

THE hafler POWER AMPLIFIER



INSTRUCTIONS for ASSEMBLY and OPERATION

CAUTION: IF THE FUSES BLOW,
SOME DISTORTED SOUND CAN BE
HEARD. THEREFORE IF AMPLIFIER
MALFUNCTIONS, ALWAYS CHECK
FOR BLOWN FUSES FIRST.

LM153
\$3.00

THE DAVID HAFLER COMPANY
5910 Crescent Boulevard, Pennsauken, New Jersey 08109

Please refer to this serial
number in all communications
regarding this equipment.

SPECIFICATIONS

Power Rating: Less than 0.025% total harmonic distortion at any power level up to 255 watts continuous average power per channel into 8 ohms at any frequency between 20 Hz and 20 kHz with both channels driven.

IM Distortion (SMPTE): Less than 0.007% from 1 watt to 255 watts into 8 ohms

Typical THD at 255 watts into 8 ohms: 1 kHz-0.002%; 10 kHz-0.007%

Frequency Response into 8 ohms: -3 dB, 0.5 Hz to 120 kHz at 1 watt
 ± 0.5 dB, 5 Hz to 40 kHz at 255 watts

Typical Channel Separation at 1 kHz: 60 dB

Signal to Noise Ratio: Exceeds 100 dB referred to 255 watts into 8 ohms, unweighted
Exceeds 90 dB referred to 1 watt into 8 ohms, A weighting

Input Impedance: 47,000 ohms

Input Sensitivity: 2.35 volts for 255 watts into 8 ohms; 0.145 volts for 1 watt

Damping Factor: 200 to 1 kHz into 8 ohms; 60 to 10 kHz into 8 ohms

Rise Time: 10 kHz, 80 volts p/p square wave, 10% to 90%: 2.5 us.

Slew Rate: 1 kHz, 120 volts p/p square wave: 45 V/us.

Semiconductor Complement: 27 transistors, 12 power Mosfets, 33 diodes, 8 zener diodes, one integrated circuit, one diode bridge.

Power Consumption: 240 VA quiescent; 1200 VA @ rated power into 8 ohms, 2 channels

Size: 7-1/4" high, 19" wide, 13" deep including handles

Net Weight: 45 lbs.

Shipping Weight: 49 lbs.

CAUTION: For continued protection, replace the power fuse only with the same type and rating as indicated.

WARNING: TO PREVENT FIRE OR SHOCK HAZARD, DO NOT EXPOSE THIS EQUIPMENT TO RAIN OR MOISTURE.

INTRODUCTION

The Hafler DH-500 is a two channel audio power amplifier designed to the very highest performance standards. It is available as a kit, or factory assembled. Its power rating of 255 watts per channel is very conservative, and it can deliver appreciably higher powers into impedances below the rated 8 ohms. You must be very cautious in the application of this amplifier, as its output capability is more than most speakers can safely tolerate. We urge you to read the "Operation" section of this manual so your speakers will be reasonably protected. The best protection is still common sense in choosing program levels which your speakers can tolerate.

The DH-500 combines power MOSFET technology with a uniquely simple and effective circuit which reduces all types of distortion at all power outputs, over the entire audio spectrum, to levels where the finest test equipment has great difficulty in measuring it. The DH-500 sets a new high in reliability and resistance to abusive operating conditions at such high powers. This is one of the direct benefits of the power MOSFET's ability to current limit under abnormal conditions.

Where the conventional bipolar transistor must be protected by special circuits from entering "thermal runaway" when it gets hot due to heavy signals, tending to get even hotter, the MOSFET self-corrects to reduce the current, and thus the heat under the same conditions. You thus gain the dual advantages of simpler circuitry and the elimination of one of the chief causes for distorted signals imposed on the music-the sound of the actuation of complex protective circuits.

The speed-measured as the slew rate-of the DH-500 delivers unmatched transient linearity, revealing the most delicate nuances of the music. In refining the basic Hafler MOSFET circuit the overall open loop gain was reduced by using more local feedback in the input stage. This required less compensation to stabilize the circuit, with the result that it was faster overall. With the built in bandwidth

limitation at the input, all other stages are free of any transient overload.

The fully complementary, symmetrical push-pull circuit is direct coupled throughout (except at the input). It uses all silicon discrete devices in a format which is directly related to the acclaimed Hafler preamplifier circuit. With its unconditional stability into virtually any load, and its enormous power capability, the result is complete freedom from listening fatigue. The longer you listen to this remarkable amplifier, the more certain you will be that you could not have made a better choice.

While modest in cost, through the elimination of frills and gadgetry, the quality is evident not only in the sound, but in the conservatively rated components. The oversized power transformer, the conservative operating levels of the MOSFETs, the computer-grade electrolytics totaling 40,000 microfarads, the enclosed relay, the use of film capacitors in signal circuits-all are evidence of the design efforts to achieve exceptional reliability simultaneously with state of the art sonics and specifications. So rugged is the DH-500 that it can deliver over 20 amperes into a short circuit!

For those with special power needs, the DH-500 can be adapted to monophonic operation, delivering in excess of 800 watts into 8 ohms, by installing the DH-502 input bridging kit.

Those who have chosen to build this amplifier from the kit will find the assembly instructions assume no technical ability other than how to make a good solder connection. Even that has been described for those who are new to the fun of kit building. Through pre-assembly and testing of the complete signal module, the performance of the kit has already been assured, for assembly involves little more than interconnection of the power supply and control elements. You can look forward to just a few hours of construction fun, to hear the finest audio amplifier yet produced.

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INSTALLATION

The DH-500 may be installed out of sight in many applications, where its power can be controlled by the AC switching of a preamplifier control unit. However, any high power amplifier may draw enormous amounts of current, so you should make sure your preamplifier has the switching capacity for the amplifier's needs, as well as any other equipment which it also switches. Inadequate switch current capacity may eventually render the switch inoperative .

The power switches in Hafler preamplifiers have been chosen for their high ratings, and have been tested and deemed suitable for normal home switching of the DH-500. However, if the amplifier is intended for operation at sustained high power levels, or where power switching is very frequent, or where the control unit must switch substantial additional current for other equipment, or if your control unit does not have the 15 ampere switching capacity, you should use the power switch on the DH-500, and connect it directly to the AC line. In such use, turn the amplifier on last, and switch it off first. This will avoid possible loudspeaker damage from turn-on transients generated by source equipment.

A power transformer of this size puts out a noticeable hum field, even though the special design of this transformer minimizes such radiation. If the amplifier is to be installed close to a record player, you should first check for freedom from hum pickup by the phono cartridge. Some cartridges are much more sensitive than others, and require more separation from the amplifier. Check at a relatively high volume setting, while swinging the tone arm throughout its arc. A few inches additional space will usually solve any problem.

Ventilation is most important! Unobstructed air circulation at the sides and back is important for long trouble-free life. A 3 speed fan operates at its lowest speed whenever the amplifier is turned on, and is automatically switched to higher speeds at the power output demands it. Air is drawn in at the sides, and expelled to the rear. With normal home music levels the cooling capacity is sufficient that the fan will rarely operate at other than low speed, where it is so quiet that your ear must be close to a vent to hear it.

The front panel is designed to facilitate mounting in a standard 19" rack. *Be sure all of the coverscrews are installed when the unit is supported by the front panel*

OPERATION

The AC power cord should be plugged into a source of 120 volts, 60 Hz, unless the amplifier is specially provided with the multi-voltage optional transformer. Press the power switch to the right to turn the amplifier on. A red pilot lamp in the power switch signifies that it is **on**. If it is not illuminated, the most likely cause is a blown AC line fuse. That is the single fuse close to the switch inside the chassis. However, since the amplifier uses a 15 ampere slo-blo fuse, and the typical home circuit is also rated at 15 amps, check that as well.

To avoid the turn-on transients generated in many control units, there is a 3 second delay before the relay connects the speakers. A few preamps may require a longer delay to avoid their internally generated turn-on pulses. Information on extending this turn-on delay is available from the company on request.

A standard 2-wire power cord was chosen in preference to a 3-wire grounded AC cord, because there is no significant current leakage in this design. Where local requirements dictate the need for a 3-wire power connection, a ground lug may be attached to the chassis adjacent to the AC line fuse holder.

If the pilot lamp should ever blink (about 2-3 times a second), this signifies that a protective thermal breaker has shut down the amplifier because of excessive heat sink temperature. The fan will be operating at its highest speed, and as soon as the heat sink temperature has declined, the amplifier will automatically return to normal operation.

Such an occurrence is extremely unlikely, and if the amplifier shuts down again and the lamp flashes, you should check for inadequate ventilation, or an excessive input signal, an extremely low load impedance, or an input which may have dangerous signal content (such as oscillation). Failing evidence of this, the fan or the amplifier may have malfunctioned. Because of the very effective fan cooling, any normal signal will not cause the amplifier to overheat.

At normal home use levels, the average power consumption is likely around 250 watts. The unit's efficiency is about 50%, so some full power tests may exceed the capacity of a 15 amp circuit. When performing tests, voltage losses due to long lines should be taken into consideration, or compensated for.

Loudspeaker Fuse Selection

The DH-500 is supplied with 2 ampere fuses in the speaker lines. This conservative value has been chosen for initial use because most high quality speaker systems cannot safely handle very high power levels, even though a high power amplifier invariably makes them sound their best. Since a substantial overload must continue for a few seconds before a fuse blows, a 2 ampere fuse will allow very high power peaks to pass without hindrance, yet will protect most speaker systems. Smaller fuses tend to blow too easily, and it is unlikely you will be using speakers with low power ratings with the DH-500. Larger fuse sizes may not adequately protect the majority of speakers intended for home listening.

If the manufacturer of your speakers recommends a specific fuse value for their protection, you should obtain 3AG type fuses of that value and substitute them for the ones supplied. The speaker fuses are included in the amplifier design solely for speaker protection. They do not protect, or affect, the amplifier's operation. A blown speaker fuse does not indicate malfunction—simply a higher than normal output signal. If the amplifier produces a low level distorted signal, a blown speaker fuse is the most likely cause.

We do not recommend the use of a slo-blo type fuse for speaker protection. If your speakers can handle the higher power levels safely, and you wish to install fuses of higher ratings, we suggest for the sake of the speakers—that you increase fuse size in 1/2 ampere increments. **THIS AMPLIFIER IS ABLE TO DELIVER SUBSTANTIALLY MORE POWER THAN MOST SPEAKERS CAN SAFELY TOLERATE.** *Therefore the Hafler Company cannot assume any responsibility for damage to the load (loudspeaker) because the choice of fuse six is in your hands.*

The 2 amp fuse, with an 8 ohm load, permits continuous power up to 32 watts, with peaks well above that. 2-1/2 amps passes 50 watts; 3 amps, 72 watts; 5 amps, 200 watts. We have included a pair of 5 amp fuses as alternates, for temporary use as spares; for testing the amplifier at very high power levels; and for operation into very low load impedances, 5 amps will pass 80 watts into a 4 ohm load. We suggest that you obtain additional type 3AG fuses of the

appropriate size for your speakers.

Loudspeaker Power Ratings

There are no U.S. standards for rating the power handling capabilities of loudspeakers. As a result the manufacturers' usual "music power" ratings, or suggested amplifier limits, are of only minimal help in determining safe operating levels with amplifiers which can deliver enormous amounts of power. On the other hand, some speakers, particularly tweeters, can also be damaged through the use of too small an amplifier if it is driven into sustained clipping. However, tweeters are also more vulnerable to high level signals which are not always noticeably loud to the ear (as from electronic music sources), so you may wish to separately protect the tweeters with fuses of lower rating. You must take into consideration the type of music, and the levels you like, to provide long term trouble-free operation of your speaker choice, when you have a very powerful amplifier like the DH-500.

If more than one pair of speakers will be connected to the amplifier, proper protection would dictate that each speaker be separately fused, since when they are operated in parallel, the combination of lower impedance and the higher power handling capacity would suggest a much larger fuse at the amplifier than would provide individual protection.

If full power tests are to be performed, particularly at low load impedances, fuse ratings above 10 amps may be required for the duration of the test.

CONNECTIONS

AC

The standard unit is intended for 120 volt, 60 Hz operation. If it is controlled by an AC switch on a preamplifier, the DH-500 power switch may be left on.

If your line voltage is other than that provided in the United States, be sure you have the alternate multi-voltage power transformer, and be sure it is wired for your mains voltage before you plug in the amplifier. The connections for other line voltages will be found in the back of this manual.

Input

Standard phono jacks are installed to accept conventional shielded cables, such as those supplied with your preamplifier. Be sure that the outer shield connection is secure, to avoid hum. The length of these cables (so as to permit remote location of the amplifier, if desired) is limited only by the output impedance of the preamplifier. If it is 1000 ohms or less, as with Hafler preamplifiers, cable lengths of up to 100 feet are permissible without loss of performance. Special low capacitance cables enable even greater distance between preamp and power amplifier. It is desirable to keep the left and right input cables close together throughout their length to minimize the likelihood of hum pickup. They should cross AC cords at right angles never running parallel to AC lines at close range.

For professional applications the phono inputjacks may be easily replaced with 1/4" phone jacks. Be sure, in that case, that they are grounded to the adjacent ground lug.

Output

The loudspeakers connect to the red and black 4-way binding posts. These are of a particularly heavy duty construction to handle the high currents which may be involved. They are spaced for double banana plugs, or you can connect stranded wire through the vertical hole in the shaft which is visible when the cap is unscrewed. To be certain that no strands of wire are unsecured, a tinned end, or a spade lug soldered to the wire is recommended.

Be sure to maintain correct speaker phasing by watching the lead identification in the hookup wire, and the identification of the speaker terminals. It is important that the "sense" of **one** speaker's connections match the others. If the speakers are out of phase, you will find that the sonic image has a "hole in the middle", and there will be a loss of bass. This will be most evident on monophonic material. Correct it by reversing the leads to one speaker.

Select speaker wire of sufficient size to preserve the high damping factor of the DH-500, Standard 18 gauge lamp cord is the minimum suggested, and is suitable for short distances. The next larger wire is #16. There are also a

number of specialty speaker cables preferred by perfectionists. If you have 4 ohm speakers, larger wire is recommended than for the typical 8 ohm speakers, too.

The black output terminals are connected to ground internally. The black terminals may be connected together (common ground) when in the normal stereo mode, to utilize headphone junction boxes, or other accessories employing a common ground system.

ASSEMBLY INSTRUCTIONS

There are three basic rules for success in electronic kit building:

1. Read the instructions carefully, and follow them in order.
2. Make **secure** solder connections which are bright and smooth.
3. Check your work carefully after each step.

The DH-500 amplifier is a versatile component with sophisticated circuitry which has been made remarkably easy to build by individuals with many years of experience in the design and engineering of the finest performing audio kits, and in the preparation of their manuals.

Kit building should be fun, and we are certain you will find this to be so. Assembly will be faster, easier, and more enjoyable if you have someone help you by reading the steps aloud, selecting the required parts, and preparing the necessary wire lengths in advance as you proceed. Fatigue increases the risk of error, so take a break rather than push to early completion. There are relatively few separate components in this design, to make it easy to pack everything away, if need be.

Your work area should have good lighting, the proper tools, and a place where the large pictorial diagram can be tacked to the wall within easy reach for checking. The tools should include:

1. A **40 to 60** watt pencil soldering iron with a 3/64" or smaller tip which reaches 700°F.
2. 60/40 (60% tin) ROSIN CORE solder, 1/16" diameter or smaller.
3. A damp sponge or cloth to wipe the hot tip of the iron.

It is important that the red terminals never be connected together when operating in stereo. Thus it is important that you carefully observe the proper connections when using a common ground device, to be sure there is no reversal.

In the special case where the amplifier has been internally modified to convert it to monophonic bridged operation, with the addition of the DH-502, then only one input jack is connected, and the output is taken only from the two red terminals. Such a "floating" connection must be maintained, with no connection to the black terminals.

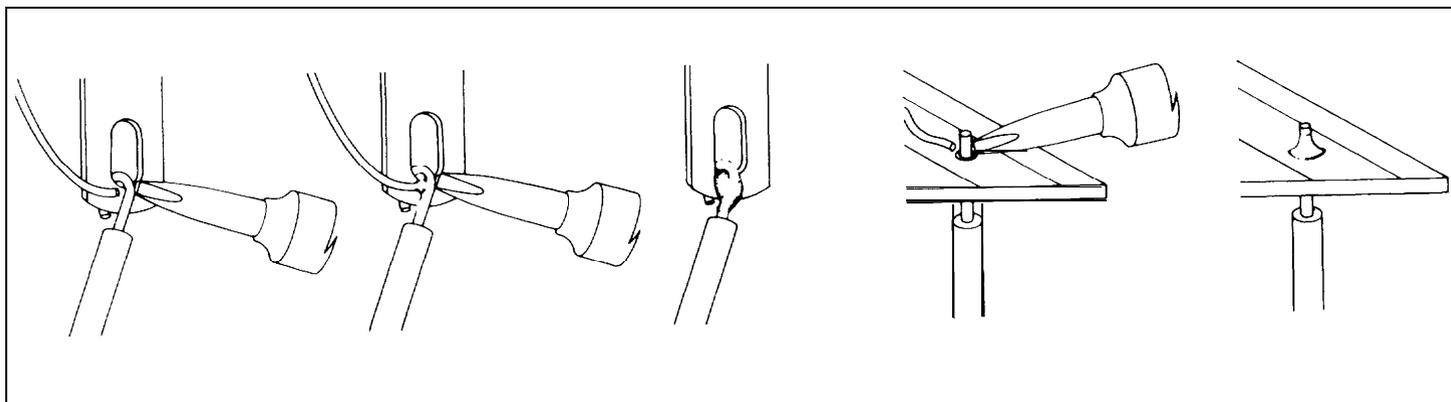
4. A wire stripping tool for removing insulation. This can be a single-edge razor blade, but inexpensive stripping tools are safer, faster and easier.
5. A medium-blade screwdriver (about 1/4" wide).
6. A #1 or #2 Phillips head screwdriver.
7. Needle-nose pliers (a long, narrow tip).
8. Diagonal or side-cutting small pliers.
9. Large "gas" or "slip-joint" pliers.
10. A 1/4" "Spin-tite" nut driver may be helpful, but is not necessary.

A soldering "gun" is *not* recommended. The unfamiliar user is more likely to damage the etched circuit boards with its higher heat potential and unbalanced weight. Also, because he may not wait long enough for it to reach operating temperature each time it is switched on, poor solder connections are more likely. Pencil irons are much lighter and easier to use, and there is no waiting time when solder connections follow in sequence, as in kit building. Make sure you have a holder for it, though, and always unplug it when you take a break.

Proper Soldering

There are four steps to making a good solder connection:

1. Make a good mechanical connection to hold the wire in position while heat and solder is applied.
2. Heat *the junction* of the wire and lug, or eyelet, with the bright, shiny tip of the iron.
3. After heating for a couple seconds, apply solder to the junction. It should melt immediately and flow smoothly around *both surfaces*.



4. Allow the connection to cool undisturbed.

Remember that the connection is made by the solder, not by mechanically attaching the wire to the terminal. Usually the wire is looped through the lug and crimped in place, but some prefer to just place it through the hole and rely on the stiffness of the wire to hold it while soldering. Eyelet connections, of course, are handled this way.

Good solder connections are essential for trouble-free, noise-free operation. A good solder joint does not require much solder around the conductors. Never “butter” partially melted solder on the joint, as it is useless. A good connection looks smooth and bright because the solder flows into every crevice when the parts are hot enough. The iron must have a bright, shiny tip to transfer heat easily to the junction. That’s why the damp sponge should be used frequently to wipe the tip, and occasionally you must add a small amount of solder to the tip, too. If a connection is difficult to heat, “wet” the tip with a small blob of solder to provide a bigger contact surface to the joint. Once the solder flows around the conductors, any movement must be avoided for a few **seconds** to allow a good bond. When cool, check the connection by wiggling the wire. If in doubt, or if the connection is not shiny, re-heat the joint. Excess solder may be removed from a connection by heating it and allowing the solder to flow onto the iron, which is then wiped on the sponge.

ALL SOLDER USED MUST BE ROSIN CORE

Never use acid core solder or any separate flux in electronic work. Silver solder is also not suitable. If in doubt about unmarked solder, always obtain a fresh supply of rosin core solder. We recommend 60/40 for easiest use. Do not confuse it with 40160, which is harder to melt.

The general procedure is to use a hot iron for a short time to heat a connection, then add solder with the iron still in contact. Remove the solder once it flows, and then remove the iron. A cooler iron applied for a longer time is more likely to damage components, or lift the copper circuit pattern from the boards. A break in the etched circuit can be mended by simply soldering a small piece of wire across it. Do not allow much build-up of solder on the tip of the iron, or it may fall into adjacent circuitry.

When soldering to an eyelet or hole on the board, insert the wire from the components side, and apply the iron to the bottom, leaving some bare wire exposed so that you can see that the eyelet is then filled with solder for a secure bond. A round wooden toothpick is suggested so that you can heat and clear an eyelet of solder if it hinders your inserting the wire. Some builders prefer to clear every eyelet first with a touch of the iron and toothpick. Others connect the lead by bringing it up to the center of the eyelet on top of the board, applying the iron from the bottom of the board, and pushing the lead in as the solder in the eyelet melts. If the wire has first been “tinned,” usually no additional solder is necessary, but it is a good practice to push the wire through, and then back it up a bit, to be sure solder fills the eyelet. On the bottom of the board, make certain a bright, shiny flow is evident from the wire onto the circuit pattern on the board.

“Tinning” refers to the process of applying a light coating of solder to the bared wire end. This keeps all the

strands secured, and also makes a good connection easier. Simply touch the wire with the iron for a couple seconds, and apply solder. Allow the excess to flow away onto the iron. When properly done, the wire is uniformly bright, and no larger than before. The hookup wire supplied with this kit does not normally need tinning, for it is pre-tinned.

Wiring the Kit

If any components are unfamiliar to you, checking the pictorial diagram should quickly identify them. Or, the quantities, and the process of elimination as you check the parts list, will help. The pictorial diagram is necessarily distorted to some extent for clarity, so that you can trace every wire in a single overall view for verification as you work. You may wish to check off on the diagram as you solder each location.

To “prepare” a wire means to cut the designated length from the coil of that color, and strip about 1/4” of insulation from each end. The wire supplied in the kit is #18 and #22, so you can set adjustable wire-strippers accordingly. The transformer leads are #18, and the line cord is #16. Be careful that you do not nick the wire when you strip it (that can happen more easily if you do not use wire strippers) for that weakens it. The wire supplied in this kit is “bonded stranded,” which provides exceptional flexibility with resistance to breakage for easier use.

Whenever a connection is to be soldered, the instructions will so state, or indicate by the symbol (S). If more than one wire is to be soldered to the same point, they will be indicated by (S-2), (S-4), etc. If soldering is not called for, other connections have yet to be made to that terminal. They would be more difficult if the connection was already soldered. Every connection in the kit will be soldered when it is complete. After soldering a connection, it is best to clip off any excess lead length to minimize the possibility of a short circuit (as on switch lugs, where terminals are very close together), and for neatness.

Be sure that uninsulated wires cannot touch adjacent terminals or the chassis metalwork.

The symbol (#) indicates a connection is to be made to that point. When a lug number is specified without (#), it is simply a locating reference.

When the instructions call for twisting two or three wires together, the length of wire indicated anticipates a fairly tight, uniform twist by hand, of three full turns every two inches. If you find the wires too short, loosening the twist will gain some needed length.

Handle **the** circuit boards carefully. They represent a major part of the kit cost. Stand-up components, such as transistors, should be checked when you install the module, to be sure all leads are separated, and that the large electrolytic capacitors have not broken loose from the board.

Take the time to be accurate and neat, and you can be sure that your completed amplifier will meet the performance of a factory assembled unit, and can continue to perform properly for years to come. Check your work, and make sure the entire step has been completed before placing a check mark in the space provided, and continuing on to the next step.

MECHANICAL ASSEMBLY

- For security in shipping, the power transformer and the amplifier module have been fastened to the chassis. Remove the chassis cover, the inner front panel and the larger front plate, and set these aside. Be particularly careful in handling the amplifier module. to see that the leads of the upright components on the circuit boards are not stressed. This module accounts for more than half the kit cost, and has already been thoroughly tested for specified performance before it was packed.

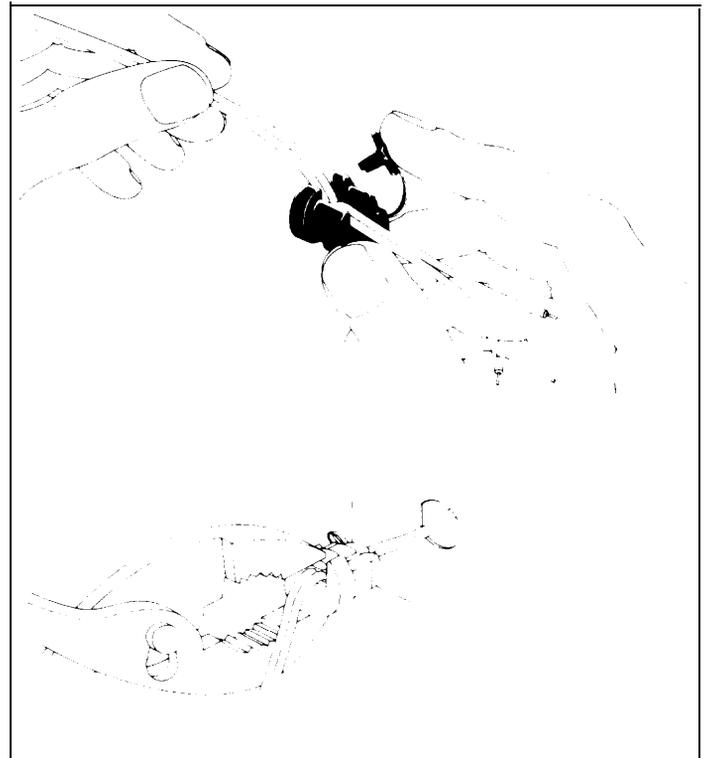
Turn the chassis upside down, and rest it on the module and transformer to remove these parts. Include all of the hardware you have removed with the rest when you check off the components against the parts list in the back of this manual. We recommend this check-off to be sure you have everything, and to enable you to identify any unfamiliar items by comparing them with the pictorial diagram. Although the perspective of the diagram has sometimes been distorted to show connections more clearly, it should enable you to recognize any unfamiliar component. An egg carton is ideal for keeping small items like hardware at hand.

It will simplify matters if you first separate the #4 nuts from the #6 nuts, which have the same outside dimensions. A #4 screw will pass through a #6 nut, aiding identification.

A "set" of hardware includes one screw and one KEP nut (with its attached lockwasher). Always install the lockwasher side of the nut first. If the size of the hardware is not specified, use the #4 size, which is the smallest. #10 is the largest. Always insert the screw from the outside of the chassis.

- With the chassis upside down, select the 4 rubber feet and 4 sheet metal screws. The screw head recesses fully into the foot. Install these in the holes which are about 1" in from each corner.
- Select the AC line cord and the plastic strain relief. Separate the two conductors of the cord for 2 inches. Strip 1/4" of insulation from each lead. Twist the bare strands tightly, and tin each lead. 13" from the ends make a sharp "V" in the cord by bending it sharply back on itself. Install the strain relief as shown, with the small end of the strain relief nearest the stripped end of the line cord. Crimp the two halves of the strain relief around the wire at the V with heavy pliers, to partially form it before insertion into the back panel. Considerable squeezing is necessary, because the thick insulation "pops back" quickly. Then grip the larger diameter of the strain relief with the tips of heavy pliers, squeeze it tightly, and insert the end of the cord through the back panel AC hole from the outside. Note that the hole has two flat sides, and the relief is shaped accordingly. This is a very tight fit—you will have to pull on the cord to help—but it snaps into position when fully inserted.

- Select the two input sockets and 4 sets of hardware. Install the sockets at LS and RS inside the chassis so that the short lug is nearest the hole in the chassis between the two sockets.
- Select the single ground lug (with lockwasher teeth) and one set of hardware. Install it between the input sockets. Point it toward the bottom, and bend it out for access. Be certain this lug is tight. The locking teeth must cut through the chassis paint for a good ground connection.
- Select the two round fuse holders with caps, and their 1/2" hardware: rubber washers, metal lockwashers, and nuts. First install the rubber washer on each holder, so it will be outside the chassis, and then fasten them at locations LF and RE. The holes have flats which mate with the fuse holder to keep it from turning. Point the tip lugs towards each other. Be sure all of this hardware is tight, as it will not be accessible once the amplifier is completed.
- Select the two red output terminals and their hardware: the red washers, 4 nuts without lockwashers, and two plain connecting lugs. Note that each part of the terminal has a flat which mates with the flat top of the chassis hole. Install the terminals in the two center holes LR and RR so that the washer flat is engaged, tighten one nut securely, add the lug pointing up, and tighten the second nut.
- Select the two black output terminals, their hardware, and two plain connecting lugs. Install them at LB and RB as in the previous step.



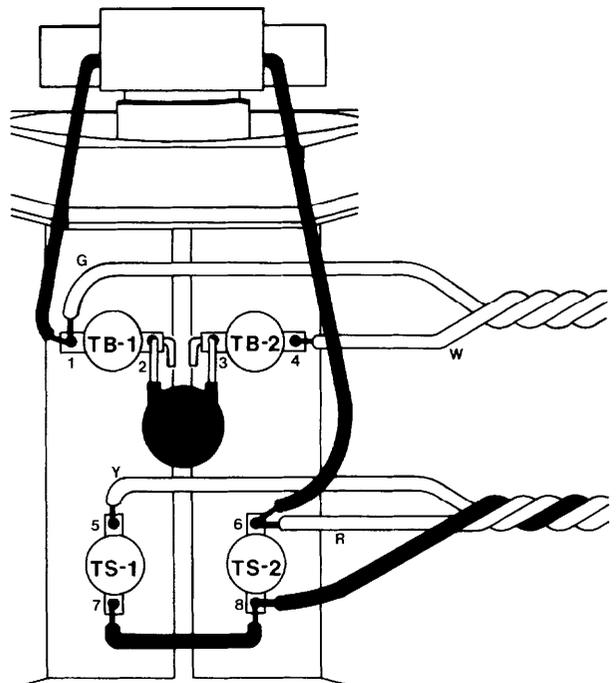
- 9 Select the plastic encased relay, the longer L-shaped mounting bracket, and 2 sets of hardware. Insert the screws through the bracket with the bracket foot pointing away from the lugs at the opposite end of the relay. lighten this hardware securely, but do not risk breaking the plastic.
- 10 Select 2 sets of hardware and mount the relay near the 2 red terminals, with the bracket facing front. Install the screws from below the chassis.
- 11 Select the 2 shorter L brackets, 4 sets of hardware, and the circuit board PC-9 . Mount the brackets on the circuit side of the board, with the feet pointing away from the board.
- 12 Select 2 sets of hardware and install the circuit board between the line cord and terminal RB, with the components facing to the rear.
- 13 Select the 7-lug terminal strip and 2 sets of hardware. Install it at the two inner holes in front of PC-9. The hole near the right chassis edge is not used. The mounting feet face forward.
- 14 Select the single fuse clip and a set of hardware. Install it in the single hole between the two “dimples” at the front of the chassis. The dimples prevent the clip from turning too far.
- 15 Select the 2 dual fuse clips and 4 sets of hardware. Install one of these in the pair of holes nearest the center of the chassis, and the other in the pair of holes aligned with it near the left edge.
- 16 Select the 3/4” long #6 screw and a nut, and the rectifier diode block which has four lugs. Install the rectifier DB in the front center hole nearest the fuse holders. Note the lug positioning in the diagram, and check the marked location of the + lug.
- 17 Select the two round capacitor brackets, the two large capacitors, and 8 sets of #6 hardware. Place a bracket around the bottom of each capacitor and fasten it with one set of hardware through each clamp. Note the direction of insertion of the screw for easy servicing access in the future. The clamp should be snug, but not tight. Place each assembly so the clamping screws are accessible from the front at locations CL and CR, and secure each with 3 sets of hardware. Then loosen the clamps and rotate the capacitors so that each + terminal is positioned as in the diagram. Make sure the capacitors are seated against the chassis and tighten both clamps.
- 18 Select the 4 plain connecting lugs and four 1/4” long large screws with lockwashers attached. Install these on top of the capacitors with the lugs pointing as in the diagram.

- 19 Select the two 2 amp fuses and install them in the round fuse holders on the back of the chassis. This will keep the caps from being loosened and lost.

This completes the basic mechanical assembly of the chassis. Set it aside for the present.

- 20 Select the large front plate, the smaller front panel with the edges turned back, the two handles, and four #10 screws. With the power switch cutouts aligned, place the screws through the panel from the rear, through the front plate, and secure the handles. Set this assembly aside.
- 21 Select the amplifier module. Handle it with care! The fan is mounted on the front of the module, with a foam gasket on the rear. On the bottom, two thermal sensors for the fan, and two safety thermal breakers are already mounted on the heat sinks. With the module upside down, and the fan away from you (to keep the left channel on the left, for consistency) cut the right fan lead to 5-3/4”, strip it 1/4”, and connect it to TS2 lug #6.
- 22 Cut the left fan lead to 4”, strip it 1/4”, and connect it to TB1 lug #1.

A soldering iron will be used regularly from now on. Be sure you wipe its tip frequently with a damp cloth or sponge, as a bright tip will make connections easier with less likelihood of overheating components. If it is difficult to heat a connection in a couple of seconds, apply a small amount of fresh solder to the tip so it can flow around the connection and provide good heat transfer.



There are two gauges of wire supplied with the kit. For connections which pass substantial current, the heavier wire is used. Other connections need only the lighter gauge wire. Connect the wires to the bottom of the module from the right side,

- 23 Prepare a 9-1/2" red wire and connect one end to TS2 lug #6. (S-2).
- 24 Prepare a 7-1/2" green wire and connect one end to TB1 lug #1. (S-2).
- 25 Select the 'inrush limiter', which is a disc about the size of a quarter. Trim the leads to 1/2" and connect it between TB1 lug #2 and TB2 lug #3. Solder both lugs.
- 26 Prepare a 7-1/2" white wire and connect one end to TB2 lug #4. (S).
- 27 Prepare a 1-1/4" black wire. Connect one end to TS1 lug #7. (S). Connect the other end to TS2 lug #8.
- 28 Prepare a 9" black wire. Connect one end to TS2 lug #8. (S-2).
- 29 Prepare a 10-1/2" yellow wire. Connect one end to TS1 lug #5. (S).
- 30 Twist the red, yellow and black wires from TS1 and TS2 together. Also twist together the green and white wires from TB1 and TB2. Place both of these wire groups off to the right of the module. Then turn the module right side up, with the fan away from you, and the wires extending off to the left.

When soldering to eyelets (holes) on the circuit boards, the wires will be connected to the outside (top) of the board, but they must be soldered securely to the circuitry on the underside. It is best to heat the eyelet on the inner surface while the wire is inserted from the outside. This requires an iron with a small tip (preferably chisel shaped) and some care on your part. It is easiest to melt a small blob of solder on the tip, and position it at the eyelet so that the solder blob, more than the tip itself, is heating the eyelet. If the eyelet is first filled with solder, and the wire end is pushed all the way through the heated eyelet first, then withdrawn part way to expose a bit of the bare end outside the board before the solder cools, you should have a firmly soldered connection if it cools undisturbed.

Always tin a wire that is to connect to an eyelet. After soldering, go back and check by twisting each wire, to make sure nothing moves on the other side of the board. It is wise to check any existing wire connected to an adjacent eyelet, to make sure your work has not loosened it. When connecting heavy gauge wire to the eyelets, if you get too much solder on in the tinning process, it will be hard for the wire to penetrate the eyelet.

While excessive heat or careless "scrubbing" with the iron can lift the circuit foil from the board, more people tend to use insufficient heat, making it difficult for the solder to flow smoothly around the connection. A smooth, bright connection is important.

- 31 Prepare an 8" black wire and an 8" red wire. Start with the red wire 1/2" longer at one end, and twist these wires together throughout their length. Connect the longer end of the red wire to eyelet #1 of the board which is to your left as you face the rear of the module. Eyelet #1 is the upper eyelet. Connect the black wire to eyelet #2. Be sure both eyelets are securely soldered. Place these wires down under the module.
- 32 Prepare an 8-1/2" black wire, and a 7-1/2" yellow wire. Allow the black wire to project 1/2" beyond the yellow wire, and twist these together. The black wire connects to the upper eyelet #2 of the circuit board to your right. (S). Connect the yellow wire to eyelet #1. (S). Place this pair under the module. Now turn the module around so the fan is toward you.

The eyelets are numbered consecutively, one to each circuit tab visible along the edge of the board, from 3 to 10. The small tab numbers are visible adjacent to each tab on the underside of the board.

- 33 Prepare two 7" white wires. Connect one to the right circuit board eyelet #8, towards the bottom. (S). Connect the other wire to eyelet #6. (S). You may find it easier to work if the module is laid flat on its back foam gasket. Bend these wires toward the bottom of the fan bracket, and twist them together throughout their length.
- 34 Prepare a 13" green wire. Connect it to eyelet #7 of the right board. (S).
- 35 Prepare an 11" white wire. Connect it to eyelet #5 of the right board. (S). Bend this wire toward the bottom of the bracket.
- 36 Prepare a 3" green wire and connect it to eyelet #10 of the right board. (S).
- 37 Prepare a 6-1/2" white wire and connect it to eyelet #3 of the right board. (S).
- 38 Prepare a 13" green wire and connect it to eyelet #7 of the left board. (S).
- 39 Prepare a 13" white wire and connect it to eyelet #5 of the left board. Bend this wire toward the bottom.

- 40 Prepare two 9" white wires. Connect one to eyelet #8 of the left board. (S). Connect the other to eyelet #6. (S). Bend these toward the bottom, and twist them together.
- 41 Prepare a 3" white wire and connect it to eyelet #3. (S).
- 42 Prepare a 6" green wire and connect it to eyelet #10 (S). Set the module aside temporarily.

CHASSIS WIRING

- 43 Select the chassis and the .39 mfd capacitor. Trim each lead to 1/2" Connect one lead of the capacitor to LT lug #3. Connect the other lead to lug #4.
- 44 Select the silicon diode. Note that one end has a stripe for identification. Connect the striped end to LT lug #3. Connect the other lead to lug #2.
- 45 Select the 1/2 watt 1 megohm (brown-black-green) resistor. Trim each lead to 1/2" and connect one lead to LT lug #2. (S-2). Connect the other lead to LT lug #1.
- 46 Prepare a 7-1/2" white wire. Connect one end to LT lug #1. (S-2). Connect the other end to fuse clip FC lug #1. (S).
- 47 Prepare a 12" green wire. Connect one end to LT lug #3. (S-3).
- 48 Select one of the spade lugs. Connect it to the other end of the green wire just attached to lug #3. (S).
The proper way to connect one of the spade lugs to the wire is to bend the shorter, wider set of tabs tightly around the bare wire, and bend the outer, longer set of tabs around the insulation. Then flow solder into the joint around the bare wire.
- 49 Check both conductors of the power cord to see that they are tinned to secure every strand. Connect one lead of the power cord to FC lug #2. (S).
- 50 Select another spade lug and connect it to the free end of the power cord. (S).
- 51 Prepare a 13" white wire. Connect one end to the lower hole of LT lug #6. (S). Using the lower hole will make it easier for other wires to be connected to the same lug.

NOTE FOR MULTIVOLTAGE OPTION: This wire may need to be 1" longer, and may connect to another terminal for some line voltages.

- 52 Select the spade lug and connect it to the free end of the white wire from LT lug 6. Place this wire to the left, and twist it lightly together with the green wire from LT lug 3.

When connecting wires to the PC-9 circuit board note that the eyelets on this board are numbered in the reverse direction from the lug numbers on the terminal strip.

- 53 Prepare a 23/4" red wire. Connect one end to PC-9 eyelet #8. (S). Connect the other end to relay RY lug #7.
- 54 Prepare a 2" yellow wire. Connect one end to PC-9 eyelet #7. (S). Connect the other end to RY lug #9.
- 55 Strip a 1-1/2" length of heavy wire bare. Connect one end to large capacitor CL lug X2. (S). Connect the other end to CR lug #3. (S). Be very sure that these connections are well soldered because they will carry considerable current.
- 56 Prepare an 8-1/2" red wire. Connect one end to PC-9 eyelet #6. (S).
- 57 Prepare a 19" black wire. Connect one end to PC-9 eyelet #5. (S).
- 58 Prepare a 9" yellow wire. Connect one end to PC-9 eyelet #4. (S).
- 59 Place the red, black and yellow wires toward the left and twist them lightly together. Keep these against the chassis and connect the red wire to dual fuse clip FR lug #5. Connect the yellow wire to FR lug #6. Connect the black wire to the center of the bare wire between the two capacitors CL and CR. (S). Six other wires will be connected to the center of this bare wire. The amplifier will have the lowest hum if the last wire to be connected (from the transformer -a heavy wire) is placed in the exact center of this link between the two capacitors, so leave a small space for it. However, all 7 wires should be connected as near to the center point as possible.
- 60 Prepare a 4-1/2" red wire and connect one end to PC-9 eyelet #3. (S).
- 61 Prepare a 5-3/4" yellow wire and connect one end to PC-9 eyelet #2. (S). Place this wire and the red wire from eyelet 3 to the left. Twist them lightly together and connect the red wire to RY lug #B. (S). Connect the yellow wire to RY lug #A. (S).

- 62 Prepare a 3" white wire. Connect one end to RY lug #4. (S). Connect the other end to red output terminal LR. (S).
- 63 Prepare another 3" white wire. Connect one end to RY lug #6. (S). Connect the other end to output terminal RR. (S).
- 64 Prepare a 16" green wire. Connect one end to black output terminal LB. (S). Connect the other end close to the center of the bare wire between the two capacitors. (S).
- 65 Prepare an 18" green wire. Connect one end to output terminal RB. (S). Connect the other end to the bare wire between the two capacitors. (S).
- 66 Prepare an 11-E" green wire. Connect one end to dual fuse clip FL lug #4. (S). Connect the other end to CR lug #4.
- 67 Prepare a 7" white wire. Connect one end to FL lug #3. (S). Connect the other end to CL lug #1.
- 68 Prepare a 12" white wire. Connect one end to FR lug #7. (S). Place this against the chassis and connect it to CL lug #1.
- 69 Prepare a 13" white wire. Connect one end to CL lug #1. (S-3). Connect the other end to the rectifier block DB lug #2. (S). This is the lug marked + on the rectifier.
- 70 Prepare a 7 1/2" green wire. Connect one end to FR lug #8. (S). Connect the other end to CR lug #4.
- 71 Prepare another 8" green wire. Connect one end to CR lug #4. (S-3), Connect the other end to DB lug #3. (S).
- 72 Strip a 3/4" piece of light wire bare. Connect it between the short ground lug of input socket LS and the separate ground lug between the 2 input sockets.
- 73 Prepare a 14" black wire, but strip 3/4" of insulation from one end. Thread the longer bared end through the separate ground lug, and connect it to the short ground lug of input socket RS. Solder only the two wires at the center ground lug at this time. Place the wire against the chassis, and connect the other end to the bare wire between the two large capacitors. (S). This is the 4th of 7 wires connected at this point. Remember to leave space in the exact center for the last wire, but keep all of these close together.
- 74 Select the yellow and black twisted pair from the left side of the module. Connect the black wire to the short ground lug of input socket LS. (S-2). Connect the yellow wire to the long lug of LS. (S).
- 75 Select the red and black pair from the right side, and connect the black wire to the short lug of input socket RS. (S-2). Connect the red wire to the long lug of RS. (S).
- 76 Select the twisted white pair from the left side. Connect the longer wire to the side lug of the fuse holder LE (S). Connect the other wire to the tip lug of LF. (S).
- 77 Select the twisted white pair from the right side. Connect the longer wire to the side lug of RF (S). Connect the other wire to the tip lug of RF (S).

Make sure that all of the unconnected long wires (except for the green wires to eyelet 7 on each board) are placed off to the right so that when the module is installed on the chassis these wires will protrude between the feet below the right circuit board. The wires to the #7 eyelets, as well as those to eyelets 3 and 10, connect towards the front of the amplifier. Carefully lift the module without touching the components on the circuit boards. Swing it into position on the chassis, and check to make sure that no wires are trapped under the mounting feet. Make sure that the input socket long lugs have not been bent so that any shorts are possible there-or to the chassis. Keep all wires away from the 'inrush limiter' disc-against the chassis.

It is a good idea at this time to check the fan by hand, to make sure it rotates freely. Shipping sometimes may cause a misalignment. If it rubs, bending a strut will correct the problem.

- 78 Select 4 sheet metal screws and secure the module to the chassis. The easiest procedure may be to tilt the whole assembly backwards so that the module is again lying on the gasket, giving you access to the bottom of the chassis. Start the screws, and then check again to make sure no wires are trapped before tightening the screws fully.
- 79 Select the green and white twisted pair from the bottom of the module. Connect the green wire to the terminal strip LT lug #1. Connect this wire to the lower hole in that lug, and solder it separately from the two wires which are soldered to the upper part of the lug. Make sure all 3 wires are soldered. Connect the white wire to LT lug #4. Use the lower hole for this wire, and solder it separately now. Do not solder the capacitor lead to the upper part of the lug at this time.

Now place the wired amplifier module behind the chassis in line with the input sockets, so that it is resting on the foam gasket, with the mounting feet against the chassis. Its wires will protrude toward the chassis, or to the right.

80 ○ Select the triad of black, red and yellow wires from under the module. These will be connected to the right end of the terminal strip, and to prevent the heat from the large resistors from melting the insulation on the wires, connect the wires from behind the terminal strip and keep them against the chassis, so the resistors will be above them. Connect the black wire to LT lug #5. Connect the yellow wire to LT lug #6. Connect the red wire to LT lug #7.

81 □ Select one of the 300* ohm 7 watt resistors. Trim each lead to 3/4". Strip two 1/2" lengths of insulation from a piece of heavy wire, and place one piece over each resistor lead as insulation. Connect one lead to LT lug #5 on the front side of the strip. Connect the other lead to lug #6. Because lug #6 will eventually have several wires, it is important that each wire be placed as low as possible in the opening, and crimped so as to maintain the largest possible opening for the last wire.

* In these two steps, use the 600 ohm resistors instead, if the overseas multivoltage transformer option is wired for 200 - 240 volt AC lines. See page 18. A 220 volt fan must be used, part #AAI28, and will have been fitted if specified.

82 □ Select the remaining 300" ohm resistor. Trim each lead to 3/4" and place this resistor on the back side of the terminal strip and connect one lead to LT lug #5. (S-3). Connect the other lead to LT lug #7. (S-2).

83 □ Select the white wire from the left circuit board, protruding from underneath the module. Connect it to RY lug #7. (S-2).

84 □ Select the long white wire from eyelet 5 on the right circuit board. Place it under the relay and connect it to RY lug #9. (S-2).

85 □ Connect the short white wire from the left side of the module to fuse clip FL lug #1. (S).

86 □ Connect the longer green wire from eyelet 7 on the left side to the bare wire between the 2 large capacitors. (S). Place it down against the chassis.

87 □ Connect the green wire from eyelet 10 on the left side to FL lug #2. (S).

88 □ Connect the short green wire from eyelet 10 on the right side to FR lug #6. (S-2).

89 □ Connect the long green wire from eyelet 7 on the right board to the bare wire between CL and CR. (S). Place this wire down against the chassis. One more connection will be made at the center of this bare wire.

90 □ Connect the white wire from eyelet 3 on the same board to FR lug #5. (S-2).

Now is the best time to turn the amplifier upside down and shake out any loose bits of solder, wire clippings, etc.

The wiring of the amplifier is now to be completed with the installation of the power transformer and two disc capacitors. The following instructions refer to the 120 volt transformer supplied for the USA. If your kit is supplied with the optional multivoltage transformer for overseas use, separate instructions in this manual will diagram, both in pictorial form, and schematically, the connection for each line voltage.

NOTE FOR MULTIVOLTAGE OPTION: The following steps which describe the installation of the capacitors, and the connection of the two red leads, and the red/yellow lead of the transformer are to be followed for all units. Only the connections for the black and black/white transformer leads, and the additional leads supplied on your transformer, may differ. You should follow all the other steps to the completion of your amplifier.

91 □ Select the 4 sets of #10 hardware and the 4 washers, and the power transformer. Carefully place the transformer in position, making sure no wires are trapped, with the transformer leads protruding toward the large capacitors. You may if you choose shorten any lead for neatness, but be sure you do not cut any lead too short, as leads which are cut too short for re-use may void the transformer warranty. If you are using the multivoltage transformer, be sure you leave leads long enough for possible alternative voltage applications.

The washers are to be placed on the screws on top of the transformer feet for stiffening. Install the bolts near the edge of the chassis first. That will determine which of the inner sets of holes are to be used. It may be easiest for you to tilt the assembly up on its right side, so the transformer weight is supported by the work surface, or you can turn it upside down. Be careful the transformer does not swing into the circuit board on the module! Before you tighten any of the mounting bolts, check to be sure the line cord and other wires are clear of the transformer feet.

92 □ Connect the black lead to LT lug #4. (S-3). One of these wires has most likely already been soldered to the lower hole of this lug.

93 □ Connect the black/white lead to LTlug #6. (S-4). One wire has most likely been soldered to the lower hole of this lug.

94 □ Connect the red/yellow lead to the center of the bare wire between CL and CR. Be sure all 7 wires are well soldered.

95 □ Connect one red lead to DB lug #1. Connect the other red lead to DB lug #4.

96 □ Prepare a 13-1/2" red wire. Connect one end to PC-9 eyelet #1. (S). Place this wire down against the chassis and connect it to DB lug #1.

97 Select the .01 mfd disc capacitor and trim each lead to 3/4". Strip two 1/2" lengths of insulation from a piece of heavy wire, and install these on the capacitor leads. Connect one lead to DB lug #1. (S-3). Connect the other lead to DB lug #4. (S-2).

98 Select the power switch and the .005 mfd disc capacitor. With the red window (or, on some switches, the #3 lug, or the separate lug) of the switch to your right, temporarily slide the white wire's spade lug part way onto the left switch lug. Slide the line cord's spade lug part way onto the middle switch lug. This simply makes it easier to attach the capacitor to these two spade lugs. Cut each capacitor lead to one inch (some freedom of movement is desirable), wrap one lead around the shaft of each spade lug, and solder each. Then carefully disconnect the wires from the switch.

99 Install the fuses. The 15 amp slo-blo fuse goes in the single fuse clip near the power switch. The four 10 ampere fuses, with the thicker elements, go into the two dual fuse clips on the chassis. If you have not already placed fuses in the speaker fuse holders on the back panel, install the 2 ampere size, for these will give good protection to most speakers. A pair of 5 ampere fuses are also included for the speaker holders, in the event your needs require very high powers. However, for steady state test signals at the full amplifier capabilities, even larger fuse sizes will be needed in the speaker fuse holders.

Now you should make a last check of all the solder connections. Look closely for possible bare wire shorts, Check for secure hardware-especially that on the output terminals. Check that wires are not lying on top of the power resistors on the 7-lug terminal strip. Remove all pieces of solder and wire clippings from the chassis.

Three wire ties have been included in the kit which you may wish to install around groups of wires to make your finished amplifier look neat. Because it is desirable that the ground wires which connect between CL and CR be kept close together, we suggest using one tie at the base of the capacitors.

100 Select the front panel assembly and the power switch, and make sure that the power switch is oriented with the red window (#3 lug, or separate lug) to the right, or nearest edge. The switch is a press snap fit from the outside of the panel.

101 Select 4 sheet metal screws, and bring the front panel to its approximate position. Carefully attach the 3 wires to the switch lugs: white to the left; green to the right. Push the lugs fully on, and assemble the front panel to the chassis. NEVER ATTEMPT TO PICK UP THE AMPLIFIER BY THE HANDLES IF THE COVER IS NOT SCREWED IN PLACE.

102 Select the remaining sheet metal screws and the cover. Before closing up the unit, plug it in and check to see that the fan turns. Because it normally operates at low voltage for low speed, a new fan may need a bit of encouragement at first. Any stiffness is normally overcome after a few minutes operation. Once you are sure it turns on each time the power switch is turned on, secure the cover.

103 Peel off the backing from the serial number label, and affix it to the bottom of the chassis.

CONGRATULATIONS!
YOU HAVE COMPLETED ONE OF THE FINEST
AUDIO AMPLIFIERS EVER DESIGNED.
ENJOY ITS SUPERB SOUND.

IF PROBLEMS ARISE

If you are certain the problem lies in the power amplifier, check first to see that the red pilot lamp is lighted. If it is blinking at about 3 times a second, this indicates that the thermal safety breaker on one channel has shut down the amplifier because of excessive temperature. In this case, the exhaust air will be warm. After a few minutes of cooling, the amplifier will commence operation automatically. If it shuts down again, and the amplifier has sufficient ventilation, the malfunction is either internal, or is the result of an excessive (and possibly inaudible) input signal.

If the lamp is not lighted at all, the main fuse in the single fuse clip inside the chassis at the front is probably open. If a replacement 15 ampere, slo-blo fuse also blows, the amplifier needs service, and there is a power supply problem. If the relay will not close (no signal at the output, with an input signal) check for excessive DC offset (over 1.8 volts) from either channel at locations 7 or 8 on PC-9-the small relay circuit board. This indicates a defective amplifier channel, requiring competent service. If there is no indication of excessive offset, the fault is in the relay or on the PC-9 circuit board.

On rare occasions with some arm/cartridge combinations, very high signal levels at subaudible frequencies may cause the relay to cut off the output briefly, because the sensing circuit sees this as DC offset. If this is annoying, and you are willing to accept a little less relay protection, you can change R107 and R108 to a higher value. These are now each 39000ohms (orange, white, red) and are located above the IC on the small circuit board PC-9A. We suggest 4700 ohms as the next step. At the other extreme, it is possible to increase the sensitivity so that the relay would protect the speaker if a stylus were dropped on the record, but then it might be activated by powerful low frequency transients.

If the fan does not turn, or makes a ticking noise, make sure it is properly centered in its supports, and that shipping abuse has not twisted it so the blades are rubbing the housing. Moderate pressure on the struts will recenter it.

CIRCUIT DESCRIPTION

The DH-500 amplifier components have been selected to protect against failure, and all parts are operated conservatively to assure unaltered performance and proper operation for many years. The semiconductors have been thoroughly researched and selected for minimum noise and distortion in sustained use, and the printed circuit board associated with the audio signals has been pretested in the circuit to insure that each kit amplifier will meet or exceed all specifications.

The amplifier stages are fully DC coupled, with a dual differential pair for the input, and a fully complementary MOSFET output stage. Its power supply is a full wave bridge with 20,000 mfd capacitors on both the plus "+" and minus "-" supplies to provide excellent filtering and dynamic load stability. Protection circuitry includes two separate power supply fuses for each channel, individual thermal sensing devices for each channel to turn the amplifier off if the heat sinks should reach excessive temperature, a relay to disengage the output if excessive DC offset is detected, and output fuses to protect the speakers, in addition to an AC line fuse.

Transistors Q3, Q4, Q5 and Q6, the input differential pairs, are matched to control the DC offset of the amplifier. To optimize the input pair parameters, they are driven from constant current sources — Q1 and Q2.

An adjustable voltage reference is formed by transistor Q9 and

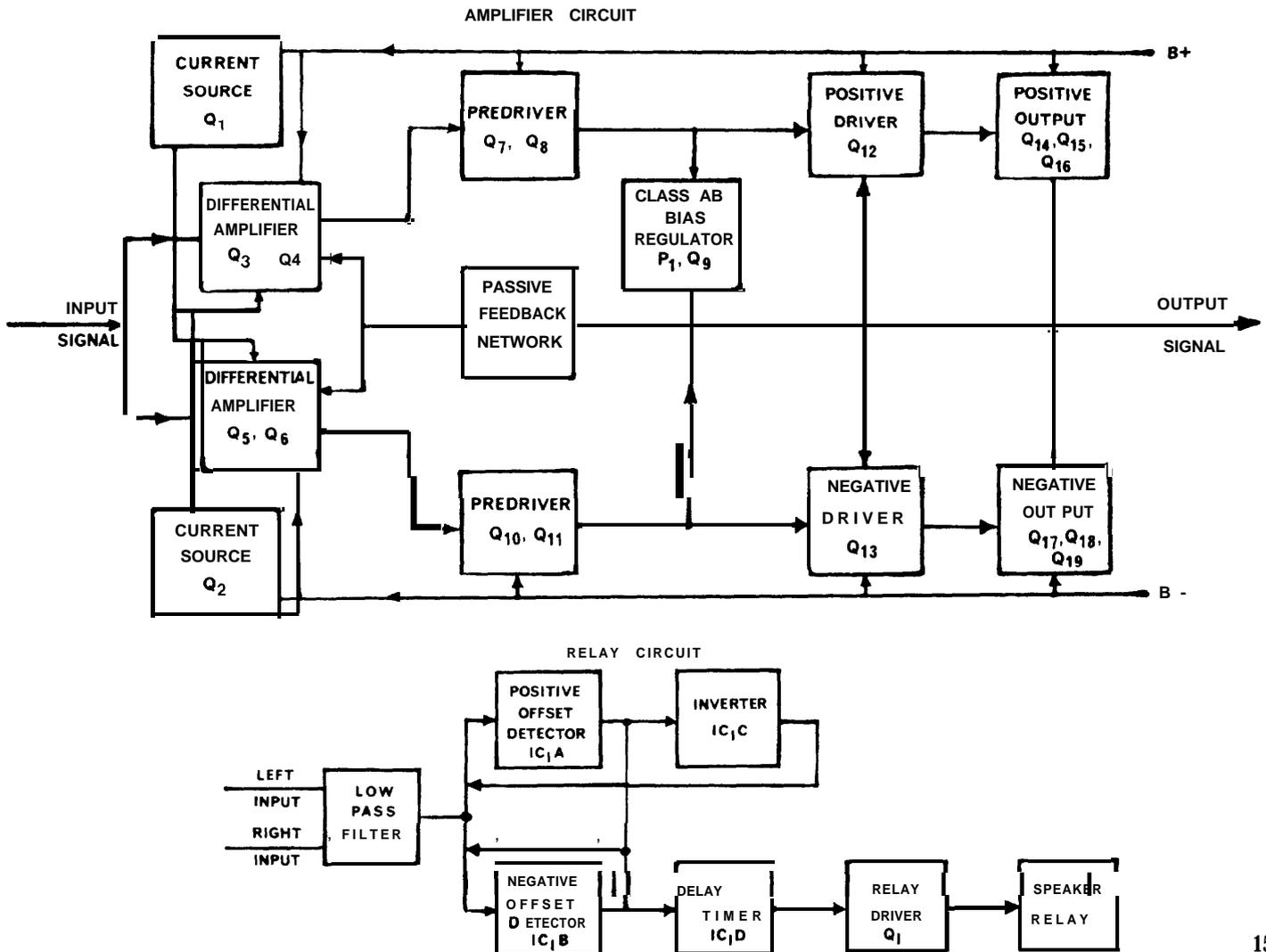
potentiometer P1. Thus the signal sees the bases of transistors Q12 and Q13 tied together. P1 adjusts the voltage to bias the amplifier for Class AB operation, and therefore determines the quiescent (idle) current in the driver and output stages. Complete circuit stability is assured by the positive temperature coefficient of the power MOSFETs.

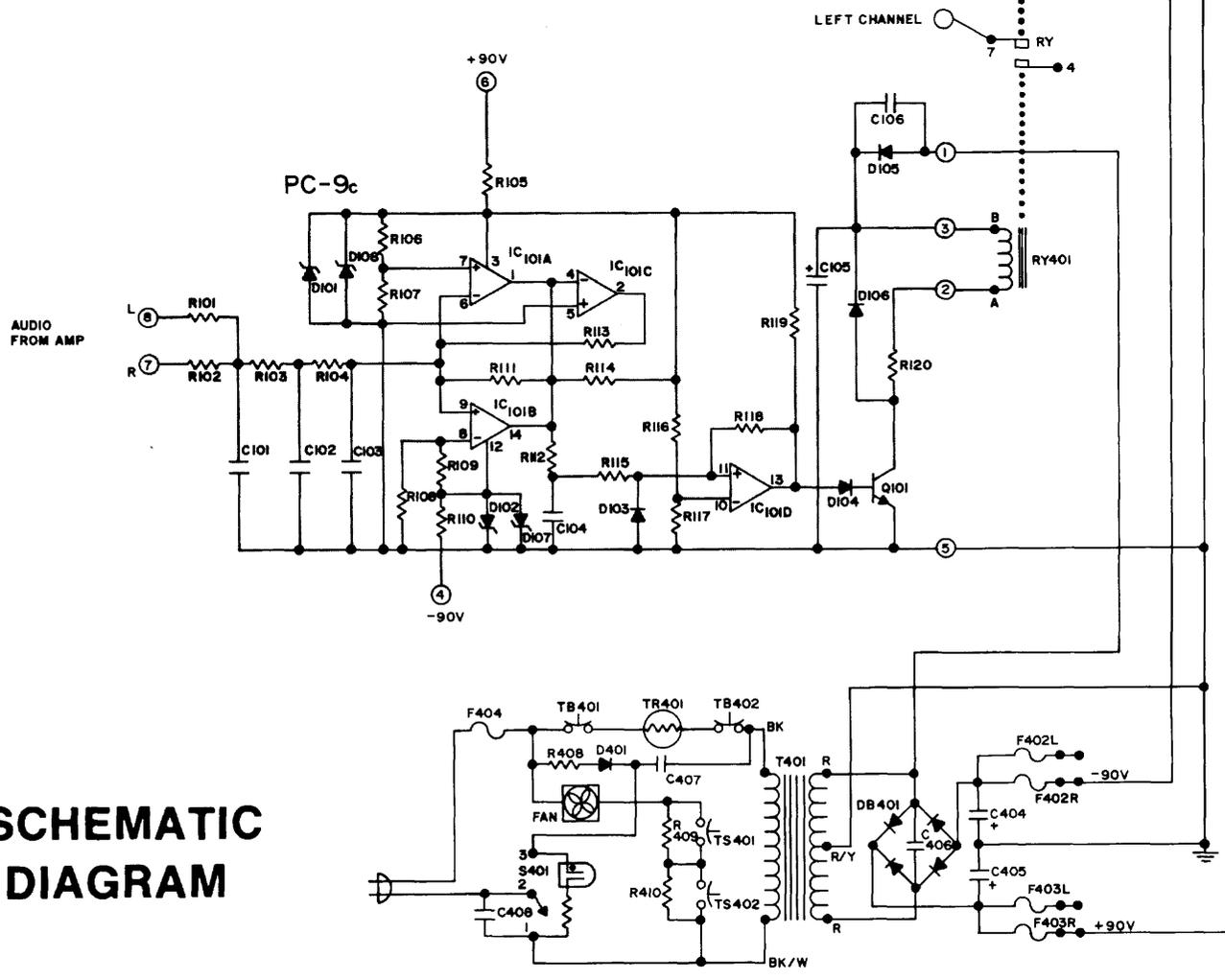
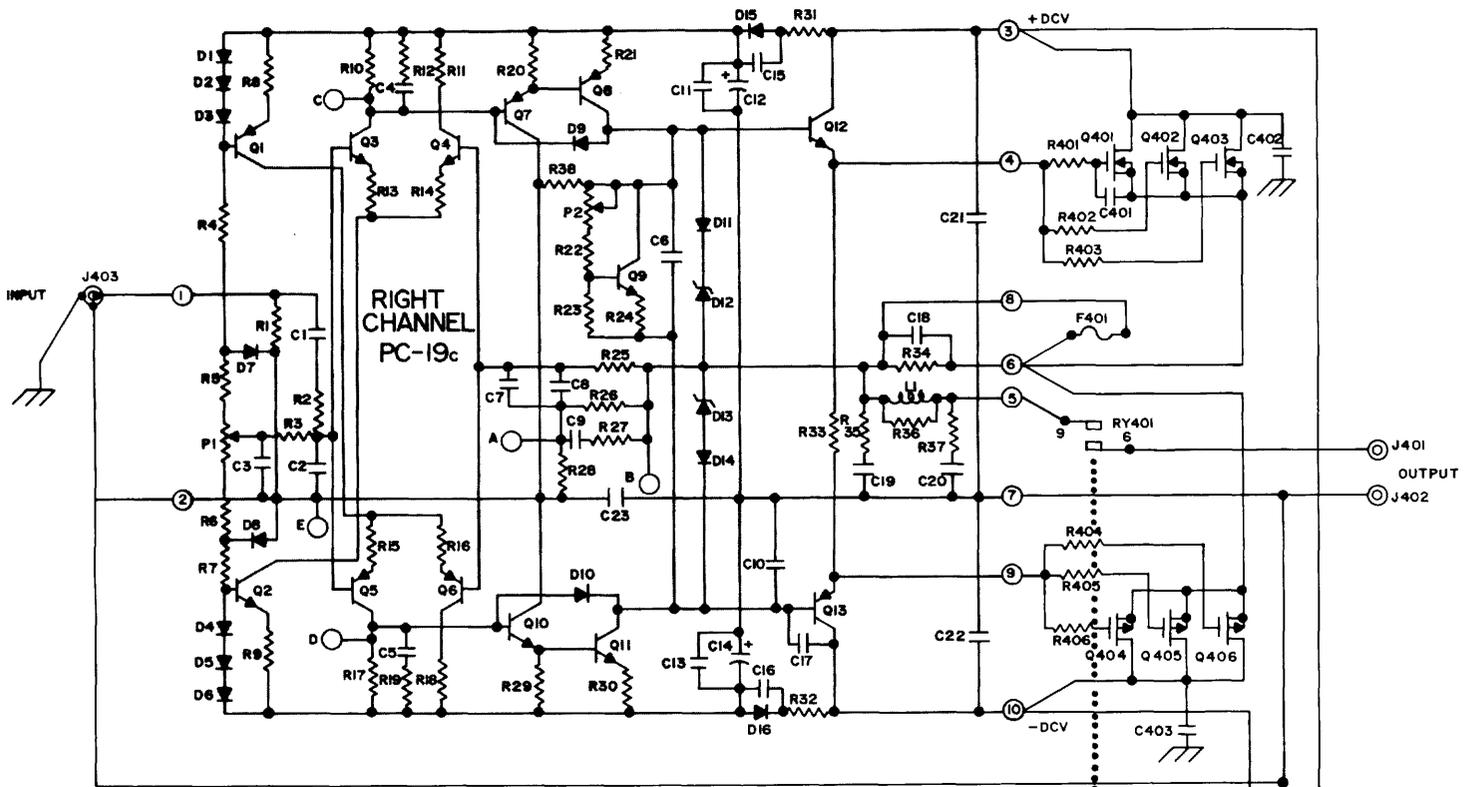
The driver and output stages of the DH-500 are of the full complementary configuration. Q14, Q15 and Q16 are N channel MOSFETs in parallel for the positive half of the signal, and Q17, Q18 and Q19 are P channel MOSFETs for the negative signal half.

There is none of the usual volt amp limiting in the DH-500. D7, D8, D9 and D10 prevent the gates of the MOSFETs from being overdriven in the event of abnormally high signal levels. The B+, B- and speaker fuses limit the maximum current in the outputs. The thermal protection, unlike most circuits, does not interrupt the output of the amplifier. If the heat sink temperature rises to 75°C, the amplifier is turned off until it cools.

The relay circuit has a 3 section low pass filter which prevents signals above 10 Hz from opening the relay. This circuit allows DC to pass to IC10A and IC10B, which sense any offset above 1.8 volts, opening the relay to protect the speakers. DI01, R106 and R107 form the reference for the positive offset detector IC10A. D102, R109 and R110 form the reference for the negative offset detector IC10B. C104's charging time is the time delay at turn on, and after any relay actuation.

FUNCTIONAL BLOCK DIAGRAM





**SCHEMATIC
DIAGRAM**

120V

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COMPONENT VALUES

All resistors are ¼ watt 5% carbon film unless otherwise noted.

All capacitors are 100 volt minimum unless otherwise noted

	Part No.		Part No.
R1	470,000 ohms	RC044	C1
R2	1,800 ohms	RC023	c2
R3	47,000 ohms	RC043	c3
R4	47,000 ohms	RC043	c4
R5	560 ohms	RC045	C5
R6	560 ohms	RC045	C6
R7	47,000 ohms	RC043	c7
R8	560 ohms	RC045	C8
R9	560 ohms	RC045	c9
R10	1,800 ohms	RC023	C10
R11	1,800 ohms	RC023	C11
R12	270 ohms	RC029	C12
R13	47 ohms	RC039	C13
R14	47 ohms	RC039	C14
R15	47 ohms	RC039	C15
R16	47 ohms	RC039	C16
R17	1,800 ohms	RC023	C17
R18	1,800 ohms	RC023	C18
R19	270 ohms	RC029	C19
R20	1,800 ohms	RC023	C20
R21	82 ohms	RC053	c21
R22	560 ohms	RC045	c22
R23	470 ohms	RC041	C23
R24	10 ohms	RC013	C101
R25	33,000 ohms	RC036	C102
R26	3,300 ohms, lw, metal film	RZ013	C103
R27	1,000 ohms, ¼ w, metal film	RM021	C104
R28	150 ohms, ¼ w, metal film	RM013	C105
R29	1,800 ohms	RC023	C106
R30	82 ohms	RC053	C401
R31	47 ohms, carbon comp.	RZ011	C402
R32	47 ohms, carbon comp.	RZ011	C403
R33	220 ohms, ½ w	RDI14	C404
R34	2,200 ohms, ½ w	RD115	C405
R35	10 ohms	RC013	C406
R36	1 ohm, 10 w	RW012	C407
R37	10 ohms, 5 w	RW013	C408
R38	28,000 ohms, ¼ w, metal film	RM053	D1-D8
R101	100,000 ohms	RC017	D9
R102	120,000 ohms	RC019	D10
R103	150,000 ohms	RC021	D11
R104	150,000 ohms	RC021	D12
R105	27,000 ohms, ½ w	RD122	D13
R106	22,000 ohms	RC026	D14
R107	3,900 ohms	RC037	D15
R108	3,900 ohms	RC037	D16
R109	22,000 ohms	RC026	D101
R110	27,000 ohms, ½ w	RD122	D102
R111	10 megohms	RC018	D103
R112	4,700 ohms	RC042	D104
R113	10 megohms	RC018	D105
R114	1 megohms	RC047	D106
R115	10,000 ohms	RC016	D107
R116	100,000 ohms	RC017	D108
R117	150,000 ohms	RC021	D401
R118	10 megohms	RC018	Q1
R119	22,000 ohms	RC026	Q2
RI20	1,500 ohms, 2 w, metal film	RZ015	Q3
R401	470 ohms, ½w	RDI17	Q4
R402	470 ohms, ½ w	RD117	Q5
R403	470 ohms, ½ w	RD117	Q6
R404	220 ohms, ½ w	RD114	Q7
R405	220 ohms, ½ w	RD114	Q8
R406	220 ohms, ½ w	RD114	Q9
R408	1 megohms, ½ w	RD113	Q10
R409	300 ohms, 7 w	RW015	Q11
R410	300 ohms, 7 w	RW015	Q12
R411	600 ohms, 7 w	RW024	Q13
R412	600 ohms, 7 w	RW024	Q101
DB401	Diode Bridge	QD117	Q401
F401	Fuse, 2A, 3AG (value optional)	SF011	Q402
F402	Fuse, 10A, GLH	SF013	4403
F403	Fuse, 10A, GLH	SF013	Q404
F404	Fuse, 15A Slo-Blo MDA	SF014	Q405
F405	Fuse, 7A Slo-Blo MDA	SF021	Q406
IC401	LM339N	QB115	S401
L1	Inductor, 1.4uH	TA112	TB401
P1	1000 ohms trimpot	RP011	TB402
P2	1000 ohms trimpot	RP011	TR401
T401	Power Transformer	TA116	TS401
T402	Power Transformer, multi-voltage	TA117	TS402
RY401	DPDT relay	SZ113	
			CPI15
			CP134
			CC124
			CP136
			CP136
			CC125
			CC125
			CNI13
			CP133
			CP134
			CC124
			CL122
			CC124
			CL122
			CC124
			CC124
			CP133
			CC124
			CC124
			CC124
			CC125
			CC125
			CP136
			CEI17
			CNI14
			CL125
			CZ112
			CM121
			CC125
			CC125
			CL123
			CL123
			CZ112
			CE117
			CZ113
			QD116
			QD121
			QD121
			QD116
			QD111
			QD111
			QD116
			QD115
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			QD111
			QD111
			QD115
			QP122
			QN128
			QN128
			QN128
			QP122
			QP122
			QP122
			QP123
			QN124
			QN128
			QN125
			QN125
			QP123
			QN128
			QN113
			QN113
			QN113
			QP113
			QP113
			QP113
			SL111
			SF024
			SF024
			RZ016
			SF025
			SF025
			AA113
			AA128

COMPONENT VALUES

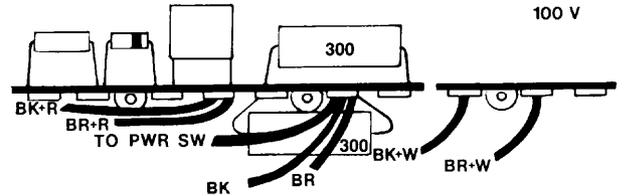
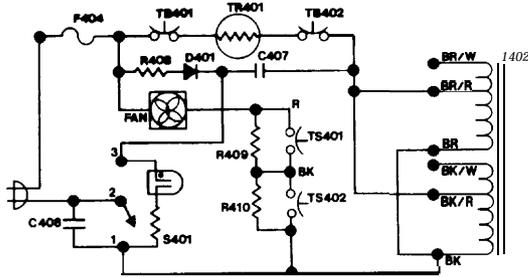
AC LINE CONNECTIONS FOR OVERSEAS USE

The power transformer supplied in DH-500 amplifiers sold in the USA is intended for 120 volt, 60 Hz operation only. For use in other countries, a multi-voltage transformer is supplied in Export versions, available at higher cost. It has dual tapped primary windings which can be connected in series or parallel combinations for 100, 120, 200, 220 or 240 volt, 50 or 60 Hz power sources. The connections which are different from the standard 120 volt connections described in the kit assembly instructions are all related to the transformer lead terminations, and to the large resistors on the 7-lug terminal strip. An additional 3-lug terminal strip is required when the

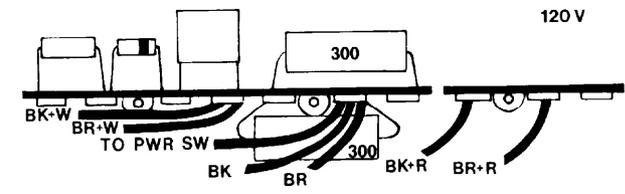
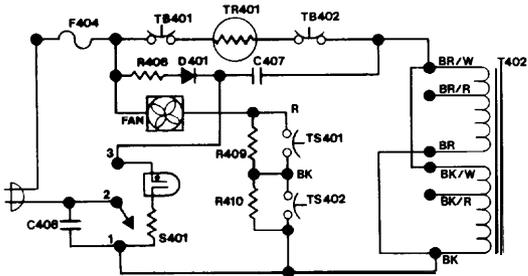
multi-voltage transformer is installed. This, the 600 ohm resistors, the mounting hardware, and the alternate line fuse are supplied in kits which include this transformer.

The diagrams below show pictorially and schematically the alternative wiring. Only the pertinent wire connections are shown. There are other wires connected to the 7-lug terminal strip which are unchanged. If the amplifier is to be operated with line voltages between 200 and 240 volts, a different fan, part #AA128, is required, the 600 ohm resistors must replace the 300 ohm values, and the 7 ampere slo-blo fuse must replace the 15 ampere line fuse.

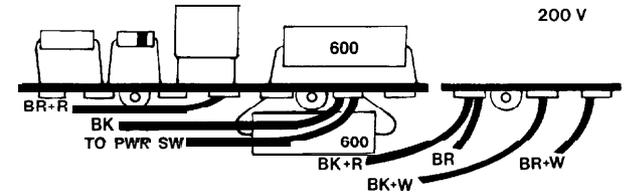
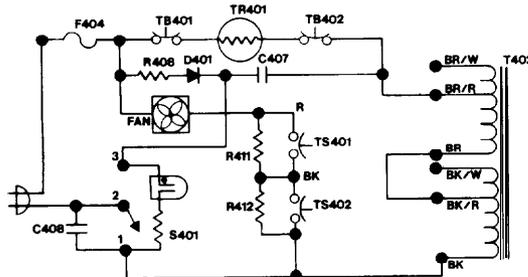
100v.



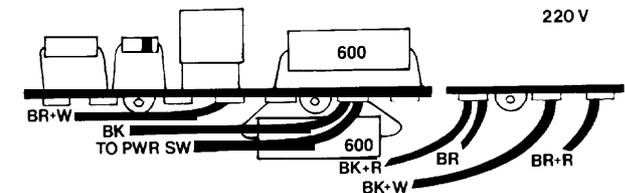
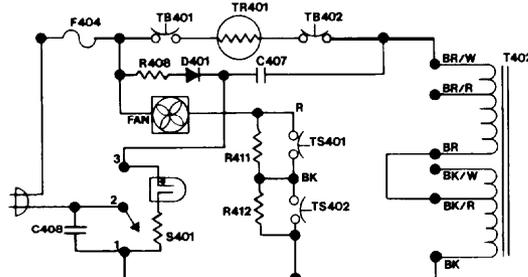
120V.



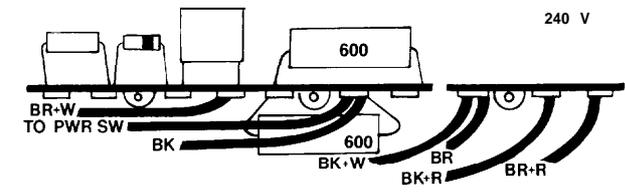
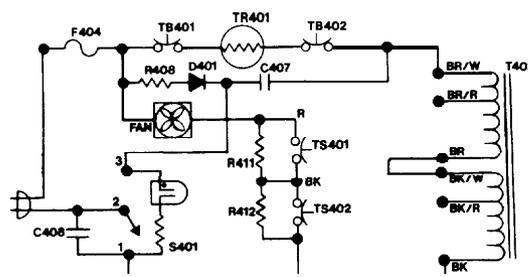
200V.



220V.



240V.



KIT PARTS LIST

Minor variations may sometimes be encountered in value or appearance. These will not affect performance. Some of the hardware listed here has been used to secure parts for shipping the kit.

		Part No.
1	Chassis	MS127
1	Cover	MS126
1	Front plate (rack mount)	MS161
1	Front panel (inside)	MS128
2	Handle	HZ167
1	Amplifier module with fan #AA1 13	AH324*
	Power transformer	TA116
1	AC line cord with plug, 16 Ga.	WA016
2	Bracket, capacitor, round	HZ124
2	Capacitor, 20,000 mfd, 100 volt	CL123
1	Circuit board, PC-9C, assembled	AC009
1	Label, serial number	LR015
1	Relay, enclosed	sz113 <i>SWH12C1</i>
1	Manual	
1	Warranty card	
	Wire, white #18	
	Wire, green #18	
	Wire, Yellow #18	
	Wire, Black #22	
	Wire, Red #22	

HARDWARE ENVELOPE

		Part No.
	Lug, ground, internal tooth, #6	HZ115
8	Lug, plain connecting, #10	HZ1 16
22	Nut, #4-40 KEP	HK111
9	Nut, #6-32 KEP	HK112
4	Nut, #10-32 KEP	HK113
2	Nut, 1/2"	HK118
22	Screw, machine, #4-40 x 5/16"	HA1 13
8	Screw, machine, #6-32 x 1/2"	HA116
8	Screw, machine, #10-32 x M"	HA119
4	Screw, SEMS, #10-32 x 1/4"	HA118
29	Screw, sheet metal, #6 x 3/8"	HPI 17
1	Screw, machine, #6-32 x 3/4"	HA1 15
4	Washer, flat, #10 x 7/8"	HW114
2	Washer, internal tooth, 1/2"	HW116
2	Washer, rubber, M"	HR117
3	Wire ties, nylon, 4"	HR138

SMALL PARTS ENVELOPE

		Part No.
2	Bracket, L-shape, 2"	MS153
1	Bracket, L-shape, 3"	MS154
1	Capacitor, 0.005 mfd Disc	CZ113
1	Capacitor, 0.01 mfd Disc	cz112
1	Capacitor, 0.39 mfd Film	CE117
1	Diode, 1N4003	QDI15
1	Inrush Limiter	RZ016
1	Resistor, 1 megohm, M watt	RD113
2	Resistor, 300 ohm, 7 watt	RWO15
3	Spade lug terminal	xzo14

LARGE PARTS ENVELOPE

1	Diode block, silicon rectifier	QD117
4	Foot, rubber	HR146
1	Fuse clip, single	XA012
2	Fuse clip, dual	XA014
2	Fuse holder, round, panel mount	XA013
2	Input socket	XP014
1	Power switch	SL111
1	Strain relief, plastic	HR144
2	Terminal post, black, complete w/black washer and 2 nuts	XK013
2	Terminal post, red, complete w/red washer and 2 nuts	XK014
1	Terminal Strip, 7 lug	XK019

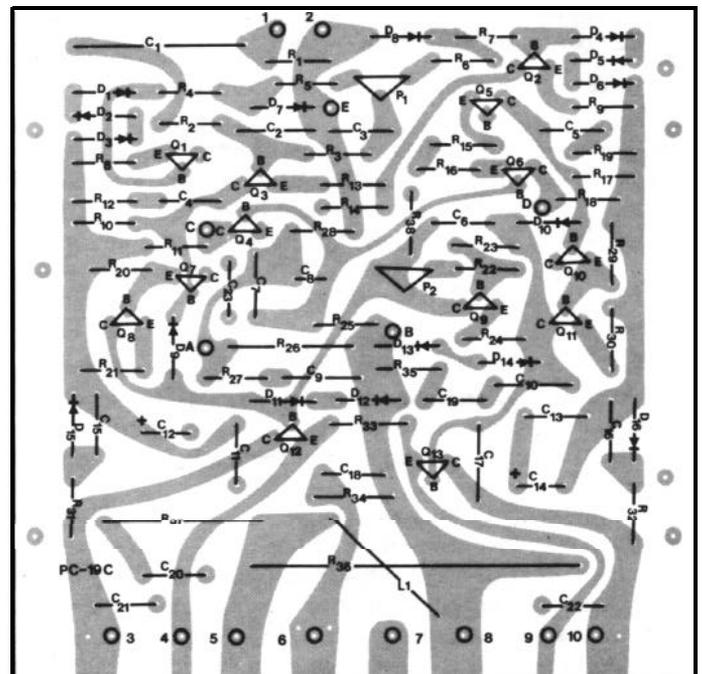
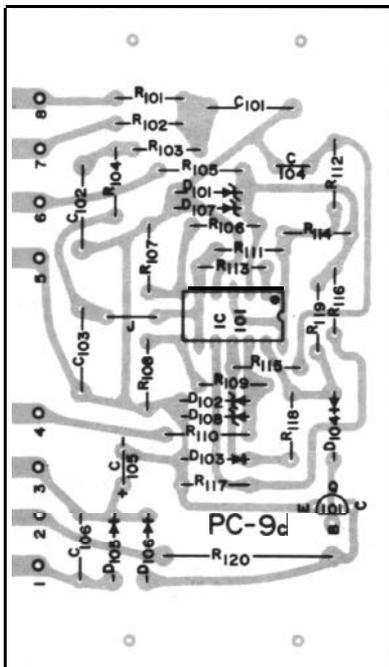
FUSE ENVELOPE

2	2 ampere	SF011
2	5 ampere	SF012
4	10 ampere	SF013
1	15 ampere, slo-blo	SF014

For Alternate Multi-Voltage Transformer Only

1	Power Tmnsformer	TA117
1	Terminal strip, 3 lug	XK017
1	Screw, machine, #4-40 x 5/16"	HA1 13
1	Nut, #4-40 KEP	HK111
1	Fuse, 7 ampere, slo-blo	SF021
2	Resistor, 600 ohm, 7 watt	RWO24

* For use with 200-240 volts AC, a different fan, part#AA128, must be fitted to the amplifier module.



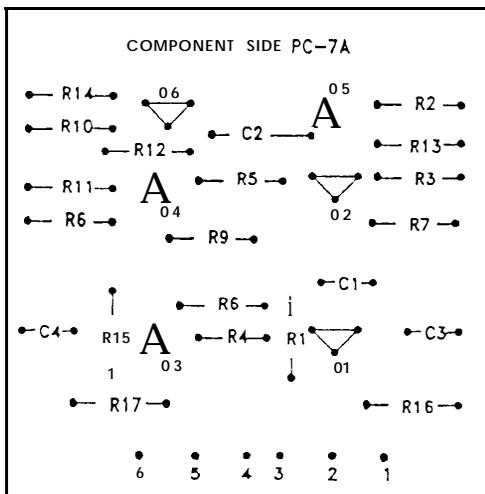
DH-502 INSTALLATION INSTRUCTIONS

1. Disconnect AC power from the DH-500 and remove all connecting cables.
2. Remove the 17 screws which secure the cover along the top front, sides and rear. Set cover aside. **DO NOT GRAB THE AMPLIFIER PANEL OR HANDLES WHEN THE COVER IS REMOVED.** You might bend the chassis.
3. Turn the amplifier over, or stand it on the transformer end. Loosen, but do not remove the two front screws which secure the amplifier module near the front (center) of the chassis. Remove the two screws at the rear which secure the module. Return the amplifier to its upright position.
4. Prepare one each red and green wires each 16" long. Twist them together throughout their length.
5. Select the PC-7A circuit board. Note that the eyelets arcnumbered on the circuit side of the board, with eyelet #1 to the left when the row of eyelets is nearest you, and the board is upside down to make soldering easier. Connect the wires from the components side of the board, and be sure each is securely soldered to the circuitry.
6. Connect the red wire of the twisted pair to eyelet # 1 of PC-7A. (S) Connect the green wire to eyelet #3. (S)
7. Prepare a 3-1/2" green wire and a 4" red wire. With one pair of ends even, twist these together. At the uneven ends, connect the green wire to eyelet #4 of PC-7A. (S). Place the pair off toward eyelet #1, and connect the red wire to eyelet #6. (S)
8. Prepare a 5" red wire and a 6" green wire. Twist these together with one pair of ends even. At the even ends connect the red wire to eyelet #2. (S) Connect the green wire to eyelet #5. (S)
9. Unsolder the twisted pair of leads from eyelets 1 and 2 of the right amplifier module at the center rear of the amplifier. This pair of leads which connects to the right input socket, will no longer be used while the amplifier is functioning monophonically. These leads must be taped securely so that there is no possibility for the bare wire to contact any portion of the circuit. Masking tape is sufficient, but electrical tape is preferred. These leads may be removed if desired.

10. Remove the rear top screw securing the right channel amplifier circuit board to the heat sink just above where the twisted pair was disconnected. Do not lose the fiber spacing washer which is between the circuit board and the heat sink. This washer is not used on later production DH-500s. Select one of the screws from the bridging kit, and the mounting bracket. The bracket is anchored at this location, flat surface up, with the screw inserted first through the single tab from inside the bracket. then through the circuit board. the fiber spacing washer, (optional) and into the heat sink.
11. Select the two screws and nuts and the circuit board PC-7A. With the components facing out, secure the board to the outer surface of the bracket tabs.
12. Select the short twisted pair of wires connected to eyelets 4 and 6. Connect the red wire to the upper eyelet #1 of the right circuit board at the center rear. (S) Connect the green wire to the lower eyelet #2. (S)
13. Place the long pair of wires from eyelets 1 and 3 down between the amplifier module mounting bracket and the back of the chassis. The module can be tilted forward to facilitate this. Connect the red wire to the lower eyelet #1 on the left circuit board. (S) The easiest way is to wrap it in a tight loop around the bare stub of the wire presently connected to this eyelet. Be sure both wires are soldered securely to the board. Connect the green wire to the upper eyelet #2 in the same fashion. (S)
14. Making sure that no wires are trapped by the mounting bracket, reinstall the two screws securing the rear of the module to the chassis. Tighten all 4 screws.
15. Connect the red wire of the remaining twisted pair from PC-7A to eyelet #6 of the PC-9 circuit board behind the power transformer, (S) This wire may be connected to the stub of the existing wire as before. Connect the green wire to eyelet #4 of PC-9. (S) Eyelet #1 of PC-9 is nearest the edge of the chassis.
- 16.0 Reinstall the amplifier cover.

PC-7A PARTS LIST

R1	22.1K, 1%, metal film	RMP/4-2212
R2	2.2K, 1/4w, 5% carbon film	RC/4-222
R3	2.2K, 1/4w, 5% carbon film	RC/4-222
R4	47 ohms, 1/4w, 5% carbon film	RC/4-470
R5	47 ohms, 1/4w, 5% carbon film	RC/4-470
R6	8.2K, 1/4w, 5%, carbon film	RC/2-822
R7	8.2K, 1/4w, 5%, carbon film	RC/2-822
R8	47 ohms, 1/4w, 5% carbon film	RC/4-770
R9	47 ohms, 1/4w, 5% carbon film	RC/4-770
R10	2.2K, 1/4w, 5% carbon film	RC/4-222
R11	2.2K, 1/4w, 5% carbon film	RC/4-222
R12	22.1K, 1%, metal film	RMP/4-2212
R13	100 ohms, 1/4w, 5% carbon film	RC/4-101
R14	100 ohms, 1/4w, 5% carbon film	RC/4-101
R15	47 ohms, 1/4w, 5% carbon film	RC/4-770
R16	3.3K, 1w, 5% metal film	RM1-332
R17	3.3K, 1w, 5% metal film	RM1-332
C1	1 OmF, 16V. non-polarized	CERNP-106
c2	6.8pF, 100V, dipped mica	CM-068
c3	22mF, 25V, electrolyte	CER-226AA
c4	22mF, 25V, electrolyte	CER-226AA
Q1	BC550C NPN transistor	SSH-650
Q2	BC550C NPN transistor	SSH-650
Q3	BC560C PNP transistor	SSH-65 1
Q4	BC560C PNP transistor	SSH-65 1
Q5	MPSA63 PNP transistor	SSH-695
Q6	MPSA13 NPN transistor	SSH-645



INSTRUCTIONS FOR THE HAFLER DH-502 AMPLIFIER BRIDGING KIT FOR THE DH-500

The DH-502 Amplifier Bridging Kit for the DH-500 consists of a PC-7A circuit board comprising a 6 transistor phase inverting amplifier, a mounting bracket, necessary hardware and connecting wire. Installation may take about an hour. All changes to the amplifier wiring are performed on the right channel - the side nearest the power switch. Only the left channel input will be utilized after conversion so an additional pair of input wires will be connected to that jack to enable it to feed the complete amplifier.

When converted to monophonic operation, the loudspeaker load is to be connected to the two centered (+) outputs only. The right (+) will act as the common and should be attached to the speaker (-). This is what is known as a floating output, for no connection is made to either black ground terminal. It is suggested that once the amplifier has been converted, some clear

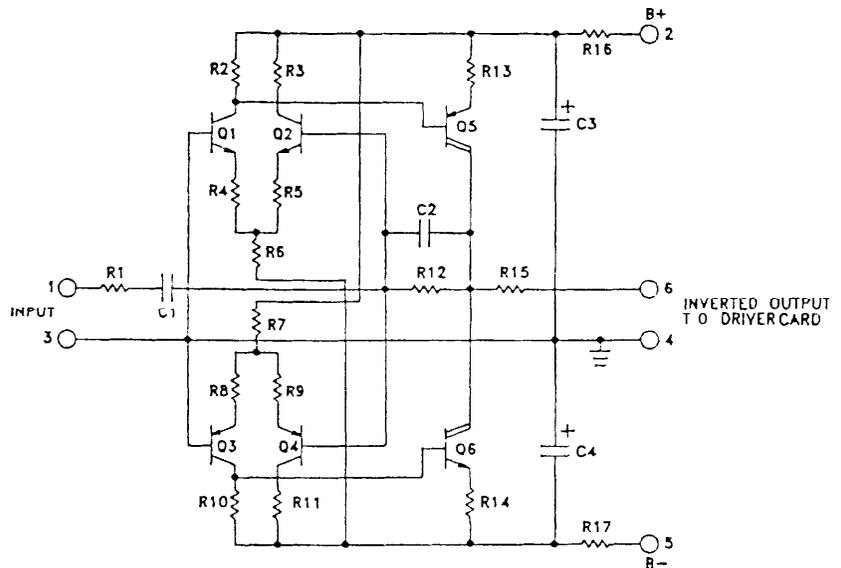
indication be made as to the appropriate connections, and that be attached to the back panel. Because of this floating output, neither side of the output signal may be grounded; such as thru a speaker switching box or head phone adapter that has a common ground between the left and right channels.

For equivalent load impedances, the speaker fuses provide the same power output protection as in stereo operation, but because of individual fuse variations, only one fuse may blow at these levels. It is best to replace both fuses if one blows, as the other may have been weakened.

These installation instructions designate connections in accordance with the DH-500 owner's manual and pictorial diagram, and use the same terminology (i.e. "S" indicates a soldered connection),

KIT PARTS LIST

1	PC-7 Board	WP-PC7
1	Mounting bracket	SM-BRT202*
2	Screw, Machine, 4-40 x 5/16"	HWH-145
2	Nut, 4-40 KEP	HWH-105
1	Wire Red #20 GA	3 0'
1	Wire, Green #20 GA	3 0'
1	Warranty Card	LIT-WAR



LIMITED WARRANTY

The parts in the DH-502 are warranted for a full year from the purchase date including parts and labor. If a defective component is found on a circuit board or in the kit, simply return the individual part, or if the problem is unknown, return the defective board to the factory, prepaid, together with the serial number and a copy of the dated bill of sale, and it will be repaired or replaced at no charge. This warranty is limited to repair or replacement of the DH-502 bridging module only. Hafler is not responsible for consequential damages. This warranty gives you specific legal rights. You may also have other rights which vary from state to state.

This warranty is void if acid core solder or paste flux has been used.

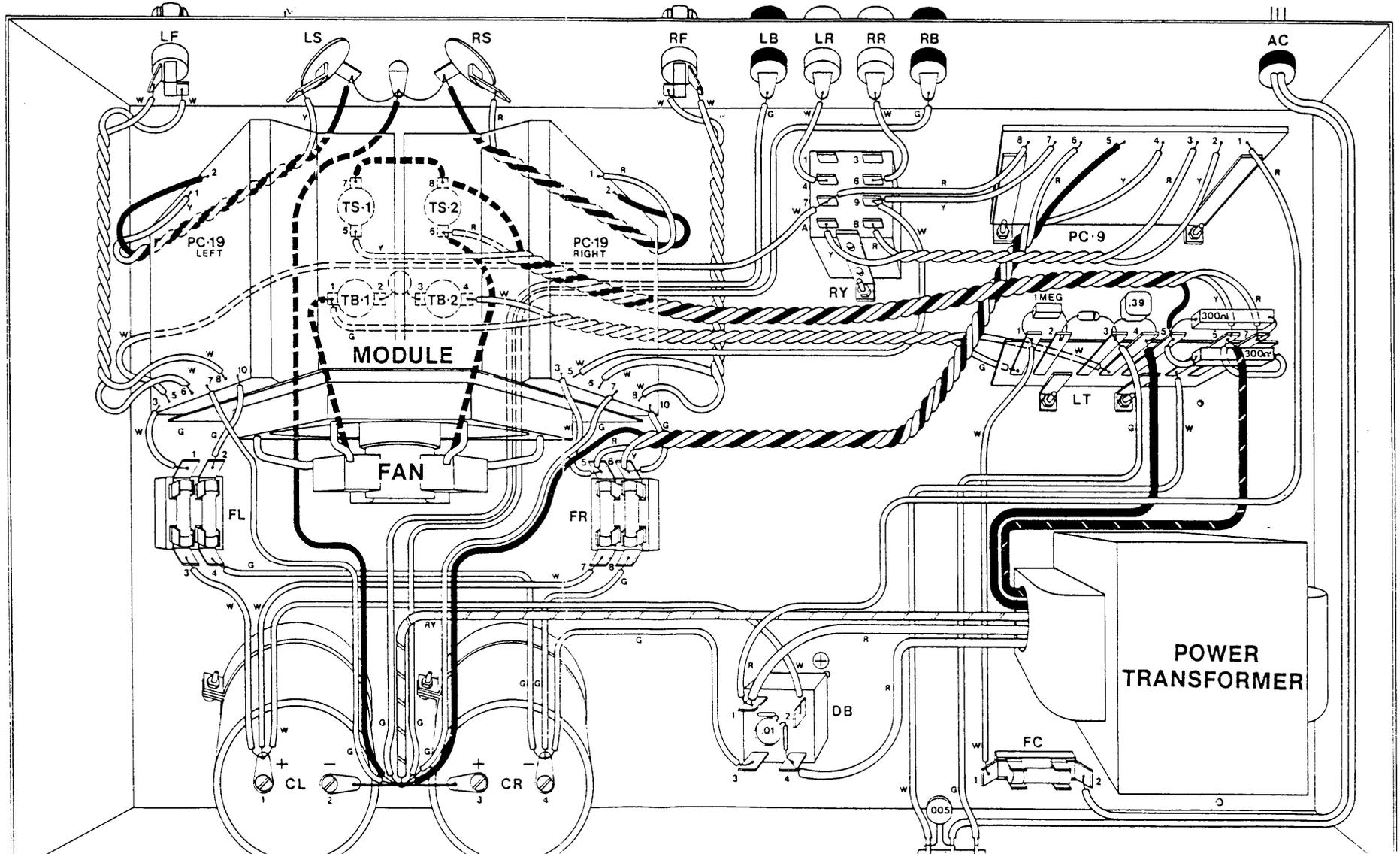
Hafler

A Division Of Rockford Corporation
613 S. Rockford Drive, Tempe, Arizona 85281 . (602) 967-3565

HAFLER DH-500 STEREO POWER AMPLIFIER PICTORIAL DIAGRAM

120 Volt AC Line
Connections Shown

REAR



SERVICE POLICY AND LIMITED WARRANTY

The DH-500 Power Amplifier has been carefully engineered to provide many years of use without requiring any maintenance or servicing.

Factory assembled units are subjected to many physical and electrical tests before shipment. The amplifier module assemblies of kit units are similarly tested to meet performance specifications prior to packing. In spite of this, shipping damage does occur, a kit may not be assembled properly, or human error interferes, so service may be needed. The David Hafler Company provides complete service facilities at the factory to make any necessary repairs. Because many of the components in this refined design are not readily available through local sources, and the performance of the unit is likely to be compromised with "similar type" substitutions, we strongly recommend factory service, or obtaining the requisite parts from the factory.

It is the owner's responsibility to return or ship the unit freight prepaid to the factory service department. Units shipped freight collect will not be accepted. For units to be repaired under warranty, a copy of the dated bill of sale must accompany the unit.

Use the complete original carton and all packing material to ship your amplifier. Enclose with the unit the following information:

1. Complete shipping address (Post Office box numbers are not acceptable, except for correspondence).
2. The serial number, if it is not on the unit.
3. Copy of dated bill of sale if repairs are to be made under warranty.
4. Description of the malfunction. If intermittent, be sure to so indicate.
5. You may also wish to attach your address directly to the unit, or to the line cord.

All service work is guaranteed for 90 days.

Warranties apply to the original purchaser only. The warranty is void if the amplifier has been modified without factory authorization; or if parts have been substituted which, in the factory's judgment, are not suitable; or if the amplifier has been either physically or electrically abused, or used for some purpose for which it was not designed or intended.

The warranty on the transformer is void if the leads have been cut too short for re-use. If you think the transformer is defective, unsolder, do not cut the leads for its return.

Technical assistance to help you locate the source of a problem may be obtained by calling the Technical Services Department at 609-662-6084, 8am-4:30 pm E.T. It is helpful to know the serial number of the unit, and the results of any tests you have performed. However, we do not recommend that you attempt your own servicing unless you are knowledgeable in this regard.

The weight of a DH-500 (unless it includes the special multi-voltage power transformer), when packed exactly as it came from the factory, should be just under 50 pounds, and may be shipped by UPS. However, be certain it is fully protected, and insure it for the full value.

If you choose, it is possible to return only a portion of the amplifier for factory service, with some disassembly on your part. This assumes that you are certain the problem lies only in the returned portion, and that you assume full responsibility for reinstalling it correctly, since a service warranty cannot be extended for other than the actual portion serviced. Because the transformer is so heavy, and a problem there is most unlikely, its removal by unsoldering a few leads is a logical choice. The balance of the amplifier should be insured for at least \$700. It is also possible to unsolder the module, and return it, if that is where the only problem lies. However, it requires much more care in packing, to protect the delicate components on the circuit boards, and many more connections must be unsoldered, so there is more risk for reinstallation error. It should be insured for \$400. The service fee for the module is \$50. If you return an amplifier for service or checkout, and it is functioning correctly, a charge will be made for the testing time required, as well as for packing and shipping.

WARRANTY FOR KIT-BUILT UNITS

The parts in a DH-500 kit are warranted for a full year from the purchase date. If a defective component is found on a circuit board or in a kit, simply return the *individual* part to the factory prepaid together with the serial number and the date of purchase, and it will be replaced at no charge.

If you cannot locate what is wrong with your DH-500, return it to the factory along with a copy of the dated bill of sale, and a check for \$75. If the cause of the problem is a defective part, the unit will be repaired and returned to you transportation prepaid, and your \$75 less the *shipping charges* will be returned to you. If the problem is found to be an error in your assembly of the amplifier, the amplifier will be put in proper working order, tested to be sure it is meeting specifications, and returned to you (freight prepaid within the continental U.S.). Excess shipping charges for expedited service, or overseas delivery are your responsibility. At the sole discretion of the factory service department, if the time required for diagnosis, repair and testing, and the nature of the malfunction warrants it, a portion of the submitted repair fee may be rebated.

This warranty is void if the kit has not been completely assembled or if other than rosin core solder has been used. Units assembled with acid core solder or paste flux will be returned unserviced.

WARRANTY FOR FACTORY ASSEMBLED UNITS

The DH-500 is warranted for three years from the purchase date including parts and labor and normal shipping costs from the factory to the owner within the continental U.S. The owner is responsible for returning the unit to the factory and must submit a copy of the dated bill of sale.

This warranty gives you specific legal rights. You may also have other rights which vary from state to state.