

I. Introduction.

Thank you for purchasing the Scotty's Sled Shed Custom Probe Modification Kit for Heathkit HW-16.

This kit is intended for models with unmodified power supplies, in the original OEM configuration.

This kit was developed to help fellow vintage electronic enthusiasts. The kit primarily replaces the original electrolytic capacitors, including the Twist Tab metal can style. The unique design provides a clean professional looking result with the use of my Multi-Cap PCB boards that fit in the original locations of the old twist tab caps. Additional capacitors and resistors are included to complete the upgrade.

You will need the following to install this kit:

1. Hot soldering iron (to remove chassis soldered original twist tab capacitors)
2. Desoldering tool or wick.
3. Solder
4. Painter's tape
5. Basic tools.
6. Eye protection suggested.
7. Fume extractor suggested.
8. Small wire snips.
9. Hemostats or fine needle nose pliers.
10. Flat head (slotted) screwdriver
11. Phillips #2screwdriver
12. ¼" nut driver
13. 5/16" nut driver

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Before you get started there is a list of items to be aware of.

1. Due to constant supply chain challenges, Scotty's Sled Shed reserves the right to substitute component OEMs. If there is an orange bodied resistor in installation guide images and you receive a blue bodied resistor, it is due to component substitutions.
2. You may see a blue capacitor in one pic and a yellow capacitor in another picture. Multiple pictures may have been taken over various kits with different capacitor values or manufacturers.
3. Scotty's Sled Shed LLC is only providing you with components for a DIY installation.
4. The following instructions are only a guide. Experienced users may have a preferred method of installation.
5. **CAUTION: Lethal voltages are present in these devices.** If you are not aware of that by now, you should NOT be doing this upgrade.
6. If you do not feel comfortable working around high voltages, please do not perform the upgrade. Find an experienced technician to perform or assist you.
7. Scotty's Sled Shed LLC is NOT liable for any damage caused to your equipment, bench, house, Power supply or that your spouse is mad at you for working on this 50-year-old piece of equipment. You are ON YOUR OWN.
8. Customer assumes all responsibilities and agrees to check all resistance, capacitance, and voltages before and after installation.
9. Customer assumes all responsibility to know how to read a schematic and perform the task this kit requires.
10. Customer assumes all responsibility to SAFELY perform procedures by following the OEM manual.
11. You get the point; you are responsible for yourself.
12. Please be sure to download the manual if you do not have it. They are readily available online at: <https://www.vintage-radio.info/heathkit>
13. Read the original OEM manual. The process for replacing components will be nearly identical to the original installation.
14. References are made in this guide to component numbers associated with the original manufacturer manual. Customers should familiarize themselves with what the components are. IE C4, C5, D7, R8
15. Some original components were pre 1970 (when the EPA was established). DO NOT CUT OPEN THE ORIGINAL CAPACITORS. There may be toxic chemicals inside. The power supply you have may have been modified.
16. Protect yourself and remember to wear protective eyewear, use a fume extractor, and have a fire extinguisher nearby.

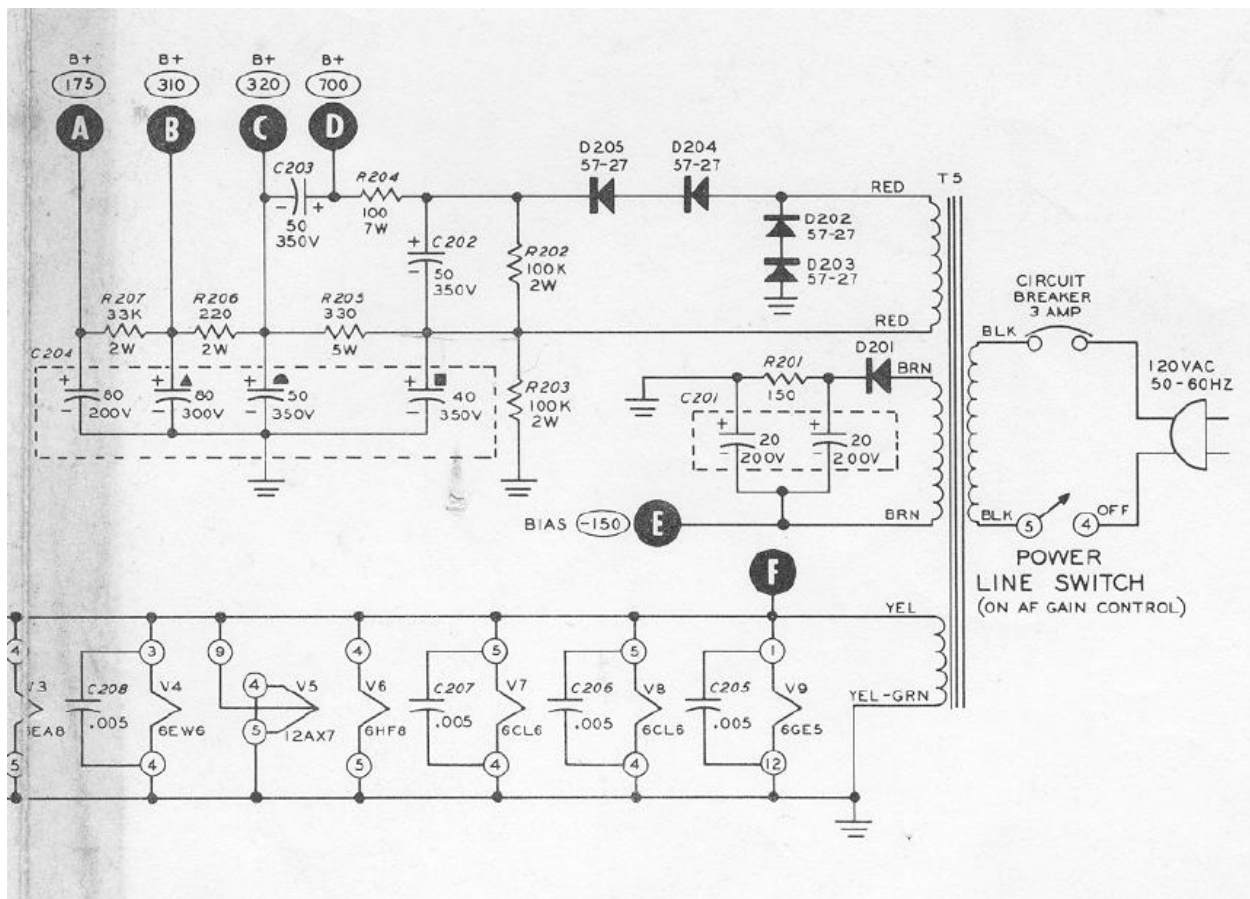
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II. Preparation

1. Take lots of pictures and video if you need to, of the original assembly for future reference.
2. Print out/copy an additional copy of the schematic.
3. Ability to label wires/components as needed-tape, label maker, etc.
4. On the extra schematic, it may help to write down where each lead of Capacitors C5, C6, C7 and associated resistors are connected to the terminal strips. Example C5 (+) to lug 1, (-) to chassis ground.
5. Be sure that all capacitors are discharged.
6. READ THE OEM OWNER/INSTALLATION MANUAL!
7. Solder paste will improve the efficiency of soldering and de-soldering.

III. Power Supply Schematic.

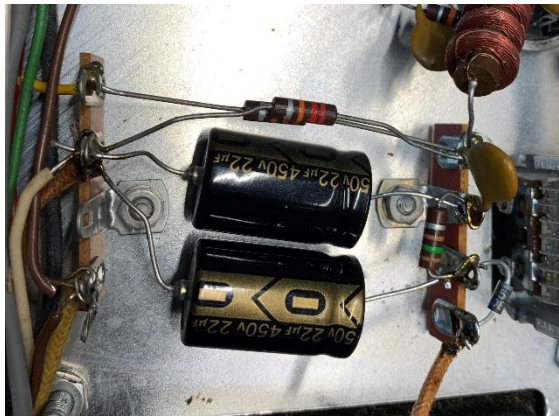
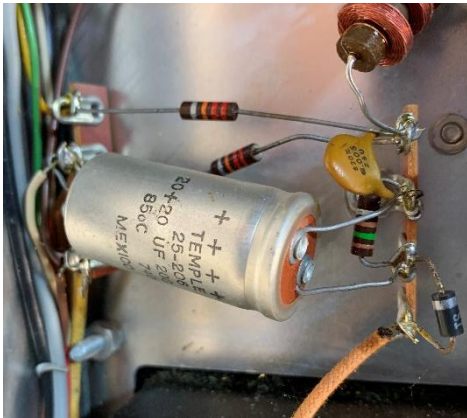
The image below is taken from the original Heathkit Manual. This is for the main power supply which is the primary focus of this kit. C204 is a 4 section Twist Tab Capacitor. C202 and C203 are single 1" twist tab can capacitors. C201 is a dual axial electrolytic located on the underside of the chassis. C88 (not in power supply) is a 10uF axial capacitor located on the top board that will also be replaced.



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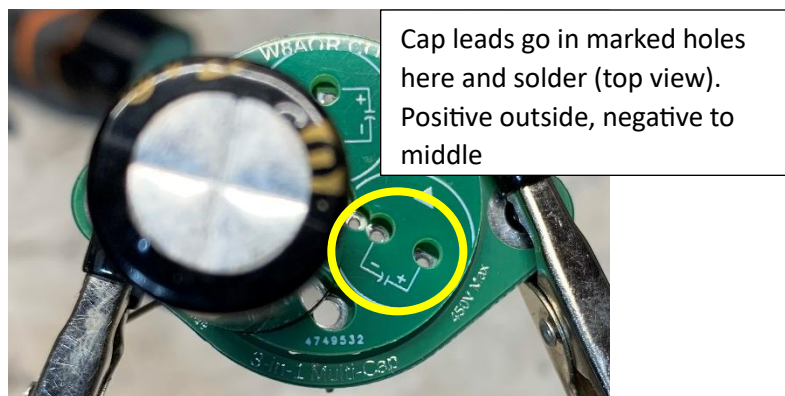
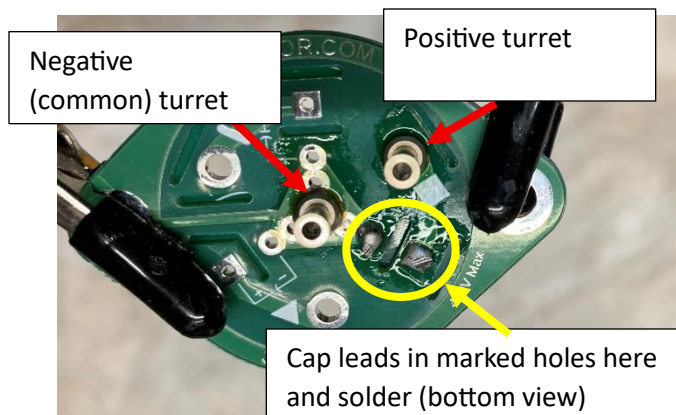
IV. Replace Capacitor C201 and Diode D201

1. Locate the dual axial electrolytic capacitors C201 and Diode D201 on the underside of the chassis.
2. Note orientation of the positive leads and the negative common lead.
3. Cut C201 out with snips and de-solder lead ends at terminal strip.
4. Install the two new supplied 22uf 450v axial capacitors.
5. Replace Diode D201 with supplied FR207 rectifier diode.

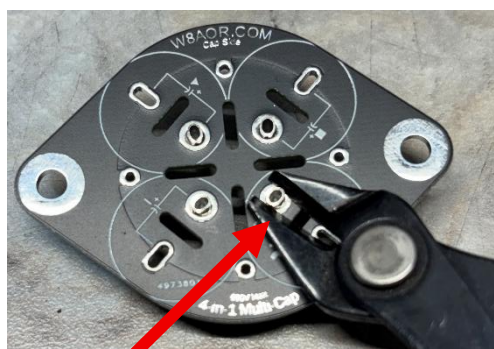
**V. Build new C202 and C203**

1. Begin by building the new C202 and C203 with the new cap board kit assembly.
2. Open bag marked C202. Locate the 3-in-1 Multi Cap board and note it has two sides marked "Turret Side" and "Cap Side".
3. On the "Turret Side" insert one of the Keystone solder turrets into the center hole. Slightly squeeze the end that pokes through on "Cap side" with a pair of pliers or snips, just enough to make it oblong. Do not squeeze the end shut. It only takes light pressure. This is to keep it from falling out when soldering.
4. On the "Turret Side" insert one of the Keystone solder turrets into hole marked with a Square. Make the end oblong on Cap Side like you did in step 3 above.
5. Apply solder paste (option) and solder the turrets on the Cap Side, but do not fill the center with solder.
6. Find the spacer board, align the markings on the spacer board with the Multi-Cap board and place on the "Cap Side".
7. Insert the 47uF 450V Radial capacitor into the + and - hole slots marked on the spacer board from the spacer board (cap side). The negative lead should be facing the center of the board. Solder and trim leads on the Turret Side.
8. NOTE: Supplied Spacer is necessary per IPC2221 specifications.
9. Repeat steps 2-7 with components in bag marked C203.

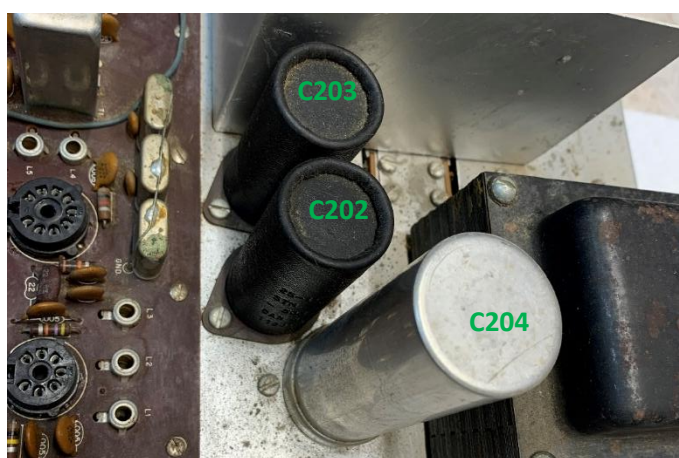
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VI. Replace Capacitor C203

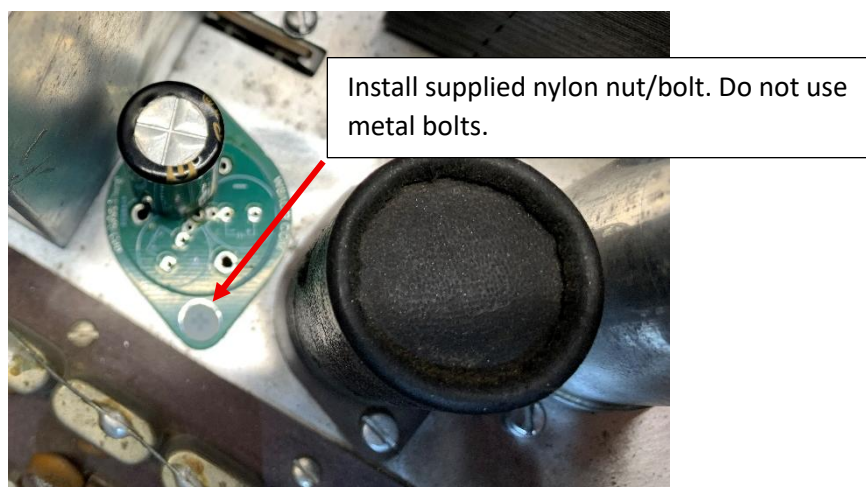


Squeeze turrets barely enough to make oval to not fall out. Do not close.



Note in the image below where each capacitor is located.

1. From the underside, Unsolder the end of the 7w 100ohm at the Positive (+) post of C203 as well as the coil and ceramic cap. Mark/Label and move aside.
2. Mark red wire at the twist tab as C203 and mark as C203 Negative.
3. Remove C203.
4. From the top side, insert the oval insulator flange on top of the chassis aligning the mounting holes.
5. Set the new C203 on top with the capacitor facing the shield plate.
6. Install with the supplied #6-32 Nylon bolt and nut hardware. Do not overtighten or you may break the nylon bolt. I use painters' tape on the head of the bolts to hold in place while I get the nut started on the bottom side.
7. Solder the red wire to the center (negative) Keystone Turret post of new C203.
8. Solder the coil, disc capacitor and 7w 100ohm resistor to Keystone Turret at Square.
9. C203 is complete.



VII. Remove Capacitor C202

1. Remove 100k and unsolder the 100ohm 7W resistors from C202 positive.
2. Unsolder jumper (may be lead of 100ohm 7w) from C202 positive to terminal strip lug 1 that connects to Diode D205 anode.
3. Remove red jumper from C202 Twist Tab and mark C202 Neg. C202 negative connects to C204 Square positive. We will move this jumper later to a terminal strip.
4. Remove Capacitor C202

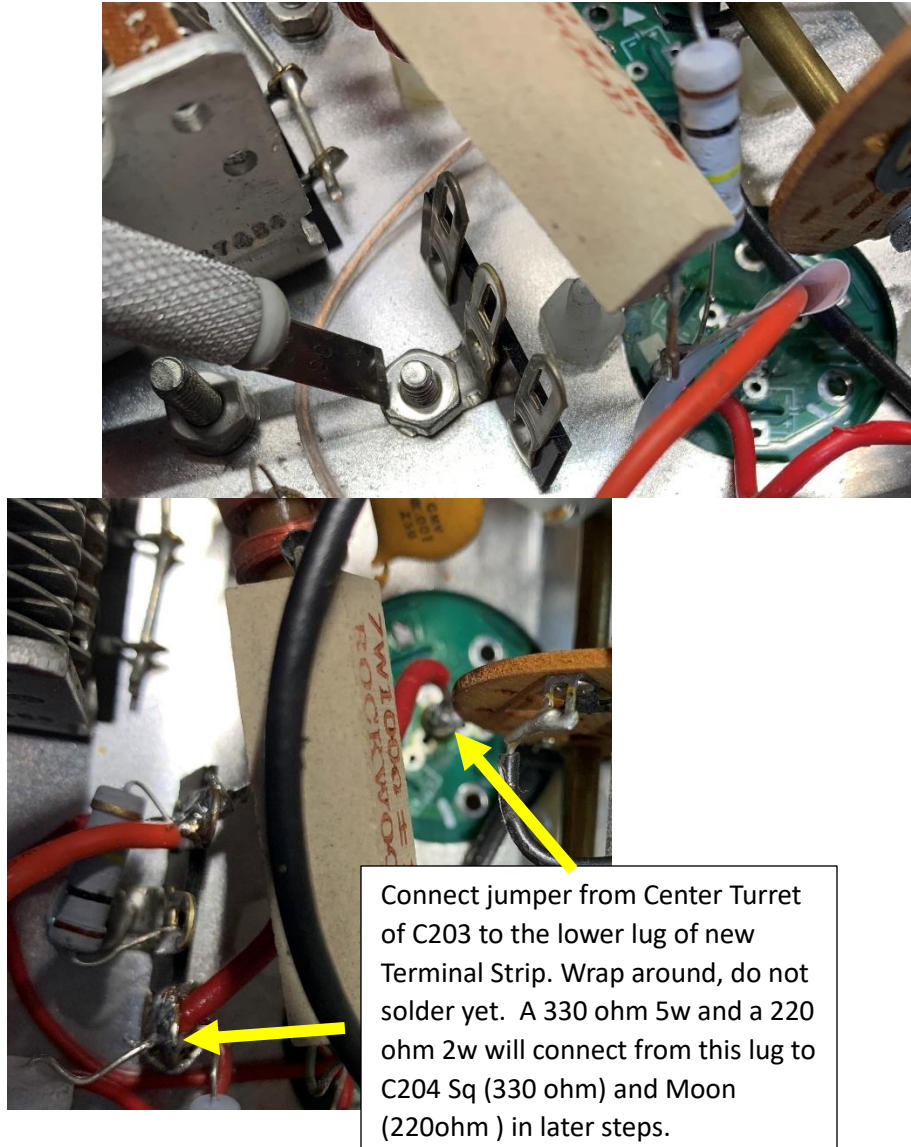
VIII. Install 3 Lug terminal strip.

C204 is very busy with connections, especially at Half-Moon and Square. Before we install the new C202 and start to work on C204, we need to add a terminal strip to lessen the burden of connections on the new C204. There is not as much surface area to work with on the Keystone Turrets as there is on the legacy Twist Tab lugs.

This can be done after installing the new C202 but may be easier before.

1. Mark a spot with marker, about 1" from the mounting hole of C202 that faces toward the transformer.
2. Drill a 5/32" hole and clean surface around the mounting hole as the center lug of new terminal strip will need to make a good chassis ground.
3. Install new supplied 3 lug terminal strip with supplied #6-32 SS hardware.
4. Add jumper from the center Turret of C203 to terminal strip lug closest to C204.

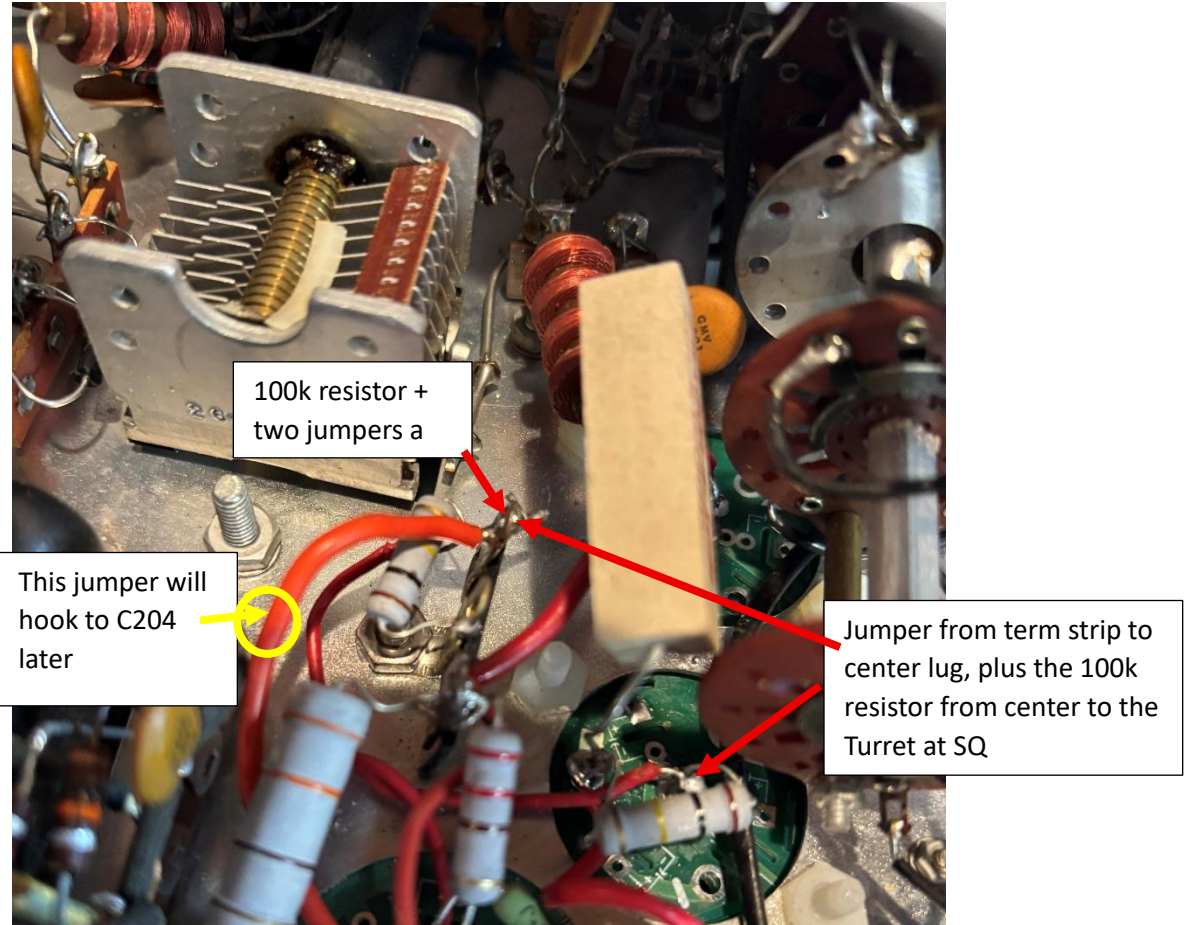
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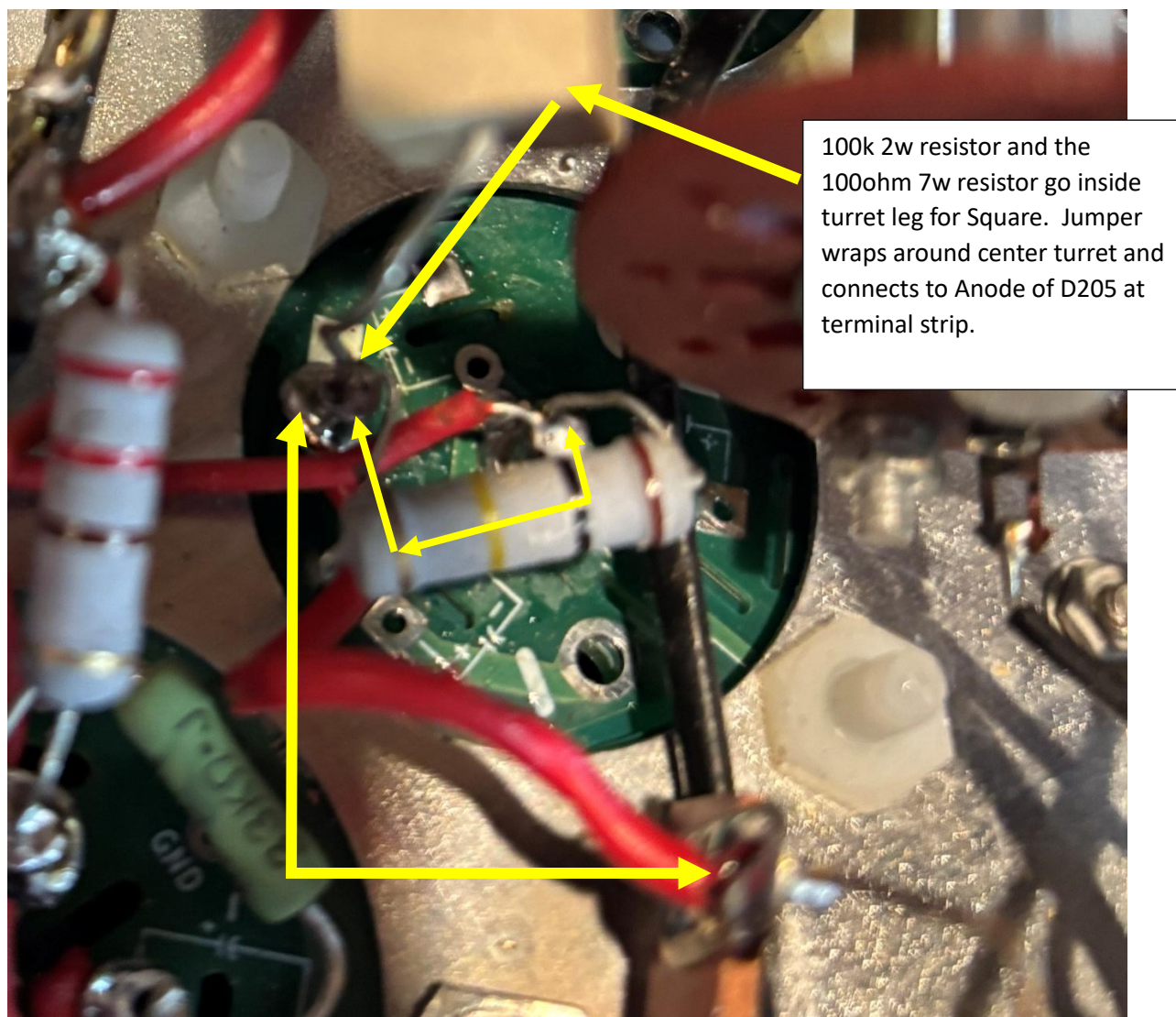
**IX. Install C202**

1. From the top side, install Oval Insulator flange, followed by the new C202.
2. Secure with the #6-32 Nylon Hardware and secure. Do not overtighten.
3. At the Positive turret for Sq, insert lead of the 7w 100ohm resistor and one leg of supplied new 100k ohm 2W resistor into the hollow end of turret. Solder.
4. Wrap jumper lead that goes to the 4 lug terminal strip where D204 Anode is on last lug. The other end wraps around turret on C202 Square turret. Solder at Lug at D204 and turret on C202 Square. Hookup wire is supplied if you must redo the jumper.
5. Using supplied jumper wire, make two jumpers about 4" long.
6. At the new terminal strip you installed, connect the second supplied 100k ohm 2w resistor to the outer leg near the tuning capacitor and the other leg to the center lug (ground). Solder the leg at center lug only.

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7. Use the jumper you made to connect to the outer lug where you just installed the 100k ohm 2W resistor and connect it to the center turret of C202. It should fit inside the turret.
8. Add the second jumper to the outer lug of the new 3 lug terminal strip near the tuning capacitor. Solder three leads. There should be two jumpers and one leg of 100k ohm 2w resistor now attached to the outer leg of the new 3 lug terminal strip.



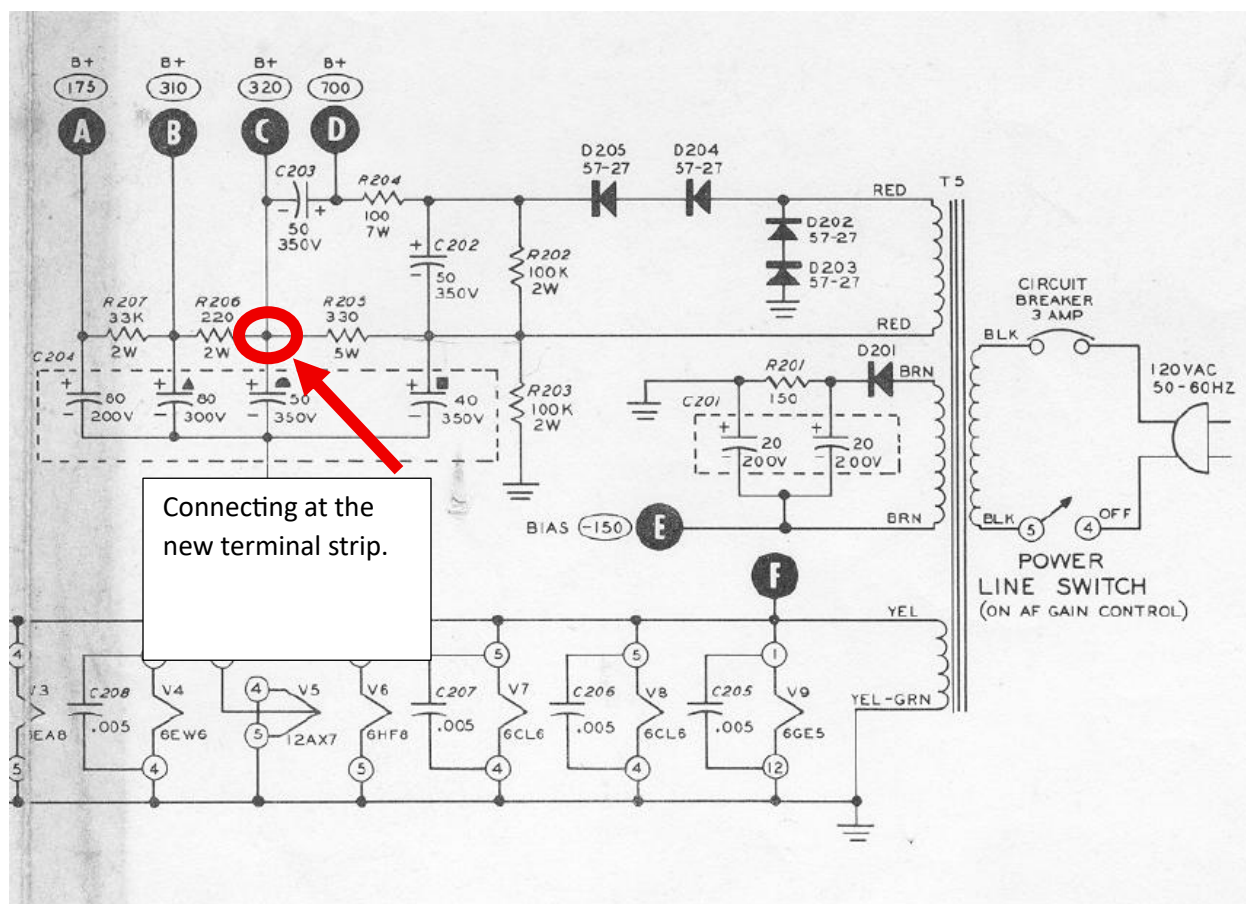


9. Insert the other leg of the 100k ohm resistor that is soldered to the positive turret of C202, to the center turret where you just installed the jumper. Both the resistor lead and jumper should fit inside turret.
10. Solder both leads at the center turret and the two lead + resistor at the new terminal strip.

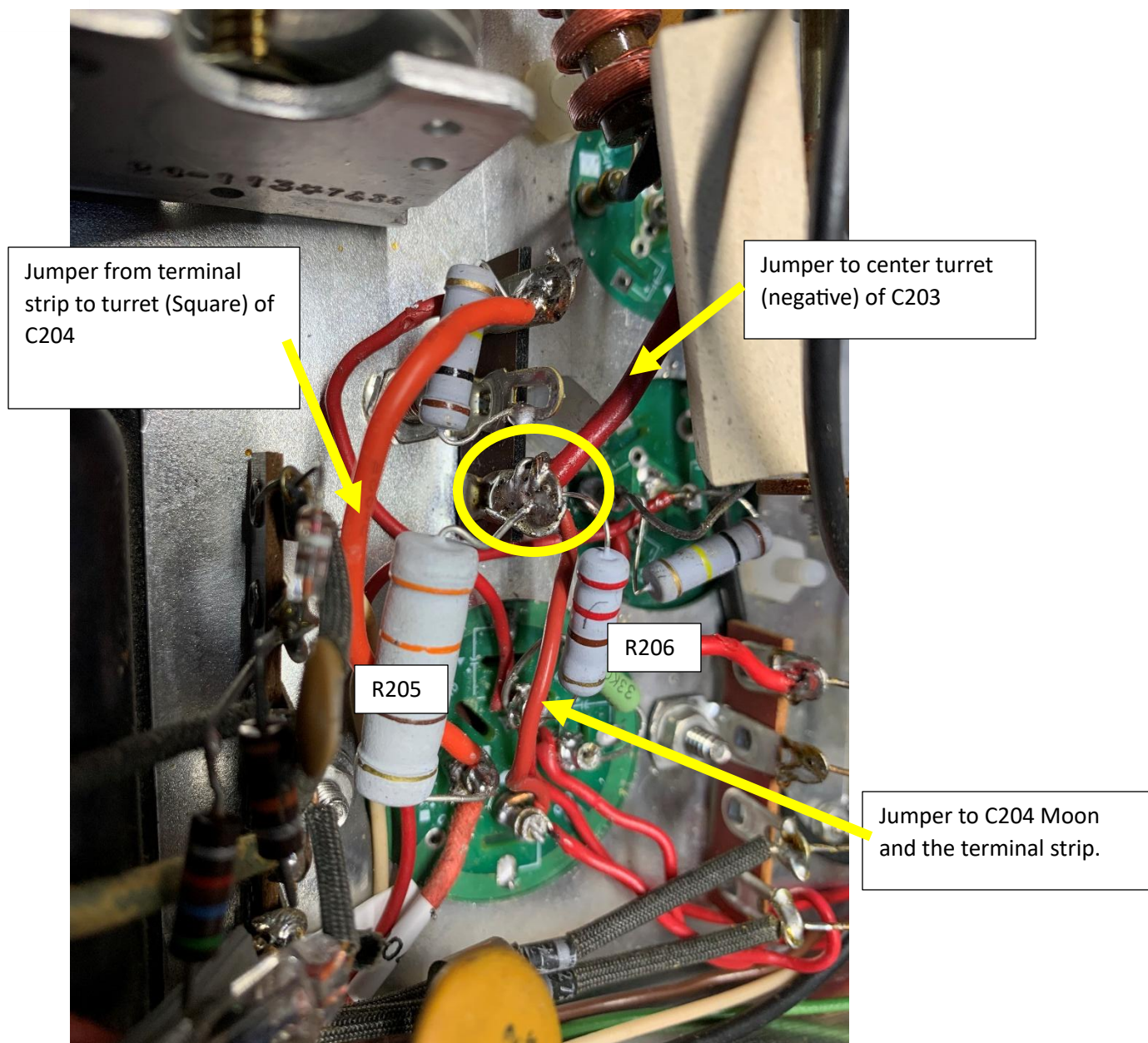
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X. C204

C204 the multi section capacitor will be challenging. Heathkit designed this with a mess of connections to C204. We are going to simplify some of these connections as there is just not enough space on the new C204 PCB turrets. Note that images you will see will show two boards, one green and one black. They connect the same. The green was Version 1 of my Wide Body board. This must be used by my Wide Body board to fit the 4 capacitors. We will be moving R205 (330ohm 5w) and R206 (220ohm 2w) from jumping from Square to moon to triangle and connecting them in series joining at the terminal strip. As well as linking the negative side of C203 to the terminal strip where C206 and 205 join. There are a lot of connections going on here. I will do my best to be as clear as possible in the instructions. The kit may include two 47uf 450v, one 100uf 450v and one 100uf 250v, or to simplify there may be two 47uf 450v and two 100uf 450v caps instead of one 100uf being 250v.

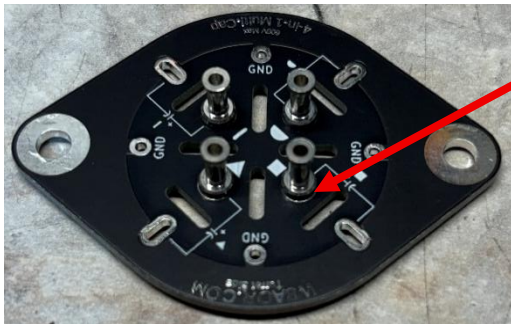


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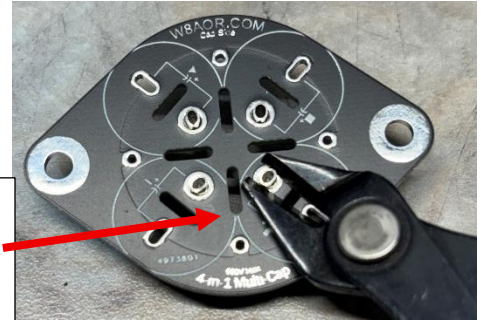
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1. Build C204 by locating the contents of bag labeled C204. On the main board find the markings "Cap Side" and "Turret Side". Just like C203 and C202, the turrets are installed on the turret side. The end will poke through the Cap Side, and we squeeze the short end to make it oval, so it doesn't fall out. Then solder all four turrets in but do not fill the center with solder. Solder from the "Cap Side" of the board.



Turrets on Turret Side

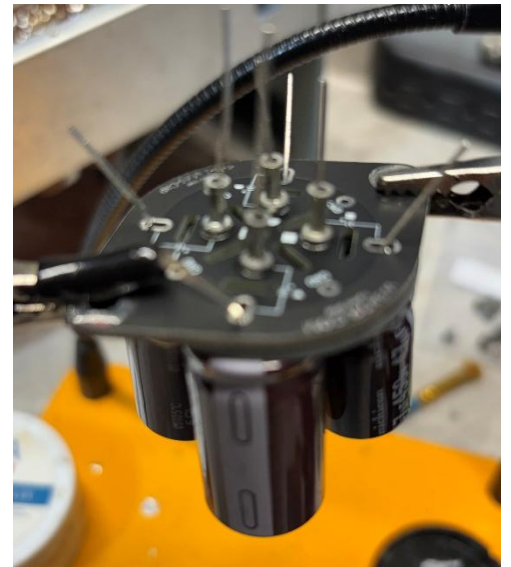
Short end will stick through on the Cap Side. Squeeze on this end



Align Spacer on Cap Side. Markings will match spacer (both sides marked). Spacer goes between board and capacitors



Moon=47uf 450v
Square=47uf 450v
Triangle=100uf 450v
Line=100uf 250 (or 450v)

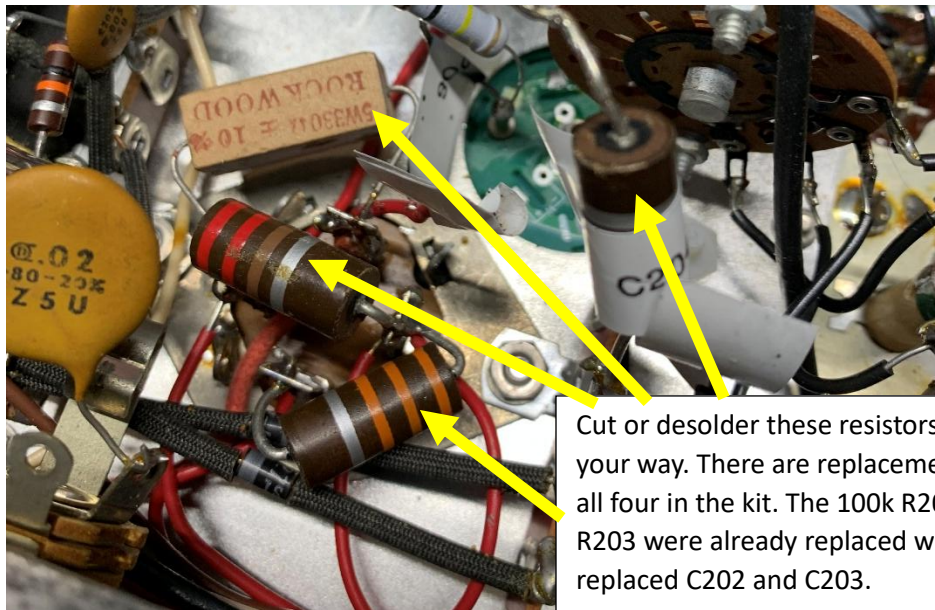


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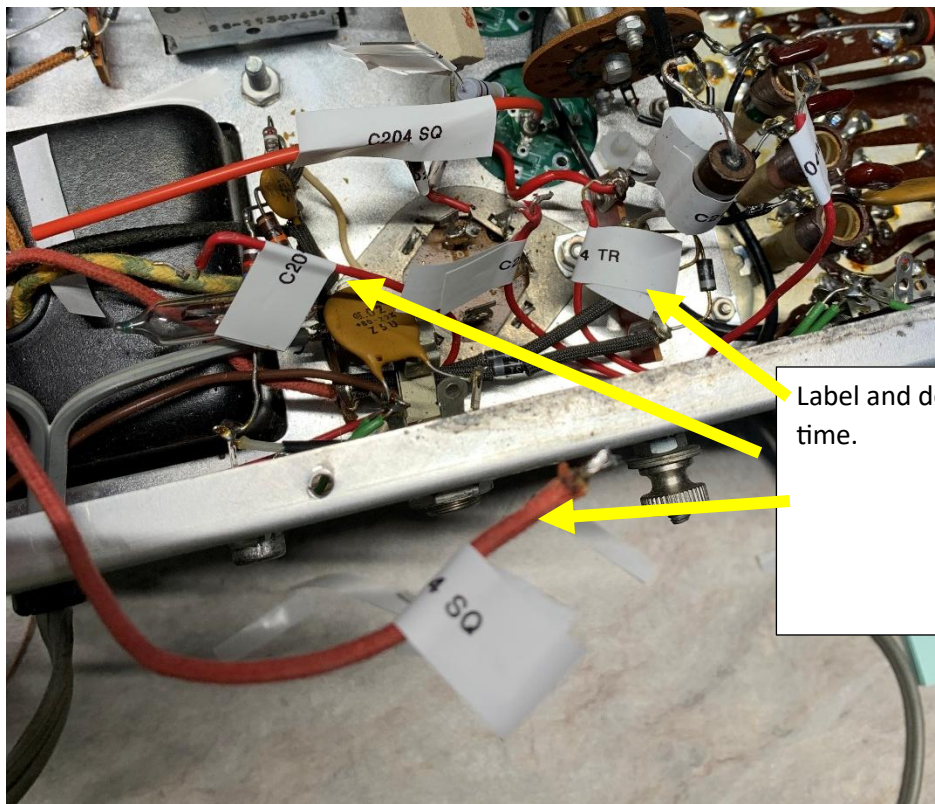
2. Install the capacitors, positive lead goes inside turret for each location. Negative leads go through (-) hole. The Negative is the outer holes; the turrets are the positive:
 - a. Moon-47uf 450v, Square-47uf 450v, Triangle-100uf 450v, Line-100uf 250v (or 450v). Bend the legs over and use hemostats to pull the leads through and tight to board so they will stay in place.
 - b. Solder the negative leads and trim.
 - c. Do not solder the positive leads in turrets yet.
3. Set aside C204 PCB assembly
4. Start marking, if you have not, all the leads going to C204 by the symbol, Moon, Square, Triangle and line (the original capacitor may not have a line or dash for the fourth section depending on the original production. If it doesn't have a marking, label the leads from that lug as line or dash).
5. Cut the three resistors from C204 out of your way with snips.
6. Begin carefully desoldering the leads from C204.
7. Remove the two 6-32 nuts and bolts from the flange of C204 that is also connected to the two adjacent terminal strips.
8. Remove C204. This may be a challenge. Break lugs off if you must remove.
9. With wire brush, clean top and bottom side of chassis around the mounting holes for C204 to get a nice clean ground.
10. Install the new C204 from the top side with the Moon and line facing back of chassis. Orientation is not critical. It can be flipped 180'. The focus is connecting the wires you marked and removed to the correct location on the new C204 PCB.
11. With the 6-32 supplied hardware put an external tooth washer and bolt (x2) together and put through the PCB holes from the top side of the chassis. Using painters' tape, tape the assembly down, covering the bolt head so when you flip it over the bolts don't fall out.
12. The terminal strips that were connected to the original C204 flange mounting bolts will need to go over these new bolts. Then add the other internal toothed washers and nuts to snug. As you tighten the nut from the bottom the external tooth on top will bite into the PCB and it should stop spinning. Remove tape and finish snugging the hardware down.
13. Ready for all the rewiring?
14. Start with line. That's easy, only one lead. Insert one end of the supplied 33k ohm 2w resistor inside turret opening at Line and at Triangle. Solder jumper and resistor at Line.
15. Connect the two jumpers marked triangle to the turret at Triangle.
16. Install 220ohm 2w resistor to C204 turret Triangle and the lug at newly installed terminal strip. Lug closest to C204 that has jumper going to C203. Solder the 33k and 220 ohm resistors and leads at Triangle. Do not solder the lug on terminal strip yet.
17. At the Square Turret, connect the transformer lead to the turret, Jumper that connects to new terminal strip at outer leg near variable capacitor (connects to C202 and R203) and install the 330ohm 5w resistor (inside the turret opening). The other end of the 330ohm resistor goes to the new terminal strip lug facing C204 where the 220ohm resistor connects. Solder at C204 turret at Square only. One more to go.
18. Connect the jumper marked moon to C204 turret Moon. Connect (make a new one) jumper from C204 Moon to the terminal strip lug where R206 (220ohm) and R205 (330ohm) and jumper

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to C203 are connected. Solder all 4 connections at terminal lug and two connections at C204 Turret Marked Moon. C204 complete. Check all your connections and jumpers.

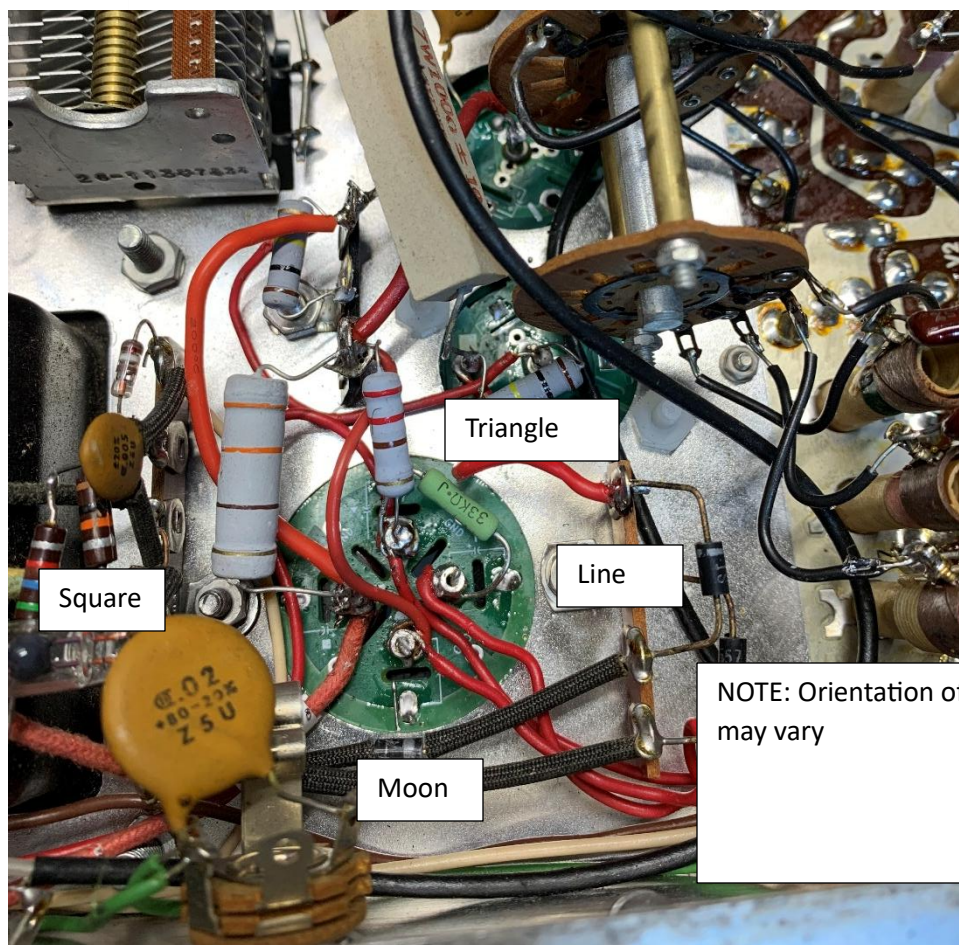


Cut or desolder these resistors out of your way. There are replacements for all four in the kit. The 100k R202 and R203 were already replaced when you replaced C202 and C203.

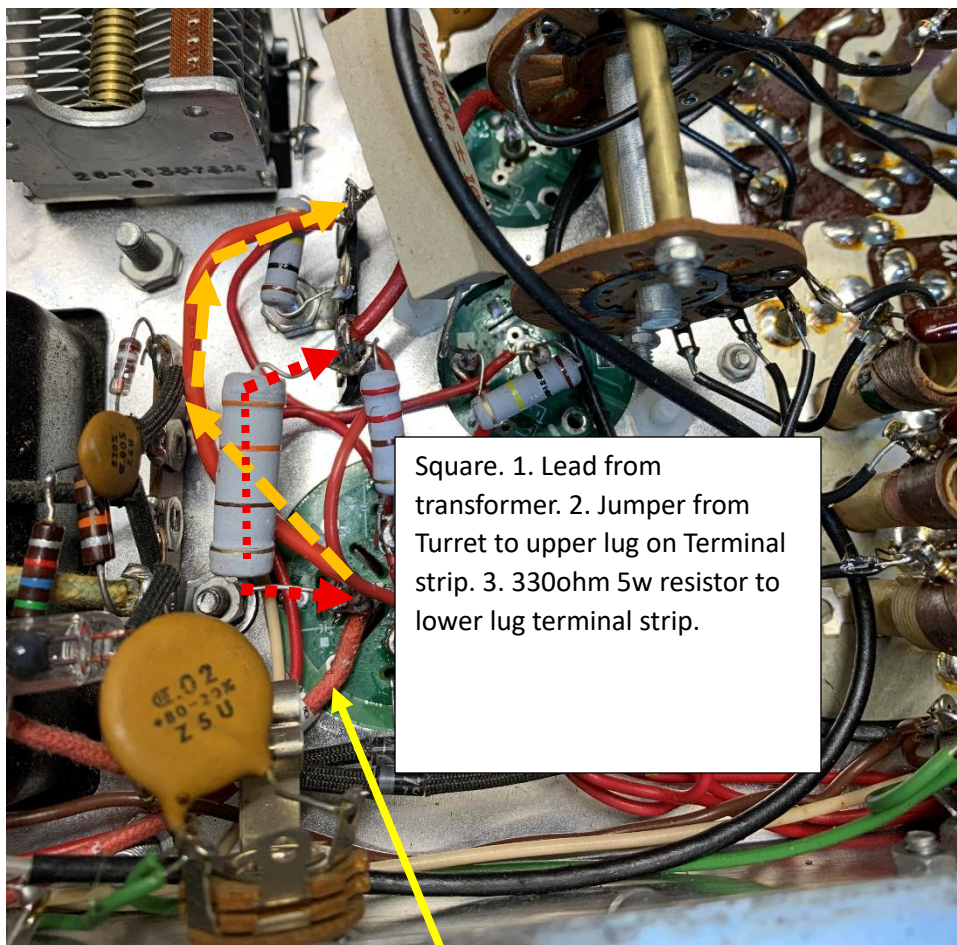


Label and desolder each lead one at a time.

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Square. 1. Lead from transformer. 2. Jumper from Turret to upper lug on Terminal strip. 3. 330ohm 5w resistor to lower lug terminal strip.

Transformer lead

XI. Summary

We are adding jumpers and moving a couple of components like R205 and R206 to the terminal strip.

R205 will go from C204 SQ positive turret to terminal Strip. R 206 will go from that same lug on the new terminal strip and back to the positive turret on C204 Moon.

We are using that same lug as a connect through from C203 negative (center turret) to the terminal where R205 and R206 now are, with another jumper to C204 Moon Positive Turret. You can just do a straight jumper between C203 negative and C204 Moon Positive if that's easier.

R203 we moved to the terminal strip on the other free lug to the ground lug (center). Then we added a jumper from C202 negative to the terminal strip where R203 is (not ground). Then a jumper from the lug where R203 is to C204 Square positive turret.

Since the new PCB turrets are limited on surface area compared to the original capacitor adding the terminal strip just lightens the load of wires at C204 Square and Moon connections.

I welcome feedback on any tips or tricks you find to make the project go faster.

I would like to see customer pics of final installations.

If you find an error in this document, please kindly let me know at mysledshed@yahoo.com

Please be professional in your communicate.

Thank you, and good luck!

73's

Scott

W8AOR