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PRECISION POWER

ELGAR

an Onan® power systems company

INSTRUCTION MANUAL

SERIES 501
POWER SOURCE

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SERIES 501
POWER SOURCE

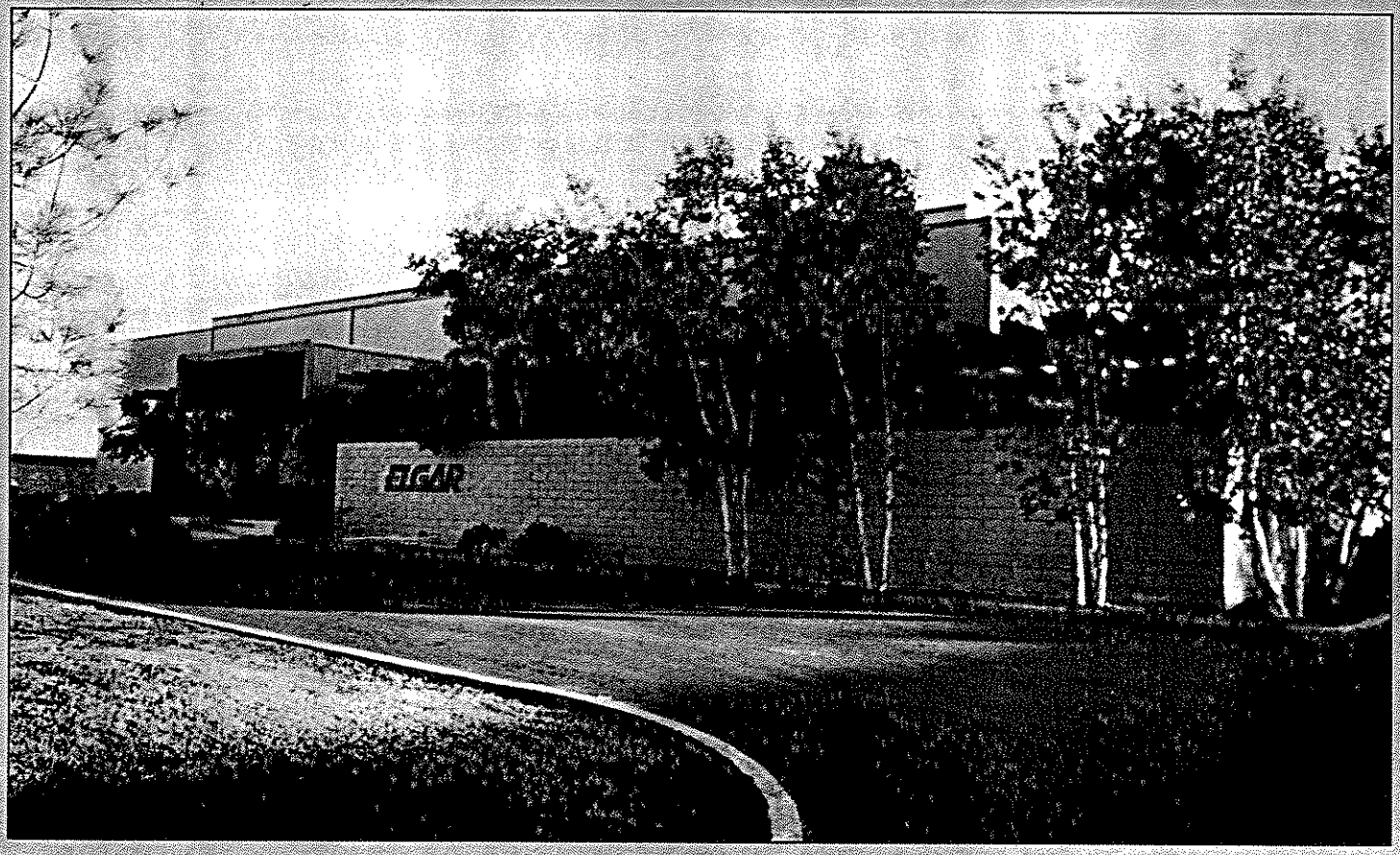
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WARRANTY

Elgar Corporation warrants each instrument it manufactures to be free from defects in material and workmanship. The corporation's obligation under this warranty is limited to servicing the instrument and replacing defective parts. This warranty is effective for one year after delivery of the instrument to the original purchaser. Defects caused by improper operating conditions, misuse, negligence, or the alteration or removal of the nameplate, will void the warranty. Elgar Corporation shall in no circumstance be liable for any direct or consequential loss or damage of any nature resulting from the malfunction of the instrument. This warranty is effective in lieu of any or all other obligations or liabilities on the part of Elgar Corporation, its agents, or representatives.

DO NOT RETURN THE UNIT FOR REPAIR WITHOUT AUTHORIZATION FROM ELGAR CORPORATION. Unauthorized returns found to be within specifications will result in a $50.00 inspection fee, plus two-way freight charges.

Unless specifically noted in the Purchase Order or Maintenance Agreement, Elgar's warranty is F.O.B. the Elgar Service Center nearest the installation site, and serviceman's travel and expenses or transportation costs will be billed to the customer at cost.



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SECTION I

INTRODUCTION AND GENERAL DESCRIPTION

SCOPE OF MANUAL

NOTE: A 2 amp fuse has been added between the #2 winding of T4 and the collector of Q3. This will prevent secondary failure of T-4 in the event Q3 should fail.

This manual describes the Series 500 Power Source manufactured by Elgar Corporation. It contains operating and maintenance instructions, circuit descriptions, a circuit diagram, and a parts list.

INTRODUCTION

The Series 500 Power Sources provide AC power at precise frequencies for testing, motor operation, and frequency conversion. The basic power amplifier consists of two DC supplies and a 4-stage, transformer-coupled amplifier with an adjustable power output transformer. The output transformer provides nominal output voltages of 28, 115, and 230 VAC. Total available power is 500 volt-amperes at full-rated outputs of 28, 115, or 230 VAC. Power at less than full voltages is derated as illustrated in Figure 1-1. Input power is 115 or 230 VAC at 50 or 60 Hz. Units operating with 400 Hz input power are available on special order.

Output power frequency is established by a plug-in oscillator. Output frequency range is 45 to 10,000 Hz. The output is derated to half power at frequencies above 5 KHz. A variety of plug-in oscillators are available, with frequency accuracy up to 0.0001%.

The Elgar Power Source facilitates equipment tests to meet military-specification operating requirements over the frequency range of 47 to 63 Hz or 47 to 425 Hz. The basic power amplifier output is single phase, but multiphase power output can be obtained by stacking two or three power amplifiers, all driven by the same plug-in oscillator.

GENERAL DESCRIPTION

The Series 500 Power Source is contained in a rack-mount enclosure with a meter for power output monitoring,

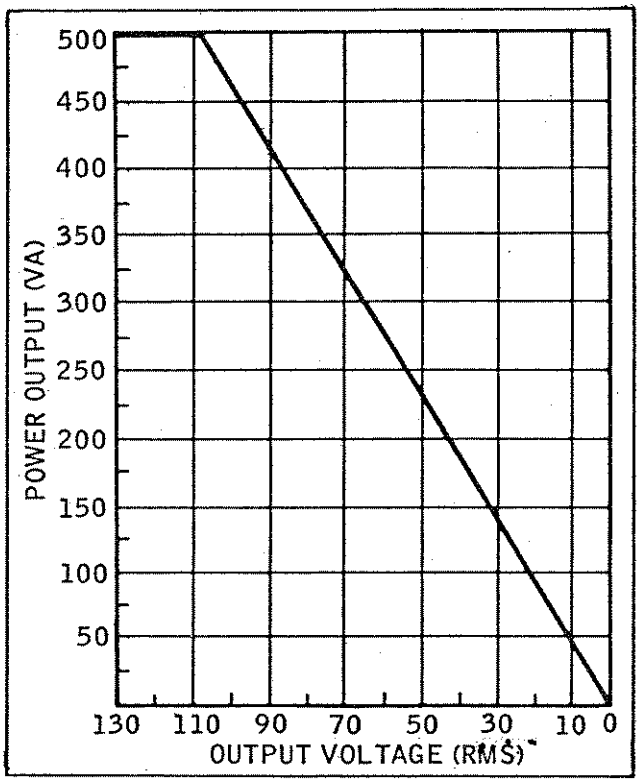


FIGURE 1-1. POWER OUTPUT DERATING VS OUTPUT VOLTAGE

a POWER ON indicator lamp, an output voltage AMPLITUDE control and a POWER switch-circuit breaker located on the front panel. Cooling air is drawn through a front panel grill and exhausted at the rear of the enclosure.

The enclosure contains two heatsinks which comprise a power amplifier. Control circuitry is mounted on a circuit board with test points and adjustment controls available at the top of the board. Output power is available at a rear panel terminal strip and at front panel connectors. An input power cord is located on the rear panel.

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SPECIFICATIONS

Specifications for the Series 500 are provided in Table 1-1.

OUTPUT POWER	0-500 VA
POWER FACTOR	Unity to ±0.7
OUTPUT VOLTAGE	Adjustable 0-28 VAC, 0-130 VAC, or 0-260 VAC
OUTPUT FREQUENCY RANGE	45 Hz to 5000 Hz at full power output
DISTORTION	Less than 1% - 45 Hz to 5000 Hz
LOAD REGULATION	1% - 45 Hz to 5000 Hz
LINE REGULATION	1/2% - 115 VAC ± 10 VAC 1/2% - 230 VAC ± 20 VAC
SHORT CIRCUIT PROTECTION	Output may be shorted indefinitely and recovers immediately when short is removed
INPUT POWER	115 VAC ± 10 VAC, or 230 VAC ± 20 VAC, 45 Hz to 480 Hz 1500 Watts maximum
TEMPERATURE RANGE	0 - 50°C
DIMENSIONS	7 in. x 19 in. relay rack panel by 17-1/2 in. deep overall
WEIGHT	Approximately 100 lbs.

TABLE 1-1. SPECIFICATIONS

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SECTION II

PRELIMINARY INSPECTION AND OPERATION

INSPECTION UPON RECEIPT

The Elgar Power Source has been aligned, calibrated, and tested prior to shipment. The instrument is therefore ready for immediate use upon receipt. The following checks should be made, however, to assure that the instrument has suffered no damage during shipment.

1. Make a visual inspection of the shipping container prior to accepting the package from the carrier. If extensive damage to the shipping container is evident, a description of the damages should be noted on the carrier's receipt, and signed by the driver of carrier agent. If damage is not apparent until the instrument is unpacked, a claim for concealed damage should be placed with the carrier and all shipping containers and filler material saved for inspection. Forward a report of damage to the Elgar Service Department, which will provide instructions for repair or replacement of the instrument.

2. Make a visual inspection of the instrument when it is removed from the shipping container.

INSTALLATION AND OPERATION

Operating the Elgar Power Source requires only the following steps:

1. Install the power source so that the flow of cooling air into the front panel grill and out the rear panel grill is unobstructed.

2. Insert the plug-in oscillator.

3. Connect the power output load to rear panel terminal board.

4. Plug power cord on rear panel to source of AC line power.

5. Set the front panel POWER switch to ON. The indicator on the front panel illuminates when power is applied.

6. Adjust the front panel AMPLITUDE control for the desired output voltage.

NOTE

Certain Elgar plug-in oscillators do not require the use of the AMPLITUDE control; others are extemally programmed. Consult the oscillator instruction manual.

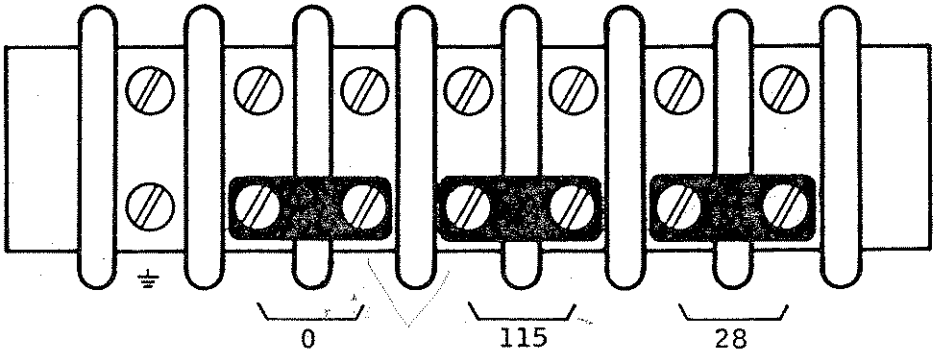
28 VAC OPERATION

Because of the amplifier current limiting circuitry, full power cannot be obtained from the 115 volt output operating at 28 volts (nominal). A 28-volt tap is provided on the output transformer to permit full power (18 amperes) to be taken from the power source at outputs of 28 volts or less. The front panel meter is wired to one of the 115 volt windings of the output transformer. When operating at 28 volts, full output voltage is indicated by a reading of approximately 115 volts. Rear panel terminal board jumper connections for 28 and 115 volt operation are illustrated in Figure 2-1.

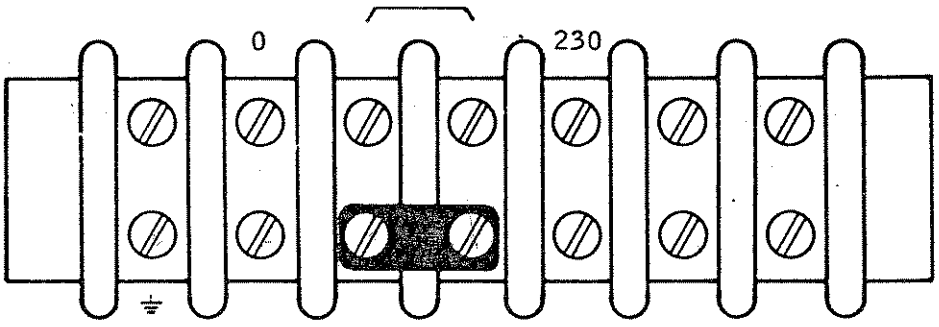
230 VAC OPERATION

For 230 VAC operation, the jumpers on the rear panel output terminal board are changed to connect the two secondary windings of the output transformer in series. The jumper connections for 230 VAC operation are illustrated in Figure 2-1.

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PARALLEL JUMPER CONNECTIONS FOR 0, 28, and 115 VAC OPERATION



SERIES JUMPER CONNECTIONS FOR 230 VAC OPERATION

FIGURE 2-1. REAR PANEL TERMINAL BOARD CONNECTIONS

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SECTION III

THEORY OF OPERATION

CIRCUIT DESCRIPTION

The input signal, at approximately 3 VRMS, is provided by the plug-in oscillator. The signal is applied to the preamplifier comprised of transistors Q1, Q2, and Q3 (see Figure 3-1). (Transistors Q1 and Q2 are located on the circuit board, and Q3 is on heatsink No. 3.) Transistor Q3 is transformer-coupled through transformer T4 to the Class B power amplifier which is comprised of two identical heatsinks (designated No. 1 and No. 2). CR5 in the preamplifier circuit is a 2N3638 transistor used as a Zener diode.

The power amplifier consists of transistors Q5 through Q11, and Q12 through Q18. The amplifier circuit has a small forward bias across diodes CR6 and CR7 from currents developed by resistors R22 and R24 in heatsink No. 1 and R32 and R34 in heatsink No. 2. Thermostat S1, which is mounted on heatsink No. 1, provides thermal protection for the instrument if it overheats due to an obstruction over the ventilating grill, or if the instrument is operated in an environment of too-high ambient temperature. If the unit reaches an unsafe operating temperature, S1 closes, grounding the collector of Q4 which causes the lamp in photocell CLM4012 to illuminate. This attenuates the input signal, reducing the output current to a low level until the operating temperature returns to normal.

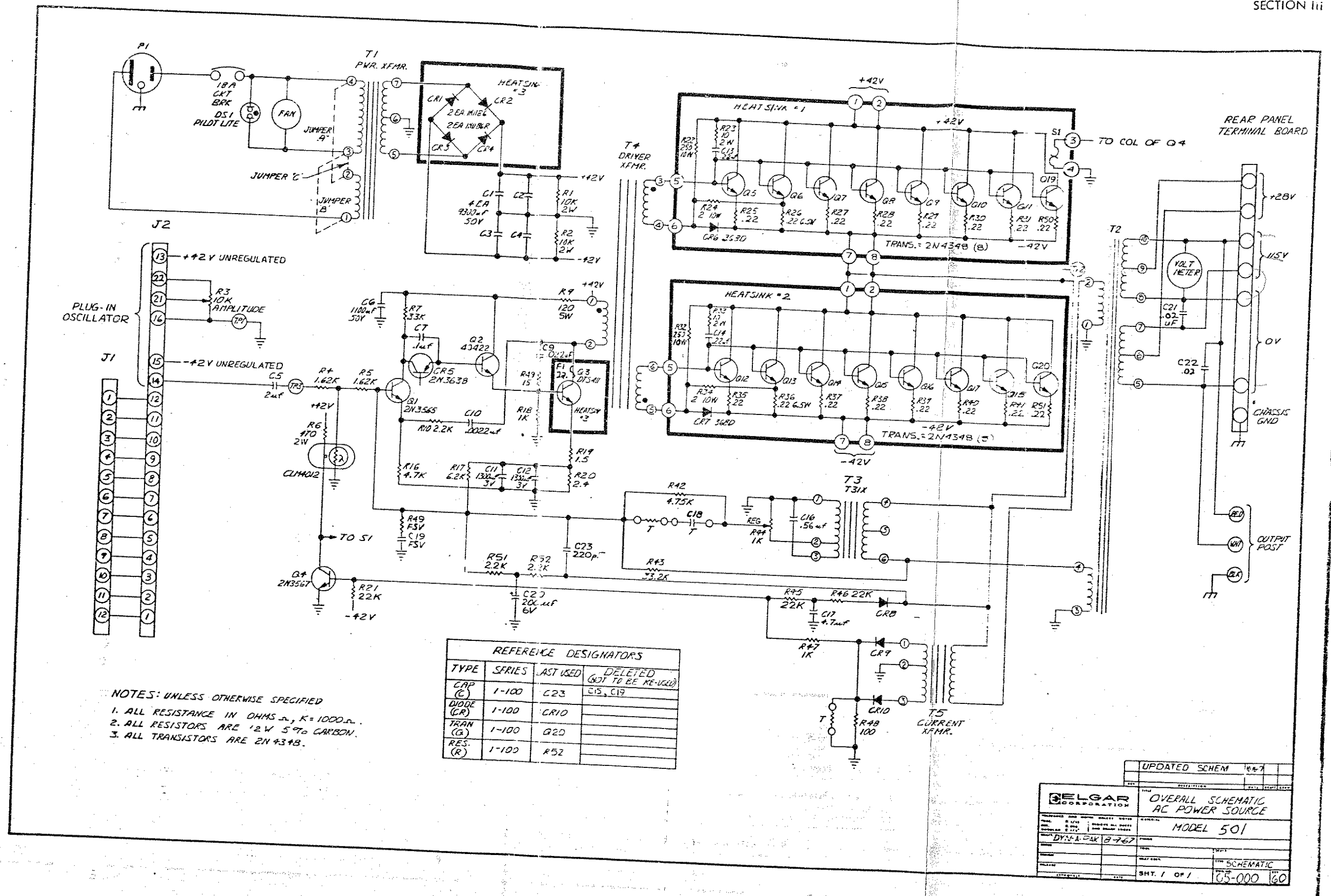
Distortion in the power amplifier section is reduced by a negative voltage feedback developed through resistor R43. A positive current feedback signal is developed in the resistance in the primary winding of transformer T2. This signal, which improves output-load regulation, is sensed by current feedback transformer T3, and is coupled through potentiometer R44 to provide regulation adjustment. The power amplifier is protected by the current-limiting circuit which utilizes current limiting transformer T5 to sense the current in output transformer T2. This is accomplished by passing the lead from T2 through the coil of T5 to form a one-turn primary loop. The current sensing signal is rectified in diodes CR9 and CR10, and compared to the -42V at transistor Q4. Overload currents turn on Q4 which, in turn illuminates the lamp in photocell CLM4012. The photocell is connected to input resistors R4 and R5, and when the lamp illuminates, the input signal is attenuated.

The amplifier output signal at TP2 is rectified by diode CR8 and introduced into the current limiting circuit through resistors R45 and R46. This provides additional protection to the output transistors by reducing the output current during short circuit conditions.

The output signal amplitude potentiometer R3 is connected through the plug-in oscillator circuit, and its use is dependent upon the type of plug-in unit used (refer to plug-in oscillator instruction manual). Power transformer (T1) output is rectified in diode bridge CR1-CR4.

INTERCONNECTIONS FOR MULTIPHASE OPERATION

Two phase operation requires two power amplifiers. Three phase operation can be accomplished with three amplifiers in "Wye" connection, or with two amplifiers in either "Wye" or open Delta connection. For two-amplifier "Wye" connection, the two secondaries on the slave amplifier gives the phase "C" output. The remaining windings from the two amplifiers are connected in series to give the phase "B" output which is the negative vector sum of the phase "A" and "C" outputs (see Figure 3-2).



REFERENCE DESIGNATORS

TYPE	SERIES	LAST USED	DELETED (DO NOT TO BE RE-USED)
CAP (C)	1-100	C23	C15, C19
DIODE (CR)	1-100	CR10	
TRAN (Q)	1-100	Q20	
RES. (R)	1-100	R52	

NOTES: UNLESS OTHERWISE SPECIFIED

1. ALL RESISTANCE IN OHMS Ω, K=1000Ω.
2. ALL RESISTORS ARE 1/2W 5% CARBON.
3. ALL TRANSISTORS ARE 2N4348.

	UPDATED SCHEM	6-67
ELGAR CORPORATION	OVERALL SCHEMATIC AC POWER SOURCE	
DYNA-CAL	MODEL 501	
	SCHEMATIC	
	SHT. 1 OF 1	05-000

FIGURE 3-1. SCHEMATIC DIAGRAM

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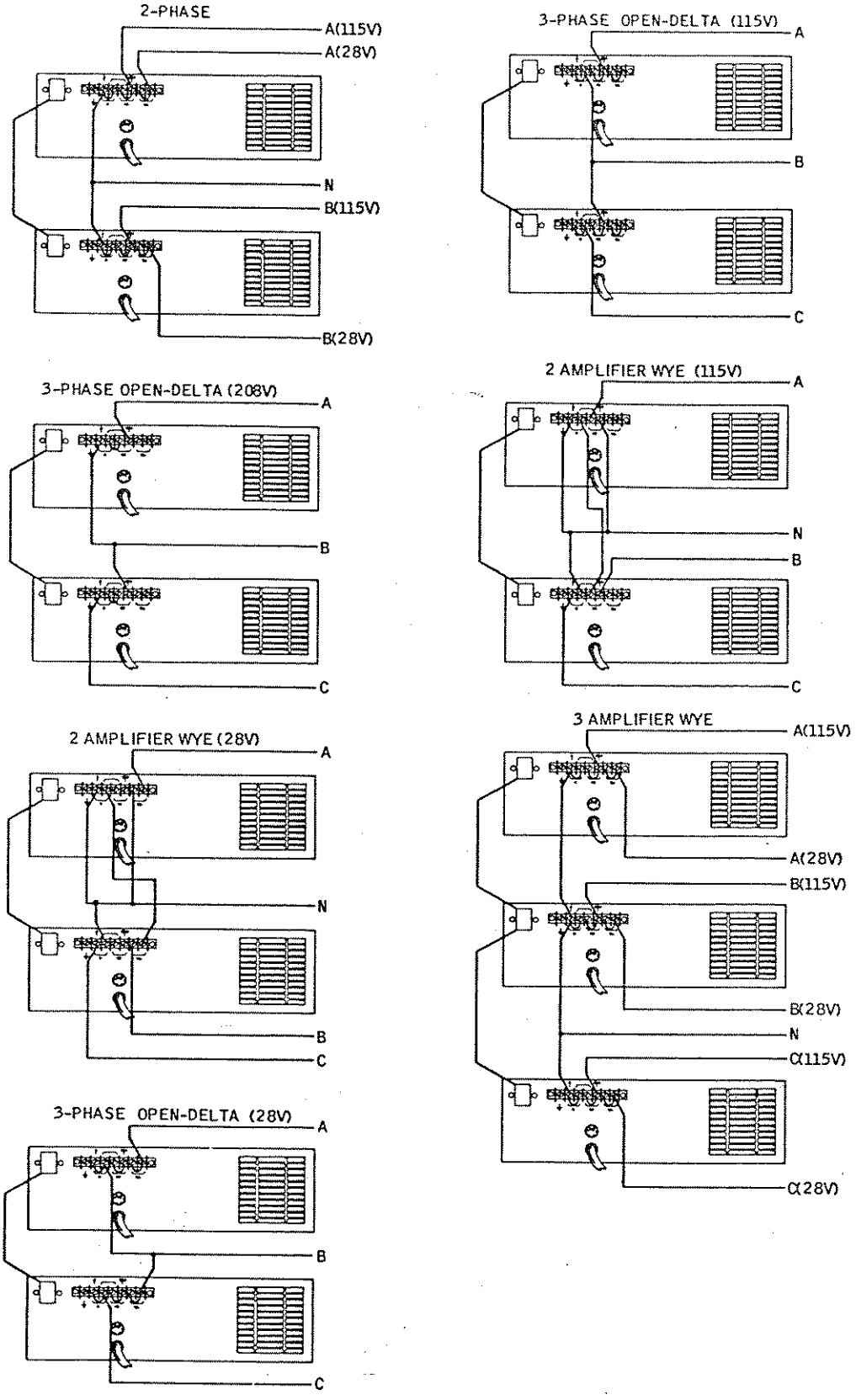


FIGURE 3-2. INTERCONNECTIONS FOR MULTIPHASE OPERATION

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SECTION IV

MAINTENANCE

SERVICE INFORMATION

Questions concerned with the operation, repair, or servicing of this instrument should be directed to the nearest Elgar representative or to the company's Service Department. INCLUDE THE MODEL NUMBER AND SERIAL NUMBER in any correspondence concerning this instrument.

FACTORY REPAIR

Should it be necessary to return an instrument to the factory for repair, please contact the Elgar Corporation Service Department for authorization to make shipment.

DO NOT RETURN THE UNIT FOR REPAIR WITHOUT AUTHORIZATION.

SHIPPING DAMAGE

It is possible for equipment to be damaged in shipment. Therefore, it is imperative that the instrument be tested and inspected as soon as it is received. If the instrument shows signs of damage, notify the carrier immediately. The carrier's claim agent will prepare a report of damage to be forwarded to the Elgar Service Department. You will be advised as to the action necessary to have the instrument repaired or replaced.

TEST POINTS

Test points are located on the circuit board, and adjustment controls are conveniently provided at the top of the control circuit board (see Figure 4-1). Adjustment procedures are given in the following paragraph.

OUTPUT REGULATION ADJUSTMENT

The output should remain within the specified ±1% after it has been adjusted for frequency and load conditions. It is adjusted as follows:

a. With the load disconnected from the power source, read the output voltage. Use a differential voltmeter (Fluke or equivalent) to obtain precise reading. The output voltage can be read at rear panel terminal board.

b. Connect the power source to the normal operating load.

c. Measure the output voltage and, using the circuit board adjustment potentiometer (R44), adjust the output voltage until it is the same as that obtained under no load conditions.

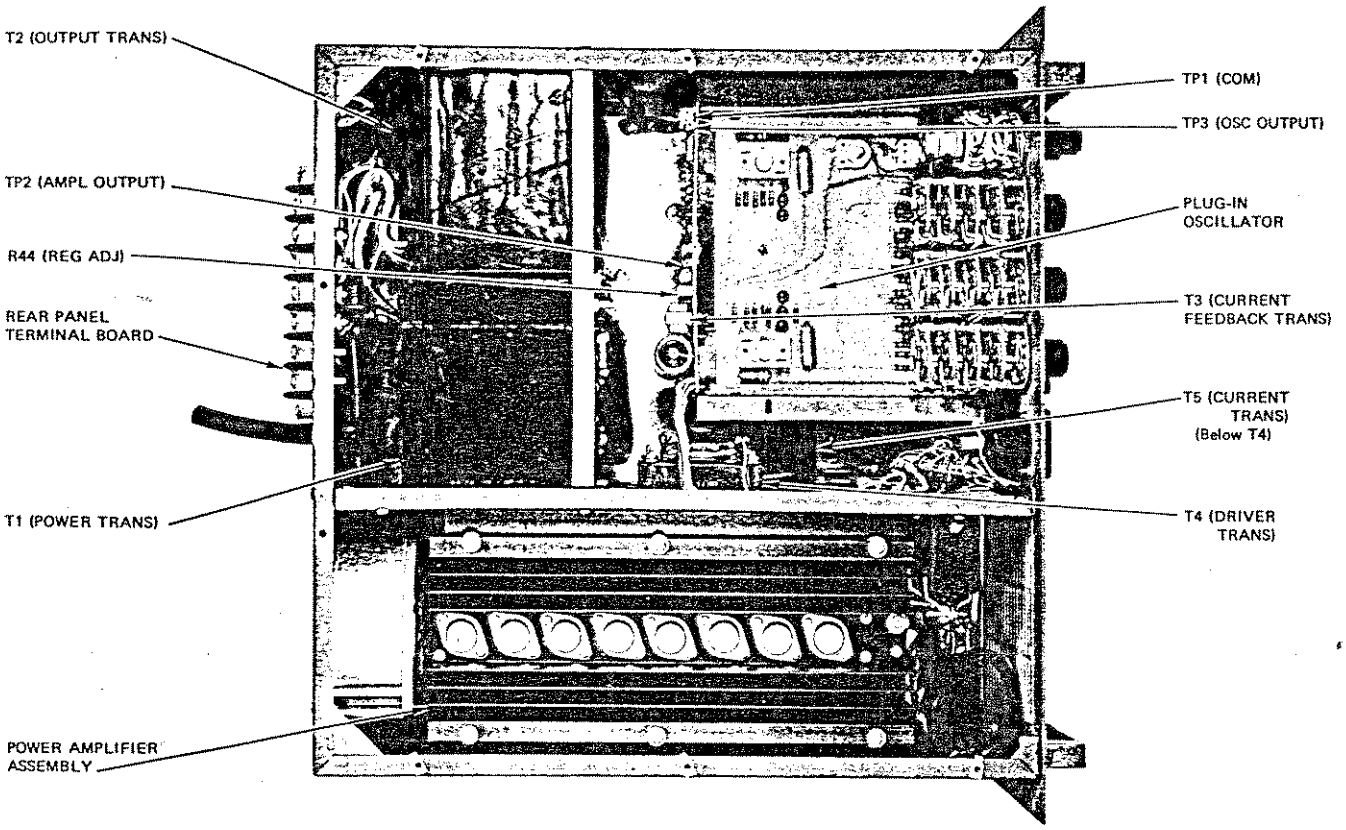
d. Repeat steps (a) through (c) for accuracy.

TROUBLESHOOTING

CIRCUIT BREAKER TRIPS. Tripping of the circuit breaker can indicate failure of a power amplifier transistor or a power rectifier. To check, pull out both heatsink connector plugs, and reapply power to the instrument. If the breaker trips again, the trouble is in the power rectifier. If the breaker does not trip, check transistors on the power amplifier heatsink circuits.

OVERHEATING. If the instrument overheats due to obstructed airflow through the ventilating grill or excessive ambient temperature, a thermostat on the heatsink causes the output current to be reduced to a low level until temperature returns to normal.

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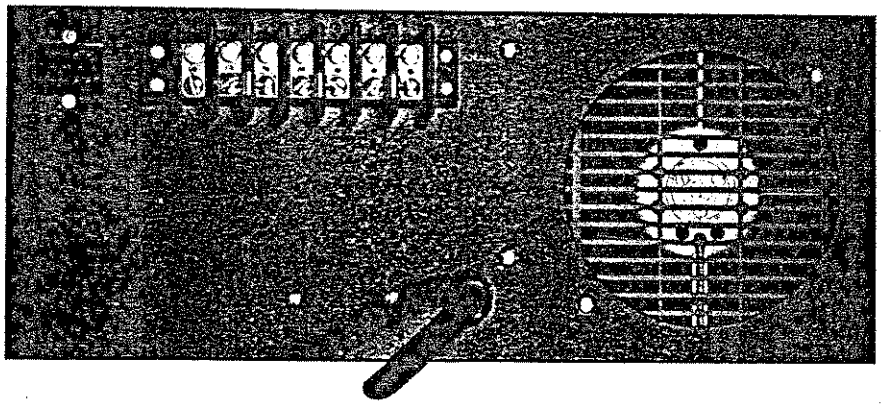


FIGURE 4-1. TOP AND REAR VIEW

SECTION V

PARTS LIST

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SCHEMATIC DESIGNATION	VALUE	DESCRIPTION OR TYPE	RATING	MANUFACTURER NAME	MANUFACTURER PART NO.
CAPACITORS					
C1, C2, C3, C4	9300 uf	ELECT	50V	G.E.	86F168M
C5	2 uf	MYLAR	200V	ELPAC	ZD2A205J
C6	1100 uf	ELECT	50V	SPRAGUE	39D118G050
C7	0.1 uf	MYLAR	200V	ELPAC	ZD2A104J
C9	0.022 uf	MYLAR	200V	SPRAGUE	192P22392
C10	0.0022 uf	CER DISC		ERIE	811Z5V222P
C11, C12	1300 uf	ELECT	3V	SPRAGUE	39D138G003
C13, C14	0.22 uf	MYLAR	200V	ELPAC	ZD2A224J
C16	0.56 uf	MYLAR	200V	ELPAC	ZD2A504J
C17	4.7 uf	TANT	35V	SPRAGUE	CS13BF475K
C18	Factory Select				
RESISTORS					
R1, R2	10K	CARB COMP	2W 5%	OHMITE	
R3	10K	POTENTIOMETER		HELIPOT	7246R10K
R4, R5	1.62K	MET FILM	1/8W 1%	TEXAS INST	RN60C1621F
R6	470	CARB COMP	2W 5%	OHMITE	
R7	33K	CARB COMP	1/2W 5%	OHMITE	
R9	120	WW	5W 5%	DALE	CW5
R10	4.7K	CARB COMP	1/2W 5%	OHMITE	
R17	6.2K	CARB COMP	1/2W 5%	OHMITE	
R18, R47	1000 Ω	CARB COMP	1/2W 5%	OHMITE	
R19	1.5 Ω	WW	50W 5%	DALE	RH50
R20	2.4 Ω	WW	10W 5%	DALE	RS10
R21, R45, R46	22K	CARB COMP	1/2W 5%	OHMITE	
R22, R32	250 Ω	WW	10W 5%	DALE	CW10
R23, R33	10Ω	CARB COMP	2W 5%	OHMITE	
R24, R34	2Ω	WW	10W 5%	DALE	CW10
R25-R31, R35-R41, R50, R51	0.22 Ω	WW	5W 5%	DALE	CW5
R42	4.75K	MET FILM	1/8W 1%	TEXAS INST	RN60C4751F
R43	33.2K	MET FILM	1/8W 1%	TEXAS INST	RN60C3322F
R44	1000Ω	TRIMPOT		HELIPOT	78PR1K
R48	100Ω	CARB COMP	2W 5%	OHMITE	
R49	47	CARB COMP	1/2W 5%	OHMITE	
SEMICONDUCTORS					
CR1, CR3		RECTIFIER		WESTINGHOUSE	1N1186R
CR2, CR4		RECTIFIER		WESTINGHOUSE	1N1186
CR5		TRANSISTOR		FAIRCHILD	2N3638
CR6, CR7		RECTIFIER		WESTINGHOUSE	409D
CR8, CR9, CR10		DIODE		CONTINENTAL	1N457

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SCHEMATIC DESIGNATION	VALUE	DESCRIPTION OR TYPE	RATING	MANUFACTURER NAME	MANUFACTURER PART NO.
TRANSISTORS					
Q1				FAIRCHILD	2N3565
Q2				MOTOROLA	2N3767
Q3				DELCO	DTS411
Q4				FAIRCHILD	2N3567
Q5-Q20				RCA	2N4348
TRANSFORMERS					
T1		PWR TRANSFORMER		ELGAR	90-047-90
T2		OUTPUT TRANS-FORMER		ELGAR	90-062-90
T3		SENSING		TRIAD	T31X
T4		DRIVER		ELGAR	90-089-90
T5		CURRENT		ELGAR	90-049-90
FUSE					
F1		2amp FUSE		FUSETRON	MDV 2
MISCELLANEOUS					
CLM4012		PHOTOMODU-LATOR		CLAIREX	CLM4012
S1		THERMOSTAT		STEMCO	A505
S2		CIRCUIT BREAKER		HEINEMAN	JA1-A3-13-18-3
B1		FAN		PAMOTOR	7500
M1		VOLTMETER		AMMON	AM-1
POWER AMPLIFIER		HEATSINK WITH THERMOSTAT		ELGAR	07-210-40
POWER AMPLIFIER		HEATSINK WITHOUT THERMOSTAT		ELGAR	07-213-40
OSCILLATOR	400 Hz	PLUG-IN		ELGAR	441-0 1

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