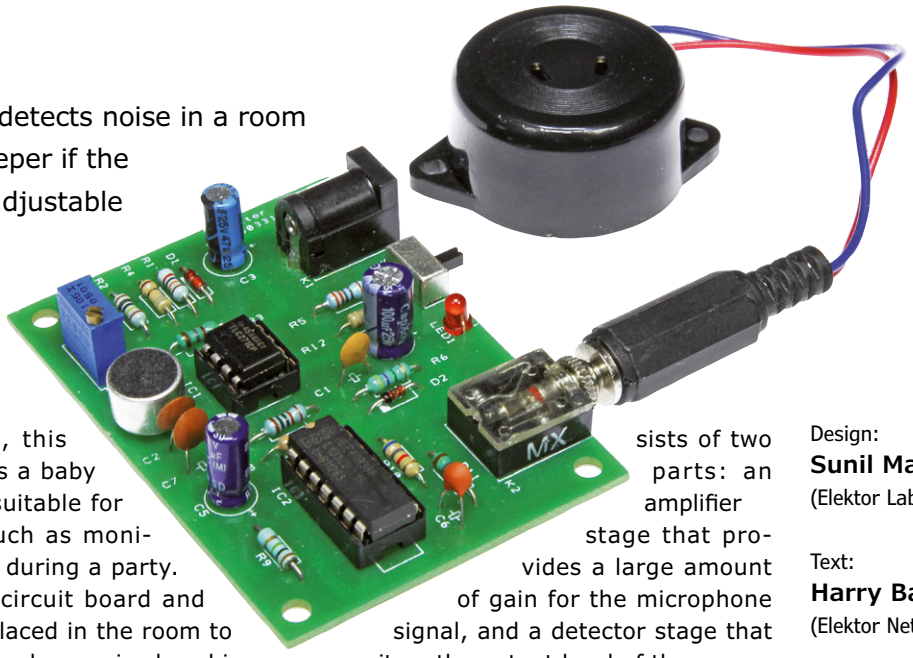
Noise Detector

Beeps when things get too loud

This simple circuit detects noise in a room and activates a beeper if the noise exceeds an adjustable threshold level.



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Among other things, this circuit can be used as a baby alarm, but it is also suitable for other applications such as monitoring the noise level during a party. The idea is that the circuit board and the microphone are placed in the room to be monitored, while the beeper is placed in another room.

Schematic diagram

Figure 1 shows the schematic diagram of the noise detector. The circuit roughly consists of two parts: an amplifier stage that provides a large amount of gain for the microphone signal, and a detector stage that monitors the output level of the opamp and drives the beeper with an AC signal if the output level is sufficiently high.

The noise is picked up by an electret microphone (MIC1). It has a built-in FET buffer stage that is supplied with power via R3 and

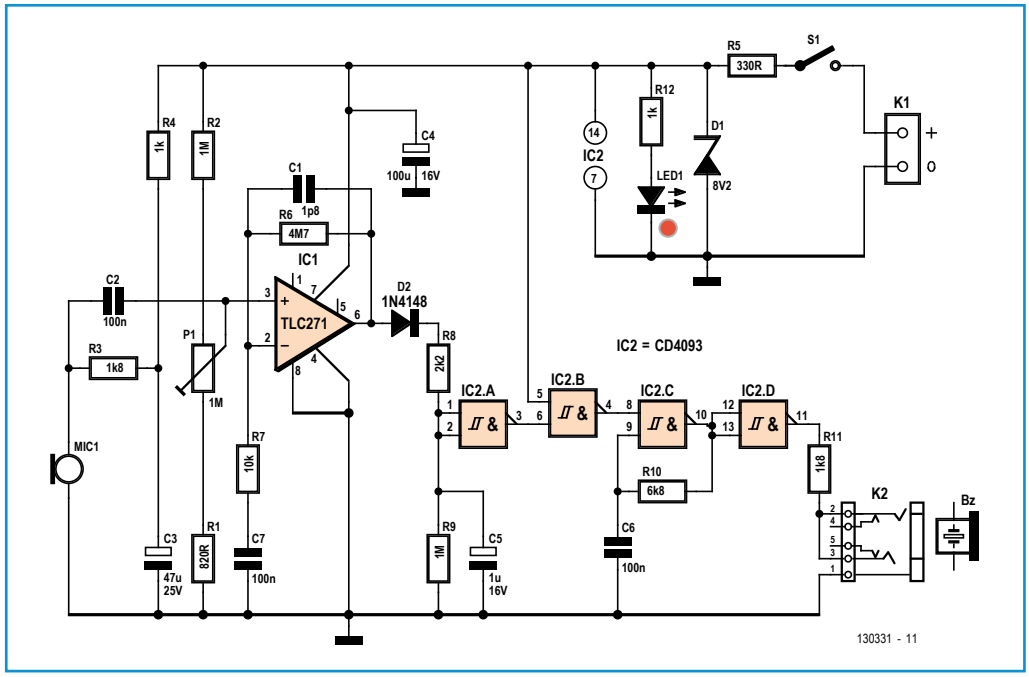
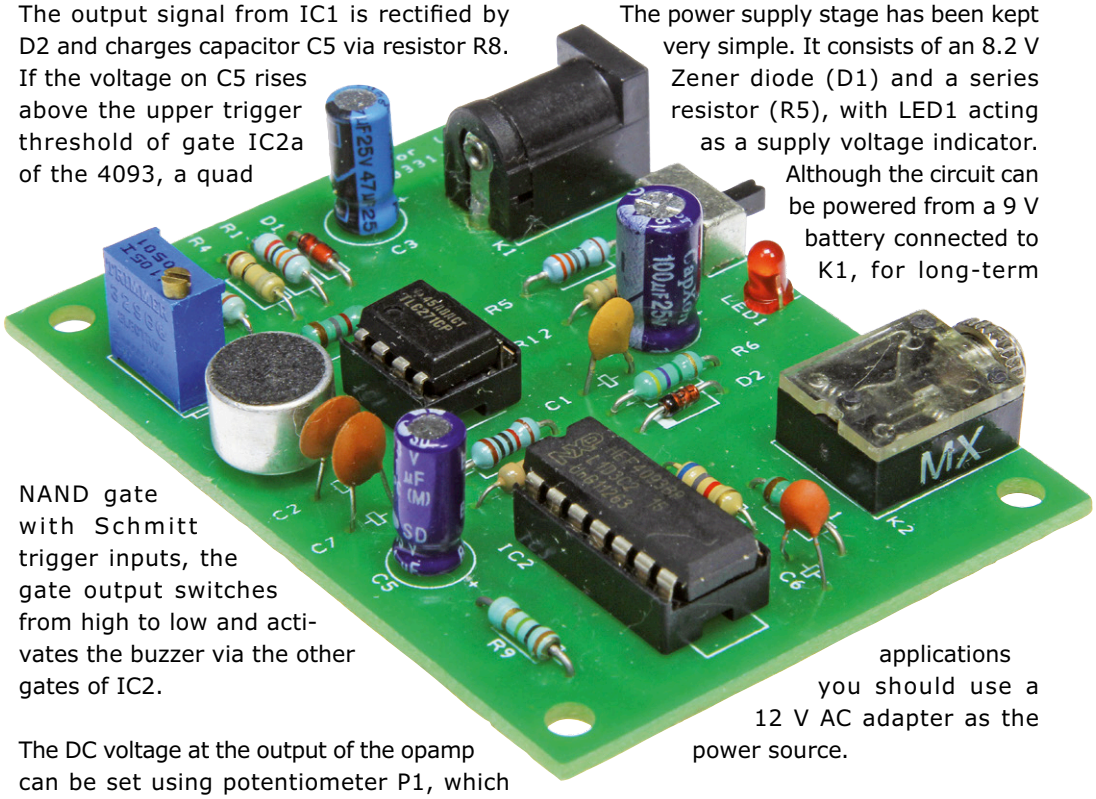


Figure 1.
The circuit consists of a microphone amplifier, a level detector and an oscillator.

R4. Capacitor C3 provides extra smoothing for the FET supply voltage to prevent any AC hum from reaching the circuit input via the supply connection. The microphone signal passes through the coupling capacitor C2 to the non-inverting input of IC1, a low-power opamp with FET inputs. The signal at the output of the opamp (pin 6) is a highly amplified version of the incoming signal on pin 3. The negative feedback network R6/R7 is dimensioned for a gain factor of nearly 500. Capacitors C1 and C7 limit the frequency range to approximately 150 Hz to 18 kHz.

The output signal from IC1 is rectified by D2 and charges capacitor C5 via resistor R8. If the voltage on C5 rises above the upper trigger threshold of gate IC2a of the 4093, a quad NAND gate with Schmitt trigger inputs, the gate output switches from high to low and activates the buzzer via the other gates of IC2.



The DC voltage at the output of the opamp can be set using potentiometer P1, which forms part of a voltage divider (R2/P1/R1) connected to the supply voltage. This allows the user to set the bias on C5 and thereby adjust the sensitivity of the circuit. It's easy to how the position of P1 affects circuit operation. If the DC voltage at the output of IC1 is set to a relatively high level, the total voltage on C5 (bias plus rectified AC signal) will reach the trigger threshold of IC2a at a relatively low noise level. The hysteresis of IC2a ensures that the output level does not switch until the voltage on C5 is distinctly above or below a specific level. The charging resistor R8 prevents the circuit from reacting directly to small noise peaks at the input, and the discharge resistor R9 allows the capacitor to discharge afterwards so that the beeper stops sounding after a few seconds.

The output signal from IC2a is inverted by IC2b, which controls a square wave generator built around IC2c that generates the drive signal for the beeper at a frequency of approximately 1.5 kHz. Finally, IC2d buffers the generator output. A 3.5-mm audio jack is fitted on the circuit board for connecting the beeper to the circuit. Here we used a stereo version because they are readily available.

The power supply stage has been kept very simple. It consists of an 8.2 V Zener diode (D1) and a series resistor (R5), with LED1 acting as a supply voltage indicator. Although the circuit can be powered from a 9 V battery connected to K1, for long-term applications you should use a 12 V AC adapter as the power source.

PCB

To make circuit assembly as easy as possible, the Elektor Lab has designed a suitable PCB layout (**Figure 2**), which is also available for download at [1]. All components are conventional leaded types, so even persons with novice soldering skills should not have any problems putting the board together. All of the components except the beeper, the microphone and the on/off switch are mounted on the PCB. To reduce the risk of damage to the ICs from overheating or static electricity, it's a good idea to follow the usual practice of fitting all the other components on the board first. After assembly, you can test the board with

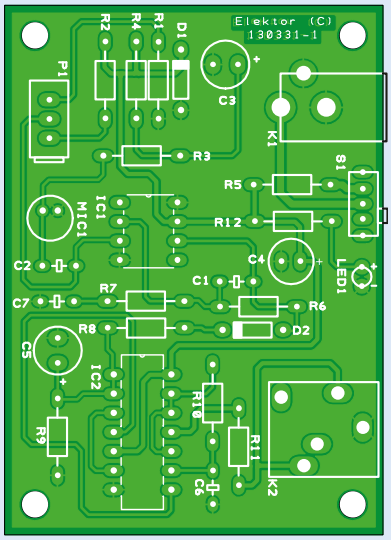
Component List

Resistors
Default ratings: 5%, 0.25W

R1 = 820kΩ
R2,R9 = 1MΩ
R3,R11 = 1.8kΩ
R4, R12 = 1kΩ
R5 = 330Ω
R6 = 4.7MΩ
R7 = 10kΩ
R8 = 2.2kΩ
R10 = 6.8kΩ
P1 = 1MΩ multiturn trimpot, vertical

Capacitors
C1 = 1.8pF
C2,C6,C7 = 100nF
C3 = 47µF 25V radial
C4 = 100µF 16V radial
C5 = 1µF 16V radial

Semiconductors
IC1 = TLC271
IC2 = CD4093
D1 = 8.2V 0.5W zener diode
D2 = 1N4148
LED1 = red, 3mm



Miscellaneous
MIC1 = electret microphone, 2 terminals
S1 = slide switch, right angled, PCB mounting
K1 = DC power adapter socket, PCB mounting
K2 = stereo jack socket, 3.5mm, PCB mounting
Passive buzzer
PCB no. 130331-1

The circuit uses leaded components to simplify PCB assembly.

power applied. First measure the voltage on D1, which should be approximately 8.2 V. Also measure the input current of the circuit by opening S1 and connecting an ammeter (set to a milliamps range) across S1. With our prototype the input current was 11 to 12 mA. To check the operation of P1, connect a voltmeter to the output of IC1 (pin 6) and measure the voltage while turning P1. It should be possible to obtain a range from approximately 2 to 6 V. The beeper should also start sounding after a short delay when the wiper of P1 is at the top position. You can also whistle into the microphone to see whether the circuit responds.

After assembling the circuit board, you can fit it in an enclosure. The microphone can be mounted directly on the PCB with a small hole in the enclosure directly in front of the microphone, but you can also use a length of shielded cable to connect the microphone to the board. You should also make a small hole in the box to allow P1 to be adjusted with a screwdriver. The beeper should of course be located some distance away from the rest of the circuit, and it can be fitted in its own enclosure.

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Web Link

[1] www.elektor-magazine.com/post