Constructional Project

WASHER BOTTLE MONITOR

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When the water runs out you are breaking the law. Avoid any problems with this unit. Uses a special fluid detector chip to warn when the reservoir needs topping up.

THIS VERY useful device will certainly appeal to the motorist who often has to travel long distances, perhaps on business. As may drivers will know, having to cope with congested motorways and city traffic can be exasperating enough, and in dirty road conditions the last thing you really need is an empty washer bottle to hinder your progress even more.

Regular checking under the bonnet will help to avoid this situation, of course, but it is still not difficult to empty the washer fluid bottle under adverse conditions. As for the business driver, he is more likely to be worrying about his urgent appointments rather than the remaining capacity of the washer bottle!

Furthermore, hatchback and estate cars often have two screen washers these days, for the front and rear screens, and possibly headlight pressure washers also. It is quite common to have one reservoir serving both screen washer pumps, the theory being that the driver simply has to maintain one water bottle instead of two. Sometimes the bottle is so large that you virtually forget that it is there – until you run out of water!

On the other hand, the bottle may not necessarily be large enough to cater for cleaning both front and rear screens in dirty conditions, and it is then quite possible to empty a full bottle within a day. In actual fact, it is illegal to drive a car which does not have a windscreen washing and wiping system which allows the driver adequate forward vision.

Some high-specification cars incorporate a warning device which alerts the driver when the washer fluid is running low. This enables the driver to economise on washer fluid in the meantime until he is able to re-fill it at, say, a filling station.

CIRCUIT DESCRIPTION

The author's first attempt at a *Washer Fluid Monitor* was published in Everyday Electronics, August 1984 and the unit to be described here is an improved, maintenance-free version which is easy to construct and install. The full circuit diagram for the Washer Bottle Monitor appears in Fig. 1.

As can be seen, there is a low component count since most of the work is performed by IC1, an LM1830 fluid level detector chip. The circuit operates directly from a 12V d.c. supply which is connected to IC1 pin 14 and pin 11 through TB1/1 (+12V d.c.) and TB1/4 (0V) of a 4-way terminal block, R1 being a dropping resistor to protect the i.c. against transient spikes.

The main function of IC1 is to generate an alternating signal which can be passed between two probes dipped into the fluid being monitored. An a.c. signal overcomes any problems that arise through electrolytic action if a direct current is used. The original fluid monitor did suffer from erosion of the probes through this electrolytic breakdown, with the result that the probes eventually weakened and broke.

The internal oscillator frequency of IC1 is determined by an external capacitor C2, and in this design the frequency of operation is about 6·6kHz as measured on the prototype. The output of the oscillator is taken from IC1 pin 13, via an internal 13k resistor, which then compares this reference resistance with that of the probes which dip into the washer fluid. The probes are connected through C1 which is a blocking capacitor, so there is no direct current flowing through the liquid, which greatly reduces the electrolytic action.

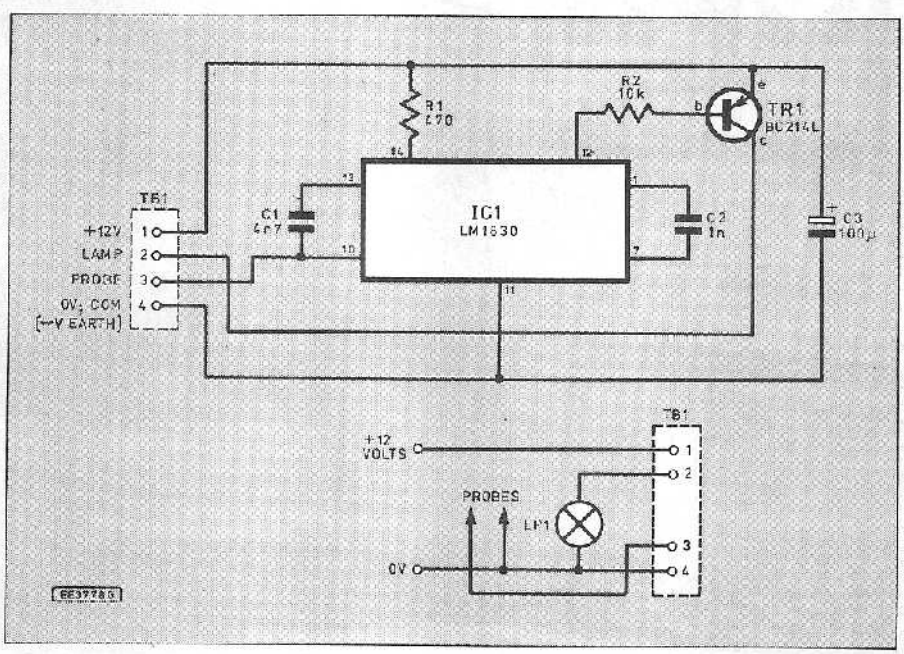
Thus IC1 generates an alternating signal out of pin 13, through the d.c. blocking capacitor C1 and then through the probes (TB1/3 and TB1/4). Pin 10 of IC1 is the detector input and if the water level drops below the probes, the probe resistance will then exceed the internal 13k reference resistor at pin 13.

This change in resistance is detected by IC1 which, in this "alarm" state, generates an output signal at pin 12. This is actually an open-collector output which will drop to nearly 0V when activated by a drop in fluid level.

The output will sink up to 20mA and would drive an l.e.d. directly but, it was decided to use a filament lamp (LP1) for the alarm indicator which is mounted on the dashboard. The lamp is driven through a transistor buffer TR1 and is connected through TB1/2 of the terminal block.

Note that the output (pin 12) actually oscillates at the same frequency as the a.c.

Fig. 1. Complete circuit diagram for the Washer Bottle Monitor.



signal generator: it is not a simple high/low output, although the bulb will appear to be continuously alight. It could be utilised, for example, to drive a loudspeaker directly and give an audible warning tone.

CONSTRUCTION

The Washer Bottle Monitor is constructed on 0·1in. matrix stripboard, size 9 strips x 24 holes. The topside component layout and details of breaks required in the underside copper track is shown in Fig. 2.

Commence construction by drilling two 6BA (or M3) clearance holes in the stripboard to accommodate the mounting hardware, then make all the breaks in the copper track using a spot face cutter. If the proper tool is not available then a handheld twist drill bit can often be used as an improvisation.

The components and link wires can now be located in accordance with Fig. 2. The constructor may prefer to protect IC1 by using a 14-pin dual-in-line socket, but the device does not require any particular anti-static precautions.

Note expecially the orientation of the transistor leads and the chip itself, together with the polarity of electrolytic capacitor C3. The two link wires should be inserted in position first as one of them runs below C3.

After assembling the circuit board, check carefully to ensure that all breaks have been made effectively in the copper strips, and that there are no wisps of solder shorting adjacent tracks. This chip can be damaged by accidental shorting of neighbouring pins and because the device is not too cheap it is worth making an extra effort to check the soldering before powering up.

CASE AND INSTALLATION

The completed prototype unit was built into a small plastic box measuring 72mm x 47mm x 25mm, with the 4-way terminal block being mounted on the outside surface

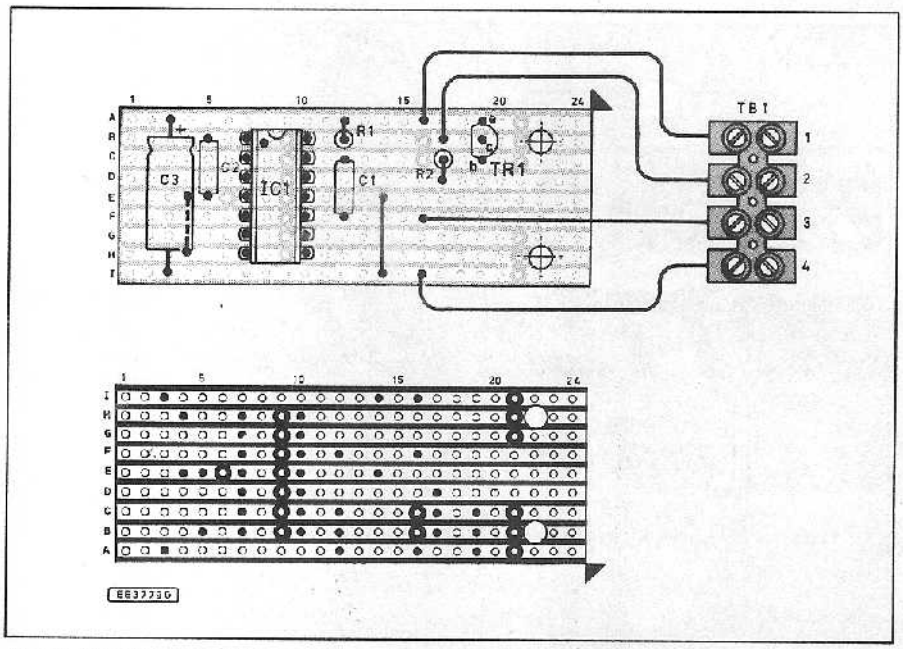
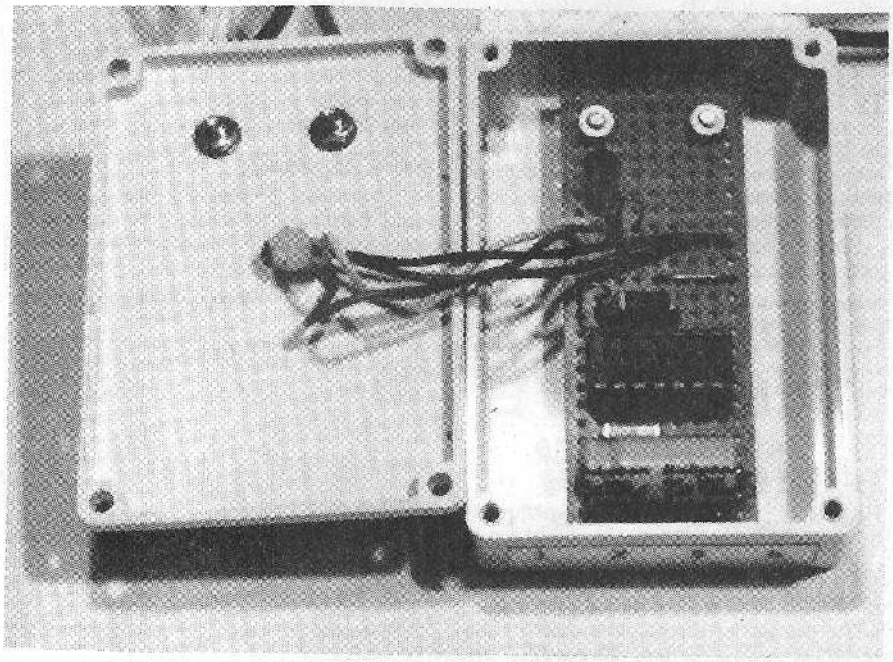
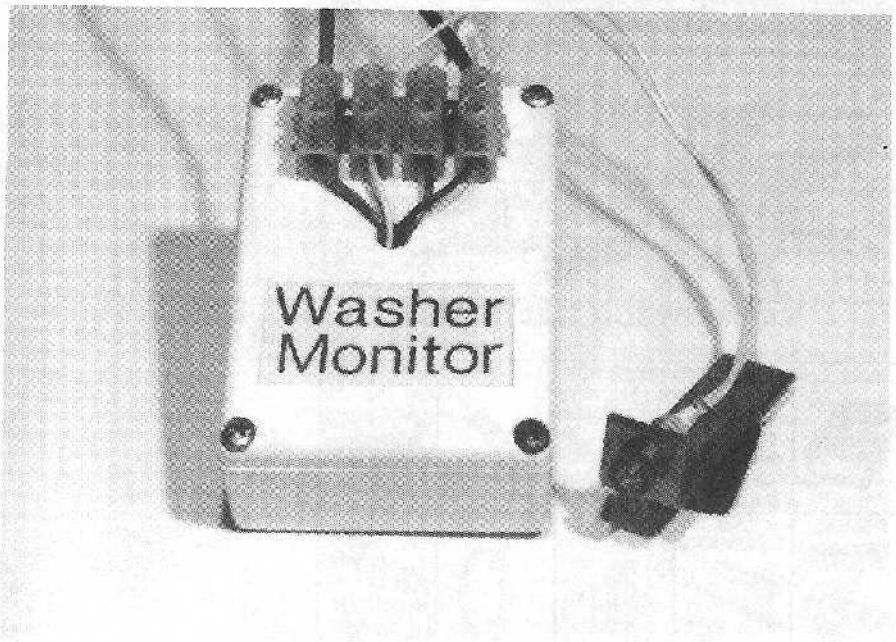


Fig. 2. Stripboard component layout and details of breaks required in the underside copper tracks.





COMPONENTS

Resistors

R1	470
R2	10k

Both 0·25W 5% carbon film

See SHOP TALK Page

Capacitors

C1	4n7 polyester
C2	1n polyester
C3	100µ axial elect., 25V

Semiconductors

IC1	LM1830 fluid level detector
TR1	BC214L *pnp* silicon transistor

Miscellaneous

LP1	12V to 14V 40mA panel mounting filament indicator lamp
TB1	4-way screw terminal block

Stripboard 0·1in. matrix, size 9 strips x 24 holes; plastic box, size 72mm x 47mm x 25mm; 14-pin d.i.l. socket; material for probes (e.g. twin-core wire); mounting hardware; interconnecting wire; Scotchlok connectors; solder etc.

Approx cost guidance only **£7**

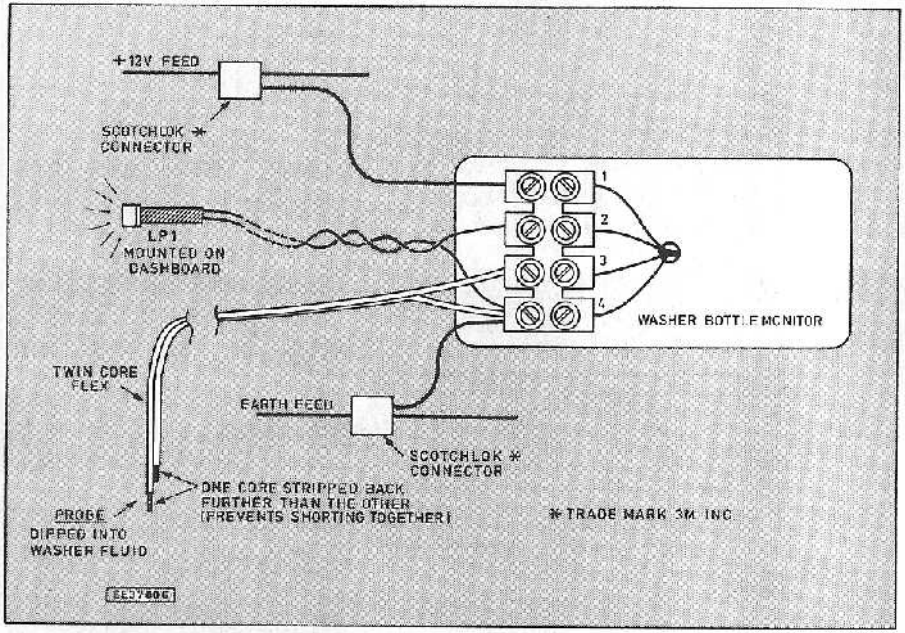


Fig. 3. Interwiring and installation details for the liquid level monitor.

and connected to the component board inside by passing the four connecting wires through a hole in the lid.

Installation is quite straightforward, see Fig. 3. The 12V d.c. supply can be obtained from any ignition-controlled accessory – perhaps the radio – but the prototype was actually wired into the front windscreen electric washer pump supply as this was readily accessible in the engine bay.

Some cars such as the Vauxhall Nova/Cavalier and Renault 5 have a single bottle with two pumps attached – one for the front screen and the other for the rear wash/wipe. You can determine which is the front windscreen washer pump by tracing the washer jet piping, so that you can tap into the right supply.

POLARITY

It is essential that the unit is correctly polarised as the i.c. may be damaged by a reverse voltage. A voltmeter will soon determine the polarity of the 12V feed to the washer pump, and Scotchlok connectors may be employed to splice into the supply.

Wiring into the pump motor feed does mean however that the warning bulb will only be illuminated when the washer pump is activated, but this has not proved to be a handicap in practice.

The prototype unit was fixed under the bonnet near the washer bottle, and the probes simply consisted of a piece of twin-core zip wire with one core stripped back further than the other (to prevent shorting to each other) with about 15mm of copper bare. The wires were pushed through a tight hole in the top of the washer bottle so that they were about 25mm (1 in.) from the bottom of the bottle. This method may be especially suitable for those cars which have a refillable bag for a reservoir instead of a plastic bottle (e.g. Fiat Uno).

If the constructor installs the unit in the engine bay, as opposed to under the dashboard, then all that is required is to route two wires through a convenient grommet in the bulkhead to the dashboard-mounting filament lamp, ensuring that *all* joints are *fully insulated* and that the wires will not chafe on metal edges.

TEST RUN

With installation complete, test the unit by firstly keeping the probes out of water, and the lamp should light up when the electrical supply to the Washer Bottle Monitor is activated. Inserting the probes into the washer bottle at the desired depth should extinguish the bulb, in which case the device is ready for service. □

PLEASE