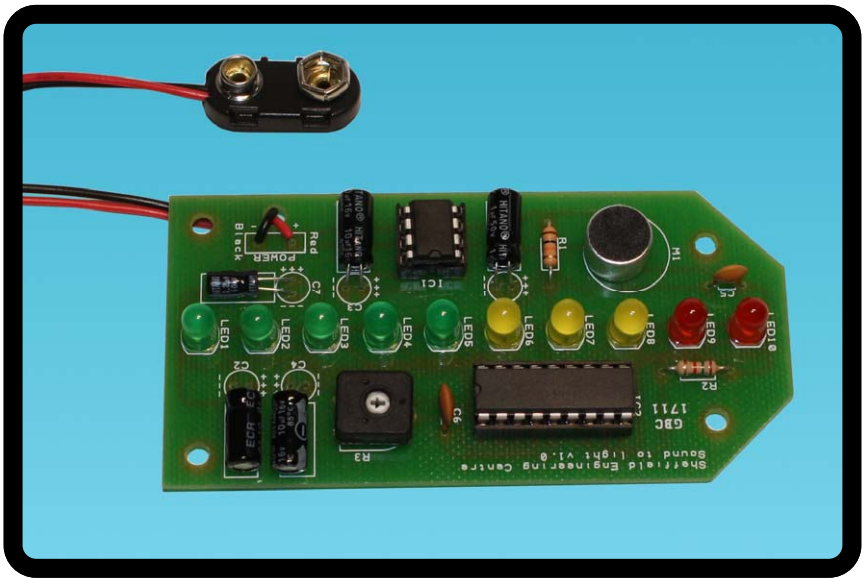
Sound Meter



Build Instructions

Issue 1.0

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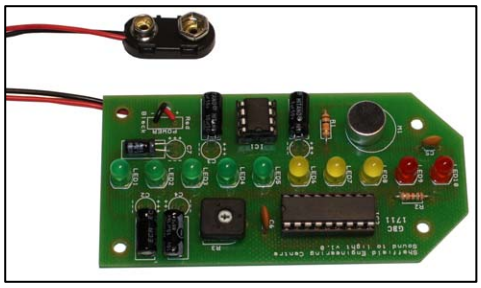


Before you put any components in the board or pick up the soldering iron, just take a look at the Printed Circuit Board (PCB). The components go in the side with the writing on and the solder goes on the side with the tracks and silver pads.

You will find it easiest to start with the small components and work up to the taller larger ones. If you've not soldered before get your soldering checked after you have done the first few joints.

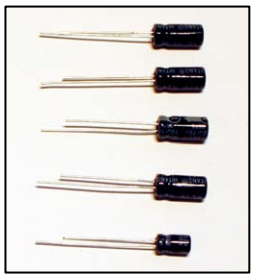
Step 1

Start with the two resistors (shown right):
The text on the PCB shows where R1, R2 etc go. Make sure that you put the resistors in the right place.

R1 is a 10K (brown, black, orange coloured bands)
R2 is a 1.5K (brown, green, red coloured bands)

Step 2

Solder the two Integrated Circuit (IC) holders in to IC1 & IC2. When putting them into the board, be sure to get it the right way around. The notch on the IC holder should line up with the notch on the lines marked on the PCB.



Step 3

Now solder in the five electrolytic capacitors (shown right). Make sure the capacitors are the correct way around. The capacitors have a '-' sign marked on them which should match the same sign on the PCB. The leads should be bent so that the capacitors end up flat on the board. The capacitors have text printed on the side that indicates their value. The capacitors are placed as:
C1 and C2 = 1µF. C3 and C4 = 10µF. C7 = 220µF.

Step 4

The two ceramic disc capacitors (shown left) should be soldered into the board as follows:
C5 = 10nF marked 103
C6 = 100nF marked 104

Step 5

The trimmer potentiometer (shown right) should be soldered into the board where it is marked R3.

Step 6

The microphone (shown left) should be soldered into the board where it is marked M1. The microphone is polarized (the two pins are off centre). For it to work the part must go inside the circle marked on the PCB.

Step 7

The ten Light Emitting Diodes (LEDs) should be soldered into the board. The LEDs won't work if they don't go in the right way around. If you look carefully one side of the LED has a flat edge, which must line up with the flat edge on the lines on the PCB. You may want to solder them in at a specific height depending upon how you have designed your enclosure (if you are making one). LED1 to LED5 should be green, LED6 to LED8 yellow and LED9 and LED10 should be red.

Step 8
The PP3 battery clip (shown left) should be attached to the terminals labeled POWER. Connect the red wire to '+' and the black wire to '-' after feeding it through the strain relief hole.

Step 9
The two ICs can now be placed into the IC holders, when doing this make sure that the notches on the ICs line up with the IC holder.

Adding an on / off switch

If you wish to add a power switch, don't solder both ends of the battery clip directly into the board, instead:

- Solder one end of the battery clip to the PCB, either black to '-' or red to '+'.
- Solder the other end of the battery clip to the on / off switch.
- Using a piece of wire, solder the remaining terminal on the on / off switch to the remaining power connection on the PCB.

Checking Your Sound Meter PCB

Carefully check the following before you insert the batteries:

Check the bottom of the board to ensure that:

- All holes (except the 4 large (3 mm) holes in the corners) are filled with the lead of a component.
- All the leads are soldered.
- Pins next to each other are not soldered together.

Check the top of the board to ensure that:

- The '-' on the capacitors match the same marks on the PCB.
- The colour bands on R1 are brown, black, orange.
- C1 and C2 are a 1µF capacitor & C7 is a 220µF capacitor.
- C5 is marked 103.
- All the LEDs match the outline on the PCB.
- The battery clip red and black wires match the red & black text on the PCB.
- The notch on the small IC is next to the LEDs and the notch on the large IC is next to C6.

Trimming the gain resistor (R3)

Turn the trimmer fully anti-clockwise. Then in a quiet room, slowly bring it back in a clockwise direction until just LED1 is left illuminated.

Fault finding flow chart - page 1

Start
Set the trimmer fully anti-clockwise, then power the board up

Do any LEDs light?

No

Check
- The battery is good and in the right way around.
- Check the power clip is connected the right way around and soldered correctly.
- R3 for dry joints.
- IC1 for dry joints on pins 5 to 7.
- IC2 for dry joins or shorts on pins 2 to 9.
- For shorts on C2 or C7.
- For dry joints on C4.

Yes

Were any LEDs missing?

Yes

Which LED was missing?

LED1	Is LED1, backwards, shorted or has a dry joint? Dry joint on IC2 pin 1.
LED2	Is LED2, backwards, shorted or has a dry joint? Dry joint on IC2 pin 18.
LED3	Is LED3, backwards, shorted or has a dry joint? Dry joint on IC2 pin 17.
LED4	Is LED4, backwards, shorted or has a dry joint? Dry joint on IC2 pin 16.
LED5	Is LED5, backwards, shorted or has a dry joint? Dry joint on IC2 pin 15.
LED6	Is LED6, backwards, shorted or has a dry joint? Dry joint on IC2 pin 14.
LED7	Is LED7, backwards, shorted or has a dry joint? Dry joint on IC2 pin 13.
LED8	Is LED8, backwards, shorted or has a dry joint? Dry joint on IC2 pin 12.
LED9	Is LED9, backwards, shorted or has a dry joint? Dry joint on IC2 pin 11.
LED10	Is LED10, backwards, shorted or has a dry joint? Dry joint on IC2 pin 10.

No

Are all the LEDs now off?

Yes

Do the LEDs light with noise?

Yes

Check
- IC1 pins 1 & 8 for dry joints.
- IC1 pins 5&6 for a short.
- C2 & C3 for dry joints.

No

Check
- IC1 pins 1 to 4 and 6&7 for shorts.
- IC1 for dry joints on pin 3/ 4.
- The notch on IC1 is next to the LEDs.
- C1 for a short.

No

Are some or all LEDs dim?

Yes

Check
- R2 for dry joints and that it is 1.5K (brown, green, red).
- IC2 pins 7&8 for a short.
- IC2 pin 8 for dry joints.

No

Go to page 2

Fault finding flow chart - page 2

* If the battery voltage is below 7V under load, only some of the LEDs will be lit and flickering won't be seen. For testing an alkaline battery is recommended.

Continued from page 1

Are the LEDs flickering on & off?*

No

Are the LEDs constantly on?

Yes

Check
- The notch on IC2 is next to the capacitor (C6).
- R3 for dry joints.
- IC1 pins 7 & 8 for dry joints.
- IC2 pin 5 for a dry joint.

No

Check
- C3 for shorts.
- C7 for dry joints.

Yes

Turn the trimmer R3 clockwise until only LED1 is on.

Was this possible?

No – all the LEDs when off or the red / yellow LEDs were left on.

Check
- IC2 pins 5 & 6 for a short.
- IC2 pin 4 & 6 for a dry joint.

Yes

When there is a lot of noise do all LEDs light?

No

Check
- R1 for dry joints.
- C1 for dry joints.
- C4 for a short.
- C6 for dry joints.

Yes

Is there still a problem?

Yes

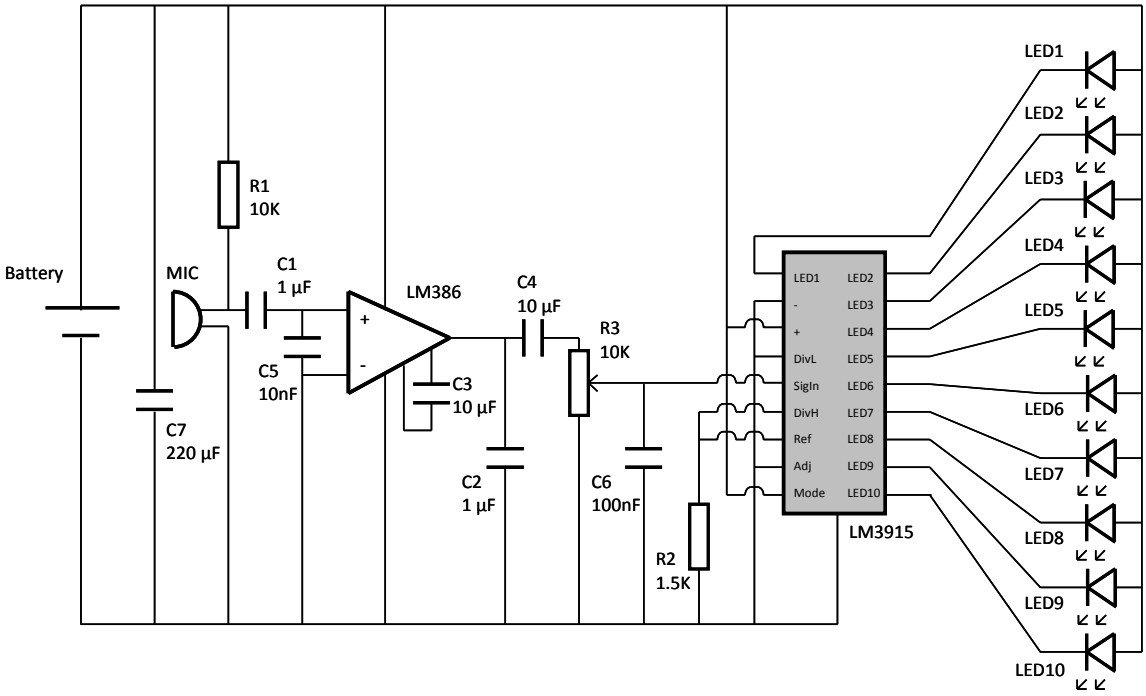
Is LED1 very bright / discoloured?
There is a short on IC2 pins 1&2.

Look carefully, on power up did the LEDs light one at a time from LED10 down to LED1?
There is a dry joint on pin 9.

No

Stop

How the Sound Meter Works



The sound meter circuit uses a microphone to detect sound and then uses a number of LEDs to indicate the how loud the sound is.

First of all the sound is detected by the microphone. This is then fed into the LM386 op amp via capacitor C1. This capacitor removes any DC offset from the signal generated by the microphone. The op amp amplifies (increases) the signal to a level that can be used. This is because the signal from the microphone is very small. The gain of the LM386 in this circuit is 200 and is set by capacitor C3.

The amplified signal is then filtered again by capacitors C2 and C4 which remove any DC off set and high frequency noise.

The LM3915 chip then looks at the size of this signal and lights up the relevant number of LEDs. It does this by generating a 1.2V reference voltage. A proportion of this is then fed into 10 comparators (inside the LM3915). Each comparator in turn is fed with a slightly lower proportion of the 1.2V reference voltage. For example the first comparator will get the full 1.2V, the next 1.1V, the next 1.0V etc. The comparators are also then fed the amplified signal from the microphone. If this signal is bigger than the comparators reference voltage then the comparator turns on its LED. The louder the sound the bigger the signal from the microphone and the more LEDs come on.

Resistor R3 is used to adjust the amount of signal fed to the LM3915 chip and can therefore be used to adjust the scale to the desired level