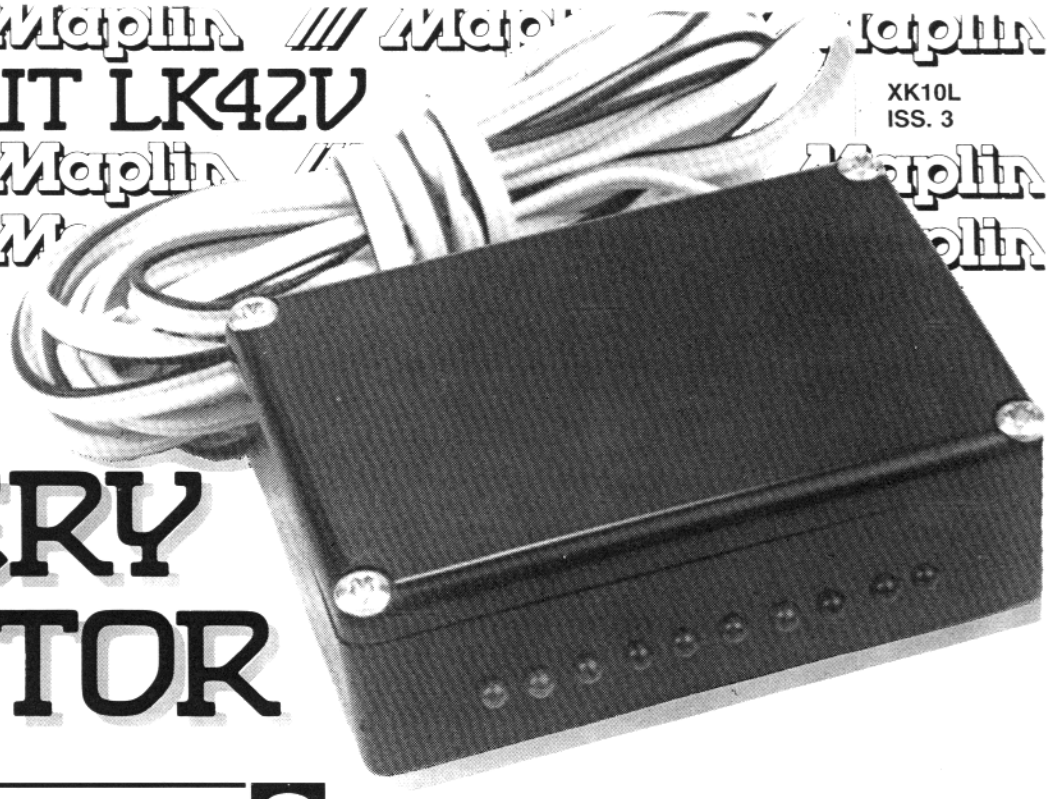
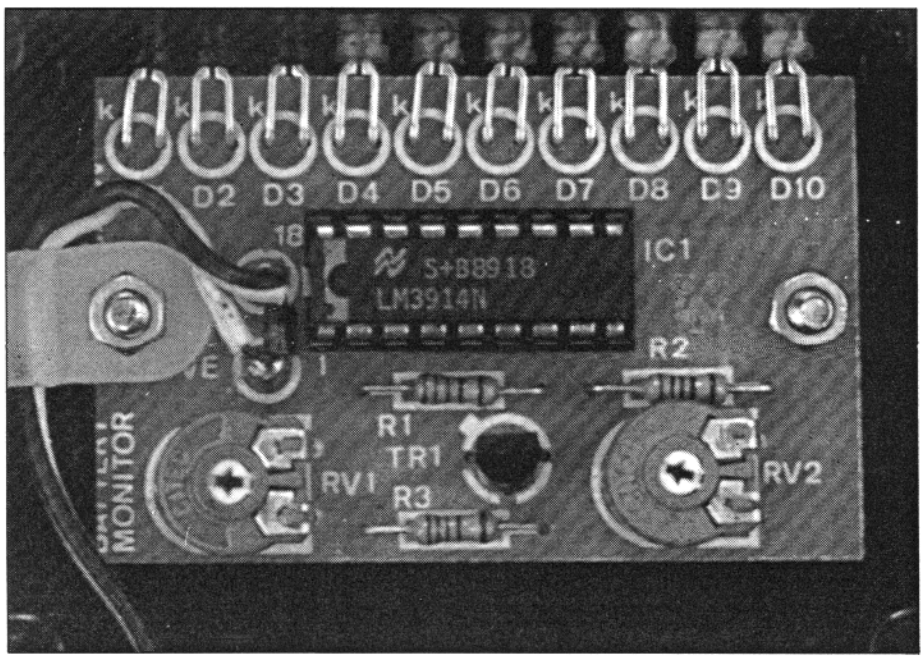
PROJECT KIT LK42V

XK10L
ISS. 3

CAR BATTERY MONITOR



PROJECT CONSTRUCTION RATING: 2



Close-up of the pcb.

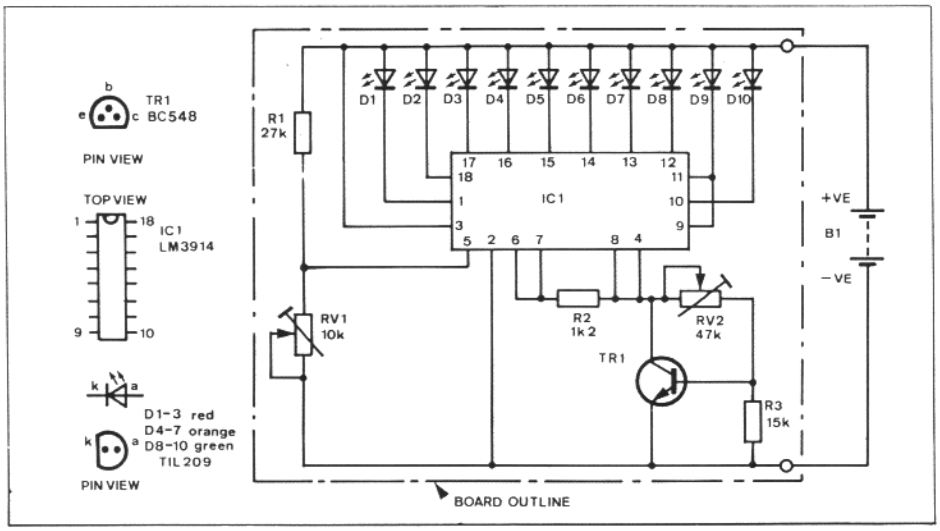


Figure 1. Circuit diagram.

This Maplin Project is rated 2 on a 1 (easy) to 5 (complex) scale of expertise and equipment required to construct the kit. The Car Battery Monitor is easy to build but not suitable for absolute beginners. This project requires access to a variable bench power supply or a battery charger for setting-up. Before starting construction please read this instruction leaflet thoroughly.

Car Battery Monitor

Any number of things from a faulty alternator to left-on headlights (or sidelights, even) can result in a flat battery – and the first you are likely to know about it is when you turn the key one morning and the car won't start! The Car Battery Monitor is a useful little unit designed to warn you in advance by displaying the battery's state of charge with a row of ten LED's.

The Monitor consumes a miserly 20mA (it would take 2,000 hours to discharge a 40Ah battery), so it can be left permanently connected to the battery if required. Alternatively it could be connected to the 'ancillaries' side of the ignition switch.

The Car Battery Monitor will even reveal faults like a slipping fan-belt; a problem which prevents the battery from charging properly, but leaves the dashboard battery warning light off. It will even show how the battery is handling the strenuous work of starting the car (did you know it takes some twenty minutes of driving to put back what a five-second start takes out!).

Circuit

The heart of the monitor is the LM3914 bar-graph driver IC, used to drive a row of red, orange and green LED's which together indicate a magnitude of the battery charge voltage in ten steps, approximately ½V each step from 9V to 14V. The IC contains an input buffer, a potential divider chain, comparators, and an accurate 1.2V reference source. Logic is also included which gives the choice of 'bar' or 'dot-mode' operation – the latter is used in this application. The comparator causes the LED's to light at 0.12V intervals of the input voltage. TR1 acts as an amplified diode, raising the lower end of the divider chain and the negative terminal of the reference source (IC1 pins 4 and 8) to 1.9V. The upper end of the chain at IC1 pin 6 is connected to a reference source output voltage of approximately 3.1V from pin 7. The potential divider formed by R1 and RV1 attenuates the supply voltage and produces the signal input to the comparator, such that a supply range of 9 – 14V covers the span of the divider chain and is indicated over the whole of the ten segment LED display.

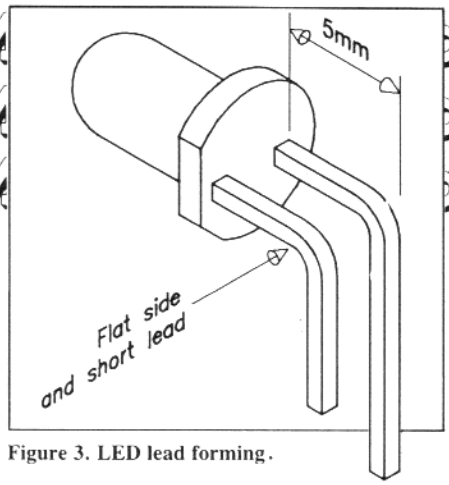


Figure 3. LED lead forming.

The LED brightness is held constant by an internal constant current source.

Construction

If you are a relatively inexperienced project builder then please refer to the constructors' guide supplied with this kit for hints and tips on soldering and constructional techniques.

Construction is straight-forward: first fit the resistors R1 to R3 (solder and crop as you go); next insert the two presets, then fit both veropins from the *track* side using a hot soldering iron to push them home. Now fit the IC socket and transistor TR1. Please note that the transistor package is *not* the same as the legend on the PCB – see Figure 1 for pin-out details.

Next, identify the polarity of each LED. Hold the LED with the cathode towards you (the cathode is the shorter lead and adjacent to the flat on the lower side of the package), then with the aid of long-nosed pliers bend the leads downwards through 90 degrees at a point approximately 5mm from the body (see Figure 3). Each LED is inserted from the component side of the PCB and then soldered in position to create a line of LED's at the same distance from the edge of the PCB. Fit in the following order: D1 – D3 red, D4 – D7 orange, D8 – D10 green. Lastly insert IC1 into its socket.

The next job is to drill the holes in the box. Cover the box with masking tape, as this helps with marking out the holes and prevents scratching the box, and it also provides a non slip surface to prevent the drill bit moving. See Figure 4, for hole positions. After having drilled all the holes, the PCB can be fitted into the box using two M3 x 16mm screws, with two M3 x ¼ inch spacers under the PCB to position it at the correct height, and the PCB secured with M3 nuts (see Figure 5). The zip wire should now be soldered to the veropins; fit the 'P' clip to the zip wire and

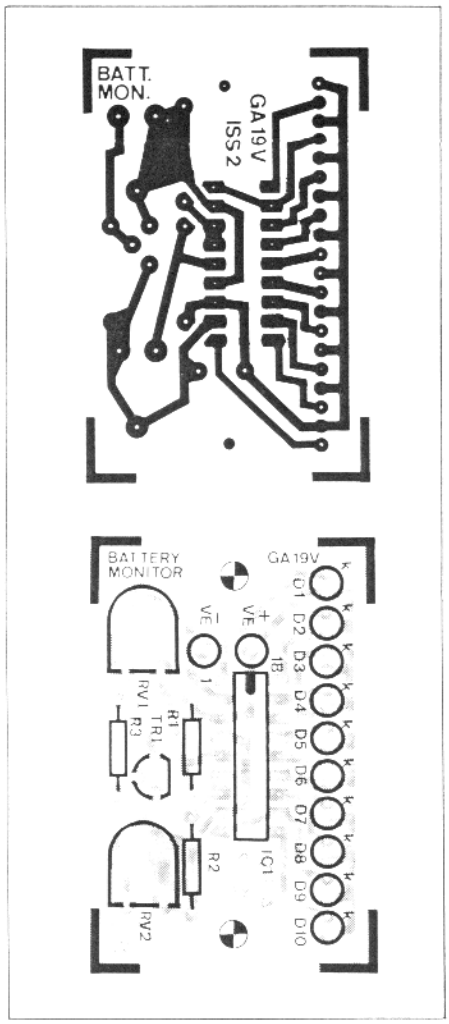


Figure 2. PCB.

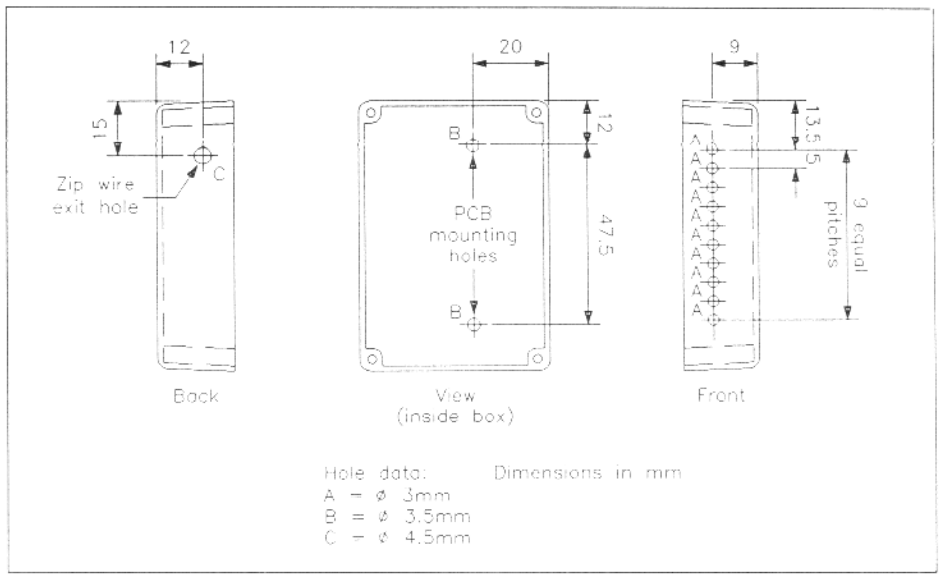


Figure 4. Box drilling details.

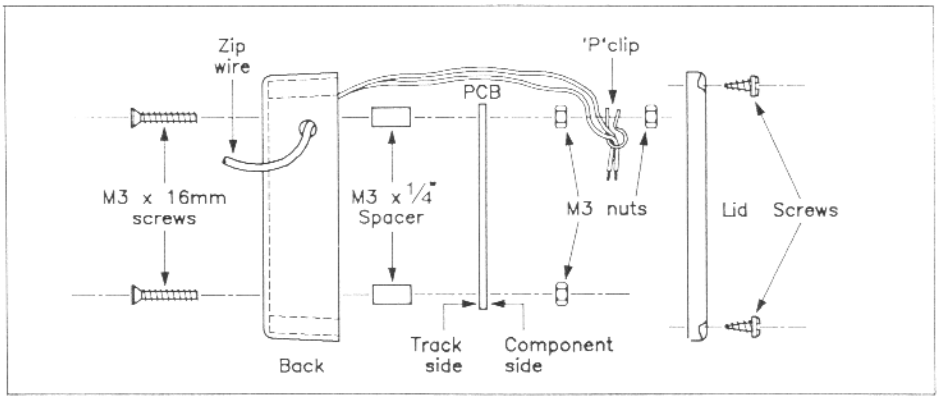


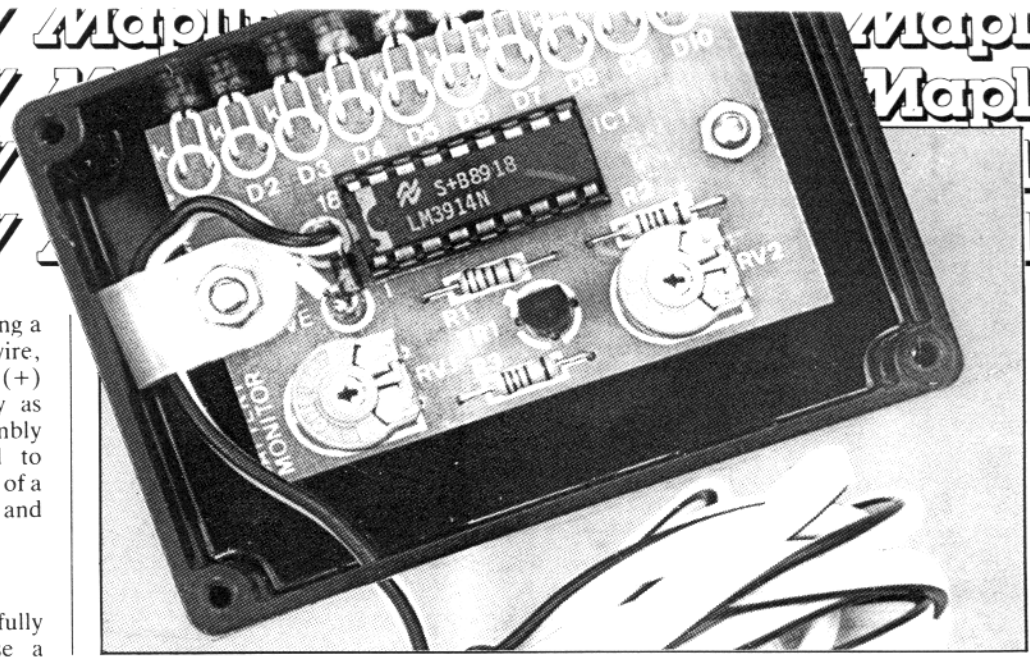
Figure 5. Box & PCB assembly.

secure it to the M3 x 16mm screw using a second M3 nut. Having fitted the zip wire, insert the fuse holder in the positive (+) supply line as close to the battery as possible, see Figure 6 for assembly instructions. The fuse is included to protect the battery wiring in the event of a short circuit. The unit is now complete and ready for calibration.

Calibration

Connect the battery monitor to a fully charged battery, or preferably use a variable voltage bench-PSU set to 14V. If this is not possible connect a battery charger to the charged battery and switch it on to ensure that a real 14V level is achieved (max. output from a car's charging/battery system while running is 14V, not 12V). Please note that connecting the battery monitor to the supply the wrong way round will result in permanent damage to IC1!

Set your multimeter to the 2V range, connect the common (black) lead to 0V, and the positive (red) lead to pin 8 of IC1. Using a screwdriver, adjust RV2 until the voltage on the multimeter reads 1.9V. Remove the meter leads, and then adjust RV1 until the top end green LED lights. The battery monitor is now calibrated. All that is left to do now is to screw the back cover onto the box, and fit it into your car. Quickstick pads have been supplied to mount the box onto the dashboard if required, and remember to secure the wiring away from hot or moving parts using cable ties (order code BF91Y) as accidents can be expensive if not dangerous. Happy motoring!



The finished unit.

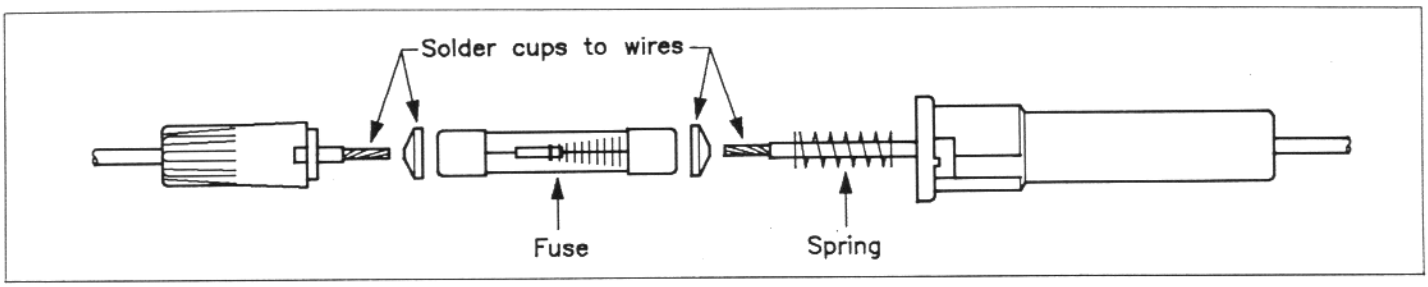


Figure 6. Fuse holder assembly.

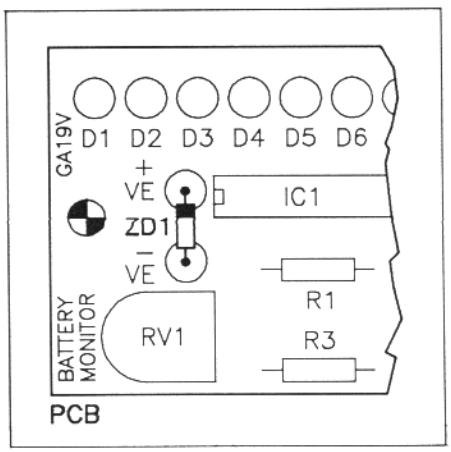


Figure 7. Adding zener diode protection to the module.

Footnote

It has been brought to our attention that there is a possibility of damage to the LM3914 IC in some vehicles due to the possibility of high voltage spikes being present on the supply line. Therefore the optional 15V zener diode should be fitted across the supply veropins as shown in Figure 7.

CAR BATTERY MONITOR PARTS LIST

RESISTORS: 0.6W 1% Metal Film			
R1	27k	1	(M27K)
R2	1k2	1	(M1K2)
R3	15k	1	(M15K)
RV1	10k Hor Encl. Preset	1	(UH03D)
RV2	47k Hor Encl. Preset	1	(UH05F)
SEMICONDUCTORS			
D1-3	Mini LED Red	3	(WL32K)
D4-7	Mini LED Orange	4	(WL34M)
D8-10	Mini LED Green	3	(WL33L)
TR1	BC548	1	(QB73Q)
IC1	LM3914	1	(WQ41U)
MISCELLANEOUS			
	Batt Mon PCB	1	(GA19V)
	DIL Socket 18 Pin	1	(HQ76H)
	Box 301	1	(LL12N)
	Zip Wire	3 Mtrs	(XR39N)
	P Clip ⅛in.	1	(JH21X)
	M3 x ¼in. Spacer	1 Pkt	(FG33L)
	M3 x 16mm Screw	1 Pkt	(JD16S)
	M3 Nut	1 Pkt	(BF58N)
	Quickstick Pad	1 Strp	(HB22Y)
	In-Line Fuse Holder	1	(RX51F)
	1¼in. 100mA Fuse	1	(WR08J)
	Constructors Guide	1	(XH79L)
OPTIONAL (not in kit)			
	Zener Diode 15V 1.3W	1	(QF57M)

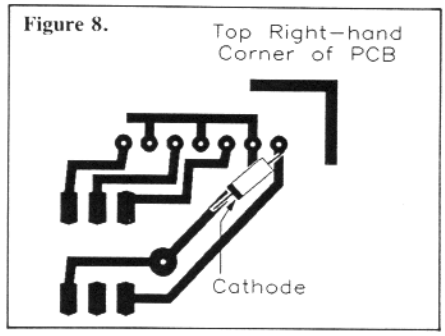
The parts listed above, excluding Optional, are avaliable as a kit:
Order As LK42V (Car Batt Monitor Kit)

Modifications

Due to manufacturing tolerances concerning IC1, and also the fact that the performance of modern LEDs is vastly improved over those available at the time of the initial introduction of this kit, LED D1 may be found to glow dimly whenever the Battery Monitor is powered up, and continue to remain lit. If you find this annoying, the problem may be alleviated by the addition of a 2·7V, 500mW Zener diode (Order Code QH00A), soldered across the two tracks shown in Figure 8. The modified circuit diagram which includes this addition is shown in Figure 9 (ZD1).

Please note also that countersunk screws (JC70M) are now supplied instead of the previously supplied panel headed screws. It is now possible to countersink the two PCB fixing holes on the outside of the box using a countersink bit or an oversized drill bit (e.g., 6·3mm or ¼in.), before fitting these two screws.

Figure 8.



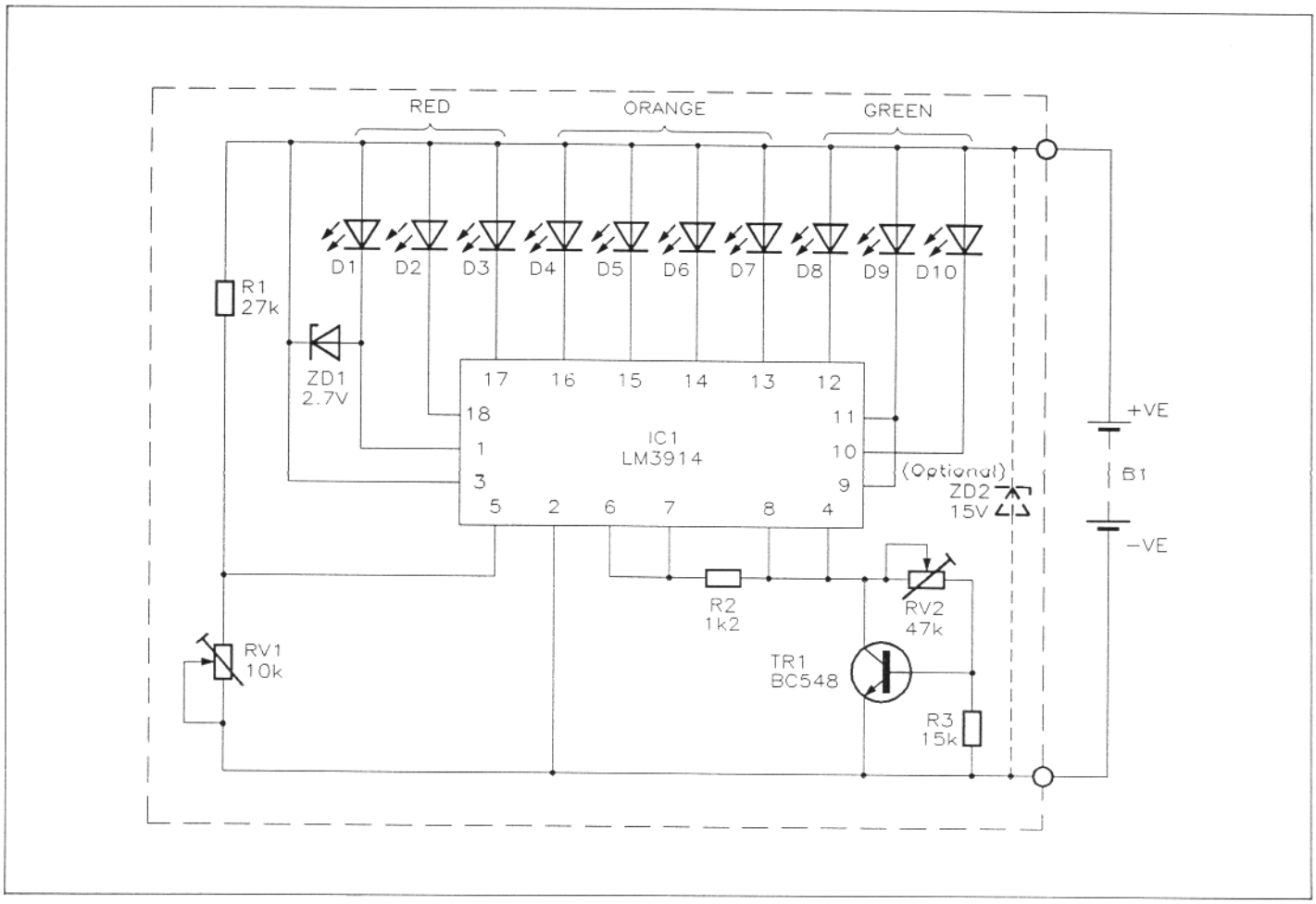


Figure 9.

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