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TECHNICAL MANUAL

for

LINEAR POWER AMPLIFIER

MODEL HFLM-1K

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THE TECHNICAL·MATERIEL CORPORATION

MAMARONECK, N.Y. OTTAWA, CANADA

PRINTED IN U.S.A.

IN1050

23 MARCH 1971

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CHANGE NO. 1

INSTRUCTION BOOK CHANGE NOTICE

Date February 1, 1972

Manual affected: Linear Power Amplifier, Model HFLM-1K IN 1050

Please make the following pen and ink corrections as indicated below.

1. On page 3-5, Table 3-4. MANUAL TUNING PROCEDURE:

   a. Change Step 10 to read: "Adjust PA BIAS control for 210 to 230 ma on PLATE METER (1)"

   b. Change Step 11 to read: "PUSH PLATE METER SELECT switch (2) up and adjust 2ND AMP for indication between 220 to 240 ma on PLATE METER (1)".

   c. Change Normal Indications column for Step 10 to read: "PLATE meter indicates quiescent current between 210 - 230 ma".

   d. Change Normal Indications column for Step 11 to read: "Plate meter indicates quiescent current between 220 - 240 ma when PLATE METER SELECT switch is pushed up".

2. On page 3-6, paragraph 3-5, change the first sentence to read:

   "When two tones of equal amplitude are applied to a SSB system, the ratio of PEP to AVERAGE POWER is .405 x PEP".

3. On page 4-3, paragraph 4-4b, second paragraph:

   Change "approximately 150 ma " to read between 210 - 230 ma
   Change "approximately 200 ma " to read between 220 - 240 ma

4. On page 5-5, paragraph 5-7, change Step 5 to read:

   Observe PLATE current meter and adjust PA BIAS control for indication between 210 - 230 ma as read on PLATE meter.

   Change the plate current values listed in Step 6 as follows:

   Change 200 ma to 220 - 240 ma
   Change 70 ma to 60 - 70 ma.

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Attn.: Director of Eng. Services.

CHANGE NO. 1 (cont)

INSTRUCTION BOOK CHANGE NOTICE

Date February 1, 1972

Manual ~~affected~~: Linear Power Amplifier, Model HFLM-1K IN 1050

5. On page 5-11, Table 5-4, change the plate current value from 150 ma to 210 - 230 ma.

6. On page 5-12, Table 5-4, change the plate current value from 220 ma to 220 - 240 ma.

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CHANGE NO. 2

INSTRUCTION BOOK CHANGE NOTICE

Date March 15, 1972

Manual affected: Linear Power Amplifier, Model HFLM-1K **IN** 1050

Please make the following pen and ink corrections as indicated below:

1. On page 7-3/7-4, Figure 7-1 (Sheet 1):

   Change switch contact designations on REFLECTED power switch as follows:

   Change contact No. 6 to No. 5
   Change contact No. 5 to No. 6
   Change contact No. 2 to No. 1
   Change contact No. 1 to No. 2

2. On page 7-9/7-10, Figure 7-2:

   Change reference designations on A101 and A102 as follows:

   Change CR1 to CR4
   Change CR2 to CR3
   Change CR3 to CR2
   Change CR4 to CR1

per EMN 20327 and EMN 20503

CHANGE NO. 3

INSTRUCTION BOOK CHANGE NOTICE

Date June 1, 1972

Manual effected: Linear Power Amplifier, Model HFLM-1K IN 1050

The High Voltage and Low Voltage Power Supplies models AP-149 and AP-150 in the HFLM-1K are replaced with power supplies models AP-151 and AP-152. When the items listed below are incorporated in the text the HFLM-1K will apply as written.

SECTION 1

1. On page 1-1 change Table 1-1 as follows:

TMC DESIGNATION	NOMENCLATURE
RF Linear Power Amplifier	TLAM-1K
Low Voltage and Bias Supply Drawer	AP-151
High Voltage Power Supply	AP-152

2. On page 1-1, paragraph 1-3(2) change as follows:

(2) Low Voltage and Bias Supply Drawer AP-151

The AP-151 is slide-mounted directly above the AP-152. It contains the filament and bias transformer, low voltage transformer, and the overload, bias, and PTT relays. Mounted on the front panel are the SCREEN and PLATE circuit breakers, an INTERLOCKS indicator, the high voltage ALARM and its associated switch, a HIGH VOLTAGE indicator (used also as a combination push-button-indicator switch in certain configurations), and indicator fuses for BLOWER, FILAMENT, LV, BIAS, DC and CONTROL.

(3) High Voltage Power Supply AP-152

The heavy high voltage power supply components are mounted on a chassis and slide-mounted in the base of the equipment cabinet. The AP-152 contains the high voltage transformer, high voltage on relay, front and rear blower motors. Mounted on the front panel are the MAIN POWER circuit breaker, H.V. Indicator and POWER Indicator lamps.

SECTION 2

1. On page 2-2, Step 3 (Primary AC Input Connections) change to read:

Connect AC input cable to AC POWER jack on rear of associated equipment cabinet.

CHANGE NO. 3 (cont)

INSTRUCTION BOOK CHANGE NOTICE

Date June 1, 1972

Manual affected: Linear Power Amplifier, Model HFLM-1K IN 1050

2. On page 2-5, Step 6B change to read:
The following modular units are slide-mounted:

RF Power Amplifier, TLAM-1K
L.V. and Bias Supply Drawer, AP-151
H.V. Power supply, AP-152

3. On page 2-5, Step 7:
Delete sentence "b"
Delete J8001 in sentence "d"

4. On page 2-7, paragraph 2-6 change to read:
Audio intelligence and CW key lines enter the HFLM-1K through Interface Panels located in the rear of associated equipment cabinet. (Refer to associated system wiring diagram for external transmitter control connections.)

Delete balance of text beginning with NOTE.
Delete page 2-8,2-9/2-10.

SECTION 5

1. On page 5-3, figure 5-3:
Replace figure 5-1 with figure 5-1 supplied with this change notice.

2. On page 5-4, Table 5-2:
Replace Table 5-2 Fuse Functions with Table 5-2 supplied.

SECTION 6

1. Replace AP-149 Parts List with AP-151 Parts List supplied.

2. Replace AP-150 Parts List with AP-152 Parts List supplied.

SECTION 7

1. Replace Figure 7-2 (AP-150) with AP-152 schematic supplied.

2. Replace Figure 7-3 (AP-149) with AP-151 schematic supplied.

Disregard Figure 7-4 (No longer applicable to HFLM-1K)

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CHANGE NO. 4

INSTRUCTION BOOK CHANGE NOTICE

Date June 5, 1972

Manual affected: Linear Power Amplifier Model HFLM-1K IN 1050

Please make pen and ink corrections to Figure 7-1 (Sheet 1) as indicated in Figure 1 and 2 below:

Figure 1

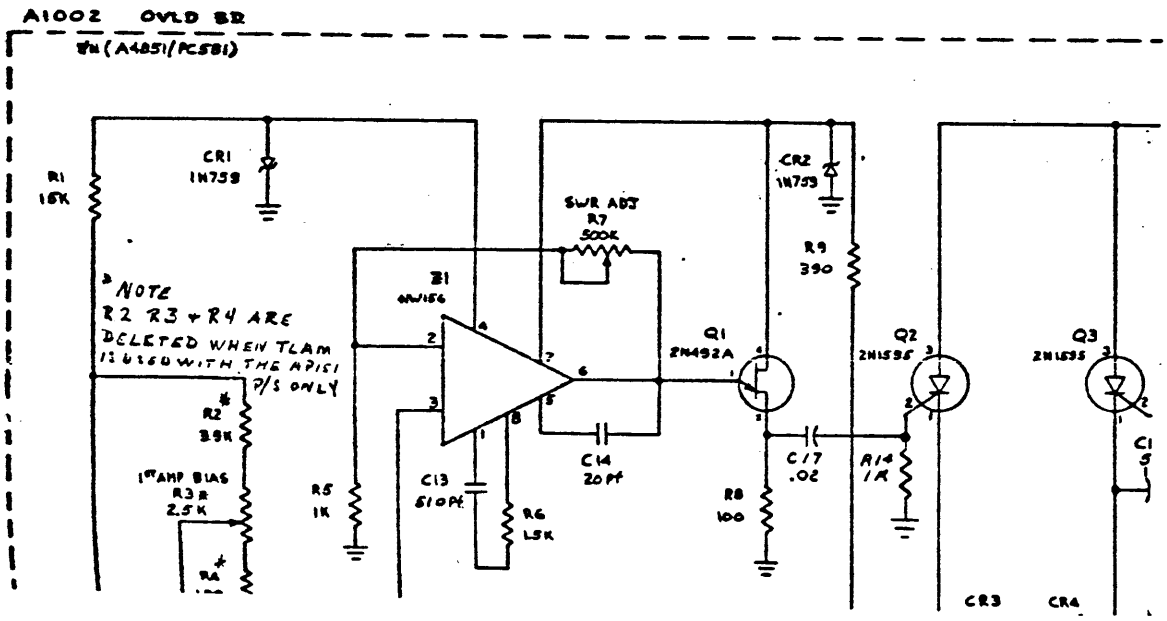
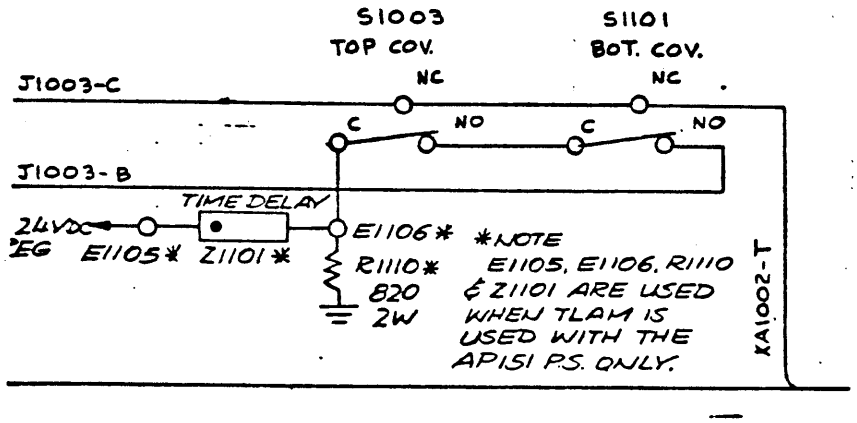


Figure 2



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CHANGE NO. 5

INSTRUCTION BOOK CHANGE NOTICE

Date June 1, 1972

Manual affected: Linear Power Amplifier, Model HFLM-1K IN 1050

1. On page 7-7/7-8, Figure 7-1:

   Please make pen and ink corrections to Figure 7-1, as indicated on the figure attached to this change notice.

2. On page 6-4, add the following to Bandswitch Assembly Parts List:

Ref Symbol	Description	TMC Part Number
L5	Coil, RF	CL474

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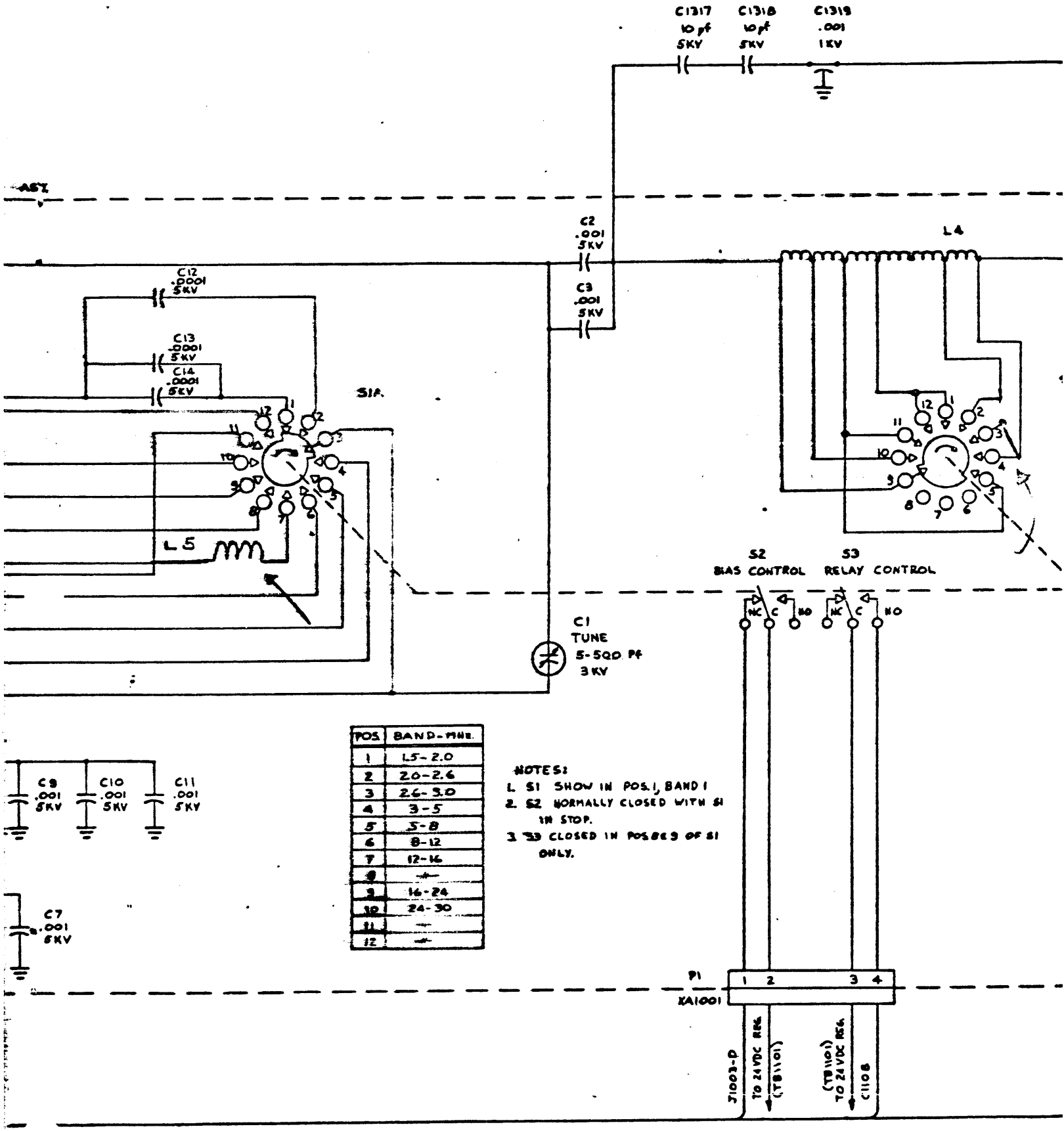

POS	BAND-MHz
1	1.5-2.0
2	2.0-2.6
3	2.6-3.0
4	3-5
5	5-8
6	8-12
7	12-16
8	—
9	16-24
10	24-30
11	—
12	—

NOTES:
1. S1 SHOW IN POS. 1, BAND 1
2. S2 NORMALLY CLOSED WITH S1 IN STOP.
3. S3 CLOSED IN POS. 8 & 9 OF S1 ONLY.

Figure 7-1. Power Amplifier TLAM-1K, Schematic Diagram (CK1845A) (Sheet 3 of 3)

TABLE 5-2. FUSE FUNCTIONS

No.	Fuse	Function
1	BLOWER Fuse	Protective fuse for blower, lights to indicate fuse defective (1.5 amp 115 vac, .75 amp 230 vac).
2	FILAMENT Fuse	Protective fuse for Filament and Bias transformer, lights to indicate fuse defective (2.0 amp 115 vac, 1.0 amp 230 vac).
3	BIAS Fuse	Protective fuse for dc return of bias supply, lights to indicate fuse defective (.2 amp).
4	L.V. Fuse	Protective fuse for primary ac input to L.V. transformer, lights to indicate fuse defective (1.0 amp 115 vac, .5 amp 230 vac).
5	DC Fuse	Protective fuse for dc return of 24 vdc supply, lights to indicate fuse defective (2.0 amp).
6	CONTROL Fuse	Protective fuse for Low Voltage and Filament-Bias transformer, lights to indicate fuse defective (1.0 amp 115 vac).
7	AC Fuse	Protective fuse for servo amplifier, lights to indicate fuse defective. (.5 amp)
8	DC Fuse	Protective for 24 vdc line, lights to indicate fuse defective. (.5 amp)

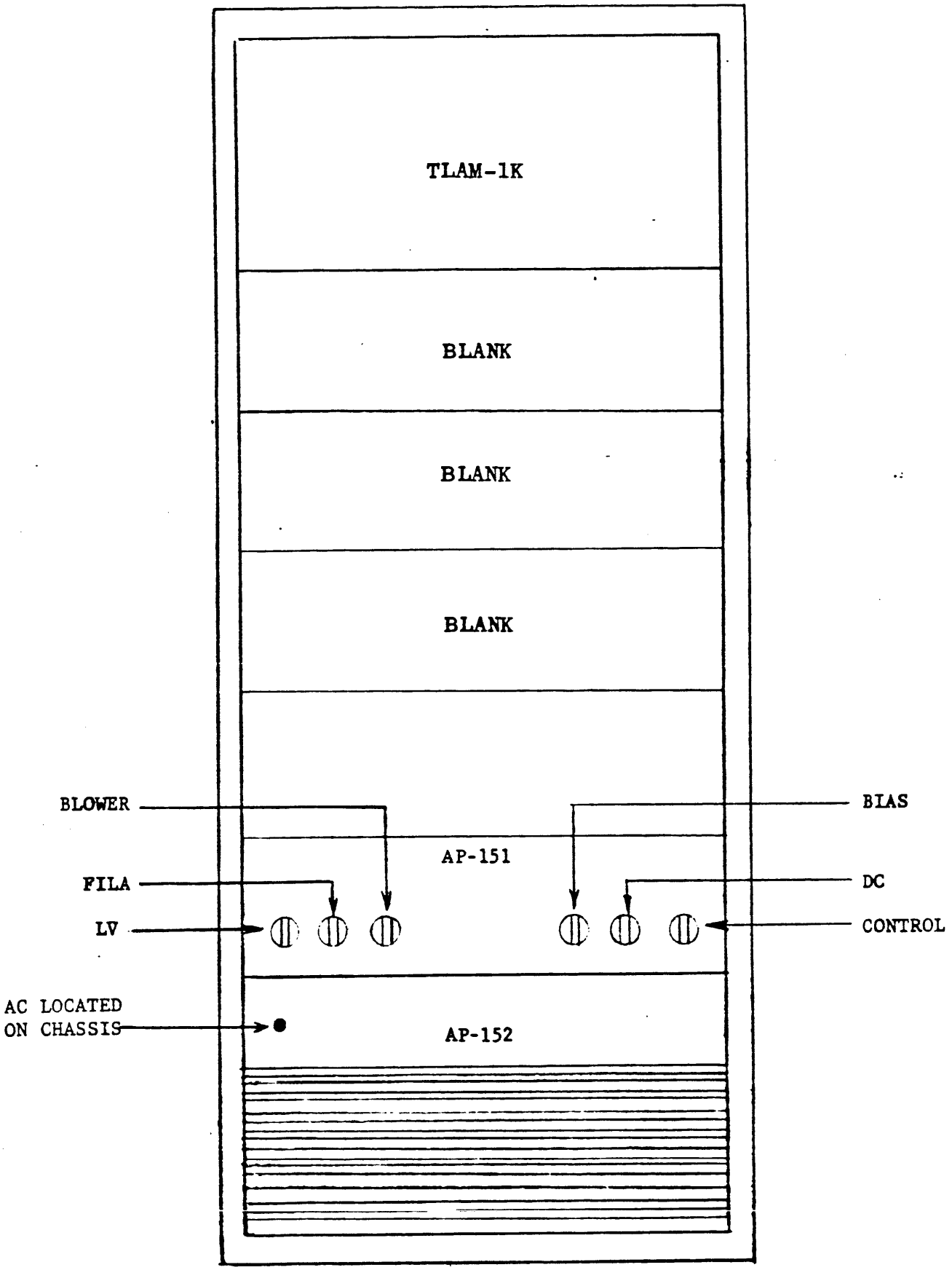

Figure 5-1. Fuse Location

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
	A-4853-6 Assembly, Board, PC Rect	
A101CR1 thru A101CR4	Rect, Scond, Dev	DD140
A101R1	Resistor, Fixed, WW 10W	RW109-4
A101R2	Same as A101R1	
A101R3	Resistor, Fixed, WW 20W	RW110-3
	A-4853-7 Assembly, Board, PC Rect	
A102CR1 thru A102CR4	Rect, Scond, Dev	DD140
A102R1	Resistor, Fixed, WW 10W	RW109-4
A102R2	Same as A102R1	
A102R3	Resistor, Fixed, WW 10W	RW109-7
	A-4875 Assembly, Board, PC Zener	
A103CR1	Scond, Dev, Dio	1N2846A
A103CR2	Same as A103CR1	
A103R1	Resistor, Fixed, Comp	RC42GF274J
A103R2	Resistor, Fixed, Comp	RC42GF124J
A103R3	Resistor, Fixed, WW 25W	RW111-33
A103R4	Same as A103R3	
A103R5	Resistor, Fixed, WW 50W	RW105-35
A103R6	Same as A103R5	
A103R7	Same as A103R5	
A103R8	Resistor, Fixed, Comp	RC42GF101J
A103R9	Same as A103R8	

AP152 H/V Power Supply

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
A101	Assembly, PC, Board, Rect	A-4853-6*
A102	Assembly, PC, Board, Rect	A-4853-7*
A103	Assembly, PC, Board, Zener	A-4875*
B101	Fan, Vent	BL106-2
B102	Same as B101	
C101	Capacitor, Fixed, Film	CN109
C102 thru C104	Same as C101	
C105	Capacitor, Fixed, Paper	CP70B1EG106K
CB101	Circuit, Breaker	SW261
DS101	Lamp, Incand	BI105-1
F101	Fuse, Circuit	FU102-.500
K101	Rel, Arm	RL184-3
L101	React, 5H	TF5034
L102 thru L104	Same as L101	
R101	Res, Fixed, WW 160W	RW117-39
R102	Same as R101	
T101	Xfmr, P1	TF413
TB101	Terminal, Bd, Barr	TM102-4
XDS101	Socket, Lamp	TS136-2FS
XF101	Fuse holder	FH105
XK101	Soc, Rel	TS196-1
Z101	Shunt, Circuit, Breaker	AR196
Z102	Shunt, Circuit, Breaker	AR197

A-4877 Board, Assembly, PC Bias

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
CR1	Rect, Scond, Dev	DD130-600-1.5
CR2	Scond, Dev, Dio	1N645
CR3 thru CR10	Same as CR2	
K1	Rel, Arm 4PDT	RL156-15
K2	Rel, Arm 4PDT	RL156-10
R1	Res, Fxd, Comp	RC42GF100J
R2	Same as R1	
R3	Res, Fxd, Comp	RC42GF122J
R4	Res, Var, Comp	RV4LAYSA252A
R5	Res, Fxd, Comp	RC42GF101J
R6	Res, Fxd, Comp	RC42GF332J
R7	Res, Var, Comp	RV4LAYSA502A
R8	Res, Fxd, Comp	RC42GF102J
R9	Res, Fxd, Comp	RC42GF472J
R10	Res, Var, Comp	RV4LAYSA103A
R11	Res, Fxd, Comp	RC42GF123J
R12	Res, Fxd, Comp	RC32GF122J
R13	Res, Fxd, Comp	RC32GF152J
R14	Same as R12	
R15	Same as R13	
XK1	Soc, Rel	TS171-4
XK2	Same as XK1	

AP151 L/V and Bias Supply

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
A301	Board, Assembly, Pc, Bias	A-4877*
C301	Capacitor, Fixed, Elec	CE52C200Q
C302	Same as C301	
C303	Capacitor, Fixed, Elec	CE116-8VN
C304	Same as C303	
CB301	Circuit, Breaker	SW262
CB302	Circuit, Breaker	SW215
CR301	Scond, Dev, Dio	1N2843RA
CR302	Scond, Dev, Dio	1N2831RA
CR303	Scond, Rect	RX108-2
CR304	Scond, Dev, Dio	1N3321B
CR305	Scond, Dev, Dio	1N3324B
DS301	Lamp, Incand	BI110-7
DS302	Same as DS301	
DS303	Gen, Audio, Sig.	BZ101-2
J301	Conn, Recep, ML	MS3102A32-414P
K301	Rel, Arm.	RL168-3C10-24 DC
L301	React. 5H	TF5028
L302	Same as L301	
R301	Res, Fxd, WW 10W	RW109-19
R302	Res, Fxd, Comp	RC42GF474J
R303	Res, Fxd, Comp	RC20GF103J
R304	Res, Fxd, WW. 10W	RW109-1
R305	Same as R304	
R306	Res, Fxd, WW 20W	RW110-5

AP151 L/V and Bias Supply

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R307	Same as R304	
R308	Res, Fxd, Comp	RC42GF392J
R309	Res, Fxd, WW 20W	RW110-6
R310	Res, Fxd, Comp	RC42GF101J
R311	Same as R310	
S301	Switch, Toggle, SPST	ST103-5-62
S302	Switch, Push, DPDT	SW522-1
T301	Transformer, Fil	TF414
T302	Transformer, L/V	TF416
TB301	Terminal, Strip, Barr	TM100-8
XA301	Conn, Pc, Board	JJ319-22DFE
XC301	Socket, Octal	TS101P01
XC302	Same as XC301	
XCR301	Soc, Scond, Dev	TS166-1
XCR302	Same as XCR301	
XDS301	Light, Ind	TS153-11
XDS302	Light, Ind	TS184
XF301	Fuseholder	FH104-3
XF302	Same as XF301	FH104-3
XF303	Same as XF301	
XF304	Same as XF301	
XF305	Fuseholder	FH104-11
XF306	Same as XF305	
XK301	Same as XC301	

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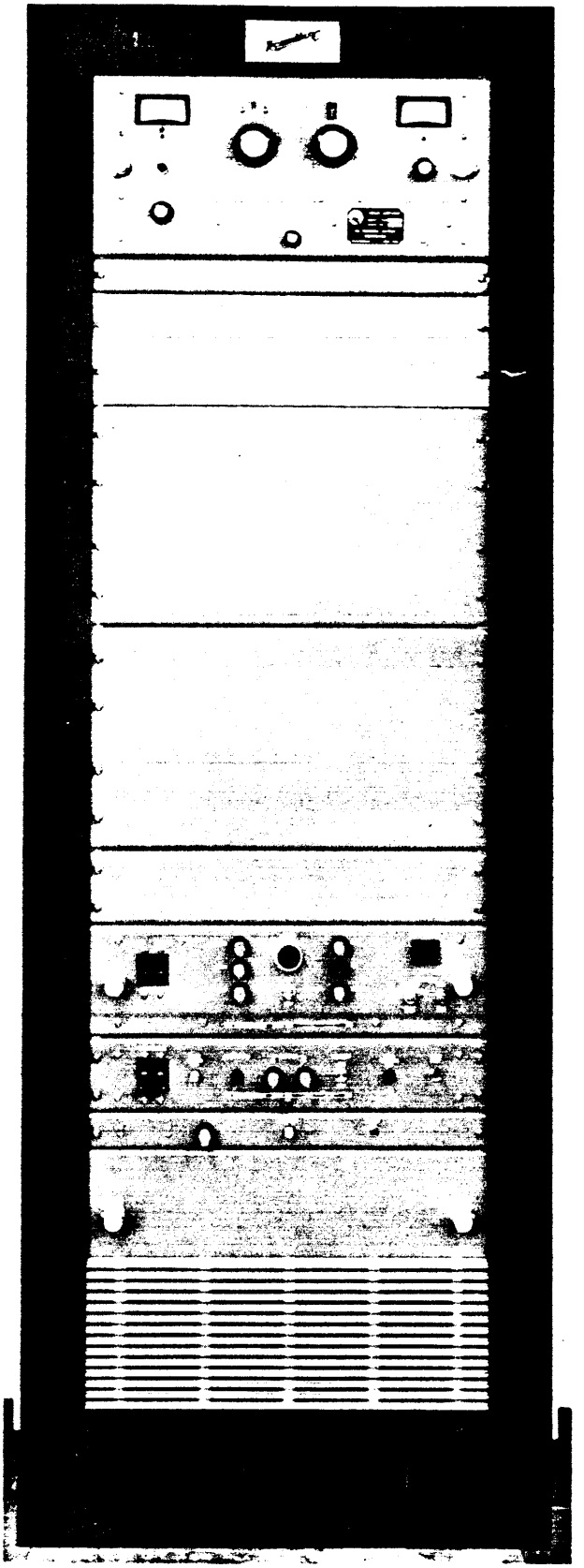


Figure 1-1. High Frequency Linear Power Amplifier HFLM-1K

SECTION 1

GENERAL INFORMATION

1-1. PURPOSE OF EQUIPMENT.

The TMC Model HFLM-1K (figure 1-1) is a High Frequency Linear Power Amplifier and when used with a suitable exciter provides 1 Kilowatt (PEP) and average throughout the frequency range of 1.5 MHz to 30 MHz. This Linear Amplifier can be used as the prime source of H. F. communication, or part of an existing transmitting system. The lightweight small size of the HFLM-1K makes it readily adaptable for shipboard, aircraft and land installations.

1-2. EQUIPMENT MAKE-UP.

Table 1-1 lists the major components of the HFLM-1K as they appear in figure 1-1.

TABLE 1-1. MAJOR COMPONENTS

TMC DESIGNATION	NOMENCLATURE
R. F. Linear Power Amplifier	TLAM-1K
Low Voltage and Bias Supply Drawer	AP-149
Power Distribution Panel	APP-18
High Voltage Power Supply	AP-150
Equipment Cabinet	RAK-110-3

1-3. DESCRIPTION OF EQUIPMENT.

a. GENERAL - As shown in figure 1-1, the HFLM-1K consists of a single equipment cabinet, housing all the components that make up the HFLM. Primary power and external input connections are made through either of two access holes in the bottom rear and side of the HFLM. RF power is routed through a directional coupler mounted in the RF Amplifier drawer to the output connector mounted in the opening located on the top of the equipment cabinet.

The HFLM-1K houses a two-stage broad band linear amplifier, power-amplifier, associated power supplies and control circuits. Provisions are made to install optional equipments, such as an exciter, antenna tuner and/or a harmonic filter, switchable or fixed.

Heavy high voltage power supply components are mounted on a chassis bolted to the base of the equipment cabinet.

(1) RF Amplifier TLAM-1K - The RF Amplifier is slide-mounted in the equipment cabinet (top unit) and serves as Power Amplifier for the HFLM-1K. The TLAM-1K contains two broadbanded, low-level RF amplifiers and a final amplifier which provides 1000 watts PEP output. The final tube is an 8576 tetrode and is air-cooled by a self-contained blower inside the unit. The front panel Plate Meter with its switch provides constant monitoring of the amplifier plate circuits. Also mounted on the front panel is an output meter that monitors power output in kilowatts. Bandswitching is accomplished manually.

(2) Low Voltage and Bias Supply Drawer, AP149 - The Low Voltage and Bias Supply Drawer is slide mounted directly above the APP-18. It contains the filament and bias transformer, low voltage transformer, Filament Timer, the Overload, Bias and PTT Relays. Mounted on the front panel are the H. V. On-Off switch, the PLATE and SCREEN circuit breaker, H. V. ALARM, H. V. Alarm ON-OFF switch and the H. V. ON indicator lamp.

(3) Power Distribution Panel, APP-18 - The Power Distribution Panel is mounted directly below the Low-Voltage and Bias Supply Drawer. It contains the Main Power Circuit Breaker, the AC Input Board (A202), the EXCITER ON-OFF switch, the Power ON, H. V. ON and Interlock indicator. A TEST KEY is mounted on the front panel for exciter key down and test purposes.

1-4. TECHNICAL SPECIFICATIONS.

FREQUENCY RANGE:	1.5 to 30 MHz standard
OPERATING MODES:	Depend on exciter used with HFLM
POWER OUTPUT:	1000 watts average and PEP power; continuous key down service
OUTPUT IMPEDANCE:	50 ohms, unbalanced (70 ohms optional)
STABILITY AND FREQUENCY CONTROL:	Within 1 part in 10^8 (depends on exciter used with HFLM)
TUNING:	Manual
RF INPUT:	Provides rated PEP output with approximately 100 milliwatts input
SPURIOUS SIGNALS:	At least 50 db down from rated PEP output
HARMONIC SUPPRESSION:	Better than -45 db for 2nd harmonic with reference to full PEP output. All other harmonics at least -55 db.
HARMONIC FILTERS:	Available fixed for all frequencies above 30 mc or bandswitched for lower frequencies. Resultant harmonics conform to latest requirements.
METERING:	Meters with special illuminated overload protection
NOISE:	Power supply ripple 55 db down from full PEP output. Other 70 db down--special "white noise" protection.
COOLING:	Filtered forced air cooling. Semi-pressurized cabinet.
ENVIRONMENTAL:	Designed to operate in any ambient temperature between the limits of 0 and 50°C. for any value of humidity to 90%.
SPECIAL FEATURES:	Overload protection and alarm. Controlled and adjustable ALDC. Safety interlocks at all high voltage points.
PRIMARY POWER:	115/230 Volts AC, Single Phase, 50/60 Hz.
POWER REQUIREMENTS:	Maximum 3.75 KW. All solid state power supply.
SIZE:	25-1/4" W x 30" D x 72" H 19" W x 26" D x 37" H (less cabinet)
INSTALLED WEIGHT:	Approximately 600 pounds. Approximately 300 pounds less cabinet.
COMPONENTS AND CONSTRUCTION:	Manufactured in accordance with JAN/MIL wherever practicable

SECTION 2

INSTALLATION

2-1. EQUIPMENT INSPECTION.

The HFLM-1K Linear Power Amplifier, hereafter referred to as Linear Amplifier, was assembled, calibrated and tested at the factory before shipment. Inspect all packages for possible damage during transit. Carefully unpack each crate as indicated by the packing list provided with the Transmitter shipment. Inspect all packing materials for parts that may have been shipped as loose items (cabinet hardware, connectors, technical manuals, etc.).

2-2. EQUIPMENT PACKAGING.

The equipment is shipped in boxes as shown by figure 2-2 (typical equipment packaging). The box number and contents are stenciled on the outside of each box.

2-3. PRIMARY POWER REQUIREMENTS.

The Linear Amplifier requires a single phase source of 230 vac 50/60 Hz, at approximately 17 amps.

2-4. INSTALLATION PROCEDURES.

A minimum number of assemblies, subassemblies, components and hardware have been disassembled from the equipment and separately packaged, thus reducing the possibility of equipment damage in transit. The method of disassembly and separate packaging also permits realistic equipment handling.

Carefully read the instructions for each step. After reading, consider the complexity involved in performing the step; it may be advisable to simulate a complex step before actually doing it. Make sure each step has been completed before proceeding to the next.

Cables, wires, and other miscellaneous items that are disconnected during equipment disassembly are tagged and taped to the equipment. The information on a given tag indicates the designated terminal on a component to which the tagged item must be connected. Make sure all cables and wires have been connected as designated on tags and that all packing material, tags and tape have been removed before sealing-up the cabinet or section of the cabinet with a front panel drawer.

Temporary removal and replacement of panels, and component mounting assemblies are specifically called out in the procedure in order to install various items. Do not anticipate instructions; to insure correct installation, perform each step exactly as it is written.

NOTE

Refer to the supplied equipment packing list to locate the appropriate crates containing the components, hardware, and units outlined in the following steps.

STEP 1

a. Unpack assorted LOOSE ITEMS from crate.

b. Check each item contained against equipment supplied list.

STEP 2

a. Unpack cabinet from crate.

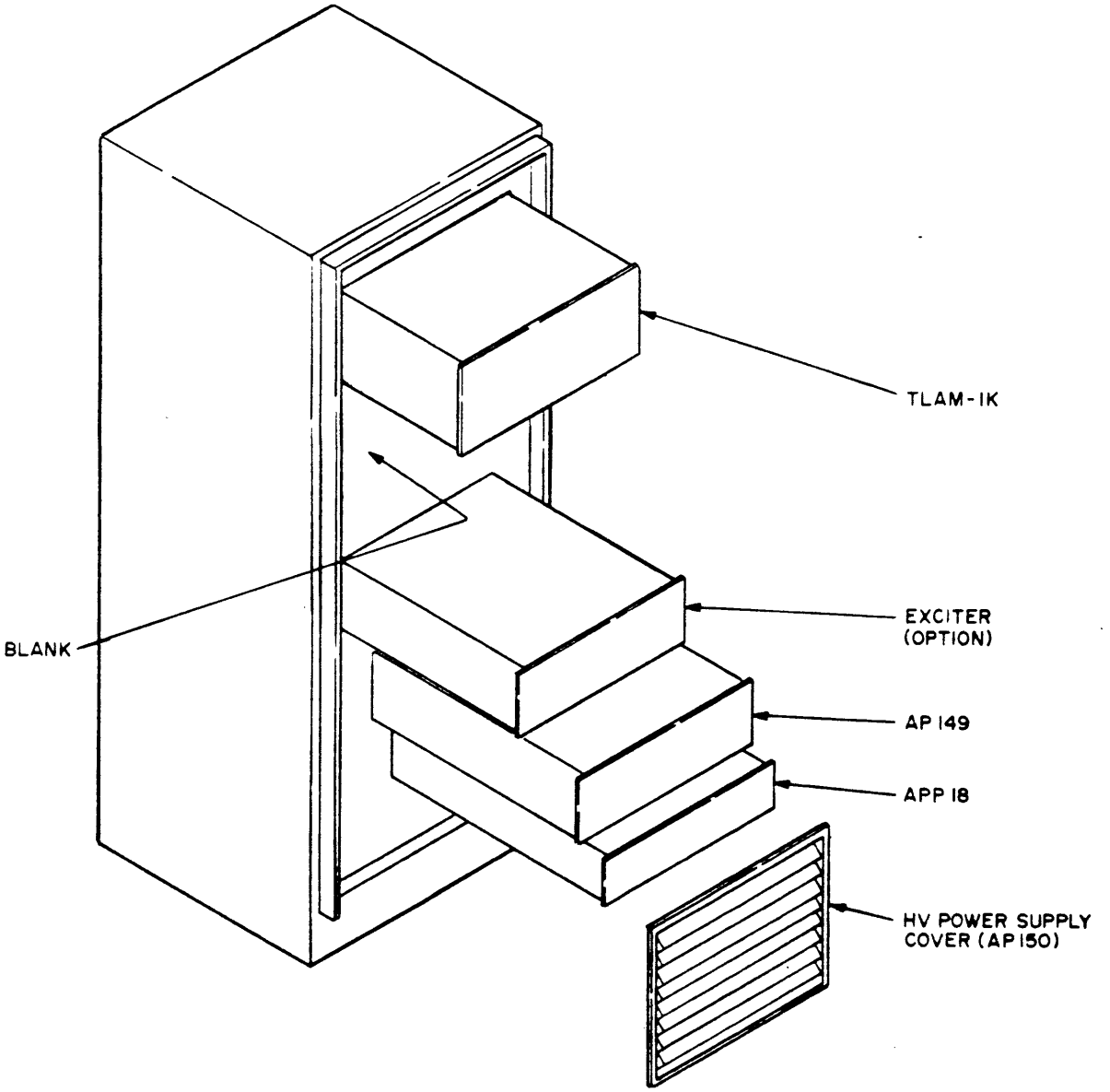


Figure 2-1. Typical HFTLM-1K Installation

b. Position cabinet upright (Technimatic indicator located on front panel indicates upright position), remove side and rear panels; this can be accomplished by turning the screw-type fastener located at the top-center of each panel.

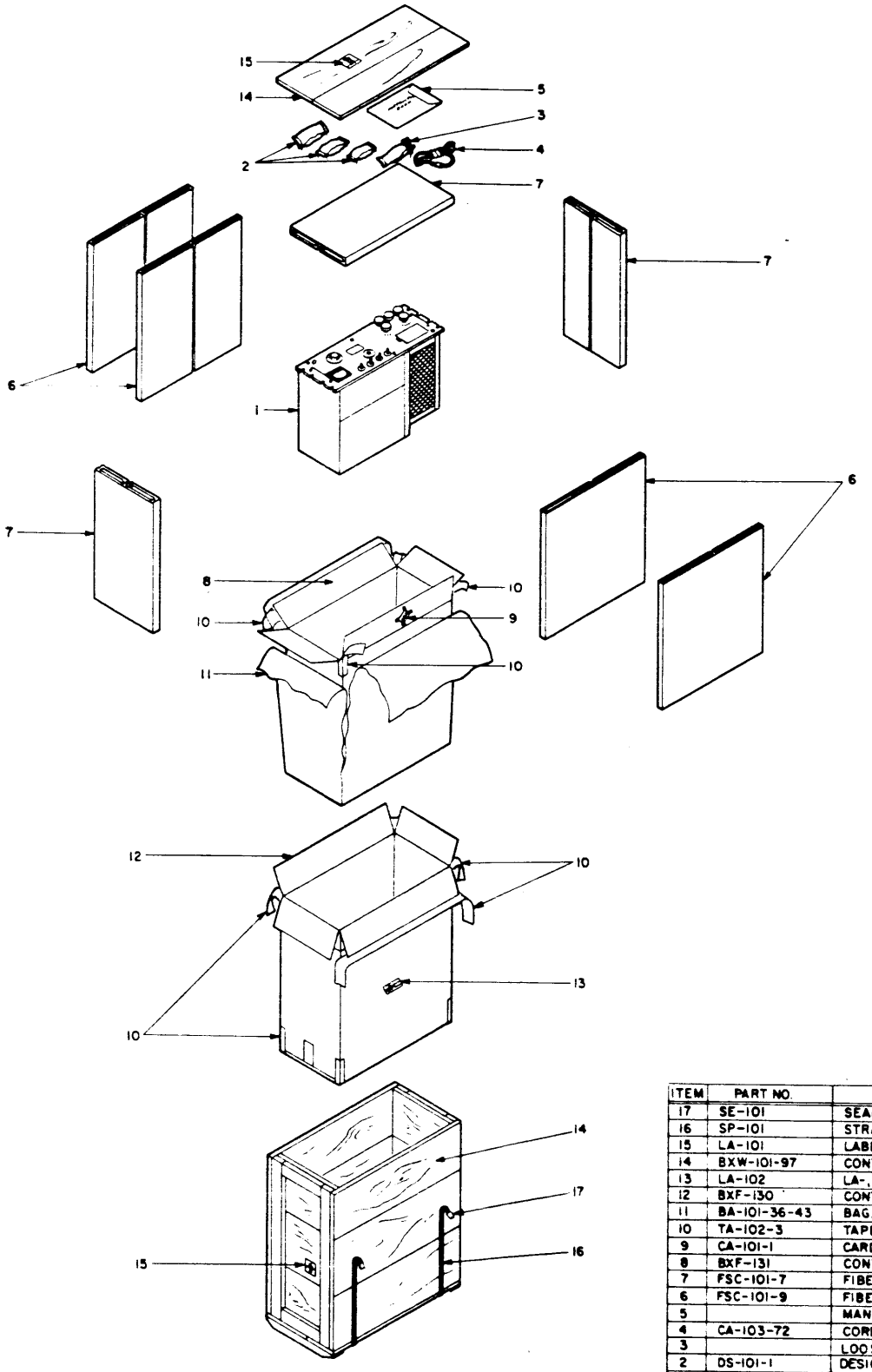
c. Remove all packing material from cabinet and position cabinet in accordance with pre-installation planning. (See figures 2-1, 2-2 and 2-3.) Figure 2-3 gives dimensions for cabinet base mounting.

WARNING

INSURE PRIMARY POWER IS OFF AND TAGGED.

STEP 3 (Primary AC Input Connections)

a. Remove top cover on APP-18 (Distribution Panel).



ITEM	PART NO.	DESCRIPTION
17	SE-101	SEALS, STRAPPING
16	SP-101	STRAPPING, STEEL
15	LA-101	LABEL, FRAGILE
14	BXW-101-97	CONTAINER, SHIPPING
13	LA-102	LA-, METHOD II
12	BXF-130	CONTAINER, OUTER
11	BA-101-36-43	BAG, BARRIER
10	TA-102-3	TAPE, PRESSURE SENSITIVE
9	CA-101-1	CARD, HUMIDITY INDICATOR
8	BXF-131	CONTAINER
7	FSC-101-7	FIBERBOARD SHEET, CREASED
6	FSC-101-9	FIBERBOARD SHEET, CREASED
5		MANUALS, INSTRUCTION
4	CA-103-72	CORD, LINE
3		LOOSE ITEMS
2	DS-101-1	DESICCANT, 16 UNIT
1		MODULAR UNIT

Figure 2-2. Modular Units, Typical Preparation for Shipment

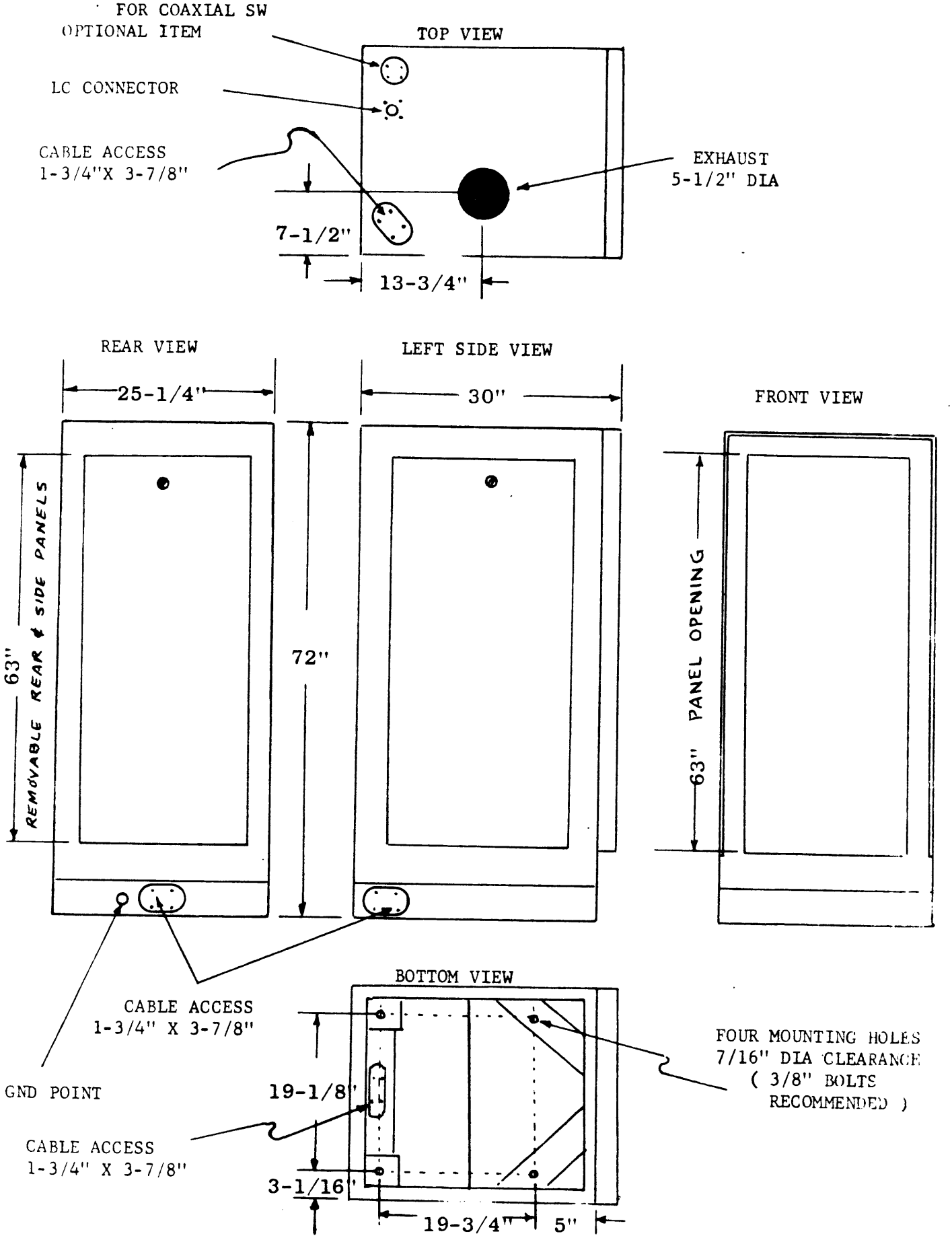


Figure 2-3. Outline Dimensional Diagram

b. Route AC input cable into base assembly through access hole and secure to appropriate terminals on AC input board located in the APP-18, Power Distribution Panel A202, terminal #7 and 9.

c. Position and secure top cover on APP-18.

STEP 4 (Power Amplifier Tube Installation) (8576)

a. Remove top cover on TLAM-1K (RF Amplifier).

b. Carefully lift power amplifier tube from crate and position it on top of the PA tube socket (located in RF Amplifier).

c. Position tube pins to line up with PA tube socket contacts.

d. Carefully lower tube straight down into socket until slight resistance is encountered. Make sure tube is centered in socket.

e. Press tube firmly down into socket. A slight amount of effort may be required to seat tube. Caution should be observed in seating the tube so as not to damage contacts in socket. Check tube seating; it must be all the way down and centered in tube socket.

f. Tighten retaining strap so that tube is held securely in place.

g. Replace TLAM top cover and secure in place.

STEP 5

a. Remove all tubes and relays from LOOSE ITEMS crate.

b. Install tubes and relays in their respective units; tighten relay and tube clamps where necessary (tubes and plug-in relays are marked for identification and ease in locating their respective sockets).

STEP 6

a. Installation of Modular Units

(Refer to figure 2-1 for information regarding cabinet location of all modular units.)

b. The following modular units are slide-mounted:

RF Power Amplifier, TLAM-1K
L. V. and Bias Supply Drawer, AP-149

c. To install any slide-mounted unit in its compartment, refer to figure 2-4 and proceed as follows:

(1) Untape or unstrap cable assemblies and all other components secured to the cabinet for shipment.

(2) Pull center section of associated track out until it locks in an extended position.

(3) Position slide mechanisms of modular unit in tracks, and ease modular unit forward into rack until release buttons engage hole in track.

(4) Start at the bottom and proceed up to prevent the equipment cabinet from tipping over.

(5) Make the necessary cable and electrical connections to the modular units.

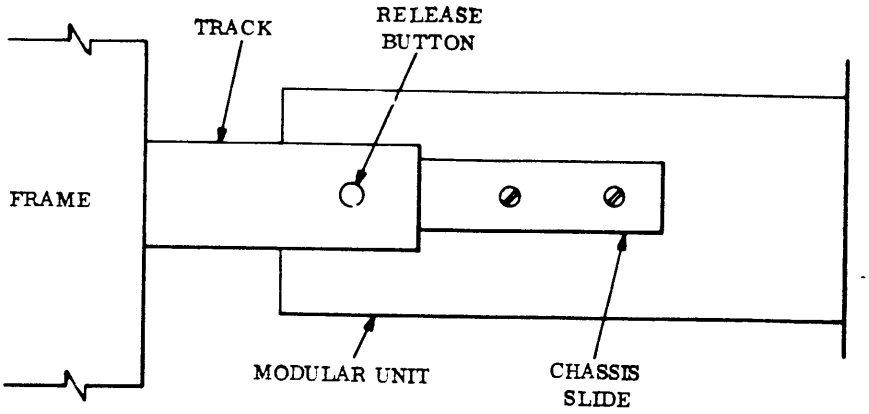
(6) Depress release buttons and slide modular unit completely into compartment.

(7) Secure front panel of modular unit to the cabinet with hardware provided.

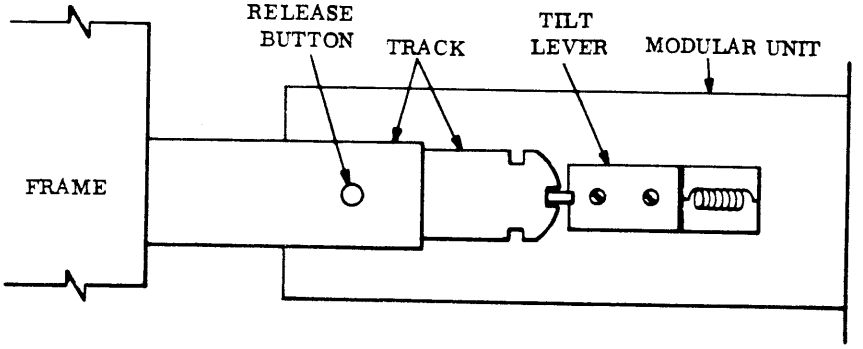
STEP 7

a. Using grounding hardware supplied, secure grounding strap to the threaded hole in rear center of base.

b. Make all necessary connections to the APP-18, Distribution Panel.



A NON-TILTING SLIDE MECHANISM



B TILTING SLIDE MECHANISM

Figure 2-4. Slide-Mounting Details

c. Affix rear panel, right and left panels to cabinet and secure in place.

d. Connect 50 ohm unbalanced antenna, or dummy load, to the output connector (J8001 located on top of equipment cabinet).

2-5. HIGH VOLTAGE TRANSFORMER CHECK (Primary AC Input).

Once the HFLM-1K has been installed and all modular units connected, it is recommended that the ac input to the High Voltage transformer be checked. To do this, carefully read the instructions below and proceed with extreme caution.

NOTE

With MAIN POWER breaker set at OFF, the single phase AC input should measure not less than 1 megohm. The positive side of the high voltage circuit should measure not less than 100K ohms.

WARNING

WHEN MEASURING AC VOLTAGE, USE EXTREME CAUTION. DO NOT TOUCH METER OR LEADS WHEN VOLTAGE IS ON. AFTER MEASURING VOLTAGE, PLACE MAIN BREAKER OFF BEFORE REMOVING LEADS.

a. Insure primary AC BREAKER is OFF and TAGGED.

b. Make sure PA BIAS, 1ST AMP BIAS and 2ND AMP BIAS potentiometers are turned to maximum bias (PA BIAS and 2ND AMP BIAS potentiometer extremely clockwise).

c. Place an AC voltmeter across the single phase input on the high voltage transformer, T101 terminals 1 and 3 (300 volt AC range).

d. Clear personnel from the HFLM and apply primary power.

e. Place primary power, MAIN POWER breaker and PLATE-SCREEN breaker to the ON position.

f. Wait approximately 10 to 15 minutes for all tube filaments to warm up.

g. Press HIGH VOLTAGE switch to apply high voltage; HIGH VOLTAGE indicator should light.

h. Note AC input voltage as measured on AC voltmeter.

i. Press HIGH VOLTAGE switch to off (HIGH VOLTAGE indicator must go out). Place MAIN POWER breaker to OFF position. Short out all HIGH VOLTAGE POINTS to ground with shorting stick provided.

j. If measured ac voltage does not correspond with the ac input terminal markings on the high voltage transformer, relocate the ac input leads to the corresponding terminals on the HIGH VOLTAGE Transformer.

2-6. EXTERNAL TRANSMITTER CONTROL CONNECTIONS (Refer to figure 2-5).

Audio intelligence and CW key lines enter the HFLM-1K through TB203 and TB204 in rear of APP-18. Remote exciter input enters through J202 PA RF. If remote RF patch panel is used, the patch panel is connected to J206 RF "IN" and J202 PA RF.

NOTE

Without patch panel, J202 and J206 has to be jumped out.

If remote ALDC patch panel is used, the patch panel is connected to J203 PA ALDC and J207 ALDC out.

NOTE

Without patch panel, J203 and J207 has to be jumped out.

Monitor output is available on J208.

a. When operating the Transmitter, connections listed below must be made to enable Transmitter operation (if controls are not desired to be operated remotely).

APP-18 REAR PANEL

1. Connect jumper from terminal 9 to 7 (ground) on TB204 (XMTR PTT).
2. Connect jumper from terminal 1 to 2 on TB202 (External Interlock, COM. - NO.).
3. Connect jumper from terminal 8 to 7 on TB202 (H. V. ON-OFF).
4. Connect jumper from terminal 2 to 3 on TB201 (OVLD RESET).

NOTE

When operating locally without the use of a remote patch panel, connections must be made as follows to enable transmitter operation: RF in (J206) and PA RF (J202)
PA ALDC (J203) and ALDC OUT (J207)

b. Audio intelligence, key lines, etc. for the exciter enter the transmitter through TB203 and TB204 as listed below:

TB203

Terminal 1	USB	600 ohms
Terminal 2	GND	
Terminal 3	USB	600 ohms
Terminal 4	LSB	600 ohms
Terminal 5	GND	
Terminal 6	LSB	600 ohms
Terminal 7	PTT	
Terminal 8	PTT	
Terminal 9	KEY	
Terminal 10	KEY	

TB204

Terminal 1	FSK +
Terminal 2	FSK -
Terminal 3	FAX +
Terminal 4	FAX -
Terminal 5	CONT. KEYING
Terminal 6	CONT. KEYING
Terminal 7	GND
Terminal 8	XMTR ON
Terminal 9	XMTR PTT (operates PTT relay located in AP149)

c. Remote Patch Panel connections enter the transmitter through TB201 and TB202.

TB201

Terminal 1	24 VDC
Terminal 2	N. O. OVERLOAD RESET
Terminal 3	N. C.
Terminal 4	GND
Terminal 5	REM. MTR. (ground has to be supplied by remote patch panel)
Terminal 6	FWD. POWER
Terminal 7	REFL. POWER
Terminal 8	GND
Terminal 9	RECYCLE
Terminal 10	RECYCLE

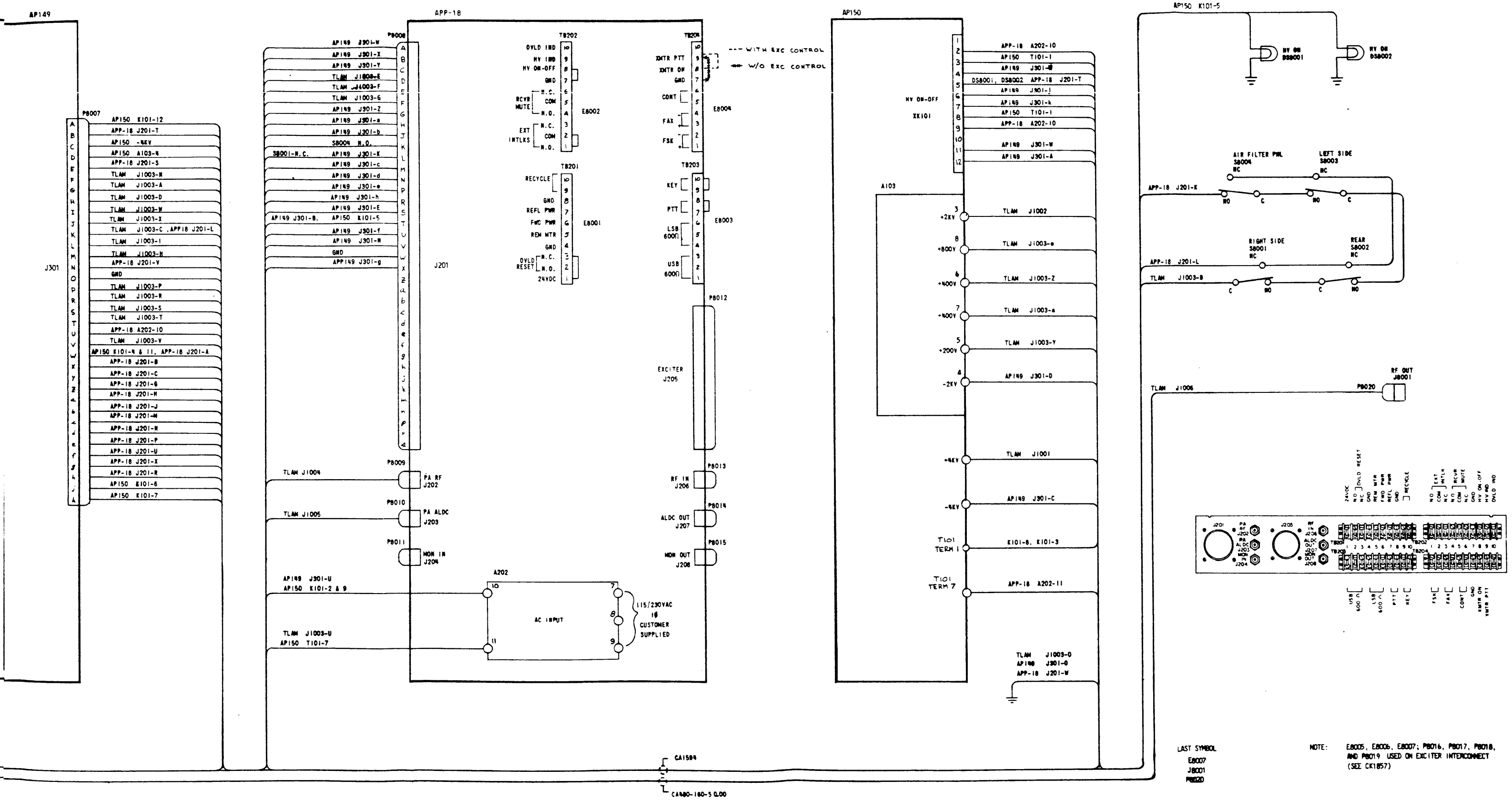
TB202

Terminal 1	N. O.	EXTERNAL INTERLOCK CONNECTIONS
Terminal 2	COM.	
Terminal 3	N. C.	
Terminal 4	N. O.	RCVR MUTE
Terminal 5	COM.	
Terminal 6	N. C.	
Terminal 7	GND	
Terminal 8	H. V. ON-OFF	
Terminal 9	H. V. IND.	
Terminal 10	OVLD. IND.	

d. Remote Patch Panel connections for RF (exciter output) and ALDC.

1. The RF patch panel is connected to J206 "RF IN" and J202 "PA RF".

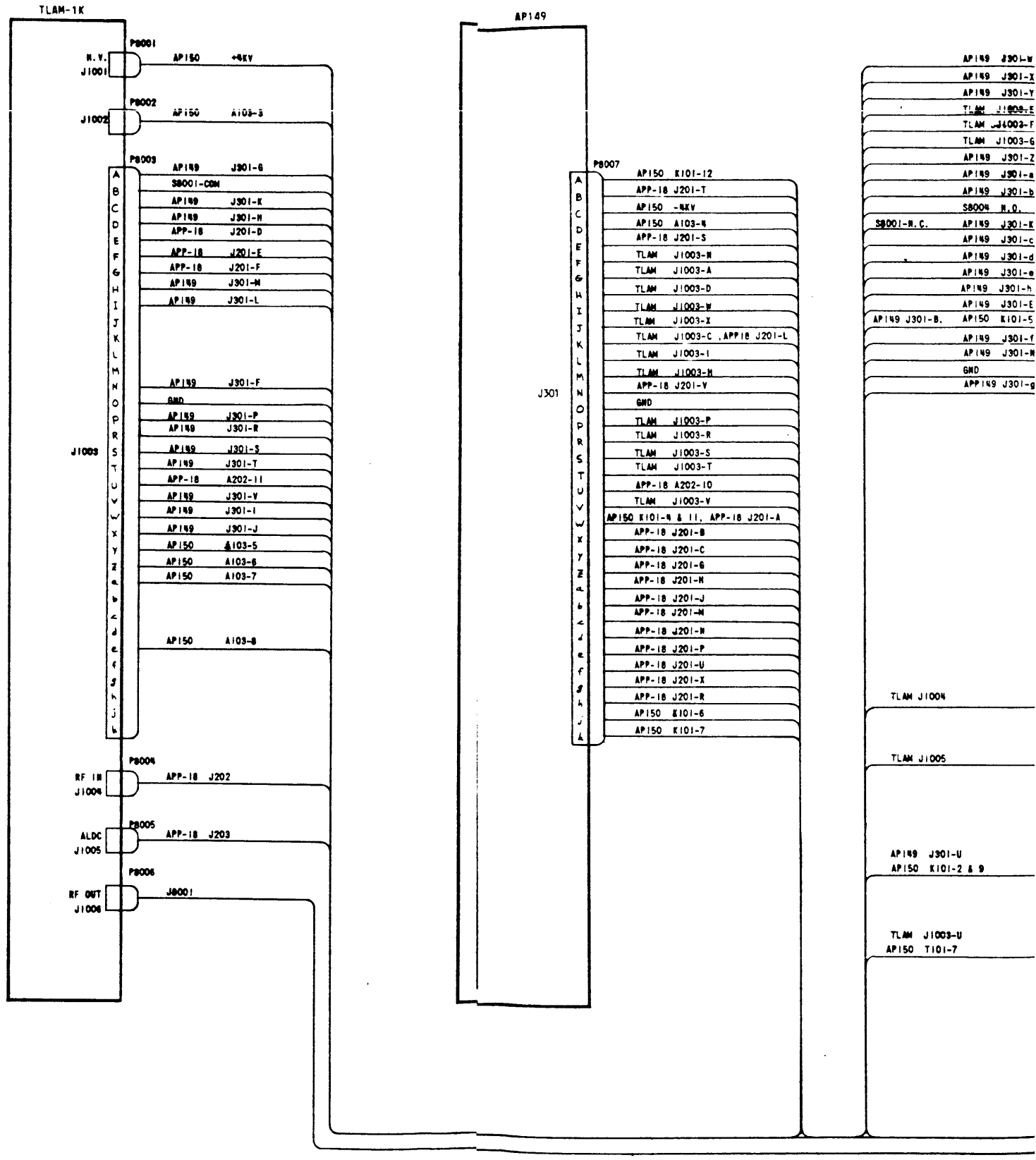
2. The ALDC patch panel is connected to J203 "PA ALDC" and J207 "ALDC out".



LAST SYMBOL
E8007
J8001
P8020

NOTE: E8005, E8006, E8007; P8016, P8017, P8018, AND P8019 USED ON EXCITER INTERCONNECT (SEE CK1857)

Figure 2-5. Rack Assembly RAK110-3, Wiring Diagram


TLAM-1K
P8001
N.Y.
J1001
AP150 +4KV
P8002
J1002
AP150 A103-5
P8003
AP149 J301-G
S8001-COM
AP149 J301-K
AP149 J301-M
APP-18 J201-D
APP-18 J201-E
APP-18 J201-F
AP149 J301-N
AP149 J301-L
AP149 J301-F
GND
AP149 J301-P
AP149 J301-R
AP149 J301-S
AP149 J301-T
APP-18 A202-11
AP149 J301-V
AP149 J301-I
AP149 J301-J
AP150 A103-5
AP150 A103-6
AP150 A103-7
AP150 A103-8
J1003
P8004
RF IN
J1004
APP-18 J202
P8005
ALDC
J1005
APP-18 J203
P8006
RF OUT
J1006
J8001
AP149
J301
P8007
AP150 K101-12
APP-18 J201-T
AP150 -4KV
AP150 A103-4
APP-18 J201-S
TLAM J1003-M
TLAM J1003-A
TLAM J1003-D
TLAM J1003-W
TLAM J1003-X
TLAM J1003-C , APP18 J201-L
TLAM J1003-I
TLAM J1003-H
APP-18 J201-V
GND
TLAM J1003-P
TLAM J1003-R
TLAM J1003-S
TLAM J1003-T
APP-18 A202-10
TLAM J1003-V
AP150 K101-4 & 11, APP-18 J201-A
APP-18 J201-B
APP-18 J201-C
APP-18 J201-G
APP-18 J201-H
APP-18 J201-J
APP-18 J201-M
APP-18 J201-N
APP-18 J201-P
APP-18 J201-U
APP-18 J201-X
APP-18 J201-R
AP150 K101-6
AP150 K101-7
AP149 J301-W
AP149 J301-X
AP149 J301-Y
TLAM J1004-E
TLAM J1003-F
TLAM J1003-G
AP149 J301-Z
AP149 J301-a
AP149 J301-b
S8004 N.O.
S8001-N.C. AP149 J301-K
AP149 J301-c
AP149 J301-d
AP149 J301-e
AP149 J301-h
AP149 J301-E
AP149 J301-B. AP150 K101-5
AP149 J301-f
AP149 J301-N
GND
APP149 J301-g
TLAM J1004
TLAM J1005
AP149 J301-U
AP150 K101-2 & 9
TLAM J1003-U
AP150 T101-7

SECTION 3

OPERATOR'S SECTION

3-1. SCOPE.

This section gives detailed operating instructions for the HFLM-1K.

3-2. GENERAL.

The operator should become thoroughly familiar with the location and function of each control of the HFLM. Bear in mind that, although an extensive interlock and overload system is designed into the HFLM, a single incorrect control setting might still overload certain components, inviting early failure and consequently transmitter "downtime", not to mention improper and illegal emission.

A definite operating sequence (as outlined by operating instructions) should be strictly followed; the operator should establish a procedural pattern, thus ensuring consistent operation.

Before applying power to the HFLM-1K, check that the antenna or dummy load connection is properly made at the output connector.

3-3. CONSIDERATIONS IN TUNING TRANSMITTER.

a. GENERAL - Before the HFLM is tuned for any specified mode of operation, it should be initially tuned and loaded on a carrier frequency.

This procedure should be followed even if suppressed carrier operation is desired. After the transmitter is tuned to carrier frequency, either or both sidebands are generated by applying the proper modulating signals required by the particular mode of operation. The carrier level may then be re-inserted or bypassed, as desired.

b. CARRIER FREQUENCY VERSUS ASSIGNED FREQUENCY - A brief description of "carrier" versus "assigned" frequency is presented at this point since these may be significantly different when operating in certain modes and will affect the choice of frequency to be selected in the exciter. "Carrier" frequency may be defined as that position in the RF spectrum reserved for the "Carrier" whether the carrier is present or not. The "assigned" frequency is a reference frequency designed to identify or reserve a given portion of the RF spectrum. Most government agencies define the "assigned" frequency as the "center of a frequency band assigned to a station". The "assigned" frequency and the "carrier" frequency may or may not be the same. In practice, the assigned frequency is frequently suffixed by the carrier frequency in parenthesis for clarification.

Example 1 - For an upper sideband transmission, with the carrier completely suppressed and with a total RF bandpass extending from 300 cps above Fc to 3 kc, the assigned frequency is 1650 cycles above the non-existent carrier frequency.

Example 2 - For an independent sideband (ISB) Transmission, with audio intelligence covering 350-7500 cycles per sideband, with or without carrier suppression, the assigned frequency and the carrier frequency are one and the same, both occupying the center of the transmitted spectrum.

c. PEAK ENVELOPE POWER VERSUS AVERAGE POWER INDICATION - A common misapprehension continues to exist over the ratio between average and PEP in high power transmitters, particularly when multichannel (Multitone) transmissions are used. Bear in mind that the Peak Envelope Power (PEP) during modulation can be many times that of the Average Power indicated on the PA OUTPUT meter. Thus the transmitter Average Power must be reduced sufficiently to avoid a serious peak overload to the transmitter, with consequent "flat topping" and possible damage.

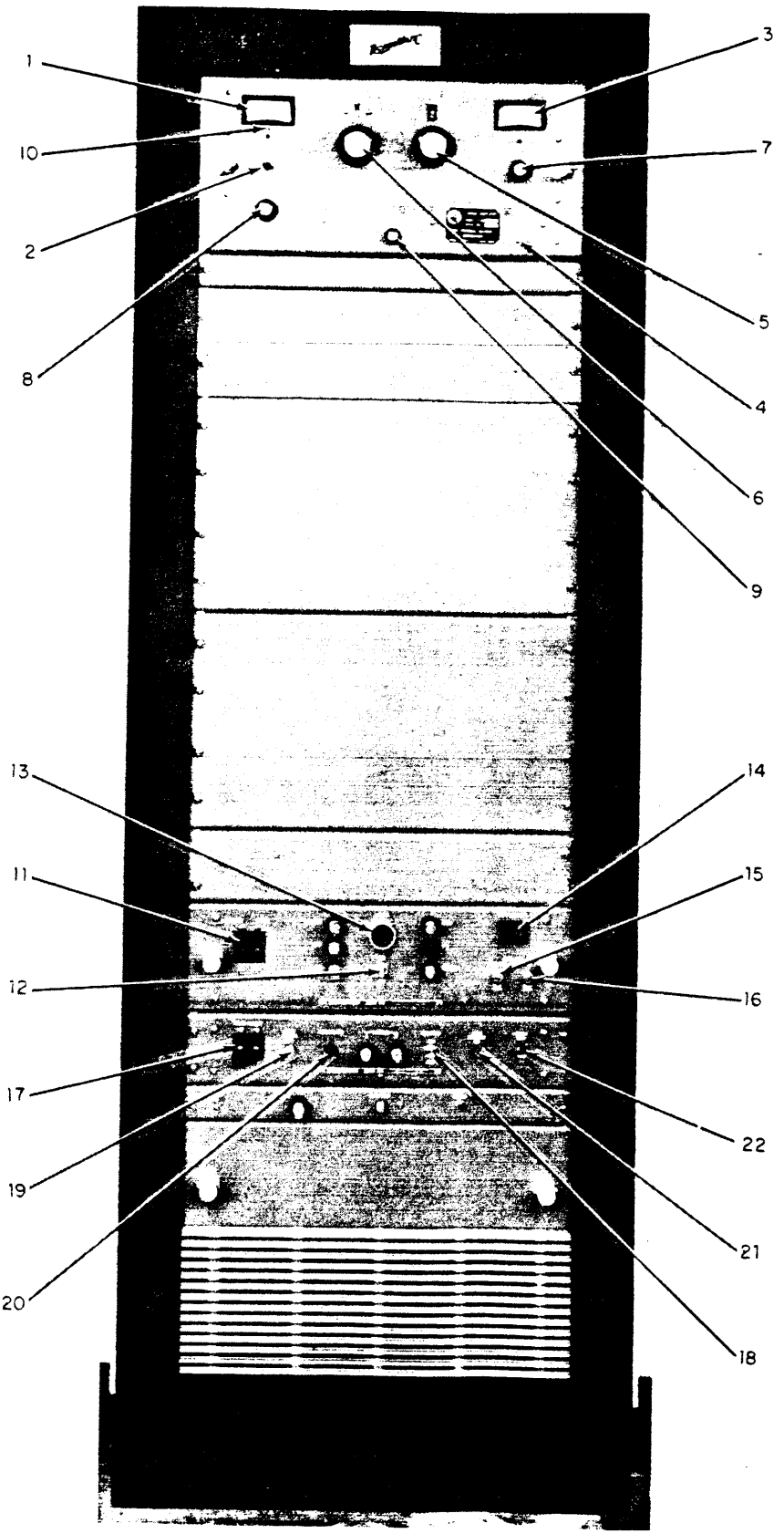


Figure 3-1. Controls and Indicators

Control and Indicator chart Table 3-1 has been prepared in conjunction with control and Indicators Location drawing (figure 3-1) to assist in the location and function of operating controls during tuning and operating of the HFLM-1K.

TABLE 3-1. CONTROLS AND INDICATIONS

Item No. Fig. 3-1	Panel Designation	Function
1	PLATE current meter	Indicates 1st RF Amplifier, 2nd RF Amplifier and PA plate currents.
2	PLATE meter switch (marked 2ND AMP, PA AMP and 1ST AMP)	When PLATE switch lever is in up position, PLATE meter indicates 2ND AMP plate current. In the down position, PLATE meter indicates 1ST AMP plate current, and in neutral position PLATE meter indicates PA plate current.
3	KILOWATT OUT and REFLECTED power meter	Indicates output power in kilowatts and reflected power.
4	REFL button	When pressed, KILOWATT meter indicates reflected power. Otherwise, KILOWATT meter indicates output power in kilowatts.
5	BANDswitch control knob	Selects bandswitch position from 1.5 to 30 MHz (1.5 - 2.0, 2.0 - 2.6, 2.6 - 3.0, 3 - 5, 5 - 8, 8 - 12, 12 - 16, 16 - 24, 24 - 30).
6	TUNE control	Operates TUNE capacitor.
7	LOAD control	Operates LOAD capacitor.
8	RF GAIN control	Adjust transmitter power output.
9	ALDC adjustment	Adjust ALDC voltage level when used with a suitable exciter.
2ND AMP plate current overload adjustment (adjustment is located on bottom of TLAM-1K)		
10	PA PLATE current overload adjust	Sets PA plate current limit to trip-off high voltage.
11	PLATE AND SCREEN breaker	In ON position, provides plate and screen voltage to RF Amplifier tubes.
12	ALARM ON/OFF switch	When ALARM switch is in ON position, with high voltage off, the audible alarm would sound to indicate the removal of high voltage.
13	ALARM	Audible alarm to indicate failure of high voltage.
14	HIGH VOLTAGE switch	When pressed to ON position, high voltage is applied and switch indicator lights. When depressed to OFF position, high voltage is removed and switch indicator goes out.
15	2ND AMP BIAS	Adjust Bias voltage of 2nd Amplifier.
16	PA BIAS	Adjust Bias voltages of PA Amplifier.

TABLE 3-1. CONTROLS AND INDICATIONS (CONT)

Item No. Fig. 3-1	Panel Designation	Function
17	MAIN POWER breaker	When placed in ON position, applies ac power to HFLM-1K.
18	EXCITER ON/OFF switch	When placed in ON position, applies power to exciter unit (when exciter is installed into equipment cabinet).
19	MAIN POWER ON indicator	When lit, indicates that main power is ON.
20	INTERLOCK indicator	When lit, indicates all interlocks are closed and interlock circuit is completed.
21	HIGH VOLTAGE ON indicator	When lit, indicates that high voltage is ON.
22	TEST KEY	The TEST KEY is a convenient front panel keying device for exciter testing and key down operation. In up position, test key locks.

3-4. MANUAL TUNING PROCEDURE (Carrier Only)

Step	Operation	Normal Indications
1	Place MAIN POWER breaker (17) to the ON position.	PA Blower must operate and MAIN POWER ON (19) must illuminate. Interlock lamp (20) will light (provided that all safety interlocks are closed and the time delay cycle has been completed).
2	Place SCREEN and PLATE breaker (11) to ON position.	No indications at this time.
3	Place ALARM ON/OFF switch (12) to OFF position.	Should alarm switch have been in the ON position with high voltage removed, the audible high voltage alarm would be on.
4	Set RF GAIN (8) to minimum.	No indications.
	NOTE The HFLM-1K is equipped with protective overload circuitry. Additionally, the PA plate current meter has an overload indicator which can be adjusted to trip at a value set by the operator. Should an overload occur, the meter face will illuminate.	
5	Adjust the overload indicator (adjustment screw located directly below the meter face of the PLATE current meter) for 600 ma (10).	PLATE current overload indicator will indicate 600 ma.
6	Set the external exciter to the desired carrier frequency. The exciter output level must be at least 100 milliwatts.	

Step	Operation	Normal Indications
7	Select frequency BAND position by rotating the BAND knob (5) to a band within the desired frequency.	Window on front panel indicates desired frequency band.
8	Adjust PA BIAS (16) and 2ND AMP Bias (15) for maximum bias.	PA and 2ND AMP Bias adjusted to maximum clockwise position.
9	Press HIGH VOLTAGE switch (14) to light indicator (it may be necessary to press HIGH VOLTAGE switch twice).	HIGH VOLTAGE switch and HIGH VOLTAGE ON indicator lamp (21) will illuminate RED when High Voltage is ON.
10	Adjust PA Bias control to 150 ma on PLATE METER (1).	PLATE meter indicates quiescent current of 150 ma.
11	Push PLATE METER SELECT switch (2) up and adjust 2ND AMP for indications of 200 ma on PLATE METER (1).	PLATE meter indicates quiescent current of 200 ma when PLATE METER SELECT switch is pushed up.

NOTE

During initial tuning of the transmitter, RF output power will be increased or decreased with the RF GAIN control (8).

12	Adjust RF GAIN control (8) clockwise slightly to cause a notable increase in PA PLATE current.	PLATE meter (1) will indicate an increase in meter reading not to exceed 250 ma.
13	Adjust TUNE control (6) for a noticeable resonant dip in Plate current.	The rotation of the TUNE control will cause the KILOWATT OUTPUT meter (3) to indicate output.
14	Adjust the LOAD control (7) as necessary to produce a maximum reading on the KILOWATT METER (3).	KILOWATT meter will indicate a further increase in power output during loading process.
15	Readjust TUNE control to insure that the transmitter is at resonance. Repeat steps 13 and 14 as necessary.	KILOWATT meter will indicate highest value when transmitter is properly tuned into antenna or load.
16	Rotate RF GAIN control (8) clockwise to increase output power to desired level.	KILOWATT meter indicates average power output level.
17	Rotate RF GAIN control (8) counterclockwise and press HIGH VOLTAGE switch (14) to OFF.	KILOWATT meter will indicate zero and HIGH VOLTAGE indicators (14)(21) will go out indicating the removal of High Voltage.

CAUTION

The aforementioned procedure outlines CARRIER TUNING. However, once the exciter has been adjusted for the desired type of intelligence and emission mode, the application of drive must be carefully adjusted to avoid exceeding the PEP rating of the transmitter (the KILOWATT meter is calibrated to read average power). Refer to figure 3-2, which illustrates the relationship between peak and average power in graphic form under multitone conditions.

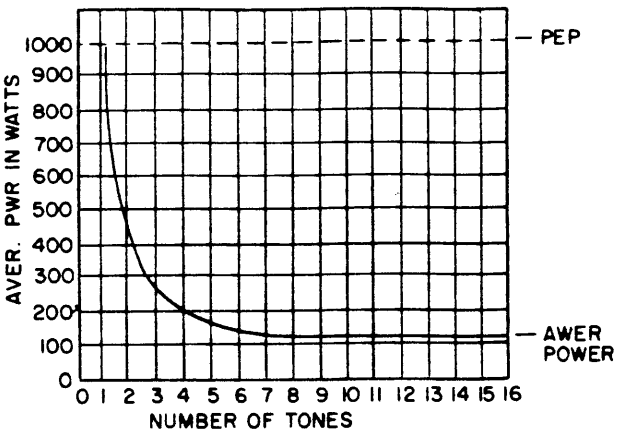


Figure 3-2. Ratio Average Power and PEP as a Function of Tones

3-5. AVERAGE POWER OUTPUT INDICATIONS.

When two tones of equal amplitude are applied to a SSB system, the ratio of PEP to Average Power is 2:1. This relationship is valid for two tones only. When the HFLM's KILOWATT meter indicates 500 watts with two tones of equal amplitude applied to the transmitter, peak envelope power (PEP) will be 1000 watts under that condition only.

SECTION 4

PRINCIPLES OF OPERATION

4-1. GENERAL.

The HFLM-1K provides one kilowatt PEP throughout the frequency range of 1.5 to 30 MHz. The RF Amplifier section contains three linear amplifier stages; the 1ST AMP, 2ND AMP and the POWER AMPLIFIER. The first and second amplifiers are broadband linears and require no tuning throughout the frequency range. The final stage is a tuned parallel L circuit that provides an output impedance of 50 ohms.

All RF Amplifier stages are air-cooled by a self-contained blower located inside the Power Amplifier section. Front panel meters monitor plate currents, output power in kilowatts and indications of current and/or SWR overloads.

4-2. BLOCK DIAGRAM ANALYSIS. (Refer to figure 4-1.)

Figure 4-1 illustrates the rf signal flow of the HFLM-1K. When all circuit conditions are met and a suitable exciter used to drive the HFLM, rf voltage is amplified and routed to the output connector in the following manner.

The external exciter's output (1.5 to 30 MHz) is routed to the RF GAIN control on the TLAM-1K. This exciter output level must be at least 100 milliwatts.

From this point the exciter output, controlled by the HFLM's RF GAIN control, is routed to the 1ST RF AMPLIFIER, V1201. V1201 serves to amplify the exciter output to a level sufficient to drive the 2ND RF AMPLIFIER, V1202. V1202 further amplifies the rf output which is routed to the input of the 1 kilowatt POWER AMPLIFIER, V1301.

The 1ST and 2ND AMPLIFIERS are broadbanded throughout the frequency range to simplify tuning and operation. However, the Power Amplifier employs the use of TUNE and LOAD controls for PA tuning and output loading. Note that the 1 kilowatt output passes through a directional coupler that samples and rectifies a portion of the rf output for metering purposes.

The directional coupler and KILOWATT meter combination monitor the HFLM's output and is calibrated in average power.

Output overload (SWR) is provided in addition to plate circuit overload to protect the HFLM against antenna voltage standing wave ratios.

Operationally during voice modulation, the possibility of high modulation peaks that may cause the HFLM to dump through it's overload circuitry is always apparent. Therefore, the Automatic Load and Drive Circuit reduces this condition when used with a suitable exciter that will accept this negative to maintain a constant input level, which in effect will provide a constant HFLM output.

4-3. AC POWER DISTRIBUTION (Refer to figure 4-2).

a. GENERAL - Single phase power is supplied to the ac input terminals (A202 terminals 7 and 9) located in the Distribution Panel, APP-18. Safety and protective interlocks are employed throughout the HFLM to prevent the application of high voltage until specific requirements are met, thus preventing injury to personnel and damage to the equipment.

b. BLOCK DIAGRAM ANALYSIS - The primary ac power is routed to the input terminals on the Distribution Panel and to one side of the MAIN POWER breaker, CB201. Closure of the MAIN POWER breaker applies ac to the PA Blower, and High Voltage ON/OFF relay, K101. When the Blower is operating, the blower air switch contacts close, providing an ac voltage path to Filament Bias Transformer T301 and Low Voltage Transformer T302. Should the Blower fail to operate, the blower air switch contacts would open and remove the primary ac voltage input to the Filament Bias and Low Voltage Transformers.

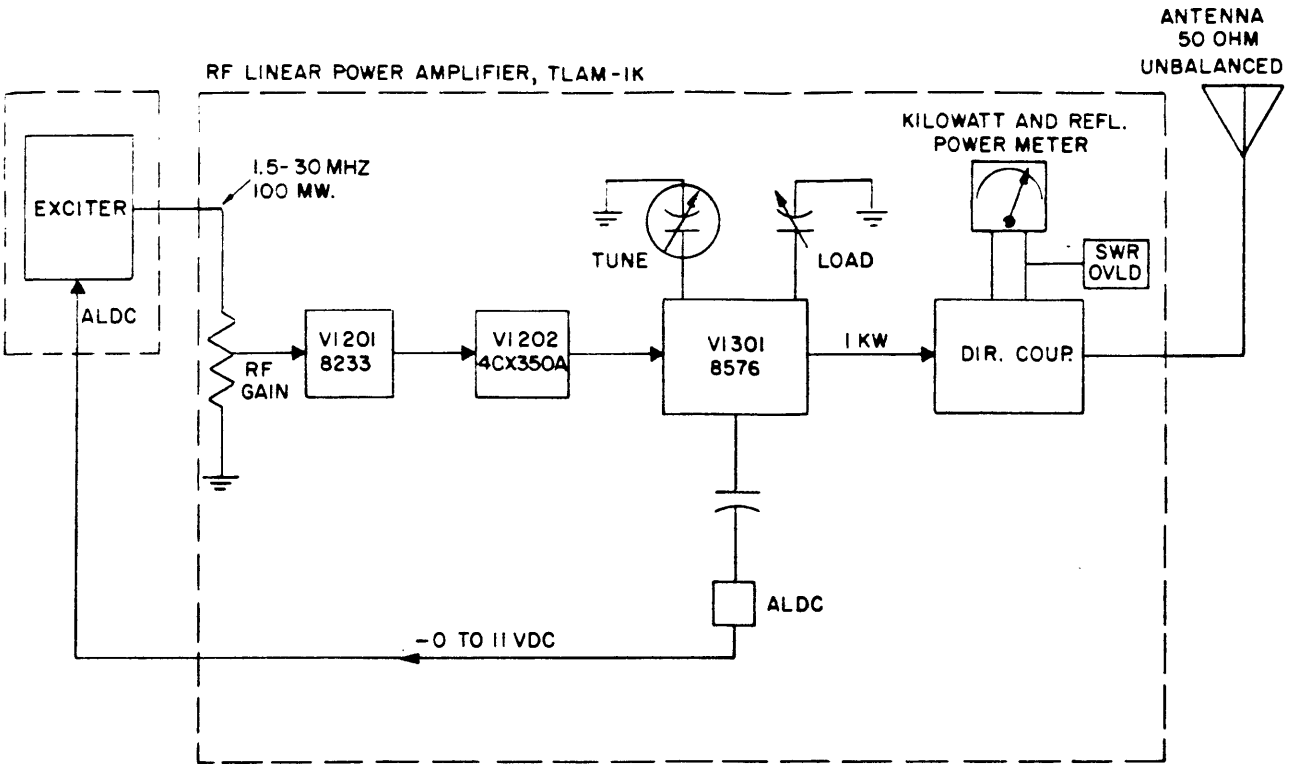


Figure 4-1. Block Diagram, HFLM-1K

The Filament Bias Transformer supplies filament voltage for V1201, V1202 and V1301. It also provides ac to the Bias Rectifier, CR302 (via the Bias On Relay).

Low Voltage Transformer T302 supplies ac input to the 24 vdc Rectifier that supplies the series interlock voltage. Completion of the series interlock chain routes 24 vdc to the Timer Interlock (timer interlock set for approximately 5 minutes to allow filament warmup time) which will supply 24 vdc to the Bias On Relay coil when the timer delay time has elapsed. This 24 vdc will cause Bias On Relay to energize; thus its contacts will close, providing an ac voltage path to Bias Rectifier, CR302. CR302 supplies the necessary negative bias voltage to the RF Amplifier tubes V1201, V1202 and V1301.

High Voltage On Off Relay (when energized by HIGH VOLTAGE On Off pushbutton) provides ac voltage to Plate and Screen transformer, T101. Transformer T101 supplies the ac input to Plate Rectifier A101 and Screen Rectifier A102. Rectifiers A101 and A102 provide plate and screen voltages to the RF Amplifier tubes.

4-4. DC POWER DISTRIBUTION. (Refer to figure 4-3.)

a. PLATE AND SCREEN VOLTAGES - Application of ac power to Plate and Screen Transformer T101 provides the necessary plate and screen voltage for RF Amplifier tubes V1201, V1202 and Power Amplifier V1301. 3500 vdc is derived from Plate Rectifier A101 for plate voltage to the PA tube V1301.

Screen Rectifier, A102, rectifies the secondary output of T101. This rectified output (2000 vdc) is fed to Zener Diode Assembly A103 that functions to regulate dc voltage potentials. Within the Zener Assembly, voltages are tapped and applied to the RF Amplifier tubes as follows:

(1) 800 vdc Power Amplifier Screen

(2) 400 vdc 2ND Amplifier Screen

(3) 200 vdc 1ST Amplifier Screen

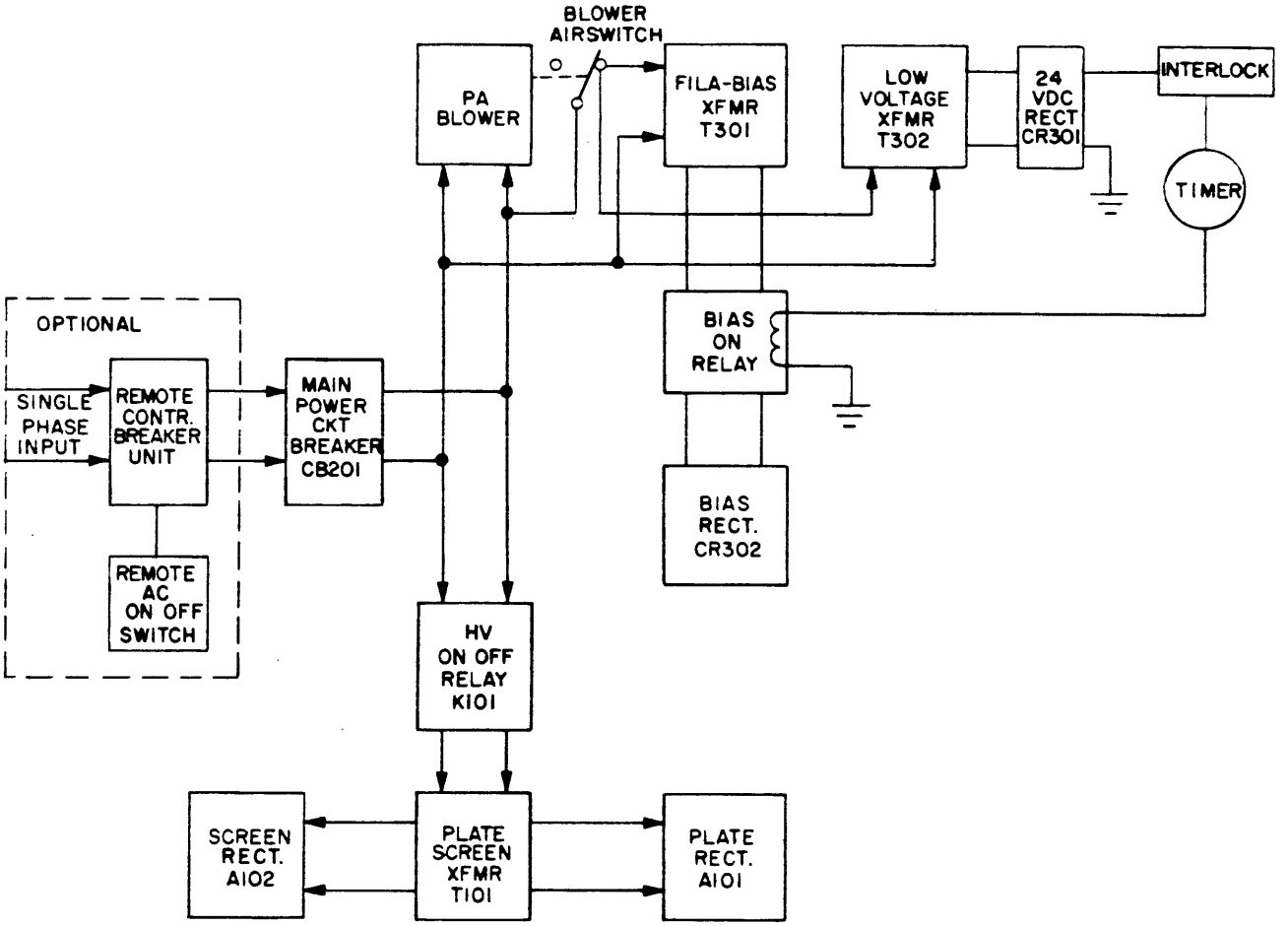


Figure 4-2. HFLM-1K Simplified Diagram, AC Power Distribution

The Screen Rectifier also furnishes 2000 vdc for the plate of 2ND Amplifier V1202 and 400 vdc for the plate of 1ST Amplifier V1201.

Filament Transformer T301 supplies ac filament voltage to each RF Amplifier tube.

b. BIAS VOLTAGE (Refer to figures 5-2 and 7-3) - When the Bias Relay K302 energizes, ac voltage is applied to the bias rectifier CR302 in the L. V. and Bias power supply. The negative dc output of CR302 (approximately -240 vdc) is filtered by L301 and L302 and C303 and C304 before application to the zener diode regulators. The dc return for the Bias supply is through F304 to protect the circuit against overloads. Regulated bias voltages are tapped from zeners CR304 and CR305 for application to the two bias potentiometers. The ground necessary for voltage drop across the bias potentiometers is supplied by contacts of the energized PTT relay K301. The bandswitch interlock circuit prevents 24 vdc from reaching the PTT relay during band changes to keep the amplifier stages at maximum bias, or close to cut-off.

The top of the zener stack (D) provides -240 vdc to the PA Bias adjust potentiometer. The PA Bias potentiometer is adjusted to provide approximately 150 ma idle current on the PLATE current meter when the METER select switch is in its normal position. The junction of CR304 and CR305 provides -120 vdc to the 2ND AMP bias potentiometer before application to the 2ND AMP grid. The 2ND AMP bias potentiometer is adjusted to provide approximately 200 ma of idle current as observed on the PLATE current meter when the PLATE meter switch is pushed up.

c. 24 VDC SUPPLY - The secondary of the L. V. Transformer T302 provides the ac input to CR301 in the Low Voltage and Bias Supply drawer. The output of the full wave bridge rectifier CR301 is filtered by C301, C302 and R301 before being regulated at +24 vdc by zener diode CR303. This regulated 24 vdc is used as control voltage for the HFLM-1K. The dc return of the 24 vdc supply is through F305 to protect against overloads.

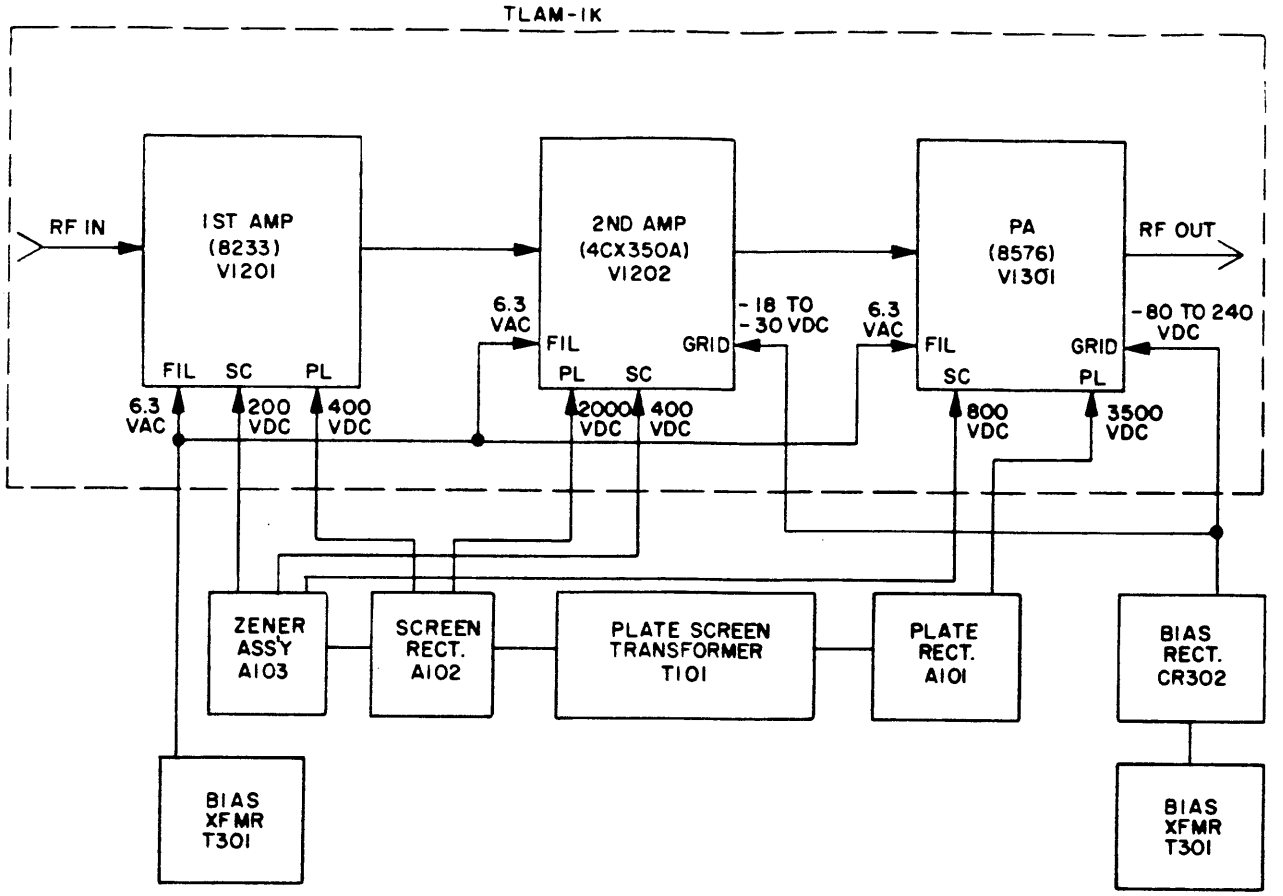


Figure 4-3. HFLM-1K Operating Potentials

4-5. PROTECTIVE OVERLOADS AND INTERLOCKS (refer to figure 4-4).

a. GENERAL - The interlock and overload circuitry of the HFLM-1K provides protection for the equipment and operating personnel. An open interlock or overload condition will de-energize K101, the H. V. ON/OFF relay.

b. SIMPLIFIED CIRCUIT ANALYSIS - The regulated 24 vdc interlock voltage is routed through the mechanically closed interlocks to the timer interlock. When the time delay of the TIMER has expired, the 24 vdc energizes the Bias ON/OFF relay. From there the 24 vdc is routed through two sets of contacts on the H. V. and Screen Overload Breaker and then to the H. V. ON/OFF switch. From the H. V. ON/OFF switch, the 24 vdc is routed through the normally closed contacts of the overload relay to one side of the H. V. ON/OFF relay. The H. V. ON/OFF relay is energized when the H. V. ON/OFF switch is depressed, providing a path through the H. V. ON/OFF relay to ground.

The H. V. ON/OFF relay provides the primary ac input to the PLATE-SCREEN Transformer T101. When K101 energizes, 24 vdc is provided for the H. V. light and the normally closed contacts open, removing 24 vdc on the ALARM ON/OFF switch, disabling the H. V. alarm when H. V. is on and ALARM switch is in the ON position.

An indication on the PLATE current meter that is equal to the setting of the red overload pointer provides a contact closure on the meter sensing circuit. The contact closure supplies a gating pulse to trigger an overload SCR, providing a path for the 24 vdc to the overload lamp on the meter, and 24 vdc to the OVLD relay, causing it to unlatch and de-energize the H. V. ON/OFF relay.

A dc sample from the reflected power diode is routed through an operational amplifier and the SWR ADJ. potentiometer. The dc sample provides a trigger for the associated SCR, providing a path for the 24 vdc to the SWR overload lamp on the RF Amplifier front panel.

To restore high voltage, the H. V. ON/OFF pushbutton switch is pressed twice. Pressed the first time, the H. V. ON/OFF switch provides 24 vdc to the reset side of the OVLD RELAY and closing the contacts on the relay. Pressed the second time, the H. V. ON/OFF switch restores the 24 vdc to the contacts necessary to energize the H. V. ON/OFF relay which applies plate and screen voltages to the transmitter again.

Should any of the interlocks open when H. V. is ON, the overload coil on the overload relay is diverted to a line connecting all the normally closed contacts of the interlocks to the overload side of the overload relay. An open interlock places the transmitter in an overload condition, preventing the potentially dangerous application of high voltage when the open interlock is closed.

4-6. ALDC.

The ALDC circuit provides a feedback voltage to an associated exciter to prevent excessive rf output from the transmitter.

A filtered and regulated 24 vdc is routed through the ALDC potentiometer and applied to the ALDC Assembly. This voltage is used to back bias the ALDC rectifier. The threshold adjusted ALDC voltage leaves the ALDC Assembly and is routed to the ALDC input of an exciter. The ALDC threshold adjustment is normally adjusted on carrier so that increase in rf will not exceed the Power Level reading.

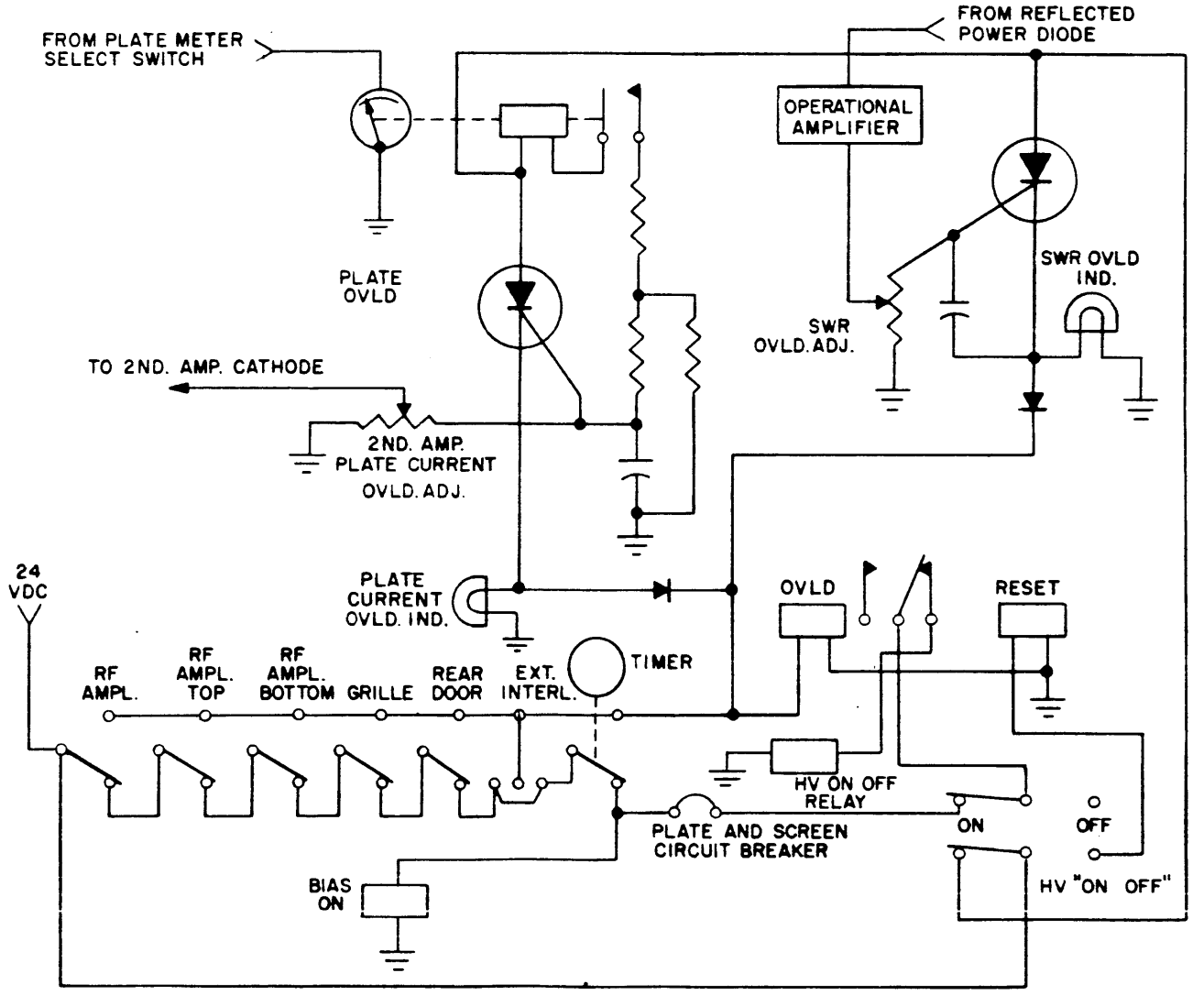


Figure 4-4. Simplified Interlock and H. V. Overload Circuits

4-7. BANDSWITCH CONTROL.

Bandswitching of the transmitter is performed manually with the BANDswitch knob. With the Bandswitch in detent at proper position, 24 vdc is routed through the Bandswitch Interlock Switch S2 (H. V. Control) to one side of the PTT relay coil.

The bandswitch interlock is adjusted to close only when the bandswitch is in one of its positions and not in between positions. When the bandswitch is rotated manually and is not in the proper (detent) position, the bandswitch interlock will not close, thus preventing the 24 vdc from arriving at one side of the PTT relay coil. The PTT relay in a non-energized state removes the ground from the bias voltage dividers and therefore maximum bias is on the grid of each RF Amplifier, placing each at or near cut-off.

SECTION 5

MAINTENANCE

5-1. INTRODUCTION.

The HFLM-1K has been designed for long term, trouble-free operation. When it becomes necessary to perform alignment and/or adjustments to the equipment, it is recommended that technicians perform the necessary operations outlined under FIELD MAINTENANCE.

a. The following maintenance aids are provided for troubleshooting, alignment and replacements of parts.

(1) System block diagram (Section 4, figure 4-1)

(2) Fuse location drawing (figure 5-1)

(3) Fuse functions (table 5-2)

(4) System overload and Bias setting procedure

(5) Maintenance programs (for troubleshooting)

5-2. LIST OF TEST EQUIPMENT REQUIRED.

SIGNAL GENERATOR:	Hewlett-Packard Model 606A, or equivalent
VTVM:	Hewlett-Packard Model 410B, or equivalent
MULTIMETER:	Simpson Model 260, or equivalent

5-3. OPERATOR'S MAINTENANCE PROCEDURE.

a. Refer to operational checkout procedures (paragraph 3-4).

b. Operator's troubleshooting chart (table 5-1).

5-4. PREVENTIVE MAINTENANCE.

In order to prevent equipment failure due to dust, dirt or other destructive elements, it is suggested that a schedule of preventive maintenance be set up and adhered to. At periodic intervals, the equipment should be pulled out on its slides for internal cleaning and inspection. The wiring and all components should be inspected for dirt, dust, corrosion, grease or other harmful conditions. Remove dust with a soft brush or vacuum cleaner. Remove dirt or grease with any suitable cleaning solvent. Use of carbon tetrachloride should be avoided due to its highly toxic effects. Trichlorethylene or Methyl Chloroform may be used, providing the necessary precautions are observed.

WARNING

WHEN USING TOXIC SOLVENTS, MAKE CERTAIN THAT ADEQUATE VENTILATION EXISTS. AVOID PROLONGED OR REPEATED BREATHING OF THE VAPOR. AVOID PROLONGED OR REPEATED CONTACT WITH SKIN. FLAMMABLE SOLVENTS SHALL NOT BE USED ON ENERGIZED EQUIPMENT OR NEAR ANY EQUIPMENT FROM WHICH A SPARK MAY BE RECEIVED. SMOKING, "HOT-WORK", ETC. IS PROHIBITED IN THE IMMEDIATE AREA.

CAUTION

When using trichlorethylene, avoid contact with painted surfaces, due to its paint removing effects.

5-5. TROUBLESHOOTING.

The first step in troubleshooting is as follows:

a. OBSERVATIONS - Observe the operation of HFLM-1K and determine whether the indications are normal or abnormal (refer to operator's section).

b. FUSE CHECKS - Should a malfunction occur, a visual check of fuses on the system must be performed. (All fuses are indicating type; refer to figure 5-1 for fuse location.)

c. VOLTAGE CHECKS - At this time, voltage checks are not necessary until localization of the malfunction.

d. LOCALIZATION OF MALFUNCTION - Perform the operational check-out procedure outlined in paragraph 3-4. Use of this procedure will help localize the particular fault at hand. Troubleshooting charts have been specially prepared to assist you in localization of a malfunction, should one occur. The manner in which the table has been written will give you a logical sequential order for localizing malfunctions.

e. FIELD MAINTENANCE - Procedures presented on the following pages will give instructions for technicians to maintain, align and/or troubleshoot the equipment.

WARNING

WHEN IT BECOMES NECESSARY TO MEASURE VOLTAGES, USE EXTREME CAUTION. HAZARDOUS VOLTAGE POTENTIALS ARE PRESENT, ALTHOUGH MAIN POWER BREAKER MAY BE OFF. IT IS RECOMMENDED THAT THE FOLLOWING PRECAUTIONS BE STRICTLY ADHERED TO.

(1) Check to ascertain MAIN PRIMARY POWER is off and tagged.

(2) Short out all H. V. points with shorting stick.

(3) Attach test meter to point of test required, clear personnel, and apply voltage to HFLM-1K.

(4) When measuring HIGH VOLTAGE potentials, do not touch test meter or leads once voltage has been applied.

(5) Establish test conditions and observe reading on test meter.

(6) Remove PRIMARY POWER, short out all HIGH VOLTAGE points, and remove test meter.

TABLE 5-1. OPERATOR'S TROUBLESHOOTING CHART

No.	Malfunction	Probable Cause of Malfunction
1	Blower will not operate.	Replace defective BLOWER Fuse.
2	PA Plate current excessive. 1ST and 2ND AMP Plate currents excessive.	Replace defective BIAS Fuse.
3	INTERLOCK Indicator will not light.	Replace defective DC Fuse.
4	No Bias or 24 vdc Voltage present.	Replace defective CONTROL Fuse.
5	HIGH VOLTAGE Indicator will not light when HIGH VOLTAGE Switch is pressed.	Replace defective LOW VOLTAGE Fuse.

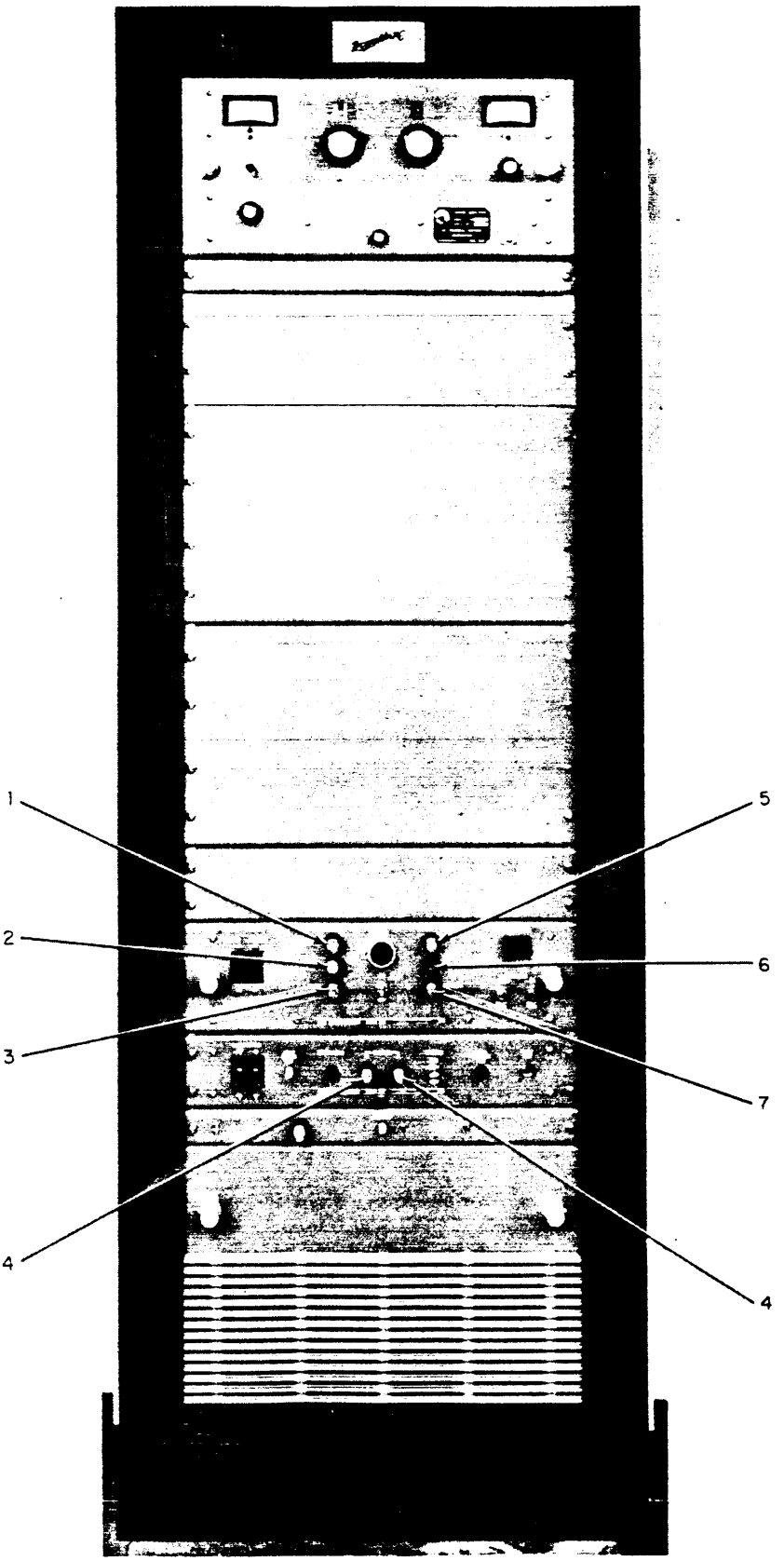


Figure 5-1. Fuse Location Drawing

TABLE 5-2. FUSE FUNCTIONS

No.	Fuse	Function
1	BLOWER Fuse	Protective fuse for blower, lights to indicate fuse defective (2 amp 115 vac, 1 amp 230 vac)
2	FILAMENT Fuse	Protective fuse for Filament and Bias transformer, lights to indicate fuse defective (2 amp 115 vac, 1 amp 230 vac)
3	L. V. Fuse	Protective fuse for primary ac input to L. V. transformer, lights to indicate fuse defective (2 amp 115 vac, 1 amp 230 vac)
4	EXCITER Fuse	Protective fuse for Exciter ac input, lights to indicate fuse defective (2 fuses) (1 amp 115 vac, .5 amp 230 vac)
5	BIAS Fuse	Protective fuse for dc return of Bias supply, lights to indicate fuse defective (.25 amp)
6	24 VDC Fuse	Protective fuse for dc return of 24 vdc supply, lights to indicate fuse defective (1.5 amp)
7	CONTROL Fuse	Protective fuse for Low Voltage and Filament-Bias transformer, lights to indicate fuse defective (5 amp 115 vac, 2.5 amp 230 vac)

5-6. ALDC ADJUSTMENT PROCEDURE.

a. PURPOSE - The ALDC adjustments outlined are for the purpose of maintaining a constant PEAK POWER reference during modulating emission modes. The HFLM provides a negative dc voltage which is adjustable and proportional to the transmitter output. When used with a suitable exciter, the exciter accepts this voltage to control the exciter rf drive. Thus a Peak to Average relationship is established in the exciter as a result of an ALDC control voltage.

(1) Tune and load HFLM to any carrier frequency between 1.5 MHz and 30 MHz.

(2) Adjust RF GAIN control for a PA Output indication of 1100 watts (on KILOWATT meter).

(3) Adjust ALDC threshold potentiometer (located on the front panel of the TLAM-1K) until the power output indication commences to decrease.

(4) Continue to adjust the ALDC threshold potentiometer for a PA Output indication of 1000 watts.

(5) Increase RF GAIN (to check ALDC capture). PA Output should remain constant.

(6) Reduce RF drive to minimum and turn off H. V. This completes ALDC adjustment procedure.

The ALDC Adjustment may be set for values lower than specified in the procedure if desired.

NOTE

Should the ALDC capture voltage be insufficient, resulting in an increase in PA Output when rf drive is increased, further adjustment of the ALDC potentiometer may be necessary to hold the PA Output constant.

5-7. TRANSMITTER BIAS ADJUSTMENT PROCEDURE.

The bias adjustments outlined below are to obtain quiescent plate current values.

NOTE

Static plate current values indicated in the procedure are normal operating values; however, should abnormal conditions exist, refer to figure 5-2 (simplified Bias Control Diagram).

Step 1 Set bias controls to maximum clockwise position (Bias voltage will be at maximum value).

Step 2 Place MAIN POWER breaker to ON position.

Step 3 Place PLATE SCREEN breaker to ON.

Step 4 Press HIGH VOLTAGE pushbutton to light indicator and apply high voltage.

Step 5 Observe PLATE current meter and adjust PA BIAS control for indication of 150 ma, as read on PLATE meter.

Step 6 Hold PLATE current meter switch in the 2ND AMP position (up), note PLATE meter indication, and adjust (PLATE current meter SELECT switch held in position) 2ND AMP Bias control for an indication of 200 ma as read on the PLATE meter. (Extract TLAM out on slides and adjust 1ST AMP bias for 70 ma, control located on bottom of TLAM-1K).

Step 7 Press HIGH VOLTAGE pushbutton to OFF.

TABLE 5-3. BIAS SUPPLY VOLTAGE (Refer to figure 5-2)

PTT RELAY - CLOSED		
Point of Test	Voltage	Reference Designation
A	230 vac	T301
B	230 vac	T301
C	-260 vdc	L301
D	-240 vdc	R310 (PA BIAS)
E	-120 vdc	R307 (2ND AMP BIAS)
F	-80 vdc	8576 (V1301)
G	-22 vdc	4CX350A (V1202)
H	24 vdc	K301 (PTT relay)
PTT RELAY - OPEN		
Point of Test	Voltage	Reference Designation
A	230 vac	T301
B	230 vac	T301
C	-260 vdc	L301
D	-240 vdc	R310
E	-120	R307
F	-240 vdc	8576
G	-120 vdc	4CX350A
H	0 vdc	K301

5-8. OVERLOAD CIRCUIT TEST

a. PURPOSE - The Overload Circuitry functions to protect the HFLM-1K against possible excessive current and VSWR overloads. The simplicity of overload adjustments and indications of overloaded conditions affords ease of overload recognition. To set the PA Plate overload, perform the following:

(1) Energize HFLM (MAIN POWER breaker ON, PLATE SCREEN breaker ON).

(2) HIGH VOLTAGE Switch ON (High Voltage indicator lit).

(3) Apply rf (11 MHz) to HFLM.

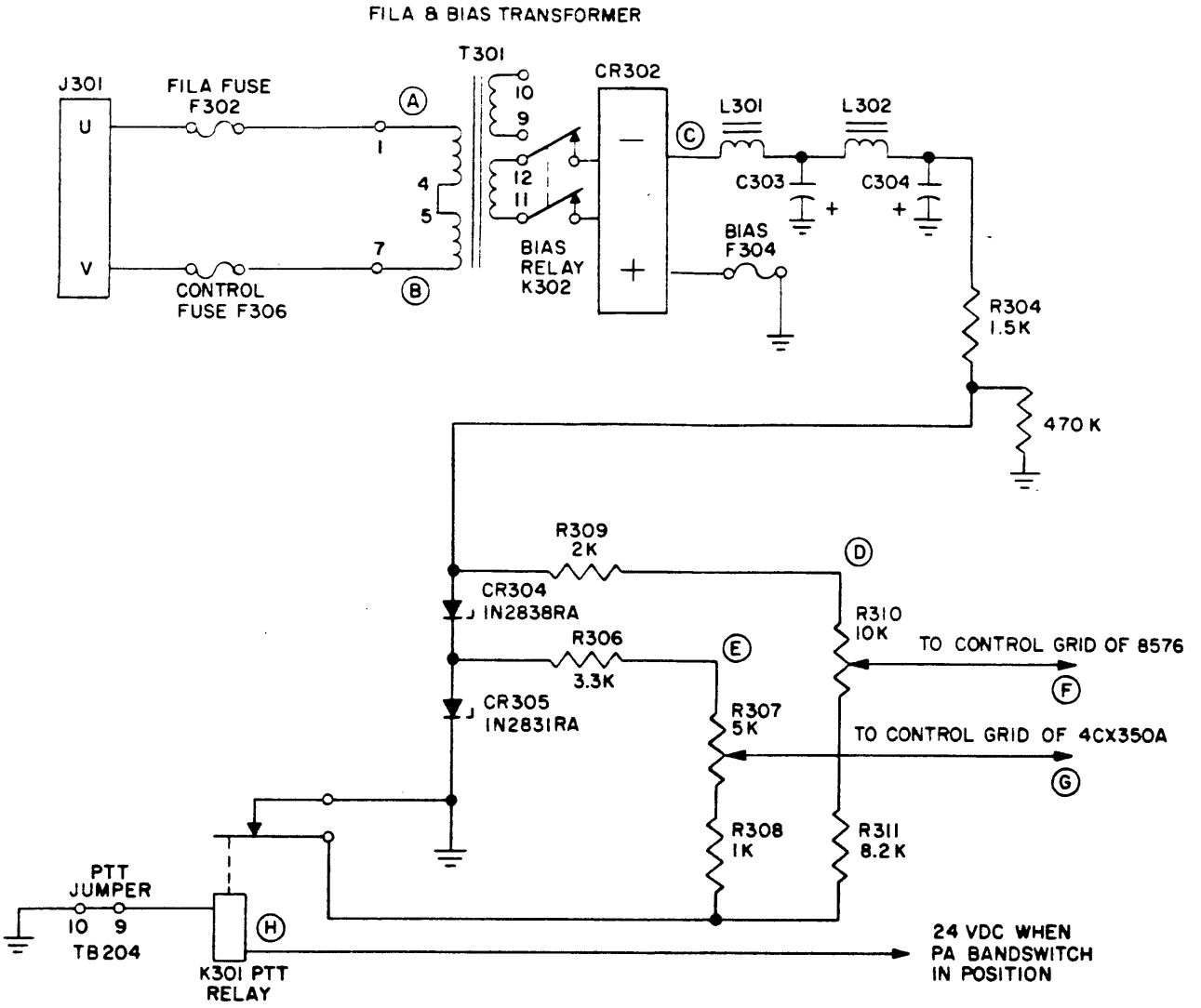


Figure 5-2. Simplified Bias Control Drawing

(4) Tune HFLM for rated output.

(5) Reduce rf drive to minimum.

NOTE

When overload occurs, HIGH VOLTAGE switch must be pressed twice to re-apply high voltage. Press to reset overload and press to apply high voltage.

5-9. PA PLATE OVERLOAD ADJUSTMENT.

Step 1 Adjust Overload indicator (adjustment screw located directly below meter face) for 300 ma as indicated on PLATE current meter.

Step 2 Increase drive until PLATE current meter indicates 300 ma. Observe the following:

a. When meter indicator reaches the value of overload indicator setting, the high voltage will trip off.

b. PLATE current meter face will illuminate, indicating overload in plate current.

c. Meter indicator will remain at the overload value to indicate value which caused overloaded condition.

Step 3 Reduce rf drive to minimum and press HIGH VOLTAGE pushbutton to reset high voltage. (H. V. Switch may have to be pressed twice.)

Step 4 To check further operation of plate overload, increase rf drive again, noting that high voltage tripped as in Step 2; set overload indicator for indication of 800 ma.

5-10. 2ND AMPLIFIER PLATE OVERLOAD ADJUSTMENT.

Step 1 Repeat paragraph 5-8 and proceed to Step 2.

Step 2 Push "PLATE meter switch" up and observe 2ND AMP plate current.

Step 3 Increase drive until 2ND AMP plate current indicates 300 ma.

Step 4 Adjust 2ND AMP PLATE OVERLOAD potentiometer until high voltage trips off (located on bottom of TLAM-1K).

a. PLATE current meter will illuminate, indicating overload in 2ND AMP plate current.

b. High voltage will trip OFF, HIGH VOLTAGE indicator will go out.

c. PLATE current meter will indicate zero.

Step 5 Reduce rf drive to minimum and press HIGH VOLTAGE pushbutton to reset high voltage (HIGH VOLTAGE switch may have to be pressed twice).

Step 6 To check further operation of 2ND AMP PLATE OVERLOAD, increase rf drive again, noting that high voltage tripped as in Step 4.

5-11. SWR OVERLOAD ADJUSTMENT.

Step 1 Repeat paragraph 5-8 and proceed to Step 2.

NOTE

In order to simulate a high SWR, the antenna has to be disconnected from the HFLM, or a 50 ohm dummy load with a capacitor (500 wvdc) in series with the output could be used.

Step 2 Simulate a high reactive condition.

Step 3 Press HIGH VOLTAGE pushbutton to apply high voltage.

Step 4 Push SWR pushbutton and increase drive until a reading of 110 watts (on KILOWATT meter, corresponding to a VSWR of 2:1) is observed on the reflected power scale.

Step 5 Adjust SWR potentiometer until high voltage trips OFF (located on bottom of TLAM-1K).

a. Reflected power indicator inside the KILOWATT OUT - SWR meter will illuminate.

b. High voltage will trip OFF; HIGH VOLTAGE indicator will go out.

c. PLATE current meter will indicate zero.

d. To further check operation of SWR overload, reduce rf drive, press HIGH VOLTAGE pushbutton to ON and increase rf drive again until overload trips high voltage OFF.

e. Connect antenna (or remove capacitor in series) to HFLM and equipment will be protected against SWR greater than 2:1.

NOTE

For SWR settings other than 2:1, refer to figure 5-3.

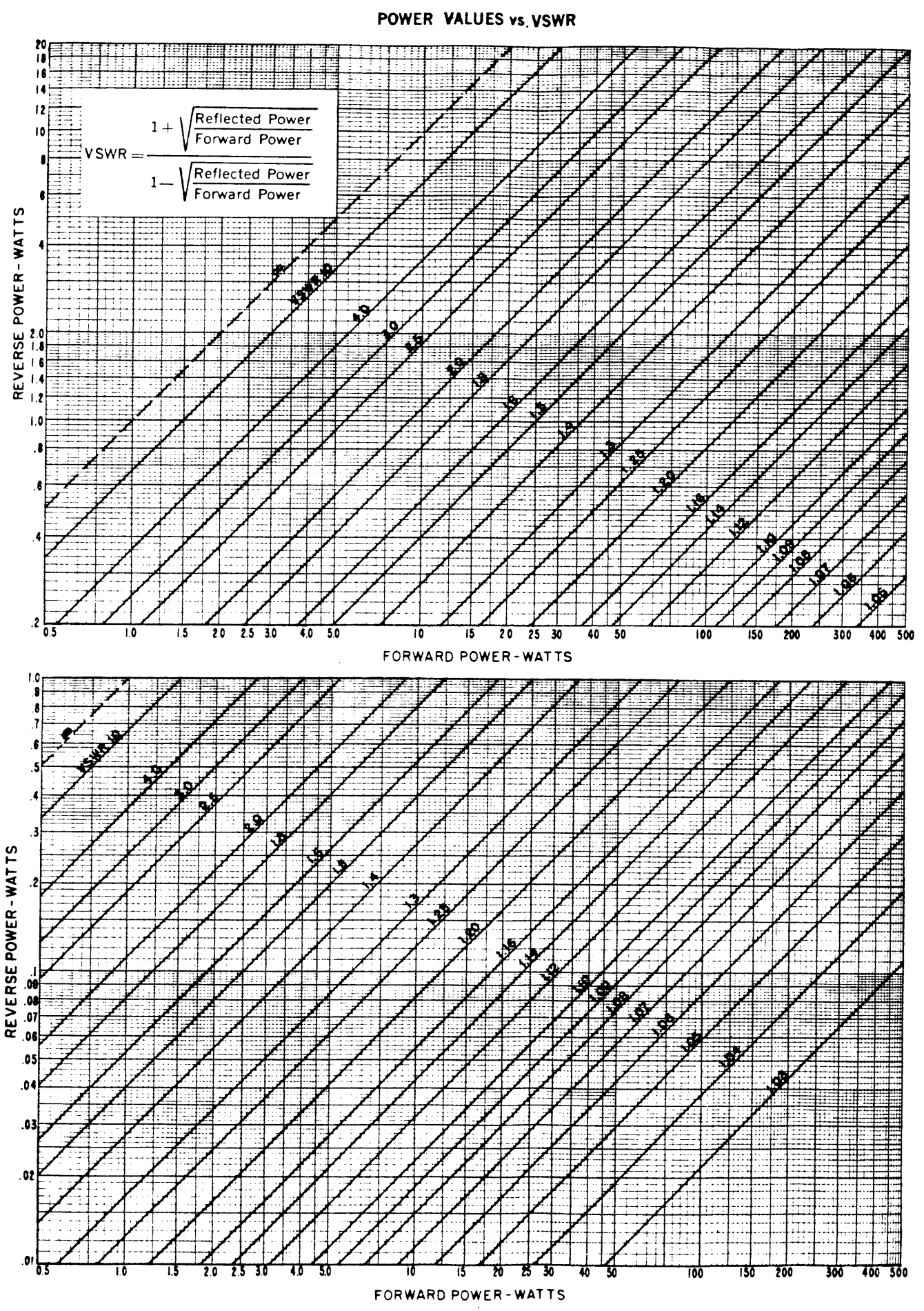


Figure 5-3. VSWR Nomograph

5-12. TROUBLESHOOTING TRANSMITTER OVERLOAD CIRCUITRY.

The overload is designed to remove high voltage in the event of excessive current conditions. Paragraphs 5-8 through 5-11 provide information for setting and checking overloads. However, if the overload circuitry does not function in accordance with paragraphs 5-8 through 5-11, troubleshoot the circuitry in the following manner:

a. Plate MAIN POWER breaker and SCREEN breaker to ON position.

b. Press HIGH VOLTAGE pushbutton to ON. Adjust overload pointer counterclockwise, to make contact with meter pointer; overload lamp should light.

NOTE

If overload lamp on associated meter board does not light, turn high voltage OFF and temporarily place a jumper across switch controls on meter board (refer to Assembly Drawing on associated schematic diagram for parts location). If overload lamps do not light with jumper check the transistor and/or the presence of 24 vdc on the associated board inputs. The voltage that lights the overload lamp also energizes the overload relay.

c. Observe overload relay K303. When the overload lamp lights on the meter board, the overload relay K303 should energize to an overload condition. If the relay does not energize, check for the presence of 24 vdc (refer to Assembly Drawing for parts location).

d. When overload relay K303 is latched in the overload condition, it must be reset to enable a high voltage ON condition. Remove temporary jumper, adjust overload pointer clockwise and press HIGH VOLTAGE pushbutton. Observe overload relay K303. It should latch into rest position and overload lamp should go out.

High Voltage Control Voltage Chart (Refer to figure 5-4)

Test Equipment MULTIMETER: Simpson 260, or equivalent

A. Test Conditions

1. MAIN POWER breaker ON
2. SCREEN breaker ON
3. Interlock circuit complete

	Point of Test	Measured Values
A	across the rectifier	28 vac
B	to ground	24 vdc
C	to ground	24 vdc
D		ground always
E	to ground	24 vdc
F	to ground	24 vdc
G		0 volts
H		ground always
J	to ground	24 vdc
K		ground always

High Voltage Control Voltage Chart (Refer to figure 5-4) (Cont)

B. Test Conditions

1. MAIN POWER breaker ON
2. SCREEN breaker ON
3. Interlock circuit complete
4. HIGH VOLTAGE pushbutton pressed (make certain HIGH VOLTAGE indicator is on)

	Point of Test	Measured Values
A	across the rectifier	28 vac
B	to ground	24 vdc
C	to ground	24 vdc
D		ground always
E	to ground	24 vdc
F	to ground	24 vdc
G		24 vdc
H		ground always
J		0 volts
K		ground always

OBJECT

To energize High Voltage Contactor.

TABLE 5-4. TROUBLESHOOTING CHARTS

The maintenance programs listed are for the purpose of assisting in troubleshooting and maintenance of the transmitter. These charts or programs do not list all possible difficulties; however, they can be used as a starting point to isolate a particular malfunction. To use the charts, follow these instructions.

1. Determine the nature of the trouble.
2. Find the programs which described it most completely (refer to program list).
3. Follow the arrow from that block to the first suggested fault - INVESTIGATE.
4. If no trouble can be found, follow the arrow to the next fault suggested - INVESTIGATE.
5. If trouble is only partially corrected, find the block which most nearly describes the remaining trouble - INVESTIGATE.
6. Proceed as in line 3 above.

MAINTENANCE PROGRAM LIST

Maintenance program "A"	PA PLATE meter reading abnormal
Maintenance program "B"	2ND AMP PLATE meter reading abnormal
Maintenance program "C"	No high voltage
Maintenance program "D"	Main Blower does not operate, interlock indicator light is out.

TABLE 5-4. TROUBLESHOOTING CHARTS (CONT)

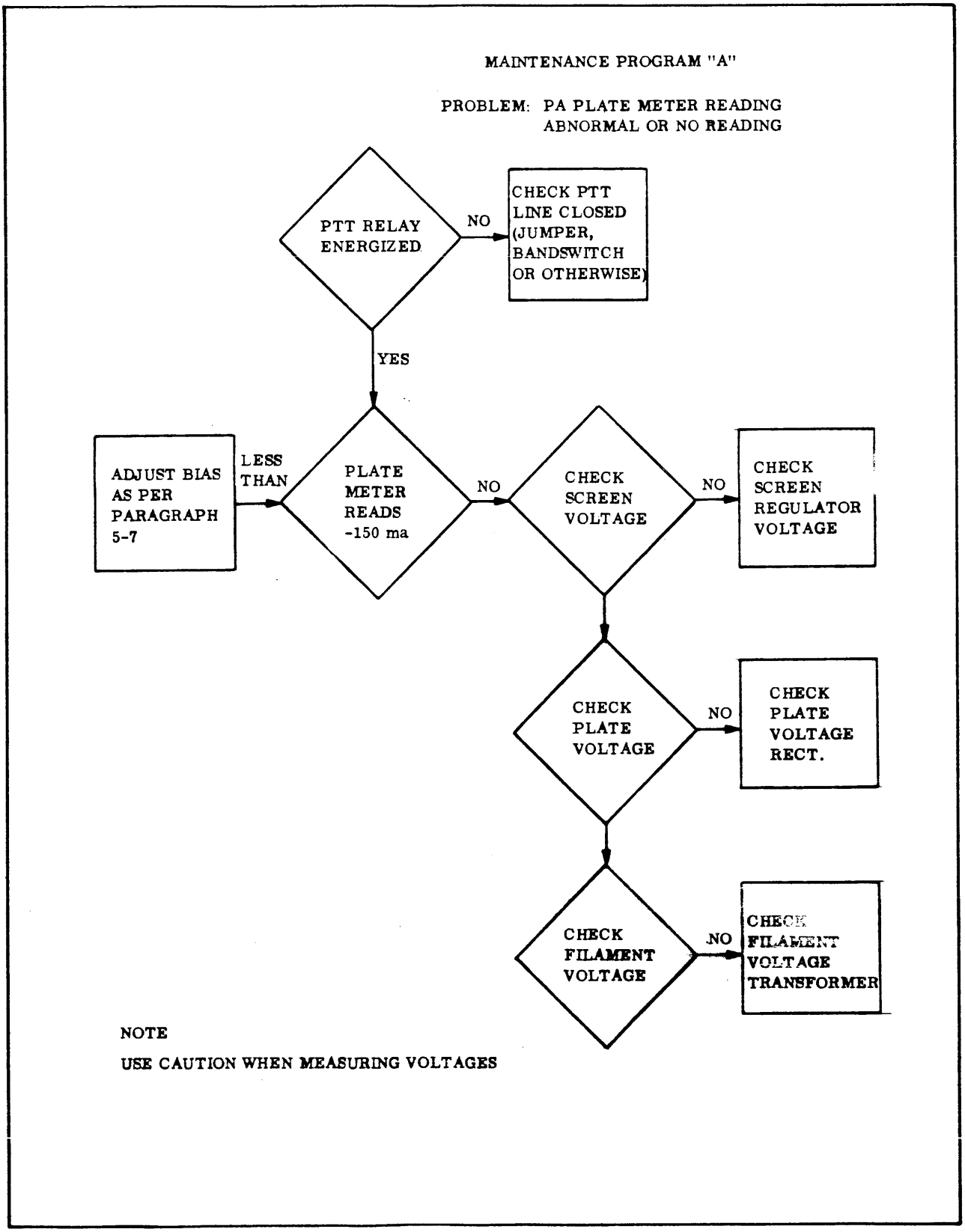


TABLE 5-4. TROUBLESHOOTING CHARTS (CONT)

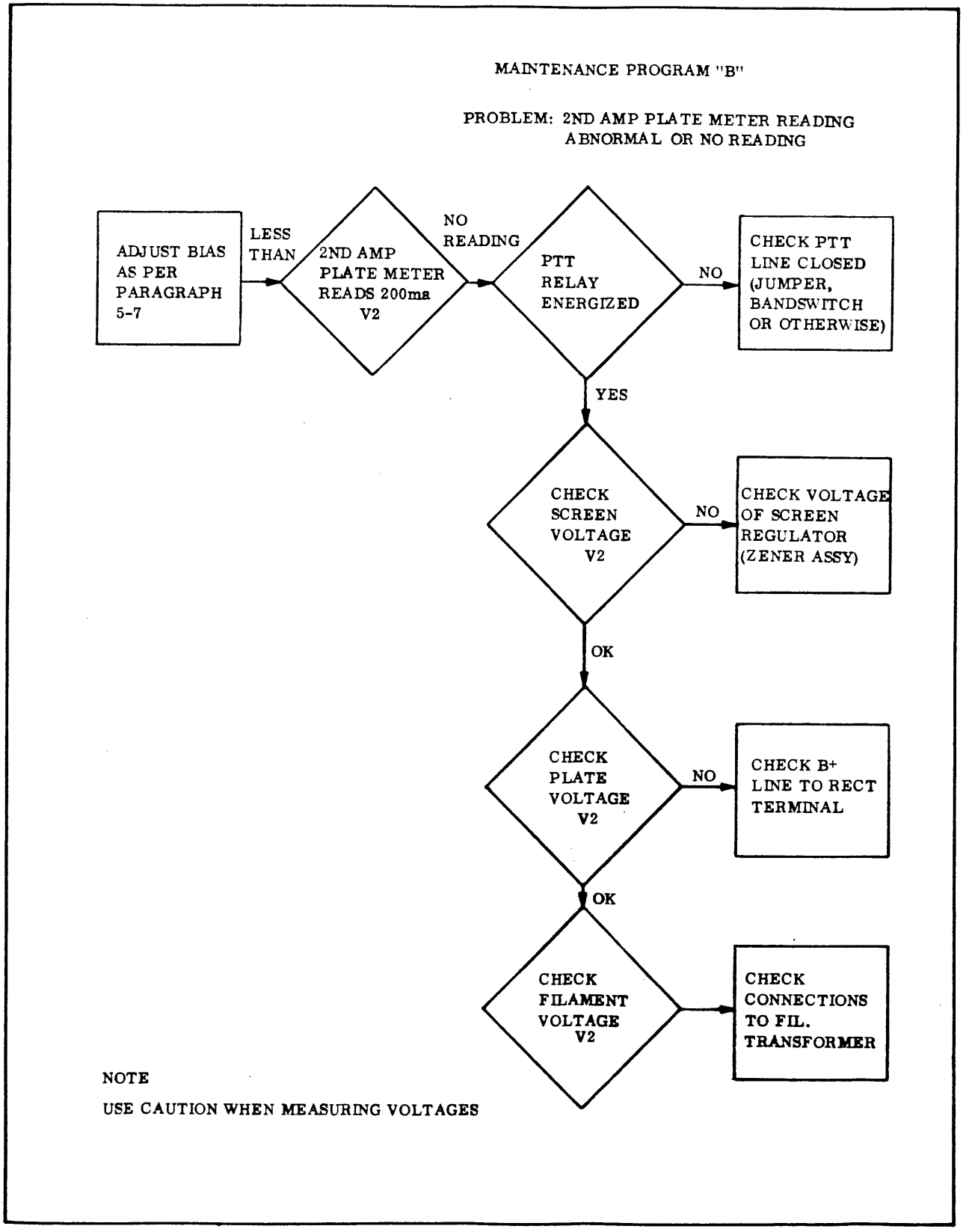


TABLE 5-4. TROUBLESHOOTING CHARTS (CONT)

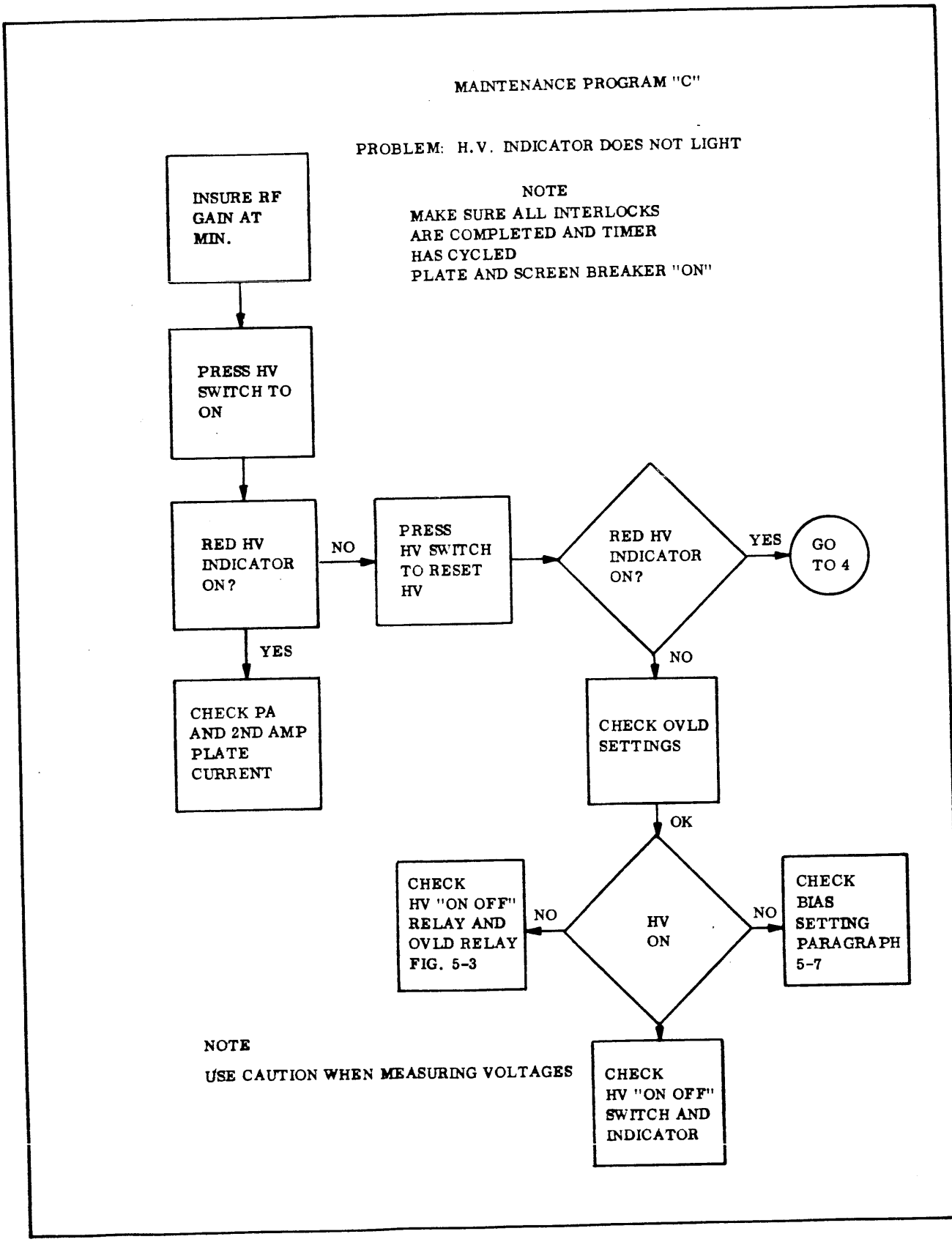


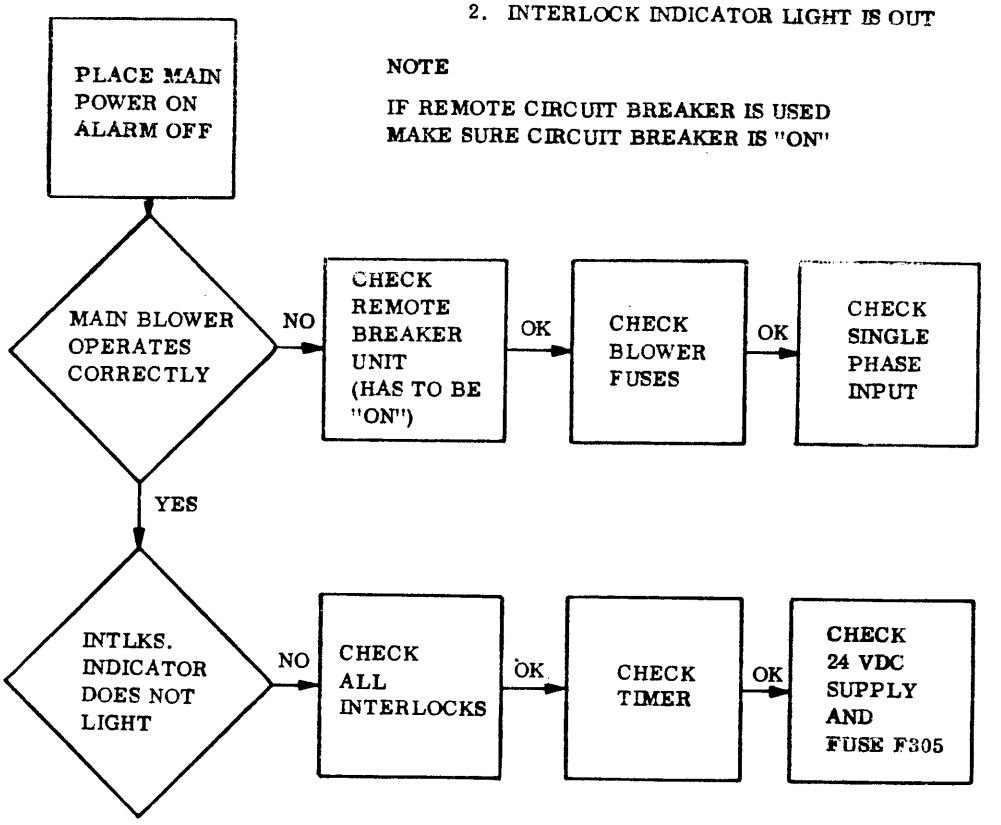
TABLE 5-4. TROUBLESHOOTING CHARTS (CONT)

MAINTENANCE PROGRAM "D"

PROBLEM: 1. MAIN BLOWER DOES NOT OPERATE
2. INTERLOCK INDICATOR LIGHT IS OUT

NOTE

IF REMOTE CIRCUIT BREAKER IS USED
MAKE SURE CIRCUIT BREAKER IS "ON"



NOTE

USE CAUTION WHEN MEASURING VOLTAGES

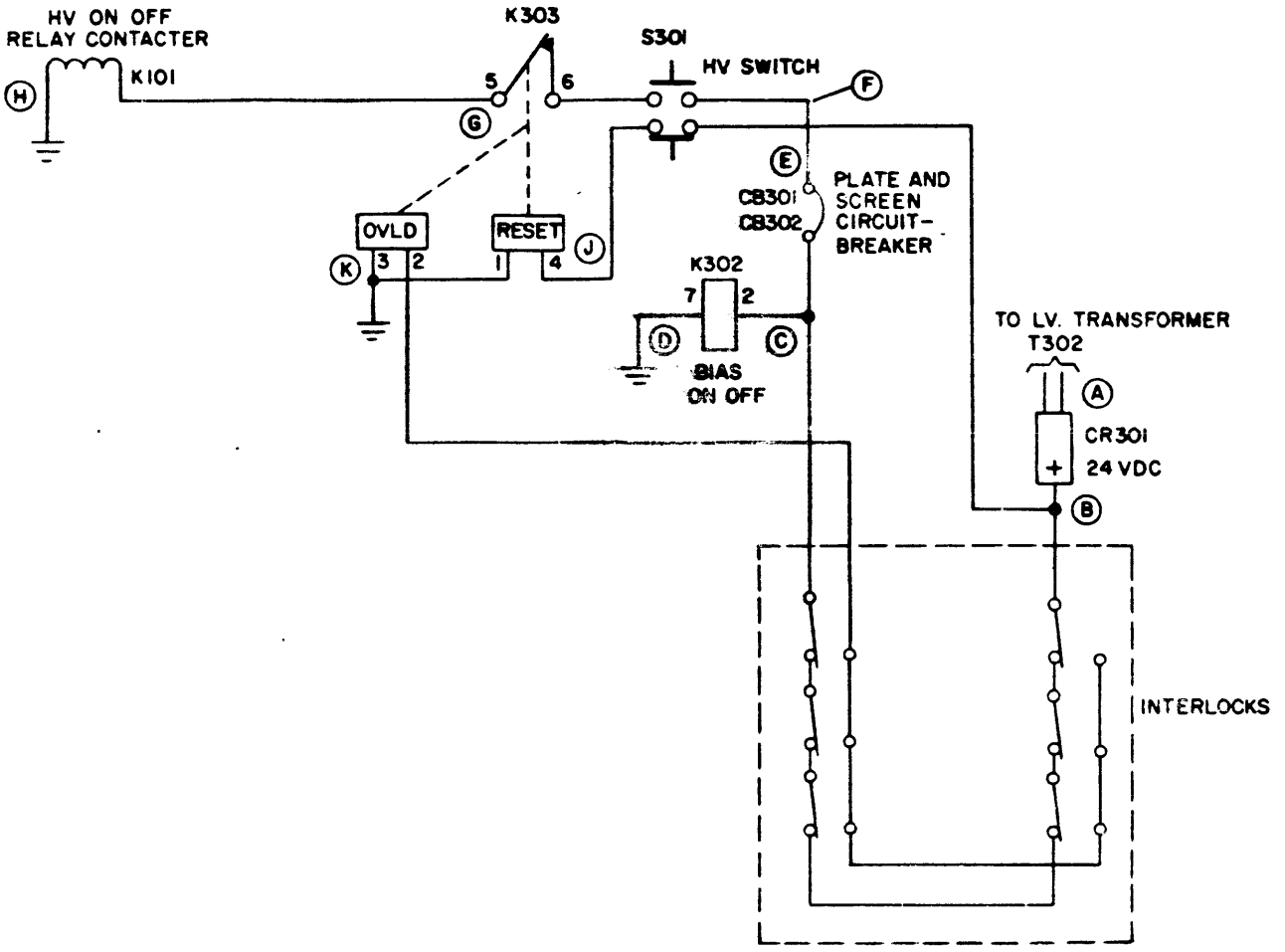
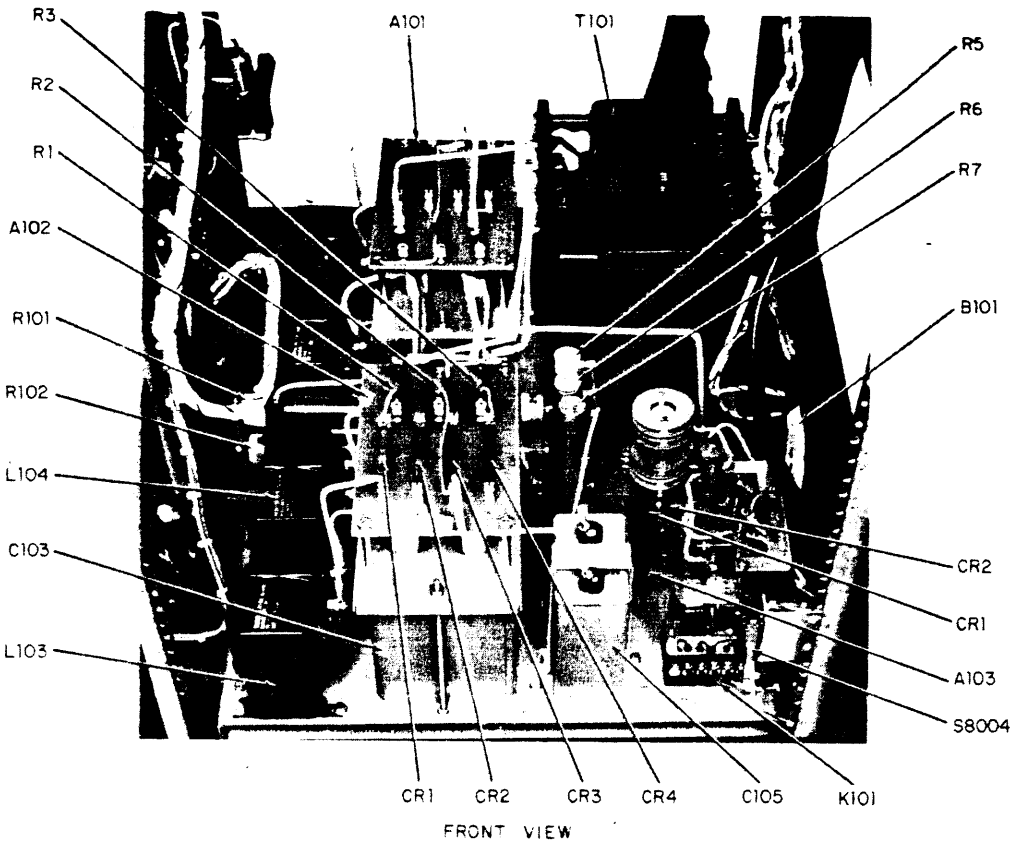


Figure 5-4. High Voltage Control



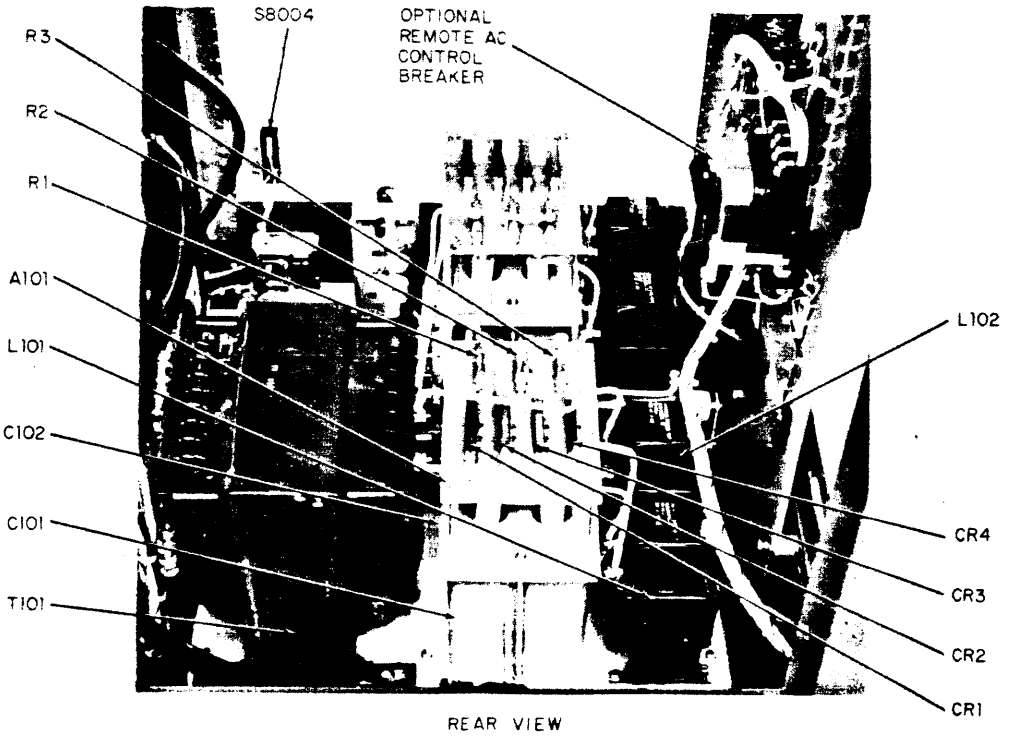


Figure 5-5. High Voltage Power Supply AP-150, Component Locations

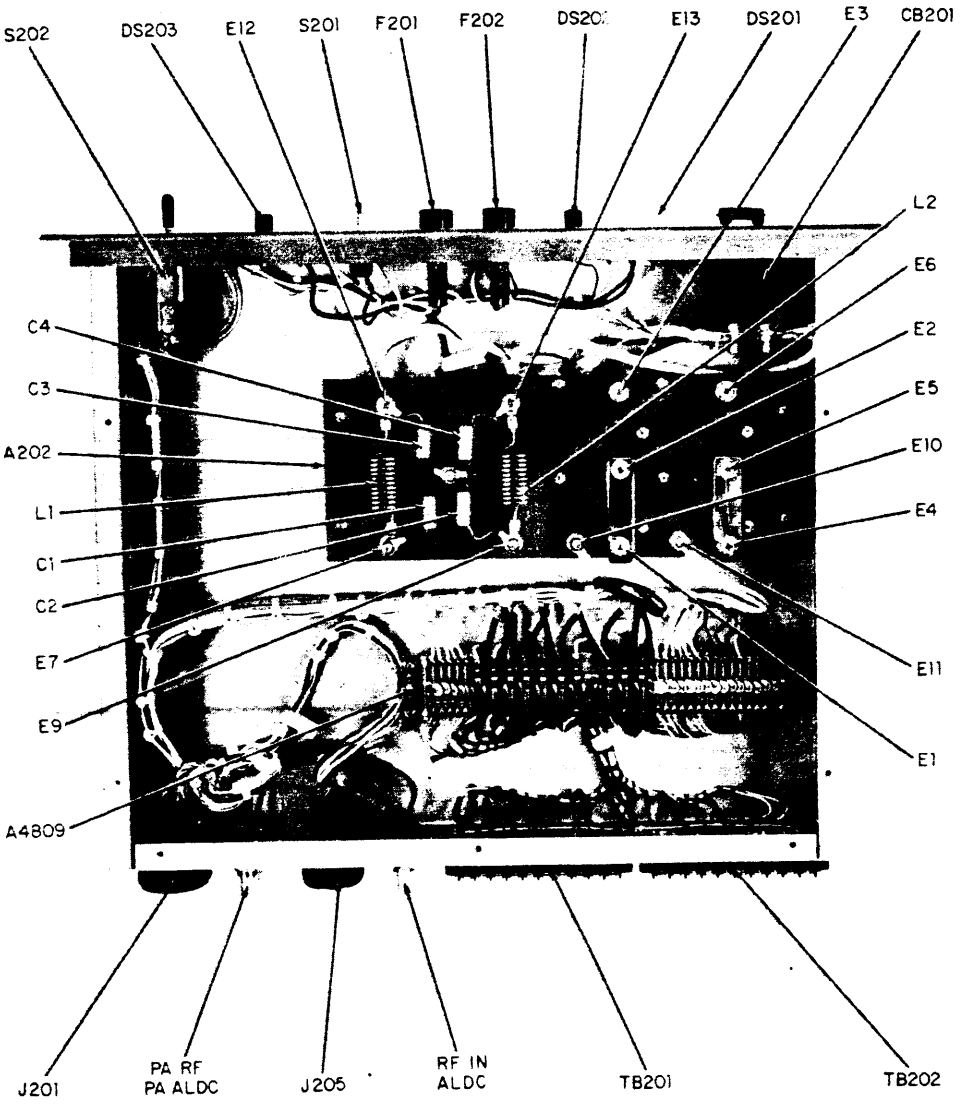
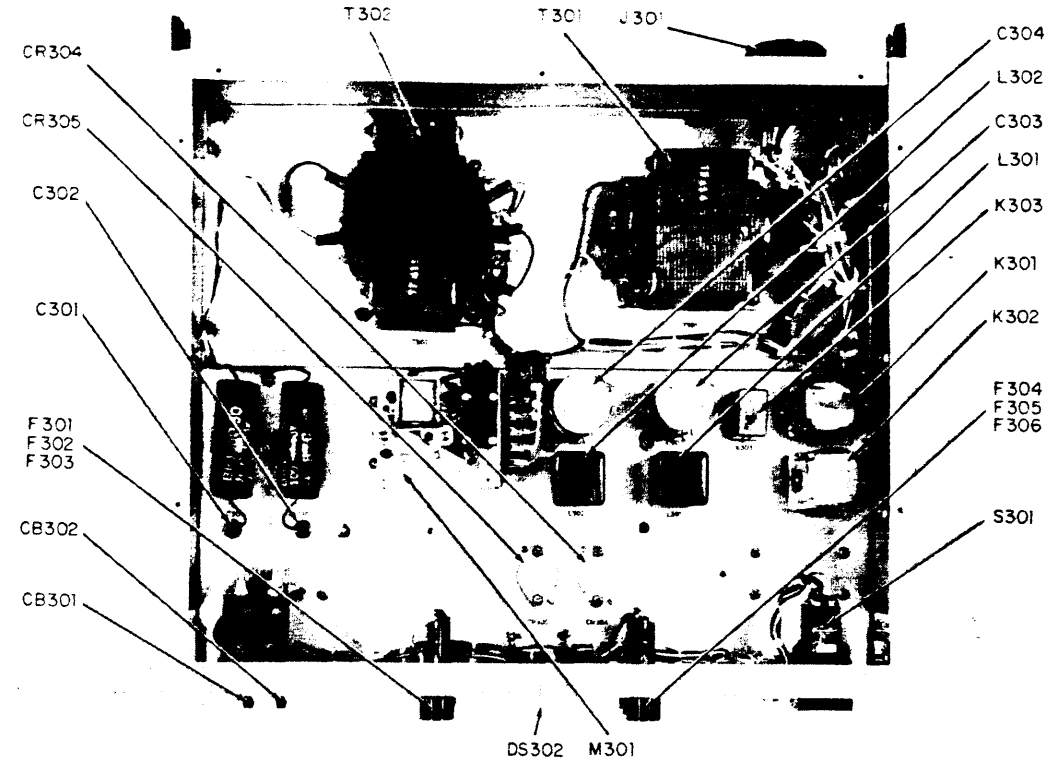


Figure 5-6. Power Distribution Panel APP-18, Component Locations



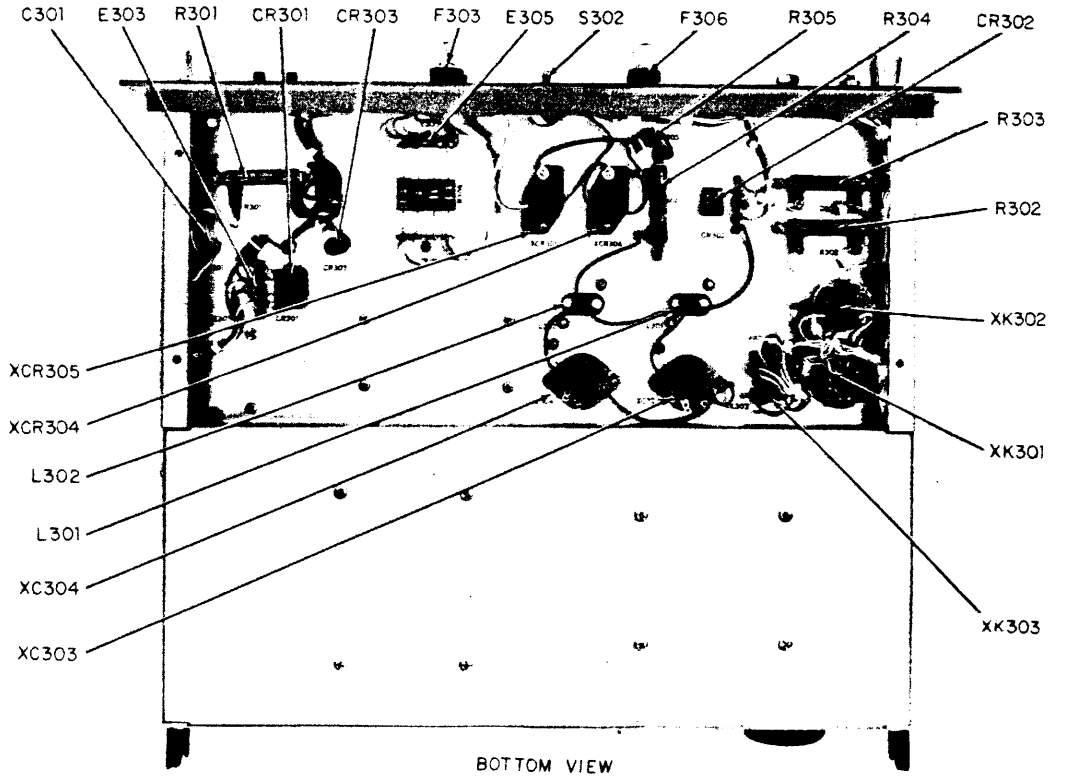
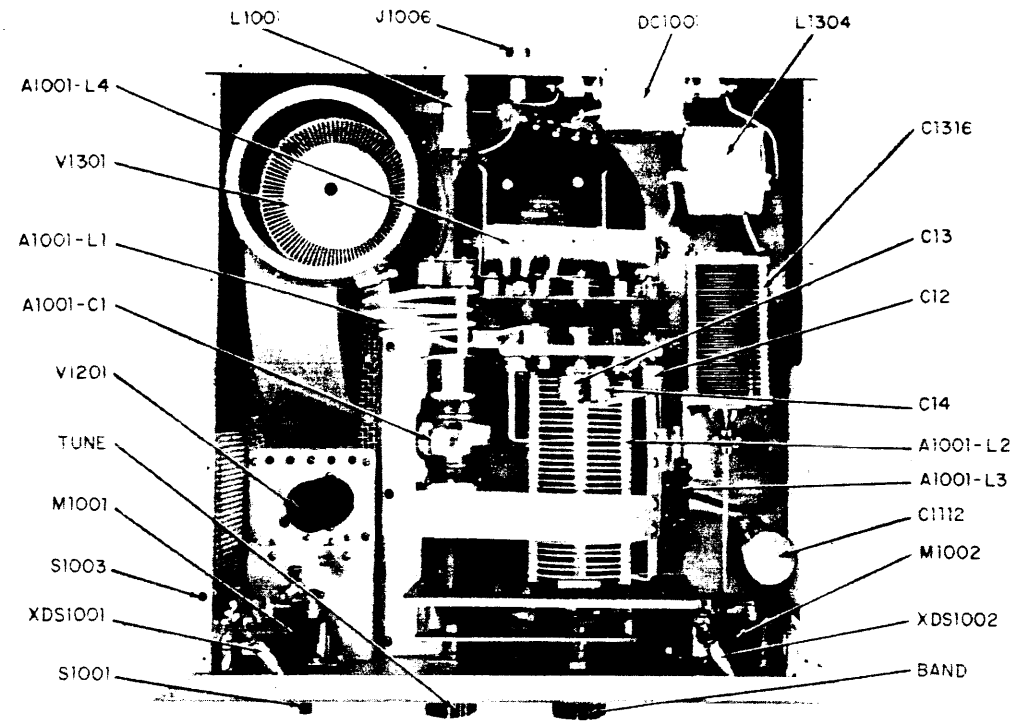
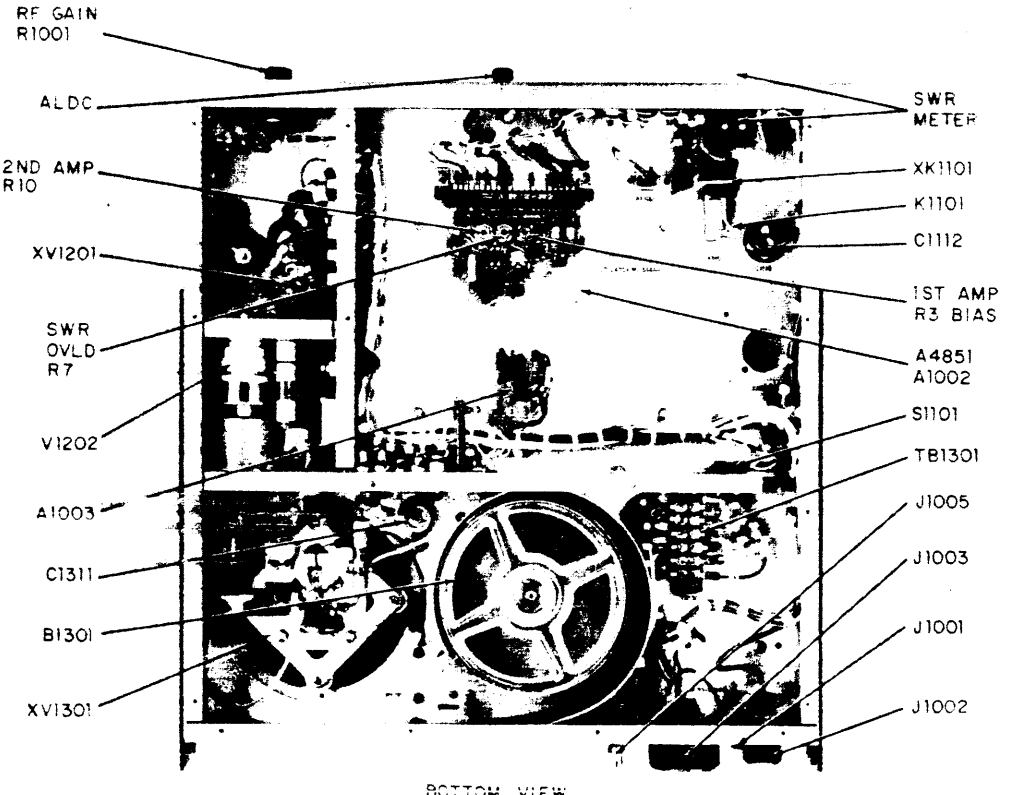


Figure 5-7. Low Voltage Filament and Bias Supply AP-149, Component Locations



TOP VIEW



BOTTOM VIEW

Figure 5-8. Power Amplifier TLAM-1K, Component Locations

SECTION 6

PARTS LIST

6-1. INTRODUCTION.

The parts list presented in this section is a cross-reference list of parts identified by a reference designation to TMC part number. The letters of the reference designation indicate the kind of part (generic group), such as resistor, capacitor, unit, subassembly, PC card, transistor, integrated circuit, electron tube, etc. The number differentiates between parts of the same generic group. Wherever practicable, the reference designation is marked on the equipment, close to the part it identifies. In most cases, mechanical and electro-mechanical parts have TMC part numbers stamped on them.

To expedite delivery when ordering any part, specify the following:

a. Reference symbol

b. Description as indicated in parts list

c. TMC part number

d. Model and serial numbers of the equipment containing the part being replaced; this can be obtained from the equipment nameplate.

For replacement parts not covered by warranty (refer to warranty sheet in front of manual), address all purchase orders to:

The Technical Materiel Corporation
Attention: Sales Department
700 Fenimore Road
Mamaroneck, New York 10543

Ref. Symbol	Description	TMC Part No.
	POWER DISTRIBUTION PANEL	APP18
A201	PRINTED CIRCUIT BOARD ASSEMBLY	A4809
A201Z1, A201Z2	BYPASS, power input	AR194
A201Z3, A201Z4	BYPASS, power input	AR195
A202	TERMINAL BOARD ASSEMBLY	A4845
A202C1 thru A202C4	CAPACITOR, fixed: mica	CM35F 103F03
A202L1, A202L2	COIL, radio frequency	CL269
CB201	CIRCUIT BREAKER	SW261
DS102,	LAMP, neon	BI111-2
DS202, DS203	LAMP, incandescent	BI110-7
F201	FUSE, slo-blo (220 vac primary)	FU102-.5
	FUSE, slo-blo (110 vac primary)	FU102-1
F202	FUSE, slo-blo (220 vac primary)	FU102-.5
	FUSE, slo-blo (110 vac primary)	FU102-1
J201	CONNECTOR, receptacle: male, 37/c	MS3102 A28-21
J202 thru J204	CONNECTOR, panel: bnc	JJ172
J205	CONNECTOR, receptacle	MS3102 A24-28S
J206 thru J208	Same as J202	
R201	RESISTOR, fixed: composition	RC20GF 224J
S201	SWITCH, toggle: dpdt	ST103-24-62
S202	SWITCH, lever	SW186-3
TB201 thru TB204	TERMINAL STRIP, barrier	TM100-10
W201	WIRING HARNESS, branched	CA1584
W202	WIRING HARNESS, branched	CA1584
W203 thru W205	CABLE ASSEMBLY, radio	CA480-133-8.00
W206	CABLE ASSEMBLY, jumper	CA409-55-9.00
W207	CABLE ASSEMBLY, jumper	CA409-49-10.00
W208	CABLE ASSEMBLY, jumper	CA409-50-10.00
XDS201	LIGHT, indicator	TS154-7
XDS202	LIGHT, indicator	TS153-11
XDS203	LIGHT, indicator	TS153-8
XF201, XF202	FUSEHOLDER, indicator	FH104-3

Ref. Symbol	Description	TMC Part No.
	LOW VOLTAGE AND BIAS POWER SUPPLY	AP149
C301, C302	CAPACITOR, fixed: electrolytic	CE116-8VN
C303, C304	CAPACITOR, fixed: electrolytic	CE52C 200Q
CB301	CIRCUIT BREAKER	SW262
CB302	CIRCUIT BREAKER	SW215
CR301	RECTIFIER, semiconductor device	DD144-6
CR302	RECTIFIER, semiconductor device	DD130-600-1.5
CR303	SEMICONDUCTOR DEVICE, diode	1N2986A
CR304	SEMICONDUCTOR DEVICE, diode	1N2838 RA
CR305	SEMICONDUCTOR DEVICE, diode	1N2831 RA
DS301	LAMP, incandescent	BI110-7
DS302	GENERATOR, audio signal	BZ101-Z
E301, E302	TERMINAL, feedthru	TE114-2
E303 thru E306	TERMINAL STRIP, miniature	TM121-2
F301 thru F303	FUSE, slo-blo (220 vac primary)	FU102-1.0
F301 thru F303	FUSE, slo-blo (115 vac primary)	FU102-2.0
F304	FUSE, slo-blo (220 vac primary)	FU102-.25
F305	FUSE, slo-blo (220 vac primary)	FU102-1.5
F306	FUSE, slo-blo (220 vac primary)	FU102-2.5
F306	FUSE, slo-blo (115 vac primary)	FU102-5
J301	CONNECTOR, receptacle: male, 35/c	MS3102 A32-7P
K301	RELAY, armature: 3 pdt	RL168-3C10-24DC
K302	RELAY, armature: dpdt	RL168-2C10-24DC
K303	RELAY, armature: 4 pdt	RL156-10
L301, L302	REACTOR, 5h	TF5028
M301	TIMER, interrupter (60 Hz)	TI105-3
M301	TIMER, interrupter (50 Hz)	TI105-4
R301	RESISTOR, fixed: wirewound, 10 w	RW109-5
R302, R303	RESISTOR, fixed: wirewound, 10 w	RW109-4
R304	RESISTOR, fixed: wirewound, 10 w	RW109-26
R305	RESISTOR, fixed: composition	RC42GF 474J
R306	RESISTOR, fixed: composition	RC42GF 332J
R307	RESISTOR, variable: composition	RV4LAY SA502A
R308	RESISTOR, fixed: composition	RC42GF 102J

Ref. Symbol	Description	TMC Part No.
	LOW VOLTAGE AND BIAS POWER SUPPLY (cont)	
R309	RESISTOR, fixed: composition	RC42GF 181J
R310	RESISTOR, variable: composition	RV4LAY SA103A
R311	RESISTOR, fixed: composition	RC42GF 103J
R312	RESISTOR, fixed: composition	RC20GF 103J
R313	RESISTOR, fixed: composition	RC42GF 123J
S301	SWITCH, push: dpdt	SW522-1
S302	SWITCH, toggle: spst	ST103-5-62
T301	TRANSFORMER, filament	TF414
T302	TRANSFORMER, low voltage	TF415
XC301, XC302	Not used	
XC303, XC304	SOCKET, tube: electrical	TS100-3
XCR301 thru XCR303	Not used	
XCR304, XCR305	SOCKET, semiconductor device	TS166-1
XF301 thru XF304	FUSEHOLDER, indicator	FH104-3
XF305	FUSEHOLDER, indocator	FH104-11
XF306	Same as XF301	
XK301	SOCKET, relay	TS100-6
XK302	SOCKET, relay	TS100-3
XK303	SOCKET, relay	TS171-3
W301	WIRING HARNESS, branched	CA1586
	HIGH VOLTAGE POWER SUPPLY	AP150
A101	ASSEMBLY BOARD, rectifier	A4853-6
A101CR1 thru A101CR4	RECTIFIER, semiconductor device	DD140
A101R1 A101R2	RESISTOR, fixed: wirewound, 10 w	RW109-4
A101R3	RESISTOR, fixed: wirewound, 10 w	RW109-3
A102	ASSEMBLY BOARD, rectifier	A4853-7
A102CR1 thru A102CR4	Same as A101CR1	
A102R1, A102R2	Same as A101R1	
A102R3	RESISTOR, fixed: wirewound, 10 w	RW109-7
A103	ASSEMBLY BOARD, zener	A4854
A103CR1, A103CR2	SEMICONDUCTOR DEVICE, diode	1N2846A
A103R1	RESISTOR, fixed: composition	RC42GF 274J

Ref. Symbol	Description	TMC Part No.
	HIGH VOLTAGE POWER SUPPLY (cont)	
A103R2	RESISTOR, fixed: composition	RC42GF 124J
A103R3, A103R4	RESISTOR, fixed: wirewound, 25 w	RW111-33
A103R5	RESISTOR, fixed: wirewound, 50 w	RW105-37
A103R6, A103R7	RESISTOR, fixed: wirewound, 50w	RW105-35
A103R8, A103R9	RESISTOR, fixed: composition	RC42HF 101J
B101	FAN, ventilator	BL106-2
C101 thru C104	CAPACITOR, fixed: film	CN109
C105	CAPACITOR, fixed: paper	CP70B1 EG106K
F101	FUSE, slo-blo	FU102-.375
K101	RELAY, armature	RL184-2
L101 thru L104	REACTOR, 5h	TF5034
R101, R102	RESISTOR, fixed: wirewound, 160 w	RW117-39
T101	TRANSFORMER, plate	TF413
XF101	FUSEHOLDER	FH105
XK101	SOCKET, relay	TS196-1
	INPUT BOARD ASSEMBLY	A4809
C1 thru C30	CAPACITOR, fixed: composition	CC100-42
E1 thru E80	TERMINAL, stud	TE0127-2
L1 thru L10	COIL, radio frequency: fixed	CL240-120
	PRINTED CIRCUIT BOARD ASSEMBLY	A4850
C1, C2	CAPACITOR, fixed: ceramic	CC100-28
C3	CAPACITOR, fixed: electrolytic	CE105-5-50
CR1	SEMICONDUCTOR DEVICE, diode	1N34A
E1	STANDOFF, rivet	TE108-1
E2, E3	TERMINAL, stud	TE127-2
R1	RESISTOR, fixed: composition	RC20GF 102J
R2	RESISTOR, fixed: composition	RC20GF 272J

Ref. Symbol	Description	TMC Part No.
	PRINTED CIRCUIT BOARD ASSEMBLY	A4851
C1 thru C12	CAPACITOR, fixed: ceramic	CC100-28
C13	CAPACITOR, fixed	CM111E511H5S
C14	CAPACITOR, fixed	CM111C200J5S
C15	CAPACITOR, fixed: electrolytic	CE105-50-15
C16	Same as C1	
C17	CAPACITOR, fixed: ceramic	CC100-35
CR1, CR2	SEMICONDUCTOR DEVICE, diode	1N759
CR3 thru CR5	SEMICONDUCTOR DEVICE, diode	1N2484
L1, L2	COIL, radio frequency	CL240-120
Q1	TRANSISTOR	2N492A
Q2, Q3	TRANSISTOR	2N1595
R1	RESISTOR, fixed: composition	RC20GF153J
R2	RESISTOR, fixed: composition	RC20GF392J
R3	RESISTOR, variable	RV111U252A
	BAND SWITCH ASSEMBLY	AS147
C1	CAPACITOR, variable: vacuum	CB177
C2, C3	CAPACITOR, fixed: ceramic	CC109-38
C4, C5	Not used	
C6 thru C11	Same as C2	
C12 thru C14	CAPACITOR, fixed: ceramic	CC109-28
L1	COIL, radio frequency	CL461
L2	COIL, main tank	CL462
L3	COIL, radio frequency	CL292
L4	COIL, output	CL467
P1	CONNECTOR, plate, 9/c	JJ313-4H
S1	Not used	
S2	SWITCH, roller: lever	SW260
S3	SWITCH, sensitive	SW353-2
W1	CABLE, bandswitch	CA1602
	TLAM-1K SUBASSEMBLY	BMA444
A1001	ASSEMBLY, bandswitch	AS147
A1002	BOARD ASSEMBLY, printed circuit	A4851
C1001 thru C1004	CAPACITOR, fixed: ceramic	CC100-28

Ref. Symbol	Description	TMC Part No.
	TLAM-1K SUBASSEMBLY (cont)	
C1316	CAPACITOR, variable: air	CB138-3AN
DS1001, DS1002	LAMP, incandescent	BI101-1819
M1001	METER, plate	MR216-1
M1002	METER, output	MR217
R1001	RESISTOR, variable: composition	RV4NAYSD500A
S1001	SWITCH, lever	SW523-3
S1002	SWITCH, actuator	SW347
XDS1001, XDS1002	LAMPHOLDER, bay	TS107-2
	MAIN CHASSIS ASSEMBLY	BMA446
A1003	ASSEMBLY, printed circuit board	A4850
C1101 thru C1106	CAPACITOR, fixed: ceramic	CK70AW202M
C1111	CAPACITOR, fixed: electrolytic	CE150-25-25
C1112	CAPACITOR, fixed: paper	CP41B1EF405K
C1113	CAPACITOR, fixed: electrolytic	CE105-10-50
C1201	CAPACITOR, fixed: ceramic	CC100-35
C1202	CAPACITOR, fixed: ceramic	CC100-16
C1203	CAPACITOR, fixed: ceramic	CC100-28
C1204, C1205	CAPACITOR, fixed: ceramic	CC100-32
C1206	CAPACITOR, fixed: ceramic	CC100-31
C1207	CAPACITOR, fixed: mica	CM111E220J5S
C1208	CAPACITOR, fixed: mica	CM112F222F3S
C1209	CAPACITOR, fixed: ceramic	CC100-37
C1210 thru C1212	Same as C1203	
C1213, C1214	Same as C1204	
C1215	CAPACITOR, fixed: mica	CM50B222G03
C1216	Same as C1204	
C1217	Same as C1209	
C1218	CAPACITOR, fixed: mica	CC109-38
E1101	BUSHING, slotted head	TE101-3
E1103	TERMINAL, turret	TE102-2
E1104	Same as E1101	
E1201 thru E1207	Same as E1103	
K1101	RELAY, armature: dpdt	RL156-1

Ref. Symbol	Description	TMC Part No.
	MAIN CHASSIS ASSEMBLY (cont)	
L1201	COIL, radio frequency	CL140-2
L1202	COIL, radio frequency	CL101-2
L1203 thru L1205	Same as L1201	
L1206	INDUCTOR, fixed	CL459
L1207	COIL, radio frequency	CL178
R1101 thru R1103	RESISTOR, fixed, composition	RR114-5W
R1104	Not used	
R1105	RESISTOR, fixed: composition	RC32GF 102J
R1106	RESISTOR, variable: composition	RV106U S10A102A
R1107	RESISTOR, fixed: composition	RC20GF 101J
R1108	RESISTOR, fixed: composition	RC20GF 224J
R1109	RESISTOR, fixed: composition	RC20GF 103J
R1201	RESISTOR, fixed: composition	RC20GF 102J
R1202	RESISTOR, fixed: composition	RC32GF 100J
R1203	RESISTOR, fixed: composition	RC42GF 120J
R1204	RESISTOR, fixed: composition	RC42GF 222J
R1205	RESISTOR, fixed: composition	RC20GF 333J
R1206	RESISTOR, fixed: composition	RC42GF 331J
R1207	RESISTOR, fixed: composition	RC42GF 472J
R1208	RESISTOR, fixed: composition	RR114-20W
S1003	SWITCH, interlock	SW219
TB1101	TERMINAL STRIP	TM121-1
V1201	TUBE, electronic	8233
V1202	TUBE, electronic	4CX350A
XK1101	SOCKET, relay	TS171-1
XV1201	SOCKET, electronic tube	TS198
XV1202	SOCKET, electronic tube	TS197
Z1201	SUPPRESSOR, parasitic	A1546-2
Z1202	SUPPRESSOR, parasitic	A1546-4

Ref. Symbol	Description	TMC Part No.
	POWER AMPLIFIER CHASSIS ASSEMBLY	BMA449
B1301	BLOWER, centrigugal	BL134
C1107, C1108	CAPACITOR, fixed: ceramic	CK70AW 202M
C1109, C1110	CAPACITOR, fixed: ceramic	CC108-4P1000M
C1303	CAPACITOR, fixed: ceramic	CC100-28
C1304	CAPACITOR, fixed	CM112F 562JS
C1305	CAPACITOR, fixed: ceramic	CC100-37
C1306, C1307	CAPACITOR, fixed: ceramic	CC100-32
C1310	Same as C1303	
C1311	CAPACITOR, fixed: ceramic	CC109-38
C1312 thru	CAPACITOR, fixed: ceramic	CC109-36
C1316	Not used	
C1317, C1318	CAPACITOR, fixed: ceramic	CC109-6
C1319	Same as C1109	
DC1001	COUPLER, directional	DC108
E1102	BUSHING, slotted head	TE0101-3
E1301, E1302	INSULATION, standoff	NS3W 0106
J1001	CONNECTOR, receptacle: male	MS3102 A18-16P
J1006	CONNECTOR, receptacle	UG560*/U
K1301	RELAY, armature	RL185
L1001	COIL, radio frequency	CL138
L1302, L1303	COIL, radio frequency	CL140-6
L1304	COIL, output	CL463
R1104	RESISTOR, fixed: wirewound, 10 w	RW109-4
R1303	RESISTOR, fixed: composition	RR116-1400W
R1305	RESISTOR, fixed: composition	RR114-5W
S1101	SWITCH, interlock	SW219
S1301	SWITCH, micro	SW252
TB1301	TERMINAL STRIP, barrier	TM102-6
T1301	TRANSFORMER, matching	TR193
V1301	TUBE, electronic	8576/PL264J
XV1301	SOCKET, electronic tube	TS182

SECTION 7

MAINTENANCE DIAGRAMS

7-1. GENERAL.

This section contains maintenance diagrams for the HFLM-1K; these consist of the following:

a. Power Amplifier TLAM-1K, Schematic Diagram (CK1845Ø)

b. High Voltage Power Supply AP150; Schematic Diagram (CK1848Ø)

c. Low Voltage, Filament and Bias Supply AP-149, Schematic Diagram (CK1840Ø)

d. Power Distribution Panel APP-18, Schematic Diagram (CK1787Ø)

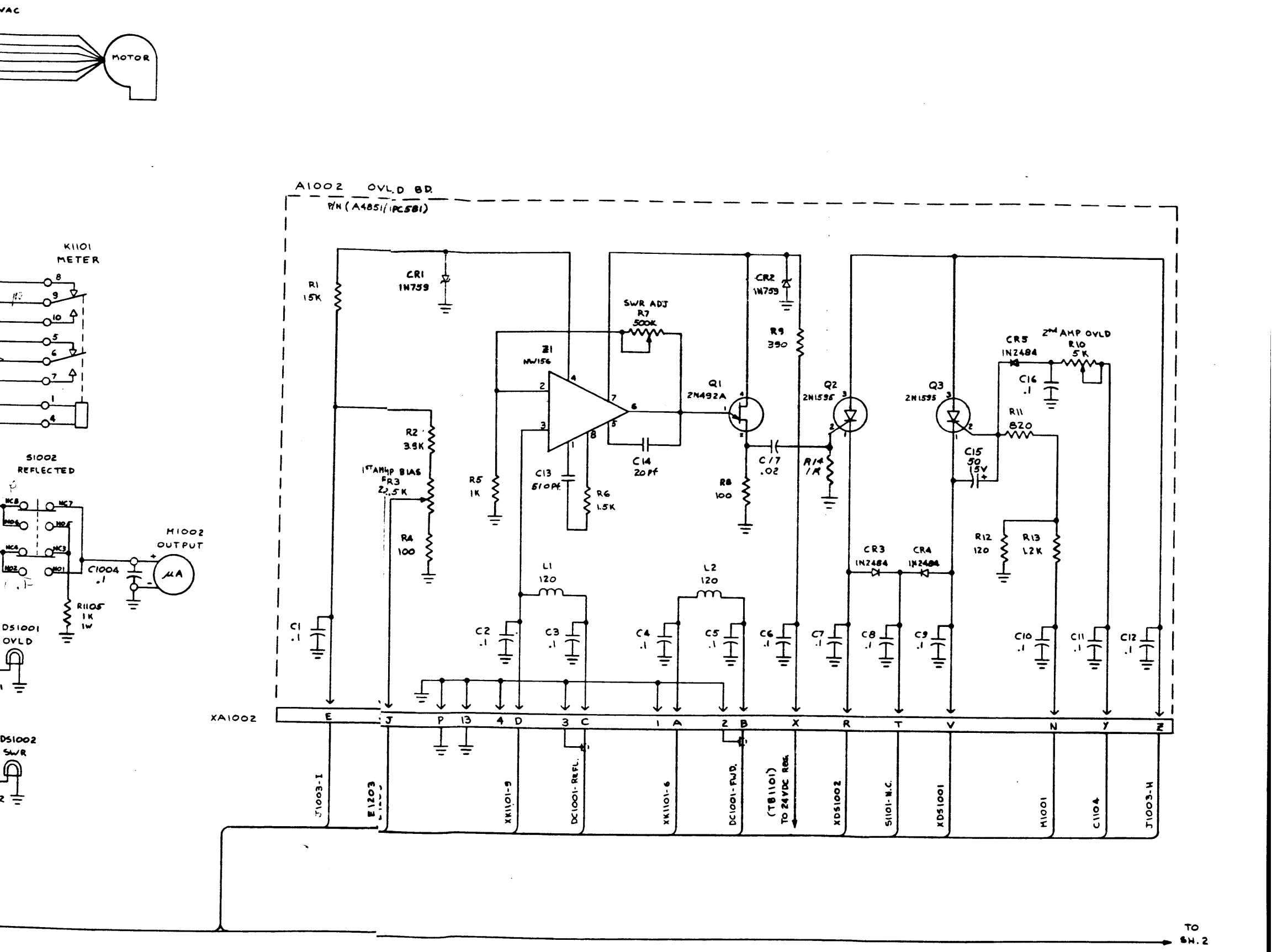
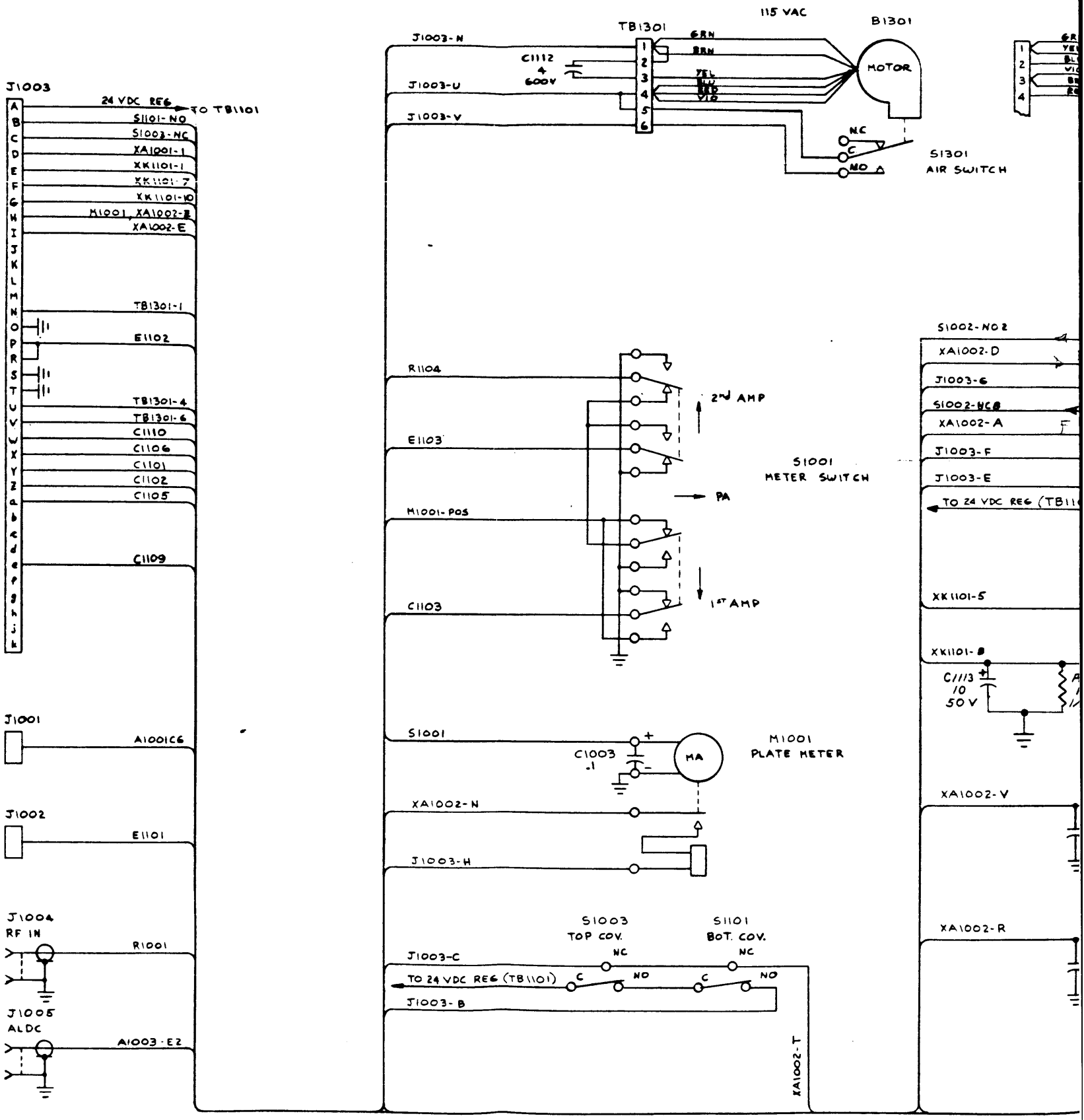


Figure 7-1. Power Amplifier TLAM-1K, Schematic Diagram (CK1845A) (Sheet 1 of 3)


J1003
24 VDC REG
TO TB1101
S1101-NO
S1003-NC
XA1001-1
XK1101-1
XK1101-7
XK1101-10
M1001, XA1002-B
XA1002-E
TB1301-1
E1102
TB1301-4
TB1301-6
C1110
C1106
C1101
C1102
C1105
C1109
J1001
A1001C6
J1002
E1101
J1004
RF IN
R1001
J1005
ALDC
A1003-E2
J1003-N
J1003-U
J1003-V
TB1301
C1112
4
600V
115 VAC
B1301
MOTOR
GRN
BRN
YEL
BLU
BLK
VIO
NC
C
NO
S1301
AIR SWITCH
R1104
E1103
M1001-POS
C1103
2ND AMP
1ST AMP
S1001
METER SWITCH
PA
S1001
C1003
.1
MA
M1001
PLATE METER
XA1002-N
J1003-H
S1003
TOP COV.
S1101
BOT. COV.
J1003-C
NC
TO 24 VDC REG (TB1101)
C
NO
J1003-B
XA1002-T
S1002-NO2
XA1002-D
J1003-6
S1002-NC2
XA1002-A
J1003-F
J1003-E
TO 24 VDC REG (TB11
XK1101-5
XK1101-8
C1113
10
50 V
XA1002-V
XA1002-R

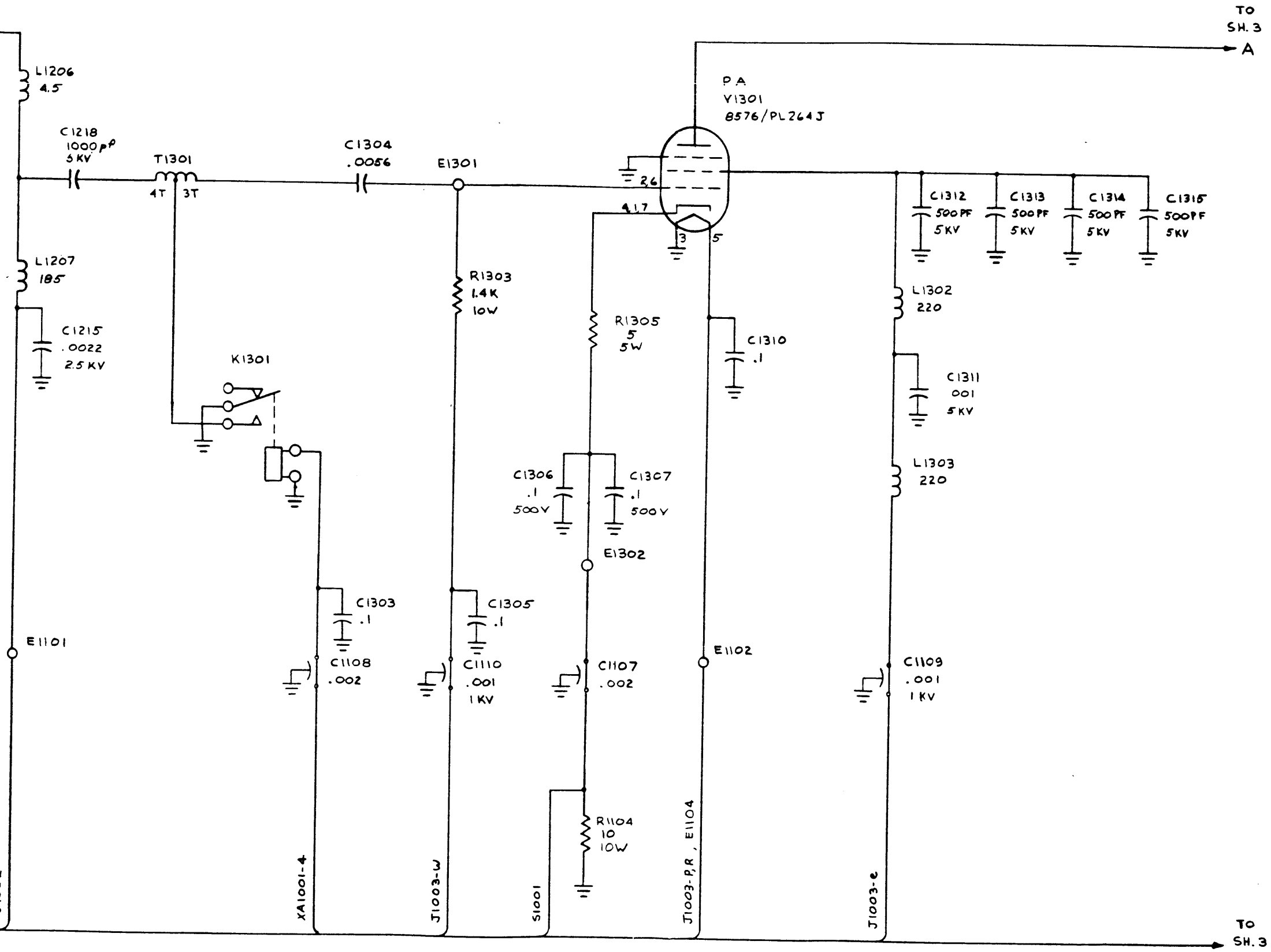
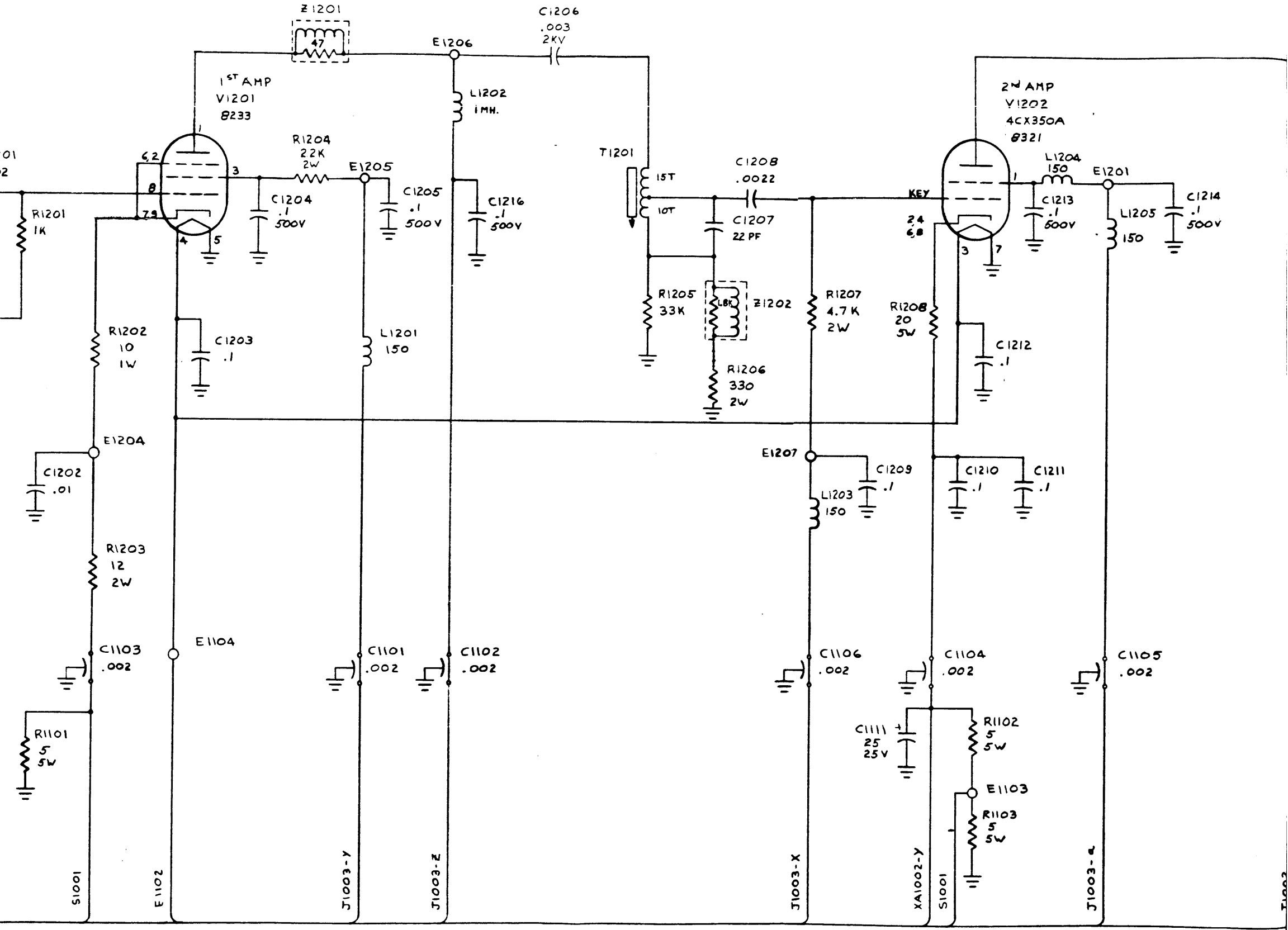
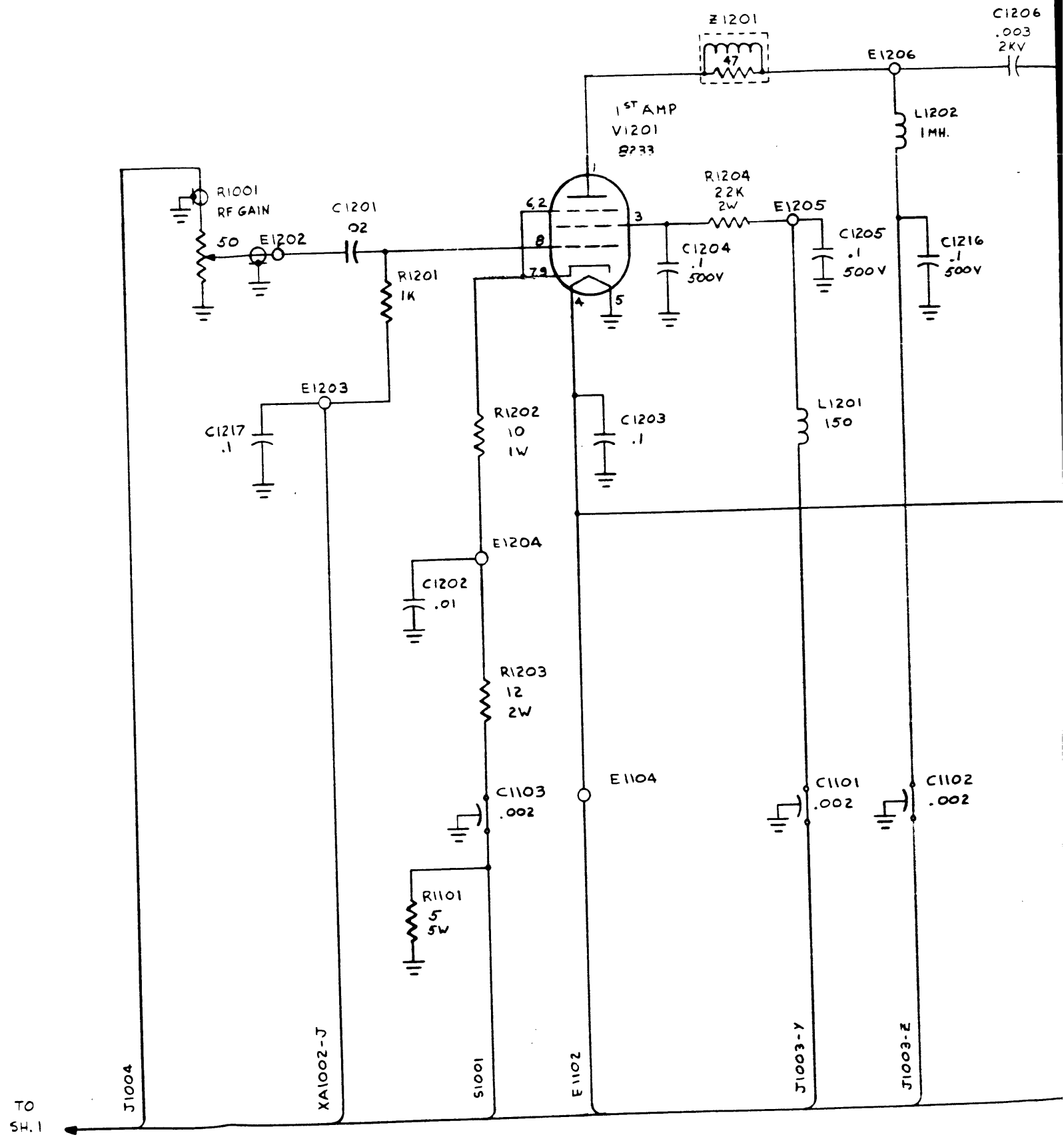
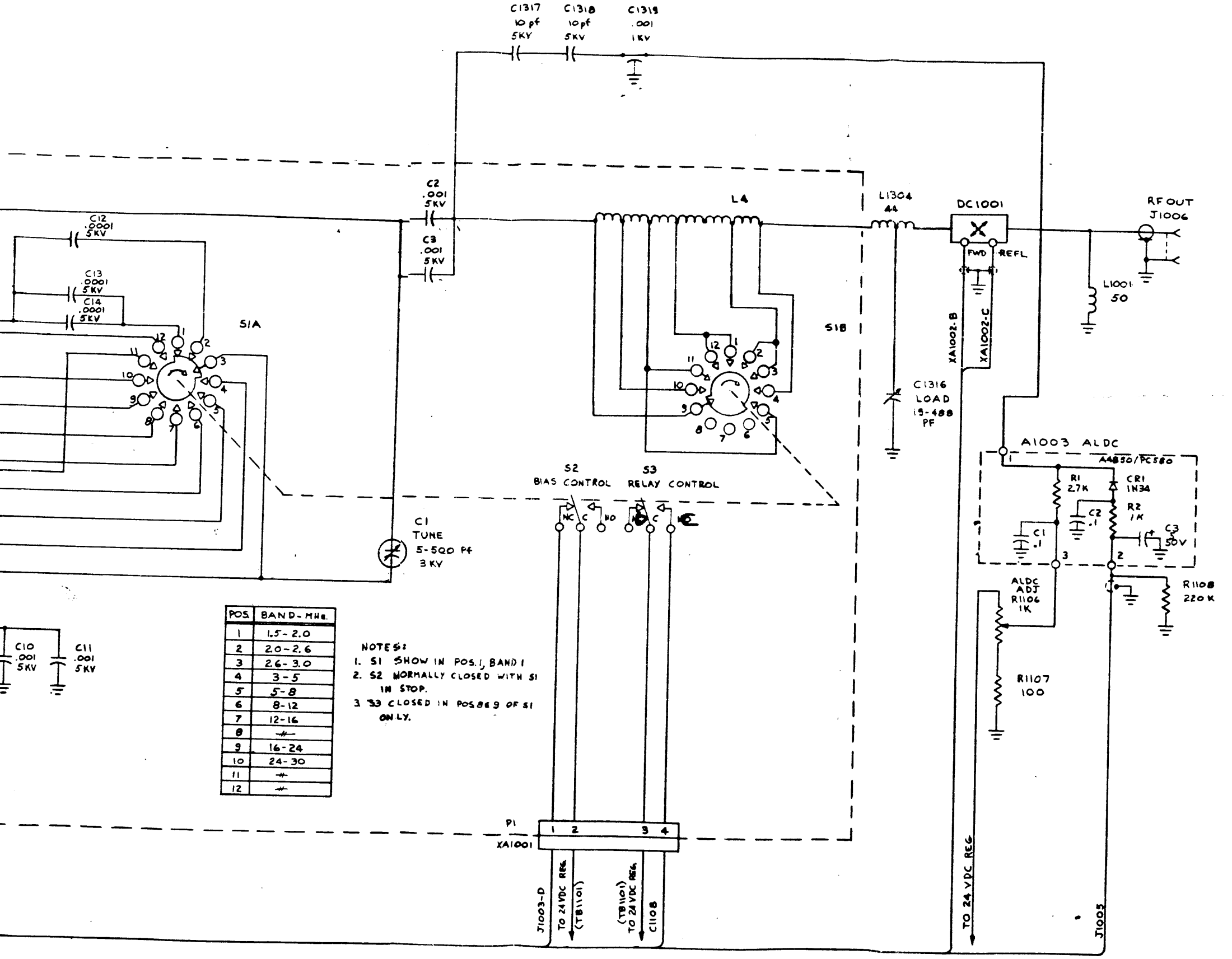


Figure 7-1. Power Amplifier TLAM-1K, Schematic Diagram (CK1845A) (Sheet 2 of 3)


Z1201
47
E1206
C1206
.003
2KV
1ST AMP
V1201
8233
L1202
1MH.
R1204
22K
2W
E1205
C1205
.1
500V
C1204
.1
500V
C1216
.1
500V
T1201
15T
10T
C1208
.0022
C1207
22PF
R1205
33K
Z1202
L8K
R1206
330
2W
R1207
4.7K
2W
2ND AMP
V1202
4CX350A
8321
KEY
L1204
150
E1201
C1213
.1
500V
L1205
150
C1214
.1
500V
R1208
20
5W
C1212
.1
R1201
1K
R1202
10
1W
C1203
.1
L1201
150
E1204
C1202
.01
R1203
12
2W
C1103
.002
E1104
R1101
5
5W
S1001
E1102
C1101
.002
J1003-Y
C1102
.002
J1003-Z
E1207
C1209
.1
L1203
150
C1106
.002
J1003-X
C1210
.1
C1211
.1
C1104
.002
C1111
25
25V
R1102
5
5W
E1103
R1103
5
5W
XA1002-Y
S1001
C1105
.002
J1003-A


Z1201
47
C1206
.003
2KV
E1206
1ST AMP
V1201
6233
L1202
1MH.
R1001
RF GAIN
50
E1202
C1201
.02
R1201
1K
6,2
3
8
7,9
4
5
R1204
22K
2W
E1205
C1204
.1
500V
C1205
.1
500V
C1216
.1
500V
E1203
C1217
.1
R1202
10
1W
C1203
.1
L1201
150
E1204
C1202
.01
R1203
12
2W
C1103
.002
E1104
C1101
.002
C1102
.002
R1101
5
5W
J1004
XA1002-J
S1001
E1102
J1003-Y
J1003-Z
TO
SH. 1



POS.	BAND - MHz.
1	1.5 - 2.0
2	2.0 - 2.6
3	2.6 - 3.0
4	3 - 5
5	5 - 8
6	8 - 12
7	12 - 16
8	—
9	16 - 24
10	24 - 30
11	—
12	—

NOTES:
1. S1 SHOW IN POS. 1, BAND 1
2. S2 NORMALLY CLOSED WITH S1 IN STOP.
3. S3 CLOSED IN POS 8 & 9 OF S1 ONLY.

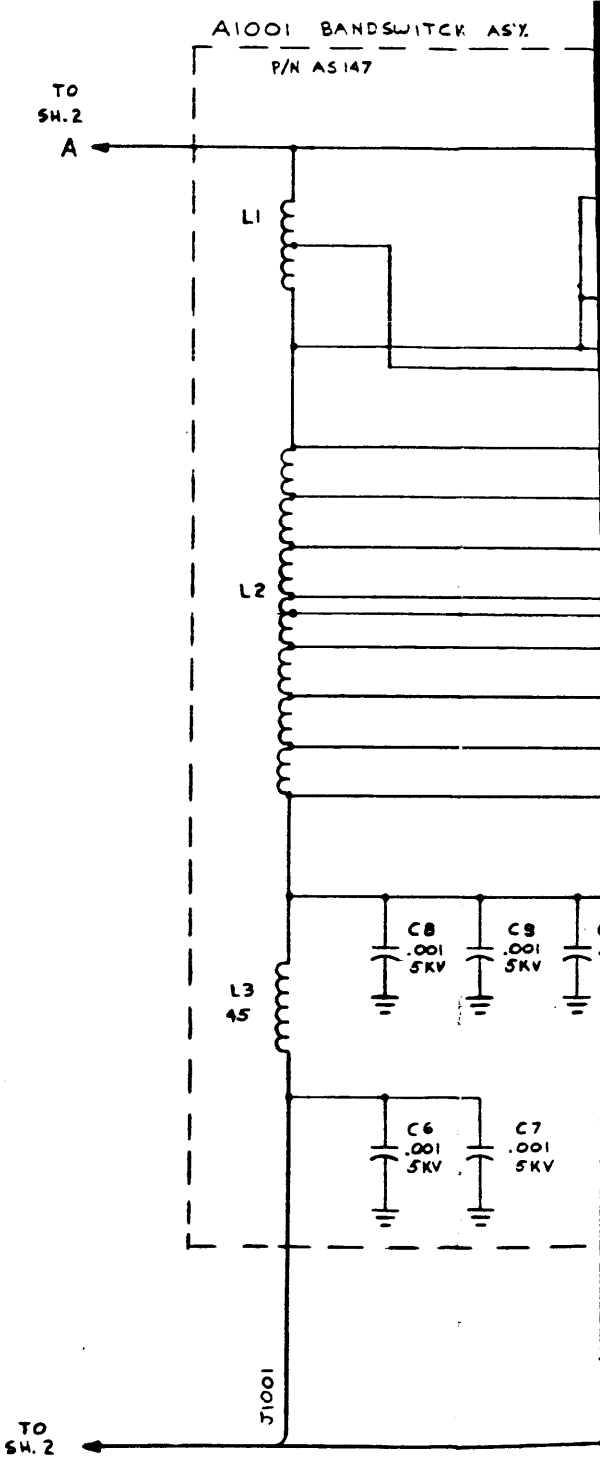
Figure 7-1. Power Amplifier TLAM-1K, Schematic Diagram (CK1845A) (Sheet 3 of 3)

LAST SYMBOLS	MISSING SYMBOLS
A1003	
C1004	
DC1001	
DS1002	
J1006	
L1001	
M1002	
R1001	
S1003	
XA1002	
XDS1002	
A1001 SERIES	
C14	C4,5
L4	
P1	
S3	
W1	
A1002 SERIES	
C17	
CR6	
L2	
R14	
Z1	
A1003 SERIES	
C3	
CR1	
E3	
R4	

LAST SYMBOLS	MISSING SYMBOLS
1100 SERIES	
C1113	
E1104	
K1101	
R1109	
S1101	
TB1101	
XK1101	
1200 SERIES	
C1218	
E1207	
L1207	
R1208	
T1201	
V1202	
XV1202	
Z1202	
1300 SERIES	
B1301	
C1319	C1301,2,8,9
E1302	
K1301	
L1304	L1301
R1305	R1301,2,4
S1301	
T1301	
TB1301	
V1301	
XV1301	

UNLESS OTHERWISE SPECIFIED:
1. RESISTANCE VALUES IN OHMS.
2. CAPACITANCE VALUES IN μfd.
3. INDUCTANCE VALUES IN μh.

PARTIAL REFERENCE DESIGNATIONS ARE USED. FOR COMPLETE DESIGNATION PREFIX PART DESIGNATION WITH SUB-ASSEMBLY DESIGNATION.



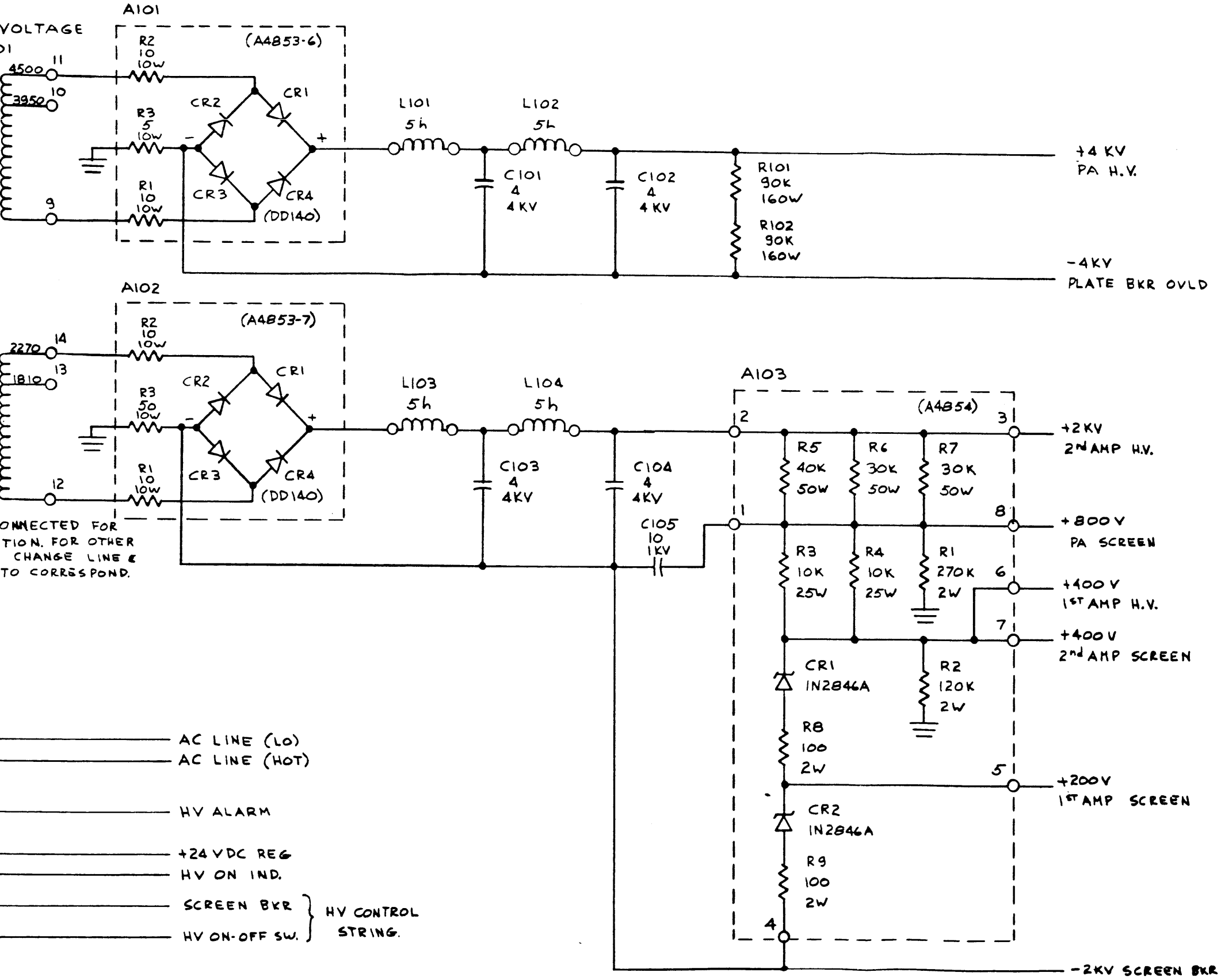
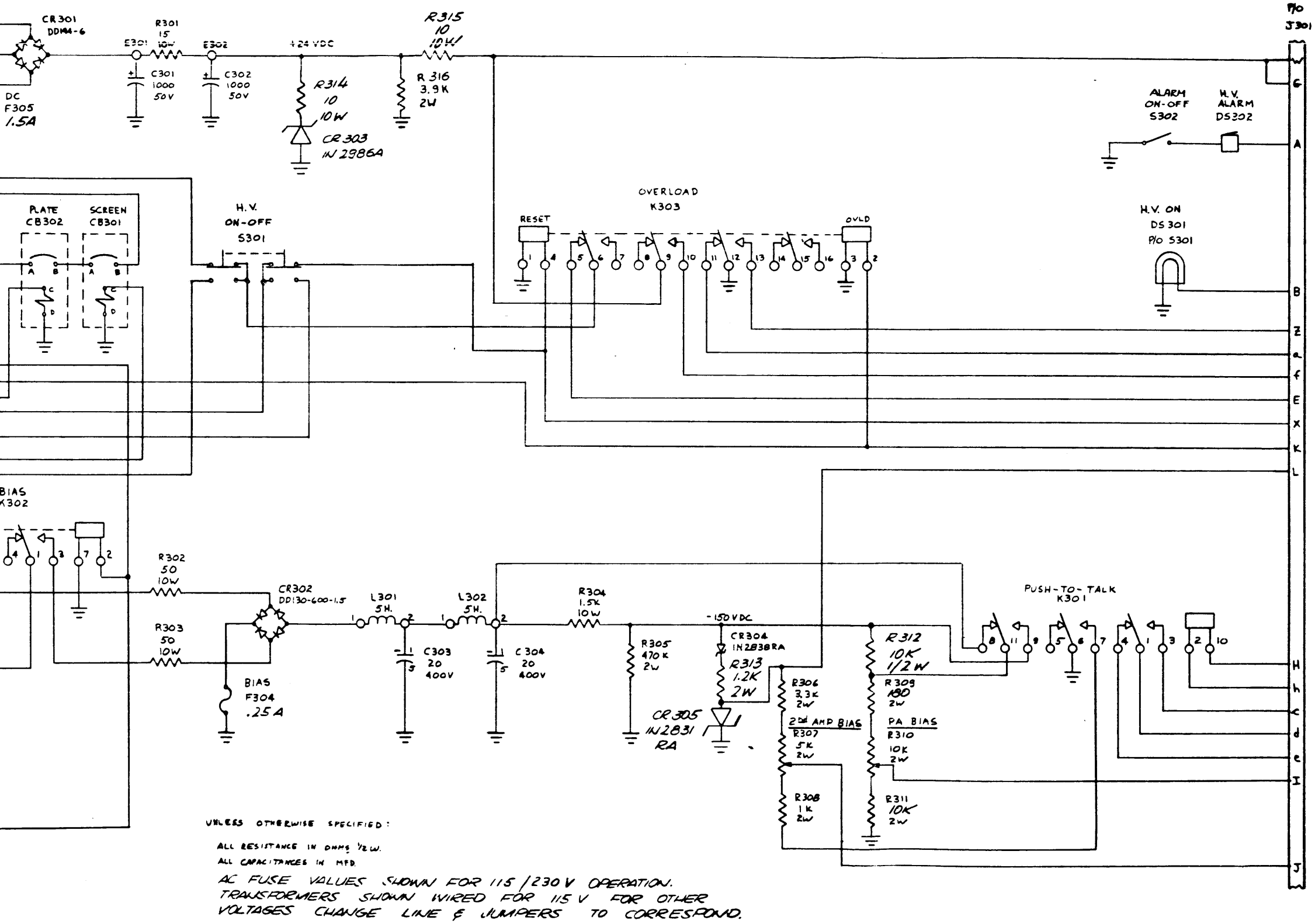


Figure 7-2. High Voltage Power Supply AP-150, Schematic Diagram (CK1848Ø)



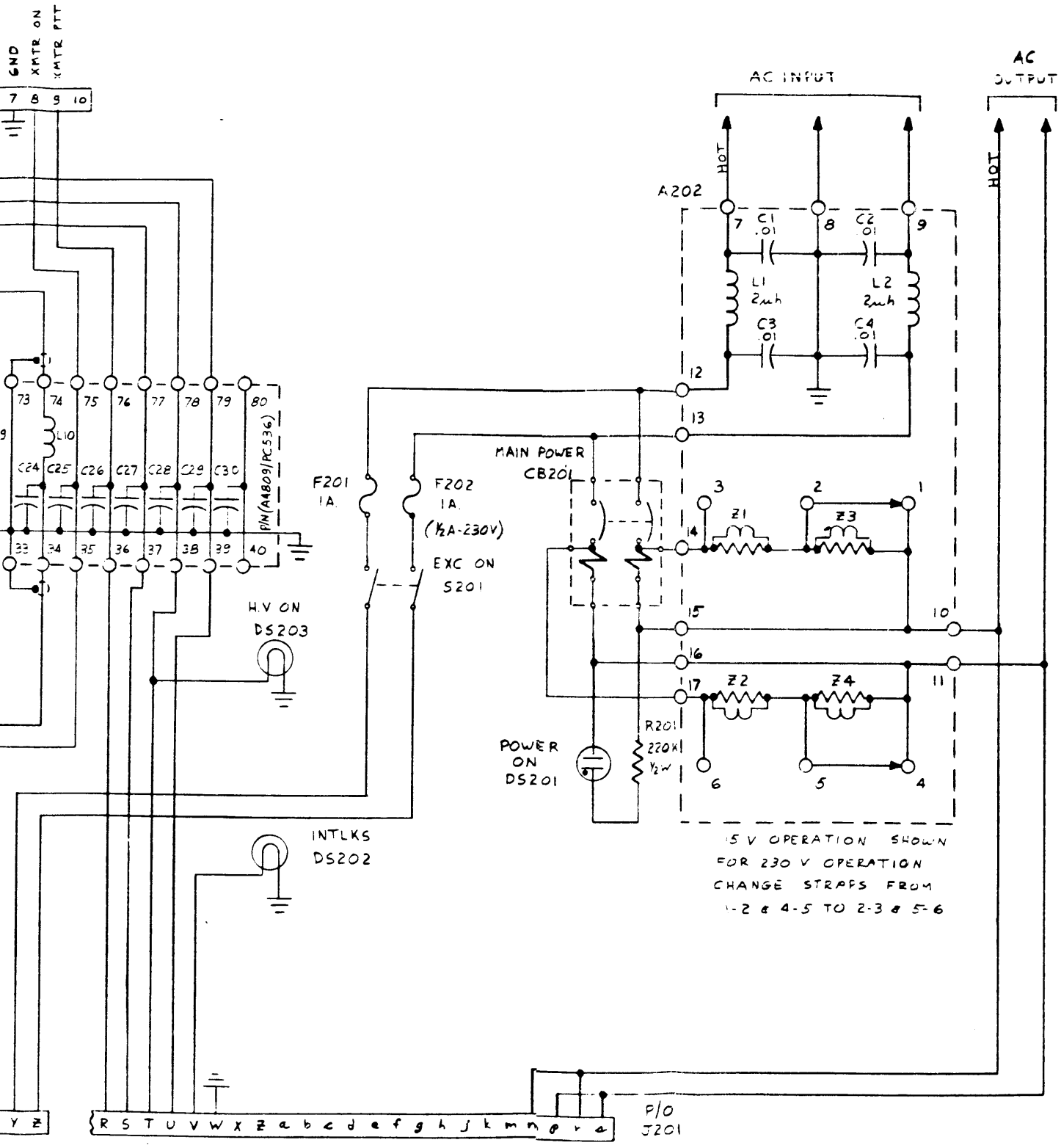
UNLESS OTHERWISE SPECIFIED:

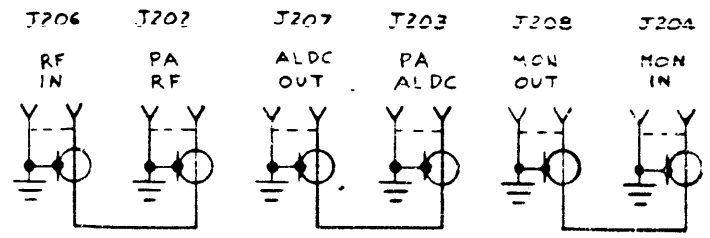
ALL RESISTANCE IN OHMS ½ W.

ALL CAPACITANCES IN MFD.

AC FUSE VALUES SHOWN FOR 115/230 V OPERATION. TRANSFORMERS SHOWN WIRED FOR 115 V FOR OTHER VOLTAGES CHANGE LINE & JUMPERS TO CORRESPOND.

Figure 7-3. Low Voltage, Filament and Bias Supply AP-149, Schematic Diagram (CK1840A)

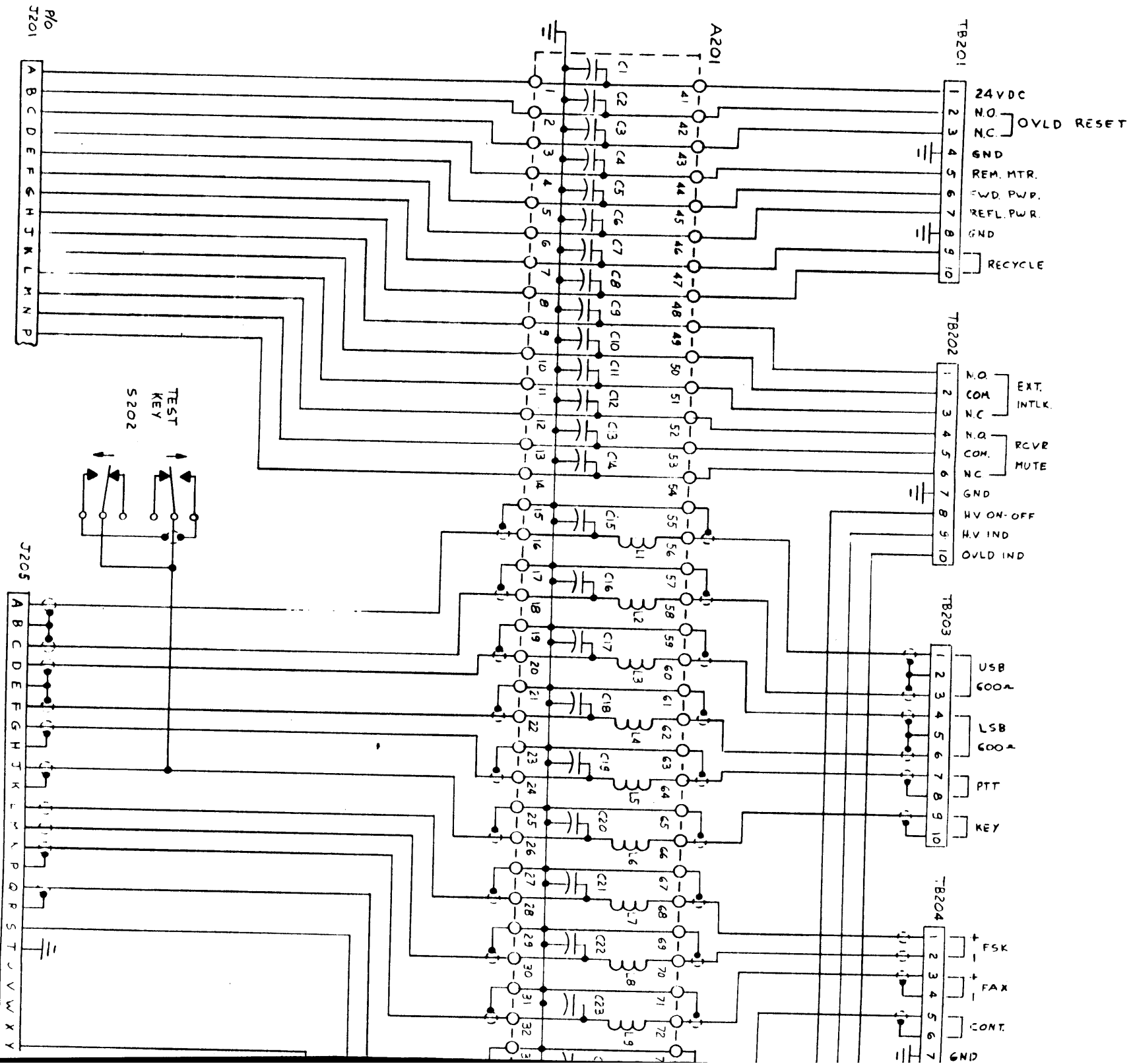




UNLESS OTHERWISE SPECIFIED:
ALL CAPACITORS IN MFD.
ALL INDUCTANCES IN uh.
A201C1-A201C30 ARE .01
A201L1-A201L10 ARE 120

	LAST SYMBOLS	
200	A201	A202
A202	C30	C4
CB201	E80	E17
DS203	L10	L2
F202		Z4
J208		
R201		
S202		
TB204		
W208		
XDS203		
XF201		

Figure 7-4. Power Distribution Panel APP-18, Schematic Diagram (CK1787Ø)


P/O J201
A B C D E F G H J K L M N P
A201
C1 C2 C3 C4 C5 C6 C7 C8 C9 C10 C11 C12 C13 C14 C15 C16 C17 C18 C19 C20 C21 C22 C23
L1 L2 L3 L4 L5 L6 L7 L8 L9
TB201
1 24VDC
2 N.O.
3 N.C. OVLD RESET
4 GND
5 REM. MTR.
6 FWD. PWR.
7 REFL. PWR.
8 GND
9
10 RECYCLE
TB202
1 N.O.
2 COM EXT. INTLK.
3 N.C
4 N.O.
5 COM. RCVR MUTE
6 N.C
7 GND
8 HV ON-OFF
9 H.V IND
10 OVLD IND
TB203
1 2 USB GOOD
3 4 LSB GOOD
5 PTT
6 KEY
TB204
1 + 2 - FSK
3 + 4 - FAX
5 CONT.
6 GND
TEST KEY S202
J205
A B C D E F G H J K L M N P Q R S T U V W X Y