

TAIT RADIOS - HAND-HELD MICROPHONE MODIFICATION

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Purpose

The original dynamic inserts in the hand-held Tait's are renowned for losing their sensitivity with age resulting in poor modulation depth on transmission and this project will restore clarity and power.

How it works

The proposed modification replaces the dynamic insert with a matching-size homebrew module containing:

- an electret microphone insert, buffer amplifier
- An optional stabilised power supply - taking advantage of the main 13.8 supply rail being available on the microphone socket.

The 12-14V supply is stabilized by an integrated 5V regulator circuit, with the two 0.1uF capacitors ensuring stability and removing any stray RF that might find its way into the circuit.

The regulator requires only 8V to operate correctly, and the overall supply current draw is only several mA which together lends itself nicely to add a light-emitting diode in series for decoration (*no homebrew project is complete without at least one glowing LED*) and as protection against accidental supply polarity reversal.

The electret insert is biased by a 10k resistor. Most electret inserts allow a constant bias current of 0.2mA, which results with the steady-state voltage of around 3V on the microphone insert with the resistance and voltage used.

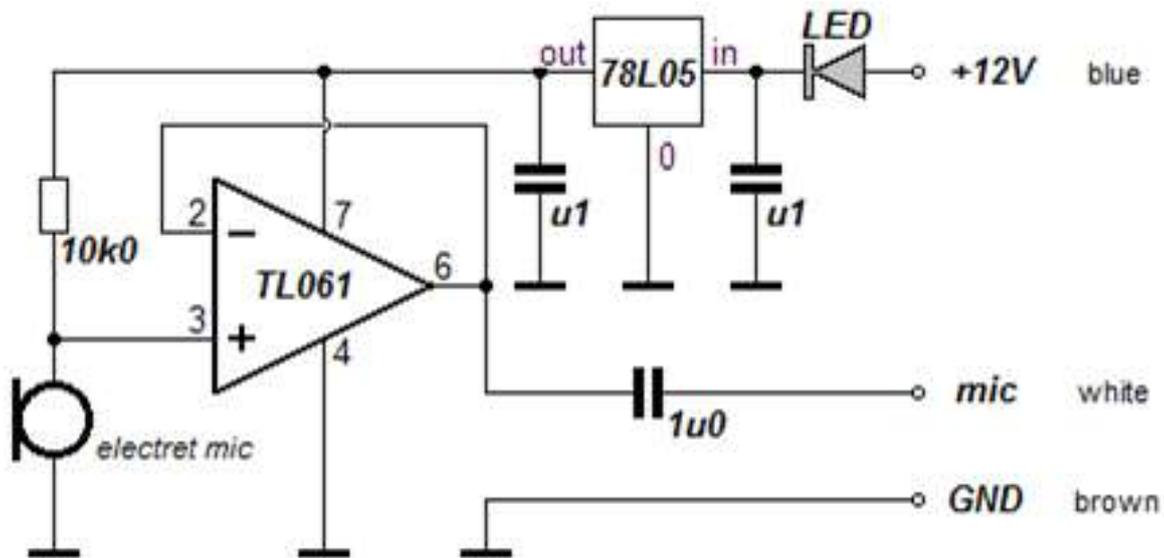
This is just sufficiently close to half the supply voltage, allowing us to use this potential to bias the buffer amplifier - no need for coupling capacitor and additional bias resistors thus reducing the parts count dramatically.

The AC signal voltage from electret microphone proved itself sufficient for Tait radios, so no additional amplification was required allowing the op-amp to work in a non-inverting, unity gain follower configuration reducing the component count even further. Just one extra capacitor is required (at least 1uF) to AC-couple the amplifier to the radio microphone input.

Any output amplitude control proved unnecessary, with the radio taking good care of any required automatic gain control.

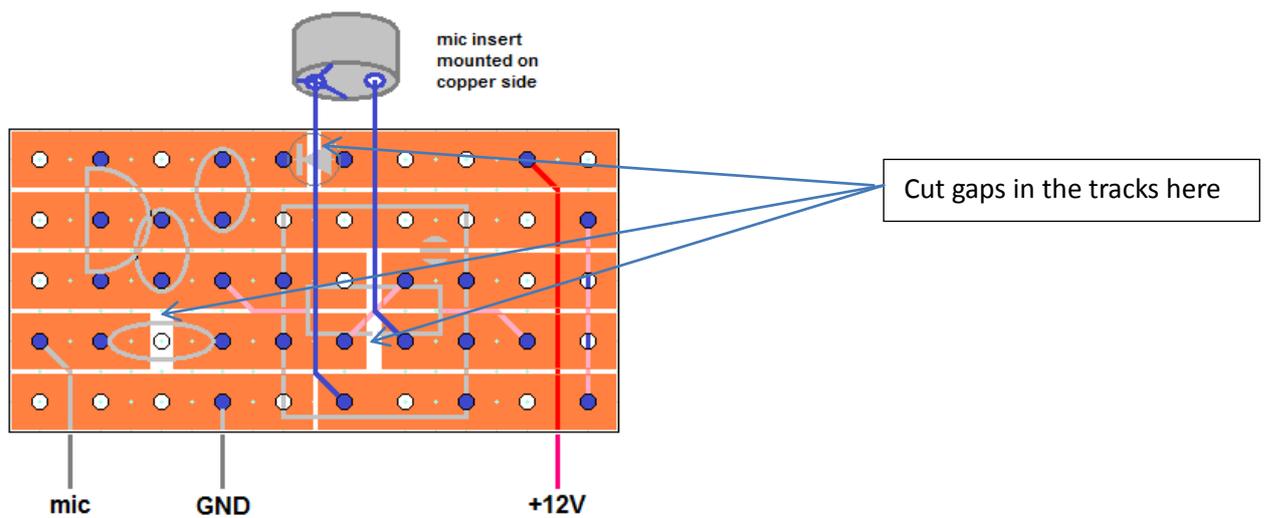
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Schematic:

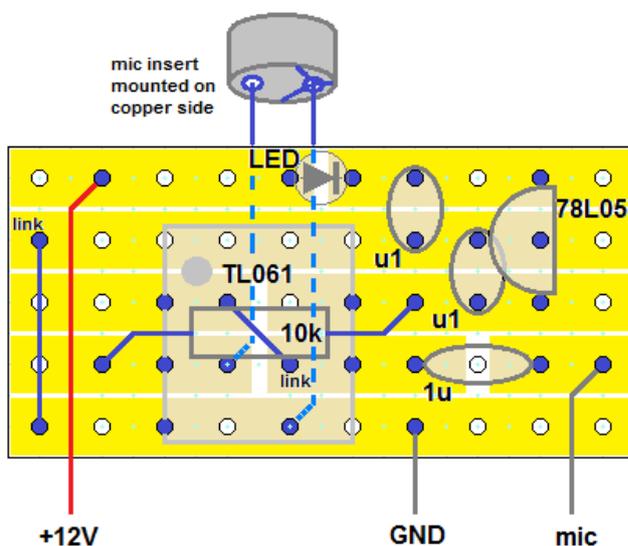


Circuit Board Diagrams

COPPER SIDE VIEW



COMPONENT SIDE VIEW



Finished project



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Step 1 - Bill of materials

The required components are listed below and also shown on the image.

- 1.1. Original Tait microphone
- 1.2. Plastic medicinal bottle top – inner safety lock required only
- 1.3. Operational amplifier integrated circuit - LF351, TL071 or similar
- 1.4. IC socket. (Two types shown; pins 1, 5, and 8 needs to be cut off or removed.)
- 1.5. Veroboard, 5 copper strips x 10 holes
- 1.6. 6-pin telephone plug (if required)
- 1.7. Electret microphone insert (Two types shown.)
- 1.8. Voltage regulator 5V (LM78L05 or similar)
- 1.9. Light emitting diode, optional, and any colour
- 1.10. Resistor 10k
- 1.11. Capacitor 0.1uF x2 (marking 104)
- 1.12. Capacitor 1uF (marking 105)
- 1.13. Sundry hook-up wires, heat shrink tubing, insulating tape etc.



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Step 2 - Dismantle and re-wire the original microphone.

2.1. Remove the Phillips-head screw from the back and open the case.

2.2. Remove the dynamic insert [A] and unsolder the brown and white cables [B]. Taking care not to damage the transparent membrane, confine the insert into the junk box for future projects.

2.3. Temporarily unsolder the black wire [E] from the lug [F] on the rear of the case. These will have to be re-soldered on completion.

2.4. Examine the individual coloured wires exiting the cable restraint [C] and how they connect to the little circuit board [D]. Examine also the 6-pin plug under a magnifying glass and note any missing wires.



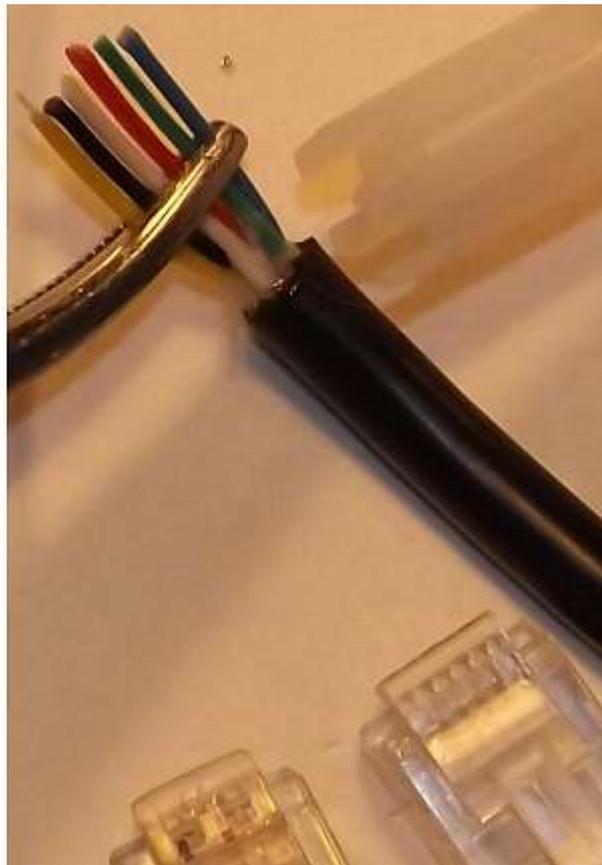
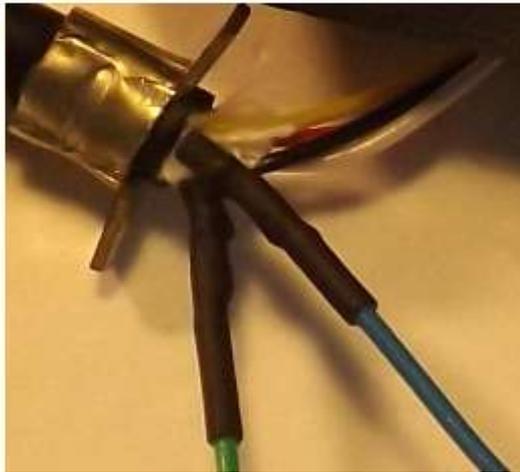
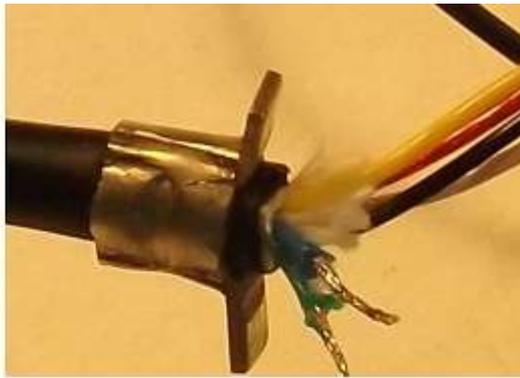
-You will note the following wires, in the sequence L to R as they appear inside the plug – cable hanging down:

- *Yellow - programming wire, grounded inside the microphone shell.*
- *Black - ground (common).*
- *White - one of the wires [B] originally connected to the dynamic insert [A].*
- *Red - PTT switch*
- *Green - programming wire. Usually not inserted fully into the plug, and, at the other end of the curly cord, either cut short or terminated to an isolated pad on the circuit board [D].*
- *Blue - This is our 13.8V. Usually treated the same as green wire by manufacturer.*

NOTE: We will need the blue wire. So, if it is cut short, strip some of the black insulation and attach a length of hook-up wire. Whilst at it, you may as well extend the green wire for future extensions. See the top photo next page.

2.5 At the other end of the curly cord - if the plug does not have all the wires inserted you need to cut it and re-terminate with a new plug. See the bottom photo next page

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Step 3 - Acquire Bottle Top

This has been acquired from common medicinal pill bottles with an adult-proof tamper lock on the screw-on tops.

3.1. Remove the foamy lining from the bottom of the top (if it makes sense).

3.2 Applying a range of manoeuvres from gentle persuasion to destructive force, extract the inner part of the bottle top and **keep this part intact**

3.3. Check that it fits upside-down into the round opening just vacated by the dynamic insert.- Should sit flat, tight, with no wobbles.

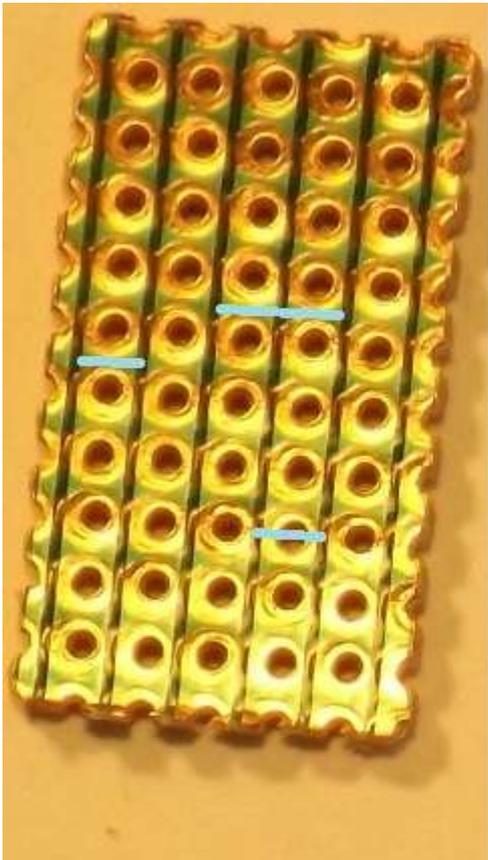


Once satisfied with the fit, proceed to the next step.

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Step 4 - Prepare the circuit board

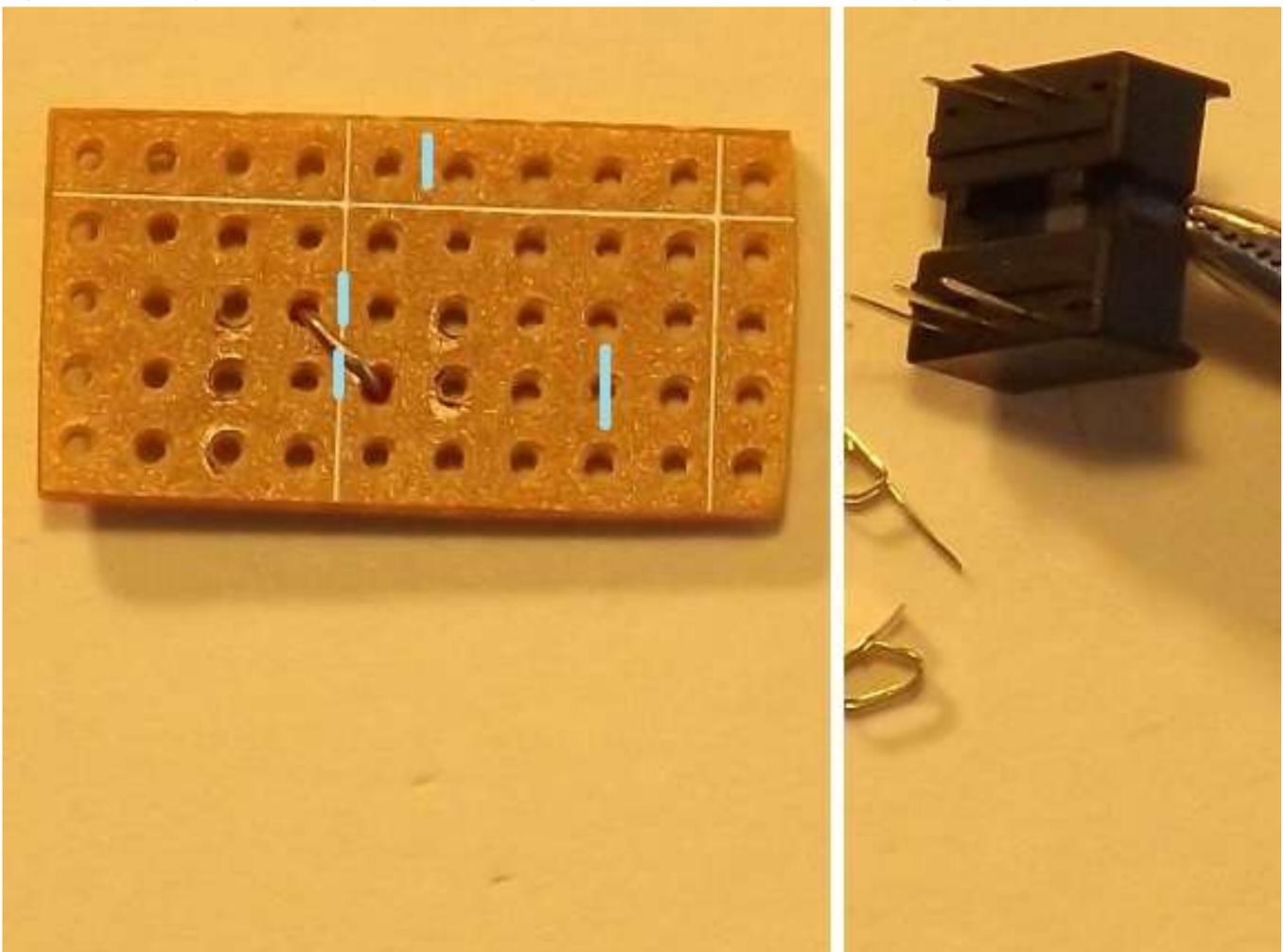
- 4.1. File the short edges of the board until it fits nicely into the plastic cup.
- 4.2. File the long edges all the way to the edge of the next copper tracks. Re-insert into the bottle top and check it can be returned to its intended home in the microphone shell, tight and with no wobbles.
- 4.3. Cut some gaps in the tracks exactly in locations as shown below. These locations are also shown on "Circuit Board Diagrams"



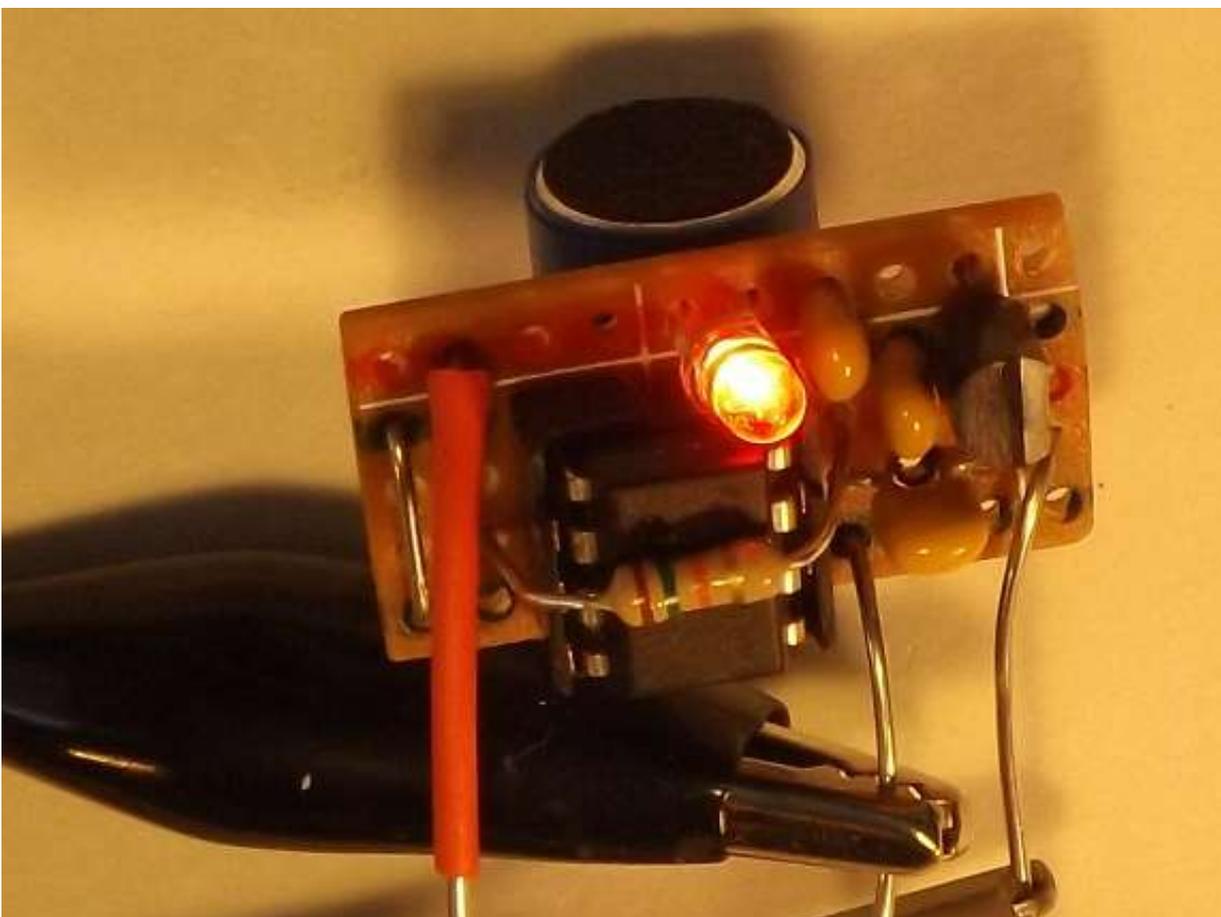
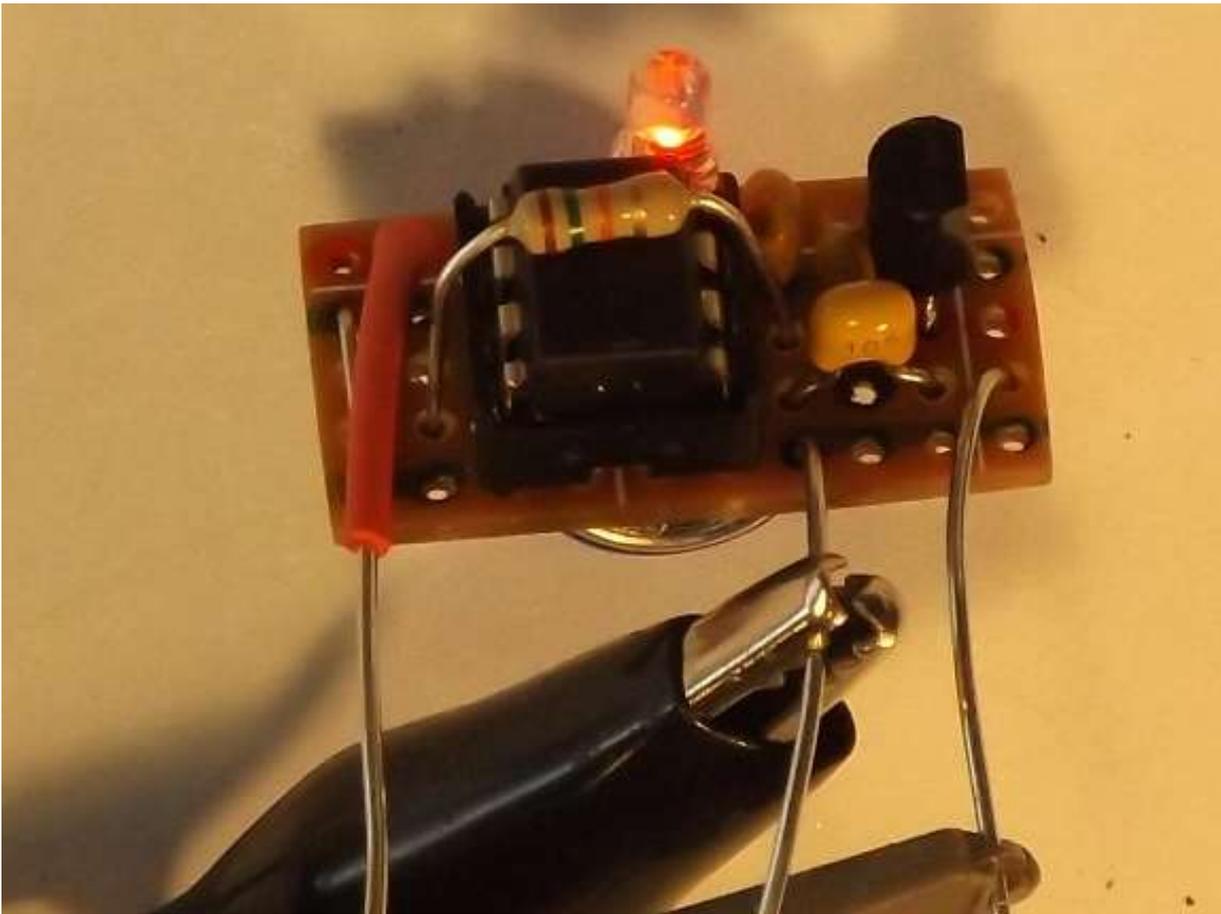
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Step 5 - Populate the board with components

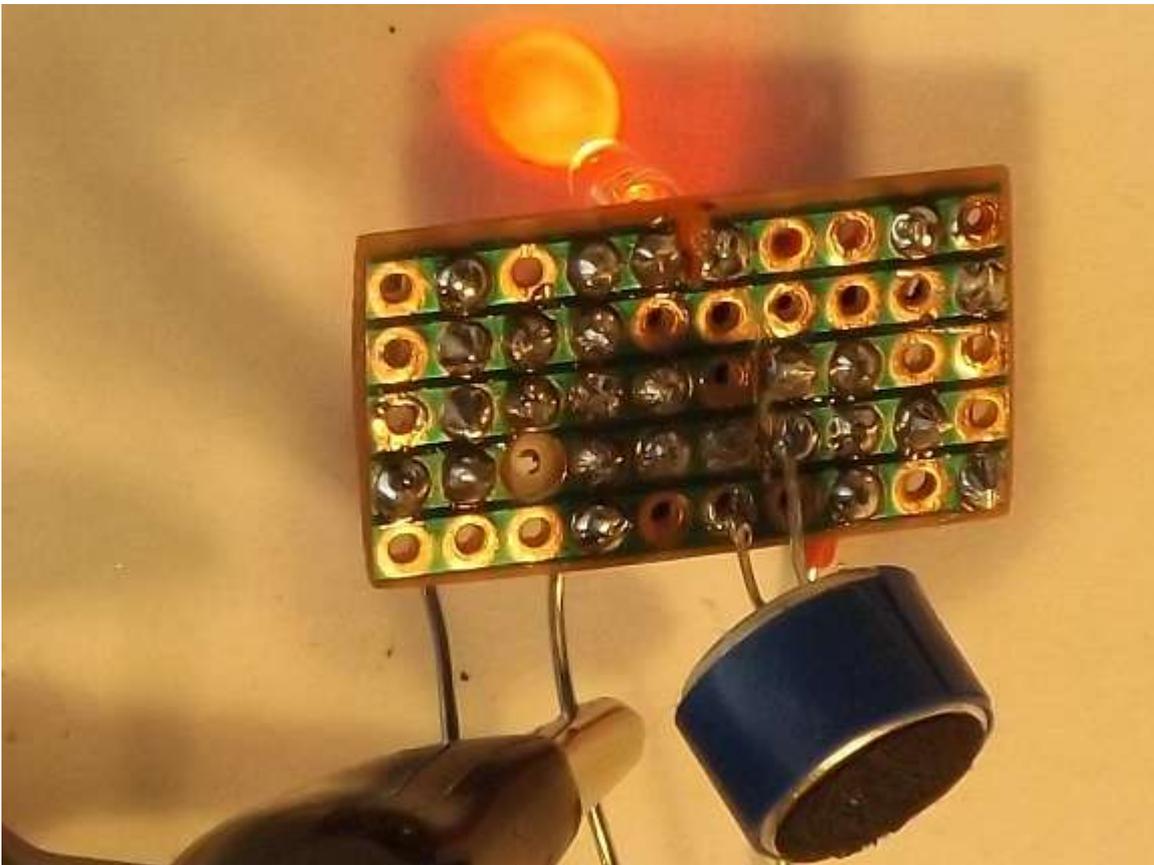
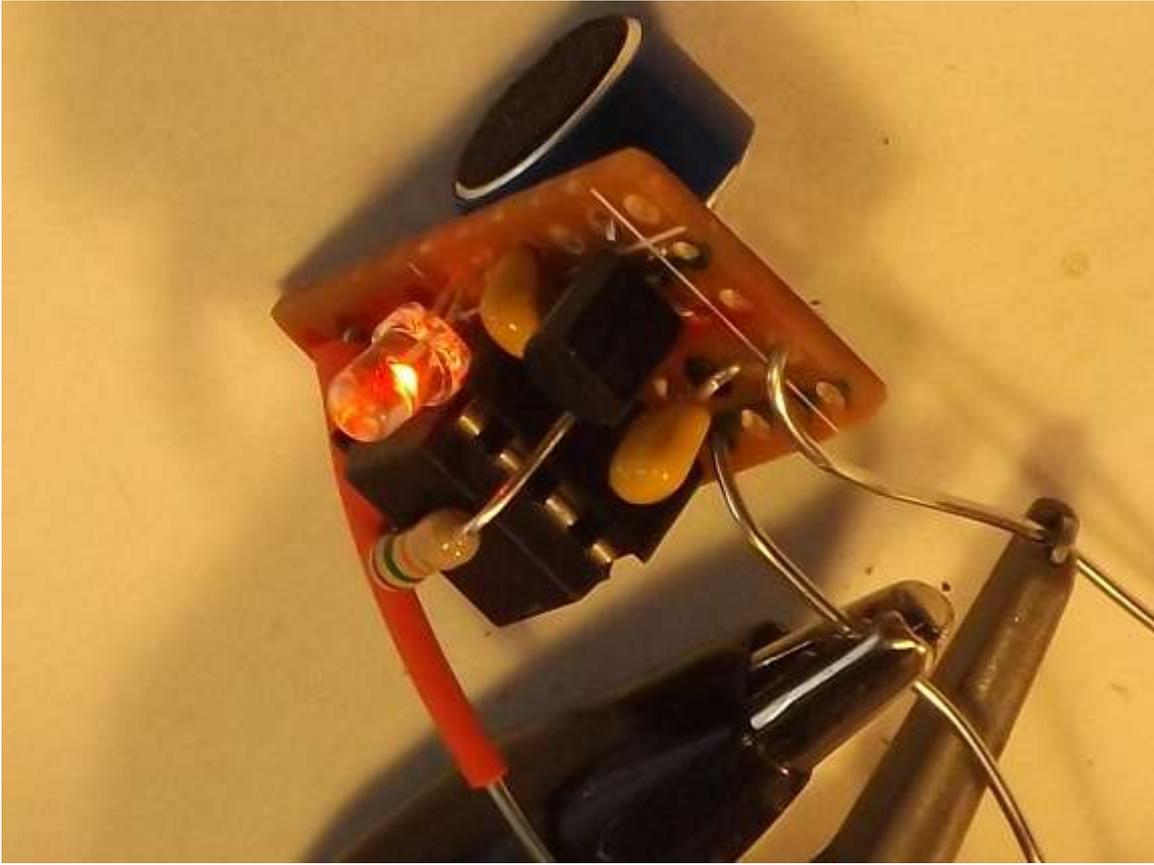
- 5.1. Install the first wire link as shown below. This will be underneath the IC socket.
- 5.2. Remove pins 1,5 and 8 from the IC socket.
- 5.3. Study the layout on "Circuit Board Diagrams" on page 2.
- 5.4. Solder the second link, IC socket, capacitors, LED, and 5V regulator. Allow about 6mm. length for the LED wires.
- 5.5. Check for correct orientations and polarities of components.
- 5.6. Check again. 😊
- 5.7. Insert the IC into the socket. Ensure correct orientation.
- 5.8. Solder the resistor, allowing it to sit over/on top of the IC.
- 5.9. Add the ground, output and positive supply wire. Use insulated wire or heat shrink tubing for the positive wire.
- 5.10. Now solder the electret microphone insert, observing polarity.
- 5.11. Check against the photographs on subsequent pages.
- 5.12. Wrap a bit of insulating tape around the microphone insert to prevent its grounded body shorting against the positive copper track.
- 5.13 Flip the completed assembly upside down (LED and microphone face down) and shape the LED and microphone legs in such a way that both components are against the table and the board is upright.



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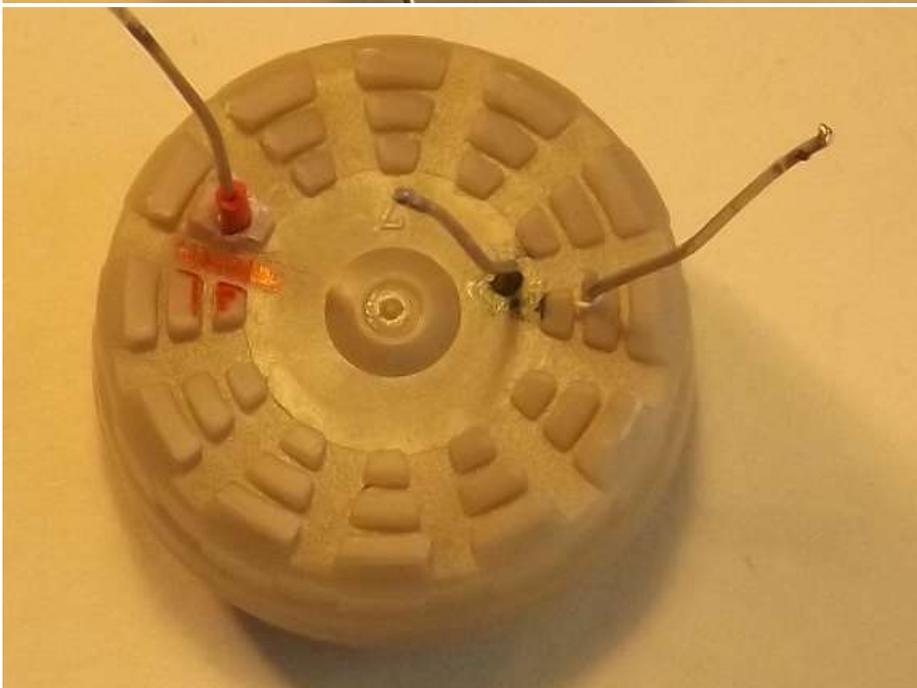
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Step 6 - Check operation

- 6.1. Connect 12V supply between the positive and ground.
- 6.2. Check the LED lights up.
- 6.3. Check DC voltages - 5V after the regulator, and around 3V on pins 2,3 and 6 of the IC.
- 6.4. Connect oscilloscope to the output and check for response to sound.
- 6.5. If all fine, proceed to the next step.

Step 7 - Mount the board in the bottle top

- 7.1. Study the following two photographs.
- 7.2. Make three holes in the bottle top as show.
- 7.3. Feed the three wires through the bottle top and position the board as shown.



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Step 8 - Mount and connect in shell

- 8.1. Position the completed module in its intended location.
- 8.2 Connect the common/ground to the brown wire previously disconnected from the dynamic insert.
- 8.3 Connect the output terminal to the white wire.
- 8.4. Connect the positive terminal to the blue wire.
- 8.5. Make sure all connections are insulated.
- 8.6. Re-assemble and perform on-air test.



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Step 9 - Completed project taking pride of place right in the centre.



Step 10 - Additional modifications

10.1. Voltage regulators with output higher than 5V can be used, up to 8V - even more if the LED is dispensed with and simply bypassed. The bias resistor may need to be increased to bring the bias voltage to approx. half the IC supply.

10.2. Increased value or bias resistor will increase the microphone sensitivity.

10.3. **NOTE:** It is likely that both the voltage regulator and the LED can be entirely dispensed with and the entire kit supplied directly from 13.8V but this hasn't been tried yet. Of course the usual above disclaimers will apply.