TECHNICAL MANUAL

for

POWER SUPPLY MODEL CPP-2

(PP-2562/URA-31)

THE TECHNICAL MATERIEL CORPORATION

MAMARONECK, N.Y. OTTAWA, CANADA

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IN-2005F Issue Date: 15 April 1964

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

CHANGE NO. 2 CPP-2

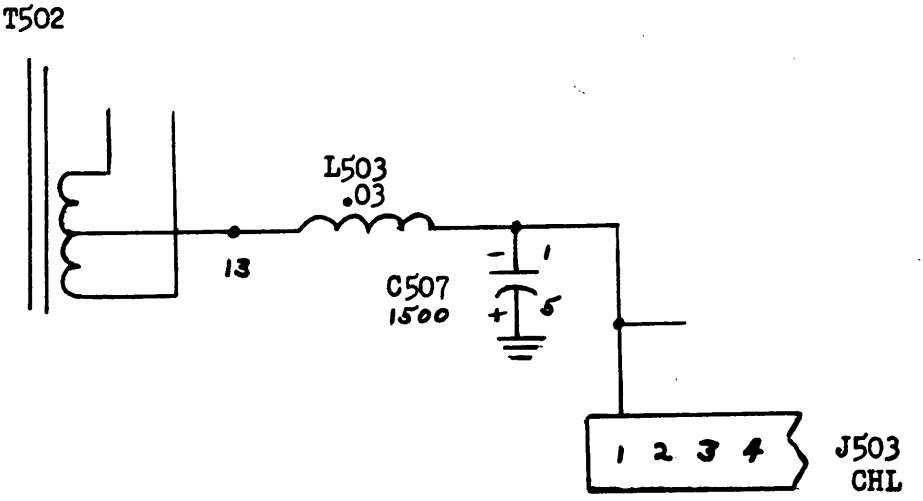
INSTRUCTION BOOK CHANGE NOTICE

Date June 17, 1964

Manual affected: Power Supply Model CPP-2 IN -2005 F

Page III(F)-8-3 - III(F)-8-4
Figure III(F)-8-1

1. Revise L503 and C507 circuitry as indicated below.



2. Change rating of F502 from 1A/115 V, .5A/230 V to 2A/115 V, 1A/230 V.

3. This change supercedes Change Notice No. 1 dated 10/4/63 and Addendum I dated 2/7/62. Remove and destroy Change Notice No. 1 and Addendum I.

L30/3/64

CHANGE NO. 3 CPP-2

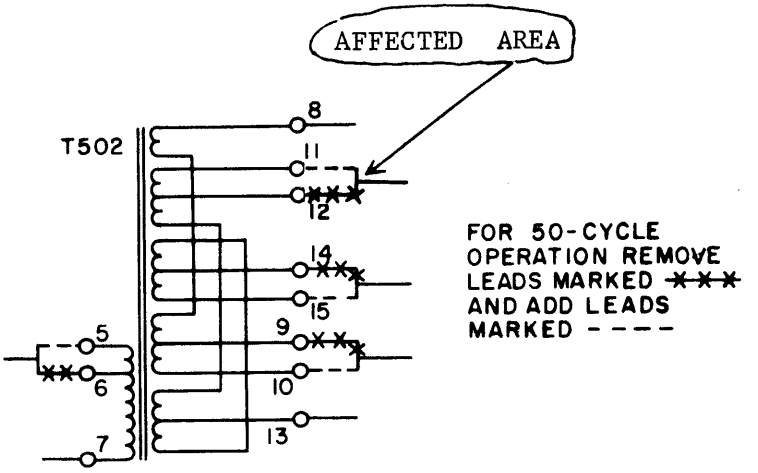
INSTRUCTION BOOK CHANGE NOTICE

Date 25 August 1966

Manual affected: Power Supply, Model CPP-2 IN -2005F

Page 2-0. Figure 2-2.

Change figure 2-2 as indicated below:



SHOULD ADDITIONAL COPIES OF THIS CHANGE NOTICE BE REQUIRED, PLEASE CONTACT: W.O. 108-66

THE TECHNICAL MATERIEL CORP., 700 Fenimore Road, Mamaroneck, New York

Attn.: Director of Eng. Services.

RECORD OF CORRECTIONS MADE

Change No.	Date of Change	Date Entered	Entered By
1	4/10/63	Void - superceded	
		by Change No. 2	9/65

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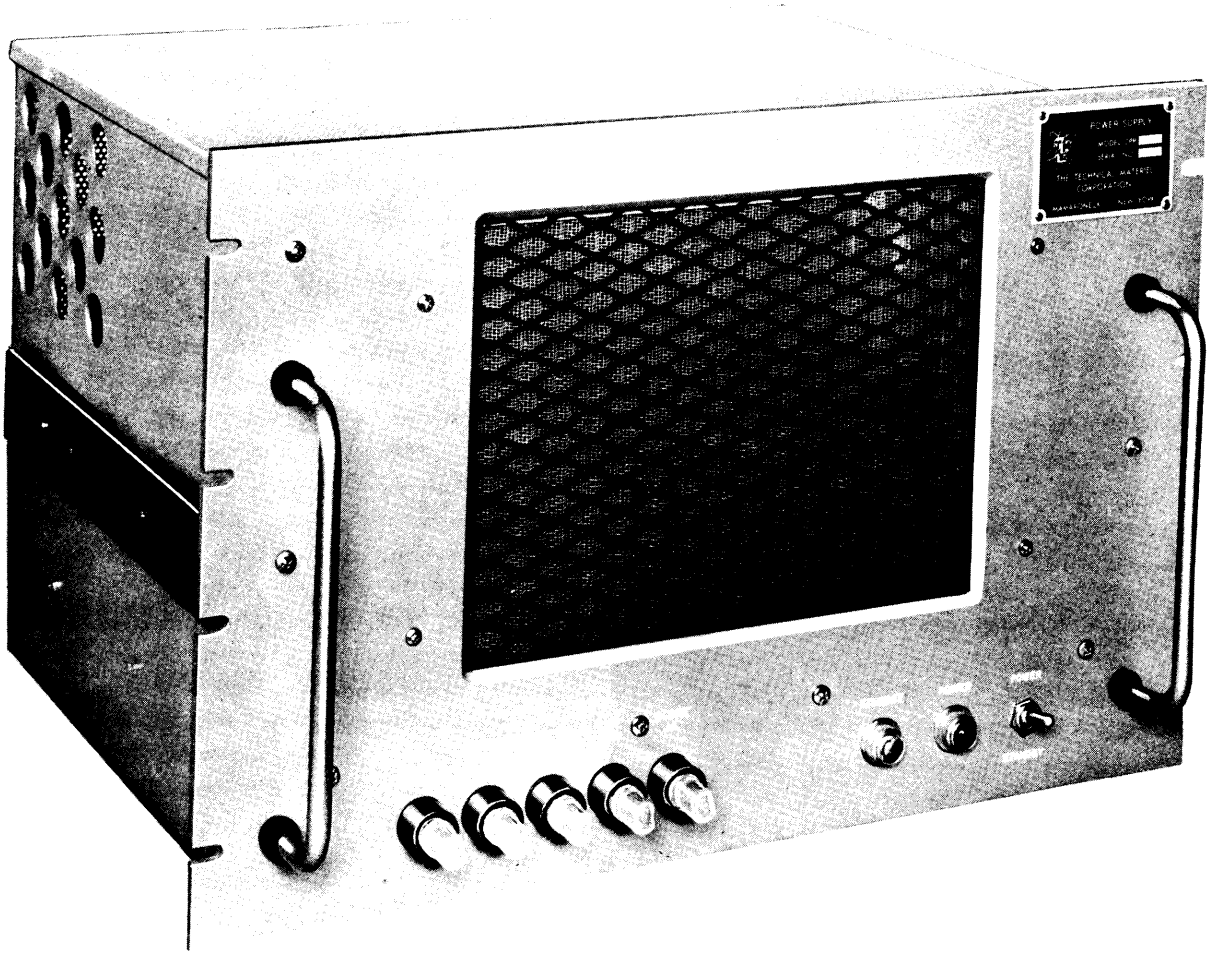


Figure 1-1. Model CPP-2 Power Supply

SECTION 1
GENERAL INFORMATION

1-1. PURPOSE OF EQUIPMENT.

The Model CPP-2 (figure 1-1), is a conventional power supply providing a-c and d-c operating voltages for various units associated with the exciter used for all TMC synthesized transmitters. The units involved are: the Controlled Oscillator, CLL-1; the Controlled Master Oscillator, CMO-1 and the Divider Chain, CHL-1.

During normal operation, the power supply provides regulated voltages of +160 vdc, -75 vdc, -6 vdc and 6.3 vac as well as unregulated voltages of -400 vdc and +380 vdc. In addition, the power supply provides 115- or 230-volts a-c as oven power for the CLL-1 and CMO-1 units. Table 1-1 lists the CPP-2 regulated and unregulated power supply voltages to the externally connected units.

TABLE 1-1. VOLTAGES SUPPLIED TO EXTERNAL UNITS

UNIT	VOLTAGE REGULATED	VOLTAGE UNREGULATED
CLL-1	+160 vdc	-400 vdc
	-75 vdc	+380 vdc
	-6 vdc 6.3 vac	115 or 230 vac
CMO-1	+160 vdc	+380 vdc
	-6 vdc 6.3 vac	115 or 230 vac
CHL-1	+160 vdc -6 vac 6.3 vac	

1-2. DESCRIPTION OF EQUIPMENT.

The CPP-2 Power Supply is normally operated from a 115- or 230-volt, 60-cycle power source. It contains the circuits required for conversion of a-c input power to regulated and unregulated output operating voltages. These circuits utilize six electron tubes, four diodes and two power transformers. Fuses, equipped with blown fuse indicators protect the equipment in the event of an overload or malfunction. Six spare fuses are located on the rear panel.

Controls and indicators of the CPP-2 Power Supply are located on the front panel. A STANDBY/POWER switch controls the output of the power supply unit. The two positions of the switch are indicated by respective neon glow indicators. Input and output power connection facilities are located on the rear of chassis.

Dimensionally the power supply front panel is 3/16-inch thick by 19-inches long and 12-1/4-inches high with the chassis extending 16-inches behind the panel. Unit weight is 67 lbs.

1-3. ELECTRICAL CHARACTERISTICS.

The electrical power characteristics of the CPP-2 Power Supply are given as follows:

Input Power . . . . . 115 or 230 volts, 50-60 cps, single phase less than 1000 watts.

Output Voltages . . . . +380 vdc (less than 1/2 amp.)
-400 vdc (less than 1/10 amp.)
+160 vdc (less than 1/2 amp.)
-75 vdc (less than 1/10 amp.)
-6.3 vdc (less than 1/10 amp.)
6.3 vac (less than 1 amp.)
115- or 230-volts, 60-cps, single phase AC

1-4. ELECTRON TUBE AND DIODE COMPLEMENT.

Table 1-2 lists the electron tubes and diodes for the CPP-2 Power Supply.

TABLE 1-2. ELECTRON TUBE AND DIODE COMPLEMENT

REFERENCE SYMBOL	TYPE	FUNCTION
V501, V502	6080	DC Regulator
V503	5U4	Rectifier
V504	6AH6	DC Amplifier
V505	0C2	Voltage Regulator
CR501, CR502	RX107-1	B-Rectifier
CR503, CR504	1N2512	Filament Rectifier

SECTION 2
INSTALLATION

2-1. INITIAL INSPECTION.

Each CPP-2 power supply unit is tested and calibrated at the factory prior to shipment. Upon arrival at the operating site, inspect the packaging case and its contents for possible damage. Inspect all packaging 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.

Once the unit is removed from its protective packaging, check the power supply for damage. Remove the top and bottom dust covers by removing the attaching screws that secure each cover to the main frame. Once the covers are removed, check that all tubes are installed and properly seated. Also, inspect for bent or broken connectors, and terminals on the rear panel. Observe that six spare fuses are securely mounted on the rear panel.

2-2. POWER REQUIREMENTS.

The unit is designed for either 115- or 230-vac operation at 50 or 60 cps, single phase, at less than 1000 watts. The unit is wired at the factory for 115 vac, 60 cps operation unless specified otherwise by the customer at the time of purchase. Wiring changes necessary to change the unit to 230-volt and for 50 cps operation is shown in figures 2-1 and 2-2, respectively. With 230-volt operation, change the following fuses: FIL fuse F502 from 2 amp to 1 amp; OVENS fuse F503 from 5 amp to 2-5 amp; and B+ LINE fuse F501 from 3 amp to 1.5 amp.

2-3. INSTALLATION.

a. PHYSICAL. The CPP-2 Power Supply is designed for rack installation. The unit is mounted on tracks that attach to a slide mechanism and eased forward until release lock buttons engage hole in track. Then unit is pushed forward completely into rack.

b. ELECTRICAL. As shown in figure 2-3, all power connections are made at the rear panel of the power supply unit. Operating voltages for the CLL-1 unit are provided at jack J501. For the CMO-1 and CHL-1 units, operating voltages are provided at jacks J502 and J503, respectively. A-c line power is connected to AC POWER jack J504.

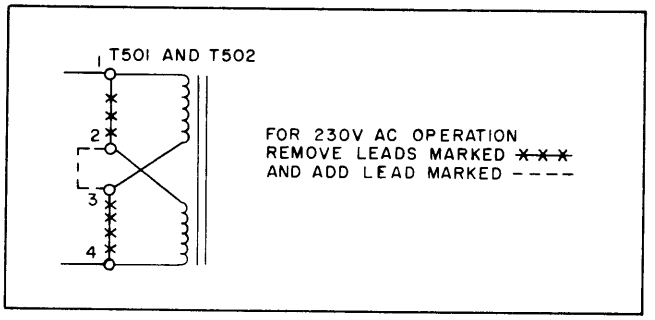


Figure 2-1. Wiring Change for 230-Volt Operation

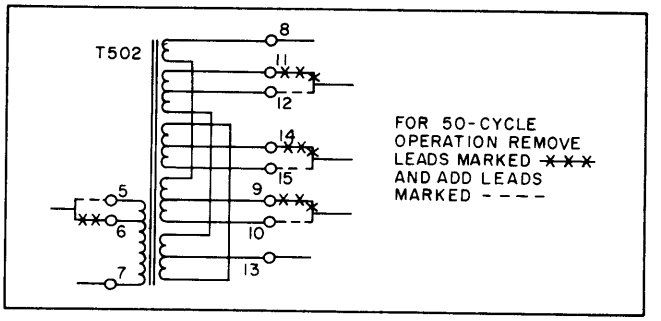


Figure 2-2. Wiring Change for 50-Cycle Operation

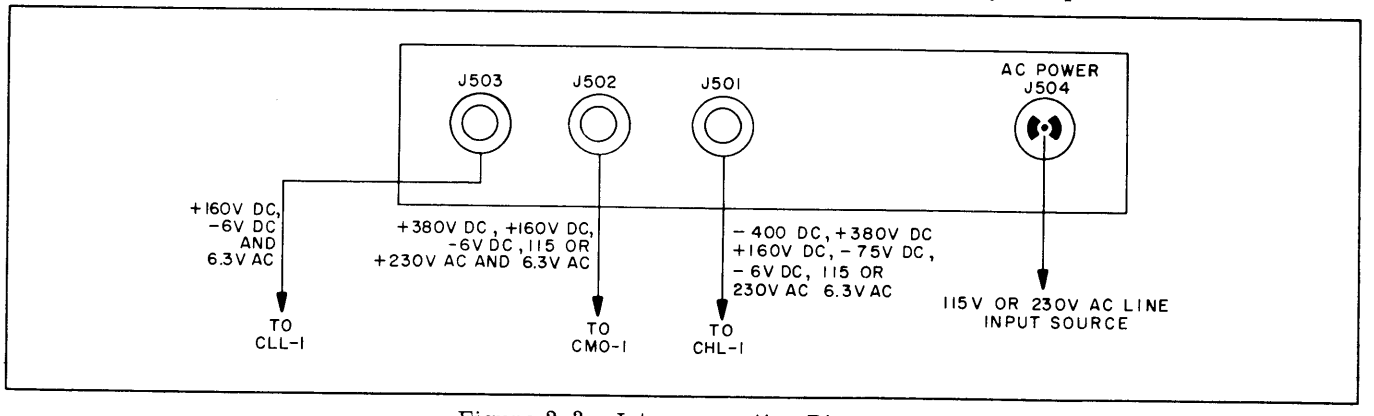


Figure 2-3. Interconnection Diagram

SECTION 3
OPERATORS SECTION

3-1. OPERATING CONTROL AND INDICATORS.

Figure 3-1 shows front panel callouts with index numbers for locating the controls and indicators of the CPP-2 Power Supply. The function of each control and indicator, the locating index number, together with their nomenclature and reference designation are given in table 3-1.

3-2. OPERATOR'S INSTRUCTIONS.

The CPP-2 Power Supply contains one control, a STANDBY/POWER switch. To apply operating power to the externally connected units, the STANDBY/POWER switch is manually set to POWER, otherwise, the switch is left in STANDBY.

3-3. OPERATOR'S MAINTENANCE.

The operator should observe whether front panel indicator lamps light properly when the STANDBY/POWER switch is operated. Indicator type fuses should be observed when a malfunction occurs. A light indicates that the fuse is blown. When replacing a defective fuse, replace it with one of equal value.

TABLE 3-1. FRONT PANEL CONTROL AND INDICATORS

INDEX NUMBER	CONTROL OR INDICATOR	FUNCTION
1	STANDBY/POWER switch S501	In STANDBY position, power supply only provides 115 or 230 volts ac. In power position, power supply functions to provide its normal operating output voltages.
2	POWER indicator lamp I501	Neon lamp glows when switch S501 is in POWER position.
3	STANDBY indicator lamp I502	Neon lamp glows when switch S501 is in STANDBY position.
4	SCOPE .1A fuseholder-indicator F504	Fuse in holder used in CLL-1 oscilloscope voltage line. Associated neon lamp glows when fuse blows.
5	B+ .5A fuseholder-indicator F505	Fuse in holder used in B+ voltage line. Associated neon lamp glows when fuse blows.
6	B+ LINE 3A/115V-1.5A/230V fuseholder-indicator F501	Fuse in holder in B+ voltage line. Associated neon lamp glows when fuse blows.
7	OVENS 5A/115V-2.5A/230V fuseholder-indicator F502	Fuse in holder used in ovens voltage line. Associated neon lamp glows when fuse flows.
8	FIL 2A/115V-1A/230V fuseholder-indicator F502	Fuse in holder used in filament voltage line. Associated neon lamp glows when fuse is blown.

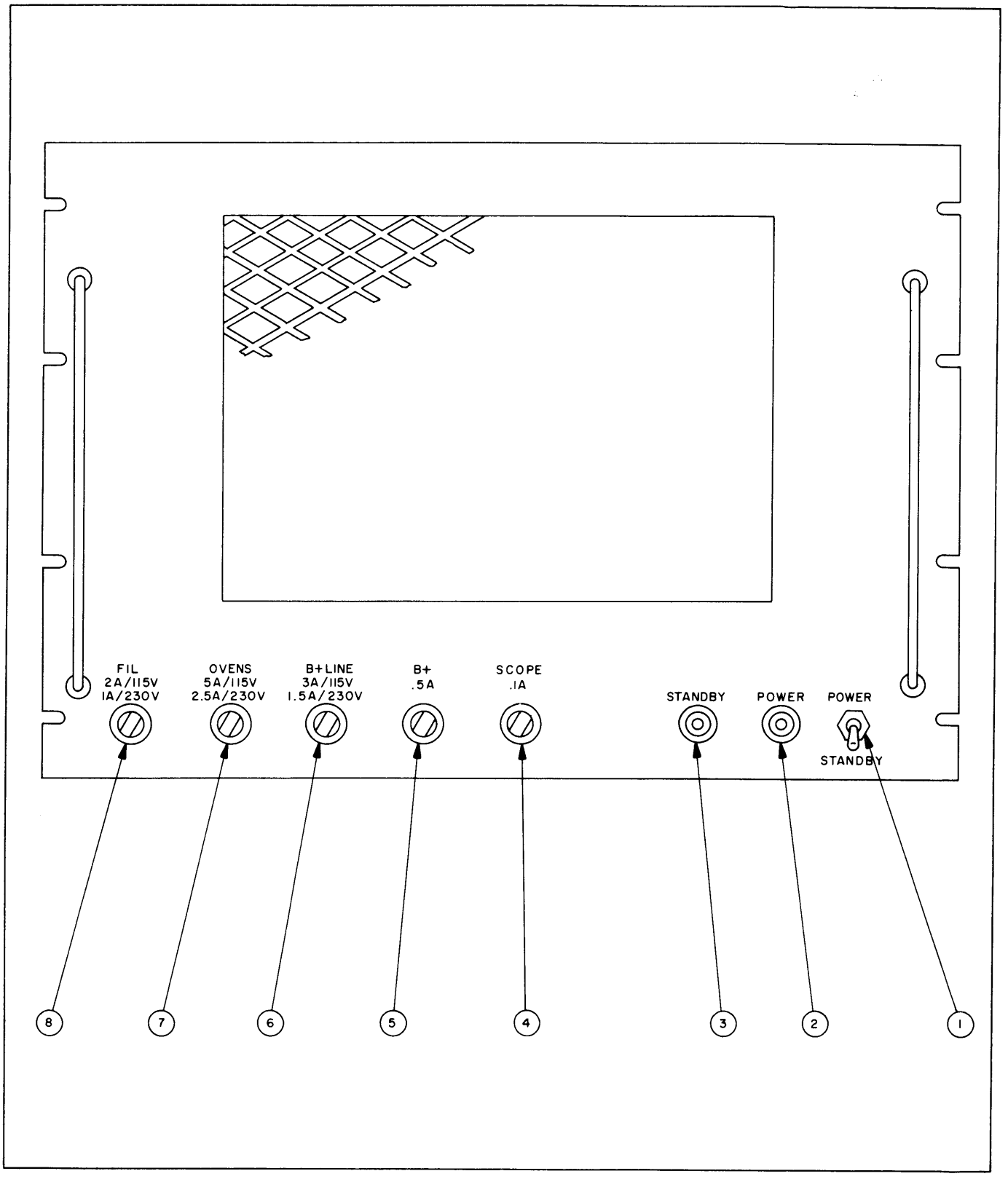


Figure 3-1. Front Panel Control and Indicators

SECTION 4
TROUBLESHOOTING

4-1. OVERALL FUNCTIONAL DESCRIPTION AND TROUBLESHOOTING OF UNIT.

a. FUNCTIONAL DESCRIPTION. (See figure 4-1.) The CPP-2 Power Supply produces regulated outputs of +160 vdc, -75 vdc, -6 vdc, 6.3 vac and unregulated outputs of -380 vdc, -400 vdc and 6.3 vac. In addition, it supplies line and oven voltages of 115- or 230 vac to the units connected to it. The regulated and unregulated output voltages are distributed to the CLL-1, CMO-1 and CHL-1 units. These outputs are controlled by the operation of STANDBY/POWER switch S501.

With the STANDBY/POWER switch S501 in the STANDBY position, a-c voltage is disconnected from power transformers T501 and T502. However, the a-c line voltage is supplied continuously to the CLL-1 and CMO-1 units where it is used to power the ovens. When STANDBY/POWER switch S501 is set to the POWER position, a-c line power is applied to power transformers T501 and T502. Transformer T501 applies 430 vac to the unregulated +380 and -400 vdc circuits. The +380 vdc circuit consists of full-wave rectifier tube V503, L501 and capacitor C504. The output, after rectification and filtering is +380 vdc, and is applied to thermal relay K501. When activated after 60-seconds, the thermal relay connects the +380 vdc as an input to the +160 vdc regulator circuit and to the CLL-1, CHL-1 and CMO-1 units.

The +160 vdc regulator circuit consists of series regulator tubes V501 and V502, and dc amplifier V504. The VOLT ADJ control R514 sets the output of the regulator to produce +160 vdc to the CLL-1, CHL-1 and CMO-1 units. The +160 vdc may be monitored at test jack J505.

The -400 vdc circuit is similar to the +380 vdc circuit in that it contains rectification and filtering components. These components, consisting of diodes CR501 and CR502, resistor R516, inductor L502 and capacitors C501 and C502 serve to rectify and filter the 430 vac input from power transformer T501. The resultant -400 vdc output is supplied to the CLL-1 unit and a regulator circuit consisting of tube V505 and resistor R510. This circuit produces a -75 vdc regulated output which is used as a reference voltage to the +160 vdc regulator circuit and as an operating voltage to the CLL-1 unit.

Filament output voltages to the external units are supplied by power transformers T501 and T502. Overload protection for the power supply is provided by fuses F501 through F505. In the event of an overload, the excessive current drain is greater than the current-carrying capacity of the fuse, and an associated blown fuse indicator will go on.

b. UNIT TROUBLESHOOTING. On the first indication of trouble, check all front panel fuseholders which light in the event of a blown fuse. Should the B+ fuse F505 blow continually, trouble exists in the power supply or an external unit. To isolate this trouble, proceed as follows:

CAUTION

To avoid damage to the oscillators in the CPO-1 units STANDBY/POWER switch S501 must be in STANDBY position when disconnecting and reconnecting the power connectors.

(1) Set STANDBY/POWER switch S501 to STANDBY.

(2) Disconnect all power connectors to the externally connected units.

(3) Replace the defective fuse.

(4) Set STANDBY/POWER switch to POWER.

(5) Observe for blown fuse indication. If fuse blows, trouble is in the power supply unit.

A loss of any of the operating voltages can be caused by an open power transformer winding, a defective tube, or a shorted electrolytic filter capacitor. A low level output in any of the operating voltages can result from a partial short in the secondary windings of transformers T501 and T502, weak tubes or diodes, or low a-c line power.

A loss or low output level from the +160 vdc regulator can be readily checked by testing tubes V501, V502, and V504. If the tubes are found to be operating normally, check the circuitry of the regulator. (Refer to paragraph 4-4.) Also, check the +380 vdc and -75 vdc circuits since the +160 vdc regulator utilizes the outputs of both circuits. Refer to paragraphs 4-3 and 4-5 for the +380 vdc and -75 vdc circuits, respectively.

The -400 vdc and -75 vdc circuits are functionally connected to one another. Therefore, a fault in one, will affect the other. (Refer to paragraph 4-3 for the B- circuitry.) With loss or low +6 vdc filament output voltage, immediately suspect transformer T502 or the +6 vdc filament circuit. (Refer to paragraphs 4-2 and 4-6.) For improper 6.3 vac filament voltages transformers T501 or T502 may be defective. (Refer to paragraphs 4-2 and 4-6.)

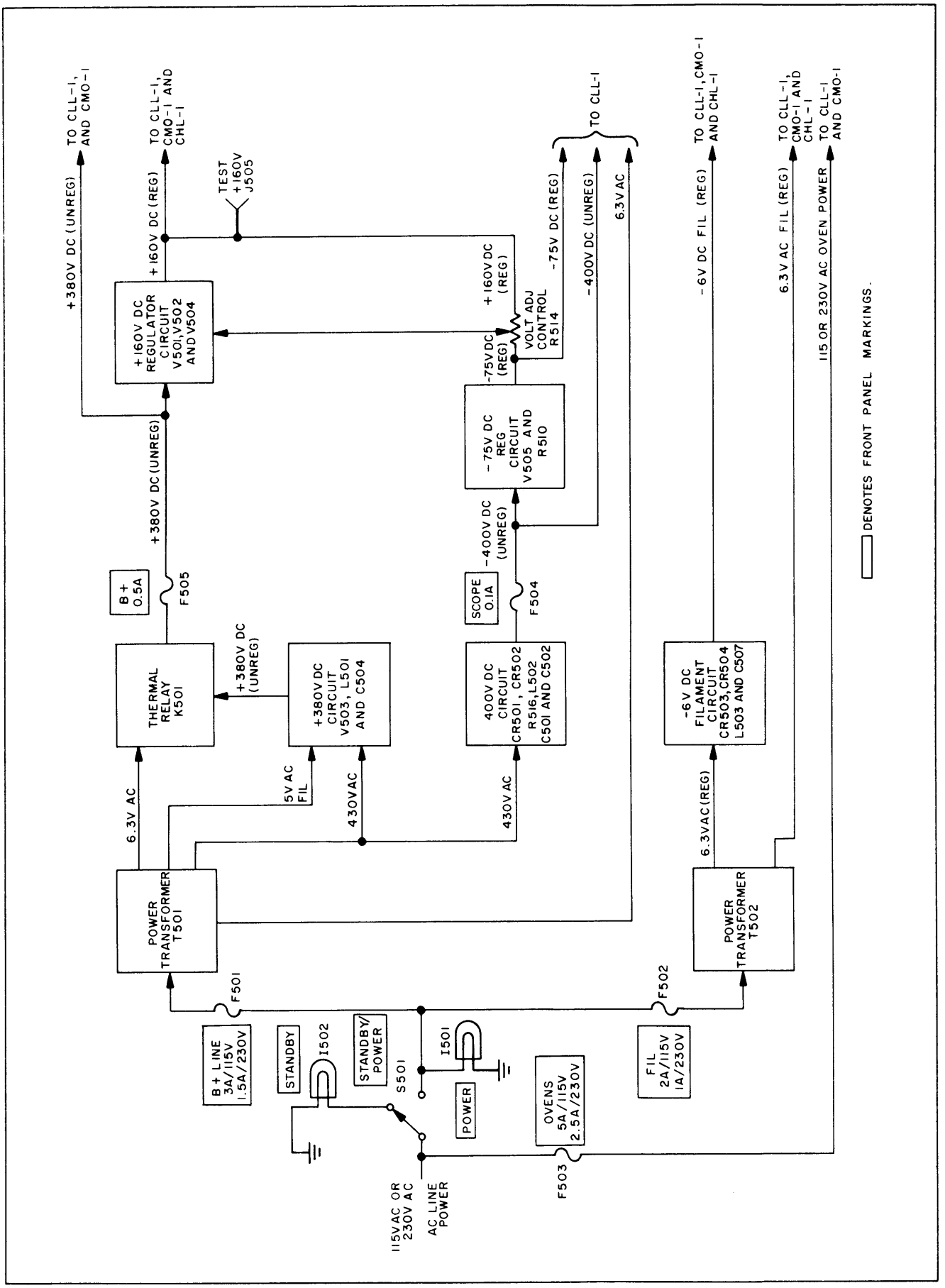


Figure 4-1. CPP-2 Power Supply, Functional Block Diagram

4-2. INPUT CIRCUITRY.

a. CIRCUIT ANALYSIS. (See figure 7-1.) The input circuits consists of STANDBY/POWER switch S501 with associated indicators, and power transformers T501 and T502, with associated fuses. Its function is to provide primary source power to transformers T501 and T502 and to the oscillator ovens in the CLL-1 and CMO-1 units.

With a-c line voltage connected to AC POWER jack J504 115 vac is applied simultaneously through OVEN fuse F503 to the oven circuits of the CLL-1 and CMO-1 units, and to the center-arm of STANDBY/POWER SWITCH S501. The OVEN fuse F503 protects the oven circuits in the event of an overload or a malfunction.

Setting STANDBY/POWER switch S501 to STANDBY causes the STANDBY indicator to go on and places the power supply unit in standby condition. This position of the switch is used to achieve oven temperature stability for the oscillators in the CLL-1 and CMO-1 units. In the POWER position, primary source power is applied to transformers T501 and T502 and POWER indicator I501 goes on.

Transformer T501 provides filament voltages to the tubes of the power supply and CLL-1 unit, and 430 volts a-c to the plates of rectifier tube V503 and B- diodes CR501 and CR502. It is protected by fuse B+ LINE fuse F501. Transformer T502 is connected in parallel with transformer T501 and is protected by fuse FIL fuse F502. It provides regulated +6 vdc and 6.3 vac filament power to the filament circuits of the power supply. (Refer to paragraph 4-6.)

b. TROUBLESHOOTING. The most probable cause of trouble in the power supply is a current overload resulting in a blown fuse. Therefore if an overload condition exists check B+ LINE fuse F501, FIL fuse F502 and OVEN fuse F503 for a blown fuse indication. Next, check the power transformer associated with the defective fuse for an open or shorted winding. Should OVEN fuse indicate a blown condition, trouble lies in the CLL-1 and CMO-1 oven circuits which are external to the power supply. If trouble is suspected of being in a functional circuit other than the input circuitry, refer to the appropriate paragraph dealing with that circuit.

4-3. +380 VDC CIRCUITRY.

a. CIRCUIT ANALYSIS. (See figure 7-1.) The input 115-vac source voltage stepped-up across power transformer T501 is applied to fullwave rectifier tube V503. The pulsating d-c output of the rectifier is applied to a choke input filter network consisting of coil L501, capacitor C504 and bleeder resistor R501. The filtered +380 vdc output is applied to contact 3 of time delay relay K501. This time delay relay operates approximately 60-seconds after primary power is applied, to insure that the filaments of tubes in the CPP-2 Power Supply attain operating temperature before B+ is applied to series regulator tubes V501 and V502. With the time delay relay activated, relay contacts 3 and 9 close, and a path is provided for the +380 vdc power to the plates of the series regulator tubes V501 and V502.

b. TROUBLESHOOTING. On the first indication of trouble, observe if the plates of rectifier tube V503 are glowing red. If so, immediately disconnect power to the unit since the excessive current drawn by the tube could burn out the secondary winding of transformer T501. When a short-circuit condition exists capacitor C504 or inductor L501 may be shorted to ground.

A loss of the +380 vdc output can be caused by an open in the contacts 3 and 9 of relay K501, inductor L501 and resistor R501, or by an open filament in rectifier tube V503. If the +380 vdc output level is low, check rectifier tube V503 as a source of trouble.

4-4. +160 VDC CIRCUITRY.

a. CIRCUIT ANALYSIS. (See figure 7-1.) The +160 vdc regulator circuit consists of series regulator tubes V501 and V502, d-c amplifier tube V504 and VOLT ADJ control R514. This circuit performs the function of supplying regulated power of +160 volts dc to the CCL-1, CMO-1 and CHL-1 units.

The filtered positive output of the +380 vdc circuit is applied to the plates of series regulator tubes V501 and V502 via closed contacts of time delay relay K501 and B+ fuse F505. The regulated positive 160 vdc output appears at the cathodes of the series regulators. The plate of d-c amplifier tube V504 is connected to the control grid of tubes V501 and V502 through resistors R503, R506 and R507 and R509. Thus, the plate voltage of dc amplifier tube V504 controls the grid bias of series regulator tubes V501 and V502. The plate voltage of d-c amplifier tube V504 is attained by adjusting VOLT ADJ control R514. This control is part of a voltage divider which includes resistors R513 and R515, connected between the +160 vdc and -75 vdc regulated outputs. The setting of control R514 determines the bias and the current flow through d-c amplifier V504 and thus the voltage drop across tube V504 plate load resistor R512.

When the +160 vdc output voltage varies, the bias on the control grid of tube V504 varies accordingly. The variations are inverted by dc amplifier tube V504 and affects the bias on series regulator tubes V501 and V502. When the bias of tubes V501 and V502 varies, the effective resistance of the series regulator tubes varies inversely as the output voltage varies, maintaining the output voltage constant.

Capacitor C505 couples a-c variations, noise or ripple in the +160 vdc output to the control grid of d-c amplifier tube V504. An out-of-phase ripple is applied to the control grids of series regulator tubes V501 and V504 through the d-c amplifier tube. Through the normal amplifier action of series regulator tubes V501 and V502, a cancellation ripple voltage is applied to the output line.

b. TROUBLESHOOTING. When troubleshooting the +160 vdc circuit, first check tubes and B+ fuse F505. Since the +160 vdc output is produced by the +380 vdc input, check the +380 vdc circuit in the event of a malfunction. (Refer to paragraph 4-3.) Also check the -75 vdc circuit since it provides a regulated -75 vdc to maintain the bias of d-c amplifier V504. With the VTVM connected to TEST 160 jack J505 check the +160 vdc output by adjusting VOLT ADJ control R514. The VTVM should indicate +160 vdc. Voltage and resistance measurements should be taken of tubes V501, V502 and V504. This method may localize the malfunction area. Carefully check such load resistors as R504, R505, R508, R518 and R512. Also, resistors R513, R514 and R515. Capacitor C505 should also be checked as a possible source of trouble since an open condition may cause excessive a-c ripple at the +160 vdc output.

4-5. B— CIRCUITRY.

a. CIRCUIT ANALYSIS. (See figure 7-1.) The B- circuitry generates the unregulated -400 and -75 vdc outputs. The -400 vdc circuit consists of B- rectifier diodes CR501 and CR502, and a pi-filter network composed of inductor L502 and capacitors C501 and C502. Voltages of 430 vac from power transformer T501 are applied across B- diodes rectifiers CR501 and CR502 which generate a negative-going pulsating d-c potential. This voltage is filtered across the pi-filter network and applied via fuse F504 as an input source voltage to the -75 vdc regulator circuit. In addition, it is supplied as an output to the CLL-1 unit via pin 5 of jack J501.

The -75 vdc regulator circuit consists of gas-filled regulator tube V505 and resistor R510. It functions to produce the regulated -75 vdc output to the CLL-1 unit via pin 4 of jack J501. The constant voltage drop across regulator tube V505 also serves to maintain the gain of d-c amplifier V504.

b. TROUBLESHOOTING. On the first indication of trouble check fuse SCOPE fuse F504 and regulator tube V505. Check if the +160 vdc output is present, since an open circuit in the primary or secondary (across pins 8 and 10) of transformer T501 results in no positive or negative output voltages. Check the -400 and -75 vdc outputs at jack J501 pins 5 and 4, respectively. Should filter components, resistors R516, or inductor L502 open, the -400 and -75 vdc voltages would not be present. With only resistor R510 open, the -75 vdc regulator circuit is disabled and the +160 vdc regulator output would read high. Should filter capacitors C501 or C502 short-circuit, current through diode rectifiers CR501 and CR502 will increase and may damage the diode rectifiers. However, with an open filter capacitor, the output voltage contains an excessive ripple and hum accompanied by a drop in the output voltage.

4-6. FILAMENT CIRCUITRY.

a. CIRCUIT ANALYSIS. (See figure 7-1.) Transformer T501 is used to generate unregulated filament voltage of 6.3 vac whereas, regulated filament voltages of 6.3 vac and +6 vdc are developed by transformer T502. The unregulated 6.3 vac filament output voltage, originating at pins 5 and 7 of transformer T501 is connected via pins 1 and 2 of jack J501, to the CLL-1 unit.

A-c line voltage is applied to the primary of transformer T502 through FIL fuse F502. Transformer T502 is a regulated type transformer and maintains a constant output within two percent with input variations between 95 and 130 vac. As a result, the secondary winding (pins 8 and 9 for 230 volt operation), develops a regulated 6.3 vac at 12 amperes. This output is applied to the CLL-1, CMO-1 and CHL-1 via pins 13 and 15 of jack J501, J502, and J503, respectively.

Diodes CR503 and CR504 are used in conjunction with a choke input filter consisting of inductor L503 and capacitor C507 to produce the regulated +6 vdc output. This output is used in the CMO, CHL-1 and CLL-1 units, via pins 1 of jacks J502, J503, and pin 9 of jack J501, respectively.

b. TROUBLESHOOTING. On the first indication of trouble check fuse or filament voltage suspected of being abnormal. Transformer T501 and T502 are protected by B+ LINE fuse F501 and FIL fuse F502, respectively. If an overload problem exists for transformer T502, check the +6 vdc regulator circuit for a short-circuited condition. Power transformer T502 could burn out due to excessive current in the secondary winding. This condition can be brought about by shorted diode rectifier CR503 or CR504 or capacitor C507. Excessive ripple in the +6 vdc line may be due to a partial short in the coil of inductor L503 or an open in capacitor C507.

If part of a secondary filament winding is short-circuited, it may result in a low output. If all the filament output voltages are low, check the a-c line input power.

4-7. VOLTAGE AND RESISTANCE MEASUREMENTS.

As an aid to troubleshooting, table 4-1 lists the voltage and resistance measurements in determining where a malfunction could occur.

TABLE 4-1. TYPICAL VOLTAGE AND RESISTANCE MEASUREMENTS

TUBE AND TYPE	TYPE OF MEASUREMENT	PIN NUMBER							
		1	2	3	4	5	6	7	8
V501 (6080)	DC	90	350	168	90	350	165	FIL	FIL
	OHMS	100K	15K	500	100K	15K	500	FIL	FIL
V502 (6080)	DC	90	350	168	90	350	165	FIL	FIL
	OHMS	100K	15K	500	100K	15K	500	FIL	FIL
V503 (5U4)	DC	NC	360	NC	475(AC)	NC	475(AC)	NC	360
	OHMS	NC	120K	NC	30	NC	30	NC	120K
V504 (6AH6)	DC	-3.6	0	FIL	FIL	88	162	0	FIL
	OHMS	4K	0	FIL	FIL	70K	50K	0	FIL
V505 (0C2)	DC	0	-72	NC	-72	0	NC	-72	NC
	OHMS	0	100K	NC	100K	0	NC	100K	NC

SECTION 5
MAINTENANCE

5-1. INTRODUCTION.

Maintenance may be divided into three categories: operators, preventive and corrective maintenance. The operators maintenance, normally the maintenance carried out by the operator as he works with the equipment, is in Section 3 of this manual. Preventive and corrective maintenance procedures are given in this section.

The CPP-2 Power Supply 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 troubleshooting techniques. If the trouble cannot be corrected by following the procedures in this section and Section 4, it is recommended that the CPP-2 Power Supply be returned to TMC for servicing.

5-2. PREVENTIVE MAINTENANCE.

a. GENERAL. In order to prevent failure of the power supply 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. At periodic intervals (at least every six months) the power supply should be removed from the rack for inspection and cleaning. Inspect wiring and all components for dirt, corrosion, charring, discoloring, or grease. Thorough cleaning is essential as dust, dirt, corrosion, rust, and moisture can seriously interfere with operation of the unit. Dirt, combined with moisture forms electrical leakage paths that lead to arc-over and eventual breakdown. A film of greasy dirt on electrical contacts produces high-resistance paths which impair operating efficiency. The power supply should be kept clean to minimize chances of breakdown.

WARNING

When using trichlorethylene, make sure that adequate ventilation exists; avoid prolonged contact with skin; and avoid use on painted surfaces, since it may remove the paint. Also, be absolutely sure that all electrical items are deenergized before attempting any cleaning procedure.

b. CLEANING OF AIR FILTER. To clean the air filter first remove top dust cover from unit. Then, remove air filter by lifting and sliding it up from guide tracks. Once removed, blow out dust from air filter with compressed air at approximately 5 psi. Then use a clean brush to remove any remaining dirt and dust.

5-3. CORRECTIVE MAINTENANCE.

a. GENERAL. Replacement of components and readjustments to the VOLT ADJ control R514 are included under the category of corrective maintenance. Replacement of components such as described herein, is confined to special considerations to be taken when replacing particular components.

b. REPLACEMENT OF COMPONENTS. Replacement of any of the components requires a readjustment of the VOLT ADJ control R514. (Refer to paragraph 5-5.) To check the a-c ripple content of the various output operating voltages, refer to paragraph 5-6. When replacing CR503 or CR504 (part number 1N2512), a long-nosed pliers or similar tool must be used to hold the lead wire being soldered in order to transfer heat away from the junction diode. See figures 5-1 and 5-2 for component location when replacing a defective part.

5-4. TEST EQUIPMENT REQUIRED.

The test equipment required to perform the corrective maintenance procedures in paragraphs 5-5 and 5-6, are given in table 5-1.

TABLE 5-1. TEST EQUIPMENT

ITEM	MODEL NO.
VTVM	Hewlett-Packard 410B or equivalent
A-c Voltmeter	Ballantine 314 or equivalent

5-5. READJUSTMENT OF VOLT ADJ CONTROL R514.

a. PURPOSE. The readjustment of VOLT ADJ control R514 is performed to insure the +160 vdc regulated output is within acceptable limits.

b. PROCEDURE. To adjust the VOLT ADJ control R514 after a defective component has been replaced, proceed as follows:

(1) Set STANDBY/POWER switch S501 to STANDBY and observe that STANDBY indicator I502 goes on.

(2) Connect the unit jack connectors to the CLL-1, CHL-1 and CMO-1 connector plugs.

(3) Connect a-c line cable to AC POWER jack J504.

(4) Set STANDBY/POWER switch S501 to POWER and observe that POWER indicator I501 goes on.

(5) Connect VTVM between TEST 160V jack J505 and ground.

(6) Adjust VOLT ADJ control R514 until VTVM reads +160 vdc.

5-6. AC RIPPLE TEST.

The ac ripple test is performed to check that the ripple component of output operating voltages are within acceptable limits. Using an a-c voltmeter measure the following voltages with respect to terminal 3 of jack J501.

TERMINAL	AC RIPPLE VOLTAGE (VOLTS AC)
4	0.01 to 0.01 (-75 vdc)
5	0.02 to 0.12 (-400 vdc)
8	0.1 to 1.0 (+380 vdc)
9	0.01 to 0.1 (-6 vdc)
16	0.001 to 0.01 (+160 vdc)

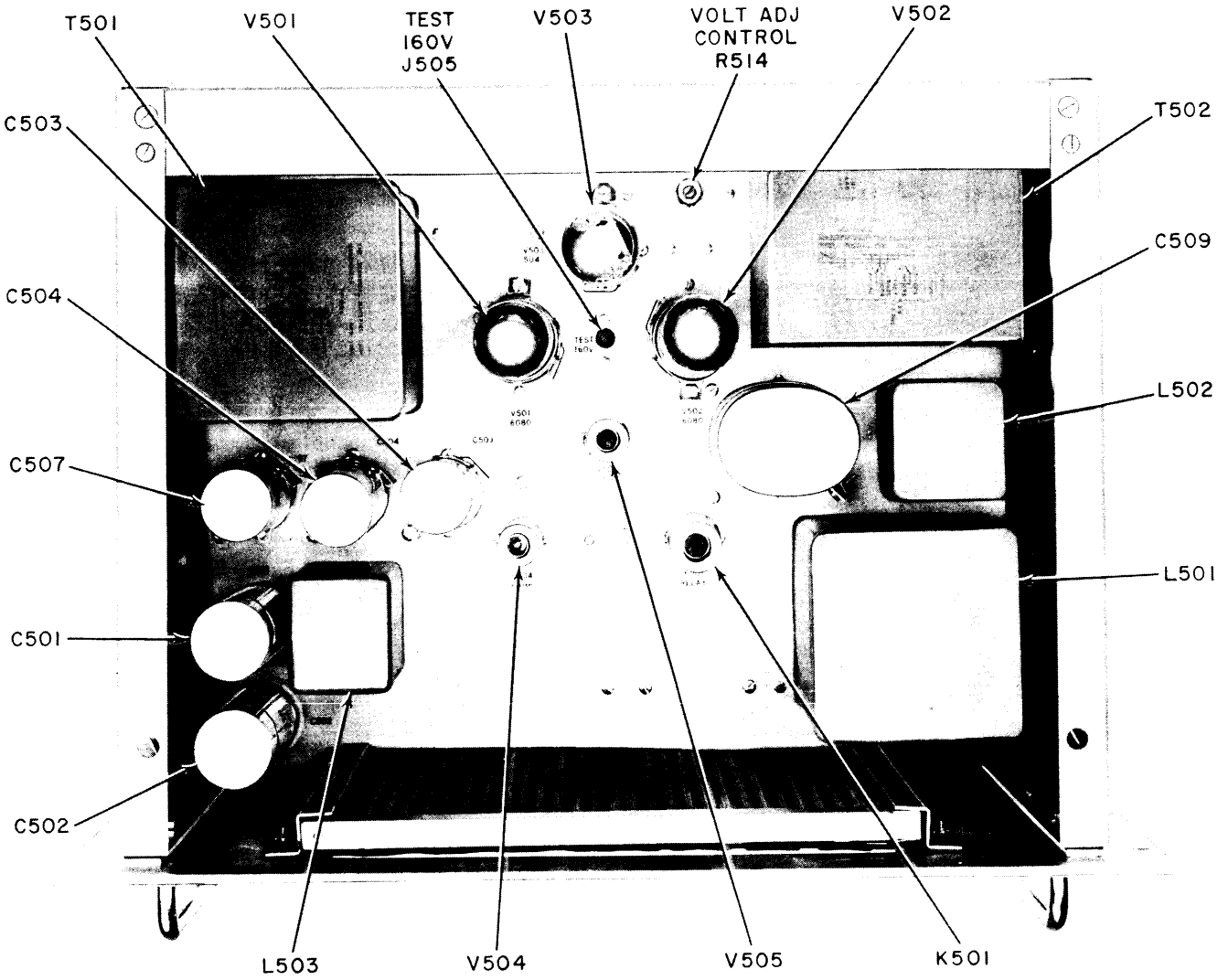


Figure 5-1. CPP-2 Power Supply, Top View

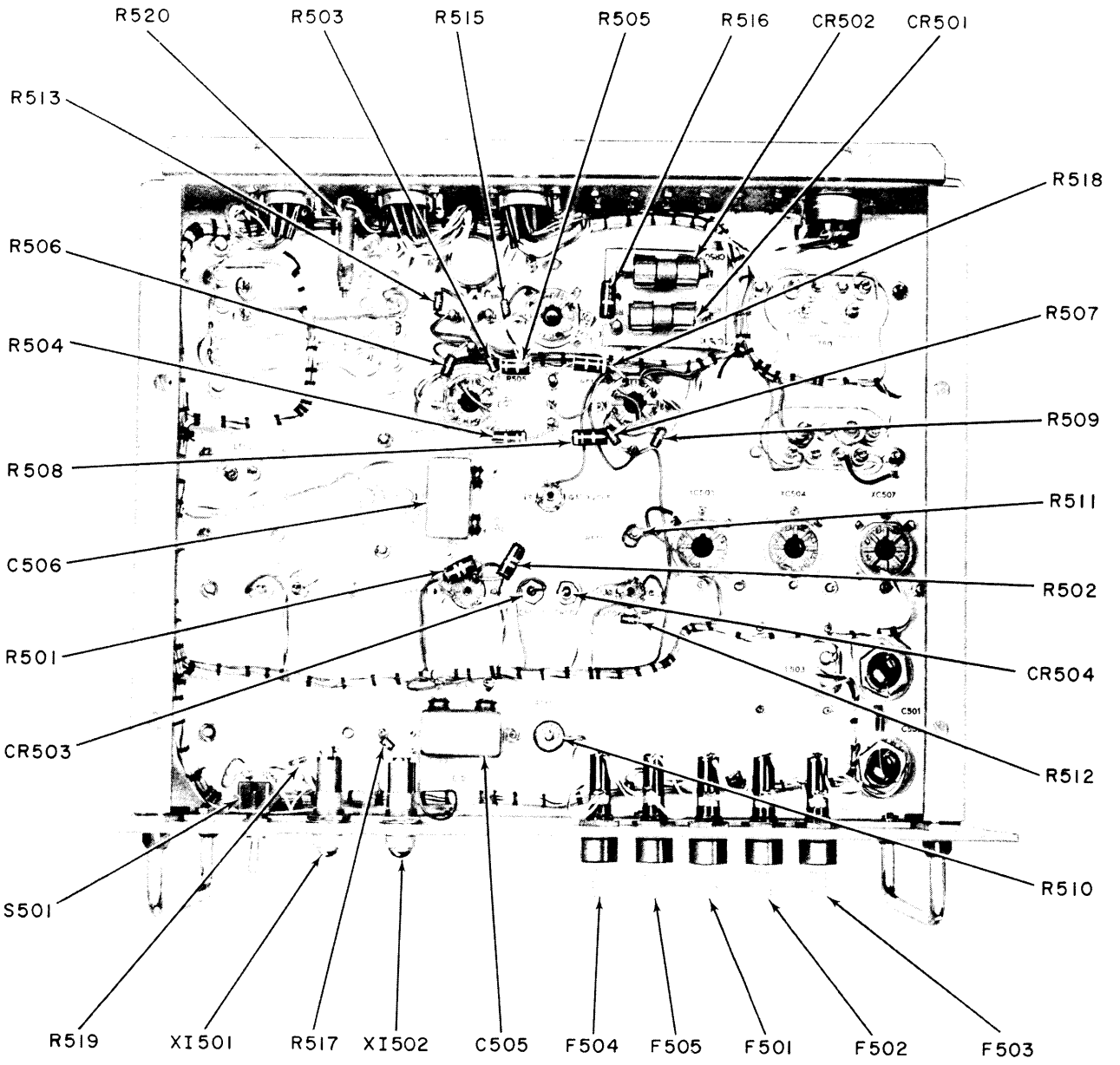


Figure 5-2. CPP-2 Power Supply, Bottom View

SECTION 6
PARTS LIST

6-1. 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 indicates how the part is used within a major component. Column 4 lists each Technical Materiel Corporation part number.

REF SYM	DESCRIPTION	FUNCTION	TMC PART NO.
C501	CAPACITOR, fixed: paper; 4 mfd, ±10%, char. F; 600 wvdc; oil filled and impregnated, hermetically sealed cylindrical metal case.	Filter	CP41B1FF405K
C502	Same as C501	Same as C501	
C503	CAPACITOR, fixed: dry electrolytic, polarized, 80 mfd; 450 wvdc.	Filter	CE51F800R
C504	Same as C503	Same as C503	
C505	CAPACITOR, fixed: paper; .5 mfd, ±10%, char. E; 600 wvdc; oil filled and impregnated, hermitically sealed bathtub case.	Coupling	CP53B1EF504K
C506	CAPACITOR, fixed: paper; .1 mfd, ±10%, char. E; 600 wvdc; oil filled and impregnated, hermetically sealed bathtub metal case.	DC Blocking	CP53B1EF104K
C507	CAPACITOR, fixed: dry electrolytic; polarized, 1,500 mfd, 15 wvdc.	Filter	CE51C152F
C509	CAPACITOR, fixed: oil filled; 3 mfd; 660 wvdc.	Rf Bypass	CP-109
CR501	RECTIFIER, selenium cartridge: 30 cells in series; 1440 volts peak inverse.	B- Rectifier	RX-107-1
CR502	Same as CR501	B+ Rectifier	
CR503	RECTIFIER, silicon diffused; junction type; peak inverse voltage 100 volts at 1.5 amps; hermetically sealed.	Filament	IN2512
CR504	Same as CR503	Same as CR503	
F501	FUSE, cartridge: time-lag; 3 amps.	Main Power	FU-102-3
F502	FUSE, cartridge: time-lag; 2 amp.	Filament Power	FU-102-2

PARTS LIST (CONT)

REF SYM	DESCRIPTION	FUNCTION	TMC PART NO.
F503	FUSE, cartridge: time-lag; 5 amps.	Oven	FU-102-5
F504	FUSE, cartridge: time-lag; 1/10 amp.	Volt. Regulator	FU-102-.1
F505	FUSE, cartridge: time-lag; 1/2 amp.	B+	FU-102-.5
I501	LAMP, neon: miniature; 110 volts, 1/25 watt; T-3-1/4 clear bulb; bayonet base.	POWER Indicator	BI-100-51H
I502	Same as I501	STANDBY Indicator	
J501	CONNECTOR, receptacle: female, 16 contacts, shell-aluminum alloy, contacts - brass, silver plated; mates with PL-187.	Power Output, CLL	JJ-184
J502	Same as J501	Power Output, CMO	
J503	Same as J501	Power Output, CHL	
J504	RECEPTACLE, plug: twist lock type; male.	Power Input	JJ-175
J505	JACK, receptacle: red body; silver plated contacts.	Test Point	JJ-114-2
K501	RELAY, thermal: delay; 60 second; ±12 sec. 115 V, 2 amps, 200 V, 1 amp; SPST; normally open voltage breakdown contact 1000 V, heater to contact 1500 V; heater wattage 2.5 W; heater voltage 6.3 V; miniature 9 pin.	Time Delay	RL-111-6N060T
L501	REACTOR, 7 hy: 350 ma DC; resistance 55 ohms, insulated test at 2000 V.	Filter Choke, V503	TF-5013
L502	REACTOR, filter: 50 hy; DC resistance approximately 800 ohms; 30 ma DC; insulated for 1500 V.	Filter Choke, V505	TF-166
L503	CHOKE, reactor: .03 hy; 1.2 amps DC, approx. .4 ohms DC resistance, insulated test 1000 volts.	Filter Choke, T502	TF-221
P501	CONNECTOR, plug: twist lock; female, (polarized) midget size, black bakelite.	Power Plug	PL-176
P502	CONNECTOR, plug: male; AC two prong.	Power Connector	PL-171
R501	RESISTOR, fixed: composition; 100,000 ohms, ±10%, 2 watts.	Voltage Dropping	RC42GF104K
R502	Same as R501	Voltage Dropping	
R503	RESISTOR, fixed: composition; 1000 ohms, ±10%, 1/2 watt.	Grid, V502	RC20GF102K
R504	RESISTOR, fixed: composition; 47 ohms, ±10%, 2 watts.	Cathode, V502	RC42GF470K
R505	Same as R504	Same as R504	
R506	Same as R503	Grid, V502	

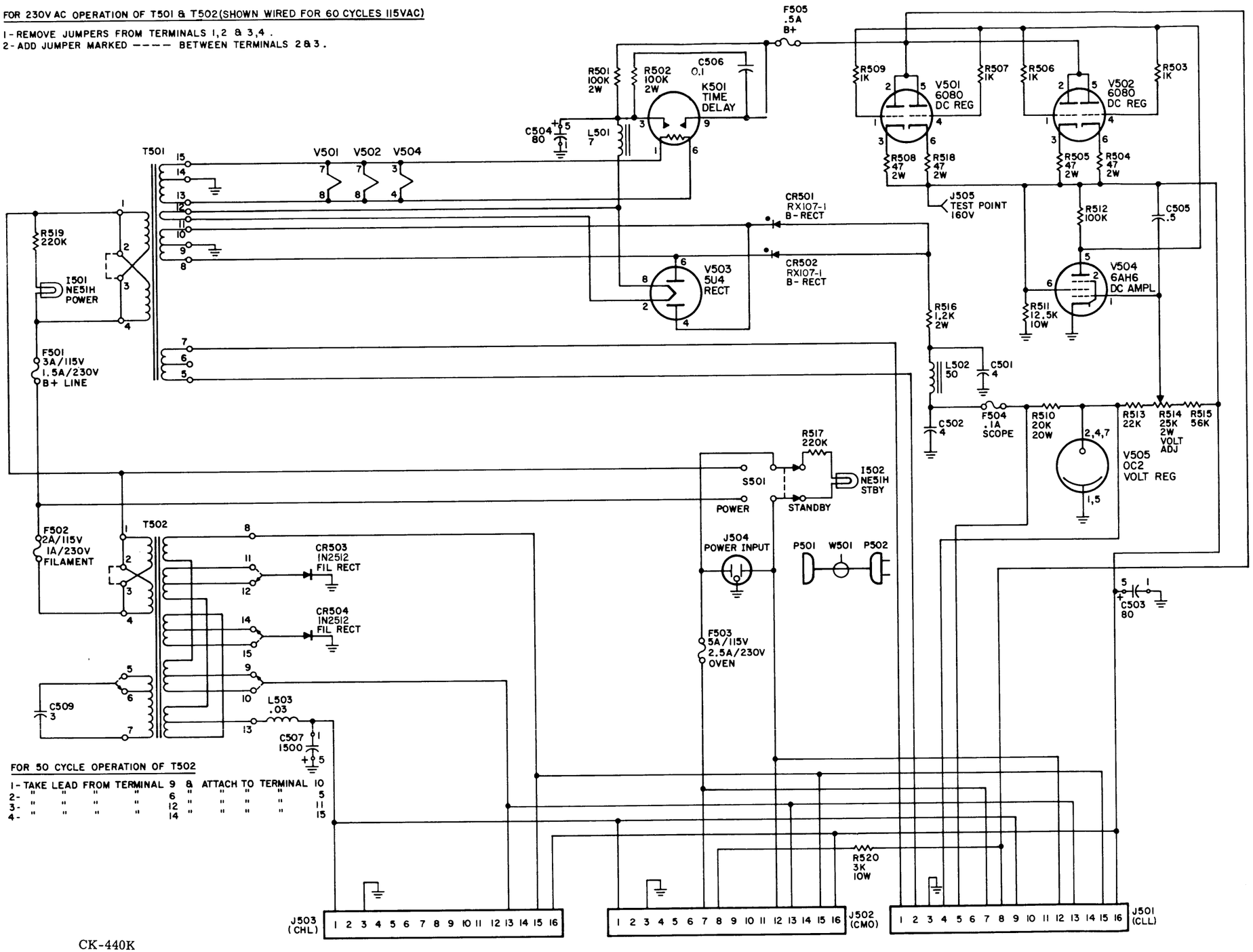
PARTS LIST (CONT)

REF SYM	DESCRIPTION	FUNCTION	TMC PART NO.
R507	Same as R503	Grid, V501	
R508	Same as R504	Cathode, V501	
R509	Same as R503	Same as R507	
R510	RESISTOR, fixed: wire wound; 20,000 ohms, ±5%, 20 watts.	Plate Load, V505	RW-110-44
R511	RESISTOR, fixed: wire wound; 12,500 ohms, ±5%, 10 watts.	Screen, V504	RW-109-35
R512	RESISTOR, fixed: composition; 100,000 ohms, ±10%, 1/2 watt.	Plate Load, V504	RC20GF104K
R513	RESISTOR, fixed: composition; 22,000 ohms, ±10%, 1/2 watt.	Voltage Divider	RC20GF223K
R514	RESISTOR, variable: composition; 25,000 ohms, ±20%, 2 watts.	Same as R513	RV4ATXA253B
R515	RESISTOR, fixed: composition; 56,000 ohms, ±10%, 1/2 watt.	Same as R513	RC20GF563K
R516	RESISTOR, fixed: composition; 1200 ohms, ±10%, 2 watts.	Voltage Dropping	RC42GF122K
R517	RESISTOR, fixed: composition; 220,000 ohms, ±10%, 1/2 watt.	Same as R516	RC20GF224K
R518	Same as R504	Cathode, V501	
R519	Same as R517	Same as R516	
R520	RESISTOR, fixed: wire wound; 3000 ohms, ±5%, 10 watts.	Same as R516	RW-109-30
S501	SWITCH, toggle: dpdt; 3 amps; 250 V.	POWER/ STANDBY switch	ST-22N
T501	TRANSFORMER, power: 115 vac at 50/60 cps; single phase, electrostatically shielded, hermetically sealed.	Main Power	TF-5014
T502	TRANSFORMER, power: step-down; primary, 115/230 vac, 50/60 cps; secondary #1, 6.3 vac at 12 amps; secondary #2, 6.3 vac.	Regulator	TF-223
V501	TUBE, electron, DC regulator.	DC Regulator	6080
V502	Same as V501	Same as V501	
V503	TUBE, electron: full-wave rectifier; octal base.	Rectifier	5U4
V504	TUBE, electron: sharp cutoff R.F. pentode; 7 pin miniature.	DC Amplifier	6AH6
V505	TUBE, electron: voltage regulator.	Voltage Regulator	0C2

PARTS LIST (CONT)

REF SYM	DESCRIPTION	FUNCTION	TMC PART NO.
W501	CABLE ASSEMBLY, power: AC; coiled length 12".	Power Cable	CA-555-1
XC503	SOCKET, electron tube: octal; high crown.	Socket C503	TS101P01/A
XC504	Same as XC503	Socket C504	
XC507	Same as XC503	Socket C507	
XF501	FUSE HOLDER, bayonet base: 100/250 volts, neon lamp, clear knob, black plastic body.	Holder F501	FH-104-3
XF502	Same as XF501	Holder F502	
XF503	Same as XF501	Holder F503	
XF504	Same as XF501	Holder F504	
XF505	Same as XF501	Holder F505	
XI501	LIGHT, indicator: with red frosted lens; for miniature bayonet base, T-3-1/4 bulb.	Holder I501	TS-106-1
XI502	LIGHT, indicator: with clear white lens; for miniature bayonet base, T-3-1/4 bulb.	Holder I502	TS-106-2
XK501	SOCKET, electron tube: 9 pin miniature.	Socket K501	TS103P01
XV501	Same as XC503	Socket V501	
XV502	Same as XC503	Socket V502	
XV503	Same as XC503	Socket V503	
XV504	SOCKET, electron tube: 7 pin miniature.	Socket V504	TS102P01
XV505	Same as XV504	Socket V505	

SECTION 7
SCHEMATIC DIAGRAMS



UNLESS OTHERWISE SPECIFIED

ALL CAPACITORS ARE IN MICROFARADS.
ALL COILS ARE IN HENRIES.
ALL RESISTORS ARE 1/2 WATT.

CK-440K

Figure 7-1. CPP-2 Power Supply, Schematic Diagram