



**The Visionary
Sound
Company**

(a.k.a. neat gizmos for hum heads!)

Instructions for building the ClipCop using the new Circuit Board V3.2

The new circuit board is slightly smaller than the generic Radio Shack circuit board as published in the *Live Sound International* articles. However, it's smaller size belies the fact that it makes the ClipCop a lot easier and a lot quicker to construct. Below are the instructions for using the new board as part of a complete kit. If you have only purchased the partial kit which includes just the new board, predrilled case and pre-cut label, you will need to source the rest of the components yourself. See [ClipCop Components and Sources](#).

Getting Everything Together

Tools Needed

The minimum tools you will need to construct this kit are as follows. I have included the Radio Shack catalogue number if you do not have anything similar.

- 15 Watt Soldering Iron with a small pointed grounded tip (64-2051)
- Thin (.032") Multicore Solder (64-005)
- Small Pair of Flush Cutting Side Cutters (64-1833)
- Small Pair of Needle Nose Pliers (64-2033)
- Small Pair of Wire Strippers (64-2129)
- Small Cross Head & Flat Head Screwdriver (64-1950)
- Scotch Tape or Gaffers Tape
- Multi-Meter preferably with Frequency measurement

Kit Components & Parts

Check that you have all the following components and identify each one. **DO NOT** take the Integrated Circuit chips off of their protective conductive foam. They will be safer if left in the foam until you need to insert them into the IC sockets in the final stages of the construction process.

Integrated Circuits	
IC1	TL061
IC2	LT1037
IC3	SSM2142
Resistors	
R1 & 2	4.7Mohm (Yellow/Violet/Green + Gold on Beige Background)
R3	3.09Kohm (Orange/Black/White/Brown + Brown on Blue Background)
R4	261ohm (Red/Blue/Brown/Black + Brown on Blue Background)
R5	365ohm (Orange/Blue/Green/Black + Brown on Blue Background)
R6	100ohm (Brown/Black/Black/Black + Brown on Blue Background)
Variable Resistors	
VR1&2	200ohm 3/8" Square Trimmer
Capacitors	
C1 to 6	0.1uF Monolithic Protection Capacitor
C7&8	1.0uF 50V Bi-Polar Electrolytic Capacitor
Diodes & Lamps	
D1	1N914
LED1	Green low-current LED
Lamp 1	#327 Incandescent Bulb
Hardware	
1	Pre Drilled Case with Battery Clip and 4 Screws
1	Pre-cut Label Insert
1	2" Piezo Horn
1	Custom Printed Circuit Board V3,2
3	8 Pin DIP Dual wiper IC Sockets
SW2	Black Switch on-(on) Momentary Action with Locking Nut
SW1	Black Switch on-on Latching Action with Locking Nut
1	Black LED holder with locking ring
2	Panel Mount Male XLR Connector
1	Panel Mount Female XLR Connector

11	Black Philips Pan Head bolts
10	Self Locking Nuts
1 Foot	Multicolored ribbon cable
1	Small Piece of Non-Slip Matting

Soldering the Components to the Circuit Board

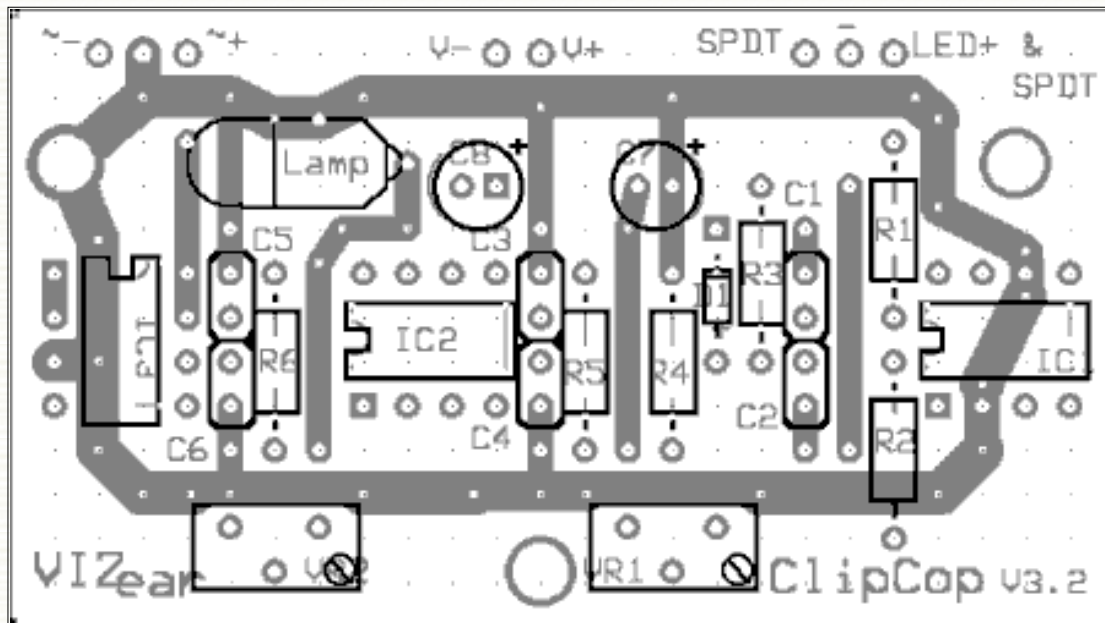


Figure 1 - Component Layout on Top of Circuit Board.

All the components are mounted on the top of the circuit board (the side with the writing) as in *figure 1* and soldered on the underneath side of the board. They should be soldered to the circuit board in the order listed below. This allows them to be held firm by the non-slip pad while soldering. After completing each group of components, all excess leads (including IC sockets legs) should be cut off flush with the circuit board. The less that sticks up, the less likely it will short the Piezo Horn when assembled.

- Resistors and Diode
- IC Sockets
- Small Protection Capacitors
- Bi-Polar Electrolytic Capacitors and Trimmers
- Lamp
- Hook-up wire

For those of you who are unaccustomed to soldering circuit boards this small, the following advice may

be of help. [Advice on Soldering Small Circuits Boards](#)

Resistors & Diodes

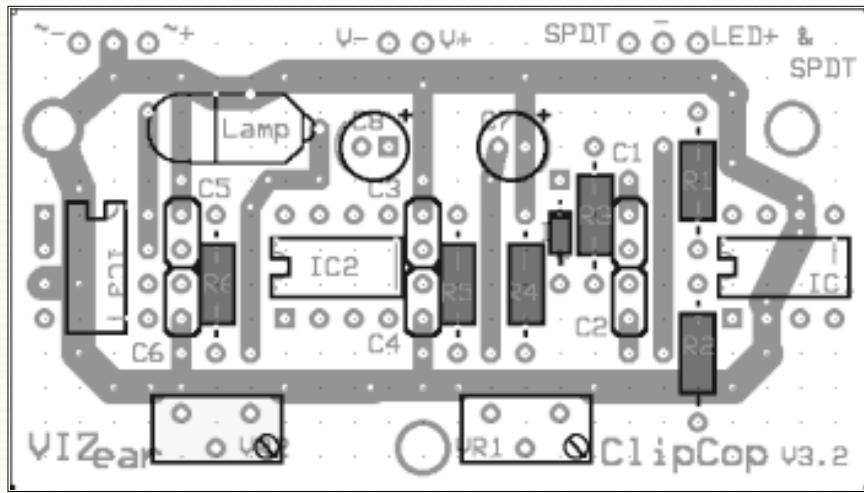


Figure 2 - Resistors & Diode Placement

The resistor leads first need to be bent to fit the hole spacing in the circuit board. This is easily accomplished using one of the IC Sockets as a form. Lay the body of the resistor long-ways between the two rows of legs on the IC Socket. You will see that the resistor body fits into the space quite conveniently. Make sure that the resistor is centered between each end. Now bend the resistors leads down over the end of the IC Socket so that they form a right angle. They should now be perfectly spaced to fit into the circuit board.

The Diode is much smaller and needs to be bent in a slightly different way. Lay it long-ways between the two rows of legs of the IC Socket as you did with the resistor. Now slide it hard up against one of the ends and just bend that one lead down over the end of the socket at right angles. Remove the Diode and turn it round. Now insert the bent leg through the tiny rectangular hole in the IC Socket and lay the rest of the Diode long-ways between the legs of the IC Socket. Push the body of the Diode hard up against the opposite end of the IC Socket and bend the remaining leg. This should now fit the Diode hole spacing in the circuit board.

It doesn't matter which way round the resistors are mounted as long as they are mounted in their correct holes. You will see that the labels R1 through R6 are plated onto the board. Consult the diagram above if you are still unsure. Match the correct color-coding (see table above) with the correct R number, insert their legs through the relevant holes and push them all the way down so that they cover up the plated R number label.

Do the same with the Diode but remember that the dark band on the Diode should be the end furthest from the plated label + (positive) mark on the circuit board.

Cover the component side of the circuit board with the non-slip matting, invert the board and put it down onto your work surface where you are going to solder it. The matting keeps the components from slipping out when you turn the circuit board over as well as stopping the board from sliding round when soldering it.

Solder (Don't weld!) the resistor and Diode leads to the circuit board and trim off the excess leads.

IC Sockets

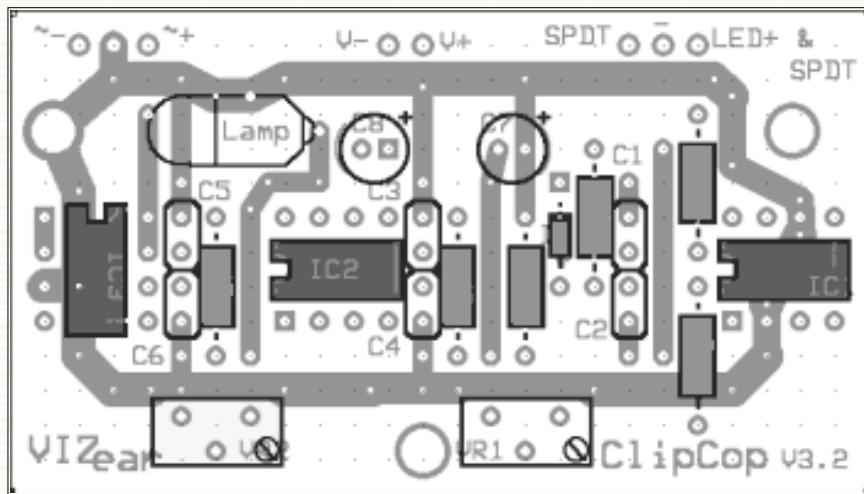


Figure 3 - IC Socket Placement

Next, insert the three IC Sockets into their respective holes on the top of the circuit board. Make sure that the notch is oriented in the correct direction as indicated in *figure 1* and on the plating of the board.

Cover the component side of the circuit board with the non-slip matting, invert the board and put it down onto your work surface where you are going to solder it. The matting keeps the components from slipping out when you turn the circuit board over as well as stopping the board from sliding round when soldering it.

Solder all the legs to their respective pads, and then trim off the excess legs that are sticking up. Inspect all the legs very carefully as it is very easy to miss soldering one!

Small Protection Capacitors

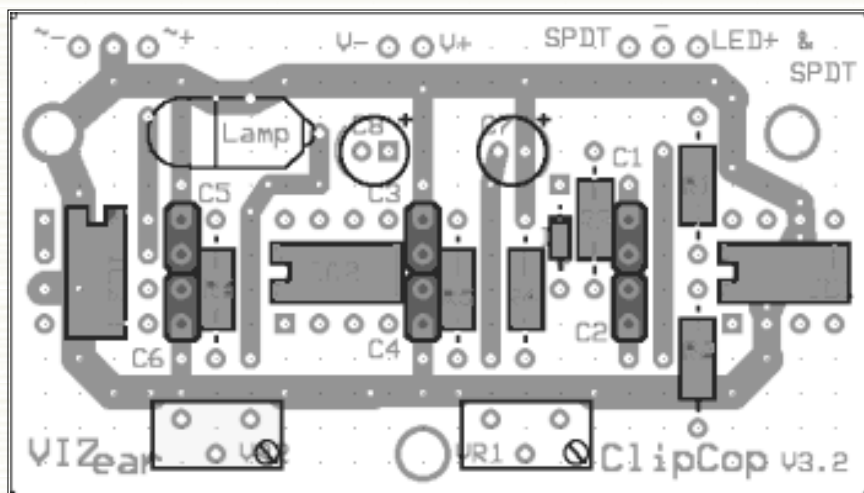


Figure 4 - Protection Capacitors Placement

The next components to mount onto the circuit board are the 6 small protection capacitors. These

actually come in two slightly different types. Some come with their leads spaced 1/10" apart and others come with their leads spaced 2/10" apart. The protection capacitors shown in Figure 1 are of the 1/10" spacing type. However, you will see that the circuit board has additional holes to accommodate the 2/10" spacing types also. Determine which ones you have by seeing which holes they fit and insert all six of them.

As previously, cover over the component side of the circuit board with the non-slip matting, invert the board and solder the protection capacitor leads to the circuit board. Trim off the excess leads flush with the circuit board.

Bi-Polar Electrolytic Capacitors and Trimmers

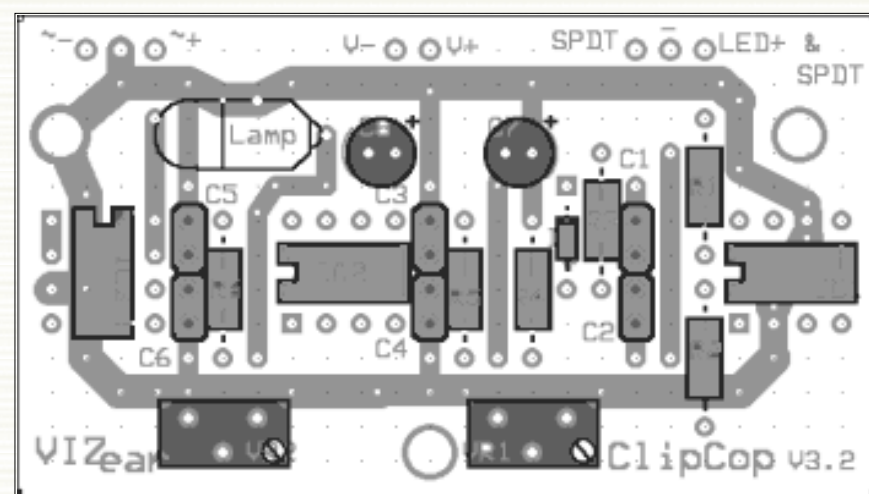


Figure 5 - Bi-Polar Electrolytic Capacitors and Trimmers Placement.

Mounting the two bi-polar electrolytic capacitors and the two trimmers has to be done quite accurately as they essentially become the 'feet' that the circuit board sits on when mounted inside the ClipCop. It is essential that they sit flush up against the circuit board. It is also essential that the two trimmers are squarely placed on the board, and not rotated in any way, as their screw head will eventually need to poke through two tiny holes in the case. The best way of accomplishing this is to insert the components, cover and invert them as previously described. However before you solder their leads, get down and visually inspect them to make sure that nothing got moved in the inversion process. Adjust as necessary, solder and trim.

Lamp

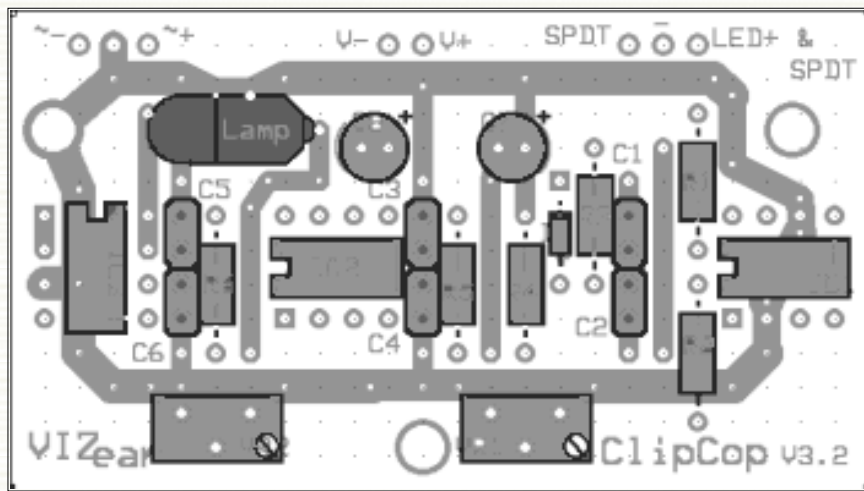


Figure 6 - Lamp Placement

The final component, the lamp, will need preparing before it can be soldered to the circuit board. If you look carefully at the shaft of the bulb you will see a little part that has already been tinned with solder. Using your snipe nose pliers to hold one of the discarded leads from the components we have already mounted, lay the end of the lead across this little tinned part and solder. Next solder another discarded component lead to the end of the bulb making sure that they are oriented in the same direction. *Figure 6a* shows the how the leads should be soldered to the bulb. Make sure that you have not made the mirror image of *Figure 6a* as the bulb will only mount in the circuit board if it looks exactly like the diagram.

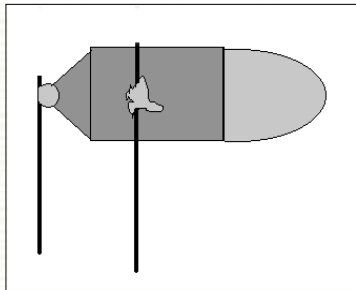


Figure 6a - Lamp with leads soldered on

Once you have prepared the bulb you can mount it to the circuit board as shown in *Figure 6*.

Hook-up Wire

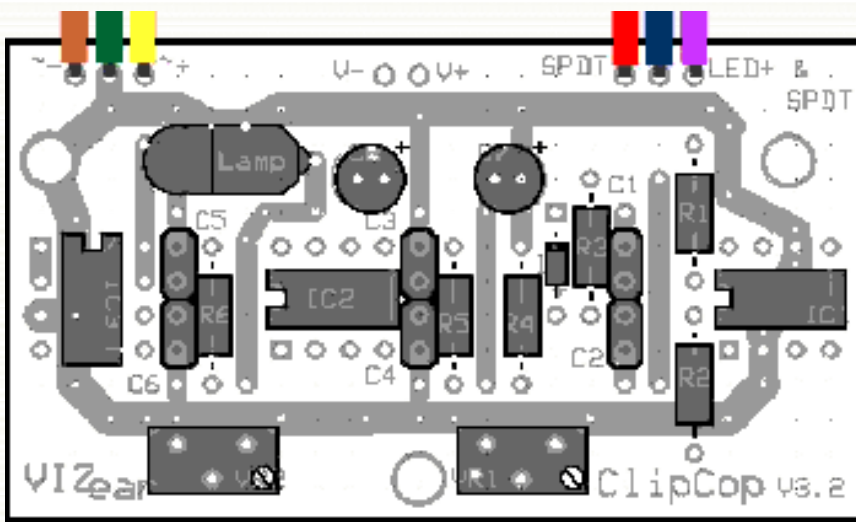


Figure 7 - Hook-up wire placement

Finally, you will need to pull apart the ribbon cable into its individual colored wires. Strip the ends of the colors as shown in the diagram and table below and insert them into the component side of the circuit board. Solder them on the underneath as we have previously done. Make sure no stray wisps of wire are exposed on the top side of the board as they are likely to short out and cause a problem

The battery leads will get soldered to the final two holes marked V- & V+ when we come to mount the circuit board inside the case.

Because the way colors sometimes display are subject to your monitor settings, I have included a table below which identifies which color should go to which connection.

~ - Cold Oscillator Output	Orange
Top Ground Buss	Green
~ + Hot Oscillator Output	Yellow
SPDT	Red
- (Middle)	Blue
LED+ & SPDT	Violet

Mounting the Hardware on the Case

Mounting the XLR Connectors

Using the bolts and nuts provided, the three XLR connectors are mounted in the three holes on the rear half of the case with the two Male XLRs mounted each side and the Female XLR in the center. They are mounted on the inside with the flange poking through the hole. Although this leaves less space inside to fit everything in, it does look a lot more professional than mounting them from the outside. They should all be oriented with pins 1 & 2 furthest away from the battery compartment.

The locking nuts take a bit of fiddling to get them on. The nylon end goes on first. Try and grab them with the snipe nose pliers and then screw them from the other side. The benefit of using locking nuts is that the ClipCop should never fall apart due to vibration as experienced on arduous tours!

Mounting the Hardware on the Front Half of the Case.

First lay the plastic label insert into the recessed part on the front of the case. Now insert the LED clip through the small center hole at the top of the case. Next insert the Green LED through the clip from the back pushing it all the way until it clicks firmly into the socket. Be careful not to bend the legs. The whole thing should now quite happily remain in place.

Unscrew the locking nut from each switch and mount them in an 'up down' orientation through the holes on the front plastic label insert and case either side of the LED. The momentary action switch should mount in the hole labeled 'TEST' with the switch paddle normally up (away from the 'TEST' label). The regular action switch mounts in the other hole marked 'ON/OFF'. Tighten each locking nut enough to hold the switch firm but not so tight as to start buckling the plastic label insert.

Lastly, mount the piezo horn from the front in the large hole with four of the remaining self locking nuts and bolts. As with the switches, don't over tighten the bolts so that the plastic label insert starts buckling. It doesn't matter which way the solder lugs on the piezo horn are pointing.

Installing the Circuit Board

We still haven't reached the stage where we need to install the IC chips into the sockets so leave them in their protective foam. We will install the chips, and connect the battery clip, once we have wired everything else up.

Before we install the circuit board we will need to prepare the center mounting post by the battery compartment in the bottom half of the case. Take your cross head screwdriver and insert it into the hole in the post and turn it back and forth. What we are trying to do is chamfer the end of the hole slightly so that it is easier to screw the screw in. Now using the last bolt, try and screw it all the way into the post. We are actually tapping a thread into this hole.

Once this is done remove the bolt and lay the circuit board face down in the bottom half of the case so that the trimmer screw heads protrude through the two tiny holes in the case, and the hole in the circuit board lines up with the post we have just tapped. Now screw the bolt in again to secure the board. It doesn't have to be tight, it just has to hold it in position. It's the piezo horn on the other part of the case that keeps the board pressed up tight against the trimmer holes.

Wiring Everything Together

Wiring everything together is simplicity itself. Just follow the diagram below.

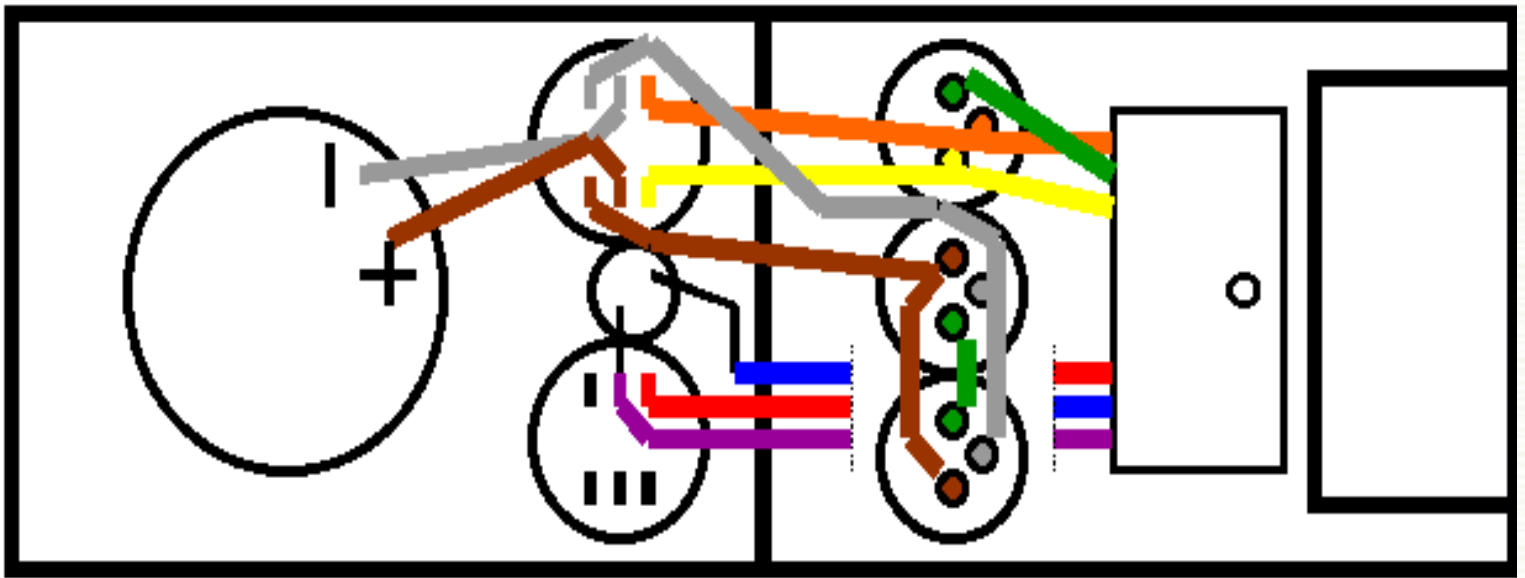


Figure 8 - ClipCop Hook up diagram

If you place the separate halves of the case as in the diagram, you can scotch tape them together to stop them moving around independently. This will make the hook-up process much easier.

Place the LED clip locking ring on the back of the LED clip before you bend and solder the leads. The longer of the two LED leads (Anode) is bent over and soldered to the same lug of the ON/OFF switch as the violet wire. The shorter of the two LED leads (Cathode) is bent down and out of the way and soldered to the blue wire. Note that the blue, red, and violet wires are actually continuous. They have been separated in the diagram for ease of viewing.

Try and make the wiring as neat as possible. Neat wiring is the one thing that separates pro-gear from amateur projects. I like to twist or braid (plat) the different groups of wires into looms. This also cuts down on RF interference.

Once everything is hooked up, unscrew the circuit board and solder the battery clip leads to the board. This is done at this final stage as you will have to feed the battery clip leads through one of the holes in the battery compartment. The Red battery clip lead goes to the V+ pad on the circuit board and the Black battery clip lead goes to the V- pad.

Now comes the part you have been longing for! Insert the IC's into their sockets making sure that the notch is oriented in the correct direction. GROUND YOURSELF FIRST so that you are not carrying any static electricity. Static kills chips!

IC1	TL061
IC2	LT1037
IC3	SSM2142

Sometimes you have to bend the legs in slightly to get them to line up. The easiest way is to gently push one row of the chips legs down sideways on a hard surface.

Before you put the two halves of the case together you need to protect the back of the circuit board from the terminals on the back of the piezo horn. Take the non-slip matting and fold it so that it is twice as thick. Now scotch tape (gaffer tape) it over the back of the piezo horn so that it covers the terminals. This should stop the circuit board and the piezo horn making electrical contact while providing

cushioning to hold the circuit board against the back of the case.

Finally put the two halves of the case together making sure that you have not trapped any of the wires (watch out for the floating LED cathode lead) and screw it together.

Testing and Calibrating

Connect a 9V battery and turn on. The Green LED should light up. Hold down the test button and you should be able to hear a tone. Don't worry, it may be quite nasty!

To calibrate the unit put a A/C voltmeter across pins two and three of the left most male XLR when looking at the back. This XLR is the oscillator out. Adjust the left-hand trimmer until the voltage reads about 1.2V. Turn the meter to read frequency and adjust the right-hand trimmer until it reads nearly 440Hz.

The left-hand trimmer is your dB adjustment and the right-hand trimmer is your Hz adjustment. An easy way to remember this is that 'dB Hurts!'.

Both trimmers slightly affect each other so you will need to repeat this process until the voltage reads 1.23V and the frequency is 440Hz.

If you do not have a meter that can read frequency do not despair! Find a piano and play middle A (the A below middle C). Hold the ClipCop up to your ear and hold down the test button to hear the tone. Adjust the right trimmer until the tone and the piano sound the same.

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