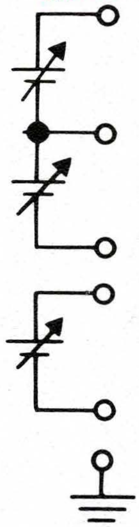
TRIPLE OUTPUT LABORATORY POWER SUPPLY
T²L, COS/MOS AND ANALOG APPLICATIONS

MODEL TP343 A

IMPROVED SPECIFICATIONS



*SOURCE A — 0-20 VDC,0-2.5A/ 0-25 VDC,0-1A

*SOURCE B — 0-20 VDC,0-2.5A/ 0-25 VDC,0-1A

SOURCE C — 0-6 VDC,0-5A / 0-15 VDC,0-2.5A

NEW

* Independent or 0.1% tracking with panel switch

NOISE & RIPPLE LESS THAN 1mV P-P

electrical specifications:

Parameter	Sources A & B (1) 0-20V, 0-2.5A each output	Source C 0-6V, 0-5A 0-15V, 0-2.5A
INPUT:	105-125, 58-440 Hz	
OUTPUT	0-20V, 0-2.5A /0-25V, 0-1A	0-6V, 0-5A/ 0-15V, 0-2.5A
LOAD REGULATION:	0.01% +1 mV per amp	0.01% +1 mV per amp
LINE REGULATION:	0.01% +0.5 mV	0.01% +0.5 mV
STABILITY (2)	0.02% +1 mV	0.02% +1 mV
RECOVERY TIME (3)	100 μs	100 μs
CURRENT LIMIT	2%-105% of rated current	2%-105% of rated current
TEMPERATURE	0-50°C	0-50°C
TEMP. COEFFICIENT	0.02% +300 μV/°C	0.02% +300 μV/°C
OV CROWBAR	Adj. 3-~~25V (4)~~ 3-30V (4)	Adj. 3-20V
TRACKING	0.1% +10 mV by front panel switch	
VOLTAGE CONTROLS	10 turn potentiometer	10 turn potentiometer
FAULT INDICATORS	Lamp indicates short circuit and overload	Lamp indicates short circuit and overload
METERING	Dual range volt/ammeter	Dual range volt/ammeter

(1) Sources A & B have one common terminal
(2) 24 hours at constant line, load and ambient temperature
(3) To recover to within 15 mV on nominal for a 10%-100% load change
(4) Both sources will crowbar if either one operates

mechanical specifications:

DIMENSIONS: 8¾" H x 7¾" W x 13½" D.
WEIGHT: 20 lbs.
FINISH: Natural anodized aluminum panel; blue vinyl enamel cabinet, with carrying handle.

features:

- No derating. All outputs may be operated simultaneously at full capacity for a maximum of 140W.
- Outputs are floating with respect to each other and chassis except for an internal connection between one negative terminal and one positive terminal of the 20 volt sources. The two 20 volt sources may be operated in series to provide 0-40 VDC, 0-2.5A in any polarity with respect to chassis or left floating. The 0-15V source may be operated in any polarity with respect to chassis or left floating.
- Independent adjustment of each output voltage utilizing 10-turn potentiometers with .05% resolution.
- Separate current limiting adjustment for each output.
- Separately adjustable overvoltage crowbars on each output. Overvoltage crowbars on 0-20V outputs trip simultaneoulsy if either one operates.
- Three taut band suspension dual range meters individually selectable for voltage or current of each source.
- A "FAULT" indicator lamp on each output signals overload, short circuit, crowbar trip or current limit operation.
- Automatic voltage tracking of the 0-20 VDC sources to ±0.1% by means of a panel toggle switch. This switch is equipped with a locking lever to prevent accidental operation. Single potentiometer control of tracking outputs.
- Outputs may be shorted into each other in any polarity without damage.

POWER DESIGNS

POWER DESIGNS INC.
1700 SHAMES DRIVE ■ WESTBURY, N.Y. 11590
Tel: 516-333-6200 ■ TWX 510-222-6561

POWER DESIGNS PACIFIC INC.
3381 MIRANDA AVENUE ■ PALO ALTO, CALIF. 94304
Tel: 415-493-6111 ■ TWX 910-373-1251

POWER
DESIGNS

INSTRUCTION MANUAL
MODELS TP 340 & TP 343A

POWER DESIGNS INC.

1700 SHAMES DRIVE • WESTBURY, N. Y. 11590 TEL (516) 333-6200
TWX (510) 222-6561
FAX (516) 333-6512

INSTRUCTION MANUAL

SECTION 1
INTRODUCTION

1.1 GENERAL

This manual contains instructions for the installation, operation and mainentance for Power Designs Model TP340 and TP343A triple output DC regulated power supply.

1.2 DESCRIPTION

This triple output regulated DC power source is suitable for general purpose laboratory and industrial applications. It features adjustable and independent current limiting and over-voltage crowbar protection for each output. A fault lamp indicates crowbar operation or an overload condition.

The following description refers to the three outputs as Source A ("A"), Source B ("B") and Source C ("C") respectively.

The power supplied by "A" and "B" is obtained from three binding posts on the front panel. The COMMON terminal is the internal connection between the negative terminal of "A" and the positive terminal of "B". This terminal is isolated from ground and both terminals of "C". The DC + terminal on source "A" produces a positive voltage with respect to COMMON. The DC – terminal on source "B" produced a negative voltage with respect to COMMON. Power from these terminals can also be obtained directly from DC + to DC –. In that case the output voltage will be the sum of the "A" and "B" voltages.

A front panel TRACKING switch provides individual control of each source or automatic Master/Slave operation. In this mode source "B" tracks source "A".

Source "C" provides power by means of two binding posts that are isolated from ground. This source may be operated in either polarity with respect to chassis or left floating.

All outputs may be operated simultaneously at full capacity with no derating.

1.3 ELECTRICAL SPECIFICATIONS

INPUT: 105 to 125 Volts, 58-440 Hz

PARAMETER	TP340 (Source A & B)	TP343 (Source A & B)	Both Models (Source C)
Output	0-32V, 0-1 AMP	0-20V, 0-2.5A	0-6V, 0-5A
		0-25V, 0-1A	0-15V, 0-2.5A
Load Regulation	0.01% + 1MV PER AMP	0.01% + 1MV PER AMP	0.01% + 1MV PER AMP
Line Regulation	0.01% + 0.5MV	0.01% + 0.5MV	0.01% + 0.5MV
Stability (Note 1)	0.02% + 1MV	0.02% + 1MV	0.02% + 1MV
Recovery Time (Note 2)	50 us	100 us	100 us
Current Limit	2%-105% of rated current	2%-105% of rated current	2%-105% of rated current
Operating Temp.	0-50 °C	0-50 °C	0-50 °C
Temp. Coefficient	0.02% + 300uv/°C	0.02% + 300uv/°C	0.02% + 300uv/°C
OV Crowbar	Adj. 3-40V (Note 3)	Adj. 3-30V (Note 3)	Adj. 3-20V
Tracking	0.1% + 10 MV	0.1% + 10 MV	
Metering	Dual Range Volt/ Ammeter	Dual Range Volt/ Ammeter	Dual Range Volt/ Ammeter

NOTES: (1) 24 hours at constant line, load and ambient temperature.

(2) To recover to within 15 MV of nominal for a 10% to 100% step change in load.

(3) Both sources will crowbar if either one operates.

1.4 MECHANICAL SPECIFICATIONS

DIMENSIONS: 8¾" H x 7¾" W x 13½" D.

WEIGHT: 20 lbs.

FINISH: Natural anodized panel, blue enamel cabinet.

SECTION 2
INSTALLATION AND OPERATION

2.1 UNPACKING AND INSPECTION

This instrument is ready for operation as shipped from the factory. After unpacking inspect for damage that might have occured in transit.

2.2 PRELIMINARY PROCEDURES

2.2.1 Set the AC switch to the OFF position and connect the line cord to an appropriate source of AC power.

2.2.2 Rotate the Current, Voltage and Crowbar controls on all three sources fully clockwise.

2.2.3 Select the mode of operation of Source A and Source B by setting the tracking switch to either TRACKING for master/slave operation (Source A controls Source B) or OFF for individual control.

2.2.4 Set the AC switch to the ON position. The AC lamp should light.

2.2.5 Set all three meter function switches to the VOLTS position. The three meters should indicate output voltage. Set the desired output voltage levels for each source with the Voltage control.

2.2.6 Connect the load to the front panel binding posts.

2.3 CONSTANT VOLTAGE OPERATION (All Sources)

2.3.1 Voltage Adjustment

(1) Rotate the voltage control for each source fully counterclockwise.
(2) Set the AC switch to the ON position. The AC pilot light should illuminate.
(3) Set the meter function switches to the VOLTS position.
(4) Set the voltage control on each source to the desired output voltage level.

2.3.2 Current Limiting

(1) Set the AC switch to the OFF position.
(2) Connect a shorting jumper across the output terminals of each source.
(3) Set the AC switch to the ON position.
(4) Set all three meter function switches to the AMPS position.
(5) Set each current control to the desired current limit level.
(6) Turn the supply off and remove the shorting jumpers from the output terminals.

2.4 OVERVOLTAGE CROWBAR ADJUSTMENT

An overvoltage crowbar circuit is provided to protect the load against an excessive voltage level. Such a condition can result from an internal malfunction of the supply or simply by the operator inadvertantly misadjusting the voltage control.

When the crowbar is activated an SCR that is electrically connected across the output terminals of the supply is triggered. This effectively places a short cirucit across the output terminals.

With the front panel overvoltage control set fully clockwise the overvoltage trip point is approximately 20% higher than the maximum rated output of the supply. To set the trip point to a lower level, proceed as follows:

(1) Remove the load from the supply.

(2) Set the meter function switch to the volts position.

(3) Adjust the voltage control to the desired trip point as indicated on the panel meter.

(4) Turn the crowbar control slowly counter-clockwise until the output voltage as indicated on the panel meter suddenly collapses to approximately 1 volt and the current mode indicator lights.

(5) Turn the voltage control counter-clockwise.

(6) Reset the crowbar by turning the AC switch OFF and then back ON.

(7) Adjust the voltage control to the proper operating level.

NOTE: Although Source A and Source B have independent OV trip settings, it is important to note that if either one operates, it will short both output terminals simultaneously.

SECTION 3
PRINCIPLES OF OPERATION

This voltage regulated power supply uses three "linear mode" (series regulator) systems to obtain output voltage regulation, low ripple and low noise characteristic. The "linear mode" technique, consists basically of the insertion of an electronically controlled variable impedance (series regulator) between a DC unregulated source and the output terminals of the equipment. Since the outputs are very similar in performance we will describe Source C which is slightly more complex due to its dual output rating characteristics.

T1 transformer secondary (terminals 15, 16, 17) in conjunction with bridge rectifier CR307 and capacitors C313, C314 and C315, produces two unregulated DC power sources, which in conjunction with series regulators Q306, Q307, Q308 and driver Q304, provide the output power of the supply. If the output voltage requirements (as determined by the output VOLTAGE control setting) is below the voltage provided by the unregulated capacitors C314, C315, the active series regulators will be Q307 and Q308. Q306 will operate as a driver. If the output voltage requirements are above the voltage provided by C314, C315, then the energy will be supplied by the series capacitor combination of the above mentioned and C313 (from C313+ to C314−). Q306 will become the series regulator and the base to emmiter junctions of Q307 and Q308 will act as a diode in series with the power path.

Transformer secondary (terminals 13, 14) in conjunction with rectifier CR301 and capacitor C301 produces an unregulated DC source used to generate a B+ superregulated bias voltage and a B− semi-regulated voltage for amplifier operation. Both bias voltages are connected to the DC+ output of the power supply.

The B+ bias voltage is generated by VR303 (main reference of the overall source), R301-R305, C302-C304, VR301, Q301 and U301B. This circuit produces, across C304, a very stable and low ripple voltage between 12.4 VDC and 13.2 VDC.

The B− bias voltage, generated by zener diode VR302, should have a voltage between 5.0 VDC and 5.8 VDC.

The variable resistor divider (R315, R325 and R344) compares the output voltage of the supply with the B+ voltage; the differential voltage is then fed to the input of voltage comparator amplifier, U301A, whose output in conjunction with current amplifiers Q303 and Q304 modify the drive of the series regulators previously mentioned, to maintain voltage regulation.

The voltage developed across R333 (current sensor) due to external load currents, is used for ammeter readings. It is also continuously compared to B+ by means of a resistor divider (R310, R311 and R342) at amplifier U301D. If the non-inverting input (pin 12) becomes lower in voltage than the inverting input, (pin 13) U301D will be activated and operate through CR303 and CR304 to decrease the drive on Q303, thus limiting the drive to the series regulators and hence the current of the power supply.

Due to the dual rating of this supply, it is imperative to protect Q306 when it is acting as a series regulator. Under this condition, the main load current goes through R330; its voltage is once again compared to the B+ by amplifier U301C, limiting the current flow on Q306 to approximately 2.75A.

If either U301C or U301D is activated, they will operate Q302, driving power to the FAULT lamp, DS301.

The variable resistor divider (R321, R343) compares the output voltage with B+ at the base to emmiter junction of Q305. Depending on the setting of R343 (overvoltage control) and the output voltage of the source, Q305 will be activated, firing the silicon control rectifier CR309, producing a short on the output of the supply, hence protecting the user's load. This short will make the power supply go inot a "FAULT" mode. If an overvoltage on the supply is produced by failure of the control circuits, there is a possibility that secondary protection fuse F301 will blow, in which case there may not be a "FAULT" indication.

SECTION 4
MAINTENANCE

4.1 GENERAL

This section covers maintenance and calibration procedures. Under normal conditions, no special maintenance is required. If trouble does develop however, the easily removable cabinet and the location of the printed circuit board provide exceptional accessibility to all components of the supply.

Regulation and ripple measurements of the output in both voltage and current mode are an excellent indication of the power supply's performance. Special techniques must be employed to properly measure these parameters to avoid measuring voltage drops due to load currents. Details of correct measurement procedures will be described.

A schematic diagram, a location of components drawing and a detailed electrical parts list are provided in the Appendix of this manual to assist in troubleshooting the supply.

4.2 CALIBRATION

All the internal controls of this instrument have been preset prior to shipment from the factory. Recalibration of the voltmeter/ammeter should be made at intervals of approximately 1 year. Calibration adjustments must be made if the power supply has been subject to a failure that required a component replacement. Calibration control function and location on the printed circuit assembly can be easily found by referring to the location of components drawing in the Appendix of this manual.

4.2.1 TEST EQUIPMENT REQUIRED:

(1) 5½ Digit Digital Voltmeter (DVM) with better than 0.1% accuracy.

(2) DC Ammeter 0-6A with better than 0.5% accuracy.

(3) Electronic or resistance load.

4.2.2 PANEL METER CALIBRATION

With power supply off, check and if necessary, adjust mechanical zero setting of each meter pointer.

4.2.3 VOLTMETER CALIBRATION

Turn on the power supply and allow for 5 minute warmup. Set front panel meter function switches S101, S201, and S301 to V (Volts).

For Source A (Meter M101), connect DVM between COMMON and DC+ ("A"). Set the output voltage to 24 VDC (TP340) or 17.5 VDC (TP343A) as measured on the DVM. Adjust R401 to set the panel meter to agree with the DVM.

For Source B (Meter M201), connect DVM between COMMON and DC– ("B"). Proceed as above except adjust R403 trimmer.

For Source C, (Meter M301), connect DVM between DC+ and DC– ("C"). Set output voltage to 12 VDC as measured on DVM. Adjust R405 trimmer to set panel meter to 12V. Check for linearity at 5, 10, and 15V. Maximum deviation between panel meter and DVM readings should not exceed 0.3V.

4.2.4 AMMETER CALIBRATION

Set meter function switches to A (amperes) and set the current controls fully clockwise. Connect the load to the source whose meter is under calibration.

For Source A (Meter M101) adjust the load current as measured on the external ammeter to 1.0 ampere (TP340) or 2.5 amperes (TP343A). Adjust R114 trimmer to set panel meter to agree with the external ammeter.

For Source B (Meter M201), proceed as before except adjust R214 trimmer.

For Source C (Meter M301), set the output voltage between 5V and 6V; adjust load current to 5 amperes as measured on external ammeter. Adjust R334 to set panel meter to 5A.

4.2.5 VOLTAGE ADJUSTMENTS

Set front panel VOLTAGE controls fully clockwise. Connect Digital Voltmeter to terminals of source to be adjusted.

For Source A adjust R129 to obtain 32.8 to 33 volts (TP340) or 20.5 to 20.7 volts (Model TP343A).

For Source B proceed as in Source A adjusting R229.

For Source C adjust R326 to obtain an output of 15.6 to 15.8 volts.

4.2.6 CURRENT LIMIT ADJUSTMENTS

Set current limit adjustments fully clockwise. Connect load in series with external ammeter to the Source under adjustment.

For Source A: Set output voltage to approximately 10 VDC output. Set trimmer R119 fully clockwise. Connect load thru external ammeter and set current to approximately 1.07 Amperes (TP340) or 2.7 Amperes (TP343A). Adjust R119 slowly counterclockwise until FAULT lamp illuminates. Reset output to 1 AMP (TP340) or 2.5 AMPS (TP343A) and confirm that lamp goes out.

For Source B: Proceed as before except adjusting R219.

For Source C: Set output voltage to 6VDC. Set trimmer R311 fully clockwise. Connect load thru external ammeter and set current to approximately 5.35A. Adjust R311 slowly counterclockwise until FAULT lamp displays. Reset output current to 5A and confirm that FAULT lamp turns off.

Readjust output current to below 1A and increase output voltage to 15 VDC. Set R318 fully clockwise. Increase output current to approximately 2.75A. Adjust R318 slowly counterclockwise until FAULT displays. Decrease current to 2.5A and confirm that FAULT lamp turns off.

4.3 TRACKING ADJUSTMENTS

Set locking toggle switch S202, to TRACKING. Set output voltage of Source A to approximately 15 volts by means of the DVM and record to within 2MV. (For example 15.037V). WITHOUT CHANGING THE SETTING OF SOURCE A OUTPUT VOLTAGE CONTROL transfer DVM to Source B. Adjust R234 to obtain the original recorded "A" voltage within 2MV. Voltages should now track through their entire range with an accuracy of 0.1% +10 MV.

4.4 POWER SUPPLY MEASUREMENT TECHNIQUES

4.3.1 General

Power supply performance measurements require special techniques to insure correct results. The correct location of instrumentation leads is critical, since voltage drops due to contact resistance and load current flow may lead to misleading results. Four terminal network techniques as shown in Figure 1 must be employed to achieve correct measurements.

In addition to the equipment listed in 4.2.1, the following are required:

(1) Adjustable AC input source (Variac) with provisions for accurately monitoring the AC input voltage.

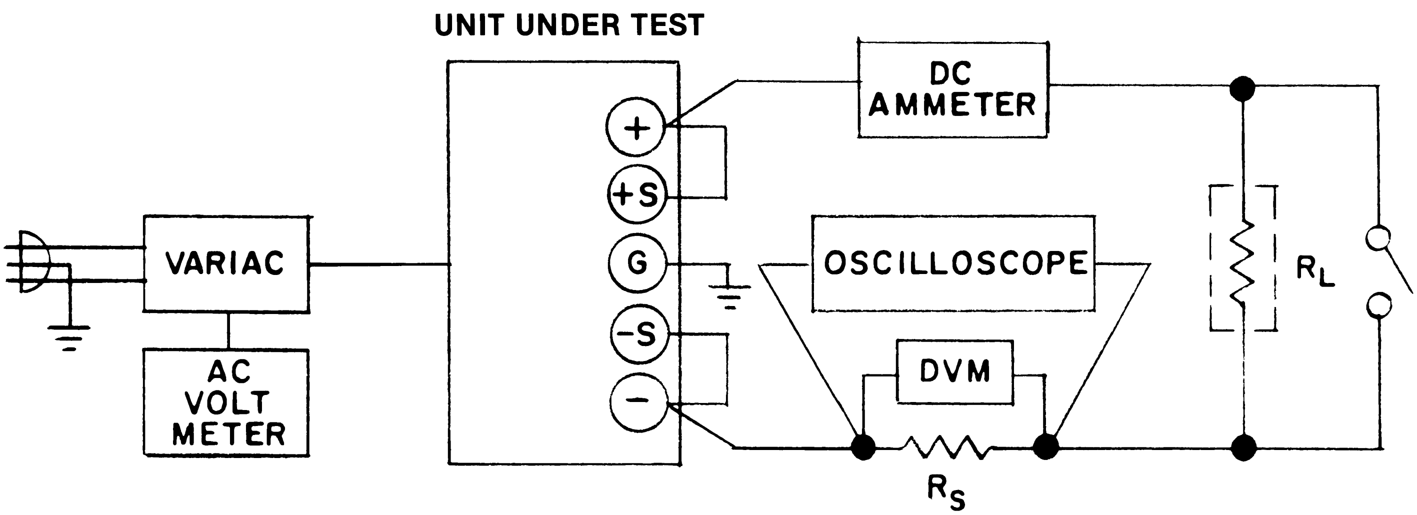
(2) Oscilloscope with a bandwidth of not more than 10 MHz and a vertical sensitivity of at least 1mV/cm.

4.4.2 Definitions

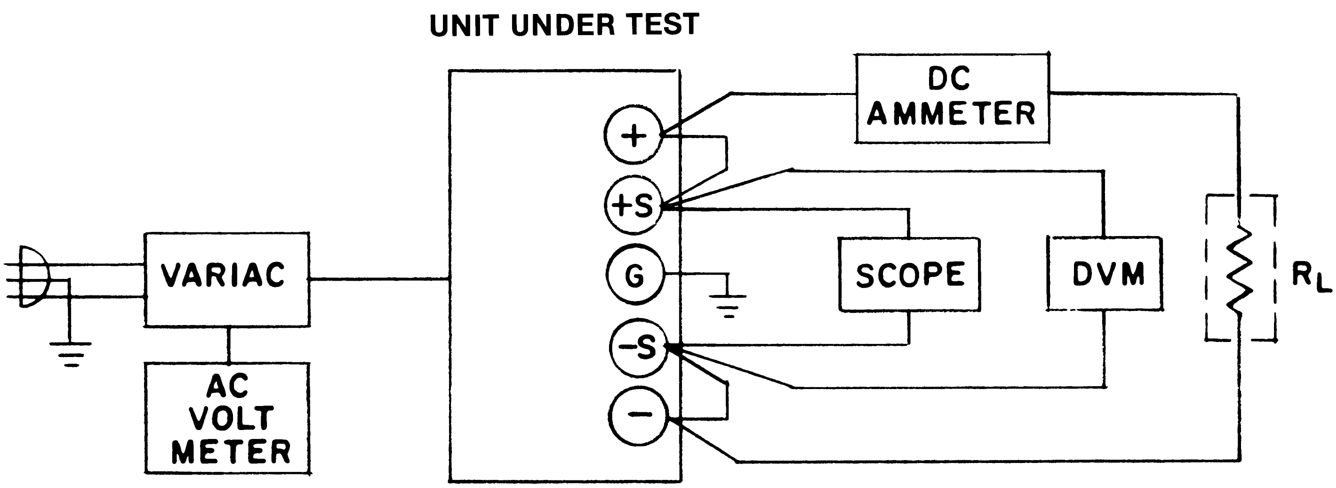
(1) Line Regulation: The change in output voltage (constant voltage mode) or current (constant current mode) when varying the AC input voltage through its specified range with a fixed load.

(2) Load Regulation: The change in output voltage (constant voltage mode) or current (constant current mode) with a specified step change in load resistance.

(3) Ripple: Any AC component that rides on the DC output of the supply. It is usually synchronized with the input AC source frequency.



CONSTANT CURRENT MEASUREMENTS



CONSTANT VOLTAGE MEASUREMENTS

FIGURE 1

SECTION 5

TROUBLE SHOOTING

5.1 GENERAL

If a malfunction is related to either Source A and/or Source B and the trouble shooter cannot identify readily the output that causes the problem, it is suggested:

a) Ascertain that the tracking switch is in the OFF position;

b) Disable Source B by removing F201 fuse on p.c. board and check Source A for proper operation.

c) Reinstall F201. Disable Source A by removing F101 fuse on p.c. board and check Source B for proper operation.

If neither b), nor c), indicate which Source is malfunctioning, there is a possibility that the problem might be caused by the common overvoltage protection. Remove CR110, CR210, CR211. If problem disappears, replace.

Since this equipment uses a quad operational amplifier to perform multiple functions, it would be advantageous to try as a first step, changing of the amplifier on the malfunctioning output to see if the problem disappears. If so, there may not be any need for equipment recalibration.

5.2 NO DC OUTPUT VOLTAGE ON ANY SOURCE

If POWER lamp DSI does not light check fuse F1 and Switch S1. If F1 blows repeatedly, check for defective transformer T1 or components as follows:

Source A	C101, C109, CR101, CR106-CR109
Source B	C201, C209, CR201, CR206-CR209
Source C	C301, C313-C315, CR301, CR307

5.3 MALFUNCTION OF SOURCE A, B, or C

The first step in trouble shooting any Source is to make sure the B+ regulated voltages measured on capacitors "A" C104, "B" C204, "C" C304 fall within 12.4 VDC and 13.2 VDC and are very stable. If these voltages are present, the voltages across zener diodes "A" VR103, "B" VR203, "C" VR302, should fall between 5.0 and 5.8V. If these voltages do not fall within the tolerances specified, check for defective components as follows:

"A"	C101-C104, CR101, Q101, VR101, *VR102, VR103, U101
"B"	C201-C204, CR201, Q201, VR201, *VR202, VR203, U201
"C"	C301-C304, CR301, Q301, VR301, VR302, *VR303, U301

*Note: "A" VR102, "B" VR202, "C" VR303, are the main reference voltage of the corresponding Source; their voltages must fall between 6.26V and 6.52VDC.

5.3.1 NO DC OUTPUT

If FAULT display is off and VOLTAGE control is clockwise, check blown secondary protection on "A" F101, "B" F201, "C" F302; if fuse blows after replacement, probable cause is shorted transistor as follows:

"A"	Q102, Q103, Q104
"B"	Q202, Q203, Q204
"C"	Q303, Q304, Q306, Q307, Q308

If fuse is not blown, check for shorted feedback capacitor "A" C111, "B" C211, "C" 312. If FAULT display is on, set the CURRENT and OV controls clockwise; if ammeter shows current reading, check for shorted component as follows:

"A"	C401, CR110, CR211, CR401
"B"	C402, CR210, CR211, CR402
"C"	C403, CR309, CR403, Q305

SECTION 6
APPENDIX

6.1 GENERAL

This section contains the schematic diagram, a location of components drawing and an electrical parts list.

All electrical parts are listed in the sequence of their circuit designation numbers as shown on the schematic diagram.

All components used in the power supply or supplied as replacements are carefully inspected at the factory. Inspections are performed on a 100% basis or at AQL levels to Military Specification MIL-Q-9858 under which Power Designs, Inc. has been qualified.

All semiconductors are inspected on a 100% basis, not only for operating parameters, but also for critical characteristics related to reliability and predicatable life expectancy. Some of these characteristics are observed when the device is taken beyond its normal operating regions. These test techniques have been developed under a "predictable reliability" program in operation at Power Designs, Inc. for the past twelve years. Under this program, quality control procedures are constantly revalued and updated as advances are made in solid state technology and experience is gained from field history.

Semiconductor manufacturers are continually modifying their products. Complete lines are discontinued to be replaced by devices having improved gain, operating voltage levels and frequency responses. The high gain, closed loop DC amplifiers used in regulator circuits are particularly sensitive to slight changes in these parameters. Commercial or military "equivalent" transistors may affect the performance of the power supply. We can assure compliance with the original specifications if replacement semiconductors are ordered from the factory.

All replacement semiconductors are processed and stocked at the factory in insure complete interchangeability with the devices in the original equipment.

When ordering replacements, please identify the device as thoroughly as possible, giving the model and serial number if available.

ELECTRICAL PARTS LIST

MODEL TP-340

Circuit No.	Description	Part No.
A1	Printed Circuit Board Assembly	PS-TP340-9
A2	Printed Circuit Board Assembly	PS-TP340-8
A3	Printed Circuit Board Assembly	PS-TP340-7
C1	Capacitor, ceramic disc, 0.022 uf, 1000 vdc	CC-A022-102
CR307	Bridge rectifier	BR-252
CR308	Diode, silicon	SY241N
CR309	Rectifier, silicon controlled	2N3897
DS1	Pilot light assembly (NEON)	PLA-24
DS101, DS201	Pilot light assembly (LED)	LED-3
DS301	Pilot light assembly (LED)	LED-3
F1	Fuse, 3A, 125V, Slo-Blo for models with 115V input	MDX
	Fuse, 1.5A, 250V, Slo-Blo for models with 230V input	MDX
M101, M201	Meter, 0-32V, 0-1A	MVA-169
M301	Meter, 0-15V, 0-5A	MVA-170
Q103, Q104	Transistor, silicon, NPN	MS1700G
Q203, Q204	Transistor, silicon, NPN	MS1700G
Q306 thru Q308	Transistor, silicon, NPN	2N6254
R134, R135	Potentiometer, wirewound, 5K ohm, ±10%, 2w	B82012-1
R136	Potentiometer, wirewound, 5K ohm, ±5%, 2w, 10t	RWV-502-3C10
R237, R238	Potentiometer, wirewound, 5K ohm, ±10%, 2w	B82012-1
R239	Potentiometer, wirewound, 5K ohm, ±5%, 2w, 10t	RWV-502-3C10
R342, R343	Potentiometer, wirewound, 5K ohm, ±10%, 2w	B82012-1
R344	Potentiometer, wirewound,5K ohm, ±5%, 2w, 10t	RWV-502-3C10
S1	Switch, toggle, SPST	ST-5
S101, S201	Switch, toggle, SPDT	ST-37
S202	Switch, toggle, DPDT	ST-36
S301	Switch, toggle, DPDT	ST-39
T1	Transformer,	
	For models with 115V, 58-440 Hz input	TTM-TP340
	For models with 115 or 230V, 48-440 Hz input	TTM-TP340K

A1 ASSEMBLY

PRINTED CIRCUIT BOARD P/N PS-TP340-9

Circuit No.	Description	Part No.
C101	Capacitor, electrolytic, 330 uf, 50 vdc	CE-331-50-SE
C102, C103	Capacitor, tantalum, 1 uf, 50 vdc	CE-1-500
C104	Capacitor, electrolytic, 100 uf, 25 vdc	CE-101-25-SE
C105	Capacitor, ceramic disc, 0.01 uf, 100 vdc	CC-A01-101
C106	Capacitor, ceramic disc, 100 pf, 1K vdc	CC-A0001-102
C107	Not used	
C108	Capacitor, plastic film, 0.001 uf, 200 vdc	CP-24-2
C109	Capacitor, electrolytic, 2200 uf, 63 vdc	CE-222-63-SE
C110	Capacitor, ceramic disc, 0.01 uf, 100 vdc	CC-A01-101
C111	Capacitor, tantalum, 1 uf, 50 vdc	CE-1-500
C201	Capacitor, electrolytic, 330 uf, 50 vdc	CE-331-50-SE
C202, C203	Capacitor, tantalum, 1 uf, 50 vdc	CE-1-500
C204	Capacitor, electrolytic, 100 uf, 25 vdc	CE-101-25-SE
C205	Capacitor, ceramic disc, 0.01 uf, 100 vdc	CC-A01-101
C206	Capacitor, ceramic disc, 100 pf, 1K vdc	CC-A0001-102
C207	Not used	
C208	Capacitor, plastic film, 0.001 uf, 200 vdc	CP-24-2
C209	Capacitor, electrolytic, 2200 uf, 63 vdc	CE-222-63-SE
C210	Capacitor, ceramic disc, 0.01 uf, 100 vdc	CC-A01-101
C211	Capacitor, tantalum, 1 uf, 50 vdc	CE-1-500
CR101 thru CR105	Diode, silicon	GI44
CR106 thru CR109	Diode, silicon	SI5A2
CR110	Rectifier, silicon controlled	C13F
CR111	Not used	
CR112	Diode, silicon	GI44
CR201 thru CR205	Diode, silicon	GI44
CR206 thru CR209	Diode, silicon	SI5A2
CR210	Rectifier, silicon controlled	C13F
CR211	Rectifier, silicon controlled	C122B
CR212	Diode, silicon	GI44
F101	Fuse, 2A, 250V, Slo-Blo	MDX
F201	Fuse, 2A, 250V, Slo-Blo	MDX
Q101	Transistor, silicon NPN	MS1700G
Q102	Transistor, silicon NPN	2N2219A
Q201	Transistor, silicon NPN	MS1700G
Q202	Transistor, silicon NPN	2N2219A
R101	Resistor, metal film, 3.92K ohm, ±1%, ¼w	RD-3921-1QA
R102	Resistor, metal film, 1.5K ohm, ±1%, ¼w	RD-152-1QA
R103	Resistor, metal film, 845 ohm, ±1%, ¼w	RD-8450-1QA
R104, R105	Resistor, metal film, 12.1K ohm, ±1%, ¼w	RD-1212-1QA
R106	Resistor, metal film, 453 ohm, ±1%, ¼w	RD-4530-1QA
R107	Resistor, metal film, 1.5K ohm, ±1%, ¼w	RD-152-1QA
R108	Resistor, metal film, 845 ohm, ±1%, ¼w	RD-8450-1QA
R109	Resistor, metal film, 1.05K ohm, ±1%, ¼w	RD-1051-1QA
R110	Resistor, metal film, 100 ohm, ±1%, ¼w	RD-101-1QA
R111	Resistor, metal oxide, 2.2 ohm, ±5%, 3w	RD-2F2-3KA
R112	Resistor, metal oxide, 1 ohm, ±5%, 3w	RD-010-3KA
R113	Resistor, metal oxide, 0.51 ohm, ±5%, 3w	RD-F51-3KA
R114	Resistor, cermet, trimmer, 200 ohm, ±10%, ½w	B83004-6
R115	Resistor, metal film, 365 ohm, ±1%, ¼w	RD-3650-1QA
R116	Resistor, metal film, 1.05K ohm, ±1%, ¼w	RD-1051-1QA
R117	Resistor, metal film, 27.4 ohm, ±1%, ¼w	RD-27F4-1QA

A1 ASSEMBLY

PRINTED CIRCUIT BOARD P/N PS-TP340-9

Circuit No.	Description	Part No.
R118	Resistor, metal film, 75K ohm, ±1%, ¼w	RD-753-1QA
R119	Resistor, cermet, trimmer, 100K ohm, ±10%, ½w	B83004-10
R120	Resistor, metal film, 511 ohm, ±1%, ¼w	RD-5110-1QA
R121	Not used	
R122, R123	Resistor, metal film, 12.1K ohm, ±1%, ¼w	RD-1212-1QA
R124	Resistor, metal film, 1.05K ohm, ±1%, ¼w	RD-1051-1QA
R125	Resistor, composition, 3.3K ohm, ±10%, ½w	EB3321
R126, R127	Resistor, metal film, 1.05K ohm, ±1%, ¼w	RD-1051-1QA
R128	Resistor, metal film, 12.1K ohm, ±1%, ¼w	RD-1212-1QA
R129	Resistor, cermet, trimmer, 2K ohm, ±10%, ½w	B83004-5
R130	Resistor, composition, 3.3K ohm, ±10%, ½w	EB3321
R131	Resistor, metal film, 3.92K ohm, ±1%, ¼w	RD-3921-1QA
R132	Resistor, wirewound, 47 ohm, ±10%, 1w	RW-470-4BAFS
R133	Resistor, metal film, 475K ohm, ±1%, ¼w	RD-4753-1QA
R201	Resistor, metal film, 3.92K ohm, ±1%, ¼w	RD-3921-1QA
R202	Resistor, metal film, 1.5K ohm, ±1%, ¼w	RD-152-1QA
R203	Resistor, metal film, 845 ohm, ±1%, ¼w	RD-8450-1QA
R204, R205	Resistor, metal film, 12.1K ohm, ±1%, ¼w	RD-1212-1QA
R206	Resistor, metal film, 453 ohm, ±1%, ¼w	RD-4530-1QA
R207	Resistor, metal film, 1.5K ohm, ±21%, ¼w	RD-152-1QA
R208	Resistor, metal film, 845 ohm, ±1%, ¼w	RD-8450-1QA
R209	Resistor, metal film, 1.05K ohm, ±1%, ¼w	RD-1051-1QA
R210	Resistor, metal film, 100 ohm, ±1%, ¼w	RD101-1QA
R211	Resistor, metal oxide, 2.2 ohm, ±5%, 3w	RD-2F2-3KA
R212	Resistor, metal oxide, 1 ohm, ±5%, 3w	Rd-010-3KA
R213	Resistor, metal oxide, 0.51 ohm, ±5%, 3w	RD-F51-3KA
R214	Resistor, cermet, trimmer, 200 ohm, ±10%, ½w	B83004-6
R215	Resistor, metal film, 365 ohm, ±1%, ¼w	RD-3650-1QA
R216	Resistor, metal film, 1.05K ohm, ±1%, ¼w	RD-1051-1QA
R217	Resistor, metal film, 27.4 ohm, ±1%, ¼w	RD-27F4-1QA
R218	Resistor, metal film, 75K ohm, ±1%, ¼w	RD-753-1QA
R219	Resistor, cermet, trimmer, 100K ohm, ±10%, ½w	B83004-10
R220	Resistor, metal film, 511 ohm, ±1%, ¼w	RD-5110-1QA
R221	Not used	
R222, R223	Resistor, metal film, 12.1K ohm, ±1%, ¼w	RD-1212-1QA
R224	Resistor, metal film, 1.05K ohm, ±1%, ¼w	RD-1051-1QA
R225	Resistor, composition, 3.3K ohm, ±10%, ½w	EB3321
R226, R227	Resistor, metal film, 1.05K ohm, ±1%, ¼w	RD-1051-1QA
R228	Resistor, metal film, 12.1K ohm, ±1%, ¼w	RD-1212-1QA
R229	Resistor, cermet, trimmer, 2K ohm, ±10%, ½w	B83004-5
R230	Resistor, composition, 3.3K ohm, ±10%, ½w	EB3321
R231	Resistor, metal film, 3.92K ohm, ±1%, ¼w	RD-3921-1QA
R232	Resistor, wirewound, 47 ohm, ±10%, 1w	RW-470-4BAFS
R233	Resistor, metal film, 100 ohm, ±1%, ¼w	RD-101-1QA
R234	Resistor, cermet, trimmer, 200 ohm, ±10%, ½w	B83004-6
R235	Resistor, metal film, 12.1K ohm, ±0.5%, ¼w	* RD-1212-1QA
R236	Resistor, metal film, 12.1K ohmn, ±0.5%, ¼w	* RD-1212-1QA
U101	Quad operational amplifier	A65802
U201	Quad operational amplifier	A65802
VR101	Diode, silicon, zener	DZE thru G
VR102	Diode, silicon, zener	1N825G thru K
VR103	Diode, silicon, zener	3EZ5.6D5
VR201	Diode, silicon, zener	DZE thru G
VR202	Diode, silicon, zener	1N825G thru K
VR203	Diode, silicon, zener	3EZ5.6D5

* Matched to within ±.5%

A2 ASSEMBLY

PRINTED CIRCUIT BOARD P/N PS-TP340-8

Circuit No.	Description	Part No.
C301	Capacitor, electrolytic, 330 uf, 50 vdc	CE-331-50-SE
C302, C303	Capacitor, tantalum, 1 uf, 50 vdc	CE-1-500
C304	Capacitor, electrolytic, 100 uf, 25 vdc	CE-101-25-SE
C305	Capacitor, ceramic disc, 100 pf,1K vdc	CC-A0001-102
C306	Capacitor, ceramic disc, 100 pf, 1K vdc	CC-A0001-102
C307	Not used	
C308	Capacitor, plastic film, 0.001 uf, 200 vdc	CP-24-2
C309	Capacitor, ceramic disc, 680 pf, 1K vdc	CC-680P-102
C310	Capacitor, tantalum, 1 uf, 50 vdc	CE-1-500
C311	Capacitor, plastic film, 0.01 uf, 200 vdc	CP-16-2
C312	Capacitor, tantalum, 1 uf, 50 vdc	CE-1-500
C313 thru C315	Capacitor, electrolytic, 10,000 uf, 25 vdc	CE-103-25-SE
C316 thru C338	Not used	
C339	Capacitor, ceramic disc, 0.01uf, 100 vdc	CC-A01-101
CR301 thru CR306	Diode, silicon	GI44
F301	Fuse, 8A, 32V, Slo-Blo	MDL
Q301	Transistor, silicon, NPN	MS1700G
Q302	Transistor, silicon, PNP	2N2905A
Q303	Transistor, silicon, NPN	2N2219A
Q304	Transistor, silicon, NPN	MS1700G
Q305	Transistor, silicon, PNP	2N2905A
R301	Resistor, metal film, 3.92K ohm, ±1%, ¼w	RD-3921-1QA
R302	Resistor, metal film, 1.5K ohm, ±1%, ¼w	RD-152-1QA
R303	Resistor, metal film, 845 ohm, ±1%, ¼w	RD-8450-1QA
R304, R305	Resistor, metal film, 12.1K ohmn, ±1%, ¼w	RD-1212-1QA
R306	Resistor, metal film, 1.05K ohm, ±1%, ¼w	RD-1051-1QA
R307	Resistor, metal film, 845 ohm, ±1%, ¼w	RD-8450-1QA
R308	Resistor, metal film, 12.1K ohm, ±1%, ¼w	RD-1212-1QA
R309	Resistor, metal film, 4.42K ohm, ±1%, ¼w	RD-4421-1QA
R310	Resistor, metal film, 75K ohm, ±1%, ¼w	RD-753-1QA
R311	Resistor, cermet, trimmer, 100K ohm, ±10%, ½w	B83004-10
R312	Resistor, metal film, 511 ohm, ±1%, ¼w	RD-5110-1QA
R313	Not used	
R314	Resistor, metal film, 475K ohm, ±1%, ¼w	RD-4753-1QA
R315	Resistor, metal film, 4.42K ohm, ±1%, ¼w	RD-4421-1QA
R316	Resistor, metal film, 27.4 ohm, ±1%, ¼w	RD-27F4-1QA
R317	Resistor, metal film, 3.24K ohm, ±1%, ¼w	RD-3241-1QA
R318	Resistor, cermet, trimmer, 200 ohm, ±10%, ½w	B83004-6
R319	Resistor, metal film, 27.4 ohm, ±1%, ¼w	RD-27F4-1QA
R320	Resistor, metal film, 475K ohm, ±1%, ¼w	RD-4753-1QA
R321	Resistor, metal film, 3.24K ohm, ±1%, ¼w	RD-3241-1QA
R322	Resistor, metal film, 12.1K ohm, ±1%, ¼w	RD-1212-1QA
R323	Resistor, composition, 3.3K ohm, ±10%, ½w	EB3321
R324	Resistor, metal film, 1.05K ohm, ±1%, ¼w	RD-1051-1QA
R325	Resistor, metal film, 29.4K ohm, ±1%, ¼w	RD-2942-1QA
R326	Resistor, cermet trimmer, 2K ohm, ±10%, ½w	B83004-5
R327	Resistor, metal film, 1.05K ohm, ±1%, ¼w	RD-1051-1QA
R328	Resistor, metal film, 100 ohm, ±1%, ¼w	RD-101-1QA
R329	Resistor, metal film, 34 ohm, ±1%, ¼w	RD340-1QA
R330	Resistor, metal oxide, 0.2 ohm, ±5%, 3w	RD-F2-3KA

A2 ASSEMBLY

PRINTED CIRCUIT BOARD P/N PS-TP340-8

Circuit No.	Description	Part No.
R331	Resistor, metal film, 511 ohm, ±1%, ¼w	RD-5110-1QA
R332	Resistor, metal film, 27.4 ohm, ±1%, ¼w	RD-27F4-1QA
R333	Resistor, wirewound, 0.1 ohm, ±10%, 7w	RW-F1-4RA
R334	Resistor, cermet, trimmer, 200 ohm, ±10%, ½w	B83004-6
R335	Resistor, metal film, 365 ohm, ±1%, ¼w	RD-3650-1QA
R336	Resistor, metal film, 100 ohm, ±1%, ¼w	RD-101-1QA
R337	Resistor, wirewound, 10 ohm, ±10%, 1w	RW-100-4BAFS
R338	Resistor, metal film, 100 ohm, ±1%, ¼w	RD-101-1QA
R339	Not used	
R340	Resistor, metal film, 6.34K ohm, ±1%, ¼w	RD-6341-1QA
R341	Resistor, wirewound, 0.1 ohm, ±10%, 7w	RW-F1-4RA
U301	Quad operational amplifier	A65802
VR301	Diode, silicon, zener	DZE thru G
VR302	Diode, silicon, zener	3EZ5.6D5
VR303	Diode, silicon, zener	1N825 G thru K

A3 ASSEMBLY

PRINTED CIRCUIT BOARD P/N PS-TP340-7

Circuit No.	Description	Part No.
C401, C402	Capacitor, electrolytic, 220 uf, 50 vdc	CE-221-50-SE
C403	Capacitor, electrolytic, 470 uf, 25 vdc	CE-471-25-SE
C404, C405	Capacitor, ceramic disc, 0.02 uf, 500 vdc	CC-23-5
CR401 thru CR403	Diode, silicon	SI5A2
R401	Resistor, cermet, trimmer 5K ohm, ±10%, ½w	B83004-4
R402	Resistor, metal film, 29.4K ohm, ±1%, ¼w	RD-2942-1QA
R403	Resistor, cermet, trimmer 5K ohm, ±10%, ½w	B83004-4
R404	Resistor, metal film, 29.4K ohm, ±1%, ¼w	RD-2942-1QA
R405	Resistor, cermet, trimmer 5K ohm, ±10%, ½w	B83004-4
R406	Resistor, metal film, 12.1K ohm, ±1%, ¼w	RD-1212-1QA

A1 ASSEMBLY

PRINTED CIRCUIT BOARD P/N PS-TP343-3

Circuit No.	Description	Part No.
R101	Resistor, metal film, 3.92K ohm, ±1%, ¼w	RD-3921-1QA
R102	Resistor, metal film, 1.5K ohm, ±1%, ¼w	RD-152-1QA
R103	Resistor, metal film, 845 ohm, ±1%, ¼w	RD-8450-1QA
R104, R105	Resistor, metal film, 12.1K ohm. ±1%, ¼w	RD-1212-1QA
R106	Resistor, metal film, 511 ohm, ±1%, ¼w	RD-5110-1QA
R107	Resistor, metal film, 2K ohm, ±1%, ¼w	RD-202-1QA
R108	Resistor, metal film, 845 ohm, ±1%, ¼w	RD-8450-1QA
R109	Resistor, metal film, 4.42K ohm, ±1%, ¼w	RD4421-1QA
R112	Resistor, metal film, 100 ohm, ±1%, ¼w	RD-101-1QA
R113	Resistor, metal oxide, 0.2 ohm, ±5%, 3w	RD-F2-3KA
R114	Resistor, cermet, trimmer 200 ohm, ±10%, ½w	B83004-6
R115	Resistor, metal film, 365 ohm, ±1%, ¼w	RD-3650-1QA
R116	Resistor, metal film, 1.05K ohm, ±1%, ¼w	RD-1051-1QA
R117	Resistor, metal film, 3.32K ohm, ±1%, ¼w	RD-3321-1QA
R118, R105	Resistor, metal film, 75K ohm, ±1%, ¼w	RD-735-1QA
R119	Resistor, cermet, trimmer, 100K ohm, ±10%, ½w	B83004-10
R120	Resistor, metal film, 511 ohm, ±1%, ¼w	RD-5110-1QA
R121	Not used	
R122	Resistor, metal film, 12.1K ohm, ±1%, ¼w	RD-1212-1QA
R123	Resistor, metal film, 100 ohm, ±1%, ¼w	RD-101-1QA
R124	Resistor, metal film, 1.05K ohm, ±1%, ¼w	RD-1051-1QA
R125	Resistor, metal film, 3.32K ohm, ±1%, ¼w	RD-3321-1QA
R126	Resistor, metal film, 6.04K ohm, ±1%, ¼w	RD-6041-1QA
R127	Resistor, metal film, 2.67K ohm, ±1%, ¼w	RD-2671-1QA
R128	Resistor, metal film, 19.1K ohm, ±1%, ¼w	RD-1912-1QA
R129	Resistor, cermet, trimmer, 2K ohm, ±10%, ½w	B83004-5
R130, R131	Resistor, metal film, 3.32K ohm, ±1%, ¼w	RD-3321-1QA
R132	Resistor, wirewound, 47 ohm, ±10%, 1w	RW-470-4BAFS
R133	Resistor, metal film, 475K ohm, ±1%, ¼w	RD-4753-1QA
R139	Resistor, metal film, 2K ohm, ±1%, ¼w	RD-202-1QA
R142	Not used	
R201	Resistor, metal film, 3.92K ohm, ±1%, ¼w	RD-3921-1QA
R202	Resistor, metal film, 1.5K ohm, ±1%, ¼w	RD-152-1QA
R203	Resistor, metal film, 845 ohm, ±1%, ¼w	RD-8450-1QA
R204, R205	Resistor, metal film, 12.1K ohm, ±1%, ¼w	RD-1212-1QA
R206	Resistor, metal film, 511 ohm, ±1%, ¼w	RD-5110-1QA
R207	Resistor, metal film, 2K ohm, ±1%, ¼w	RD-202-1QA
R208	Resistor, metal film, 845 ohm, ±1%, ¼w	RD-8450-1QA
R209	Resistor, metal film, 4.42K ohm, ±1%, ¼w	RD-4421-1QA

A1 ASSEMBLY

PRINTED CIRCUIT BOARD P/N PS-TP343-3

Circuit No.	Description	Part No.
R212	Resistor, metal film, 100 ohm, ±1%, ¼w	RD-101-1QA
R213	Resistor, metal oxide, 0.2 ohm, ±5%, 3w	RD-F2-3KA
R214	Resistor, cermet, trimmer 200 ohm, ±10%, ½w	B83004-6
R215	Resistor, metal film, 365 ohm, ±1%, ¼w	RD-3650-1QA
R216	Resistor, metal film, 1.05K ohm, ±1%, ¼w	RD-1051-1QA
R217	Resistor, metal film, 3.32K ohm, ±1%, ¼w	RD-3321-1QA
R218	Resistor, metal film, 75K ohm, ±1%, ¼w	RD-753-1QA
R219	Resistor, cermet, trimmer 100K ohm, ±10%, ½w	B83004-10
R220	Resistor, metal film, 511 ohm, ±1%, ¼w	RD-5110-1QA
R221	Not used	
R222	Resistor, metal film, 12.1K ohm, ±1%, ¼w	RD-1212-1QA
R223	Resistor, metal film, 100 ohm, ±1%, ¼w	RD-101-1QA
R224	Resistor, metal film, 1.05K ohm, ±1%, ¼w	RD-1051-1QA
R225	Resistor, metal film, 3.32K ohm, ±1%, ¼w	RD-3321-1QA
R226	Resistor, metal film, 6.04K oh, ±1%, ¼w	RD-6041-1QA
R227	Resistor, metal film, 2.67K ohm, ±1%, ¼w	RD-2671-1QA
R228	Resistor, metal film, 19.1K oh, ±1%, ¼w	RD-1912-1QA
R229	Resistor, cermet, trimmer 2K ohm, ±10%, ½w	B83004-5
R230, R231	Resistor, metal film, 3.32K ohm, ±1%, ¼w	RD-3321-1QA
R232	Resistor, wirewound, 47 ohm, ±10%, 1w	RW-470-4BAFS
R233	Resistor, metal film, 100 ohm, ±1%, ¼w	RD-101-1QA
R234	Resistor, cermet, trimmer 200 ohm, ±10%, ½w	B83004-65
R235	Resistor, metal film, 12.1K ohm, ±0.5%, ¼w	* RD-1212-1QA
R236	Resistor, metal film, 12.1K ohm, ±0.5%, ¼w	* RD-1212-1QA
R237	Not used	
R239	Resistor, metal film, 2K ohm, ±1%, ¼w	RD-202-1QA
R242	Not used	
U101	Quad operational amplifier	A65802
U201	Quad operational amplifier	A65802
VR101	Diode, silicon, zener	DZE thru G
VR102	Diode, silicon, zener	1N825G thru K
VR103	Diode, silicon, zener	3EZ5.6D5
VR201	Diode, silicon, zener	DZE thru G
VR202	Diode, silicon, zener	1N825G thru K
VR203	Diode, silicon, zener	3EZ5.6D5

* Matched to within ±.5%

A1 ASSEMBLY

PRINTED CIRCUIT BOARD P/N PS-TP343-3

Circuit No.	Description	Part No.
C101	Capacitor, electrolytic, 330 uf, 50 vdc	CE-331-50-SE
C102, C103	Capacitor, tantalum, 1 uf, 50 vdc	CE-1-500
C104	Capacitor, electrolytic, 100 uf, 25 vdc	CE-101-25-SE
C105	Capacitor, ceramic disc, 0.01 uf, 100 vdc	CC-A01-101
C106	Capacitor, ceramic disc, 390 pf, 1K vdc	CC-390P-102
C107	Not used	
C108	Capacitor, plastic film, 0.001 uf, 200 vdc	CP-24-2
C109	Capacitor, ceramic disc, 390 pf, 1K vdc	CC-390P-102
C110	Capacitor, ceramic disc, 0.01 uf, 100 vdc	CC-A01-101
C111	Capacitor, tantalum, 1 uf, 50 vdc	CE-1-500
C115	Capacitor, tantalum, 15 uf, 20 vdc	CE-15-20
C201	Capacitor, electrolytic, 330 uf, 50 vdc	CE-331-50-SE
C202, C203	Capacitor, tantalum, 1 uf, 50 vdc	CE-1-500
C204	Capacitor, electrolytic, 100 uf, 25 vdc	CE-101-25-SE
C205	Capacitor, ceramic disc, 0.01 uf, 100 vdc	CC-A01-101
C206	Capacitor, ceramic disc, 390 pf, 1K vdc	CC-390-102
C207	Not used	
C208	Capacitor, plastic film, 0.001 uf, 200 vdc	CP-24-2
C209	Capacitor, ceramic disc, 390 pf, 1K vdc	CC-390P-102
C210	Capacitor, ceramic disc, 0.01 uf, 100 vdc	CC-A01-101
C211	Capacitor, tantalum, 1 uf, 50 vdc	CE-1-500
C214	Capacitor, plastic film, 0.01 uf, 200 vdc	CP-16-2
C215	Capacitor, tantalum, 15 uf, 20 vdc	CE-15-20
CR101 thru CR105	Diode, silicon	GI44
CR110	Rectifier, silicon controlled	C13F
CR112	Diode, silicon	GI44
CR201 thru CR 205	Diode, silicon	GI44
CR210	Rectifier, silicon controlled	C13F
CR212	Diode, silicon	GI44
F101	Fuse, 4A, 32V	MDL
F201	Fuse, 4A, 32V	MDL
Q101	Transistor, silicon NPN	MS1700G
Q102	Transistor, silicon NPN	2N2219A
Q105	Transistor, silicon NPN	MS1700G
Q201	Transistor, silicon NPN	MS1700G
Q202	Transistor, silicon NPN	2N2219A
Q205	Transistor, silicon NPN	MS1700G

ELECTRICAL PARTS LIST

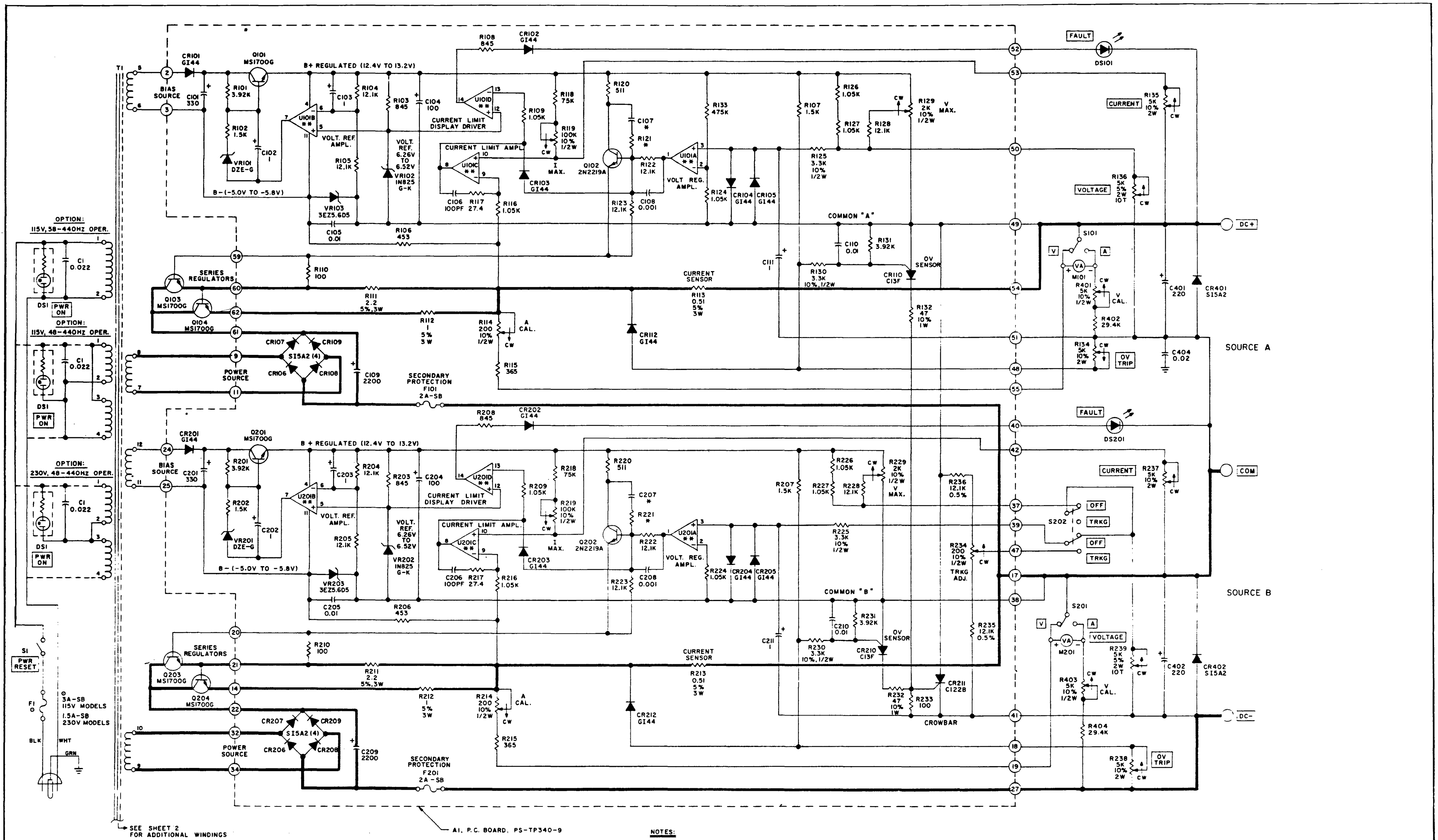
MODEL TP343A

Circuit No.	Description	Part No.
A1	Printed Circuit Board Assembly	PS-TP343-3
A2	Printed Circuit Board Assembly	PS-TP340-8
A3	Printed Circuit Board Assembly	PS-TP340-7
A4	Printed Circuit Board Assembly	PS-TP343-5
C1	Capacitor, ceramic disc, 0.022 uf, 1000 vdc	CC-A022-102
CR211	Rectifier, silicon controlled	2N3897
CR307	Bridge rectifier	BR-252
CR308	Diode, silicon	SY241N
CR309	Rectifier, silicon controlled	2N3897
DS1	Pilot light assembly (NEON)	PLA-24
DS101, DS201	Pilot light assembly (LED)	LED-3
DS301	Pilot light assembly (LED)	LED-3
F1	Fuse, 4A, 125V Slo-Blo	MDX
M101, M201	Meter, 0-25V, 0-2.5V	MVA-173
M301	Meter, 0-15V, 0-5A	MVA-170
Q103, Q104	Transistor, silicon, NPN	2N6254
Q203, Q204	Transistor, silicon, NPN	2N6254
Q306 thru Q308	Transistor, silicon, NPN	2N6254
R110	Resistor, metal film, 27.4 ohm, ±1%, ¼w	RD-27FA-1QA
R111	Resistor, metal film, 34 ohm, ±1%, ¼w	RD-340-1QA
R134, R135	Potentiometer, wirewound, 5K ohm, ±10%, 2w	B82012-1
R136	Potentiometer, wirewound, 5K ohm, ±5%, 2w, 20t	RWV-502-3C10
R210	Resistor, metal film, 27.4 ohm, ±1%, ¼w	RD-27F4-1QA
R211	Resistor, metal film, 34 ohm, ±1%, ¼w	RD-340-1QA
R237, R238	Potentiometer, wirewound, 5K ohm, ±10%, 2w	B82012-1
R241	Resistor, metal oxide, 0.2 ohm, ±5%, 3w	RD-F2-3KA
R243	Potentiometer, wirewound, 5K ohm, ±5%, 2w, 10t	RWV-502-3C10
R342, R343	Potentiometer, wirewound, 5K ohm, ±10%, 2w	B82012-1
R344	Potentiometer, wirewound, 5K ohm, ±5%, 2w, 10t	RWV-502-3C10
S1	Switch, toggle, SPST	ST-5
S101, S201	Switch, toggle, DPDT	ST-39
S202	Switch, toggle, DPDT	ST-36
S301	Switch, toggle, DPDT	ST-39
T1	Transformer	TTM-TP343

A4 ASSEMBLY

PRINTED CIRCUIT BOARD P/N PS-TP343-5

Circuit No.	Description	Part No.
C112, C113	Capacitor, electrolytic, 10,000 uf, 25 vdc	CE-103-25-SE
C212, C213	Capacitor, electrolytic, 10,000 uf, 25 vdc	CE-103-25-SE
CR106 thru		
CR109	Diode, silicon	SI5A2
CR113	Diode, silicon	MR752
CR206 thru		
CR209	Diode, silicon	SI5A2
CR213	Diode, silicon	MR752



NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   ALL RESISTORS ARE IN OHMS, 1%, 1/4W.
   ALL CAPACITORS ARE IN MICROFARADS.
2. ALL FRONT PANEL CONTROL FUNCTIONS AND INDICATORS ARE SHOWN IN RECTANGLES. ALL OTHER CONTROLS ARE ON THE P.C. BOARD.
3. NUMERALS IN CIRCLES THAT ARE CONNECTED BY DASH LINES INDICATE P.C. BOARD TERMINAL NUMBERS.

*4. COMPONENTS MARKED WITH AN ASTERISK (*) ARE NOT USED ON THIS MODEL.

**5 EACH AMPLIFIER SECTION MARKED WITH A DOUBLE ASTERISK (**) REPRESENTS 1/4 OF QUAD OPERATIONAL AMPLIFIER PER SPEC. CONTROL DWG. NO. A65802.

SHEET 1 OF 2

NOTE: FOR LOCATION OF COMPONENTS SEE DWG NO PS-TP340-13

NOTICE

SYM	DESCRIPTION	APPD	DATE
A	RELEASED		

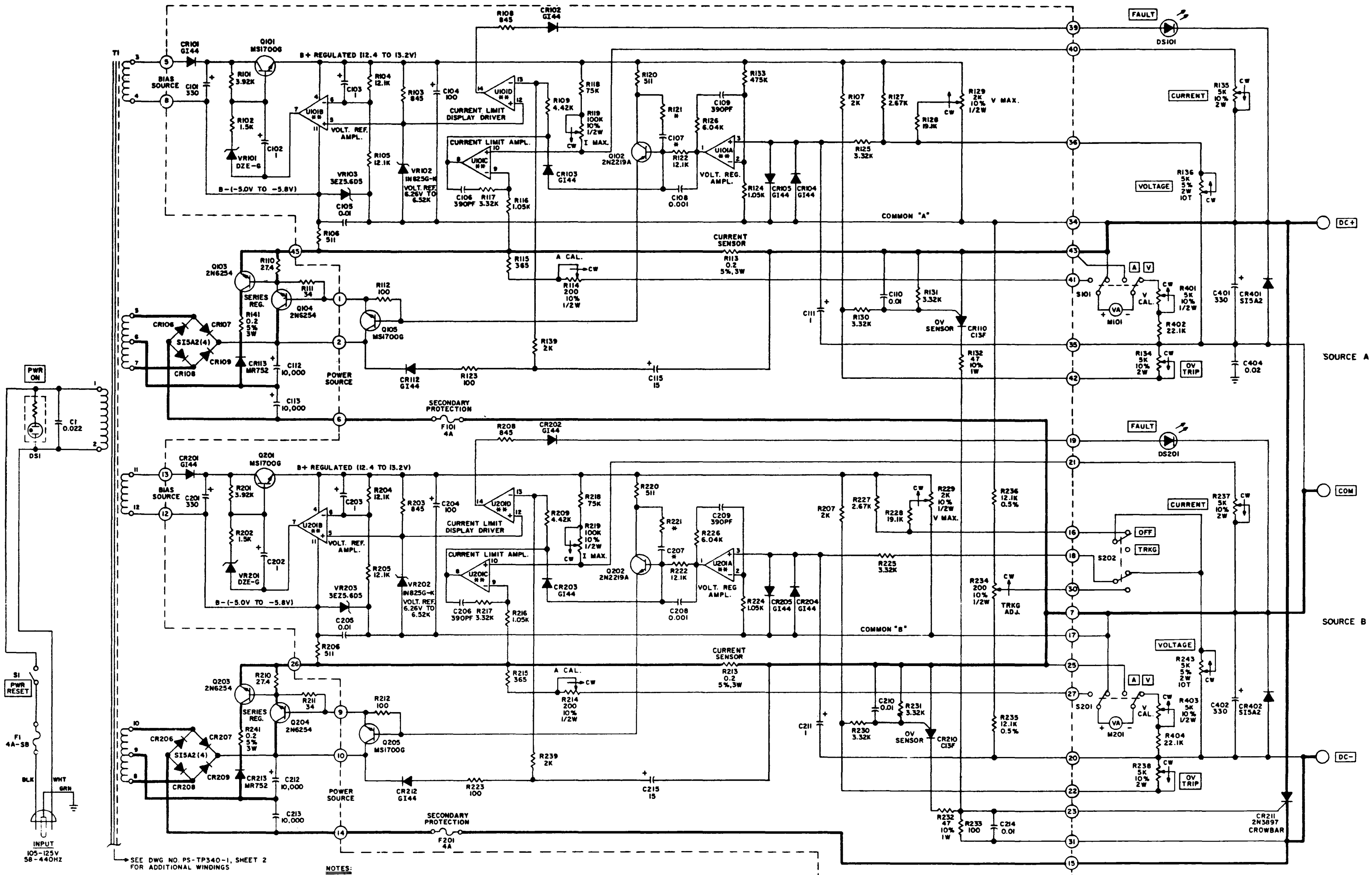
REVISIONS

DRAWING NO. PS-TP340-1 REV A

TITLE SCHEMATIC, SOURCE A & B MODEL TP340

DRAWN HC | CHECKED | APPROVED
DATE 3/18/83 | DATE | DATE

Power Designs inc.
NEW YORK



NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   ALL RESISTORS ARE IN OHMS, 1%, 1/4W.
   ALL CAPACITORS ARE IN MICROFARADS.
2. ALL FRONT PANEL CONTROL FUNCTIONS AND INDICATORS ARE SHOWN IN RECTANGLES. ALL OTHER CONTROLS ARE ON THE P.C. BOARD.
3. NUMERALS IN CIRCLES THAT ARE CONNECTED BY DASH LINES INDICATE P.C. BOARD TERMINAL NUMBERS.

*4. COMPONENTS MARKED WITH AN ASTERISK (*) ARE NOT USED ON THIS MODEL.

**5. EACH AMPLIFIER SECTION MARKED WITH A DOUBLE ASTERISK (**) REPRESENTS 1/4 OF QUAD OPERATIONAL AMPLIFIER PER SPEC. CONTROL DWG. NO. A65802.

NOTE: 1 FOR SCHEMATIC OF SOURCE C SEE DWG NO. PS-TP340-1, SHEET 2
2 FOR LOCATIONS OF COMPONENTS SEE DWG NO PS-TP343-8

SYM	DESCRIPTION	APPD	DATE
A	RELEASED		

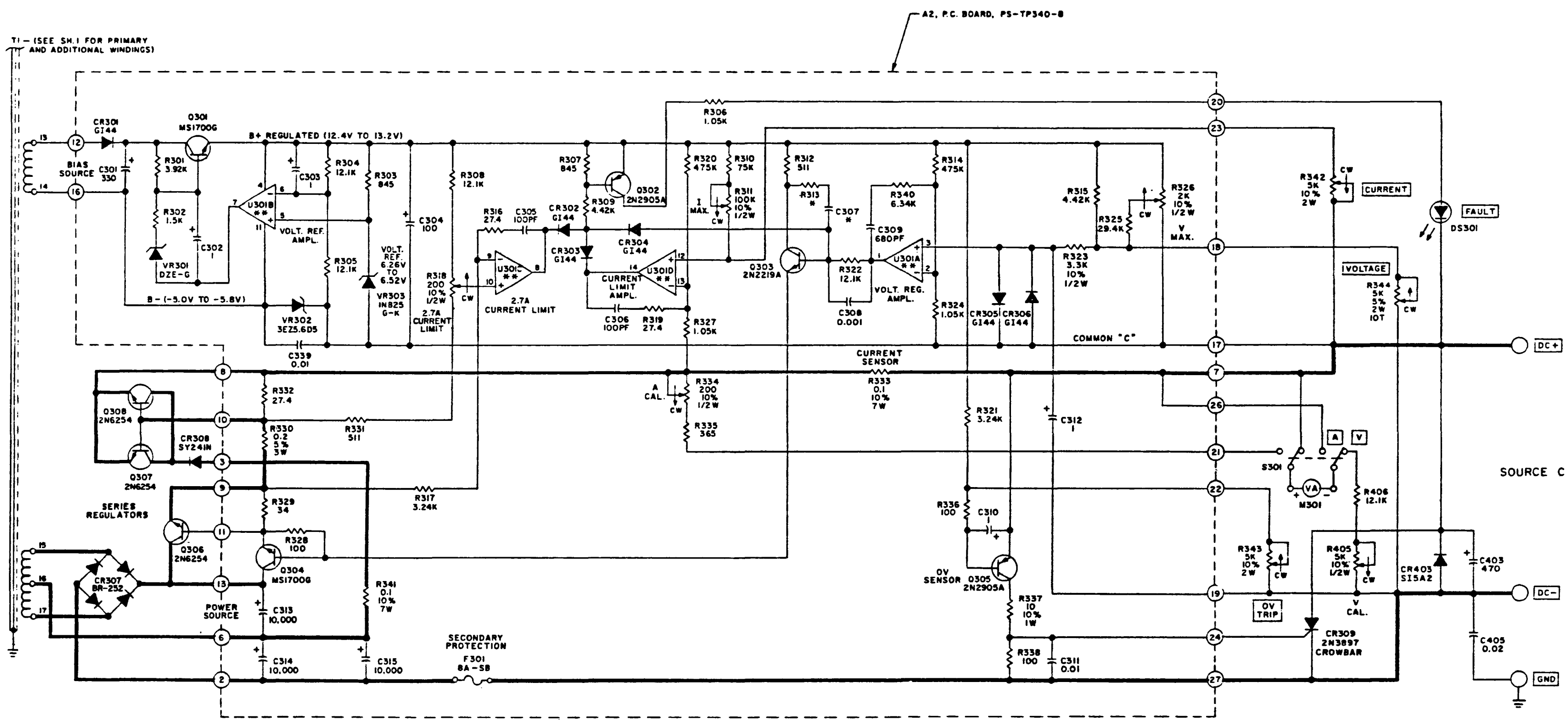
REVISIONS

DRAWING NO. PS-TP343A-1 REV A

TITLE SCHEMATIC, SOURCE A & B MODEL TP343A

DRAWN MC	CHECKED	APPROVED
DATE 4/10/84	DATE	DATE

Power Designs inc. NEW YORK



NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   ALL RESISTORS ARE IN OHMS, 1%, 1/4W.
   ALL CAPACITORS ARE IN MICROFARADS.
2. ALL FRONT PANEL CONTROL FUNCTIONS AND INDICATORS ARE SHOWN IN RECTANGLES. ALL OTHER CONTROLS ARE ON THE P.C. BOARD.
3. NUMERALS IN CIRCLES THAT ARE CONNECTED BY DASH LINES INDICATE P.C. BOARD TERMINAL NUMBERS.
4. * COMPONENTS MARKED WITH AN ASTERISK (*) ARE NOT USED ON THIS MODEL.
5. ** EACH AMPLIFIER SECTION MARKED WITH A DOUBLE ASTERISK (**) REPRESENTS 1/4 OF QUAD OPERATIONAL AMPLIFIER PER SPEC CONTROL DWG. NO. A65802.

SHEET 2 OF 2

NOTE: 1. FOR MODEL TP340 LOCATION OF COMPONENTS SEE DWG. NO. PS-TP340-13.
2. FOR MODEL TP343 LOCATION OF COMPONENTS SEE DWG. NO. PS-TP343-8.

SYM	DESCRIPTION	APPD	DATE
B	REVISED. ECN 3272		
A	RELEASED		

REVISIONS

DRAWING NO. PS-TP340-1 REV. B

TITLE SCHEMATIC, SOURCE C MODELS TP340 & TP343

DRAWN	CHECKED	APPROVED
HC		
DATE 3/18/83	DATE 4-5-83	DATE 4-5-83

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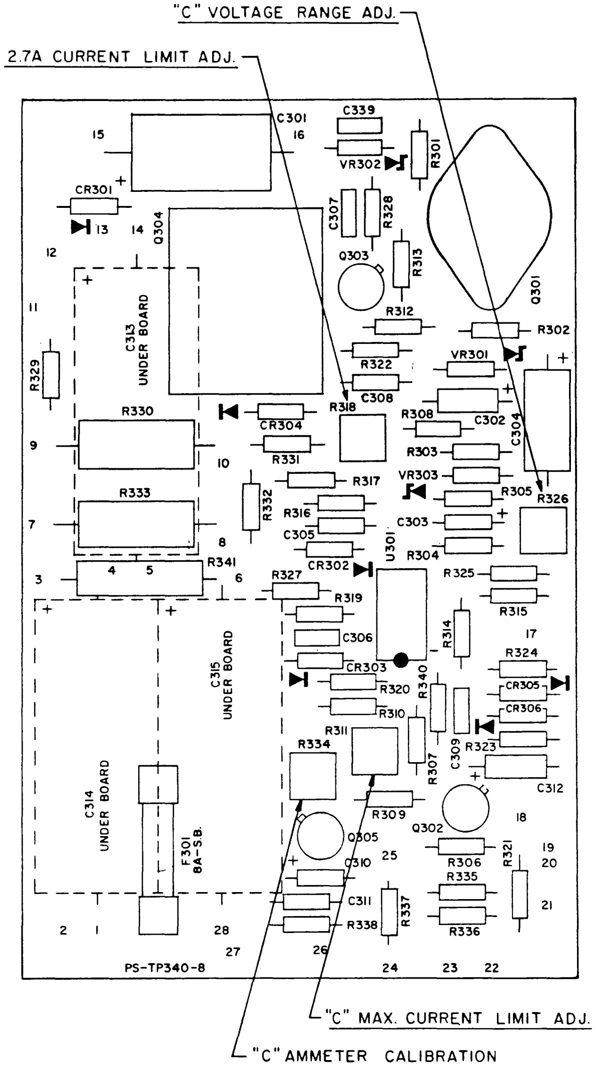
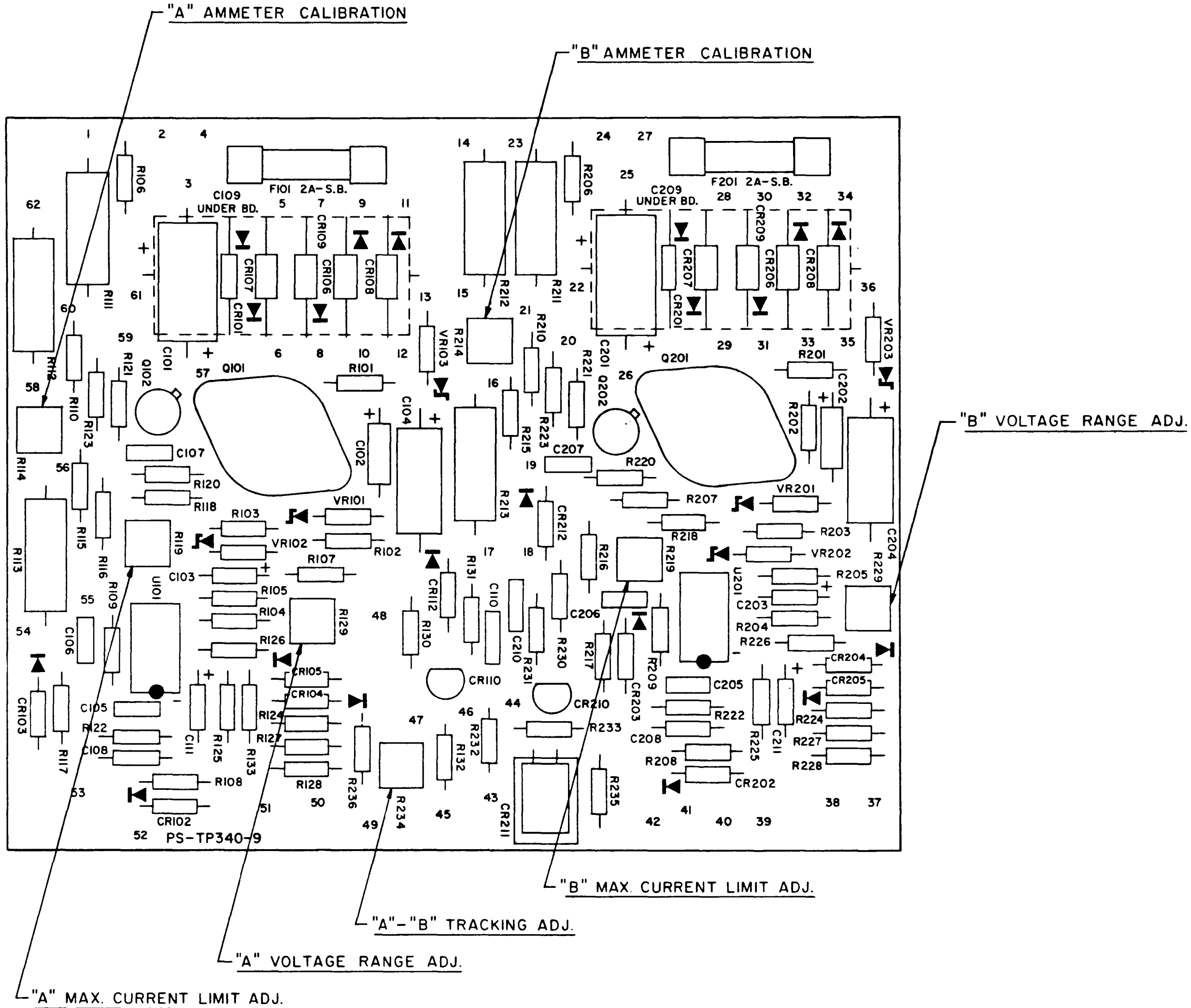


A2, P.C. BOARD, PS-TP340-8

"C" OUTPUT



A1, P.C. BOARD, PS-TP340-9

"A" & "B" OUTPUTS

SHEET 2 OF 2

NOTE: FOR SCHEMATICS OF SOURCES A, B & C SEE DWG. NO. PS-TP340-1

SYM	DESCRIPTION	APP'D	DATE
A	RELEASED		4/5/83

REVISIONS

DRAWING NO. PS-TP340-13 REV A

TITLE LOCATION OF COMPONENTS MODEL TP340

DRAWN HC	CHECKED	APPROVED
DATE 3/18/83	DATE 4-5-83	DATE 4-5-83

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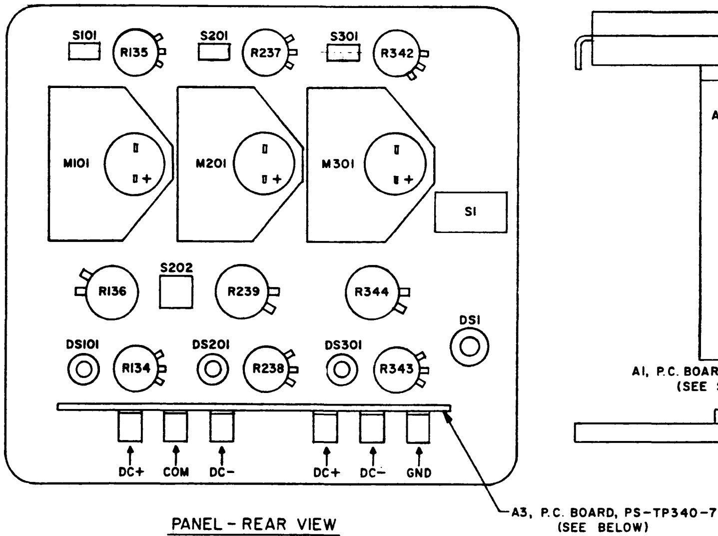
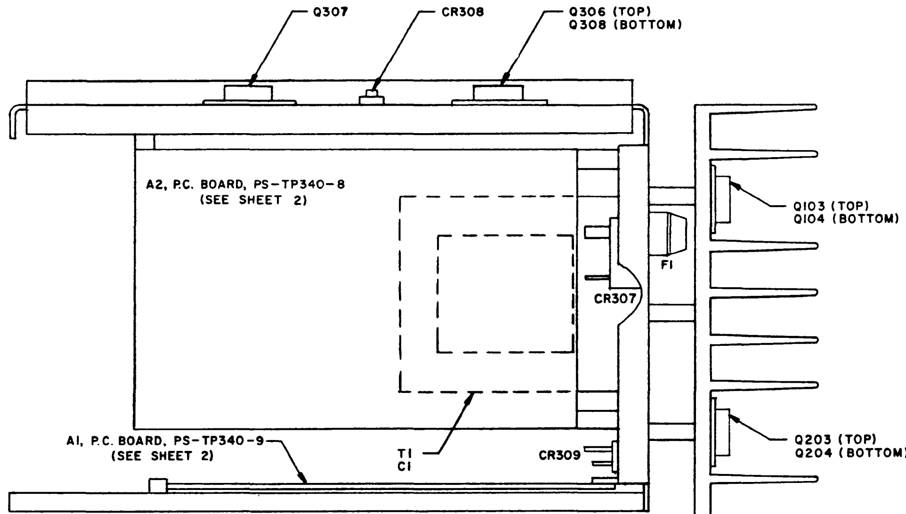
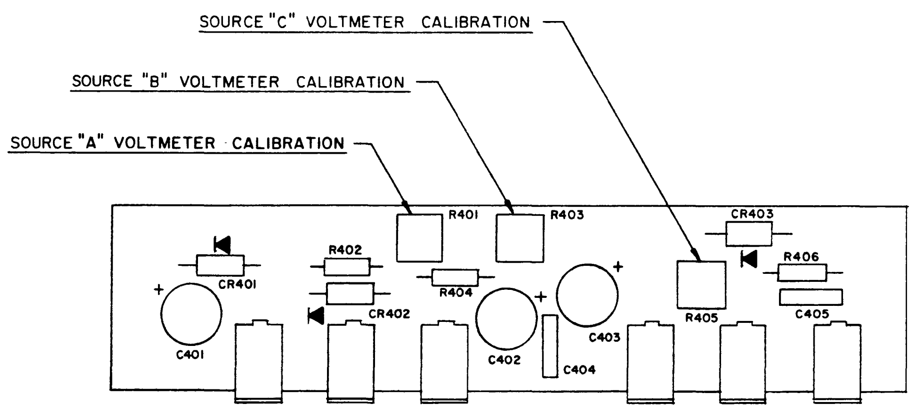


PANEL - REAR VIEW



TOP VIEW OF UNIT



A3, P.C. BOARD, PS-TP340-7

SHEET 1 OF 2

NOTE: FOR SCHEMATICS OF SOURCES A, B&C SEE DWG. NO. PS-TP340-1

SYM.	DESCRIPTION	APPD.	DATE
A	RELEASED		

REVISIONS

DRAWING NO. PS-TP340-13			REV. A
TITLE LOCATION OF COMPONENTS MODEL TP340			
DRAWN HC	CHECKED	APPROVED	
DATE 3/15/83	DATE 4-13-83	DATE 4-13-83	

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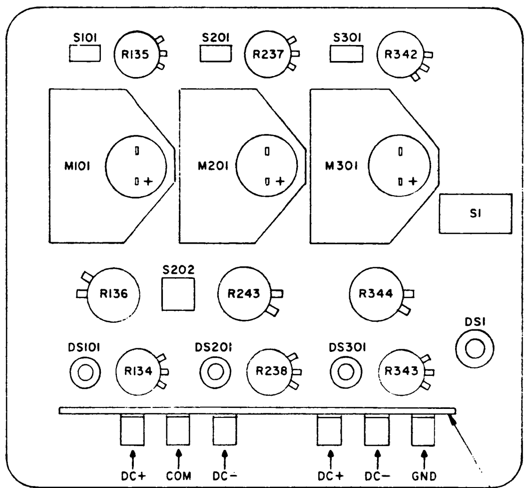
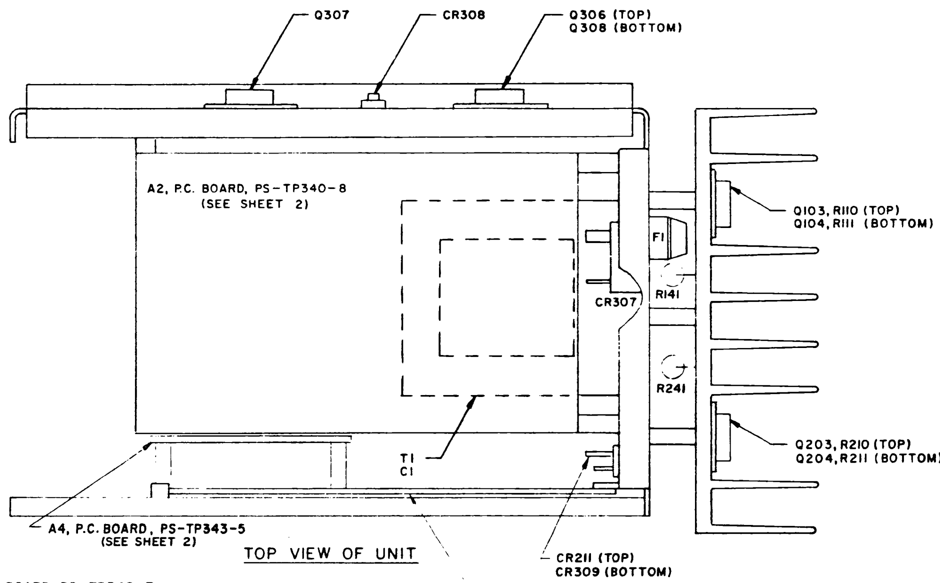


PANEL - REAR VIEW

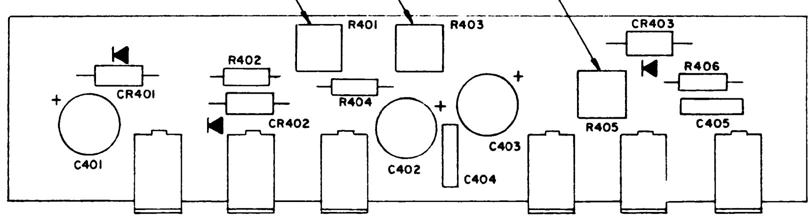


TOP VIEW OF UNIT

SOURCE "C" VOLTMETER CALIBRATION

SOURCE "B" VOLTMETER CALIBRATION

SOURCE "A" VOLTMETER CALIBRATION



A3, P.C. BOARD, PS-TP340-7

SHEET 1 OF 2

NOTE: 1. FOR SCHEMATIC OF SOURCES A & B SEE DWG. NO. PS-TP343A-1.
2. FOR SCHEMATIC OF SOURCE C SEE DWG. NO. PS-TP340-1, SHEET 2.

A	RELEASED		
SYM.	DESCRIPTION	APP'D	DATE
REVISIONS			
DRAWING NO. PS-TP343-8			REV. A
TITLE LOCATION OF COMPONENTS MODEL TP343			
DRAWN HC	CHECKED	APPROVED	
DATE 10/3/83	DATE	DATE	

Power Designs inc.
NEW YORK

GUARANTEE

POWER DESIGNS INC. guarantees to the original purchaser, each instrument sold by us, or our authorized agents, and all the parts thereof, to be free from defects in material or workmanship under normal use and service within the specified ratings and operating conditions. The provisions of this warranty shall not apply to any product which has been subjected to misuse or which has been repaired or altered in any way by the purchaser.

POWER DESIGNS' obligations under this guarantee is hereby limited to the repair or replacement of the instrument, or part thereof, which is returned to us by the original owner within five (5) years after date of shipment, and which shall prove, after our examination to be defective. Certain product catagories as listed are limited to a one (1) year guarantee. All other terms and conditions shall apply.

A minimum retest and inspection charge of $50.00 will be applicable to units returned for repair in warranty unless the unit is found to be defective.

All products returned under warranty must be shipped prepaid to the factory with documentation explaining the malfunction noted. The units will be evaluated, repaired or replaced and promptly returned prepaid if warranty claims are substantiated.

Products covered by a five year guarantee include Regulated Low Voltage D.C. Laboratory Power Supplies; Precision Low Voltage Power Sources; Low Voltage NIM Power Sources.

Products covered by a one year guarantee include Precision High Voltage Power Sources; Modular High Voltage Power Sources; Special Purpose Power Sources: Custom OEM Power Supplies.

POWER DESIGNS INC., reserves the right to discontinue any instrument without notice, or to make modifications in design at any time, without incurring any obligation to make these modifications in instruments previously sold.

POWER DESIGNS INC
Westbury, L.I., New York