dynaco STEREO 80

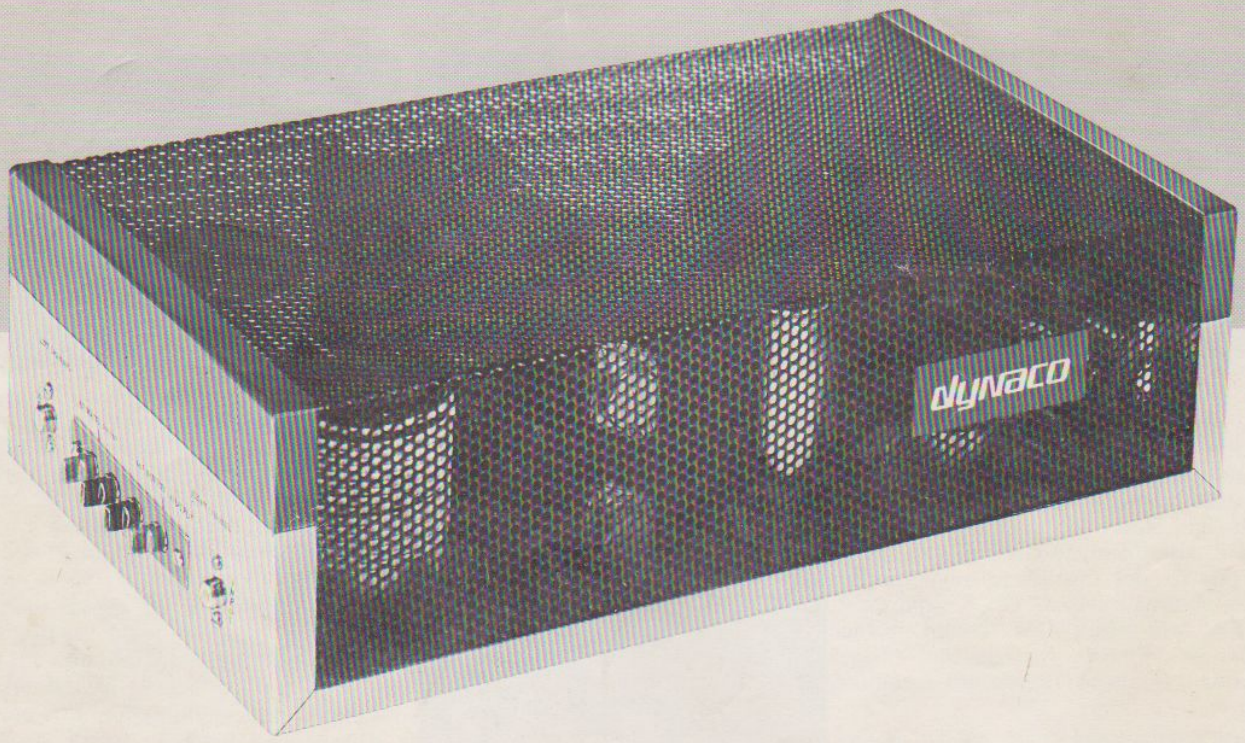
SERIAL NUMBER

26945192

This number must be mentioned in all communications concerning this equipment.

MICHAEL KIRSCH

INSTRUCTIONS FOR ASSEMBLY OPERATION



Price $1.00

patents pending

929020

dynaco INC. 3060 Jefferson St., Philadelphia, Pa. 19121 U.S.A.

CONTENTS

SPECIFICATIONS

FREQUENCY RESPONSE: 10 Hz to 50 kHz ±0.5 db.

POWER BANDWIDTH (IHF): 8 Hz to 50 kHz half power output at less than 0.5% total harmonic distortion into an 8 ohm load.

HARMONIC DISTORTION: *Less than* 0.5% at any power level up to 40 watts per channel into 8 ohms at any frequency between 20 Hz and 20 kHz. Distortion decreases at lower power levels.

INTERMODULATION DISTORTION: *Less than* 0.1% at any power level up to 40 watts per channel into 8 ohms with any combination of test frequencies. Distortion decreases at lower power levels.

NOISE: 90 db below rated output.

DAMPING FACTOR: Greater than 40 from 20 Hz to 20 kHz.

SEPARATION: More than 60 db from 20 Hz to 10 kHz.

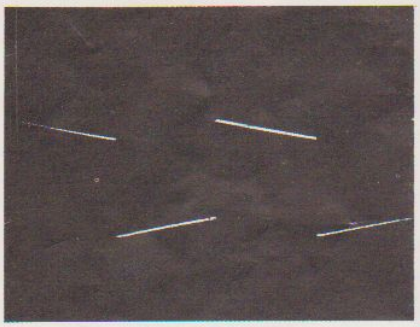
INPUT: 100,000 ohms; 1.3 volts for 40 watts output.

SEMICONDUCTOR COMPLEMENT: 12 transistors; 10 diodes.

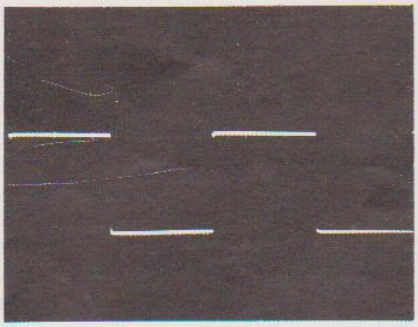
SIZE: 14" x 8" x 4".

WEIGHT: 13 lbs.

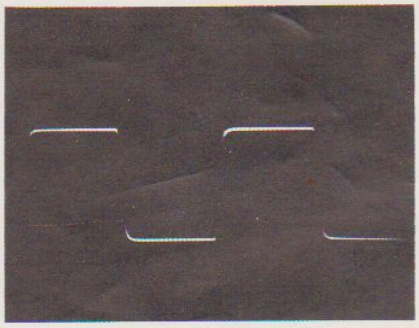
MAXIMUM POWER CONSUMPTION: 250 watts.



100 Hz

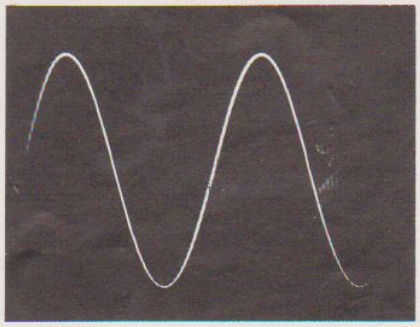


1 kHz



10 kHz

SQUARE WAVE PERFORMANCE: This is a good indication of linearity from 10 Hz to 100 kHz, since good square wave reproduction requires bandwidth in excess of 1/10th to 10 times displayed frequency.



20 kHz

LOW POWER FREEDOM FROM DISTORTION: at 1/10th watt, a 20kHz sine wave (the most difficult audio frequency) shows absolutely no signs of crossover or notch distortion.

THE DYNACO STEREO 80

Do not attempt to install or use this amplifier until the section "Operating Instructions" has been carefully read.

INTRODUCTION

The Dynaco Stereo 80 is an all silicon transistor basic power amplifier for use with separate preamplifiers such as the Dynaco PAS-3X or PAT-4, or for use with tape recorders or tuners such as the Dynaco FM-3 which have their own volume controls. The Stereo 80 contains two 40 watt amplifiers on one chassis with a common power supply.

The Stereo 80 has been designed to be used under normal conditions without special safety precautions, just as if it were a high grade tube amplifier. There are no circuit breakers, speaker fuses, or other resettable devices to impede the use of the Stereo 80 under any reasonable conditions of use or abuse. This is achieved by using novel circuits (on which patents are pending) which automatically and instantly protect the amplifier.

The components in the Stereo 80 are of the highest quality to protect against failure, both now and for many years in the future. All parts are used conservatively with close tolerances to assure proper operation, and etched circuit modules are pretested under actual use conditions to ensure that every unit, after assembly, will meet the specifications normally associated with laboratory prototypes.

The specifications of the Stereo 80 speak for themselves. The distortion at low levels is comparable to that of the finest tube designs, while the high power distortion remains inaudible. Specifications do not reveal all the facets of sound quality, however. In use with varying program material, the Stereo 80 justifies its design efforts to have qualities of ease and naturalness always sought and rarely achieved in solid state designs. There is no extra brightness or stridency which is unfortunately sometimes attributed to high fidelity sound, but rather there is an impression of limitless range and effortless handling of the highest power peaks.

Like any precision equipment, the superior capabilities of the Stereo 80 will best be obtained when it is utilized properly. Therefore, read these instructions, and make the specified connections to the input audio source and to the loudspeakers *before connecting the amplifier to a source of AC power.*

OPERATING INSTRUCTIONS

Connection from preamplifier or other signal source

Since the Stereo 80 is a *basic* stereo power amplifier, it has no operating controls; it should be supplied with an audio signal from a stereo preamplifier or similar signal source (such as a multiplex tuner or a stereo tape player with a volume control). Most preamplifiers can supply the required 1.3 volt signal and can operate into the 100,000 ohm input impedance of the Stereo 80. In particular, the Dynaco PAS-3X (or PAS-2X) is recommended with the Stereo 80, as well as the solid state PAT-4 preamplifier. With earlier Dynaco preamplifiers such as the PAS-2, PAS-3 or a pair of PAM-1s, a simple change of a resistor on each channel will provide the proper match for the Stereo 80. The installation of this resistor in the preamplifier is described in a later section of this manual. Earlier Dynaco preamps which have been modified by adding the TC-3X tone control kit are directly useable.

If the Stereo 80 is being used with another make of preamplifier, tuner or tape recorder, you should check with the manufacturer of the equipment to see if it is suitable for 100,000 ohm load impedance.

From the preamplifier, or other source, conventional single-conductor shielded cables with standard "phono" plugs should be connected to the inputs of the Stereo 80. Make certain that the plugs are pushed fully into the sockets, and that the outer ground connections on the plugs are gripping the sockets tightly at each end. The maximum length of these shielded cables is determined by the output impedance of the preamplifier and can generally be as much as 25 feet if the Stereo 80 is to be remotely installed.

Connection to loudspeakers

The Stereo 80 is supplied with two pairs of different color output terminals, one pair for each channel output. The "common" terminal is black, and the "hot" connection is red. The two black posts are electrically connected internally, and are also connected to the chassis, so that the amplifier may be used with special output connections which require common grounds if desired. *You must be certain that the polarity of such output connections is never reversed, and that the "hot" sides are never accidentally connected together in accessory equipment.*

The output terminals may be easily tightened with the fingers. "Spade lugs" are provided with the unit for attaching to the speaker wires to assure a good connection. These can be simply crimped over the bared end of the wire, but if a soldering iron is available, soldering them on will make a neater and more permanent job. If stranded wire is used (as from lamp cord) the wire strands should be twisted together or "tinned" with solder first to avoid fraying. Make certain that no wire strands are able to touch another terminal or the chassis before you turn the amplifier on.

Quality loudspeakers whose rated impedances are between 4 and 16 ohms can be connected directly to the output terminals. For short distances (25 feet or less) ordinary #18 lamp cord can be used. For longer distances, it is suggested that heavier cable (#16 or #14) be used.

The terminals on loudspeakers are marked in different ways, and sometimes are left unidentified. They may be (+) and (−), (1) and (2), or (C) and (8 ohms) for

example. These markings are provided so that proper phasing of a pair of speakers can be maintained. It is not necessary when connecting the leads from the amplifier to the speaker to be sure that the red amplifier terminal is connected to the (+) speaker terminal, or that the (C) terminal is connected to the black amplifier terminal. However, once the "sense" of the wiring has been established by connecting one speaker to the amplifier, the second speaker must be connected in the same way so that the speakers will be in phase. With ordinary lamp cord, this is easy, because one lead is coded — usually either with a "tracer" thread wound around one of the wires, or with a slight molded ridge on the outer plastic insulation of one conductor, or with different color conductors.

The nominal power rating of the Stereo 80 is based on a load impedance of 8 ohms. Loudspeakers with impedances of 4 and 16 ohms can also be utilized with slight reduction of the maximum power capability at some frequencies. Since all loudspeakers have varying impedance characteristics with frequency, an optimum match to any amplifier is a compromise over much of its range. The maximum power output into a given speaker varies with frequency with both tube and transistor amplifiers, because the speaker's rated impedance is typically its minimum impedance, especially in the low frequency range where power demand is generally the greatest. The Stereo 80 can deliver 36 watts into the nominally rated 4 ohm AR-3, for example, throughout the speaker's useable range, and the speaker's impedance rises well above 4 ohms below 100 Hz. With a 16 ohm speaker, maximum power can be expected to be about 26 watts. This question has been largely overlooked in the past because the output transformers in tube amplifiers could match to different nominal speaker impedances, but the problem was not significantly different. A more detailed explanation of amplifier power output characteristics is available on request from Dynaco.

Monophonic operation

It is generally *not* advisable to parallel (connect together) the two output channels of a *transistorized* power amplifier in an attempt to obtain higher power output. If they are paralleled, there is little benefit of power increase under practical conditions, since the optimum load must be of very low impedance.

For higher power monophonic applications, the preferred procedure is to drive each channel of the Stereo 80 with identical signals (using the "A+B" or "Mono" position on the preamplifier, or a "Y" connection) and connect each output channel to a *separate* loudspeaker system. This has the advantage that the speaker will be operated with less likelihood of overload, for speakers are rarely designed to handle more than 40 watts of sustained power.

Of course, either channel may be used independently as a 40 watt mono amplifier by simply leaving the input and output of the second channel unconnected. No "load" is required on the unused channel when there is no input signal.

Cautions to be observed

The Stereo 80 contains circuits which will provide nearly complete protection against abuse (including the cautions noted below), but you should not challenge fate. We all know that parachutes are quite safe — but why jump to test one? The need for protective circuitry in solid state equipment is a direct result of its inherent susceptibility to failure compared with the ruggedness of vacuum tube equipment. You will avoid possible damage to costly transistors and other components if you follow these few simple rules:

1. Do not connect or disconnect inputs or outputs when the amplifier power is on.
2. If you hear any abnormal noises, turn off the equipment and locate and eliminate the source of the noises before using the Stereo 80. These noises may result from partially connected audio cables or similar faults not connected with the Stereo 80, but they can be signals or symptoms of signals of excessive amplitude.
3. The volume control of the preamp or other source should be at a low setting when the amplifier is turned on. At any time that the sound is weak or garbled, locate the trouble *before advancing the volume control.*
4. Do not operate a tape recorder in the fast wind or rewind mode when the volume control is advanced, as this could produce large signals at inaudible frequencies.
5. Avoid any output connection system which risks connecting the "hot" side of one channel to the "hot" side (red terminal) of the other channel when stereo (different) signals are involved. This is not likely in any properly wired system or accessory, but an accidental change of polarity in the connections to a system requiring common ground connections could be costly. Of particular note: headphone junction boxes.
6. If it is necessary to switch from one speaker to another when the amplifier is turned on (as in a distribution system to several rooms) *always make the changes at a low setting of the preamp volume control.* The setting of individual speaker level controls is unimportant.
7. Avoid shorting together the two wires to a loudspeaker, and do not use any switches in the output of the shorting type. Be sure that no strands of connecting wires are free to touch anything except the intended terminal.
8. Do not operate the amplifier if excessive temperature rise is noted.

Amplifier operation

Now you are ready to plug the line cord into the proper AC outlet and listen to the system. A switched outlet on the preamplifier will be the most convenient arrangement, for then the power switch on the Stereo 80 can be left on and switching will be automatic when the preamplifier is turned on. If the Stereo 80 is inadvertently left on for a lengthy period of time, no problems will be encountered. The components do not get hot with extended use under normal or under no-signal conditions. The slight warmth felt when the unit is on is from some power resistors on the power supply board. The transistors and other components will remain cool except under high signal conditions. With sustained high power output it is normal for the bottom to become much warmer than the cover, because the heat sinks dissipate heat through the chassis.

Since there is little heat in normal use, the Stereo 80 does not require the degree of ventilation needed for a tube amplifier, though what heat is generated must be effectively dissipated. The amplifier may be placed almost anywhere, in any position, as long as it is not blanketed with magazines, records or similar obstructions. If the amplifier is used where sustained high power output is required (and transistors heat up the fastest at about half the maximum power output) adequate ventilation is necessary. At full power continuous output on both channels, the Stereo 80 draws almost 250 watts and it, like any other

transistor amplifier, will generate as much heat as a comparable tube amplifier.

Those who desire to use headphones with this amplifier will find that most headphone manufacturers make adapters available which provide the necessary level controls or resistors to reduce the power to the headphones, and to maintain low noise. General information on this subject is available on request from Dynaco.

Checking speaker phasing

The simplest procedure for determining correct speaker phasing is to play a monophonic program (turn the preamplifier to "A+B" or "Mono") through both speakers. Then if the phasing is correct, there will be a smooth transition of sound as you move from one speaker to the other. If the speakers are not in phase, there will be an abrupt shift from one to the other at some point between the two. If convenient, an alternative method is to face the two speakers toward each other about 6 inches apart, and when the "Common" and "Hot" leads to one speaker are interchanged, there will be a noticeable loss of bass energy when the speakers are out of phase. Only the pair of leads from the amplifier to *one* of the speakers should be interchanged to correct the phasing, and there is no need to alter the phasing once the speakers are properly connected.

TECHNICAL INFORMATION

CIRCUIT DESCRIPTION

The Stereo 80 has a number of unique circuit features on which there are patent applications. They contribute to the amplifier's exceptionally low distortion, long term reliability, resistance to abuse, and to its remarkable degree of reproducibility which marks a truly successful design. Those not interested in the technology may omit this section. A more detailed technical description for servicing will be found in a later section of this manual.

The audio portion of the Stereo 80 includes unique circuitry to provide an unusual amount of protection while delivering exceptional performance. Transistors Q1 and Q2 are a direct-coupled feedback pair providing a high degree of stability and great linearity. This pair drives the power section, transistors Q3 through Q6, which are direct-coupled and include DC feedback stabilization. These four transistors act as a push-pull power transformer in that they do not have voltage gain, but they transform the signal from high impedance to low impedance. All six transistors in the driver and power sections are included in one overall feedback loop.

The amplifiers are designed to *reduce*—not just limit—the current through the output stage when there is any tendency to exceed a reference limit as a result of excessive drive signals or heavy loads. This protects both the load (the loudspeaker) and the source (the output transistors).

In the Stereo 80 the output transistors are operated *without quiescent current* and without the consequent heat rise caused by the bias current, eliminating the need for temperature compensating devices. However, the Stereo 80 does not exhibit any signs of the "Class B notch" commonly attributed to a lack of bias current.

The output signal is taken from the junction of Q5 and Q6 through coupling capacitor C7, which prevents DC from reaching the speaker. An output capacitor large enough to assure unrestricted low frequency response was chosen instead of the conventional and less costly plus-minus output circuit. It eliminates any need for balance adjustments or matching of components, and assures speaker protection in the event of output transistor failure.

All of the large capacitors used in the Stereo 80 are special high-purity "computer grade" electrolytics chosen for maximum reliability. The output capacitors also serve as convenient forms for small value air-core chokes in the output which, in conjunction with an R-C circuit, roll off the response in the RF region (above 500,000 Hz), reducing interference and affording absolute stability under all circuit conditions.

PERFORMANCE TESTS

Special care must be taken when subjecting transistorized amplifiers to laboratory tests. Solid state circuits draw much more current at the frequency extremes than in the mid-band, and tests with other than the 8 ohm load for which the amplifier is designed may also draw higher current. High current raises transistor temperatures, causing increased current demand, so tests must be performed quickly under these conditions to avoid the action of the protective cut-back circuits which limit the current in the Stereo 80 for safety reasons. The action of the protective circuitry may yield erroneous results, such as a notably lower apparent power output for rated distortion.

High power measurements should first be "set up" with a low input signal, and then raised to a previously determined level for a quick reading. The extended power and frequency response of the Stereo 80 requires that even low power tests above and below the audible range be made quickly to avoid protective cut-back. This limits the practical duration of high frequency square wave tests, for example.

Prolonged tests at high power levels, at the frequency extremes, or with abnormal load impedances require adequate thermal recovery time. Without it, the transistors are rendered more susceptible to subsequent overload, and the safety margin afforded by the protective circuits is sharply reduced. Callous disregard of these effects may result in eventual failure, for there is no such thing as absolute protection against deliberate abuse.

Some of the heat generated is dissipated through the heat sinks to the chassis, so the bottom of the amplifier will get quite hot during tests. Remember that the maximum dissipation in transistorized circuits occurs at about half power. At maximum current drain, the Stereo 80 will dissipate as much heat as two 40 watt tube amplifiers, so adequate ventilation must be provided.

The line fuse in the Stereo 80 has been chosen to provide maximum protection while allowing short duration currents in excess of its rating. The current demand for both channels operating at full power steady-state at 20 kHz (the severest test), for example, will slightly exceed the fuse rating, but the slo-blo fuse will handle this for several seconds.

When making full power tests at the frequency extremes, it is important that the line voltage be corrected for power line drop because of the high current demand. The reserve capacity of the supply will be limited by excessive line losses, and the indicated distortion may rise at maximum power when both sides are driven simultaneously.

USE WITH DYNACO PREAMPLIFIERS

The Dynaco PAS-2X, PAS-3X and PAT-4 preamplifiers and the Dynatuner may be used directly with the Stereo 80 without modification. Older model Dynaco PAS-2 and PAS-3 preamplifiers may be updated to the latest "X" series by adding the TC-3X tone control modification kit. Buy the TC-3X from your dealer or order it directly from Dynaco for $10.00 (no C.O.D.'s, please). You may also modify the Dynaco PAM-1, PAS-2 and PAS-3 preamps to accommodate the 100,000 ohm input impedance of the Stereo 80 without making the tone control changes of the TC-3X. This is accomplished as follows in the PAS-2 and PAS-3 stereo preamplifiers:

1. Purchase two 100,000 ohm, ½ watt, 10% tolerance resistors.
2. Unsolder and discard the two 510,000 ohm (green-brown-yellow) resistors connected to the audio output sockets on the back panel of the preamplifier and replace them with the 100,000 ohm resistors. Solder all connections.
3. Snip out and discard the two 62,000 ohm (blue-red-orange) resistors on the PC-5 circuit board adjacent to eyelets #8 and #18. This completes the modification.

The modification for the PAM-1 mono preamp is as follows:

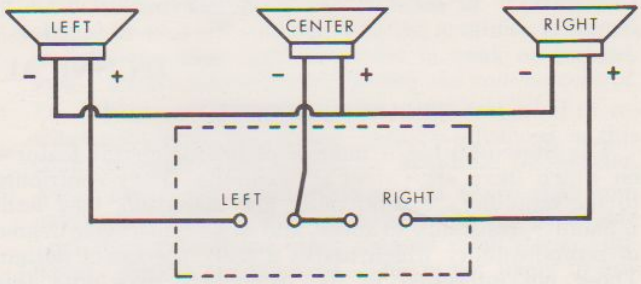
1. Purchase one 100,000 ohm, ½ watt, 10% tolerance resistor for each preamplifier.
2. Unsolder and discard the 510,000 ohm (green-brown-yellow) and the 62,000 ohm (blue-red-orange) resistors between lugs #2 and #3 of the 7-lug terminal strip in the preamp. Solder the 100,000 ohm resistor between these two lugs. This completes the change.

DYNACO CENTER CHANNEL SYSTEM FOR 3 SPEAKER STEREO

This method of deriving the center (third) channel of a stereo system is an exclusive Dynaco development which utilizes special circuitry in the Dynaco PAS-2X, PAS-3X and PAT-4 preamplifiers to provide the proper in-phase (A+B) signal without loss of stereo separation and without the need for an additional amplifier. It is useful where the left and right speakers must be widely separated, and it also enables the use of the third channel speaker as a monophonic system in another location.

It should be recognized, however, that a two channel system will have a wider apparent sound source than any system utilizing a center speaker in a derived third channel arrangement, if the spacing between the left and right channel speakers remains the same. In order to maintain equivalent spread of sound, somewhat greater spacing between the outside speakers is required in any 3 speaker system.

The connection of the 3 speakers is diagrammed below. The use of 3 *identical* speakers is essential to achieve the most natural sound throughout their range. In any event, all speakers must have the same efficiency, and the left and right speakers should be identical. Connection of dissimilar speakers will reduce separation and adversely affect spatial orientation. The use of individual level controls in series with any of the speakers will also reduce separation. They are neither necessary nor desirable when matched speakers are used. If the speaker systems provide controls for the adjustment of relative tweeter or midrange levels, these should be set before the system is adjusted as described below. Be sure all speakers are correctly phased.



Adjusting the system is easy. Set the tone controls in their "flat" centered positions, switch off the loudness compensation and scratch filter, and adjust the volume control for normal listening level. Switch the stereo-mono selector on the preamp to the 6db blend position. Now use a *monophonic* source so that identical signals will be fed to both channels, and temporarily remove *one* of the wires to the center speaker. Either wire gives the same result. Adjust the balance control for *minimum* sound output. If necessary, the balance control knob can be slipped off the shaft and recentered so that the upright pointer indicates the position of precise balance. Then reconnect the speaker wire.

Now all program material, both stereo and mono, can be played with the preamp in the 6db blend mode, and generally without any need to readjust the balance control. Monophonic programs will appear predominantly in the center speaker. Stereo programs will retain their separation, and when the listener changes position, the apparent distribution of sound will not shift, so that the stereo perspective will be less dependent on the listening position. If you wish to turn off the center channel speaker, normal two channel stereo is obtained by shorting across the terminals of the center speaker, and switching the preamp back to full stereo.

If the third channel is to be used as a remote monophonic speaker, it is advisable to first install it as a center channel of the stereo system for proper balance adjustment as indicated above. It then may be moved to another area.

Additional information regarding the use of a third amplifier for 3 channel systems is available on request from Dynaco.

ASSEMBLY INSTRUCTIONS

GENERAL INFORMATION

Assembly of the Stereo 80 is exceptionally simple when compared to other kits. The preassembled etched circuit boards have saved you much of the work, and the assembly that remains is arranged in an open, uncluttered layout that makes wiring quick and easy. The construction time will be only a few hours, but it is best to work slowly and carefully rather than worry about the time.

When you unpack your kit, check off the components against the parts list at the back of the manual. You can identify unfamiliar parts by matching them to the pictorial diagram or photograph.

Have the proper tools at hand before starting assembly. You will need a pencil-type soldering iron of 30- to 60-watt rating with a small tip, long nosed pliers, diagonal cutting pliers, a medium-sized screwdriver, and 60/40 *rosin core* solder not larger than 1/16" diameter. You will also find a damp sponge or cloth helpful to wipe the tip of the iron clean periodically. An inexpensive wire stripping tool is helpful, but some people prefer a single-edged razor blade for removing the insulation.

SOLDERING INSTRUCTIONS

A good solder connection does not require a large amount of solder around the joint. A well-made connection looks smooth and shiny because the solder *flows into the joint* when both parts are hot enough.

There are four steps to making a good solder connection:

1. Make a good mechanical connection.
2. Heat *both* parts with the tip of the iron *at the junction.*
3. Apply solder to the *junction* until it melts and flows.
4. Allow the connection to cool undisturbed.

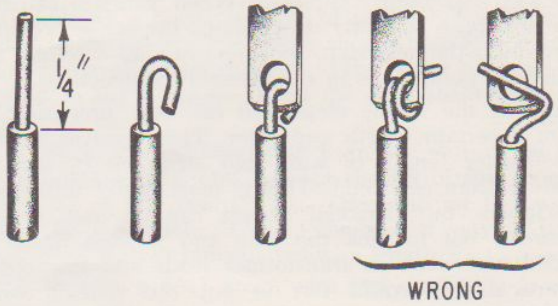
All SOLDERING MUST BE DONE WITH A GOOD GRADE OF ROSIN CORE SOLDER.

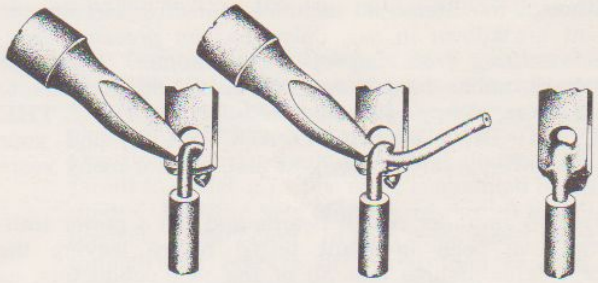
Under no circumstances should acid core solder be used. Unmarked solder, cheap solder or any of doubtful origin should be discarded, and *separate solder fluxes should never be used.* The warranty is voided on any equipment in which acid core solder or acid type fluxes have been used. Silver solder is not suitable. The recommended solder is 60/40 (60% tin, 40% lead) *ROSIN CORE.* Do not confuse this with 40/60, which is harder to use.

If you have a soldering gun, it should be used with care, especially when working on the circuit boards. A soldering gun can provide more heat than is necessary, with some risk that an unskilled user might damage the board, and because it requires some time to heat each time the trigger is squeezed, many users tend to make poor solder connections simply because they do not wait long enough for it to reach its operating temperature each time.

You should realize that delicate components such as transistors are less likely to be damaged in the soldering process if you use a hot iron for a short time, rather than a cooler iron for a longer period. You will also make a better connection with the hot iron. If you keep the iron clean by wiping the tip frequently, and occasionally add a small amount of solder to the tip, it will aid the transfer of heat to the connection. Do not allow too much solder to build up on the tip, though, or it may fall onto adjacent circuitry.

One of the best ways to make a good mechanical connection is to bend a small hook in the end of the wire, and then to crimp the hook onto the terminal lug. The amount of bare wire exposed need not be exactly 1/4-inch, but if it is too long, the excess might touch another terminal lug or the chassis. Do not wrap the wire around the lug more than one time, as this makes the connection difficult to remove if an error is made.





When soldering a lead to an eyelet on the circuit board, the Stereo 80 makes it easy to apply the iron to one side of the board while the tinned wire end is pressed into the solder-filled eyelet from the opposite side. When the eyelet is heated, the wire enters easily, but be careful that you *do not push the wire all the way into the eyelet up to the insulation.* If you do, you will not be able to see if you have made a secure connection, or if more solder is needed to provide a smooth flow from the wire, to the eyelet, and onto the circuitry on the board.

WIRING THE KIT

The position of all wire leads should follow the diagram and photograph closely, bearing in mind that the pictorial diagram has necessarily been distorted somewhat to show all connections clearly. See that uninsulated wires do not touch each other unless, of course, they are connected to the same point. It is especially important that uninsulated wires or component leads or terminals do not touch the chassis accidentally.

Whenever one wire is to be soldered to a connection such as a lug or a transistor lead, the instructions will indicate this by the symbol (S). If more than one wire is to be soldered to the same point, the instructions will cite the number of wires that should be connected to that point when it is to be soldered. If no soldering instruction is specifically given, do not solder; other connections will be made to that point before soldering is called for.

When the instructions refer to "tinning" a wire, apply the iron to the bared wire end, and after a moment, touch the solder to the wire so that the solder lightly coats the wire. This makes it easier to get a good connection when the wire is inserted into an eyelet, for example.

Components such as resistors and capacitors are marked individually with their values, or with a color code. The color code will be given in the instructions when needed. The first color band on a resistor is the one nearest the end.

Check your work after each step, and make sure the entire step has been completed. When you are satisfied that it has been correctly done, check the space provided and go on to the next step. Be sure you read carefully the explanatory paragraphs in the assembly instructions.

Many of the wiring steps will call for "preparing" a wire of a certain length and color. This involves cutting the necessary length of wire, and stripping ¼ inch of insulation from each end. This is most easily done with wirestrippers, but diagonal cutters can be used if you are careful not to nick the wire and weaken it. With stranded wire such as transformer leads and line cords, be particularly careful not to cut the strands when stripping the ends.

Although the Stereo 80 includes protective circuitry to prevent breakdown in *use*, only *you can prevent breakdown resulting from improper construction*. Transistor equipment, unlike much tube equipment, will not tolerate wiring errors, sloppy or incomplete soldering. TAKE THE TIME TO BE NEAT AND ACCURATE, and your amplifier will operate properly at first, and for many years to come.

The two amplifier circuit boards and the 4 power transistors have been in-circuit tested before leaving the factory. This assures that all of the semi-conductors, as well as most of the other parts, are performing to specifications. Only the interconnection of these parts is left to you.

Two sizes of screws and nuts are supplied with the kit: the small #4 size, and the large #6 size. For your convenience, no #4 lockwashers are supplied. Use #6 lockwashers when #4 hardware is called for.

Also supplied are 12 #6 self-tapping screws, which can be identified by their tapered shape and scored tip. These should be separated from the rest of the hardware and set aside until called for in the instructions.

All mounting screws are installed from the *outside* of the chassis, and a lockwasher is used under each nut, except when otherwise specified.

Before starting work, orient the chassis as shown in the pictorial diagram, with the ends upwards and the long rectangular cutout to your right. In this normal assembly position, the locations of parts mentioned in the instructions will be the same on the chassis as on the diagram.

1( ) Select the four terminal output strip and two sets (screws, nuts and lockwashers) of #4 (small) hardware. Mount the strip on the *outside* of the chassis in the long rectangular cutout, with the lugs projecting inward, and toward the bottom.

2( ) The two input sockets JR and JL each have a short lug and a long lug. With the short lug nearest the outer edge of the chassis, install each socket on the inside of the chassis adjacent to the output terminal strip as shown, using 4 sets of #4 hardware.

3( ) Remove the nut and lockwasher from the fuse holder, but leave its rubber ring washer in place. With its side lug upwards as shown, install it from the outside in the top hole at the left of the chassis, fastening it with its lockwasher and nut.

4( ) Position the AC power switch behind the rectangular hole next to the fuse holder, so that the two small wires coming from inside the switch are toward the *bottom* of the chassis. Fasten it with two #4 screws. No lockwashers or nuts are needed here.

5( ) Select two of the rubber feet and two sets of #6 (large) hardware. Turn the chassis upside down, place the feet over the two small holes nearest the left corners of the chassis, and force a screw down through each foot until the head of the screw is countersunk within the foot. Fasten both with lockwashers and nuts.

The next 3 steps describe the installation of the four capacitor mounting brackets. All mounting screws are installed from the outside (bottom) of the chassis, first through a rubber foot if one is called for. The capacitor bracket is then placed in position, followed by a terminal strip if specified, and fastened with a lockwasher and nut. One set of #6 hardware is to be installed in each bracket *clamp* before mounting. In each case refer to the pictorial diagram for the correct orientation of the clamp, and also for the direction of insertion of the clamping screw. This will facilitate servicing access if required in the future.

Because the brackets are flexible, you will find that the capacitors will be held most securely if they are temporarily slipped into each bracket for sizing when the bracket mounting bolts are tightened. While squeezing the bracket around the capacitor, tighten all the mounting bolts, starting first with the bolt farthest from the clamp. Then remove the capacitor. *Do not remove the outer insulation from any capacitor.*

6( ) Select two of the larger three mounting brackets, eight sets of #6 hardware, and the two rubber feet. Place the feet over the corner holes at the right of the inverted chassis and force two screws into them as before. Inside the chassis, orient the brackets, and complete the installation.

7( ) With three sets of #6 hardware install the smaller of the two remaining capacitor brackets for C11 as shown.

8( ) With four sets of #6 hardware and the 3-lug terminal strip, install the remaining bracket for C9, with the terminal strip adjacent to the power switch as shown.

9( ) The power transformer has six color-coded leads protruding from the top, and two red leads from the bottom at the other end. These have been left longer than may be necessary for the connections which follow. You may shorten them for a neater appearance if you wish, but remember that the warranty on the transformer is voided if they are cut too short for re-use. When removing insulation from these stranded leads, be careful not to cut through any of the strands, and always "tin" the ends before installation. Mount the transformer with the six leads nearest the fuse holder, using four sets of #6 hardware in the two round and two elongated holes in the left front corner of the chassis.

10( ) Prepare a 3″ black wire. Connect one end to lug #2 of the power switch. (S). Connect the other end to the top (side) lug of the fuse holder. (S).

The following 4 steps refer to wiring the power transformer for the 120 volts AC line used in the United States. Instructions for use with other AC line voltages will be found in the back of this manual. If one of these alternatives is chosen, cross out the next 4 steps now.

11( ) Prepare a 1¼″ black wire. Connect one end to lug #1 of the power switch. (S). Connect the other end to lug #6 of the power switch by hooking it *around the lug,* since two more wires are to be connected through the hole in this lug in the next step.

12( ) Twist together the black and the black-white transformer leads, and connect them both to lug #6 of the power switch. (S-3).

13( ) Twist together the violet and the violet-white transformer leads, and connect them both to lug #3 of the power switch. (S-2). Cut off any excess stubs of wires to the power switch to avoid the possibility of short circuits.

14( ) Twist together the yellow and green transformer leads, and connect the green lead to lug #3 of the 3-lug terminal strip. (S). Connect the yellow lead to lug #1 of the terminal strip. (S).

The next 4 steps describe the sub-assembly of the power supply circuit board. The placement of each part is marked on the side of the board on which most of the parts are mounted, by lines to the holes into which its leads will be inserted. Dotted lines indicate parts mounted on the copper side of the board. *Except where specifically indicated otherwise,* the parts should be mounted tightly against the board, just as you see those on the other circuit boards mounted.

Each part will be identified by a part number, color code, or written value. First bend the leads to fit the space between the marked holes, then push the leads through the holes and spread them slightly to hold the part in place for soldering. Solder each lead carefully to the copper foil, being sure the solder flows all around the lead and smoothly onto the copper, without any bridges to other parts of the circuitry. Cut off all excess leads. The copper side of the board has been coated with a corrosion inhibitor which is also conducive to soldering, but there is no substitute for good soldering technique.

15( ) Install the 68 ohm (blue-gray-black) one-half watt resistor R21.

16( ) Install the four silicon rectifier diodes #544322, D4, D5, D6 and D7. Be certain the markings are all faced the same way, with the cathode end nearest resistor R21. The ones supplied may be any of the three types shown in the illustration. Although different in appearance, they are electrically equivalent.

17( ) Install the two 7 watt, 5%, 400 ohm resistors R16 on the circuit board, *but do not mount them flush against the board. Allow at least ⅛″ but not more than ¼″ space between the resistor body and the board for ventilation, as these get quite hot in normal use.*

18( ) Install the two remaining 7 watt, 5%, 400 ohm resistors R17 on the *reverse (copper) side* of the board, leaving between ⅛″ and ¼″ ventilating space.

19( ) To make connections to the eyelets easier, "tin" all 9 eyelets on the board now, by applying enough solder to fill the eyelet, and to solder it securely to the adjacent copper circuitry.

The wires in the next three steps are to be connected to the copper side of the circuit board. A good connection is more certain if the wire if first "tinned" by heating it and applying a small amount of solder before it is connected to the eyelet. The solder should then flow smoothly across the eyelet from the wire to the board when solder is applied to the junction. Hold the wire steady while the connection cools.

20( ) Strip 1¼″ of insulation from one end of the black hookup wire, and connect the tip of this to eyelet #7 on the board. (S). Then clip off this wire at the insulation. This is the easiest way to handle such a short uninsulated wire length.

21( ) Prepare a 6¾″ green wire and connect it to eyelet #6. (S).

22( ) Prepare a 6¼″ red wire and connect it to eyelet #5. (S).

23( ) The two right-angle brackets have one leg shorter than the other. The shorter leg is to be mounted to the power supply board, and the longer one to the chassis. They fasten to opposite sides of the board. One bracket makes contact with the copper foil adjacent to eyelet #7. The other is mounted below the diodes. Use two sets of #4 hardware to mount the brackets to the board. In both cases insert the screw through the bracket first, and then through the board, fastening it with a lockwasher and nut.

24( ) With one set of #6 hardware mount the ungrounded bracket (below the diodes) to the chassis via the round hole next to the power transformer's red wires.

25( ) Select the two ground lugs, and one #6 screw and nut. Pass the screw up through the chassis from below, through the second mounting bracket, and then through the two ground lugs arranged in a "V", and fasten with the nut, as shown. A total of 8 wires will be connected to these ground lugs, but it makes no difference which is used for any wire. Be certain this bolt is securely tightened.

26( ) Connect the short bare wire from eyelet #7 to one of the ground lugs.

27( ) Twist together the two red leads from the power transformer. Connect one lead to eyelet #9. (S). Connect the other lead to eyelet #8. (S). Push the lead through the eyelet from the diode side, as you apply the soldering iron to the copper side of the board. This will avoid damaging the diodes with excessive heat. Make sure all strands of each transformer lead are soldered to the eyelet.

28( ) There are two coils of heavy gauge wire supplied. From one of them, cut an 8½″ length, and strip 1″ of insulation from one end, and ¼″ from the other end. On the longer bared end, put a right-angle bend just beyond where the wire emerges from the insulation. Pass the bent end up through lug #2 of the four terminal output strip. Then bend it over, and down through lug #3. (S). Now also solder lug #2. (S). Position the wire along the

center of the chassis, and connect the other end to one of the ground lugs.

29( ) Prepare a 12″ length of black wire and a 12″ length of red wire. Twist them together along the entire length except for the last 1″ at each end. At one end connect the red wire to the *long* lug of input socket JR. (S). Connect the black wire to the *short* lug of JR. (S). Position this pair along the rear edge of the chassis.

30( ) Prepare a 10″ length of black wire and a 10″ length of green wire. Twist them together as in the previous step. Connect the green wire to the *long* lug of JL. (S). Connect the black wire to the *short* lug of JL. (S). Position this pair along the front edge of the chassis.

31( ) Each of the two coils of heavy gauge wire will be formed into a coil around one of the large C7 (5000 mfd) capacitors. To facilitate forming these coils, you will use the *smaller* capacitor C11 (1000 mfd) as a form. Strip ¼″ of insulation from one end of one coil and form a small hook at that end. Hook the wire around one of the lugs of C11, swing the wire around so that it passes the other lug, and bend it sharply down over the rim of the capacitor. About ¼″ below the rim, bend it sharply to the left, to start the wire in a *clockwise* direction when looking at the top (lug end) of the capacitor. See detail A. Wind the wire tightly, with the turns as close together as possible, until all the wire is used. You must hold the "start" while you wind, and feed the wire by *unwinding* the coil supplied. Pulling the wire straight off the coil may cause it to kink. This is the most tedious part of the kit. Take the time to do a good job.

When you release your hold, the wire will spring loose to form a larger diameter coil. Disengage the hook from the lug and slide the coil off C11. Select one of the larger (5000 mfd) capacitors and fit its lug end into the part of the formed coil that is farthest from its hooked end. Guide the coil onto the capacitor a loop at a time, as though you were threading it on. With care and patience, you can avoid deforming the coil and keep it snug. When the coil is all on the capacitor, slide it around until the hook will fasten through the black lug, and solder this connection. (S).

Detail A

32( ) Form a second coil as above, but wind this one in the *opposite (counter-clockwise) direction,* bending the wire to the *right.* Install this coil on another 5000 mfd capacitor, and solder the hook to the black lug. (S).

33( ) Select the capacitor with the coil wound in the *counter-clockwise* direction, count 17 complete turns, allow 1½″ extra wire, and clip off the excess. Strip ¼″ of insulation from the end, and put a sharp right-angle downward hook in the bared tip. Fit the assembly into the bracket for C7R with the lugs positioned as shown. Make sure the coil is snug, and connect the hooked end to lug #1 of the output terminal strip. Seat the capacitor snugly to the chassis and tighten the bolt in the bracket clamp.

34( ) Take the *clockwise* coil-capacitor assembly, count 17 full turns, allow 1½″ extra, and cut off the excess. Strip and hook the end of the coil, and install the assembly in C7L as in the previous step. Connect the end to lug #4 of the output terminal strip. Seat the capacitor fully and tighten the bolt in the clamp.

There will be a total of 8 wires connected to the two ground lugs in the center of the chassis. When you have connected 4 wires to *one* of the lugs you may wish to solder those connections to that lug, though the instructions will later refer to soldering all 8 wires, after the heat sinks are in place. It will be easier to solder these wires, and later verify their solidity, if you connect each wire by hooking it *up through the lug from underneath,* since the insulation will not then be in the way.

35( ) Prepare a 7″ black wire. Connect one end to a ground lug, and position it along the chassis towards the power switch.

36( ) Prepare a 4¾″ black wire. Connect one end to a ground lug, and position it over to the bracket for C11.

37( ) Prepare a 5½″ black wire. Connect one end to a ground lug, and position it along the chassis towards C7R.

38( ) Prepare a 6″ black wire. Connect one end to a ground lug, and position it along the chassis towards C7L.

Each of the two amplifier channels comprises a black aluminum finned heat sink with two output transistors already mounted, and a preassembled and tested circuit board. The four items fit together like the sides of a box, with two adjacent sides (heat sink and board) comprising one channel.

The output transistors on the heat sinks have their undersides coated with a white silicone grease which is an effective heat conductor to facilitate transfer of heat to the aluminum heat sink. It is also an electrical insulator, so you should wipe off the solder (ground) lugs and transistor pins on each of these subassemblies with a clean paper tissue in case any of this grease has been smeared on terminals which will have to be soldered later.

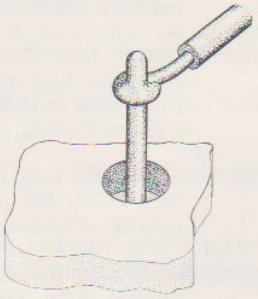
Be careful not to bend the transistor pins, for it is important that neither the pins nor connections to them be allowed to touch the heat sink.

Detail B shows the wiring to the left channel heat sink, with the connections identified by a letter which will follow the number of the transistor, as Q5-E. For convenience you may wish to mark these letters on the heat sink with a soft pencil. Keep your wiring neat, and observe the direction in which each wire is to be oriented on the diagram before soldering. Different right channel wire lengths are given in italics.

In some places the instructions will tell you to form a loop in some of the wires. This is done with the tips of long-nosed pliers, to produce a closed ring at the end of the wire that is just large enough to fit snugly over the transistor pins, which is then squeezed around the pin with the pliers to hold it for soldering.

While excessive heat may damage any transistor, the silicon types used in the Stereo 80 are very rugged, and it is more important that you have the transistor pin and the wire you are connecting to it hot enough before you apply the solder, so that the solder will flow quickly over the junction, giving you a smooth connection. A small drop of solder on the tip of the iron will assist in heat transfer and good soldering. If the solder does not flow easily around the connection, allow it to cool, and try again after the tip of the iron is again hot.

To avoid short circuits to the heat sinks, all connections must be made to the *tip* of the transistor pins, and solder must not be allowed to flow into the recess formed by the hole in the heat sink.



39 ( ) Orient one of the heat sinks as in Detail B, with the ground lug on the end to the right. Trim the leads on one of the 0.47 ohm resistors (yellow-violet-silver) to a length of ¾". Bend the leads to form a "U", and form a loop in one lead. Tuck the resistor into the innermost channel on the heat sink, and pass the tip of the straight lead through lug Q6C. Connect the loop to Q5E. (S).

40 ( ) Prepare a 2¾" green wire, and form a loop at one end. Connect this from the right to Q5B. (S).

41 ( ) Prepare a 5½" green wire and a 2½" green wire. Connect one end of each wire from the right to lug Q5C. (S-2). Put a right-angle bend near the end of the short wire for later identification.

42 ( ) Prepare a 3½" black wire, and form a loop at one end. Connect this from the right to Q6E.

43 ( ) Prepare a 4½" black wire, and form a loop at one end. Connect this from the left to Q6E. (S-2).

44 ( ) Prepare a 4" green wire and connect one end from the right to lug Q6C. Bend a hook at the free end for later identification.

45 ( ) Prepare a 6" green wire and connect one end from the left to lug Q6C. (S-3).

46 ( ) Prepare a 3½" green wire, and form a loop at one end. Connect this from the right to Q6B. (S).

47 ( ) The heat sink assembly is to be mounted with 4 of the *self-tapping* screws initially set aside. With the lugs toward the center of the chassis, and lug Q5C upwards, bend the two wires at the bottom toward the center of the chassis, and install it between C7R and C11 by threading the screws into the four "C" shaped channels. Do not tighten the heat sink mounting screws until all four are properly threaded into the heat sink. Bend the longest top wire towards C11.

48 ( ) Locate the black wire at the bottom of the heat sink and connect it to one of the two ground lugs next to the power supply board, hooking it *up* from underneath.

49 ( ) Orient the second heat sink as in Detail B. Trim the leads of the remaining 0.47 ohm resistor (yellow-violet-silver) to ¾", bend them to form a "U", and form a loop in one lead. Tuck the resistor into the channel, slide the straight lead through lug Q6C, and connect the loop to Q5E. (S).

50 ( ) Prepare a 2¾" red wire, form a loop at one end, and connect this from the right to Q5B. (S).

51 ( ) Prepare a 9" red wire, and a 2½" red wire. Connect one end of each wire from the right to lug Q5C. (S-2). Put a right-angle bend near the end of the short wire for later identification.

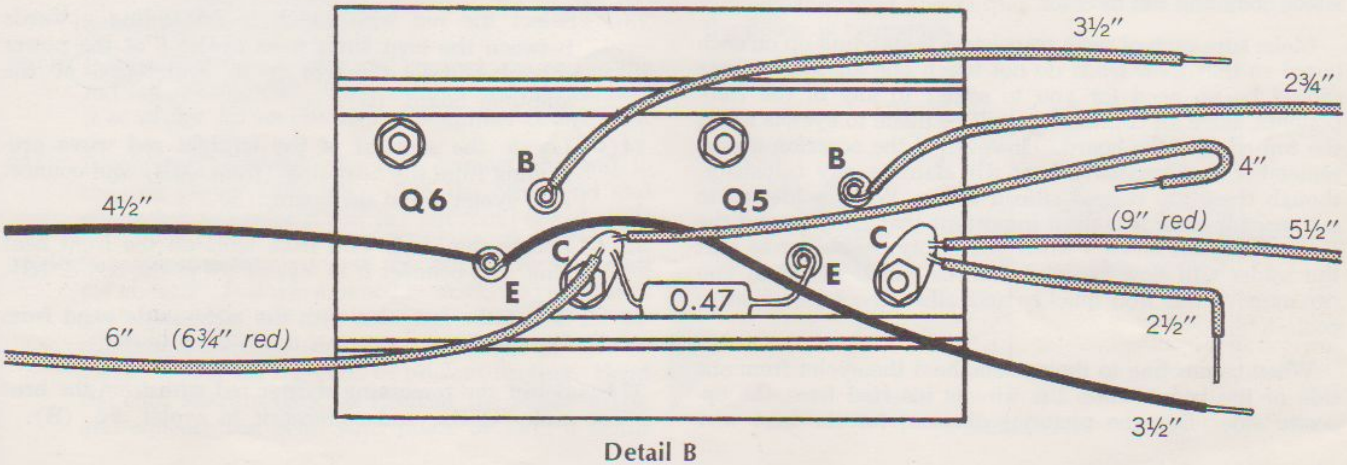
52 ( ) Prepare a 3½" black wire, form a loop at one end and connect this from the right to Q6E.

53 ( ) Prepare a 4½" black wire, form a loop at one end and connect this from the left to Q6E. (S-2).

54 ( ) Prepare a 4" red wire and connect one end from the right to lug Q6C. Bend a hook in this wire for later identification.

55 ( ) Prepare a 6¾" red wire and connect one end from the left to lug Q6C. (S-3).

56 ( ) Prepare a 3½" red wire, form a loop at one end and connect this from the right to Q6B. (S).



Detail B

57 ( ) Mount this heat sink assembly *facing* the other one with 4 *self-tapping* screws as before. Bend the longest top wire to the left, towards C9. Now check *both* heat sinks to be certain that the connections to the 4 solder lugs do not touch the black heat sink itself, and that all transistor pins are centered in their holes.

58 ( ) Locate the black wire at the bottom of the second heat sink, position it along the chassis and connect it to one of the ground lugs next to the power supply board, hooking it *up* from underneath. Now *solder all eight wires* connected to these two ground lugs, and double-check each for security.

59 ( ) Now "tin" the free ends of each of the wires on the chassis, to facilitate their later connection to eyelets on the circuit boards.

60 ( ) Locate the green wire at the bottom of the rear heat sink, position it against the chassis, and connect it to eyelet #4 of the power supply board. (S).

61 ( ) Locate the red wire at the bottom of the front heat sink, position it against the chassis, and connect it to eyelet #3 on the power supply board. (S).

62 ( ) Locate the red and green wires coming from eyelets 5 and 6 of the power supply board, and place these along the chassis toward the C7 capacitors. Place the red and black twisted pair from JR against the chassis, behind C7R, in *front* of the adjacent heat sink, and upwards near C11. Place the green and black twisted pair from JL against the chassis in front of C7L, and upwards near the heat sink. Place the two black wires from the ground lugs along the center of the chassis and bend them upwards between the two heat sinks.

The amplifier circuit boards are identical, and have been individually tested in the circuit before inclusion in your kit. You can ignore the two unused holes in each board just below eyelets 11 and 12. Three protective cardboard rings surround the finned radiators on each board to keep the transistors from being crushed against the board. Gently remove these rings without dislodging the radiators from the transistors. You may wish to snip them off with a small pair of scissors. The radiators are friction-fitted on the transistors, and if one must be replaced, slide a support under the transistor to *avoid flexing the leads.* Heat conducting silicon grease is used between the transistor body and the radiator.

Make sure each of the 4 transistors is standing up on each board so that their leads do not touch one another. There should be no need for you to solder to any of the components, since all connections will be made to eyelets along the top edge of the board. However, if the occasion arises, remember that excessive heat will damage any transistor, though these are rugged silicon types. When soldering to a transistor lead, it is most important that the iron and the junction be hot enough when you apply the solder so that the solder will flow rapidly into the junction. Then you can remove the iron quickly and allow the connection to cool.

When connecting to the eyelets, heat the eyelet from one side of the board while the wire is inserted from the opposite side. See the pictorial diagram for the best wire placement. After the solder connection has cooled, wiggle each wire to be sure the connection is secure, and that there is a smooth flow of solder from the wire to the eyelet, and from the eyelet to the board. If in doubt, reheat the connection and add a bit more solder.

63 ( ) The circuit boards slide into the pairs of "C" shaped channels on the heat sinks, resting on the mounting screws at the bottom. Orient one of the boards with the eyelets uppermost, the components toward the power supply board, and the circuit (soldered) side to the right, and slide it into the pair of channels nearest the power supply board.

64 ( ) Connect the red wire of the red and black twisted pair to eyelet #12 of the amplifier board. (S). Connect the black wire to eyelet #11. (S).

65 ( ) Install capacitors C9 and C11 in their brackets with the lugs oriented as in the diagram. Make sure they are seated tightly to the chassis, and tighten the clamps.

66 ( ) Select the long black wire from the chassis ground lugs which was previously placed towards the power switch. Connect it to the black lug of C9. (S).

67 ( ) Select the black wire near C11 from the chassis ground lugs, and connect it to the black lug of C11. (S).

68 ( ) Prepare a 3¼" red wire and connect one end to the red lug of C9. Tin the other end, and connect it to eyelet #2 of the power supply board from either side. (S).

69 ( ) Prepare a 2½" red wire and connect one end to the red lug of C11. Tin the other end, and connect it to eyelet #1 of the power supply board. (S).

70 ( ) Prepare another 2½" red wire and connect one end to the red lug of C11. Tin the other end, and connect it to eyelet #10 of the amplifier board. (S).

71 ( ) There are two black wires from the chassis ground lugs protruding upwards between the heat sinks. Select the *shorter* of these, and connect it to eyelet #9. (S).

72 ( ) Select the *hooked red* wire from Q6C of the front heat sink, and connect it to eyelet #8 of the board. (S).

73 ( ) Select the red wire which is protruding upwards between the heat sinks from eyelet 5 of the power supply board. Connect it to eyelet #6 of the amplifier board. (S).

74 ( ) Locate the shortest of the straight red wires protruding from the heat sink (from Q6B) and connect it to eyelet #3 of the board. (S).

75 ( ) Locate the black wire from Q6E on the front heat sink, and connect it to eyelet #2 of the board. (S).

76 ( ) Select the red wire with the right-angle bend from lug Q5C and connect it to eyelet #4. (S).

77 ( ) Select the remaining shorter red wire from the heat sink (Q5B), and connect it to eyelet #5. (S).

78(✓) Connect the long red wire from lug Q5C to the red lug of C9. Position it as shown in the diagram.

79(✓) Install the other amplifier board with the eyelets up, and the components facing to the right, and the circuit side facing the first board. Be sure that the single black and green wires protrude between the boards, but the twisted pair stays outside.

80(✓) Connect the green wire of the green and black twisted pair to eyelet #12. (S). Connect the black wire to eyelet #11. (S).

81(✓) Locate the black wire from the chassis ground lug and connect it to eyelet #9. (S).

82(✓) Locate the green wire from eyelet 6 of the power supply board, and connect it to eyelet #6 of the amplifier board. (S).

83(✓) Locate the black wire from Q6E of the rear heat sink and connect it to eyelet #2 of the board. (S).

84(✓) Select the *hooked* green wire from Q6C, and connect it to eyelet #8. (S).

85(✓) Locate the shortest of the straight green wires protruding from the heat sink (from Q6B) and connect it to eyelet #3. (S).

86(✓) Locate the green wire with the right-angle bend from lug Q5C and connect it to eyelet #4. (S).

87(✓) Select the remaining shorter green wire from Q5B and connect it to eyelet #5. (S).

88(✓) Connect the remaining long green wire from lug Q5C to the red lug of C9. (S-3).

89(✓) Prepare a 6″ green wire and connect one end to the red lug of C11. (S-3). Tin the other end and connect it to eyelet #10 of the right hand board. (S).

90(✓) Prepare another 6″ green wire and connect one end to lug #4 of the output terminal strip. (S-2). Tin the other end and connect it to eyelet #1 of the *nearest* amplifier board. (S). Be careful not to touch the coil insulation on C7L with the soldering iron.

91(✓) Prepare a 7″ red wire and connect one end to lug #1 of the output terminal strip. (S-2). Tin the other end and connect it to eyelet #1 of the left hand amplifier board. (S).

92(✓) Prepare a 3″ green wire and connect one end to the red lug of C7L. (S). Tin the other end and connect it to eyelet #7 on the *nearest* amplifier board. (S).

93( ) Prepare a 4½″ red wire and connect one end to the red lug of C7R. (S). Tin the other end and connect it to eyelet #7 of the left hand board. (S).

94(✓) Separate the two wires at the end of the line cord for about 2″, and use a pencil to mark the cord about 2½″ from the end. If necessary, strip ¼″ of insulation from each wire, twist the separate strands together, and tin the ends to prevent fraying. Bend the cord sharply back on itself at the pencil mark, and squeeze the bend with pliers to form a sharp "V". Install the strain relief at the V as shown in Detail C, with the small end of the relief nearest the bare wire ends. Use pliers to squeeze the two halves of the strain relief together around the wire, to partially shape the wire before insertion. Then grasp only the larger diameter part of the relief with the tips of the pliers as shown, squeeze it fully closed and insert the bared wire ends and the strain relief from outside the chassis through the hole below the fuse holder. The relief will snap into its locked position when fully inserted.

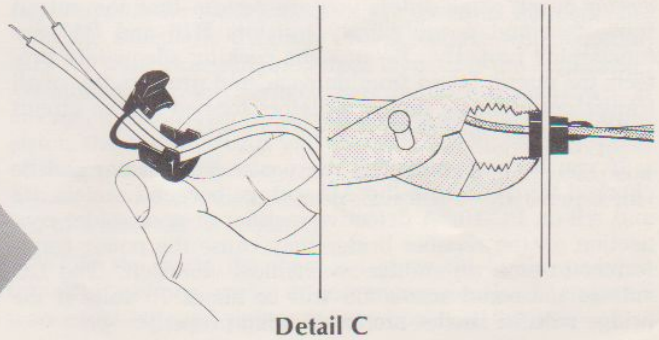
95( ) Connect one of the conductors of the line cord to the tip of the fuse holder. (S). Connect the other conductor to lug #5 of the power switch. (S).

This completes the circuitry of your Stereo 80. Insert the fuse into the fuse holder. Install the two black nylon head screws in terminals 2 and 3 of the output terminal strip, and the red screws in the outside terminals 1 and 4. Spade lugs have been included to attach to your speaker wires in order to provide a more secure speaker connection. Twist the ends of stranded speaker wire together first, and tin them to avoid fraying, and then crimp the lugs around the bared ends with pliers before soldering the lugs in place.

Before hurrying to try out your amplifier, take a few moments to check your work. Be sure there are no unattached wires and no unsoldered connections. The *center* lug of the 3-terminal strip near the power switch will have *no connection*. With a pair of diagonal cutting pliers, clip off any excessive stubs of wires to make a neat job. Pay particular attention to the power switch, so that there will be no possibility for leads to touch any but the correct lug. Also check the 4 lugs on the output terminal strip, to see that these wires do not touch the chassis. Make sure the solder lugs on the heat sinks do not project at all above the top of the heat sinks, and that their connections do not touch the heat sinks.

Now turn the chassis over and shake out any bits of wire or solder. Check to see that the power transformer leads, and the twisted pairs of input leads will not interfere with the turned-under edges of the cover, and then slide the cover in place. The perforated metal edges stay inside the chassis. Turn the unit over, and secure the cover with the 4 self-tapping screws through the holes along the edges.

If you have not already done so, *read the "Operating Instructions" before turning the amplifier on.* Remember to connect the input and output leads to the amplifier before the power is turned on.



Detail C

IN CASE OF DIFFICULTY

Your Stereo 80 should function properly after assembly, but sometimes a wiring error, poor solder connection, or defective component may require trouble-shooting. Because 90% of the difficulties which are encountered in kit-built units can be attributed to incorrect wiring or a poor solder connection, it is strongly recommended that you ask someone else to check your wiring against the pictorial diagram, as frequently one person will make the same error twice.

Your Stereo 80 has been designed to provide exceptional accessibility for the serviceman, but the average kit-builder should confine his servicing to the basic suggestions given here, after checking to make sure the fuse is intact. Audio transistors, unlike tubes, cannot be easily checked locally for any other than gross defects, and even this should be left to the qualified technician. For this reason your Stereo 80 is considered to have "no user-serviceable parts inside".

Each of the amplifier circuit boards and all 4 power transistors have been tested to assure that they meet specifications prior to shipment, so routine trouble-shooting can eliminate these as the *source* of the trouble, although they could have been subsequently damaged. You should, however, examine the back of each circuit board closely to make sure there are no solder splashes, and be sure that no solder has been allowed to flow into the holes around the leads of power transistors mounted on the heat sinks.

Check the connections at each eyelet along the edge of the circuit boards. Sometimes a connection which appears solid between the eyelet and the wire will not have a smooth flow of solder from the eyelet to the circuitry on the board. If a vacuum tube voltmeter is available, you should check each eyelet against the voltage chart on the schematic diagram. A deviation greater than 10% indicates a possible error or component failure.

You may be able to isolate a fault in one amplifier channel by removing the wire to one of the amplifiers from the red lug of the capacitor C9. *Turn off the amplifier before you make or break any connections.* If the other channel then functions normally, the disconnected channel is suspect.

In the event of difficulty with one of the channels, this circuit board assembly and related heat sink can be removed and returned to Dynaco for test and service while the rest of the amplifier continues to function monophonically. The 10 wires should be unsoldered at the "far end" for safety so that no unattached wires will be left in the amplifier. If you wish, the wires may be unsoldered from the assembly, and each insulated with electrical tape.

Because the assembly is light in weight, it may be shipped by air if desired, since shipping time accounts for a large part of the necessary service delay. *Do not return the circuit board alone* unless you are *certain* that the output transistors and power supply resistors R16 and R17 are functioning properly. Be sure the packing adequately protects the circuit board from damage, and protects the small transistors with the finned radiators located on the circuit board, *so that their leads will not be crushed.*

If you have a voltmeter, the power transformer can be checked by measuring the AC voltage between eyelets #8 and #9 on PC-19. A defective rectifier or poor solder connection on the rectifier bridge may cause the power transformer to emit an audible mechanical vibration. The DC voltage measured across C9 will be about 75 volts if the bridge rectifier diodes are functioning properly.

Beyond the most rudimentary checks, servicing of transistorized equipment should be left to the qualified technician. The Stereo 80 needs no maintenance in normal use, and there are no adjustments required during the life of the amplifier. Improper servicing can impair its performance or damage it, so it is very important that the technician familiarize himself with the Circuit Description and with the Service Information which follows, before proceeding. Unless you are confident that a local repairman has the specialized knowledge and equipment for servicing high quality solid state audio equipment, *factory service is strongly recommended.*

SERVICE INFORMATION FOR THE TECHNICIAN

(FOR QUALIFIED PERSONNEL ONLY)

Before attempting to service the Stereo 80, be sure to read the circuit description in the front of this manual, as well as the preceding section, "In Case Of Difficulty". Some of the amplifier's unique features are not immediately apparent when examining this essentially simple circuit. A systematic check of voltages and signal paths, based on an understanding of the functioning of each section, will lead to a rapid diagnosis of any malfunction.

Each of the four screws which secures the cover is located along the edge of the chassis. All of the numbered test points are located along the edges of each circuit board.

There are three parts to the circuit. One is the power supply. The other two are essentially identical audio amplifiers. Capacitors C9 and C11 provide power supply filtering and decoupling; and there is an output coupling capacitor C7 for each channel.

There are certain general precautions to be observed in servicing any transistorized equipment:

1. Never make circuit changes (connections or disconnections) of any kind when the amplifier is turned on.
2. Be particularly careful not to short any transistor leads to each other or to the chassis when the power is on.
3. When using test equipment, you must avoid transient voltage peaks and excessive test voltages.
4. Exercise caution when soldering and unsoldering transistor and diode leads to avoid excessive heat.

Amplifiers

The left and right audio channels are electrically identical. Each amplifier has two basic sections. The direct-coupled pair Q1 and Q2 is the Class A amplifier-driver with a DC feedback loop from the second emitter to the input base. Audio signals at the input base of Q1 are amplified and appear at the collector of Q2 to drive the four-transistor Class B power output section.

Q3 and Q4 are a complementary-symmetry driver directly coupled to Q5 and Q6 output power transistors. The Class B section provides a power gain, but no voltage gain. The input junction of Q3 and Q4, and the output junction of Q5 and Q6 swing together through the signal cycle. The ability of the output junction to follow the input junction (and the consequent linearity of this section) depends on the feedback path from the collector of Q6 to the emitter of Q4. Variations at Q4 emitter compared to its base potential will create a corrective signal for Q6, which makes the output follow the input.

Diodes D2 and D3 are in this feedback path, in a direction which would not be conductive (breaking the feedback path) were it not for the forced current through bleeder resistors R16 and R17. When the current in Q4 reaches that in R16 and R17, the diodes D2 and D3 no longer conduct, and the feedback path is broken. Simultaneously D1 starts conducting and makes a short circuit between the input of Q3 and Q4, and the output of Q5 and Q6.

Thus when the current demand in the feedback loop exceeds the limit determined by the bleeder resistors, the ability of the circuit to drive is restricted, and excessive currents cannot be induced in Q5 and Q6. The action of D1 short circuits the drive from Q2, reducing the drive until the cause of the high current demand is corrected. Thus an excessive drive signal, or too heavy a load on the output, which would require excessive current, switches the circuit to a configuration which prevents damaging current flow through the output and driver transistors.

Trouble shooting the amplifiers

Any signs of scorched resistors or wire should be a basis for further investigation. If either R13 or R14 is burned, or smokes when the amplifier is on, then at least one of the transistors Q5 or Q6 and possibly Q3 or Q4 has been damaged, and replacement will be required. It must be emphasized that *if one of the transistors in the Class B section (Q3, Q4, Q5, Q6) is defective, the other three must be tested before proceeding further* to avoid possible repetitive breakdown. Resistors R16 and R17 on the power supply board normally get hot because of the reference bleed current. If only one of the pair is hot, Q5 or Q6 may be shorted, or D2 or D3 may be open. Heat observed under no signal conditions indicates excessive bias drop or oscillation (either internal, or from the source).

The voltage at the positive terminal of C7 should be about 36 volts (one half of the supply voltage). If this voltage is far off value, this can be a sign of trouble in one or more of the Class B transistors, and all should be checked.

If the voltage at the input bases of Q3 and Q4 is significantly different (more than 1.5 volts) from the voltage at C7, the voltage at the other end of C4 should be checked to determine if something is wrong in the Class A section, Q1 and Q2. A fault in either of these transistors can change the voltage at the collector of Q2 (input of C4), and this can be reflected in an incorrect potential at the bases of Q3 and Q4, which is further reflected in the junction of Q5 and Q6 (the positive terminal of C7). Voltages at either end of C4 may be inter-related when C4 is in the circuit. If one end of C4 is lifted, the voltage deviations from normal at either end will indicate whether a fault lies before or after C4.

It is unlikely that all voltages in the audio section are correct if there is no signal. However, if this condition occurs, it is most likely an open input capacitor C1, or coupling capacitors C4 or C7, or a shorted C2.

A signal which has some distortion, or is limited in power output, is more difficult to diagnose. See the section relating to performance tests. This requires a distortion analyzer and an oscilloscope to check the signal, and then routine signal tracing should locate the fault.

Checking transistors

An ohmmeter is all that is required to locate a transistor which has failed. Small transistors must be removed from the circuit board for test. The power transistors need not be removed from the heat sinks, but the wires to their terminals must be detached for measuring. All transistors can be considered (for this test procedure) to be two diodes connected in series with common elements tied together. The junction point represents the base of the transistor. The identification of the larger power transistors is shown in the photograph of each heat sink. The smaller ones, observed from the bottom, have the collector, base and emitter arranged counter-clockwise, with the collector attached directly to the case.

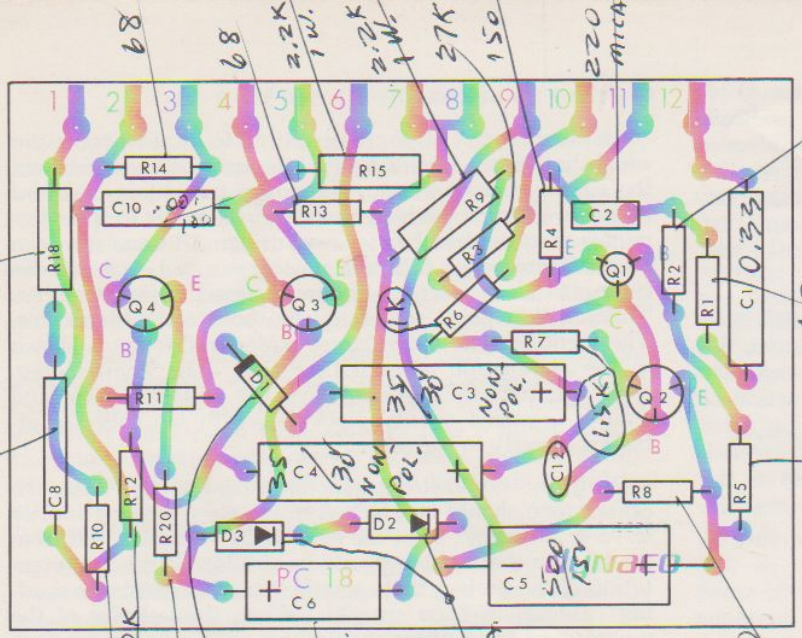
With one ohmmeter probe connected to the base, the other probe should be touched to the collector and emitter in turn. Readings from the base to the collector, and from the base to the emitter should be similar. With one orientation of the probes, there should be a high resistance reading (almost an open circuit). When the polarity of the probes is reversed, there should be a relatively low reading. The high reading will appear with one orientation of the probes for a pnp transistor, and with the opposite orientation for an npn transistor. Then the ohmmeter should be connected from collector to emitter, and a high resistance (almost open circuit) should be read, regardless of the orientation of the probes. If all of these qualifications are met, the transistor does not exhibit any gross defects. Qualitative evaluation of acceptable transistors requires equipment beyond the scope of local service facilities.

In similar fashion, diodes can be checked by verifying that they have a high resistance in one direction, and low resistance in the other.

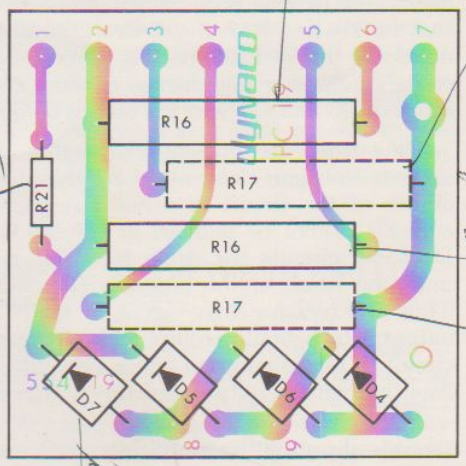
When replacing transistors, the small ones with the finned radiators should have the radiators transferred to the replacement. The silicon grease between transistor and radiator should be transferred to the new transistor. Be careful to insert the leads into the proper eyelets. Do not use excessive heat on the leads—let the heat go to the eyelet instead. When replacing the power transistors on the heat sinks, maintain the mica insulator between the transistor and the heat sink. Spread some of the silicon grease, which is a heat transfer compound, between the mica insulator and the transistor, as well as between the heat sink and the insulator. Be sure to use the nylon insulators around the mounting screws.

When making replacements, standard types can be used provided they are screened beyond the manufacturer's routine specifications. This is necessary because transistors of a given type vary far more widely than do tubes. The requirements for each transistor are given in the parts list with the schematic diagram. No screening will be necessary for transistors obtained from Dynaco if the application (Q-number) or the Dynaco part number is specified. If emergency needs require substitution of an unscreened transistor, the audio circuits will function but the effectiveness of the protective circuitry may be somewhat reduced. The Dynaco audio circuit has been designed so that no matching of transistors is required.

While the parts list does not show all of the possible transistor options, under no circumstances should unlisted transistors be used unless factory-approved in advance.



PC-18



PC-19

COMPONENT VALUES

All resistors are ½ watt, 5% unless otherwise specified.

		PART#
R 1	4,700 ohms	113472
R 2	4,700 ohms	113472
R 3	27,000 ohms	113273
R 4	150 ohms	113151
R 5	100,000 ohms	113104
R 6	1,000 ohms	113102
R 7	1,500 ohms	113152
R 8	330 ohms	113331
R 9	2,200 ohms, 1 watt	116222
R10	1,000 ohms	113102
R11	10,000 ohms	113103
R12	10,000 ohms	113103
R13	68 ohms	103680
R14	68 ohms	103680
R15	2,200 ohms, 1 watt	116222
R16	400 ohms, 7 watt, 5%	120401
R17	400 ohms, 7 watt, 5%	120401
R18	4.7 ohms, 1 watt, 10%	125040
R19	0.47 ohms, 2 watt, 10%	128004
R20	3.3 ohms	103030
R21	68 ohms	103680
C 1	0.33 mfd	263334
C 2	220 pf mica	245221
C 3	35 mfd, 30v., non-polarized	283366
C 4	35 mfd, 30v., non-polarized	283366
C 5	500 mfd, 15v.	283501
C 6	50 mfd, 10v., non-polarized	282506
C 7	5000 mfd, 80v.	284508
C 8	0.1 mfd	264104
C 9	5000 mfd, 80v.	284508
C10	0.001 mfd, 100v.	244102
C11	1000 mfd, 100v.	284108
T 1	Dynaco power transformer	464020
S 1	DPDT lighted switch	334001
F 1	fuse 2 amp slo-blo	342020
F 2	fuse 1 amp slo-blo (alternate)	342010
L 1	114 inches of #16 insulated wire	319913

			PART#
D 1	zener diode, 5.1 volt, 5%, 400 mw		540405
D 2	silicon diode, 0.8 volt max. drop @ 100 ma.		544015
D 3	silicon diode, 0.8 volt max. drop @ 100 ma.		544015
D 4	silicon diode, 3 amperes, 200 prv.		544322
D 5	silicon diode, 3 amperes, 200 prv.		544322
D 6	silicon diode, 3 amperes, 200 prv.		544322
D 7	silicon diode, 3 amperes, 200 prv.		544322
Q 1	40233	100-250 Beta	572683
Q 2	2N5320	140-260 Beta, 90 V_{cer}, r=5KΩ	572002
Q 3	2N5320	100-200 Beta, 90 V_{cer}, r=5KΩ	572001
Q 4	2N5322	100-160 Beta, 90 V_{cer}, r=5KΩ	562671
Q 5	2N3055	17-25 Beta @ 3 A, 90 V_{cer}, r=200Ω	571844
Q 6	2N3055	17-25 Beta @ 3 A, 90 V_{cer}, r=200Ω	571844

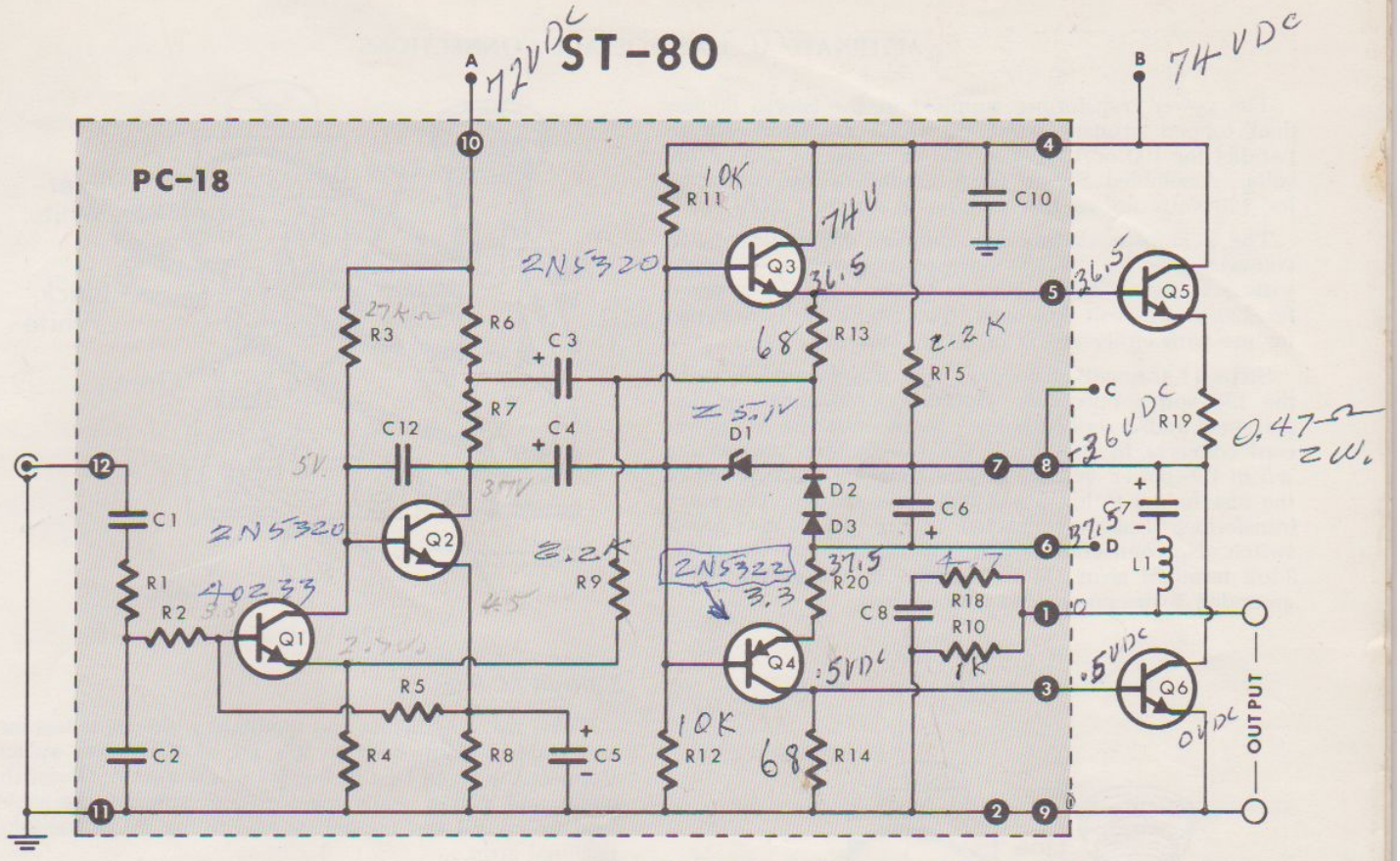
VOLTAGE TEST POINTS

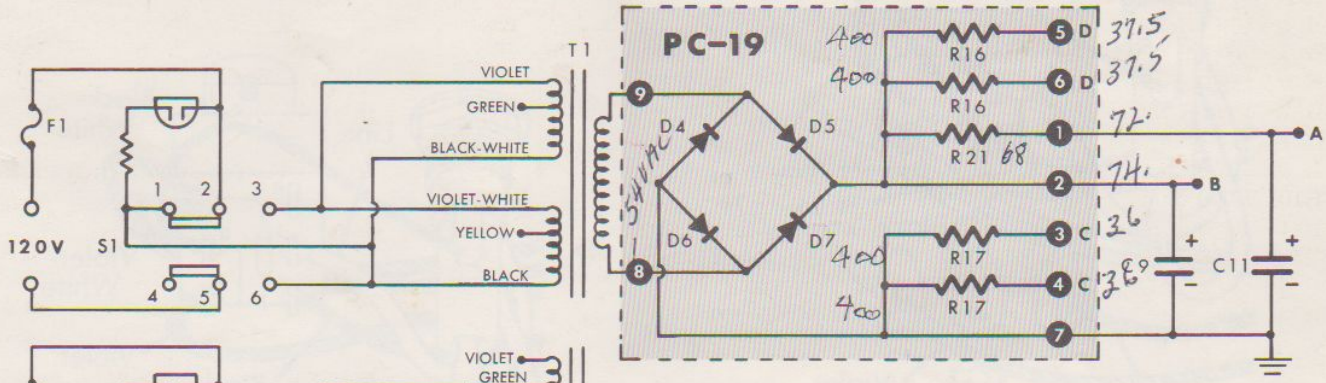
Measured with VTVM at rated AC line voltage, 8 ohm load, shorted input. All voltages are DC unless specified AC.

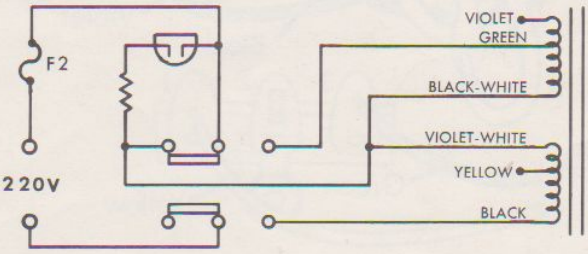
PC-18		*PC-19*	
#1	0	#1	72
#2	0	#2	74
#3	<0.5	#3	36
#4	74	#4	36
#5	36.5	#5	37.5
#6	37.5 } 1.4 to	#6	37.5
#7	36 } 1.6*	#7	0
#8	36	#8 }	54 AC*
#9	0	#9 }	
#10	72		
#11	0		
#12	0		

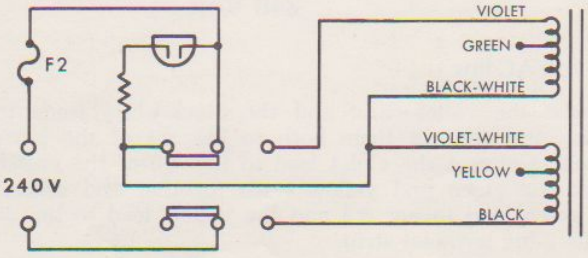
*Measured between eyelets located on circuit board edge

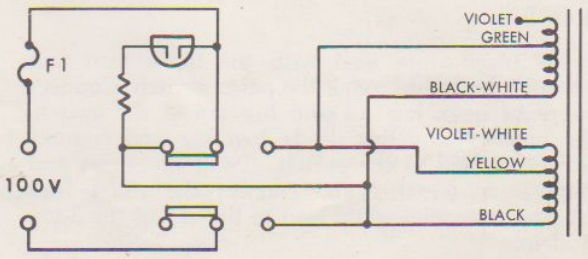
ST-80











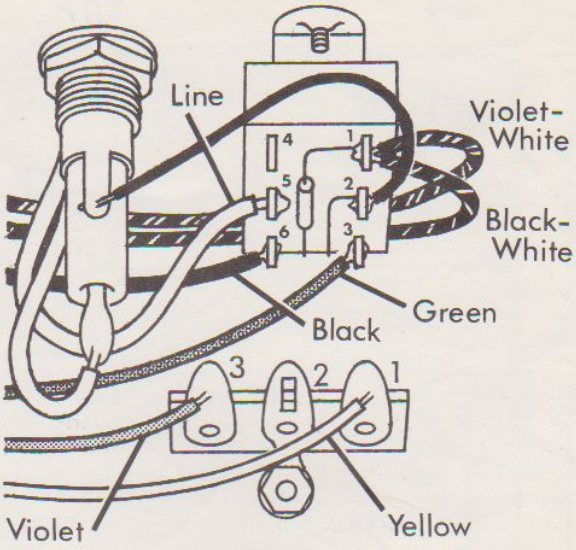
SCHEMATIC DIAGRAM

ALTERNATE AC LINE VOLTAGE CONNECTIONS

The power transformer supplied in the Stereo 80 has dual tapped primary windings which are connected in parallel for 100 or 120 volts, and in series for 220 or 240 volts. Assembled Stereo 80/A amplifiers are connected for 120 volts unless this manual is stamped "240 volt".

The 2 ampere slo-blo fuse supplied for standard 120 volt wiring or for the 100 volt option should be replaced with a 1 ampere slo-blo fuse when the amplifier is wired for 220 or 240 volt AC lines. The Stereo 80 is designed for use with either 50 Hz or 60 Hz current.

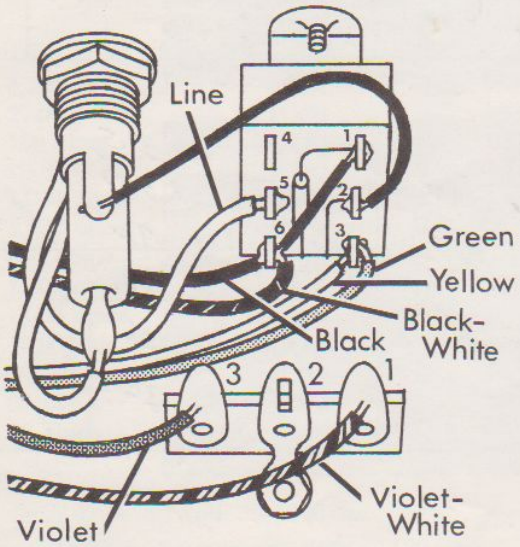
Steps 11 through 14 on page 9 of this manual describe the 120 volt connections. Optional connections are diagrammed and described below. In *all* cases the AC power cord connects to the tip of the fuse holder, and to lug #5 of the power switch. A wire connects the side lug of the fuse holder to lug #2 of the power switch. The *black* transformer lead is connected to lug #6 of the power switch. No connection is normally made to lug #2 of the 3-lug terminal strip. It is provided in the event that a grounded 3-wire power cord is to be used.



220 Volt

220 volt AC line

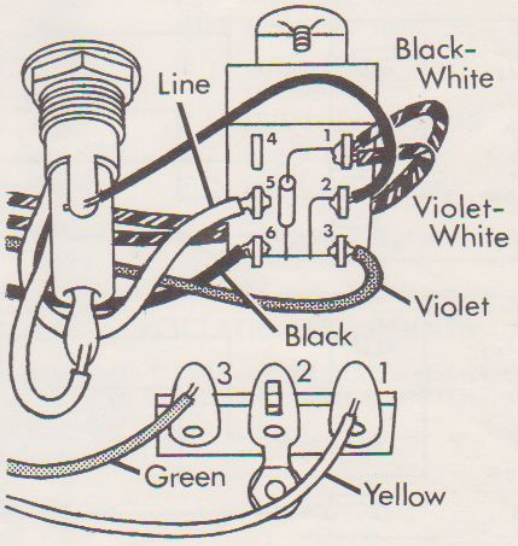
Twist the violet-white and the black-white leads together and connect them both to lug #1 of the power switch. Connect the green lead to lug #3 of the switch. Twist the violet and yellow leads together and connect the violet lead to lug #3 and the yellow lead to lug #1 of the 3-lug terminal strip.



100 Volt

100 volt AC line

Twist the black-white lead with the black lead and connect them both to lug #6 of the power switch. Connect a 1¼" wire between lug #1 and lug #6 of the switch. Twist the green and yellow leads together and connect them both to lug #3 of the switch. Twist the violet and violet-white leads together and connect the violet lead to lug #3 and the violet-white lead to lug #1 of the 3-lug terminal strip.



240 Volt

240 volt AC line

Twist the violet-white and the black-white leads together and connect them both to lug #1 of the power switch. Connect the violet lead to lug #3 of the switch. Twist the green and yellow leads together and connect the green lead to lug #3 and the yellow lead to lug #1 of the 3-lug terminal strip.

FACTORY SERVICE AND WARRANTY

The Stereo 80 has been designed to provide reliable, trouble-free operation for a long period of time when it has been properly assembled and installed. It incorporates unprecedented circuit protection against failure caused by abnormal operation. So conservative is its design that it will deliver specified performance with the maximum variations in AC line voltage (110 to 130) permitted in normal use.

Despite these precautions, service may sometimes be needed, and you should be sure to return the warranty card promptly to validate your warranty. Dynaco maintains a complete factory test and repair facility for which no return authorization is required. Unless specifically authorized in advance by the factory, Dynaco cannot assume any responsibility for local service charges.

A factory assembled Stereo 80/A is warranted to be free of defects in materials and workmanship for a period of one year from the date of purchase. During the warranty period, no charge will be made for testing or servicing any defective factory assembled Stereo 80/A returned to Dynaco.

All parts used in a Stereo 80 kit are warranted to be free of manufacturing defects for one year from the date of purchase. Defective parts will be replaced promptly at no charge upon receipt for inspection at the factory. After the warranty period has passed, Dynaco will supply any non-standard parts at net prices. Standard parts can generally be obtained from a local electronics supply store.

The warranty does not apply to other than the original purchaser, nor to units which have been subjected to neglect, abuse, misuse or accident.

If you suspect a defect in the power transformer, *the leads must be unsoldered, not cut* for its return. The warranty on the transformer is void if the leads have been cut too short for re-use.

If the kit has been completely assembled, yet does not function properly, or if difficulty develops after some use, Dynaco will service the Stereo 80 for a *maximum* charge of $12.50. After one year, assembled units and kits are subject to the same charge, plus the cost of parts.

As described elsewhere in this manual, the circuit board assembly and related heat sink can be removed and returned for service at the factory. The service charge for each assembly will be a maximum of $7.50, plus the cost of out-of-warranty parts. The service charge for two such assemblies returned together will not exceed $12.50 plus parts.

Once a complete Stereo 80 has been serviced by Dynaco for which a regular service fee was charged, a 90 day service warranty is given. No service warranty can be extended for individual circuit board assemblies.

Factory service is not available for kits which are incompletely wired, or kits wired with other than rosin core solder, or units physically or electrically modified or used contrary to the *Operating Instructions*, without prior factory authorization.

Technical assistance which may facilitate local diagnosis or service is available at no charge. Such assistance depends entirely on your description of the difficulty and any tests performed. Be as complete as possible.

The serial number of the amplifier which is on the cover of this manual should be mentioned in all correspondence, and whenever a part or the unit is returned to the factory.

When shipping the amplifier to Dynaco Inc. for service, include a note listing the symptoms, the name and address of the sender, and the serial number of the unit. Pack the unit securely to withstand the abuses of handling in transit. The complete original packing, if properly used, and in good condition, will be sufficient for Express or U.P.S. shipment. *PARCEL POST IS NOT A SAFE METHOD OF SHIPMENT, AND SHOULD NOT BE USED.* If no alternative is available, the unit must be double-packed with substantial packing between the cartons, and *it must be insured.*

Shipments should be made by insured prepaid Express or Motor Freight. Serviced units will be returned by Express or United Parcel Service, *collect* for all transportation and service charges, unless these charges have been prepaid.

Dynaco reserves the right to limit the service facility or the established service fees to one year from the date of purchase. Dynaco assumes no liability or responsibility for damages or injuries sustained in assembly or operation of this equipment.

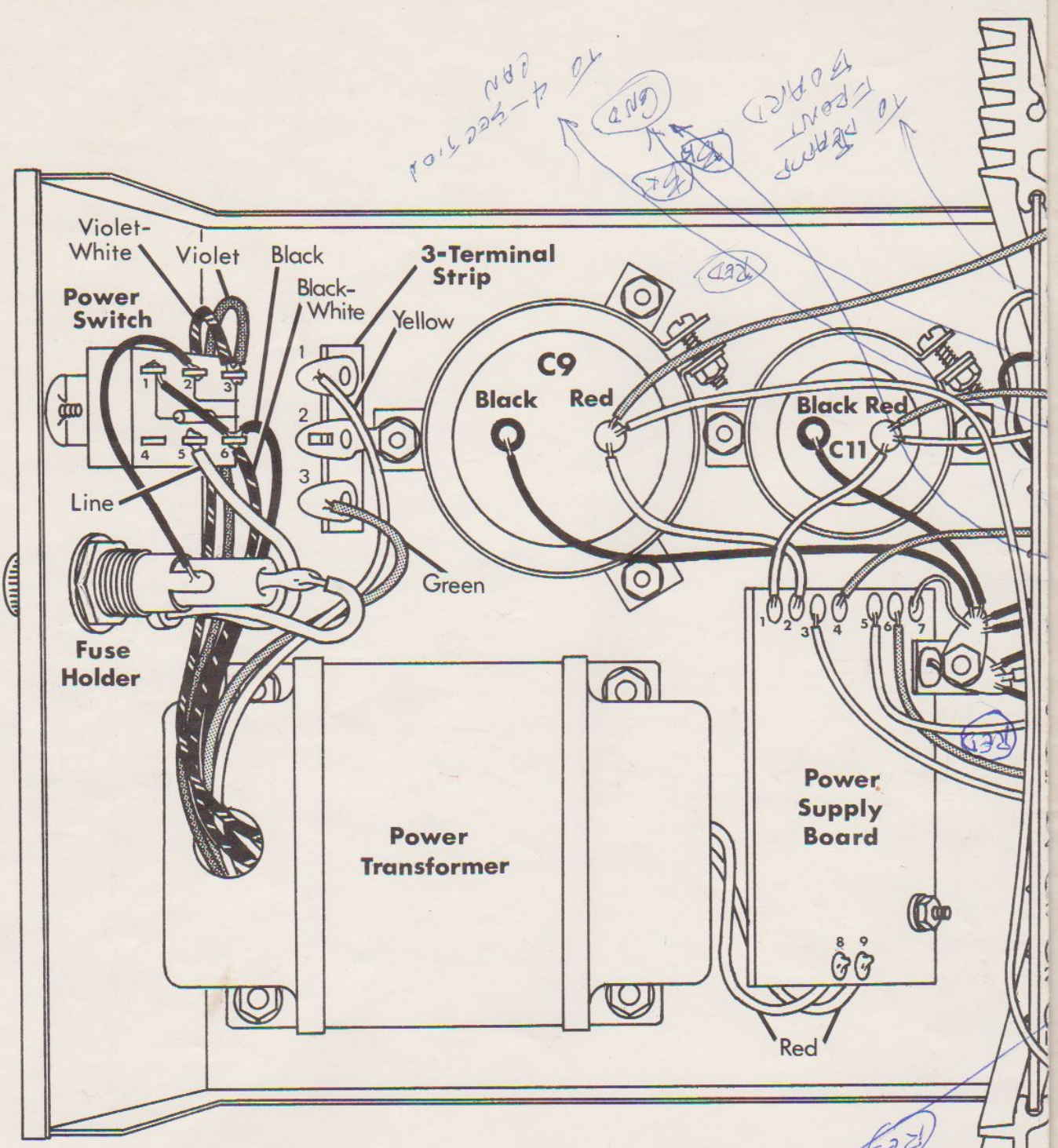
PARTS LIST

Parts of similar type which do not change performance will sometimes be included as a matter of expediency. This will account for slight variations in value and appearance.

		PART #
1	Chassis	711120
1	Chassis cover	711220
1	Transformer, power	464020
2	Circuit board assembly, amplifier, PC-18	557018
2	Heat sink, amplifier, with 2 mounted transistors	964080
1	Bracket, 1½" diameter	717002
3	Bracket, 2" diameter	717003
1	Capacitor, 1000 mfd @ 100 volts	284108
3	Capacitor, 5000 mfd @ 80 volts	284508
2	Coil, #16 heavy wire	319913
1	Fuse holder with hardware	341001
1	Line cord	322092
2	Resistor, 0.47 ohm, 2 watt, 10% (yellow-violet-silver)	128004
1	Switch, power	334001
1	Terminal strip, 4 screw	374005
1	Terminal strip, 3 lug	373001
1	Wire, hook-up, black	
1	Wire, hook-up, green	
1	Wire, hook-up, red	
1	Card, warranty	
1	Manual, instruction	

		PART #
Envelope #1		
4	Foot, rubber	859001
1	Fuse, 2 ampere Slo-Blo	342020
30	Lockwasher, #6	617305
2	Lug, ground	639308
4	Lug, spade	620308
8	Nut, hexagonal, #4-40	614245
23	Nut, hexagonal, #6-32	614355
10	Screw, machine, #4-40 x ¼"	611245
23	Screw, machine, #6-32 x ½"	611385
2	Screw, nylon head, black	611360
2	Screw, nylon head, red	611370
12	Screw, self-tapping, #6-32 x ⅜"	613365
2	Socket, input	355001
1	Strain relief, plastic	895001
Envelope #2		
1	Circuit board, power supply, PC-19	554019
2	Bracket, right-angle	717011
4	Diode, rectifier, 3 amp, 200 prv	544322
1	Resistor, 68 ohm, ½ watt, 10% (blue-gray-black)	112680
4	Resistor, 400 ohm, 7 watt, 5%	120401

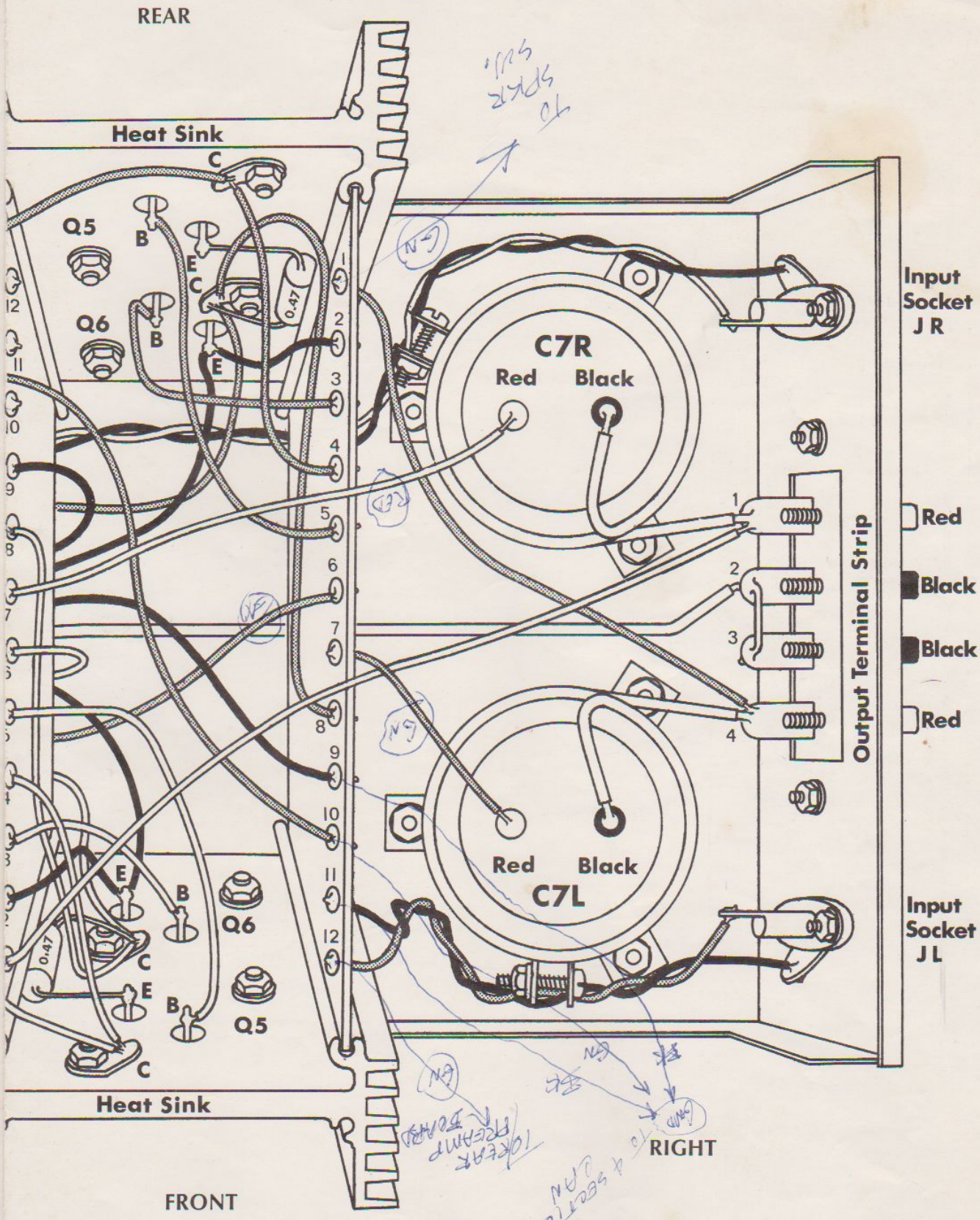
Do not remove the insulating covering on the four large capacitors (C7 left & right, C9 & C11).



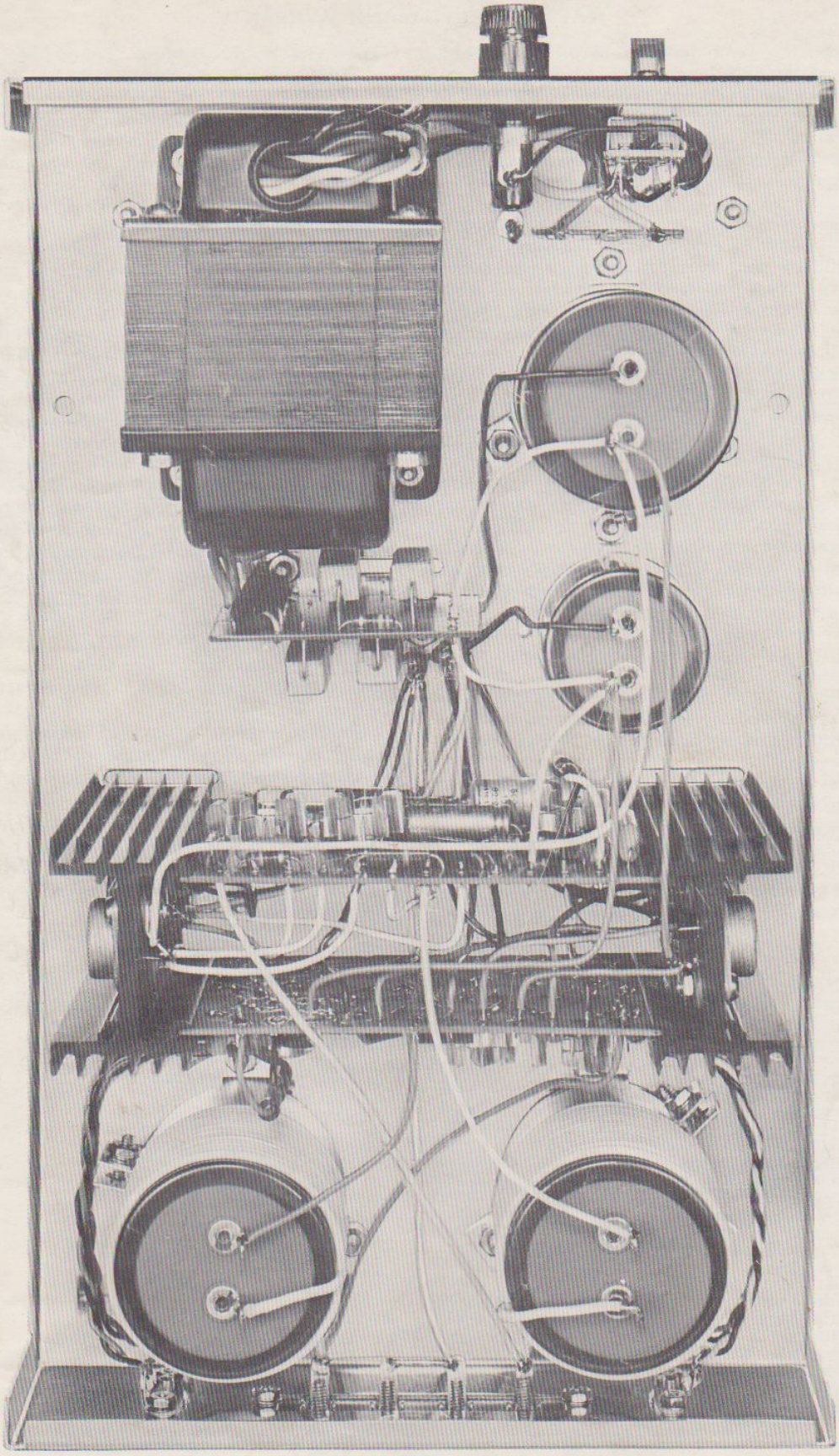
LEFT

WIRING SHOWN FOR 120 VOLT AC LINE

PICTORIAL


REAR
Heat Sink
C
Q5
B
E
C
0.47
Q6
B
E
C7R
Red
Black
Input Socket J R
Output Terminal Strip
Red
Black
Black
Red
C7L
Red
Black
Input Socket J L
Q6
Q5
Heat Sink
RIGHT
FRONT

DIAGRAM



Printed in U.S.A.