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TECHNICAL MANUAL
for
LINEAR POWER AMPLIFIER
MODEL PAL-1K(B3)



THE TECHNICAL MATERIEL CORPORATION
MAMARONECK, N. Y. OTTAWA, CANADA

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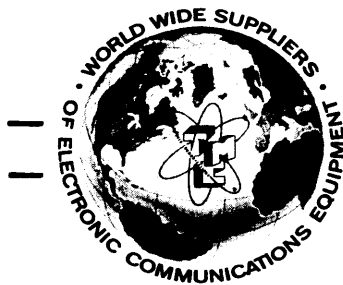


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NOTICE

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THE TECHNICAL MATERIEL CORPORATION

C O M M U N I C A T I O N S E N G I N E E R S

700 FENIMORE ROAD

MAMARONECK, N. Y.

Warranty

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

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

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

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

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

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

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

*Electron tubes also include semi-conductor devices.

PROCEDURE FOR RETURN OF MATERIAL OR EQUIPMENT

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

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

PROCEDURE FOR ORDERING REPLACEMENT PARTS

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

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

PROCEDURE IN THE EVENT OF DAMAGE INCURRED IN SHIPMENT

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

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

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

LINEAR POWER AMPLIFIER

MODEL PAL-1K(B3)

Linear Power Amplifier PAL-1K(B3) is similar to Linear Power Amplifier PAL-1K(A); therefore, the Technical Manual for PAL-1K(A) (IN-523) will apply as written, with the following exceptions:

- a. Change all references to PAL-1K(A) to PAL-1K(B3).
- b. Change all references to PS-5 to PS-5B, and all references to PS-4A to PS-4B1. The note on the PS-4B1 schematic is important to insure proper keying operation.
- c. Change the electrical characteristics given in table 1-1 to comply with those given in table 1 of this addendum.
- d. Replace figures 8-2, and 8-3 with schematic diagrams correspondingly numbered.
- e. Figure 5-4 should be changed to show PA BANDSWITCH and PA LOADING switch modifications as indicated in figures 1 and 2 of this addendum.
- f. The parts list (section 7) should be changed in accordance with 1 thru 4 below and new parts list supplied (see sheet 8).
 - 1. On page 7-2, delete symbol C244.
 - 2. On page 7-4, delete symbol C272 and C274.
 - 3. On page 7-4, add symbols C291 through C296 as given in table 2 of this addendum.
 - 4. On page 7-8, delete symbols V401 and V402 and add symbols as given in table 2 of this addendum.
- g. The PA BANDSWITCH and PA LOADING switch circuitry of figure 8-1 (page 8-1/8-2) should be changed in accordance with figure 3 of this addendum.

TABLE 1. ELECTRICAL CHARACTERISTICS, PAL-1K(B3)

ITEM	CHARACTERISTICS
FREQUENCY RANGE:	2 to 32 mc continuous, bandswitched.
MODES OF OPERATION:	CW, MCW, AM, AME, SSB, FSK, and FAX*.
POWER OUTPUT:	At least 1000 watts PEP. 1000 watts CW and FSK.
OUTPUT IMPEDANCE:	50 ohms nominal. Pi network will match a load with up to 2:1 VSWR.
INPUT IMPEDANCE:	70 ohms nominal.
TUNING:	All tuning and bandswitching accomplished from front panel (no plug-in components).
SIGNAL/DISTORTION RATIO:	<ol style="list-style-type: none"> 1. At least 40 db below either tone of standard two-tone test at 1 kw PEP, at frequencies below 30 mc. 2. At least 35 db below either tone of standard two-tone test at 1 kw PEP, 30 to 32 mc.
HARMONIC SUPPRESSION:	Second harmonic at least 40 db down, all others at least 50 db down from full PEP output.
ALDC:	An Automatic Load and Drive Control circuit is incorporated to generate a DC voltage for external control of an associated exciter. The DC voltage varies from 0 to -14 volts and can be extended back to the exciter to provide improved linearity and to minimize distortion.
METERING:	Front-panel meters provide indications of the operation of all critical circuits.
ENVIRONMENTAL CONDITIONS:	Designed to operate in any ambient temperature between 0° to 50°C, and any value of humidity up to 90%.
COOLING:	High capacity, filtered, forced air cooling.
SAFETY FEATURES:	Full interlock protection. Full overload and fuse protection.
PRIMARY POWER REQUIREMENTS:	115/230 volts, single phase, 50/60 cycle AC, approximately 2500 watts under full power output, 400 watts on standby.

* With appropriate exciter.

TABLE 2. PARTS LIST

SYMBOL	DESCRIPTION	TMC PART NO.
C291	CAPACITOR, PORCELAIN, HIGH VOLTAGE: 2,000 uuf, $\pm 5\%$; 2,000 volts RMS at 500 WVDC; current rating 22 amps RF.	CC113-2-202J
C292	Same as C291.	
C293	CAPACITOR, PORCELAIN, HIGH VOLTAGE: 1,000 uuf, $\pm 5\%$; 2,000 volts RMS at 500 WVDC; current rating 22 amps RF.	CC113-1-102J
C294	Same as C293.	
C295	Same as C291.	
CR401	Half Wave Rectifier	DD134-1
CR402	Half Wave Rectifier	DD134-1

The additional circuitry included in the PA-4B1 is for remote control of CW keying and Push-to Talk (PTT) operation. Mode switch S100A provides for the selection of CW, PTT or NORMAL operation.

When switch S100A is set at NORMAL, a ground path for Relay K101 is completed thus Relay K101 energizes.

NOTE

PTT operation is by either direct or indirect control of relay K100. In either case the PTT line must meet specific requirements which should be well within station capabilities. Thus, line series resistance must not exceed 1000 ohms, and line shunt resistance should be not less than 10,000 ohms.

When mode switch S100A is set at PTT, either -24 vdc or ground is applied to terminal 10 of E701 which results in energizing K101. There are eight sets of A, B, and 6 sets of B, C, terminals that must be correctly jumped within the PS-4B1 for Ground or negative PTT operation as follows:

1. Ground PTT Operation. - (Refer to Figure 8-1 of this addendum). For Ground operation, 6 sets of B and C Jumpers must be connected. When terminal 10 of E701 is grounded, the circuit completed by one set of B and C terminals energizes Relay K100. Closed contacts (6 and 7) of Relay K100 extends the ground supplied by switch S100A to relay K101 thus completing its operate path.

2. Negative PTT operation. - (Refer to Figure 8-1 of this addendum). For negative operation, 8 sets of A and B Jumpers must be connected.

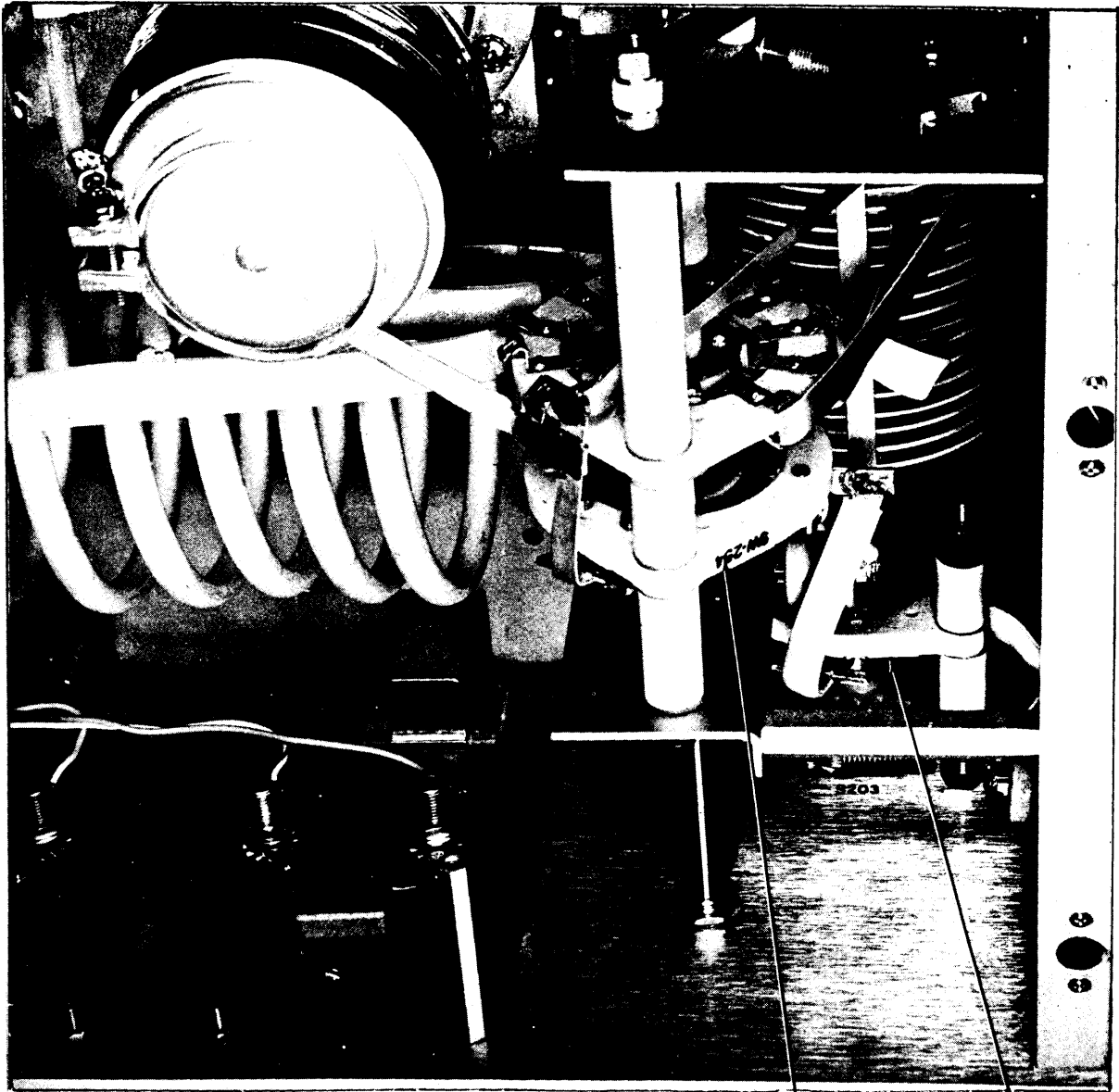
When -24 vdc is applied to terminal 10 of E701, the forward bias applied to the base of Q100 (developed by the voltage drop across R103, R101, R100, C101 and C102) is overcome. Reduce current flow through the emitter collector circuit of Q100, de-energizes relay K100. Closed contacts 5 and 6 of de-energized relay K100 extend the ground supplied by switch S100A to Relay K101 thus completing its operate path.

When mode switch S100A is set at CW, keyed voltage or current signals from the associated key line are extended via pins c and d of J100, and limiter resistors

(R115, R114, R106 and R105) to diode bridge rectifier circuit.

Negative Ground CW operation. - (Refer to figure 8-1 of this addendum). - For negative ground operation, 6 sets of B and C jumpers must be connected. When keyed signals are applied to terminals C and D of J100, the positive output of the diode bridge is extended via CR-103 to the base of transistor Q100 and to an RC timing circuit. This positive voltage forward biases Q100. The increased emitter collector current of forward biased Q100 energizes relay K100. Closed contacts 6 and 7 of K100 extend the ground supplied by switch S100A to Relay K101 thus completing its operate path. The RC Timing circuit (comprising C102, C101, R101, and R100 maintains forward bias during keying cycles. Diode CR-100 functions as a voltage regulator thus maintaining the positive keying signal level.

Positive Ground CW Operation - (Refer to figure 8-1 of this Addendum). - For positive Ground Operation, 6 sets of A and B contacts must be jumpered. When keyed signals are applied to terminals C and D of J100, the negative output of the diode bridge circuit is extended via CR-102 to the base of transistor Q100 and an RC Timing circuit. The negative voltage overcomes the forward bias developed by R103 and R101 thus reducing the emitter collector current through Q100, de-energizing relay K100. Closed contacts 5 and 6 of de-energized relay K100 extend the ground supplied by switch S100A to relay K101 thus completing its operate path.

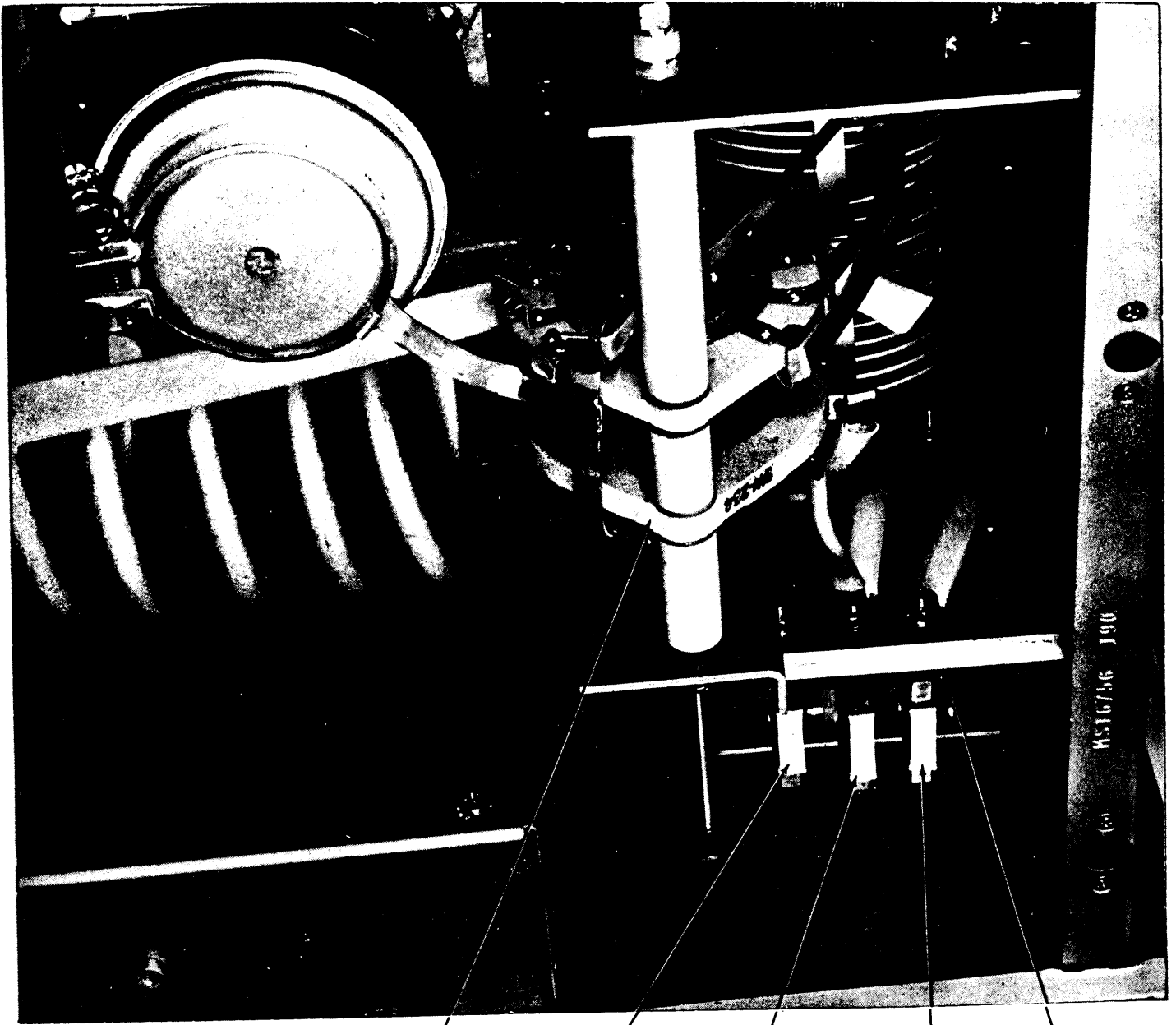


S202

S203

Figure 1. RFD-1A

655.3-1



S202

C293

C291

C295

S203

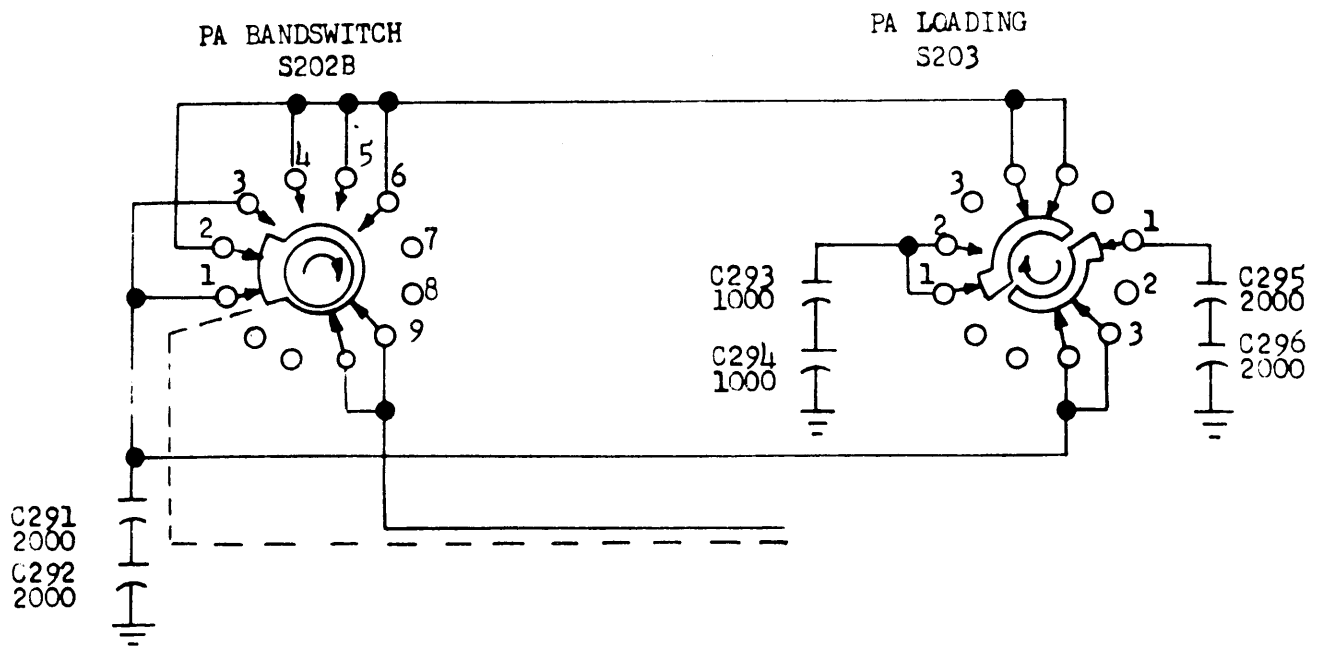
Figure 2. RFD-1B

PARTS LIST
for
LOW VOLTAGE POWER SUPPLY, PS-4B1

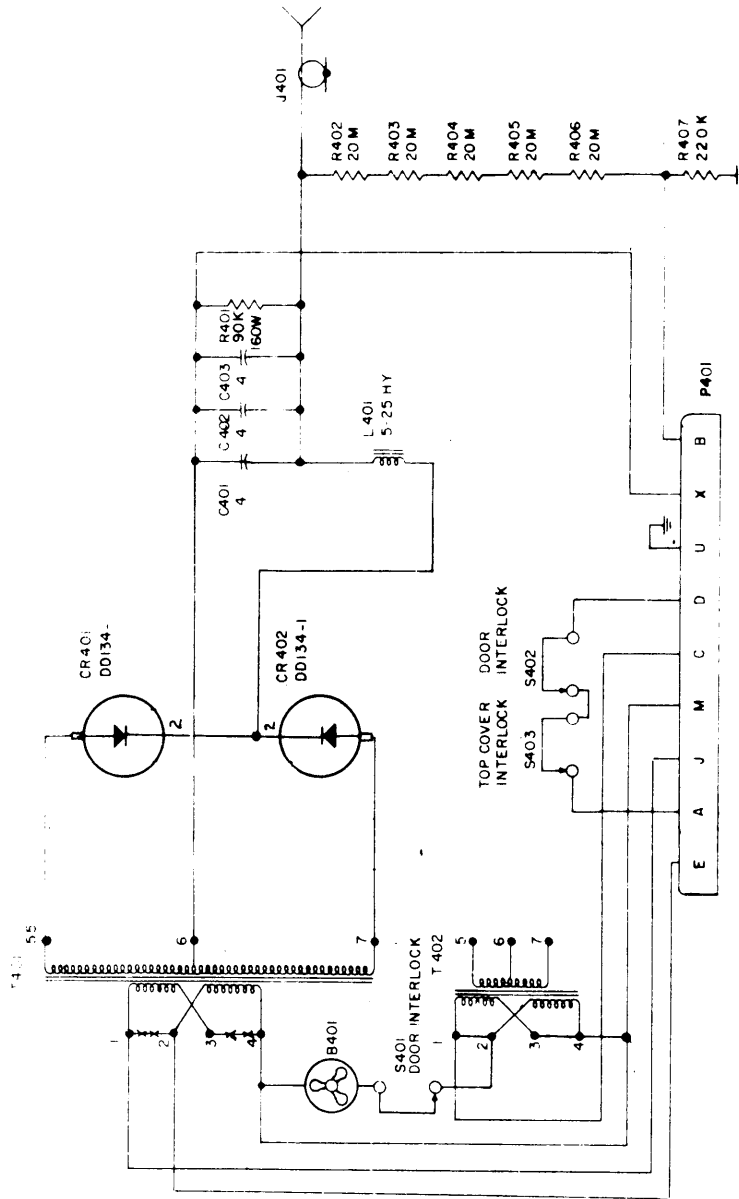
REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C100	CAPACITOR, FIXED, ELECTROLYTIC: 50 uf, -10% +150% at 120 cps 25° centigrade; 15 WVDC.	CE105-50-15
C101	CAPACITOR, FIXED, ELECTROLYTIC: 50 uf, =10% +150% at 120 cps 25° centigrade; 15 WVDC.	CE105-75-15
C102	Same as C101.	
C103	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 100,000 uuf, +80% -20%; 100 WVDC.	CC100-28
CR100	SEMI CONDUCTOR DEVICE, DIODE	1N961
CR101	SEMI CONDUCTOR DEVICE, DIODE	1N2986B
CR102	SEMI CONDUCTOR DEVICE, DIODE	1N2484
CR103 thru CR109	SEMI CONDUCTOR DEVICE, DIODE	1N91
K100	RELAY, ARMATURE: DPDT; 700 ohms, <u>+10%</u> DC resistance; operating voltage 24 VDC; current rating 35 ma, 700 mu at 25° C; 8 contacts rated for 5 amps at 29 VDC; clear high impact styrene dust cover case.	RL156-1
K101	RELAY, ARMATURE: contacts rated for 5 amps at 115 VDC non-inductive; stud mounted.	RL116DC3C115
Q100	TRANSISTOR	2N1308
R100	RESISTOR, FIXED, COMPOSITION: 100 ohms, <u>+5%</u> ; 1/4 watt.	RC07GF101J
R101	RESISTOR, FIXED, COMPOSITION: 5600 ohms, <u>+5%</u> ; 1/4 watt.	RC07GF562J
R102	RESISTOR, FIXED, COMPOSITION: 47,000 ohms, <u>+5%</u> ; 1/4 watt.	RC07GF473J
R103	RESISTOR, FIXED, COMPOSITION: 150,000 ohms, <u>+5%</u> ; 1/4 watt.	RC07GF154J
R104	RESISTOR, FIXED, COMPOSITION: 8200 ohms, <u>+5%</u> ; 1/4 watt.	RC07GF822J
R105	RESISTOR, FIXED, COMPOSITION: 3300 ohms, <u>+5%</u> ; 1 watt.	RC32GF332J

PARTS LIST
for
LOW VOLTAGE POWER SUPPLY, PS-4B1

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R106	Same as R105.	
R107	RESISTOR, FIXED, COMPOSITION: 47,000 ohms, $\pm 5\%$; 2 watts.	RC42GF473J
R108	RESISTOR, FIXED, COMPOSITION: 10,000 ohms, $\pm 5\%$; 2 watts.	RC42GF103J
R109	RESISTOR, FIXED, WIRE-WOUND: 7500 ohms, current rating 50 ma; 20 watts.	RW110-32
R110	Same as R109.	
R111	RESISTOR, FIXED, WIRE-WOUND: 10,000 ohms, current rating 32 ma; 10 watts.	RW109-34
R112	RESISTOR, FIXED, WIRE-WOUND: 15,000 ohms, current rating 25.5 ma; 10 watts.	RW109-36
R113	RESISTOR, FIXED, COMPOSITION: 100,000 ohms, $\pm 5\%$; 1/2 watts.	RC20GF104J
R114	RESISTOR, FIXED, COMPOSITION: 56 ohms, $\pm 5\%$; 1 watt.	RC32GF560J
R115	Same as R114.	



LAST SYMBOLS
 R401
 L403
 J401
 L401
 R407
 S403
 T401
 CR402
 P401



FOR 230V OPERATION REMOVE
 JUMPERS MARKED *-*-* AND
 CONNECT TERMINALS 2 6 3
 AT T401.

Figure 8-3. Schematic Diagram, KIT-261 (PS-5B)