INSTRUCTION MANUAL

MODEL TW5005W SERIAL _____

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SECTION 1

GENERAL DESCRIPTION

1.1 DESCRIPTION

The Model TW5005W is a general-purpose power supply containing two sources in a single case. Each source may be operated in either the constant-voltage or constant-current mode and the two sources may be operated independently or combined in a series or parallel arrangement. Transfer from constant-voltage to constant-current or vice versa is automatic.

A single ten-turn potentiometer in each source provides voltage control with 15 millivolt resolution. Each source has two current ranges, 50 or 500 ma. When the current range is switched, the current limit adjustment and the meter range are automatically transferred.

The output voltage and current may be remotely programmed by the connection of an external resistance to a rear panel terminal strip.

Compact and light, the Model TW5005W is self-contained in a portable housing designed for bench use. Panel adapters are available for assembling one or two units in a standard 19-inch rack.

1.2 ELECTRICAL SPECIFICATIONS

INPUT: 105 - 125 V, 57 - 440 Hz, 90 W.

FRONT-PANEL OUTPUT TERMINALS: Three insulated binding posts are provided for each source to handle positive output, negative output, and chassis ground. The positive or negative output of either source may be grounded, or the source may be left floating.

REAR-PANEL OUTPUT TERMINALS: A separate terminal strip is provided for each source. Screw terminals are included for: positive output, negative output, remote voltage programming, and remote current programming.

OPERATING TEMPERATURE RANGE: 0 - 50°C.

CONSTANT VOLTAGE MODE (EACH SOURCE)

RANGE: 0 - 50 VDC, 0 - 500 MA, continuously adjustable.

SERIES OPERATION: 0 - 100 VDC, 0 - 500 MA, continuously adjustable.

PARALLEL OPERATION: 0 - 50 VDC, 0 - 1 AMP, continuously adjustable.

REGULATION: Better than 0.005% + 1 MV at front and rear access terminals for 100% change in rated load or line variations within operating range.

RIPPLE AND NOISE: Less than 1 millivolt peak-to-peak, 350 microvolts rms.

RESPONSE TIME: Output will return to within a 50 millivolt band of the original setting within 50 microseconds for a step load change within 10% and 100% of rating.

SOURCE IMPEDANCE: Less than 0.002 ohm at DC, 0.1 ohm at 20 KHz, 0.7 ohm at 1 MHz.

STABILITY: Less than 0.01% + 2 MV drift per 24 hour period after warm-up, at fixed line, load, and ambient temperature.

TEMPERATURE COEFFICIENT: Less than 0.01% + 0.5 mV per °C.

REMOTE PROGRAMMING RESISTANCE: 200 ohms/volt nominal.

VOLTAGE CONTROL: Ten turn potentiometer with resolution better than 15 mV.

CONSTANT CURRENT MODE (EACH SOURCE)

RANGE: 0 - 500 MA, continuously adjustable.

PARALLEL OPERATION: 0 - 1 AMP, continuously adjustable.

VOLTAGE COMPLIANCE: 50 volts in single or parallel operation.

REGULATION: Output current change less than 300 micro-amps for line voltage change of ± 10% or load variations down to a short circuit across the output terminals.

RIPPLE AND NOISE: Less than 300 microamps, peak-to-peak.

SOURCE IMPEDANCE: Greater than 100,000 ohms.

STABILITY: Less than 0.05% + 250 microamps drift per 24 hour period after warm-up, at fixed line, load, and ambient temperature, and with low TC programming resistance.

TEMPERATURE COEFFICIENT: 0.02% + 100 μ A per °C.

CURRENT CONTROL: 0 - 50 MA and 0 - 500 MA, in two ranges with 0.25 MA resolution on 50 MA range and 2.5 MA resolution on 500 MA range.

1.3 MECHANICAL SPECIFICATIONS

DIMENSIONS: 7 3/4" x 8 5/8" x 10 1/2" deep behind front panel.

WEIGHT: 17 1/2 pounds.

FINISH: Panel is finished in brushed, natural aluminum with lithographed black lettering. Housing is finished in blue-gray vinyl enamel.

SECTION 2

INSTALLATION AND OPERATION

2.1 INSTALLATION

a. Laboratory Bench: The Model TW5005W is a portable unit designed for bench use. No preliminary processing or unpacking procedures are required. The power supply is ready for operation as shipped from the factory.

b. Rack Mounting: Panel adapters are available for mounting one or two units in a standard 19 inch relay rack. Hardware kits are provided with each panel adapter. The supply is fastened to the rear surface of the panel adapter by means of the black anodized rivnuts in each corner of the power supply panel. If the rubber bumper feet interfere with the assembly of the equipment to the rack, they can be removed by removing the housing and unscrewing them.

2.2 CONSTANT-VOLTAGE OPERATION

a. Voltage Adjustment:

1) Rotate the CURRENT ADJUST control fully counterclockwise.

2) Rotate the VOLTAGE control fully counterclockwise.

3) Set the POWER toggle switch in its off position. Connect the power cord into a convenient source of either 115 VAC or 230 VAC, 47 to 440 Hz, depending on the rating of the unit supplied.

4) Set the POWER switch to ON. The neon pilot indicator should illuminate.

5) Set the meter function switch to V and adjust the VOLTAGE control to the desired output voltage.

b. Output Current Limiting:

1) Set the POWER switch to its off position.

2) Connect a jumper wire across the output terminals.

3) Set the POWER switch to ON and the meter function switch to MA.

4) Set the CURRENT RANGE control to the desired current range and adjust the CURRENT ADJUST control to the desired current-limit level.

5) Set the POWER switch to its off position.

6) Remove the jumper wire from the output terminals.

7) Connect the external load to the front-panel binding posts or to the rear-panel terminals marked DC+ and DC-.

8) If desired, connect a jumper wire from either output terminal to the G (chassis ground) terminal on the front panel.

9) Set the POWER switch to ON.

c. Output Current Limiting (Alternate Method): An alternate, but less-accurate, method of current limiting may be employed when a load is connected to the output terminals.

1) Set the POWER switch to ON and the meter function switch to V.

2) Rotate the CURRENT ADJUST control counterclockwise from its maximum position until the CURRENT MODE light illuminates.

3) Rotate the CURRENT ADJUST control clockwise from this threshold (voltage-to-current transfer) point to the approximate current-limiting point desired.

2.3 CONSTANT-CURRENT OPERATION

a. Current Adjustment:

1) Rotate the VOLTAGE control fully clockwise.

2) Set the CURRENT RANGE control to the desired current range and the CURRENT ADJUST control fully counterclockwise.

3) Connect a jumper wire across the output terminals.

4) Set the POWER switch to ON.

5) Set the meter function switch to MA and adjust the CURRENT ADJUST control to the desired output current.

6) Set the POWER switch to its off position.

7) Remove the jumper wire and connect the external load to either the front-panel or rear-panel DC+ and DC- terminals.

8) If desired, connect a jumper wire from either output terminal to the G (chassis ground) terminal on the front panel.

9) Set the POWER switch to ON.

NOTE

The constant-current supply is effectively a high-impedance source. The electrostatic (capacitive) relationship of the source and the load to external grounds and/or the AC line may affect the ripple component of the output current. Experimentally selecting an optimum ground point at the load, or floating the power supply output terminals may minimize the ripple component.

b. Voltage Limiting: With the voltage controls set fully clockwise, the maximum compliance voltage of the supply is approximately 53 volts. If it is desired to limit the maximum output voltage of the supply below this value, proceed as follows:

1) Set the POWER switch to its off position and remove the load from the supply.

2) Set the meter function switch to V and the POWER switch to ON.

3) Adjust the VOLTAGE control to the desired maximum compliance value (as indicated on the front-panel meter).

4) Connect the load to the supply and set the POWER switch to ON.

2.4 REMOTE VOLTAGE PROGRAMMING

The output voltage can be programmed remotely by an external fixed or variable resistance. For remote programmed constant voltage, proceed as follows:

a. Set the POWER switch to its off position.

b. Remove the link between screw terminals RV1 and RV2 on the rear-panel terminal strip.

c. Select the required resistance by multiplying the required value of voltage by 200 (programming constant is approximately 200 ohms per volt). The resistance may have to be trimmed slightly to produce the exact output voltage required. A constant current of 5 milliamperes will flow through this resistance, and its wattage rating should be chosen to minimize drift due to heating effects.

d. Connect the external programming resistance between the RV1 and DC- terminals.

e. Set the POWER switch to ON.

CAUTION

If the remote programming connections are opened while the supply is operating, the output voltage will rise to the maximum compliance of the supply

(approximately 80 volts). When a switch is used to select resistors for output-voltage programming, it should have shorting-type contacts, to avoid voltage spikes.

2.5 REMOTE CURRENT PROGRAMMING

The output current can be programmed remotely by employing external fixed or variable resistance. For remote programmed constant current, proceed as follows:

a. Set the POWER switch to its off position.

b. Rotate the CURRENT ADJUST control fully clockwise. This control will affect the current output if not left in this position.

c. Select the required resistance by using the following relationships:

With the CURRENT RANGE switch set to 0 - 500 MA:

$$R = \frac{11\,I + 90}{530 - I}$$

With the CURRENT RANGE switch set to 0 - 50 MA:

$$R = \frac{110\,I + 90}{530 - 10\,I}$$

Where I = desired output current in milliamperes
R = remote programming resistance in kilohms

d. Connect the external programming resistance between the RC and DC+ terminals on the rear-panel terminal strip.

e. Set the POWER switch to ON.

2.6 SERIES OPERATION

The two independent power sources of the Model TW5005W may be operated in series to provide up to 100 volts. In series operation, the CURRENT RANGE and CURRENT ADJUST controls on all units should be set completely clockwise. The ground terminals on all units may be left floating or may be connected together and tied to either the most negative or positive output terminal. After the units are connected together, proceed as directed in paragraph 2.2.

2.7 PARALLEL OPERATION

Two sources may be operated in parallel to obtain up to one ampere as follows:

a. Connect the load to one source.

b. Turn on the source and turn up the voltage to the desired value.

c. Turn the CURRENT ADJUST control maximum clockwise. If more than 500 MA is being drawn by the load, the CURRENT MODE lamp will be illuminated.

d. Turn the VOLTAGE control of the second source fully counterclockwise.

e. Connect the second source to the load and turn the POWER switch ON.

f. Turn the VOLTAGE control clockwise until the CURRENT MODE lamp on the first unit goes out. The two sources are now current sharing.

SECTION 3

THEORY OF OPERATION

The Model TW5005W is a dual, "linear mode" (series regulator) power supply, with output voltage or current regulation (automatic crossover), low ripple and low noise content. The "linear mode" technique consists basically of the insertion of an electronically controlled variable impedance between a DC unregulated source and the output terminals of the equipment. Two independent supplies are contained within the cabinet; this manual will describe the operation of one of them with the understanding that the other supply is identical.

The DC unregulated source is obtained from the input line by means of transformer T1, diodes CR3, CR4, CR5, and CR6 and capacitor C8. R15 is a bleeder resistor which allows the voltage across C8 to decay rapidly when power is turned off. The series pass regulator transistor (variable impedance) is Q2.

The series pass regulator transistor is controlled by transistor Q3 and its associated components R21 and R14. Q3 is driven by either voltage amplifier U1A and its associated parts (R8, R9, R24, R27, R30, C15, C13, CR10, CR11) or current amplifier U1B and its associated circuitry (R20, R25, R26, C11, C12, CR8) through diode CR9, depending upon whether voltage or current regulation is being called for. Crossover from voltage to current regulation is automatic.

The basic reference voltage for the supply as well as B+ and B- voltages for the amplifier is obtained by means of a separate auxiliary regulated power source, fed by transformer T1, diodes CR1 and CR2, and capacitor C1. This consists of series regulator pass transistor Q1, amplifier U1D, main reference VR3, and associated components R1, R2, R3, R6, R7, C2, C3, C4, C6, VR1 and VR2.

If voltage regulation is called for, the output voltage is sensed by the comparison of the reference and output voltage by means of resistors R10 and R11 and front panel VOLTAGE potentiometer R13. C16 is a speed-up capacitor.

If current regulation is called for, the output current is sensed across either R3 (for the 500 MA full scale current) or the combination of R3 and R17, R18, and R19 (for the 50 MA full scale current). It is compared with the reference voltage through front panel CURRENT ADJUST potentiometer R12 and R35, R36, and R37. DS2, which is turned on by U1B through Q4 and R29, provides a visual indication that the supply is operating in the current mode.

Amplifier U1C and resistors R3 and R5 are the current source for reference VR3. Utilizing this circuitry compensates for certain internal currents that would otherwise go through the current meter, thus assuring that the meter reads only the current supplied to the load.

The voltmeter senses the voltage across the output terminals of the supply, with R31 and R32 the calibration resistor and potentiometer, respectively. Current is sensed across resistor R16 or R16 and R17, with R33 serving as the 500 MA meter calibrator and R19 as the 50 MA meter calibrator.

SECTION 4

MAINTENANCE

4.1 GENERAL

Under normal conditions, no special maintenance of the Model TW5005W is required. Should servicing be necessary, read this section before calibrating or repairing.

4.2 CALIBRATION AND ADJUSTMENTS

All the internal controls of this instrument have been preset prior to shipment. Under normal operation of the power supply, readjustment of these controls might not be necessary.

Recalibration of the Voltmeter/Ammeter should be made at intervals of approximately one year. Recalibration and control readjustments must be made if the power supply has been subject to a catastrophic failure that requires a component replacement.

Test equipment required:

a) 5 1/2 Digit Digital Voltmeter with better than 0.1% accuracy.

b) DC Ammeter 0 - 1A with better than 0.5% accuracy.

c) Electronic or resistance load.

Remove power supply from its cabinet and set current control fully clockwise.

4.2.1 PANEL METER CALIBRATION

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

Turn on the power supply and allow for 15 minute warm-up. Set METER FUNCTION switch to V (Volts). Connect Digital Voltmeter to power supply terminals and set the output voltage to 50 VDC. Adjust R32 potentiometer (on P.C. board) to set panel meter to 50 VDC. Decrease output voltage to 25 VDC. Meter should read 25 ± 1 VDC.

Set METER FUNCTION switch to MA (milliamperes) and CURRENT RANGE control to 0 - 500 MA. Connect load to power supply terminals with calibrating ammeter in series. Adjust load to obtain 500 MA DC on external meter. Adjust R33 potentiometer (on P.C. board) to set panel meter pointer at 500 MA.

Set CURRENT RANGE control to 0 - 50 MA. Adjust load to obtain 50 MA on external meter. Adjust 50 MA meter calibration potentiometer R19 until panel meter reads 50 MA.

4.2.2 VOLTAGE RANGE ADJUSTMENT

With the power supply unloaded, rotate VOLTAGE control fully clockwise.

Connect Digital Voltmeter to DC+ and DC- terminals on rear output block. Select resistor R10 for an external meter reading of 52.0 to 54.5 VDC.

4.2.3 CURRENT LIMIT ADJUSTMENT

Set output voltage of power supply to approximately 10 VDC. Set front panel CURRENT control fully clockwise and switch in 500 MA position.

Connect load to power supply terminals with calibrating ammeter in series.

Select R36 to obtain 520 - 540 MA DC.

4.3 TROUBLESHOOTING

General

Standard troubleshooting procedures are recommended for use in maintaining this equipment. However, the following paragraphs will aid in isolating a faulty component.

4.3.1 NO DC OUTPUT VOLTAGE

If AC lamp DS1 does not light, check fuse F1 and AC switch S1.

If fuse F1 blows repeatedly, check transformer T1, diodes CR1 - CR6, capacitors C1 and C8. If one diode in any rectifier group is defective, replace all diodes in that group; failure of one may have partially destroyed any of the others.

4.3.2 DC OUTPUT VOLTAGE OUT OF SPECIFICATION

If the output voltage is too high or too low, check the values of the auxiliary B+ and B- voltages as shown on the schematic. If B+ is out of specification, check U1B, VR3 and their associated circuitry. If B- is incorrect, check VR2. If B+ and B- are normal, check U1A, Q3, and Q2.

If the current mode is not operating properly, check U1B. If the current mode is operating, but the current mode light does not illuminate, check Q4 and DS2.

4.3.3 DC OUTPUT VOLTAGE NORMAL. POOR RIPPLE AND REGULATION.

If ripple frequency is neither at the AC line or twice the AC line frequency, the supply might be oscillating. Check U1A, R24, C15, Q3 and Q2.

If ripple frequency is equal to or twice the AC line frequency and at an excessively high level, check Q2 and C8.

APPENDIX

1. INTRODUCTION

This Appendix contains an Electrical Parts List, Schematic Diagram, Parts Location Diagram and Equipment Warranty.

2. ELECTRICAL PARTS LIST

All electrical and electronic parts are listed in the sequence of their circuit numbers as shown on the Schematic Diagram. A brief description of each part is given, followed by the code number of the manufacturer and his part number. All manufacturers' code numbers are taken from Cataloging Handbooks H4-1 and H4-2, Federal Supply Code for Manufacturers. These handbooks can be obtained from Federal Agencies or ordered directly from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

We recommend that all parts with the code number 98095 be ordered directly from Power Designs, Inc. The commercial equivalents of these parts may have wide parameter tolerances or require special factory inspection or modification before they can be used in the power supply.

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 predictable life expectancy. Some of these characteristics are observed when the device is taken beyond it's 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 revaluated 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 to insure complete interchangeability with the devices in the original equipment. These devices are coded with a Power Designs, Inc. part number. For example:

MS	1028	A
Semiconductor Manufacturer's Code	Power Designs, Inc. Type	Suffix Identifying Special Parameters

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

The replacement part you receive may not have the same part number as that shown on the Electrical Parts List. This can be due to several factors:

a) A different prefix indicates that Power Designs, Inc. is using another vendor source. The operating characteristics of the devices are identical.

b) A completely different part number indicates:

1. The original vendor has discontinued manufacture of the item or can no longer manufacture it to the original specifications.

2. A better device for use in a particular circuit has been substituted.

3. Tighter controls for interchangeability have provided greater assurance of reliability with the replacement.

MODEL TW5005W

ELECTRICAL PARTS LIST

The Model TW5005W consists essentially of two independent power sources. However, certain parts are common to the two sources.

NOTE: BEFORE REPLACING SEMICONDUCTORS SEE PARAGRAPH 2 OF THIS APPENDIX

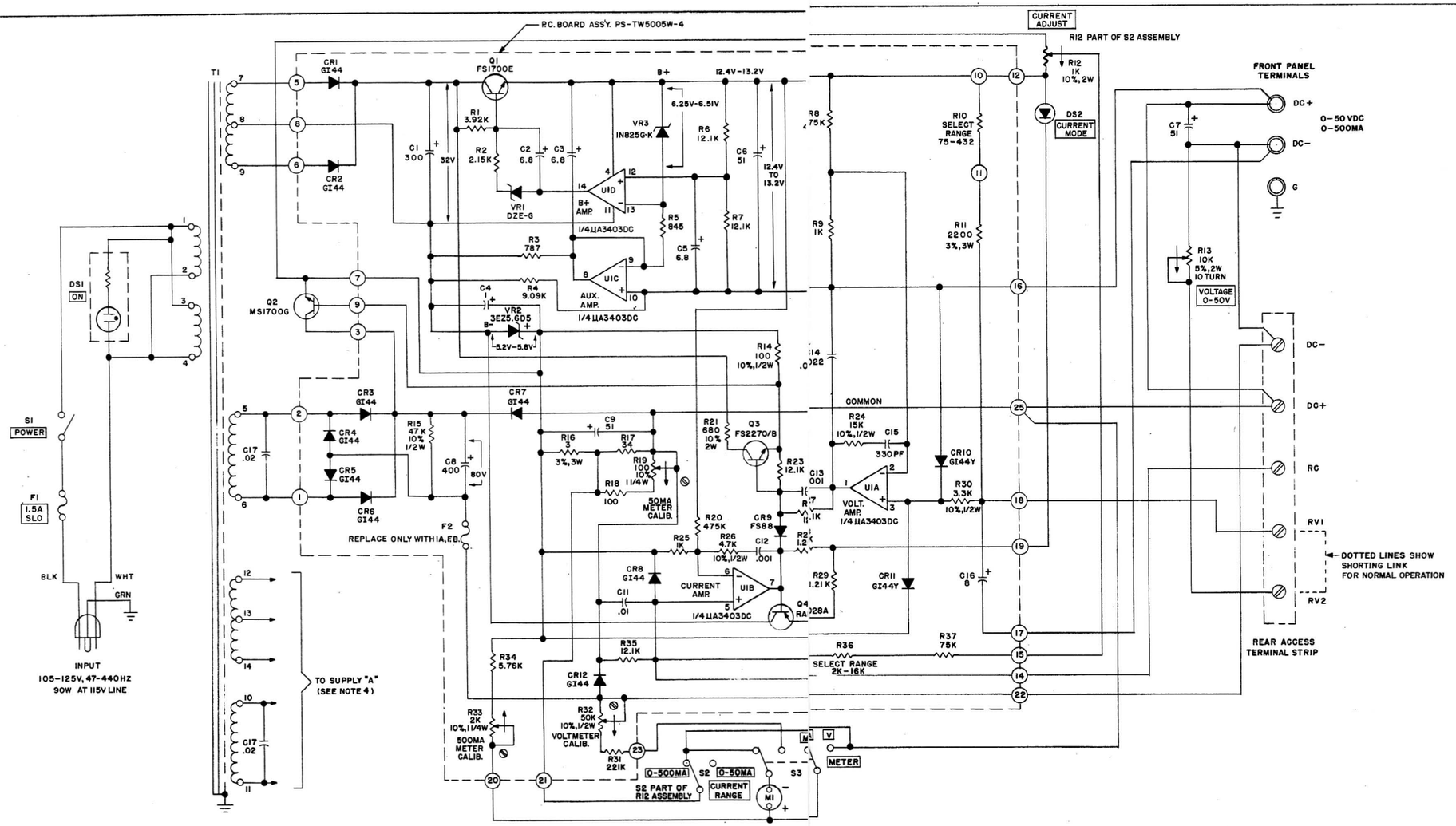
CIRCUIT NUMBER	DESCRIPTION	MFR CODE NUMBER	PART NUMBER
COMMON PARTS:			
DS1	Neon Lamp	98095	PLA-24
F1	Fuse, 1-1/2 A, Slo Blo (AC)	71400	MDL
S1	Switch, toggle, S.P.S.T.	98095	ST-5
T1	Transformer	98095	TTM-TW5005W-101
NON-COMMON PARTS:	Applicable to each of the two sources.		
C1	Capacitor, electrolytic, 300 μf, 40 vdc	98095	CE-301-40
C2, C3	Capacitor, tantalum, 6.8 μf, 35 vdc	98095	CE-6A8-.35
C4	Capacitor, tantalum, 1 μf, 50 vdc	98095	CE-1-500
C5	Capacitor, tantalum, 6.8 μf, 35 vdc	98095	CE-6A8-.35
C6, C7	Capacitor, electrolytic, 51 μf, 25 vdc	98095	CEX-51-25
C8	Capacitor, electrolytic, 400 μf, 100 vdc	98095	CE-83-.85
C9	Capacitor, electrolytic, 51 μf, 25 vdc	98095	CEX-51-25
C11	Capacitor, plastic film, 0.01 μf, 200 vdc	98095	CP-16-2
C12, C13	Capacitor, plastic film, 0.001 μf, 200 vdc	98095	CP-24-2
C14	Capacitor, plastic film, 0.0022 μf, 200 vdc	98095	CP-A0022-2
C15	Capacitor, ceramic, tubular, 330 pf, 100 vdc, ± 10%	98095	CCT-330P-101
C16	Capacitor, electrolytic, 8 μf, 100 vdc	98095	CE-42-1
C17	Capacitor, ceramic disc, 0.02 μf, 500 v	98095	CC-23-5
CR1 thru CR8	Diode, silicon	98095	GI44
CR9	Diode, silicon	98095	FS88
CR10, CR11	Diode, silicon	98095	GI44Y
CR12	Diode, silicon	98095	GI44
VR1	Diode, silicon, zener	98095	DZE, F, G
VR2	Diode, silicon, zener	98095	3EZ5.6D5
VR3	Diode, silicon, zener	98095	1N825 G thru K
DS2	LED, light emitting (current mode indicator)	98095	LHSBR5531
F2	Fuse, 1A, fast blo (DC)	71400	AGC

CIRCUIT NUMBER	DESCRIPTION	MFR CODE NUMBER	PART NUMBER
M1	Meter, 0 - 50 V, 0 - 500 MA	98095	MVA-140
Q1	Transistor, silicon, NPN	98095	FS1700E
Q2	Transistor, silicon, NPN	98095	MS1700G
Q3	Transistor, silicon, NPN	98095	FS2270/B
Q4	Transistor, silicon, PNP	98095	RA1028A
U1	Integrated circuit	98095	μA3403DC
R1	Resistor, precision, 3.92 kΩ, ± 1%, 1/4 w	98095	RD-3921-1QA
R2	Resistor, precision, 2.15 kΩ, ± 1%, 1/4 w	98095	RD-2151-1QA
R3	Resistor, precision, 787 Ω, ± 1%, 1/4 w	98095	RD-7870-1QA
R4	Resistor, precision, 9.09 kΩ, ± 1%, 1/4 w	98095	RD-9091-1QA
R5	Resistor, precision, 845 Ω, ± 1%, 1/4 w	98095	RD-8450-1QA
R6, R7	Resistor, precision, 12.1 kΩ, ± 1%, 1/4 w	98095	RD-1212-1QA
R8	Resistor, precision, 475 kΩ, ± 1%, 1/4 w	98095	RD-4753-1QA
R9	Resistor, precision, 1 kΩ, ± 1%, 1/4 w	98095	RD-102-1QA
R10	*Resistor, precision, (selected range) see end of electrical parts list		
R11	Resistor, wirewound, 2.2 kΩ, ± 3%, 3 w	98095	RW-222-7KA
R12	Potentiometer, 1 kΩ, ± 10%, 2 w (part of S2/R12 Assy.)	98095	B67043
R13	Potentiometer, 10 turn, 10 kΩ, ± 5%, 2 w	98095	RWV-103-3C10
R14	Resistor, composition, 100 Ω, ± 10%, 1/2 w	01121	EB1011
R15	Resistor, composition, 47 kΩ, ± 10%, 1/2 w	01121	EB4731
R16	Resistor, wirewound, 3 Ω, ± 3%, 3 w	98095	RW-030-7KA
R17	Resistor, precision, 34 Ω, ± 1%, 1/4 w	98095	RD-340-1QA
R18	Resistor, precision, 100 Ω, ± 1%, 1/4 w	98095	RD-101-1QA
R19	Resistor, wirewound, trimmer, 100 Ω, ± 10%, 1 1/4 w	98095	RWTP-101-C4
R20	Resistor, precision, 475 kΩ, ± 1%, 1/4 w	98095	RD-4753-1QA
R21	Resistor, composition, 680 Ω, ± 10%, 2 w	01121	HB6811
R23	Resistor, precision, 12.1 kΩ, ± 1%, 1/4 w	98095	RD-1212-1QA
R24	Resistor, composition, 15 kΩ, ± 10%, 1/2 w	01121	EB1531
R25	Resistor, precision, 1 kΩ, ± 1%, 1/4 w	98095	RD-102-1QA
R26	Resistor, composition, 4.7kΩ, ± 10%, 1/2 w	01121	EB4721
R27	Resistor, precision, 12.1 kΩ, ± 1%, 1/4 w	98095	RD-1212-1QA
R28, R29	Resistor, precision, 1.21 kΩ, ± 1%, 1/4 w	98095	RD-1211-1QA
R30	Resistor, composition, 3.3 kΩ, ± 10%, 1/2 w	01121	EB3321
R31	Resistor, precision, 221 kΩ, ± 1%, 1/4 w	98095	RD-2213-1QA
R32	Resistor, wirewound, trimmer, 50 kΩ, ± 10%, 1/2 w	98095	RWT-503-4A
R33	Resistor, wirewound, trimmer, 2 kΩ, ± 10%, 1 1/4 w	98095	RWTP-202-C4
R34	Resistor, precision, 5.76 kΩ, ± 1%, 1/4 w	98095	RD-5761-1QA
R35	Resistor, precision, 12.1 kΩ, ± 1%, 1/4 w	98095	RD-1212-1QA
R36	**Resistor, precision, (selected range) see end of electrical parts list		
R37	Resistor, precision, 78.7 kΩ, ± 1%, 1/4 w	98095	RD-7872-1QA

CIRCUIT NUMBER	DESCRIPTION	MFR CODE NUMBER	PART NUMBER
S2	Switch, DPST (part of S2/R12 Assy.)	98095	B67043
S3	Switch, toggle, DPDT	98095	ST-39
R10 *	Selected range, 75 Ω to 432 Ω, ± 1%, 1/4 w select for 52 to 54.5 vdc output	98095	
R36 **	Selected range, 2.87 kΩ to 12.1 kΩ, ± 1%, 1/4 w select for 0.515 to 0.535 amps	98095	

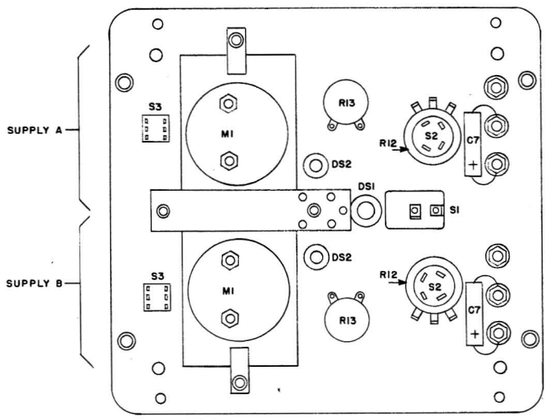
CODE LIST OF MANUFACTURERS

01121	Allen Bradley Company	Milwaukee, Wisconsin
71400	Bussman Mfg. Division	St. Louis, Missouri
98095	Power Designs Inc.	Westbury, New York

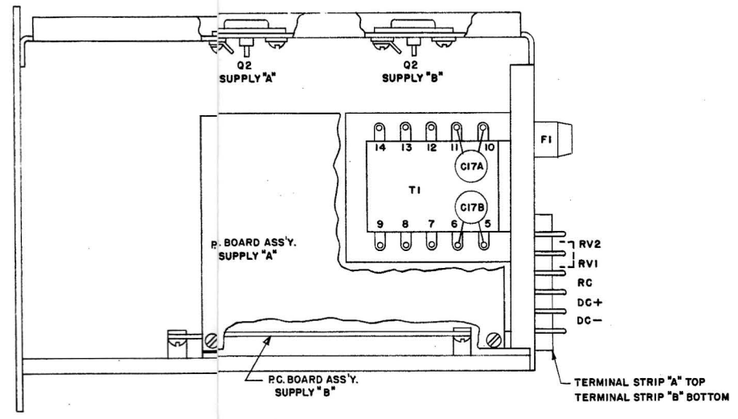


NOTES:

1. UNLESS OTHERWISE SPECIFIED
   ALL RESISTORS ARE IN OHMS, 1/4W, 1%
   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. SUPPLY "B" SCHEMATIC IS SHOWN. SUPPLY "A" SCHEMATIC IS IDENTICAL EXCEPT FOR TRANSFORMER SECONDARY CONNECTIONS. (TERMINALS 10, 11 AND 12, 13, 14 ARE USED INSTEAD OF TERMINALS 5, 6 AND 7, 8, 9)
5. VOLTAGES INDICATED ARE DC AND ARE MEASURED WITH 115V, 60HZ INPUT.



REAR VIEW OF FRONT PANEL ASSEMBLY



TOP VIEW OF UNIT WITH CASE REMOVED

SYM.	REVISIONS DESCRIPTION	APPD.	DATE
A	RELEASED		

DRAWING NO. PS-TW5005W-1 REV. A

TITLE SCHEMATIC, MODEL TW5005W
TWIN POWER SUPPLY

DRAWN	CHECKED	APPROVED
DATE 7/28/80	DATE	DATE

Power Designs Inc.
NEW YORK

WARRANTY

POWER DESIGNS INC., warrants 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.

Its obligation under this warranty is hereby limited to the repair or replacement of any instrument, or part thereof, which is returned to us within one year after delivery, and which shall prove, after our examination, to be thus defective.

This warranty does not include the cost of transportation charges to and from the factory and/or the cost of packaging or crating of instruments for return to the factory, unless such instrument is returned within thirty (30) days from the date of original shipment as shown on the packing list or shipping documents, and prior written authorization for such costs is obtained from the factory.

The repair or replacement of an instrument, or any part thereof, does not void or extend the original warranty.

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

POWER DESIGNS PACIFIC, INC.
Palo Alto, California