ANYONE who has experienced the discovery of a flat car battery, particularly at the *wrong* end of a journey in the pouring rain, will appreciate the value of being able to watch the battery voltage. Since most modern cars do not have a voltmeter fitted as standard, it was decided to "dream up" a small indicator unit. The circuit arrived at gives the tri-state indication of HIGH, NORMAL, and LOW voltage condition; the two presets providing a wide range of possible settings.

BATTERY CONDITION INDICATOR

P. SCARGILL

PRINCIPLE OF OPERATION

The circuit works by comparing a stable reference voltage level to a fixed ratio of the battery's actual supply level. The reference chosen was about half the theoretical battery voltage, which for most modern cars will be 6V. Zener diodes of around this value do not create too much trouble with temperature variations, although in the final analysis the Zener voltage will not be entirely critical anyway.

As the battery voltage fluctuates due to loading, charging, and its general state of health, it will be compared to the relatively stable reference voltage, and the difference between the two levels magnified by the comparitor to drive the l.e.d.s. These will not indicate by how much the reference voltage has been exceeded or fallen short of, only that one of the preset limits either side of it has been crossed over. Crossing the upper limit will indicate overcharging, and crossing the lower limit will indicate undercharging or overloading.

CIRCUIT DESCRIPTION

Referring to Fig. 1, the reference voltage is generated by R4 and D1, and is fed to the non-inverting input of IC1; the current through R4 being just under 2·4mA. This is compared to (or amplified with reference to) a fixed proportion of the car battery voltage, the ratio being determined by VR1.

Sensitivity to change is controlled by VR2 and R1. This is simply the gain control of the amplifier, and is used to determine how little voltage difference at the input, is needed to reach the l.e.d. threshold levels after amplification.

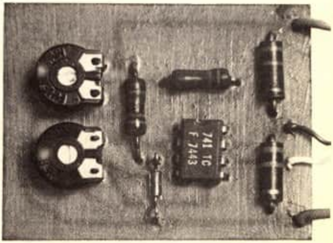
COMPONENTS . . .

Resistors
R1 1·5kΩ
R2, R3 330Ω
R4 2·7kΩ
All 10% ¼W carbon

Potentiometers
VR1 10kΩ lin preset
VR2 4·7MΩ lin preset
All miniature horizontal

Semiconductors
IC1 741 d.i.l.
D1 5·6V 400mW Zener
D2 TIL209 red (or similar)
D3 TIL209 green (or similar)

Miscellaneous
FS1 200mA
Flying fuse holder for FS1
Printed circuit board, etc.



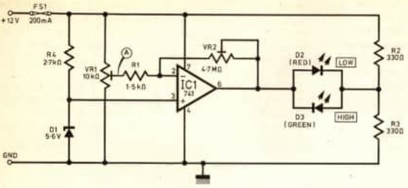


Fig. 1. Circuit diagram of Battery Condition Indicator. (For positive earth vehicles, simply connect the input supply wires the opposite way around, so that the line through FS1 connects to chassis instead)

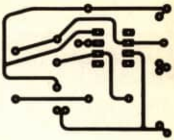


Fig. 2. Printed circuit layout. (Full size)

Since the reference is approximately half the supply voltage, then it follows that the switching mid-point will be roughly correct when VR1 is set halfway. If the battery voltage *increases*, the voltage at point "A" will also increase, and eventually exceed the reference voltage. When this happens, the output of IC1 swings low and illuminates D3. Conversely, if the battery voltage *falls* D2 will light up; and of course the nominal battery voltage will leave both l.e.d.s off. Resistors R2 and R3 limit the current in D3 and D2 respectively, and the maximum current, as a result of these will be around 20mA. Therefore the unit can be wired independently of the ignition switch, since this would take months to drain the average car battery.

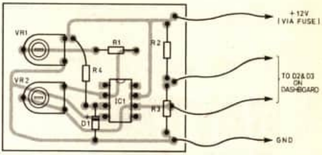
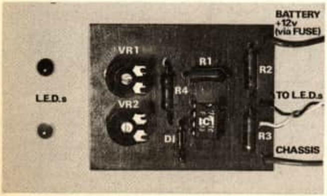


Fig. 3. Component layout for Battery Condition Indicator. A fuse (FS1) should be inserted into the +ve supply wire using a flying lead type fuse holder

CONSTRUCTION

A full size p.c.b. layout is shown in Fig. 2, the component layout of which is shown in Fig. 3. Care should be taken over the correct orientation of IC1 and D1. The l.e.d.s are mounted on the vehicle dashboard in an eye-catching position, and only two leads are necessary for the connection of these. The type of l.e.d.s used is completely a matter of choice, but larger ones will be noticed more readily. It would be a good policy to mount these l.e.d.s away from too much ambient light.

Note that in the photograph the posture of R4 is slightly different to that in Fig. 3. This is of no significance. If the component board is to be mounted behind the fascia panel, there is ample space on the p.c.b. to drill fixing holes.



Tri-state l.e.d.s are now available which will illuminate either red, green, or remain off. These are merely two back to back l.e.d.s in one package, and although one of these is "made for the job", they are considerably more expensive than using two discrete diodes.

The circuit board can be mounted in a box, or simply screwed behind the fascia panel, but it is a good idea to lacquer the component board to protect it against moisture.

SETTING UP

Both presets should be set to midway position, and the unit connected to the car battery *ensuring that the correct polarity is applied*, otherwise IC1 will be damaged.

Assuming that the car battery is at the correct voltage to start with, adjust VR1 until both l.e.d.s are off. If this cannot be achieved, set VR2 for less sensitivity (clockwise) and try again. VR1 should be adjusted to the centre of the "dead zone", and then VR2 re-adjusted to give a dead zone supply variation of ±1V either side of nominal (13V) before a l.e.d. lights up. A wider range than this can be adjusted for, if other applications are envisaged. ★