acdc electronics

INSTALLATION AND OPERATION MANUAL

OEM SERIES

POWER SUPPLY MODULES

DUAL AND TRIPLE OUTPUTS

ACDC ELECTRONICS
DIVISION OF EMERSON ELECTRIC CO.
401 JONES ROAD, OCEANSIDE, CALIFORNIA 92054
TELEPHONE (714) 757-1880 TWX: 910-322-1470

REGIONAL SALES & SERVICE
524 SOUTH AVENUE EAST
CRANFORD, NEW JERSEY 07016
TELEPHONE: (201) 272-3377 TWX: 710-996-5968

5 YEAR WARRANTY

When used within specified operating conditions, every catalog listed ACDC Power Supply is unconditionally guaranteed to meet all of its published specifications for a period of five years. This guarantee covers all parts of the module, including semiconductors, capacitors and mechanical parts, without regard to the date of purchase or installation. All terms of this guarantee are fully transferable when the power supply is sold as original equipment. If at any time, the power supply is in need of warranty service or calibration, the purchaser should promptly notify ACDC or its authorized representative describing the conditions. The method and place of warranty service should be forwarded to the specified service location freight prepaid. Where, without charge, the unit will be adjusted to meet its original specifications. The sole obligation of ACDC and purchasers' exclusive remedy under this or any other warranty, expressed or implied, is the adjustment or replacement of defective modules as provided above. ACDC shall not be responsible for incidental or consequential damage whether or not foreseeable, caused by defects in the power supply.

ELECTRICAL STANDARDS

All ACDC instrument standards are either certified directly or traceable to certification by the National Bureau of Standards.

CLAIMS FOR DAMAGE IN SHIPMENT

This instrument received comprehensive visual, mechanical and electrical inspection prior to shipment from the factory. Please examine it carefully for external damage or evidence of internal damage immediately upon receipt from the carrier and prior to operation. Claims for damage should be filed with the carrier with a copy of the report forwarded to ACDC. Advice of disposition and/or arrangement for repair or replacement of the instrument will be made by ACDC or its authorized representative. Please include model and serial numbers in all correspondence.

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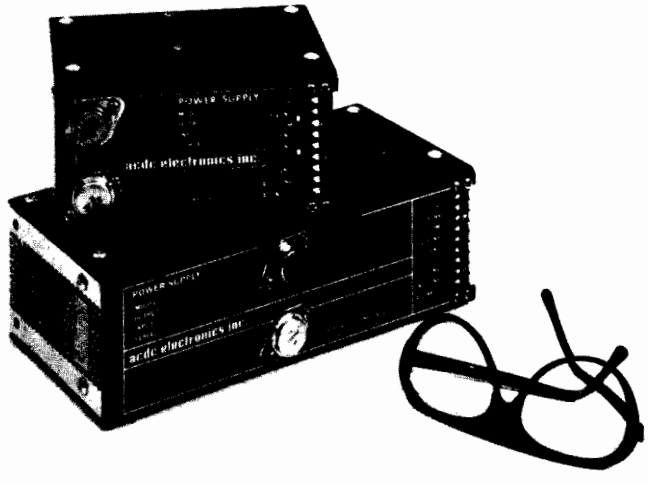
TABLE OF CONTENTS

dual output OEM series power supplies

±12 and ±15 volts
Up to 2.7 amps
0.1% regulation
U/L recognized*
Optional overvoltage protection
Stock delivery
Open frame construction
Optional cover
Racks Available

Nominal output voltage	Adj. range ±V	Maximum current rating (Amps)			Case size	Model Number add -1 for OVP add-2 for Cover
		40°C	55°C	71°C		
±12	.5	1.5	1.3	1.0	R1	OEM12D1.5
		2.7	2.3	1.8	R2	OEM12D2.7
±15	.5	1.3	1.1	0.8	R1	OEM15D1.3
		2.4	2.0	1.6	R2	OEM15D2.4



Designed specifically for driving op amps or A-D converters these dual output power supplies feature low price, 0.1% regulation, and excellent long-term stability. A common reference assures absolute tracking of both the positive and negative outputs so they won't drift independently.

*Recognized under the Component Program of Underwriters' Laboratories, Inc. (file number E48765).

SPECIFICATIONS

Input	105-125 VAC, 47-63 Hz (Usable also at 400 Hz; consult factory for derating.)/100, 210-250 VAC input is available.
Output	±12V or ±15V (see table). Isolated from line and ground. Fully adjustable: Pos. voltage adjustment controls both outputs, Neg. voltage adjustment controls negative alone. Current: Zero to full load.
Regulation	0.1% +5mV NL-FL, ±0.1% ±5mV for 10% Input change.
Ripple	2mV RMS max., 20mV P-P max.
Stability	Typically 10mV (Pos. to Neg. relative stability 5mV) for eight hour period after initial warmup.
Transient Response	Output voltage returns to within regulation limits within 50 μsec in response to a 50% load step.
Remote Sensing	Terminals are provided to maintain regulation at the load, compensating for the DC voltage drop in the load cable.
Remote Voltage Adjustment	Output voltage may be remotely adjusted over a limited range by insertion of a variable resistor in the positive sensing line.
Ambient Temperature	Operating: 0 to 71°C Storage −55 to 85°C
Overload Protection	Inherently protected against overload and short circuit by a foldback type characteristic.
Overvoltage Protection (Optional)	Any model can be furnished with overvoltage protection which crowbars both outputs in the event the sum of the output voltages rises between 3 to 4 volts. This protection circuit is completely independent of the supply and is adjustable. The addition of overvoltage protection does not add to the outline dimensions of the supply.
Construction	Integral aluminum chassis and heatsink. Three sides are open to allow unobstructed ventilation, easy inspection and accessibility. (Optional perforated covers are available.)
Mounting	Units may be mounted on five surfaces for unusual mechanical versatility. Self-locking mounting hardware for all mounting variations supplied with each unit.
Connector	Barrier strip. (Covers Available — See pg. 15.)
Output Impedance	DC-1KHz: 0.001 R_L or 0.005 ohm max. 1KHz-100KHz: 0.005R_L or 0.5 ohm max. (R_L is the rated load)
Temperature Coefficient	0.02%/°C max.
Dimensions	See Page 7 — 8

triple output OEM series power supplies

SPECIFICATIONS

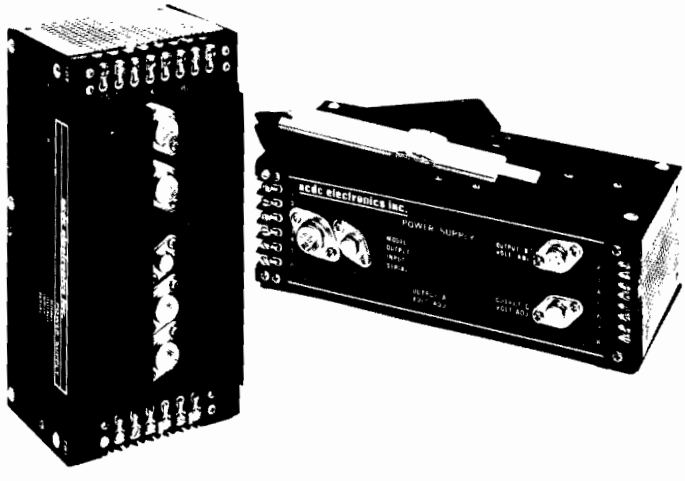
Input:	105-125 VAC, 47-63 Hz (Usable also at 400 Hz; consult factory for derating.) /100, 210-250 VAC input is available.
Output:	Three outputs (see table). Isolated from line and ground. The dual outputs are internally connected in a tracking configuration. Output "B" volt adj. controls both outputs while the output "C" volt adj. controls only the negative output. The unit is available with all three outputs isolated. (Consult factory).
Regulation:	0.1% +5 mV NL-FL, ±0.1% ±5 mV for ± 10% input change.
Ripple:	2 mV RMS maximum, 20 mV P-P maximum.
Stability:	Typically 10 mV for eight hour period after initial warmup.
Transient Response:	Output voltage returns to within regulation limits within 50μsec. in response to a 50% load step.
Remote Sensing:	Terminals are provided to maintain regulation at the load, compensating for the DC voltage drop in the load cable.
Remote Voltage Adjustment:	Output voltage may be remotely adjusted over a limited range by insertion of a variable resistor in the positive sensing line.
Ambient Temperature:	Operating: 0°C to 55°C (For 71°C, contact factory)② Storage: −55°C to 85°C
Overload Protection:	Inherently protected against overload and short circuit by a foldback type characteristic.
Overvoltage Protection:	The 5 volt output has overvoltage protection which will crowbar the output in the event of a voltage rise of 1 to 2 volts above the maximum adjustable output voltage. The trip point is adjustable. Protection on the dual outputs is optional. The addition of overvoltage protection does not add to the outline dimensions.①
Construction:	Integral aluminum chassis and heatsink. Three sides are open to allow unobstructed ventilation, inspection and repairability. (Optional perforated covers are available).
Mounting:	Units may be mounted on five surfaces for unusual mechanical versatility. Self-locking mounting hardware for all mounting variations supplied with each unit.
Connector:	Barrier strip. (Covers Available — See pg. 15.)
Output Impedance:	DC to 1 kHz: 0.001 R_L or 0.005 ohm max. 1 kHz to 100 kHz: 0.005 R_L or 0.5 ohm max. (R_L is the rated load.)
Temperature Coefficient:	0.02%/°C max.
Dimensions	See Page 7 — 8

5, ±12 volts or 5, ±15 volts
Up to 10 amps 0.1% regulation
Built-in overvoltage protection on single output, optional on dual
Stock delivery
Open frame construction
Optional cover
Racks Available

Nominal Output Voltage	Adj. Range ±V	Maximum Current Rating (Amps) 40°C	55°C	Optional 71°C②	Case Size	Model Number add -1 for OVP① add -2 for Cover add "3" for 71°C
5 ±12	0.25 .5	3.0 .75	2.6 .64	2.0 .49	R1	TR101
5 ±15	0.25 .5	3.0 .64	2.6 .54	2.0 .42	R1	TR102
5 ±12	0.25 0.5	5.0 1.0	4.2 0.85	3.2 .65	R2	TR201
5 ±15	0.25 0.5	5.0 0.85	4.2 0.72	3.2 .55	R2	TR202
5 ±12	0.25 0.5	10.0 1.0	8.4 0.85	6.4 .55	R3	TR301
5 ±15	0.25 0.5	10.0 0.85	8.4 0.72	6.4 .55	R3	TR302

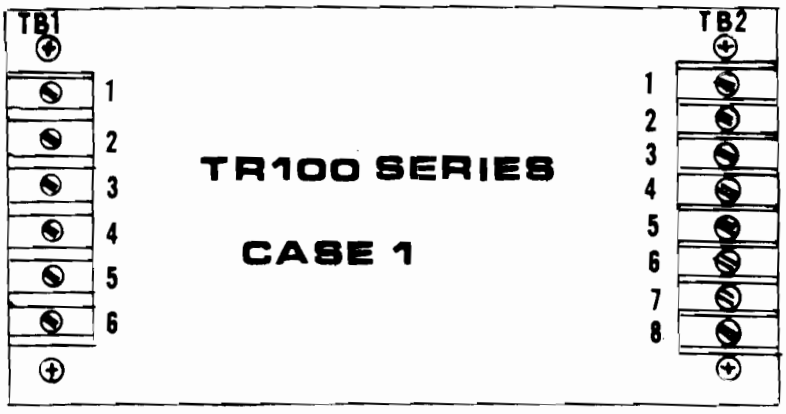
① Overvoltage protection on the 5 volt output is built-in. To specify OVP on the dual output, add -1 to the part number.

② Standard models are rated to 55°C only. If the power supply is to be operated at 71°C it must be specified when ordering so selected high temperature components can be used. Add "3" to model number for 71°C option.

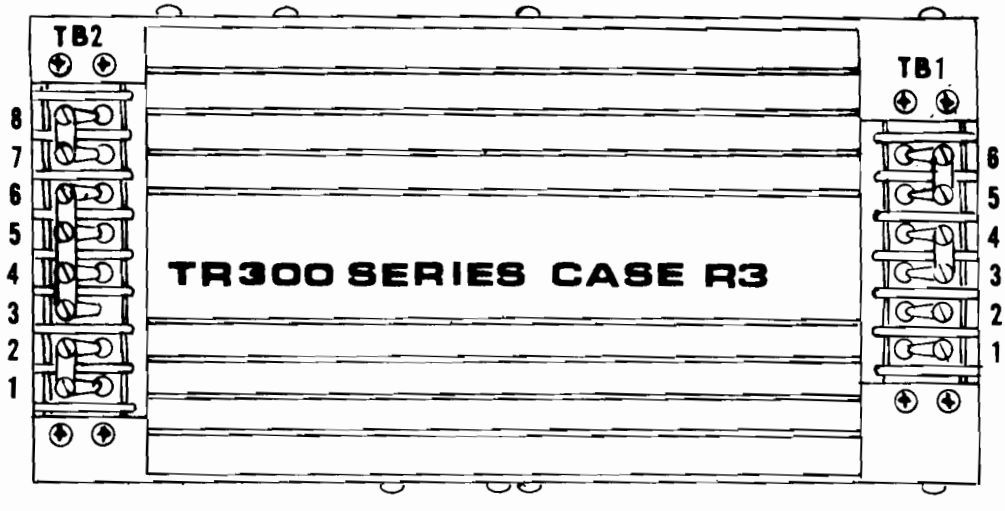


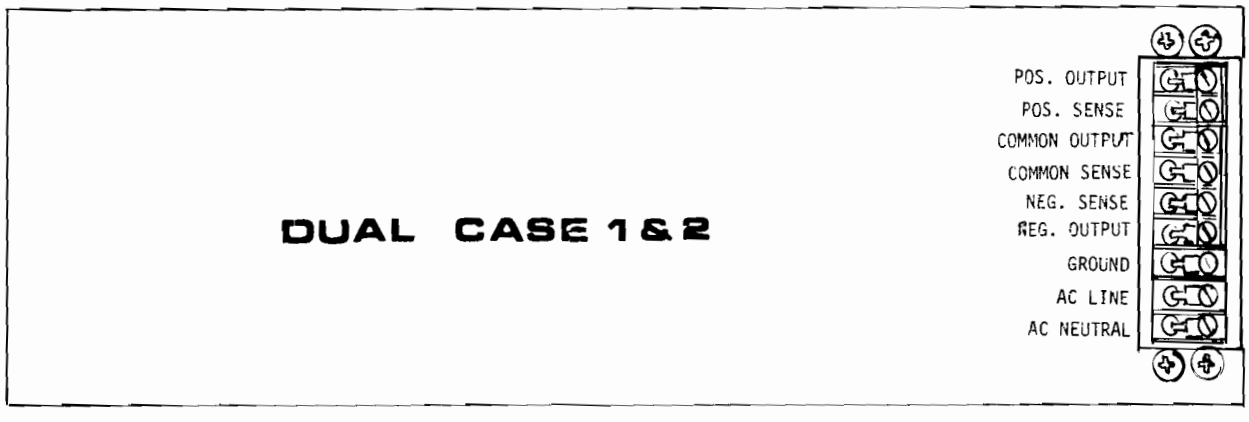
These new triple output power supplies provide a single voltage (5 volts) output for driving IC logic and a dual voltage output (±12V or ±15V) for driving operational amplifiers or A to D converters. Combining these functions into a single compact package, results in a considerable savings in cost, plus reduced size and weight.

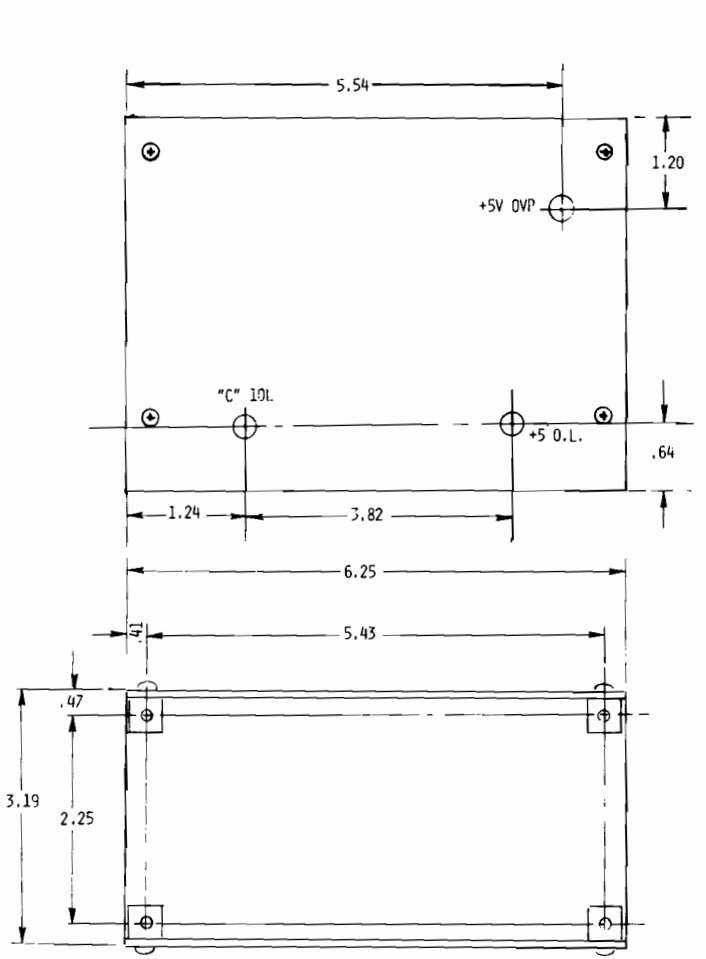
terminal functions



Triple Output	
TB1	
1	AC Line
2	AC Neutral
3	5V Output
4	Pos. Sense
5	Neg. Sense
6	5V Ret.
TB2	
1	Pos. Output
2	Pos. Sense
3	Common Sense
4	Common Output
5	Common Output
6	Common Sense
7	Neg. Sense
8	Neg. Output

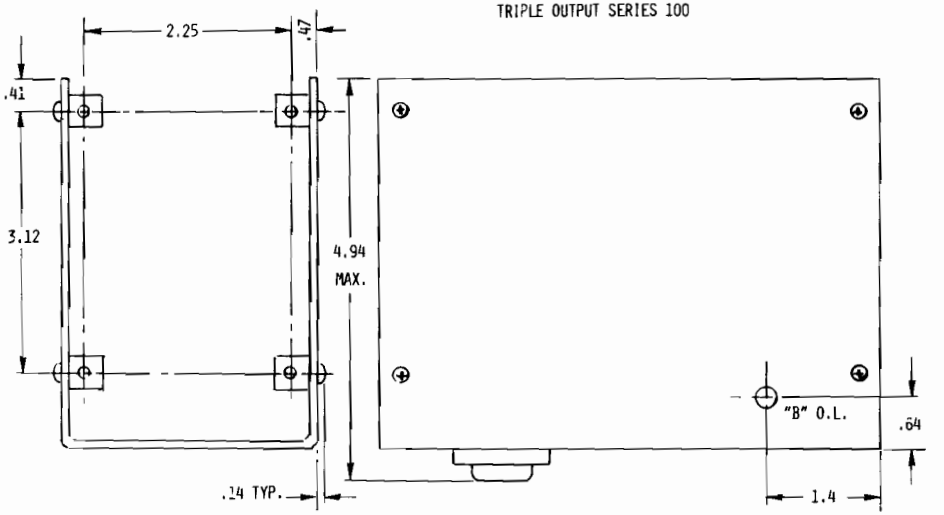


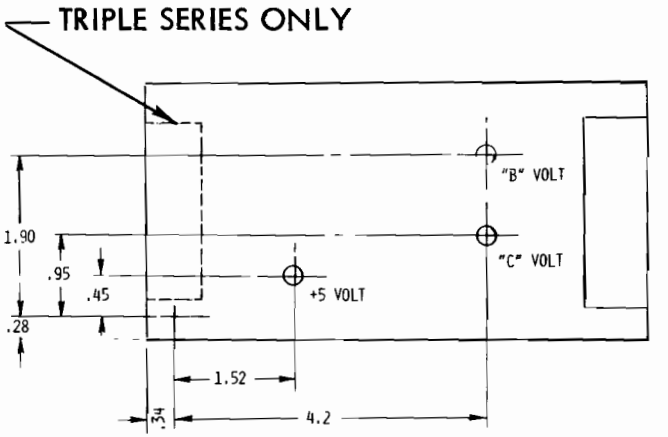




TR100 SERIES

TRIPLE OUTPUT SERIES 100

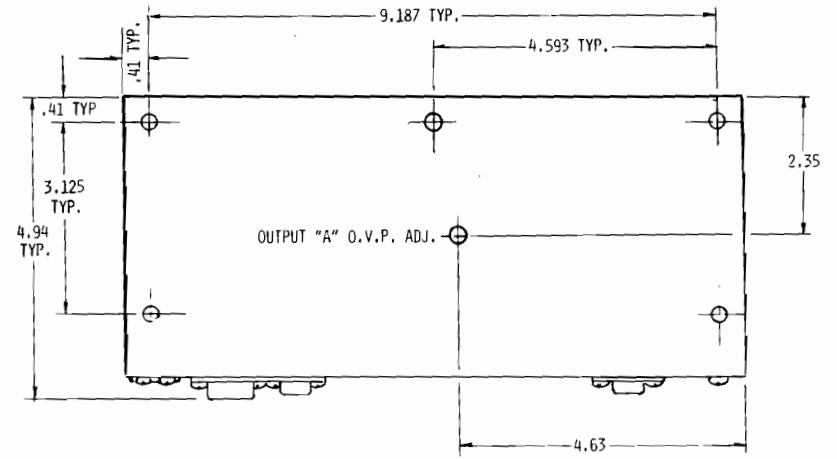


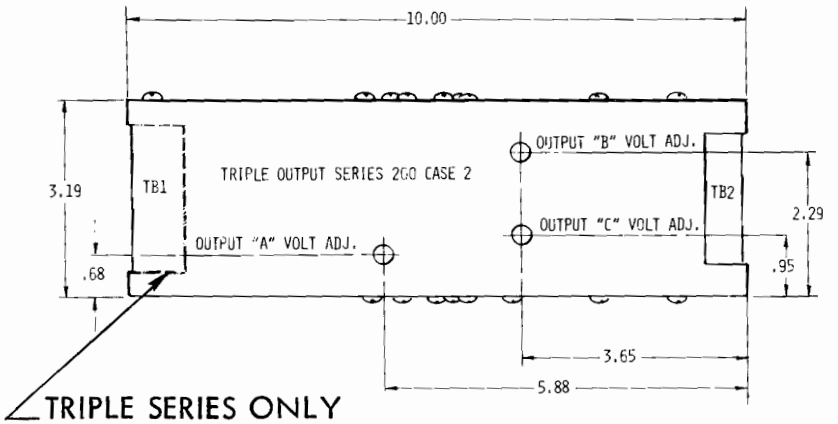


OUTLINE AND MOUNTING DIMENSIONS FOR OEM DUAL AND TRIPLE SERIES
CASE I

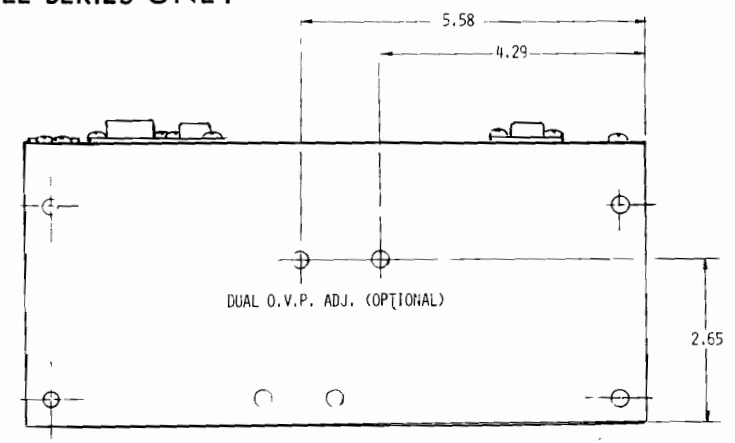
OEM

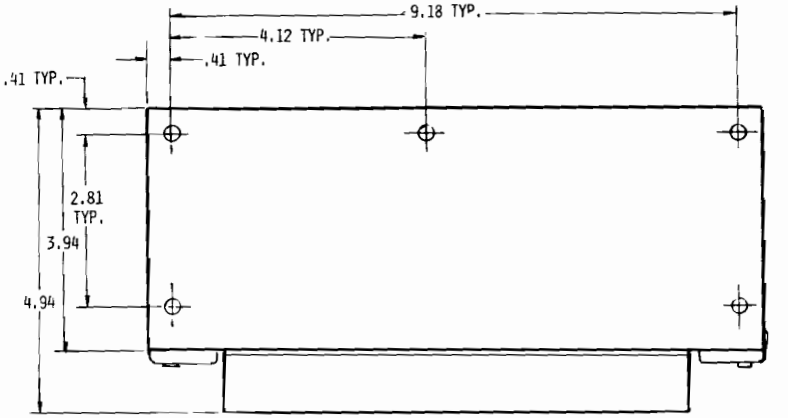
OEM

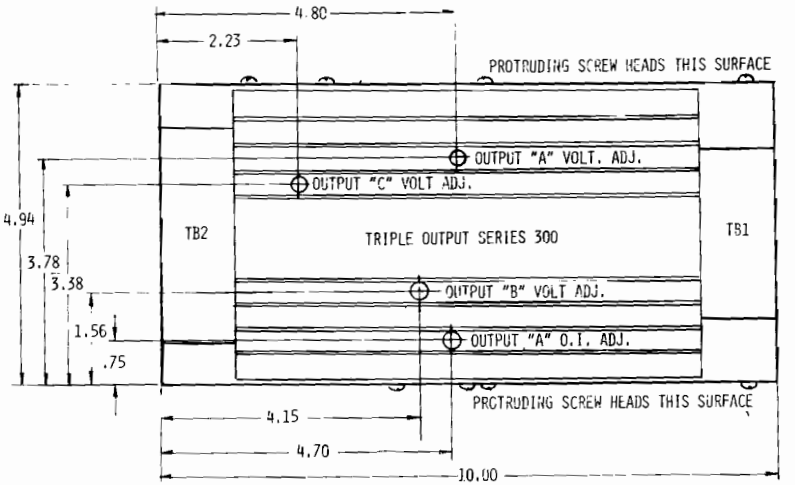


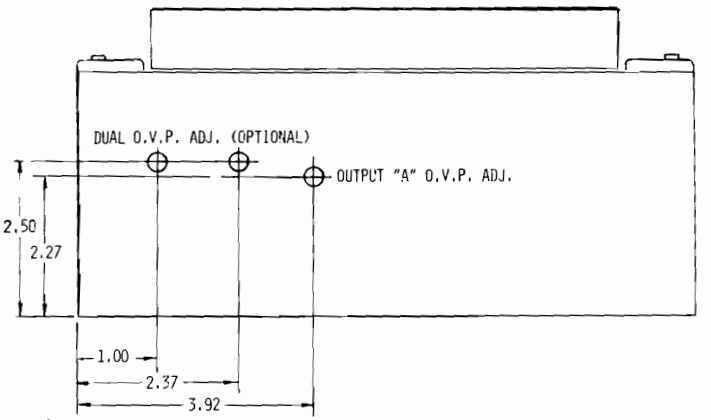


TRIPLE SERIES ONLY









DUAL AND TRIPLE SERIES CASE 2

OUTLINE AND MOUNTING DIMENSIONS

TRIPLE SERIES CASE 3

INSPECTION AND TEST PROCEDURE

Physical
Check unit for any physical damage. If the unit has a cover, check that the cover has not been damaged, possibly causing a short to the internal components.

Dielectric Breakdown Test

There shall be no breakdown between AC input to ground at 1000VAC.

Insulation Resistance Test

Insulation resistance between input to ground, input to output, or output to ground at 500VDC should be 10 megohms minimum.

Test Procedure
Connect power supply as shown in figure 1 (see NOTE*).

Sense leads must be connected to the power leads. All instrumentation must be connected directly to the sense leads with separate twisted pairs, or shielded cable, to avoid coupling and pickup problems.

The power supply has an output impedance less than 1 milliohm and sense terminations must be made with care. The use of clip leads or similar terminations are not acceptable.

Apply AC input slowly to nominal AC input voltage and check for nominal DC output voltage at no load.

Voltage Adjustment
(See NOTE*) With nominal AC input and NO LOAD, adjust each output voltage with potentiometer labeled (Volts Adj. or Volts). Verify the specified adjustment range. Refer to Specifications, Sheets 4 or 5. Adjust to nominal output voltage.

If output voltage does not adjust within specified output limits (unit trips overvoltage), adjust potentiometer fully CCW and recycle AC input prior to continuing with voltage adjustment. Refer to overvoltage adjustment section if unit trips OVP prior to reaching specified output voltage limits.

Load Regulation
With input voltage at minimum, measure the change in output voltage as the load is changed from no load to full load. Repeat with AC input voltage at maximum. Regulation limit is 0.1% plus 5Mv. Measure each output independently.

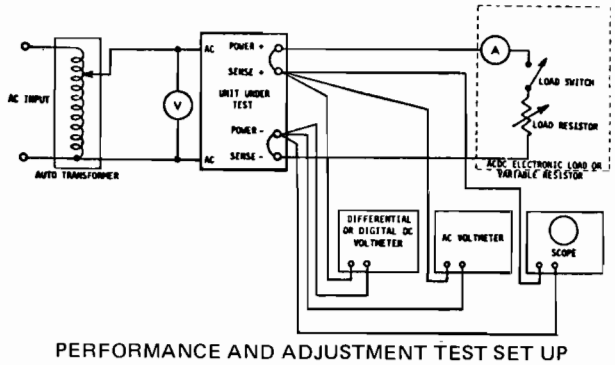
Line Regulation
Set OEM for full load and measure change in output voltage as input AC voltage is varied from minimum to nominal and nominal to maximum. (Typical 105-115-125VAC.) Repeat at no load. Regulation limit is ±0.1% plus ±5Mv. Measure each output independently.

RIPPLE
Vary the AC input voltage from minimum to maximum and the load from no load to full load. Monitor the ripple voltage. Ripple limits are 2Mv RMS and 20Mv peak to peak maximum. Measure each output independently.

Overload
With AC input voltage at nominal, increase the load current until the output voltage decreases and ripple increases. The maximum current should be 115 to 140% of rated output current. Reduce load current to rated value. Measure each output independently. (See NOTE*.)

Overvoltage (Optional)
With nominal AC input and NO LOAD, increase the output voltage until the overvoltage trips (output drops to approximately 1 volt). The trip point should be 10 to 20% or 1 to 2 volts (whichever is greater) above maximum rated output voltage. Refer to overvoltage adjustment, page 10.

Short Circuit
With nominal AC input and NO LOAD, short each individual output for a short period of time. Remove the short and the output should recover to nominal output voltage.



PERFORMANCE AND ADJUSTMENT TEST SET UP
FIGURE 1
(HOOKUP SHOWN FOR SINGLE OUTPUT)

NOTE*: On dual and triple output power supplies, each individual output (Pos., Neg., +5v) is measured and adjusted individually (each output has its own overload and voltage adjustment potentiometers). The positive output (positive to —common terminal) is always adjusted and measured prior to the negative output (+ common to negative terminal).

REQUIRED TEST EQUIPMENT

AC power source (VARIAC) 0-140VAC and 0-7AC amps. Example: DIGITAL GRW10MT3A.

DC differential voltmeter. 0-100VDC with 1Mv F.S. sensitivity. Example: HICKOK 3400-3.

AC voltmeter 1Mv and 3Mv RMS range. Example: Hewlett Packard MOD. 400F.

Variable resistor. Appropriate resistance and wattage rating. Note: ACDC Electronics manufactures an electronic load (EL 750) with meter ranges of 0-60VDC. Voltmeter, 0-10-50-100-200A ammeter, and maximum loading power of 750 watts.

Megometer 50 to 500VDC. Example: General Radio MOD. 1862.

Oscilliscope, 1Mv peak to peak vertical sensitivity. Bandwidth 0-500Khz minimum range. Example: Tektronix MOD. T921.

Volt-Ohm-Multimeter. Example: Triplett MOD. 630NA.

ADJUSTMENT OF OVERLOAD AND OVERVOLTAGE PROTECTION CIRCUITS

1. **General**
   The overload and overvoltage adjustments are normally set at the factory and should not require adjustment.

   If these adjustments have been changed or require calibration, the following procedure can be used by personnel familiar with circuit operation.

2. **Overload**
   The overload circuit is adjusted using a potentiometer located on the printed circuit board and accessible through a hole in the chassis.

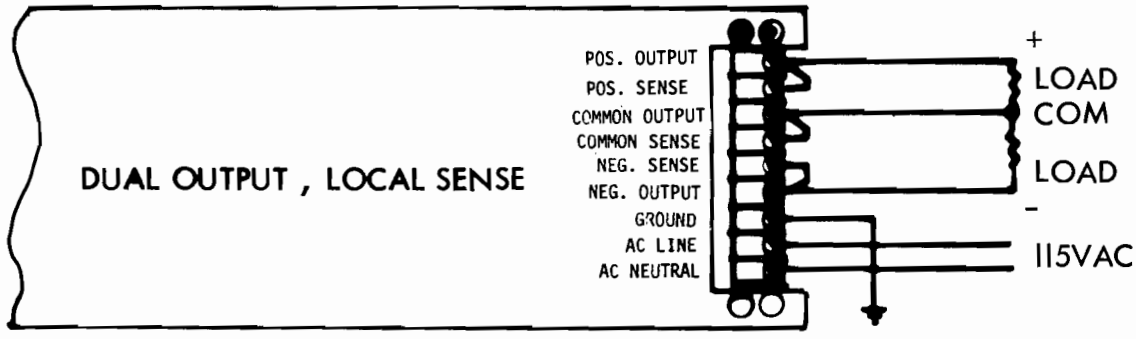
   ADJUSTMENT PROCEDURE:
   a. Adjust the potentiometer fully clockwise.
   b. Connect the power supply as shown in the test set-up. See NOTE*, page 9.
   c. Apply nominal input AC voltage and adjust each output voltage to the lowest voltage of the specified adjustment range.
   d. Adjust the load current to 120 ± 5% of rated output current. Example: A 5.7 Amp unit should be set at 6.84 Amps.
   e. Slowly turn the overload adjustment potentiometer counterclockwise until the output voltage decreases and ripple increases.

3. **Overvoltage**
   Single output units should have the overvoltage circuit adjusted at 2 volts or 10% (whichever is greater) above the maximum rated output voltage. Example: OEM 5N5.7-1 is adjustable 4.75 to 5.25 VDC and should be adjusted to 7.25 volts. Dual output units should be adjusted to 4 volts or 20% (whichever is greater) above the sum of both nominal output voltages. Example: The OEM 12D1.5-1 is adjusted to 28.8 volts. The response time of the overvoltage circuit will not allow adjustment close to the rated output voltage. Noise or transients across the output from any source can cause nuisance tripping.

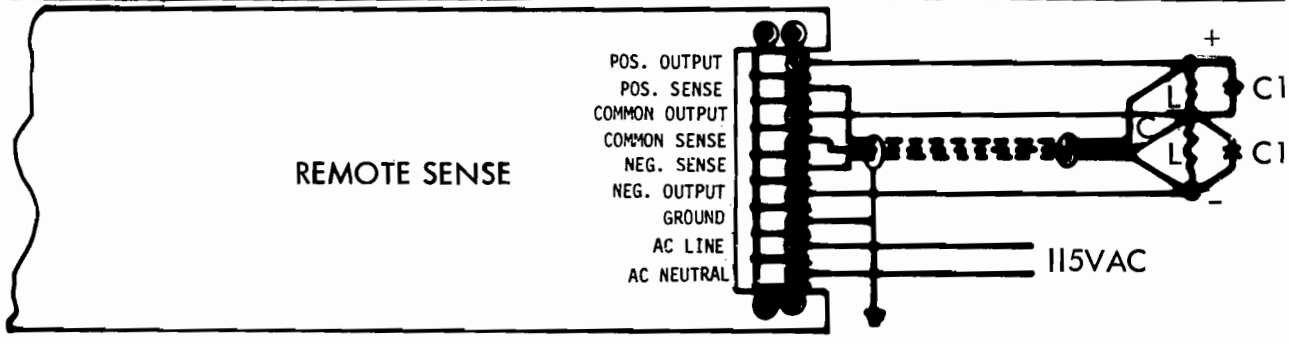
   The overvoltage circuit is located on the main printed circuit board or a separate OVP module depending on model number.

   PROCEDURE:
   a. Adjust OVP adjustment potentiometer fully clockwise.
   b. Connect the power supply as shown in the test set-up at no load. On dual output units, measure pos to neg terminal, common not used.
   c. Adjust the output voltage to the desired overvoltage trip point. On dual output units, adjust positive voltage adjustment potentiometer to obtain desired OVP trip point.
   d. Adjust the overvoltage adjustment potentiometer counterclockwise until the output voltage is crowbarred to approximately 1 volt.
   e. Turn the AC input off and adjust the output voltage down. Reapply AC input power and adjust the output voltage up to verify the set point. Repeat the process if required and readjust the output voltage to nominal.

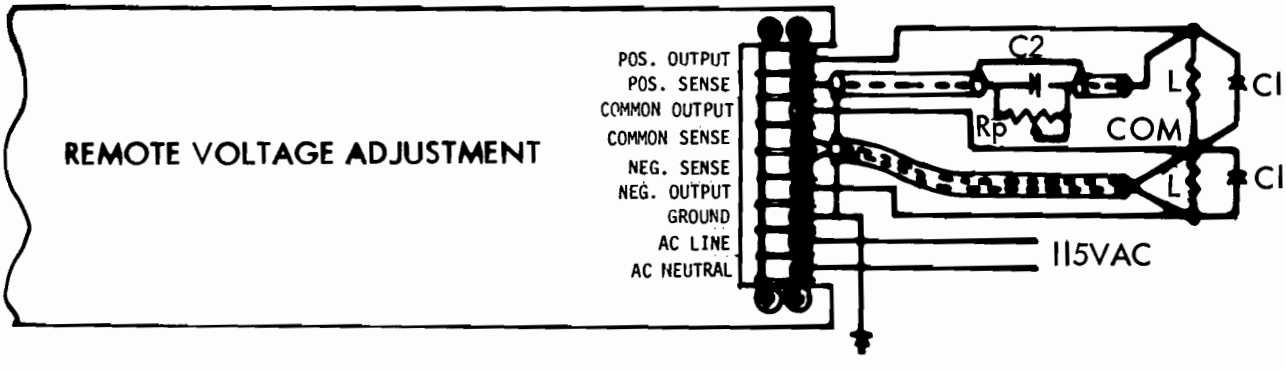
hook-up instructions



THE POSITIVE AND NEGATIVE OUTPUTS ARE REFERENCED TO THE COMMON. THE OUTPUTS MAY BE ADJUSTED BY POTENTIOMETERS ACCESSIBLE THROUGH HOLES IN THE COVER. THE POWER SUPPLY IS EQUIPPED WITH AUTOMATIC OVERLOAD PROTECTION. THE POSITIVE OUTPUT IS THE MASTER, WHEN THE POSITIVE OUTPUT IS SHORTED BOTH OUTPUTS WILL BE TURNED OFF.



USE SHIELDED SENSE LEADS AND ROUTE FOR MINIMUM PICKUP. RUN POWER LEADS CLOSE TO EACH OTHER. CAPACITOR (C1) IS SUGGESTED TO REDUCE THE OUTPUT IMPEDANCE AND IMPROVE CIRCUIT STABILITY. CAPACITOR VALUE SHOULD BE APPROXIMATELY 100MFD/AMP.



OBSERVE ALL INSTRUCTIONS FOR REMOTE SENSING. TO PROGRAM OUTPUTS, ADJUST VOLTAGE ADJUSTMENT POTENTIOMETERS FOR MINIMUM DC OUTPUT. CONNECT THE PROGRAMMING RESISTANCE (Rp) AS SPECIFIED, USING EXTREME CARE THAT LEADS ARE PERMANENTLY CONNECTED. DO NOT SWITCH. DO NOT ATTEMPT TO PROGRAM ABOVE OR BELOW SPECIFIED ADJUSTMENT RANGE. THE VALUE OF Rp SHOULD BE APPROXIMATELY 200 OHMS PER VOLT. Rp MUST BE A LOW NOISE, TC TYPE RESISTOR. SHIELDED LEADS AND A CAPACITOR (C2) ARE NECESSARY TO MAINTAIN LOW RIPPLE. THE CAPACITOR SHOULD HAVE A LOW LEAKAGE AND ESR.

APPLICATION CONSIDERATIONS

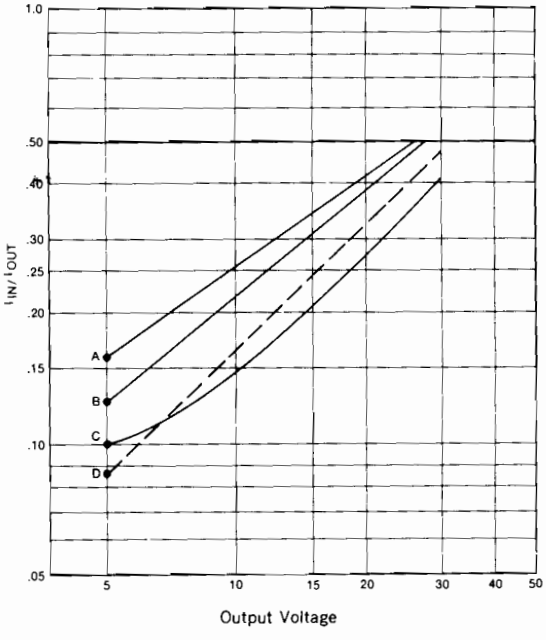
Input:

The input cable should be rated for expected input current. The IZ drop of the cable should be less than 1% of the input voltage.

The input source must have a current rating at least 200% of rated input current.

Waveform should be sinusiodal with no distortion, square wave, and higher frequency inputs can cause problems. Consult the factory.

Primary overload protection, fuse or magnetic type circuit breaker is required on all units with overvoltage protection.



CURVE (A) Low-Power CD type, single and dual-output printed circuit assemblies.

CURVE (B) Standard OEM type single and dual-output modules.

CURVE (C) 300 to 500 watt HCM type power supplies.

CURVE (D) 300 and 500 watt high-efficiency switching JP type power supplies.

EXAMPLES: Our OEM5N17 power supply is a 5 volt, 17 amp output, 85 watt unit. Using curve B, the input/output current ratio is .125. The input current is .125 x 17 = 2.1A RMS. Use a 3A fuse.

For dual OEM15D2.4, use twice the rated output current. A ±15V, 2.4A module has an input/output current ratio of .30. The input current is .30 x 2.4 x 2 = 1.44A RMS. Use a 3A fuse.

Output:

Reference hook up instructions page for proper termination. The sense leads must be connected local or remote. OPEN SENSE LEADS IS ONE OF THE MOST SERIOUS APPLICATION PROBLEMS.

The load line must be selected to limit the voltage drop within the power supply capability. The voltage drop in the power leads reduces the voltage available at the load and can affect the current limit circuit.

The load line has a significant effect on the output impedance and transient response. Load line termination may be required for stability and low output impedance at high frequency.

The current limit circuit is foldback type. The current limit is normally 120±10% of rated current.

Start problems could result on some motor, selenoid or filament leads which exhibit a high ratio of 10-to-1 between actual load and starting impedance. This problem can be corrected by adjustment of the short circuit current. The short circuit current should not be adjusted above 50% of rated current.

The output is floating, either positive or negative can be grounded. The output is isolated from the chassis and can be floated at 250VDC maximum.

Overvoltage Protection:

Overvoltage protection is an electronic crowbar circuit. Operation time is microseconds. This circuit should be adjusted to allow a margin for noise and transients to avoid nuisance tripping. The SCR has a maximum I^2T rating. If the load contains a lot of capacitance the SCR could be damaged.

Remote Programming:

Remote programming capability is provided on most models. The termination must receive special attention to reduce noise. The programming should not be switched or open circuited because this condition, similiar to open sense leads, cause high output voltage.

Dual Outputs:

Dual output modules are designed to provide a positive and negative output. The outputs are tracking and exhibit a high degree of temperature stability. A dual contains a master and slave output. The master determines the amplitude and performance of the slave. The slave can have a temperature coefficient that is the summation of both outputs. The outputs are normally connected so that if one output is shorted the other will be reduced also. Overvoltage protection if provided is connected from the positive to negative outputs and will detect a failure of either output and reduce both outputs.

Parallel Operation:

Parallel operation of identical OEM modules is not possible without circuit modification. OEM type modules have been paralleled but they do not current share. One supply is then operating in current limit or 120% of rated load which is not recommended. The HCM model has parallel capability that requires a special inter-connection. Strict control of the load line and circuit is necessary for proper current sharing.

Redundant Operation:

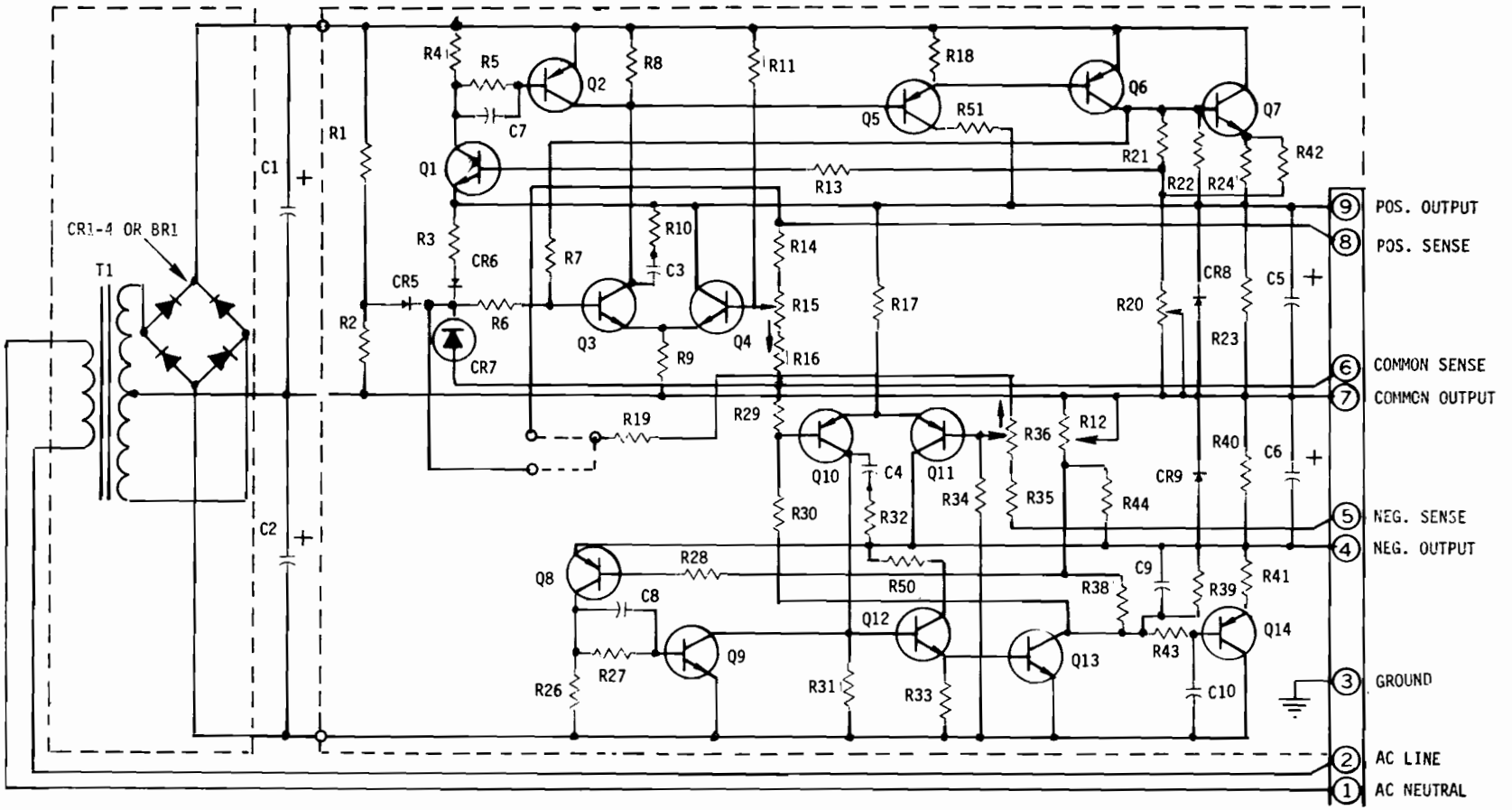
When power supplies are connected for redundant operation some complex problems exist. Because of these problems you should contact the factory for assistance.

Stability:

Stability is the change in output voltage for a eight hour period after a 30 minute warm up at CONSTANT LINE, LOAD AND AMBIENT TEMPERATURE. The stability specifications of the instrumentation must be at least an order of magnitude (10 times) better than the change to be measured. Line, load and temperature must be constant.

Temperature Coefficient:

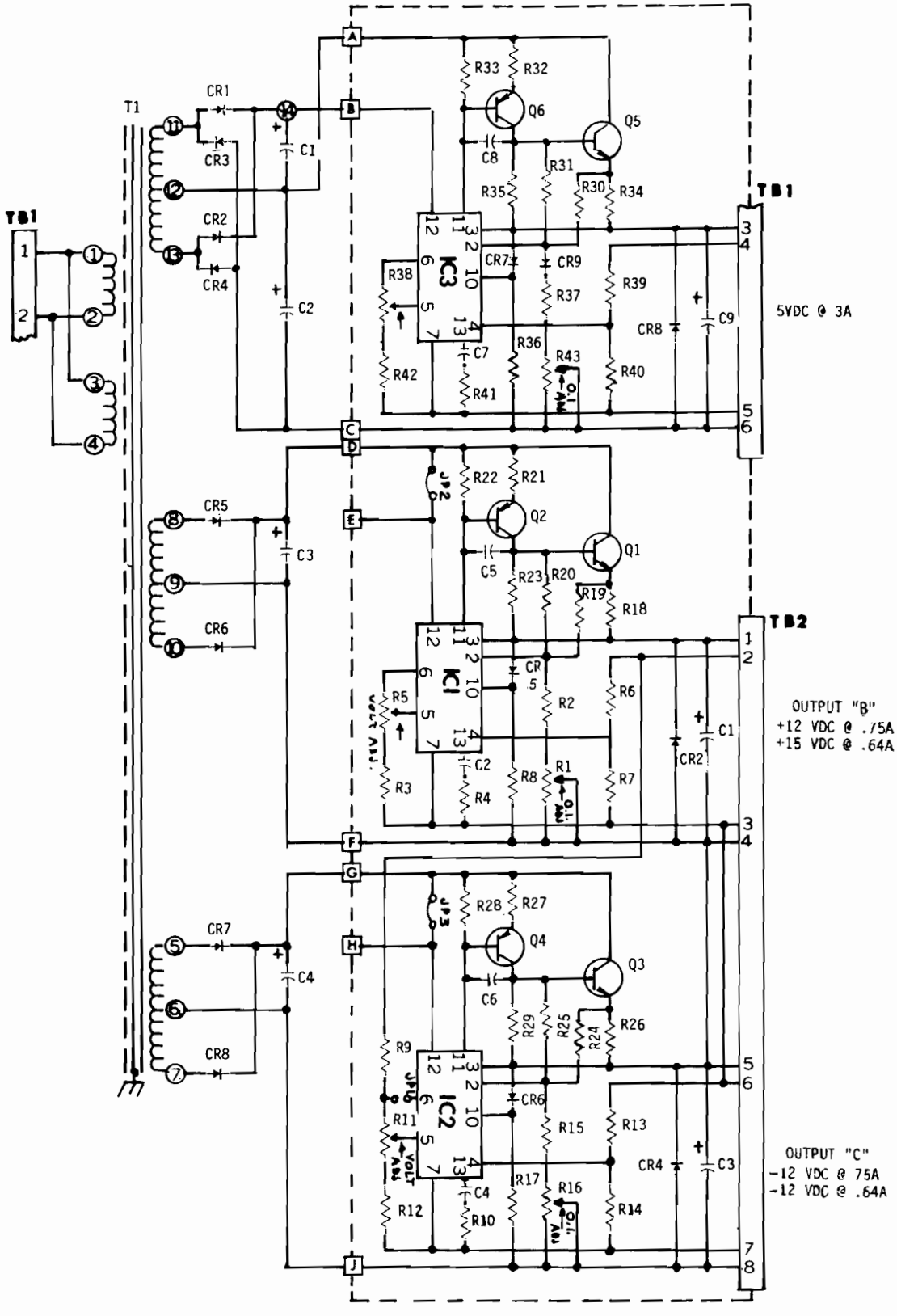
Temperature coefficient is the change in output voltage per degree centigrade in ambient temperature. The AC INPUT, OUTPUT VOLTAGE SETTING and LOAD must BE CONSTANT. The power supply must be allowed to stabilize at each temperature of measurement.



SCHEMATIC OEM DUAL (±12V,15V)

DUAL OUTPUT SERIES

SYMBOL	DESCRIPTION	SUG/MFG. TYPE	12D1.5	15D1.3	12D2.7	15D2.4
		FINAL ASSEMBLY				
C1,2	CAPACITOR	SPRAGUE 32D	4600/30V	4600/30V		
C1,2	CAPACITOR	STM9IC			7500/30V	7500/30V
CR1-4	DIODE	SEMTECH	IN5624	IN5624		
BR1	RECT. BRIDGE	MOTOROLA			MDA980-3	MDA980-3
Q7	TRANSISTOR	RCA	2N3055	2N3055	2N3055	2N3055
Q14	TRANSISTOR	MOTOROLA	2N5875	2N5875	2N5875	2N5875
T1	TRANSFORMER	ACDC	95287	95276	95772	95773
C11,12	CAPACITOR	SPRAGUE SHK-S10	N/A	N/A	0.01/500V	0.01/500V
		PRINTED CIRCUIT BOARD				
C3	CAPACITOR	RMC JG-222	.0022	.0022	.0022	.0022
C5,6	CAPACITOR	MALLORY TCG39	350/25V	350/25V	350/25V	350/25V
C7	CAPACITOR	CENTRALAB DD121	120Pf	120Pf	120Pf	120Pf
C4,9	CAPACITOR	MALLORY SM250	.005	.005	.005	.005
C10	CAPACITOR	CENTRALAB DD821	820Pf	820Pf	820Pf	820Pf
CR5,6	DIODE	G.E	IN4454	IN4454	IN4454	IN4454
CR7	DIODE	MOTOROLA	IN823A	IN823A	IN823A	IN823A
CR8,9	DIODE	SEMTECH	IN4004	IN4004	IN4004	IN4004
R1	RESISTOR	RC20	10K	10K	10K	10K
R2	RESISTOR	RC20	2K	2K	2K	2K
R3	RESISTOR	RC20	680	1K	680	1K
R4	RESISTOR	RC20	100	100	100	100
R5	RESISTOR	RC20	1.5K	1.5K	1.5K	1.5K
R6	RESISTOR	RC20	2K	2K	2K	2K
R7	RESISTOR	RC20	470K	470K	470K	470K
R8	RESISTOR	RC20	2.2K	2.2K	2.2K	2.2K
R9	RESISTOR	RC20	2.7K	2.7K	2.7K	2.7K
R10	RESISTOR	RC20	470	470	470	470
R11	RESISTOR	RC20	10MEG	10MEG	10MEG	10MEG
R12	POTENTIOMETER	BOURNS	10K	10K	10K	10K
R13	RESISTOR	RC20	1.5K	1.5K	1.5K	1.5K
R14	RESISTOR	RN60C	12.4K	19.1K	12.4K	19.1K
R15	POTENTIOMETER	CTS115A	5K	5K	5K	5K
R16	RESISTOR	RN60C	13K	13K	13K	13K
R17	RESISTOR	RC20	5.6K	5.6K	5.6K	5.6K
R18	RESISTOR	RC20	1K	1K	1K	1K
R19	RESISTOR	RN60C	30.9K	30.9K	30.9K	30.9K
R20	POTENTIOMETER	BOURNS	10K	10K	10K	10K
R21	RESISTOR	RC20	150	150	150	150
R22	RESISTOR	RC20	100	100	100	100
R23	RESISTOR	RC20	620	620	620	620
R24	RESISTOR	IRC BWH	0.3/2W	0.3/2W	0.2/3W	0.2/3W
R25	RESISTOR		N/A	N/A	N/A	N/A
R26	RESISTOR	RC20	100	100	100	100
R27	RESISTOR	RC20	5.6K	5.6K	5.6K	5.6K
R28	RESISTOR	RC20	1.5K	1.5K	1.5K	1.5K
R29	RESISTOR	RC20	2K	2K	2K	2K
R30	RESISTOR	RC20	470K	470K	470K	470K
R31	RESISTOR	RC20	2.2K	2.2K	2.2K	2.2K
R32	RESISTOR	RC20	470	470	470	470
R33	RESISTOR	RC20	1K	1K	1K	1K
R34	RESISTOR		MAY VARY OR BE OMITTED			
R35	RESISTOR	RN60C	30.9K	30.9K	30.9K	30.9K
R36	POTENTIOMETER	CTS115A	5K	5K	5K	5K
R37	RESISTOR		N/A	N/A	N/A	N/A
R38	RESISTOR	RC20	150	150	150	150
R39	RESISTOR	RC20	100	100	100	100
R40	RESISTOR	RC20	620	620	620	620
R41	RESISTOR	IRC BWH	0.3/2W	0.3/2W	0.2/3W	0.2/3W
R42	RESISTOR	RC20	OMIT	OMIT	OMIT	OMIT
R43	RESISTOR	RC20	2.7	2.7	2.7	2.7
R44	RESISTOR	RC20	470	560	300	430
R48,49	RESISTOR		N/A	N/A	N/A	N/A
R50	RESISTOR	RC20	100	100	100	100
R51	RESISTOR	RC20	100	100	100	100
Q1	TRANSISTOR	MOTOROLA	2N2222A	2N2222A	2N2222A	2N2222A
Q2	TRANSISTOR	MOTOROLA	2N2907A	2N2907A	2N2907A	2N2907A
Q3,4	TRANSISTOR	MOTOROLA	2N2222A	2N2222A	2N2222A	2N2222A
Q5	TRANSISTOR	MOTOROLA	2N2907A	2N2907A	2N2907A	2N2907A
Q6	TRANSISTOR	MOTOROLA	2N4234	2N4234	2N4234	2N4234
Q8	TRANSISTOR	MOTOROLA	2N2907A	2N2907A	2N2907A	2N2907A
Q9	TRANSISTOR	MOTOROLA	2N2222A	2N2222A	2N2222A	2N2222A
Q10,11	TRANSISTOR	MOTOROLA	2N2907A	2N2907A	2N2907A	2N2907A
Q12	TRANSISTOR	MOTOROLA	2N2222A	2N2222A	2N2222A	2N2222A
Q13	TRANSISTOR	MOTOROLA	2N2219A	2N2219A	2N2219A	2N2219A



SCHEMATIC TR100

TRIPLE OUTPUT SERIES TRI00

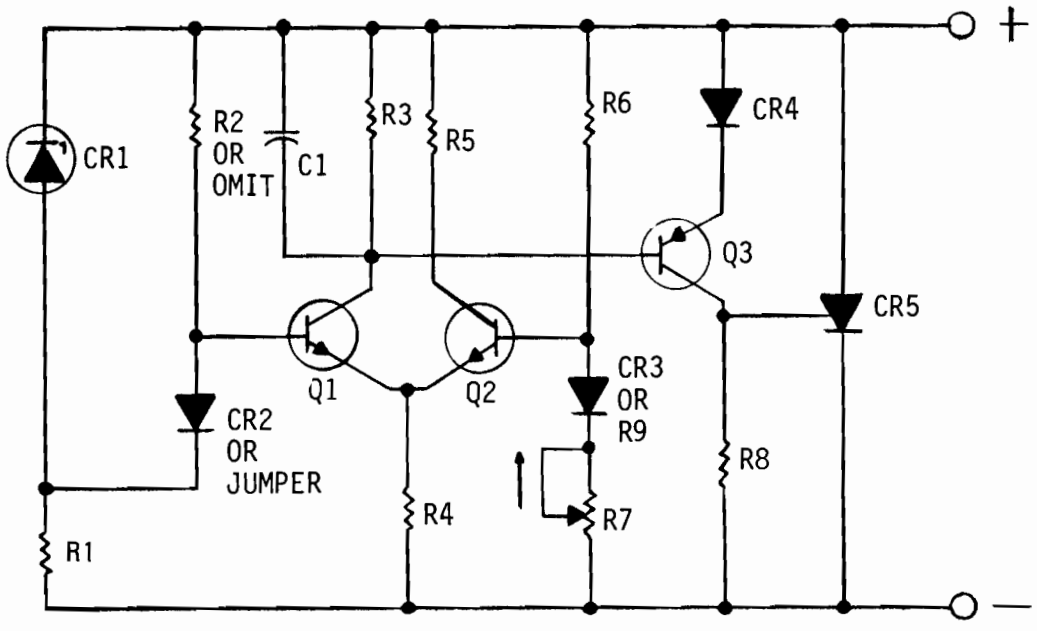
CIRCUIT SYMBOL	DESCRIPTION	MFG/TYPE	TRI01	TRI02
	FINAL ASSEMBLY			
C1	CAPACITOR	SPRAGUE 30D	150/25V	150/25V
C2	CAPACITOR	STM71C	11K/15V	11K/15V
C3	CAPACITOR	STM33C	2800/25V	2800/25V
C4	CAPACITOR	STM33C	2800/25V	2800/25V
CR1	DIODE	SEMTECH	IN4004	IN4004
CR2	DIODE	SEMTECH	IN4004	IN4004
CR3	DIODE	RCA	INI200A	INI200A
CR4	DIODE	RCA	INI200A	INI200A
CR5	DIODE	G.E.	IN5624	IN5624
CR6	DIODE	G.E.	IN5624	IN5624
CR7	DIODE	G.E.	IN5624	IN5624
CR8	DIODE	G.E.	IN5624	IN5624
Q1	TRANSISTOR	RCA	40250	40250
Q3	TRANSISTOR	RCA	40250	40250
Q5	TRANSISTOR	RCA	2N3771	2N3771
T1	TRANSFORMER	ACDC	97677	97678
	PRINTED CIRCUIT BOARD			
C1	CAPACITOR	SPRAGUE 30D	150/25V	150/25V
C2	CAPACITOR	SPRAGUE C069	.0047/25V	.0047/25V
C3	CAPACITOR	SPRAGUE 30D	150/25V	150/25V
C4	CAPACITOR	SPRAGUE C0 69	.0047/25V	.0047/25V
C5	CAPACITOR		OMIT	OMIT
C6	CAPACITOR		OMIT	OMIT
C7	CAPACITOR	SPRAGUE C069	.0047/25V	.0047/25V
C8	CAPACITOR		OMIT	OMIT
C9	CAPACITOR	SPRAGUE 30D	250/12V	250/12V
CR1	JUMPER		TC22	TC22
CR2	DIODE	SEMTECH	IN4004	IN4004
CR3	JUMPER		TC22	TC22
CR4	DIODE	SEMTECH	IN4004	IN4004
CR5	DIODE	SEMTECH	IN4004	IN4004
CR6	DIODE	SEMTECH	IN4004	IN4004
CR7	DIODE	SEMTECH	IN4004	IN4004
CR8	DIODE	SEMTECH	IN4004	IN4004
CR9	DIODE	G.E.	IN4454	IN4454
R1	POTENTIOMETER	BOURNS	5K	5K
R2	RESISTOR	RC07	5.6K	7.5K
R3	RESISTOR	RN60C	2.49K	2.49K
R4	RESISTOR	RC07	100	100
R5	POTENTIOMETER	BOURNS	1K	1K
R6	RESISTOR	RN60C	5.62K	8.25K
R7	RESISTOR	RN60C	4.99K	4.99K
R8	RESISTOR	RC20	1.2K	1.2K
R9	RESISTOR	RN60C	8.25K	11.3K
R10	RESISTOR	RC07	100	100
R11	POTENTIOMETER	BOURNS	1K	1K
R12	RESISTOR	RN60C	2.49K	2.49K
R13	RESISTOR	RN60C	5.62K	8.25K
R14	RESISTOR	RN60C	4.99K	4.99K
R15	RESISTOR	RC07	5.6K	7.5K
R16	POTENTIOMETER	BOURNS	5K	5K
R17	RESISTOR	RC20	1.2K	1.2K
R18	RESISTOR	IRC BWH	0.51/2W	0.51/2W
R19	RESISTOR		OMIT	OMIT
R20	RESISTOR	RC07	300	300
R21	RESISTOR	RC20	3	3
R22	RESISTOR	RC07	2.7K	2.7K
R23	RESISTOR	RC07	220	220
R24	RESISTOR		OMIT	OMIT
R25	RESISTOR	RC07	300	300
R26	RESISTOR	IRC BWH	0.51/2W	0.51/2W
R27	RESISTOR	RC20	3	3
R28	RESISTOR	RC07	2.7K	2.7K
R29	RESISTOR	RC07	220	220
R30	RESISTOR		OMIT	OMIT
R31	RESISTOR	RC07	300	300
R32	RESISTOR	RC20	3	3
R33	RESISTOR	RC07	2.7K	2.7K
R34	RESISTOR	RW69	.15/3W	.15/3W
R35	RESISTOR	RC07	220	220
R36	RESISTOR	RC20	150	150

TRIPLE OUTPUT SERIES TRI00 CONT.

CIRCUIT SYMBOL	DESCRIPTION	MFG/TYPE	TRI01	TRI02
R37	RESISTOR	RC07	2K	2K
R38	POTENTIOMETER	BOURNS	1K	1K
R39	RESISTOR	RN60C	1.00K	1.00K
R40	RESISTOR	RN60C	30.9K	30.9K
R41	RESISTOR	RC07	100	100
R42	RESISTOR	RN60C	1.50K	1.50K
R43	POTENTIOMETER	BOURNS	1K	1K
Q2	TRANSISTOR	MOTOROLA	2N2907A	2N2907A
Q4	TRANSISTOR	MOTOROLA	2N2907A	2N2907A
Q6	TRANSISTOR	MOTOROLA	2N2905A	2N2905A
IC1	I C REGULATOR	ACDC		
IC2	I C REGULATOR	ACDC	⚠1	⚠1
IC3	I C REGULATOR	ACDC		

⚠1 SPECIAL MANUFACTURED TO ACDC SPECIFICATIONS
66-780-000

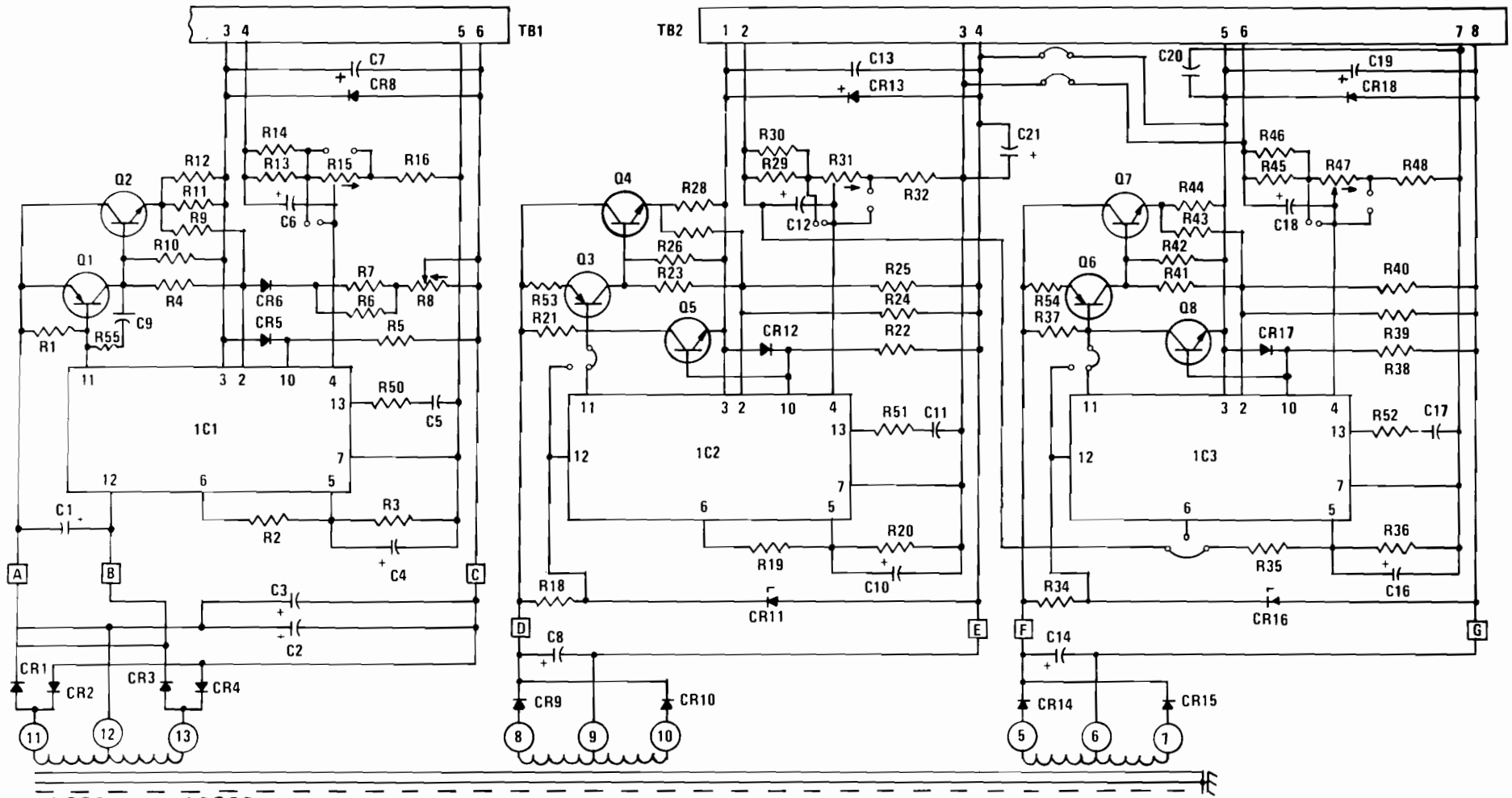
OVP SCHEMATIC AND PARTS LIST

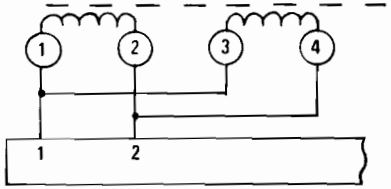


\+ TERMINAL OF OVP CONNECTS TO + OUTPUT TERMINAL OF POWER SUPPLY

\- TERMINAL OF OVP CONNECTS TO - OUTPUT TERMINAL OF POWER SUPPLY

CKT SYMBOL	DESCRIPTION	4-5V MODELS	6-8V MODELS	10-20V MODELS	22-32V MODELS	MFR.,TYPE
Q1	TRANSISTOR	2N2222A	2N2222A	2N2222A	2N2222A	MOTOROLA
Q2	TRANSISTOR	2N2222A	2N2222A	2N2222A	2N2222A	MOTOROLA
Q3	TRANSISTOR	2N2907	2N2907	2N2907	2N2907	MOTOROLA
CR1	DIODE	1N751A	1N748A	1N751A	1N751A	MOTOROLA
CR2	DIODE	1N4454	JUMPER	JUMPER	JUMPER	G.E.
CR3	DIODE	1N4454	(USE R9)	(USE R9)	(USE R9)	G.E.
CR4	DIODE	1N4454	1N4454	1N4454	1N4454	G.E.
CR5	DIODE	2N682	2N682	2N682	2N682	G.E.
R1	RESISTOR	82 OHM	390 OHM	1K	2.2K	RC20
R2	RESISTOR	10K	OMIT	OMIT	OMIT	RC20
R3	RESISTOR	470 OHM	470 OHM	470 OHM	470 OHM	RC20
R4	RESISTOR	100 OHM	820 OHM	1.2K	2.7K	RC20
R5	RESISTOR	100 OHM	100 OHM	100 OHM	100 OHM	RC20
R6	RESISTOR	4.99K	3.65K	2.05K	1.5K	RN60C
R7	RESISTOR	5K POT.	5K POT.	5K POT.	5K POT.	CTS115
R8	RESISTOR	100 OHM	100 OHM	100 OHM	100 OHM	RC20
R9	RESISTOR	(USE CR3)	1.74K	2.67K	4.99K	RN60C
C1	CAPACITOR	.1MFD	.1 MFD	.1 MFD	.1 MFD	SPRAGUE HY 320





TERMINAL FUNCTIONS

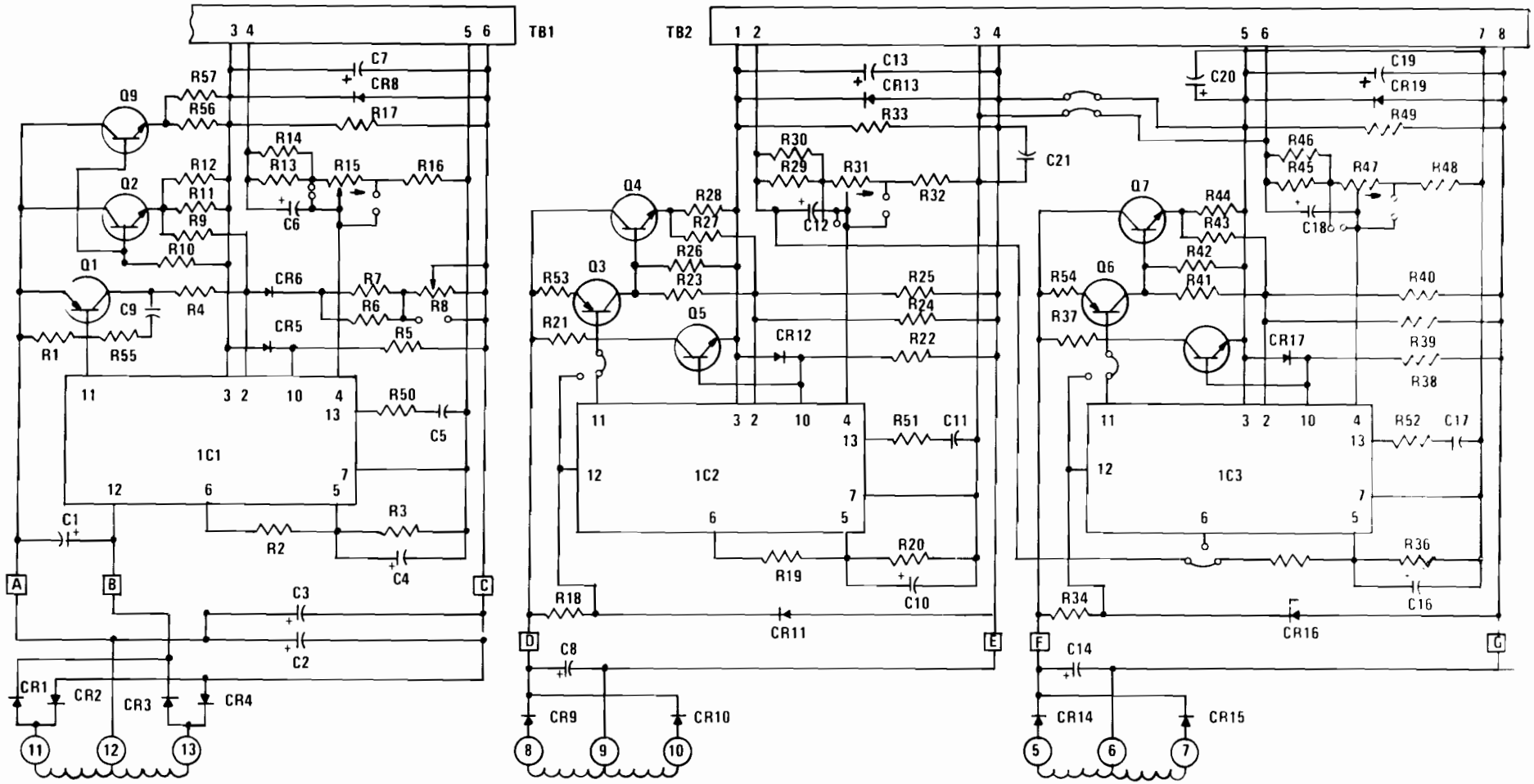
TB1		TB2	
1. AC LINE		1. + OUT	
2. AC NEUTRAL		2. + SEN	
3. + OUT		3. –SEN	OUTPUT "B"
4. + SEN		4. –OUT	
5. –SEN	OUTPUT "A"	5. + OUT	
6. –OUT		6. + SEN	
		7. –SEN	OUTPUT "C"
		8. –OUT	

DIAGRAM-SCHEMATIC
TRIPLE OUTPUT POWER SUPPLY
TR200 SERIES

TRIPLE OUTPUT SERIES TR200

SYMBOL	DESCRIPTION	MFG. TYPE	TR201	TR202
		FINAL ASSEMBLY		
C2,3	CAPACITOR	STM71C	IIK/15V	IIK/15V
C2,3	CAPACITOR	STM91C		
C8,14	CAPACITOR	SPRAGUE 39D	4600/30V	4600/30V
CR1,CR3	DIODE	SEMTECH	IN4004	IN4004
CR2,4	DIODE	RCA	IN1200A	IN1200A
CR9,10,14,15	DIODE	G.E.	IN5624	IN5624
CR9,10,14,15	DIODE	SEMTECH		
Q1	TRANSISTOR	RCA	2N5956	2N5956
Q2	TRANSISTOR	RCA	2N3771	2N3771
Q4,7	TRANSISTOR	RCA	40250	40250
Q4,7	TRANSISTOR	RCA		
Q9	TRANSISTOR	RCA	N/A	N/A
T1	TRANSFORMER	ACDC	96566	96566
		PRINTED CIRCUIT BOARD		
C1,13,19	CAPACITOR	SPRAGUE 30D	150/25V	150/25V
C4,10,16,20	CAPACITOR	SPRAGUE 154D	2.2/20V	2.2/20V
C5	CAPACITOR	SPRAGUE HY-735	.047/25V	.045/25V
C6,9,12,18	CAPACITOR	MAY VARY OR BE OMITTED		
C7	CAPACITOR	SPRAGUE 39D	1200/25V	1200/25V
C11,17	CAPACITOR	SPRAGUE HY-725	.022/25V	.022/25V
C21	CAPACITOR	SPRAGUE C069D	.01/25V	.01/25V
CR5,6,12,17	DIODE	G.E.	IN4454	IN4454
CR8,13,18	DIODE	SEMTECH	IN4004	IN4004
ICI,2,3	I.C. REGULATOR	⚠	⚠	⚠
R1	RESISTOR	RC20	2.2K	2.2K
R2	RESISTOR	RN60C	2.74K	2.74K
R3	RESISTOR	RN60C	4.42K	4.42K
R4	RESISTOR	RC20	300	300
R5	RESISTOR	RC20	100	100
R6*	RESISTOR	RC20	270	270
R8	POTENTIOMETER	62P	5K	5K
R8	POTENTIOMETER	CTS115		
R15,31,47	POTENTIOMETER	CTS115	5K	5K
R9,25,27,40,42,7,14,30,46,55,20		MAY VARY OR BE OMITTED		
R10	RESISTOR	RC20	470	470
R11,12	RESISTOR	RW69	0.2/3W	0.2/3W
R13,18,34	JUMPER		TC22	TC22
R16	RESISTOR	RN60C	6.65K	6.65K
R19,22,38	RESISTOR	RC07 ¼W	1K	1K
R21,37	RESISTOR	RC07 ¼W	3.3K	3.3K
R23,41	RESISTOR	RC07 ¼W	300	300
R24,39	RESISTOR	RC07 ¼W	4.3K	4.3K
R26,42	RESISTOR	RN60C	470	470
R28,44	RESISTOR	IRC BWH	.5/2W	.5/2W
R29	RESISTOR	RN60C	6.04K	11.5K
R32,48	RESISTOR	RN60C	10K	10K
R33,49	RESISTOR	RC20	1.5K	1.5K
R35	RESISTOR	RN60C	11.5K	15.4K
R36	RESISTOR	RN60C	4.99K	4.99K
R45	RESISTOR	RN60C	6.04K	11.5K
R50,43	RESISTOR	RC20	680	680
R51,52	RESISTOR	RC20	330	330
R53,54	RESISTOR	RC07 ¼W	3	3
R55	RESISTOR	RW69		
Q3,6	TRANSISTOR	MOTOROLA	2N2907A	2N2907A
Q5,8	TRANSISTOR		OMIT	OMIT

⚠ MANUFACTURED PER ACDC SPECIFICATION 66-780-000



TERMINAL FUNCTIONS

TB1		TB2	
1. AC LINE		1. + OUT	
2. AC NEUTRAL		2. + SEN	OUTPUT "B"
3. + OUT		3. –SEN	
4. + SEN		4. –OUT	
5. –SEN	OUTPUT "A"	5. + OUT	
6. –OUT		6. + SEN	
		7. –SEN	OUTPUT "C"
		8. –OUT	

DIAGRAM-SCHEMATIC
TRIPLE OUTPUT POWER SUPPLY
TR300 SERIES

TRIPLE OUTPUT SERIES TR300

SYMBOL	DESCRIPTION	MFG. TYPE	TR301	TR302
		FINAL ASSEMBLY		
C2,3	CAPACITOR	STM71C		
C2,3	CAPACITOR	STM91C	16K/15V	16K/15V
C8,14	CAPACITOR	SPRAGUE 39D	4600/30V	4600/30V
CR1,CR3	DIODE	SEMTECH	IN4004	IN4004
CR2,4	DIODE	RCA	IN1200A	IN1200A
CR9,10,14,15	DIODE	G.E.		
CR9,10,14,15	DIODE	SEMTECH	IN4720	IN4720
Q1	TRANSISTOR	RCA	2N5956	2N5956
Q2	TRANSISTOR	RCA	2N3771	2N3771
Q4,7	TRANSISTOR	RCA		
Q4,7	TRANSISTOR	RCA	2N3055	2N3055
Q9	TRANSISTOR	RCA	2N3771	2N3771
T1	TRANSFORMER	ACDC	96571	96590
		PRINTED CIRCUIT		
C1,7	CAPACITOR	SPRAGUE 39D	1200/15V	1200/15V
C4,10,16,20	CAPACITOR	SPRAGUE 154D	2.2/20V	2.2/20V
C5	CAPACITOR	MALLORY SM215	0.005/500V	0.005/500V
C6,9,12,18	CAPACITOR		MAY VARY OR BE OMITTED	
C11,17	CAPACITOR	MALLORY SM215	0.0015/500V	0.0015/500V
C13,17	CAPACITOR	SPRAGUE 30D	150/25V	150/25V
C21	CAPACITOR	SPRAGUE C069D	.01/25V	.01/25V
CR5,6,12,17	DIODE	G.E.	IN4454	IN4454
CR8,13,18	DIODE	SEMTECH	IN4004	IN4004
IC1,2,3	I.C. REGULATOR	⚠	⚠	⚠
R1	RESISTOR	RC20	2.2K	2.2K
R2	RESISTOR	RN60C	2.74K	2.74K
R3	RESISTOR	RN60C	4.42K	4.42K
R4,23,41	RESISTOR	RC20	300	300
R5	RESISTOR	RC20	150	150
R6,17	RESISTOR	RC20	270	270
R8,15,31,47	POTENTIOMETER	CTS115	5K	5K
R14,30,46	RESISTOR	MAY VARY OR BE OMITTED		
R9,25,27,40,43,55	RESISTOR	MAY VARY OR BE OMITTED		
R10	RESISTOR	RC20	470	470
R11,12,56,57	RESISTOR	RW69	0.2/3W	0.2/3W
R13,18,34	JUMPER		TC22	TC22
R16	RESISTOR	RN60C	6.65K	6.65K
R19,22,38	RESISTOR	RC20 1/2W	1K	1K
R21,37	RESISTOR	RC20 1/2W	3.3K	3.3K
R24,39	RESISTOR	RC20 1/2W	5.1K	6.8K
R26,42	RESISTOR	RC20 1/2W	100	100
R28,44	RESISTOR	IRC BWH	.5/2W	.5/2W
R29,45	RESISTOR	RN60C	6.04K	11.5K
R32,48	RESISTOR	RN60C	10K	10K
R33,49	RESISTOR	RC20	1.5K	1.5K
R35	RESISTOR	RN60C	11.5K	15.4K
R36	RESISTOR	RN60C	4.99K	4.99K
			5.1K	6.8K
R50	RESISTOR	RC20		
R50	RESISTOR	RC20	68	68
R51,52	RESISTOR	RC20	68	68
R53,54	RESISTOR	RC20	3	3
Q3,6	TRANSISTOR	MOTOROLA	2N2905A	2N2905A
Q5,8	TRANSISTOR		OMIT	OMIT

⚠ MANUFACTURED PER ACDC SPECIFICATIONS

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