WD11 Kit Assembly

Assembly of the WD11 kit requires intermediate skills including staking, filing or Dremel grinding and bench grinding, painting, as well as normal soldering of through hole components. This document is a step by step guide to assemble of the kit.

This picture shows the fully assembled PCBs before insertion into the base.

Tools and Material required

Tools:

- Hack saw or equivalent fine tooth saw
- Initial Staking tool (awl or similar tool) and hammer
- Finish staking tool (Old screwdriver works well).
- Dremel tool with approximately 1/8 inch grinding tool or round file
- Bench Grinder or file
- Soldering Iron and solder
- Small paint brush

Materials:

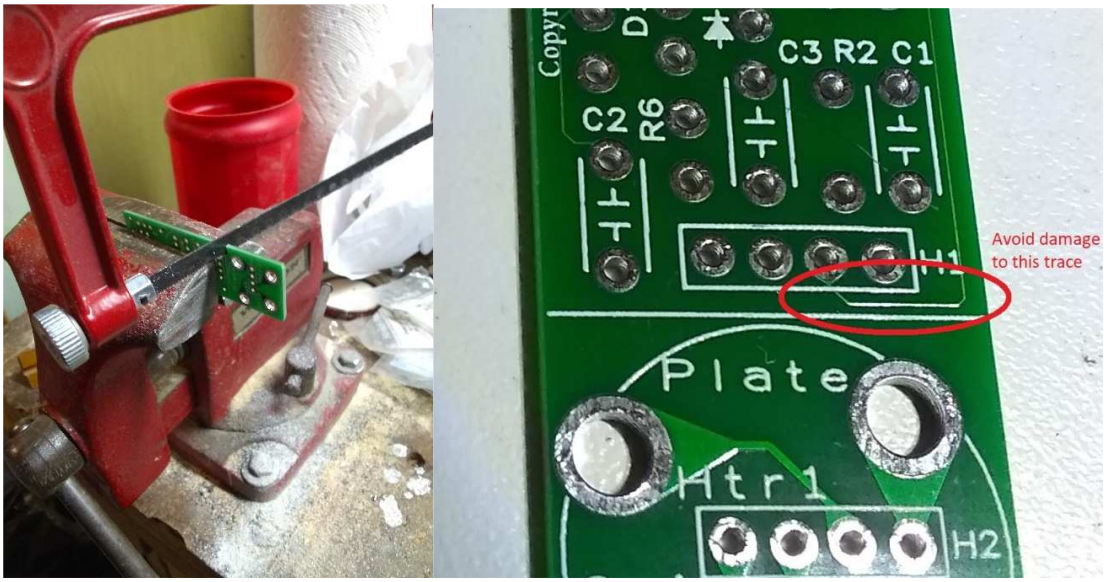
- ½ inch plywood 2 x 2 inches or larger
- Adhesive – two part epoxy works well

- Silver or Chrome paint

Step 1 PCB preparation

Separate the two parts of the PCB using a hacksaw or similar fine tooth saw.

Important caution: There is a PCB trace near the bottom of the upper PCB. Be sure to saw below the white line to avoid damage the PCB trace as shown in the picture on the right.



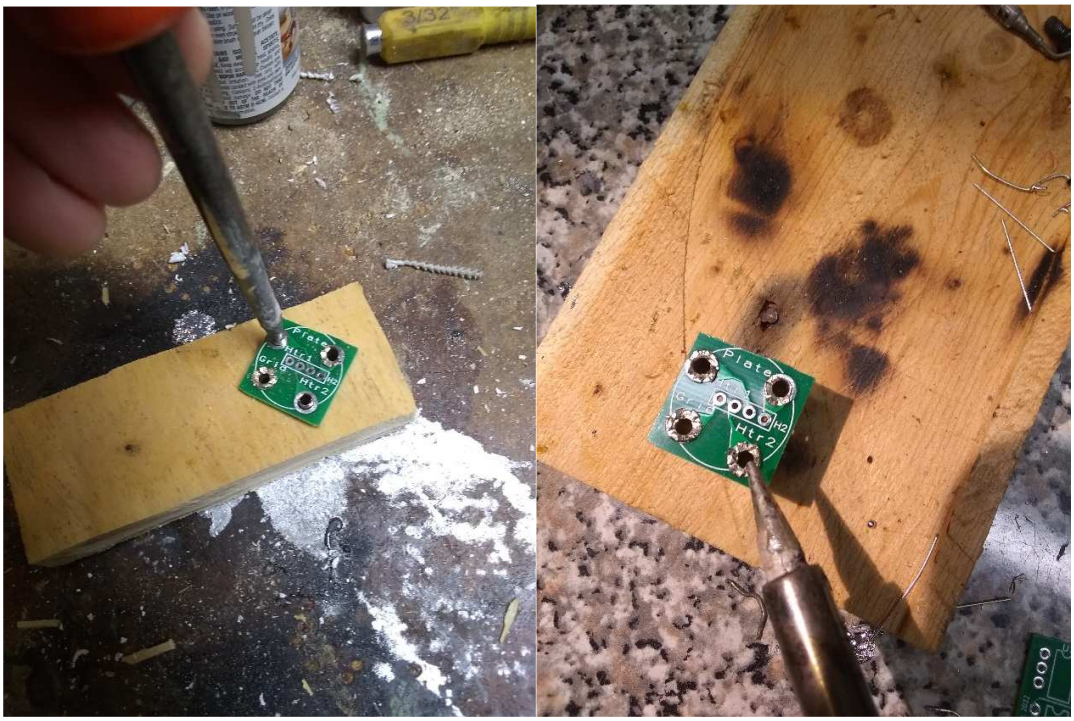
Step 2 Create fixture for staking pins

Use the lower PCB as a guide to drill a fixture to hold the pins straight during staking. A 1/8 inch drill bit is used to drill holes in ½ inch plywood. Drill the “Plate” hole first, then install a pin and place the PCB over the pin while drilling the remaining holes.

Be sure to mark the Plate pin position since the pattern of pin positions is not symmetrical.

Step 3 Stake pins to lower PCB

Insert pins into each hole in the fixture, place the lower PCB face up over the pins with the plate position on the fixture matching the plate position on the PCB. Use an awl and hammer or similar tool to start the staking process then follow up with a blunt tool like an old flat blade screwdriver to finish the staking process. Finally flatten with the hammer. Then solder the staked area to the PCB as shown in the picture on the right.



Step 4 Add 3/16 tube to Plate Pin

First file the ends of the 3/16 tube to be smooth and square. Apply solder the Plate pin then slide the tube over the pin, squeeze the copper tube onto the pin and allow the solder to cool. Finally file the end of the soldered tube to assure smooth entry into the tube socket.



Step 5 Prepare Base

This step is only necessary if the PCB does not fit flat into the base.

Use a Dremel tool or round file to prepare the base to accept the lower PCB. First mark the base where the pins will need to pass through the rim of the base then use the Dremel to grind away the interfering material


Step 6 Grind lower PCB to fit base

Use a bench grinder or file to fit the lower PCB into the round base. The white line on the PCB can be used as a grinding guide. Note that a small portion of the staked area will be removed in the grinding process.

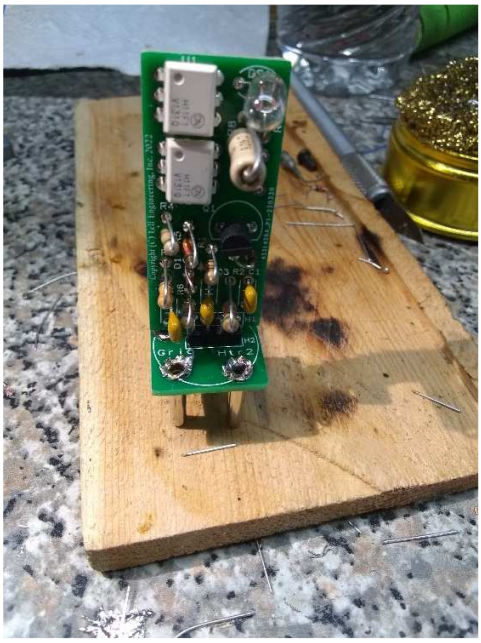
This picture shows the grinding, fitting, and final fit with the PCB snug against the rim of the base.

Use a good quality adhesive to attach the lower PCB into the base. I use two part epoxy and apply it to the lower PCB between the pins. Be careful that the adhesive does not migrate onto the pins since that would insulate the pin from the tube socket and possibly block full entry of the pin into the socket.

Most adhesives will migrate due to gravity while drying. It is recommended to place the assembly as shown in the picture while the adhesive dries to preclude adhesive from migrating down the pins.

Step 7 Assemble and solder upper PCB

Assembly and soldering of the upper PCB is straightforward. Follow the silkscreen and the picture below to arrange the components the solder them in place. Diodes D1 and D2 look similar but have very different characteristics, be careful not to confuse them.



Step 7A

Working from the lower end of the board, insert C1, R2 (green-brown-red) , C3, R6 (blue-gray-red) and C2. Solder and trim leads.

Step 7B

Insert D2 (black band on upper or left end), R1 (brown-gray-brown), D1 (black band on upper to top end), R3 (orange-orange-yellow), solder and trim leads.

Step 7C

Insert Q1, R5 (orange-orange-red) and R4 (brown-gray-yellow), solder and trim leads.

Step 7D

Insert R7 (use a lead trimmed off earlier to short this resistor), R8 (brown-black-black) and DS1, solder and trim leads. Do not install a resistor in R9.

Step 7E

Insert U1 and U2, be sure the circle marking pin 1 is at the top left for both parts then solder.

Step 7F

Insert and solder the header at the bottom.

This completes Step 7, Assembly and soldering of the upper PCB.

Step 8 Solder upper PC to lower PCB

Assemble and solder the upper PCB to the lower PCB. The four pin header is offset so that when the PCBs are oriented correctly the boards align. If oriented incorrectly the boards will be significantly

offset. Trim the pins to sufficient length to penetrate the lower PCB before soldering since it can be difficult to trim them after soldering due to interference with the large pins.

Step 9 Test before adding shell

The assembly from Step 8 can be tested in a radio and other test devices like a tube tester. Be sure the PCB is working as intended before proceeding to Step 10.

Step 10 Prepare Shell

Cut the test tube to the correct length, and trim the edge. WD11 were manufactured In several lengths. Early tubes, used in Aerola radios, were 3 3/4 inches from base to top, while later models used in Radiolas were 2 7/8 or 2 ¾ inches. The longer length is useful in Aerola radios to aid insertion and removal.

The plastic shell can be painted to look similar the the original WD11 with its silver getter. Use a good quality silver paint like Kester Chrome. Apply the paint to the outside of the shell. Paint applied to the inside of the shell will appear shiny on the inside but appear gray and dull on the outside since it is viewed from the “back side” of the paint.

Step 11 Install the Shell

Use a good quality adhesive to attach the shell to the base.

This completes the assembly of the kit.

A word about A battery voltage, R8 and R9 and filament current

If using an adjustable battery eliminator (power supply), set the A voltage to 1.6 volts. If using a battery the voltage should be 1.5 to 1.6 volts. Most battery chemistries deliver voltage in this range. Higher voltage, up to 3 volts, will not cause harm but will not allow minimum volume. Lower voltage will not achieve full volume.

WD11 Kit uses an optocoupler to reduce gain as the filament voltage is reduced when the Radiola III "Battery Setting" control is reduced. The optocoupler requires about 1.3 to 1.4 volts to maintain full volume. With R9 open the WD11 kit draws about 60 mA resulting in a voltage drop across the Battery Setting control of 0.12 volts. With the A battery voltage at 1.5 volts there is just enough voltage to achieve full volume with the Battery Setting control at full clockwise.

The original WD11 tube is rated for 0.25 amps filament current. If a 5 ohm resistor is installed in R9 the filament current in the WD11 Kit will be close to 0.25 amps but the voltage available to the optocoupler will be too low to achieve full volume and volume may be very low.

For this reason it is important to leave R9 open and to use only WD11 kits in the radio, not mixed or matched with other true WD11s or with replacement tubes that draw 0.25 amps filament current.

With R9 open and R8 at 5 ohms the WD11 kit will deliver full volume with the Battery Setting control at full clockwise and will provide smooth volume control to near zero as the Battery Setting is reduced by turning the control counter clockwise until the detent is reached when A and B battery currents are reduced to zero.

Alternate shell

It is possible to use a true glass shell in place of the plastic shell included in the kit. The glass shell can be removed from a retro lamp available at most building supply stores. The glass shell from a FEIT T8, clear glass, 3.3 watt vintage style bulb can be removed and used in the kit.

To remove the shell from the bulb build a fixture like this picture and use it to score the bulb.

Once the bulb is well scored which may take several turns in the fixture, the glass can be separated by alternate heating and cooling. I used the hot air from a solder rework station to heat the glass and a can of cool water the cool the glass. Three cycles of heat and cooling is usually sufficient to separate the glass. A heat gun or hair dryer may be sufficient as the heat source. Some internet sources suggest using a candle.

Once the bulb is separated, it can be painted and attached to the base similar to Steps 11 and 12.

Revisions

R1 5/26/22 Corrected colors or R2. Added suggestions on base. Corrected minor typos.

R2 7/7/22 Modified assembly of base. Added info on length variations. Added footer with page number and copyright.