

I. Introduction

Thank you for choosing our ST-70 PC-3U Stereo-70 upgrade driver module. It has been developed and designed to replace the original Dynaco input pc board (PC-3) with an all triode design that maintains the musical mid frequency character of the stock Dynaco 7199 board and extends that performance to both the bass and high frequencies where the original design weaknesses are apparent. In addition to the audible improvements the measured THD+N and IMD performance are improved by a factor of 10 over Dynaco's original design. Compared to Dynaco's stock pentode-triode design, our all triode design is unconditionally stable allowing the user to directly substitute almost any 9 pin miniature dual triode (with a 6 Volt filament) such as 6DJ8, 7308, 6FQ7 thereby permitting the tailoring of the sound to match individual preferences.

An optional DC Balance circuit is available that allows the user to trim to balance the bias current in each of the output tubes. This clever design balances the two output tube bias currents initially so that afterward only the original bias set pot need be used to trim both tubes simultaneously.

This document describes the specific instructions and steps required to assemble and install the ASM-3U module into you Dynaco Stereo-70 power amplifier. It may be used with the original Dynaco quad cap and bias supply or any aftermarket quad cap module including our own ASM-S7U-B quad capacitor module.

Additional documents referenced (and available from our web page www.curcioaudio.com) are:

- General Overview Assembly Notes (CAE Tech Note # 1)
- Soldering Tutorial (CAE Tech Note # 2)
- Recommended Tools & Test Instruments (CAE Tech Note # 3)

Please take the time to familiarize yourself with all of these documents.

In addition to the assembled board (ASM-S7U-B) we suggest the following items to complete this project:

- Hook-up wire – Four 10' lengths each of red, black, green, and white, stranded 22ga silver plated copper with Teflon insulation. CAE P/N: TWK will meet this requirement.

Also, please note that this module houses components that have lethal voltages present on their leads and cases. Please take the appropriate care in both installing and operating this module.

II. General Overview

Take time to review all of the documentation provided including the aforementioned tech notes related to soldering technique and proper tools and test equipment. In the following sections we will guide you through several project phases. Each section has been carefully prepared with our own notes and comments from our customers to be sure that any anticipated question has been considered. The sequence is identical to that which we follow when we complete the installation for our customers here in our lab. Please follow the same sequence to maximize efficiency and eliminate errors. It is also very helpful to read each section before beginning to gain a visual idea of the construction.

Your project will be built in stages:

- **Printed Circuit Board (PCB) Assembly** - If you have purchased the PC Board in its unassembled form (PWB-3U) you will first assemble the components onto that board (becomes the ASM-3U).
- **Amplifier Preparation** - Next, you will prepare your Stereo-70 by un-wiring and removing the original Dynaco PC-3 (7199) driver module. If you have purchased the our DC Balance Option, you will also make some wiring changes to your amplifier.
- **ASM-3U Module Installation** - You will then install the CAE replacement ASM-S3U and reconnect the original wires to their corresponding terminals followed by a few electrical tests and power up sequence.
- **Test & Adjustment** - Finally you will take a few electrical readings to be sure there are no errors and set the amplifier output tube bias (bias pots settings) for each channel.

Although you are unlikely to encounter any problems, should they occur they would almost certainly be based on an improper assembly of the PC Board or the wiring to the Stereo 70. Therefore to avoid the time consuming and frustrating task of troubleshooting afterwards please remember these simple suggestions:

- **Proper soldering is crucial.** Please refer to our soldering tutorial and practice on surplus boards until you master the technique. Be especially careful to avoid solder bridges or “cold” solder joints. Our experience shows that nearly **95% of all problems are associated with soldering related errors.**
- Some components are color coded with their value (mostly resistors, but there may be others). If you are not proficient at reading these codes, use an ohmmeter to double check the value of each resistor before insertion. It is very easy to confuse a 100 ohm metal film resistor with a 1000 ohm resistor or worse with a 100K ohm resistor.
- You will need to have some extra hook-up wire for this project to connect to the new module and possibly extend one or more of the power transformer leads. Unless

otherwise specified, **you should use 20 to 22 gauge stranded wire with Teflon insulation.** Thicker wire, solid wire, or PVC insulation will cause problems - if not now (too much strain on the boards or parts) or later (reliability issues). CAE offers a Teflon Wire Kit (#TWK) that includes sufficient lengths of various color Teflon wire to complete this project.

III. Stage 1 – Printed Circuit Board Assembly - Refer to Figures 1A & 1B

Components are to be inserted on the non foil side and soldered on the foil side. The sequence of assembly has been chosen so that the components with the lowest profile (such as jumpers, low power resistors, IC's etc.) are installed first with higher profile components added until the highest profile components are installed last.

Refer to the component placement drawing (Figure 1A). Be sure to check with an ohmmeter resistor values if you are not absolutely sure of how to read metal film resistor color codes.

1. Install all of the ½ Watt resistors. There are a total of 18 ½ Watt resistors specified. Refer to Figure 1A (Top View PC Board Component Placement Diagram). The board has been designed so that a gentle radius near the body of the resistor will position the leads in alignment with the associated holes in the PC Board.
Note : The ½ Watt resistors should be inserted so that the body of the resistor rests gently against the PC Board. After inserting the resistor leads thru the board, a slight bending outward of the leads will hold the part in place until you can solder it in place.
Note: The value of the resistors is determined by a color code bands. We suggest that you use your Digital Voltmeter (resistance setting) to measure each resistor to verify its value before installation. You can also refer to the color code chart.
2. **DC Balance Option** - If you have purchased the DC BAL option, install the two small square 1 Meg Ohm potentiometers (P1 and P2 as shown in Figure 1B) near the short edges of the PC Board. Adjust each pot for center of its rotation.
3. **AC Balance Option** – If you have purchased the AC Balance Option, install the two 10K vertical potentiometers as shown in figure 1B. If you have not purchased the AC BAL option place a shorting wire across the outer holes of the triangle formed by the three holes for the AC BAL pot. This shorting wire will be parallel to the long edge of the pc board.

4. **AC Balance Option** – If you have purchased the AC balance option, install the two 43K Ohm / 3 Watt resistors as shown in Figure 1B (R8 & R21 locations). If you have not purchased the AC Balance Option – skip to the next step.
5. Install the Six (6) 3 Watt metal Oxide resistors (Reference Figure 1B - R1, R7, R14, R20, and R8 & R21 if you have not installed them from the previous step). You should also gently bend the leads of these resistors similar to the ½ Watt resistors (but of course with a greater radius). But unlike the ½ Watt resistors, the 3 Watt Resistors should be spaced away from the plane of the PC Board by 1/8” to allow for heat dissipation.
6. Install the 3 nine (9) pin miniature tube sockets (at positions V1, V2, and V3). Be careful to insure that the leads fully extend thru the PC Board and that you have sufficient tab length to obtain a solid solder connection.
7. Install the 8 capacitors. There are two small 390 pf capacitors (C4 & C8), the two 0.1uF capacitors (C1 & C5) and the four 0.47uF capacitors (C2, C3, C4, C7). These are film caps and therefore are not polarized therefore you can install them in either direction.
8. Visually inspect all of your solder connections. Quality solder connections should be smooth and shiny. Dull surface or large blobs on the PC board should be cleaned and resoldered. In this case remove the old solder with solder wick or similar and resolder the connection.
9. Install the 3 small 6922 driver board Tubes (V1, V2, V3).

IV. Stage 2 – Stereo-70 Amplifier Preparation – Refer to Fig 5

1. To begin removing the original Dynaco PC-3 board, remove the top cover (should be held in place with either 4 or six screws (depending upon the vintage) along the side. These screws will release both the top perforated metal cage and the bottom “U” cover.
2. Remove the 4 output tubes (and label them for reinstallation later). I recommend that you clean the dust and grime from the topside both inside and outside of the amplifier. A vacuum cleaner with a soft paintbrush will work very well here.
3. Next begin desoldering each wire from the original PC-3 card. The original Dynaco wires were solid PVC insulated. The PVC is not very tolerant of heat and therefore you should be very careful not to melt the insulation. Normally a “wetted” soldering iron tip will have better thermal transfer causing the solder to

melt quickly before the heat travels up the lead of the wire compromising the PVC insulation. Also, when you remove the wire from the PC Board, it is not uncommon for the wire to “break” at the other end – look for this and repair if it happens. I suggest having some replacement wire available. You can use solid PVC wire as in the original however if possible, however I strongly recommend using 22 ga. stranded Teflon Insulated wire in this application. Please do not use anything larger – it is not necessary and it will compromise the reliability of your amplifier as you attempt to make reliable connections on terminals unable to withstand the strain. Note – it may be necessary to extend wires # 6, 21, 4 & 5.

4. Desolder each wire and using masking tape (a temporary identifier) label each wire to make installation of the replacement module much easier. The wires attaching to terminals 3, 8, 10 and 18 (all originating from the front panel octal sockets) will not be used -you can cut them off at the octal socket.
5. After you have desoldered all of the wires from the original Dynaco driver board (PC-3) remove it by removing the four (4) 4-40 nuts from the bottom of the board. The board should fall loose (if not identify if any other wires still remain).
6. Remove the two (2) 470K ohm connected to the audio input connector tabs. These resistors are no longer necessary.
7. **DC Balance Option – Refer to Figures 2 & 3-** If you have purchased the DC Balance Option complete the following steps (otherwise skip to the following section):
 - a. Reference Fig 2 - At the RIGHT output tube socket pair, remove the original 15.6 ohm bias set resistor and the wire connecting pins 1& 8 of one of the output tubes with pins 1&8 of the other output tube.
 - b. Reference Fig 2 - Install the two 10 ohm / 2 Watt resistors as shown.
 - c. Referencing Figure 2 - At the LEFT output tube socket pair,, remove the original 15.6 ohm bias set resistor and the wire connecting pins 1& 8 of one of the output tubes with pins 1&8 of the other output tube.
 - d. Referencing Figure 2- Install the two 10 ohm / 2 Watt resistors as shown.
 - e. Referencing Figure 3 - At the 7 Pin Terminal Strip located under the left output transformer, replace the 10K ohm resistor connected to terminals 1 & 2 to 7.5K ohms.
 - f. Referencing Figure 3 - At the 7 Pin Terminal Strip located under the left output transformer, replace the 10K ohm resistor connected to terminals 3 & 4 to 4.7K ohms.

V. Stage 3 – Installation of the New CAE-PC-3U Stereo 70 Driver Board – Refer to Figure 4

1. Locate the CAE replacement Driver board (PC-3U) and orient it so that the row of 14 ½ watt resistors are placed nearest the front plane of the amplifier. The board should be mounted so that the top surface of the PC Board rests inside the Dynaco ST-70 chassis cutout (as per the original). Be careful not to capture any wires and secure the board in places with the original 4, 4-40 screws/nuts.
2. Begin reconnecting the wires originally removed for the original Dynaco PC-3 board to the corresponding terminal on the CAE replacement Board (PC-3U). I suggest placing the stripped and tinned wire into the hole in the board and then quickly soldering the wire to the terminal. Be sure to inspect each connection as discussed before. Note that terminal 3, 8, 10 and 18 (that originally connected to the octal socket on the front of the amplifier) are no longer used. You should have previously cut these wires near the octal socket. As you complete each wire, remove its masking tape identifier. Although I have designed the replacement board's terminals to be very near the original board, some amplifiers may have been constructed so that lengthening may be required. Specifically, it is not uncommon for wires #6, 21, 4 & 5 to be extended.
 - Note – Figure 4 shows wires connecting to terminals 4&5 and 15&16 originating from the output tube sockets. Some amplifiers will have these wires originating from the front panel octal sockets – either is acceptable.
3. Once completed, inspect each connection again and carefully look for signs of melted insulation near adjacent wires.

VI. Stage 4 –Final Checkout & Initial Power Application

1. Replace the power fuse (3A Slo-Blo) with a 1A AGC (quick trip).
2. If you haven't already, remove the rectifier tube. Plug in and turn on the amplifier. Examine the filaments on the new replacement driver board. All three should be illuminated.
3. (If you have purchased the DC Balance Option, skip this step and refer to the DC Balance instructions below.) Remove the three driver tubes and insert the rectifier tube and the two left channel output tubes. Do not install the right channel output tubes right now. Replace the original 3A fuse. Rotate both original Bias Potentiometers fully counterclockwise. Connect your DC Voltmeter to monitor the current thru the output tubes by measuring the voltage across the 15.6 ohm resistor located at pins 1 & 8 of the output tubes - connect the negative lead

(Black) to the chassis and connect the Positive lead (Red) to the junction of the 15.6 ohm resistor and the Output Tube pins 1 & 8. Monitor the voltage as the tubes reach operating temperature. If the voltage begins to exceed 2.5 volts quickly remove power. Otherwise adjust the Bias pot to obtain 1.2 volts.

If you have the DC BALance option:

- a. Reference Figure 2 - Remove the three driver tubes and insert the rectifier tube (if you are using a tube rectifier) and the two left channel output tubes (V1 & V2). Do not install the right channel output tubes right now.
- b. Replace the original 3A fuse.
- c. Rotate both original Bias Potentiometers fully counterclockwise.

We will first start with the LEFT Channel:

- d. Connect the positive (Red) your DC Voltmeter to pins 1&8 of Output tube V1 and connect the negative (Black) lead of your DC Voltmeter to ground.
- e. Adjust the left bias pot until you obtain a voltmeter reading of 0.5VDC.
- f. Connect the negative (Black) lead of your DC Voltmeter to pins 1&8 of output tube V2 (the red lead should remain on V1 pins 1&8).
- g. Adjust the Left DC Balance pot on (it is located on the short edge of your CAE Upgrade driver board, PC-3U, nearest the tubes being monitored) to obtain a voltage reading of 0 (zero) volts +/- 0.05VDC.
- h. Reconnect the negative lead of your DC voltmeter to the chassis (ground) and adjust the left bias pot until you obtain a voltage reading of 1.0 VDC.

We will now repeat the same steps for the RIGHT Channel (Ref Figure 2):

- i. Connect the positive (Red) your DC Voltmeter to pins 1&8 of Output tube V6 and connect the negative (Black) lead of your DC Voltmeter to ground.
- j. Adjust the Right bias pot until you obtain a voltmeter reading of 0.5VDC.
- k. Connect the negative (Black) lead of your DC Voltmeter to pins 1&8 of output tube V7 (the red lead should remain on V6 pins 1&8).
- l. Adjust the Right DC Balance pot on (it is located on the short edge of your CAE Upgrade driver board, PC-3U, nearest the tubes being monitored) to obtain a voltage reading of 0 (zero) volts +/- 0.05VDC.
- m. Reconnect the negative lead of your DC voltmeter to the chassis (ground) and adjust the Right bias pot until you obtain a voltage reading of 1.0 VDC.
- n. Once this procedure is completed, you need only to adjust the main (chassis) bias adjust pot in the future (the DC currents should remain matched between both output tubes)

4. Install the three small signal driver tubes.
5. **AC Balance Option Set-Up** - If you have purchased the AC BALance option, connect your amplifier to an IMD distortion analyzer. The AC BALance potentiometers should be set for minimum IMD at an output power of 10W RMS with an 8 ohm load.
6. Replace the cover and enjoy.

Resistor Color Code

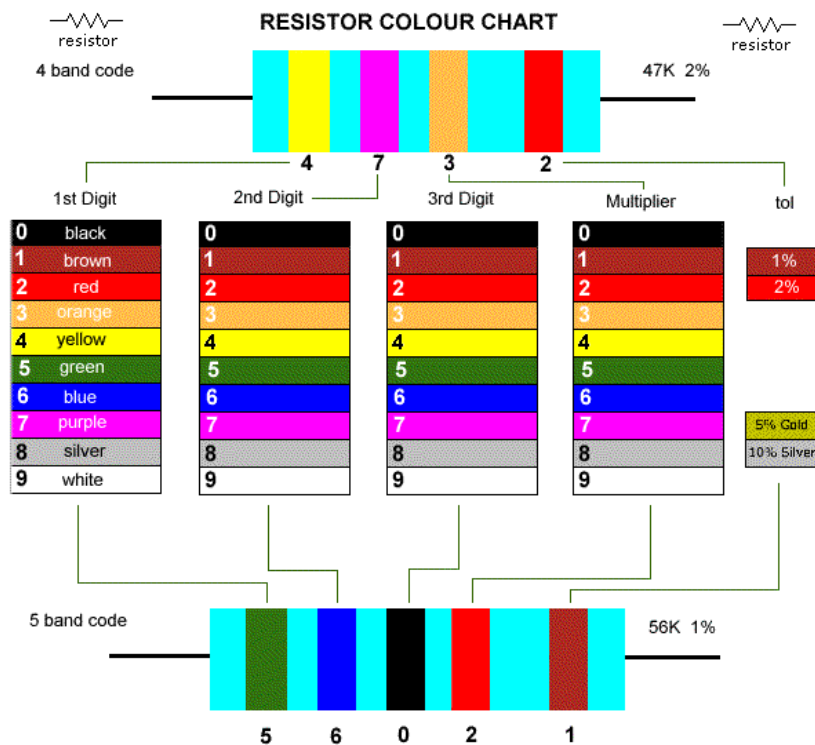


Figure 1A – PC-3U Assembly (Component Values)

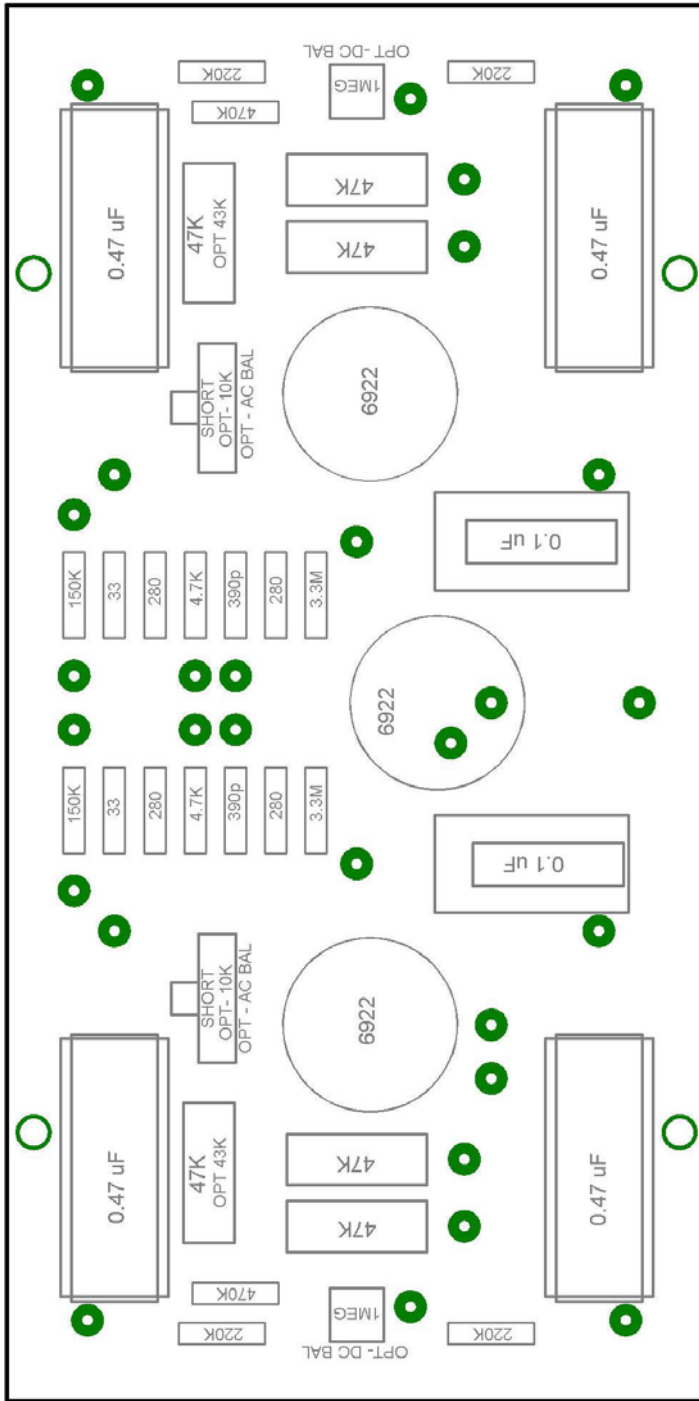


Figure 1B – PC-3U Assembly (Component Names)

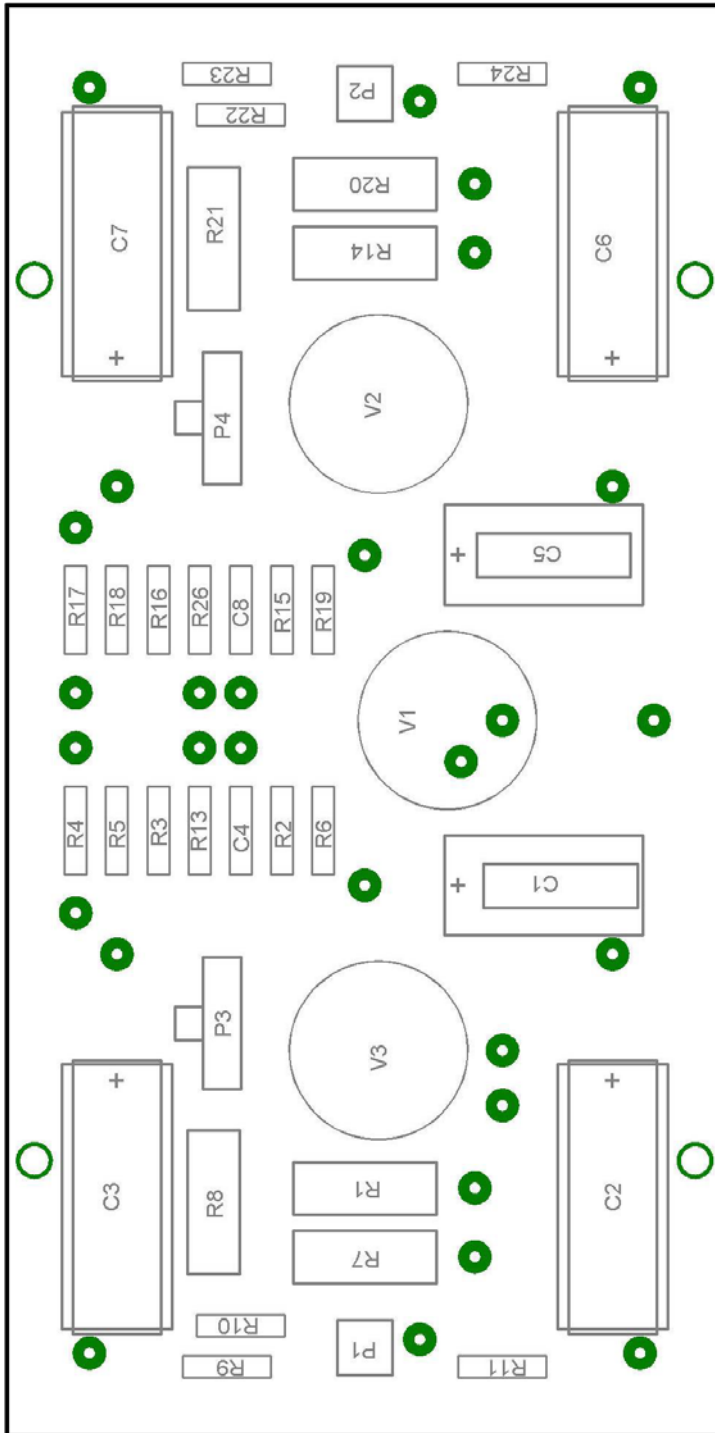


Figure 2 – DC Balance Option Wiring Diagram – Output Tubes

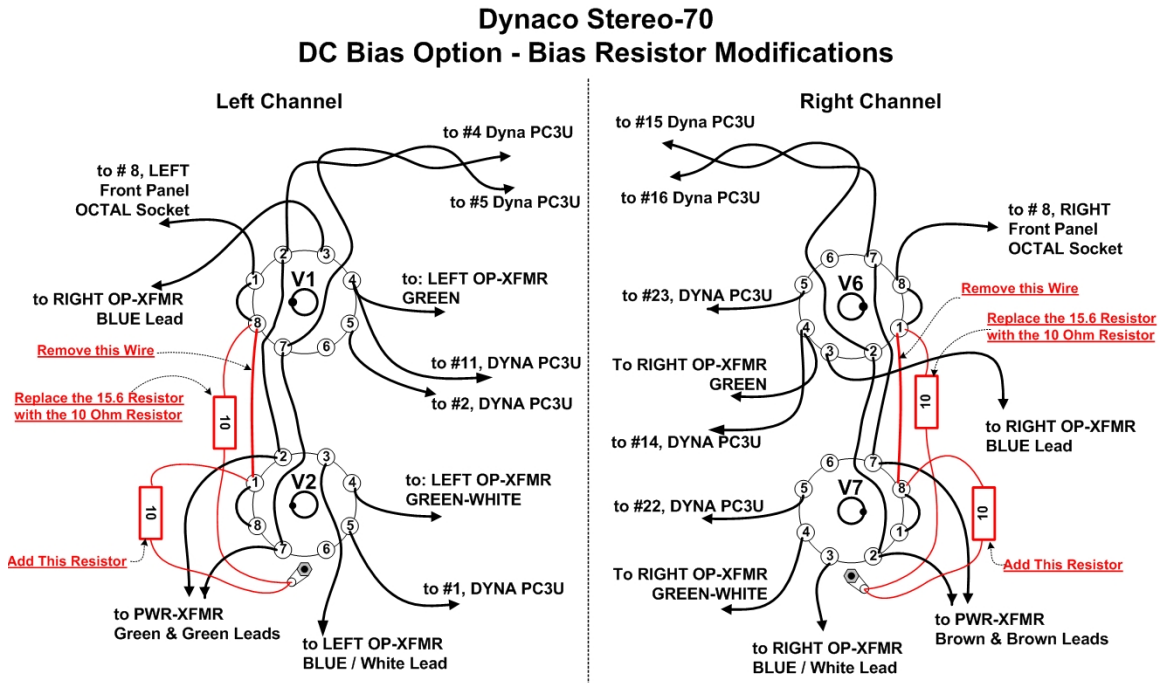


Figure 3 – DC Balance Option Wiring Diagram – 7 Pin Terminal Strip

7 Pin Terminal Strip - DC Balance Option Wiring Diagram

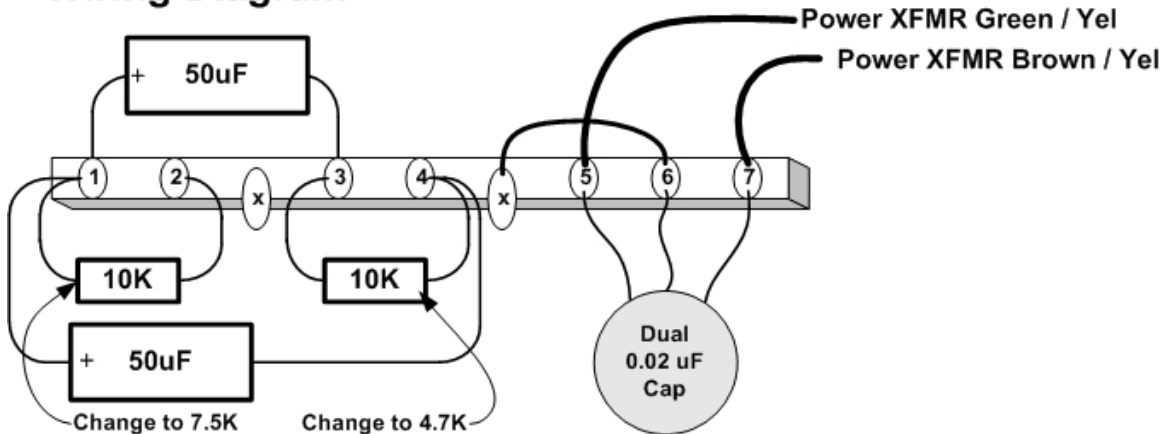


Figure 4 – CAE ASM-3U Installation (Bottom View)

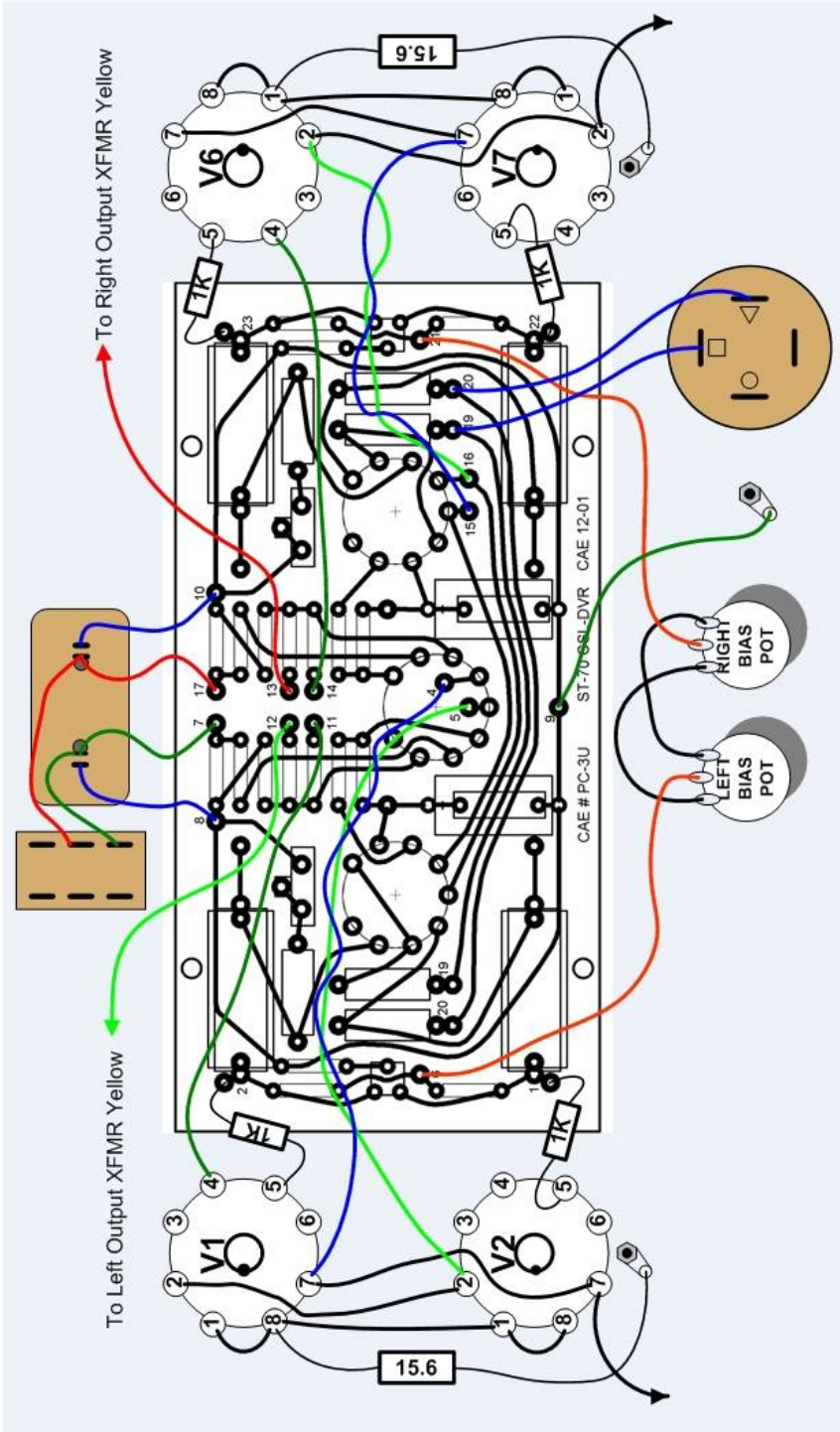
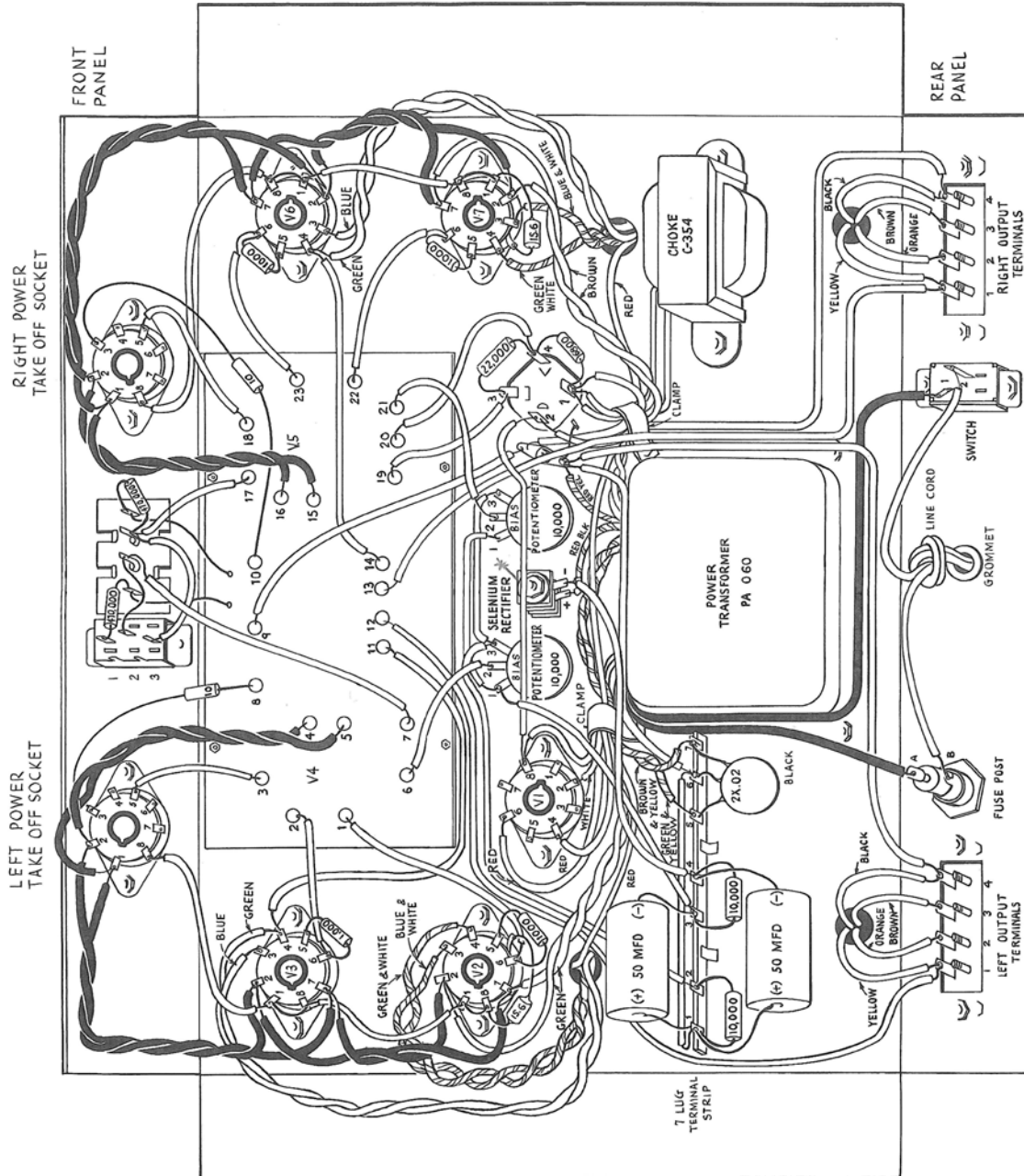
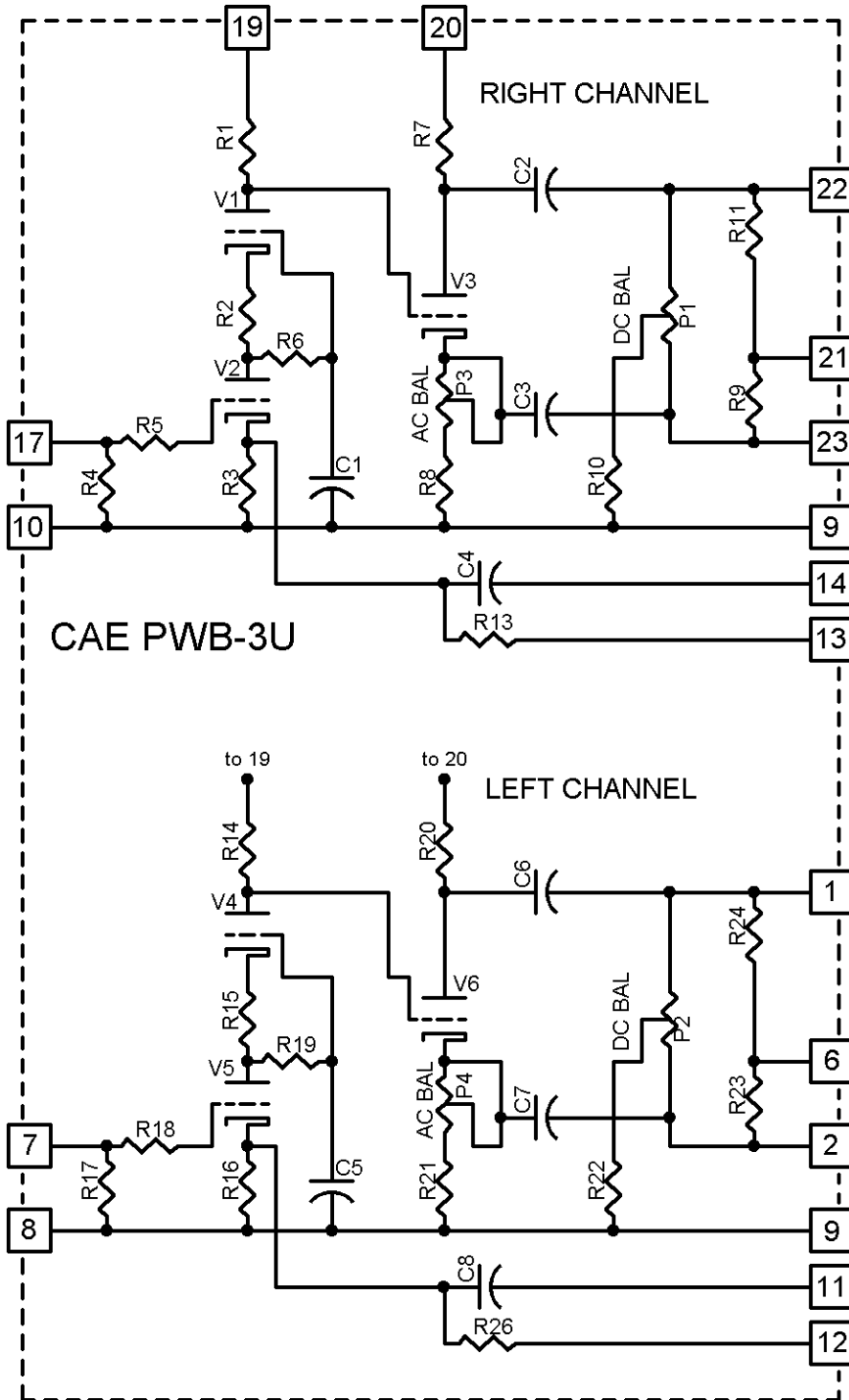


Figure 5: Original Stereo 70 Wiring Diagram



PICTORIAL DIAGRAM - DYNAKIT STEREO 70

CAE ASM-3U Schematic Diagram



Assembly, Installation, and Adjustment Instructions

CAE Dynaco Driver Replacement Module PC-3U – R4: 1-11

Stereo 70 Driver Upgrade Module, BoM - CAE# ASM-3U

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DESIG	DESCRIPTION	QNTY	PART NUMBER	VAL / VOLT
C1 & C5 OPT-PPC - C1 & C5	CAPACITOR, MYLAR CAPACITOR, POLYPRO	2	MSR# 5989-400V.1 MSR# 715P400V0.1	0.1uF/200VDC
C2, C3, C6, C7 OPT-PPC -C2, C3, C6, C7	CAPACITOR, MYLAR CAPACITOR, POLYPRO	4	MSR# 5989-400V.1 MSR# 715P400V0.47	0.47uF/400VDC
C4 & C8	CAPACITOR, MICA	2	MSR# 5982-5-300V390	390pF, 5%
R1, R7, R14, R20	RESISTOR, METAL OXIDE	4	MSR# 283-47K	47 K , 3W
R2, R3, R15, R16	RESISTOR, METAL FILM	4	MSR# 273-280	280, 1/2 W
R4 & R17	RESISTOR, METAL FILM	2	MSR# 273-150K	150K, 1/2W
R5 & R18	RESISTOR, CARBON FILM	2	MSR# 293-33	33, 1/2 W
R6 & R19	RESISTOR, CARBON FILM	2	MSR# 293-3.3M	3.3M, 1/2 W
R8 & R21 OPT-ACB - R8 & R21	RESISTOR, METAL OXIDE RESISTOR, METAL OXIDE	2 2	MSR# 283-47K MSR# 283-43K	47 K , 3W 43 K , 3W
R9, R11, R23, R24	RESISTOR, CARBON FILM	4	MSR# 293-220K	220K, 1/2 W
R10, R22	RESISTOR, CARBON FILM	2	MSR# 293-470K	470K, 1/2 W
R13, R26	RESISTOR, METAL FILM	2	MSR# 273-7.5K	7.5K, 1/2 W
OPT-DCB -P1 & P2	POTENTIOMETER	2	DK# 3306F-105-ND	1Meg Ohm
OPT-ACB -P3, P4	POTENTIOMETER	2	DK# 201XR103B-ND	10K
OPT -V3	PREMIUM TUBE, TRIODE	3	CAE# 6922	6922 / 7308
X1	PRINTED CIRCUIT BOARD	1	CAE# PWB-3U	
X4	PC BOARD TUBE SOCKETS, 9 PIN	3	CAE# PC-9	
OPT-DCB	RESISTOR, METAL OXIDE	4	MSR# 283-10	10 OHM, 3W
OPT-DCB	RESISTOR, METAL OXIDE	1	MSR# 281-4.7K	4.7K, 1W
OPT-DCB	RESISTOR, METAL OXIDE	1	MSR# 281-7.5K	7.5K, 1 W

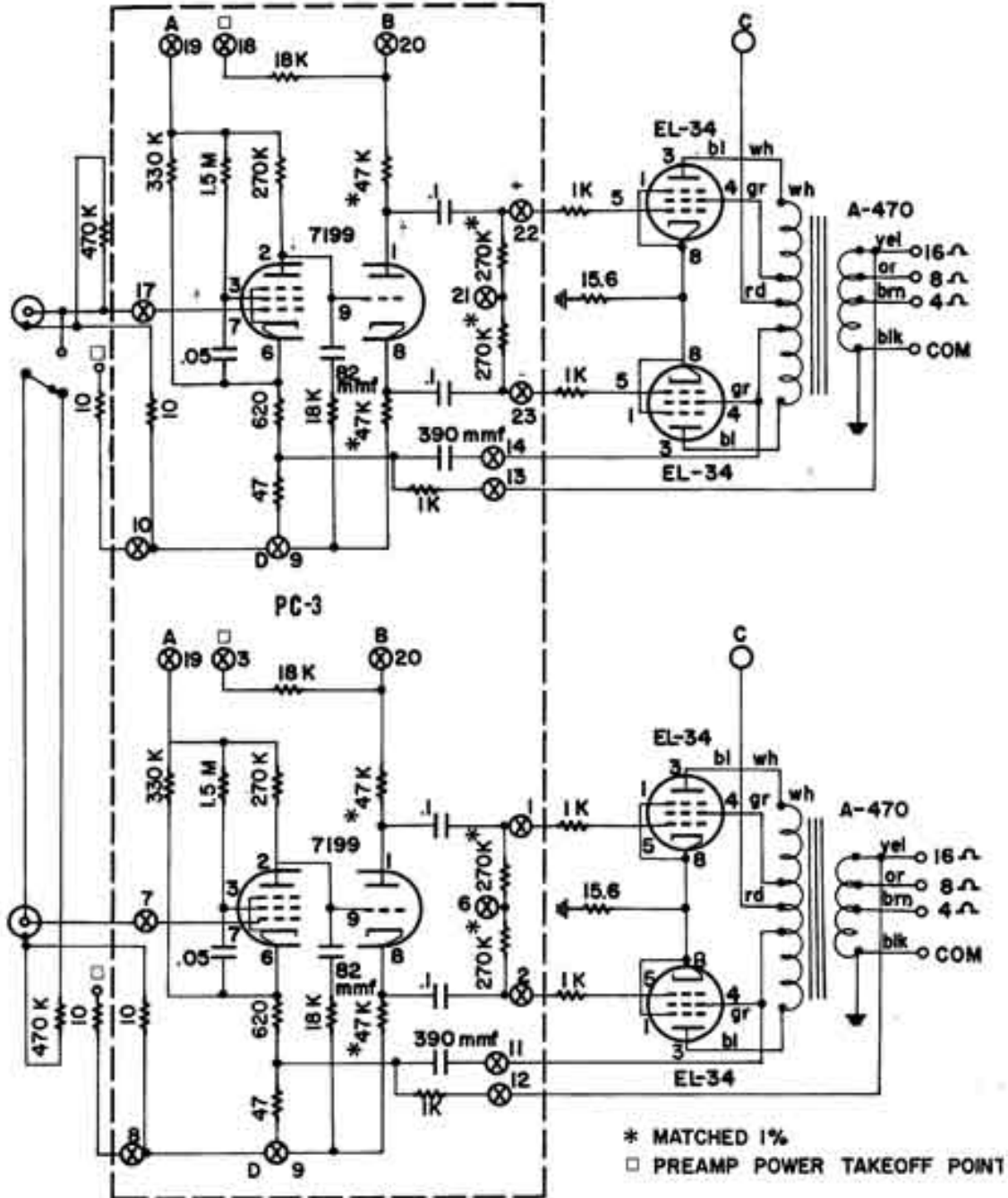
NOTES:

CAE# - Curcio Audio PN
 DK# - DigiKey Part Number
 MSR# - Mouser Part Number
 AES# - Antique Electronic Supply Part Number

Assembly, Installation, and Adjustment Instructions

CAE Dynaco Driver Replacement Module PC-3U – R4: 1-11

ORIGINAL DYNACO STEREO 70 SCHEMATIC





Assembly, Installation, and Adjustment Instructions

VOLTAGE TEST POINTS

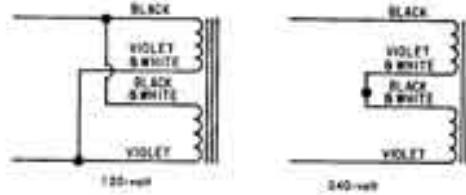
Pin #	Any EL-34	GZ-34	Either 7199
1	1.56	—	*
2	—	435	*
3	—	—	*
4	410	—	*
5	415	380 ac	0.4 ac
6	-32**	—	1.0
7	-32**	390 ac	0
8	1.56	435	*
9	—	—	*

*Measurements at these points vary from tube to tube and do not indicate whether performance is normal.

**Measurements at these points can only be made with a vacuum tube voltmeter. The two tubes in a pair should have identical readings.

Capacitor lug	Selenium rectifier	Printed circuit
A ■ 305	Bottom (+) lug 50 ac	Eyelets #3 and #15
B ▲ 375	Top (-) lug -65 dc	370 volts dc
C 415		
D ▲ 435		

SPECIAL INSTRUCTIONS FOR OPTIONAL 120-240 VOLT POWER TRANSFORMERS



Stereo 70s supplied with power transformer PA-521 may be connected for either 120 volt or 240 volt AC operation as follows:

For 120 Volt Operation

- 1 () Twist together the black and black-white leads, and connect both to lug A of the fuse post (S).
- 2 () Twist together the violet and violet-white leads, and connect both to lug #1 of the on-off switch (S).

For 240 Volt Operation

- 1 () Connect the black lead to lug A of the fuse post (S).
- 2 () Connect the violet lead to lug #1 of the on-off switch (S).
- 3 () Twist together the violet-white and the black-white leads, and solder them together. Insulate this connection with electrical tape.

When connected for 240 volt operation, a 1½ ampere slow blow fuse should be used.

