

POWER SUPPLY

MODEL XP-800

TWO AC VARIABLE VOLTAGES; 0-120V and 0-40V @ 7A,
PLUS 0-28VDC @ UP TO 10A



Instruction Manual

Elenco Electronics, Inc.

INTRODUCTION

The XP-800 contains three output voltages: 0 to 28VDC, 0 to 40VAC and 0 to 120VAC. The maximum current from the 28VAC supply is 10 amps. At 10 amp load current, the maximum attainable voltage is 20VDC. The maximum current from the 40VAC supply is 7 amps. At 5 amp load current, the maximum voltage attainable is 38VAC. The maximum current from the 120VAC supply is 2 amps. A 10 amp circuit breaker on the back panel protects the 28VDC supply. A 3 amp circuit breaker on the back panel protects the 120VAC supply. This circuit breaker also protects the 40VAC supply by limiting the current to the power transformer. In addition, the XP-800 contains a 5 amp fuse on the AC input. This fuse is located on the back panel.

All three supplies are controlled by the Voltage Adjust knob on the front panel. The unit contains two digital meters to simultaneously display the voltage and current of any supply. Which supply is displayed is controlled by a knob on the front panel. This knob selects only which output is displayed. All three supply voltages are present at all times.

SAFETY PRECAUTIONS

CAUTION: When removing cover, always disconnect the power cord from the AC socket. Service repair should be done by qualified personnel who are knowledgeable of electrical hazards.

Certain safety precautions must be observed when this power supply is used with external circuits that are connected to AC power lines. There is always some danger when working with electrical equipment or circuits that operate at hazardous voltages. You should thoroughly familiarize yourself with the equipment before working on it. High voltages may appear at unexpected points in defective equipment.

The XP-800 is equipped with a three wire line cord which grounds the chassis to the power line ground. **DO NOT CUT OFF OR DISABLE THE GROUND PLUG.**

The 28VDC and 40VAC circuits are isolated from the AC input via the power transformer. When working with other equipment, this may not be the case. Always be familiar with the equipment rating. Keep in mind that defective equipment can have dangerous voltages at unexpected places.

SPECIFICATIONS

Input

Input Voltage 120VAC
Current Protection 5 Amp fuse

28VDC Supply

Output Current 10 Amps max.
Output Voltage 28VDC max. for light loads
 20VDC max. for 10 Amp load
Ripple Less than .2 Volts RMS at 10 Amp load
Current Protection 10 Amp Circuit Breaker
Meter 0 to 28VDC, .1 Volt resolution
 0 to 10 Amps, .1 Amp resolution

40VAC Supply

Output Current 7 Amps max.
Output Voltage 40VAC max. for light loads
 38VAC max. for 5 Amp load
Current Protection 3 Amp Circuit Breaker
 (on transformer primary)
Meter 0 to 40VAC, .1 Volt resolution
 0 to 7 Amps, .1 Amp resolution

120VAC Supply

Output Current 2 Amps max.
Output Voltage 120VAC max.
Current Protection 3 Amp Circuit Breaker
Meter 0 to 120VAC, 1 Volt resolution
 0 to 2 Amps, .1 Amp resolution

OPERATING INSTRUCTIONS

WARNING

The 28VDC output is filtered with a very large capacitor. If the DC supply is unloaded or lightly loaded, the capacitor will maintain the voltage on the output terminals even after the voltage adjust knob is turned to zero. Before connecting any equipment, this voltage should be checked. If any voltage is present, the capacitor should be discharged by connecting a resistor across the output terminals. Use a 10 ohm (or greater) 5 watt (or greater) resistor.

Connect the power supply as follows:

1. Check the voltage rating of the equipment to be powered. Care must be taken not to exceed this rating.
2. Plug the line cord into a 120V 60Hz outlet.
3. With the power supply turned off, connect the load to the desired voltage output.
 - a. **28VDC Supply** - Connect the positive lead of your equipment to the red terminal on the front panel and the negative lead to the black terminal.
 - b. **40VAC Supply** - Connect your equipment leads to the yellow terminals on the front panel.
 - c. **120VAC Supply** - Plug your equipment into the 3 wire power outlet located on the back panel.

The 120 Volt Supply is connected to the AC input and grounded to the chassis. The 40VAC and 28VDC are isolated from the AC input by the power transformer. Since the 28VDC and 40VAC supplies use the same power transformer, they must not be connected to each other. **WARNING - ANY SHORT BETWEEN EITHER TERMINAL OF THE 28VDC SUPPLY AND EITHER TERMINAL OF THE 40VAC SUPPLY MAY RESULT IN DAMAGE TO THE POWER SUPPLY.** If properly isolated, the different outputs may be used at the same time. However, care must be taken that the total current does not exceed the circuit breaker ratings.

4. Set the meter switch to the supply to be monitored.
5. Turn the voltage adjust knob to zero (fully counterclockwise) and turn the power on.
6. Turn the voltage adjust knob clockwise to set the desired voltage. The numbers on the voltage adjust dial represent percent of maximum voltage, not actual voltage.

If the power supply is overloaded, either the 3 amp or 10 amp circuit breaker may trip. When this happens, the button in the center of the breaker will pop out. To reset the breaker, push the button back in. Both are thermal circuit breakers so you may have to wait a while for the breaker to cool before it will reset. If the output voltage does not return after the power supply has cooled, check the 5 amp fuse located on the back panel.

CIRCUIT DESCRIPTION

As shown in Figure 1, the basic circuits of the XP-800 Power Supply are 1) the power source, 2) the power transformer, 3) the bridge rectifier and 4) the meter circuits. Each of these circuits will be discussed below.

POWER SOURCE

The power source consists of the variable transformer T1. This transformer is fed by the input AC line. The output of the transformer may be varied from zero to the full 120VAC input. The output of the transformer is fed through circuit breaker CB1 to the power outlet plug J2. To sense the current, the shunt resistor R19 is placed in series with the power outlet.

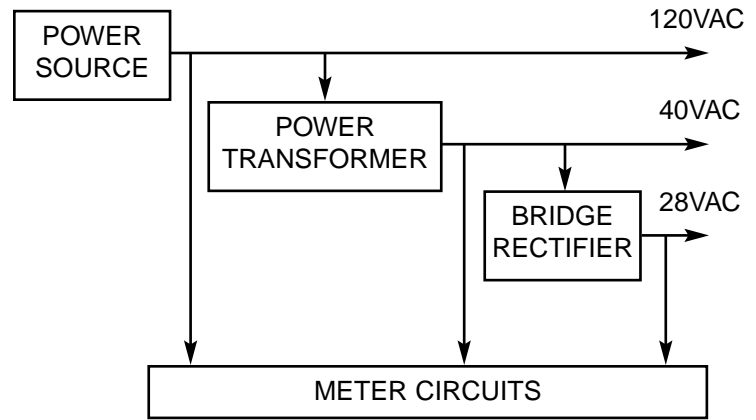


Figure 1

POWER TRANSFORMER

The power transformer T2 is a center tapped 3 to 1 step down transformer which steps the 0-120VAC from the variable transformer down to 0-40VAC. This output is fed to the bridge rectifier BR1 and, through shunt resistors R23 through R26, to the 0-40VAC output terminals. The power transformer also serves to isolate the 40VAC and 28VDC from the AC input.

BRIDGE RECTIFIER

The bridge rectifier BR1 serves as a full wave rectifier to convert the center tapped 0-40VAC to 0-28VDC. Capacitor C6 filters the bridge output and reduces the ripple, at 10 amps, to approximately .2V RMS. This output is fed through circuit breaker CB2 to the 0-28VDC output terminals. Shunt resistors R20-R22 sense the current in the ground circuit of the DC supply.

METER CIRCUITS

As shown in Figure 2, the meter circuits consist of 1) the scalers, 2) the meter switch, 3) the AC - DC converter, 4) the meter assembly and 5) the meter power supply.

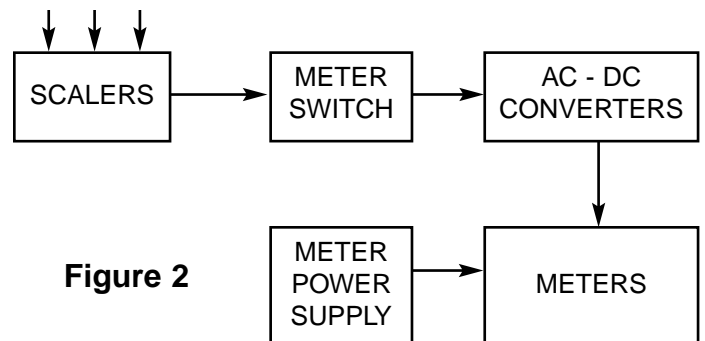


Figure 2

SCALERS - There are two sets of scalers, one for voltage and one for current. The voltage scalers divide the various output voltages down to voltages suitable for input to the voltmeter. Resistors R8 and R7 divide the 28VDC output down to approximately 540mV. Similarly R4 and R5 divide the 40VAC output and R1 and R2 divide the 120VAC output. Resistors R2 and R5 are variable resistors to allow calibration of the meter. The current scalers divide the voltage across the shunt resistors down to voltages suitable for input to the ammeter. For the 28VDC supply, resistors R9 and R18 divide the voltage across shunt resistors R20 - R22. Similarly, R6 divides the voltage across shunt resistors R23 - R26 for the 40VAC supply and R3 divides the voltage across shunt resistor R19 for the 120VAC supply.

METER SWITCH - The meter switch selects which supply is monitored by the voltmeter and ammeter. Switch sections A, B and C select the proper current scaler, ground, and voltage scaler to feed to the AC - DC converter. Switch section D selects the proper decimal point for the voltmeter.

AC - DC CONVERTER - There are two AC - DC converters, one for the voltmeter and one for the ammeter. The voltmeter converter consists of 1/2 of a 358 op-amp U1A configured as a unity gain amplifier. Since the amplifier is biased at ground, only the positive portion of the AC signal from the 40VAC and 120VAC voltage scalers is passed through the amplifier. The output is then attenuated 20:1 by resistors R12 and R28, filtered by the low pass filter R13 and C4 and fed to the voltmeter. The DC signal from the 28VDC voltage scaler passes through the amplifier unchanged. The ammeter converter, U1B, performs the same function as the voltmeter converter. Since the output of the 28VDC current scaler is negative, U1B is configured for a gain of -1. The output is attenuated 52:1 by resistors R16 and R27.

METERS - Meter operation centers around the 7107 integrated circuit (IC). This chip contains a dual slope A/D (analog to digital) converter, display latches, seven segment decoder, and display drivers.

The input of the 7107 IC is fed to an A/D converter. Here the DC voltage is changed to a digital format. The resulting signals are processed in the decoders to light the appropriate LED segments.

Timing for the overall operation of the A/D converter is derived from a 40kHz external oscillator. The IC divides this frequency by four and the resulting clock pulses are used to drive its decade counters. It is then further divided to form three convert-cycle phases. The final readout is clocked at about 2.5 readings per second.

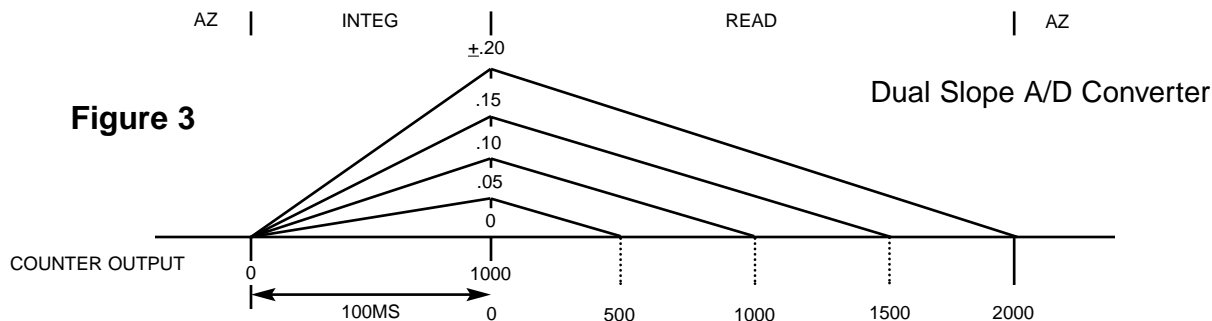
The digitized data is presented to the display as four decoded digits (seven segments) plus polarity. The decimal point position on the display is determined by the selector switch setting.

A/D Converter - Any given measurement cycle performed by the A/D converter can be divided into three consecutive time periods, autozero (AZ), the integrate (INTEG) and read. A counter determines the length of the time periods. The integrate period is fixed at 1,000 clock pulses. The read period is a variable time that is proportional to the unknown input voltage. It can vary from zero counts for zero input voltage to 2,000 counts for a full scale input voltage. The autozero period varies from 1,000 to 3,000 counts. For an input voltage less than full scale, autozero gets the unused portion of the read period.

During the autozero cycle, the accumulated off set voltage errors in the converter are measured and stored as a voltage on the external autozero capacitor. This voltage is used to correct for the offset voltage errors during the read cycle.

During the INTEG cycle, the INTEG capacitor is charged up for 1,000 clock pulses (100ms.), see Figure 3. The charging rate is determined by the unknown input voltage. At the end of the integrate cycle, the voltage on the capacitor is proportional to the unknown input voltage.

During the read cycle, the INTEG capacitor is discharged at a constant rate. The time required for the discharge



is therefore proportional to the unknown input voltage. This time is converted to a digital format by counting the number of clock pulses that occur during the discharge.

METER POWER SUPPLY - The digital meters require +5VDC. This is supplied by the meter power supply consisting of a 7805 regulator IC U2, a step down transformer T3, a diode bridge D4-D7, and filter capacitors C1-C3.

MAINTENANCE AND CALIBRATION

The XP-800 has been designed and manufactured to require no routine maintenance. The following information is provided in the event the digital meters require calibration.

CALIBRATION PROCEDURE

Remove the chassis cover. Note the two pots on the meters almost immediately behind the words VOLTS and AMPS on the front panel. These are the voltage GAIN pot and the ammeter GAIN pots referred to below. Before calibrating, set the voltage adjust knob on the front panel to zero and discharge the 28VDC filter capacitor by placing a 10 ohm (or greater) 5 watt (or greater) resistor across the output terminals.

28VDC - VOLTAGE

1. Connect an accurate digital voltmeter to the output terminals and set the voltage adjust knob on the front panel for 20.0 volts on this meter.
2. Adjust the voltage GAIN pot for 20.0 volts on the XP-800 voltmeter.

28VDC - CURRENT

1. Connect an accurate digital ammeter and a suitable load to the output terminals. Set the load to draw 8.0 amps on this meter.
2. Adjust the ammeter GAIN pot to read 8.0 amps on the XP-800 ammeter.

40VAC - VOLTAGE

1. Connect an accurate digital voltmeter to the output terminals and set the voltage adjust knob on the front panel for 30.0 volts on this meter.
2. Adjust R5 (see Figure 4) on the XP-800 PC board for 30.0 volts on the XP-800 voltmeter.

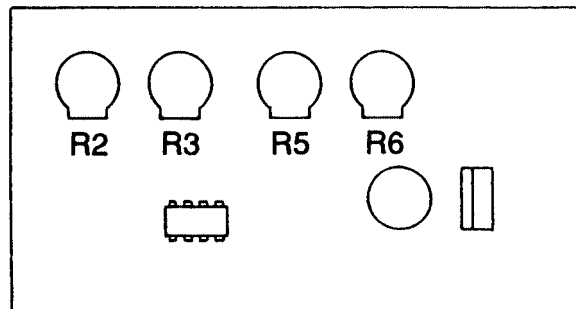


Figure 4

40VAC - CURRENT

1. Connect an accurate digital ammeter and a suitable load to the output terminals. Set the load to draw 5.0 amps on this meter.
2. Adjust R6 on the XP-800 PC board to read 5.0 amps on the XP-800 ammeter.

120VAC - VOLTAGE

1. Connect an accurate digital voltmeter to the output terminals and set the voltage adjust knob on the front panel for 100 volts on this meter.
2. Adjust R2 on the XP-800 PC board for 100 volts on the XP-800 voltmeter.

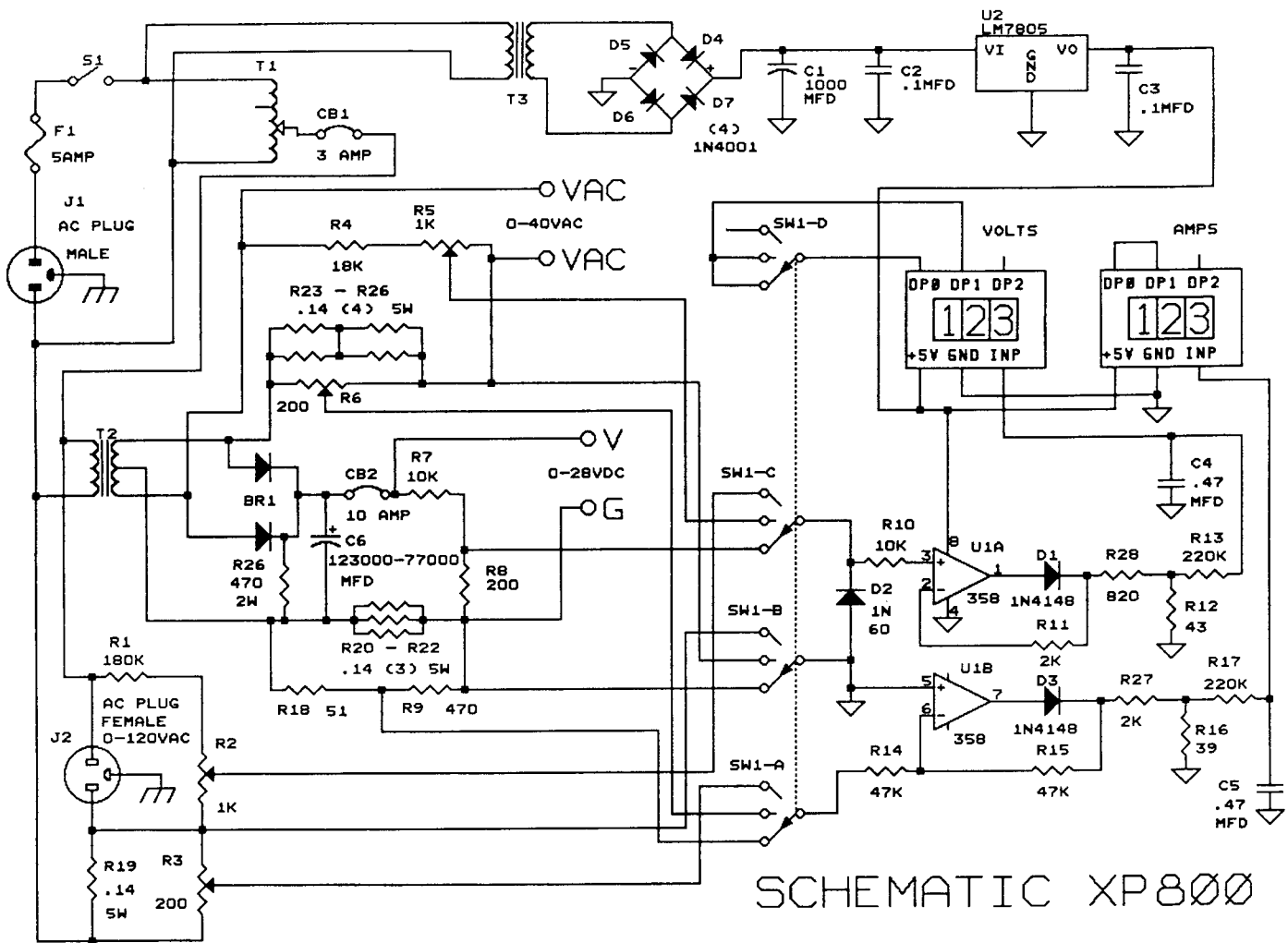
120VAC - CURRENT

1. Connect an accurate digital ammeter and a suitable to the output terminals. Set the load to draw 1.5 amps on this meter.
2. Adjust R3 on the XP-800 PC board to read 1.5 amps on the XP-800 ammeter.

PARTS LIST

Qty.	Description	Part #	Qty.	Description	Part #
	Resistors			Miscellaneous	
□ 8	.14Ω 5% 5W	101405	□ 1	Bracket	613522
□ 1	39Ω 5% 1/4W	123900	□ 1	Heat Sink Clip On	615005
□ 1	43Ω 5% 1/4W	124300	□ 2	Knob Rheostat	622080
□ 1	51Ω 5% 1/4W	125100	□ 1	Bushing Strain 3 wire	624003
□ 1	200Ω 5% 1/4W	132000	□ 3	PC Standoff	625002
□ 1	470Ω 5% 1/4W	134700	□ 1	Binding Post Black	625031
□ 1	470Ω 5% 2W	134703	□ 4	Lockwasher	625031LW
□ 1	820Ω 5% 1/4W	138200	□ 4	Hex Nut	625031HN
□ 2	2kΩ 5% 1/4W	142000	□ 1	Binding Post Red	625032
□ 2	10kΩ 5% 1/4W	151000	□ 2	Binding Post Yellow	625034
□ 1	18kΩ 5% 1/4W	151800	□ 1	Power Outlet 3 Wire	627003
□ 2	47kΩ 5% 1/4W	154700	□ 4	Screw 10-32 x 3/8"	641158
□ 1	180kΩ 5% 1/4W	161800	□ 1	Screw 4-40 x 3/4" Phil	641482
□ 2	220kΩ 5% 1/4W	162200	□ 9	Screw 6-32 x 5/16"	641640
□ 2	Pot 200Ω	191320	□ 2	Screw 10-32 x 3/8"	641855
□ 2	Pot 1kΩ	191410	□ 12	Screw #6 x 3/8" Phil	642652
	Capacitors		□ 1	Nut 9mm	644102
□ 2	.1μF	251010	□ 4	Nut M3 x .5mm	644104
□ 2	.47μF	254717	□ 1	Pal Nut (circuit breaker)	644105
□ 1	Lytic 1000μF	291045	□ 1	Knurl Nut (circuit breaker)	644107
□ 1	Lytic 77000/123000μF	298000	□ 1	Nut 4-40 Hex	644400
	Semiconductors		□ 9	Nut 6-32 Hex	644600
□ 1	Bridge Rect.	310135	□ 4	Nut 10-32 Hex	644810
□ 1	Diode 1N60	311065	□ 1	Flatwasher #4	645000
□ 4	Diode 1N4001	314001	□ 4	Flatwasher #10	645010
□ 2	Diode 1N4148	314148	□ 1	Flatwasher 9mm x 15mm	645103
□ 1	IC LM-358	330358	□ 4	Fiber Washer #4	645404
□ 1	IC LM-7805 5V 1.5A	337805	□ 4	Flatwasher 7/16" OD x 11/64" ID	645615
□ 1	LED Display Volt	355614M1	□ 1	Lockwasher #4 Int	646401
□ 1	LED Display Amp	355614M2	□ 9	Lockwasher #6 Int	646600
	Miscellaneous		□ 2	Lockwasher #8 Ext	646828
□ 1	Transformer YD-1485	440111	□ 1	Lockwasher 3/8" Int	646900
□ 1	Transformer 120-41.5	440800	□ 4	Lockwasher #10 Ext	646910
□ 1	Transformer Variable	447777	□ 1	Terminal Strip 3 Lug	651003
□ 1	Circuit Breaker 3A	502777	□ 2	Terminal Strip 4 Lug	651004
□ 1	Circuit Breaker 10A	502779	□ 1	Solder Lug #8	661002
□ 1	PC Board XP-800	512009	□ 1	Butt Connector	661100
□ 1	Fuse 5A	530500	□ 2	Crimp Lug #10	661114
□ 1	Switch Rocker Illuminated	541204	□ 6	Rubber Feet	662001
□ 1	Switch Rotary 4P3POS	542404	□ 1	Fuse Holder Lower Body	663005LB
□ 1	Cover	611075	□ 1	Fuse Holder Nut	663005N
□ 1	Chassis XP-800	612800	□ 1	Fuse Holder Upper Body	663005UB
			□ 1	Fuse Holder Washer	663005W
			□ 1	Socket IC 8-Pin	664008
			□ 1	Line Cord 3 Wire	862105

SCHEMATIC DIAGRAM



WARRANTY POLICY

Your XP-800 Power Supply has been tested and conforms to our rigid requirements on performance and durability. It is guaranteed to be free of defects in workmanship, materials and construction for a period of 2 years. If this product should fail during normal use within the first 3 months from the date of purchase, Elenco will repair or replace the unit at no cost. For the remainder of the warranty period, a nominal service charge is required to cover shipping and handling.

When returning merchandise for repair, please include proof of purchase, a brief letter of explanation of problem and sufficient packing material. Before returning any merchandise, please call our service department at (847) 541-3800 to obtain a return authorization number (RMA).

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