

# THE HAFLER DH-100 PREAMPLIFIER KIT BUILDER'S MANUAL

LM164

## 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-100 preamplifier 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. 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 and the proper tools. The tools should include:

1. A 40 to 60 watt pencil soldering iron with a 3/16" 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.
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. Needle-nose pliers (a long, narrow tip).
7. Diagonal or side-cutting small pliers.
8. Large "gas" or "slip-joint" pliers.
9. 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

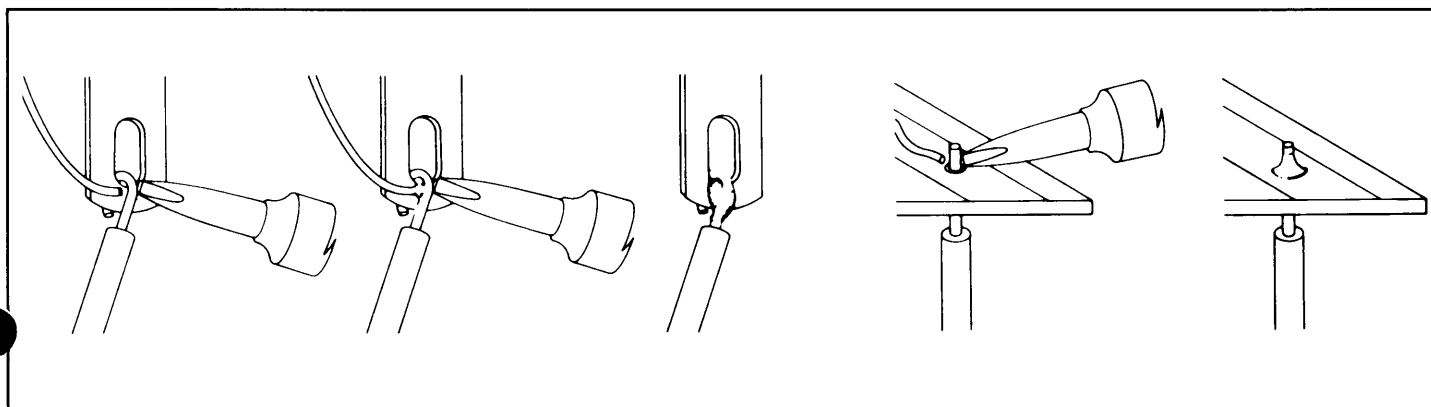
There are four steps to make a good solder connection:

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 circuitry on the board, with the bright, shiny tip of the iron.
3. After heating for a couple of 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. Connections to the circuit board, 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.

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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 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 40/60, 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 board. 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 onto adjacent circuitry and cause a short circuit.

#### Assembly Tips

A 'set' of hardware includes a screw and a KEP nut (which has a lockwasher attached). Always install the lockwasher side first. Screws are always inserted from the outside of the chassis unless otherwise specified in the instructions. #4 hardware is smaller than #6, and in this kit, the #6 screws are finished in black, to match the cover.

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

Whenever a connection is to be soldered, the instructions will so state, or will indicate by the symbol (S). If more than one wire is to be soldered at the same point, the indication will be (S-2) or (S-3). 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, but some builders prefer to solder each connection as they go. Every connection in the kit will be soldered when it is complete. Every lead which connects to a hole on the circuit board is to be soldered. After soldering a connection, clip off any excess lead length for neatness, and to minimize the possibility of a short circuit.

'Tinning' refers to the process of applying a light coating of solder to a bared wire end. On the line cord, for example, it keeps all the strands secured, and also makes a good connection easier. Simply touch the wire with the iron for a couple of 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, as it is pre-tinned.

It is a good idea to check off all the parts before you begin, to make sure that nothing has been overlooked, and to help you identify any unfamiliar items by comparing them with the list for each parts bag, and with the pictorial diagram. If a part is missing, a postcard, or a phone call to Customer Service at (609) 662-6084 will bring a prompt response.

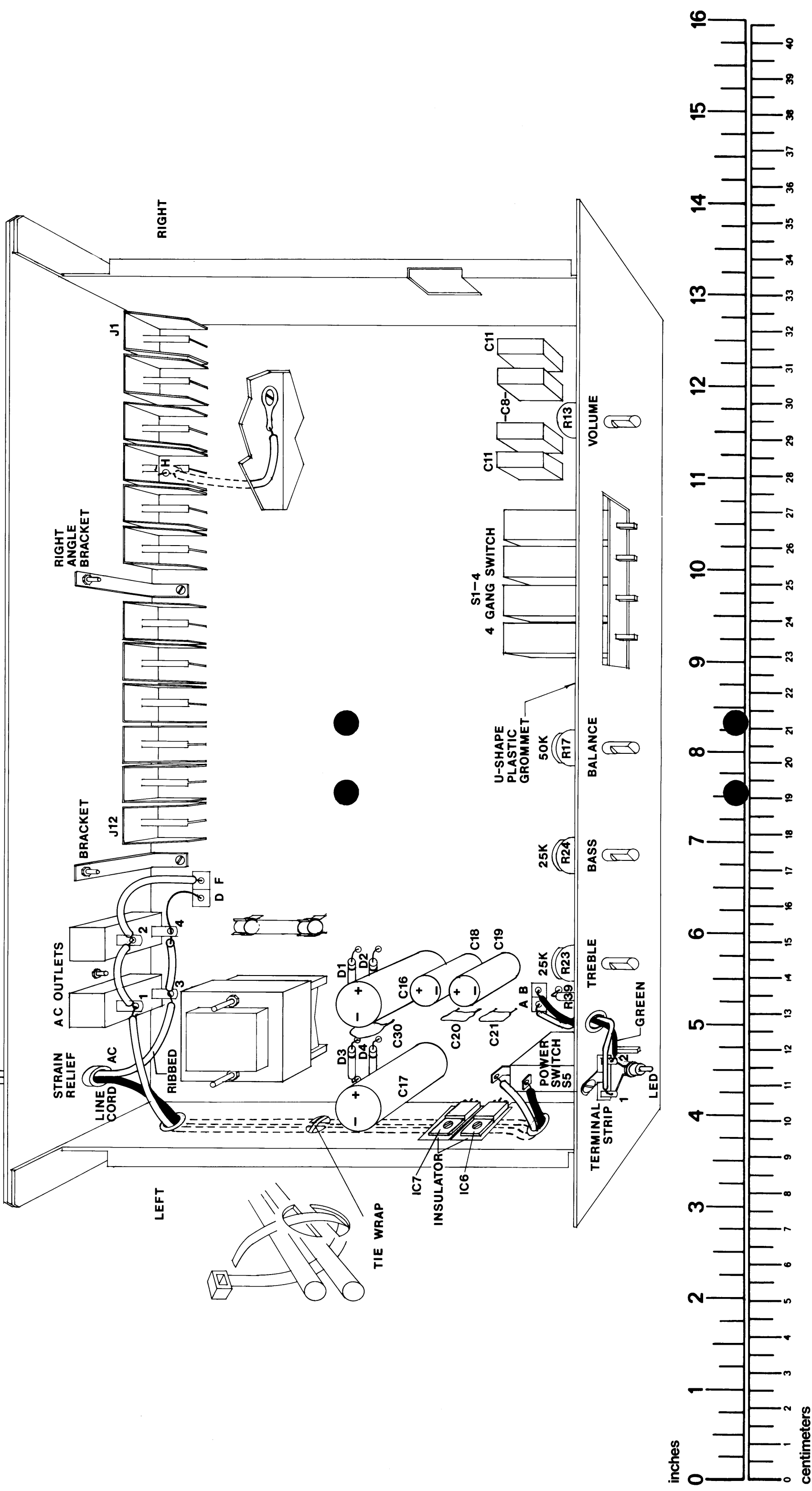
#### KIT PARTS LIST

This list is in addition to the individual lists included in each of the parts bags, #1 through #4.

	Part No.		Part No.		
1	Circuit board assembly, PC-23	KF343	1	Fuse, spare, 1/16 amp slo-blo	SF019
1	Cover	MS174	2	End cap, front panel	MC111
1	Back panel	MS199	4	Knob, metal	HD117
1	Bottom plate	MS173	1	Line cord with plug	WA043
1	Front panel	ME118	1	Transformer, power, 120 volt	TA126
1	Front sub-panel	MS169		or alternate 240 volt	TA127
2	Side pieces	MS171	1	Label, serial number	LR015
1	Allen wrench, L-shape, 5/32"	HZ138	1	Registration card	LM016
1	Allen wrench, L-shape, #8 set screw	HZ139	1	Owner's Manual	
1	Cable pair, audio	WA017			

# HAFLER DH-100 STEREO PREAMPLIFIER PICTORIAL DIAGRAM

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## BUILDING THE DH-100 KIT

Because many of the circuit components are already installed on the etched circuit board, the essential performance of your preamplifier has already been confirmed to meet specifications before it was packed in the kit. Most of the remaining assembly is simply mechanical, but good solder connections are essential. Read the preceding section carefully if electronic kit construction is not familiar to you.

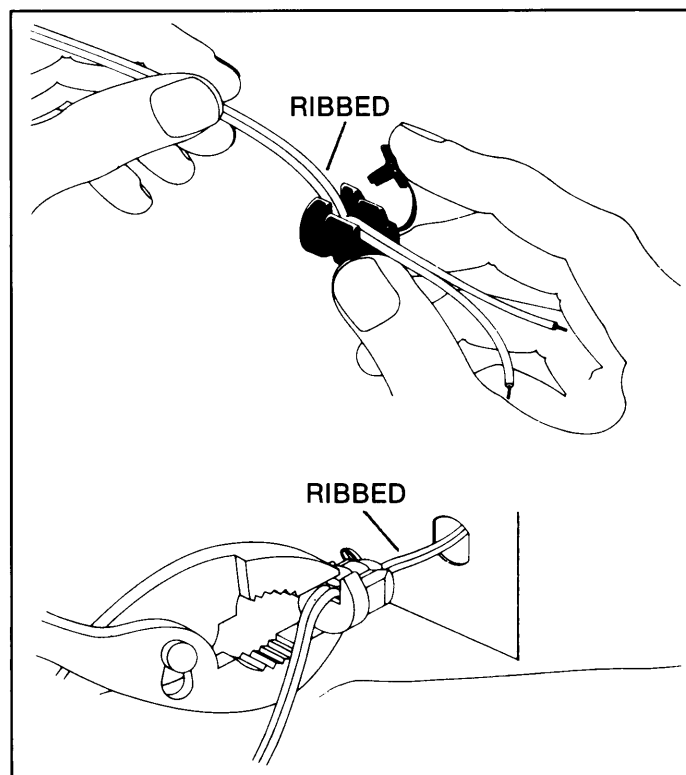
The pictorial diagram shows every connection, and the parts that you will install on the circuit board. The top of the board is marked with each component designation next to the mounting holes. Separate lists for each parts 'bag' will help you identify unfamiliar parts as you unpack them, and these, together with the pictorial diagram (which is sometimes distorted for clarity of connections) should leave no question as to where each part goes. In some cases, a specific orientation of a part is called for, and the circuit board will identify the + lead, or marked end. However, some part manufacturers will instead identify the opposite, or (-) lead on the component, so be sure you install these parts correctly.

Mechanical connections in a preamplifier must be tight, because many of them conduct electrical signals, even through the chassis. The exception will be the nylon screws and nuts used in special cases, where they should be tightened only until they resist your tools slightly, to avoid stripping their threads. It will be easier if you first separate the hardware by size and type in an egg carton, verifying the count on the parts list as a check on how they are identified. #4 and #6 nuts look almost alike, but the larger #6 size can be selected by sliding it over the single long #4 screw.

- We'll tackle the most difficult step in this kit right away—installing the AC line cord and its strain relief. This requires heavy 'gas' or slip-joint pliers because of the stiffness of the line cord. Select the back panel, the AC line cord, and the plastic strain relief. 9" from the cut end of the cord, make a sharp 'V' in the line cord by bending it back on itself with the ribbed conductor positioned as shown. Install the strain relief with the smaller diameter nearest the cut end of the cord. Crimp the two halves of the strain relief around the cord at the 'V' to partially form it before insertion into the back panel. Then grip the larger diameter section with the tips of the pliers and squeeze tightly. Avoid scratching the back panel when you insert the cord end and the smaller part of the strain relief through the hole AC from the outside. Note that the hole has 'flats' which keep the relief from twisting. It snaps into position when fully inserted.

Separate the two conductors of the line cord. Cut the **ribbed** conductor so that 2" projects from the strain relief, and strip 1/4" of insulation from the end. Strip 1/4" from the longer end as well. Twist the strands of each conductor tightly, and 'tin' each end with solder to secure the strands.

- Select the two right angle brackets and 3 sets of #6 hardware (1/2" black screws). Fasten the long leg of each bracket to the inside of the back panel at either end of the long central cutout. The third bolt simply fills the holes between the two rectangular openings for the AC outlets. This hole has no purpose in your kit.
- Select the two AC outlets. Note that one plug slot on each outlet is wider. The wider slot goes at the bottom of the back panel when you snap them in from the outside. Connect the ribbed end of the line cord to AC outlet lug #3 (wide).
- Prepare a 2" length of white wire, but strip 1" of insulation from one end. Connect the shorter bared end to AC outlet lug #3. (S-2). Pass the longer bared end all the way through AC outlet lug #4, and 3/8" beyond that lug, bend the wire downward at a right angle. Solder lug #4.
- Prepare a 1-3/4" white wire. Connect one end to AC outlet lug #2, pointing the wire toward the angle bracket.
- Prepare a 1-1/4" white wire. Connect one end to AC outlet lug #2. (S-2). Connect the other end to AC outlet lug #1.
- Prepare a 9" white wire. Connect one end to AC outlet lug #1. (S-2).



- 8  Select the ground lug, the longer bright screw, a #4 KEP nut, and the knurled thumb nut. Fasten the ground lug on the inside of the back panel with the screw head on the inside, secured with the KEP nut on the outside, at the lower hole labeled 'GND.' The ground lug should point toward the strain relief. Be sure this connection is tight. Then place the knurled thumb nut on the screw.
- 9  Prepare a 1-1/4" white wire. Connect one end to the ground lug so that the wire projects towards the strain relief. (S). Set the back panel aside temporarily.
- 10  Select the bright finished front sub-panel, and one of the rubber grommets. Orient the panel so that the two single holes are in the upper left corner, and install the grommet in the larger of the two holes.
- 11  Select the two lug terminal strip, and one set of #4 hardware. Mount the terminal strip next to the grommet on the outside (facing you with the grommet in the upper left) of the panel, below its mounting hole.
- 12  Select the power switch and two #4 screws. Mount it on the inside of the panel, below the terminal strip, so that its two connecting lugs are uppermost behind the terminal strip. Set the front panel aside temporarily.

When installing components on the etched circuit board, be sure you are using the correct holes, then make sure the part is oriented correctly if that is specified, place the part flat against the board, solder the leads on the underside of the board, and cut off the excess lead. This board has 'plated through' holes, which means that the hole is coated with metal on the inside. Solder will be drawn into the hole when it is heated along with the lead, so you do not have to leave a large mound of solder on the outside. Just be sure the connection is smooth and bright. It is expected that you will solder every component lead which passes through the board, so individual instructions will not repeat that point.

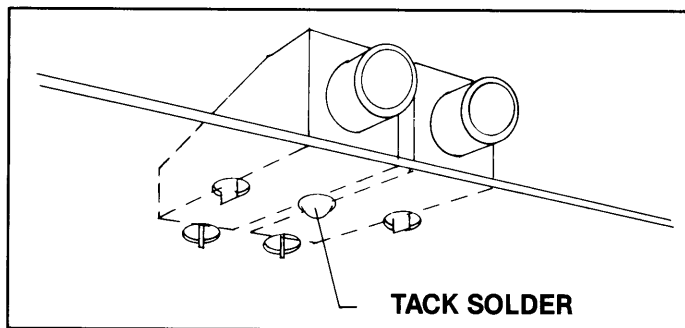
- 13  Select the circuit board and the 4 diodes, which are marked with a stripe on one end. The stripe must be on the end which is nearest the center of the board when these are installed in the locations marked D1, D2, D3 and D4, below the transformer location in the upper left corner. Solder every lead.
- 14  Select the disc capacitor C30 (502M), and install it between the diodes.
- 15  Select the 2700 ohm resistor, which has color bands red/violet/red, and install it at R39 near the left front corner of the circuit board.
- 16  Select the two .033 mfd capacitors, and install them at C20 and C21.

- 17  Select the two 470 mfd capacitors. Note that the negative lead may be marked, and/or the positive lead is longer. The hole for the positive lead is marked by an arrow on the board at locations C18 and C19. Be sure these are oriented correctly.

- 18  Select the four 1 mfd capacitors (1.0K) and install them in the lower right corner of the board, in the 2 locations marked C8 and in the 2 locations marked C11.

- 19  The 12 phono jacks will now be installed at locations J1 through J12, along the back of the board. It is important that these be mounted flat against the board, and it is also important that a phono plug be inserted in the jack while the center conductor is soldered to the board. Because the outside mounting lugs of adjacent jacks share a common hole in the circuit board, we suggest the following procedure as the simplest way to make sure all of the jacks are properly aligned.

Install the jacks in pairs, starting at J1, but temporarily 'tack solder' only the two mounting lugs in the one hole at the center of each pair. This will hold the jacks in position for checking and resoldering as necessary, until they are all in a straight, flush row. The go back and solder the remaining mounting lugs securely. After a final alignment check, go down the line and permanently solder those lugs which were just tacked in place at first. Now insert a phono plug (one end of the audio cables supplied in the kit) fully into each jack as you solder the center conductor of each.



- 20  Select the four gang pushbutton switch, and note that the flat metal mounting bar will be tight against the top surface of the circuit board when the switch assembly is installed correctly.

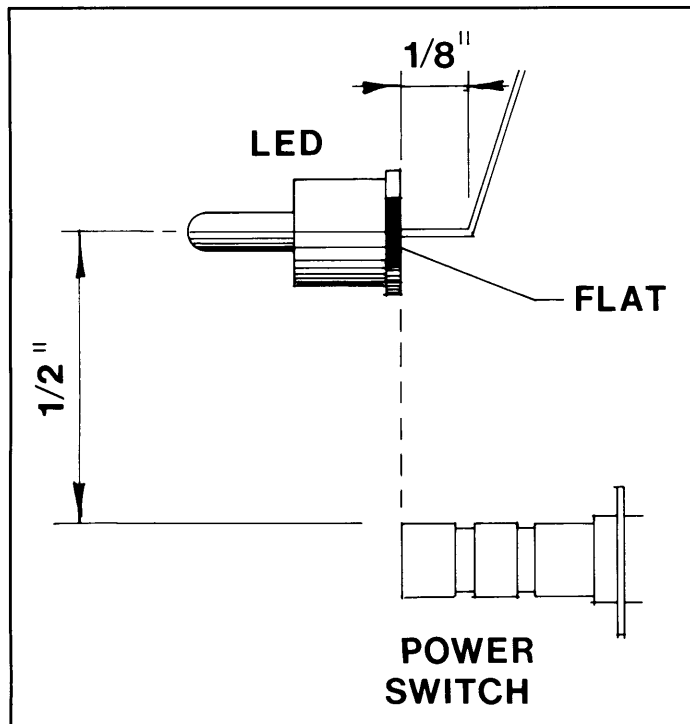
Initially tack solder two opposite corner switch lugs, and check to make sure the switch assembly is flush against the board, and that all lugs project through the board. When you are certain that it is correct, solder every switch lug securely.

- 21  The 4 potentiometers, or controls, may look alike, but only two are identical. The balance control will be marked '50K' as a part of the printed numbers on the control, but otherwise it looks like the 25K bass and treble pots. The volume control is also 50K, but it does not have the metal disc on the back. Install the volume control in the right corner of the board first. Because control position is critical for proper mounting to the front panel, and

it is very difficult to make any change after multiple lugs are soldered, we suggest that you solder only *one* lug on each control as you install them at this time. Even so, take care to position each so that it is flush against the board, and so that the control shaft is parallel to the surface of the board. Select the 50K balance control, and install it in the center location. Then install the two 25K pots in the bass and treble positions.

- 22  Select the two large 1000 mfd capacitors, and noting the + lead arrows on the board, install these at C16 and C17, just below the diodes.
- 23  Select one of the side pieces, and two sets of #4 hardware. Position the side piece on top of the left edge of the board, with the flanges pointing outward, and with the rectangular cutout above the designation for 'Regulators IC6 and IC7'. Bolt the side piece to the board.
- 24  Select the two rubber grommets and install them in the holes in the side piece.
- 25  Select the two regulators, IC6 and IC7, their 2 flat plastic insulators, 2 insulating shoulder washers, and 2 sets of #4 hardware. Install IC7, designated #7815, on the inside at the rear of the cutout in the side piece. The flat side of the regulator is towards the side piece, when the leads are inserted in the correct holes on the board. Install a shoulder washer on a screw with the larger diameter next to the screw head. Hold a flat insulator between the IC and the side piece, and insert the screw from the inside, through the IC, the insulator, and the metal side. Fasten snugly with a nut, but don't overtighten. Solder each lead on the bottom of the board. Install IC6, #7915, in the same manner in the adjacent front location.
- 26  Select the other side piece, and two sets of #4 hardware. Mount it on the board with the rectangular cutout toward the front of the board, at the top.
- 27  Select the front sub-panel assembly, and the 4 large Allen socket-head black screws. Mount the sub-panel to the board, just sliding the screws into their corner holes. They need not be secured with nuts at this time.
- 28  Select the 4 nuts and 4 washers for the controls, and secure the controls to the panel.
- 29  Solder all of the remaining lugs of the 4 front panel controls to the underside of the circuit board.
- 30  Select the power transformer and the two long nylon screws and two nylon nuts. Note the lug numbers on the transformer. Position the transformer so that these match the numbers on the circuit board, and solder each transformer lead after making sure that the transformer is flat against the board. In the 100-120 volt version used in the USA, there are no lugs at positions 2 and 3. Install the nylon screws from the *bottom* of the board, and secure with the nylon nuts, but do not overtighten these.
- NOTE: If the transformer supplied with your kit has lugs at positions 2 and 3, it operates only from 200-260 volt AC mains.
- 31  Select the back panel assembly, and 4 sets of #6 hardware. Feed the end of the AC line cord and the white wire through the rear grommet in the side piece from the inside, making sure the angle brackets are on top of the board, and secure the back panel to both side pieces.
- 32  Select the two sets of #4 hardware, and fasten the back panel angle brackets to the top of the circuit board.
- 33  Connect the short bare wire from AC outlet lug #4 to hole 'D' on the circuit board. (S). Connect the white wire from AC outlet lug #2 to hole 'F.' (S).
- 34  On the bottom of the board, connect the white wire from the ground lug to hole 'H.' Solder this on the bottom of the board. Check to make sure that the bare wire cannot protrude above the top of the board so far as to risk contacting a phono plug inserted in that socket.
- 35  Thread the line cord and white wire through the front grommet in the side piece. Connect the white wire to the rear lug of the power switch. (S). Connect the line cord to the top lug of the switch. (S).
- 36  Select the plastic wire tie and thread it through the two slots in the center of the left side piece, to secure the line cord and the white wire. This tie can be used only once, and it locks securely when the tail is pushed through the head end from the flat side. Cut off the excess after pulling it tight.
- 37  Prepare a 4" red wire, and a 3-1/2" green wire. Starting with one pair of ends even, twist these wires together throughout their length. At the even ends, connect the red wire to hole 'A' on the board, near the power switch. (S). Connect the green wire to hole 'B.' (S). Thread these wires through the rubber grommet in the front sub-panel, and connect the red wire to the farther lug #1 of the terminal strip. Connect the green wire to lug #2.

- 38  Select the red LED, and note that adjacent to one lead the red flange has a tiny flat which marks the cathode lead. This lead will be connected to the green wire, and thus to hole 'B' on the board. To position the LED properly, so that it will engage the hole in the front panel, hold the LED pointing toward you with the flat on the right side. Bend the lead upwards at a right angle, 1/8" behind the red base flange. Then bend the leads into an open 'V,' so that they may be pushed up through the holes in the lug terminal strip. When the tip of the LED is 1/2" above the top surface of the square plastic switch shaft, bend the LED leads sharply outward to support the LED while it is soldered. This should position it so that the rear surface of the red flange is in a vertical line with the front of the switch handle when it is out (released). Solder the red and green wires to the lugs, as well as the two LED leads. Before you cut off the excess LED lead length, it is best to check by temporarily putting the front panel in position, after placing the black plastic switch pushbuttons on the switches for alignment.



- 39  Remove the round pushbutton from the power switch shaft, and select the piece of black plastic shrink tubing. Cut a 1/4" length of tubing, and slip it

over the LED so that it touches the upturned leads at the rear. Hold a lighted match below it, and it will shrink to fit, and thus prevent extraneous glow from the rear of the LED.

- 40  Reinstall the round plastic pushbutton on the switch shaft, and select the 4 knobs, the 4 set screws, and the small L-shaped Allen wrench. Place a screw on the end of the wrench, and thread it into a knob. Install each of the knobs so that the set screw engages the flat on the control shaft.
- 41  Select the front panel, the two end caps, and the four large nuts. Remove the long cap screws which were temporarily holding the front sub-panel in place, slip the end caps into the ends of the front panel, and install the assembly on the chassis. Be sure the LED protrudes through the front panel hole properly. Fasten the assembly to the chassis with the four cap screws and their nuts, using the large Allen wrench.
- 42  Install the long U-shaped piece of plastic grommet over the top lip of the front sub-panel.

Make a visual inspection of the diode orientation, capacitor orientation, the green wire which is connected to the 'B' hole, and the nomenclature on the controls, as well as the general quality of solder connections on the bottom of the board. Make sure the wire to hole 'H' does not protrude too far. Check that the fuse is in place.

- 43  With 6 of the black sheet metal screws, install the bottom so that the edges turn *inward*, toward the top of the unit. The narrow edge is to the rear. Select the 4 rubber feet, remove their backing, and install them in the corners of the bottom plate, about 1" in.
- 44  Slide the cover on from the rear, and secure it with 4 sheet metal screws on the bottom, and one at the center rear. Affix the self adhesive serial number label to the center rear of the bottom.

You may wish to secure the small Allen wrench (for the knobs) to the bottom of the unit with tape, for future convenience.

CONGRATULATIONS!

Enjoy this truly outstanding preamplifier.