

CONSTRUCTION BOOK

GENERAL INTRODUCTION

The EICO kit you are about to assemble and wire has been designed to meet the highest standards of performance. It is a high quality unit to be constructed from the finest components available anywhere.

The following Construction Book has been written to carefully guide you through the construction of your kit. If you follow all the instructions implicitly and work carefully without haste, you will be rewarded with many years of fine performance from this instrument and a personal inner satisfaction from a job well done.

The Construction Section: Beginning with the number on this page, and throughout the rest of the construction Book, the page numbers are followed by a "C" (1C, 2C, etc.). The Instruction Manual, detailing the installation, operation and maintenance of your instrument, are identified by numerals only, without any letters following these numerals.

The Construction Manual pages are stapled together and slipped into the separately bound Instruction Manual. After you are certain that you have successfully completed the wiring of your kit, you may discard the Construction Manual. Keep the Instruction Manual for information as to the installation and operation, as well as for any maintenance that may be necessary in the future, on your unit.

Choosing a Workbench and Tools: To avoid the accidental loss or misplacement of components, choose a convenient workbench before unpacking your new kit. You will find it most advantageous to choose a corner on a table that will not be used for any other purpose until you have completed the construction of your kit. Proper precautions should be observed to prevent damage to any table top from a soldering iron or heavy tools.

When you check the component parts against the Parts List later on, it will be convenient to separate the various pieces into types of components and hardware sizes. It will be helpful to keep these sorted pieces separated in the compartments of specially made trays. Small cartons, egg trays or a refrigerator ice tray with dividers serve equally well.

Several basic tools are required to construct this kit. They are:

1. Screwdriver - 3/16" to 1/4" blade
2. Screwdriver - 1/8" blade
3. Longnose pliers - 5" or 6"
4. Gas Pliers
5. Diagonal wire cutters
6. Small soldering iron or pencil iron (35 watts or less).
7. High quality 60-40 rosin core radio solder. **DO NOT** use Acid Core solder or paste fluxes under any circumstances.

The following tools are useful, but are not absolutely necessary to construct this kit.

1. Socket wrench set
2. Open end wrench set
3. Wire stripper

Unpacking the Kit: This procedure serves two purposes. First, it lets you get acquainted with the various types of components. Second, it enables you to ascertain if you have received all the parts required to build the kit. This is your opportunity to have any packing errors corrected.

When unpacking, handle all parts carefully so that you will not damage any fragile components. Do not throw any packing material away until you have completed the checking of all components. Check each part off against the "Parts List" which you will find in your Instruction Manual. Check the packing for any small parts.

From time to time, due to modernization or possible error, it may be necessary to correct your Parts List. If there are any changes to be made, they will be listed on the loose addenda sheets included with this book. Make the corrections, if any, before checking the components. If no corrections of your Parts List are noted on the addenda sheets, or if there are no addenda sheets, assume that your Parts List is correct and commence to check all components against this list.

To enable rapid identification of electronic parts, each part has been assigned one or two letters of the alphabet called a "reference designation". These "reference designations" are nothing more than an initial letter or two representing the name of the part. For example, a tube has been assigned the "reference designation" letter "V", and a transformer the letter "T". Thus, if you have six tubes and four transformers in your kit, these parts would be identified by the designations V1 through V6 and T1 through T4, respectively.

The reference designation assigned to capacitors is C.

The unit of capacitance is the "Farad. 1/1,000,000 of a Farad is the microfarad (abbreviated MF or MFD). 1/1,000,000 or a microfarad is a micro-microfarad (abbreviated MMF or MMFD). 1000 micro-microfarads is denoted by the letter "K". Thus 0.1mfd = 100Kmmf = 100,000mmf.

Some capacitors, such as electrolytics, have a plus (+) mark next to one end. These are the only capacitors that must be mounted in a specific direction. Follow the directions for mounting described in the appropriate steps below. When no direction is mentioned, mount the capacitor either way.

The peak or working voltages are important capacitor characteristics. A capacitor marked with a higher voltage may be substituted for a lower voltage unit. Thus, a 50 volt capacitor may be used in place of a 10 volt unit. The reverse is obviously not true. You cannot use a 10 volt unit as a substitute for a 50 volt capacitor. Where more than one capacitor of identical value but different breakdown voltages are used, the unit you are to use is indicated in the appropriate construction step.

Ceramic capacitor tolerance may be noted by a letter rather than a number. "K" is 10%. "M" is 20%. "P" or "GMV" means guaranteed minimum value.

Ceramic capacitors have specific temperature characteristics — percent and degree of variation of

capacity with temperature. These variations are indicated by means of a code number stamped on most capacitors. Thus, a capacitor marked 68 Z5E indicates a 68mmf capacitor having a Z5E temperature characteristic. The actual meaning of Z5E, or any other characteristic, is important to the engineer. When building the kit, be sure to use the capacitor with the characteristic specified by the engineer, if it is indicated in the construction steps. If no value is indicated in the construction book, use any of the ceramic capacitors of proper value, tolerance and voltage characteristics, supplied with the kit.

Resistors are denoted by the symbol letter R.

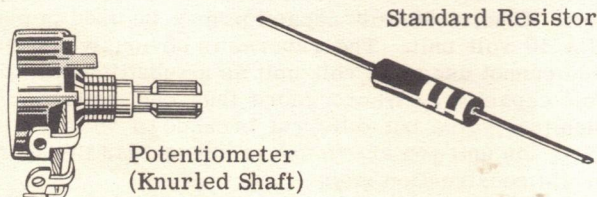
The unit of resistance is the "ohm". The letter "K" indicates multiplication by 1000 and the letter "M" indicates multiplication by 1,000,000. Thus 1000 ohm = 1K or 1 kilohm. 1,000,000 ohms = 1M or 1 megohm.

Some resistors have their resistance value stamped on the surface of the resistor body. However, other fixed resistors are coded with color bands which indicate their value. The actual color code of these resistors is noted in the parts list. In some instances, even when the color code is noted in the book, the actual resistor value may be stamped on the body, rather than the color code.

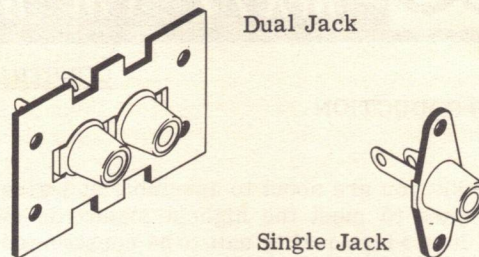
The tolerance of a resistor is the amount the resistance can vary around its marked value. Thus, if a 1K ohm (1000 ohms) resistor has a $\pm 10\%$ tolerance, its actual value can be between 900 ohms and 1100 ohms. If the same resistor has a $\pm 5\%$ tolerance, its actual value can be between 950 ohms and 1050 ohms. In all cases, the tolerance is always stated or given as part of the color code when the resistor is listed. If the resistor is marked with a number rather than a color code, the tolerance is stamped on the body. In your kit, 5% resistors may be substituted for 10% components and 10% resistors substituted for the 20% ones. However, be certain that you do not use a 10% resistor when a 5% resistor is required or a 20% resistor when a 10% or 5% resistor is specified.

Resistors are capable of dissipating power. Large resistors handle more power while smaller ones handle less. A 1/4 watt resistor is usually smaller than a 1/2 watt unit, while a 1/2 watt resistor is usually smaller than a 1 watt unit. If like valued resistors are used in the kit, differing in power rating, the proper resistor to use is designated in the particular construction step.

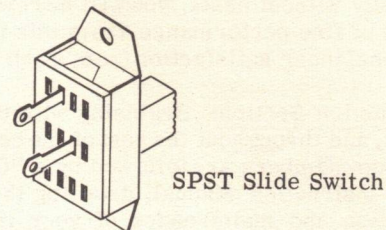
Besides the fixed resistors discussed, there are also variable resistors known as potentiometers. The type used in this unit is illustrated.



The reference designation assigned to jacks (receptacles) is the letter J. The types of jacks used in this kit are illustrated here as well as in the construction steps.

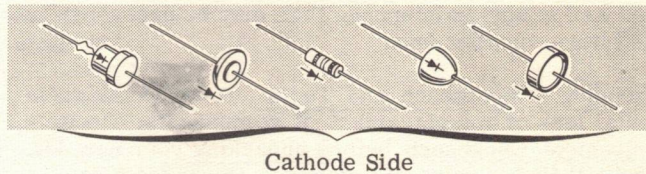


Switches are designated by the letter S. In the MX-99 SPST slide switches are used.

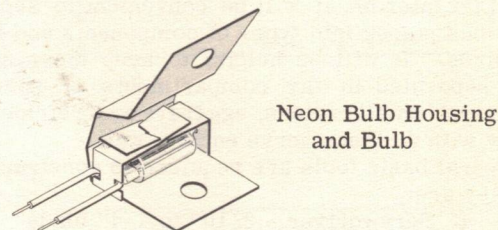


The rectifier symbol CR, designates solid state diodes. One end is the cathode. The second end is the anode. Some popular shapes of rectifiers are illustrated. The cathode end is pointed out in each case.

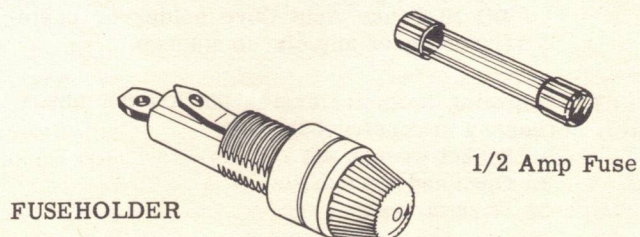
DIODES



The reference designation given to the neon indicators is I. The bulb will be mounted in the neon bulb housing as shown below.



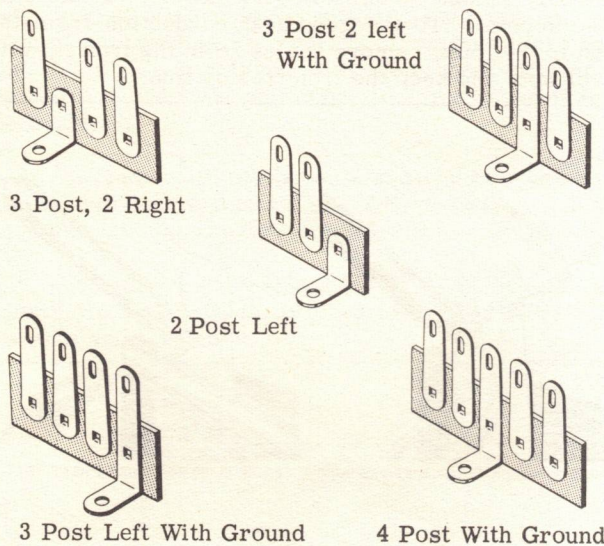
The fuse has been assigned the reference designation, F1, while the fuse holder is denoted by XF1.



When other shapes of rectifiers are supplied, the symbol for the rectifier, shown in the figure, is usually printed on the unit. The lead near the end indicated by the symbol as the cathode, protrudes from the cathode side of the rectifier. If there is no symbol, a red dot will indicate the cathode. Connect the cathode lead of any of these rectifiers to the proper lug, when so indicated in the construction step as shown.

TERMINAL STRIPS

The various types of terminal strips are assigned the designation letters TB. The types used in this kit are illustrated.



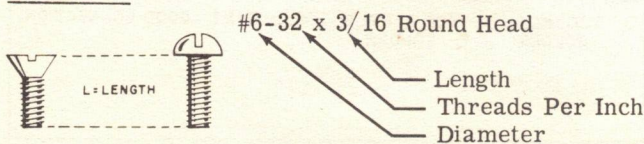
HARDWARE

Hardware is a general term for mechanical parts used in the assembly of EICO kits. Such items are usually screws, nuts and washers. Machine screws are sized in accordance with the diameters of the threaded portion (No. 2, No. 4, No. 6), with the smaller number denoting the smaller diameter. The second number indicates the number of threads to an inch. Thus, a No. 6-32 screw has a No. 6 diameter with 32 threads per inch. The final number indicates the length of the threaded portion. A No. 6-32 x 3/8 screw has a 3/8" long threaded portion. The diameters are shown in the figure.

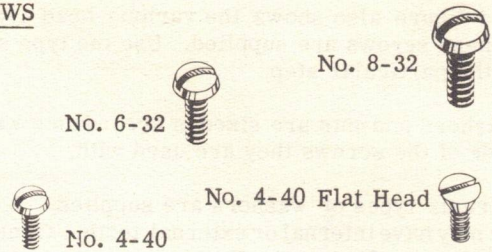
ACTUAL DIAMETER



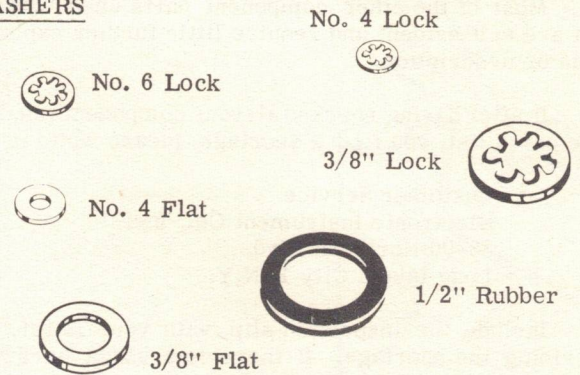
EXAMPLE



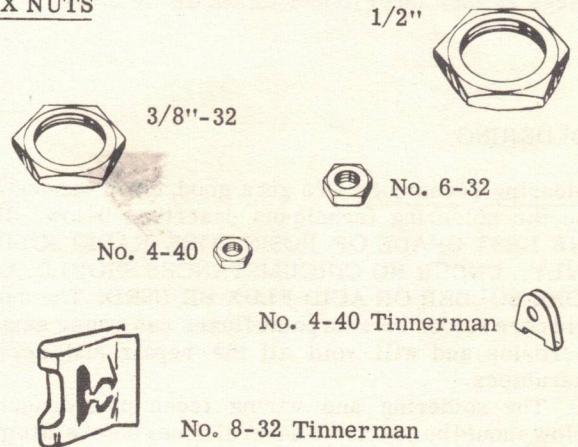
SCREWS



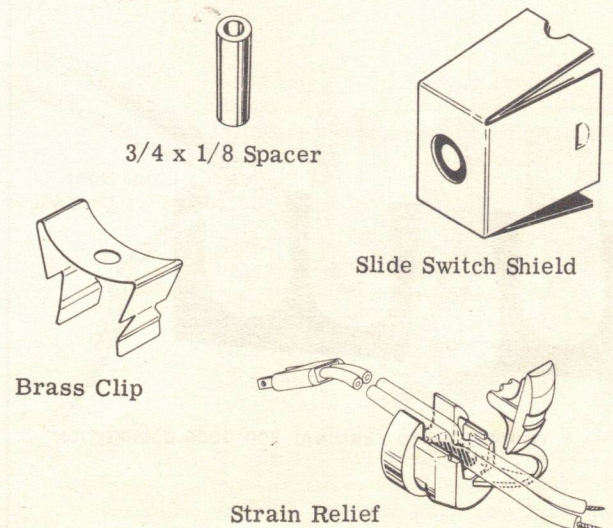
WASHERS



HEX NUTS



MISCELLANEOUS



The figure also shows the various head types in which these screws are supplied. Use the type specified in the particular step.

Washers and nuts are sized in accordance with the diameter of the screws they are used with.

Various types of washers are supplied. A lock-washer may have internal or external teeth. Tinnerman speed nuts are generally used for mounting to a chassis.

Most of the other component parts used with the kit are self evident and require little further explanation or description.

If after having checked all your components against the parts list, you find a shortage, please write us at:

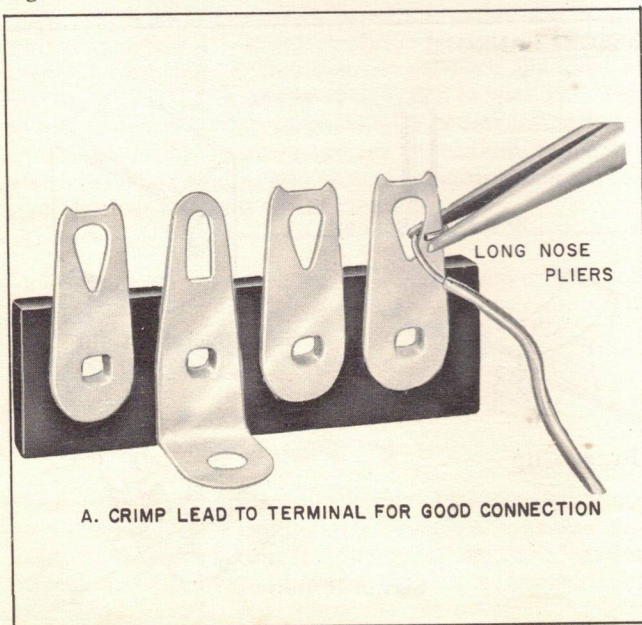
Customer Service
Electronic Instrument Co., Inc.
33-00 Northern Blvd.
Long Island City 1, N.Y.

Include the inspection slip, with your letter, describing the shortage. If there is a slight hardware shortage, you can expedite matters by purchasing these pieces at your local jobber or hardware store.

SOLDERING

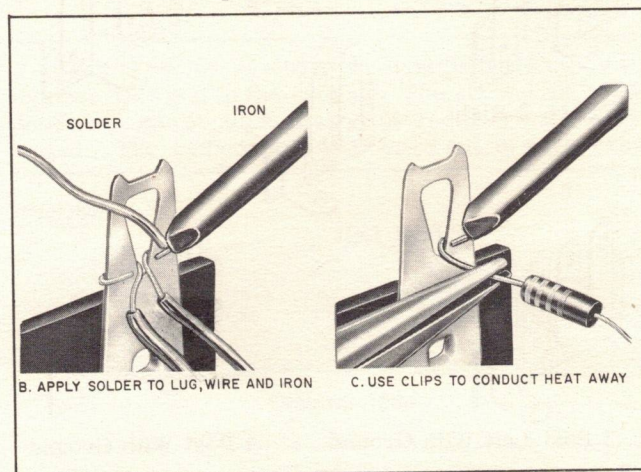
Soldering Techniques: To get a good, clean connection, use the soldering techniques described below. **USE THE BEST GRADE OF ROSIN CORE RADIO SOLDER ONLY. UNDER NO CIRCUMSTANCES SHOULD ACID CORE SOLDER OR ACID FLUX BE USED.** The use of acid core solder or acid paste fluxes can cause serious corrosion and will void all the repair and service guarantees.

The soldering and wiring techniques described below should be practiced several times before attempting to wire or solder components in the actual kit.

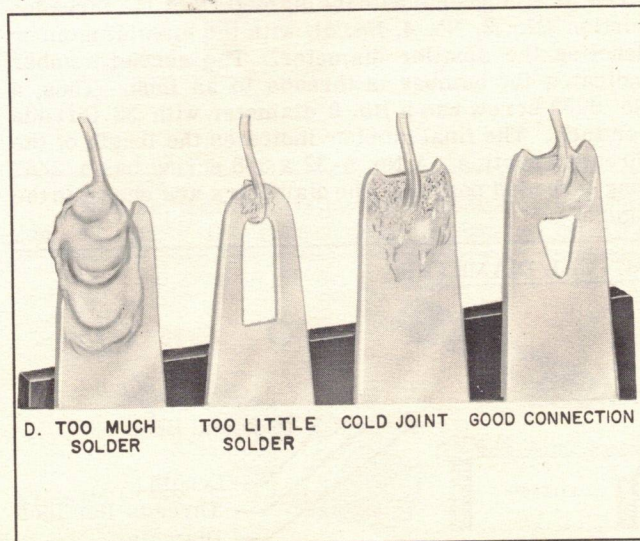


Practice several connections with a spare piece of wire and a socket or terminal strip that can be purchased at your local jobber.

First make a good mechanical connection. Remove 1/4" of insulation from the end of the wire. Feed the wire through the solder lug opening so that the wire insulation just touches the lug. With the long-nose pliers, bend the wire lead around the lug and crimp the wire lead to the lug. To solder the connection, place the tip of the hot soldering iron on the lug or terminal at a point close to the wire being soldered. Apply the solder to the junction of the lug, wire and soldering iron. When the lug and wire have been heated to the correct temperature, the solder will flow into and over the joint. Remove the iron when the solder starts to flow and remove the solder immediately after. Use only enough solder to cover the wire at the connection point. To get good heat conduction from the iron to the joint, remove scales from the iron tip with steel wool and keep the iron freshly tinned.



A poor solder connection is obvious by its appearance. A grainy or pitted joint is a poor connection due to insufficient heat. Blobs on the wire or solder lug is also due to insufficient heat. Solder should flow as a result of the heated lug and wire. Do not solder by applying solder to the iron tip and then wiping the hot solder onto the joint. A well soldered joint is indicated by a smooth shiny finish on the soldered connection.



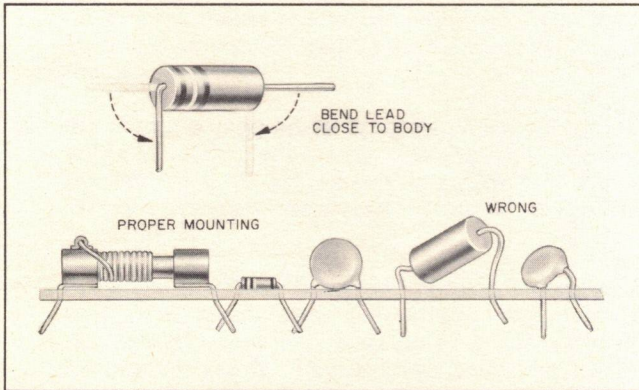
Printed Board Techniques: There are several primary advantages to using a printed circuit board in your unit. Among them are greater ease of assembly, more rapid construction, less chance of wiring error and improved repetitive performance. To achieve all the benefits derived from the use of the board, requires that you follow the few special wiring and soldering techniques outlined below.

The body of each component should touch or be very close to the printed circuit board. The leads of each component should then be bent slightly outward to keep them from moving or falling out of the holes. The components are then to be carefully soldered to the etched wiring at the hole through which the lead passes. Cut any excess lead length close to the board.

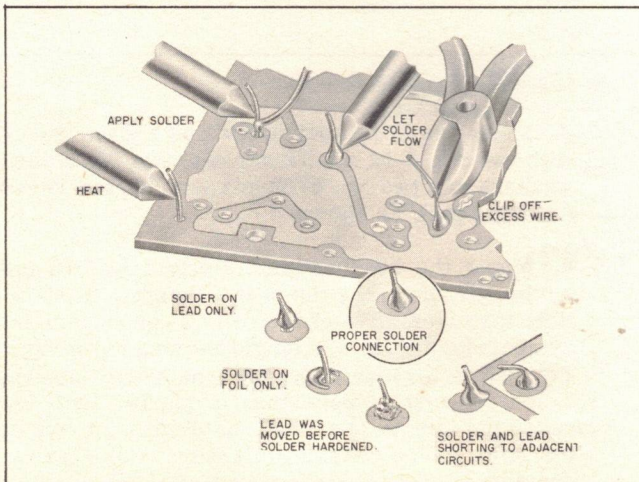
One side of the board consists of the etched wiring. All components are to be mounted onto the opposite side of the board — the side away from the etched wiring. This side is marked with the component symbol numbers at the location the particular component is to be mounted.

The leads of all components are to be bent as shown and mounted as described in the appropriate step and inserted into the appropriate holes in the board.

The soldering technique is straightforward and must be followed carefully to avoid damage to the components and the board.



1. Hold the tip of the soldering iron against the lead to be soldered. This point should be about 1/2" from the board (labeled HEAT in the figure).



2. Put the solder against this lead midway between the iron and the board (labeled APPLY SOLDER in the figure).

3. When solder begins to flow lower the iron and then solder to the board (labeled LET SOLDER FLOW in the figure).

4. Remove the iron immediately after the solder has melted over the etched foil and the component lead.

Care should be exercised that too much heat should not be applied to the board. Excess heat may lift the foil off the board.

Too much solder on the board is also an undesirable condition. It can short two conductors. Should this happen, reheat the solder and wipe the excess away with a cloth.

Should solder clog an unused hole, melt the solder with the iron and open the hole by pushing a lead from a resistor or capacitor through it. Remove the resistor or capacitor before the solder cools to prevent it from being soldered into this newly cleaned hole.

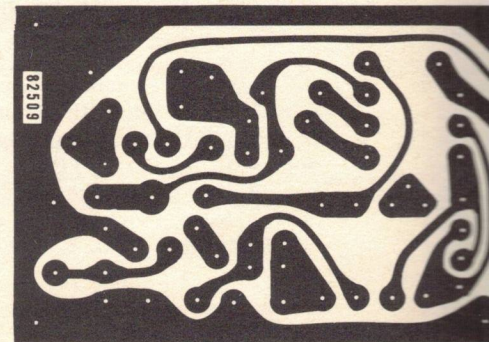
Should there be a break in the foil at any time, it can be repaired easily. A piece of bare wire can be used to join the two ends of the foil where the break occurred.

By carefully following the soldering techniques given, the board should be clean from cold solder joints, shorts, etc.

The drawing below shows the bottom of the MX-99 board. Refer to this diagram for reference should you suspect a short between conductors.

Construction Hints: The various lengths of wire to be used in the kit are specified in the construction steps. After cutting the wire to the length specified, strip the insulation off 1/4" from each end. The exposed wire will be used to make the actual connection to the solder lug.

Components such as resistors and neon indicator lamps, may have longer leads than specified. Cut the leads to the length indicated in the particular construction step. This length is to be measured from the body of the component. In the case of insulated leads, strip 1/4" of insulation off from the ends and twist the strands (if any) of the wire together.



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As an example, one step may specify that each lead on a resistor be cut to 1/2". 1/4" of each lead is used to make a mechanical connection to the solder lug. The other 1/4" is between the terminal board and the component so that the component will not be overheated when soldering.

When a connection is indicated, a (C) or an (S) will appear next to the lug involved, when appropriate. The (C) indicates that the connection should be simply mechanical without soldering, since other leads are to be connected to this same lug. The (S) indicates that the connection should be made and soldered immediately. However, the (S) is always followed by a number, such as (S1), (S2), (S3), etc. This number indicates the number of connections made to the lug. It is a check on the accuracy of your work.

As an example, if it says (S3) you should count three leads going to the lug to be soldered. If there are less than three leads at this particular lug, you will know that you have forgotten one or more leads, or connected them to the wrong lugs. If there are more than three leads, you can be certain you have connected an extra wire to this lug, which should probably go elsewhere.

When you assemble the parts in your unit, mark the symbol of each component on the chassis near the part, with a crayon. This will facilitate your wiring operation.

When wiring, dress the leads and components as shown in the drawing. Be careful to avoid shorts at the lugs.

Next to each step number you will find a parenthesis (). After you have completed each step, make a check mark in the parenthesis so that you will have a record of your work. Follow the steps in the sequence given in the book. Do not skip steps or pages.

If any addendas are included in your book to modernize your instrument or to make corrections or part substitutions, be sure to correct the Construction Book first before you start to assemble and wire your kit.

You are now ready to construct your fine instrument.



Bottom of MX-99 Printed Board

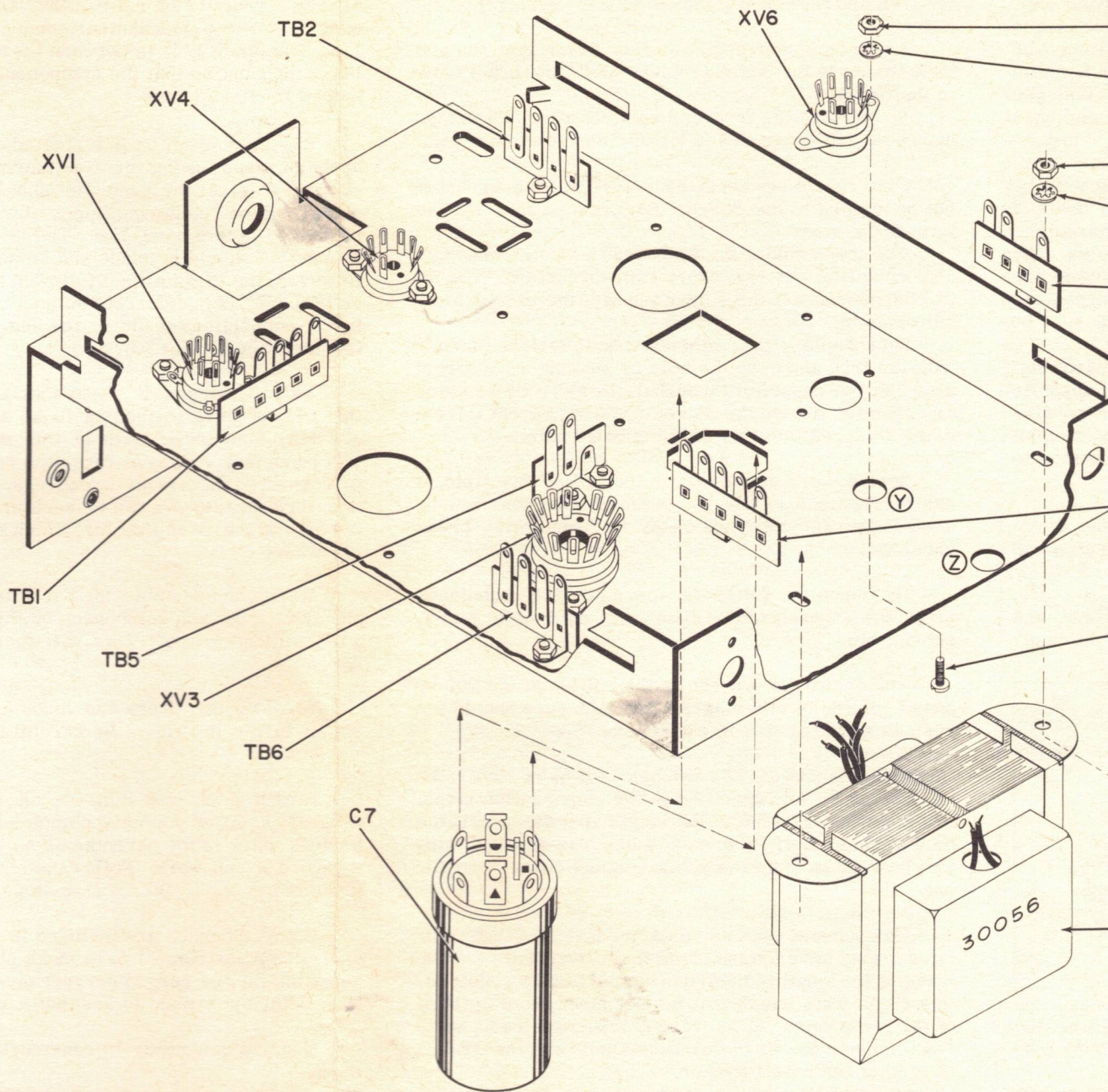
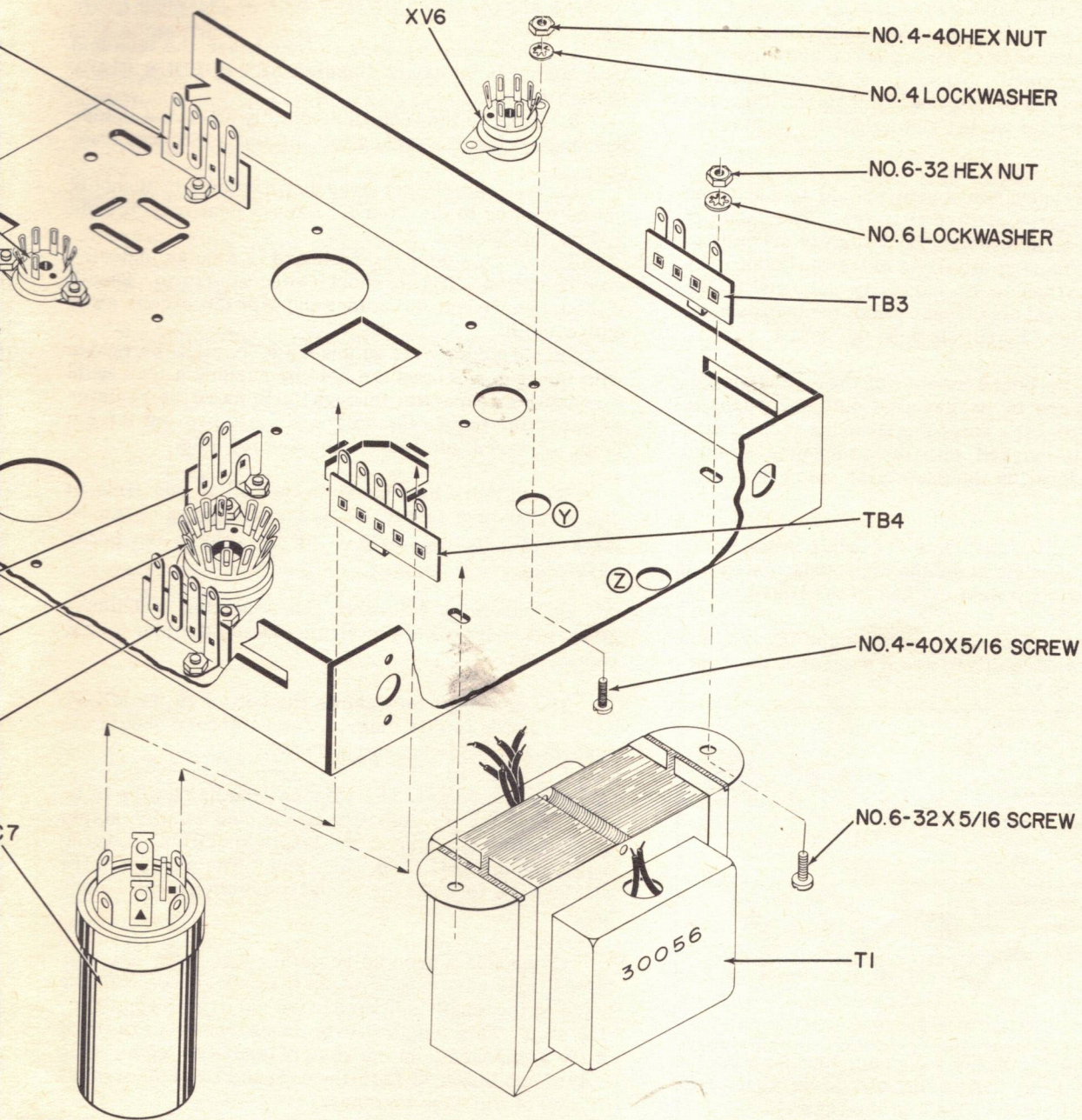


Figure 1C. Bottom Chassis Mounting

The following steps refer to figure 1C.

- (✓) 1. On power transformer T1, cut all leads to 3", mount it to the chassis, as shown. Pass the two black leads through hole "Z" and the remainder of the leads through hole "Y". Secure with two No. 6-32 x 5/16 screws, two No. 6 lockwashers and two No. 6-32 hex nuts. On the set of hardware, closest to the side apron, mount the 3 post 2 right terminal strip, TB3.
- (✓) 2. Mount the nine pin miniature bottom mount socket, XV1, as shown. Secure with two No. 4-40 x 5/16 screws, two No. 4 lockwashers and two No. 4-40 hex nuts. Position the 4 post with ground terminal strip, TB1, on one set of hardware, as shown.
- (✓) 3. Mount the remaining terminal strips as follows: The 3 post 2 left with ground, TB2; the 4 post with ground, TB4; the 2 post left, TB5; and the 3 post left with ground, TB6. Carefully observe the orientation of each terminal strip and secure each with one No. 6-32 x 5/16 screw, one No. 6 lockwasher and one No. 6-32 hex nut.
- (✓) 4. Mount the two seven pin miniature bottom mount sockets, XV4 and XV6, as shown. Secure each with two No. 4-40 x 5/16 screws, two No. 4 lockwashers and two No. 4-40 hex nuts. Orient the keyway

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- (✓) 4. Mount the two seven pin miniature bottom mount sockets, XV4 and XV6, as shown. Secure each with two No. 4-40 x 5/16 screws, two No. 4 lockwashers and two No. 4-40 hex nuts. Orient the keyway

(missing pin), as shown.

- (✓) 5. Mount the 12 pin socket, XV3, as shown. Secure with two No. 6-32 x 5/16 screws, two No. 6 lock-washers and two No. 6-32 hexnuts. Orient keyway (missing pin), as shown.
- (✓) 6. Mount the 20-40-40mfd, electrolytic can capacitor, C7, from the top of the chassis, as shown. Note the orientation of the can as per the terminal symbols (semicircle, triangle and square) on figure 6C. Twist all four mounting tabs a little less than a quarter turn. More than a quarter turn may cause the tabs to shear off. Solder the tab without the hole, to the chassis, to assure a good ground contact.

The following steps refer to figure 2C.

- (✓) 1. Orient the printed wiring board with the copper side downward and the silk screen (lettered) side upward.
- (✓) 2. Position the nine pin miniature, top mount with shield, sockets, XV5 and XV2 over their appropriate holes. Press each socket firmly into the board. Note that the socket can only go in one way. Turn the board over and solder each of the nine pins and the center pin for each socket to the copper wiring. Follow the techniques as outlined in the introductory material.
- (✓) 3. Position the 38kc oscillator coil, T4, over its appropriate hole and press it into the board. Note that the coil can only be mounted in one way. Turn the board over and solder the seven lugs.

The following steps refer to the bulb holder drawings figures "A" through "H".

- (✓) 1. Place one fishpaper bulb holder on table in position as shown in figure "A". Figures "A" through "D" show the construction sequence of the bulb holder for I1.
- (✓) 2. Fold cover as shown in figure "B".
- (✓) 3. Fold arms as shown in figure "C" and secure by locking the slots together. Place one of the neon bulbs inside the arms. Slip one lead of the bulb into each notch and force the glass tip into the small round hole.
- (✓) 4. Fold the cover flap over the arms so that the holes on each piece meet. Cover both leads of the bulb with 1-3/4" piece of spaghetti. Figure "D" is a completed bulb holder ready to be mounted in figure 3c.
- (✓) 5. Place the other fishpaper bulb holder on table in position as shown in figure "E". Figures "E" through "H" show the construction sequence of the bulb holder for I2. Repeat steps 2 through 4 using figures "E" through "A".

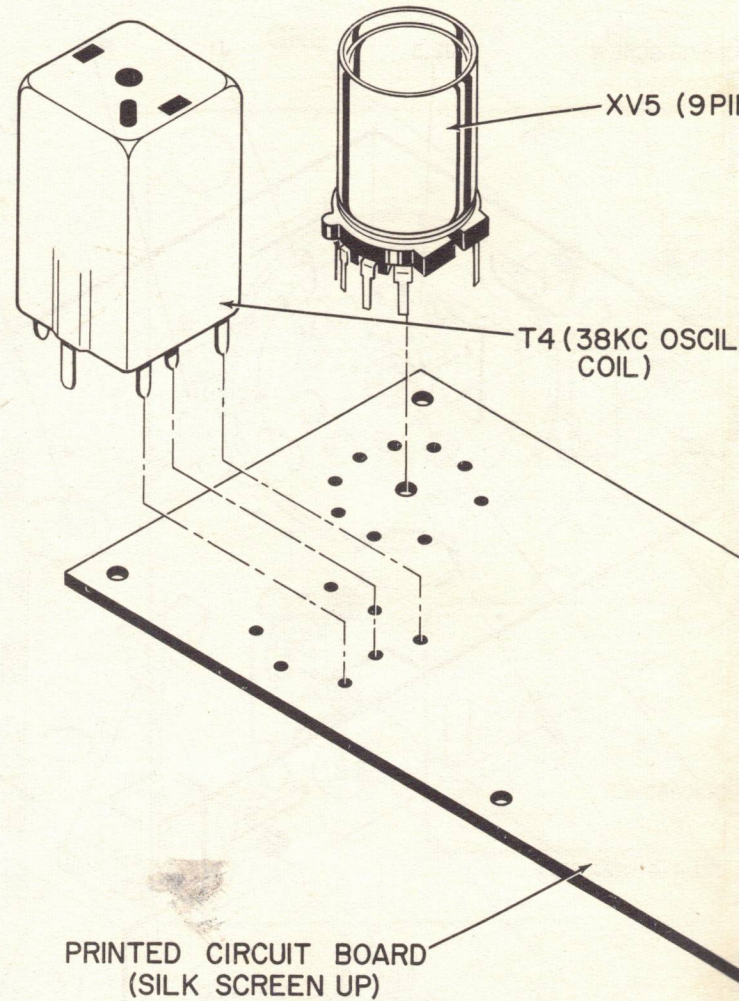
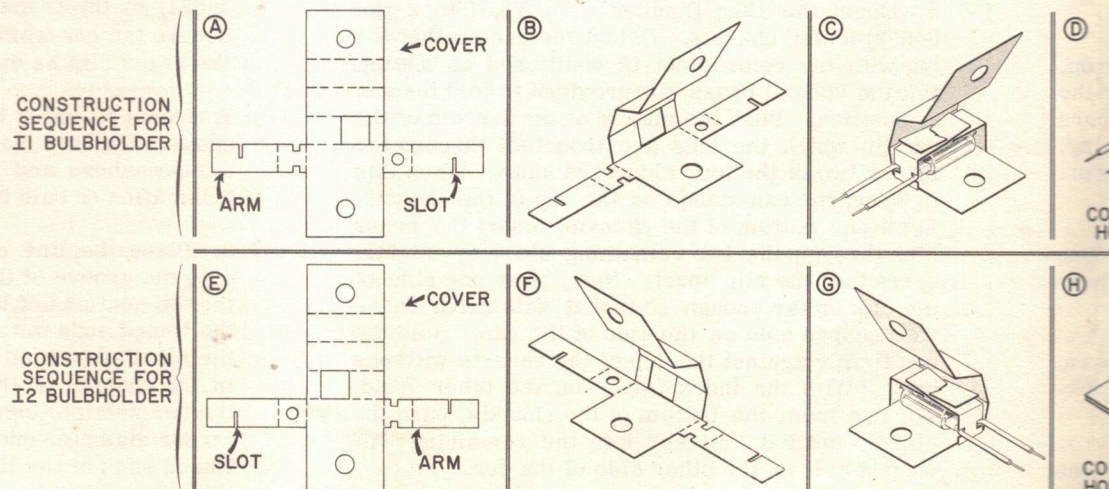


Figure 2C. Component Mounting



the copper
(soldered) side

mount with
appropriate
the board.
way. Turn
nine pins
the copper
soldered in the

over its
board. Note
way. Turn
.

drawings

a table in
figures "A"
reference of the

and secure
one of the
lead of the
tip into the

so that the
leads of
. Figure
is mounted

refer on table
figures "E"
reference of the
with 4 using

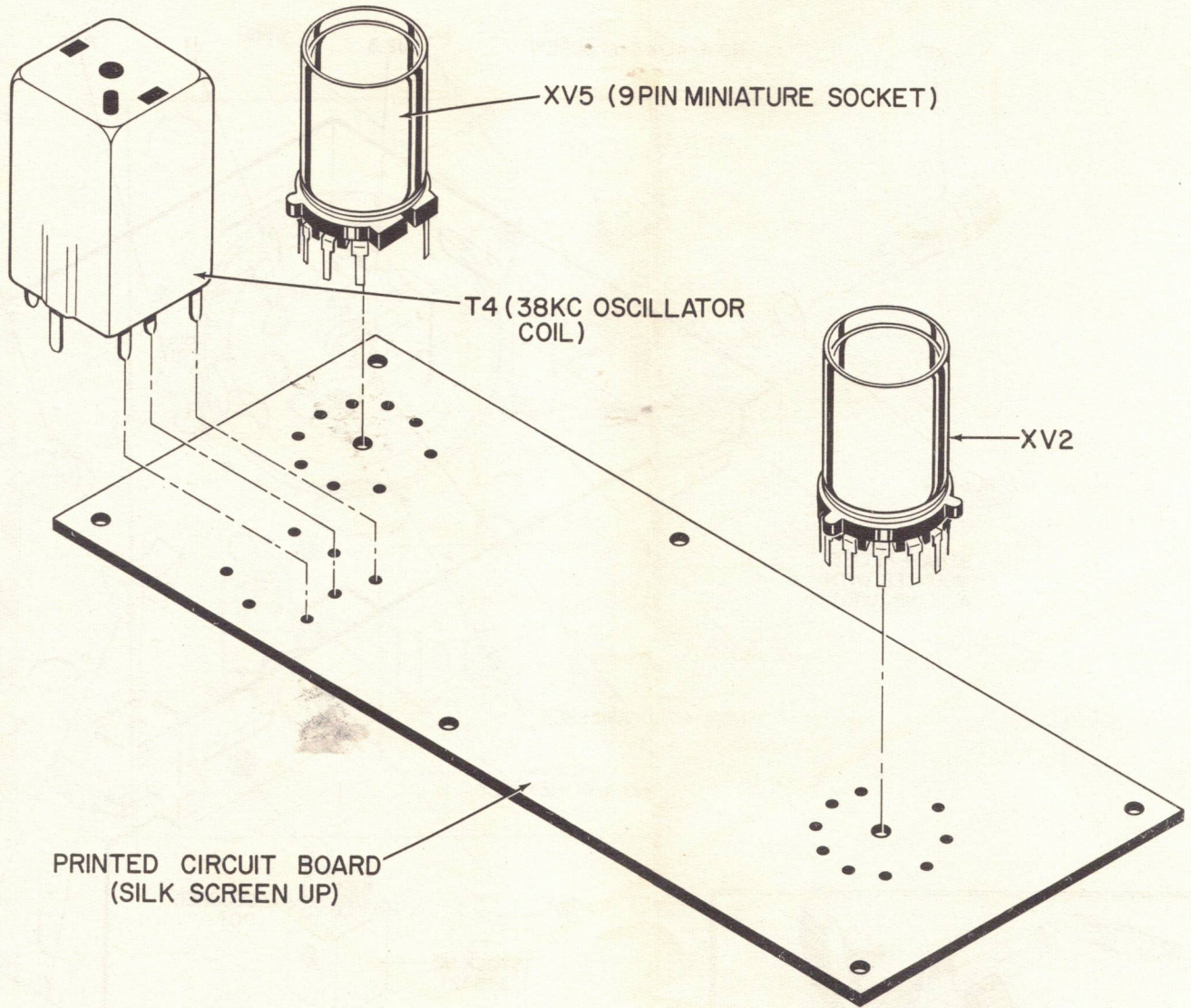
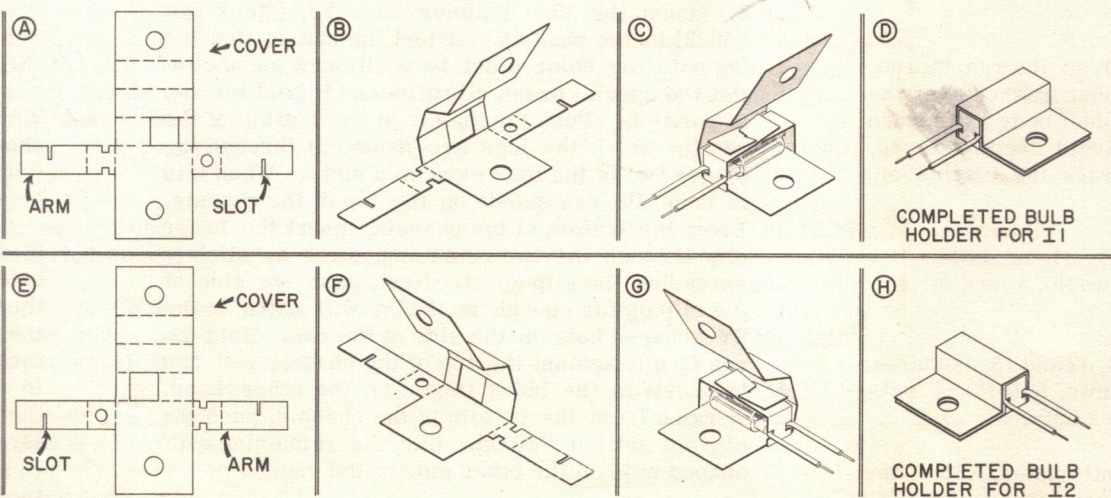
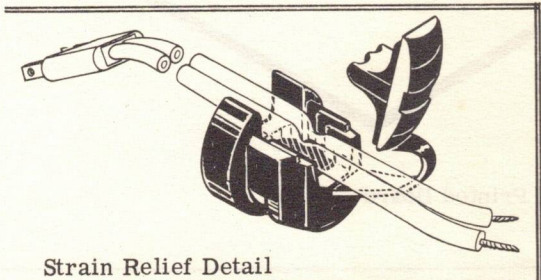
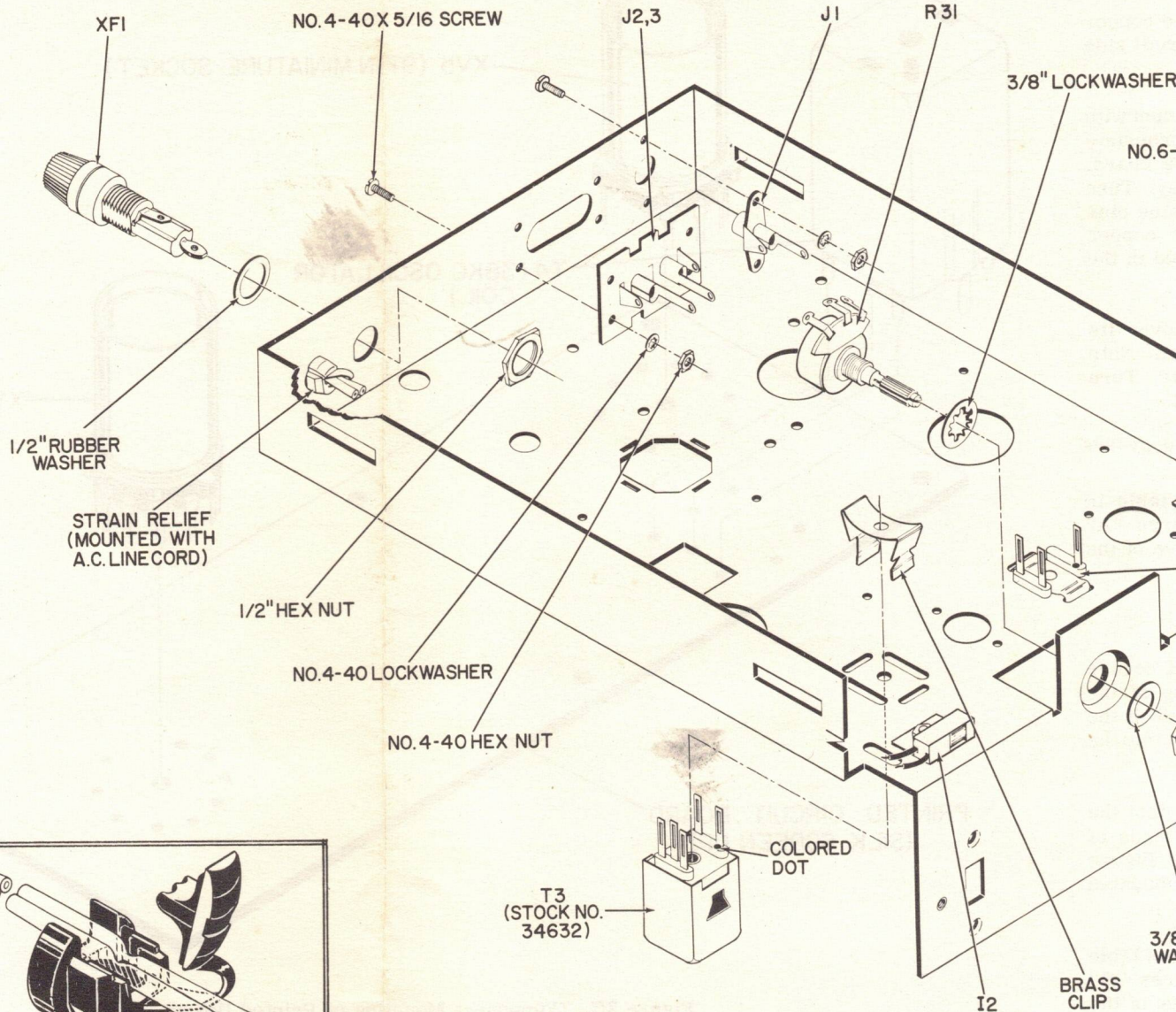


Figure 2C. Component Mounting of Printed Board





Strain Relief Detail

The following steps refer to figure 3c.

- (✓) 1. Mount the fuseholder, XF1, to the rear apron, as shown. Pass the 1/2" rubber washer over the threaded portion of the fuseholder body and secure same with a 1/2" hex nut. Avoid overtightening, as extreme pressure will crack the fuseholder.
- (✓) 2. Mount the single input jack, J1, as shown. Use two No. 4-40 x 5/16 screws, two No. 4 lockwashers and two No. 4-40 hex nuts.
- (✓) 3. Mount the dual output jacks, J2 and J3, as shown. Use four No. 4-40 x 5/16 screws, four No. 4 lockwashers and four No. 4-40 hex nuts.
- (✓) 4. Mount the 250K ohm potentiometer, R31, to the front apron. Use one 3/8" lockwasher, one 3/8" flat washer and one 3/8" hex nut.
- (✓) 5. Mount the 19kc Doubler Can, T3, (Stock No. 34632) to the chassis. Orient the can so that the lug with the colored dot is positioned as shown. Use the special brass clip provided to hold the can in position. Push the plastic at the bottom of the can (in which the lugs are mounted) through the longer two of the four elongated slots. When this is done, the can stands on the top of the chassis. From the bottom of the chassis, insert the brass clip through the two remaining slots by slightly spreading the clip apart. Next, push one side of the clip up far enough so that it will catch in the "Y" shaped hole on the side of the can. Hold the can firmly against the top of the chassis with one hand. With the index finger on the other hand, working from the bottom of the chassis, push the clip up until it "clicks" into the remaining "Y" shaped hole on the other side of the can.
- (✓) 6. Mount the 19kc Filter Can, T2, (Stock No.

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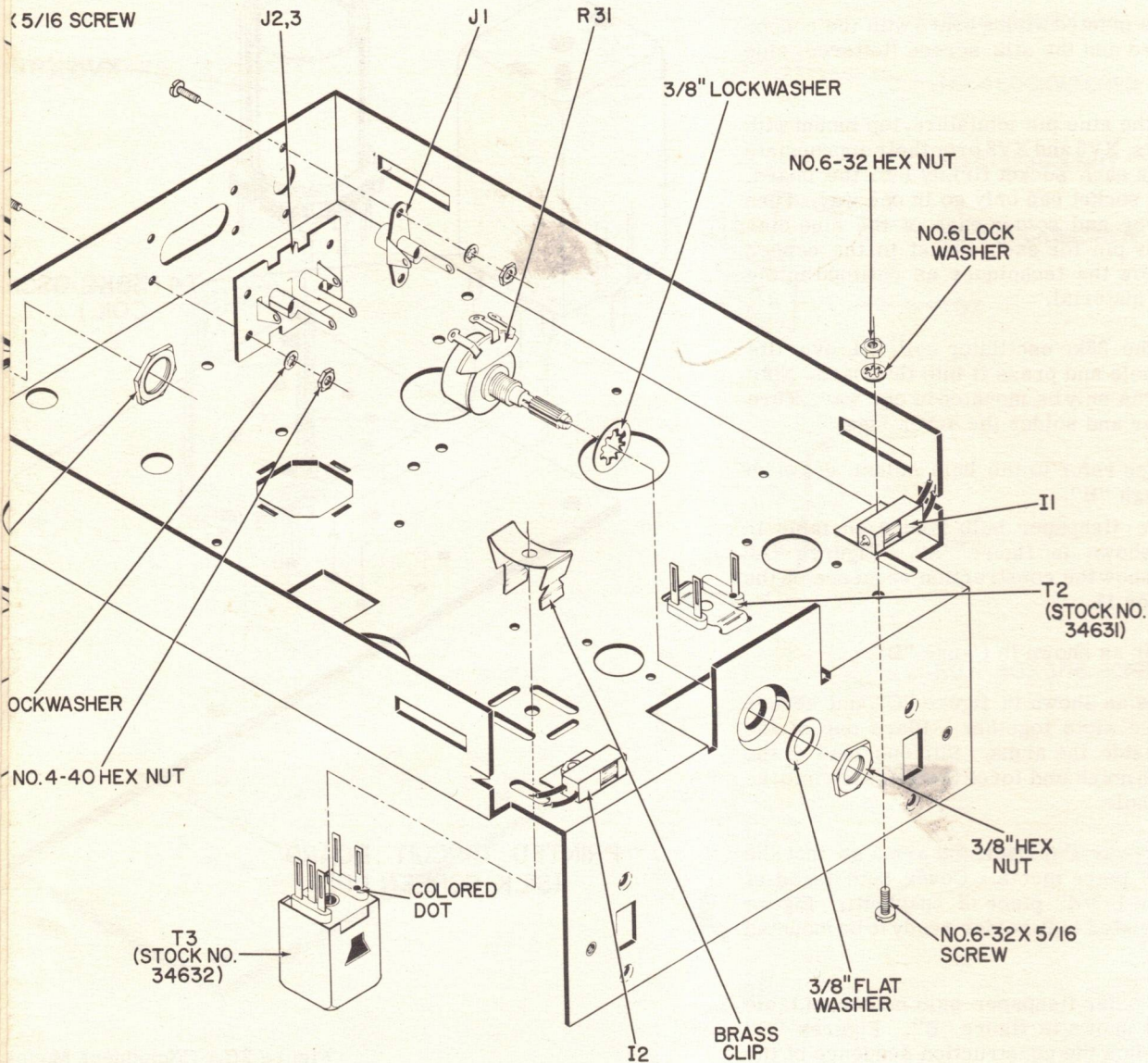


Figure 3C. Bottom Chassis Mounting (Cont'd.)

- (✓) 5. Mount the 19kc Doubler Can, T3, (Stock No. 34632) to the chassis. Orient the can so that the lug with the colored dot is positioned as shown. Use the special brass clip provided to hold the can in position. Push the plastic at the bottom of the can (in which the lugs are mounted) through the longer two of the four elongated slots. When this is done, the can stands on the top of the chassis. From the bottom of the chassis, insert the brass clip through the two remaining slots by slightly spreading the clip apart. Next, push one side of the clip up far enough so that it will catch in the "Y" shaped hole on the side of the can. Hold the can firmly against the top of the chassis with one hand. With the index finger on the other hand, working from the bottom of the chassis, push the clip up until it "clicks" into the remaining "Y" shaped hole on the other side of the can.
- (✓) 6. Mount the 19kc Filter Can, T2, (Stock No.

34631) to the chassis. Orient the can as shown. Secure the can from the bottom of the chassis with the brass clip as explained in step 6.

- (✓) 7. Mount I1 and I2 to the bottom of the chassis as shown. Use two No. 6-32 x 5/16 screws, two No. 6 lockwashers and two No. 6-32 hex nuts. Note orientation of bulb holders in figure 6C.
- (✓) 8. Place the line cord 2" from the tinned ends, onto the groove of the larger section and between the two sections of the two piece strain relief, with the tinned ends toward the smaller section. Bend the smaller section over the line cord and position in the channel of the larger section. Compress the two sections together with a plier grasping the larger diameter end of the strain relief. Pass the tinned ends of the line cord through the hole from the rear of the chassis and press it in until it snaps into position.

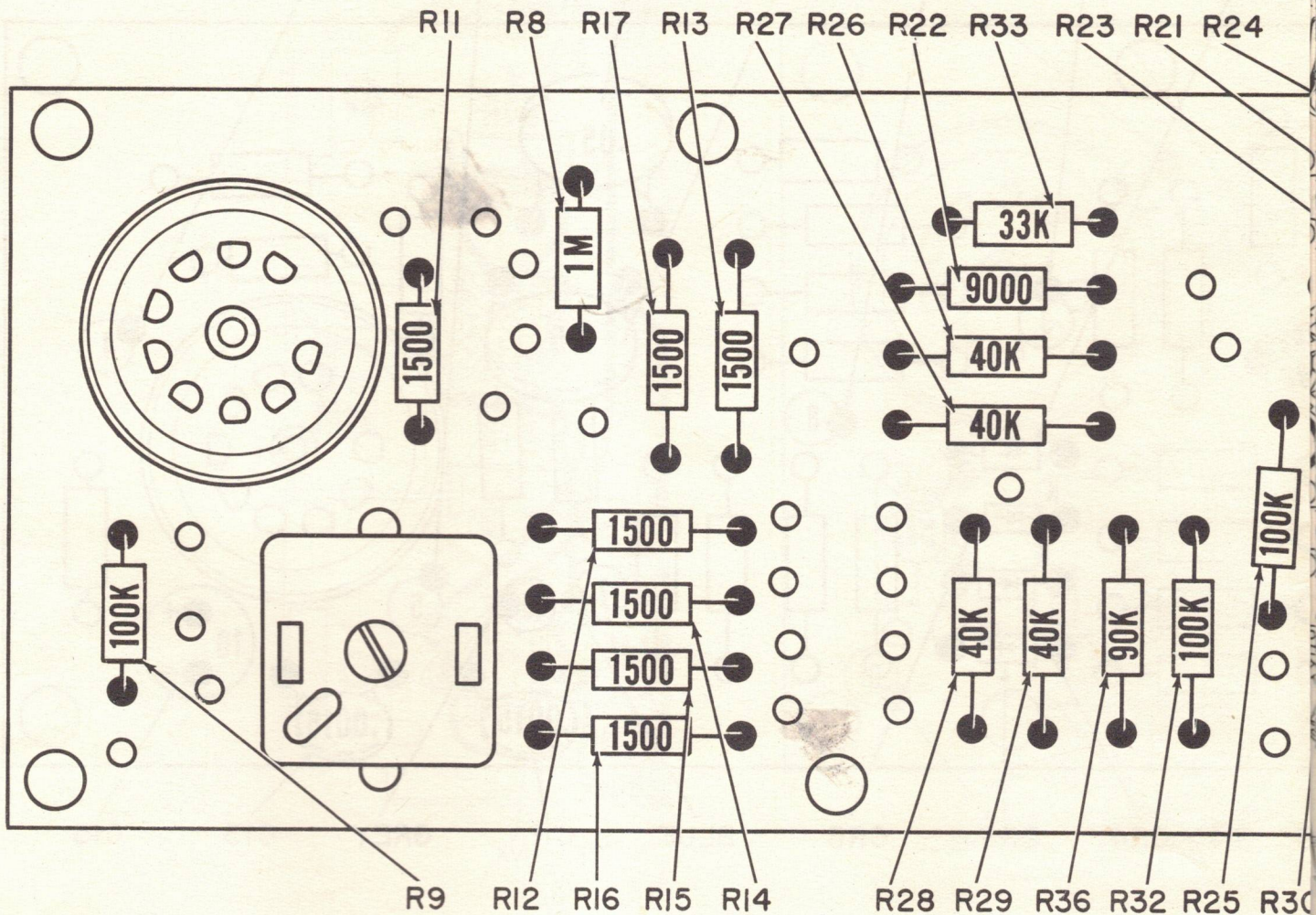


Figure 4C. Mounting and Soldering Resistors

The following steps refer to figure 4c.

NOTE: Follow the procedure outlined in the introductory material for the proper insertion and soldering of each component. After each step solder each component to the copper foil. Clip off excess wire.

- (✓) 1. Insert the six 1500 ohm, 1/2 watt, 1%, resistors, R12 through R17, into the printed circuit board.
- (✓) 2. Insert the three 1500 ohm (brown, green, red, silver) 1/2 watt, 10%, resistors, R11, R23 and R34 into the printed circuit board.
- (✓) 3. Insert the three 100K ohm, 1/2 watt, 1% resistors, R25, R30 and R32 into the printed circuit board.
- (✓) 4. Insert the four 40K ohm, 1/2 watt, 1% resistors, R26 through R29 into the printed circuit board.
- (✓) 5. Insert the 9000, 1/2 watt, the printed circuit board.
- (✓) 6. Insert the 9500, 1/2 watt, the printed circuit board.
- (✓) 7. Insert the 90K, 1/2 watt, the printed circuit board.
- (✓) 8. Insert the 2.2 Meg (red resistor, R21, into the printed circuit board.
- (✓) 9. Insert the 33K (orange, resistor, R33, into the printed circuit board.
- (✓) 10. Insert the 1 Meg (brown resistor, R8, into the printed circuit board.
- (✓) 11. Insert the 100K (brown, resistor, R9, into the printed circuit board.

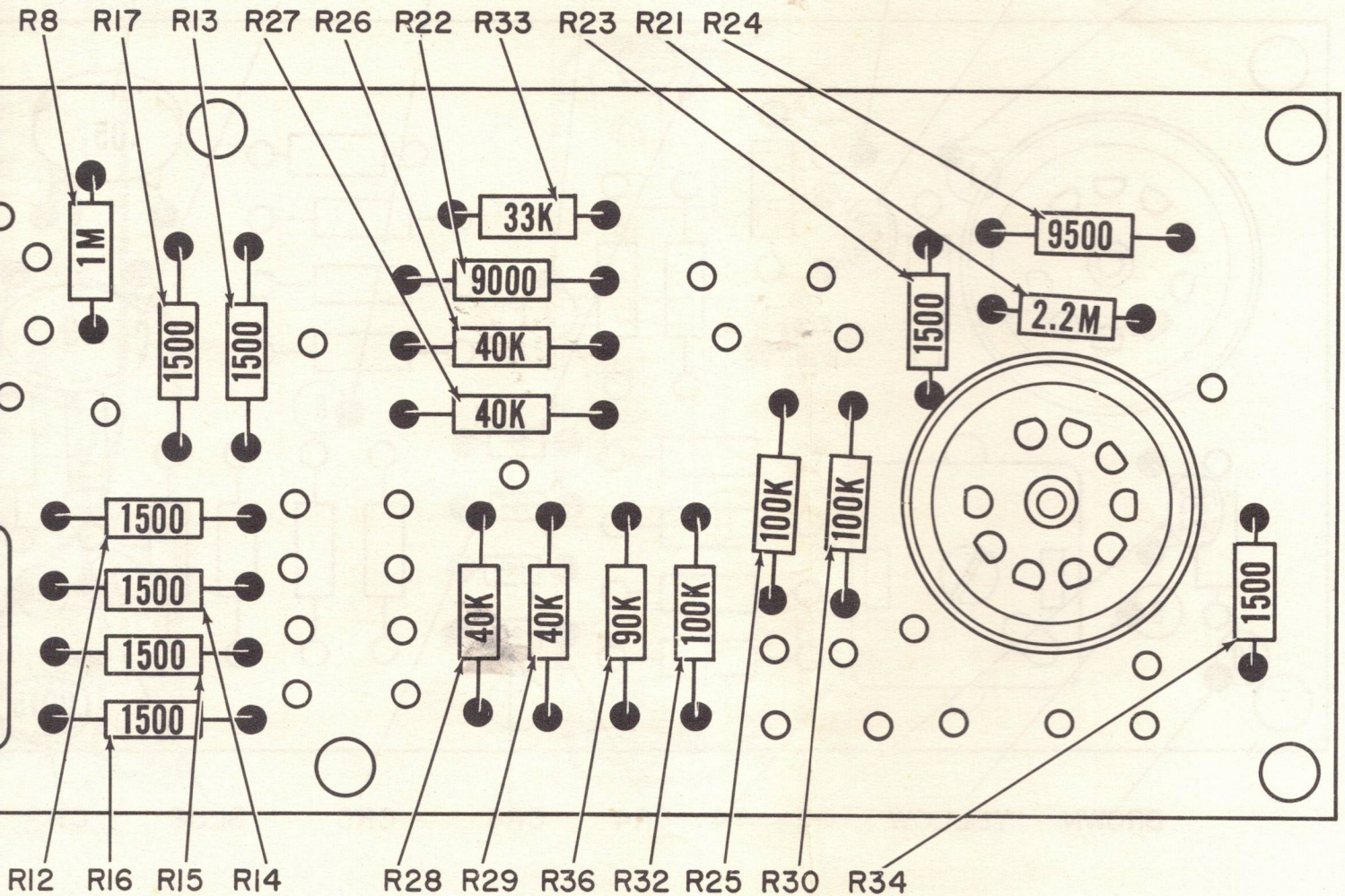


Figure 4C. Mounting and Soldering Resistors

steps refer to figure 4c.

Follow the procedure outlined in the introductory material for the proper insertion and soldering of each component. After each step solder the component to the copper foil. Clip off excess leads.

Insert the six 1500 ohm, 1/2 watt, 1%, resistors, R12, R13, R14, R15, R16, and R17, into the printed circuit board.

Insert the three 1500 ohm (brown, green, red, 1/2 watt, 10%, resistors, R11, R23 and R34 into the printed circuit board.

Insert the three 100K ohm, 1/2 watt, 1% resistors, R25, R26, and R32 into the printed circuit board.

Insert the four 40K ohm, 1/2 watt, 1% resistors, R28, R29, R30, and R31 into the printed circuit board.

- (✓) 5. Insert the 9000, 1/2 watt, 1% resistor, R22, into the printed circuit board.
- (✓) 6. Insert the 9500, 1/2 watt, 1% resistor, R24, into the printed circuit board.
- (✓) 7. Insert the 90K, 1/2 watt, 1% resistor, R36, into the printed circuit board.
- (✓) 8. Insert the 2.2 Meg (red, red, green, silver) resistor, R21, into the printed circuit board.
- (✓) 9. Insert the 33K (orange, orange, orange, silver) resistor, R33, into the printed circuit board.
- (✓) 10. Insert the 1 Meg (brown, black, green, silver) resistor, R8, into the printed circuit board.
- (✓) 11. Insert the 100K (brown, black, yellow, silver) resistor, R9, into the printed circuit board.

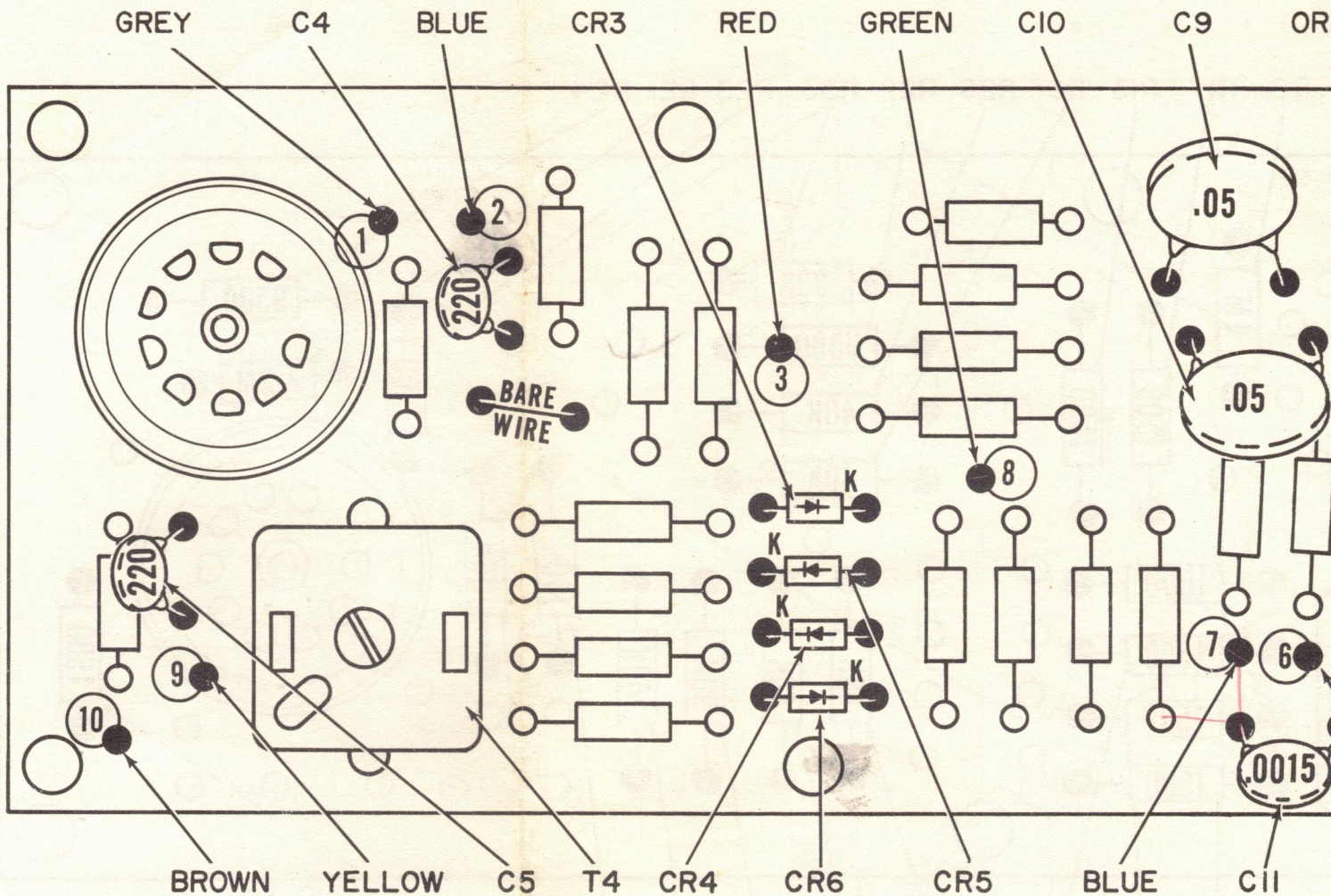


Figure 5C. Capacitor Mounting and Soldering

The following steps refer to figure 5c.

- (✓) 1. Insert the two .0015mfd (1.5K or 1500mmf), 10% disc capacitors, C11 and C13, into the printed circuit board.
- (✓) 2. Insert the two .05mfd (50K or 50,000mmf), disc capacitors, C9 and C10, into the printed circuit board.
- (✓) 3. Insert the two 220mmf, 10% disc capacitors, C4 and C5, into the printed circuit board.
- (✓) 4. Insert the 10mfd, 12 volt electrolytic capacitor, C15, into the printed circuit board. A plus (+) symbol is marked near one of the leads. Be sure to insert this lead into the hole marked plus (+) on the printed circuit board.
- (✓) 5. Mount the four rectifiers, CR3 through CR6, into the printed circuit board. See the introductory pages to ascertain which end of the rectifier is the cathode. Insert each rectifier so that it is oriented as shown in the drawing. Note that the cathode end of the two inner rectifiers face the oscillator

can, T4, and that the cathode end of the remaining rectifiers face the opposite direction. Apply a minimum of heat when soldering. Excessive heat can easily ruin the rectifier.

- (✓) 6. Bend a 1" piece of bare wire to fit the holes marked "bare wire" on the board and cut off any excess.
- (✓) 7. In the following steps, connect the bare wire to the hole indicated into the board. The other ends of these wires will be connected later.
Cut wires to required lengths as follows:
 () 13" grey wire to hole No. 1
 () 5-1/2" blue wire to hole No. 2
 () 7" red wire to hole No. 3
 () 6" black wire to hole No. 4
 () 9" orange wire to hole No. 5
 () 5" grey wire to hole No. 6
 () 5" blue wire to hole No. 7
 () 8" green wire to hole No. 8
 () 6" yellow wire to hole No. 9
 () 6" brown wire to hole No. 10

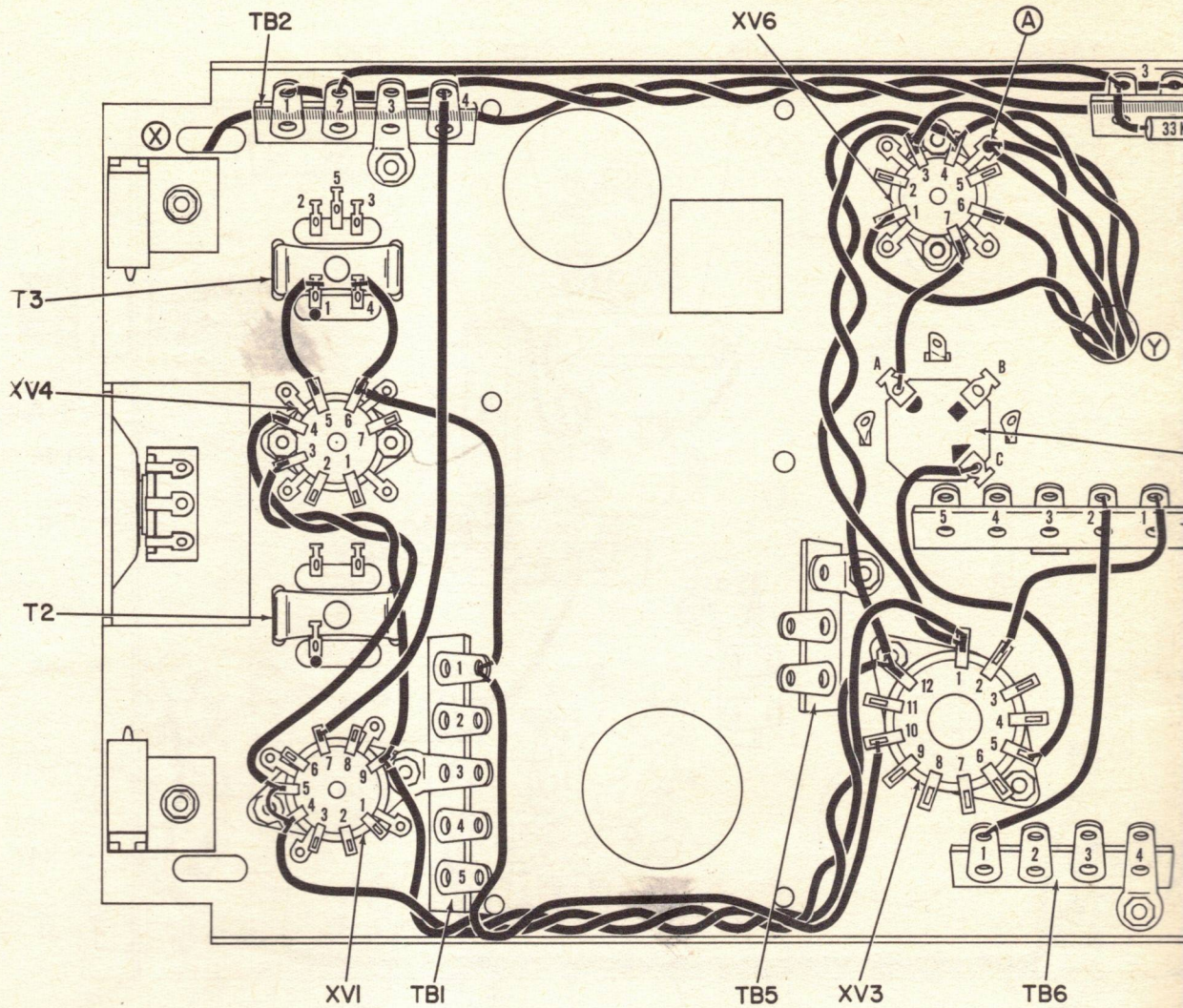


Figure 6C. Bottom Chassis Wiring

The following steps refer to figure 6c.

- (✓) 1. From hole "Z", connect one black lead to TB3-1 (C) and the second black lead to TB3-2 (C).
- (✓) 2. From hole "Y", connect the red-yellow and white leads to ground lug "A" (S2) at XV6. Connect one red lead to XV6-1 (S1) and the second red lead to XV6-6 (S1). Connect one green lead to XV6-3 (C) and the second green lead to XV6-4 (C).
- (✓) 3. Connect one end of a 6" piece of yellow wire to XV6-4 (C) and one end of a 6" piece of brown wire to XV6-3 (C). Twist the two leads together. Connect the other end of the yellow lead to XV3-1 (C) and the other end of the brown lead to XV3-12 (C).
- (✓) 4. Connect one end of a 9" piece of brown wire to XV3-12 (S2) and one end of a 9" piece of yellow wire to XV3-1 (S2). Twist the two leads together and run them along the chassis as shown. Connect the other end of the brown wire to XV1-4 (C) and the other end of the yellow lead to XV1-9 (C).
- (✓) 5. Connect a 1/2" piece of bare wire from XV1-4 (S2) to XV1-5 (C).
- (✓) 6. Connect one end of a 4" piece of brown wire to XV1-5 (S2) and one end of a 4" piece of yellow wire to XV1-9 (S2). Twist the two leads together. Connect the other end of the brown wire to XV4-3 (S1) and the other end of the yellow wire to XV4-4 (S1).
- (✓) 7. Connect a 7-1/2" piece of black cotton covered wire from TB3-3 (C) to TB2-2 (C).
- (✓) 8. Connect one end of an 8-1/2" piece of black-white wire to TB3-2 (S2) and one end of a 12" piece of black cotton wire to XF1-2 (S1). Twist the leads together and run them along the chassis as shown. Connect the other end of the black-white lead to TB2-1 (C) and pass the other end of the black lead through hole "X" to the top surface of the chassis.
- (✓) 9. Cut both leads on a 33K (orange, orange, orange, silver) resistor, R18, to 1". Cover each lead with a 3/4" piece of spaghetti. Connect from TB3-3 (S2) to TB3-1 (C).
- (✓) 10. Connect a 2-1/2" piece of red wire from XV6-7 (S1) to C7-A (C).

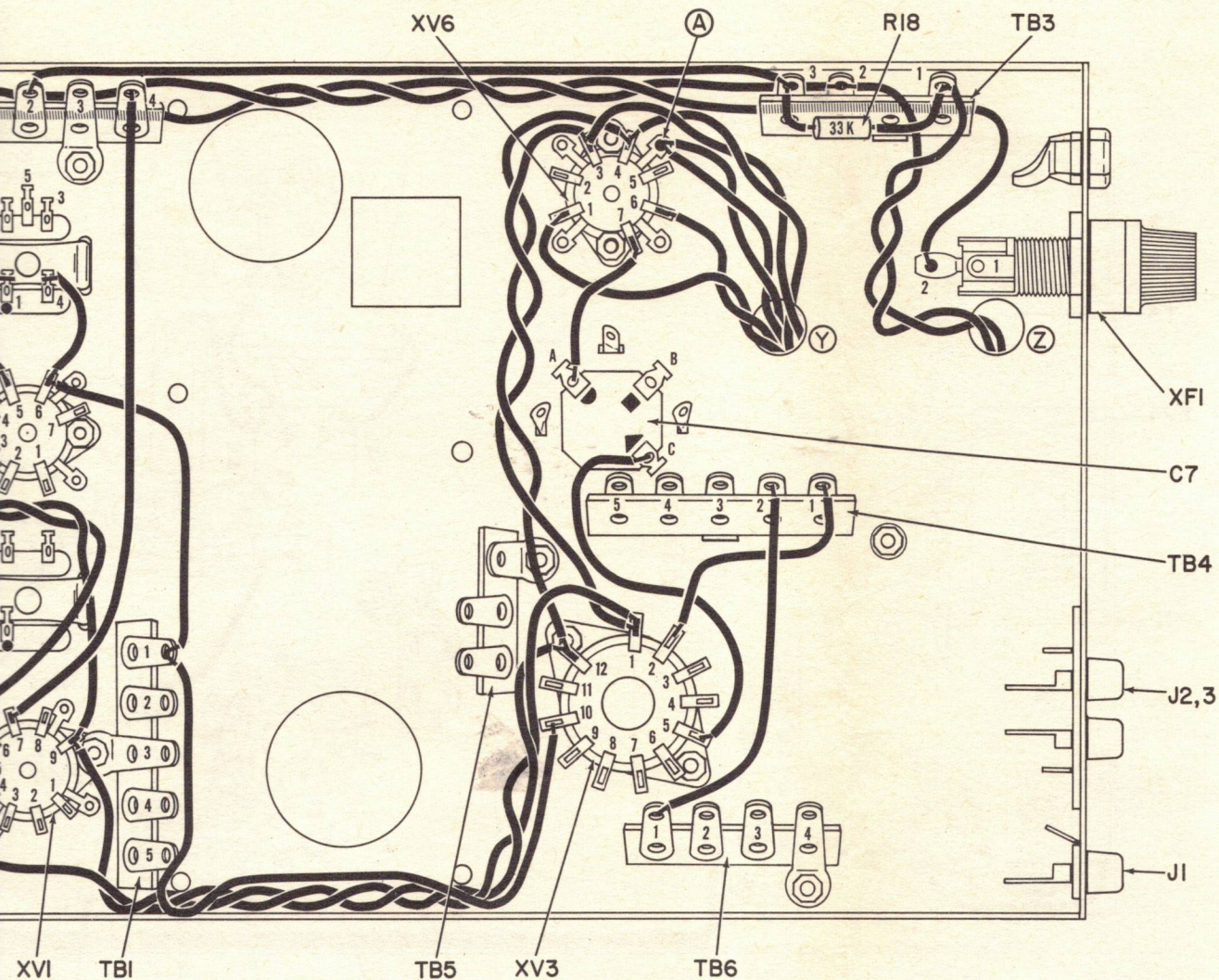


Figure 6C. Bottom Chassis Wiring

- (✓) 6. Connect one end of a 4" piece of brown wire to XV1-5 (S2) and one end of a 4" piece of yellow wire to XV1-9 (S2). Twist the two leads together. Connect the other end of the brown wire to XV4-3 (S1) and the other end of the yellow wire to XV4-4 (S1).
- (✓) 7. Connect a 7-1/2" piece of black cotton covered wire from TB3-3 (C) to TB2-2 (C).
- (✓) 8. Connect one end of an 8-1/2" piece of black-white wire to TB3-2 (S2) and one end of a 12" piece of black cotton wire to XF1-2 (S1). Twist the leads together and run them along the chassis as shown. Connect the other end of the black-white lead to TB2-1 (C) and pass the other end of the black lead through hole "X" to the top surface of the chassis.
- (✓) 9. Cut both leads on a 33K (orange, orange, orange, silver) resistor, R18, to 1". Cover each lead with a 3/4" piece of spaghetti. Connect from TB3-3 (S2) to TB3-1 (C).
- (✓) 10. Connect a 2-1/2" piece of red wire from XV6-7 (S1) to C7-A (C).
- (✓) 11. Connect a 3" piece of red wire from C7-C (C) to XV3-5 (C).
- (✓) 12. Connect a 3" piece of red wire from TB4-1 (C) to XV3-2 (C).
- (✓) 13. Connect a 4" piece of green wire from TB4-2 (C) to TB6-1 (C).
- (✓) 14. Connect a 6-1/2" piece of red wire from XV3-10 (C) to TB1-1 (C).
- (✓) 15. Connect a 4" piece of red wire from TB1-1 (C) to XV4-6 (C).
- (✓) 16. Connect a 1-1/2" piece of red wire from XV4-6 (S2) to T3-4 (C).
- (✓) 17. Connect a 1-1/2" piece of green wire from XV4-5 (S1) to T3-1 (C).
- (✓) 18. Connect a 6" piece of blue wire from TB2-4 (C) to XV1-7 (S1).

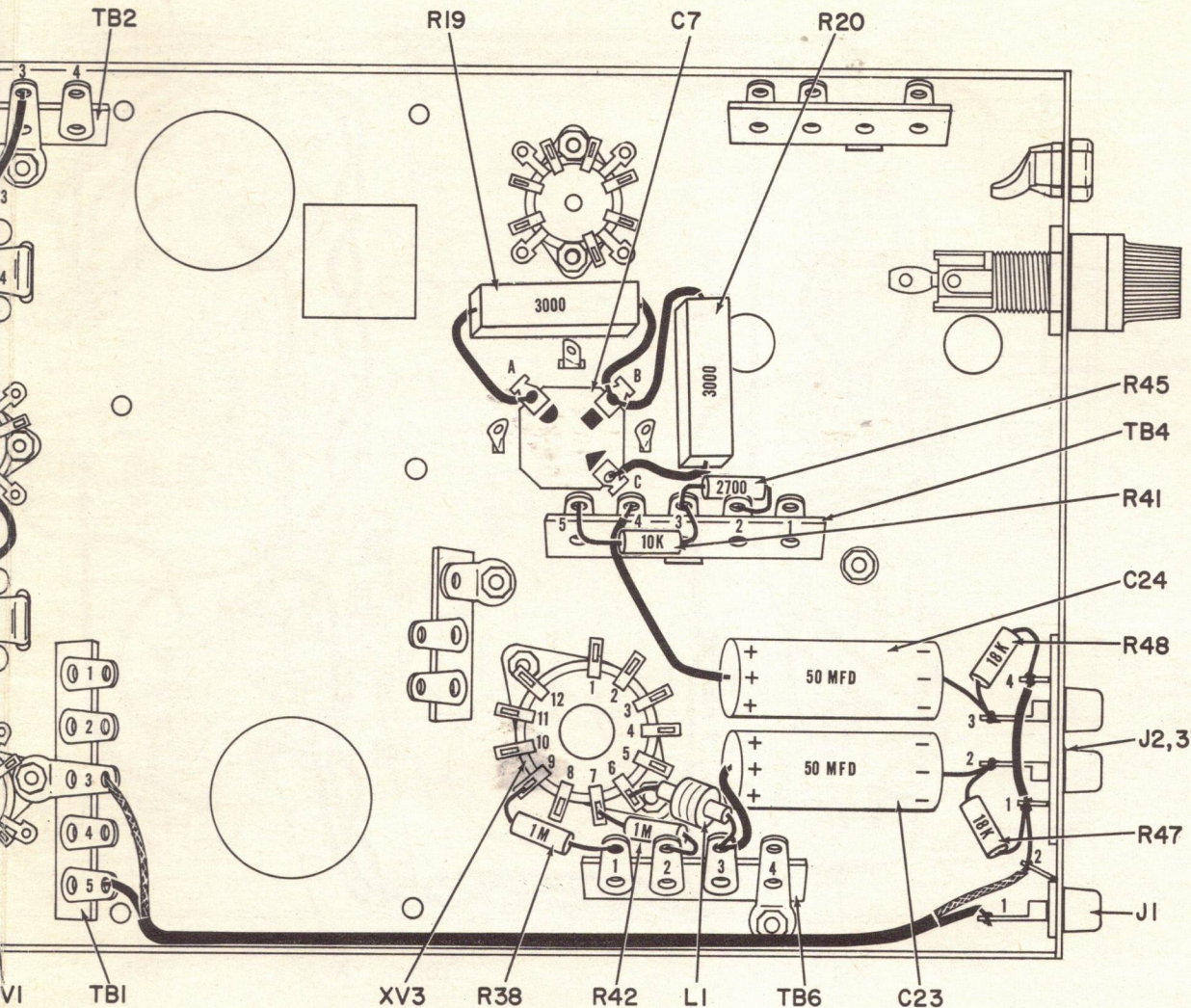


Figure 7C. Bottom Chassis Wiring (Cont'd.)

8. Strip the outer insulation back 1" from both ends of an 8-1/2" piece of single conductor shielded cable. Twist the shield strands together on each end. Strip the insulation back 1/4" from each end of the inner conductor. On one end, connect the shield strands to J1-2 (C) and the inner conductor to J1-1 (S1). On the other end, connect the shield strands to TB1-3 (C) and the inner conductor to TB1-5 (C).
9. Connect a 1-1/2" piece of black wire from J2,3-1 (C) to J2,3-4 (C).
10. Connect a 3/4" piece of bare wire from J1-2 (S2) to J2,3-1 (C).
11. Cut all leads on two 18K (brown, grey, orange, silver) resistors, R47 and R48, to 1/2". Connect R47 from J2,3-1 (S3) to J2,3-2 (C). Connect R48 from J2,3-4 (S2) to J2,3-3 (C).
12. Cut all leads on two 1M (brown, black, green, silver) resistors, R38 and R42, to 1/2". Connect R38 from XV3-9 (C) to TB6-1 (S2). Connect R42 from XV3-7 (C) to TB6-2 (C).
13. Cut both leads on choke L1 to 1/2". Connect from XV3-6 (C) to TB6-3 (C).
14. On the 50mfd, 150V electrolytic capacitors, C23 and C24, cut the positive (+) leads to 1-1/4" and the negative (-) leads to 3/4". Cover the positive (+) leads with 1" pieces of spaghetti. Connect the positive (+) lead of C23 to TB6-3 (C) and the negative lead to J2,3-2 (S2). Connect the positive (+) lead of C24 to TB4-4 (C) and the negative lead to J2,3-3 (S2).
15. Cut all leads on two 3000 ohm, 5 watt resistors, R19 and R20, to 1". Cover each lead with 3/4" pieces of spaghetti. Connect R19 from C7-A (S2) to C7-B (C). Connect R20 from C7-B (S2) to C7-C (C).
16. Cut both leads on the 2700 (red, violet, red, silver) resistor, R45, to 1/2". Connect from TB4-2 (C) to TB4-3 (C).
17. Cut both leads on the 10K, 1% resistor, R41, to 1/2". Connect from TB4-3 (C) to TB4-5 (C).

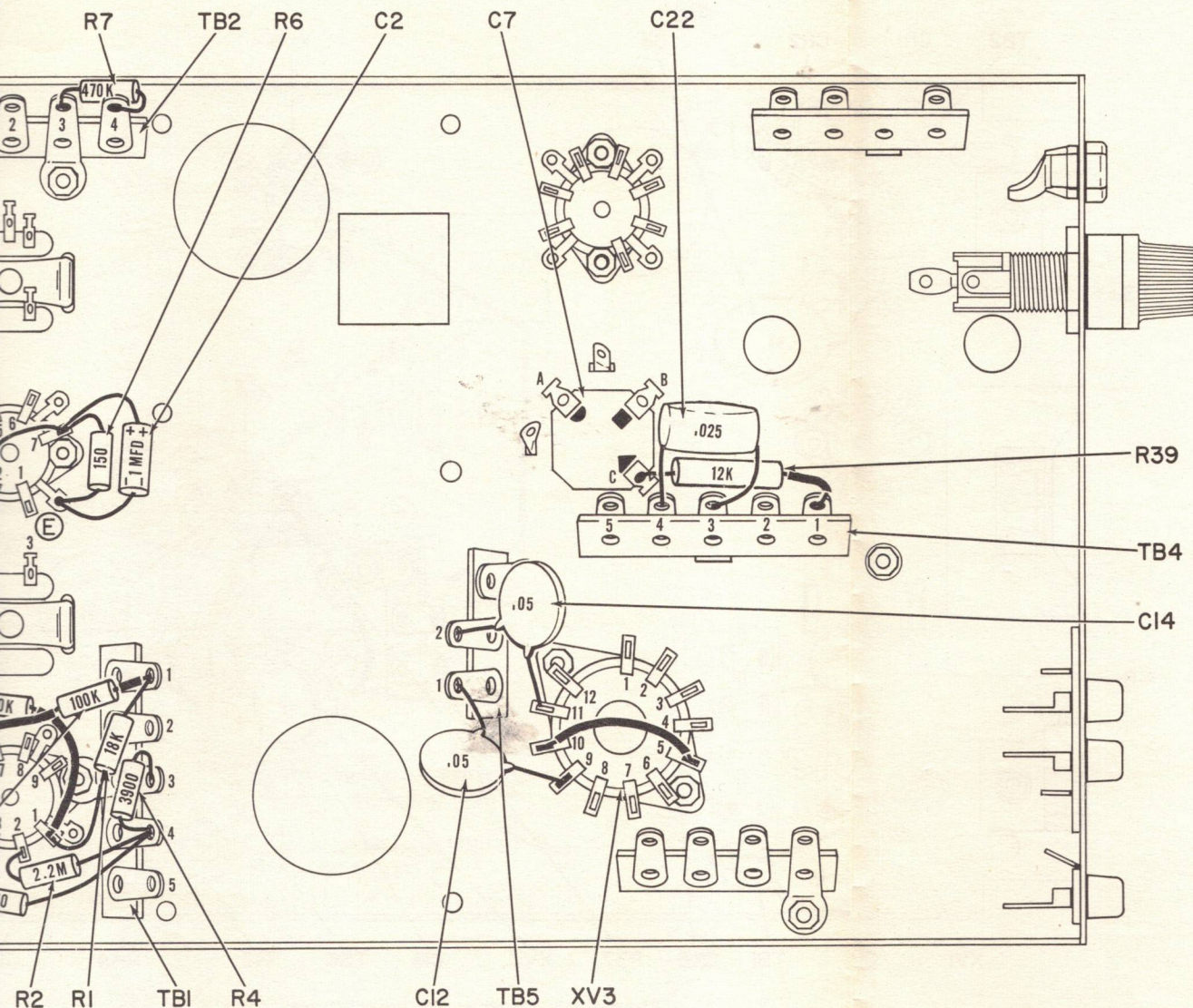


Figure 8C. Bottom Chassis Wiring (Cont'd.)

lead with a 3/8" piece of spaghetti and connect to XV1-3 (S1). Connect the other lead to TB1-4 (C).

- (✓) 7. Cut both leads on the 3900 (orange, white, red, silver) resistor, R4, to 1/2". Connect from TB1-3 (C) to TB1-4 (C).
- (✓) 8. Cut both leads on the 150K (brown, green, yellow, silver) resistor, R5, to 1". Cover each lead with a 3/4" piece of spaghetti. Connect from XV1-1 (C) to T2-1 (S1).
- (✓) 9. Cut both leads on a 100K (brown, black, yellow, silver) resistor, R10, to 1". Cover each lead with a 3/4" piece of spaghetti. Connect from XV1-6 (C) to TB1-1 (C).
- (✓) 10. Cut both leads on the 18K (brown, grey, orange, silver) resistor, R1, to 3/4". Connect from XV1-1 (C) to TB1-1 (C).
- (✓) 11. Cut both leads on the 1mfd, 150V electrolytic capacitor, C6, to 1". Connect the positive (+) lead

to XV1-6 (S3) and the negative (-) lead to ground lug "C" (S2) at XV4.

- (✓) 12. Cut both leads on the 68K (blue, grey, orange, silver) resistor, R35, to 1". Cover each lead with a 3/4" piece of spaghetti. Connect from R31-1 (S1) to ground lug "D" (S1) at XV4.
- (✓) 13. Cut both leads on the 1mfd, 15 volt electrolytic capacitor, C2, to 5/8". Connect the positive (+) lead to XV4-7 (C) and the negative (-) lead to ground lug "E" (C) at XV4.
- (✓) 14. Cut both leads on the 150 ohm (brown, green, brown, silver) resistor, R6, to 1/2". Connect from XV4-7 (C) to ground lug "E" (S2) at XV4.
- (✓) 15. Connect a 1" piece of bare wire from XV4-7 (S3) to XV4-2 (S1).
- (✓) 16. Cut both leads on the 470K (yellow, violet, yellow, silver) resistor, R7, to 1/2". Connect from TB2-3 (S2) to TB2-4 (C).

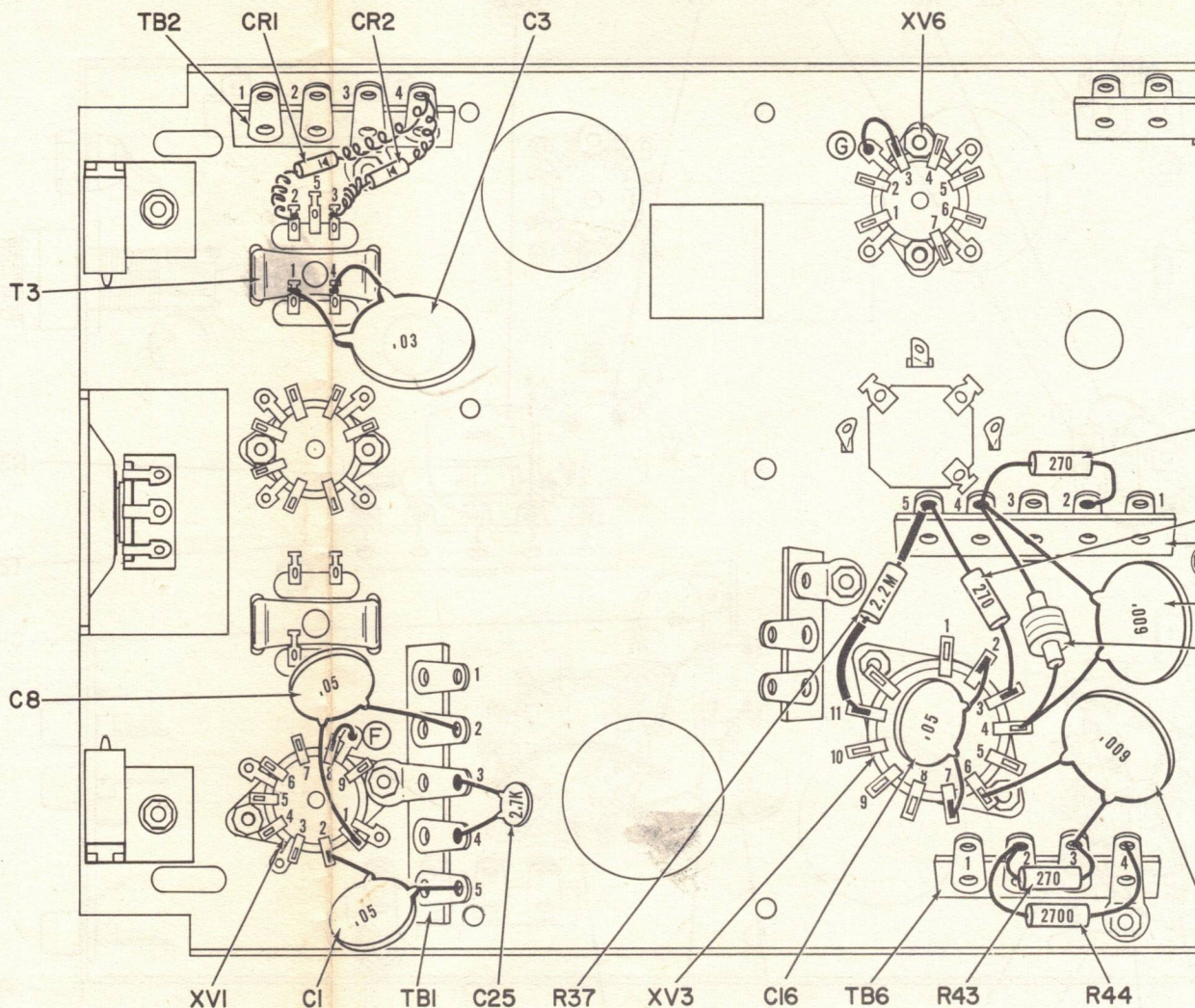


Figure 9C. Bottom Chassis Wiring (Cont'd.)

The following steps refer to figure 9c.

- (✓) 1. Wind one lead of rectifier CR1 three turns around a piece of insulated wire. Begin winding the lead from the body of the rectifier. Wind it loosely so that the insulated wire moves freely in the spirally wound leads. Remove the wire and the lead will remain in the form of a spring. Repeat this process for the other lead of CR1 and both leads of CR2. The purpose of this procedure is to keep the leads as long as possible and yet look neat when wired into the circuit. Connect the cathode lead of CR1 to T3-2 (S1) and the other lead to TB2-4 (C). Connect the cathode lead of CR2 to T3-3 (S1) and the other lead to TB2-4 (C). Caution: Excess heat on the leads of the rectifiers can ruin them. While soldering the rectifier leads, place a pair of long nose pliers on the lead between the junction to be soldered and the rectifiers. This will help conduct the excess heat away from the rectifiers. Take precautions that the leads should not short against adjacent wiring and that the rectifier cathode leads should not short to each other.
- (✓) 2. Cut both leads on the .03mfd, 5%, mylar capacitor, C3, to 1/2".

- 3. Connect from T3-1 (S2) to T3-4 (S2).
- (✓) 3. Cut both leads on the .0027mfd (2.7K or 2700) mmf) disc capacitor, C25, to 1/2". Connect from TB1-3 (S3) to TB1-4 (S4).
- (✓) 4. Cut all leads on two .05mfd (50K or 50,000mmf) disc capacitors, C1 and C8, to 5/8". Connect C1 from XV1-2 (S2) to TB1-5 (S2). Connect C8 from XV1-1 (S3) to TB1-2 (C).
- (✓) 5. Cut both leads on a 2700 (red, violet, red, silver) resistor, R44, to 1/2". Connect from TB6-2 (C) to TB6-4 (C).
- (✓) 6. Cut both leads on a 270 ohm (red, violet, brown, silver) resistor, R43, to 1/2". Connect from TB6-2 (S3) to TB6-3 (C).
- (✓) 7. Cut both leads on a 270 ohm (red, violet, brown, silver) resistor, R46, to 1/2". Connect from TB4-2 (S3) to TB4-4 (C).
- (✓) 8. Cut both leads on a 2.2 Meg (red, red, green,

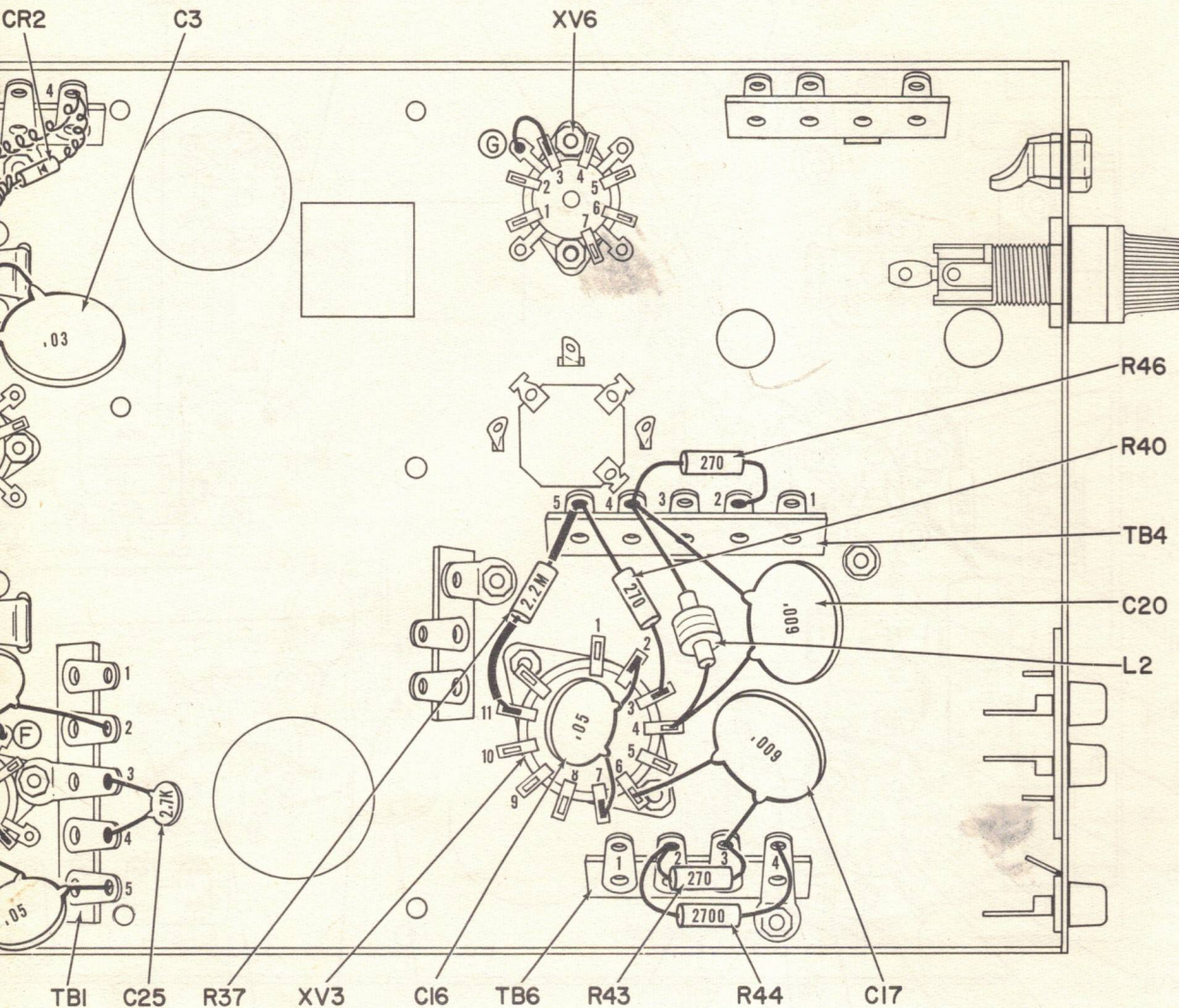


Figure 9C. Bottom Chassis Wiring (Cont'd.)

acitor, C3, to 1/2". Connect from T3-1 (S2) to T3-4 (S2).

3. Cut both leads on the .0027mfd (2.7K or 2700 mmf) disc capacitor, C25, to 1/2". Connect from TB1-3 (S3) to TB1-4 (S4).
4. Cut all leads on two .05mfd (50K or 50,000mmf) disc capacitors, C1 and C8, to 5/8". Connect C1 from XV1-2 (S2) to TB1-5 (S2). Connect C8 from XV1-1 (S3) to TB1-2 (C).
5. Cut both leads on a 2700 (red, violet, red, silver) resistor, R44, to 1/2". Connect from TB6-2 (C) to TB6-4 (C).
6. Cut both leads on a 270 ohm (red, violet, brown, silver) resistor, R43, to 1/2". Connect from TB6-2 (S3) to TB6-3 (C).
7. Cut both leads on a 270 ohm (red, violet, brown, silver) resistor, R46, to 1/2". Connect from TB4-2 (S3) to TB4-4 (C).
8. Cut both leads on a 2.2 Meg (red, red, green,

silver) resistor, R37, to 3/4". Cover each lead with a 1/2" piece of spaghetti. Connect from XV3-11 (S2) to TB4-5 (C).

9. Cut both leads on a 270 ohm (red, violet, brown, gold) 5% resistor, R40, to 1/2". Connect from XV3-3 (S1) to TB4-5 (S3).
10. Cut both leads on choke L2 to 1/2". Connect from XV3-4 (C) to TB4-4 (C).
11. Cut both leads on a .05mfd (50K or 50,000mmf) disc capacitor, C16, to 1/2". Connect from XV3-2 (S2) to XV3-7 (S2).
12. Cut all leads on the .009mfd (9K or 9,000mmf) disc capacitors, C17 and C20, to 5/8". Connect C17 from XV3-6 (C) to TB6-3 (C). Connect C20 from XV3-4 (C) to TB4-4 (S5).
13. Connect a 1/2" piece of bare wire from XV6-3 (C) to ground lug "G" on XV6 (S1).
14. Connect a 1/2" piece of bare wire from XV1-8 (S1) to ground lug "F" on XV1 (S1).

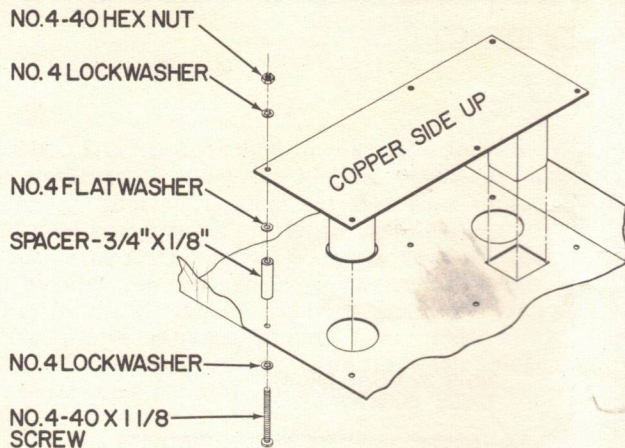


Figure 10C (a). Printed Board Mounting

The following steps refer to figure 10c (a).

- () 1. Place a No. 4 lockwasher over one No. 4-40 x 1-1/8" screw. Pass the screw through one of the holes on the top of the chassis used for mounting the printed board. Hold the assembly in place by using a piece of scotch tape over the head of the screw. Mount the other five screws in a similar manner.

From the bottom of the chassis place six 3/4 x 1/8 spacers and six No. 4 flatwashers in that order over the screws.

Mount the printed board (copper side up) over the remaining portion of the screws. Secure the board by using six No. 4 lockwashers and six No. 4-40 hex nuts. Do not overtighten or the board

may crack. Make certain that all the free wires on the board are pulled to the outside of the board. Refer to figure 10c (b). Remove the tape from all six of the screw heads.

The following steps refer to 10c (b)

- () 1. The wires on the printed board are to be connected as indicated in the following steps.

- (L) Hole No. 1 - pass the grey wire through hole "W" to the top of the chassis. It will be connected later.
- (L) Hole No. 2 - connect the blue wire to TB2-4 (S6). *(Do not use excessive heat.)*
- (L) Hole No. 3 - connect the red wire to TB1-1 (S5).
- (L) Hole No. 4 - connect the black wire to TB1-2 (S2).
- (L) Hole No. 5 - connect the orange wire to R31-2 (S1).
- (L) Hole No. 6 - connect the grey wire to TB5-1 (S2).
- (L) Hole No. 7 - connect the blue wire to TB5-2 (S2).
- (L) Hole No. 8 - connect the green wire to R31-3 (S1).
- (L) Hole No. 9 - connect the yellow wire to XV6-4 (S3).

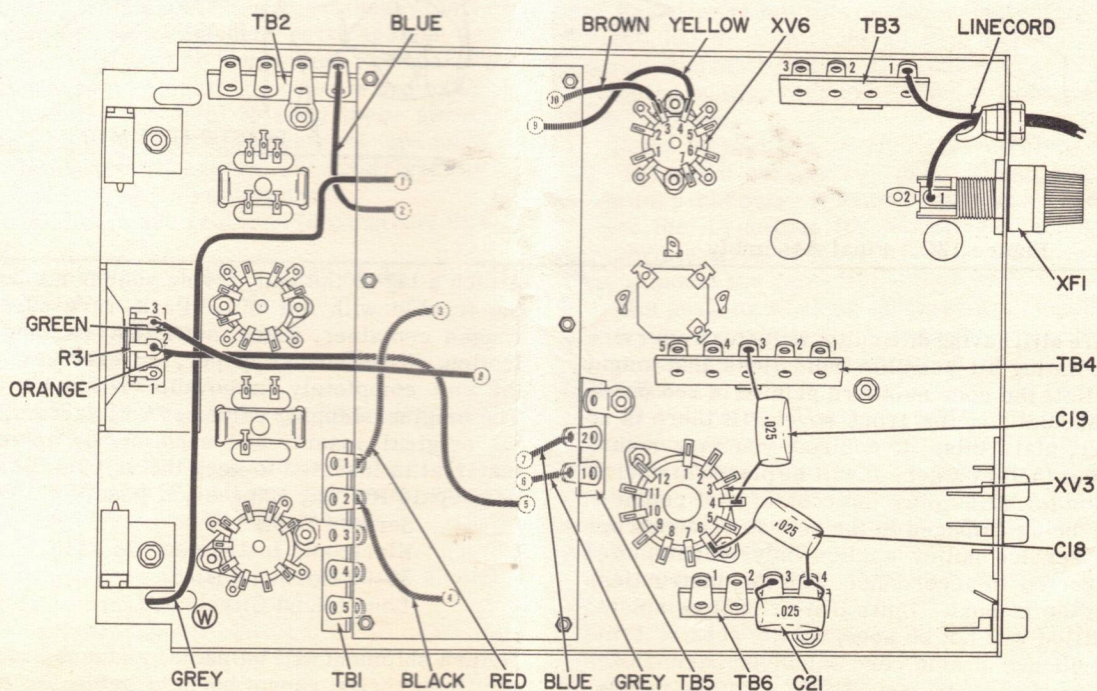


Figure 10C (b). Final Chassis Wiring

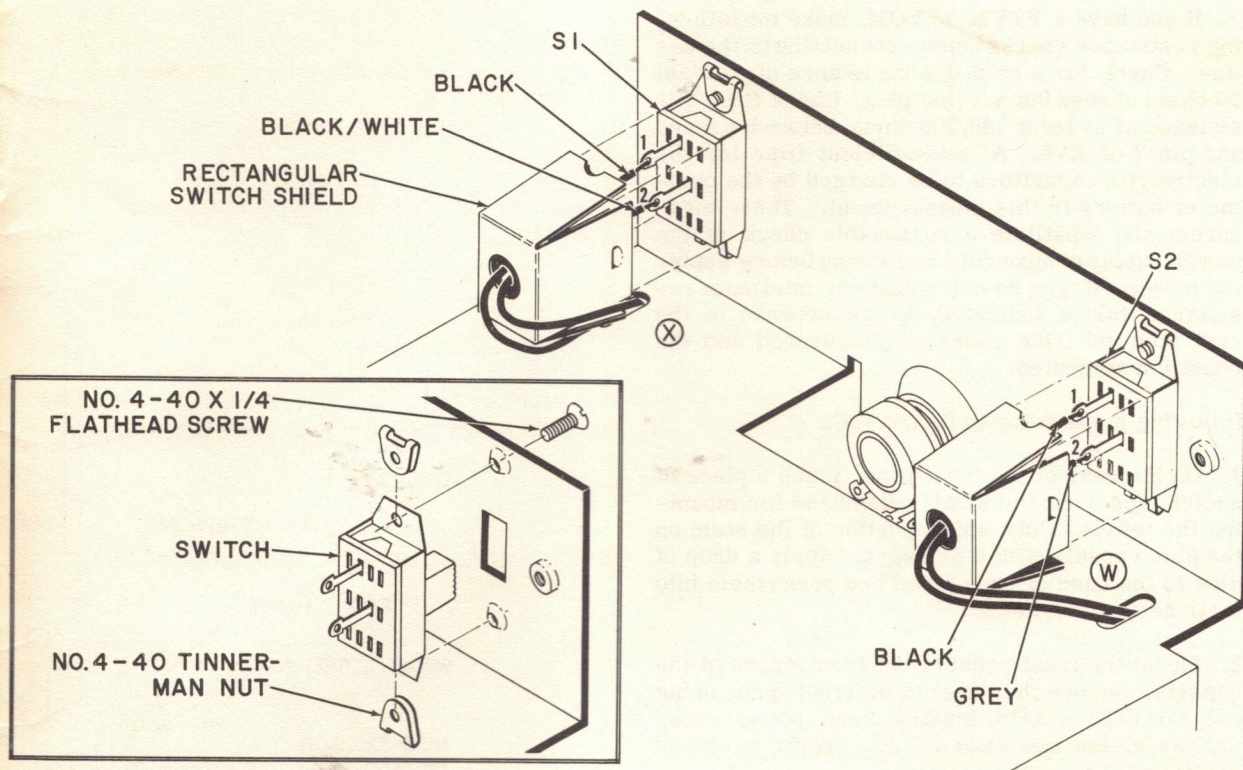


Figure 11C. Mounting and Wiring of Switches

- (+) Hole No. 10 - connect the brown wire to XV6-3 (S4).
- (✓) 2. Cut all leads on the .025 mfd capacitors, C18, C19 and C21, to 5/8". Connect C18 from XV3-6 (S3) to TB6-4 (C). Connect C19 from XV3-4 (S3) to TB4-3 (S4). Connect C21 from TB6-3 (S6) to TB6-4 (S3).
- (✓) 3. Cut both leads on the line cord to 2". Connect one lead to TB3-1 (S3). Connect the other lead to XF1-1 (S1).

- (✓) 4. Slip the two wires from hole "W" through the rear hole of the rectangular switch shield.
- (+) 5. Connect the black wire from hole "W" to S2-1 (S1) and the grey wire to S2-2 (S1).
- (✓) 6. Snap the rectangular shield onto switch S2 as shown in figure 11c.

FINAL STEPS

You have now completed the assembly and wiring of your amplifier. When you have completed the following steps your amplifier will be ready for use.

The following steps refer to figure 11c.

MOUNTING SWITCHES

- (✓) 1. Slip a No. 4-40 Tinnerman nut over both holes on switch S1 as shown in detail mounting drawing.
- (✓) 2. Secure switch S1 to front panel by using two No. 4-40 x 1/4 flat head screws.
- (✓) 3. Following steps 1 and 2, mount switch S2.

WIRING SWITCHES

- (✓) 1. Slip the two wires from hole "X" through the rear hole of the rectangular switch shield.
- (✓) 2. Connect the black wire from hole "X" to S1-1 (S1) and the black white wire to S1-2 (S1).
- (✓) 3. Snap the rectangular shield onto switch S1 as shown in figure 11c.

- (✓) 1. To catch any wiring errors, it is suggested that the entire wiring be checked point-by-point against the wiring instructions (and preferably also against the schematic wiring diagram) in order to become more familiar with the component layout and circuitry. While doing so, check for rosin joints, loose lumps of solder, poor lead dress, and accidental shorts or leakage paths arising from the flow of rosin between contacts. Remove any rosin with a stiff brush dipped in carbon tetrachloride, being careful not to inhale fumes or to contact the carbon tetrachloride with your skin).
- (✓) 2. Insert tubes V1 through V6 in their socket. Be sure to insert the correct tube in each socket. See tube placement chart in the instruction manual. Tubes V2 and V5 on the printed circuit have telescoping shields. Pull these shields up so that they cover each tube. Insert fuse F1 in the fuseholder. Do Not Plug Line Cord Into Power Line. Put switch S1 upwards into the "ON" position.

- (✓) 3. If you have a VTVM or VOM, make the following resistance checks before connecting to the a-c line: Check for a cold d-c resistance of at least 20 ohms across the a-c line plug. Check for a resistance of at least 140,000 ohms between ground and pin 7 of XV6. Allow sufficient time for the electrolytic capacitors to be charged by the ohmmeter battery in this measurement. These measurements constitute a reasonable check of the power supply components and wiring before applying power. If you do not obtain the minimum resistance values indicated, do not proceed to the next step until the cause is discovered and the condition remedied.

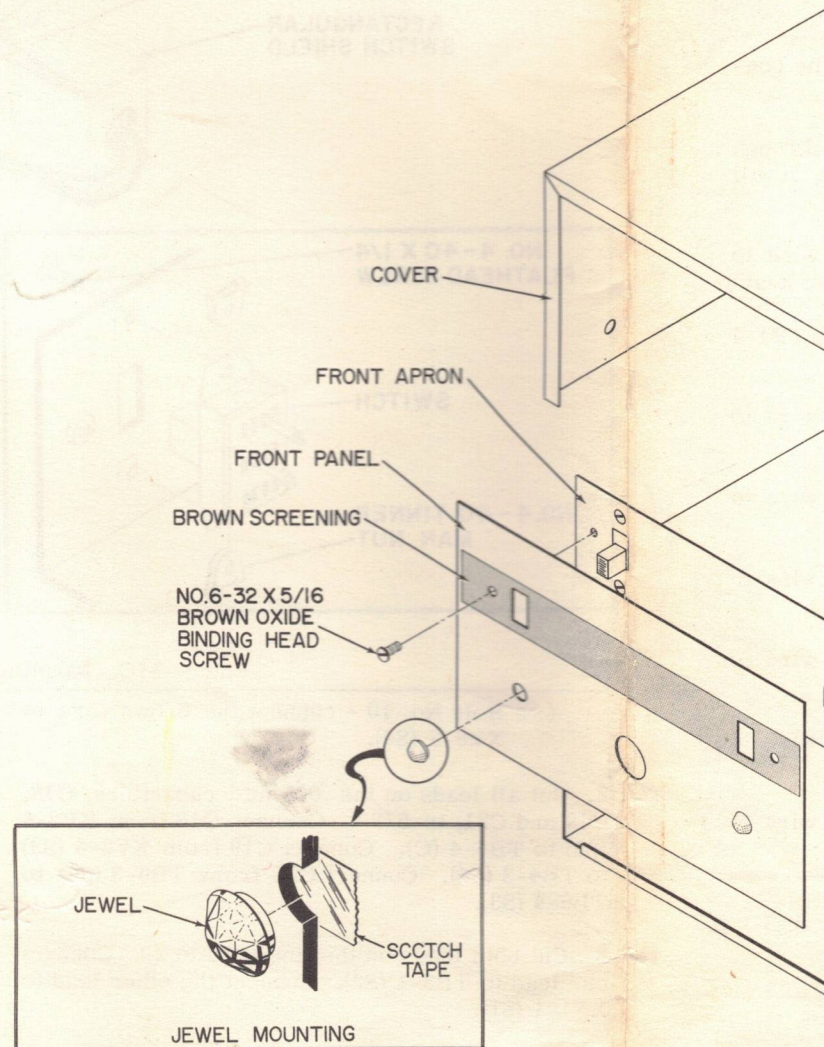
The following steps refer to figure 12C.

- (✓) 1. On the rear of the front panel place a piece of scotch tape over the small holes used for mounting the jewels. Cut a small portion of the stem on the glue capsule with a scissors. Apply a drop of glue to the base of each jewel and press them into their respective holes.
- (✓) 2. Mount the front panel to the front apron of the chassis. Secure the panel to the front apron using two No. 6-32 x 5/16 binding head brown oxide screws at the two ends in the brown screened section of the panel.
- (✓) 3. On two side flanges of the bottom plate there are four holes. Place a No. 8-32 Tinnerman nut on each of the four holes with the flat surface of the nut facing away from the bottom plate. There are two rectangular cutouts on the bottom surface of the bottom plate. Insert two No. 8-32 Tinnerman nuts into each of the cutouts with the flat surface of the nut facing away from the bottom plate. Note orientation of each Tinnerman nut as shown in figure 12c.
- (✓) 4. Insert the grooved portion of a plastic foot into one of the holes provided on the bottom plate. Press the small protruding plastic cylinder into the foot so that the grooved portion expands and secures itself to the bottom plate.

- (✓) 5. Mount the remaining three feet to the bottom plate following the instructions in step 4.
- (✓) 6. Remove the backing from the Tube Layout label and adhere to the tape of the chassis next to the power transformer. Likewise adhere the nomenclature label to the outside of the rear apron.
- (✓) 7. Place the bottom plate inside the two flanges of the chassis. Make certain that the front flange of the bottom plate sits flush against the rear of the front panel and that the threads of the four Tinnerman nuts are visible through the rectangular cutouts on the chassis.

Place the brown perforated cover over the unit so that the four holes on the sides line up with the four cutouts on the chassis flanges.

Insert four No. 8-32 x 3/8 binding head brown oxide screws into the four cover holes through



the rectangular cutouts of the chassis into the Tinnerman nuts on the bottom plate as shown.

Do not tighten any screws before making certain that the cover is flush against the front panel and that all preceding parts have been properly "squared off" with respect to your table surface. After making this check tighten the four screws.

- (✓) 8. Turn the potentiometer R31 to the maximum counter-clockwise position. Place the knob over the shaft with the marker pointing to the first calibrated point on the panel.
- (✓) 9. If the multiplex autodapter is to be mounted in a console, read carefully the "Mechanical Installation" section of the instructions and follow procedures outlined.

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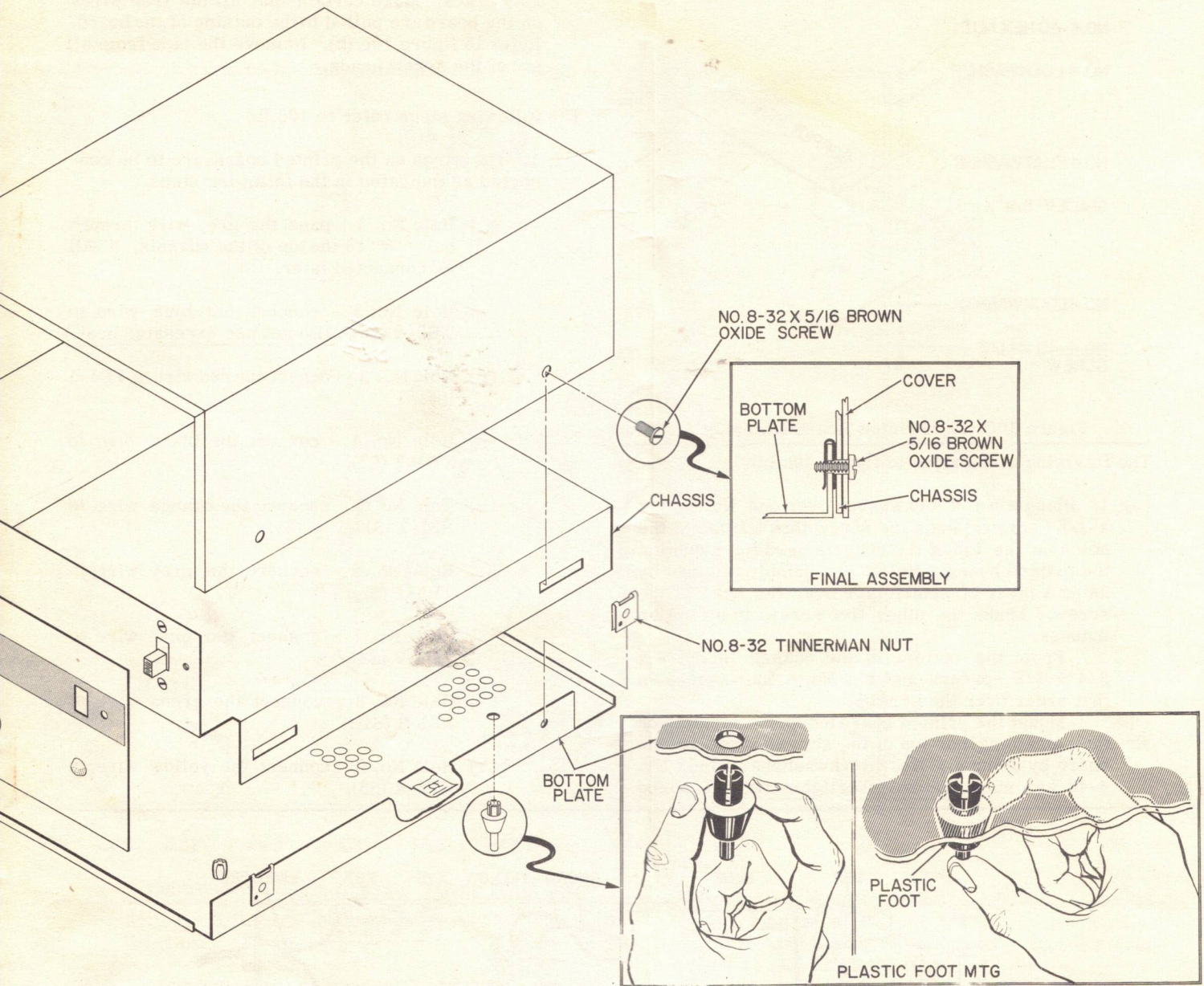


Figure 12C. Final Assembly

SERVICE

If you are still having difficulty, write to our service department listing all possible indications that might be helpful. Note the code numbers printed in red under the word "Manual" on the front cover. If there is no code number, state this. If desired, you may return the unit to our factory where it will be placed in operating condition for \$7.50 plus the cost of part replaced due to their being damaged in the course of construction. This service policy applies only to completed units constructed in accordance with the instructions as stated in the manual. Units that are not completed or are modified will not be accepted for repair. Units that show evidence of acid core solder or paste fluxes will be returned not repaired. NOTE: Before returning this unit, be sure all parts are securely mounted.

Attach a tag to the unit, giving your home address and the trouble with the unit. Pack very carefully in a rugged container, using sufficient packing material (cotton, shredded newspaper, or excelsior), to make the unit completely immovable within the container. The original shipping carton is satisfactory, providing the original inserts are used or sufficient packing material is inserted to keep the unit immovable. Ship by prepaid Railway Express, if possible, to the:

Service Dept.
Electronic Instrument Co., Inc.
33-00 Northern Blvd.
Long Island City 1, N.Y.

Return shipment will be made by express collect. Note that the carrier cannot be held liable for damages in transit if packing IN HIS OPINION, is insufficient.