Service Notes
on
ENTRON MODEL PSR-1
POWER SUPPLY

ENTRON PSR-1 POWER SUPPLY

SPECIFICATIONS

Power Receptacles	4
Output Voltages	225 volts dc at 200 MA 150 volts dc at 50 MA 6.3 volts ac at 10 A
DC Regulation	± 1%
Tube Complement	1 5AU4 1 0D3 (VR-150) 2 0A3 (VR- 75) 1 6AS7-G 1 5654
Fuse Complement	Primary 3AG 3 A B Minus 3AG 0.5 A Bias 3AG 0.1 A Slo Blo
Power Requirements	140 watts max. 100-130 volts 60 cps
Weight	Net - 24 lb Shipping - 26 lb
Dimensions	Width - 6" Length - 19" Depth - 7"
Mounting	19" Rack
Finish	Black Wrinkle

The Entron PSR-1 Power Supply will supply all power for a maximum of four (4) APL preamplifiers.

SERVICE NOTES ON ENTRON MODEL PSR-1 POWER SUPPLY

GENERAL: The following information and service data is presented for use only by properly qualified and trained tv technicians or engineers. In no case should radical changes in circuit design or incorrect parts replacements be made. Proper performance is greatly dependent upon correct installation and use of standard replacement parts as specified in the attached parts list.

FUNCTION: The PSR-1 is designed to provide the necessary operating voltages for one to four APL pre-amplifiers, or the operating potentials of equipment having comparable power requirements. The output ratings are given under Specifications.

INSTALLATION: The PSR-1 is designed for mounting in a standard 19" rack. Mounting should be secure, preferably near the base of the rack where it will stabilize the weight distribution of the entire rack, since the PSR-1 is considerably heavier than other head-end equipment, such as APL strips. If repairs are required, or a replacement is made, use the original chassis wiring arrangement and replace all leads as they were before removal of the PSR-1 was made. An external ground to a pipe sunk in the earth, for protection of operating personnel in event of short circuits or charges induced by nearby lightning, is specified by most Fire Underwriters. Ground cable of this kind should be a number 8 or larger insulated or bare copper wire. Avoid, in all grounding and wiring, rubbing or scraping of metal to metal which may cause an intermittent r-f noise or interference in signal circuits. Be sure the line plug connections are tight since arcing at this point might cause considerable noise.

DESCRIPTION: The PSR-1 is a carefully engineered power supply designed to provide satisfactory service with a minimum of service troubles. It utilizes six tubes, as follows:

VT-1 FULL-WAVE RECTIFIER

VT-2 GASEOUS REGULATOR

VT-3 GASEOUS REGULATOR

VT-4 ELECTRONIC CONTROL AMPLIFIER

VT-5 ELECTRONIC REGULATOR

VT-6 GASEOUS REGULATOR

In addition, the PSR-1 uses a selenium half-wave rectifier which is the equivalent of an added tube without the space and bulk requirements. A reference setting of the output voltage at 225 volts may be made with R-9 which controls the regulator system. R-9 is shown in the circuit diagram, Fig. 1 and in the top view, Fig. 2.

CIRCUIT: Referring to Fig. 1, the line voltage of 115 volts is applied to the power transformer primary through fuse F-1 and the series connections of the gaseous regulator tubes, VT-2, VT-3, VT-6. The circuit is arranged in this fashion to protect the power supply and prevent its being turned on with one or more regulator tubes not in the proper sockets. The fuse affords protection against an expensive power transformer burn-out in the event of short circuits or overloading. Capacitors C-1 and C-2 prevent noise or stray signals from getting into the supply and also prevent noise or hum modulated r-f from leaking through the power transformer and line to other units in signal circuits, thus serving a two-fold purpose. The effectiveness of the filtering, however, is greatly dependent on a short, low resistance ground being connected to the PSR-1 chassis.

Additional fuse protection is offered by F-2 in the center-tap lead of the high voltage winding of T-1 and bias circuit winding of T-2 is protected against overload by fuse F-3.

PLATE AND SCREEN CIRCUIT SUPPLY: The high voltage rectifier VT-1 works into a brute force filter consisting of C3A and C3B with choke L-1. The plate output to jacks J-1, J-2, J-3, J-4, occurs via the effective series resistance of VT-5 which is interposed between C3B and the output jacks, and is a variable dependent upon the output level. If the output voltage goes up, due to increased power line voltage or due to decreased load current, VT-5 changes its resistance in an increasing direction to counteract the effect, and has the opposite change for a lower than normal output. The reference axis voltage about which the regulator performs is set by the adjustment of R-9 which changes the reference grid potential of the electronic control amplifier tube, VT-4. This tube works with VT-5 to form a regulator system. The grid potential of VT-4 will change as the PSR-1 output voltage changes, thus changing the plate potential of VT-4. As the grids of VT-5 are dc coupled to the plate of VT-4, the grids will follow the VT-4 plate potential changes and the action will be one of amplified control. The screen potential of VT-4 is stabilized for better control action by gaseous regulator tube VT-3. A negative (-75 volts) reference bias potential is supplied to the grid circuit of the regulator tubes by the half-wave rectifier power supply, using rectifier 1 and the 125 volt winding of T-2. Filtering in this circuit is afforded by C-7, C-8, R-12, R-13 and C-9. C-9 also serves as an r-f by-pass for VT-6.

R-4 and R-5 act as parasitic suppressors. C-5 and C-6 by-pass the gaseous regulator circuit to limit development of noise signals which might modulate stray r-f and get into signal circuits.

A 150 volt screen potential is supplied to the screen connections of jacks J-1, J-2, J-3, J-4 via R-1. Gaseous regulator tube VT-2 stabilizes the potential of the screen circuit.

The 6.3 volt supply for APL units is afforded by the two parallel-connected 6.3 volt windings on transformer T-1.

OUTPUT ADJUSTMENT: With the desired number of APL units (four, maximum) connected to the PSR-1 power supply, adjust R-9 for an output of 225 volts, as measured with an accurate dc voltmeter connected across the 225 volt circuit at the power supply.

TYPICAL TROUBLES: No matter how carefully designed and produced, electronic equipment may occasionally develop faults. The following is a summary of some usual and unusual troubles, with appropriate remedies.

TYPICAL SERVICE TROUBLES

NO OUTPUT: If the 6.3 volt ac circuit does not provide an output, and plate and screen voltages are zero, the entire supply is out of order and the trouble may be that it is not plugged in at the 115 volt ac outlet, fuse F-1 is open, or one or more of the following tubes are not in the proper sockets: VT-2, VT-3, VT-6. If a 6.3 volt ac output is obtained but not plate or screen outputs, the primary circuit of T-1 and T-2 is probably all right and the fault lies in the bias, filter or regulator circuits.

An open in fuse F-2 would disable the entire plate and screen supply. Failure of this fuse might be due to a gassy or shorted rectifier tube, VT-1; leaky filters C3A and C3B; or excessive loading of the supply as the result of a fault in one or more APL units powered by the PSR-1. At least one APL or dummy load should be connected to the PSR-1 if power is on. Otherwise, VT-2 will operate incorrectly due to excessive current flow through it. This condition should be avoided by placing a load on the supply.

Improper operation at any time might be caused by a defective tube. As in servicing other electronic equipment, suspected tubes may be checked by a replacement method but preferably should be checked first in a tube tester, since a shorted or gassy tube may have caused circuit damage which should be checked before inserting another tube. Ohmmeter tests may be made from point to point, referring to the circuit diagram in Fig. 1 to determine locations of short circuits or defective components. Condensers may be checked on a condenser bridge or with an ohmmeter. Leakage resistance should be reasonably high; in testing, test leads are reversed and the highest resistance measurement is the correct one in checking electrolytics.

A shorted or excessively leaky filter condenser in the bias circuit might cause fuse F-3 to blow, disabling this circuit and preventing normal operation of the electronic regulator system.

ERRATIC OR INTERMITTENT OPERATION: A defective potentiometer in which the arm makes intermittent contact with the resistance element might cause erratic or intermittent operation of the plate circuit, and may be tested by carefully examining the potentiometer and adjusting it during operation, noting the effect on output voltage. Tubes should be firmly seated in their respective sockets. Intermittent operation possibly may be caused by a defective selenium rectifier, particularly if the effect seems to occur only after warming up, and may be difficult to locate; a substitution check of the rectifier with one known to be good is recommended to correct this difficulty.

POOR VOLTAGE REGULATION: The most likely cause of this trouble would be a fault in the regulator system, or a fault in one or more APL units such that excessive current is drawn from the PSR-1, thus limiting the ability of the PSR-1 to compensate for changes in load current occurring with agc action or variations in line voltage.

ELECTRICAL TESTS

POWER OFF

1. Check power transformer primary circuit with low resistance range of ohmmeter. Resistance should be approximately 1 ohm.

2. Check resistance from each rectifier plate to ground. Should be about 25 ohms. If not, look for open 1/2 amp. fuse or defective holder.

3. Check resistance across input filter condenser (10 MFD unit). Should be over 1 megohm. If not, reverse test leads. If still low, filter or wiring may be shorted. Make this test to prevent blowing rectifier. Be sure filter condensers are connected correctly and that 30 mfd unit is <u>not</u> in input circuit but in output circuit.

4. Check resistance across 40 mfd unit in selenium rectifier circuit. Should be over 100,000 ohms. If not, reverse test leads. If still low, check 40 mfd unit and circuit wiring.

5. Check test load with ohmmeter. Resistance should be variable from 900 ohms to 3,750 ohms.

6. Check resistance from pin 6 or 3 of VT5 to pin 2 of VT6. Value should be 74K ohms $\pm$ 10%. If not, check components and wiring in this circuit.

ELECTRICAL TESTS

POWER ON

<u>TEST EQUIPMENT REQUIRED</u>:

1. A.C. Voltmeter 0-150V A.C.
2. D.C. Voltmeter (20,000 ohms/volt) 0-500 and 0-100.
3. D.C. Milliammeter 0-300 MA.
4. General Radio Variac (A.C. line voltage control) or equivalent.
5. Test Load jig (See test jig specifications).

<u>TESTS TO BE MADE</u>:

1. Line voltage normal (115V)
   Heavy Load

2. Line voltage normal (115V)
   Light Load

3. Line voltage low (105V)
   Heavy Load

4. Line voltage high (125V)
   Heavy Load

5. Line voltage high (125V)
   Light Load

TEST 1

1. Connect heavy load to output (see load fixture specifications).

2. Set 10K regulator pot at about half-scale on PSR-1.

3. Connect 10 amp. load to 6.3 volt, 10 amp. filament circuit of PSR-1.

4. Apply 115V A.C. to primary of PSR-1 power transformer via G-R Variac and check with A.C. voltmeter.

5. Adjust PSR-1 regulator pot to give output voltage of 225V as checked by D.C. voltmeter.

TEST 2

1. Connect light load. Output voltage should be 225 volts ± 1%.

TEST 3

1. Adjust line to 105V A.C.

2. Connect heavy load.

3. Check D.C. load voltage. It should be 225 volts D.C. ± 1%.

TEST 4

1. Adjust line voltage to 125 volts.

2. Connect heavy load.

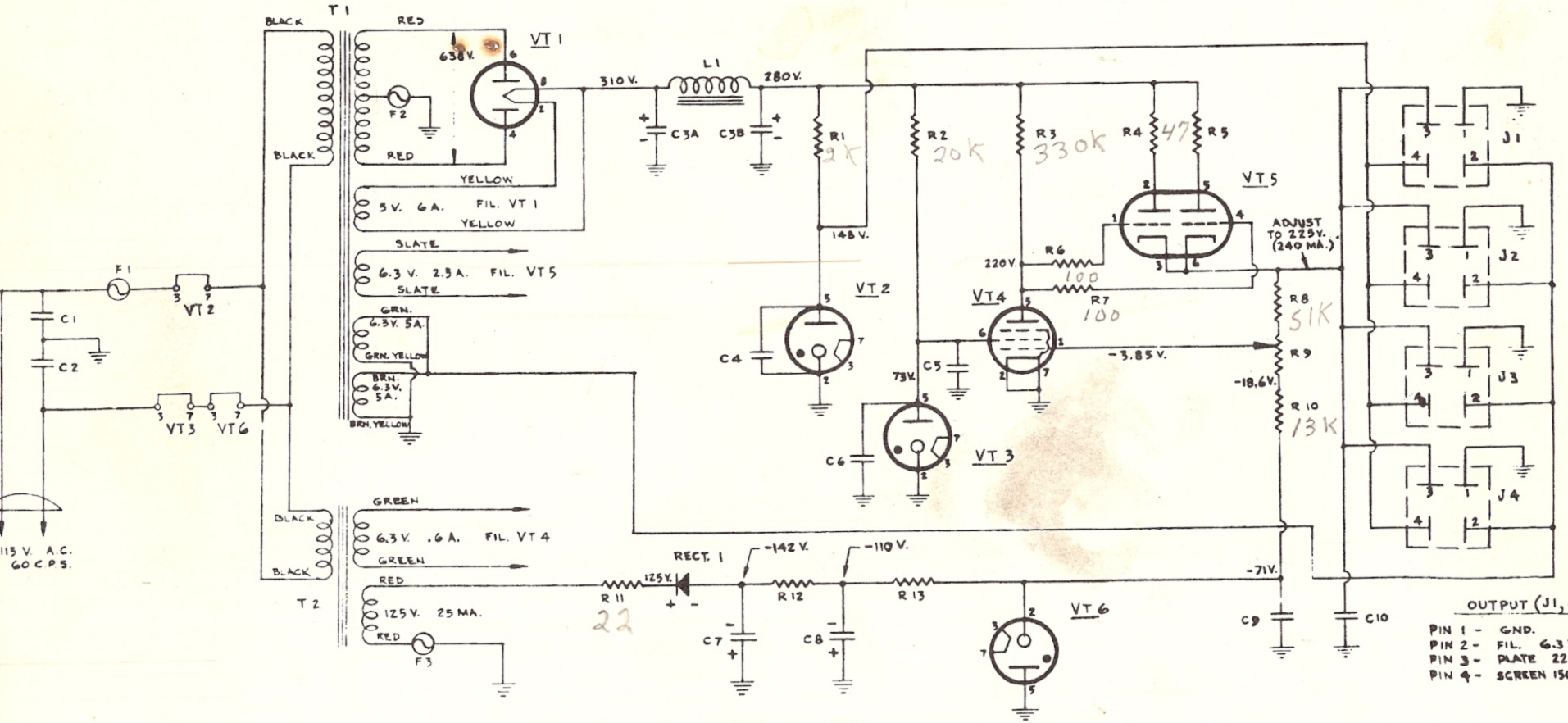
3. Measure output voltage, which should be 225 volts ± 1%.

TEST 5

1. Adjust line voltage to 125V.

2. Connect light load.

3. Measure output voltage, which should be 225 volts ± 1%.



OUTPUT (J1, J2, J3, J4)

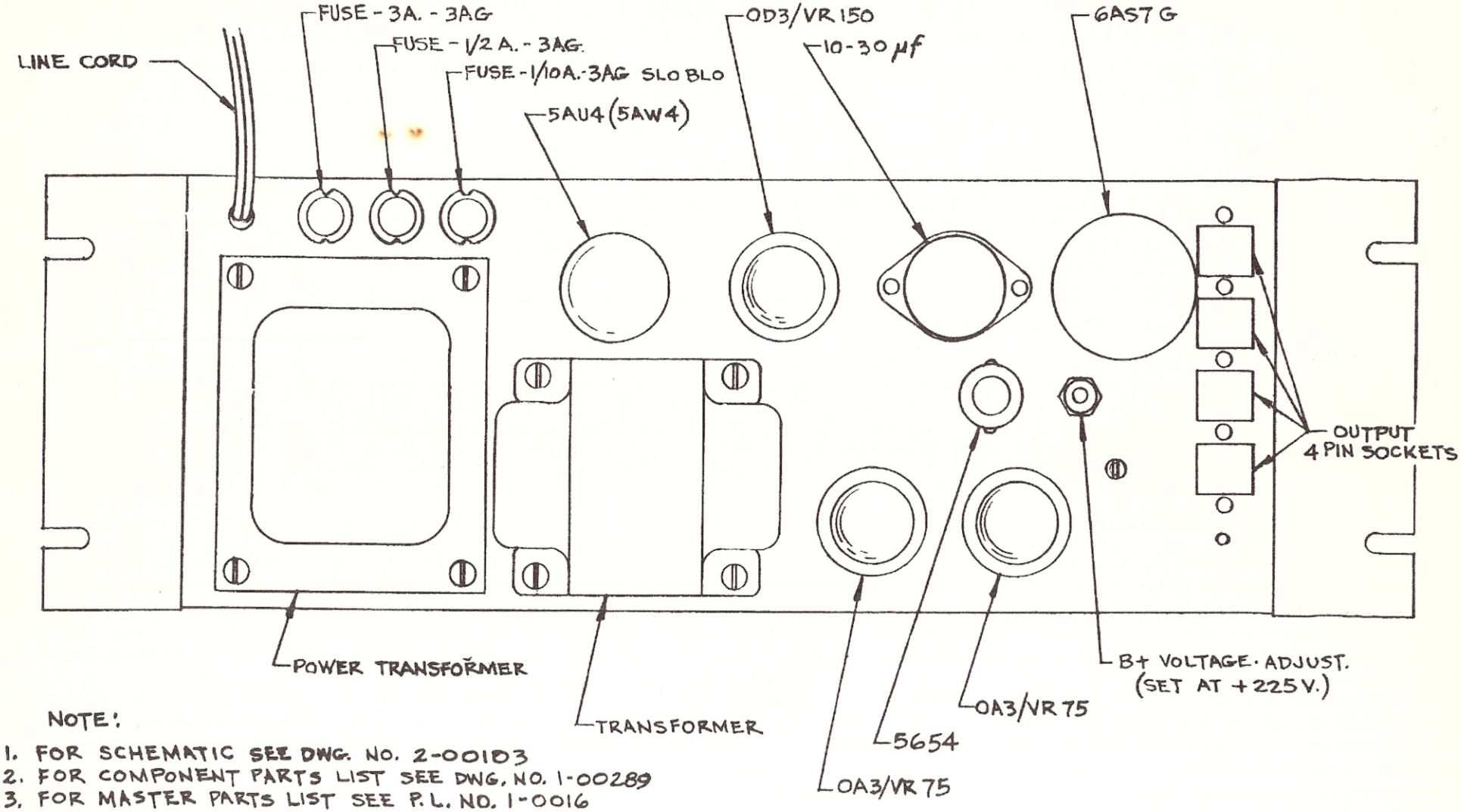
PIN 1 - GND.
PIN 2 - FIL. 6.3 V. AC 10 A.
PIN 3 - PLATE 225 V. DC 240 MA.
PIN 4 - SCREEN 150-160 V. DC 48 MA.

NOTE:

1. VOLTAGES MEASURED TO GROUND, EXCEPT READINGS ACROSS THREE SECONDARY WINDINGS OF T1 & ONE SECONDARY WINDING OF T2.

Fig. 1

DRAWN BY JA	DATE 16JUN54	POWER SUPPLY MODEL PSR-1 SCHEMATIC	entron INCORPORATED
CHECKED BY	DATE		
APPROVED BY	DATE		BLADENSBURG MARYLAND
SCALE: NTS	DO NOT SCALE THIS DRAWING	DWG. NO.	2-00103



NOTE:

1. FOR SCHEMATIC SEE DWG. NO. 2-00103
2. FOR COMPONENT PARTS LIST SEE DWG. NO. 1-00289
3. FOR MASTER PARTS LIST SEE P.L. NO. 1-0016

DRAWN BY JMA	DATE 24 AUG 54	OUTLINE DRAWING TOP VIEW POWER SUPPLY MODEL PSR-1	entron INCORPORATED BLADENSBURG MARYLAND
CHECKED BY	DATE		
APPROVED BY	DATE		
SCALE: 1/2	DO NOT SCALE THIS DRAWING	DWG. NO.	1-00288

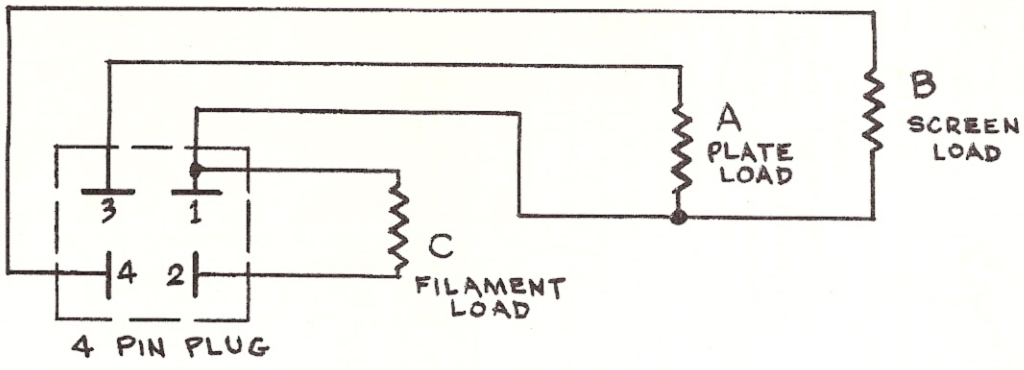
Fig. 2

PSR-1
ELECTRICAL PARTS LIST

CIRCUIT DESIGNATION	COMPONENTS	ENTRON PART NO.
C-1, C-2	.005 mf Disc Ceramic	
C-3A	10 mf Electrolytic	
C-3B	30 mf "	
C-4,C-6,C-9	.01 mf Disc Ceramic	
C-5	.005 mf " "	
C-7, C-8	40 mf Electrolytic	
C-10	1 mf Paper	
F-1	Primary Fuse 3AG 3 A	
F-2	B Minus Fuse 3AG 0.5 A	
F-3	Bias Fuse 3AG 0.1 A SloBlo	
T-1	Power Transformer	
T-2	Transformer	
VT-1	5AU4	
VT-2	0D3	
VT-3, VT-6	0A3	
VT-4	5654	
VT-5	6AS7-G	
Rect. 1	Selenium Rectifier 20 ma	
L-1	Filter Choke 8 Henry	
J-1,J-2,J-3,J-4	4-Pin Socket	
R-1	2K ohms ± 10% 20W	
R-2	20K ohms ± 10% 20W	
R-3	330K ohms ± 10% 1W	

PSR-1
ELECTRICAL PARTS LIST (Con't)

CIRCUIT DESIGNATION	COMPONENTS	ENTRON PART NO.
R-4,R-5	47 ohms ± 20% 2W	
R-6,R-7	100 ohms ± 20% 1/2W	
R-8	51K ohms ± 5% 1W	
R-9	10K ohms Variable 2W	
R-10	13K ohms ± 1W	
R-11	22 ohms ± 10% 1/2W	
R-12,R-13	2.2K ohms ± 2W	



RESISTOR VALUES

LIGHT LOAD					
A		B		C	
R	W	R	W	R	W
5KΩ	20W.	10KΩ	5W.	2.5Ω	20W.

HEAVY LOAD					
A		B		C	
R	W	R	W	R	W
1KΩ	50W.	3KΩ	10W	.63Ω	60W.

LOAD TEST FIXTURE SPECIFICATIONS