Building the “Code Practice Oscillator”

Introduction

The “Code Practice Oscillator” is a simple to build audio oscillator designed to be used as a morse code practice oscillator. The CPO is built on a double sided circuit board and mounted to a small wooden breadboard. Unlike many currently available CPO’s using a sawtooth oscillator, the “CPO” uses a more pleasant sounding sine wave oscillator. The tone is amplified by a single integrated circuit and delivered to a small speaker under the circuit board. A built-in key is included and an external key may be plugged into a board mounted jack. This feature allows two persons to practice together!

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.

Finishing The Breadboard

1.The wooden breadboard furnished with your kit is your opportunity to express yourself. You get to finish it any way that you like...pick your color, pick your finish. MAY WE SUGGEST THE FOLLOWING?

1. Use fine grit sand paper to remove any roughness from the wood. The four 1/4 inch sides will need some light sanding to remove some of the dark color left by the laser cut, especially if you are using a light color paint. Otherwise, several coats of paint may be used to cover well.

2. You can use brush on or spray paint or stain or no finish at all...it's up to you.

3. You are in charge of getting the board ready. Three coats with light sanding between coats and about 24 hours of drying time will produce great results.

4. When the board is finished, locate the circuit board and place it on top of the breadboard. Center the circuit board at the top of the board as shown and using a small nail, phillips screwdriver or other small pointed object, push a small starter hole into the breadboard at each corner mounting hole. Drill a hole with a 1/16th inch bit at each starter hole. The hole will be used to mount the assembled circuit board in the proper location at the end of the project. Place the breadboard aside for now.

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

Parts List

<u>1/8 watt resistors</u>

R1 1megohm

R2 470K ohm

R3 10K ohm potentiometer

R4 2.2k ohm

R5 100 ohm

R6 33K ohm

R7 10K ohm

R8 2.2K ohm

R9 220 ohm

Capacitors

C1 0.1 uf ceramic disc

C2 0.047 uf ceramic disc

C3 47 uf electrolytic

C4 0.01 uf ceramic disc

C5 0.01 uf ceramic disc

C6 0.047 uf ceramic disc

C7 0.022 uf ceramic disc

Other Parts

IC1 TL431

Q1 2N3904

SW1 SPDT slide switch

SW2 SPST momentary tactile switch

BP1 negative battery post

BP2 positive battery post

Speaker

4 wood screws

4 black spacers

5 rubber feet

wooden breadboard

circuit board

Hook-UP Wire

Brass strip

Building the Kit

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. Mount and solder R1, 1M ohm (brown, black, green) Save one of the cut leads to be use later.

2. Mount and solder R2, 470k ohm (yellow, violet, yellow)

3. Mount and solder R3, 10K ohm potentiometer. Make sure that mounting tabs are fully inserted in mounting holes.

4. Mount and solder R4, 2.2K ohm (red, red, red)

5. Mount and solder R5, 100 ohm (brown, black, brown)

6. Mount and solder R6, 33K ohm (orange, orange, orange)

7. Mount and solder R7, 10K ohm (brown, black, orange)

8. Mount and solder R8, 2.2K ohm (red, red, red)

9. Mount and solder R9, 220 ohm (red, red, brown)

10. Mount and solder C1, 0.1 uf. (104)

11. Mount and solder C2, 0.047 uf. (473)

12. Mount and solder C3, 47 uf. electrolytic

13. Mount and solder C4, 0.01 uf. (103)

14. Mount and solder C5, 0.01 uf. (103)

15. Mount and solder C6, 0.047 uf. (473)

16. Mount and solder C7, 0.22 uf. (223)

17. Mount and solder IC1, TL431 Flat side faces forward

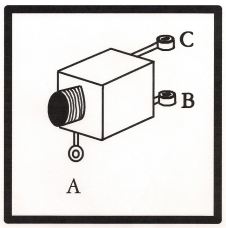
18. Mount and solder Q1, 2N3904 Flat side faces right

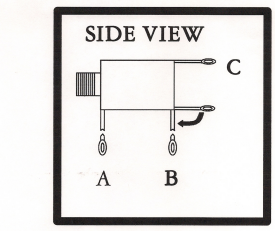
19. Mount and solder SW1 SPDT (may be a tight fit...make sure switch is all the way in)

20. Mount and solder SW2 Tactile switch (First straighten the mounting tabs. Place the tabs into the four mounting holes...when in correctly you should see the tabs from the front and rear of the circuit board.

21. Mount and solder BP1 and BP2 in the appropriate positions...negative has smaller round contact and positive has larger almost square shape.

22. Locate J1 a 1/8th inch phone jack and it's mounting position on the left edge of the circuit board. Refer to diagram 1 and modify the two lower soldering lugs to fit in the two mounting holes closest to the left side of the board. Bend the lower back lug (lug B) 90 degrees so that it points down like the front lug. Using diagonal cutters, clip off the ends of lugs A and B as close as possible to the soldering hole. The remaining lugs should be as long as possible so that they will fit through the mounting holes in the circuit board. Place J1 into position with lug A and B in the mounting holes and solder with J1 flush against the board. The lugs may need slight trimming with the diagonal cutters to fit the holes. Lug B may not come all the way through the hole, but a little extra solder to fill the hole will sufficiently hold it in place. Use one of the wire leads saved from step one to complete mounting J1. Pass one end of the wire through lug C of J1 and into the circuit board mounting hole. Secure the top end of the wire to lug C of J1 and solder in place. Solder the other end of the wire on the bottom of the board and clip the excess wire.





23. Cut two pieces of hook up wire each to 2 & 1/2 inches. Strip 1/4 inch of insulation from each end and lightly tin each end. Solder one end of each wire to the speaker solder tabs on the rear of the speaker. Solder the other ends to the two mounting holes located next to C1. Pass the wires through the bottom of the board and solder on the top of the board. The wires can be twisted by rotating the speaker several times.

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.

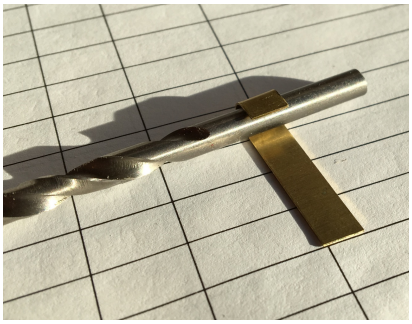
Final Assembly

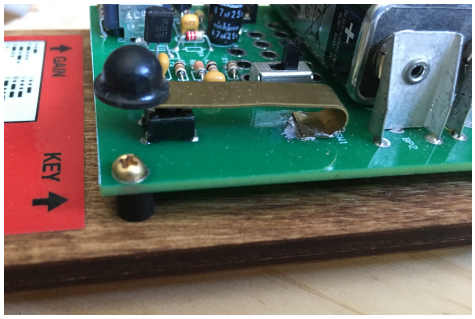
Mount the circuit board to the wooden breadboard with the black spacers and brass wood screws. Before securing all the way, place the speaker between the circuit board and the breadboard. The cone of the speaker must face up so that sound will pass through the 10 large holes near the center of the circuit board. The speaker is held in place by compression and magnetism when the wood screws are tightened.

The key is mounted to the circuit board. The finished key should just touch the button of SW4.

The key arm is supplied as a 1/4 by approximately 1 inch strip of sheet brass. The arm must be fashioned by making a 180 degree bend on one end using a 3/16th inch drill bit.

NOTE: It is important to make a nice round bend...this creates the “spring” action. Once fashioned, the short end is tined on the bottom side with solder. The via (hole) labeled KEY is also tinned with solder. Hold the Brass strip with needle nose pliers so that the tinned area makes contact with the tinned via and the long end is over the key switch SW4. Apply heat with your soldering iron to the top (un-tined) side of the brass strip in contact with the tined via. Allow the solder to melt and hold the brass strip steady as the heat is removed and the soldered connection is hard. Once in place, you may trim the other end of the brass and apply the black rubber finger knob.

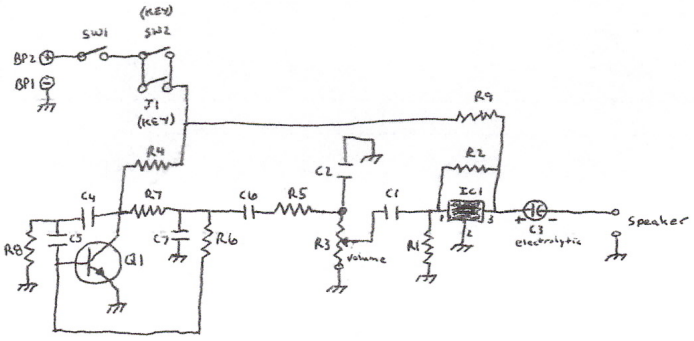




Peel and attach the sticker to the CPO base below the circuit board as shown. Apply four rubber feet to the bottom of the base. Connect a 9.0 volt alkaline battery to the CPO.

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



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by W4FSV