# INSTRUCTION MANUAL

## WESTAMP A5283-001

## CAUTION

The maintenance procedure described herein should be attempted only by highly skilled technicians using proper test equipment. Read your warranty provisions before starting, to avoid voiding your warranty.



WESTAMP

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INSTRUCTION MANUAL - A5283-001 AMPLIFIER

FOREWORD:

This manual is a special purpose manual, covering the installation, application, adjustment, theory, and trouble-shooting of the A-5283-001 Linear D.C. Transistor Amplifier. The manual specifically applies to one individual amplifier. The information is presented so that it may be applied to the A5283-001 amplifier in conjunction with its associated drawings and parts lists.

SPECIFICATIONS:

| | |
|---|---|
| GAIN NO. 2 AND 3 | 1000 |
| GAIN NO. 1 | 330 |
| D.C. DRIFT PER INPUT | 10 MV per $^{\circ}$ C |
| INPUT VOLTAGE MAX | ± 50 V |
| INPUT IMPEDANCE | 10 K Ohms |
| OUTPUT IMPEDANCE | 1000 Ohms |

ADJUSTMENTS:

Gain

Balance

Current Limit

Current Limit Balance

| | |
|---|---|
| BAND WIDTH[2] | 2 KHz |
| POWER INPUT | 120 VAC<br>60 Hz |
| AMBIENT TEMPERATURE | $0^{\circ}$ to + $50^{\circ}$ C |

OUTPUT CURRENT and VOLTAGE: [3]

DESCRIPTION:

The amplifier covered by this manual has a linear bi-polar D.C. type of output. The amplifier has easy access for adjustments and easily removable sub-assemblies for maintenance.

NOTES:

1. The amplifier is supplied with current feedback. The current feedback is obtained by connecting Terminal 1 of J3 to Terminal 2.

2. The bandwidth is 2 KHz at 2/3 max. output.

3. 28 Amps peak.

   12 Amps. Cont.

   ± 30 VDC

INSTALLATION:

GENERAL: Your Westamp Servo Amplifier is a precision piece of equipment. When handling and installing the amplifier, it should be treated with Tender Loving Care. The following general provisions should be observed when installing the equipment:

1. The amplifier should be oriented so that air flow through the heat-sinks will be up for normal convection cooling.
2. Leave space around the amplifier for access to adjustments and test points.
3. Provide adequate clearance around high voltage circuits.
4. Allow space for routing of heavy conductors. Avoid routing high level power and output circuits adjacent to sensitive signal circuits.
5. Use shielded twisted pairs of Signal and Tachometer Circuits.
6. Check the tabs on any dual voltage transformers to be sure they are set for the actual voltage to be applied.
7. Mount the amplifier in a location which will be as free of oil, dirt and moisture as possible.

WIRING: Connect the amplifier as shown in Fig. 1, Installation Drawing 28900 Sheet 6.

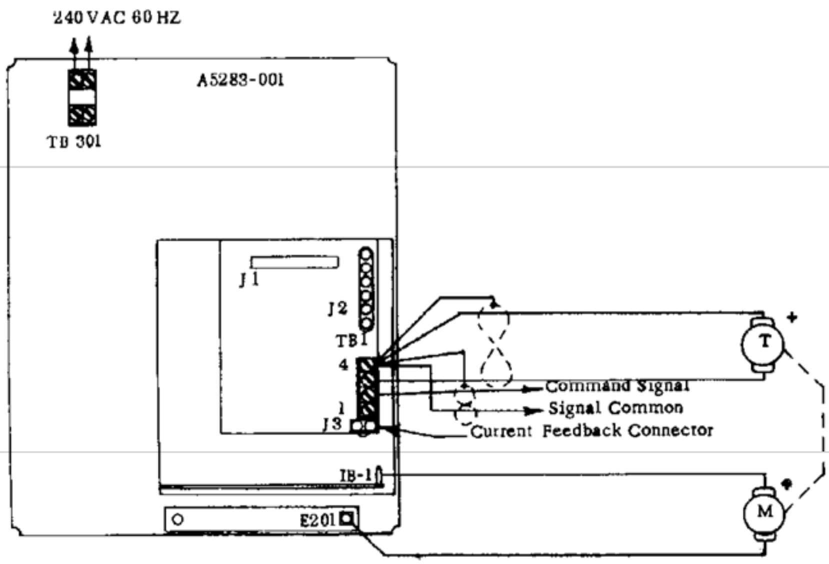



Fig. 1

ADJUSTMENTS:

LOCATION: See Fig. 2

FUNCTION:

Gain 1, adjustable zero to max. at the maximum setting, sets the amplifier gain to 330. Gain 2 and 3, adjustable zero to max. at the maximum setting, sets the amplifier gain to 1000.

BAL A, adjusts the amplifier D.C. balance. The BAL A part should not be used to cancel out any offsets from external signals coming into the amplifier.

LIMIT: Adjust the maximum value of D.C. output current.

BAL C: Adjust the current limit amplifier D.C. balance.

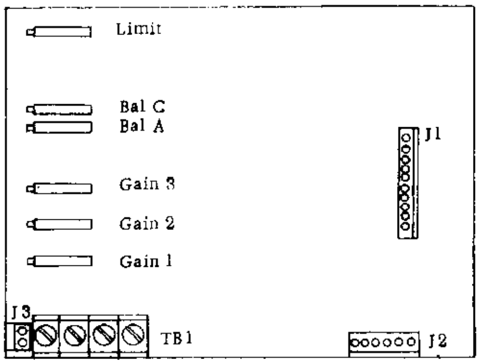



Fig. 2

## OPERATION - FIRST TIME START-UP

Follow this step by step procedure carefully for first time start-up to eliminate potential catastrophes. The procedure tells exactly how to arrive at a good working system the first time. After you have gained experience, you may find that you can minimize some of these steps.

## DETAIL PROCEDURE:

1. Connect the amplifier in accordance with Fig. 1 and the specific Installation Drawing.

2. Check all dual voltage transformers for correct primary tap connections.

3. Connect a D. C. signal simulator (source of D. C. test voltage typical 0 Volts to 15 Volts) to TB1-2 with respect to TB1-4. Connect the Tachometer to TB1-3 with respect to TB1-4. Use shielded wires.

4. Set all signal gain pots fully counterclockwise.

5. Connect the oscilloscope probe to TB1-3 with respect to TB1-4. Set the vertical sensitivity to 0.5 Volts per cm. Set the horizontal sweep to 100 milliseconds per cm. Apply power to the amplifier.

6. With a zero input signal the motor shaft should remain stationary. If not, adjust BAL A such that the motor shaft does not rotate. Apply a small positive signal from the signal simulator and adjust the signal input potentiometer - in this case gain 2 slightly clockwise. The motor shaft should now rotate. Observe the oscilloscope and the tachometer voltage TB1-3 with respect to TB1-4 should be negative. If it is, adjust the tachometer input potentiometer - in this case gain 3 slightly clockwise, so as to cause the motor speed to be reduced by the negative tach feedback.

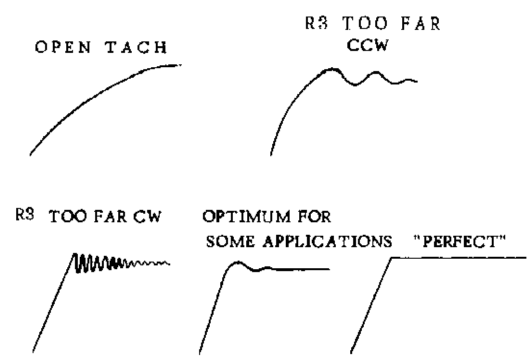



Fig. 3

While applying step inputs, rotate gain 3 slowly clockwise until a desired response curve is obtained. Note Fig. 3.

CAUTION: Always observe the response frequently, when making adjustments to avoid system oscillation. If the system does oscillate, immediately turn off power and start over with reduced tach.

BLOCK DIAGRAM

Figure 4 is a block diagram of the complete servo amplifier, showing the general direction of folow of signals and power through the amplifier. The flow of signals starts at the three signal inputs and proceeds through the pre-amplifier A1-A working in conjunction with the Diode Assembly. The output of the pre-amplifier A1-A proceeds to the second voltage amplifier A1-B. The output of the second voltage amplifier A1-B is summed with the output of the current limit amplifier A2 and proceeds to the Differential Amplifier input at Q2 base.

The output of the Differential Amplifier at Q2 and Q3 collector proceeds to the Pre-Driver transistor Q7 through Q10, providing current gain for the driver transistors. The driver transistors provide additional current gain to drive the power output bridges. The power output bridge or bridges driven out of balance by the driver transistors provide the bi-polar voltage source for the load. The load current flowing through the output bridge is sampled differentially in the output bridge and tied to the current limit amplifier A2. The output of the current limit amplifier A2 proceeds to the summing junction at the output of the second voltage amplifier A1-B, and also to the current feedback input TB1-1.

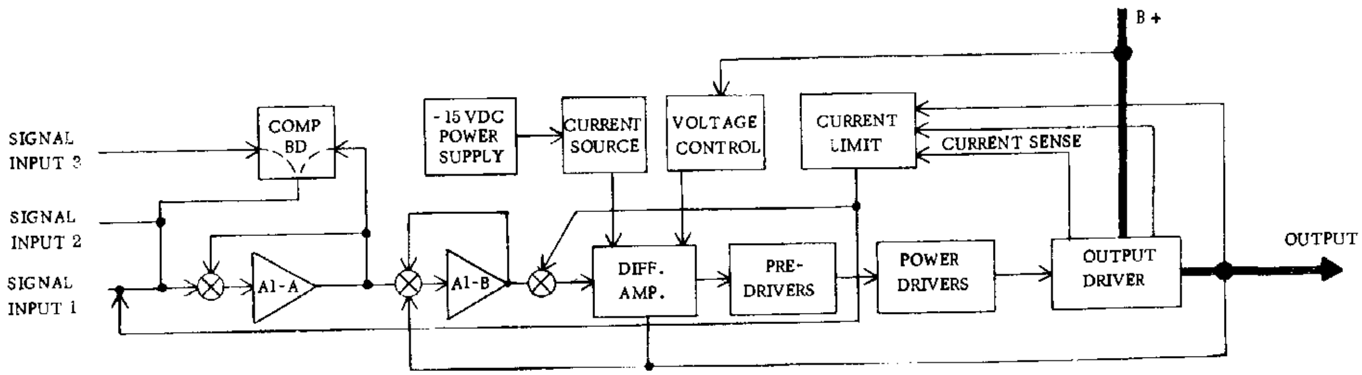



Fig. 4

## PRE-AMPLIFIER Fig. 5

The pre-amplifier A1-A accepts bi-polar D.C. input signals from three channels through a resistive summing junction and its inverting input. Pre-amplifier A1-A supplies a large amount of gain and also an inversion of input signals.

A1-A has a balance pot R4 to compensate for input offset levels. The output of A1-A is resistively tied to the inverting input of the second voltage amplifier A1-B.

## SECOND VOLTAGE AMPLIFIER Fig. 6

Voltage amplifier A1-B is connected as a typical inverting amplifier. Employing a 4.7 K Ohm input resistor and a 1 meg Ohm feedback resistor amplifier A1-A would typically have a very high gain. However, there is an additional negative stabilizing feedback loop from the output of the bridge. In addition, there is a back to back Diode Network at the input to prevent input saturation and two back to back Zener Diodes shunting the standard feedback resistor to prevent large output voltage excursions. The output of the second voltage amplifier is summed with the output of the current limit amplifier A2 and proceeds to the input of the Differential Amplifier.

## DIFFERENTIAL AMPLIFIER Fig. 7

The Differential Amplifier is formed by Q2 and Q3, R37, 38, CR20, 21 CR34 and 35, transistors Q2 and Q3 forming the active elements and resistors R37 and 38 the bias elements. Diode CR20, CR21 CR34 and CR35 are to compensate for temperature variations and to provide current limiting. Diode CR22 through CR33 are employed to snub peak currents. The constant current transistor Q1 is biased, so that with zero signal the collectors of Q2 and Q3 are approximately equal to one half of the main power supply voltage. If a plus signal is applied to the base of Q2, it will appear amplified in a 180° inverted at Q2 collector. It will also be coupled through Q2 emitter to Q3 and will appear amplified and in phase at Q3 collector. When this occurs, the voltage at Q2 collector will decrease and the transistor will conduct more current. At the same time the voltage at the collector of transistor Q3 will increase and the transistor will conduct less current.

## PRE-DRIVER TRANSISTORS Fig. 7

As transistor Q2 conducts more current, it provides greater base drive for pre-driver transistor Q9 and less base drive for pre-driver transistor Q7. As the voltage at the collector of Q3 increases, it provides greater base drive for pre-driver transistor Q8 and less base drive for pre-driver transistor Q10.

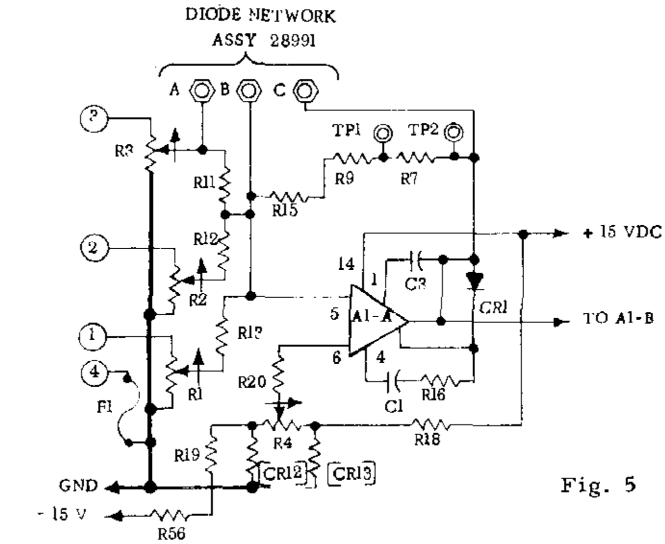



Fig. 5

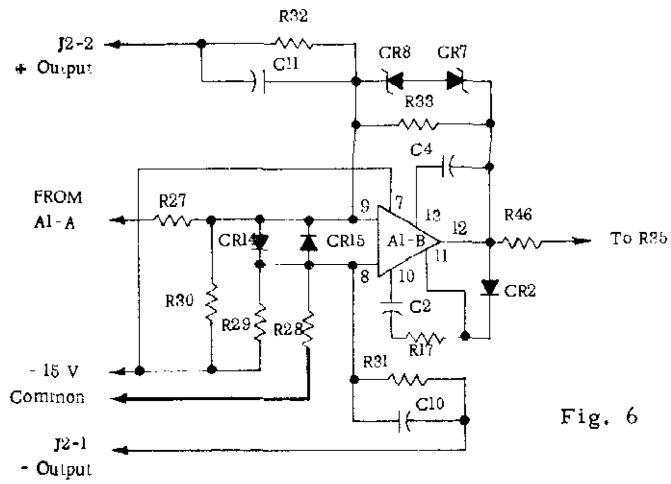



Fig. 6

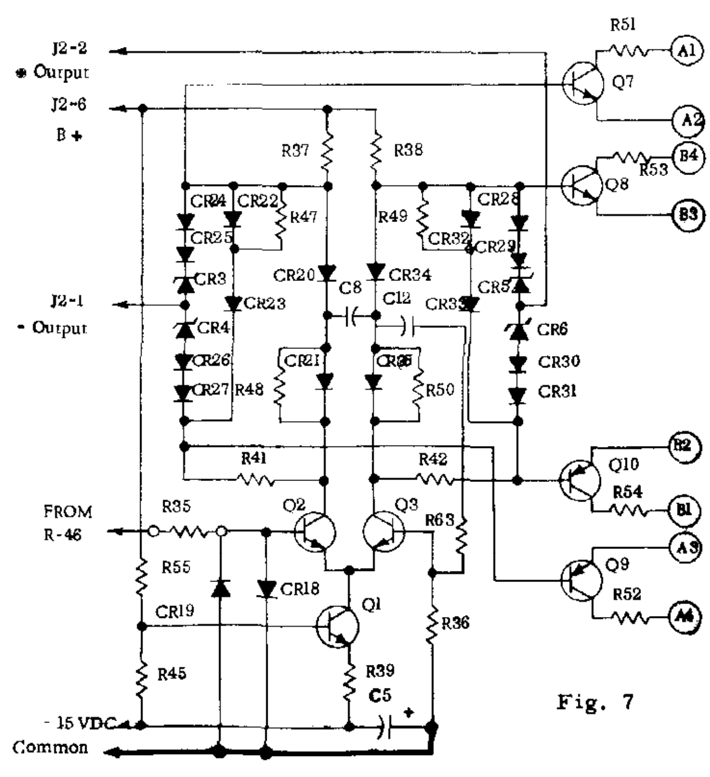



Fig. 7

POWER DRIVERS Fig. 8

The purpose of the power drivers is to provide additional current gain from the low power pre-driver transistors to the high power output bridges. Pre-driver transistor Q7 is tied to driver transistor Q3, therefore, transistor Q3 will conduct in exactly the same manner as Q7. Also, pre-driver transistor Q10 and driver transistor Q1 are connected together, also pre-driver transistor Q8 and driver transistor Q2, pre-driver transistor Q9 and driver transistor Q4.

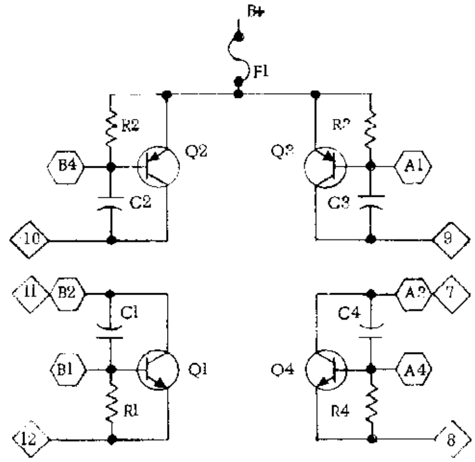



Fig. 8

OUTPUT BRIDGE Fig. 9

The output is operated as a current supply for the motor armature, with two transistors connected to power supply plus and two connected to Signal Common. Because the output for the load is derived from a bridge, Null or zero output is achieved, when all transistors within the bridge are conducting equally. As the bridge is driven out of a balance or as diagonal pairs of transistors conduct more heavily, current will be supplied to the motor or other load. Bipolar outputs are achieved by driving opposite diagonal pairs of transistors to heavier conduction. The basic heatsink consists of four transistors in a single bridge. The A5283-001 has three parallel output bridges.

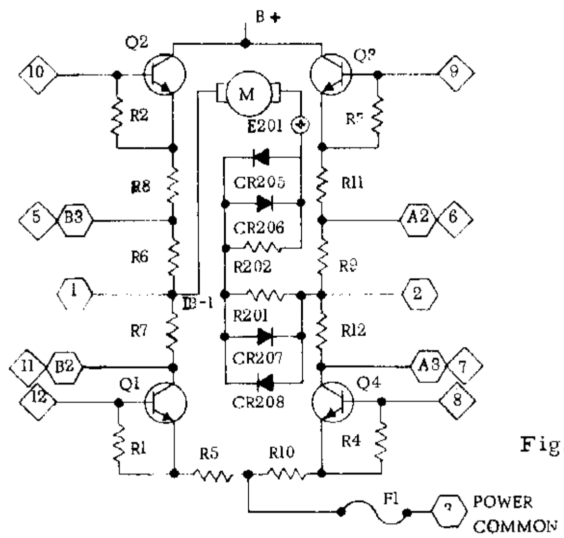



Fig. 9

CURRENT SENSE Fig. 9

As the bridge is driven out of balance and current flows through the load, it also flows through sampling resistors in each heatsink R6, 7, 8, 9, 11 & R12, providing a voltage output proportional to current.

CURRENT LIMIT AMPLIFIER Fig. 10

At the input to the current limit amplifier A2 are two voltage dividers, consisting of R57 and 58 and R59 and R60 connected across the sampling resistors on each heatsink. The outputs of these two voltage dividers are connected differentially to the current limit amplifier A2 at the inverting and non-inverting inputs. As current flows through the sampling resistors altering the voltage drop across them, the two dividers will be driven out of balance, providing an input for current limit amplifier A2. If load current flows from IB-1 through the load and returns to E201, resistors R59 and R60 will be driven more positive than resistors R57 and R58, which results in a positive potential at R43 with respect to R34. This positive potential is impressed at the inverting input Terminal 4 of the current limit amplifier A2.

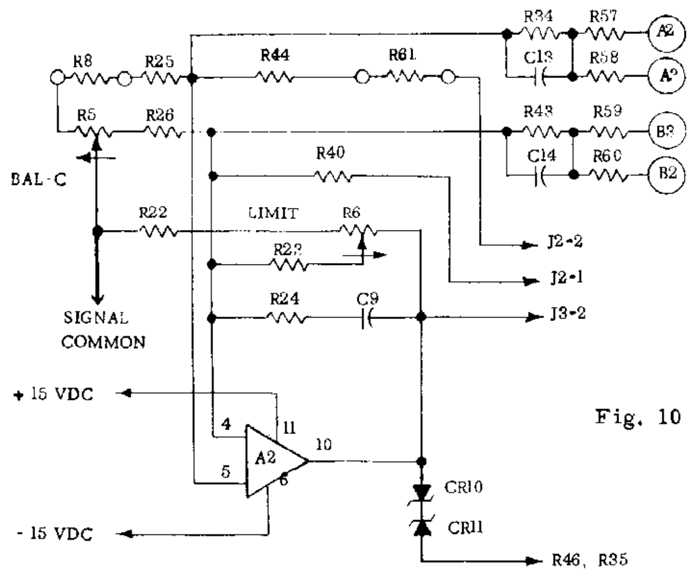



Fig. 10

The signal is amplified and inverted and appears at Terminal 10 of A2 as a negative voltage. When this negative voltage reaches a magnitude of approximately 5.7 Volts D.C., Diodes CR10 and CR11 conduct and apply the negative signal in its opposition to the positive signal at the junction of R46 and R35. This prevents any further increase in the voltage level at that junction. Therefore, output current will be limited. The level at which output current will be limited, is determined by the gain of current limit amplifier A2. The gain of A2 is set by the potentiometer R6 and the feedback loop around A2. Adjusting R6 counter-clockwise provides less feedback around amplifier A2 and the gain will be increased. It will then take less output current to drive A2 to the level of clamping, thus adjustable current limit is achieved. To lower the common mode, voltage is applied to Pin 4 and 5 of current limit amplifier A2. Resistors R25 and 26 are employed in conjunction with factory selected resistors R8 and C balance pot R5 with the wiper terminated at Signal Common. Resistor R8 is selected to balance the input impedance of A2 with R5 set to mid range. After R8 is selected, balance pot R5 may then be adjusted to compensate for impedance changes caused by various settings of R6.

## TEST SET - DRIVER/OUTPUT HEAT SINK A5283-001 Fig. 11

Shown to the right is a schematic for a heat sink tester, using four push buttons and a 4 pole 5 position selector switch. For a quick test in field service, it is possible to use two resistor decade boxes connected alternately to the different terminal pairs to be tested.

The purpose of this test set is to be able to test the driver/output heat sink portion of the A5283-001 amplifier without having to use a circuit board. The output bridge portion of the amplifier consists of four quadrants and this test set will enable the user to isolate a trouble to any one of the four. The test set is useful for locating the following kinds of trouble:

1. Shorted transistors 2. Open transistors 3. Low Gain

The test set is designed to provide base drive to the driver transistor and this is accomplished by supplying positive DC to the base through a resistor. The amount of resistance used is selected with a selector switch which connects the same base input resistance to each of the four driver quadrants. This test should always be done by starting with the highest resistance first and then decreasing the resistance step by step until the proper output is obtained. The test indication is obtained from a DC ammeter connected in series with the power supply to the heat sink. In addition, it may be desirable to use a resistor in series with the DC supply of a 1 Ohm value to limit the ultimate maximum current which may pass through the unit under test.

CAUTION: This test can be destructive since it is essentially a short circuit test. In the short circuit condition, small currents cause high power dissipation and, therefore, the test buttons should be pressed momentarily so as to get a reading on the ammeter.

The buttons on the tester labelled 7, 8, 9, and 10, correspond to the equivalent transistors on the circuit board identified as Q7, Q8, Q9, and Q10. The vertical button pairs, 7 and 9, and pair 8 and 10 turn on transistors in the bridge which are directly in series across the DC power supply. Button pairs 7 and 10 and pair 8 and 9 turn on transistors in the arrangement which would be turned on for normal operation of the amplifier. In order to get a complete test when pressing these diagonal pairs, it is necessary to connect the output terminals of the amplifier through a 1 Ohm load resistance.

The normal procedure for operating the tester is to connect the plug J1 into the matching plug from the heat sink. Then connect the heat sink to the DC power supply with an appropriate ammeter, and a series resistor if desired. Do not connect a load resistor yet. Now, press buttons 7 and 9 and decrease the resistance to the base of the transistors by turning the switch clockwise from position 1 towards position 5 in order to get an adequate reading on the ammeter. However, if there are some shorted transistors, there may be readings on the ammeter for the first few positions of the switch. Now, press buttons 8 and 10 and there should be about the same current reading on the ammeter. By pressing only one button, a current reading indicates that there are shorted transistors in the associated part of the bridge. If it is not possible to get any current reading, then there are open transistors in the associated part of the bridge. Now, an additional check can be made by either connecting the load resistor to the output terminals and repeating the test by pressing buttons 8 and 9 and checking for a current reading.

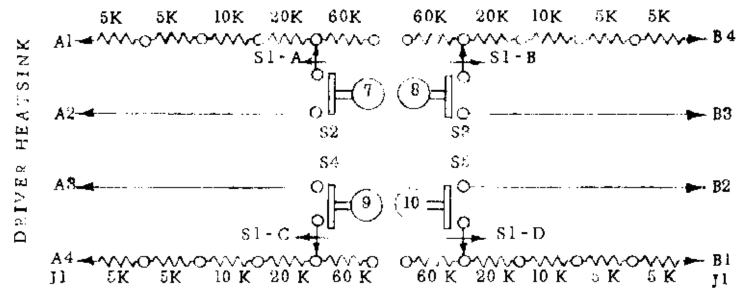



Fig. 11

DUMMY LOAD - A5283-001 CIRCUIT BOARD: Shown below is a schematic for a Dummy Load to be used in testing the circuit board without the Power Driver and Output transistors. Troubleshooting of the amplifier is simplified when the circuit board and the power transistors are tested separately. Preliminary troubleshooting of the circuit board can be done with output plu J1 removed and J6 on the interconnect board removed. However, to test for full output voltage swing and symmetry at TP-1 and 2 on dummy load, it is necessary to have the dummy load connected.

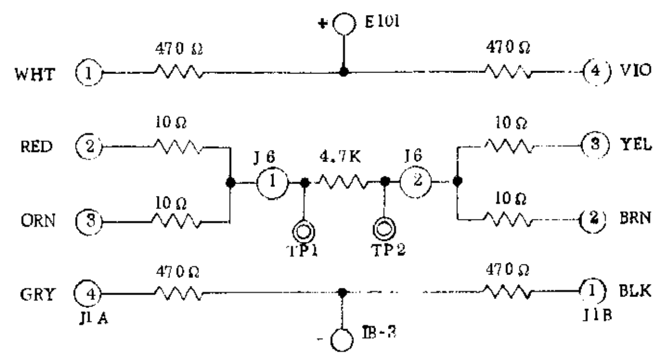



Fig. 12

DC SIGNAL SIMULATOR: Shown below is a schematic for a DC signal source for providing + and - variable amplitude signals. The unit also has push button switches to create step outputs and reverse signals useful for servo system alignment.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SW1 | DPDT | Toggle | R1 | 18 K | 1/4 W | R5 | 470 Ω | 1/4 W |
| SW2 | DPDT | Mom Pushon | R2 | 180 K | 1/4 W | R6 | 470 Ω | 1/4 W |
| SW3 | SPST | Toggle | R3 | 1-8 M | 1/4 W | R7 | 5 K | Dual |
| SW4 | SPST | Mom Pushon | R4 | not used | | B1 | 9 V Battery | |
| | | | | | | B2 | 9 V Battery | |

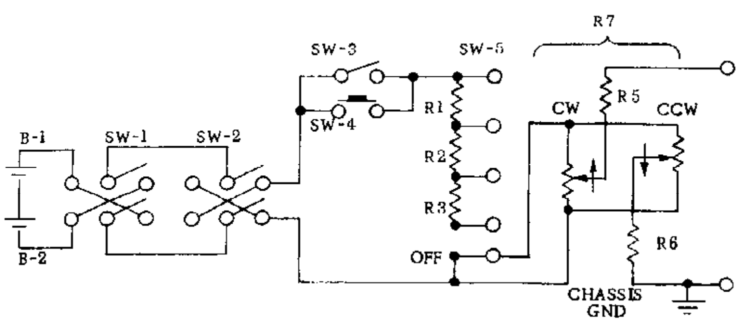





Fig. 13

ALIGNMENT PROCEDURE
A5283-001

CONNECT PER INSTALLATION DRAWING 28900 PAGE 2

Check to be certain the primary jumpers on the power transformer are connected for the voltage to be applied.

1. PRELIMINARY ADJUSTMENTS

1.1 Adjust "C-BAL" pot to mid range.
1.2 Adjust "A-BAL" pot to mid range.
1.3 Connect decade resistor across R61 Terminals tentatively set to 510 Ohms.
1.4 Connect decade resistor across R8 Terminals tentatively set to 1.6 K Ohms.
1.5 Adjust R6 "LIMIT" pot fully C.W.
1.6 Jumper TP-1 to TP-2 on Main Board.

2. CURRENT LIMIT ADJUSTMENTS

2.1 Connect Simpson 260 VOM set to 2.5 VDC scale to J3-2 w.r.t. TB1-4.
2.2 Connect Voltmeter to IB-1 w.r.t. E201 (output voltage monitor).
2.3 With no output load connected, apply power to the Amplifier.
2.4 Using oscilloscope referenced to TB1-4, check presence of + 15 ± 0.5 VDC at CR9-C.
2.5 Check for presence of - 15 ± 0.5 VDC at J2-3.
2.6 With all gain pots fully C.C.W., verify zero output volts (if necessary adjust R4 "A-BAL" to zero output.
2.7 Trim decade resistor R8 for zero volts at J3-2 w.r.t. TB1-4.
2.8 Rotate Gain Pots fully C.W. and apply sufficient input signal to drive amplifier to full output.
2.9 Trim decade resistor R-61 for zero volts at J3-2 with respect to TB1-4.
2.10 Install selected values for R-8 and R-61.

3. BALANCE

3.1 With all gain pots fully C.C.W., measure 0 ± 0.5 VDC output. "A-BAL" may be adjusted.

4. GAIN AND PHASE

4.1 Connect a 5 Ohm 1000 W load to the output terminals.
4.2 Connect variable tap connection on power transformer secondary to $X_1$ and $X_3$.
4.3 Rotate gain pot under test fully C.W. All other gain pots fully C.C.W.

4.4

| OUTPUT IB-1 w.r.t. E201 | G1 | G2 | G3 | INPUT w.r.t. TB1-4 | |
|---|---|---|---|---|---|
| + 4 VDC | CW | CCW | CCW | + 12 to + 17 MVDC | _____ |
| - 4 VDC | CW | CCW | CCW | - 12 to - 17 MVDC | _____ |
| + 9 VDC | CCW | CW | CCW | + 8.5 to + 11 MVDC | _____ |
| - 9 VDC | CCW | CW | CCW | - 8.5 to - 11 MVDC | _____ |
| + 4 VDC | CCW | CCW | CW | + 4.2 to + 5.5 MVDC | _____ |
| - 4 VDC | CCW | CCW | CW | - 4.2 to - 5.5 MVDC | _____ |

5. MAXIMUM OUTPUT

5.1 Apply a + 0.5 VDC input signal with G3 CW and read + 30 VDC or greater at the output _____
5.2 Apply a - 0.5 VDC input signal and read - 30 VDC or greater at the output _____

6. CURRENT LIMIT

6.1 Connect a 0.2 Ohm Resistor (200 W) to IB-1 w.r.t. E201

6.2 Connect oscilloscope set to 1 V/DIV and 100 m/sec. sweep to IB-1 w.r.t. E201

NOTE: For acceleration purposes Amplifier must deliver 28 Ampere peaks to motor. Continuous rating of amplifier is 12.5 Amperes.

6.3 Adjust "LIMIT" pot R6 fully C.C.W. Adjust "C-BAL" pot R5 for zero volts at J3-2 w.r.t. TB1-4 Check _____

6.4 Apply a positive 0.5 VDC input signal and read + 1 Volt max. continuous at IB-1 w.r.t. E201 _____

6.5 Apply a negative 0.5 VDC input signal and read - 1 Volt max. continuous at IB-1 w.r.t. E201 _____

6.6 Apply a positive 0.5 VDC input pulse, and adjust R6 and "C-BAL" to read + 5.6 peak output voltage _____

6.7 Apply a negative 0.5 VDC input pulse, and adjust R6 and "C-BAL" to read - 5.6 peak output voltage _____

7. MOTOR LOAD (Inertial Motor, Integral Tachometer) see Installation Drawing 28900 Sheet 6 page of A5283-001 Manual.

7.1 Connect hollow cup motor with tachometer to amplifier with tach output connected to TB1-3 w.r.t. TB1-4
7.2 Connect Command Signal Input to TB1-2 w.r.t. TB1-4
7.3 Adjust closed tach loop by A5283-001 Manual page for optimum performance.

8. BURN IN AMPLIFIER FOR 8.0 HOURS Check _____

9. After burn-in, conformal coat amplifier where applicable and check for conformance to Production Acceptance Test Data Sheet. Check _____

PRODUCTION ACCEPTANCE TEST PROCEDURE REV. B

WESTAMP MODEL A5283-001
TRANSISTOR AMPLIFIER SERIAL NO.____ DATE ____

APPROVED [signature] DATE ________

VALIDATION __________ TESTER ______________

1. TEST EQUIPMENT REQUIRED

1.1 D.C. Input Voltmeter
1.2 D.C. Output Voltmeter, Simpson 260 or equivalent
1.3 5 Ω Resistive Load, 0.2 Ω, 1000 W, 1 Ω, 1000 W
1.4 D.C. Signal Simulator
1.5 Motor Load with Tachometer
1.6 40 - 0 - 40 Amp. D.C. Ammeter
1.7 Oscilloscope, Tektronix 502 A or equivalent

2. PRELIMINARY ADJUSTMENTS

2.1 Current Limit Pot fully C.W.
2.2 Remove Diode Assembly Compensation Terminals B & C
2.3 Gain Pots 1, 2, & 3 fully C.C.W.
2.4 Connect Resistive Load in series with Ammeter to Output Terminals shown on Installation Drawing ( 5 Ω Load)

3. CONNECT AS SHOWN ON INSTALLATION DRAWING 28900 Sheet 6

4. NULL

4.1 Short Terminals 1, 2 & 3 on TB1 to Signal Common TB1-4 ______
4.2 Adjust Balance Pot A for ± 0.5 VDC Output ______

5. GAIN AND POLARITY

5.1 Turn Gain Pot corresponding to Input under Test fully C.W. All others fully C.C.W. ______

5.2 OUTPUT IB-1 w.r.t. E201 — INPUT TB1-3 w.r.t. TB1-4

Gain 3 fully C.W.
Gain 1 & 2 fully CCW

| OUTPUT | INPUT | |
|---|---|---|
| +4 VDC | + 4.2 to 5.5 MVDC | ____ |
| -4 VDC | - 4.2 to 5.5 MVDC | ____ |
| +9 VDC | +8.5 to 11 MVDC | ____ |
| -9 VDC | -8.5 to 11 MVDC | ____ |

5.3 OUTPUT IB-1 w.r.t. E201 — INPUT TB1-2 w.r.t. TB1-4

Gain 2 fully C.W.
Gain 1 & 3 fully CCW

| OUTPUT | INPUT | |
|---|---|---|
| +4 VDC | + 4.2 to 5.5 MVDC | ____ |
| -4 VDC | - 4.2 to 5.5 MVDC | ____ |

5.4 OUTPUT IB-1 w.r.t. E201 — INPUT TB1-1 w.r.t. TB1-4

Gain 1 fully C.W.
Gain 2 & 3 fully CCW

| OUTPUT | INPUT | |
|---|---|---|
| +4 VDC | + 12 to 17 MVDC | ____ |
| -4 VDC | -12 to 17 MVDC | ____ |

6. MAXIMUM OUTPUT GAIN 2 & 3 FULLY C.W.

6.1 Apply a + 500 MVDC Signal at TB1-3 with respect to TB1-4 and read + 30 VDC or greater at IB-1 w.r.t. E201 ____
6.2 Apply a - 500 MVDC Signal at TB1-3 with respect to TB1-4 and read - 30 VDC or greater at IB-1 w.r.t. E201 ____

7. CURRENT LIMIT USE 0.2 Ω LOAD (Momentary Test)

7.1 Connect Scope across Load Resistor (set vertical attenuator to 2 V/Div).
7.2 Apply a + 500 MVDC Pulse at TB1-3 w.r.t. TB1-4 and read + 5.6 VDC Peak Output on Oscilloscope ____
7.3 Apply a - 500 MVDC Pulse at TB1-3 w.r.t. TB1-4 and read - 5.6 VDC Peak Output on Oscilloscope ____

8. CURRENT FEEDBACK

8.1 Replace 0.2 Ω Load with 1 Ω Load, Gain 1, 2 & 3 fully C.W.
8.2 Connect J3-1 to J3-2
8.3 Install .0015 uf Capacitor across Op-Amp Compensation Terminal B & C

8.4 OUTPUT CURRENT — INPUT TB1-3 w.r.t. TB1-4

| OUTPUT CURRENT | INPUT | |
|---|---|---|
| + 5 Amps | more than + .80 VDC | ____ |
| - 5 Amps | more than - .80 VDC | ____ |

9. CURRENT FEEDBACK SET

9.1 Apply a + 0.7 VDC at TB1-3 w.r.t. TB1-4 and set Gain 1 CCW until Output Ammeter reads + 5 Amps. ____

10. MOTOR LOAD

(Closed Tach Loop with Diode Assembly installed across Compensation Terminals B & C) in place of resistive load.
Take care not to overspeed the motor.

10.1 Apply a varying input signal and ensure motor speed smoothly follows command input. ____

END OF TEST

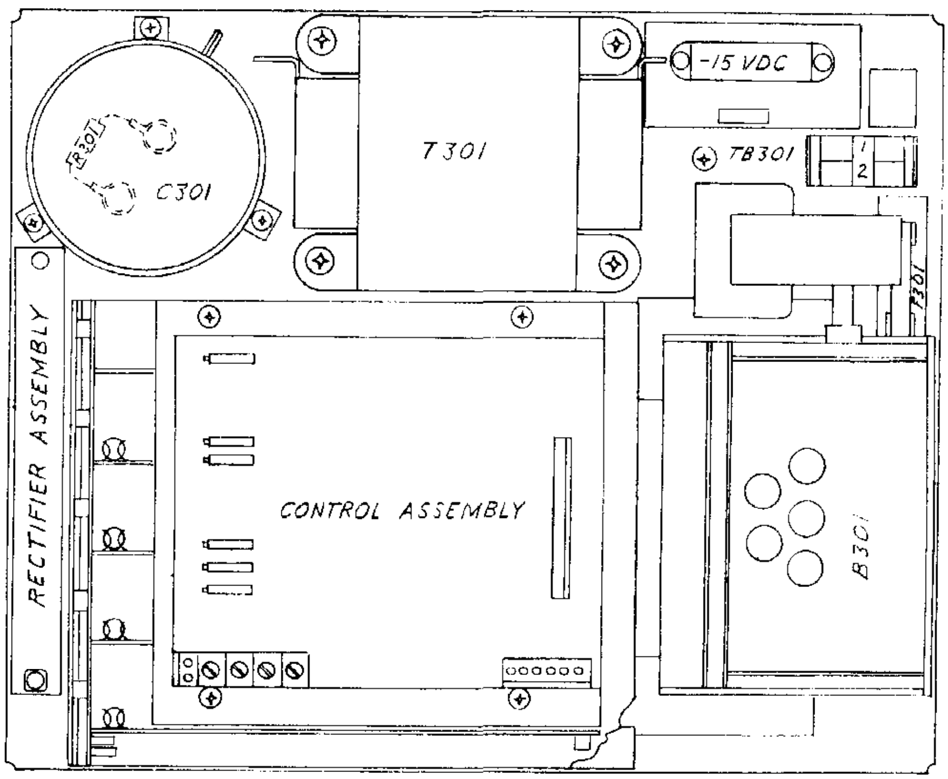



Fig. 14
Top Assembly
(28975)

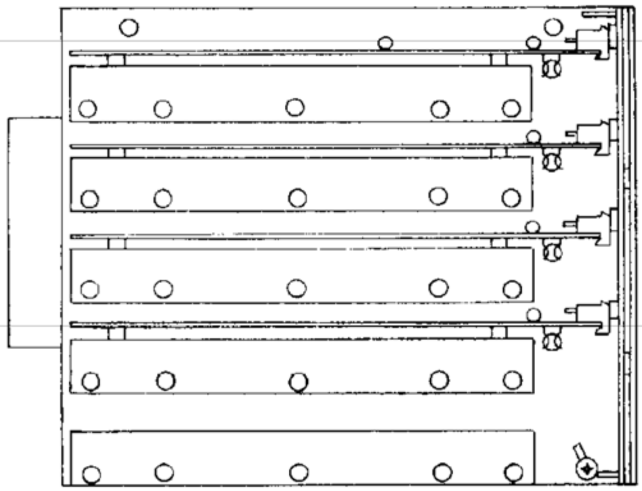


Fig. 15
Heatsink Assembly

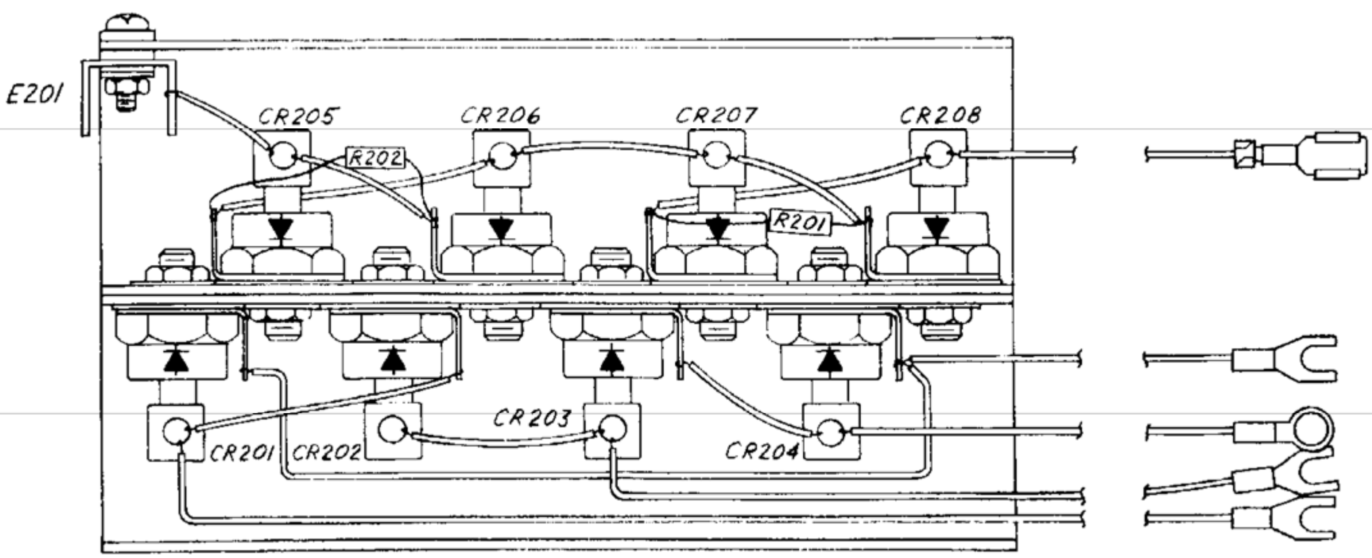



Fig. 16
Rectifier Assembly (28969)

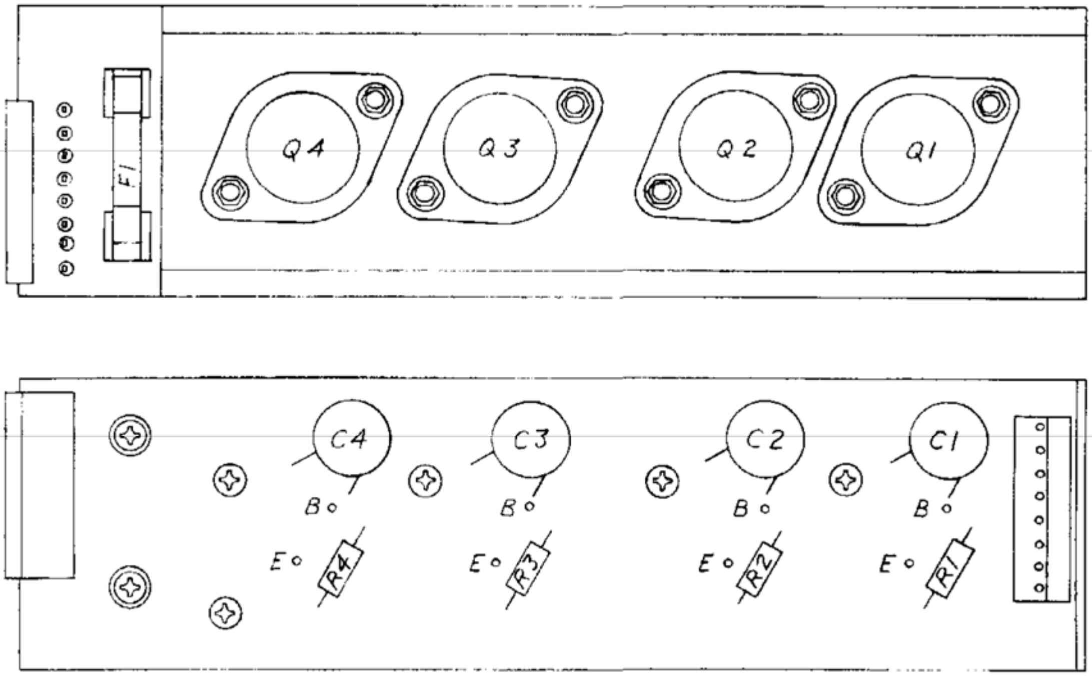



**Fig. 17**

**Driver Heatsink**

**(28984)**

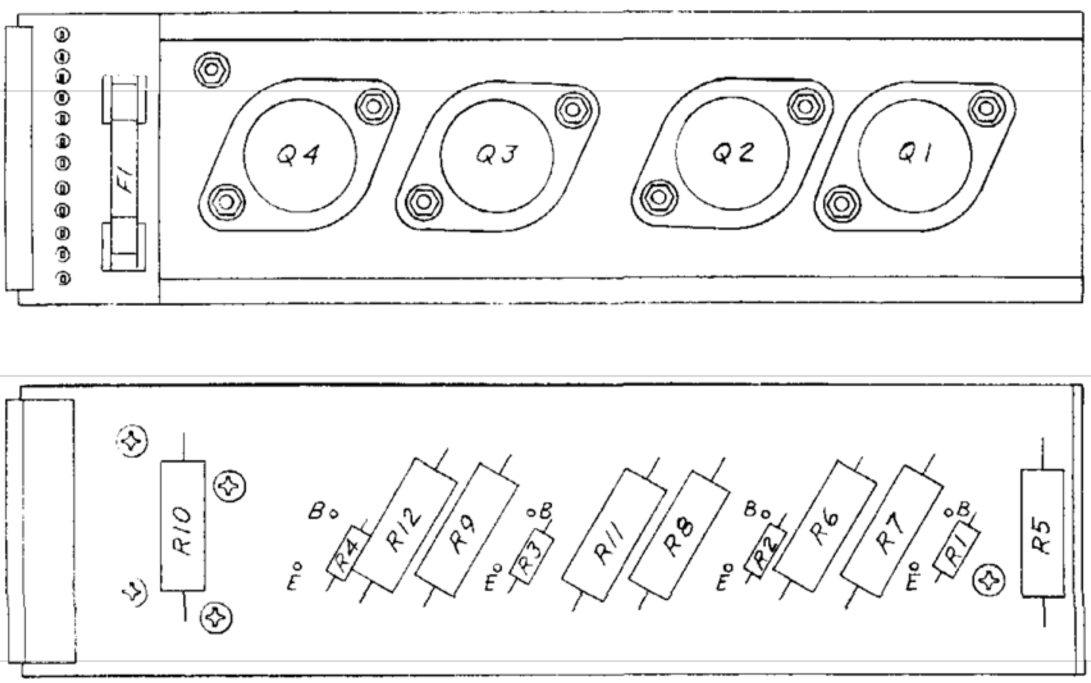



**Fig. 18**

**Output Heatsink**

**(28985)**

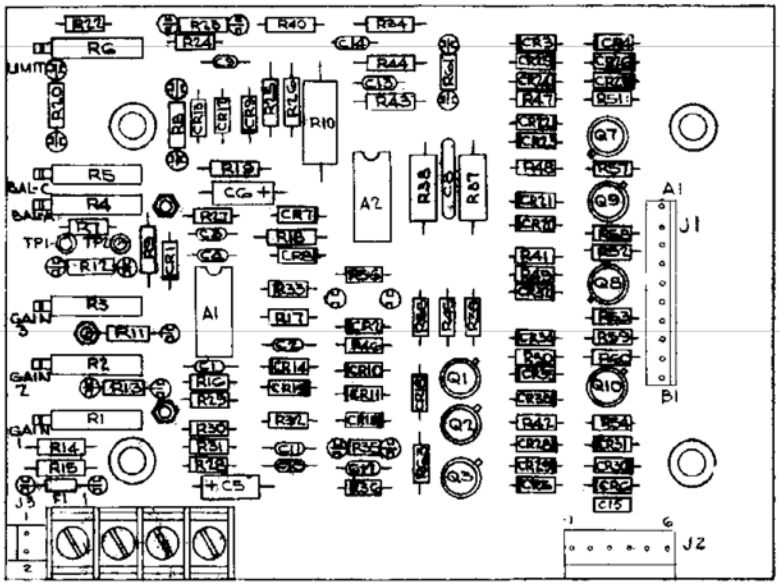


Fig. 19
Control Card Assembly (28107)

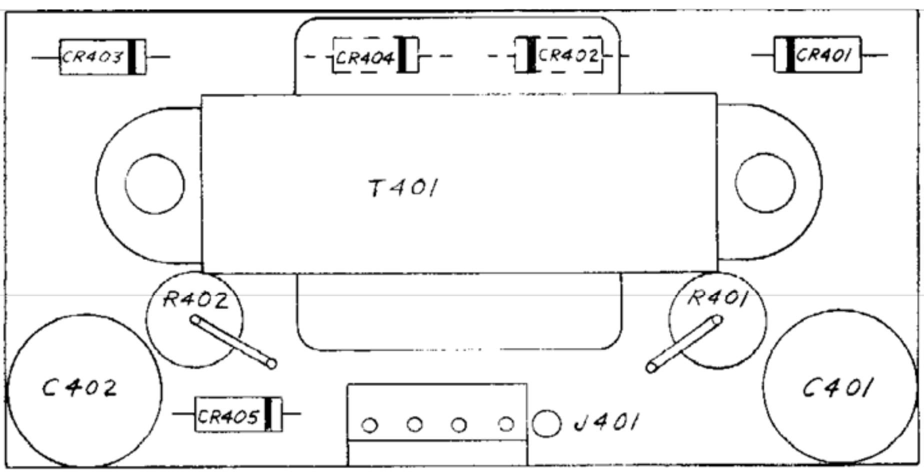



Fig. 20
- 15 VDC Power Supply

D.C. AMPLIFIER ASSEMBLY 28107 Fig. 19

| | | |
|---|---|---|
| A1 | MC1437L | |
| A2 | MC1741CL | |
| C1 | .005 uf | 50 VDC |
| C2 | .005 uf | 50 VDC |
| C3 | 220 pf | 500 VDC |
| C4 | 220 pf | 500 VDC |
| C5 | 15 uf | 20 VDC |
| C6 | 15 uf | 20 VDC |
| C7 | not used | |
| C8 | .015 uf | 200 VDC |
| C9 | 330 pf | 500 VDC |
| C10 | 680 pf | 500 VDC |
| C11 | 680 pf | 500 VDC |
| C12 | 220 pf | 500 VDC |
| C13 | 220 pf | 500 VDC |
| C14 | 220 pf | 500 VDC |
| C15 | .22 uf | 100 VDC |
| C16 | not used | |
| C17 | not used | |
| CR1 | 1N914 | |
| CR2 | 1N914 | |
| CR3 | 1N5221 | |
| CR4 | 1N5221 | |
| CR5 | 1N5221 | |
| CR6 | 1N5221 | |
| CR7 | 1N748A | |
| CR8 | 1N748A | |
| CR9 | 1N4744 | |
| CR10 | 1N751A | |
| CR11 | 1N751A | |
| CR12 | 1N914 | |
| CR13 | 1N914 | |
| CR14 | 1N914 | |
| CR15 | 1N914 | |
| CR16 | not used | |
| CR17 | not used | |
| CR18 | 1N914 | |
| CR19 | 1N914 | |
| CR20 | 1N914 | |
| CR21 | 1N914 | |
| CR22 | 1N914 | |
| CR23 | 1N914 | |
| CR24 | 1N914 | |
| CR25 | 1N914 | |
| CR26 | 1N914 | |
| CR27 | 1N914 | |
| CR28 | 1N914 | |
| CR29 | 1N914 | |
| CR30 | 1N914 | |
| CR31 | 1N914 | |
| CR32 | 1N914 | |
| CR33 | 1N914 | |
| CR34 | 1N914 | |
| CR35 | 1N914 | |
| F1 | 1/2 A | |
| Q1 | 2N5320 | |
| Q2 | 2N657 | |
| Q3 | 2N657 | |
| Q4 | not used | |
| Q5 | not used | |
| Q6 | not used | |
| Q7 | 2N5320 | |
| Q8 | 2N5320 | |
| Q9 | 2N5322 | |
| Q10 | 2N5322 | |
| R1 | 10 K | |
| R2 | 10 K | |
| R3 | 10 K | |
| R4 | 10 K | |
| R5 | 200 Ω | |
| R6 | 20 K | |
| R7 | 3.9 Ω | 1/4 W |
| R8 | ( ) | 1/4 W |
| R9 | 3.9 Ω | 1/4 W |
| R10 | 1.6 K | 2 W |
| R11 | 10 K | 1/4 W |
| R12 | 10 K | 1/4 W |
| R13 | 30 K | 1/8 W |
| R14 | not used | |
| R15 | 499 K | 1/4 W |
| R16 | 1.5 K | 1/4 W |
| R17 | 1.5 K | 1/4 W |
| R18 | 15.0 K | 1/4 W |
| R19 | 15.0 K | 1/4 W |
| R20 | 6.19 K | 1/4 W |
| R21 | not used | |
| R22 | 2.2 K | 1/4 W |
| R23 | 69.8 K | 1/4 W |
| R24 | 3.9 Ω | 1/4 W |
| R25 | 3.01 K | 1/4 W |
| R26 | 4.99 K | 1/4 W |
| R27 | 4.7 K | 1/4 W |
| R28 | 4.7 K | 1/4 W |
| R29 | 100 K | 1/4 W |
| R30 | 100 K | 1/4 W |
| R31 | 100 K | 1/4 W |
| R32 | 100 K | 1/4 W |
| R33 | 1 meg | 1/4 W |
| R34 | 20 K | 1/4 W |
| R35 | 910 Ω | 1/4 W |
| R36 | 1.5 K | 1/4 W |
| R37 | 3 K | 1 W |
| R38 | 3 K | 1 W |
| R39 | 560 Ω | 1/4 W |
| R40 | 20 K | 1/4 W |
| R41 | 75 Ω | 1/4 W |
| R42 | 75 Ω | 1/4 W |
| R43 | 20 K | 1/4 W |
| R44 | 19.6 K | 1/4 W |
| R45 | 3.3 K | 1/4 W |
| R46 | 1.1 K | 1/4 W |
| R47 | 220 Ω | 1/4 W |
| R48 | 82 Ω | 1/4 W |
| R49 | 220 Ω | 1/4 W |
| R50 | 82 Ω | 1/4 W |
| R51 | 82 Ω | 1/4 W |
| R52 | 82 Ω | 1/4 W |
| R53 | 82 Ω | 1/4 W |
| R54 | 82 Ω | 1/4 W |
| R55 | 18 K | 1/4 W |
| R56 | 3.9 Ω | 1/4 W |
| R57 | 100 Ω | 1/4 W |
| R58 | 100 Ω | 1/4 W |
| R59 | 100 Ω | 1/4 W |
| R60 | 100 Ω | 1/4 W |
| R61 | select | 1/4 W |
| R62 | not used | |
| R63 | 10 K | 1/4 W |

DIODE NETWORK ASSY 28991

| | |
|---|---|
| CR1 | 1N914 |
| CR2 | 1N914 |
| CR3 | 1N914 |
| CR4 | 1N914 |
| CR5 | 1N914 |
| CR6 | 1N914 |
| CR7 | 1N914 |
| CR8 | 1N914 |

RECTIFIER ASSY 28969 Fig. 16

| | | |
|---|---|---|
| CR201 | 1N1184A | |
| CR202 | 1N1184A | |
| CR203 | 1N1184A | |
| CR204 | 1N1184A | |
| CR205 | 1N250B | |
| CR206 | 1N250B | |
| CR206 | 1N250B | |
| CR207 | 1N250B | |
| CR208 | 1N250B | |
| R201 | 1 K | 1/4 W |
| R202 | 1 K | 1/4 W |

DRIVER HEATSINK ASSEMBLY 28984 Fig. 17

| | | |
|---|---|---|
| C1 | .0047 uf | 500 VDC |
| C2 | .0047 uf | 500 VDC |
| C3 | .0047 uf | 500 VDC |
| C4 | .0047 uf | 500 VDC |
| Q1 | 2N4915 | |
| Q2 | 2N4906 | |
| Q3 | 2N4906 | |
| Q4 | 2N4915 | |
| R1 | 1 K | 1/2 W |
| R2 | 1 K | 1/2 W |
| R3 | 1 K | 1/2 W |
| R4 | 1 K | 1/2 W |

OUTPUT HEATSINK ASSEMBLY 28985 Fig. 18

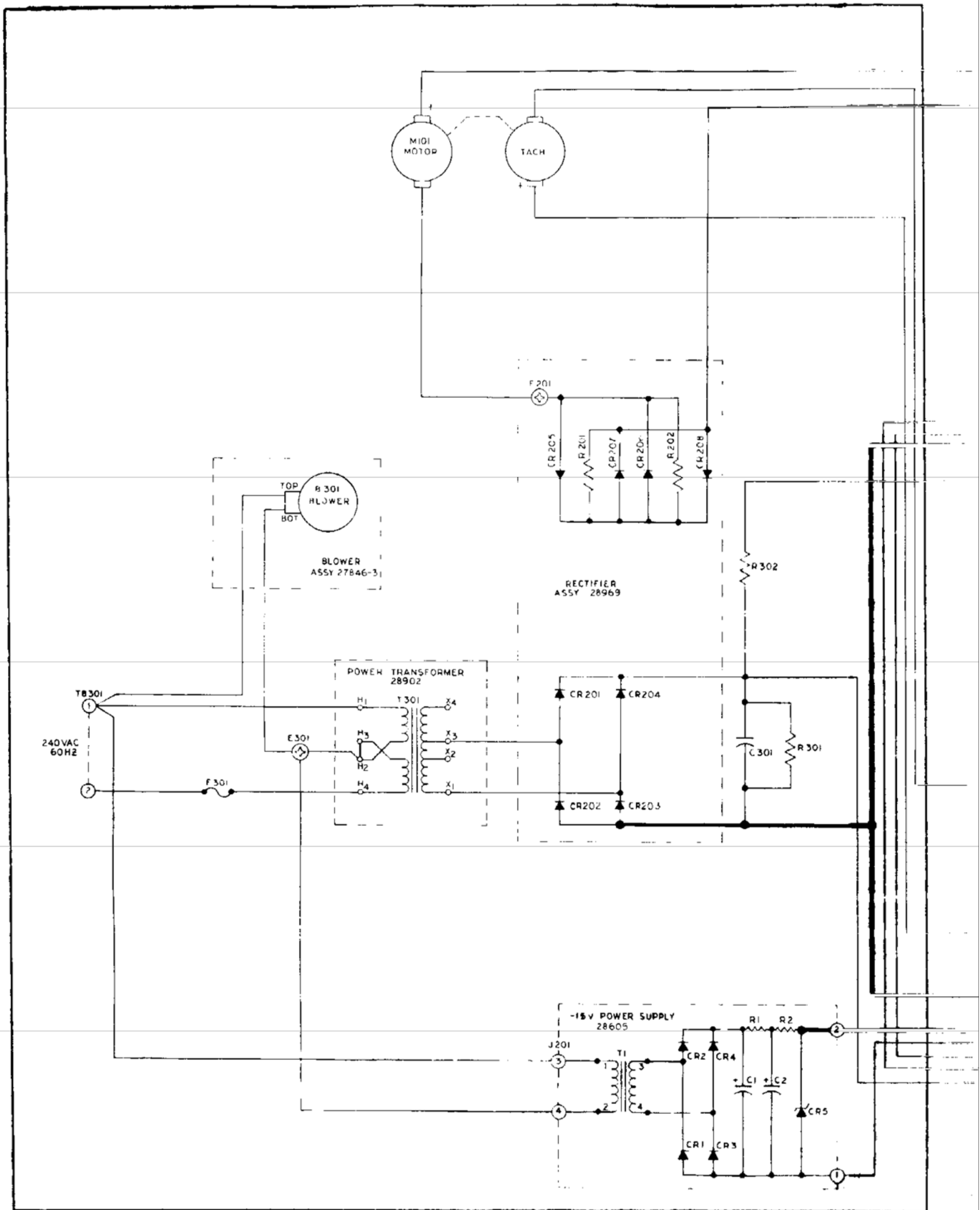
| | | |
|---|---|---|
| Q1 | 2N6258 | |
| Q2 | 2N6258 | |
| Q3 | 2N6258 | |
| Q4 | 2N6258 | |
| R1 | 100 Ω | 1/2 W |
| R2 | 100 Ω | 1/2 W |
| R3 | 100 Ω | 1/2 W |
| R4 | 100 Ω | 1/2 W |
| R5 | .1 Ω | 5 W |
| R6 | .1 Ω | 5 W |
| R7 | .1 Ω | 5 W |
| R8 | .1 Ω | 5 W |
| R9 | .1 Ω | 5 W |
| R10 | .1 Ω | 5 W |
| R11 | .1 Ω | 5 W |
| R12 | .1 Ω | 5 W |

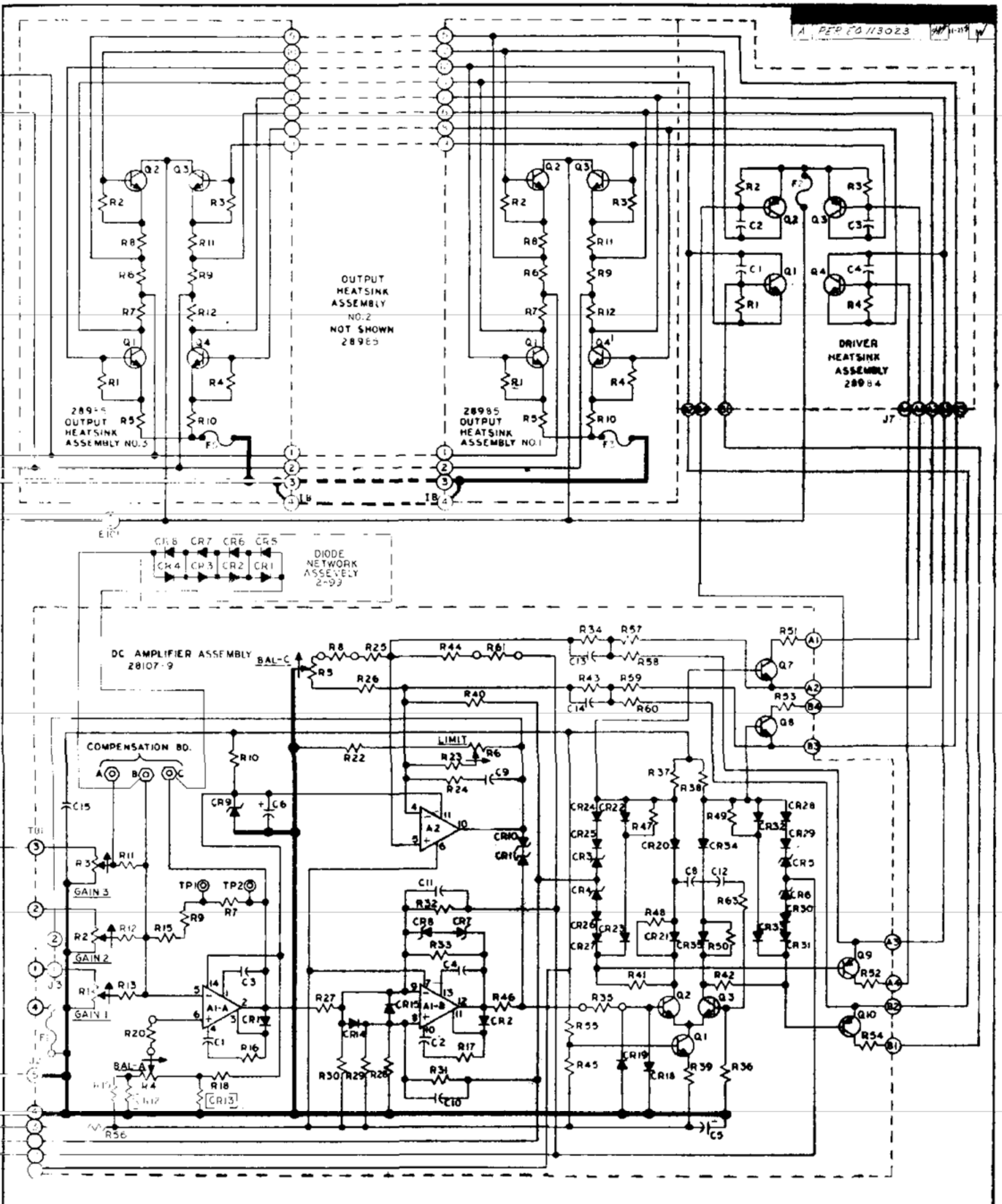
SERVO AMPLIFIER ASSEMBLY 28975 Fig. 14

| | | |
|---|---|---|
| R301 | 1.2 K | 5 W |
| R302 | 1 Ω | 91 V |
| C301 | 14000 MF | 75 VDC |
| F301 | MD A 5 A | 5 A |
| T301 | 28902 | |
| B301 | 27846-3 | |
| TB301 | SWT-2 | |
| | SW96-2 | |

15 VDC POWER SUPPLY 28605 Fig. 20

| | | |
|---|---|---|
| C401 | 100 uf | 50 VDC |
| C402 | 100 uf | 50 VDC |
| CR401 | 1N645 | |
| CR402 | 1N645 | |
| CR403 | 1N645 | |
| CR404 | 1N645 | |
| CR405 | 1N4744 | |
| R401 | 300 Ω | 2 W |
| R402 | 300 Ω | 2 W |
| T401 | T963 | |
| J401 | 09-60-1041 | |


M101
MOTOR
TACH
E201
CR205
R201
CR207
CR206
R202
CR208
TOP
B301
BLOWER
BOT
BLOWER
ASSY 27846-3
R302
RECTIFIER
ASSY 28969
POWER TRANSFORMER
28902
T301
TB301
240VAC
60HZ
E301
F301
CR201
CR204
C301
R301
CR202
CR203
-15V POWER SUPPLY
28605
J201
T1
R1
R2
CR2
CR4
C1
C2
CR5
CR1
CR3




3. [ ] SPECIFICALLY SELECTED FOR APPLICATION
2. FOR WIRING DIAGRAM SEE DWG 28994
1. FOR ASSEMBLY SEE DWG 28975
NOTES: UNLESS OTHERWISE SPECIFIED

| PART NO | DESCRIPTION | MATERIAL | ITEM |
|---|---|---|---|

SYSTEM SCHEMATIC DIAGRAM

FIRST USED ON A5283-001

WESTAMP INCORPORATED
1542 15TH STREET
SANTA MONICA, CALIF

DWG NO 2899[illegible]