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DESCRIPTION

The 1594C Power Amplifier delivers in excess of 100 watts of power at less than 1% total harmonic distortion (THD) from 35-20,000 Hz. It has a high-impedance direct input and an octal socket to accept a line-matching or line-bridging transformer. A selectable high-pass filter having a cutoff frequency of 300 Hz is available to provide driver protection in speech reinforcement systems.

The 1594C provides transformer-isolated

outputs for 4-ohm, 8-ohm and 16-ohm loudspeakers, plus a 70V line output for distribution systems.

The 1594C operates from a 120V or 240V ac source or from a 28V dc battery. Designed for rack mounting, the 1594C is four rack units high and 8½ inches deep. A hinged front panel allows servicing without removing the amplifier from the rack.

SPECIFICATIONS

Gain:	64 dB	Operating Temperature Range:	Up to 55°C (131°F) ambient
Input Sensitivity:	0.8V rms for rated output	Special Features:	Dissipation sensing circuit for protection of output transistors Automatic transfer from ac to dc power if ac power fails High-pass filter (300 Hz cutoff) switch on rear panel
Power Output:	100 watts at less than 1% THD, 50 to 12,000 Hz	Dimensions:	7" (17.8 cm) H 19" (48.3 cm) W 8½" (21.6 cm) D
Frequency Response:	±1 dB, 20 to 20,000 Hz at 1 watt output. ±1 dB, 50 to 12,000 Hz at rated output.	Weight:	35 pounds (15.88 kg)
Input Impedance:	15,000 ohms (potentiometer) 150 or 600 ohms balanced with 15095A Line Transformer 15,000 ohms balanced with 15335A Line Transformer	Color:	Black
Load Impedance:	4, 8, 16, 50 ohms	Accessories (must be ordered separately):	15095A Line Transformer 15335A Line Transformer
Load Voltage:	20, 28, 40, 70.7 volts	Design and Performance Approvals	Underwriters Laboratories listing 209J for Commercial Audio Systems, File E8783(N) Underwriters Laboratories listing 89MO for Fire Protective Signaling Systems, File S2925(N)
Output Impedance:	Less than 10% of nominal load impedance		
Noise Level:	85 dB below rated output		
Gain Control:	Potentiometer, continuously variable		
Power Required:	100/120/220/240V ac, 50/60 Hz 20 watts at zero signal 290 watts at 100 watts output — or — 24/28V dc (battery (-) is ground) 0.2 amp at zero signal 8.5 amps at 100 watts output		

ARCHITECT'S AND ENGINEER'S SPECIFICATIONS

The power amplifier shall be capable of operating from a 100/120/220/240V ac line or from a 24/28V dc battery. The power supply shall automatically transfer the power to dc operation if ac power fails. An octal socket shall be provided on the rear panel for installation of an accessory line transformer. The front panel shall be hinged to permit access to the chassis interior without removing the amplifier from the equipment rack.

The power amplifier shall meet the following criteria. Gain, 64 dB. Input sensitivity, 0.8V rms for rated output. Power output, 100 watts at less than 1% THD from 50 Hz to 12 kHz. Frequency response at 1 watt output, ±1 dB from 20 Hz to 20 kHz and ±1 dB 50 Hz to 12

kHz at rated output. Input impedance; 15,000 direct or balanced with line-bridging transformer accessory, 150 or 600 ohms balanced with line-matching transformer accessory. Load impedance; 4, 8, 16 and 50 ohms. Load voltage; 20, 28, 40 and 70.7 volts. Output impedance, less than 10% of nominal load impedance. Noise level, 85 dB below rated output. Operating temperature range, up to 55°C (131°F). Dimensions, 7" H x 19" W x 8½" D. Weight, 35 pounds. Color, black.

The power amplifier shall be Underwriters Laboratories listed for use in commercial audio systems and fire protection signaling systems.

The power amplifier shall be the ALTEC Model 1594C.



P.O. BOX 26105, OKLAHOMA CITY, OK 73126-0105, U.S.A

OPERATING INSTRUCTIONS

The ALTEC 1594C Power Amplifier delivers up to 100 watts of output power for all types of sound reinforcement systems. It remains stable with operating conditions of varying line voltages and with all types of loads, including long, unloaded speaker lines having considerable capacitance.

CONTROLS AND INDICATORS

Two operating controls are on the front panel; a VOLUME control and a primary power ON-OFF switch. A pilot indicator is lit when the power is ON.

HIGH-PASS FILTER

A two-section high-pass filter is provided with the 1594C to protect driver loudspeakers from excessive low-frequency power demands. Filter use is indicated when high power output from the amplifier is applied to driver loudspeakers not equipped with protective crossover networks. The 3 dB frequency of the high-pass filter is 300 Hz.

A screwdriver-operated FILTER IN-OUT switch is located on the rear of the chassis (see Figure 1). The switch is placed in the OUT position when the 1594C is shipped from the factory.

ALTEC's Active Dissipation Sensing Circuit provides fail-safe protection for the output transistors. Circuit action is immediate and effective at all frequencies within the pass-band of the amplifier, limiting only that portion of program material that would damage or degrade the output transistors.

ACCESSORIES

A plug-in 15095A or 15335A Line Transformer is available to provide line isolation. Input sensitivity for full-rated amplifier output is 0.2V rms with the 15095A transformer and 0.8V rms with the 15335A transformer.

INSTALLATION

The 1594C may be installed in a standard 19-inch equipment rack. Vertical space required is 7 inches (four rack units).

RACK INSTALLATION

1. Remove four screws securing front panel. Open and lower panel.
2. Install 1594C in equipment rack with appropriate four screws supplied.
3. Close front panel and secure with four screws previously removed.

VENTILATION

The 1594C generates minimal heat during normal use. Although the amount of heat is relatively low, the amplifier must be ventilated to prevent an excessive temperature rise. Because transistors are heat sensitive, the 1594C should not be placed adjacent to heat-generating equipment or in areas where ambient temperature exceeds 55°C (131°F).

If the 1594C is installed in an equipment rack or cabinet with other heat-producing equipment installed above and/or below (two or more 1594Cs or one 1594C with real time analyzer, oscilloscope, etc.), space must be provided between the units or the 1594C may become too warm. When several amplifiers or other heat-producing units are installed in a single rack or cabinet, acceptable air temperature may be in doubt. To determine temperature conditions, operate the system until temperature stabilizes, then measure air temperature with a bulb-type thermometer held at the bottom of the uppermost amplifier. Do not let the thermometer bulb touch metal because the metal probably will be hotter than the ambient air. If air temperature exceeds 55°C (or if it is a hot day), the equipment should be spaced farther apart or a blower should be installed to ventilate the cabinet.

CAUTION

When shelf-mounting the 1594C, allow at least 1 3/4" between the unit and any wall behind it to assure air circulation past the output transistors.

ELECTRICAL

120 Volt, 50/60 Hz Power Connections

Equipment supplied for domestic use is provided with the power transformer primary strapped for 120 volts. Specified voltage rating is located on the chassis, adjacent to the power cord. See Figure 1. Verify that line voltage is in accordance with the specified voltage rating *before* connecting the 1594C to line power.

100V, 240V, 50/60 Hz Power Connections

Export equipment is provided with the power transformer primary strapped for 100V or 240V. Specified voltage rating is located on the chassis, adjacent to the power cord. See Figure 1. Verify that line voltage is in accordance with the specified voltage rating *before* connecting the 1594C to line power.

Conversion of Primary Power Operating Voltage

The Model 1594C Power Amplifier may be wired for operation at 100V, 120V, and 240V, 50/60 Hz. To change operational voltage rating of the amplifier, refer to the service instructions.

Battery Connections

If desired, the 1594C may be connected to an external 24/28 volt battery with minus (-) as ground. Terminals for the dc power connections are on TB4 (see Figure 1). If ac power fails, transfer to dc power is instantaneous, automatic and silent. The battery power supply is not operated by the primary power ON-OFF switch on the front panel. If switching of battery power is desired, an external relay or switch should be provided by the user.

Input Connections

Input connections may be either direct-coupled or transformer-isolated at the INPUT terminal board (see Figure 1). Direct coupling is accomplished by connecting the input leads (shielded conductor recommended) to terminals 1 and 2. Terminal 2 is ground. Table I lists the terminals and applications of the INPUT terminal board.

For transformer-isolated input, a plug-in 15095A or 15335A Line Transformer must be plugged into receptacle J1 (see Figure 1). The input leads are connected to terminals 3 and 4 of the INPUT terminal board.

150-Ohm Input

When shipped from the factory, pins 3 and 4 of J1 are strapped together to provide a 600-ohm input. A 150-ohm input may be obtained by changing the strapping; see Service Instructions.

Output Connections

Output transformer taps provide connections for 4-ohm, 8-ohm and 16-ohm speakers, plus a 70.7-volt speaker distribution system (see Figure 1). For 25-volt (80 watt) speaker distribution systems, use the 8-ohm tap. Connect to the terminal of desired impedance and terminal 5 (com-

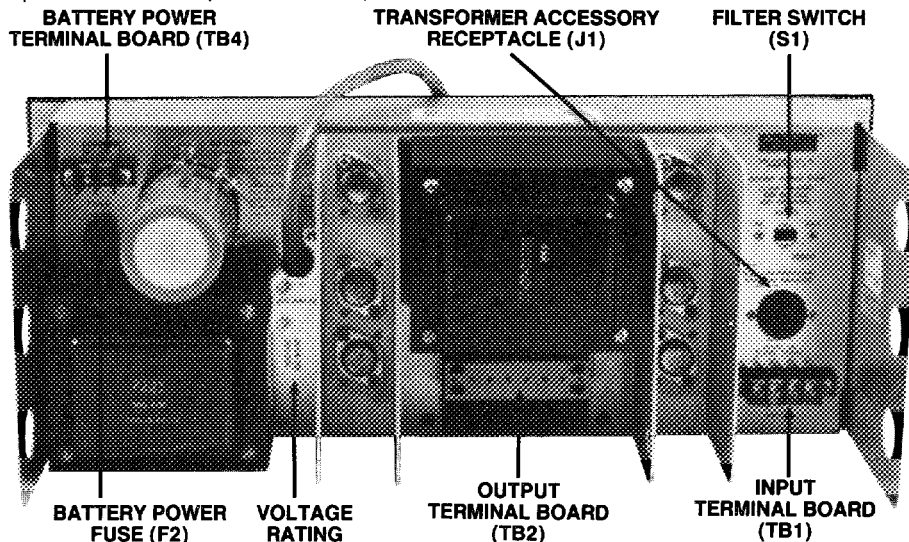


Figure 1. Rear View of 1594C Power Amplifier

Table I. Terminals and Applications of INPUT Terminal

Terminals	Function/Application	
1,2 (GND)	Direct-Coupled	For unbalanced high-impedance sources
		For bridging unbalanced low-impedance lines having signal voltages of 0.8V rms or higher
3,4	Transformer-Isolated	For balanced or unbalanced lines of 150 or *600 ohms up to level of + 15 dBm (with 15095A Line Transformer)
		For low-impedance line-bridging input or 15K ohm line-matching input (with 15335A Line Transformer)

*Factory wiring at receptacle J1 is for 600 ohms

mon). Terminal functions and designations are listed in Table II. If stray electrostatic radiation causes interference, strap terminal 5 (common) to terminal 6 (ground).

Table II. Speaker Outputs

Terminal	Function
TB2-1	70.7V (50 ohms) speaker distribution systems
TB2-2	16 ohms (40V) speaker systems
TB2-3	8 ohms (28V) speaker systems. May be used for 25V (80W) speaker distribution systems.
TB2-4	4 ohms (20V) speaker systems
TB2-5	Common
TB2-6	Ground

CAUTION

When using stranded wire, be sure no frayed wire strands short circuit one terminal to another terminal.

Speaker Matching

Use the output tap most nearly equal to total speaker impedance. If the load impedance falls between two output terminal values, use the terminal of lower impedance.

Speaker Power Distribution

Total power distribution to all speakers should be not greater than the power rating

of the amplifier system. The 70.7V distribution outlet permits connection to a large number of speakers, each speaker operating at its required power level. Computing impedance is not necessary for this application. Each speaker is equipped with a line transformer having various power taps. Select the tap which yields the power desired for that speaker.

SERVICE

NOTICE

REPAIR PERFORMED BY OTHER THAN AUTHORIZED WARRANTY STATIONS (DEALERS) OR OTHER QUALIFIED PERSONNEL SHALL VOID THE WARRANTY PERIOD OF THIS UNIT. TO AVOID LOSS OF WARRANTY, SEE YOUR NEAREST ALTEC AUTHORIZED DEALER OR CALL ALTEC CUSTOMER SERVICE DIRECTLY AT (405) 324-5311, OR WRITE:

**ALTEC Customer Service/Repair
P.O. Box 26105
Oklahoma City, OK 73126**

For factory service, ship the unit prepaid to ALTEC Customer Service/Repair, 10500 W. Reno, Oklahoma City, OK 73128. For additional information or technical assistance, call (405) 324-5311 or Telex 160369.



1594C

POWER AMPLIFIER

SERVICE INSTRUCTIONS

***** CAUTION *****

No user serviceable parts inside. hazardous voltage and currents may be encountered within the chassis. The servicing information contained within this document is for use only by ALTEC LANSING Corp. authorized warranty stations and qualified service personnel. To avoid electric shock, DO NOT perform any servicing other than that contained in the Operating Instructions unless you are qualified to do so. Refer all servicing to qualified service personnel.

SERVICE AND MAINTENANCE INSTRUCTIONS

CAUTION: No user-serviceable parts inside. Hazardous voltage may be encountered within the chassis. Installation and Service information within this document is for use only by ALTEC sound contractors, factory authorized warranty stations and qualified service personnel.

IMPORTANT: Il est enjoint à l'utilisateur de ne pas réparer lui-même les pièces internes de l'appareil, des courants à haute tension pouvant passer à l'intérieur du châssis. Les renseignements inclus dans ce document sont destinés uniquement à l'usage des installateurs agréés des systèmes acoustiques ALTEC, des centres de réparation sous garantie autorisés, ainsi que du personnel d'entretien qualifié.

CAUTION

Customer modifications of Altec Lansing products is not recommended. Such modifications shall be at the customer's sole risk and expense, and damage or injury to person or property resulting therefrom shall not be covered under warranty or otherwise.

This service information is for the use of authorized warranty stations (dealers) only. Service must be performed by an ALTEC Qualified Service Representative.

NOTICE

REPAIR PERFORMED BY OTHER THAN AUTHORIZED WARRANTY STATIONS (DEALERS) OR OTHER QUALIFIED PERSONNEL SHALL VOID THE WARRANTY PERIOD OF THIS UNIT. TO AVOID LOSS OF WARRANTY, SEE YOUR NEAREST ALTEC AUTHORIZED DEALER OR CALL ALTEC CUSTOMER SERVICE DIRECTLY AT (405) 324-5311, OR WRITE:

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ACCESS

Remove the four screws securing the front panel, then open and lower the hinged front panel to gain access to the chassis interior.

Conversion of Primary Power Operating Voltage

The Model 1594C Power Amplifier may be wired for operation at 100V, 120V, and 240V, 50/60 Hz. To change operational voltage rating of the amplifier, refer to the conversion chart of Figure 1 and proceed as follows:

1. Remove four screws securing front panel; open and lower panel.
2. Locate terminal block TB8/TB9 within the chassis; see Figure 4.
3. Referring to Figure 1, disconnect leads of transformer T1 from terminal block TB8/TB9. Pull each wire firmly to disengage push-on terminal connector. Reconnect leads in accordance with terminal designations that correspond to the desired operating voltage.
4. Select the appropriate voltage rating label from the rating label strip supplied with the amplifier. Affix label over previous voltage rating designation on chassis.

TERMINAL BLOCK TB8/TB9 CONNECTIONS

Transformer T1 Wire Color	100V	120V	240V
Brown	TB9-4	TB8-4	TB8-4
White	TB8-4	TB9-4	TB9-2
Black	TB9-7	TB9-7	TB9-5
White-Brown	TB9-1	TB8-3	TB9-4
White-Black	TB9-8	TB9-8	TB9-8

PERMANENT AC POWER CONNECTIONS*	
SW2-4	TB9-6
AC Cord (black)	TB8-9
AC Cord (white)	TB9-9
Switch SW2-3	TB8-5
Fuse F1-2	TB8-8
Capacitor C7	TB9-10
Capacitor C6	TB8-10

*Do not make any wiring changes of these wire connections when altering the amplifier for different primary power operating voltage.

Figure 1. Primary Power Conversion Chart for 100V, 120V, and 240V 50/60 Hz Operation

5. Close front panel and secure with four screws previously removed.

ADJUSTMENT OF POWER DRIVER BALANCE CONTROL

The Power Driver Balance Control (R116 on Power Driver PCB) balances the outputs of transistors Q104 and Q105 on the PCB. If this control is not adjusted properly, high-frequency distortion results. If adjustment is indicated, use the following procedure:

1. Connect a 16-ohm dummy load across terminals 2 (16 ohms) and 5 (common) of TB2 (see Figure 6).
2. Apply a 15 kHz sine wave to terminals 1 and 2 of the INPUT terminal board (TB1).
3. Adjust VOLUME control for 100-watt output (40 volts).
4. Connect a frequency distortion analyzer (preferred) or an oscilloscope to terminals 2 and 5 of TB2 (16-ohm speaker output) and observe output.
5. Remove four screws securing front panel, then open and lower panel.
6. Adjust R116 on Power Driver PCB (see Figures 2 and 6) until minimum distortion is observed on distortion measuring instrument.
7. Close front panel and secure with four screws previously removed.

150-Ohm Input

When shipped from the factory, pins 3 and 4 of J1 are strapped together to provide a 600-ohm input. A 150-ohm input may be obtained by removing the strap from pins 3 and 4 and then strapping pins 1 and 4 and pins 3 and 6 (see Figure 3).

ADJUSTMENT OF OUTPUT "Q" BALANCE CONTROLS

Output "Q" Balance Controls R136 and R137 on Power Driver PCB (see Figure 2) balance the bias current of power transistors Q1, Q2, Q3 and Q4. Inadequate adjustment of these controls may result in distortion and excessive current drain from one or more transistors. If adjustment is indicated (such as replacement of one or

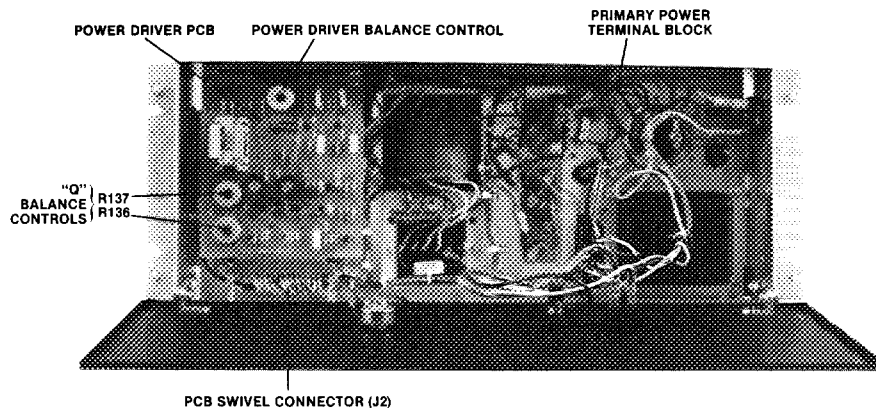


Figure 2. Front View with Hinged Panel Open

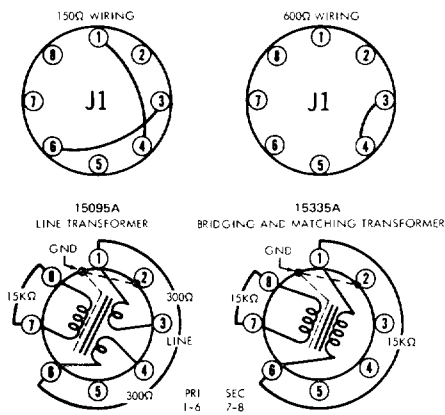


Figure 3. Socket Wiring for Transformer-Isolated Input Using 15095A Line Transformer

more power transistors), use the following recommended procedure:

1. Turn VOLUME control fully counterclockwise (0).
2. Remove four screws securing front panel, then lower panel for access to interior.

CAUTION

High voltage may be encountered when the chassis is opened for service. This procedure should be referred to a qualified service technician.

3. Turn Output "Q" Balance Controls R136 and R137 fully counterclockwise (see Figure 2).
4. Turn on power and allow a 5-minute warmup period.

5. Adjust R136 and R137 by one of the following method [method (a) is preferred]:

- (a) Locate wire attached to terminal 1 of output transformer T2. Connect a clamp-on milliammeter to this wire and adjust R136 for a "Q" current of 40 mA. Change connection of milliammeter to wire attached to terminal 3 of output transformer T2 and adjust R137 for a "Q" current of 40 mA.
- (b) Remove two screws securing Power Drive PCB to chassis and lower PCB on hinged connector. Connect a millivoltmeter across resistor R2 (see Figure 5). Adjust R136 for meter reading of 400 mV. Connect millivoltmeter across resistor R3 and adjust R137 for meter reading

of 400 mV. Remove millivoltmeter and secure PCB to chassis with two screws previously removed.

6. Close front panel and secure with four screws removed in Step 2.

ASSEMBLY REPLACEMENTS

Fuses

The ac primary power fuse is mounted on the front panel. The battery power fuse is located on the rear of the chassis (see Figure 5). If fuse replacement is required, determine and correct any cause of failure before replacing fuse. Install an identical fuse (see PARTS LIST) by unscrewing fuse holder, replacing fuse and resealing fuse holder.

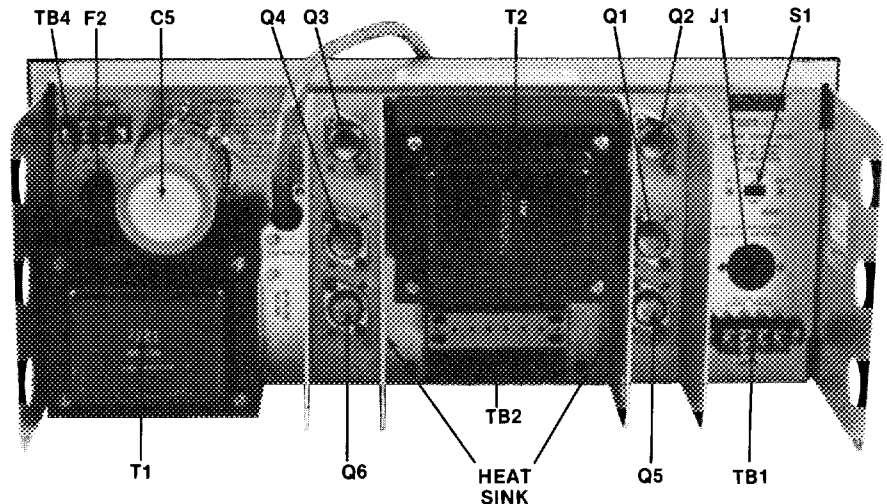


Figure 5. Component Locations on Rear of Chassis

Power Driver PCB

If the amplifier falls because of a faulty power driver PCB, operation may be restored by replacing the PCB with a new or repaired PCB. Use the following procedure:

1. Remove four screws securing front panel. Open and lower panel for access to PCB (see Figure 2).
2. Remove two screws securing PCB to chassis brackets.
3. Lower hinged connector of PCB and carefully remove PCB from connector.
4. Carefully insert new or repaired power driver PCB into connector. **Do not** warp, bend or twist the board or conductor may fracture.
5. Secure PCB with two screws removed in Step 2.
6. Perform ADJUSTMENT OF POWER DRIVER BALANCE CONTROL procedure.

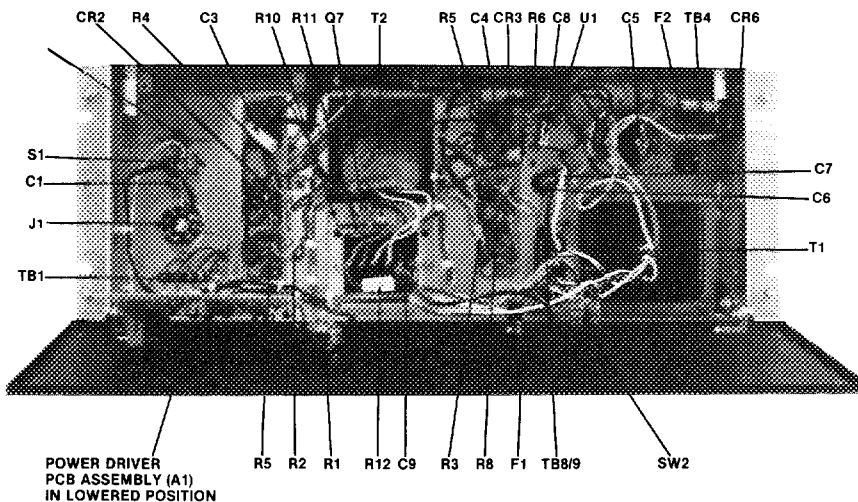
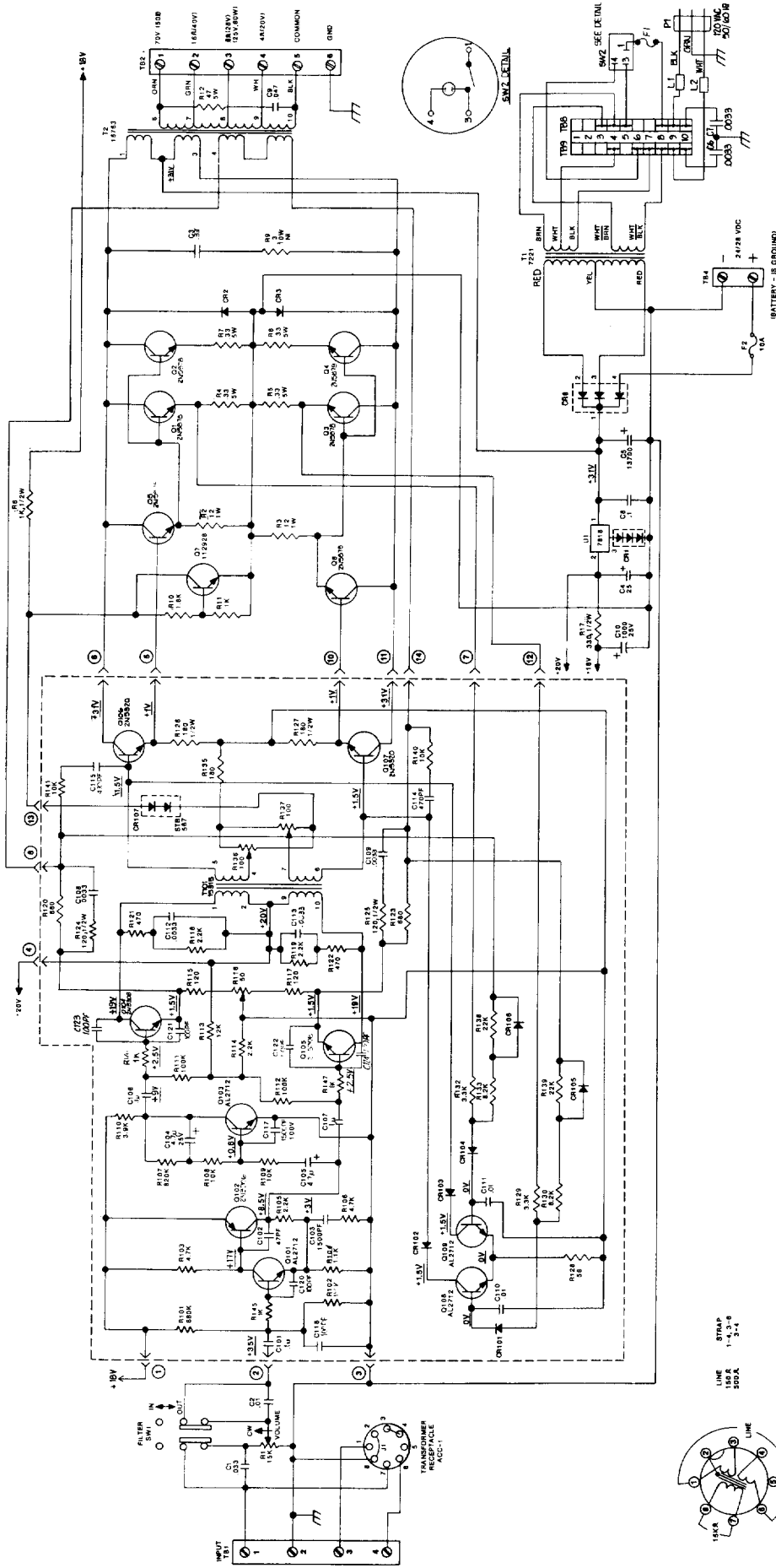


Figure 4. Component Locations Inside Main Chassis



- 7. T1 SHOWN FOR 120 VAC.
- 8. CR101 THRU CR104 - 1M456A.
- 9. FOR SEPARATE BILL OF MATERIAL, SEE 10-02-01-154.
- 4. FOR ASSEMBLY, SEE DRAWING NO J0157.
- 3. UNDERSCORED VOLTAGES ARE DC MEASURED TO GND (M45880) WITH AC LINE VOLTAGE 120V ZERO SIGNAL.
- 2. CAPACITOR VALUES ARE IN MICROFARADE.
- 1. RESISTOR VALUES ARE IN OHMS 1/4 WATT, 5%

NOTES : UNLESS OTHERWISE SPECIFIED

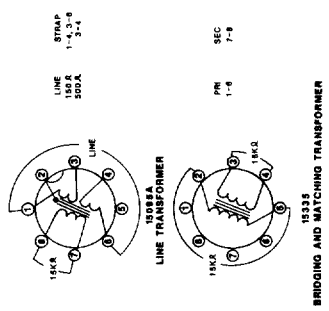


Figure 6. Schematic (3D186-28), 1594C Power Amplifier

PARTS LIST

Main Chassis

Reference Designator	Ordering Number	Name and Description
A1	27-01-042843-09	Driver PCB Assembly
C1	15-06-118653-01	Cap., 0.033 μ F \pm 10%, 250V
C2	15-02-100307-01	Cap., 0.01 μ F \pm 20%, 100V
C3	15-06-100130-01	Cap., 0.03 μ F \pm 10%, 100V
C4	15-01-100215-01	Cap., 25 μ F, 25V
C5	15-01-100299-02	Cap., 13500 μ F, 35V
C6,7	15-02-122768	Cap., .0033 μ F \pm 20%, 1.4Kv
C8	15-02-100109-01	Cap., 0.1 μ F 20%, 100V
C9	15-06-100083-02	Cap., 0.047 μ F \pm 10%, 400V
C10	15-01-107485-01	Cap., 1000 μ F, 25V
CR1	45-01-107429-02	Diode, Stbstr, 12V
CR2, 3	48-02-042787-01	Rect., 1N4004, selected
CR6	48-02-122238-01	Rect. Bridge, 15A
F1	51-04-102601-01	Fuse, 3A, slo-blo
F2	51-04-121664-01	Fuse, 10A, 32V, 3AG
J1	21-02-100973-01	Socket, octal
L1, 2	56-01-044110-01	Choke, ferrite bead, 6D472
P1	60-06-012636-04	Cord 18GA, 3-conductor
Q1, 2, 3, 4, 5, 6		Transistor. See NOTE \triangle
Q7	48-03-112928-03	Transistor, 2N5305, selected
R1	47-06-042509-01	Pot., 15 k Ω \pm 15%
R2, 3	47-01-120434-01	Res. 12 Ω \pm 10%, 2W
R4, 5, 7, 8	47-01-110784	Res., 9.33 Ω \pm 5%, 5W
R6	47-01-102264-01	Res., 1 K Ω \pm 5%, 1/2 W
R9	47-02-109388-01	Res., 3 Ω \pm 10%, 5W
R10	47-01-102084-01	Res., 1.8 K Ω \pm 5%, 1/4 W
R11	47-01-102078-01	Res., 1 K Ω \pm 5%, 1/4 W
R12	47-02-100713-01	Res., 47 Ω \pm 10%, 5W
R13	47-01-102551-01	Res., 470 Ω \pm 10%, 1W
R14	47-02-100715-01	Res., 200 Ω \pm 10%, 5W
R15	47-02-100712-01	Res., 47 Ω \pm 5%, 5W
R16	47-01-102306-01	Res., 56 K Ω \pm 5%, 1/2 W
R17	47-01-102252	Res., 330 Ω \pm 5%, 1/4 W
S1	51-02-118703-01	Switch, DPDT, slide
S2	51-02-124346	Switch, power W/light
T1	56-08-007221-16	Transformer, power
T2	56-07-016763-06	Transformer, output
U1	17-01-118679-02	Int. Ckt., UGH7818393, Fairchild

NOTE \triangle Two different output transistors have been used, please verify the device installed before placing orders:

Driver PCB Assembly

Reference Designator	Ordering Number	Name and Description
C101	15-01-100156-01	Cap., 1 μ F, 25V
C102	15-02-107455-01	Cap., 47 pF \pm 10%, 100V
C104,105	15-01-108543-01	Cap., 5 uF, 25V
C106,107	15-06-102605-01	Cap., 0.47 μ F \pm 10%, 100V
C108,109, 112, 113	15-02-107047-01	Cap., 0.0033 μ F \pm 20%, 100V
C110,111	15-02-100307-01	Cap., 0.01 μ F \pm 20%, 100V
C114,115	15-02-100035	Cap., 470 pF \pm 10%, 500V
C116,120, 121,122	15-02-107454-01	Cap., 100 pF \pm 10%, 100V
C123	15-06-124353	Cap., 100 pf \pm 10%, 100V
C124	15-06-124353	Cap., 100 pf \pm 10%, 100V
C117,103	15-02-107469	Cap., 1.5 nF \pm 10%, 100V
CR101 thru 106	48-01-107017-01	Diode, 1N456A, 100 mA, 25V
CR107	48-01-100881-03	Diode, Stabistor, 12V
Q101,103, 108,109	48-03-101098-04	Transistor, 2N2712, selected
Q102	48-03-107102	Transistor, 2N3906, selected
Q104,105	48-03-119140-02	Transistor, 2N5308, low noise, selected
Q106,107	48-03-107447-04	Transistor, 2N5320, 75V, 10W, selected
R101	47-01-100479-01	Res., 680 K Ω \pm 10%, 1/4 W
R102	47-01-109298-01	Res., 180 K Ω \pm 5%, 1/4 W
R103	47-01-102094-01	Res., 4.7 K Ω \pm 5%, 1/4 W
R104	47-01-102079-01	Res., 1.1 K Ω \pm 5%, 1/4 W
R105,106, 114,118, 119	47-01-102086-01	Res., 2.2 K Ω \pm 5%, 1/4 W
R107	47-01-108487-01	Res., 820 K Ω \pm 5%, 1/4 W
R108,109, 140,141	47-01-102102-01	Res., 10 K Ω \pm 5%, 1/4 W
R110	47-01-102092-01	Res., 3.9 K Ω \pm 5%, 1/4 W
R111,112	47-01-102127-01	Res., 100 K Ω \pm 5%, 1/4 W
R113	47-01-102104-01	Res., 12 K Ω \pm 5%, 1/4 W
R115,117	47-01-102056-01	Res., 120 Ω \pm 5%, 1/4 W
R116	47-05-014697-01	Pot., 50 Ω \pm 20%, 2W
R120,123	47-01-100647-01	Res., 680 Ω \pm 10%, 1W
R121,122	47-01-102070-01	Res., 470 Ω \pm 5%, 1/4 W
R124,125	47-01-102242-01	Res., 120 Ω \pm 5%, 1/2 W
R126,127	47-01-102246-01	Res., 180 Ω \pm 5%, 1/2 W
R128	47-01-102048-01	Res., 56 Ω \pm 5%, 1/4 W
R129,132	47-01-102090-01	Res., 3.3 K Ω \pm 5%, 1/4 W
R130,133	47-01-102100-01	Res., 8.2 K Ω \pm 5%, 1/4 W
R135	47-01-102060-01	Res., 180 Ω \pm 5%, 1/4 W
R136,137	47-05-100797-01	Pot., 100 Ω 2W
R138,139	47-01-102110-01	Res., 22 K Ω \pm 5%, 1/4 W
R145,146,147	47-01-102078	Res., 1.0 k Ω \pm 5%, 1/4 W
T101	56-07-015315-11	Transformer, output