Headlight delay unit

With this simple project you can use your car headlights to illuminate your pathway for about 50 seconds; safe on a dark night from the horrors of stumbling into bushes or slipping on those nasty smelly things lying on the footpath. The unit is easy to build and install and switches off automatically.

Jennie Whyte

THIS IS a simple circuit which lets you use your car headlights to light your way. It saves you from falling over rubbish bins or walking into fences on a dark night.

After you have parked your car and turned the delay unit on, the headlights will come on for a pre-set period of about 50 seconds. At the end of this period the unit turns the headlights off automatically. So if you haven't manoeuvred the obstacle course by this stage then you're out of luck.

THE 555 AND HOW IT WORKS

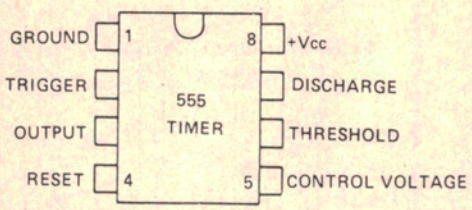


Figure 1.

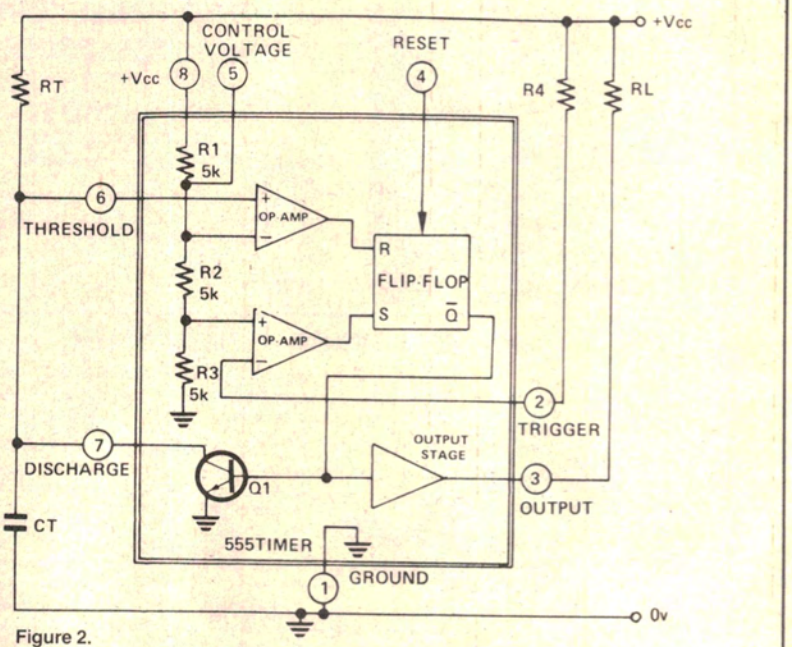


Figure 2.

The 555 timer is a very versatile IC designed specifically for precision timing applications.

It can operate from 4.5 V to 16 V and its output can source (supply) or sink (absorb) any load current up to a maximum of 200 mA. It can directly drive loads such as relays, LEDs, low-power lamps and high impedance speakers.

When used in the 'timing' mode, the IC can produce accurate timing periods variable from a few microseconds to several hundred seconds, via a single resistor-capacitor (RC) network. Timing periods are virtually independent of supply rail voltage, can be started via a 'trigger' command signal and can be stopped by a 'reset' command signal.

The device is available in a number of packaging styles, including 8 and 14-pin dual-in-line (DIL) and 8-pin TO-99 types. Figure 1 shows the outline and pin notations of the standard 8-pin DIL version of the 555. Figure 2 shows the functional block diagram of the same device (within the double lines), together with the connections for using it as a basic monostable generator or timer.

The 555 houses two diodes, 15 resistors and 23 transistors. These components are arranged to form one voltage-reference potential divider, two voltage comparator op-amps, one 'reset-set' (RS) flip-flop, a low-power complementary output stage and a slave transistor.

The period timer, as it is used in the headlight delay unit, gives a direct voltage output at pin 3 which is normally low, but goes high for the duration of the timing period.

The timing action is initiated by momentarily shorting pin 2 to ground via the PB1 START switch. As this voltage is below the reference value of the built-in potential divider the output of the lower voltage comparator op-amp changes state and causes the RS flip-flop to switch over.

As the RS flip-flop switches over it cuts off Q1 and drives the pin 3 output of the 555 to the high state. As Q1 cuts off it removes the short from the timing capacitor connected to pin 7 and the capacitor starts to charge up. Then the RS flip-flop switches back to its original condition, Q1 turns on, the capacitor discharges and simultaneously the pin 3 output of the IC reverts to its low state.

PARTS LIST — ETI-323

Resistors ..... all ½W, 5%
R1 ..... 22k
R2 ..... 470k
R3 ..... 1k

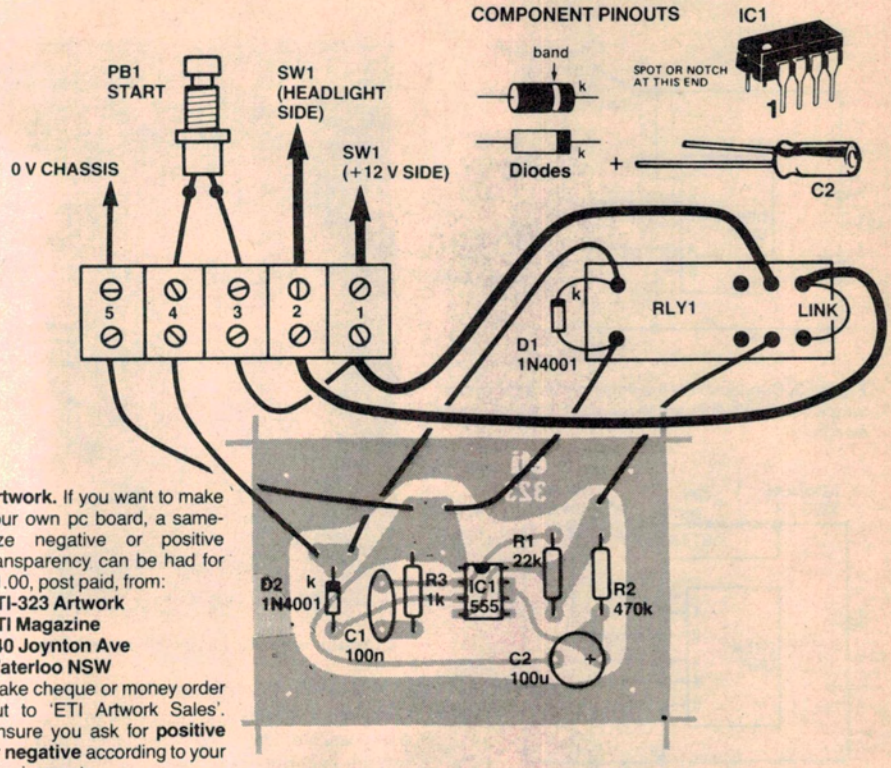
Capacitors
C1 ..... 100n greencap
C2 ..... 100u/25 V RB electro.

Semiconductors
D1, D2 ..... 1N4001, 1N4002, EM401, EM402, etc.
IC1 ..... uA555, NE555, LM555, DS555, etc.

Miscellaneous
RLY1 ..... DPST or DPDT relay, 5A-rated contacts with 12 V coil (120 ohms or greater).
PB1 ..... momentary action pushbutton (e.g: D.S.E. S-1102, S-1199 types, or similar).

ETI-323 pc board; five-way plastic terminal block; box (if necessary); wire etc.

Price estimate
$14 — $16



Artwork. If you want to make your own pc board, a same-size negative or positive transparency can be had for $1.00, post paid, from:
ETI-323 Artwork
ETI Magazine
140 Joynton Ave
Waterloo NSW
Make cheque or money order out to 'ETI Artwork Sales'. Ensure you ask for **positive** or **negative** according to your requirements.

Component overlay and external wiring. How the parts are assembled onto the printed circuit board — watch which way around you assemble D2, IC1 and C2. Wiring to the external components is also shown. The pc board and relay may be housed in any suitable box, if you wish.

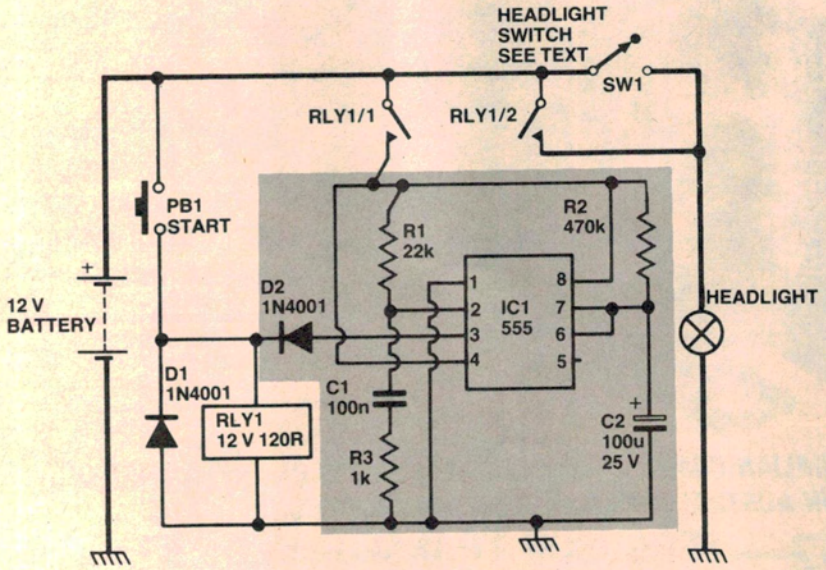
Construction

The unit is easy to build and install and works off the car's 12 V battery. The circuit does not interfere with normal headlight operation under actual driving conditions.

Construction is simple because there are only a few components and the layout on the pc board is clearly shown. Before you assemble the components on the board, check that the board has no track breaks or shorts between the tracks, particularly between the IC pins. Make sure you solder the diodes the correct way round.

The relay can be any 12 V DPDT (double-pole, double-throw) type with a coil resistance of 120 ohms or greater. The contacts should be rated to switch 5 A or greater at 12 Vdc. Note that the IC, a 555, is shown on the circuit diagram with all its connections in the standard manner. Look for the notch and make sure that it's positioned on the pc board correctly, soldering it in after the other components.

Kits and components. See 'Shoparound' in this issue to find suppliers stocking kits or components for this project.



Circuit diagram. The parts in the shaded area are located on the pc board.

HOW IT WORKS — ETI-323

This circuit has been designed around the 555 IC timer which has already been described.

The pin 3 output is connected to a relay which has two sets of normally open contacts. D2 is wired in series with the relay coil to counteract the slight residual voltage that appears at pin 3 of the IC under the OFF condition and this makes sure that the relay turns fully off. The START switch, PB1, is also normally open so there's no power going to the timer circuit and the lights are off. Capacitor C1 is discharged under this condition.

When PB1 is momentarily closed power is fed directly to the relay coil and the relay turns on. As the relay turns on, contacts RLY1/2 close and apply power to the vehicle lights and contacts RLY1/1 close and apply power to the timer circuit. At this moment pin 2 of the IC is briefly tied to ground via C1 and R3 so a negative trigger pulse is immediately fed to pin 2 and a timing cycle is initiated.

Consequently, pin 3 of the 555 switches high at the moment that the relay contacts close, and thus locks the relay into the ON condition irrespective of the subsequent state of the PB1 START switch so the lights remain on for the duration of the timing cycle.

The period of the timing cycle depends on the values of R2 and C2. With the component values shown, this period is roughly 50 seconds.

At the end of the timing cycle pin 3 of the IC switches to the low state, so the relay turns OFF and contacts RLY1/2 and RLY1/1 open, disconnecting power from the timing circuit and the lights. The operating sequence is then complete.

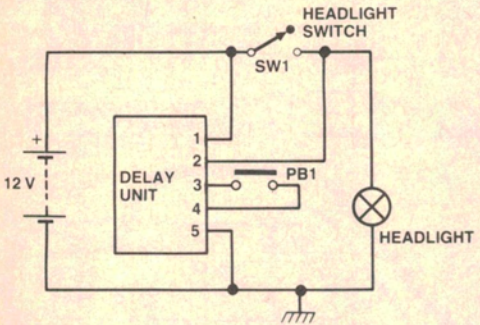


Figure 3. Connection of the delay unit to a car system where the headlights are independent of the ignition switch.

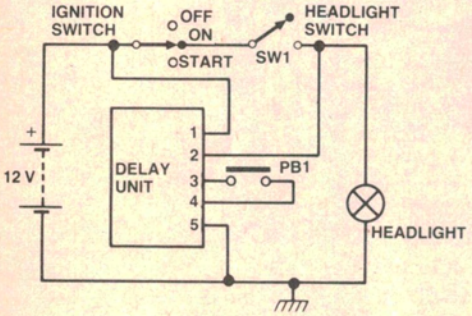
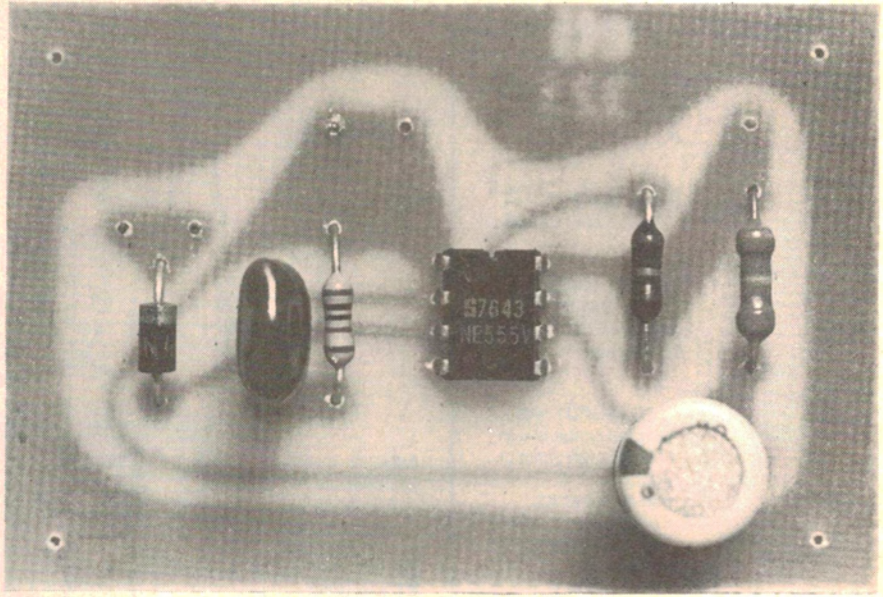


Figure 4. Connection to all other systems.



Closeup. View of the assembled printed circuit board, about four times life size!

When it comes to installing the unit, note that two methods of connection to the vehicle are possible. On some vehicles the headlight switch is connected directly to the battery so that the headlights operate even when the ignition is turned off (see Figure 3).

Many vehicle manufacturers are now adopting the practice of feeding the headlight switch via the ignition switch, so that the headlights operate only when the ignition is turned on. If your car uses this type of connection then you'll have to install the unit as shown in Figure 4. ●