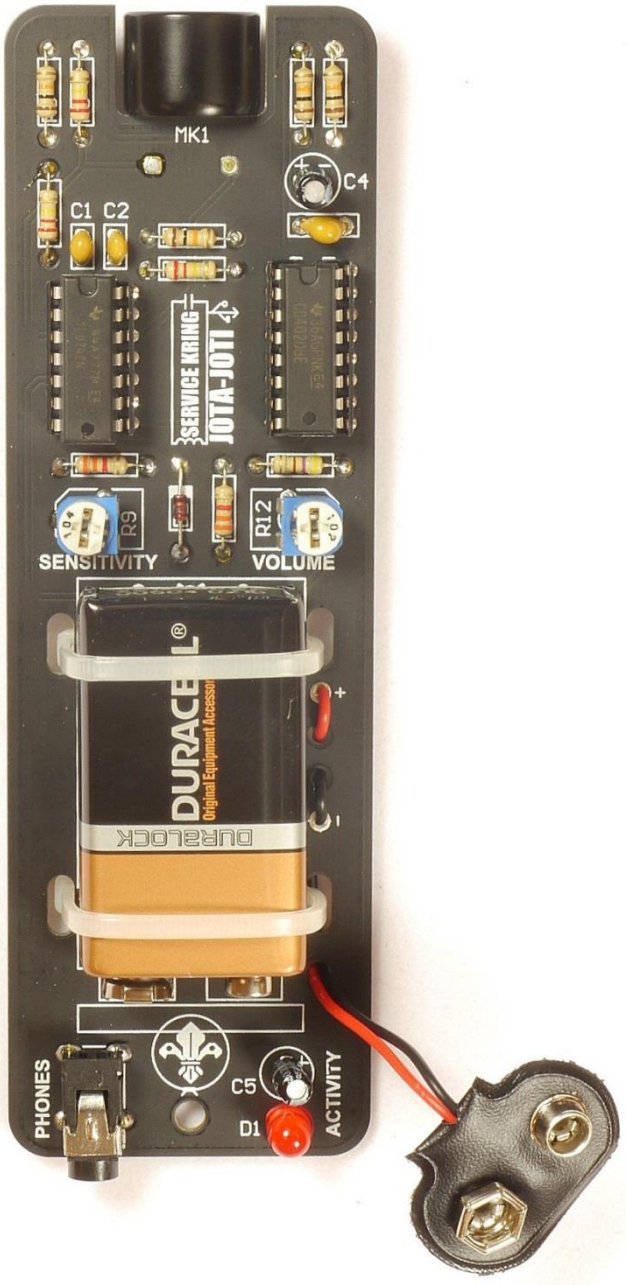
BAT DETECTOR 2015

Manual Bat Detector kit



A project of the Service Kring JOTA-JOTI.

Do you like the Bat Detector, do you have great ideas ?
Tell us, please see how on the last page .

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Remarks

Unlike in previous years, all documentation around the kit is included in one big document. This is to provide all background information and other interesting facts together with the construction description.

To the instructors: we want to advise you to read this entire document beforehand carefully. It is sufficient to print only pages 6 and 7 for the purpose of building it. During construction, it can be useful, as a quick reference, to have page 8 on hand too.

TIP: To build one kit yourself before the JOTA-JOTI is besides fun also educational.
Note: See the note on page 4 for details on the contents of the package.
Note: Solder the potentiometers carefully and do not heat it too long! Otherwise it can melt and loosen the runner contact, perhaps decide to let the Assistant do this soldering.

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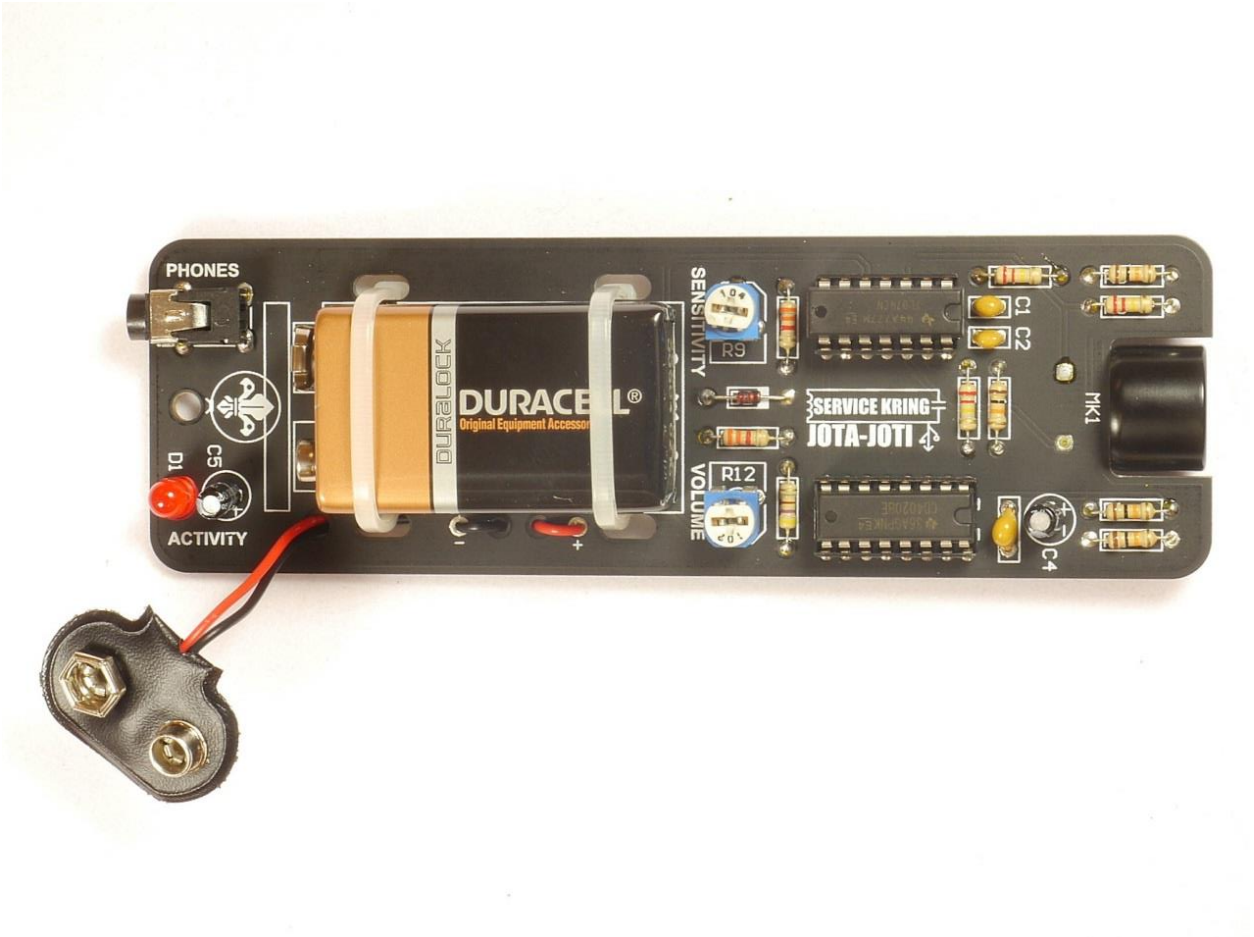
Introduction

Again the Service Kring JOTA -JOTI managed to create a fun and educational construction project for 2015 which we have named BAT DETECTOR . As in previous years this kit is intended for use by children (under supervision) to be soldered together and in this way the children can experience the technical world of electronics.

The ready built PCB captures ultrasonic sound such as, for example, is made by bats. The frequencies of these sounds are so high that we cannot hear them. The Bat Detector "translates" them into audible sound. If there are no bats, the Bat Detector can also be tested for example by crumpling paper, rubbing your fingers against each other or to "listen" to a running tap, more on page 8 .
Have fun with the construction and use of the Bat Detector !



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Contents of the Package

The table below can be used to check the contents of the kit . Soldering tin, headphones and a 9 volt battery must be added by yourselves.

Component	Value	Qty	Pos. on board	Remarks
Resistor	10 KΩ	4	R1, R2, R3, R6	brown, black, orange, gold
Resistor	220 KΩ	3	R4, R5, R7	rood, rood, yellow, gold
Resistor	3,3 KΩ	2	R8, R11	orange, orange, rood, gold
Resistor	470 KΩ	1	R10	yellow, purple, brown, gold
Potentiometer	100 KΩ	1	R9	inscription 104
Potentiometer	1 KΩ	1	R12	inscription 102
Capacitor	1 nF	2	C1, C2	yellow, inscription 102
Capacitor	100 nF	1	C3	yellow, inscription 104
Capacitor	10 µF	2	C4, C5	black, mind for polarity
LED	rood 5 mm	1	D1	mind for polarity
Diode	1N4148	1	D2	mind for polarity
IC socket	14 pens	1	U1	mind for direction
IC socket	16 pens	1	U2	mind for direction
IC	TL074CNE4	1	U1	in socket, mind direction
IC	CD4020	1	U2	in socket, mind direction
US mic.	TCT40-16R	1	MK1	mind shield
Headphone connector	3,5 mm	1	J1	
9V battery clip		1		
PCB		1		

Remark:

During the assembly of the construction kits in China there was a mistake with resistor R10. In place of the prescribed 470 Ω, there is attached a resistance of 470 KΩ.
This works only the LEDs but very little light.
For use at dusk or at night in the forest, this is sufficient and can even be an advantage. , If desired, the still brighter LED to light its resistance of 470 Ω (yellow, purple, brown, gold) supplied separately.

The photos were made in this document with a 470 Ω resistor

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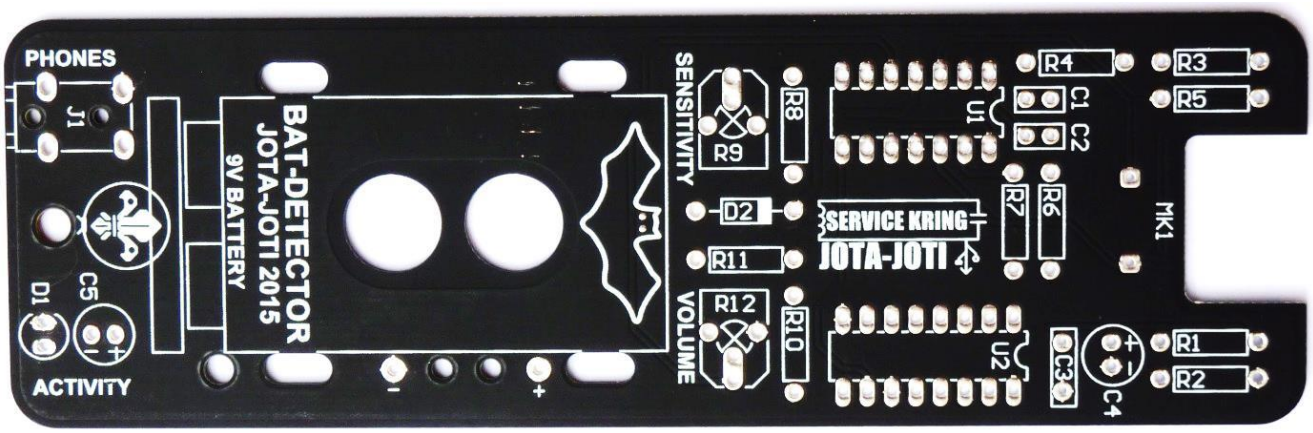
Component Numbering and Component Values

Board txt	Component	Board txt	Component
R1	10 KΩ	C1	1 nF
R2	10 KΩ	C2	1 nF
R3	10 KΩ	C3	100 nF
R4	220 KΩ	C4	10 µF
R5	220 KΩ	C5	10 µF
R6	10 KΩ	D1	LED red
R7	220 KΩ	D2	1N4148
R8	3,3 KΩ	U1	IC- socket 14 pins
R9	100 KΩ	U2	IC- socket 16 pins
R10	470 KΩ	U1	TL074CNE4
R11	3,3 KΩ	U2	CD4020
R12	1 KΩ	MK1	TCT40-16R
		J1	3,5 mm chassis



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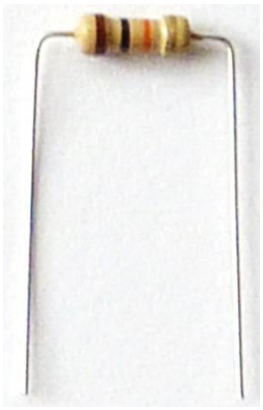
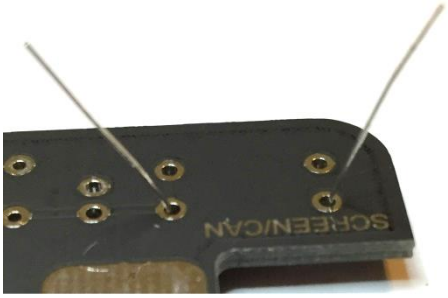


Building Description of the Bat Detector

It is easiest to assemble the components from the bottom upwards. All resistors and diode D2 should be mounted flat against the PCB. For this purpose bend both wires at an angle of 90 degrees, taking into account the distance between the holes on the PCB. Insert the resistor through the board holes and bend the wires on the copper side of the PCB gently slightly outwards. The PCB can now be turned upside down for soldering without the resistor or diode falling out. After soldering, cut off the excess wire just above the soldering joint and do the same for all other components with longer wires such as capacitors and LEDs.

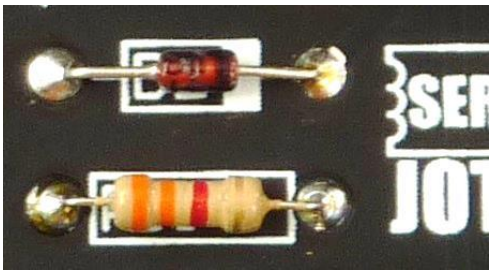
Tip 1: Check or colour the dots at the beginning of the line to indicate which components are already mounted.
Tip 2: When in doubt about the Mountation of a component look at the picture of the finished print, once soldered incorrectly a repair can be tricky.



Mounting Sequence

Successively Assemble the following resistors:

- R1, R2, R3, R6: 10 kΩ (brown, black, orange, gold)
- R4, R5, R7: 220 KΩ (rood, rood, yellow, gold)
- R8, R11: 3,3 KΩ (orange, orange, rood, gold)
- R10 470 KΩ (yellow, purple, yellow, gold) See Page 10 for the value of R10.

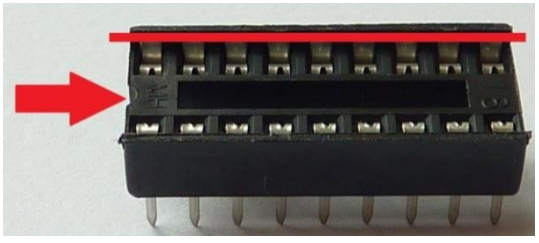


- Mount the diode D2 (1N4148).

This is a glass tube with a black stripe.
WATCH FOR: The line must match the drawing on the board.
The stripe is located on the side of the inscription “Service Kring JOTA-JOTI.

Mount the de capacitors:

- C1, C2: 1 nF (yellow, inscription 102)



Mount both IC-feet:

- U1
- U2.

Make sure they are tightly mounted against the PCB.
Important: there is a notch in one of the ends of the IC sockets,

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this should match the drawing on the board. Make sure all pins protrude right through the PCB before you solder, at the top level all connections must be aligned and in line.

- Mount the de capacitors C3 (100 nF, yellow, inscription 104).

- Mount headphone jack J1, make sure it's closely mounted against the PCB

- Mount both the Potentiometers:
- R9: 100 KΩ (inscription 104)
- R12: 1 KΩ (inscription 102)

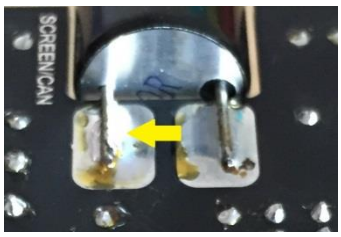
Look carefully at the inscription and do not mix them up
Solder the potentiometers carefully and do not heat it too long! Otherwise it can melt and loosen the runner contact, perhaps decide to let the Assistant do this soldering.

- Mount the capacitors C4 and C5.

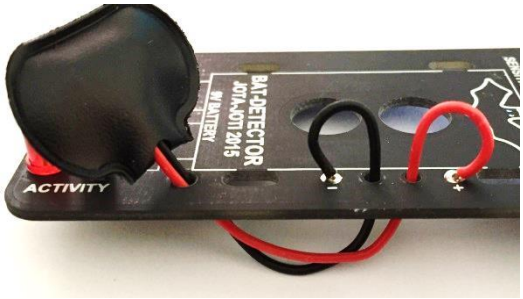
Important: These have a plus and a minus connection. The long wire is the positive and should be marked in the hole by plus (+) on the board.

- Mounted D1.

Important: This LED should in some way be mounted otherwise it will not function, the long wire is on the outside of the PCB. The short wire must goes on the inside of the PCB at the inscription D1.



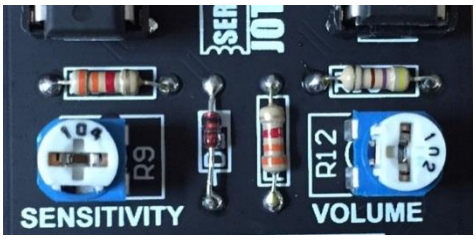
- Mount MK1.
- This is a kind of microphone that can the high pitched bat sound.
  Important: There are two wires, one with a black circle around it and one attached to the metal. See the yellow arrow in the picture. This must be soldered to the PCB on the box with inscription "screen / can".



Mount the battery connector.
Look at the picture to see how this should be done.

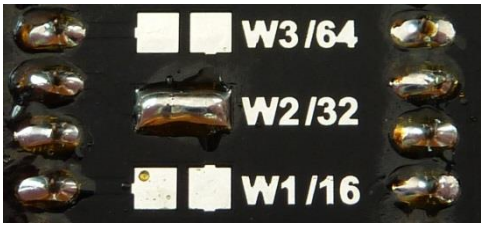
- Then, as last step, place the Chips in its feet

Important: in one of the ends of the IC's is a notch (slit), it must match the drawing on the board and the notch in the previously mounted IC sockets.



- Set the Potentiometers like the picture (see page 8).

- At the back side connect ONE solder bridge (and not more then 1). W1 gives the highest tone, W2 a bit lower, W3 de lowest (see again page 8).



- Connect the battery and the BAT detector can be tested!

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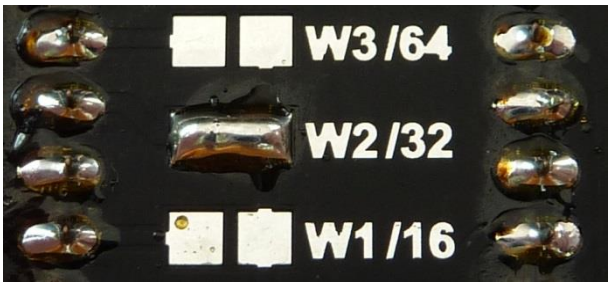
Use and Operation

Function

The Bat Detector receives, as previously indicated, ultrasonic sound waves which are transmitted for example by bats. These high frequencies are converted into frequencies that can be heard by us, human beings. The Bat Detector receives frequencies of about 30-60 kHz.

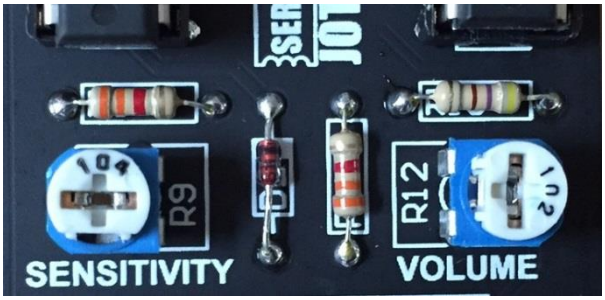
Pitch

The pitch of the headphone signal can be set by connecting one of the sets solder bridges on the back of the PCB . Jumper W1 gives the highest tone and W3 the lowest, and as expected, W2 is in between.



Settings

On the PCB there are two potentiometers, one of which is for setting the headphone volume (R12, VOLUME), the other one is for adjusting the sensitivity of the circuit (R9, SENSITIVITY).This allows you to set the sensitivity of the circuit and thus how quickly it responds to ultrasound. The position of the potentiometers, as the photo, is a good start to test and it usually does not need changing



Ultrasonic Sources

In the absence of bats, there are also a number of other sources of ultrasound:

- Using your fingers, rub together.
- Rattling with keys.
- Net adapters (especially small ones for a mobile phone).
- Dimmed light bulbs (you will hear the phase-control).
- Pierce lemonade, the tiny bubbles make a lot of ultrasound.
- Running water (depends a bit on the tap).

Upon receipt of ultrasound the LED will switch on or off. The LED is therefore not in line with ultrasonic reception but will switch on when it was off and vice versa when detecting ultrasound.

Mounting the battery and Installing the PCB

The shape of the PCB is designed so that the battery can be put firmly with tie-wraps or wide elastic band (like used in underwear).
The width of the PCB is chosen such that it fits (with battery) in a PVC pipe of 50 mm (2”). In this manner, the board can be mounted well protected. You might use a piece of pipe with two covers, at the top with a hole for the ultrasonic transducer, at the bottom an on / off switch. At the bottom of the print is also an additional mounting hole so that it can be secured to a cover using a bent aluminium strip.

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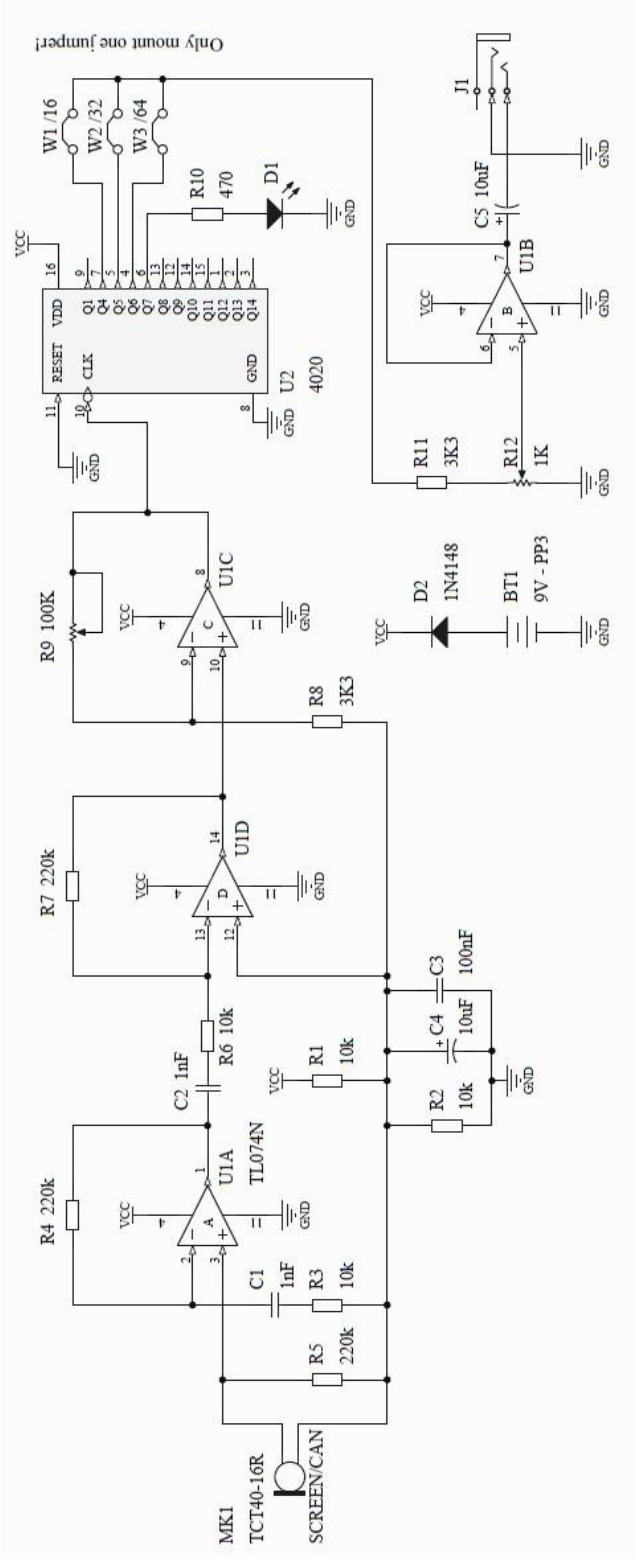
Schematic



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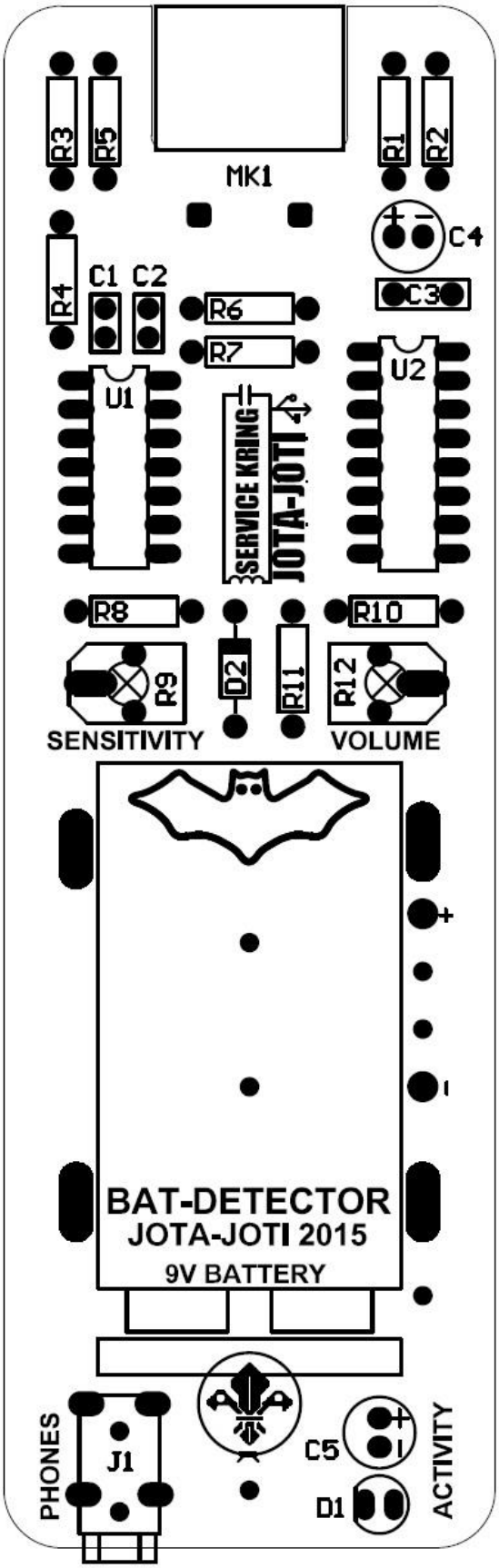
Component Setup



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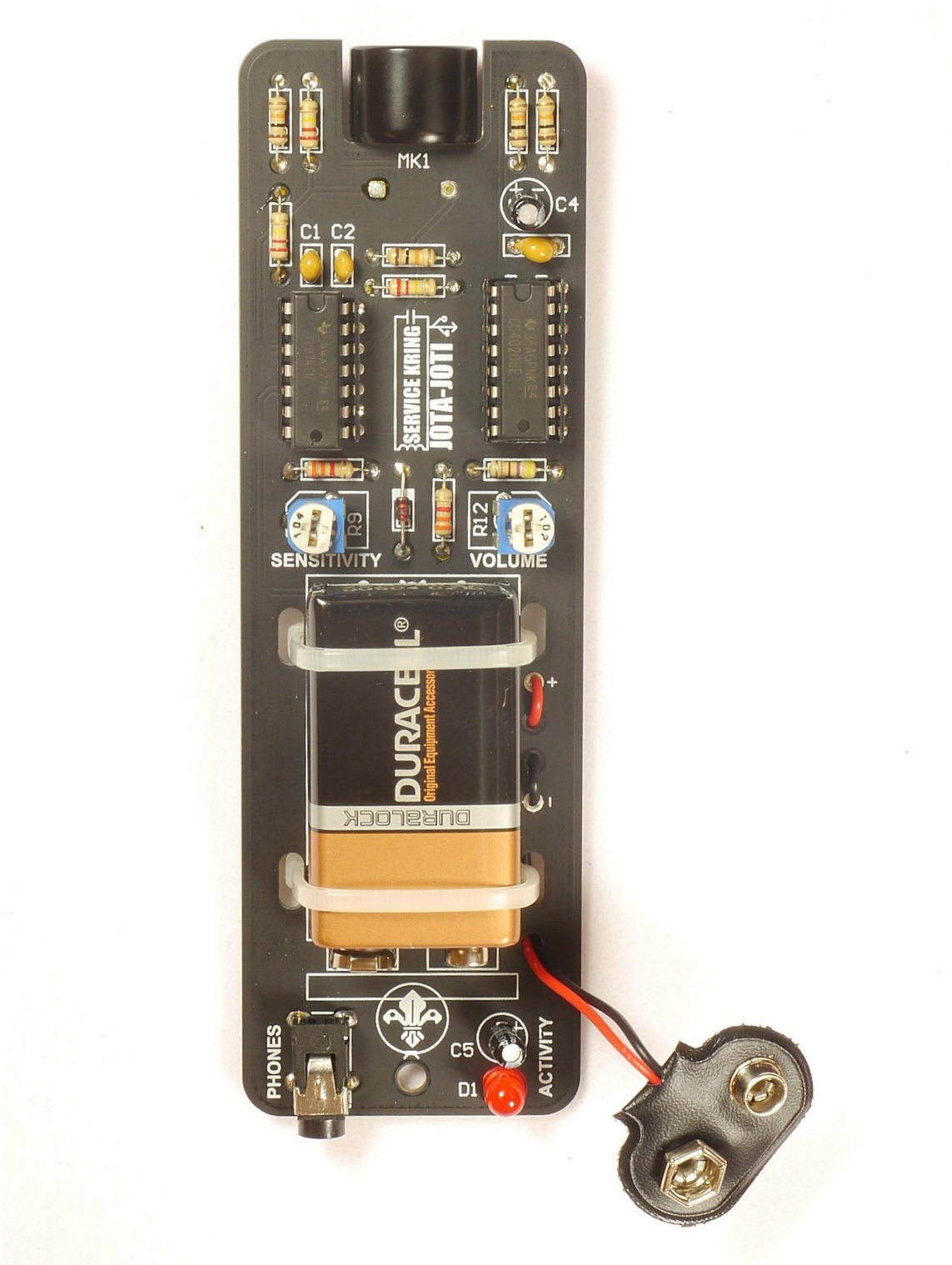
Fully build board



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Soldering with Children

There are at soldering with children some pitfalls imaginable, by avoiding this, it is likely thatthe new little project is successfully completed.

The following items we see in the field:
• The making of the soldered connection takes (much) too long, A good soldered connection is made in about 3 seconds. Approximately 1.5 seconds for pre-heat (with a little solder to the tip for good heat conduction), attach solder, solder and remove the soldering iron. Children do not have this skill yet and the materials are heated for too long and thus too hot.
• Children often tend to put solder on the soldering iron and than "stick" the solder on the board, the flux is already burning and poor soldering is the result. In an attempt to get it right,the solderconnection heats up too long, causing component failures ed.
• Temperature-controlled soldering irons are set at too high a temperature, for leaded solder around 320 ° C is a good temperature for soldering.
• NON-controlled soldering irons often have to high power, and the pin temperature can reach 450-500 ° C. A iron with a power of about 15 to 20 W is for this purpose the most suitable.
• The assitant has previously not read the manual and do not know exactly what to do.
• There is to little guidance in relation to the number of participants. Certainly the youngest children, many need much guidance. A directive is to go aim for one attendant on one beaver, with cubs / gnomes one supervisor per soldering (2 scout members per soldering station). With older Scouts go for one supervisor on four members. As the members are more experienced this can be adjusted of course.
• It is advisable to have besides the solder guidance, one supervisor who controls the PCB with components build on it and (if applicable) places the IC's ect. This troubleshooter can also look at mailfunctional PCB that do not work right away.

Feedback

Do you have comments or would like to give you feedback about the Bat Detector?
Do you have comments or questions about the Service Kring JOTA-JOTI?
Please contact us via the contact form on the site www.kitbuilding.org.

On behalf of the Service Kring JOTA-JOTI, we wish everyone a lot of fun building but also enjoy listening to the Bat Detector!