

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 or an external key may be plugged into a board mounted jack.

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

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.
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 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

1/8 watt resistors

- 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
2 machine screws
2 nylon washers
2 white spacers
4 black spacers
4 rubber feet
wooden breadboard
circuit board
knob
Hook-UP Wire

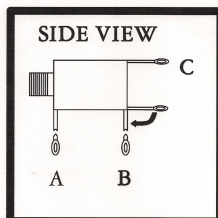
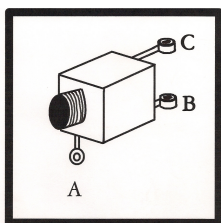
Building the Kit

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 its 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.



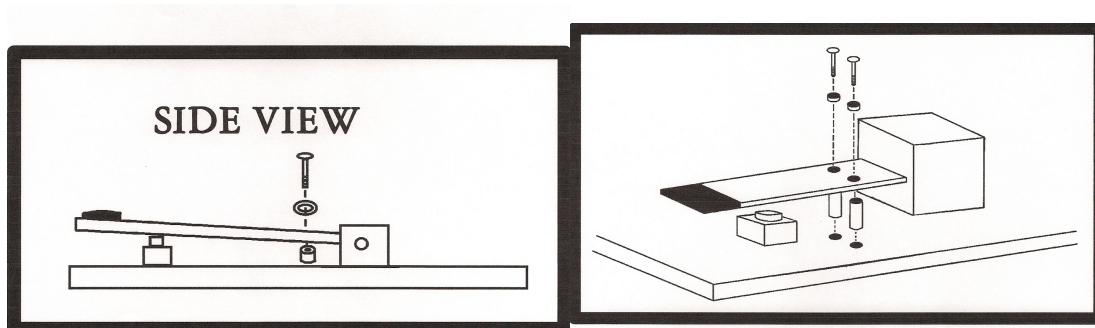
23. Cut two pieces of hook up wire each to 2 & 1/2 inches. Strip 1/4 inch of insulation from each end and lightly tin each end. Solder one end of each wire to the speaker solder tabs on the rear of the speaker. Solder the other ends to the two mounting holes located next to C1. Pass the wires through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

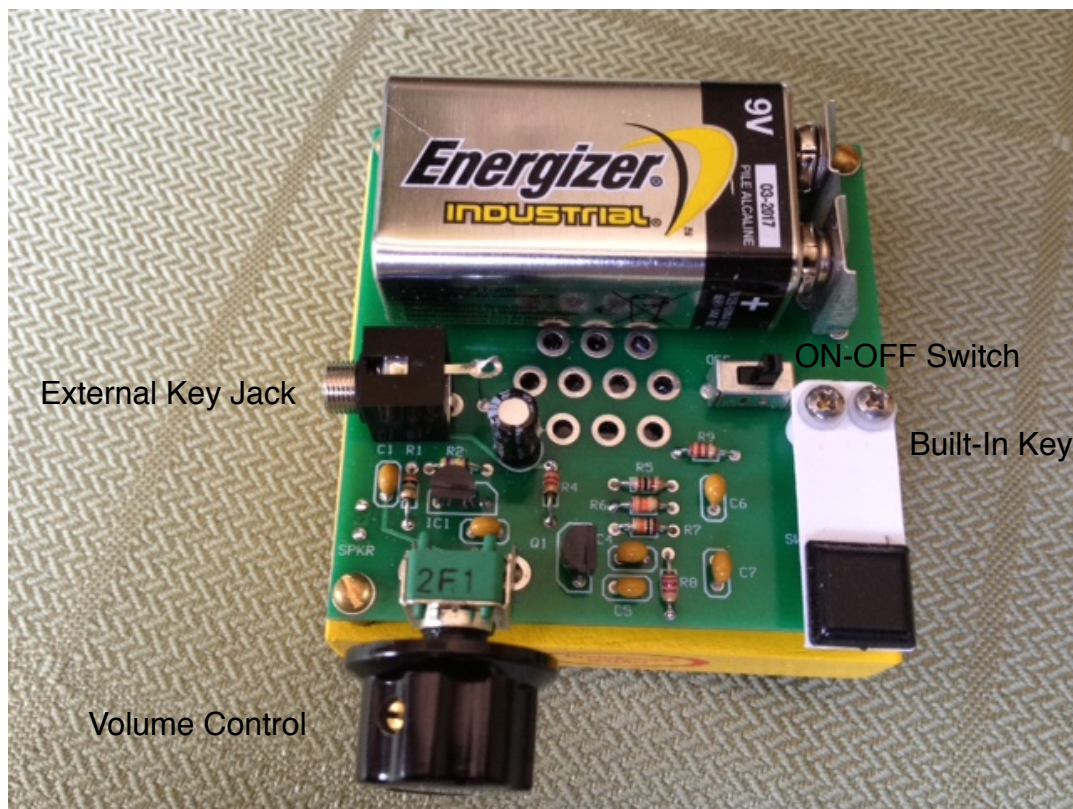
This completes construction of the circuit board. Inspect the board for proper parts placement. Make sure that solder connections are good and that there are no solder bridges.

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.

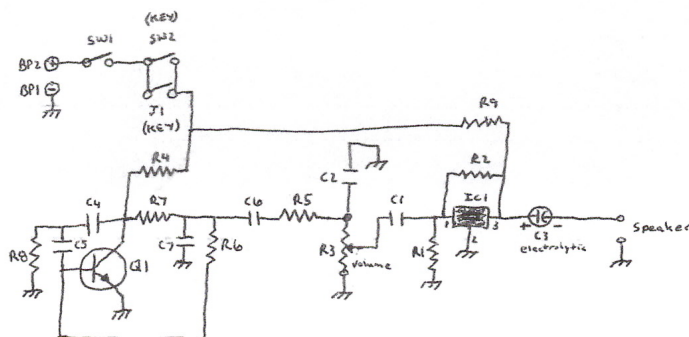
The key is mounted to the circuit board with two 1/2 inch #4-40 machine bolts and white 3/8th inch white plastic spacers. The bolts will self tap into the holes...be careful not to over tighten and strip the holes. The bolts should just protrude from the bottom of the board. Should the holes become stripped, heat the hole with a soldering iron and melt a small amount of solder in the hole. The solder will narrow the hole diameter to allow the bolt to re-tap. The key is supplied pre-drilled, but may require some fit adjusting. The mounting holes may need to be slightly enlarged with a small rat tail file or xacto blade tool. The finished key should just touch the button of SW4. You may clean-up the edges of the key with light sand paper. When satisfied, place the black square rubber stick-on bumper on the end of the key to serve as a finger riser (knob). SEE DETAIL.





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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