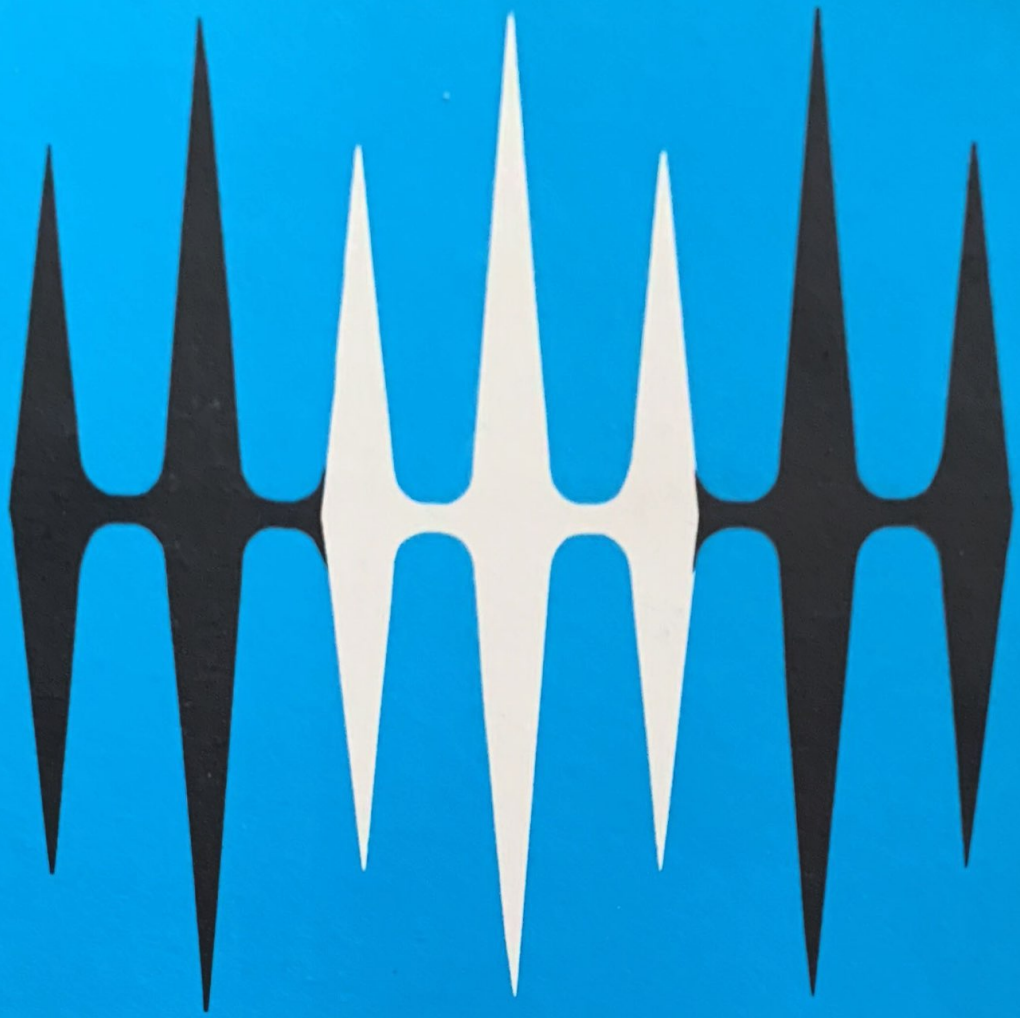
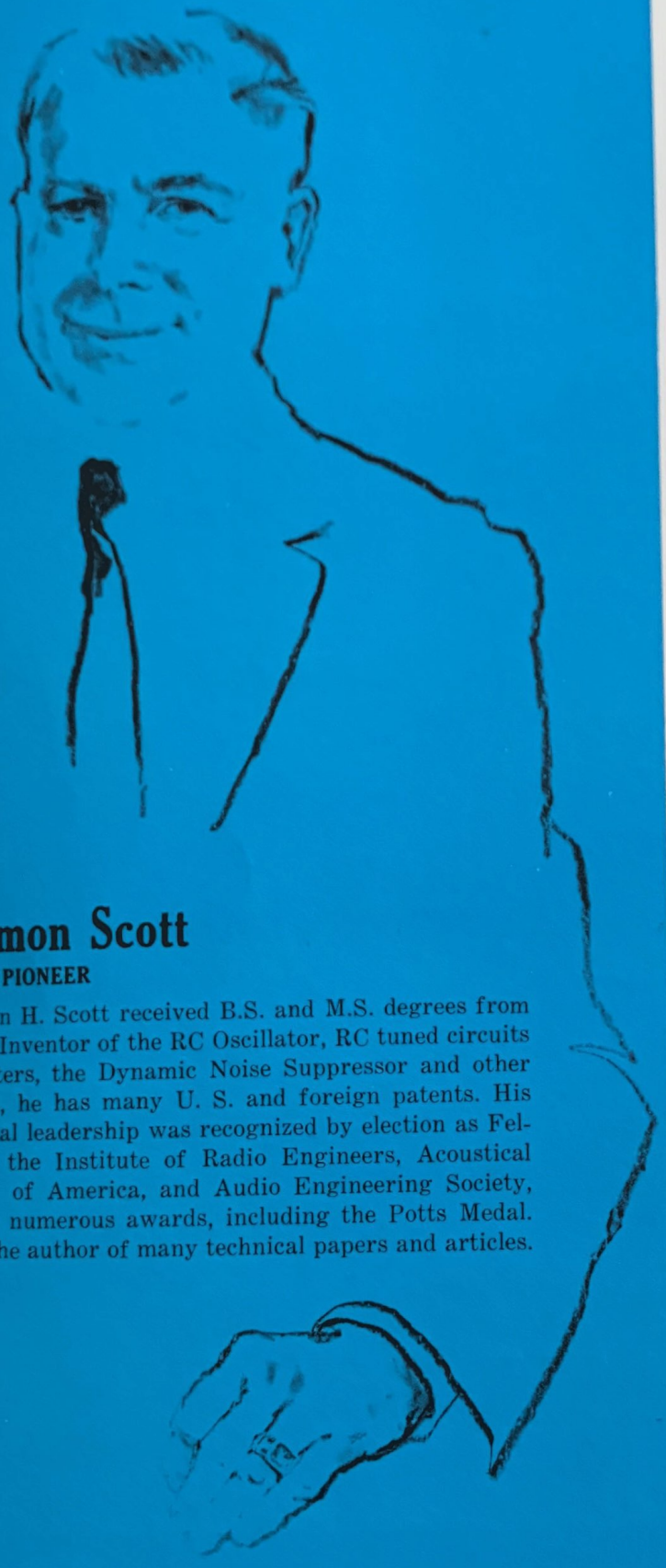


INSTRUCTION BOOK

H·H·SCOTT

LEADER IN AUDIO ENGINEERING AND DESIGN

Model LK-150



Hermon Scott

AUDIO PIONEER

Hermon H. Scott received B.S. and M.S. degrees from M.I.T. Inventor of the RC Oscillator, RC tuned circuits and filters, the Dynamic Noise Suppressor and other devices, he has many U. S. and foreign patents. His technical leadership was recognized by election as Fellow in the Institute of Radio Engineers, Acoustical Society of America, and Audio Engineering Society, and by numerous awards, including the Potts Medal. He is the author of many technical papers and articles.

Important Firsts . . .

BY H. H. SCOTT

First high fidelity AM-FM Stereo tuner using wide range AM design. First to successfully use wide-band circuitry in high-fidelity FM tuners. First to market The Stereo-Daptor, a stereo control unit that prevents obsolescence. First to provide center channel ouput on Stereo amplifiers for added realism in playback.

Introduction

The first true high fidelity complete amplifier appeared in 1947, H. H. Scott's Model 210A. This remarkable instrument introduced a score of unusual design features, which today are accepted and used by all manufacturers. The engineering innovations introduced in the 210A are typical of H. H. Scott, a company which has continued to pioneer in designing and producing new and better audio instruments. The exceptional design and careful manufacture that went into the 210A have been proven over the years . . . most of them are *still* in service, after more than 14 years. They work perfectly and compare favorably to products available today.

H. H. Scott's philosophy is not only to develop new and better instruments, but also to produce equipment that will last. There is no built-in obsolescence in H. H. Scott products. These brief notes try to indicate how this is accomplished by using the latest example of the H. H. Scott engineering laboratories, the LK-150.

What is the function of a Power Amplifier

The purpose of a high fidelity power amplifier is to take weak signals, increase their strength tremendously, and convert them into watts of power necessary to move the cone of a speaker. It must do this without adding, subtracting, or altering the contents of the original signal in any way. Such alteration of the original program is referred to as " distortion."

Your LK-150 offers on one compact chassis, two pieces of precision equipment. There is a 65 watt power amplifier for the left channel (Channel A), and a 65 watt power amplifier for the right channel (Channel B). It is actually a remarkable accomplishment in engineering design, to have such outstanding laboratory performance on a single chassis.

How does the Amplifier Work

INPUT STAGE

The LK-150 receives a weak output signal from the preamplifier control center. This can be from a fraction of a volt to as high as ten volts. A power amplifier must take this weak signal, amplify it, and convert it into sufficient power to cleanly drive the loudspeaker.

The amplifier must provide a certain amount of gain. This means that for a given number of volts coming in, there will be a given number of watts going out. H. H. Scott preamplifiers have very high outputs for lowest noise, so the amplifier must provide less gain. Otherwise, you would hardly be able to turn up your loudness control without the volume getting unbearably loud. However, many preamplifiers do not have such high output. For these units, additional gain must be provided in order to obtain the full power of the amplifier. In the LK-150, the SW-1 Input Level Switch permits the user to vary the gain of the amplifier for use with either high or low output preamplifiers. This switch controls the feedback in the output stages so it does not introduce any phase distortion common with conventional level controls.

SUBSONIC ROLLOFF

Before the signal reaches the first amplification stage it passes through the rolloff circuit. The human ear cannot hear signals below 20 cycles per second. However, all turntables and records contain noises of lower frequency. In addition, eccentric records and tone arm resonances create large peaks of sound in the 8 to 20 cycle range. These noises, which you cannot hear, are capable of being reproduced by the amplifier. Often these subsonic sounds will generate such enormous signals that they waste much of the amplifier's power and overload many loudspeakers. This can adversely affect the system's ability to reproduce desired program material. By placing the rolloff switches in the *normal* position, the user can eliminate most of these problems. In this position, a filter is introduced which attenuates the frequency response of the amplifier below 20 cycles.

Many users will wish to make laboratory measurements (such as square waves) with the LK-150. For such critical applications, the rolloff switch can be moved to the *lab* position to provide frequency response down to below 5 cycles per second. In addition, many critical music listeners claim that a frequency response to below 5 cycles is needed to provide perfect music reproduction in the audible range. For these people, the advantage of having rolloff switches is obvious.

Voltage Amplifier and Phase Splitter

The pentode-triode 7199 (V5 for Channel A, V6 for Channel B) provides an additional stage of gain, and splits the phase for the push-pull output stage. The advantages of a push-pull output stage are higher power and lower distortion. To obtain the advantages of this system, it is necessary to have some means of in-

verting the phase of the signal so that one tube in the output stage will be exactly out of phase with the other (in other words – one will be " pushing " while the other is " pulling ").

It is also essential that the phase splitter be able to send signals of exactly equal strength to each output tube. In most circuits this is accomplished by having special AC and DC balance controls which can only be set with expensive laboratory equipment. In the LK-150, the AC and DC balance controls are eliminated by using a true self-balancing phase splitter with special matched components. To further reduce distortion, negative feedback is applied to this stage.

Feedback is a method whereby part of the output signal is fed back into the input. Negative feedback indicates that the resultant input signal is reduced in strength. While this causes a loss in gain, it also virtually eliminates distortion.

Output Stages

Two sets of matched 6550 output tubes are used in push-pull (Class AB_1) for each output stage (V3 and V4 are in channel A, V7 and V8 are in Channel B). The way these output tubes are operated is typical of H. H. Scott standard design procedure. A tube manufacturer usually rates his tubes according to the average amount of power they can safely produce. A pair of 6550s are conservatively rated at 100 watts. In the LK-150, they are only asked to produce 65 watts. This means a long, trouble-free life for these superb tubes.

By using matched output tubes, distortion caused by imbalances in the push-pull stage can be markedly reduced. To further insure extremely low distortion, the bias voltage can be set exactly, using the meter and the bias adjustment controls. The bias for the output tubes is fixed (as opposed to the less desirable self-biasing of some amplifiers) and is derived from the selenium rectifier, SR1.

The output tubes supply the necessary power to drive the speaker, but unfortunately the output impedance of the tubes will be high, while most speakers are of low impedance. In order to match these impedances, it is necessary to use output transformers. You can have the most elaborate and complicated amplifier circuitry in the world, but you will not have a good amplifier unless you have good output transformers. Unfortunately, good output transformers are very expensive. Two indications of a good output transformer are size and weight. Only a large well-designed transformer can supply low distortion and clean response from the lowest audible frequencies to the highest. The oversize transformers on your LK-150 do just that. An exceptionally large amount of feedback is taken around this output stage to reduce distortion to the vanishing point.

An additional advantage of large amounts of feedback is that it provides the amplifier with a high damping factor. In non-technical terms an amplifier with a high damping factor will exercise a tighter control over the loudspeaker system, especially in the low frequency region. The speaker system will produce cleaner, tighter sounds without boom and hangover. This is one explanation for the astonishing improvement in sound when you switch from a conventional amplifier to the H. H. Scott LK-150.

There is one loudspeaker system which may require a lower damping factor for optimum results. With this low efficiency, air suspension speaker (the AR-3) a lower damping factor can be obtained by switching the **Input Level Switch** to ***1.5.***

One hazard of using large amounts of feedback is that it increases the possibilities of instability. An amplifier must be completely stable, and only reproduce signals fed to it, not originate signals of its own. Many amplifiers lack this essential requirement and will produce a powerful supersonic oscillation. This can happen when the amplifier is used with electrostatic speakers (which act as a capacitive load), or if the amplifier is operated with no speakers attached (no load). In extreme cases this oscillation is capable of burning out an amplifier or speaker in a few minutes.

H. H. Scott amplifiers like the LK-150 are completely stable under all conditions – no load, resistive, inductive, or capacitive load. This means that if the speaker wire should accidentally be disconnected, you need not fear damage to your amplifier. Some amplifiers are made stable by increasing the high frequency distortion. Some amplifiers sacrifice stability to keep distortion down. In all H. H. Scott amplifiers, both stability and low distortion have been maintained.

Power Supply

In order to supply the necessary voltages to all the stages of this powerful amplifier a rugged power supply is needed. The oversize power transformer, the two GZ34/5AR4 rectifier tubes, the SR1 selenium rectifier, and the four condenser cans comprise the heart of the power supply. All the components are operated far below their manufacturers' ratings to provide extended life. Using GZ34 rectifiers provides an additional benefit. These tubes have a slow warmup. This gives the other tubes and capacitors an opportunity to reach normal operating condition before the full force of the high voltages is transmitted by the rectifiers.

While the power supply is providing large amounts of electricity to the various parts of the amplifier, it also provides an excellent source of hum. Many precautions have been taken to prevent hum from entering the audio signal. The power transformer is supplied with a copper strap to reduce radiation. An aluminum chassis is used instead of conventional steel, because aluminum being non-magnetic acts as a hum shield. The filtering provided in the power supply is enormous. As a result of these extra precautions, the LK-150 produces less than 1.5 mv. noise and hum! This is so low it approaches the limit of measuring instruments.

Another associated problem is heat. Under normal conditions, you can expect the amplifier to use between 250 and 300 watts of electricity. This will generate a considerable amount of heat. The heat has to be rapidly transferred away from the output stages where most of it is generated. If it is not, the life of the tubes and other components will be greatly curtailed. One of the ways the heat is carried away is by convection to the air. The many openings in the chassis are designed to encourage air circulation.

Equally important is the use of an aluminum chassis. Most amplifier chassis are steel which is a less expensive material. Unfortunately, steel is not a good conductor of heat, so such units will have output stages that are overheating even though the rest of the amplifier is cool. Aluminum is an excellent conductor of heat, so it rapidly conducts the heat away from output stages to other parts of the chassis where it can be readily transferred to the air.

POWER OUTPUT

The most conspicuous aspect of an amplifier's performance is its power output. The LK-150 is rated at 65 watts per channel (music waveforms) and 60 watts per channel (steady state). You may notice that other amplifiers (many less expensive) with smaller transformers claim similar or greater power. All amplifiers are rated at 1000 cycles, a frequency at which you do not need a particularly good amplifier to get good measurements. It is at the low frequencies (below 50 cycles) that an amplifier needs plenty of power to drive a high quality, low efficiency loudspeaker. A typical LK-150 will produce over 75 watts (steady state) and 80 watts (music waveforms) at *20 cycles!* This is a true indication of the capabilities of this remarkable amplifier.

LOW DISTORTION

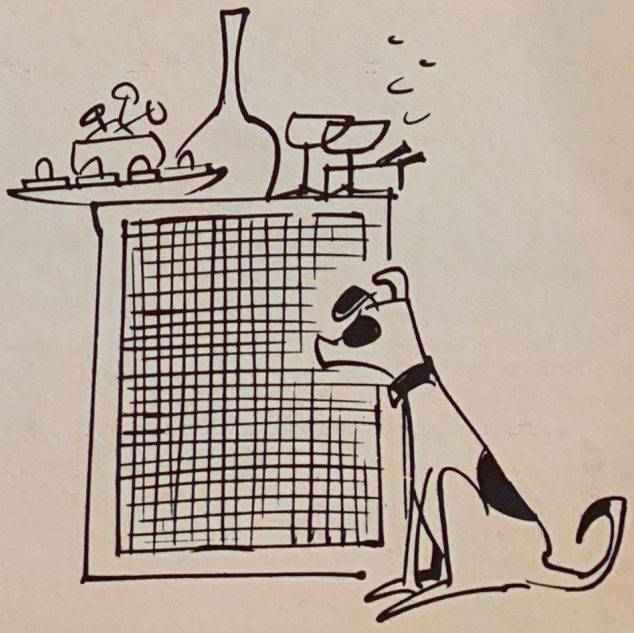
A wide frequency response, ample reserve power, and low hum and noise are important but cannot compensate for high distortion. The LK-150 will produce its rated output of 65 watts at less than 0.5% distortion (harmonic or intermodulation). Even more important than this is the distortion at normal listening levels (1 to 10 watts). Many amplifiers are designed to measure low distortion at rated outputs, only to have *increased* distortion at normal listening levels. This defeats the purpose of using a high-powered amplifier. The LK-150 has such low distortion at normal listening levels that it cannot be accurately measured with even the finest of laboratory test equipment. The translucent sound of the LK-150 is proof of this low distortion.

CURVES AND MEASUREMENTS

A complete set of specifications for the production run including your particular kit is supplied on the Service Bulletin enclosed. You will also note the complete set of curves and square wave pictures. These point up the astonishing performance capabilities of the LK-150.

Conclusion

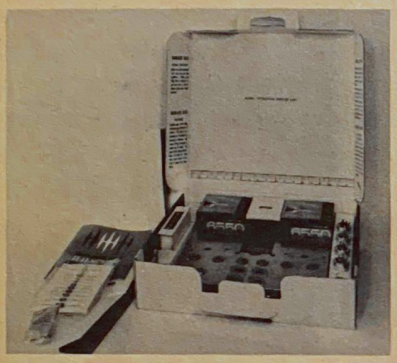
There are many ingredients involved in designing a high quality power amplifier. However, as this discussion has attempted to show, compromise is not one of them.



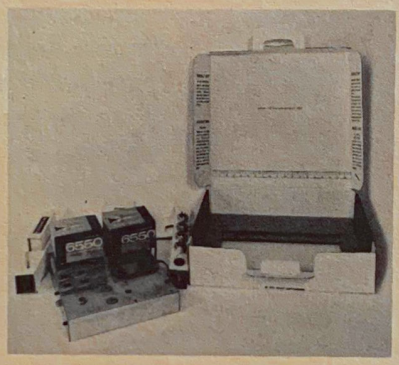
Instruction for the Model LK-150 130 Watt Complete Stereo Power Amplifier

The LK-150 is a complete two-channel stereo power amplifier consisting of dual 65 watt power amplifiers on a single chassis. It employs the same engineering concepts and features that have made H.H. Scott amplifiers the standard in the industry. Conservatively designed, the LK-150 will bring you years of listening pleasure.

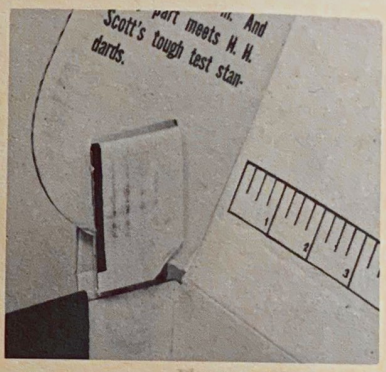
IMPORTANT: Every effort has been made to insure that this kit, when assembled, will perform perfectly. In order to achieve this result, you must read all of the instructions and follow them precisely. Let us repeat . . . READ ALL INSTRUCTIONS CAREFULLY . . . FOLLOW THEM EXACTLY.



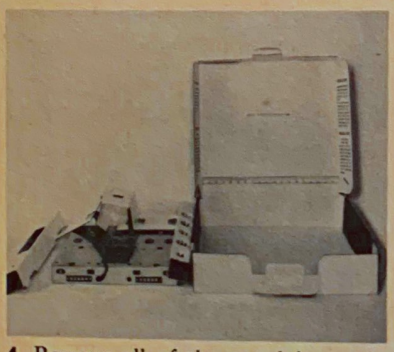
1. Remove book, Part-Charts and scored cardboard filler pieces.



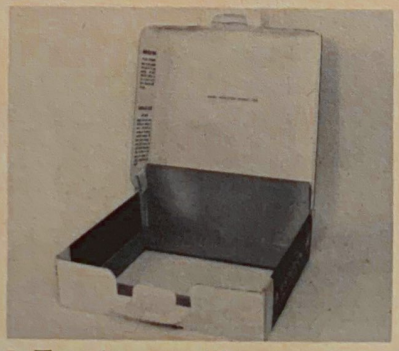
2. Remove chassis, tube boxes and white folded platform.



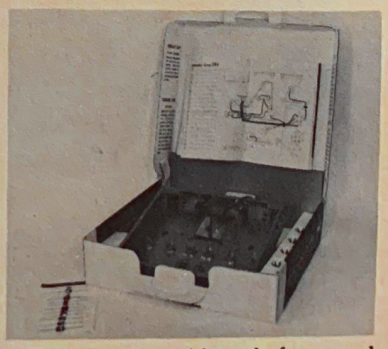
3. The back cover of your Kit-Pak will stay open when you insert special flap through slits in cover.



4. Remove all of the remaining parts from the folded white platform.



5. Turn brown cardboard pad over and lift up flap in rear.



6. Replace the white platform and position chassis in the center with instruction book behind flap.

Unpacking your Kit-Pak

Figure 1 demonstrates the step by step procedure in unpacking your kit, as well as the extremely simple procedures involved in setting it up as a convenient work bench. With the Kit-Pak you can work on any table in the house. When it is time to stop working for the evening, all you have to do is close the cover and turn off the soldering iron. Everything is put away in minutes.

You are now ready to begin the construction. After reading these introductory notes, place the instruction booklet into the groove between the cardboard flap and the box cover. In this way the instructions will be in front of you at all times for easy reference.

Check the parts

Below is a descriptive list of the parts included. Before beginning the assembly it is recommended that you check all the parts with this list. It will insure that there are no missing parts, and will help you become familiar with the various items. If you should accidentally damage or misplace any parts, write to the LABORATORY KIT SERVICE DEPARTMENT at the factory immediately.

A four foot length of insulated wire has been supplied. It is to be used to replace any missing wires or ones accidentally damaged. Simply cut off the length required (a convenient ruler is printed on the inside cover) and strip off ¼" of insulation at each end.

Occasionally we may make minor substitution of parts. Such substitutions are carefully checked and the parts supplied will work as satisfactorily as those specified in the manual. These changes will be obvious and are mentioned here only to prevent confusion in checking the parts list. For example, .005 μf. capacitors are used interchangeably with .0047 μf. capacitors.

Tools Required

A small screwdriver is provided. In addition, you will need a pair of long nose pliers, a regular size screwdriver, a pair of wirecutters, and a soldering iron or gun. A 35 watt (or more) pencil type soldering iron is actually the easiest to use. The iron should be supplied with a small tip. If a soldering gun is used, it should also have a small tip, and should be used carefully because of the enormous heat it supplies.

LK-150 Parts List

1	LK-150-M1	Main Chassis
1	LK-150-M2	Right Main Brkt.
1	LK-150-M3	Left Main Brkt.
1	LK-150-M4	Bottom Cover
1	A-BT-260	Meter Clip
4	A-FT-3S	Rubber Feet
4	A-GR-9	Rubber Grommets
1	CEC-4 x 75/75	Electrolytic (C1)
3	CEC-2 x 30/500	Electrolytic (C2-C3-C4)
1	D-LK-10	Owner's Name Plate
1	E-LT-AV-R	Solder Pack
1	E-LT-SD	Screw Driver
2	F-5B-3.2	Fuse
1	H-LW-6	Lock Washer (M-1 mtg.)
4	H-DLW-8	Cup Washer (T1)
2	H-N-⅜ x ½	Hex Nut (P1 and SW-1)
2	H-N-⅜ x ½B	Brass Hex Nut (P2 and P3)
4	H-N-832	Hex Nut (T1)
4	H-NK-832	Lock Nut (F/Rubber Feet)
8	H-NK-1032 x ⅜	Lock Nut (T2 and T3)


H-N-⅜ x ½ HEX NUT


LOCK NUT


H-N-832 HEX NUT

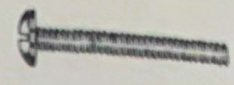

CLIP

A-GR-6


RUBBER GROMMET

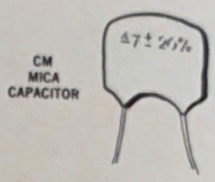

CUP WASHER

8	H-MS-1032 x ⅛B	Machine Screw (T2 and T3)
14	H-SMS-6 x ¼HW	Sheet Metal Screw (bottom cover mtg.)
1	H-MS-632 x ¼B	Machine Screw (meter clip mtg.)
2	KN-P-13	Knob
1	M-MA-3	Meter (M1)
2	RCV-50K-S	Potentiometer (P2 and P3)
1	SP-11-B	Switch (SW-3)
1	SP-11-R	Switch (SW-2)
1	SPR-11	Switch (P1)
1	SR-125/100	Rectifier (SR-1)
1	SRW-22-1	Input Switch (SW-1)
2	TRA-15-2	Transformer (T2 and T3)
1	TR-30-4-2	Transformer (T1)
1	V-PL-12	Pilot Light Bulb
2	V-7199	Tube (V1 and V2)
2	V-GZ-34/5AR4	Tube (V5 and V6)
4	V-6550	Tube (V3-V4-V7-V8)
1	XF-3AG	Fuse Post
1	XPL-12	Pilot Light Socket (PL-1)
2	CM15-47	Mica Capacitor
4	CM15-150	Mica Capacitor
2	CET-4/250	Tubular Electrolytic
2	CPM-.047	Tubular Capacitor
2	CPM-.1	Tubular Capacitor
4	CMPM-.25/600	Tubular Capacitor

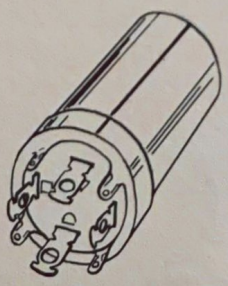


MACHINE SCREW

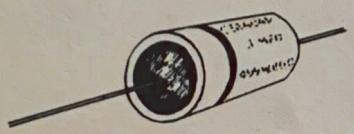
H-SMS-6 x ¼ HW
SHEET METAL SCREW



CM
MICA
CAPACITOR



CEC
ELECTROLYTIC
CAPACITOR



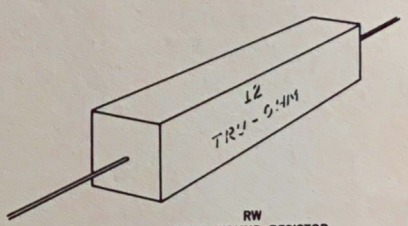
CPM
MOLDED TUBULAR
CAPACITOR

4	RC21-1K	Brown/Black/Red	½ Watt Resistor
2	RC21-1.2K	Brown/Red/Red	½ Watt Resistor
1	RC21-3.3K	Orange/Orange/Red	½ Watt Resistor
2	RC21-8.2K	Grey/Red/Red	½ Watt Resistor
2	RC21-12K	Brown/Red/Orange	½ Watt Resistor
2	RC21-22K	Red/Red/Orange	
2	RC21-33K	Orange/Orange/Orange	½ Watt Resistor
2	RC21-[illegible]	Yellow/Purple/Orange	½ Watt Resistor
4	RC21-100K	Brown/Black/Yellow	½ Watt Resistor
4	RC21-220K	Red/Red/Yellow	½ Watt Resistor
4	RC21-330K	Orange/Orange/Yellow	½ Watt Resistor
4	RC21-1M	Brown/Black/Green	½ Watt Resistor
2	RC31-2.7	Red/Purple/Gold	1 Watt Resistor
1	RC31-220	Red/Red/Brown	1 Watt Resistor
4	RC31-15K	Brown/Green/Orange	1 Watt Resistor
2	RC41-10	Brown/Black/Black	2 Watt Resistor
1	RC41-1.5K	Brown/Green/Red	2 Watt Resistor
1	RC41-10K	Brown/Black/Orange	2 Watt Resistor
1	RW7-4000		7 Watt Wire Wound Resistor
1	RW10-1.2K		10 Watt Wire Wound Resistor
1	RW10-15KH		10 Watt Wire Wound Resistor
2	RW20-80		20 Watt Wire Wound Resistor

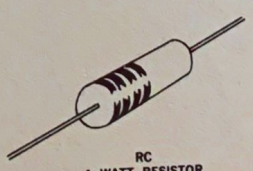
(BROWN, GREEN, YELLOW)

150K

RC
½ WATT RESISTOR



RW
WIRE WOUND RESISTOR



RC
1 WATT RESISTOR

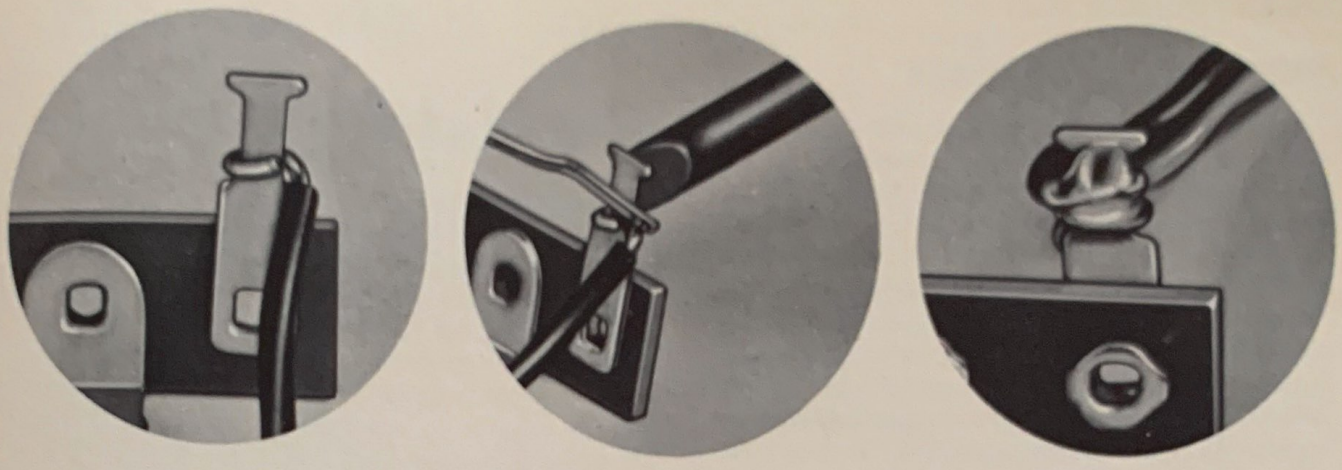


FIGURE 2

Simplified soldering and wiring instructions

All the solder needed to assemble the unit is supplied. If for any reason additional solder is needed, make sure that you obtain 60/40 ROSIN CORE SOLDER. Under no circumstances should you use Acid Core solder. **All guarantees are voided if Acid Core solder is used.**

Here's how to solder joints correctly (see Fig. 2):

1. Before using the soldering iron or gun, the tip must be tinned for ease of use. First heat up the iron. Then when the tip is hot, wipe with a cloth till bright and shiny, and apply a generous amount of solder. Remove any excess. Repeat this process for all sides of the tip.
2. Make sure that all leads (wires) and terminals to be soldered are completely clean. Do not use fluxes or paste of any sort.
3. The leads should be mechanically secure before soldering. This does not mean wrapping leads around the contacts several times. It means a single turn around the contact which is then pinched tightly with the long nose pliers. If the wire is too large for bending, position the wire so that a good solder connection can still be made.
4. Leads on resistors, capacitors, and similar components are generally much longer than they need to be to make the indicated connections. In these cases, the excess leads should be cut off before the part is added to the chassis. In general, the leads should be long enough to reach their termination allowing for a little left over to make a good mechanical joint. A very handy way of gauging the length of lead to trim off is to superimpose the capacitor or resistor right on the pictorial. The pictorials are all full scale, so by placing the component over its picture and allowing about ¼" extra on each end for the mechanical joint, you can shorten the leads quickly and accurately.
   Sometimes a lead will not seem quite long enough to reach the desired mounting point. In such a case, the terminal lug can be bent slightly to make the connection possible.
5. Place a flat side of the soldering iron tip against the joint to be soldered until it is heated sufficiently to melt the solder.
6. Place the solder against the heated terminal (with the soldering iron still in contact) and it will immediately flow over the joint. Use only enough solder to thoroughly wet the joint. Too much solder may cause short circuits. The soldering iron does not actually come into contact with the solder, only with the joint. It is the heated joint that melts the solder.
7. As soon as sufficient solder has flowed, remove the solder tube and then a second later, the iron. Use care not to move the leads until the joint has hardened (about 5 seconds). A good solder joint should appear to be bright and shiny. Check the joint for rigidity. If it is not firm and tight, reheat the joint and permit the solder *already present* to flow again. Sometimes a little more solder will have to be added.
8. When soldering certain of the components, such as diodes and resistors, it is advisable to use no more heat than is necessary. Excessive heat can damage these components.
9. Keep the soldering iron clean and bright by occasionally wiping with a rag. The iron does not have to be cooled for this purpose.
   If you have never done any soldering before, it would be an excellent idea to practice on scraps of wires before beginning.

Basic electrical assembly procedure

Your amplifier kit is built on one main chassis. The symbol M is used to refer to this chassis.

Each terminal, tube, transformer, etc. has a code number (i.e. T1, V2, and so forth). Every pin on each of these terminals, or tube sockets is also numbered (i.e. pin 1, pin 2, and so forth). The instructions will call for a wire to be connected to pin 3, V4, for example. With the instructions will be a pictorial, clearly showing in full color the connection to be made and its location. With this information you should experience no difficulty in making the correct connection.

A series of Part-Charts are provided with all the necessary resistors and capacitors mounted. Each chart applies to a particular page of the electrical assembly instructions.

For example – in the instructions that follow you will find a section marked "Assembly Group BM-3." The "B" indicates that this is part of the electrical assembly. The "M" indicates that you will be working on the main chassis. The "3" means that this is the third part of the electrical assembly instructions. In the bag of Part-Charts, you will find a Part-Chart BM-3. Take this out and keep it next to you when working on this section. The first step on the page is called BM-3-1 and refers to a CPM .047. The first part on the Part-Chart is a CPM .047. The color pictorial that goes with this section clearly depicts the part. Carefully connect the part as described in the book and as shown on the color pictorial. Once the part is connected, the step is checked off with a pencil as completed.

The many wires used in the amplifier kit are packed in a small plastic envelope. For example – Assembly Group BM-1 involves connecting a group of wires of different colors and lengths. Open the bundle of wires and spread them out near you. The first step, BM1-1, calls for a 10″ grey wire. From the grey wires select the ones of the appropriate length and hold them up to the ruler printed on the inside cover of the Kit-Pak. Once you have the correct one, you may proceed as above.

IT IS IMPORTANT TO POSITION THE WIRES OR COMPONENTS IN THE SAME POSITION AS SHOWN IN THE PICTORIAL.

If the symbol – (S-) appears in the instructions after any connection, it means that the particular connection with all other wires on the same pin, should be soldered. After the "S" will appear a number. This number indicates exactly how many leads or wires are supposed to be connected to the terminal or pin in question. For example: connect an orange wire to pin 2, V6 (S-3). The soldering number (S-3) will always be printed in parentheses, so it can be found quickly. It indicates that there should be 3 wires or leads (including the orange one) connected to pin 2, V6, and that all three of them are to be soldered. This provides an additional check for wiring errors.

Do not solder any connection that is not marked with an (S-). Other connections are yet to be made to this pin before it can be soldered. Frequently one end of a lead or component will be soldered while the other end will not (for the moment). The (S-) will only appear after the description of the end that is to be soldered. After completing the soldering, cross out the (S-) symbol with your pencil indicating that it has been done. This is in addition to checking off each step. In this way you can glance over the assembly instructions and spot any (S-) that has not been crossed out, indicating that you may have overlooked a joint to be soldered.

The instructions which follow have been arranged in a logical order to insure perfect results. Follow them exactly, checking off each step as completed.

For easy reference keep this instruction manual on the inside of the top cover of your KIT-PAK as shown in Fig. 1.

What to do if you make a mistake

No matter how careful you may be, it is still possible to break something accidentally or to cut a lead too short. We might add that if you work when tired, or try to do too much, too fast, then the possibility of mishap increases greatly. Nevertheless, it is easy to correct most common errors.

1. Cutting a wire or lead too short – If you cut the wire from one of the components too short you can easily correct it by taking a small piece of uninsulated wire (buss wire) and splicing it on as shown in Fig. 3. If a wire supplied is damaged, you can cut off a replacement from the 4 feet of spare wire supplied.

2. Breaking a terminal strip – The terminal strips are quite sturdy and will withstand a great deal of handling. Nevertheless, if you are extremely rough, a terminal pin can be broken off. It this happens, make all connections to the small hole below the broken pin. Be careful to avoid having any of the bare wires touch the chassis. If the phenolic material cracks but does not break off, you can continue on as the wires themselves will keep the broken piece in place.

In the unlikely circumstance that the entire terminal strip breaks off, it is necessary to replace it. Write to the parts department at the factory for a replacement. Drill out the rivet holding the broken strip, using a number 28 drill. Mount the replacement with a regular 6-32 x ¼" machine screw, lockwasher, and nut.

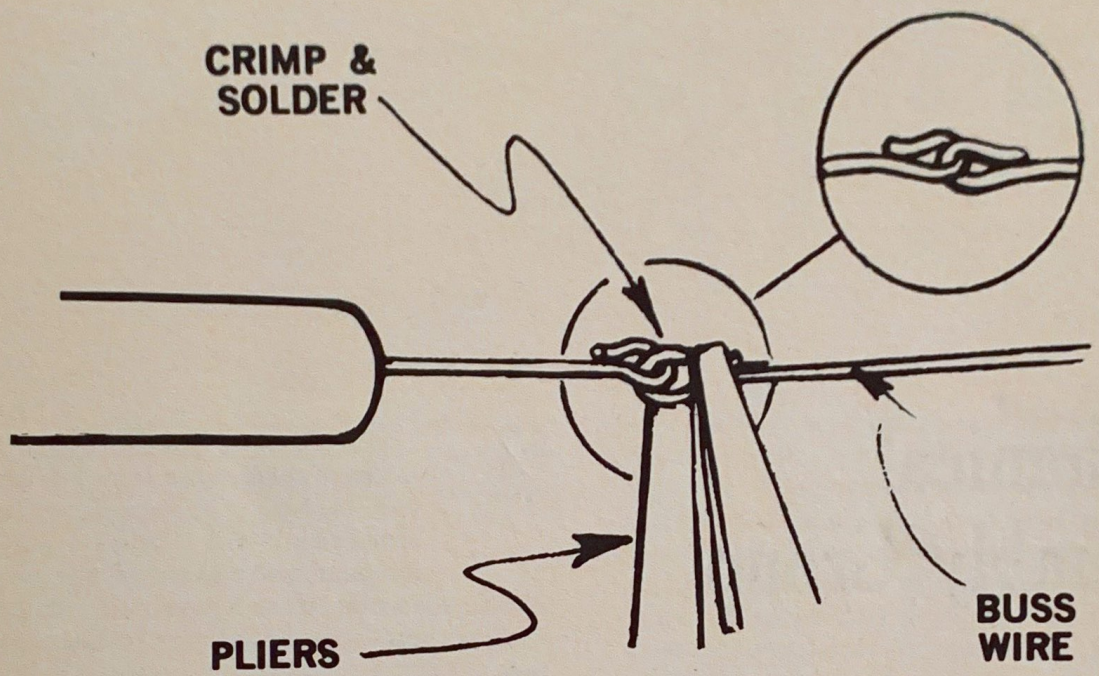


FIGURE 3

Do not proceed unless you have read all the instructions given above

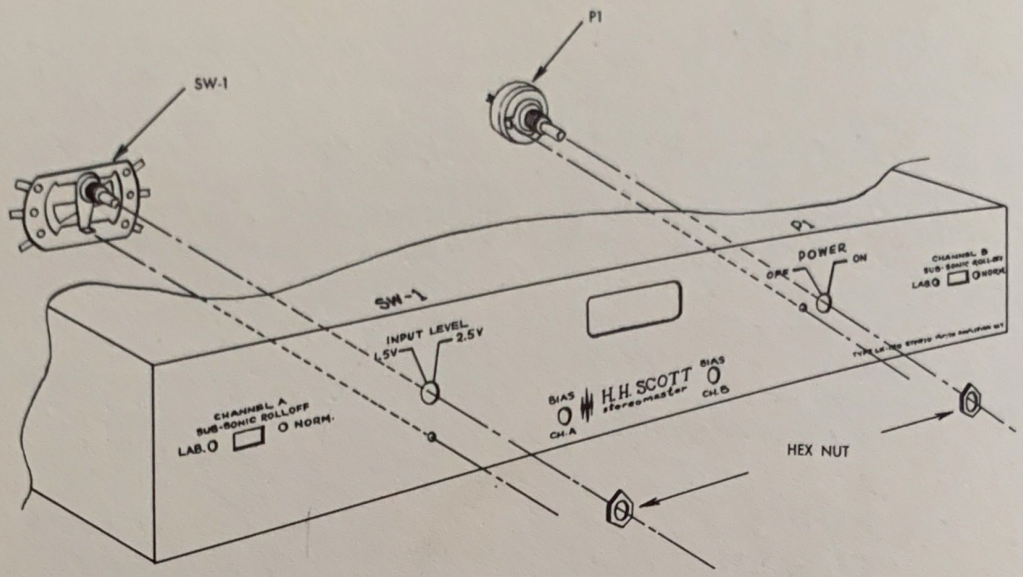


FIG. 4

Mechanical Assembly Group A-1

Read each step completely before performing the operation specified. Check off each step as it is completed. The parts needed in the following will be found in the plastic envelopes. Keep Chart AM-1 handy for reference.

☒ A1-1. Mount the Input level switch (marked SRW-22-1 on the switch itself) into the hole marked SW-1. A glance at Chart AM-1 will help you identify this switch readily. Make sure the locating lug on the front of the switch fits into the little opening below the main hole. A ⅜ x ½" hex nut threaded on the shaft will hold it in place. See Fig. 4.

☒ A1-2. Mount the "On-Off" switch (marked SPR-11 in small letters on the side of the switch) into the hole marked P1. See Fig. 4. Observe that the locating lug fits into the small opening on the side of the main hole. Use a ⅜ x ½" hex nut to hold in place.

☒ A1-3. Locate the small red pushbutton switch. Unscrew the hex nut from the front, but leave the washer in place. Insert into hole identified as SW-2 (labelled Ch. A Bias on the front) and replace the hex nut. Make sure the switch is positioned with the terminals facing up as shown on Chart AM-1.

☒ A1-4. Refer to Fig. 5 in the illustrations. Take the small bracket and place it over the slit in the chassis as shown. Use a 6-32 x ¼" machine screw and a lockwasher. Do not tighten fully. Remove the fine shipping wire that is connected across the terminals on the back of the meter. Insert the meter into the meter hole. Slide the bracket forward in the slit so that it is holding the meter firmly against the front apron. Tighten the screw firmly.

☒ A1-5. Remove the hex nut from the black pushbutton switch, but leave the washer on. Place the pilot light bracket over the washer as shown in Fig. 6. Put into hole marked SW-3 (Ch. B Bias) and thread the hex nut back on. Make sure the pilot light socket is angled upwards slightly.

☒ A1-6. Locate the two potentiometers (controls) with the number RCV 50 K-S etched in small letters. Working under the chassis, insert one of the pots up into the hole marked

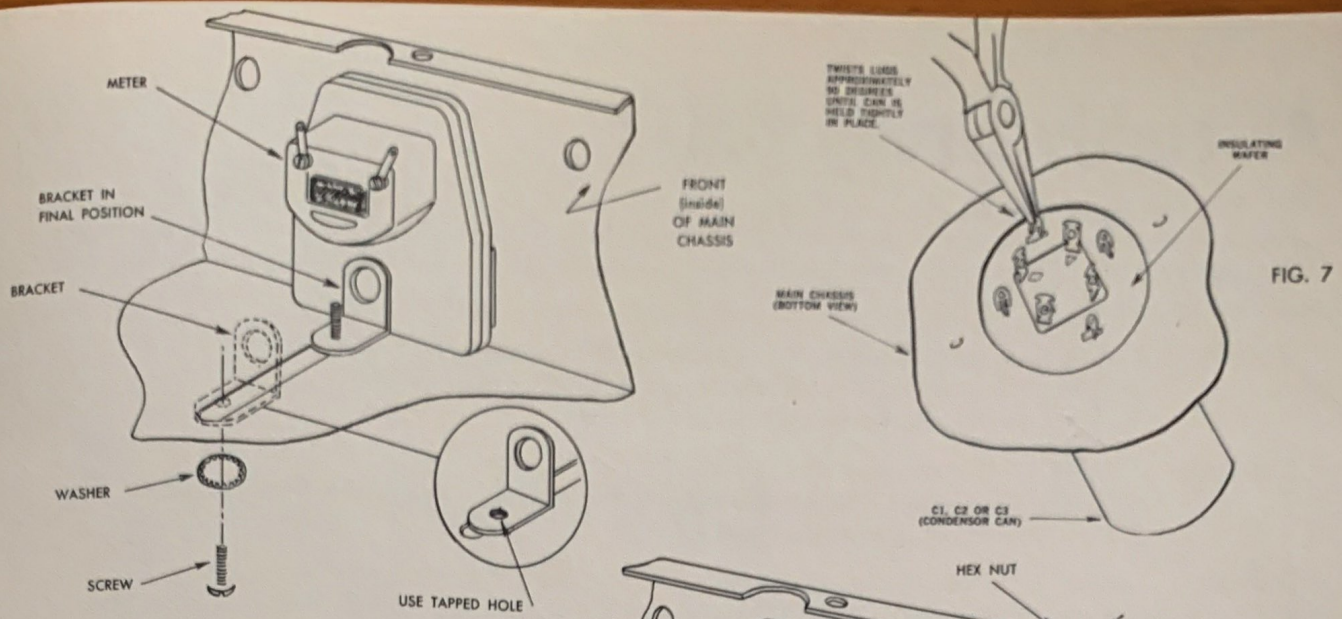


FIGURE 5

FIG. 7

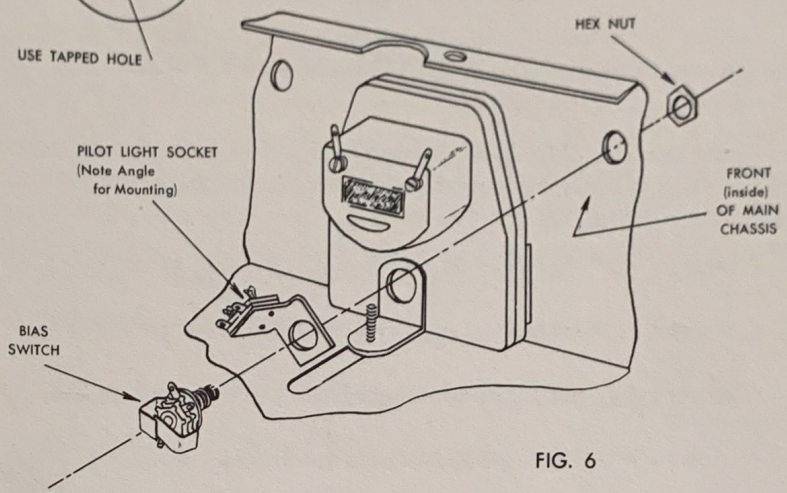


FIG. 6

P2. Make sure the locating lug lines up with the small opening alongside P2. Use a brass hex (six-sided) nut to hold in place. Repeat with the other pot in P3.

☒ A1-7. Mount the four large condenser cans, C1, C2, C3, and C4 in the places indicated on Chart AM-1. (C1 is a 4 x 75/75, while C2, C3, and C4 are identical 2 x 30/500.) Position the cans so the little symbols stamped or punched on the bottom of the cans (triangle, square, semi-circle, etc.) are in exactly the same position as shown on the chart. After the cans have been mounted, lock them in by turning the lugs 90 degrees with your long nose pliers. See Fig. 7.

☒ A1-8. Insert the four rubber grommets in the holes marked " X " on Chart AM-1.

Electrical Assembly

INTRODUCTORY NOTES

To obtain the really fine performance this amplifier is capable of, all lead lengths from components (resistors and capacitors) must be as short as possible. Follow the diagrams closely. Keep all parts as close to the chassis as possible. This refers to all components and insulated wires. Bare wires, of course, should not touch the chassis, unless instructions indicate otherwise.

The biggest source of mishaps, next to poorly soldered joints, are short circuits. A short circuit occurs when two uninsulated wires that are not supposed to, accidentally touch each other. It can also happen when a wire going towards one pin accidentally touches another pin or the metal chassis nearby. The main body of a resistor or a capacitor is fully insulated so it does not matter if this part touches something. It is only the bare wires on the ends that you have to watch for. As the number of parts in the amplifier starts to increase, you will realize how possible it is for short circuits to occur.

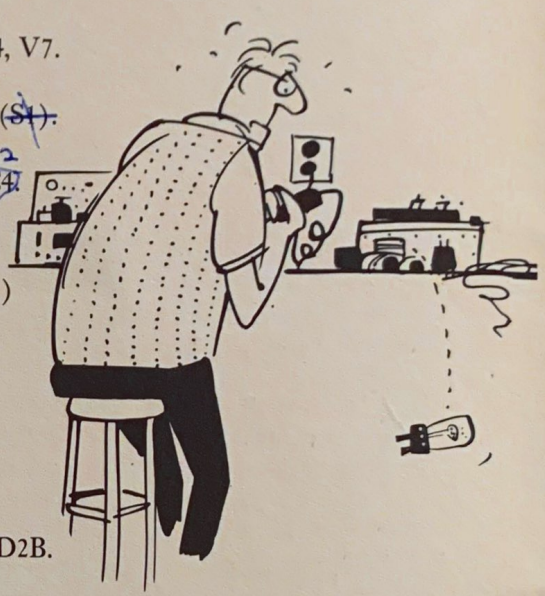
Extra quantities of black insulation material (spaghetti) have been supplied. Whenever you suspect that a short circuit may occur (either to the chassis, to another bare wire, or to another pin), slide a small piece of spaghetti over the bare wires in question. If you position the parts exactly as shown in the pictorials, you will not need to use spaghetti very frequently. However, it is better to be on the safe side if you have any doubts.

Check off each step as soon as it is completed. Cross off each (S) as soon as the soldering required is done. Connect your soldering iron now so that it will be ready.

Assembly Group BM-1

There is a bundle of wires. Open this bundle and spread out the wires near you. Refer to the color pictorial for this part of the assembly. Some terminal pins will eventually have 4 or 5 leads connected to them, so try to keep your mechanical joints small and neat. Where more than one hole is provided for making connections, divide the leads between them.

- ☒ **BM1-1.** Connect a 10″ grey wire to Pin 7, V3. Connect a 9″ brown wire to Pin 2, V3. (There will eventually be a total of 4 wires connected to this terminal.) Twist together and connect the grey wire to Pin 5, V1 (S1). Connect the brown wire to Pin 4, V1 (S1).
- ☒ **BM1-2.** Connect a 5¼″ heavy grey wire to Pin 7, V3 (S2). Connect a 4″ heavy brown wire to Pin 2, V3. (There will be a total of 4 wires connected to this terminal.) Twist and connect the grey to Pin 7, V4. Connect the brown to Pin 2, V4.
- ☒ **BM1-3.** Connect a 5¼″ heavy grey wire to Pin 7, V7. Connect a 4″ heavy brown wire to Pin 2, V7. Twist and connect the grey to Pin 7, V8, and the brown to Pin 2, V8. (There will be a total of 4 wires connected to this terminal.)
- ☒ **BM1-4.** Connect a 6½″ grey wire to Pin 7, V8 (S2). Connect an 8¼″ brown wire to Pin 2, V8. (There will be a total of 4 wires connected to this terminal.) Twist and connect the grey to Pin 5, V2, and the brown to Pin 4, V2.
- ☒ **BM1-5.** Connect a 4¾″ red/white wire from Pin 4, V3 (S1) to Pin 4, V4.
- ☒ **BM1-6.** Connect a 9¾″ red/white wire from Pin 4, V4 (S2) to Pin 4, V7.
- ☒ **BM1-7.** Connect a 4¾″ red/white wire from Pin 4, V7 to Pin 4, V8 (S1).
- ☒ **BM1-8.** Connect a 3″ red/white wire from Pin 4, V7 (S3) to Pin 2, C4. 4 C2
- ☒ **BM1-9.** Connect a 3¾″ black wire from Pin 2, D2A to Pin 3, D3B. (There will be a total of 4 wires connected to this terminal.)
- ☒ **BM1-10.** Connect a 6½″ red wire from Pin 1, D1D to Pin 1, D1B. (There will be a total of 5 wires connected to this terminal.)
- ☒ **BM1-11.** Connect an 8¾″ red wire from Pin 1, D1D to Pin 1, D1H.
- ☒ **BM1-12.** Connect a 7″ red/white wire from Pin 1, D2A to Pin 4, C1.
- ☒ **BM1-13.** Connect an 11¾″ red/white wire from Pin 1, D2A to Pin 1, D2B.
- ☒ **BM1-14.** Connect a 3¾″ heavy yellow wire from Pin 1, D1E to Pin 1, D1F.
- ☒ **BM1-15.** Connect a 4½″ heavy yellow wire from Pin 2, V5 (S1) to Pin 2, V6 (S1).
- ☒ **BM1-16.** Connect a 2″ heavy yellow wire from Pin 4, V5 (S1) to Pin 6, V5.
- ☒ **BM1-17.** Connect a 2″ heavy yellow wire from Pin 4, V6 (S1) to Pin 6, V6.
- ☒ **BM1-18.** Connect a 3¾″ black wire from Pin 1, D1G to Pin 3, C4.
- ☒ **BM1-19.** Connect a 2½″ heavy black wire from Pin 2, C2 (S1) to Pin 3, C4 (S2).
- ☒ **BM1-20.** Connect a 3¾″ blue wire from Pin 1, D1A to Pin 3, C2.
- ☒ **BM1-21.** Connect a 4¼″ blue wire from Pin 1, D1A to Pin 3, D3C.
- ☒ **BM1-22.** Connect a 3¼″ blue/white wire from Pin 1, C2 to Pin 1, D3C. (There will be a total of 4 wires connected to this terminal.)



☒ **BM1-23.** Connect a 2" heavy grey wire from Pin 4, C3 (S1) to Pin 5, C4 (S1).

☒ **BM1-24.** Connect a 3¼" black wire from Pin 2, D3B to Pin 5, C1 (S1).

☒ **BM1-25.** Connect a 2¾" heavy black wire from Ground Lug " B " (ground lug " B " refers to the small hole in the side of the terminal strip which is on the strip riveted to the chassis), D3B to Pin 1, C3 (S1).

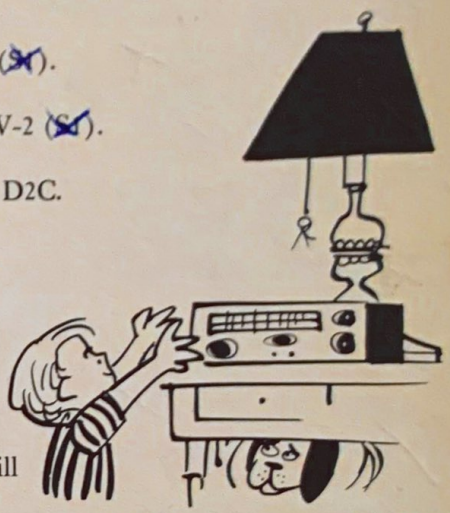
☒ **BM1-26** CONNECT A BUSS WIRE FROM PIN 2, D1A & PIN 1, C2.

☒ **BM1-27** CONNECT A BUSS WIRE FROM PIN 4, C2 (S3) TO PIN 5 C 2 (S1).

Assembly Group BM-2

Refer to the next color pictorial. Keep all mechanical joints small, and watch out for short circuits. Position all bare wires and terminals so they are not near other bare wires or terminals.

☒ **BM2-1.** Connect a 3¼" black wire from Pin 2, D2A through Pin 1, V3 and connect to Pin 2, V3. You will have to strip off another ¼" of insulation from the end of the lead passing through Pin 1, in order to make a good contact. Keep in mind that any time a wire is passed through a pin as in this instance, it should be counted " two " not " one " when adding up the number of leads to that pin. There will be a total of 4 leads connected to Pin 1 and to Pin 2 eventually.



☒ **BM2-2.** Connect a 4¾" black/white wire from Pin 8, V3 to Pin 8, V4 (S1).

☒ **BM2-3.** Connect a 13¼" black/white wire from Pin 8, V3 to Pin 2, SW-2 (S1).

☒ **BM2-4.** Connect a 14¼" green/white wire from Pin 2, SW-1 to Pin 2, D2C.

☒ **BM2-5.** Connect a 7¾" black wire from Pin 2, V3 (S1) to Pin 1, TB1.

☒ **BM2-6.** Connect a 2½" black wire from Pin 2, J1 (S1) to Pin 2, TB1.

☒ **BM2-7.** Connect a 12" blue wire from Pin 3, D3A to Pin 1, D1A. (There will be a total of 4 wires connected to this terminal.)

☒ **BM2-8.** Connect a 10¼" blue/white wire from Pin 1, D3A (there will be a total of 4 wires connected to this terminal) to Pin 1, C2.

☒ **BM2-9.** Connect a 4¾" white wire from Pin 4, SS1 to Pin 7, V1.

☒ **BM2-10.** Connect a 5¼" black wire from Pin 1, SS1 to Pin 1, D3B.

☒ **BM2-11.** Connect a 2¼" green/white wire from Pin 3, SW-1 to Pin 6, V1.

☒ **BM2-12.** Connect a 10" green wire from Pin 4, SW-1 to Pin 6, V2.

☒ **BM2-13.** Connect a 14" green wire from Pin 5, SW-1 to Pin 1, D2D.

☒ **BM2-14.** Connect a 2¾" black/white wire from Pin 1, SW-2 to Pin 2, M-1 (S1).

☒ **BM2-15.** Connect a 3¾" brown wire from Pin 1, SW-2 (S2) to Pin 1, SW-3 (S1).

☒ **BM2-16.** Connect an 11¼" black/white wire from Pin 2, SW-3 (S1) to Pin 8, V8.

☒ **BM2-17.** Connect a 4¾" black/white wire from Pin 8, V8 to Pin 8, V7 (S1).

☒ **BM2-18.** Connect a 2½" black wire from Pin 2, D2B through Pin 2, V8 (S1) and connect to Pin 1, V8. (See comment under BM2-1.)

☒ **BM2-19.** Connect a 4¼" black wire from Pin 3, D3D to Pin 1, V8.

☒ **BM2-20.** Connect an 8¾" black wire from Pin 1, V8 to Pin 1, TB2.

☒ **BM2-21.** Connect a 2¾" black wire from Pin 2, J2 (S1) to Pin 2, TB2.

☒ **BM2-22.** Connect a 2½" white wire from Pin 4, SS2 to Pin 7, V2.

☒ **BM2-23.** Connect a 6½" grey wire to Pin 2, PL-1 (S1). Connect a 6¼" brown wire to Pin 1, PL-1 (S1). Twist and connect the grey to Pin 5, V2 (S1) and the brown to Pin 4, V2 (S1).

☒ **BM2-24.** Connect a 12" heavy yellow wire to Pin 1, P1 (S1). Connect a 16½" heavy yellow wire to Pin 2, P1 (S1). Twist and connect the shorter one to Pin 2, AC2. DO NOT CONNECT THE LONGER ONE AT THIS TIME.

☒ **BM2-25.** Connect a 7½" heavy yellow wire from Pin 1, AC1 (S1) to Pin 1, AC2.

☒ **BM2-26.** Connect a 7½" heavy yellow wire from Pin 2, AC1 (S1) to Pin 2, AC2.

☒ **BM2-27.** Connect a 1" buss wire (buss wire refers to the uninsulated wire found in your plastic hardware bag. This can be trimmed down to any length desired, and usually, should be kept as short as possible) from Pin 2, V1 to Pin 9, V1.

☒ **BM2-28.** Connect a 4½" buss wire to Ground Lug "A", D3B (S1). Run it to Pin 1, D3B. Wrap it once then run it to Pin 2, D3B. Wrap once, run to Pin 3, D3B. Wrap once and connect it to Ground Lug " B ", D3B (S1).

☒ **BM2-29.** Connect a 2½" buss wire to Pin 1, D1B. Wrap it through Pin 2, C3 (S2) and connect it to Pin 3, C3 (S1).

☐ **BM2-30.** Connect a 1¾" buss wire to Pin 1, C4 (S1). Wrap it through Pin 2, C4 (S3) and connect it to Pin 1 D1C.

☒ **BM2-31.** Connect a 1" buss wire from Pin 2, V2 to Pin 9, V2.

☒ **BM2-32.** Connect a 4½" buss wire to Ground Lug "A", D3D (S1). Run it to Pin 1, D3D, wrap once, run to Pin 2, D3D, wrap once, then run it to Pin 3, D3D, wrap once and connect to Ground Lug " B ", D3D (S1).

☒ **BM2-33.** Connect a 1" buss wire from Pin 1, C1 to Pin 2, C1.

☒ **BM2-34.** Connect a 1" buss wire from Pin 4, C1 (S2) to Pin 6, C1.

☒ **BM2-35.** Connect a 1" buss wire from Pin 1, TB2 to Pin 2, TB2.

☒ **BM2-36.** Connect a 1" buss wire from Pin 1, TB1 to Pin 2, TB1.

Assembly Group BM-3

There is a part chart for this assembly group. Refer to the next color pictorial for positioning parts. You will find that from here on you will be soldering pins that have many leads connected to them. Be very careful to insure that each and every lead is fully soldered and not just the ones on top. If you find that in order to solder a pin, your soldering iron comes extremely close to some nearby leads, move the leads out of the way during the soldering process. You can reposition them afterwards.

BM3-1. Connect the black band end of a CPM .047 to Pin 6, SS1 (S1). Connect the other end to Pin 4, SS1 (S2).

BM3-2. Connect an 8.2K resistor (grey, red, red) from Pin 2, SW-1 to Pin 3, SW-1.

BM3-3. Connect a CM 150 from Pin 2, SW-1 (S3) to Pin 3, SW-1 (S3).

BM3-4. Connect an 8.2K resistor (grey, red, red) from Pin 4, SW-1 to Pin 5, SW-1.

BM3-5. Connect a CM 150 from Pin 4, SW-1 (S3) to Pin 5, SW-1 (S3).

BM3-6. Connect a large 1.5K resistor (brown, green, red) from Pin 2, SR-1 (S1) to Pin 1, C1 (S2). This is a fairly difficult connection to the SR-1. Do not try to make a good mechanical connection. Simply position the end of the resistor between the two little prongs on the end of the terminal, and solder it securely.

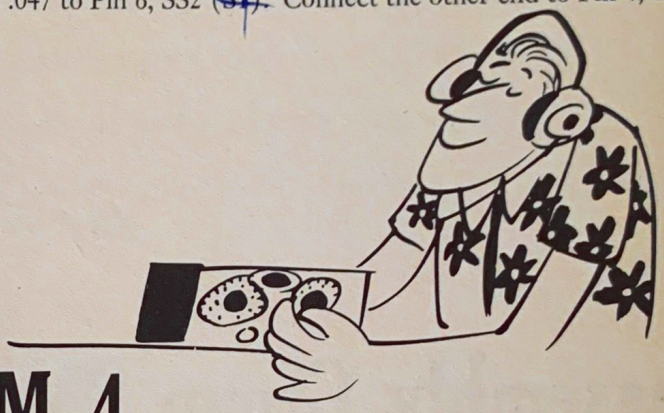
BM3-7. Connect a large 220 ohm resistor (red, red, brown) to Pin 2, C1 (S2). Connect the other end to Pin 6, C1 (S2).

BM3-7A

BM3-8. Connect a 3.3K resistor (orange, orange, red) from Pin 1, M-1 (S1) to Pin 3, C1 (S1).

BM3-9. Connect a large 10K resistor (brown, black, orange) from Pin 1, C2 (S3) to Pin 3, C2 (S2).

BM3-10. Connect the black band end of a CPM .047 to Pin 6, SS2 (S1). Connect the other end to Pin 4, SS2 (S2).



Assembly Group BM-4

In the next groups, you will be connecting a few very large resistors like the one in Step BM4-2. These resistors get quite warm in actual operation. When positioning them try to avoid letting any other wires or parts come in *direct* contact with them. It is perfectly all right to have them come close by.

BM4-1. Connect the *plus* (+) end of a CET 4/250 to Pin 3, V1. Connect the other end to Pin 6, V1. (Black band, if present, indicates negative or minus end.)

BM4-2. Connect an RW 4000 from Pin 1, D1A (S1) to Pin 1, D1C.

BM4-3. Connect an RW 1200 from Pin 1, D1B to Pin 1, D1C.

BM4-4. Connect the *plus* (+) end of a CET 4/250 to Pin 3, V2. Connect the other end to Pin 6, V2.

BM4-5. Connect a 1K resistor (brown, black, red) from Pin 5, V3 (S1) to Pin 6, V3. Press body of resistor down on chassis.

BM4-6. Connect a 1K resistor (brown, black, red) from Pin 5, V4 (S1) to Pin 6, V4. Press body of resistor down on chassis.

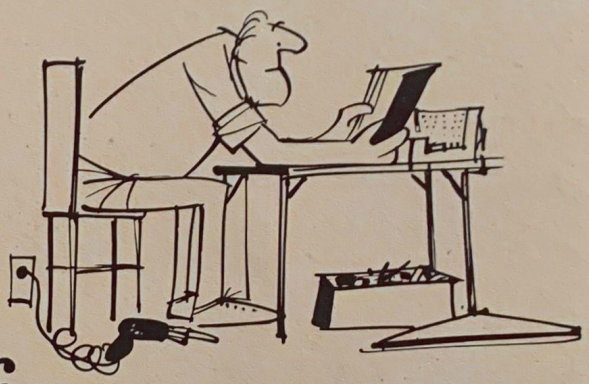
BM4-7. Connect a 1K resistor (brown, black, red) from Pin 5, V7 (S1) to Pin 6, V7. Press body of resistor down on chassis.

BM4-8. Connect a 1K resistor (brown, black, red) from Pin 5, V8 (S1) to Pin 6, V8. Press body of resistor down on chassis.

Assembly Group BM-5

The parts for this next group will be found in a separate package. These are the very large resistors and capacitors. When connecting the resistors, refer to the comments made under BM-4.

- [x] **BM5-1.** Connect the red band end of a CMPM .25 to Pin 6, V3. Add a 1" piece of black insulation to the other end and connect to Pin 1, V1.
- [x] **BM5-2.** Connect the red band end of a CMPM .25 to Pin 6, V4. Add a 1" piece of black insulation to the other end and connect to Pin 8, V1.
- [x] **BM5-3.** Connect an RW80 from Pin 1, D1B to Pin 1, D1E (S2).
- [x] **BM5-4.** Connect an RW80 from Pin 1, D1F to Pin 1, D1B (S1).
- [x] **BM5-5.** Connect an RW15000 from Pin 1, D1G (S2) to Pin 1, D1C (S4). (This part will be found in the plastic hardware bag.)
- [x] **BM5-6.** Connect the red band end of a CMPM .25 to Pin 6, V7. Add a 1" piece of black insulation to the other end and connect to Pin 1, V2.
- [x] **BM5-7.** Connect the red band end of a CMPM .25 to Pin 6, V8. Add a 1" piece of black insulation to the other end and connect to Pin 8, V2.



Assembly Group BM-6

These parts are on a part chart. Watch for short circuits and near short circuits. Make sure *all* leads to be soldered are fully and securely soldered.

- [x] **BM6-1.** Connect a 330K resistor (orange, orange, yellow) from Pin 6, V3 to Pin 1, V3.
- [x] **BM6-2.** Connect a 330K resistor (orange, orange, yellow) from Pin 6, V4 to Pin 2, V4.
- [x] **BM6-3.** Connect a 330K resistor (orange, orange, yellow) from Pin 6, V7 to Pin 2, V7.
- [x] **BM6-4.** Connect a 330K resistor (orange, orange, yellow) from Pin 6, V8 to Pin 1, V8.
- [x] **BM6-5.** Connect a large 2.7 ohm resistor (red, purple, gold) from Pin 1, V3 (S4) to Pin 8, V3 (S3).
- [x] **BM6-6.** Connect a 22K resistor (red, red, orange) from Pin 1, P2 (S1) to Pin 1, D2A (S3).
- [x] **BM6-7.** Connect a 150K resistor (BROWN, GREEN, YELLOW) from Pin 2, P2 to Pin 2, D2A (S3).
- [x] **BM6-8.** Connect a 22K resistor (red, red, orange) from Pin 1, P3 (S1) to Pin 1, D2B (S2).
- [x] **BM6-9.** Connect a 150K resistor (BROWN, GREEN, YELLOW) from Pin 2, P3 to Pin 2, D2B (S2).
- [x] **BM6-10.** Connect a 2.7 ohm resistor (red, purple, gold) from Pin 1, V8 (S5) to Pin 8, V8 (S3).

Assembly Group BM-7

Use the next color pictorial. Many of these resistors will have to be positioned over the large CMPM .25 capacitors. It is perfectly all right to put the resistors right down on the body of the big capacitors. The latter are fully insulated and this will cause no problems.

- [x] **BM7-1.** Connect a 1M resistor (brown, black, green) from Pin 1, D3A to Pin 3, V1 (S2).
- [x] **BM7-2.** Connect a 220K resistor (red, red, yellow) from Pin 1, D3A to Pin 2, V1.
- [x] **BM7-3.** Connect a 33K resistor (orange, orange, orange) from Pin 2, D3A to Pin 2, V1 (S3).
- [x] **BM7-4.** Connect a large 15K resistor (brown, green, orange) from Pin 3, D3A (S2) to Pin 1, V1 (S2).
- [x] **BM7-5.** Connect a CM47 from Pin 1, D3A (S4) to Pin 2, D3A (S2).
- [x] **BM7-6.** Connect a 1.2K resistor (brown, red, red) from Pin 1, D3B (S4) to Pin 6, V1 (S4).
- [x] **BM7-7.** Connect a 220K resistor (red, red, yellow) from Pin 2, D3B to Pin 7, V1 (S2).
- [x] **BM7-8.** Connect a large 15K resistor (brown, green, orange) from Pin 2, D3B (S3) to Pin 8, V1 (S2).
- [x] **BM7-9.** Connect a 1M resistor (brown, black, green) from Pin 3, D3B (S4) to Pin 9, V1 (S2).
- [x] **BM7-10.** Connect a 100K resistor (brown, black, yellow) from Pin 6, V3 (S4) to Pin 2, P2.
- [x] **BM7-11.** Connect a 100K resistor (brown, black, yellow) to Pin 2, P2 (S3). Add a ½" piece of black insulation to the other end and connect to Pin 6, V4 (S4).

Assembly Group BM-8

- [x] **BM8-1.** Connect a 1M resistor (brown, black, green) from Pin 1, D3C to Pin 3, V2 (S2).
- [x] **BM8-2.** Connect a 220K resistor (red, red, yellow) from Pin 1, D3C to Pin 2, V2.
- [x] **BM8-3.** Connect a 33K resistor (orange, orange, orange) from Pin 2, D3C to Pin 2, V2 (S3).
- [x] **BM8-4.** Connect a large 15K resistor (brown, green, orange) from Pin 3, D3C (S2) to Pin 1, V2 (S2).
- [x] **BM8-5.** Connect a CM47 from Pin 1, D3C (S4) to Pin 2, D3C (S2).
- [x] **BM8-6.** Connect a 1.2K resistor (brown, red, red) from Pin 1, D3D to Pin 6, V2 (S4).
- [x] **BM8-7.** Connect a 220K resistor (red, red, yellow) from Pin 2, D3D to Pin 7, V2 (S2).
- [x] **BM8-8.** Connect a large 15K resistor (brown, green, orange) from Pin 2, D3D (S4) to Pin 8, V2 (S2).
- [x] **BM8-9.** Connect a 1M resistor (brown, black, green) from Pin 3, D3D (S4) to Pin 9, V2 (S2).
- [x] **BM8-10.** Put ½" piece of black insulation to one end of a 100K resistor (brown, black, yellow) and connect to Pin 6, V7 (S4). Connect other end to Pin 2, P3.
- [x] **BM8-11.** Add a ½" piece of black insulation to one end of a 100K resistor (brown, black, yellow) and connect to Pin 6, V8 (S4). Connect the other end to Pin 2, P3 (S3).

Mechanical Assembly Group A-2

Pick up the chassis, turn it over and shake violently. This is to get all the little pieces of wire out of the unit. Make certain that there are no pieces caught in any crevices, tube sockets, or condenser can bases. This could cause short circuits.

☒ **A2-1.** You are now going to mount the three transformers to the top of the chassis. Take the power transformer which is the largest of the three and is marked TR-30-4-2. Mount on top of the chassis with 4 cupped lockwashers and hex nuts as shown in Fig. 8. The transformer should be placed so all the wires come out on the side away from the back of the chassis.

Take the remaining two transformers which are identical output transformers. Take one and position it with its feet lining up over the mounting holes in the chassis, as in Fig. 8. Feed all the transformer wires through the rubber grommets, as shown in the color pictorial. Notice that the green, yellow, orange, and black leads come out on the side nearest the back of the chassis. Pull up on the leads to get all the slack out.

Take the left chassis bracket (as viewed from the front) and place it over the two mounting holes toward the front of the chassis. Make sure all leads and wires already on the chassis are dressed around the bracket or pass through the semi-circular slit on one side of it. Take two of the machine screws and pass them from the top of the chassis through the feet of the transformer, the chassis holes, and into the chassis bracket. Thread on the lock nuts firmly to hold this in place. Now put the other two machine screws into the remaining two mounting holes and hold them on with lock nuts, too.

Repeat this operation with the other output transformer.

☒ **A2-2.** Mount the fuse post into the hole provided on the rear. See Fig. 9 Note position of the terminal on the side of the post. For future connections, it is a good idea to bend up this terminal slightly. Take one of the fuses provided (there is one for a spare), unscrew the cap of the fuse post and insert the fuse into the cap. Then put the fuse into the post, push in the cap and rotate it clockwise in order to fasten securely.

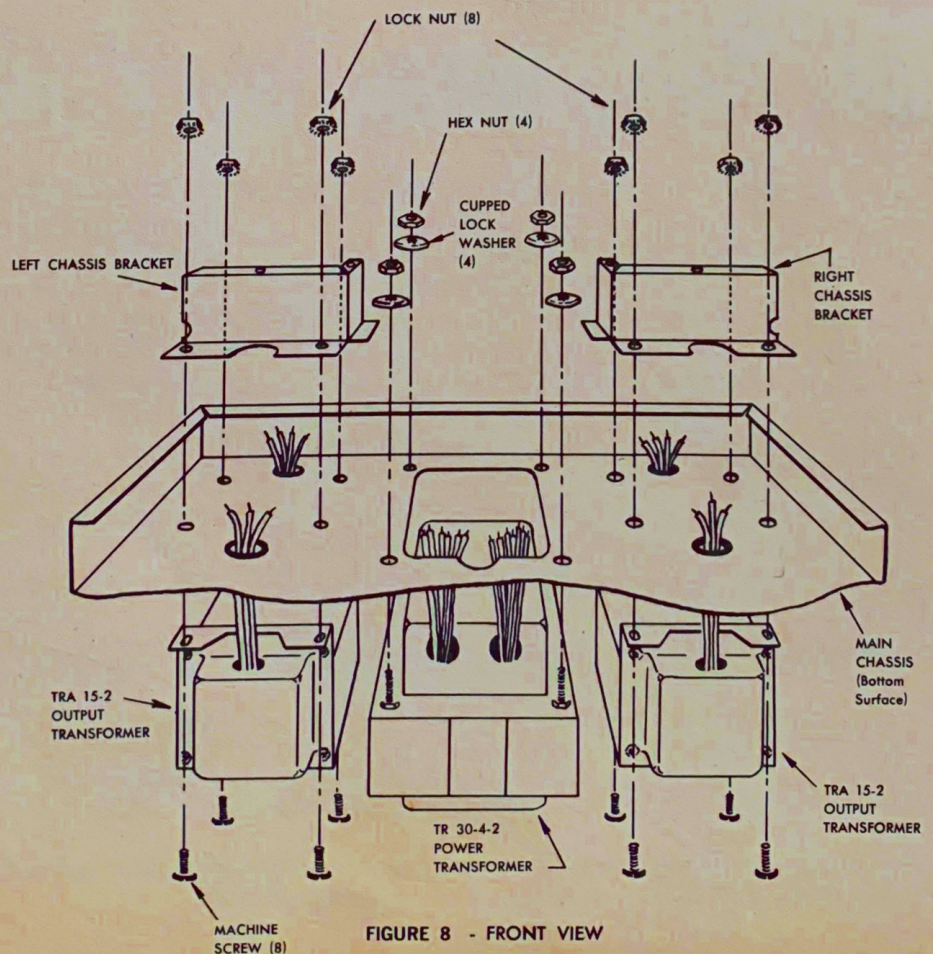


FIGURE 8 - FRONT VIEW

Assembly Group BM-9

The term " mic lapel " refers to a type of insulated cable. It can easily be recognized by the two lengths of buss wire inside. One is bare and uninsulated, the other is covered by a clear plastic insulation. For the most part you will be working with heavy transformer leads. These wires are large and difficult to bend. When connecting them to tube terminal pins which have two small connecting holes, it might be a good idea to move the other leads to the lower hole and place the transformer lead by itself in the upper one. This is not essential but might help. In some cases, you will not be able to make good mechanical joints due to lack of space. In such cases, use sufficient solder to insure a strong tight connection. A few of the leads coming from the power transformer may seem short. If you firmly pull on the leads, you will find that there is enough slack to make the difference.

BM9-1. Connect the yellow wire coming from P1 to Pin 1 on the tip of the fuse post (S1).

BM9-2. Connect the insulated wire at one end of an 11¾" yellow mic lapel to Pin 5, SS1 (S1). Connect the bare wire at this end to Pin 1, SS1 (S2). Clip out the bare wire at the other end and connect the insulated wire to Pin 1, J1. (S1).

BM9-3. Connect the insulated wire at one end of an 11¾" green mic lapel to Pin 5, SS2 (S1). Connect the bare wire at this end to Pin 1 D3D (S4). Clip out the bare wire at the other end and connect the insulated wire to Pin 1, J2 (S1).

(The following wires come from T2)

BM9-4. Connect the blue transformer wire to Pin 3, V3 (S1).

BM9-5. Connect the brown wire to Pin 3, V4 (S1).

BM9-6. Connect the red wire to Pin 1, D1D (S3).

BM9-7. Connect the black wire to Pin 1, TB-1 (S3).

BM9-8. Connect the orange wire to Pin 3, TB-1 (S1).

BM9-9. Connect the yellow wire to Pin 4, TB-1 (S1).

BM9-10. Connect the green wire to Pin 5, TB-1.

(The following wires are from T3)

BM9-11. Connect the blue wire to Pin 3, V7 (S1).

BM9-12. Connect the brown wire to Pin 3, V8 (S1).

BM9-13. Connect the red wire to Pin 1, D1H (S2).

BM9-14. Connect the black wire to Pin 1, TB-2 (S3).

BM9-15. Connect the orange wire to Pin 3, TB-2 (S1).

BM9-16. Connect the yellow wire to Pin 4, TB-2 (S1).

BM9-17. Connect the green wire to Pin 5, TB-2.

(The following wires are from T1)

BM9-18. Connect one of the yellow wires to Pin 8, V5 (S1).

BM9-19. Connect the other yellow wire to Pin 8, V6 (S1).

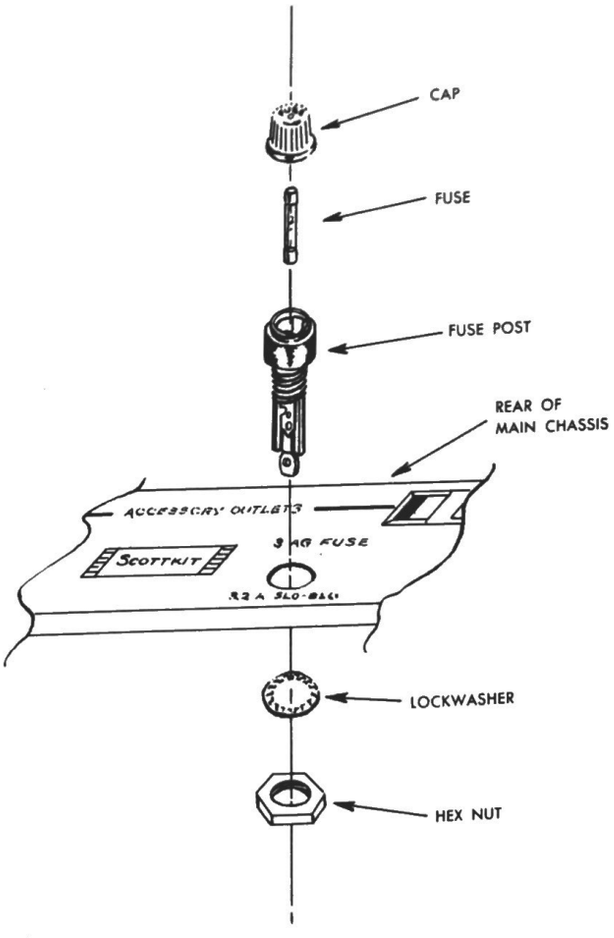


FIGURE 9

☒ **BM9-20.** Connect the orange wire to Pin 1, SR1 (S4).

☒ **BM9-21.** Connect the yellow/black wire to Pin 1, D1F (S4).

☒ **BM9-22.** Connect the red/yellow wire to Pin 4, C4 (S4).

☒ **BM9-23.** Connect the red/blue wire to Pin 6, V6 (S4).

☒ **BM9-24.** Connect the black wire coming out of the right side of transformer to Pin 1, AC2.

☒ **BM9-25.** Connect the red wire to Pin 6, V5 (S4).

☒ **BM9-26.** Twist the two green wires and connect the shorter one to Pin 2, V7 (S3). Connect the other one to Pin 7, V7 (S4).

☒ **BM9-27.** Twist the two blue wires and connect one to Pin 2, V4 (S3). Connect the other one to Pin 7, V4 (S4).

☒ **BM9-28.** Connect the black wire coming out of the left side of transformer to Pin 2 on the side of the fuse post (S4).

☒ **BM9-29.** Connect one of the line cord wires to Pin 1, AC2 (S3). Connect the other one to Pin 2, AC2 (S3).

Assembly Group BM-10

For these last few steps, return to the original color pictorial you began with. You are almost done, but don't go too fast and make errors.

☒ **BM10-1.** Connect a large 10 ohm resistor (brown, black, black) from Pin 1, D2C to Pin 2, TB-1 (S3).

☒ **BM10-2.** Connect the black band end of a CPM .1 to Pin 1, D2C (S2). Connect the other end to Pin 5, TB1.

☒ **BM10-3.** Connect a 12K resistor (brown, red, orange) from Pin 2, D2C to Pin 5, TB-1.

☒ **BM10-4.** Connect a CM150 from Pin 2, D2C (S3) to Pin 5, TB-1 (S4).

☒ **BM10-5.** Connect a large 10 ohm resistor (brown, black, black) from Pin 2, D2D to Pin 2, TB-2 (S3).

☒ **BM10-6.** Connect the black band end of a CPM .1 to Pin 2, D2D (S2). Connect the other end to Pin 5, TB-2.

☒ **BM10-7.** Connect a 12K resistor (brown, red, orange) from Pin 1, D2D to Pin 5, TB-2.

☒ **BM10-8.** Connect a CM150 from Pin 1, D2D (S3) to Pin 5, TB-2 (S4).

Very Important! the Double Check System

The electrical assembly is now complete. It is time to pause for a moment and make sure that there are no errors, and that every joint has been soldered properly. It is quite understandable that at this stage of the assembly there will be a tremendous incentive to forge ahead quickly to finish the job. Unfortunately this attitude can cause you to overlook a small error that will lead to serious and expensive damage to your amplifier.

In extensive evaluation tests we had LK-150 kits built by a wide variety of people. Over 90% of the kits worked perfectly upon completion. Of this percentage, virtually everyone had taken the trouble to follow this double checking procedure, and most of them reported catching small errors. In those units that did not work we discovered that malfunction could, in every case, be traced directly to skipping of the double-check. Simple miswiring errors or short circuits prevented proper operation of the amplifier. Stop for a moment, RELAX, and be sure to check over your work.

An easy method of doing this has been provided. Call in a friend or another member of the family. Have them look over chart AM1. On this diagram of the underside of the chassis, a series of numbers have been placed next to each pin or terminal. These numbers indicate the number of wires and leads (including those from resistors or capacitors) that have been soldered to that pin. While you count off the number of leads on each pin and terminal, your assistant can check your count against the chart. When you count these leads going to pin 1 of V3, your helper will observe that this agrees with his chart and place a small check mark on it. This will be continued until the entire amplifier is checked over. It will seldom take more than 20 minutes for this complete check.

While you are counting the wires, you can also be checking for short circuits and proper soldering. It would be very handy if you had a tool with a small sharp point (like an ice pick) to probe the connections and make certain they are soldered properly. A pencil with a sharp point can also be used. Even the most meticulous worker can make a mistake or have a poorly soldered joint. LOOK SHARP! Move every lead and wire a little bit to insure it is not accidentally causing a short circuit with some other wire or pin.

If a mistake is caught and it involves a component which is now too short to reach the correct pin, refer to Fig. 3 on splicing a piece of buss wire. This will work quite well and eliminate the need for purchasing a replacement.

Final Assembly

Turn the chassis over and shake it violently. This is to get all the little pieces of wire out of the unit. Make certain that there are no pieces caught in any crevices or in the tube sockets or condenser can bases. This could cause short circuits.

Assembly Group A-3

☒ A3-1. Mount the tubes in the proper tube sockets. Make sure each set of matched output tubes is kept as a pair. The sockets are clearly identified right on the chassis. Insert the pilot light bulb into the pilot light socket above the meter. Put the knobs on the two front panel switches. Use your small screwdriver for this purpose.

☒ A3-2. It is time to check the amplifier. Turn the two pots on top of the chassis, P2 and P3, completely clockwise. Make sure the On-Off switch is in the Off position. Insert the line cord into an AC outlet. Position the amplifier on its side so that you can observe the underside as well as the topside. Turn the On-Off switch to On. Watch carefully for any sign of arcing or overheating under the chassis, or any evidence of extreme glowing in the tubes. If this occurs, immediately turn off the unit. (Check for wiring errors and for poor solder joints and short circuits.) If all is well, remove line cord.

☒ A3-3. Mount the rubber feet on the bottom cover with the 4 lock nuts. (See Fig. 10). Then mount the bottom cover with the 10 sheet metal screws.

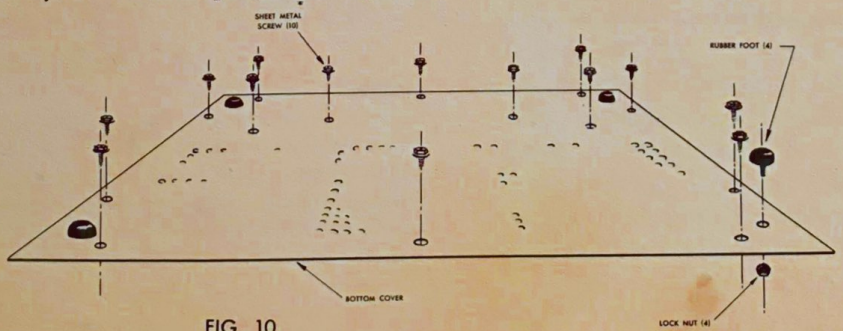


FIG. 10