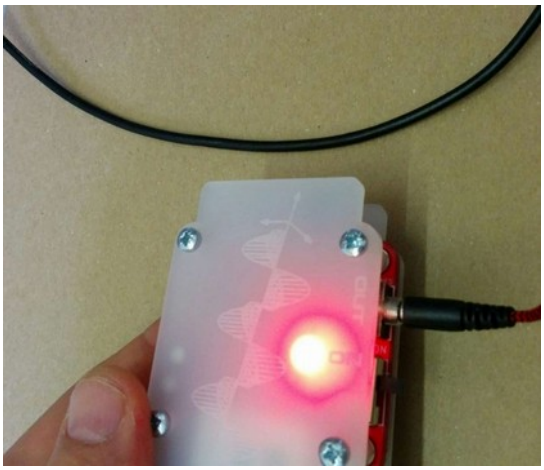
THE CURIOUS ELECTRIC CO.

EMF Detector Kit Instructions

Date:	18/10/16	Version:	1.0	By:	Matt Little



Build your own
Electro-Magnetic Field Detector!

This electronic circuit detects changes in local electro-magnetic fields and converts them to human-audiable sounds.

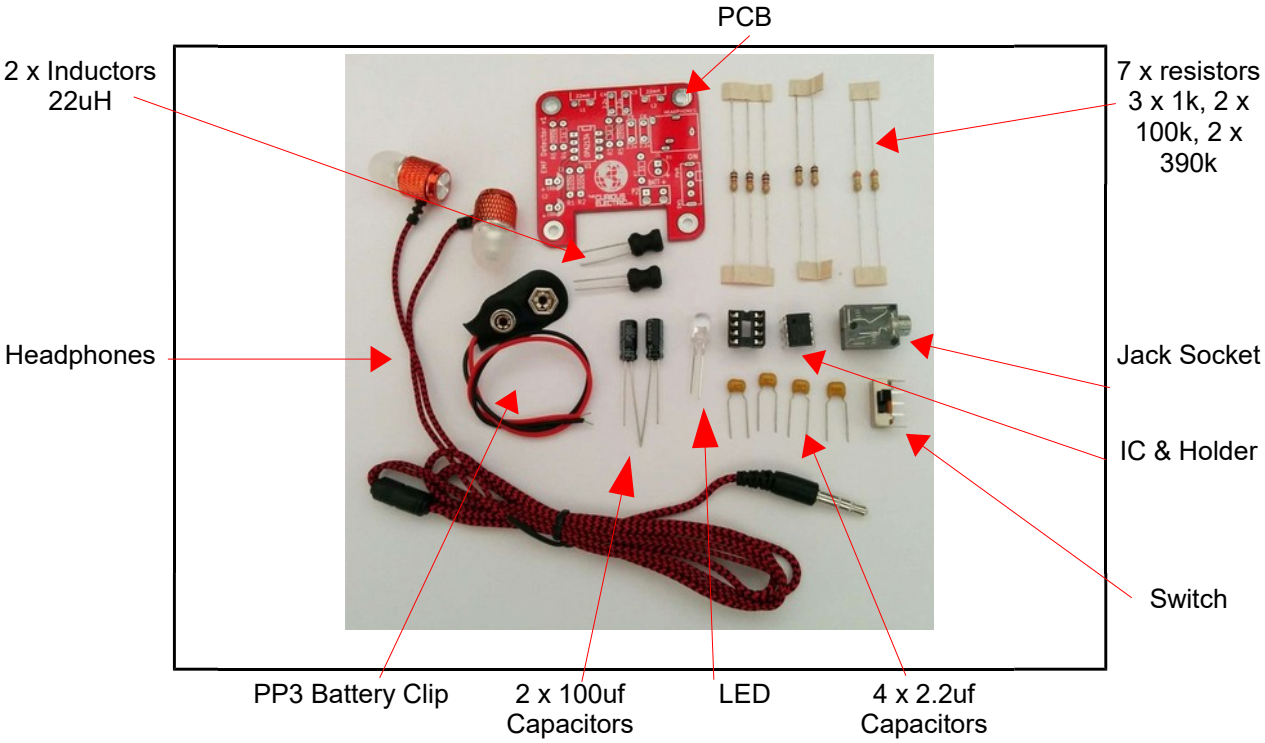
Electro-magnetic fields are all around us, but are usually invisible and silent. This detector uses two inductors to give a stereo output of the noise created by electro-magnetic fields.

This is useful for investigating electronic circuits, checking power supplies and investigating the unseen world around us.

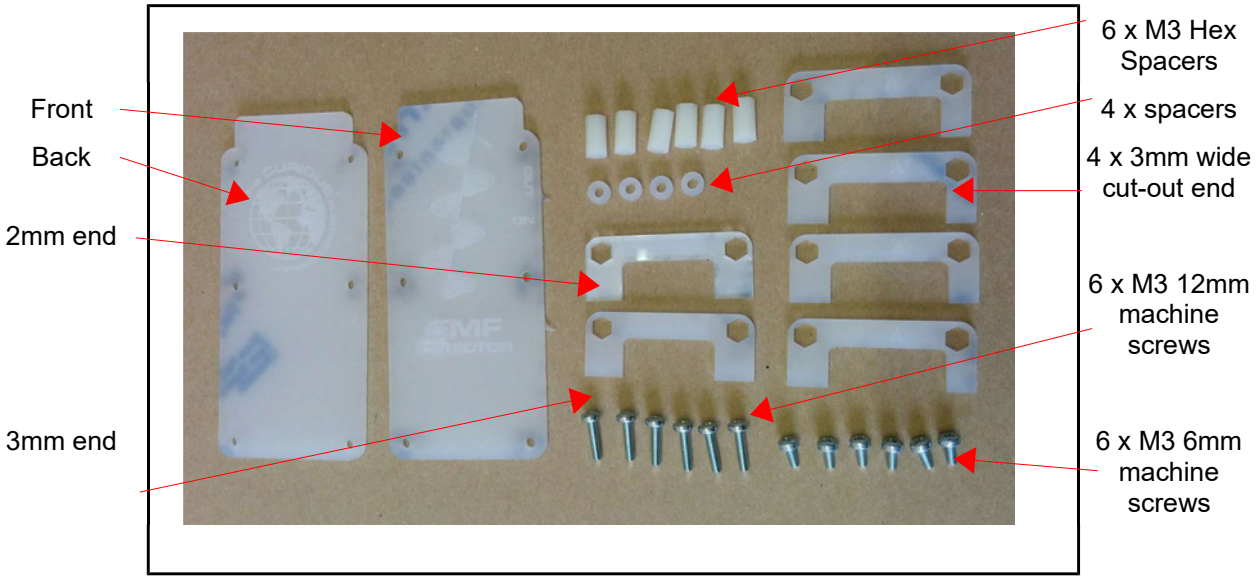
This kit includes a pair of in-ear earphones.

This is an easy kit to build and should take in the region of 1 hour to construct.

Parts included:



Enclosure Parts:



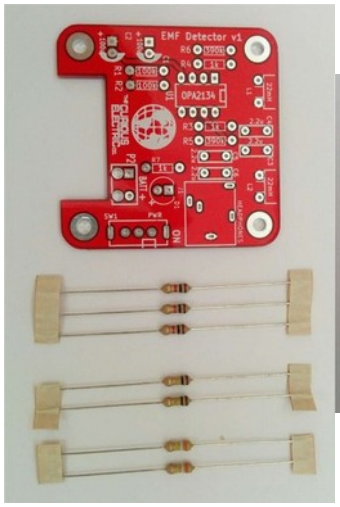
Parts list:

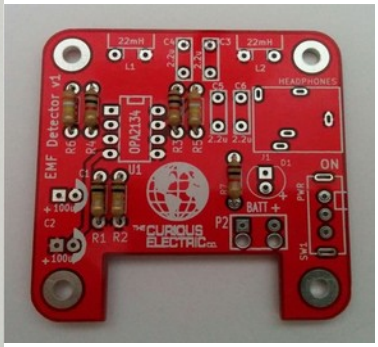
Item	Ref	Item	Ref
PP3 Battery Clip	BT1	100k Resistor	R1, R2
100uf Capacitor	C1,C2	1k Resistor	R3,R4,R7
2.2uf Capacitor	C3,C4,C5,C6	390k Resistor	R5,R6
5mm Red LED	D1	Switch	SW1
Jack Phone Socket	J1	OPA2134 Op-Amp	U1
22mH Inductors	L1,L2	8 Pin IC Holder	
		In-ear headphones	
Enclosure			
Front	x1	3mm PCB spacer rings	x4
Back	x1	M3 Hex spacers 9mm	x6
2mm Clear Spacer	x1	M3 6mm machine screws	x6
3mm Wide Spacer (marked "M")	x4	M3 10mm machine screws	x6
3mm narrow spacer	x1		

Tools required:

PCB Instructions:

Step: 1	Solder resistors

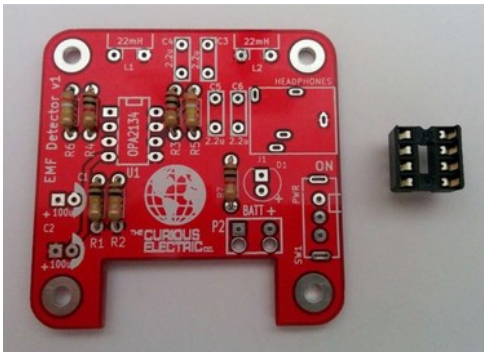


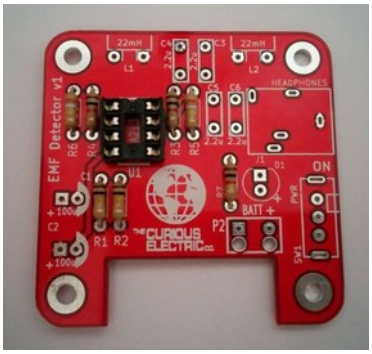


Value	Ref	Colour
100k	R1,R2	Brown, Black, Yellow, Gold
1k	R3,R4,R7	Brown, Black, Red, Gold
390k	R5,R6	Orange, White, Yellow, Gold

Insert and solder the resistors.
Polarity does not matter for resistors.
Ensure they are soldered flat close to the PCB.
Use a multimeter or colour code chart to ensure correct resistor values.

Step: 2	Solder IC holder





An 8-pin IC holder fits into U1

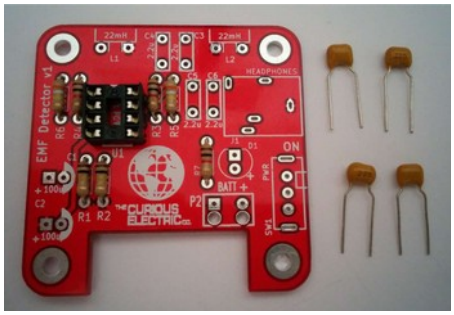
Ensure correct orientation!

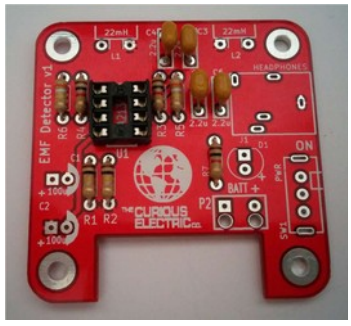
Ensure the notch on the holder aligns with the notch shown on the PCB.

Step: 3	Solder non-polarised capacitors

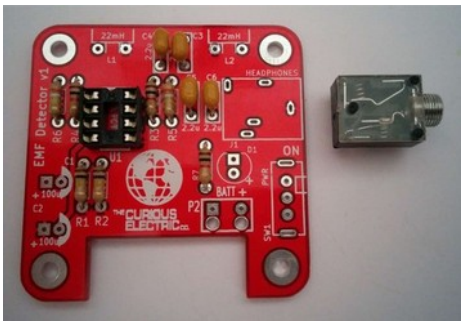
First solder the non-polarised capacitors.
Orientation of these does not matter:

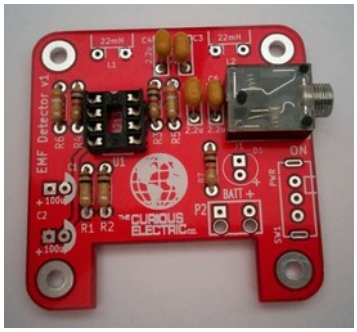
Value	Ref	Marking
2.2uf	C3,C4,C5, C6	225 (brown blob)





Step: 4	Solder jack plug socket





The jack plug socket has 5 connections. These need to be carefully aligned for the component to fit.

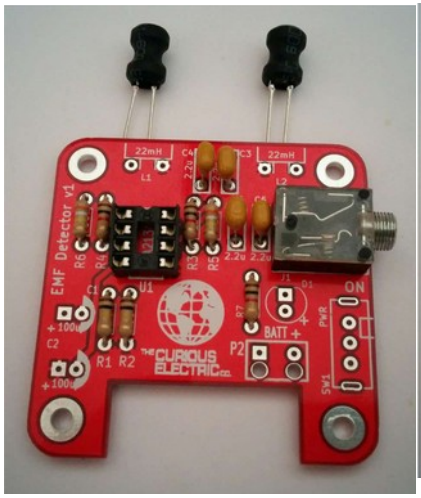
If it does not fit, then slightly adjust the pins to fit the holes on the PCB.

Step: 5	Solder Inductors

The inductors are our sensors. These need to stick out of the top of the circuit board.

To do this, bend them forwards, off the PCB, as shown.

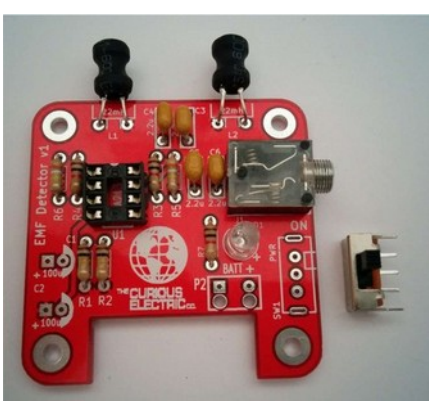
Their polarity does not matter.

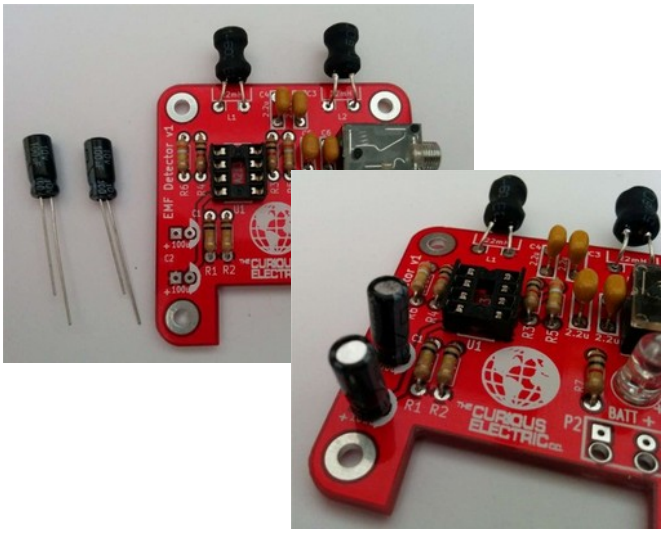


Step: 6	Solder LED

Ensure correct orientation for this component.

Solder the LED into D1.
The long lead is positive, so place that into the hole marked +. The negative side is slightly flat.

Step: 6	Solder Switch
The switch fits into the holes marked SW1. The switch knob goes off the PCB. Solder all metal tabs.	 

Step: 7	Solder polarised capacitors
	Next solder the polarised capacitors. Ensure correct orientation of these components. The negative lead is marked with a white strip. The positive lead is slightly longer than the negative. Align the positive lead with the + sign and the negative lead with the white PCB marking.

Value	Ref	Marking
100uf	C1, C2	10V 100uf

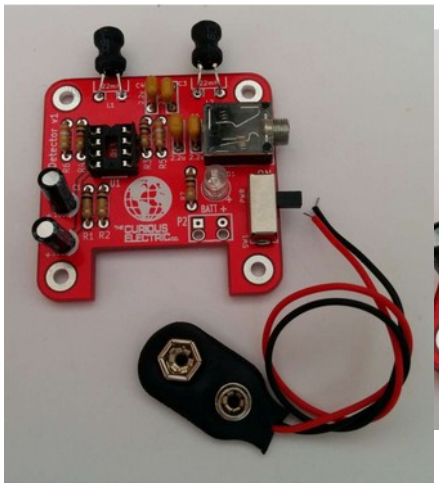
Step: 8	Solder PP3 battery connector

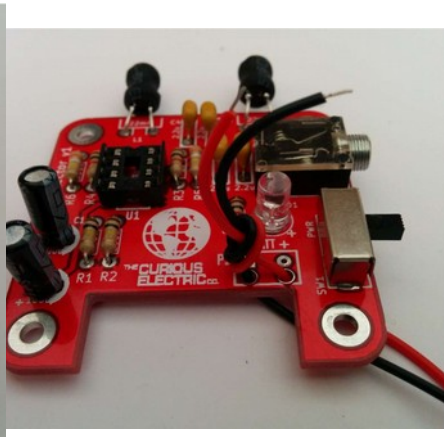
The PP3 battery clip as two wires: one positive (red) and one negative (black).

The cables then go through the larger holes and are fed back into the solder pads.

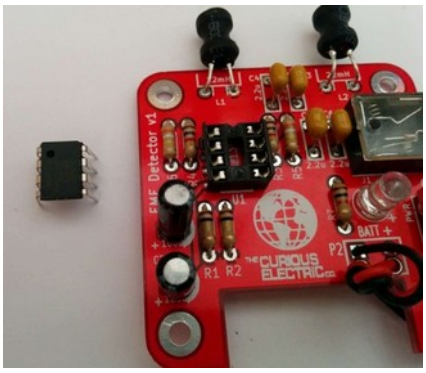
I usually put a knot in the cable for strain relief.

The red cable goes through the hole to the pad marked “+”.



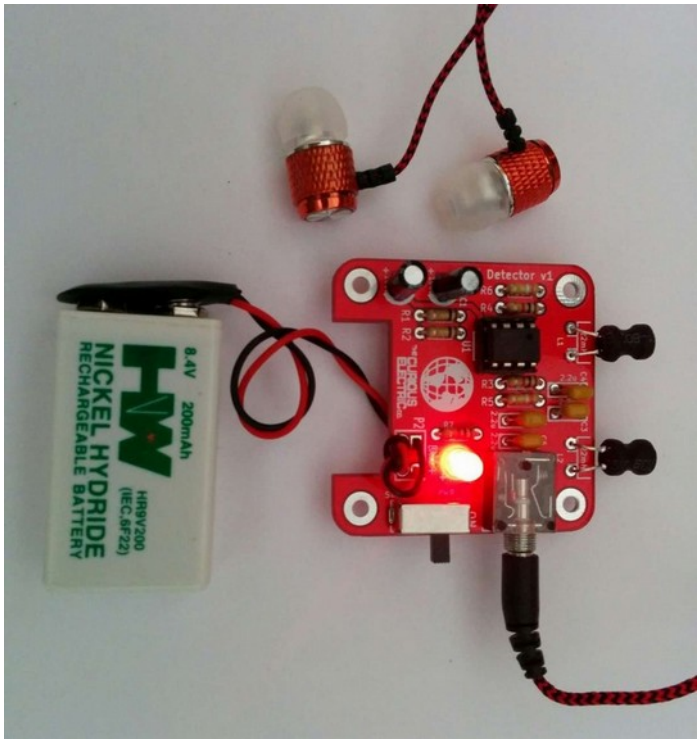


Step: 9	Insert IC



Now we need to insert the IC into it’s holder.

The IC should be marked “OPA2134”.
Ensure the notches align with the notches on the IC holders and the PCB.

Step: 10	Insert battery and test
Add a PP3 9V battery to the battery clip. Switch the unit on. The red LED should switch on to indicate power on. When listening to the ear-phones you should hear a slight hum or hiss. Hold the inductors close to a switch mode power supply or to the front panel of a smart phone with the screen lit and activated. You should start to hear the sounds created by the electro -magnetic waves.	

Step: 16	PCB is finished!
	Have a nice cup of tea. 

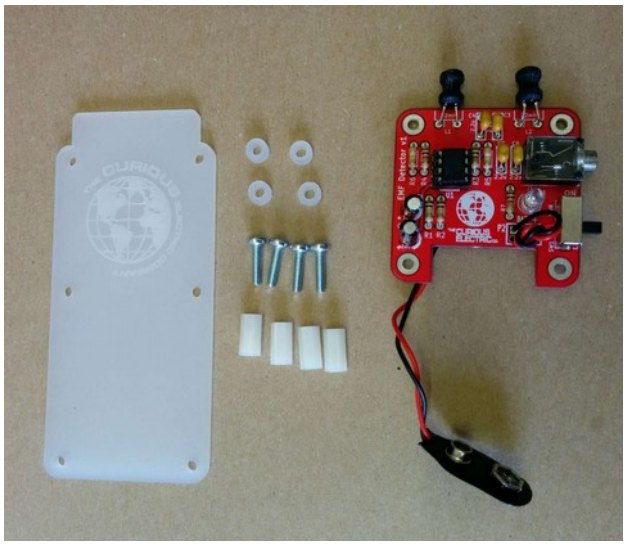
Enclosure Instructions:

Step: 1	Push out laser-cut parts and peel off protective layer

Sometimes not all the small laser-cut pieces have been removed. These can be pushed out using the point of a screwdriver. Only slight force should be required.

There is a protective film on one side of the laser cut parts. This can be removed by peeling off the film.

Step: 2	Screw down the PCB



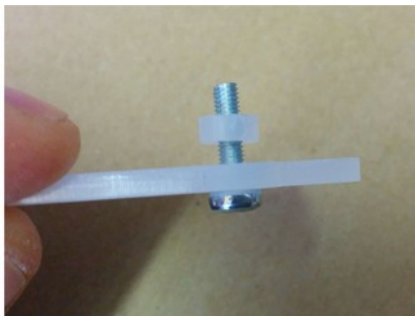
The PCB is held onto the back plate using the M3 10mm screws and the hex spacers.

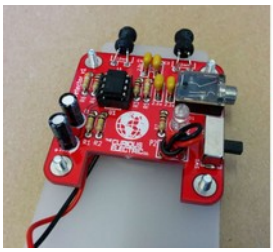
The back plate has the text facing to the back.

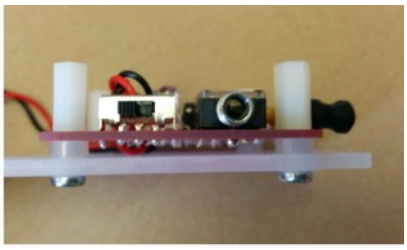
The screws fit through the back plate then through a small circular spacer ring and then through the PCB.

It is then held in place using the threaded hex spacer.

Do this for all four corners of the PCB.





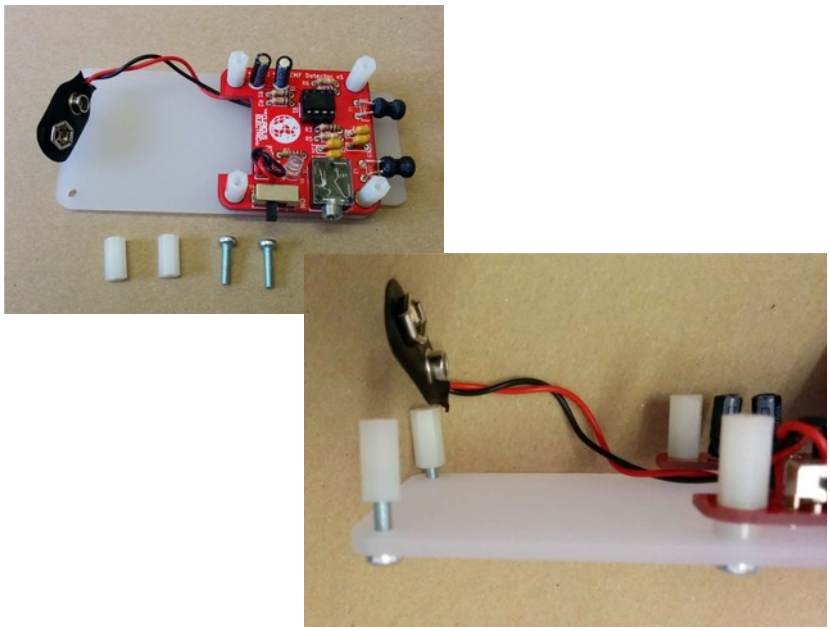


Step: 3	Add end spacers

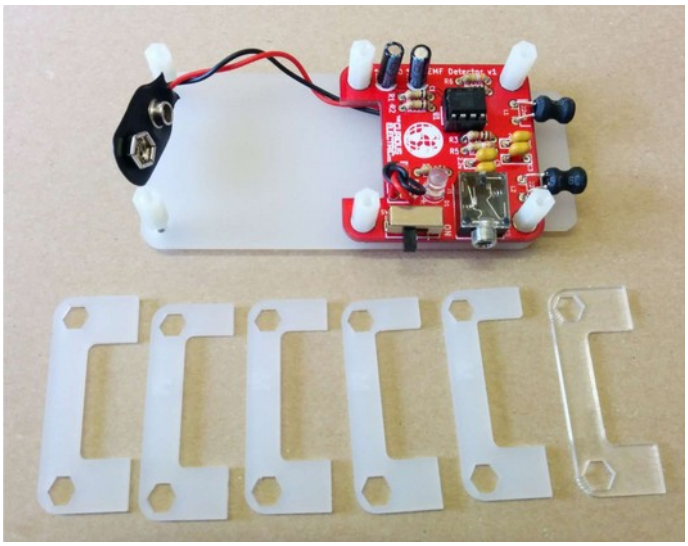
To hold the end spacers in place we again use the 10mm screws and 2 of the hex spacers.

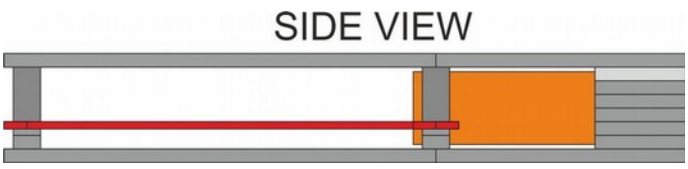
Put them through the back plate and slightly screw the hex spacer onto the screw.

Do not fully tighten this, as it will need to spin to be adjusted in the next step.



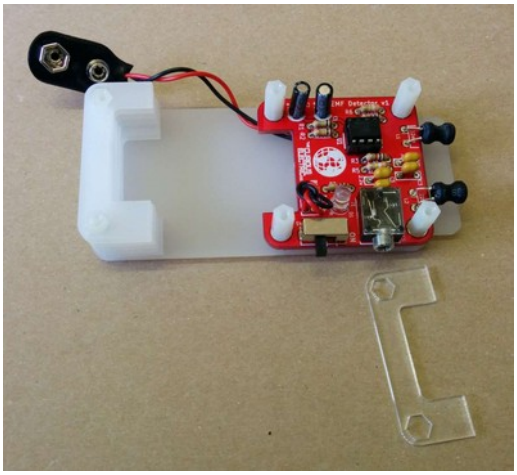
Step: 4	Add battery holders





The battery holders are 6 spacers which holds one end of the battery, with the other end being held the notch in the PCB.
There are three types of spacer:
1 x narrow 3mm spacer (in white frosted plastic)
4 x wide 3mm spacers (with an “M” etched on them).
1 x narrow 2mm spacer in clear plastic.

These fit onto the hex spacers we just added.
First add the narrow 3mm piece, then the 4 wide 3mm piece (marked “M”).



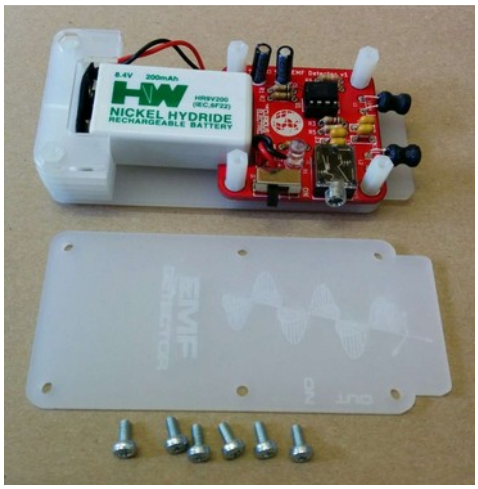
We then put the battery into the enclosure. The PP3 battery clip fits within the wider section, with the cable able to come out of the side.

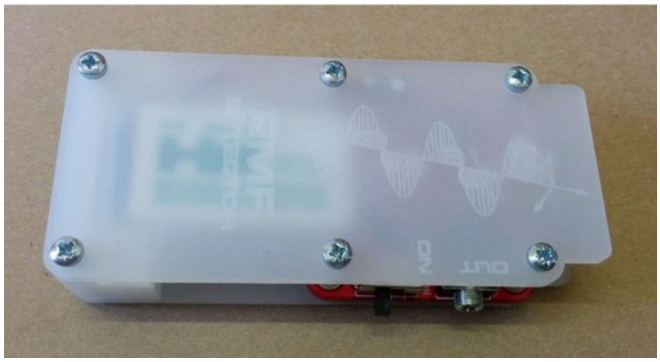
The final narrow 2mm space is put on top of the battery.

Step: 5	Fit top cover

The front cover is then put on with the text facing upwards.
Use the final 6 x 6mm M3 machine screws to hold the front cover in place.
These fasten into the threaded hex spacers.

Tighten the screw on the back of the unit as well at this point.





Step: 6	Finished!
	That is the unit finished! The on/off switch and the phono socket for the headphones are accessible via the side of the unit. You now have your own Electro-Magnetic Field detector. There are many things you can investigate including: EMF from power supplies EMF from monitors and displays EMF from smart phones EMF from fluorescent lights Basically anything where there is some kind of electro-magnetic field. Get out and get investigating!

Contact details:

We would like you to be happy with this kit. If you are not happy for any reason then please contact us and we will help to sort it out.

Please email **hello@curiouselectric.co.uk** with any questions or comments.
Please tweet us at **@curiouselectric**

If any parts are missing from your kit then please email **hello@curiouselectric.co.uk** with details and, if possible, where the kit was purchased.

More technical information can be found via **www.curiouselectric.co.uk**

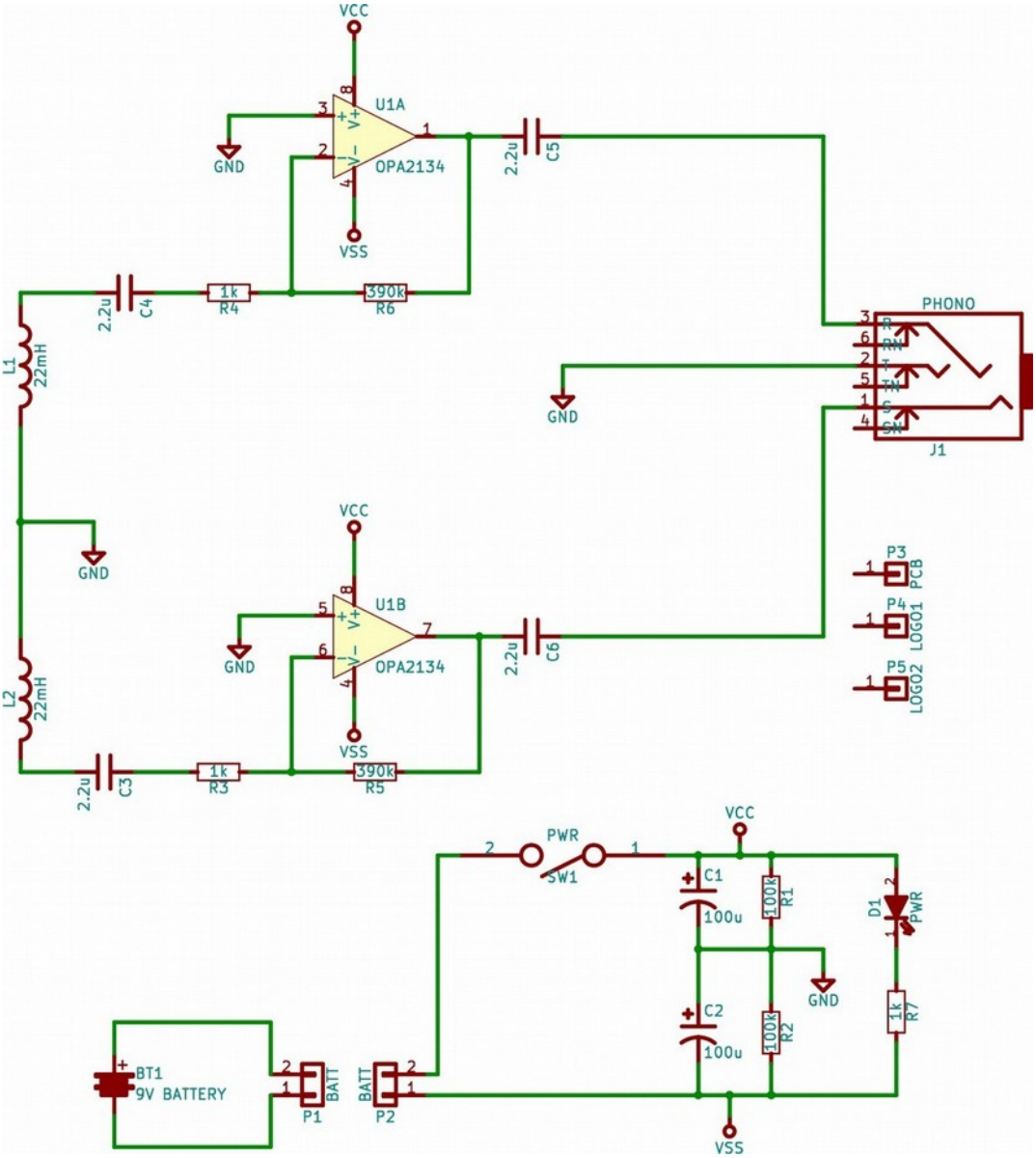
This kit has been designed and produced by:

The Curious Electric Company
hello@curiouselectric.co.uk
www.curiouselectric.co.uk
Hopkinson, 21 Station Street, Nottingham, NG2 3AJ, UK

History

This kit is based upon an open-source project, the ElektroSlutch, developed by Jonas Gruska and originally published by MAKE: magazine
http://makezine.com/projects/weekend-project-sample-weird-sounds-electromagnetic-fields/
and was originally developed as a workshop for Nottingham Hackspace:
www.nottinghack.co.uk

Circuit Schematic



Resistor Colour Codes