EDITION 1

Assembly Manual

LED Battery Voltage Indicator

K-3118

(PCB and components only)

Please read Disclaimer carefully as we can only guarantee parts not the labour content you provide.

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Here's a flexible circuit that can be used in just about any piece of battery operated equipment, to combine the functions of a power-on LED and battery voltage indicator. Measuring only 25mm square, the circuit can be easily mounted in the smallest of spaces, to give you warning of impending battery failure.

I came up with this little circuit to answer my need for a combination power-on LED and battery voltage indicator, in a compact piece of equipment that I was developing. Its three-pin red/green LED glows green as long as the battery voltage is adequate, but changes to red when it drops below an adjustable threshold, giving a clear indication of when the battery needs changing.

Current consumption is only 3mA at 6V and 8mA at 10V, which is only a few milliamps more than that of a LED on its own.

The circuit is quite flexible, being usable over a voltage range of about 6 to 30V, and could have other uses. For example, by simply reversing the LED's connections, it would produce a red glow to indicate that the voltage has *exceeded* a preset value.

Building it

All components except the LED are mounted on a 25mm (1") square PCB coded ZA1255 (95bi9), which doesn't have any mounting holes because it can easily be held in place with a small piece of double-sided foam adhesive tape.

With only nine components on the board, construction is very straightforward. IC1 is available in both the usual TO-92 package and a TO-46 metal can; the pin-outs for both packages is shown on the overlay diagram. You can use either a horizontal or vertical mount trimpot for VR1, as the board has been designed to accommodate both styles.

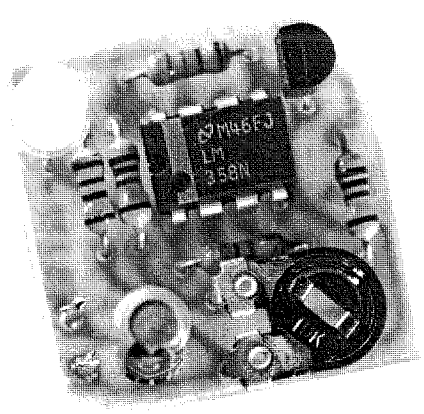
Operation isn't terribly complicated. IC1 is a precision 2.5V voltage reference device, and IC2a compares its voltage with a proportion of the incoming supply voltage, adjusted by VR1. As long as VR1's wiper voltage exceeds 2.5V, IC2a's output stays at almost the negative rail voltage.

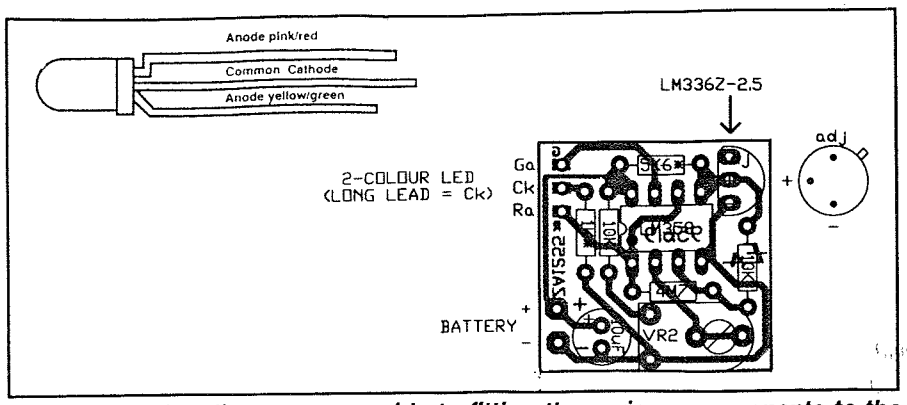
IC2b functions as a simple 'inverter'; when IC2a's output is below 2.5V, IC2b's output (pin 7) rises to almost the full supply voltage. The voltage difference between the two outputs causes current to flow through the green half of the LED, turning it on.

If VR1's wiper voltage drops below 2.5V (due to the supply voltage falling), pin 1 of IC2 rises to nearly the supply voltage, while the output of IC2b drops to a very low voltage — reversing the current through LED1, which changes colour to red.

R3 and R4 provide a small amount of 'hysteresis' to IC1a, to ensure a sharp transition between the two states.

The component values on the circuit are suitable for supply voltages of about 9 to 12V, but if you want to use it with





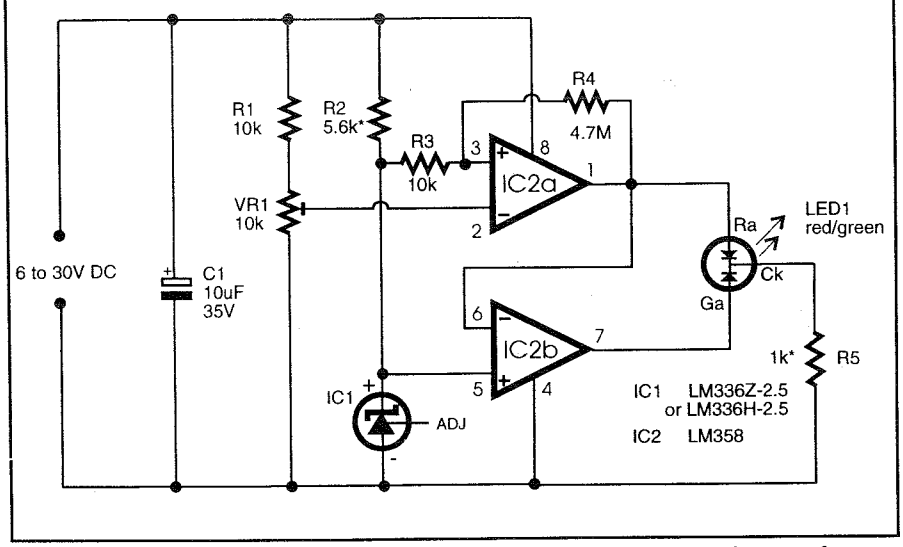
Use this overlay diagram as a guide to fitting the various components to the voltage indicator's PC board. Note that the value of the 5.6k and 1k resistors need to be changed to suit the battery voltage being monitored.

Parts List

R1,3	10k (brn-blk-org)
R2	5.6k (grn-blu-red) - see text
R4	4.7M (yel-vio-grn)
R5	1k (brn-blk-red) - see text
VR1	10k horiz. or vert. trimpot
C1	10uF 35/63VW RB electrolytic
LED1	Red/green bi-polar LED
IC1	LM 336Z-2.5 (or LM 336H-2.5) 2.5V voltage reference
IC2	LM 358 dual low power op-amp

PCB coded (ZA1255) 95bi9 25mm x 25mm; 4 x PC pins; hook-up wire, etc.

Circuit Diagram



As you can see, the voltage monitor uses a dual op-amp, a voltage reference chip and a dual polarity two-colour LED, with a handful of passive components. Preset pot VR1 is used to adjust the circuit's threshold.

voltages outside this range, it may be necessary to vary the value of R5 to keep the LED current in the area of 5 to 15mA. IC1 only needs about 0.5mA minimum to function correctly, so at higher supply voltages, R2's value could be increased to minimise supply current.

To set the circuit up, connect it to a variable DC power supply and adjust VR1 until the LED changes colour at the desired voltage. You can now install it in your latest piece of equipment, and never be caught out with a flat battery again.

Notes & Errata