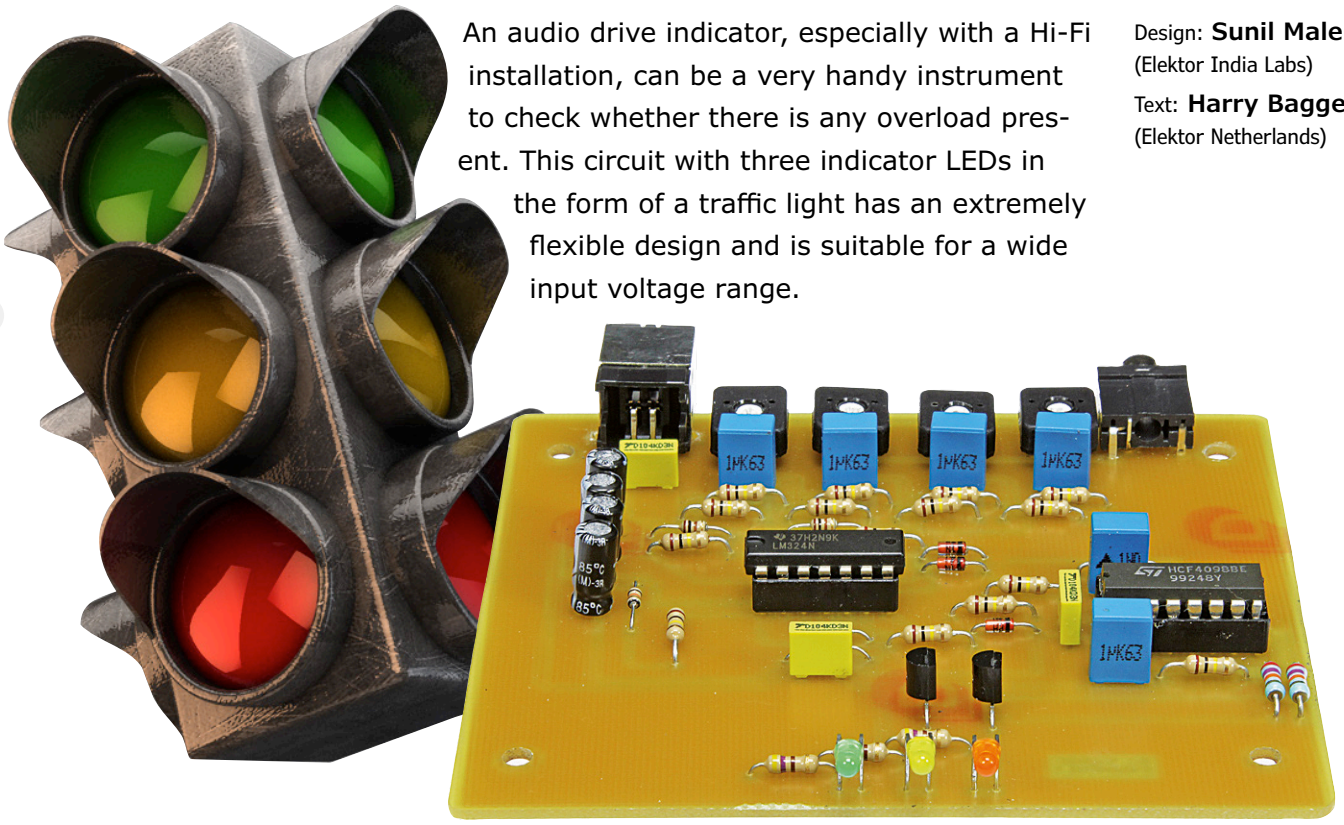
Audio Indicator

Using three LEDs

Design: **Sunil Malekar**
(Elektor India Labs)
Text: **Harry Baggen**
(Elektor Netherlands)



An audio drive indicator, especially with a Hi-Fi installation, can be a very handy instrument to check whether there is any overload present. This circuit with three indicator LEDs in the form of a traffic light has an extremely flexible design and is suitable for a wide input voltage range.

Audio level meters of all shapes and sizes have previously been published in Elektor. In this case we have conceived of something different from the usual VU meters and LED bars. Such comprehensive meters are somewhat excessive on, for example, a Hi-Fi amplifier. It is usually sufficient to have an indication to show whether and output signal is present, how much headroom there is and whether the amplifier is being overdriven. All this requires only two or three LEDs.

In this case the indicator comprises three LEDs in a kind of traffic light design. These indicate the following. The green LED is always on when the power supply voltage is present. This one therefore serves as the power-on indicator for the pre-amplifier. The yellow (or orange) LED will light up whenever there is a signal at the output of the pre-amplifier. In this way you can see at a glance whether the pre-amplifier is supplying a signal to the power and/or headphone amplifier. But it can also be adjusted such that it will light up when the threshold of 3 or 6 dB headroom has been reached. Finally, the red LED indicates whether the output signal from the pre-amplifier exceeds some threshold at which the final amplifier will be overloaded. You can, however, also set the LED to turn on when a specific sound level has been exceeded.

Schematic

The circuit for the control of the LEDs can be seen in **Figure 1**. We start with the simplest part, the green LED D7. This LED is connected to the power supply voltage via series resistor R4. The other two LEDs each have their own signal detector which examines the amplitude of the output signal from the pre-amplifier (or MP3-player or smartphone) and on the basis of that turns the corresponding LED on or off. Each detector also has a pulse stretcher which ensures that the LEDs are clearly visible even if the signal peaks are very brief.

The detector part for the red LED consists of IC1A, IC1B and IC2A, the corresponding part for the orange LED is built around IC1C, IC1D and IC2B. The stereo input signal enters via jack-socket K1. This makes it easy to connect the circuit to a portable audio device, but when built into an amplifier enclosure this socket can be omitted of course. The right input signal is routed to trimpots P1 and P3 and the left input signal to P4 and P2. We will now only describe the detector part for the yellow LED. The wipers of P1 (R) and P2 (L) are each connected to the non-inverting input of an opamp (IC1C and IC1D). Each opamp is configured as an AC amplifier with a very high gain (2200x). At the output of IC1C there is therefore the greatly amplified signal from the right channel and the output of IC1D the greatly amplified left channel. The output signals from IC1C and IC1D are half-wave rectified by diodes D3 and D4. The cathodes of these diodes are connected to the trigger input of the retriggerable monostable multivibrator IC2B. The Q output of IC2B, via

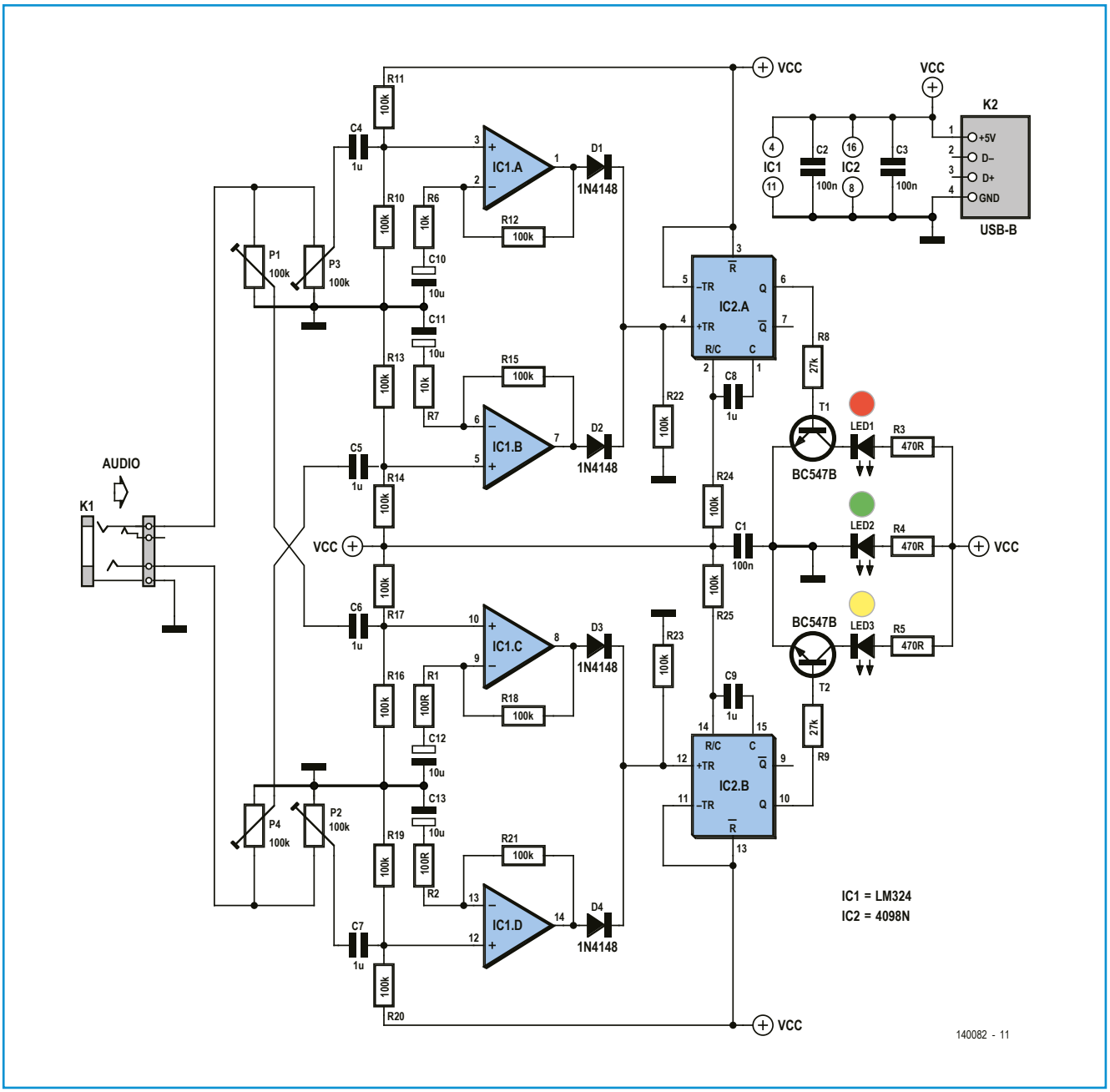


Figure 1.
The circuit measures the input level of each channel individually and then drives a yellow and a red LED via two MMVs.

R9 and T2, drives the yellow LED D6. The MMV will turn on the LED for 0.5 s when the output voltage from D3 and/or D4 exceeds about 3.5 V. Using the potentiometers you can set the sensitivity, separately for each channel, when the yellow LED should turn on.

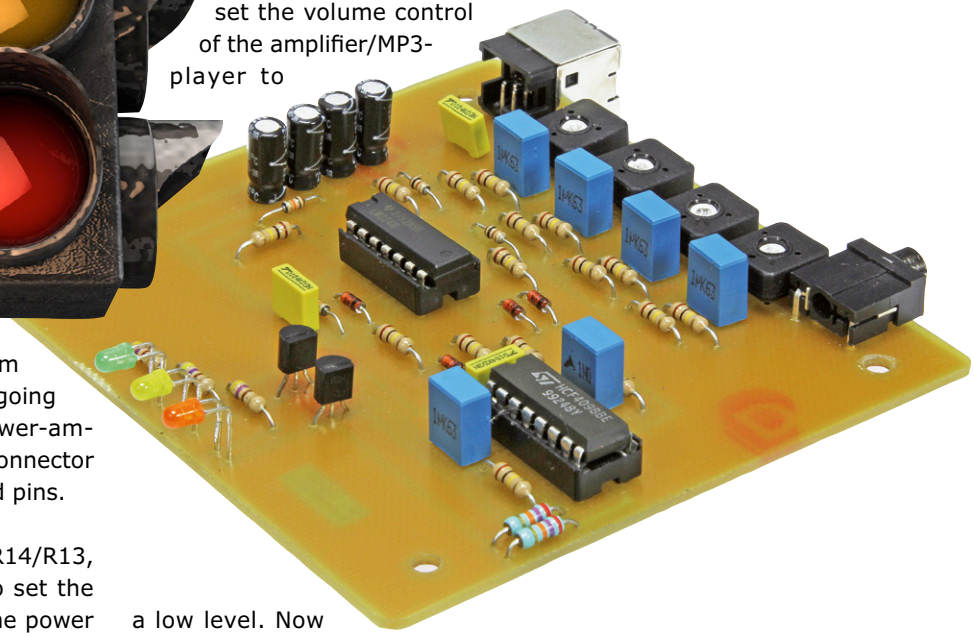
The section for the red LED is identical to that of the yellow LED; the only difference is that the gain of opamps IC1A and IC1B is less because the input sensitivity for the red LED does not need to be as big as that for the yellow LED. This largely concludes the circuit description. Now a few other details: The power supply voltage for the circuit amounts to 5 V (current consumption of 50 mA max.). When you use the circuit with a portable device you could obtain the power supply from a USB connection (K2). If you are going to use the circuit with a pre- or power-amplifier then you can omit the USB connector and replace it with two circuit board pins.

Voltage divider resistors R11/R10, R14/R13, R17/R16 and R20/R19 are used to set the DC-bias of the opamps to half of the power supply voltage. The left and right input signals are amplified separately in each detector circuit in order to prevent the LED from turning on when the left and right signals happen to be of opposite phase; now the circuit only reacts to the larger of the two input signals. You can change the gain of the opamps by changing the value of the resistor for each opamp (R6 for IC1A, R7 for IC1B, R1 for IC1C and R2 for IC1D); the larger the resistor value, the lower the gain. The length of time that the yellow LED is lit is determined by C9 and R25, and for the red LED by C8 and R24. If you would like to increase the minimum on time then you will need to increase the value of the capacitor.

Construction and adjustment

Figure 2 shows the circuit board for the circuit. The whole design is quite spacious and only through-hole components have been used so that construction should not give you any problems at all. As mentioned earlier, whether you fit the USB connector or signal jack depends on how you personally intend to use the circuit. If you would like to house the circuit in its own enclosure then you will find a suggestion for a suitable box from Hammond in the component list.

The adjustment for the LEDs also depends on your personal preference. If you would like the yellow LED to light up when there is a signal at the input then do the following. Rotate P1 and P2 to zero, turn on some music and set the volume control of the amplifier/MP3-player to a low level. Now turn the two trimpots up until the yellow LED just turns on.



Another option, for example, is for the yellow LED to light up at –6 dB below clipping (handy in a pre- / power-amplifier combination). In this case you will have to know the output voltage level of the preamplifier that will cause the power amplifier to clip. Take half of this value and apply this (via a test CD or signal generator) to the input. Then rotate P1 and P2 such that the LED will just turn on. It may be necessary in this case to reduce the gain of IC1C and IC1D by taking a larger value for R1 and R2. The adjustment has to be carried out for each channel separately. The red LED is adjusted with P3 and P4 such

that it will light up when the sound level is too high (with and MP3 player or amplifier just use your own hearing to judge this). Another possibility is to set P3 and P4 so that the red LED will turn on when the power amplifier is clipping. Again you will need to know the signal level at which this occurs, after which you apply the appropriate signal level using a test CD or signal generator to the input and then adjust P3 and P4 until the red LED just lights up.

As you can see this circuit offers quite a few different configuration options and can be used in practically any situation.

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Web Link

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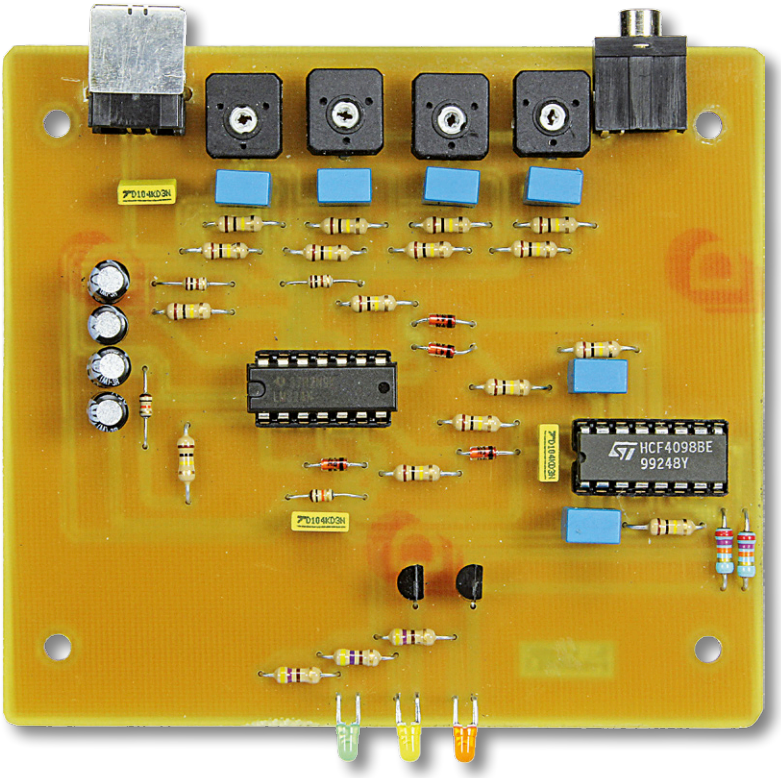

Component List

Resistors:

R1,R2 = 100Ω
R3–R5 = 470Ω
R6,R7 = 10kΩ
R8,R9 = 27kΩ
R10–R25 = 100kΩ
P1–P4 = preset 100kΩ, horizontal

Capacitors

C1-C3 = 100nF, 0.2” pitch
C4-C9 = 1µF, 0.2” pitch
C10-C13 = 10µF 50V, pitch 2mm

Semiconductors

IC1 = LM324, quad opamp
IC2 = CD4098BE
T1,T2 = BC547C
D1–D4 = 1N4148
LED1 = LED red, 3mm
LED2 = LED green, 3mm
LED3 = LED yellow, 3mm

Miscellaneous

DIP-16 IC socket for IC1
DIP-14 IC socket for IC2
K1 = stereo 3.5-mm jack socket, PCB mount
K2 = right angled USB-B connector, PCB mount, or 2 PCB pins
PCB no. 140082-1
Case, e.g. Hammond 1591, dim. 122.5 x 96 x 35 mm

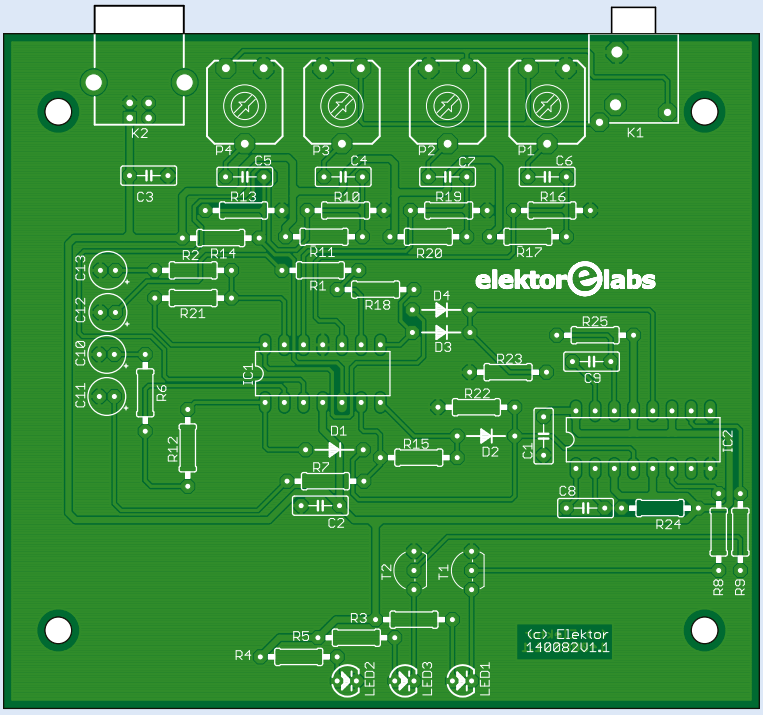

Figure 2. The circuit board for the signal level indicator is generously sized so that everything is easily fitted and soldered.