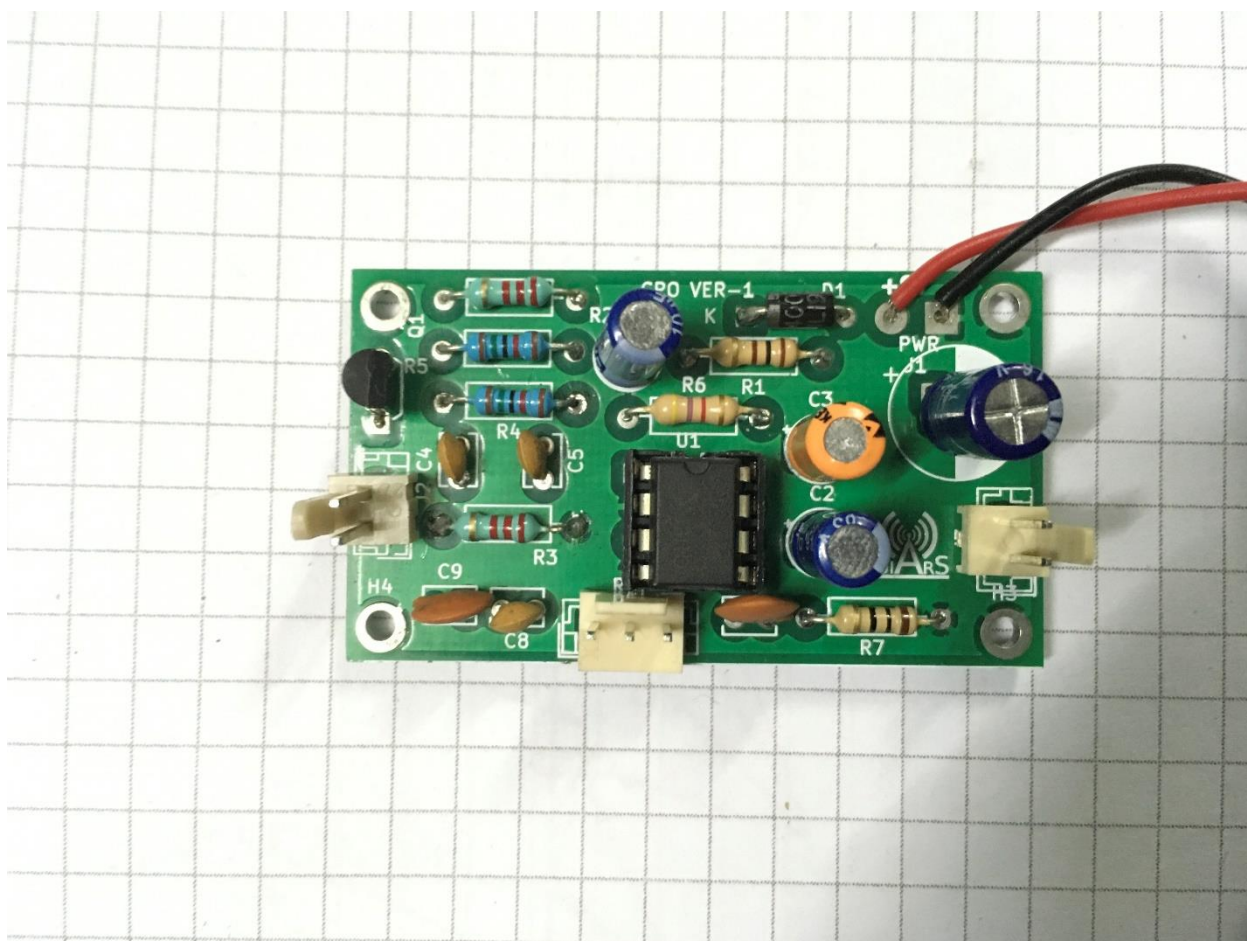


# SIARS CPO KIT

## Assembly Instructions



PCB and Kitting by: Sinosh, VU2LN  
Assembly Manual by: Ragav, VU3VWR  
(for South India Amateur Radio Society)



Welcome to the wonderful world of electronics and amateur radio!

This kit was intended to give beginners a hands-on experience with building electronic circuits, which is meant to support the electronics theory that was covered during your ASOC classes.

Please read the entire manual once before proceeding to build the circuit. Some components require proper orientation and placement to get them to work; getting them wrong will damage the part and cause headaches later!

It is important to know how to solder electronic components to complete this project successfully; There are plenty of youtube tutorials on soldering through hole components , it is highly recommended that the builder watches them multiple times to understand how to solder on a PCB.

### **I.Parts Inventory:**

Please open the plastic bags only when needed to prevent losing the components. It is advisable to use a small plastic or metal box when sorting the components to keep them safe.

It is always a good practice to proceed with an inventory check before starting the project. Please mark the components in the bag against the list; if there are any missing components, please get in touch with us.

#### **Resistors:** (7 Fixed and 1 Variable)

- R1**100E 1/4W 1pc
- R2, R3** 2K2 1/4W 2pc
- R4, R5** 15K 1/4W 2 pc
- R6** 4K7 1/4W 1pc
- R7** 10E 1/4W 1pc
- RV1** 100K Variable Resistor 1pc

#### **Capacitors:** (4 Electrolytic and 5 Non electrolytic)

- C1, C2** 10uF, 63V 2pc
- C3** 4.7uF, 63V 1pc
- C4, C5, C8** 0.022uF [22nF] Ceramic Disc (223) 3pc
- C6** 220uF, 16V 1pc
- C7, C9** 0.047uF [47nF] Ceramic Disc (473) 2pc

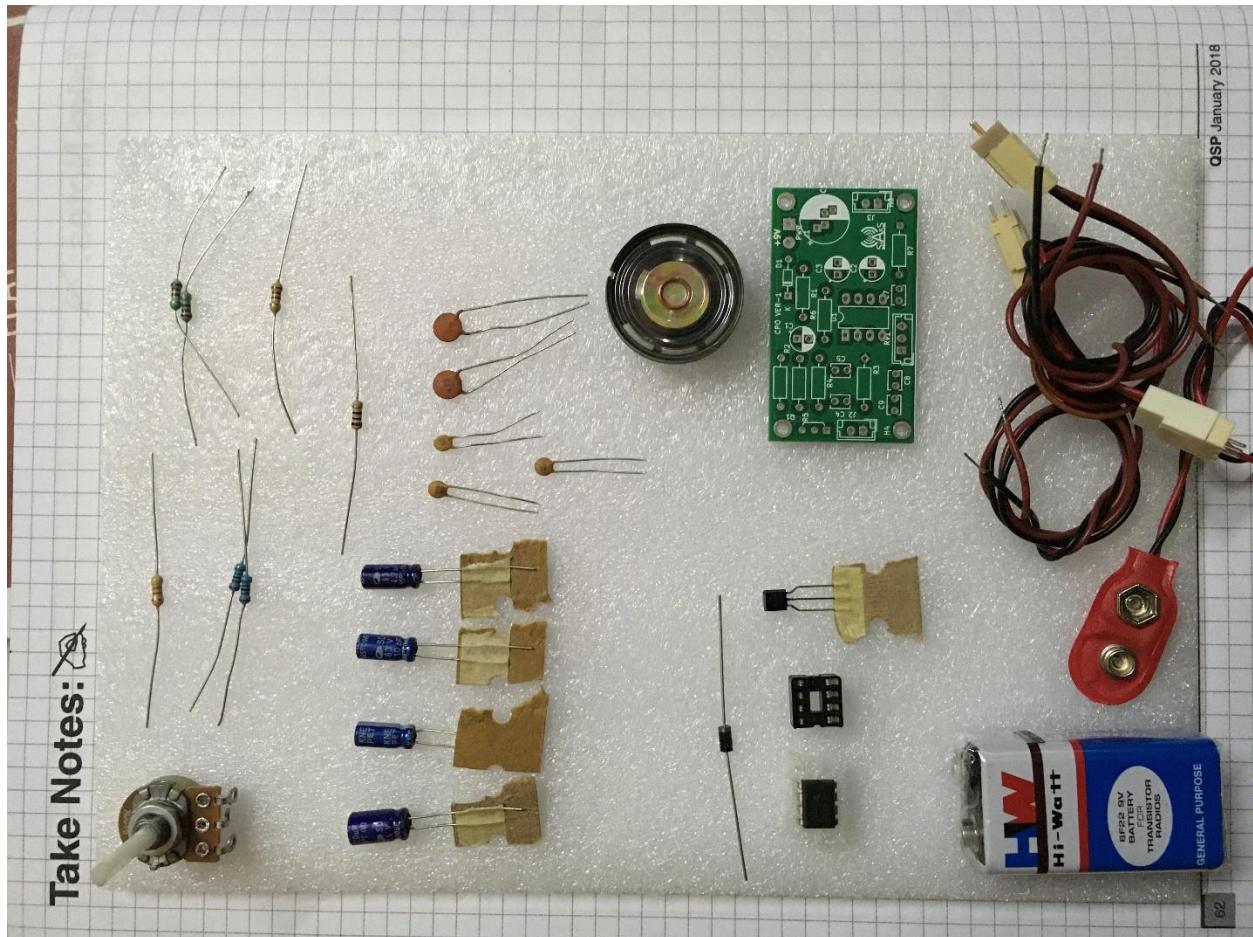
#### **Semiconductors:** (1 Diode, 1 Transistor, and 1 Integrated Circuit with base)

- D1** 1N4007 rectifier Diode 1pc
- Q1** 2N2222A NPN Transistor 1pc
- U1** LM386N Audio Amplifier IC 1pc



Hardware: (3 Connectors, 1 9V Battery and Battery snap, 1 8 Ohm Speaker, 1 PCB)

- J2, J3** 2 Pin RMC Connector and wire 2pc
- RV1** 3 Pin RMC Connector and wire 1 pc
- 8 Ohm Speaker 1pc
- 9V Battery connector 1pc
- 9V Battery 1pc
- CPO Printed Circuit Board 1pc



Tools Needed:

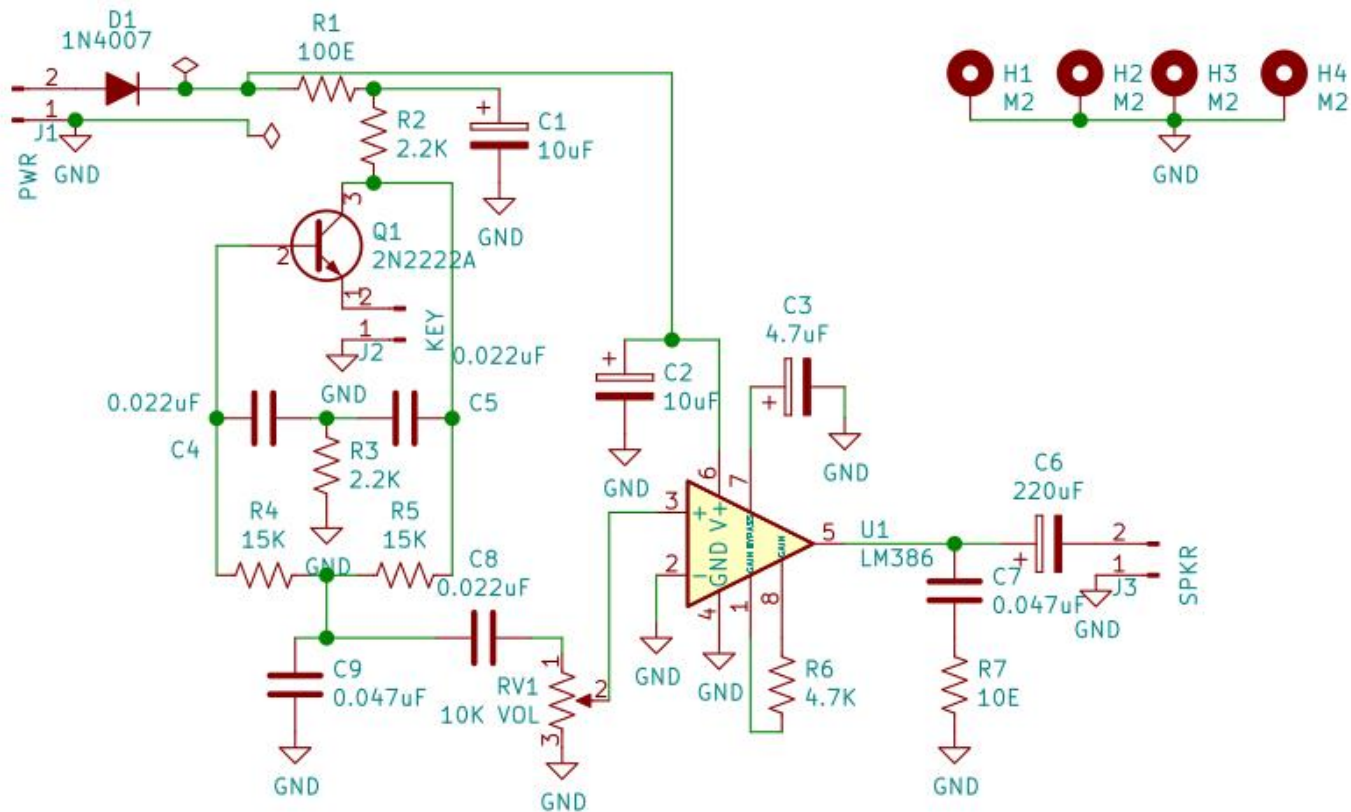
- 25-35 W Soldering Iron
- 60/40 Soldering lead
- Component lead cutters or nail cutter
- Digital Multimeter

Optional:

Plastic box for enclosure

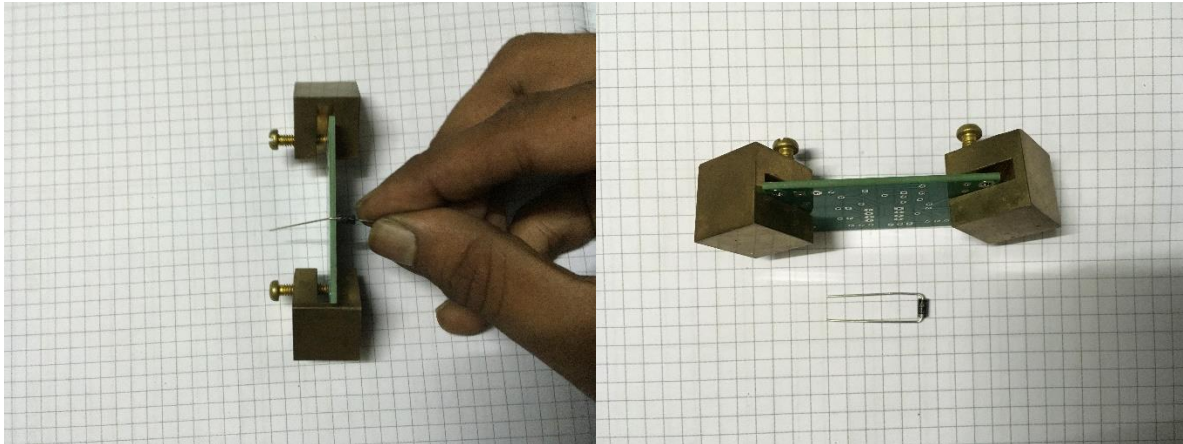
3.5mm Stereo jack and plug

Hot glue gun or 5 Minute Epoxy (Araldite Quick)

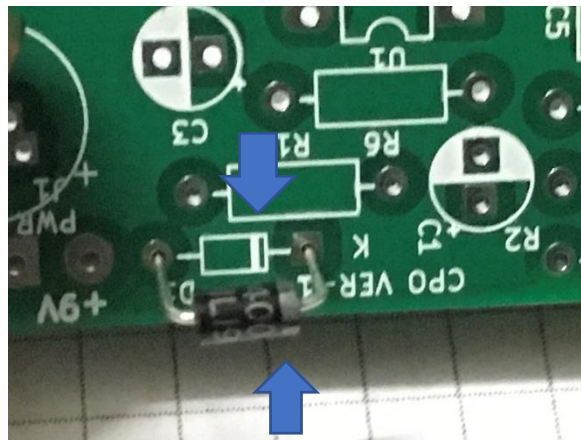


## II. Assembly and testing:

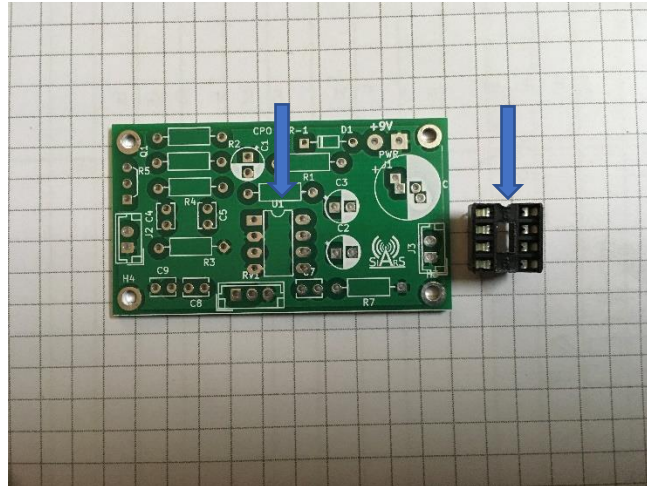
Tip: Before installing axial components like resistors, use the PCB to bend the leads so that the component fits properly, and the end result looks neat



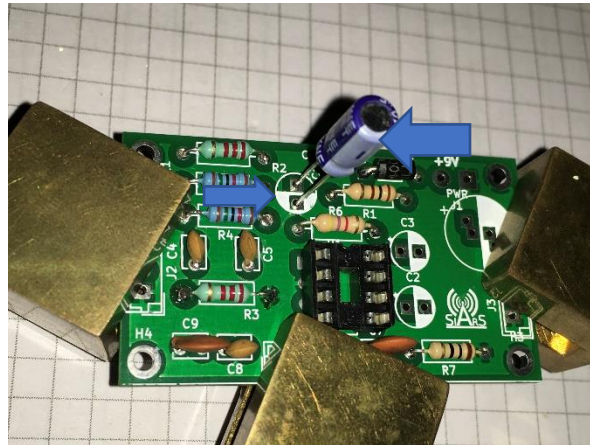
- Install Diode D1. Pay attention to the polarity of the diode; the band on the diode should align with the band on the PCB



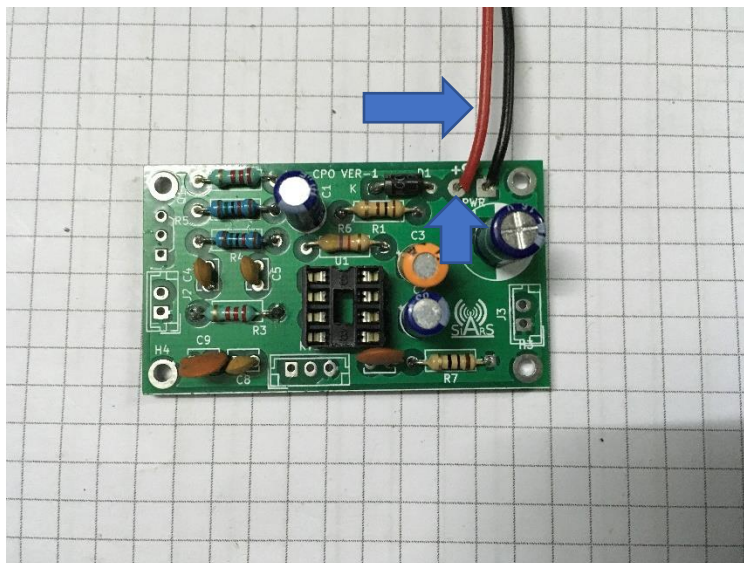
- Install Resistors R1 - R7 after double checking the values on the multimeter.
- Install the non-electrolytic Capacitors C4, C5, C7, C8, C9 after double checking the values
- Install IC base, aligning notch in base with PCB marking



- Install Electrolytic capacitors C1, C2, C3, C6. Pay attention to the polarity of the capacitors; the positive and negative terminals marked on the capacitor should match the marking on the PCB

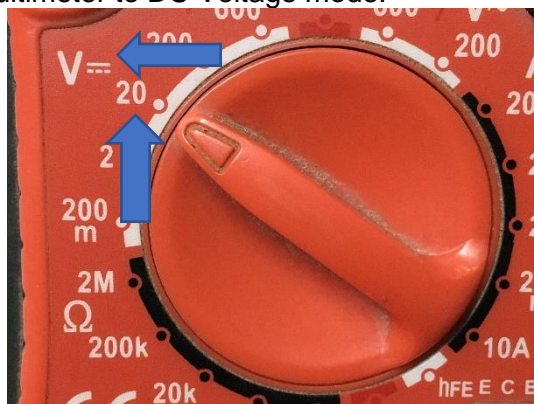


- Install Power lead with the battery connector; Remember, Red is positive and black is negative



- Install the 2 Pin male header connectors J3 and the 3 Pin header to RV1

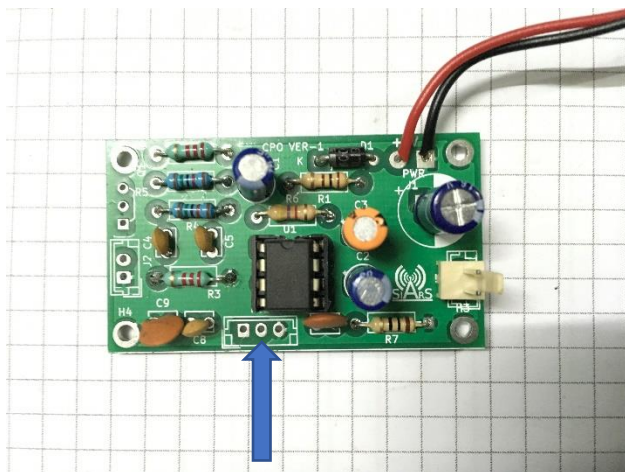
Time for a power on test; Power up the circuit by attaching the battery snap to the battery terminals. Switch on the multimeter to DC Voltage mode.



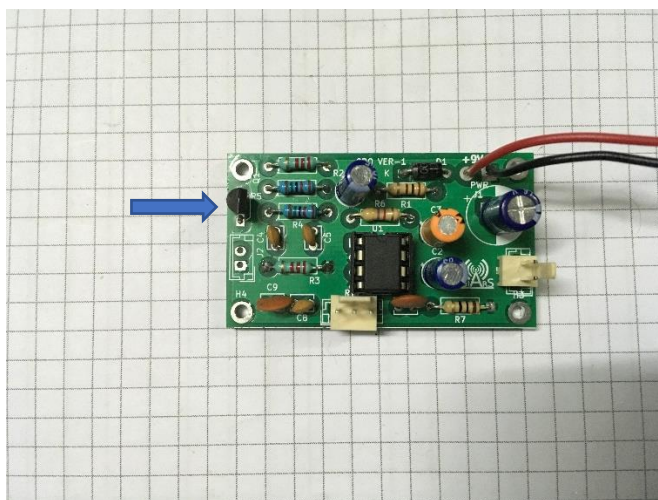
Verify the voltages given below against the test points by touching them with the red lead while the black lead is touching one of the screw mounting holes.  
Make a note of your voltage readings here:







- Install Transistor Q1, paying attention to match its orientation with the marking on the PCB; the flat side of the device should be facing the rest of the PCB. Semiconductors are sensitive devices and should not be subjected to prolonged heating for more than 2-3 seconds per lead!



- Solder the three-wire connector to the variable resistor; the center wire goes to the center terminal. The other two wires can be connected in any way for now; Connect RV1 to the PCB by plugging it in.

Plug in the speaker, variable resistor and the battery. Touch the leftmost pin of the variable resistor to produce a “click” sound on the speaker, by adjusting the rotation of the variable resistor the volume of the click sound should increase and decrease; if the volume control is working in the wrong direction, reverse the two outer wires.

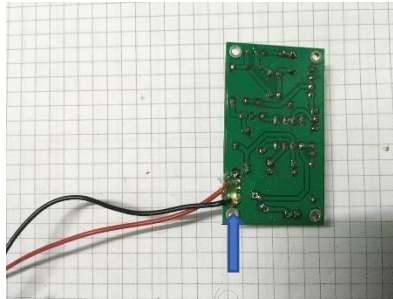
- Connect J2 to your Morse Key. Keying down should produce a tone on the speaker.

**Congrats, your Code Practice Oscillator is now ready for action!**



### III. Finishing up and final touches:

Use hot glue or 5-minute epoxy to glue down the power wire to the PCB and the speaker wire to the speaker.



A 3.5mm Stereo Plug and jack can be installed on the Morse key connection, for ease of access

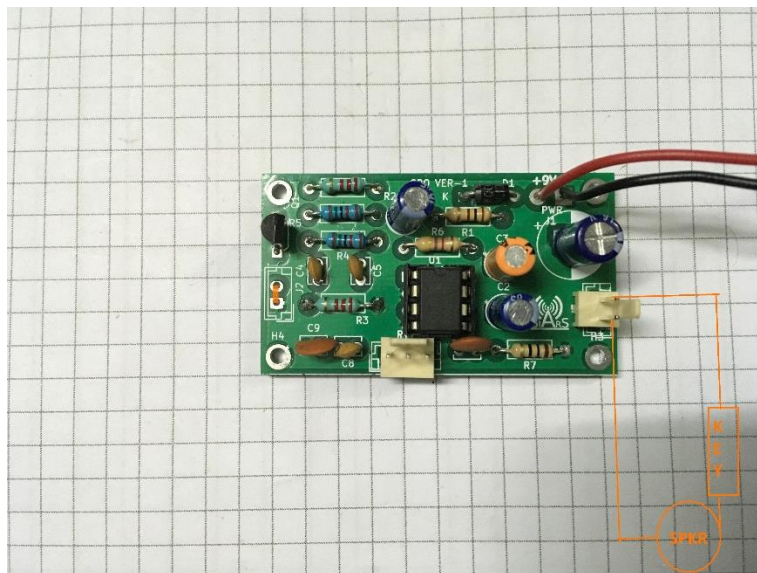
You can put up this circuit and the battery inside an old plastic soap box or snack box.

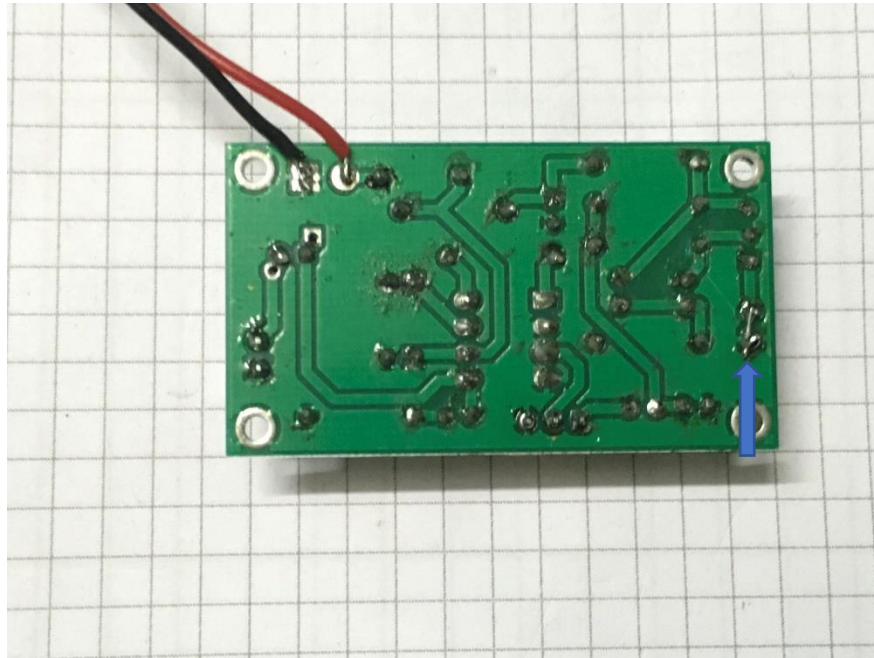
The excess plastic shaft of the potentiometer can be cut carefully with a fine-tooth hacksaw to fit a suitable knob.

### IV. Modifications:

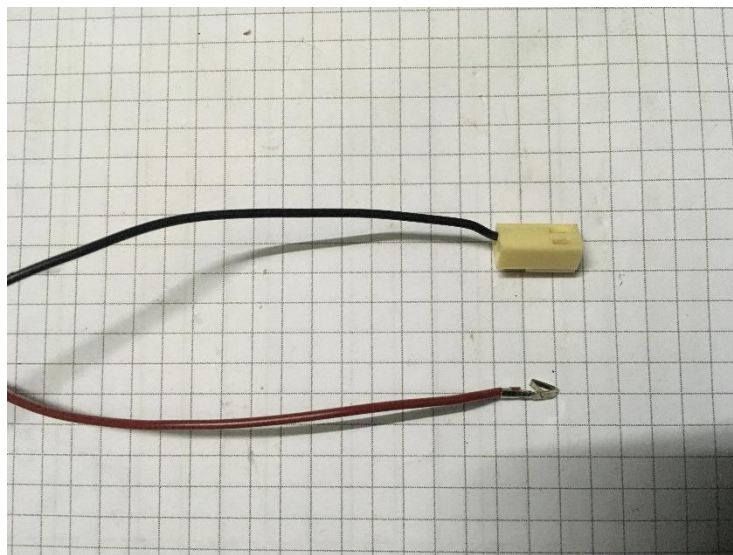
If a loud, thumping noise or a shift in the tone frequency is heard, modify the circuit by shorting the two leads of connector J2 and by removing one wire of the speaker and connecting it to one of the terminals of the Morse key. Run a small length of wire (from the unused original key connector) from the other terminal of the key to the speaker.

By performing this modification, we are leaving the oscillator and the amplifier constantly running and keying the speaker output. This results in reduced frequency shift in the tone and removes the thumping noise from the speaker.

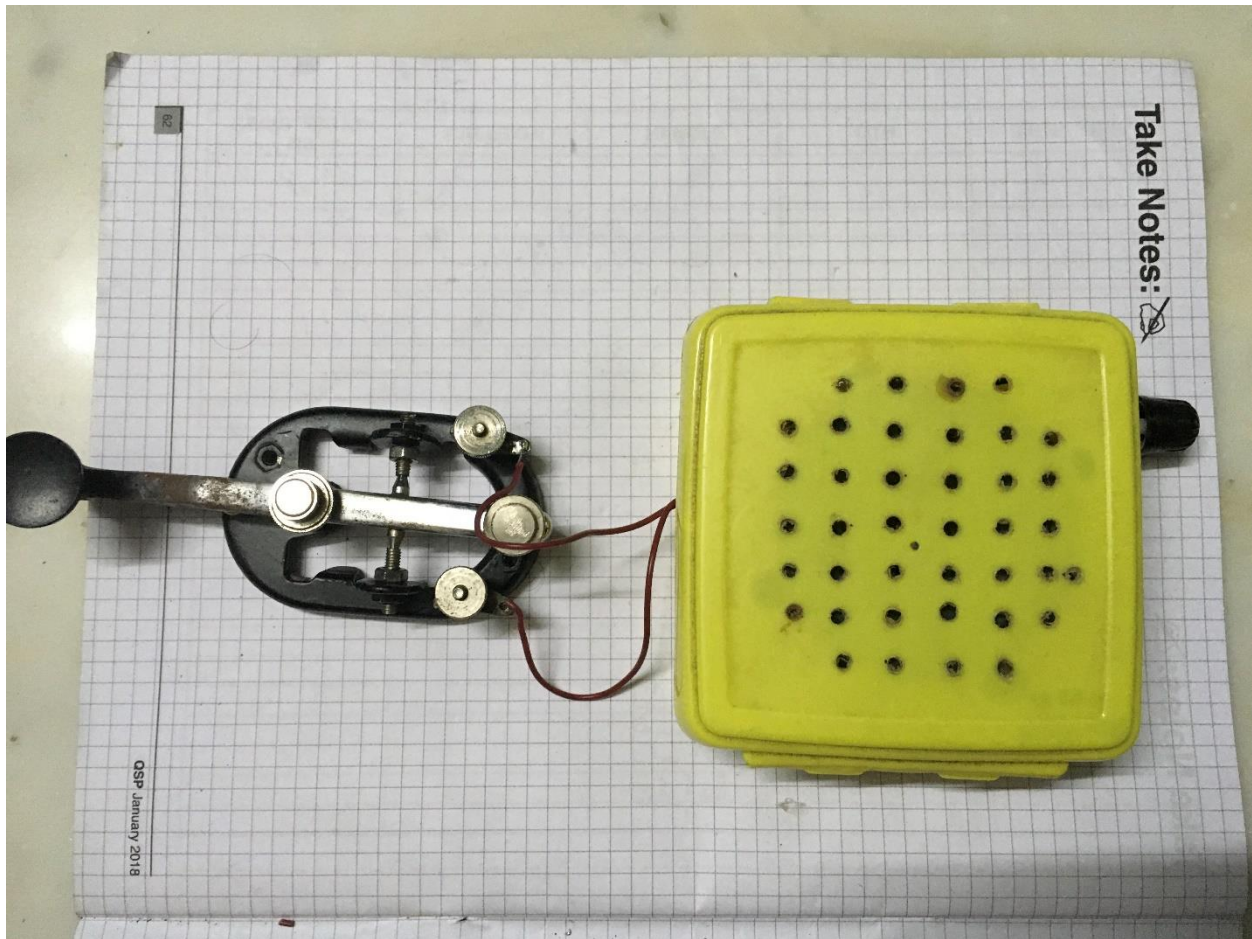




J2 is shorted using a small length of discarded component lead



The wire from the unused morse key connector can be attached to the key and speaker



Finished CPO housed in a plastic snack box. Builders can encouraged to find creative solutions for mounting the CPO.