Building the “Wood Stain” QRP Dummy Load with R.F. Probe

Introduction

The “Wood Stain” is a simple QRP dummy load with a built-in R.F. probe that allows for power output measurements when connected to a high impedance digital volt-ohm-meter. The dummy load will handle up to 8 watts momentarily and QRP levels for up to 30 minutes or longer depending on power (see chart). When a high impedance digital voltmeter is attached to the dummy load, the built-in R.F. probe converts the R.F. to a D.C. voltage than is measured on the voltmeter. This measured voltage can be converted to power in watts with a simple formula or a pre-printed conversion chart.

Building Rules

1. Take your time. We recommend that you take at least two or three hours to complete your kit. If you take your time, in three hours you can have a beautiful working project that you will be proud to own and operate.

2. If you don’t know how to solder parts on a circuit board, get help. Learning to solder is not hard, but please do not start this kit if you have never soldered before!

3. Most of the parts are tiny. Please use a magnifying glass.

4. Build the kit by the instructions, one step at a time.

5. Use protective eyewear.

6. Be careful with the ICs and transistors to avoid damage from static.

7. All parts should be mounted flush or as close as possible to the circuit board keeping leads short. After soldering, clip all wires close to the board.

Building the Circuit Board

Tools and supplies needed to build the circuit board:

1. needle nose pliers

2. diagonal cutters

3. small flat blade and phillips screwdrivers

4. Magnifying glass

5. 20-40 watt soldering iron

Locate the parts bag. All of the parts required for circuit board construction are enclosed. You can work from the bag and find each part as it is called for, but placing all of the parts from the bag into a bowl or small plastic tray may make it easier to sort and properly identify the parts.

As each part is called for, be sure to identify it, then locate the proper mounting holes on the board. Insert the part and check it's placement before soldering it in place. Cut all leads flush with the board.

1. Locate the three 2 watt 150 ohm resistors. Mount and solder them at R2, R3 and R4. Save two of the cut off leads for step 5, below.

2. Locate the 1/8 watt 0 ohm resistor. Mount and solder at R1.

3. Locate the 0.1pf (104) ceramic disc capacitor and mount and solder it at C1.

4. Locate the 1N34A glass diode and mount and solder in place at D1.

5. Solder the two resistor leads from step 1 above to the board at the designated locations. The leads must protrude from the bottom of the board.

This completes construction of the circuit board. Inspect the board for proper parts placement. Make sure that solder connections are good and that there are no solder bridges.

Preparing the Can Lid

The can lid requires three 1/4 inch holes to be carefully made for the R.F. In and D.C. Out connections. You are responsible for making these holes. Be advised that if you have never had to make holes in light tin sheet metal...it can be challenging! There are perhaps no one best way to do so. However, if you follow one of the methods below and are careful and take your time, you can expect good results.

Making the Holes

1. Locate the white circular decal. Peel it from the backing and place it on the top of the lid. Be sure to carefully center it.

2. Using a felt tip pen, make a small dot on the metal in the center of the three decal hole cut-outs.

3. Make a starter hole in each of the three hole cut-outs at the center dot. Use one of the following methods.

A. Drill a 1/8th inch starter hole with a metal cutting drill bit. Use a small block of wood under the metal to keep the cut clean and avoid deforming.

B. Using a sharp nail and a hammer, pierce a hole in each of the center dot locations. Use a small block of wood under the metal to keep the cut clean and avoid deforming.

Once the starter hole has been made, use one or more of the following methods to enlarge the holes to 1/4 inch each.

A. Use a small phillips head screwdriver to ream the hole larger and keep using progressively larger screwdrivers until the hole is the proper size.

B. Use a drill press and a progressive step bit.

C. Use small rat tail files.

Once the holes are the required size you will need to remove any large metal tags or burrs from the bottom side of the lid. Use sharp diagonal cutters, but <u>be careful to clip not tear</u> the metal or the tear will extend beyond the edge of the hole. OR You can use a dremel tool with a small grinding stone to remove the burrs...this works very well! Note: The holes do not need to be perfect, since washers will cover the holes.

If you should need a new lid, they are available for $3.00 postage included.

Mounting the Connectors

1. Mount the two DC terminal jacks using a large nylon washer and 1/4 inch nut on each. The black jack goes in the right (-) hole and the red jack goes in the left (+) hole.

2. Using the included hardware, mount the RCA phono jack in the R.F. INPUT hole. The jack mounts from the top and is secured on the bottom with the solder tab first followed by the lock washer and nut. The tab should be facing to the side with the negative (black) DC post. Bend the tab up at a 45 degree angle.

Final Assembly

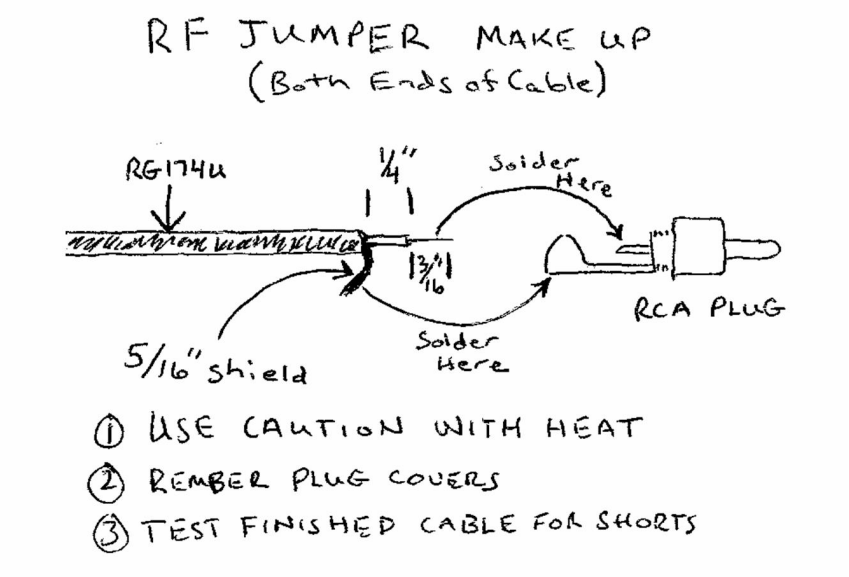
1. Mount the circuit board to the two terminal posts on the can lid. Use pliers to crimp the tips so that they will fit into the circuit board holes and then solder them in place. The top side of the board (with parts and parts legend) will be facing away from the can lid.

2. Solder the two resistor leads from the board bottom to the RCA jack mounted on the can lid. Keep the leads short and observe the polarity (positive lead to center and negative lead to the ground tab).

3. After checking your work, place the lid on the can with care taken not to disturb the circuit board.

4. Place the Wood Stain label on the can. The label is self sticking. Peel the backing off of one end and stick it to the can using the vertical line on the can as a guide. Then roll the label around the can.

5. Make a coax jumper using the supplied length of RG-174U coaxial cable and two RCA phono jacks. Be careful not to use too much heat when soldering. See diagram.



Alignment and Testing

Before proceeding examine your work to make sure that all parts are in the correct place, all solder joints are good and there are no shorts.

Since the Wood Stain contains only passive components, alignment is not indicated and testing is accomplished by using the device.

Using the Wood Stain

The Dummy Load presents a 50 ohm resistive load to the transmitter under test. The load is made up of three 150 ohm 2 watt resistors in parallel. The length of time that the load can be energized depends on two main factors, power and heat. Power is the transmitter R.F. output in watts. Heat is the energy radiated by the resistors. Both power and heat are the factors that determine the "allowed key down time" which is presented by the chart on the dummy load can label. QRP power levels can be adequately handled during the normal time required to measure output power or make other adjustments, etc. The ratings are conservative, but it is not recommended that you exceed them. Although the can could be flooded with mineral oil to provide more heat dissipation, it is not needed if used within the charted limits. Also the oil could leak from the jacks on the can's lid.

R.F. power measurements are made by connecting a high impedance digital volt-ohm meter to the built in R.F. probe through the red and black jacks. Use a low DC voltage scale. The transmitter output is connected to the RCA jack on the can top.

NOTE: Not all digital volt-ohm meters are of the same impedance. Only some will actually be labeled as such. In testing we purchased six VOM's from Lowe's, Harbor Freight and Radio Shack. All worked fine, but no two produced the exact same readings. However, all produced readings within 10% of each other.

When a working VOM is connected and R.F. is applied to the dummy load, the meter will display a voltage reading. The reading will be slightly fluctuating (can be minimized by using a higher voltage scale). Use a reading to one digit past the decimal point, example: 2.4 or 10.2 volts.

The voltage reading can be converted to power (in watts) by using the Approximate Power chart on the can's label. Note that the label provides an approximate power conversion. For more accurate readings you will need to use one of the following methods.

1. Use the formula: Power = (voltage)x(voltage)/50 example: 3.2 x 3.2 /50 = 10.24 / 50 = .204.8 or 205 milliwatts

This is the indicated power output.

2. Since there are losses introduced by the circuit, a small “correcting voltage” can be added to the formula. We have determined that 0.25 volts will yield a good result. In the example above you would add 0.25 to the 10.24 to get 10.49 volts, which when divided by 50 gives 210 milliwatts when rounded up.

This is corrected power output.

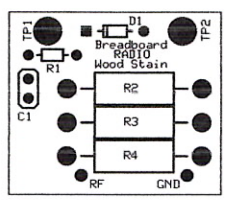
NOTE: All watt meters have some error! It is not uncommon to get slightly different readings form different wattmeters.

If you have another watt meter that you trust, you can compare readings and calculate your own “correcting voltage” to be added to the formula. If you use a directional wattmeter, remember to add the forward and reflected power together to get the total power out.

HOWEVER: Please remember that this is a simple device! It will get you a good “in the ball park” reading, but is not 100% accurate...nor will any other wattmeter!

Problems

If you have any problems with your kit, please email us at: w4fsv@breadboardradio.com You can also refer to our website at: www.breadboardradio.com


TP1
D1
TP2
Breadboard
RADIO
Wood Stain
R1
C1
R2
R3
R4
RF
GND