UNCLASSIFIED

TECHNICAL MANUAL

for

POWER SUPPLY

MODEL MFP-1

(PP-4261/FRR)

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

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MAMARONECK, N.Y. **OTTAWA, CANADA**

IN-4004E Issue Date: 18 August 1965

NOTICE

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

Warranty

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

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

1. That any claim of defect under this warranty is made within sixty (60) days after discovery thereof and that inspection by TMC, if required, indicates the validity of such claim to TMC's satisfaction.

2. That the defect is not the result of damage incurred in shipment from or to the factory.

3. That the equipment has not been altered in any way either as to design or use whether by replacement parts not supplied or approved by TMC, or otherwise.

4. That any equipment or accessories furnished but not manufactured by TMC, or not of TMC design shall be subject only to such adjustments as TMC may obtain from the supplier thereof.

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

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

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

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

*Electron tubes also include semi-conductor devices.

PROCEDURE FOR RETURN OF MATERIAL OR EQUIPMENT

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

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

PROCEDURE FOR ORDERING REPLACEMENT PARTS

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

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

PROCEDURE IN THE EVENT OF DAMAGE INCURRED IN SHIPMENT

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

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

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

RECORD OF CORRECTIONS MADE

Change No.	Date of Change	Date Entered	Entered By

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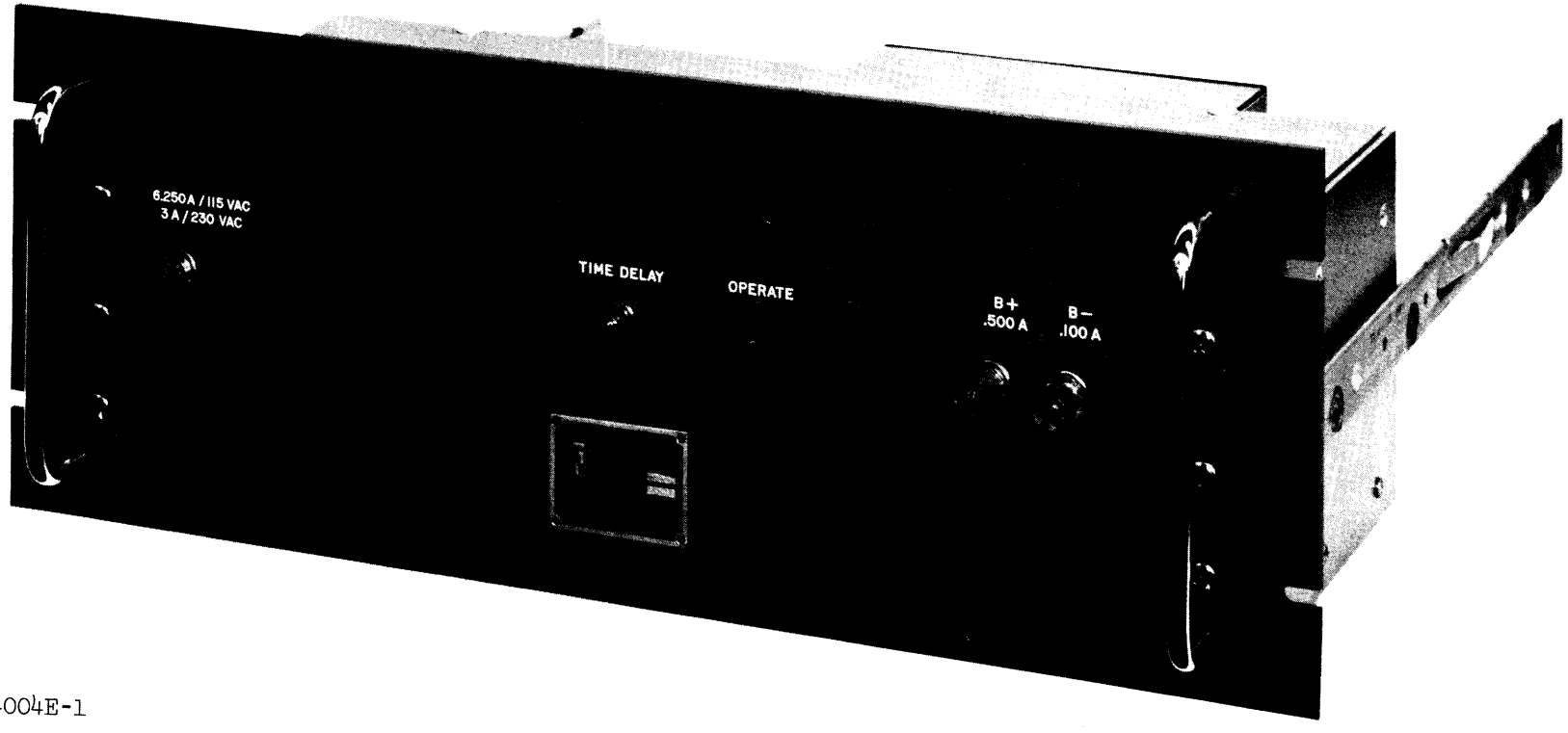

4004E-1

Figure 1-1. Power Supply, Model MFP-1

SECTION I
GENERAL DESCRIPTION

1-1. FUNCTIONAL DESCRIPTION.

Power Supply, Model MFP-1 (figure 1-1) is a self-contained power supply providing regulated B+, regulated bias, and filament voltages. Additionally, primary a-c voltage is available for accessory use, such as in low-power consumption supplies in associated system units. This type of primary power takeoff allows deactivation of the power supply and associated units with a main control switch.

1-2. PHYSICAL DESCRIPTION.

The MFP weighs 37 pounds, and is designed for mounting on non-tilt slides in a 19-inch wide rack. It requires 7 inches of height and 9-3/4 inches of depth in the rack. Indicating lamps and indicating type fuses are located on the front panel. All input and output connectors are located on the rear of the chassis.

1-3. MILITARY NOMENCLATURE. .

Commercial and military nomenclature for the MFP is as follows:

Commercial	Military
Power Supply, Model MFP-1	Power Supply, 115/230V 1 Ø 50/60~ PP-4261-FRR

TABLE 1-1. ELECTRICAL CHARACTERISTICS, MFP

	CHARACTERISTICS
Output voltages:	Two 6.3 vac sources at 1.5 amp each 6.3 vac at 5.5 amps 6.8 vac at 17 amps +200 vdc at 500 milliamperes -105 vdc at 70 milliamperes 115/230 vac extension
Input power requirements:	115/230 volts ac, 48 to 62 cps, 1 phase 6 amps at 115 volts 3 amps at 230 volts
Fusing:	+200 vdc output, -105 vdc output, and line input fused

TABLE 1-2. ELECTRON TUBE AND DIODE COMPLEMENT

REFERENCE DESIGNATION SYMBOL	TYPE	FUNCTION
CR7001 through CR7006	1N547	Rectifiers
CR7007	1N3006RB	Zener Regulator
V7001	6336A	Series Regulator
V7002	6AH6	D-C Amplifier

SECTION 2
INSTALLATION

2-1. INITIAL INSPECTION.

Each unit has been calibrated and tested at the factory before shipment. Upon arrival the the operating site, inspect the packing case and its contents for possible damage. Unpack the equipment carefully. Inspect all packing material for parts which may have been shipped as loose items. With respect to damage to the equipment for which the carrier is liable, The Technical Materiel Corporation will assist in describing methods of repair and the furnishing of replacement parts.

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

Although the MFP is designed for 115- or 230- volts, 50- or 60- cps, single-phase power, it is factory wired for 115 volts. If 230-volt operation is required, minor changes may be made at T7001, T7002, and T7003 transformer primaries. Figure 2-1 illustrates the wiring arrangement for 115- and 230- volt operation. For 230-volt operation, replace fuse F7002 with a fuse of half the amperage rating of that for 115-volt operation.

2-3. INSTALLATION.

Install the MFP in a 19-inch wide rack or other housing as desired. The unit mounts on a set of non-tilt slides that are supplied in the rack shipment. Mating plugs and cables for the connectors located on the rear of the unit are included in the rack shipment and directions for installing these are included in the technical manual describing the system. Figure 2-2 shows the dimensional outline of the MFP and includes mounting dimensions. Figure 2-3 is a rear view of the MFP showing locations of connectors.

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Figure 2-1. Transformer Wiring, 115-Vs. 230-Volt Line Supply

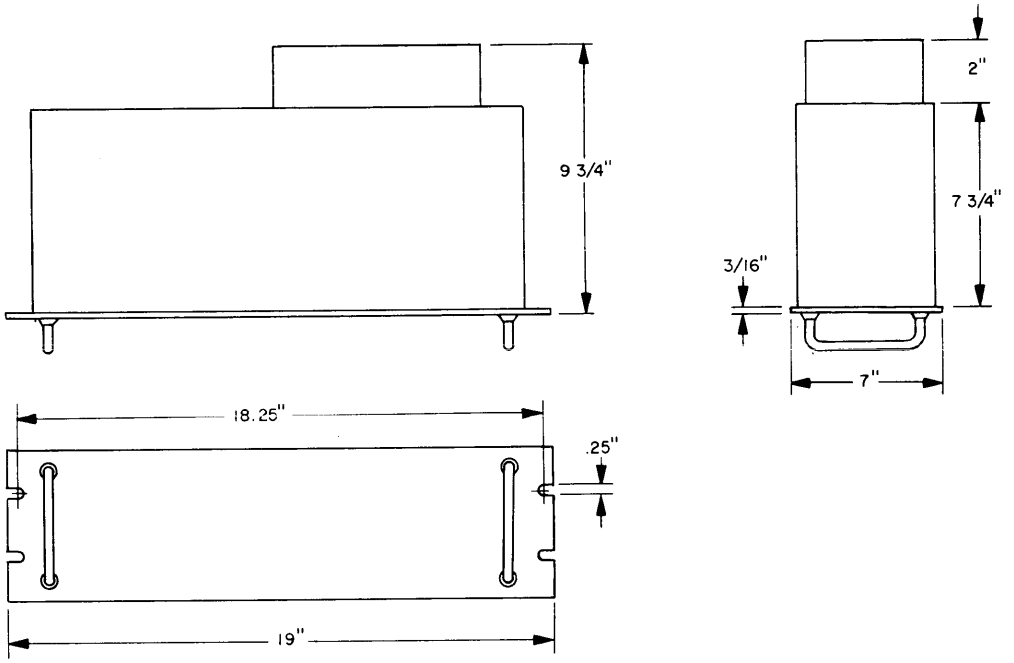

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Figure 2-2. Outline Dimensional Drawing, MFP

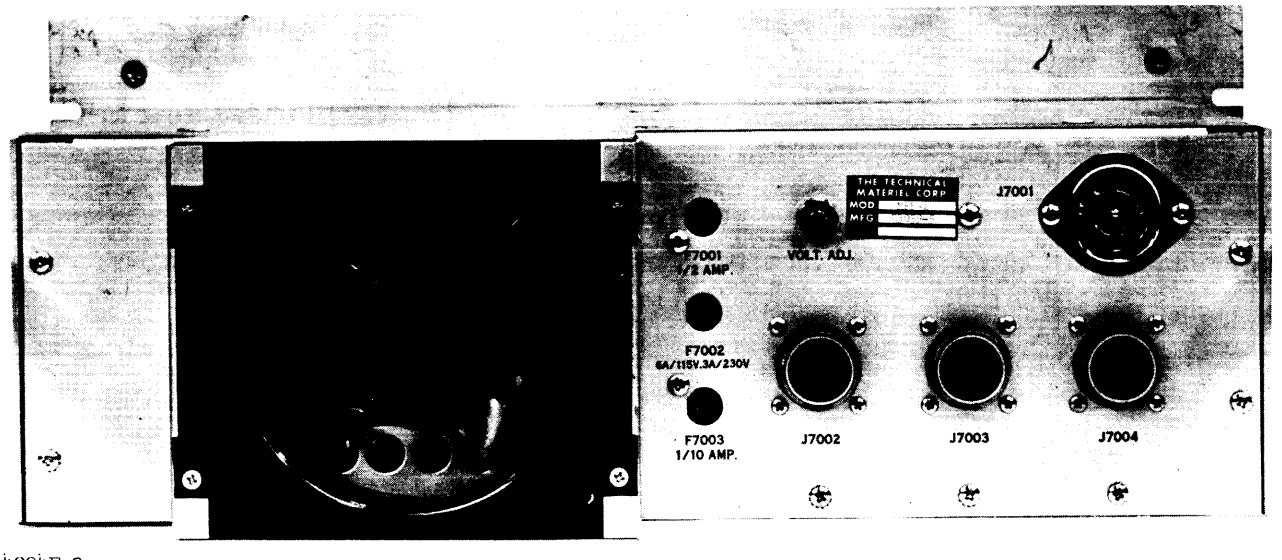

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Figure 2-3. Power Supply MFP, Rear View

SECTION 3
OPERATOR'S SECTION

3-1. OPERATION OF UNIT.

a. INTRODUCTION. - The MFP does not have any operational controls. The front panel contains indicator lamps and indicator type fuses. The front panel of the MFP is shown in Figure 3-1; the functions of the lamps and fuses are listed in Table 3-1.

b. TURN-ON PROCEDURE.

(1) Set system main power switch at ON; TIME DELAY lamp on the MFP will light. Before proceeding to next step, refer to applicable system manual for required oscillator-oven warm-up period.

(2) Set system standby/operate switch at OPERATE. After approximately one minute, TIME DELAY lamp will go out, and OPERATE lamp will light.

3-2. OPERATOR'S MAINTENANCE.

Operator's maintenance generally consists of replacing fuses and lamps, attending to equipment cleanliness, and making sure that rear panel connectors are properly seated.

WARNING

Never replace a fuse with one of higher rating. If a fuse burns out immediately after replacement, do not replace it a second time until the cause of trouble has been located and corrected.

TABLE 3-1. INDICATOR AND FUSE FUNCTIONS, MFP

ITEM NO. (Figure 3-1)	PANEL DESIGNATION	FUNCTION	SYMBOL (Figure 8-1)
1	F7002 6.25 A/115V 3 A/230V	Protects a-c input circuit of MFP and auxiliary line voltage outputs. If cap is lit, fuse has blown.	F7002
2	TIME DELAY lamp	Lights to indicate that MFP is in STANDBY condition; i.e., MFP is sending oven-heater voltage to system units.	DS7002
3	OPERATE lamp	Lights to indicate that MFP is in OPERATE condition; i.e., MFP is sending full operating voltages to system units.	DS7001
4	B+ .5 A	Protects B+ supply circuit in MFP.	F7001
5	B- .100 A	Protects bias supply circuit in MFP.	F7003

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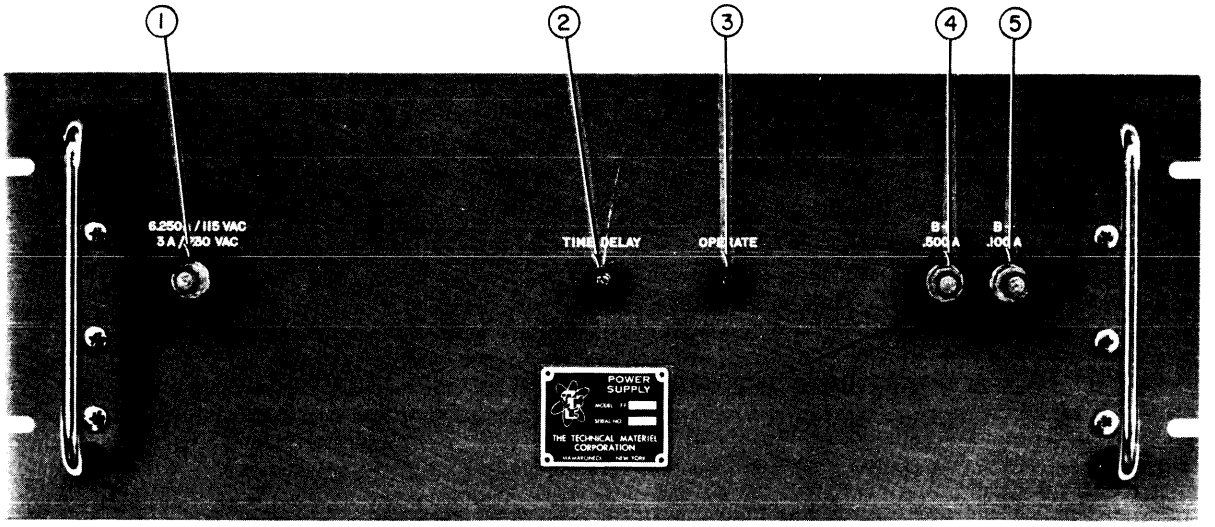

4004E-4

Figure 3-1. Power Supply MFP, Front Panel

SECTION 4
PRINCIPLES OF OPERATION

4-1. INTRODUCTION.

The overall schematic wiring for the MFP is shown in figure 8-1. As shown in figure 4-1, block diagram, primary line voltage is converted into 6.3 vac, 6.8 vac, regulated -105 vdc, and regulated +200 vdc for use in associated system equipments. In addition, line voltage is routed to jacks J7003 and J7004. In the +200 vdc supply, the series regulator, comparator, and d-c amplifier work as a closed loop to maintain the B+ output to within ±1%. This voltage regulation is maintained against line variations between 105 and 125 volts and load variations from zero to full. In the -105 vdc bias supply branch, the output of T7003 is sent through a full wave rectifier, an LC filter, and a zener diode shunt regulator. The -105 vdc output from the regulator contains a maximum ripple of 5 millivolts, under conditions of constant line voltage and constant load. The output is maintained within a 1 volt variance through line voltages of 105 to 125 volts and load currents of 0 to 20 milliamperes. The bias supply output is also used as a reference voltage in the B+ regulator.

4-2. SEQUENCE OF OPERATION. (See figure 4-2.)

a. STANDBY CONDITION. - With line voltage applied to jack J7001, the MFP is in standby condition. In this condition, line voltage is routed to jacks J7003 and J7004, and to transformers T7001 and T7002. Transformer T7001 supplies 6.3 vac to jacks J7002 and J7003. The line voltage and 6.3 vac outputs are used to maintain oscillator-oven temperature and similar applications in associated system units. Therefore, no long warm-up is required if the system is kept in a standby condition during non-operative periods. Transformer T7002 supplies 6.3 vac to the filaments of series regulator V7001 and d-c amplifier V7002. TIME DELAY lamp DS7002 is energized through half of the primary of transformer T7003 and fan B7001.

b. OPERATE CONDITION. - To place the system in operate condition, the operator sets the system standby/operate switch at OPERATE; this action shorts pins P and U of jack J7002. If the power supply has been in standby condition longer than one minute, the 6.3 vac voltage circuit to the coil of relay K7002 is completed through the contacts of relay K7001. Relay K7002 applies line voltage to the primary of transformer T7003, applies 115 vac to fan B7001, and turns off TIME DELAY lamp DS7002. The remaining 6.3 vac supplies, the 6.8 vac supply, the -200 vdc supply, and the -105 vdc supply are all taken from the secondary windings of transformer T7003. If line voltage is interrupted for more than 30 seconds, the contacts of relay K7001 will open, and remain open for approximately one minute after line voltage is reapplied. This action insures that series regulator V7001 and d-c amplifier V7002 have sufficient cathode warm-up before plate voltage is applied.

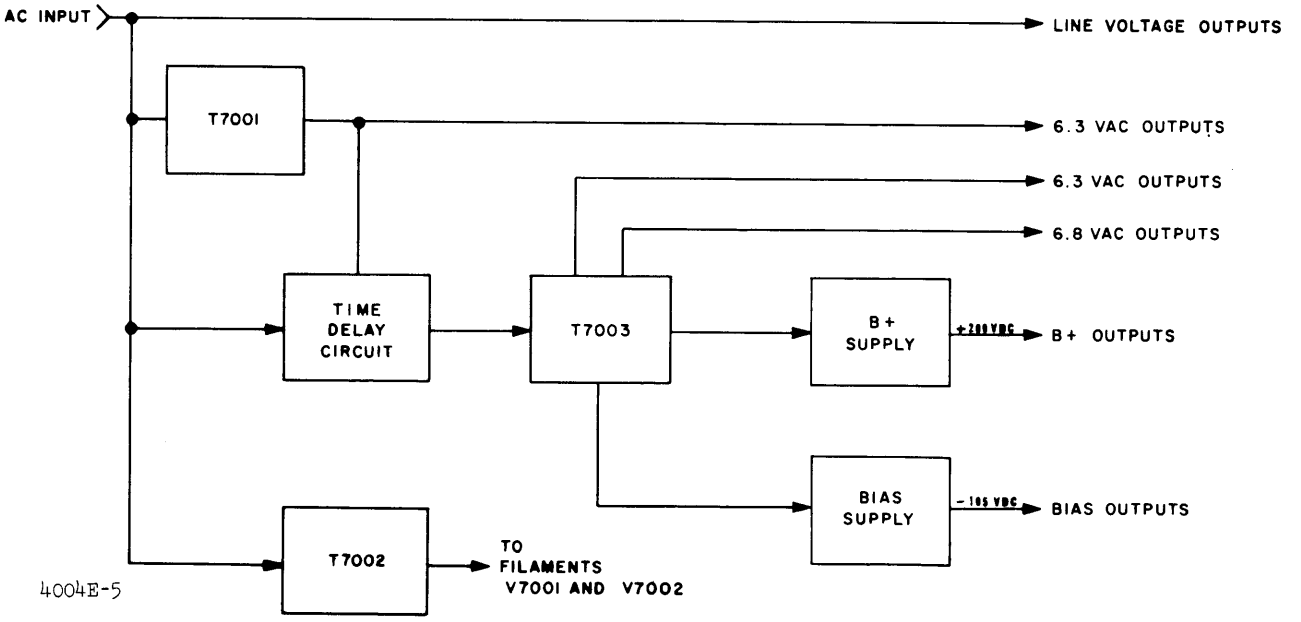

Figure 4-1. Block Diagram, MFP

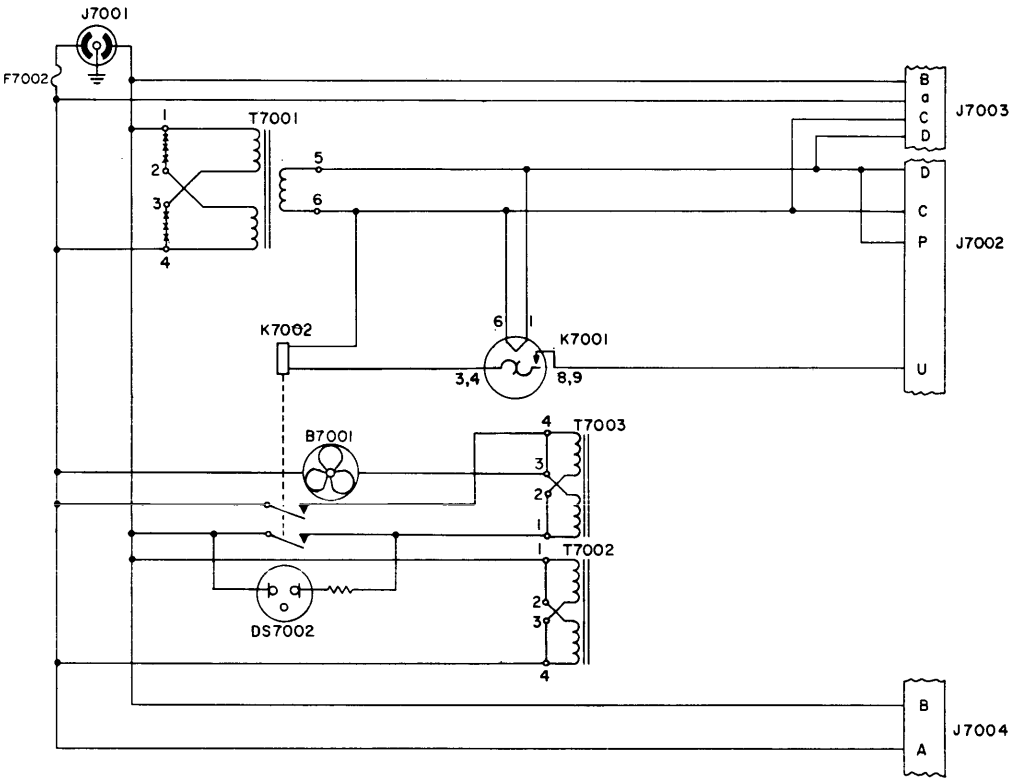

Figure 4-2. Simplified Schematic, Sequential Control Circuit, MFP

4-3. BIAS SUPPLY CIRCUIT. (See figure 4-3.)

The bias supply circuit consists of a full wave rectifier, an LC filter, and a zener diode controlled shunt regulator. It has a -105 vdc output. The negative output of the filter appears across capacitor C7005, and is approximately -150 volts. The shunt regulator consists of zener diode CR7006 and resistor R8008. Input voltage and current variations are absorbed by the zener diode, which has a nominal breakdown voltage of -105 volts. The diode regulator maintains this voltage by adjusting its zener current to vary the IR drop across resistor R7014. As a result of this characteristic, diode dissipation will be maximum at minimum load (about 7 watts). The -105 volt output is also used as a reference for the B+ regulator circuit.

4-4. B+ SUPPLY CIRCUIT. (See figure 4-4.)

The B+ supply circuit consists of a full-wave bridge rectifier, an RC filter, and an amplifier-controlled series regulator. The d-c output voltage of the filter appears accross capacitor C7003, and is a nominal +300 volts at full load. This voltage will exceed +400 volts under no-load conditions. The regulator comprises three subsections: a series regulator or passing tube, (V7001); a d-c amplifier tube (V7002); and a comparator network consisting of resistors R7006, R7007, and R7008. The voltage across resistor R7009 is B+, and is the difference between the voltage across C7003 and the voltage drop across V7001. V7001 acts as a variable resistor, controlled by its grid potential. The plate of V7002 is directly coupled to the grids of V7001 through parasitic suppressors R7004 and R7005. The comparator network of R7006, R7007, and R7008 is connected between B+ and the reference voltage at zener diode CR7007. The voltage at the arm of R7007 is the bias for V7002 and hence will determine the quiescent point of the tube. The plate voltage of V7002 is the same as the grid potential of V7001 and hence will determine the B+ output voltage. The B+ output can be adjusted by changing the position of the arm of R7007, and in the MFP is set at +200 vdc. Since the voltage at CR7007 is constant, any change in the B+ output will produce a corresponding change in the bias of V7002 and a resultant change in bias of B7001; this also results in a change in the resistance of V7001. The change in the resistance of V7001 and the resultant IR drop will compensate for the original B+ output voltage change. The circuit operates as a closed loop system for line voltage variations or load current variations.

4-5. INTERCONNECTING WIRING.

As shown in figure 8-1, interconnections between various units of the system are accomplished through the MFP. The specific interconnect functions are dependent upon the particular system in which the MFP is used. Refer to the applicable system manual for further description of these interconnections.

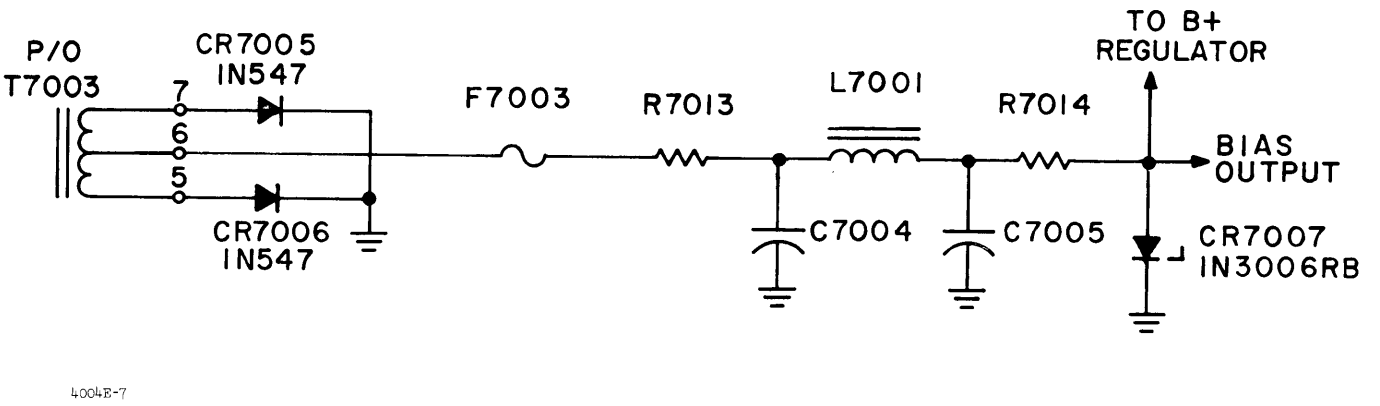

Figure 4-3. Simplified Schematic, Bias Supply, MFP

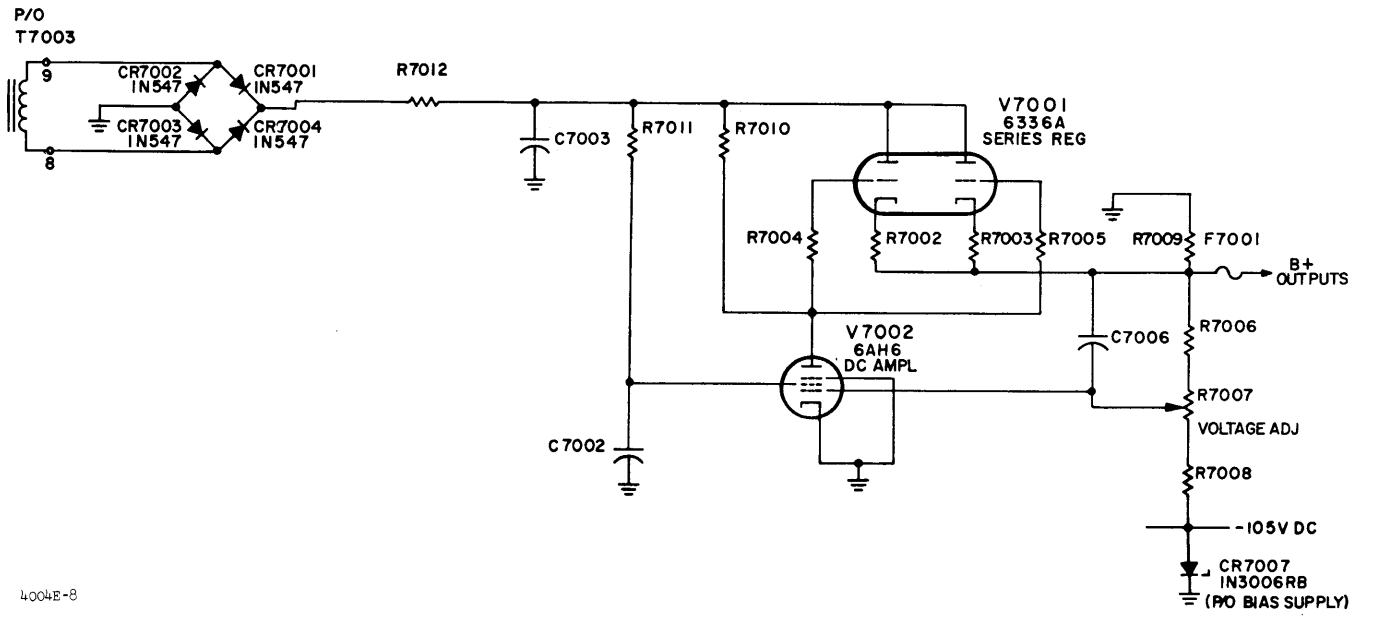

Figure 4-4. Simplified Schematic, B+ Supply, MFP

SECTION 5
TROUBLESHOOTING

5-1. GENERAL.

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

5-2. TROUBLESHOOTING SHORT-CUTS.

When a piece of equipment has been working satisfactorily and suddenly fails, the cause of failure may be apparent either because of circumstances occurring at the time of failure or because of symptoms analogous to past failures. In these cases, it is unnecessary to follow a lengthy and orderly course of troubleshooting in order to locate the faulty part.

A second short-cut in troubleshooting is to ascertain that all tubes and fuses are in proper working order and that the equipment receives proper supply voltages. Many times this eliminates further investigation.

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

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

5-3. VOLTAGE AND RESISTANCE MEASUREMENTS

Figure 5-1 and 5-2 are top and bottom views, respectively, of the MFP showing locations of major components. D-c voltage and resistance measurements are given in table 5-1. Ripple voltage measurements are given in table 5-2 and may be useful in locating faulty filter or regulator components. Additional voltage data is shown in figure 5-3 through 5-6 with varying conditions, such as line-voltage and load-current changes.

The procedure for setting VOLTAGE ADJ potentiometer R7007 is given in Section 6.

WARNING

High voltages (up to 400 volts) are present in this equipment. Use care in making measurements on live circuits.

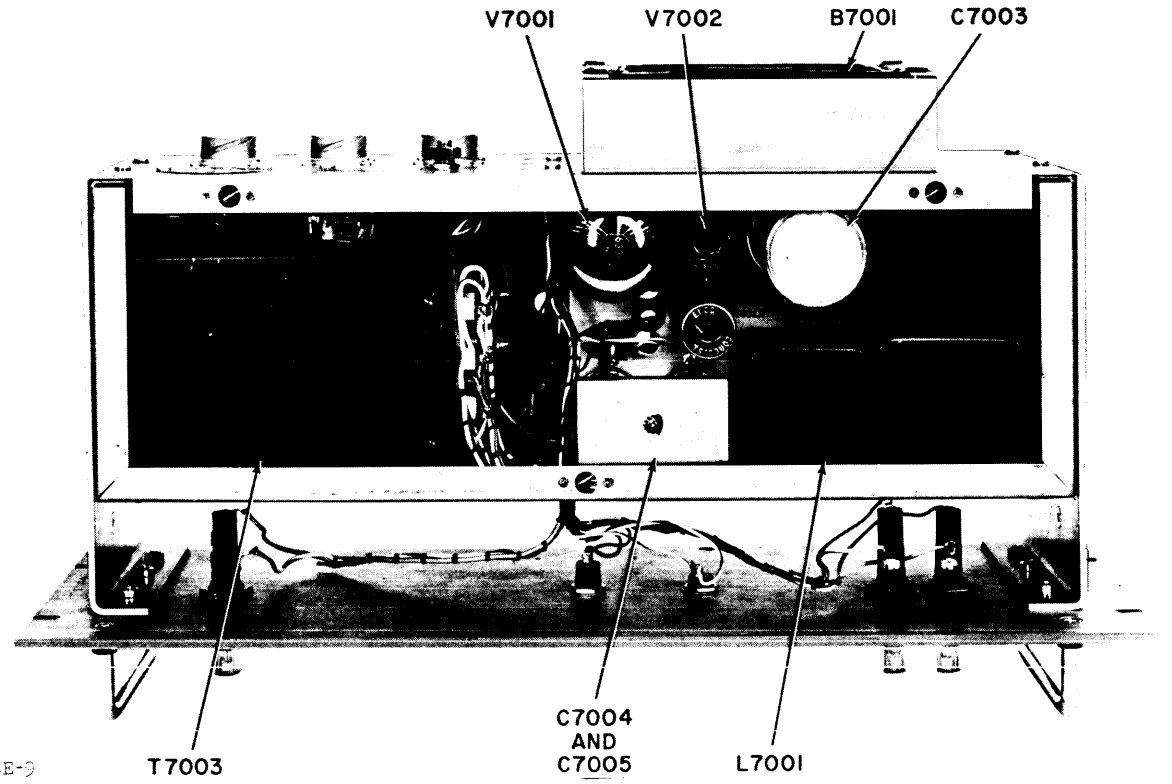

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Figure 5-1. Power Supply MFP, Top View

TABLE 5-1. D-C VOLTAGE AND RESISTANCE MEASUREMENTS

TUBE	CONDITION	CATHODE	GRID	SCREEN	PLATE
V7001	VOLTAGE AT FULL LOAD	200	130		290
	VOLTAGE AT NO LOAD	205	195		380
	RESISTANCE	10K	100K 200K		15K 150K
V7002	VOLTAGE AT FULL LOAD	0	-5.7	270	130
	VOLTAGE AT NO LOAD	0	-5.4	320	195
	RESISTANCE	0	30K 50K	100K 180K	100K 200K

NOTES

1. Voltage measurements are with respect to ground using a 20, 000 ohms/volt meter. Voltages are positive unless otherwise noted.
2. Resistance measurements are with respect to ground with the a-c input plug disconnected. Since the circuit contains semiconductor components, the resistance measurements will vary with meter polarization; therefore two measurements are given.

TABLE 5-2. A-C VOLTAGE MEASUREMENTS

A-C VOLTAGE	TEST CIRCUIT
100 mv, RMS, maximum	B+ circuit
5 mv, RMS, maximum	Bias output

NOTE

Measured with Daven model 170 VTVM or equivalent.

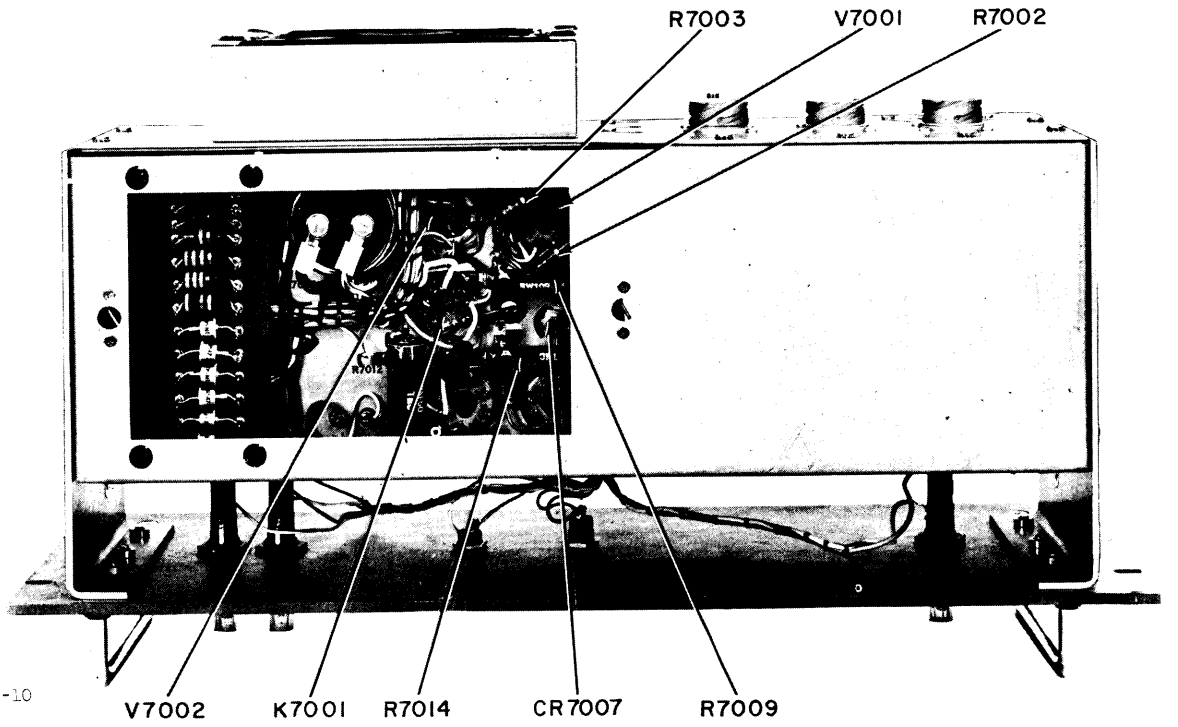

Figure 5-2. Power Supply MFP, Bottom View

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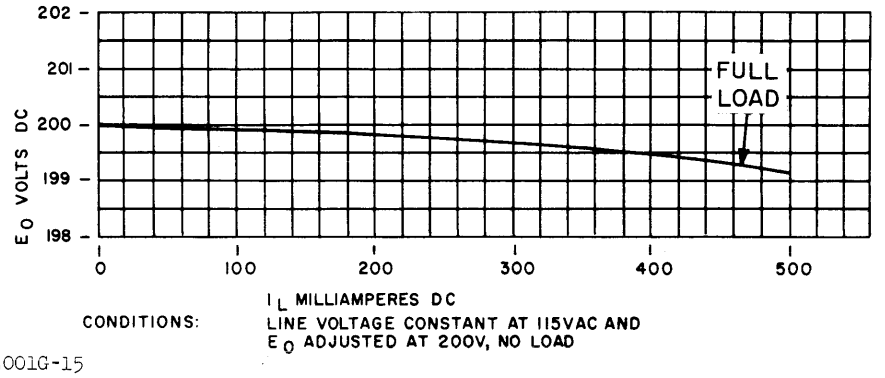


Figure 5-3. B+ Output Voltage (Eo) Vs. Load Current with Constant Line Voltage

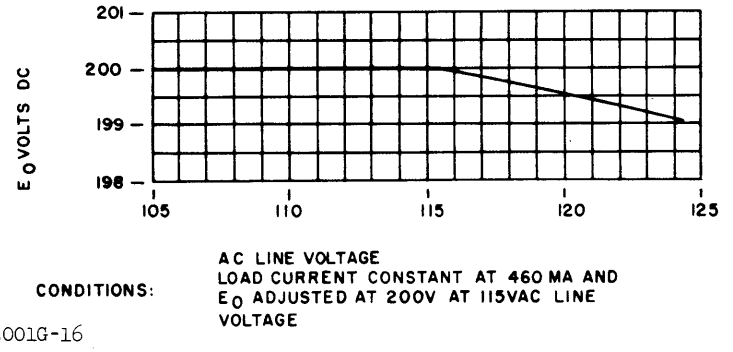


Figure 5-4. B+ Output Voltage (Eo) Vs. Line Voltage with Constant Load

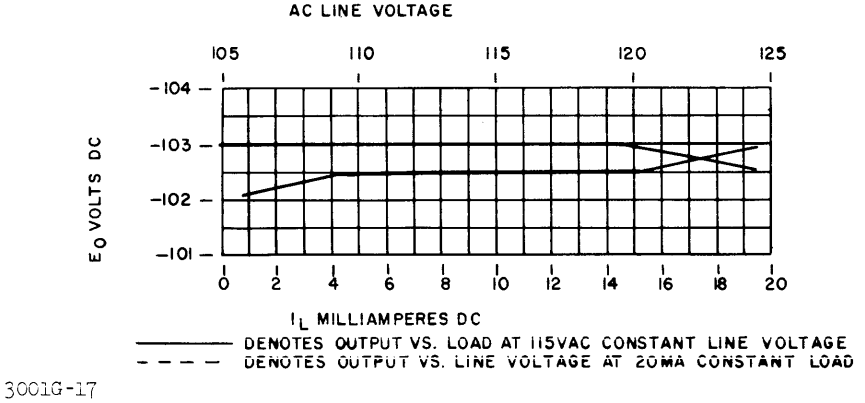
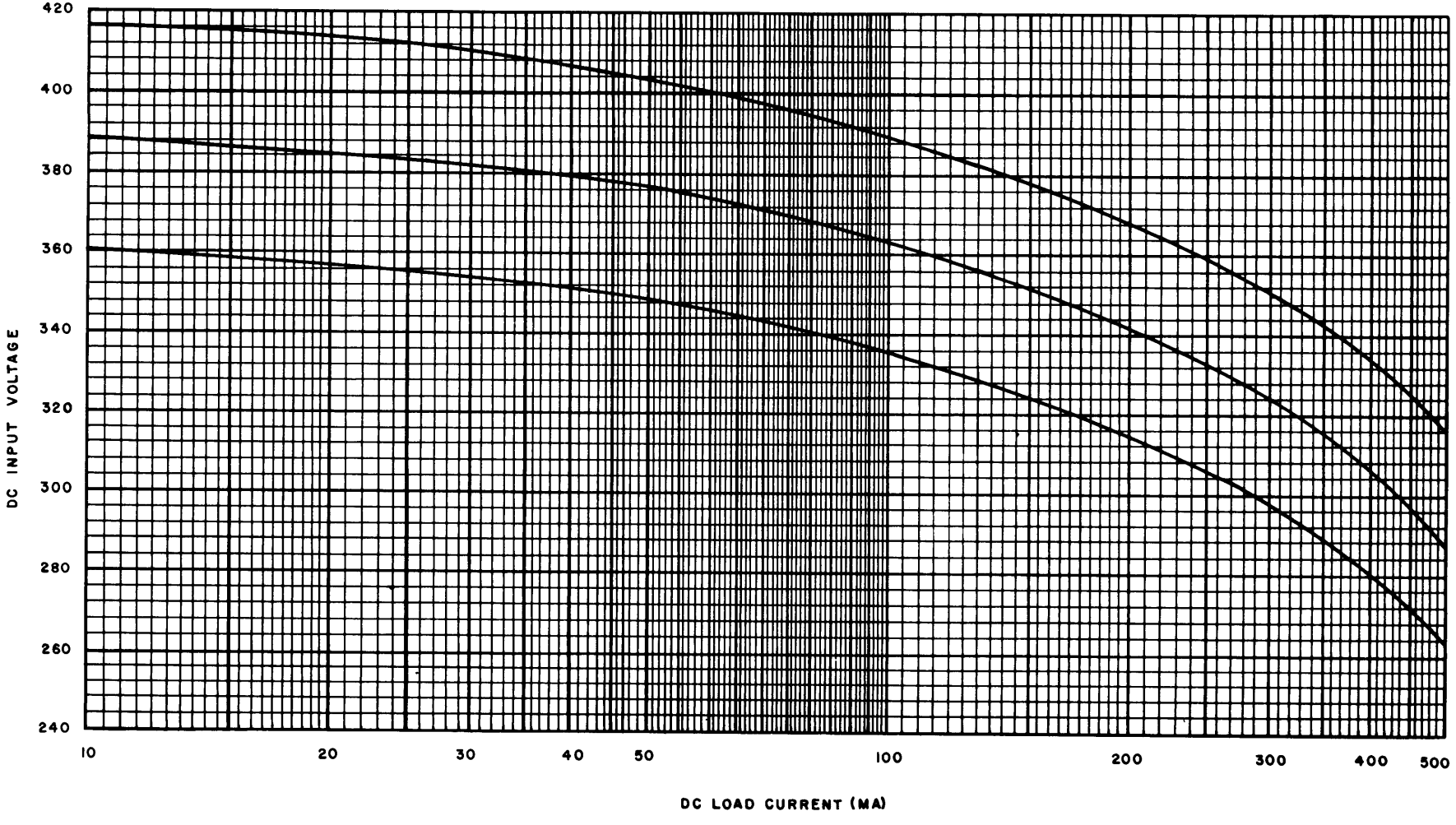


Figure 5-5. Bias Output (Eo) Vs. Line Voltage and Load Current



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NOTES

1. DC INPUT VOLTAGE MEASURED AT PLATES OF V7001.
2. LOAD CURRENT IS THE TOTAL CURRENT THROUGH THE SERIES REGULATOR TUBE.
3. AMBIENT TEMPERATURE IS 25°C.

Figure 5-6. DC Input to B+ Regulator VS. Load Current

SECTION 6
MAINTENANCE

6-1. GENERAL.

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

The MFP has been designed to provide long-term trouble-free operation under continuous duty conditions. It is recommended that any necessary maintenance be done by a competent maintenance technician familiar with power supply techniques. Otherwise, advantage may be taken of the required specialized test equipment and personnel trained in its use in the test department of Technical Materiel Corporation. If trouble develops which cannot be corrected by the procedures outlined in the following paragraphs, it is recommended that the instrument be returned to Technical Materiel Corporation for servicing. To expedite the return of the serviced equipment to you, it is recommended that the equipment be shipped to us by Air Freight and that we be authorized to return it the same way.

6-2. PREVENTIVE MAINTENANCE.

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

b. CLEANING AND INSPECTION. - At periodic intervals, the equipment should be removed from the rack for cleaning and inspection. All accessible covers should be removed and the wiring and all components inspected for dirt, corrosion, charring, discoloring or grease; in particular, the tube sockets should be carefully inspected for deterioration. Dust may be removed with a soft brush or a vacuum cleaner, if one is available. Remove dirt or grease from electrical parts with trichloroethylene or ethylendichloride. Remove dirt or grease from other parts with any good dry cleaning fluid.

WARNING

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

c. TUBE CHECK. - While unit is out of the rack and with covers removed, it is advisable to check the tubes.

d. LOOSE PARTS. - Carefully inspect for loose solder connections or screws, especially those on solder lugs. Recommended time interval is every 6 to 12 months, depending on the amount of vibration encountered in service.

6-3. CORRECTIVE MAINTENANCE.

a. GENERAL. - Replacement of components and readjustments to chassis-mounted variable components are included under the category of corrective maintenance. Replacement of components, as described here, is confined to special considerations to be taken when replacing particular components.

b. REPLACEMENT OF COMPONENTS.

Replacement of any of the components in the B+ circuit requires a readjustment of the VOLTAGE ADJ potentiometer. This readjustment is described in paragraph 6-3c. When replacing any of the semiconductor diodes, a long-nosed pliers or similar tool must be used to conduct heat away from the junction when soldering the leads.

c. SETTING OF VOLTAGE ADJ POTENTIOMETER.

(1) With the unit mounted in the rack and connected to the system, pull the unit out on its slides.

(2) Set system main power switch at ON.

(3) Set system standby/operate switch at OPERATE.

(4) After OPERATE lamp lights, connect a d-c voltmeter to the junction of resistors R7009, R7002 and R7003 (see figure 5-2). Adjust VOLTAGE ADJ potentiometer R7007 to obtain 197 volts. Disconnect meter.

NOTE

Voltage is adjusted for 197 volts instead of 200 volts to allow for voltage creep experienced when unit warms up under normal load.

(5) Push MFP back into rack. Allow about 30 minutes for unit to reach normal temperature. Pull unit out and readjust potentiometer to obtain 200 volts.

SECTION 7
PARTS LIST

7-1. INTRODUCTION.

Reference designations have been assigned to identify all maintenance parts of the equipment. They are used for marking the equipment (adjacent to the part they identify) and are included on drawings, diagrams, and the parts list. The letters of a reference designation indicate the kind of part (generic group), such as resistor, amplifier, electron tubes, etc. The number differentiates between parts of the same generic group. Sockets associated with a particular plug-in device, such as electron tube or fuse, are identified by a reference designation which includes the reference designation of the plug-in device. The parts for each major unit are grouped together. Column 1 lists the reference series of each major unit, followed by the reference designations of the various parts in alphabetical and numerical order. Column 2 gives the name and describes the various parts. Major part assemblies are listed in their entirety; subparts of a major assembly are listed in alphabetical and numerical order with reference to its major assembly. Column 3 lists each Technical Materiel Corporation part number.

PARTS LIST

SYM	DESCRIPTION	TMC PART NO.
B7001	FAN, AXIAL: ventilating; 115 V, 50/60 cps; 14 watts; 100 cfm; blade dial. 4-1/2"; o/a dim., 1-5/8" x 5-5/32" x 6-1/8"; with grill cover and mounting clips.	BL106-3
C7001	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 20,000 uuf, +80% -20%; 500 WVDC.	CC100-24
C7002	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 100,000 uuf, +80% -20%; 500 WVDC.	CC100-32
C7003	CAPACITOR, FIXED, ELECTROLYTIC: 250 uf; 525 VDC surge; 450 WVDC; polarized; insulated tubular aluminum case.	CE112-1
C7004	CAPACITOR, FIXED, ELECTROLYTIC: 45 uf; 450 WVDC; polarized; tubular case; octal plug-in type.	CE51C450P
C7005	Same as C7004.	
C7006	Same as C7002.	
CR7001	SEMICONDUCTOR DEVICE, DIODE: silicon; 600 V max. peak inverse voltage; 0.75 max. DC forward amps at 150°C.	1N547
CR7002 thru CR7006	Same as CR7001.	
CR7007	SEMICONDUCTOR DEVICE, DIODE: silicon; 115 V, 10 watts non-inductive; cathode grounded to case.	1N3006RB
DS7001	LAMP, GLOW: 110/125 VAC/VDC; nom. current 0.6 ma; 1/15 watt; midget flange base; T-3-1/4 bulb.	BI111-1
DS7002	LAMP, INCANDESCENT: 6.3 VAC/VDC; 0.20 amp; single contact; midget flange base; T-3-1/4 bulb.	BI110-8
DS7003	Non-replaceable item. Part of XF7001.	
DS7004	Non-replaceable item. Part of XF7002.	
DS7005	Non-replaceable item. Part of XF7003.	
EK7001	SHIELD, ELECTRON TUBE: 2-3/8" high x 1.079" dia.; tension spring, twist lock.	TS103U03
EV7001	Not Used	
EV7002	SHIELD, ELECTRON TUBE: brass or copper, nickel plated; 1-3/4" lg. x 0.930" dia.; tension spring, twist lock.	TS102U02
F7001	FUSE, CARTRIDGE: 1/2 amp; time lag; 1-1/4" lg. x 1/4" dia.; slow blow.	FU102-.5
F7002	FUSE, CARTRIDGE: 6-1/4 amps; time lag; 1-1/4" lg. x 1/4" dia.; slow blow. (For 115 V operation)	FU102-6.25
F7002	FUSE, CARTRIDGE: 3 amps; time lag; 1-1/4" lg. x 1/4" dia.; slow blow. (For 230 V operation)	FU102-3
F7003	FUSE, CARTRIDGE: 1/10 amp; time lag; 1-1/4" lg. x 1/4" dia.; slow blow.	FU102-.1

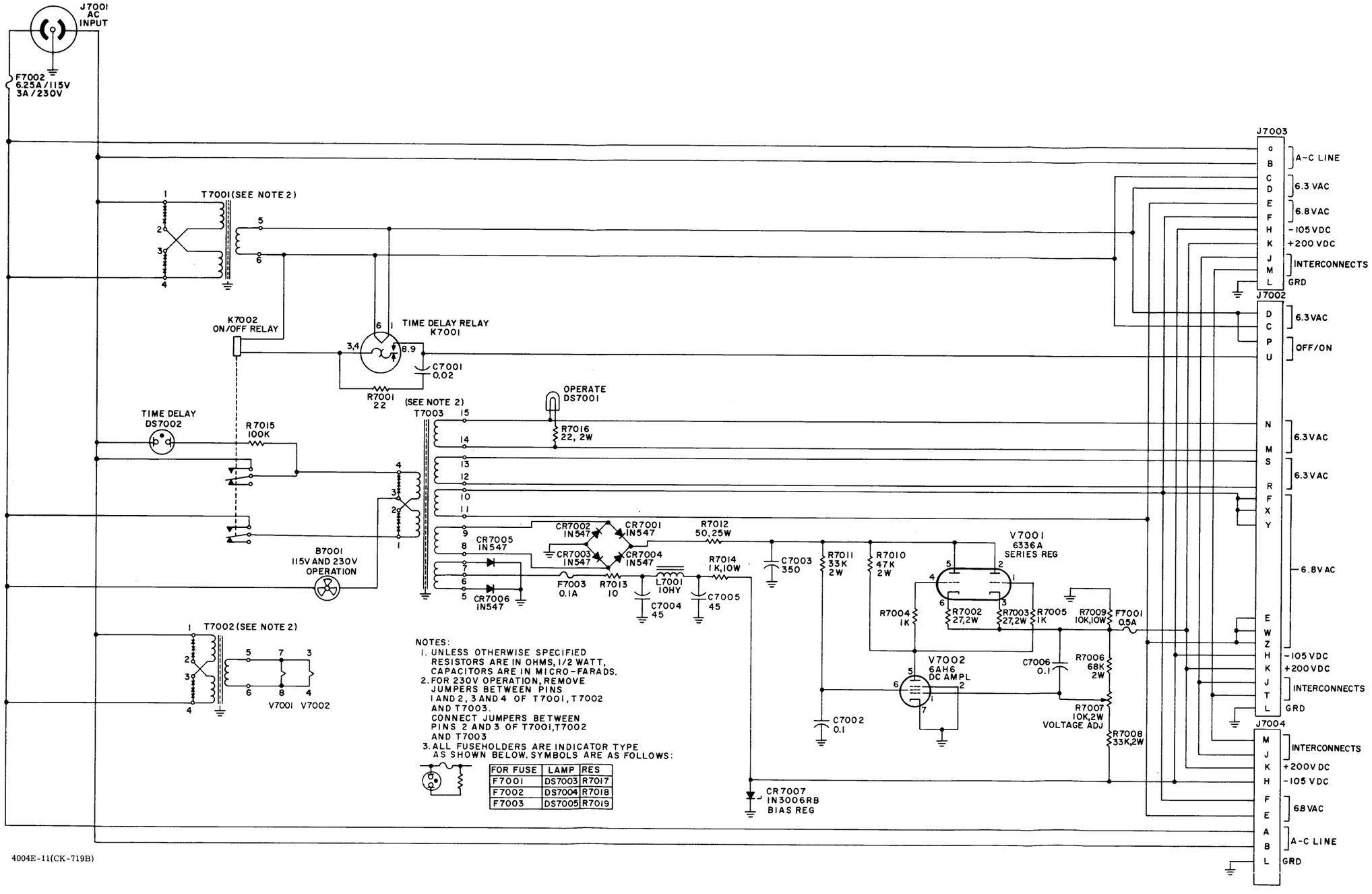
PARTS LIST (CONT)

SYM	DESCRIPTION	TMC PART NO.
J7001	CONNECTOR, RECEPTACLE, ELECTRICAL: male; AC power; 2 contacts; 250 V at 10 amps, 125 V at 15 amps; polarized; twist lock.	JJ175
J7002	CONNECTOR, RECEPTACLE, ELECTRICAL: 24 #20 female contacts rated at 7.5 amps per contact.	JJ200-3
J7003	CONNECTOR, RECEPTACLE, ELECTRICAL: 14 #16 female contacts rated at 17.0 amps per contact.	JJ200-1
J7004	Same as J7003.	
K7001	RELAY, THERMAL: delay type, 60 sec., ±12 sec., SPST, normally open; 6.3 VAC heater voltage; contact rating, 115 VAC at 2 amps or 220 VAC at 1 amp non-inductive 1,000 V contact to contact breakdown, 1,500 V heater to contact breakdown; temperature range -55 to +70°C; glass case, 9 pin miniature base.	RL1116N060T
K7002	RELAY, ARMATURE: 33 ohms coil resistance; 6.3 VAC; contacts rated at 115 V non-inductive.	RL116AC2C6.3
L7001	REACTOR: filter; 10 hy; 280 ohms DC resistance; 70 ma; insulated for 1,500 V RMS; hermetically sealed metal case.	TF5006
R7001	RESISTOR, FIXED, COMPOSITION: 10 ohms, ±10%; 1/2 watt.	RC20GF100K
R7002	RESISTOR, FIXED, COMPOSITION: 27 ohms, ±5%; 2 watts.	RC42GF270J
R7003	Same as R7002.	
R7004	RESISTOR, FIXED, COMPOSITION: 1,000 hms, ±5%, 1/2 watt.	RC20GF102J
R7005	Same as R7004.	
R7006	RESISTOR, FIXED, COMPOSITION: 68,000 ohms, ±5%; 2 watts.	RC42GF683J
R7007	RESISTOR, VARIABLE, COMPOSITION: 10,000 ohms, ±10%; 2 watts; taper A.	RV4LAYSA103A
R7008	RESISTOR, FIXED, COMPOSITION: 33,000 ohms, ±5%; 2 watts.	RC42GF333J
R7009	RESISTOR, FIXED, WIREWOUND: 10,000 ohms, ±5%; 10 watts; solder lug type terminals.	RW109-34
R7010	RESISTOR, FIXED, COMPOSITION: 47,000 ohms, ±10%; 2 watts.	RC42GF473K
R7011	Same as R7008.	
R7012	RESISTOR, FIXED, WIREWOUND: 50 ohms, ±5%; 25 watts; solder lug type terminals.	RW111-7
R7013	Same as R7001.	
R7014	RESISTOR, FIXED, WIREWOUND: 1,000 ohms, ±5%; 10 watts; solder lug type terminals.	RW109-24

PARTS LIST (CONT)

SYM	DESCRIPTION	TMC PART NO.
R7015	RESISTOR, FIXED, COMPOSITION: 100,000 ohms, ±5%; 1/2 watt.	RC20GF104J
R7016	RESISTOR, FIXED, COMPOSITION: 22 ohms, ±5%; 2 watts.	RC42GF220J
R7017	Non-repacleable item. Part of XF7001.	
R7018	Non-replaceable item. Part of XF7002.	
R7019	Non-replaceable item. Part of XF7003.	
T7001	TRANSFORMER, POWER, STEP-DOWN: primary, 115/230 V, 50/60 cps, single phase; secondary 6.3 V, 5.5 amps, AC; electrostatic shield.	TF239
T7002	Same as T7001.	
T7003	TRANSFORMER, POWER, STEP-DOWN, STEP-UP: primary, 115/230 V, 50/60 cps, single phase; secondary, (#1) 6.8 VAC, 17 amps, (#2) 6.3 VAC, 1.5 amps, (#3) 6.3 VAC, 1.5 amps, (#4) 240 VAC, 0.07 amp, center tapped, (#5) 270 VAC, 0.5 amp; electrostatic shield, hermetically sealed metal case.	TF240
V7001	TUBE, ELECTRON: octal; twin power triode.	6336A
V7002	TUBE, ELECTRON: sharp-cutoff pentode; 7 pin miniature.	6AH6
XC7001 thru XC7003	Not Used	
XC7004	SOCKET, ELECTRON TUBE: saddle type, 8 contacts, phosphor bronze or beryllium copper plated with tin, hot solder dipped; low crown; 2 mounting holes, 0.156" dia.; molded thermosetting plastic insulator body.	TS165P01
XC7005	Same as XC7004.	
XDS7001	LIGHT, INDICATOR: with yellow (amber) lens; accepts T-3-1/4 single contact, midget flange bulb.	TS154-3
XDS7002	LIGHT, INDICATOR: red transparent lens, for T-3-1/4 single contact, midget flange bulb.	TS153-1
XF7001	FUSEHOLDER: extractor post type; for 1-1/4" lg. x 1/4" dia. fuse cartridge; with neon indicator lamp and 220K ohm resistor, clear octagonal lens; 100/250 V, 20 amps. Consists of DS7003 and R7017.	FH104-2
XF7002	Same as XF7001. Consists of DS7004 and R7018.	
XF7003	Same as XF7001. Consists of DS7005 and R7019.	
XK7001	SOCKET, ELECTRON TUBE: 9 pin miniature.	TS103P01
XV7001	Same as XC7004.	
XV7002	SOCKET, ELECTRON TUBE: 7 pin miniature.	

SECTION 8
SCHEMATIC DIAGRAMS



NOTES:
1. UNLESS OTHERWISE SPECIFIED RESISTORS ARE IN OHMS, 1/2 WATT, CAPACITORS ARE IN MICRO-FARADS.
2. FOR 230V OPERATION, REMOVE JUMPERS BETWEEN PINS 1 AND 2, 3 AND 4 OF T7001, T7002 AND T7003. CONNECT JUMPERS BETWEEN PINS 2 AND 3 OF T7001, T7002 AND T7003
3. ALL FUSEHOLDERS ARE INDICATOR TYPE AS SHOWN BELOW. SYMBOLS ARE AS FOLLOWS:

FOR FUSE	LAMP	RES
F7001	DS7003	R7017
F7002	DS7004	R7018
F7003	DS7005	R7019

4004E-11(CK-719B)

Figure 8-1. Schematic Diagram, Power Supply, MFP