

Bargraph Car Voltmeter

A 'must' for the proud automobile owner. An all solid-state 10-LED expanded-scale car voltmeter or battery-condition indicator.

A VOLTMETER is a useful accessory to have fitted to a car since it can, when properly used, give the owner an excellent indication of the state of the battery and its charging circuit. Under no-load conditions, with the engine turned off, a sound and well charged battery will give a reading of 12 to 13 volts. Any value lower than 12 volts indicates a defective battery.

With the engine turned off and all lights switched on, the battery reading should fall to 11 to 12 volts. Again, any reading lower than this indicates a faulty battery.

With the engine running at a fast idle and the electrical system lightly loaded, the battery reading should rise to between 13 and 14 volts. A reading below the lower value indicates a faulty alternator or a defective regulator. A reading above the upper value indicates a defective regulator.

You'll notice from the above statement that the range of voltmeter readings that are of interest span only a very limited range, from say 10.5 volts minimum to 15 volts maximum, so a special type of 'suppressed zero' voltmeter should ideally be used in the car.

Our car voltmeter is very special. It is an all solid-state design that gives a readout on a two-coloured line of ten LEDs (light emitting diodes). The unit has excellent long-term and thermal accuracy once it has been initially calibrated to span the range 10.5 to 15 volts. The unit is very easy to install in the vehicle and has a total building cost of only 10 dollars or so. The unit gives a 'dot' display in which only one of the ten LEDs is illuminated at any one time.

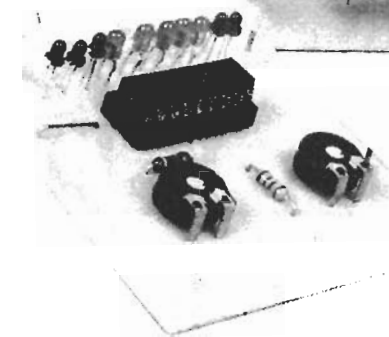
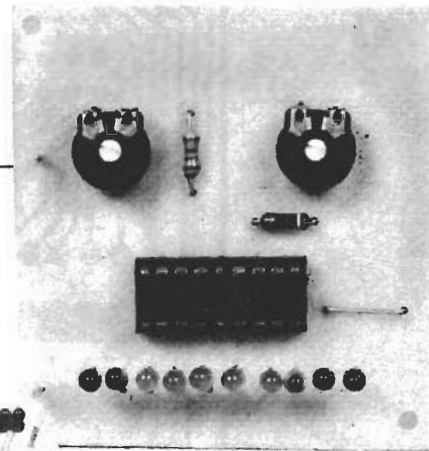
Construction And Use

The entire circuit, including the ten LEDs, is built up on a small PCB and construction should present very few problems. Note that IC1 is an 18-pin device and also that it should be fitted to the PCB via a suitable holder. We advise testing each one of the LEDs, to confirm its functioning and polarity, before fitting it to the PCB.

To check each LED, connect it in series with a 470R resistor and then connect the combination across a 12-volt supply. If necessary switch the LED connections until the LED illuminates, under which condition the lead closest to the positive supply rail is the anode.

When construction is complete, double-check the circuit wiring and connect the unit to a variable voltage DC supply that can span the 10-15 volt range. Monitor the supply voltage with a reasonably accurate meter and calibrate the unit as follows.

Set the supply to 15 volts and adjust RV1 so that LED 10 just turns on. Reduce the supply to 10 volts and adjust RV2 so that LED 1 just turns on. Recheck the set-



tings of RV1 and RV2. The calibration is then complete and the unit can be installed in the vehicle by taking the '0' volt lead to chassis and the '+ 12 volt' lead to the vehicle's battery via the ignition switch.

Parts List

Resistors (all 1/4 W 5%)

R1 4k7
R2 1k2

Potentiometers

RV1,2 4k7 preset

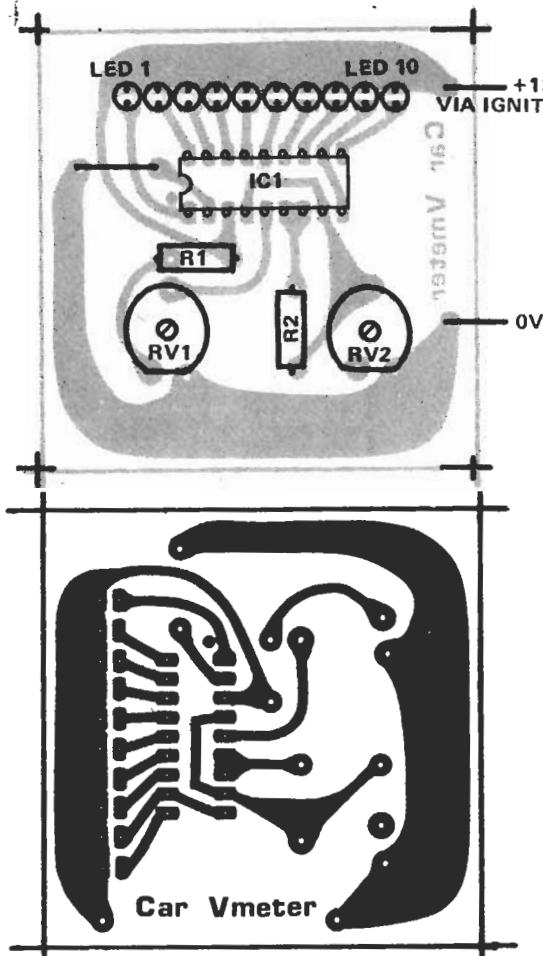
Semiconductors

IC1 LM3914
LEDs 1,2,3,9,10 TIL 209
LEDs 4,4,6,7,8 TIL 211

How It Works

There is little we can say other than the IC1 acts as a LED-driving voltmeter that has its basic maximum and minimum readings determined by the values of R2 and RV2. When correctly adjusted, the unit actually spans the approximate range 2.5 volts to 3.6 volts, but is made to read a supply voltage span of 10-10.5 volts to 15 volts by interposing potential divider R1-RV1 between the supply line and the pin-5 input terminal of the IC.

The IC is configured to give a 'dot' display, in which only one of the ten LEDs is illuminated at any given time. If the supply voltage is below 10.5 volts, none of the LEDs illuminate. If the supply equals or exceeds 15 volts, LED 10 illuminates.



PCB overlay for the Voltmeter (left). Note the position of IC1. PCB foil patter (lower left). Take care to avoid solder splashes.

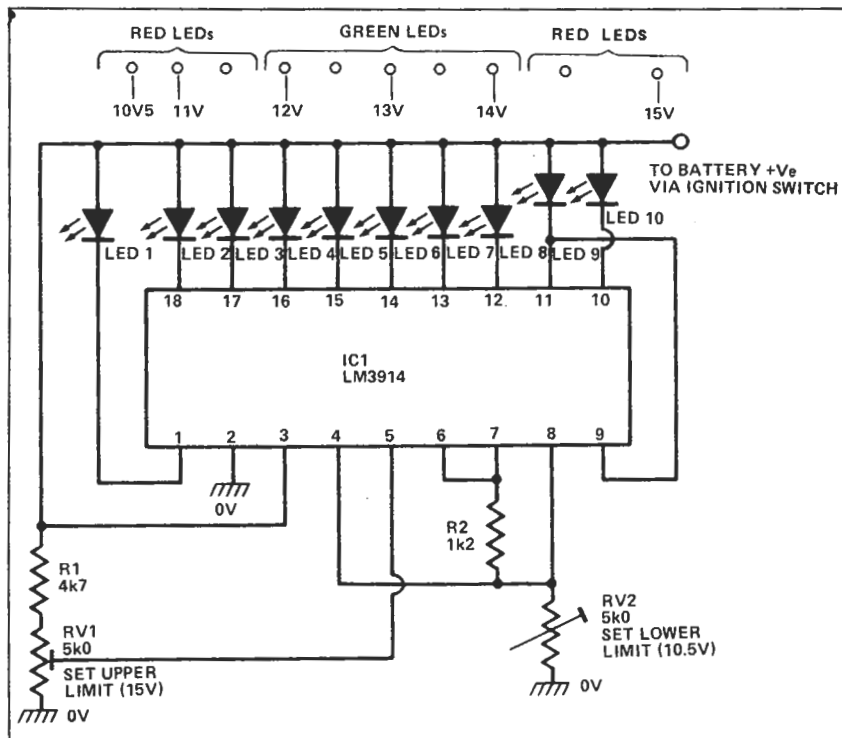


Fig. 1. Circuit diagram of the ETI Bargraph Car Voltmeter. The choice of a box is determined by the type of installation required.

Led Tachometer

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case try to fit some kind of light shield to the face of the unit, so that the LEDs are shielded from direct sunlight.

To wire the unit into place, connect the supply leads to the tach via the vehicle's ignition switch and connect the unit's points terminal to the points terminal on the vehicle's distributor.

The lower range of the tach is of great value when adjusting the engine for correct idle. It is thus advantageous to arrange the tach housing so that it can be easily dismounted from the instrument panel.

Parts List

Resistors all 1/4 W, 5%

R1,2,5	10k
R3,13	22k
R4	470R
R6,15	1k2
R7,9,10,12	330R
R8,11	270R
R14	27k
R16,20	2k2
R17	270k
R18,19	12k
R21	1M0
R22	6k8
R23	4k7

Potentiometers

PR1,2	100k miniature horizontal preset
PR3	47k miniature horizontal preset

Capacitors

C1,2	22n polycarbonate
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C3,8	220n polycarbonate
C4	1u0 35V tantalum
C5	4u7 35V tantalum
C6,7	47u 16V tantalum
C9	100u 25V electrolytic

Semiconductors

IC1	LM2917N
IC2,3	LM3914
IC4	CA3140
IC5	ICM7555
Q1	2N3904
ZD1	400mW 12V
D1,2	1N4148
D3	1N4001
LED1-21	Red, square type.

Miscellaneous

SW1	3-pole double throw switch
PCB, case.	