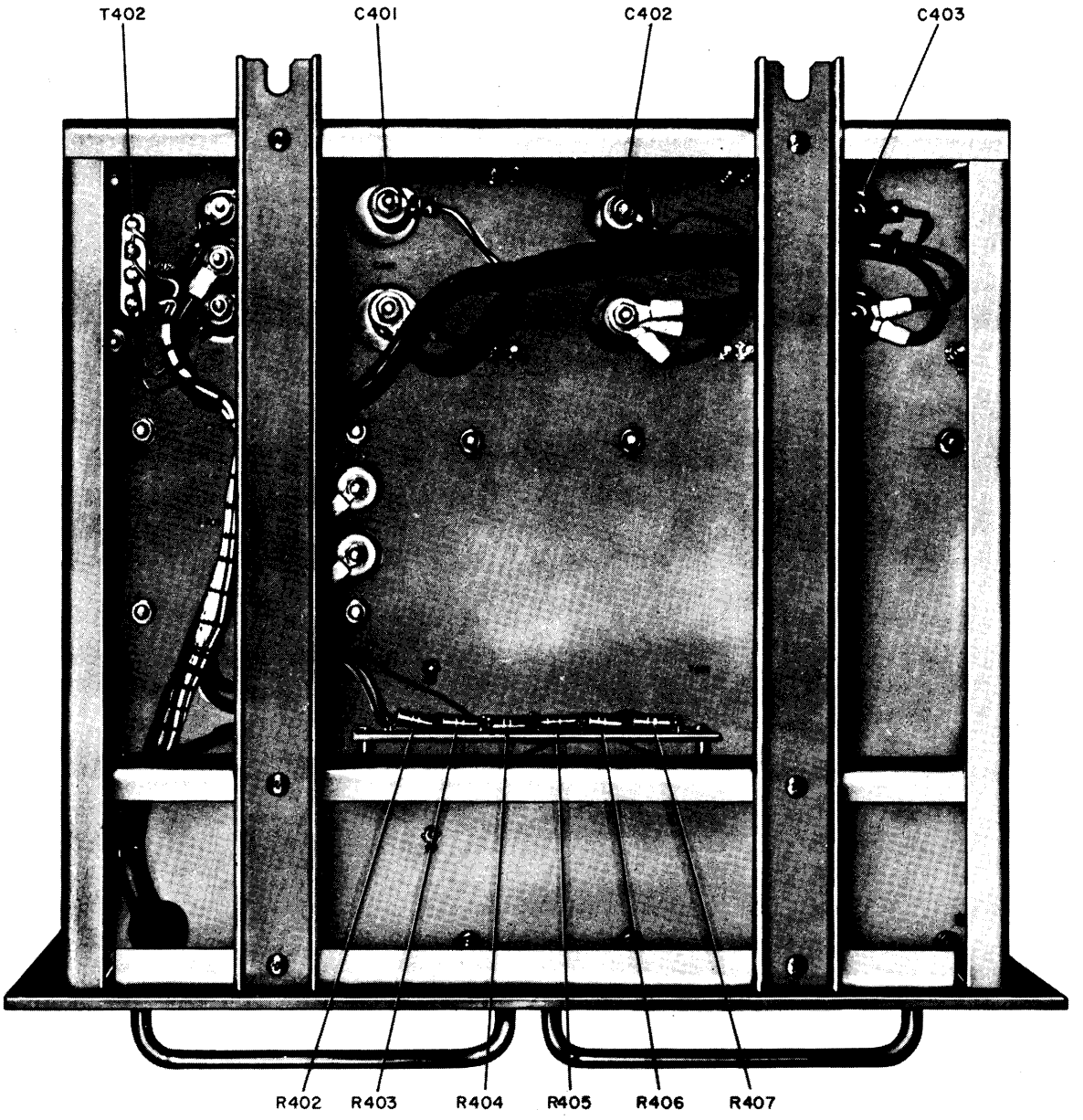


Figure 5-9. Location of Major Electronic Components, Bottom View, PS-5

SECTION 6
MAINTENANCE

6-1. INTRODUCTION. Maintenance may be divided into three categories: operator's maintenance, preventive maintenance and corrective maintenance. Operator's maintenance for this unit is described in Section 3. Preventive maintenance is included in Section 6. Corrective maintenance is sometimes considered as consisting of information useful in locating and diagnosing equipment troubles and maladjustments, existing and/or pending, and information necessary to remedy the equipment troubles and maladjustments. For reasons stated in Section 5, the remedial type of information is presented under corrective maintenance (Section 6) while the diagnosis of information is presented under trouble-shooting (Section 5).

The PAL-1K(A) has been designed to provide long-term, trouble-free operation under continuous duty conditions. It is recommended that any necessary maintenance be done by an experienced technician familiar with radio techniques. Otherwise, advantage may be taken of the required specialized test equipment and personnel trained in its use in the Test Department of Technical Materiel Corporation. If trouble develops which cannot be corrected by procedures outlined in this manual, it is recommended that the instrument be returned to Technical Materiel Corporation for servicing. To expedite the return of the serviced equipment to you, it is recommended that the equipment be shipped to us by Air Freight and that we be authorized to return it the same way.

6-2. REPLACEMENT OF COMPONENTS.

All chassis mounted components are accessible only by removing covers which form part of the safety interlock system. Before removing these covers and if the equipment is receiving power, the "normal shutdown" procedure, outlined in paragraph 3-7c, should be followed in order to preserve the life of the PA tube in the RFD-1A Amplifier. Then the appropriate shields and covers may be removed.

WARNING

Although removal of any chassis cover breaks the interlock circuit and disconnects high voltage power sources, dangerous lingering voltages may remain for some time on capacitors and components containing capacitance. Before touching component, short out charge with screwdriver to ground.

6-3. PREVENTIVE MAINTENANCE.

a. GENERAL. In order to prevent failure of the equipment due to corrosion, tube failure, dust, or other destructive elements, it is suggested that a schedule of preventive maintenance be set up and adhered to. 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, and loose parts (due to vibration).

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 can readily cause more, rather than less, potential trouble. Good preventive maintenance requires constant vigilance and good judgement of when, what, and how to apply remedial measures.

b. ONCE EACH SHIFT DURING AN "ON THE AIR" PERIOD. Check the operator's PAL-1K(A) 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 meters and compare observations with established standards for irregularities. Observe indicator lights and rectifier tubes for abnormal color and signs of internal flashing.

c. DAILY DURING AN "OFF THE AIR" PERIOD. Visually and manually inspect all parts in the PAL-1K(A) for overheating and damage. Inspect all sliding and moving coil contacts. Feel blower motors for overheating and observe rotating parts for wear. Note deposits of dust and dirt. Inspect condition of relay contacts. Check operation of all door interlocks.

d. MONTHLY DURING "OFF THE AIR" PERIODS. Recondition rotary and switch contacts as necessary. Use crocus cloth and trichloroethylene or ethylenedichloride for cleaning. Remove dirt or grease from non-electrical parts with any good dry-cleaning fluid.

WARNING

When using trichloroethylene or carbon tetrachloride, make sure that adequate ventilation exists. These are toxic substances. Avoid prolonged contact with skin.

Check the condition of the air filters; replace or clean dirty filters. Inspect the PAL-1K(A) for loose solder connections or screws especially in those cases experiencing appreciable vibration in service. Note the condition of gear trains; those showing signs of becoming dry should be lubricated with a drop or two of any high quality, light machine lubricant. Check the condition of all tubes.

6-4. CORRECTIVE MAINTENANCE.

a. GENERAL. After a defective part has been localized and isolated by the trouble-shooting technique presented in Section 5, replacement generally presents no major problem, particularly in the case of failure of non-complex electrical and mechanical components. However, when a complicated mechanical assembly fails, fabrication of parts peculiar without suitable tools makes replacement of the entire assembly more practical than disassembly, fabrication and reassembly. Pieces of PAL-1K(A) equipment that fall into this category are band and load switches, blowers, contactors, relays, etc.

b. ALIGNMENT. The procedure presented below is essentially Technical Material Corporation's factory alignment procedure for the PAL-1K(A). In general, however, re-alignment should not be performed indiscriminately and should only be done when necessary. Such indications are inability to get peaks within the correct range of tuning controls.

The following test equipments, or their equivalents, are required:

RF Signal Generator (Boonton Measurements Model 82)

Load resistor, 51.5 ohms, 2,500 watts (Termaline Model 82C or equivalent)

R-f ammeter (thermocouple type) 0-8 amperes (Simpson Model 39 or equivalent)

Tuning chart shipped with PAL-1K(A)

Voltmeter (Hewlett-Packard Model 410B or equivalent)

Alignment of the PAL-1K(A) is comprised of the 8 following adjustments and should be performed as shown in table 6-1 and in that order. (Figures in parentheses refer to Figure 3-1.)

1- Preliminary Adjustments

2- Alignment of 2- to 4-mc Band

3- Alignment of 4- to 8-mc Band

4- Alignment of 8- to 16-mc Band

5- Alignment of 16- to 22-mc Band

6- Alignment of 22- to 32-mc Band

7- Neutralization

8- Automatic Load and Drive Control Alignment

Set up equipment as shown in figure 5-1.

TABLE 6-1. ALIGNMENT PROCEDURE, PAL-1K(A)

ADJUSTMENT	STEP	OPERATION
1	1	With all power switches in OFF position, remove V203 tube from its socket in the RFD-1A Amplifier.
	2	Set MAIN POWER circuit breaker (28) to ON. Adjust PA FIL PRI ADJUST switch knob (16) for a reading on red mark on PA FIL PRI METER (15) dial.
	3	Observe the direction of B201 blower motor rotation in RFD-1A Amplifier. Rotation should cause air to circulate through the socket of V203.
	4	Set MULTIMETER switch (3) on the RFD-1A Amplifier to PA DC BIAS V x 10. Adjust PA BIAS ADJ potentiometer R703 on the PS-4A for an indication of 100 on MULTIMETER (4) red scale.
	5	Set MAIN POWER circuit breaker (28) to OFF. Then reinsert V203 tube in its socket in RFD-1A Amplifier.
	6	Set MAIN POWER circuit breaker (28) and PA OVERLOAD circuit breakers (21) (22) and (23) to ON. Set TRANSMITTER VOLTAGES switch (27) to ON.
	7	Tune the r-f generator to: 2-mc at 1-volt output level.
	8	Set DRIVER BAND switch (8) to 2-4 and PA BAND switch to 2-2. 5.
	9	Set MULTIMETER switch (3) to RF 1ST AMPL PLATE V x 1 and adjust 1ST AMPL TUNING knob (7) for a peak reading on MULTIMETER (4).
	10	Set MULTIMETER switch (3) to RF PA GRID and adjust PA GRID TUNING knob (2) for a peak reading on MULTIMETER (4).
	11	Reduce r-f generator output level to zero, then set PA LOADING switch (14), PA TUNING knob (10) and PA LOADING knob (13) for 2 mc as indicated on tuning chart.
	12	Set FINAL VOLTAGES switch (25) to ON.
	13	Adjust PA TUNING knob (10) for a pronounced dip on PA PLATE CURRENT meter (5).
	14	Adjust PA LOADING knob (13) until reading on PA PLATE CURRENT meter (5) begins to rise.
	15	Attach voltmeter at terminals 9 and 11 (ground) of E701 terminal block on PS-4A unit. Adjust MV ADJ potentiometer R716 on the PS-4A unit to obtain +500 VDC reading on the voltmeter. Remove voltmeter.
	16	Turn PA OVLD ADJ potentiometer R722 on PS-4A unit fully counterclockwise. Increase the output level of the r-f generator until PA PLATE CURRENT meter (5) indicates 600. Then turn PA OVLD ADJ potentiometer R722 on PS-4A unit clockwise until PA OVERLOAD PLATE circuit breaker (21) opens.
	17	Set FINAL VOLTAGES switch (25) to OFF.
2	18	Leave the r-f generator set at 2-mc and 1-volt output level.

TABLE 6-1. ALIGNMENT PROCEDURE, PAL-1K(A) (C nt.)

ADJUSTMENT	STEP	OPERATION
2 (Cont.)	19	With DRIVER BAND switch (8) set 2-4, at adjust C202 capacitor to approximately half capacity position (mid-way position).
	20	Set 1ST AMPL TUNING knob (7) to 0. 5 and set MULTIMETER switch (3) to RF 1ST AMPL PLATE V x 1; adjust L201 inductor on RFD-1A unit for maximum deflection on MULTIMETER (4).
	21	Set MULTIMETER switch (3) to RF PA GRID V x 10 and set PA GRID TUNING knob (2) to 1; adjust L219 inductor for maximum deflection on MULTIMETER (4). Return MULTIMETER switch (3) to RF 1ST AMPL PLATE V x 1.
	22	Tune r-f generator for 4-mc. Set 1ST AMPL TUNING knob to 9. 5 and adjust C202 capacitor on RFD-1A unit for maximum deflection on MULTIMETER (4).
	23	Set MULTIMETER switch (3) to RF PA GRID V x 10 and adjust PA GRID TUNING knob (2) for maximum deflection on MULTIMETER (4).
	24	The PA GRID TUNING knob (2) should now point to 9. 5. If not, repeat steps 18 through 23, using a setting slightly different from 0. 5 for 1ST AMPL TUNING knob (7) in step 20, until condition is met.
3	25	Tune r-f generator for 4-mc at 1 volt output level. Set DRIVER BAND switch (8) to 4-8 and adjust neutralizing capacitor C229 on RFD-1A unit to approximately 1/4 capacity.
	26	Set 1ST AMPL TUNING knob (7) to 0. 5 and set MULTIMETER switch (3) to RF 1ST AMPL PLATE V x 1. Adjust L202 inductor on RFD-1A unit for maximum deflection on MULTIMETER (4).
	27	Set MULTIMETER switch (3) to RF PA GRID V x 10 and set PA GRID TUNING knob (2) to 0. 5. Adjust L220 inductor on RFD-1A unit for maximum deflection on MULTIMETER (4). Return MULTIMETER switch (3) to RF 1ST AMPL PLATE V x 1.
	28	Tune r-f generator for 8-mc and adjust 1ST AMPL TUNING knob (7) for maximum deflection on MULTIMETER (4).
	29	Set MULTIMETER switch (3) to RF PA GRID V x 10 and adjust PA GRID TUNING knob (2) for maximum deflection on MULTIMETER (4).
	30	Both the 1ST AMPL TUNING knob (7) and PA GRID TUNING knob (2) should point to position 9. 5. If not, repeat steps 25 through 29 using a setting slightly different from 0. 5 for 1ST AMPL TUNING knob (7) in step 26, until condition is met.
4	31	Tune r-f generator for 8-mc at 1-volt output level. Set DRIVER BAND switch (8) to 8-16.
	32	Set 1ST AMPL TUNING knob (7) to 0. 5 and set MULTIMETER switch (3) to RF 1ST AMPL PLATE V x 1. Adjust L209 inductor on RFD-1A unit for maximum deflection on MULTIMETER (4).
	33	Set MULTIMETER switch (3) to RF PA GRID V x 10 and set PA GRID TUNING knob (2) to 0. 5. Adjust L223 inductor on RFD-1A unit for maximum deflection on MULTIMETER (4).

TABLE 6-1. ALIGNMENT PROCEDURE, PAL-1K(A) (Cont.)

ADJUSTMENT	STEP	OPERATION
4 (Cont.)	33 (Cont.)	Return MULTIMETER switch (3) to RF 1ST AMPL PLATE V x 1.
	34	Tune r-f generator for 16-mc and adjust 1ST AMPL TUNING knob (7) for maximum deflection on MULTIMETER (4).
	35	Set MULTIMETER switch (3) to RF PA GRID V x 10 and adjust PA GRID TUNING knob (2) for maximum deflection on MULTIMETER (4).
	36	Both the 1ST AMPL TUNING knob (7) and PA GRID TUNING knob (2) should point to position 8. If not, repeat steps 31 through 35, using a setting slightly different from 0.5 for 1ST AMPL TUNING knob (7) in step 32, until condition is met.
5	37	Tune r-f generator for 16-mc at 1-volt output level. Set DRIVER BAND switch (8) to 16-22.
	38	Set 1ST AMPL TUNING knob (7) to 4 and set MULTIMETER switch (3) to RF 1ST AMPL PLATE V x 1. Adjust L210 inductor on RFD-1A unit for maximum deflection on MULTIMETER (4).
	39	Set MULTIMETER switch (3) to RF PA GRID V x 10 and set PA GRID TUNING knob (2) to 3. Adjust L224 inductor on RFD-1A unit for maximum deflection on MULTIMETER (4). Return MULTIMETER switch (3) to RF 1ST AMPL PLATE V x 1.
	40	Tune r-f generator for 22-mc and adjust 1ST AMPL TUNING knob (7) for maximum deflection on MULTIMETER (4).
	41	Set MULTIMETER switch (3) to RF PA GRID V x 10 and adjust PA GRID TUNING knob (2) for maximum deflection on MULTIMETER (4).
	42	Both the 1ST AMPL TUNING knob (7) and PA GRID TUNING knob (2) should point to position 8. If not, repeat steps 37 through 41, using a setting slightly different from 4 for 1ST AMPL TUNING knob (7) in step 38, until condition is met.
6	43	Tune r-f generator for 22-mc at 1-volt output level. Set DRIVER BAND switch (8) to 22-32. Adjust C202 capacitor on RFD-1A unit to approximately half capacity (mid-way position).
	44	Set 1ST AMPL TUNING knob (7) to 3 and set MULTIMETER switch (3) to RF 1ST AMPL PLATE V x 1. Adjust L211 inductor on RFD-1A unit for maximum deflection on MULTIMETER (4).
	45	Set MULTIMETER switch (3) to RF PA GRID V x 10 and set PA GRID TUNING knob to 2. Adjust L225 inductor on RFD-1A unit for maximum deflection on MULTIMETER (4). Return MULTIMETER switch (3) to RF 1ST AMPL PLATE V x 1.
	46	Tune r-f generator for 32-mc and adjust 1ST AMPL TUNING knob (7) for maximum deflection on MULTIMETER (4).
	47	Set MULTIMETER switch (3) to RF PA GRID V x 10 and adjust PA GRID TUNING knob (2) for maximum deflection on MULTIMETER (4).

TABLE 6-1. ALIGNMENT PROCEDURE, PAL-1K(A) (C nt.)

ADJUSTMENT	STEP	OPERATION
6 (Cont.)	48	Both the 1ST AMPL TUNING knob (7) and PA GRID TUNING knob (2) should point to position 8. If not, repeat steps 43 through 47, using a setting slightly different from 3 for 1ST AMPL TUNING knob (7) in step 44, until condition is met.
7	49	Tune r-f generator for 8-mc at 1-volt output level. Set DRIVER BAND switch (8) to 8-16 and PA BAND switch (6) to 8-12.
	50	Set MULTIMETER switch (3) to RF 1ST AMPL PLATE V x 1 and adjust 1ST AMPL TUNING knob (7) until a peak reading is obtained on MULTIMETER (4).
	51	Set MULTIMETER switch (3) to RF PA GRID V x 10 and adjust PA GRID TUNING knob (2) until a peak reading is obtained on MULTIMETER (4).
	52	Set PA TUNING knob (10), PA LOADING knob (13) and PA LOADING switch (14) to positions as indicated on tuning chart for 8-mc.
	53	Set FINAL VOLTAGES switch (25) to ON.
	54	Slowly increase r-f generator output level until the reading on PA PLATE CURRENT meter (5) is approximately 220 milliamperes.
	55	Adjust PA TUNING knob (10) until a minimum reading is produced on PA PLATE CURRENT meter (5). Adjust PA LOADING knob (13) until reading on PA PLATE CURRENT meter (5) begins to rise.
	56	Decrease setting of r-f generator output level until reading on PA PLATE CURRENT meter (5) is restored to 220 milliamperes.
	57	Set MULTIMETER switch (3) to RF OUT V x 10 and note level of r-f output. Repeat steps 55 and 56 until reading on MULTIMETER (4) begins to drop. When this occurs, readjust controls (10) and (13) back to settings of previous adjustment to regain ultimate tuning point.
	58	Observing MULTIMETER (4), slowly increase r-f generator output level until full rated output power is obtained, as indicated by a reading of 23 on MULTIMETER (4). Check PA PLATE CURRENT meter (5); reading now should be approximately 300 milliamperes.
	59	Set FINAL VOLTAGES switch (25) to OFF. Adjust NEUT control (1) with screwdriver until a minimum reading is obtained on MULTIMETER (4).
	60	Set FINAL VOLTAGES switch (25) to ON. Tune r-f generator for 30-mc at 1-volt output level. Set DRIVER BAND switch (8) to 22-32 and PA BAND switch (6) to 22-32.
	61	Repeat steps 50 through 58, setting PA TUNING knob (10), PA LOADING knob (13) and PA LOADING switch (14) as indicated on tuning chart for 30-mc in step 52. Then perform step 59 again. If NEUT control (1) setting is not the same for 30-mc as for 8-mc, repeat process from step 49 for 8-mc and 30-mc until a compromise setting is obtained, which will keep MULTIMETER (4) indications at a minimum at both frequencies.

TABLE 6-1. ALIGNMENT PROCEDURE, PAL-1K(A) (C nt.)

ADJUSTMENT	STEP	OPERATION
8	62	Set ALDC switch (on rear of RFD-1A Chassis) to INT. Set panel controls as follows: Control — Setting DRIVER BAND (8) ..... 2-4 PA BAND (6) ..... 2-2.5 PA LOADING (13) ..... See Tuning Chart for 2-mc signal MULTIMETER ..... RF 1ST AMPL PLATE PA LOADING (14) ..... See Tuning Chart for 2-mc signal PA TUNING (10) ..... See Tuning Chart for 2-mc signal ALDC (11) ..... Fully counterclockwise FINAL VOLTAGES (25) ..... OFF
	63	Tune r-f generator for 2-mc and adjust output level for 1-volt. Adjust 1ST AMPL TUNING knob (7) for a peak reading on MULTIMETER (4).
	64	Set MULTIMETER switch (3) to RF PA GRID and adjust PA GRID TUNING knob (2) for a peak reading on MULTIMETER (4).
	65	Reduce r-f generator to zero. Set FINAL VOLTAGES switch (25) to ON. Slowly increase r-f generator output level until a reading of 220 milliamperes is obtained on PA PLATE CURRENT meter (5).
	66	Adjust PA TUNING knob (10) for a pronounced dip on PA PLATE CURRENT meter (5).
	67	Adjust PA LOADING knob (13) until reading on PA PLATE CURRENT meter (5) begins to rise.
	68	Decrease setting of r-f generator output level until reading on PA PLATE CURRENT meter (5) is restored to 220 milliamperes.
	69	Set MULTIMETER switch (3) to RF OUT V x 10 and note level of r-f output. Repeat steps 66 through 68 until reading on MULTIMETER (4) begins to drop. When this occurs, readjust controls (10) and (13) back to settings of previous adjustment to regain ultimate tuning point.
	70	Observing MULTIMETER (4), slowly increase r-f generator output level until full rated output power is obtained, as indicated by a reading of 23 on MULTIMETER (4). Check PA PLATE CURRENT meter (5); reading now should be approximately 300 milliamperes.
	71	Turn ALDC knob (11) slowly clockwise until reading on MULTIMETER (4) begins to decrease.

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 RFD-1A Amplifier are numbered in the 200 series, PS-4A Power Supply in the 700 series and PS-5 Power Supply in the 400 series. A socket associated with a particular plug-in device, such as electron tube or fuse, is identified by a reference designation which includes the reference designation of the plug-in device. For example, the socket for fuse F701 is designated XF701. 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 names 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 their major assemblies. Column 3 indicates how the part is used within a major component. Column 4 lists each Technical Materiel Corporation part number.

SYMBOL	DESCRIPTION	FUNCTION	TMC PART NO.
B201	BLOWER, motor and fan: 115/230V, 50/60 cps, single phase; 3200 rpm, 4 uf capacitance; clockwise rotation from shaft end of motor.	Final Cooling	BL-103
C201	CAPACITOR, fixed: mica; button type; 1000 uuf, ±10%, 300 wvdc.	Tank Elevating	CB21QW102K
C202	CAPACITOR, variable: ceramic; 7-45 uuf, char. C; 500 wvdc.	Tuning Trimmer	CV11C450
C203	CAPACITOR, variable: air dielectric; 12.5 to 270 uuf; single section.	Main Tuning	CB-139-1
C204	Same as C201.	Plate Bypass	
C205	CAPACITOR, fixed: mica; 1000 uuf, ±5%, char. C; 300 wvdc.	Coupling Plate	CM20C102J
C206	Same as C201.	Screen Bypass	
C207	Same as C205.	Bias Filter	
C208	Same as C201.	Bias Filter	
C209	CAPACITOR, fixed; ceramic; feed-thru type; 2000 uuf, ±20%, char. A; 500 wvdc.	Plate Bypass	CK70A202M
C210	Same as C209.	Bias Bypass	
C211	CAPACITOR, fixed: mica; 1600 uuf, ±5%, char. C; 500 wvdc.	Input Coupling	CM20C162J
C212	Same as C209.	Screen Bypass	
C213	Same as C201.	Bias Filter	
C214	Same as C205.	Coupling	
C215	Same as C209.	Bias Filter	
C216	CAPACITOR, fixed: mica; 5 uuf; ±5%, char. C; 300 wvdc.	Metering Divider	CM15C050J
C217	CAPACITOR, fixed: mica; 47 uuf, ±5%, 300 wvdc, char. C.	Metering Divider	CM15C470K
C218	Same as C201.	Metering Divider	
C219	Same as C209.	Metering Divider	
C220	CAPACITOR, fixed: mylar; .1 uf, ±5%, 200 wvdc, char. C.	Metering Divider	CN108C1003J
C221	CAPACITOR, fixed: mica; .01 uf, ±10%, char. B; 300 wvdc.	Filament Filter	CM35B103K
C222	Same as C221.	Meter Bypass	

SYMBOL	DESCRIPTION	FUNCTION	TMC PART NO.
C223	Same as C209.	Screen Bypass	
C224	Same as C209.	Plate Bypass	
C225	Same as C201.	Cathode Bypass	
C226	CAPACITOR, fixed: mica; 100 uuf, ±10%, char. C; 500 wvdc.	Neutralizing	CM20C101K
C227	Same as C201.	Plate Bypass	
C228	Same as C201.	Screen Bypass	
C229	CAPACITOR, variable: ceramic; 1.5-7 uuf, 500 wvdc.	Neutralizing	CV11A070
C230	Same as C205.	Coupling	
C231	CAPACITOR, variable: air dielectric; 1 section, 19 plates; 3.2-50 uuf, 500 wvdc.	Tuning Trimmer	CT-104-1
C232	CAPACITOR, variable: air dielectric; 12.5 to 270 uuf, single section.	Main Tuning	CB-139-3
C233	Same as C201.	Tank Elevating	
C234	CAPACITOR, fixed: mica; .001 uf, ±10%, char. B; 500 wvdc.	Coupling	CM20B102K
C235	Same as C209.	Interlock Bypass	
C236	Same as C209.	Interlock Bypass	
C237	Same as C221.	Meter Bypass	
C238	Same as C220.	Meter Filter	
C239	Same as C209.	Meter Filter	
C240	Same as C201.	Meter Filter	
C241	CAPACITOR, fixed: mica; button type; 150 uuf, .±10%, 300 wvdc, char. W.	Meter Divider	CB21QW151K
C242	CAPACITOR, fixed: ceramic dielectric; 3 uuf, char. SL; ±0.25 uuf, 500 wvdc.	Meter Divider	CC21SL030C
C243	Same as C209.	Meter Filter	
C244	CAPACITOR, fixed: ceramic; 1000 uuf, ±20%, 5000 wvdc.	Interlock Filter	CC-109-38
C245	Same as C220.	Meter Filter	
C246	Same as C201.	Meter Filter	

SYMBOL	DESCRIPTION	FUNCTION	TMC PART NO.
C247	CAPACITOR, fixed: ceramic; 500 uuf, ±20%, 5000 wvdc, 6-32 tapped studs each end, 13/16" dia x 7/8" lg o/a. Not a replaceable item, part of XV203.	Screen Bypass	CC-109-36
C248	Same as C201.	Screen Bypass	
C249	Same as C209.	Screen Bypass	
C250	Same as C209.	Bias Filtering	
C251	CAPACITOR, fixed: mica; button type; 270 uuf, ±10%, char. W, 300 wvdc.	Meter Divider	CB21QW271K
C252	Same as C205.	Meter Coupling	
C253	CAPACITOR, fixed: trylar; 500 uuf, ±10%, 8000 wvdc.	Coupling	CX102K501P
C254	CAPACITOR ASSEMBLY, variable: vacuum; capacity 5-750 uuf, 42 amps RMS, with gear.	Tuning	AM-111
C255	KIT, capacitor, replacement: consisting of 1 each: A-1845 - Neutralizer Plate Assembly MS-1667 - Plate, Neutralizing Capacitor PX-465 - Insulator, Plate, Neutralizing Capacitor	Neutralizing	AC-113
C256	CAPACITOR, fixed: ceramic; 100 uuf, ±10%, 5000 wvdc, temp. coef - N750.	Interlock Filter	CC-109-28
C257	CAPACITOR, fixed: ceramic; 3 uuf, ±10%, 5000 wvdc.	Meter Divider	CC-109-1
C258	CAPACITOR, fixed: trylar; .01 uf, ±5%, 4000 wvdc.	Plate Bypass	CX102J103M
C259	CAPACITOR, fixed: trylar; 2000 uuf, ±10%, 4000 wvdc.	Plate Bypass	CX102K202M
C260	Same as C259.	Plate Bypass	
C261	CAPACITOR, fixed: mica; 500 uuf, ±5%, char. B; 500 wvdc.	Filament Filter	CM30B501J
C262	Same as C201.	ALDC Filtering	
C263	Same as C201.	ALDC Filtering	
C264	Same as C209.	ALDC Bias Filtering	
C265	Same as C209.	ALDC Filtering	
C266	Same as C209.	Meter Filter	
C267	Same as C220.	Meter Filter	

SYMBOL	DESCRIPTION	FUNCTION	TMC PART NO.
C268	Same as C201.	Meter Filter	
C269	CAPACITOR, variable: vacuum; 7-1000 uuf, 42 amps RMS, with locking shaft and bevel gear.	Loading	AM-100
C270	Same as C257.	Meter Divider	
C271	Same as C241.	Meter Divider	
C272	Same as C244.	Loading	
C273	CAPACITOR, fixed: ceramic; 10 uuf, ±10%, 5000 wvdc.	Feedback	CC-109-8
C274	Same as C244.	Loading	
C275	Same as C253.	Coupling	
C276	Same as C209.	Bypass	
C277	NOT USED.		
C278	Same as C209.	Filament Bypass, V203	
C279	Same as C209.	Filament Bypass, V203	
C280	Same as C209.	Bypass, S206	
C281	Same as C209.	Bypass, S206	
C282	Same as C209.	Filament Bypass, V203	
C283	Same as C209.	Filament Bypass, V203	
C284	Same as C209.	Grid Bypass, V203	
C285	Same as C247. Not a replaceable item, part of XV203.	Screen Bypass, V203	
C286	Same as C247. Not a replaceable item, part of XV203.	Screen Bypass, V203	
C287	Same as C247. Not a replaceable item, part of XV203.	Screen Bypass, V203	
C288	CAPACITOR, fixed: ceramic; H.V., 5 uuf, ±10%, 5000 wvdc.	Feedback	CC-109-4
C289	CAPACITOR, fixed: mica, 10 uuf, ±10%, char. B; 300 wvdc.	p/o Parallel Tank Ckt.	CM15B100K
C290	Same as C289.	p/o Parallel Tank Ckt.	
CR201	DIODE; germanium: .140 dia. x .350 lg; 1 in. lg wire leads.	Grid Metering, V202	1N67
CR202	Same as CR201.	Grid Metering, V203	

SYMBOL	DESCRIPTION	FUNCTION	TMC PART NO.
CR203	DIODE, bonded silicon: .265 x .155 x .255 o/a; 1 in. lg wire leads.	Plate Metering, V203	1N303
CR204	Same as CR203.	ALDC	
CR205	Same as CR203.	Output Metering	
E201	NOT USED.		
E202	TERMINAL BOARD, barrier type: plastic; 4 terminals, screw w/feed thru solder lug type.	Blower Term. Bd.	TM-100-4
E203	CONTACT, electrical: consists of one brass, nickel plated button contact with 10-32 threaded rod; two ceramic insulators; one teflon gland; two fiber washers; one neoprene washer; one flat washer; one lockwasher; and one hex nut.	Feed-thru	AX-241
J201	JACK, connector: series UHF, teflon dielectric.	Input Jack	SO-239A-TEF
J202	CONNECTOR, receptacle: female; insulated; mtg dim. four 1/8 in. holes on 29/32 in. mtg. center.	Output	UG-560/U
L201	COIL, R.F.: tuned; 2-4 mc; Q = 50 at 2.5 mc.	2-4 Mc Tuning	CL-181
L202	COIL, R.F.: tuned; 4-8 mc; 4.5 to 7.5 uhy.	4-8 Mc Tuning	CL-150
L203	COIL, R.F.: 10 millihenries; 100 ma max. current; DC resistance approximately 30 ohms, bakelite body.	Plate Filter	CL-101-4
L204	COIL, R.F.: 128 microhenries, ±10%, Q = 100.	Plate Filter	CL-177
L205	NOT USED.		
L206	NOT USED.		
L207	COIL, R.F.: fixed; 4.5 uhy.	Filament Filter	CL-134-1
L208	Same as L204.	Screen Filter	
L209	COIL, R.F.: tuned; 8-16 mc; 1.3 to 1.6 uhy.	8-16 Mc Tuning	CL-175
L210	COIL, R.F.: tuned; 16-22 mc; minimum value = .47 uhy, maximum value = .82 uhy; Q-150 or greater.	16-22 Mc Tuning	CL-258
L211	COIL, R.F.: tuned; 22-32 mc; .20 to .28 uhy; Q = 135 or greater.	22-32 Mc Tuning	CL-257

SYMBOL	DESCRIPTION	FUNCTION	TMC PART NO.
L212	Same as L204.	Bias Filter	
L213	COIL, R.F.: 750 microhenries, ±20%; 100 ma max. current; DC resistance approximately 17 ohms; bakelite body.	Meter Compensation	CL-100-5
L214	Same as L204.	Meter Filter	
L215	COIL, R.F.: fixed; 26.4 microhenries, ±5%; Q = 110.	Meter Filter	CL-180
L216	Same as L204.	Plate Filter	
L217	Same as L204.	Screen Filter	
L218	Same as L204.	Plate Filter	
L219	COIL, R.F.: tuned; 2-4 mc; L = 10 uhy; Q = 40.	2-4 Mc Tuning	CL-173
L220	COIL, R.F.: tuned; 4-8 mc; L = 3.7 uhy to 4.7 uhy.	4-8 Mc Tuning	CL-256
L221	Same as L207.	Filament Filter	
L222	Same as L213.	Cathode RF	
L223	COIL, R.F.: tuned; 8-16 Mc.	8-16 Mc Tuning	CL-146
L224	COIL, R.F.: tuned; 16-22 mc; L = .55 to .85 uhy.	16-22 Mc Tuning	CL-259
L225	COIL, R.F.: tuned; 22-32 mc.	22-32 Mc Tuning	CL-260
L226	Same as L204.	Meter Filter	
L227	COIL, R.F.: fixed; 1.1 uhy.	Meter Compensator	CL-139
L228	Same as L204.	Meter Filter	
L229	Same as L215.	Meter Filter	
L230	Same as L215.	Meter Filter	
L231	Same as L204.	Screen Filter	
L232	Same as L204.	Screen Filter	
L233	Same as L213.	Meter Compensator	
L234	COIL, R.F.: fixed; 36 uhy.	Plate Filter	CL-152
L235	NOT USED.		
L236	COIL, R.F.: fixed; 185 microhenries, ±15 microhenries; Q = 50.	Plate Filter	
L237	COIL, filament: fixed; L - nom. 3.0; Q = 35; F-2 Mc.	Filament Filter	CL-171

SYMBOL	DESCRIPTION	FUNCTION	TMC PART NO.
L238	Same as L213.	ALDC Bias Filter	
L239	Same as L204.	ALDC Bias Filter	
L240	Same as L204.	ALDC Filter	
L241	Same as L204.	Meter Filter	
L242	Same as L215.		
L243	Same as L215.	Meter Filter	
L244	Same as L213.	Meter Compensator	
L245	COIL, R.F.: 12-28 mc.	HF Tuning	CL-143
L246	COIL, R.F.: single layer wound type; 23 turns CW.	LF Tuning	CL-174
L247	Same as L204.	PA Grid Choke	
L248	Same as L213.	Meter Compensator	
M201	METER, D.C.: 0-750 milliamps.	PA Plate Current	MR-110-750-S
M202	METER, D.C.: micro amp; 0-25 red, 0-50 black, 0-100 green scale	Multimeter	MR-150
P201	CONNECTOR, plug: male; pin type	Power Plug	MS3106B-32-7P
P202	CONNECTOR, plug: AN pin type; 1 contact; 35 amps; 3000 vdc, 210 vac (rms).	HV Cap	MS3106B-18-16P
PS201	SUPPRESSOR, parasitic.	Plate Parasitic Suppressor	AX-163
PS202	SUPPRESSOR, parasitic.	Plate Parasitic Suppressor	AX-164
R201	RESISTOR, variable: composition; 50,000 ohms, 2 watts, linear taper.	ALDC Bias Adj	RV4ATRA503B
R202	RESISTOR, fixed: composition; 10 ohms, ±10%, 1/2 watt.	Bias Divider	RC20GF100K
R203	RESISTOR, fixed: composition; 270 ohms, ±10%, 1/2 watt.	Input	RC20GF271K
R204	RESISTOR, fixed: composition; 47,000 ohms, ±10%, 1 watt.	Bias Divider	RC32GF473K
R205	Same as R204.	Bias Divider	
R206	RESISTOR, fixed: composition; 100 ohms, ±10%, 1/2 watt.	Input Divider	RC20GF101K
R207	RESISTOR, fixed: composition; 22,000 ohms, ±10%, 1/2 watt.	Voltage Dropping	RC20GF223K

SYMBOL	DESCRIPTION	FUNCTION	TMC PART NO.
R208	RESISTOR, fixed: composition; 680 ohms, ±10%, 1/2 watt.	Tank Elevating	RC20GF681K
R209	RESISTOR, fixed: composition; 150K ohms, ±5%, 1/2 watt.	Meter Calibration	RC20GF154J
R210	RESISTOR, fixed: composition; 220 ohms, ±10%, 1/2 watt.	Cathode Bias, V202	RC20GF221K
R211	RESISTOR, fixed: composition; 47,000 ohms, ±10%, 1/2 watt.	Bias	RC20GF473K
R212	RESISTOR, fixed: composition; 12 ohms, ±10%, 1/2 watt.	Bias Filter	RC20GF120K
R213	Same as R208.	Tank Elevating	
R214	RESISTOR, fixed: composition; 3300 ohms, ±10%, 1/2 watt.	Meter Compensator	RC20GF332K
R215	RESISTOR, fixed: composition; 20 megohms, ±5%, 1 watt.	Screen Metering	RC32GF206J
R216	NOT USED.		
R217	RESISTOR, fixed: composition; 120K ohms, ±5%, 1/2 watt.	Meter Calibration	RC20GF124J
R218	RESISTOR, fixed: composition; 750K ohms, ±5%, 1/2 watt.	Meter Calibration	RC20GF154J
R219	Same as R207.	Meter Compensator	
R220	RESISTOR, fixed: composition; 8200 ohms, ±10%, 1 watt.	Screen Current Meter	RC32GF822K
R221	RESISTOR, fixed: composition; 68,000 ohms, ±10%, 1 watt.	Bias Divider	RC32GF683K
R222	RESISTOR, fixed: composition; 12 ohms, ±10%, 2 watts.	Screen Current Meter	RC42GF120K
R223	RESISTOR, fixed: composition; 180,000 ohms, ±10%, 1 watt.	Screen Load	RC32GF184K
R224	RESISTOR, fixed: composition; 560K ohms, ±5%, 1/2 watt.	Meter Calibration	RC20GF564J
R225	RESISTOR, fixed: composition; 5.1 megohms, ±5%, 1/2 watt.	Bias Meter	RC20GF515J
R226	RESISTOR, fixed: composition; 12,000 ohms, ±10%, 1/2 watt.	ALDC Bias Divider	RC20GF123K
R227	RESISTOR, fixed: composition; 390,000 ohms, ±10%, 1/2 watt.	ALDC Bias Divider	RC20GF394K
R228	RESISTOR, fixed: composition; 180 ohms, ±5%, 1/2 watt.	Cathode Bias, V201	RC20GF181J

SYMBOL	DESCRIPTION	FUNCTION	TMC PART NO.
R229	RESISTOR, fixed: composition; 10,000 ohms, ±5%, 1 watt.	ALDC Bias Divider	RC32GF103J
R230	NOT USED.		
R231	NOT USED.		
R232	RESISTOR, fixed: composition; 47,000 ohms, ±5%, 1/2 watt.	Bias Divider	RC20GF472J
R233	Same as R228.	Voltage Dropping	
S201A, B, C, D	SWITCH, rotary: shorting; 2 sections, 5 positions; 30° angle of throw; silver plated brass, mycalex insulation.	Drive Band	SW-258
S202	SWITCH ASSEMBLY, rotary: dual section 9 positions, 1 pole each section, steatite insulation, nickel silver shaft.	PA Band	AS-118
S203	SWITCH, rotary: 8 contacts, 30° angle of throw, steatite insulation, nickel silver shaft.	PA Loading	AS-101
S204 A,B	SWITCH, rotary: 2 sections; 8 positions, 30° angle of throw; micalex insulation, silver plated contacts.	Meter Select	SW-245
S205	SWITCH, push button: momentary contact; normally closed; SPST, 15 amp at 125, 250 or 460 VAC, 1/2 amp at 125 VDC 1/4 amp at 250 VDC.	Bandswitch Interlock	SW-169
S206	SWITCH, rotary: low torque micro switch counter-clockwise direction of rotation; SPDT, 5 amps, 125 or 250 VAC.	Air Interlock	SW-252
S207	SWITCH, interlock: push to operate; total travel app. 0.312 in.; 15 amp, 120, 250 VAC; 2 amps resistive at 250 VDC.	Top Cover Interlock	SW-230
S208	Same as S207.	Bottom Cover Interlock	
S209	SWITCH, toggle: DPDT, 3 amp, 250 V.	ALDC switch	ST-22N
V201	TUBE, electron: power pentode; wide band amp., 9 pin miniature.	1ST Amplifier	5763
V202	TUBE, electron: beam power; large wafer octal base with sleeve, duo triode; 9 pin miniature.	Driver	6146
V203	TUBE, electron: power tetrode.	Power Amplifier	TV-100
XV201	SOCKET; electron tube: 9 pin miniature.	V201 Socket	TS103P01

SYMBOL	DESCRIPTION	FUNCTION	TMC PART NO.
XV202	SOCKET, electron tube: octal.	V202 Socket	TS101P01
XV203	SOCKET ASSEMBLY, tube (includes C247, 285, 286, 287)	V203 Socket	TS-142

SYMBOL	DESCRIPTION	FUNCTION	TMC PART NO.
C701	CAPACITOR, fixed: electrolytic, 25 uf, 450 wvdc, polarized, tubular case, octal plug-in type.	Filter, V701	CE51F250R
C702 A, B	CAPACITOR; fixed: paper dielectric, dual sections, 0.1 uf ±20%, 1000 wvdc, bathtub.	C702A Arc Supp., K701; C702B Screen Bypass V704	CP54B6FG104M
C703	CAPACITOR, fixed: paper dielectric, 2 uf, ±10%, 1000 wvdc, hermetically sealed cylindrical metal case.	Filter, V702	CP40C2FG205K
C704	CAPACITOR, fixed: paper dielectric, 0.1 uf, ±20%, 1000 wvdc, hermetically sealed bathtub metal case.	Arc Suppressor	CP54B1EF104M
C705	CAPACITOR, fixed: paper dielectric, 4 uf, ±10%, 600 wvdc, hermetically sealed cylindrical metal case.	Filter K703	CP40C2FF405K
C706	CAPACITOR, fixed: paper dielectric, 4 uf, ±10%, 600 wvdc, hermetically sealed cylindrical metal case.	Phase shift, RFD Blower	CP41B1FF405K
C707	Same as C704		
C708	Same as C704		
CB701	CIRCUIT BREAKER: dual magnetic and hydraulic combination blow out; DPST; contacts: 230 VAC, 60 CPS, 15 amps; insulated 1500 V; series trip release; delay curve 5 toggle lever type overload protection, manual reset.	MAIN POWER	SW-261
CB702	CIRCUIT BREAKER: magnetic and hydraulic combination blowout; SPST; contacts: 250 VAC, 50/60 CPS, 15 amps; coil rated 0.01 amps dc, insulated 1500V; shunt trip release; instantaneous toggle lever type; overload protection manual reset.	PA OVERLOAD CONT GRID	SW-229
CB703	CIRCUIT BREAKER: magnetic and hydraulic combination blowout, SPST; contacts: 250 VAC, 50/60 CPS, 15 amps; coil rated 0.06 amps dc, insulated 1500V; shunt trip release, delay curve 5, toggle lever type; overload protection manual reset.	PA OVERLOAD SCRN GRID	SW-262
CB704	CIRCUIT BREAKER: magnetic and hydraulic combination blowout; SPST; contacts: 250 VAC, 50/60 CPS, 15 amps; coil rated 0.1 amps dc, insulated 1500V; shunt release, instantaneous toggle lever type; overload protection manual reset.	PA OVERLOAD PLATE	SW-215

SYMBOL	DESCRIPTION	FUNCTION	TMC PART NO.
CR701	SEMICONDUCTOR DEVICE, diode: 200 wvdc; ±5%; reverse polarity; 50 watts; hermetically sealed metal case.	Bias Regulator	VR-100-200R5
E701	TERMINAL BOARD: barrier type; 11 double screw terminals, #6-32 thread; phenolic body.	External Connections	TM-100-11
E702	TERMINAL BOARD: barrier type; 4 feed-thru screw terminals, #6-32 thread; phenolic body.	Internal Connections, Power and Control	TM-102-4
F701	FUSE, cartridge: 5 amp, 250 volts; 1/4 in. dia. by 1-1/4 in. long; instantaneous type.	115V LINE	FU-100-5
F702	FUSE, cartridge: 1/10 amp, 250 volts, 1/4 in. dia. by 1-1/4 in. long; delay type.	L.V.B.-	FU-102-.1
F703	FUSE, cartridge: 2 amps, 250 volts, 1/4 in. dia. by 1-1/4 in. long; instantaneous type.	BLOWER	FU-100-2
F704	FUSE, cartridge: 1/4 amp, 250 volts, 1/4 in. dia. by 1-1/4 in. long; instantaneous type.	M.V.B.+	FU-100-.250
I701	LAMP, incandescent: 120 volts, 3 watts, S-6 clear bulb, bayonet base.	MAIN POWER Indicator	BI-102-3
I702	Same as I701	TRANSMITTER VOLTAGES Indicator	
I703	Same as I701	FINAL VOLTAGES Indicator	
J701	CONNECTOR, receptacle: 35 female contacts; 28 #16 contacts, 7 #12 contacts; straight type.	Interconnecting Jack for RFD-1A	MS3102A-32-7S
J702	CONNECTOR, receptacle: 22 female contacts; 18 #16 contacts; 4 #12 contacts; straight type.	Interconnecting Jack for PS-5	MS3102A-28-11S
J703	CONNECTOR, receptacle: 3 male contacts; polarized; straight type.	AC Input Jack	PL-133NG
J704	CONNECTOR, receptacle: r-f coaxial, type, female.	External ALDC	UG-625B/U
K701	RELAY, thermal: 180 second delay type; heater voltage, 115 VAC; heater wattage 2.5W; contacts SPST, normally open; contact rating, 115V, 3 amps AC; 220V, 1 amp AC; contact breakdown, contact-to-contact 1000V; heater-to-contact, 1500V; glass envelope; standard octal base.	180 Second Time Delay	RL-111-115-N0180

SYMBOL	DESCRIPTION	FUNCTION	TMC PART NO.
K702	RELAY, armature: coil voltage, 120 VDC; coil resistance, 10,000 ohms dc; contacts 3, form C; contact rating, 115V, 5 amp, non-inductive.	Control Relay	RL-116-DC-3C120
K703	RELAY, armature: coil voltage, 115 VDC; coil resistance, 5000 ohms dc; contact 1, form C, 4 form A; contact rating, 115V, 25 amp; non-inductive.		RL-114
L701	REACTOR: 10 henries; dc resistance 280 ohms; 70 ma dc; insulated for 1500V RMS; hermetically sealed metal case.	AC Filter	TF-5006
L702	REACTOR: 10 henries; dc resistance 85 ohms, 200 ma dc; insulated for 1500V; hermetically sealed metal case.	AC Filter	TF-144
M701	VOLTMETER: 0-150 volts ac; approx. resistance 25,000 ohms; linear scale; 3-1/2 in. rectangular case.	Primary Voltage for PA Filter	MR-152
R701	RESISTOR, fixed: wire wound 1500 ohms ±5%, 20 watts, solder lug terminals.	Series Dropping, V701	RW-110-23
R702	RESISTOR, fixed: composition, 6.8K ±5%, 2 watts.	Series Dropping, V701	RC42GF682J
R703	RESISTOR, variable: composition, 10K ±10%, 2 watts, taper A.	PA BIAS ADJ Potentiometer P/O Bleeder	RV4ATXA103A
R704	RESISTOR, fixed: composition, 10K ±5%, 2 watts.	P/O Bleeder	RC42GF103J
R705	RESISTOR, fixed: composition, 27K ±5%, 1 watt.	Series Dropping	RC32GF273J
R706	RESISTOR, fixed: composition, 100-ohms ±10%, 2 watts.	Arc Suppressor	RC42GF101K
R707	RESISTOR, fixed: composition, 150K ±5%, 1 watt.	Plate Load V704	RC32GF154J
R708	Same as R707	Screen Grid Dropping, V704	
R709	RESISTOR, fixed: composition, 1K ±10%, 1/2 watt.	Parasitic Supp.	RC20GF102K
R710	Same as R709	Parasitic Supp.	
R711	Same as R709	Parasitic Supp.	
R712	Same as R706	Cathode Bias, V703	
R713	Same as R706	Cathode Bias, V703	

SYMBOL	DESCRIPTION	FUNCTION	TMC PART NO.
R714	RESISTOR, fixed: wire wound, 8K ±5%, 20 watts, solder lug terminals.	Series Dropping	RW-110-46
R715	RESISTOR, fixed: composition, 33K ±5%, 2 watts.	P/O Bleeder Network	RC42GF333J
R716	RESISTOR, variable: composition, 25K ±10%, 2 watts.	Mid Voltage Adj. Pot, P/O Bleeder Network	RV4ATXA253A
R717	RESISTOR, fixed: composition, 3.9K ±5%, 2 watts.	Dropping, K702	RC42GF392J
R718	RESISTOR, fixed: composition, 27K ±5%, 2 watts.	P/O Bleeder Network	RC42GF273J
R719	RESISTOR, fixed: wire wound, 100K ±5%, 20 watts, solder lug terminals.	Bleeder for B +	RW-110-43
R720	Same as R706	Arc Suppressor	
R721	RESISTOR, fixed: wire wound, 10 ohms ±5%, 10 watts, solder lug terminals.	Protection for Meter Burn-out	RW-109-4
R722	RESISTOR, variable: wire wound, 15 ohms ±10%, 12.5 watts, taper A, locking type shaft.	PA Overload Adj. Rheostat, P/O CB704 Shunt Network	RP100XH150K
R723	RESISTOR, fixed: wire wound, 7.5 ohms ±5%, 10 watts, solder lug terminals.	P/O CB704 Shunt Network	RW-109-48
R724	Same as R706	Arc Suppressor	
R725	RESISTOR, fixed: wire wound, .009 ohms ±5%, 15 amps, 115 volts.	CB701 Shunt	AR-111
R726	Same as R725	CB701 Shunt	
R727	RESISTOR, fixed:wire wound, 20K ±5%, 10 watts, solder lug terminals.	Series Dropping I702	RW-109-37
R728	RESISTOR, fixed: wire wound, 15K ±5%, 10 watts, solder lug terminals.	Series Dropping V707, 708	RW-109-36
S701	SWITCH, rotary: single pole, 7 position, non-shorting, rates at 150 VAC, 10 amps.	PA FIL PRI ADJUST switch	SW-167-7
S702	SWITCH, toggle: DPST, 250V, 20 amps, ball lever	TRANSMITTER VOLTAGES switch	ST-104
S703	Same as S702	FINAL VOLTAGES switch	
T701	TRANSFORMER, power: fixed autotransformer, 115/230 VAC; 50/60 CPS, single phase; output seven positions tapped in 5V steps from 100V to 130V, any tap to deliver load at 3 amps.	Filament Voltage to PA tube	TF-164

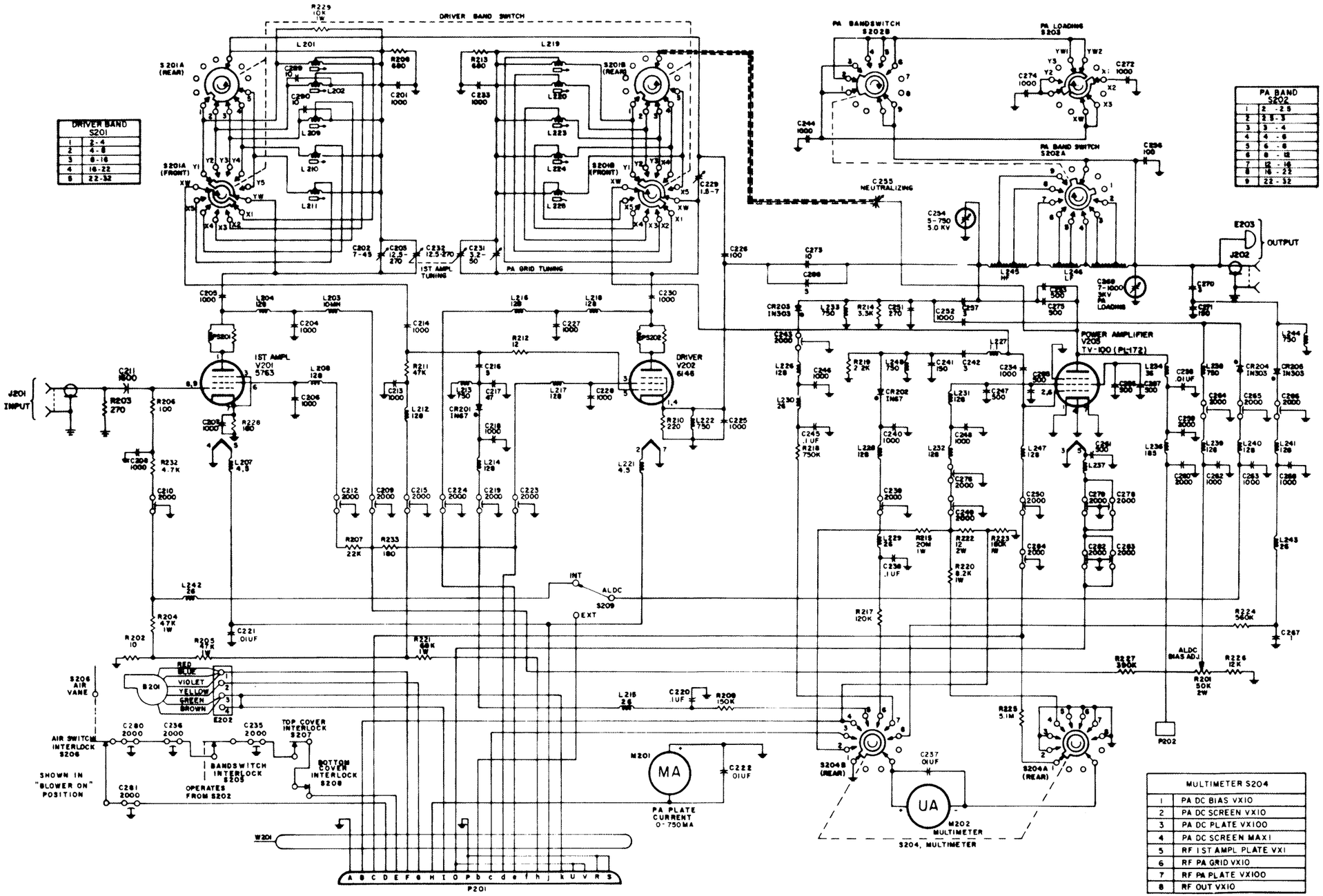
SYMBOL	DESCRIPTION	FUNCTION	TMC PART NO.
T702	TRANSFORMER, power: step-down, primary 115/230 VAC, 50/60 CPS, single phase; secondary, one winding, 6.3V, 2 amp tapped, 6V, 14 amps; insulated 1500V; rectangular metal case, hermetically sealed.	Filament Voltage to RFD-1A	TF-202
T703	TRANSFORMER, power: step-down, and step-up; primary 110/220V, 50/60 CPS; secondary, 6.3V at 5 amps, 6.3V at 2 amps, 680V CT at 100 ma, 5V at 2 amps; insulated for 1000 volts, rectangular metal case, hermetically sealed.	Filament & B+ for PS-4A	TF-101
T704	TRANSFORMER, power: step-up; primary 115/230 VAC, 50/60 CPS; secondary, one winding, 1150V at 200 ma, CT 500V insulation, hermetically sealed rectangular metal case.	Mid-Voltage Rect. Plate Voltage	TF-231
V701	TUBE, electron: full wave rectifier, 7-pin miniature.	Bias Rectifier	6X4
V702	TUBE, electron: full wave rectifier, octal.	Mid-Voltage Rectifier	5R4GY
V703	TUBE, electron: twin-triode amplifier, octal.	Mid-Voltage Series Regulator	6336A
V704	TUBE, electron: sharp-cutoff pentode; 7 pin miniature.	DC Amplifier	6AU6
V705	TUBE, electron: voltage regulator; 7 pin miniature.	PA Screen Grid Regulators	OA2
V706	TUBE, electron: voltage regulator; 7 pin miniature.	PA Screen Grid Regulators	OB2
V707	Same as V705.	Reg. Volt Reference	
V708	Same as V706.	Reg. Volt Reference	
XC701	SOCKET, electron tube: octal type; high crown, 3/16 in. high; moulded thermosetting plastic.	C701 Socket	TS101P01A
XF701	FUSEHOLDER, extractor post type: for cartridge fuse; overall length 2-9/64 in.; bushing mounted tapped 1/2 in. dia. 32 thd per in., with movable end terminal.	F701 Holder	FH-100-4
XF702	Same as XF701.	F702 Holder	
XF703	Same as XF701.	F703 Holder	
XF704	Same as XF701.	F704 Holder	

SYMBOL	DESCRIPTION	FUNCTION	TMC PART NO.
XI701	LIGHT, indicator: bayonet base with green frosted lens.	I701 Socket	TS-124-2
XI702	LIGHT, indicator: bayonet base with red frosted lens.	I702 Socket	TS-124-1
XI703	Same as XI702	I703 Socket	
XK701	Same as XC701	K701 Socket	
XV701	SOCKET, electron tube: 7 pin miniature, moulded thermosetting plastic.	V701 Socket	TS102P01
XV702	Same as XC701	V702 Socket	
XV703	Same as XC701	V703 Socket	
XV704	Same as XV701	V704 Socket	
XV705	Same as XV701	V705 Socket	
XV706	Same as XV701	V706 Socket	
XV707	Same as XV701	V707 Socket	
XV708	Same as XV701	V708 Socket	

SYMBOL	DESCRIPTION	FUNCTION	TMC PART NO.
B401	FAN, centrifugal: 100 cfm; CW rotation; 1-1/2 in. x 4-11/16 in. x 4-11/16 in. o/a.	Main Blower	BL-106-2
C401	CAPACITOR, fixed: paper dielectric; 4 mfd., ±10%; 4000 wvdc; w/mtg. brackets.	Filter	CN-109
C402	Same as C401.	Filter	
C403	Same as C401.	Filter	
J401	CONNECTOR, receptacle: AN socket type; one contact; 35 amps, 3000 VDC, 2100 VAC (rms); mtg. dim. 1.156 in. dim. cutout with four 3/16 in. holes on 1-1/16 in. mtg. centers.	Output Voltage Jack	MS3102A-18-16S
L401	REACTOR, filter: 10 hy at 600 ma; 25 hy at 100 ma; DC resistance less than 60 ohms; insulated for 4000V; in accordance with MIL-T-27; GR. 1, CL. A, FAM. 04.	Filter Choke	TF-5012
P401	CONNECTOR, plug: AN pin type; 4 contacts; 35 amps, 18 contacts, 20 amps; 200 VDC, 150 VAC (rms).	Power Input Plug	MS3106B-28-11P
R401	RESISTOR, fixed: wire wound; 90,000 ohms, ±5%, 160 watts, 42 ma.	Bleeder	RW-117-39
R402	RESISTOR, fixed: composition; 20 megohms, ±5%, 2 watts.	P/O Voltage Divider	RC42GF206J
R403	Same as R402.	P/O Voltage Divider	
R404	Same as R402.	P/O Voltage Divider	
R405	Same as R402.	P/O Voltage Divider	
R406	Same as R402	P/O Voltage Divider	
R407	RESISTOR, fixed: composition; 220,000 ohms, ±10%; 2 watts.	P/O Voltage Divider	RC42GF224K
S401	SWITCH, micro: push; 10 amps at 125/250 VAC; 1/2 amp at 125 VDC.	Door Interlock	SW-189
S402	Same as S401	Door Interlock	
S403	SWITCH, interlock: push to operate; total travel approx. .156; SPDT; 5 amps 250 VAC; 4 amps resistance at 30 VDC.	Top Cover Interlock	SW-219

SYMBOL	DESCRIPTION	FUNCTION	TMC PART NO.
T401	TRANSFORMER, power: step up; primary 115/230 VAC, 50/60 cps, single phase; secondary - to deliver 2800 V at 680 ma into load of 4120 ohms. Hermetically sealed rectangular steel case; four 1/4-20 thd. mtg. inserts on 6 in. x 6 in. mtg. centers.	Main Power	TF-193
T402	TRANSFORMER, power: filament; 115/230 VAC; 50/60 cycles 5 VAC at 15A CT insulated for 7000 V in accordance with MIL-T-27 GR. 1, CL. A, FAM. 01.	Filament	TF-147
V401	TUBE, electron: mercury vapor half wave rectifier; 4 pin base.	Rectifier	872A
V402	Same as V401.	Rectifier	
XV401	SOCKET, tube: jumper; twist lock; 4 pin base.	V401 Socket	TS-123-211-1
XV402	Same as XV401.	V402 Socket	

SECTION 8
SCHEMATIC DIAGRAMS



DRIVER BAND S201	
1	2-4
2	4-8
3	8-16
4	16-22
5	22-32

PA BAND S202	
1	2-2.5
2	2.5-3
3	3-4
4	4-6
5	6-8
6	8-12
7	12-16
8	16-22
9	22-32

MULTIMETER S204	
1	PA DC BIAS VX10
2	PA DC SCREEN VX10
3	PA DC PLATE VX100
4	PA DC SCREEN MAX1
5	RF 1ST AMPL PLATE VX1
6	RF PA GRID VX10
7	RF PA PLATE VX100
8	RF OUT VX10

NOTES

1. UNLESS OTHERWISE SPECIFIED, ALL CAPACITORS ARE IN UUF, INDUCTANCES ARE IN UH.
2. WAFER SWITCHES SHOWN IN EXTREME COUNTER-CLOCKWISE POSITION AND ARE VIEWED FROM FRONT. FRONT OF WAFER IS SIDE TOWARD CONTROL KNOB. WAFER NEAREST CONTROL KNOB IS SECTION A.
3. SWITCH S209 IS MOUNTED ON THE REAR OF THE CHASSIS.
4.

DESIGNATION	PANEL MARKING
C203-C232	1 ST AMPL TUNING
C231	PA GRID TUNING
C254	PA TUNING
C255	NEUT
C269	PA LOADING
M201	PA PLATE CURRENT
M202	MULTIMETER
R201	ALDC
S201	DRIVER BAND
S202	PA BAND
S203	PA LOADING
S204	MULTIMETER
S209	ALDC

5. CONNECTOR P201 VIEWED FROM PIN SIDE.

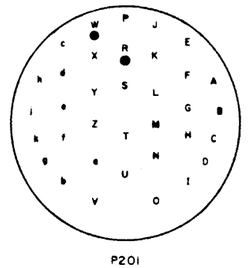


Figure 8-1. Schematic Diagram, RFD-1A RF Linear Amplifier

NOTES:

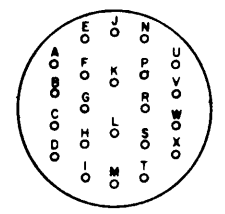
1. UNLESS OTHERWISE SPECIFIED, ALL RESISTANCES ARE IN OHMS, ALL CAPACITORS ARE IN UF.

2

DESIGNATION	PANEL MARKING
CB701	MAIN POWER
CB702	PA OVERLOAD CONT GRID
CB703	PA OVERLOAD SCRN GRID
CB704	PA OVERLOAD PLATE
F701	LINE 5A
F702	L.V.B. - 1/10A
F703	BLOWER 2A
F704	M.V.B. + 1/4A
I701	MAIN POWER
I702	TRANSMITTER VOLTAGES
I703	FINAL VOLTAGES
M701	PA FIL PRI
S701	PA FIL PRI ADJUST
S702	TRANSMITTER VOLTAGES
S703	FINAL VOLTAGES

3. SWITCH S701 SHOWN IN EXTREME COUNTERCLOCKWISE POSITION AS VIEWED FROM THE FRONT. FRONT OF S701 IS SIDE TOWARDS CONTROL KNOB.

4. RECEPTACLES VIEWED FROM MATING SIDE.



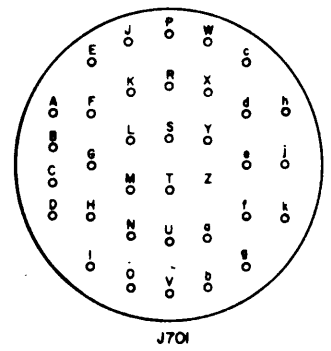
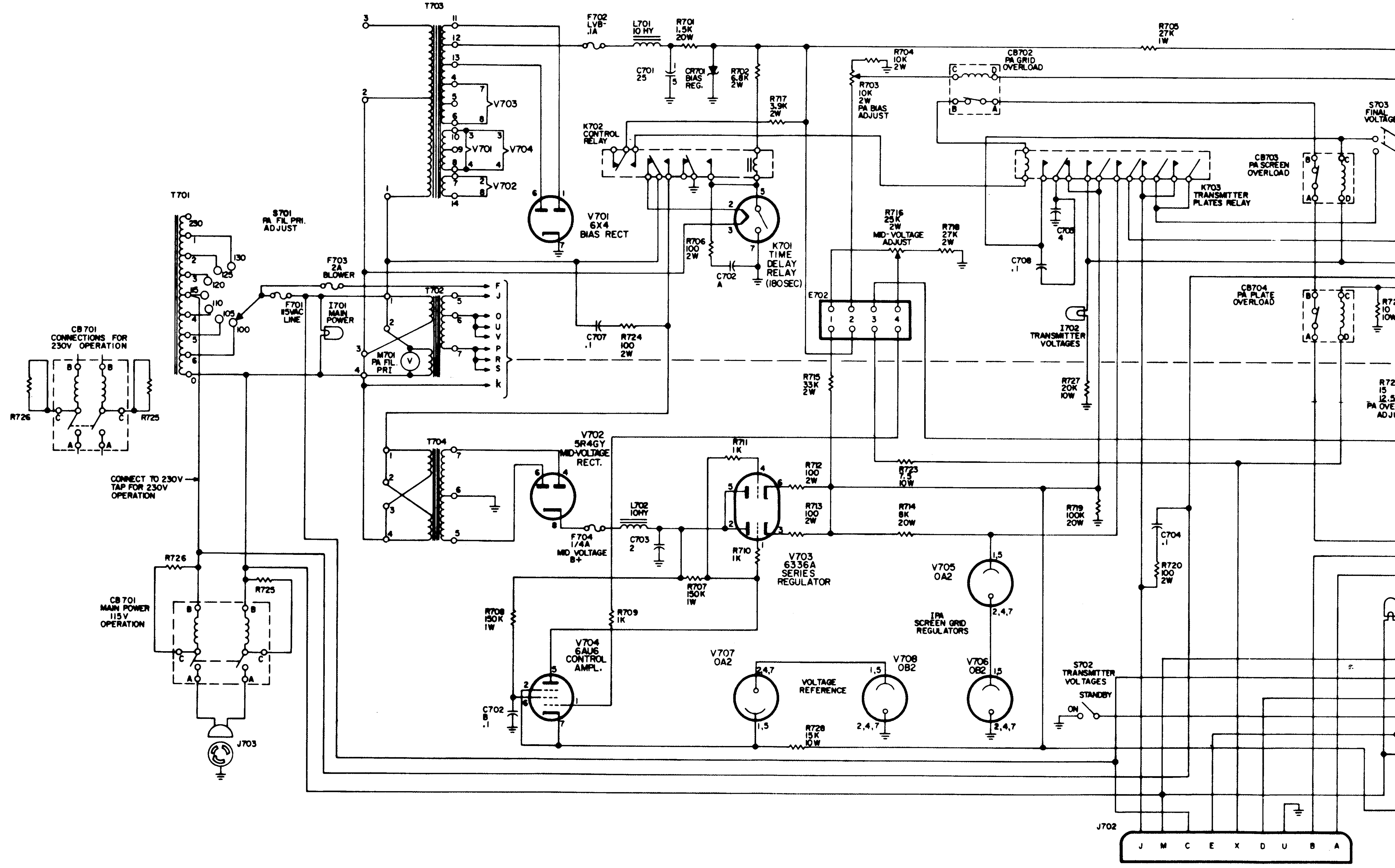


Figure 8-2. Schematic Diagram, PS-4A Low Voltage Power Supply



T701
T702
T703
T704
S701 PA FIL PRI ADJUST
F701 115VAC LINE
F702 LVB .1A
F703 2A BLOWER
F704 1/4A MID VOLTAGE B+
I701 MAIN POWER
M701 PA FIL PRI
L701 10 HY
L702 10HY
R701 1.5K 20W
C701 25
CR701 BIAS REG.
R702 6.8K 2W
R717 3.9K 2W
K702 CONTROL RELAY
V701 6X4 BIAS RECT
K701 TIME DELAY RELAY (180SEC)
R706 100 2W
C702 A
C707 .1
R724 100 2W
R704 10K 2W
R703 10K 2W PA BIAS ADJUST
CB702 PA GRID OVERLOAD
R705 27K 1W
R716 25K 2W MID-VOLTAGE ADJUST
R718 27K 2W
E702
R715 33K 2W
K703 TRANSMITTER PLATES RELAY
C705 4
C708 .1
I702 TRANSMITTER VOLTAGES
R727 20K 10W
CB703 PA SCREEN OVERLOAD
CB704 PA PLATE OVERLOAD
S703 FINAL VOLTAGE
V702 5R4GY MID-VOLTAGE RECT.
C703 2
R711 1K
R712 100 2W
R713 100 2W
R710 1K
R723 7.5 10W
R714 8K 20W
R719 100K 20W
V703 6336A SERIES REGULATOR
R707 150K 1W
R708 150K 1W
R709 1K
V704 6AU6 CONTROL AMPL.
C702 B .1
V705 0A2
V706 0B2
IPA SCREEN GRID REGULATORS
V707 0A2
V708 0B2
VOLTAGE REFERENCE
R728 15K 10W
C704 .1
R720 100 2W
S702 TRANSMITTER VOLTAGES
STANDBY
ON
J702
J M C E X D U B A
J703
R725
R726
CB701 MAIN POWER 115V OPERATION
CB701 CONNECTIONS FOR 230V OPERATION
CONNECT TO 230V TAP FOR 230V OPERATION

Figu

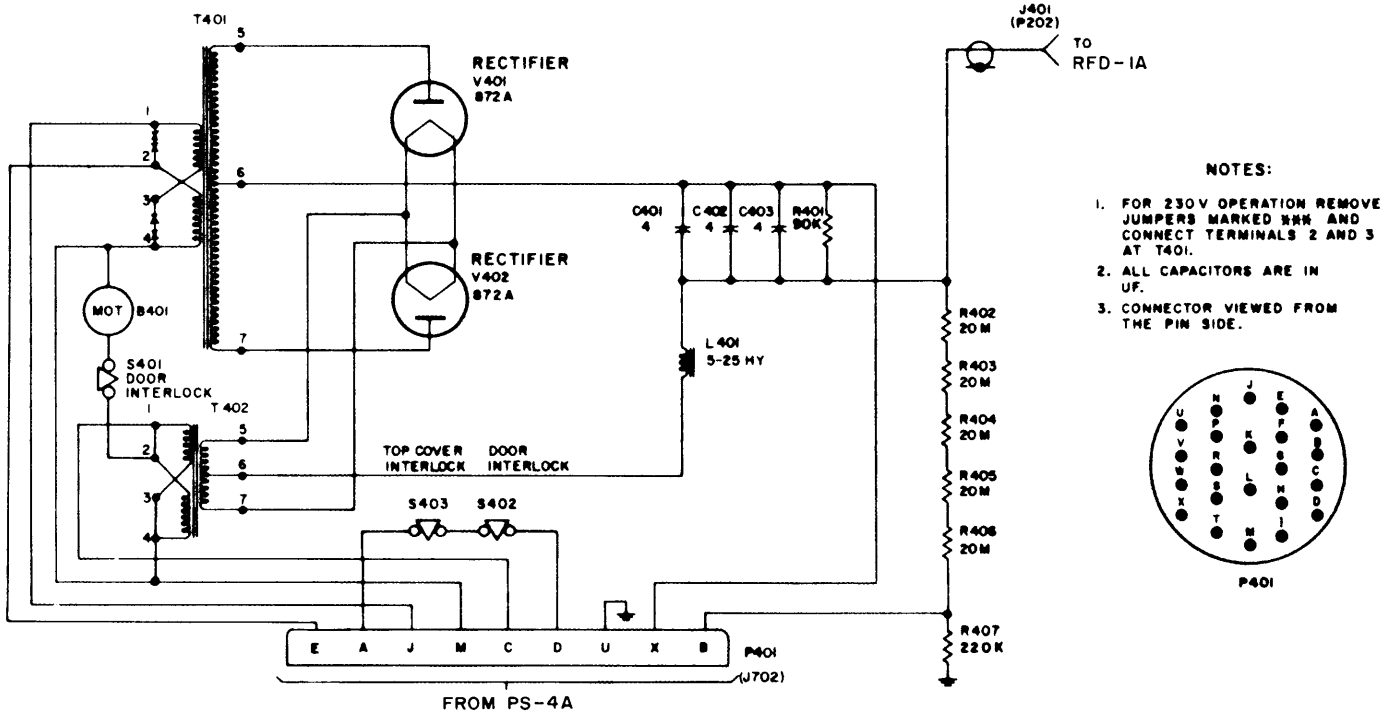


Figure 8-3. Schematic Diagram, PS-5 High Voltage Power Supply