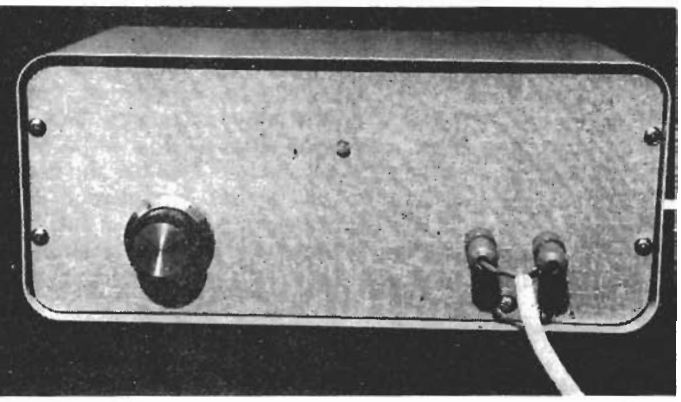
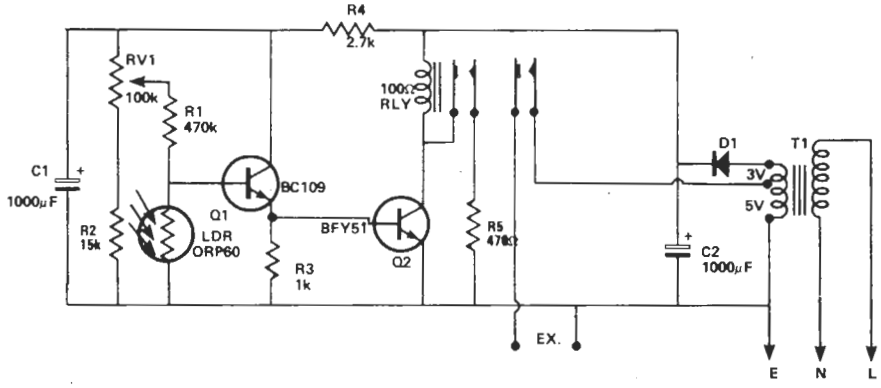
AUTO LUME



THIS UNIT is automatically operated by the level of general illumination, or the strength of light falling upon it. The most frequent uses of such a device include operating a child's night light, or switching on a light in a room, when darkness falls, as a deterrent to burglars, when leaving the house unoccupied.

The unit is operated from a.c. mains, and is adjustable to operate over a wide range of light intensities. It switches on an external circuit when light fades below a set level, as in the evening and switches off this circuit when light increases, as with the arrival of morning.



The circuit.

AUTO-LUME CIRCUIT

This is shown in Fig. 1. The resistance of the light-dependent resistor LDR rises as the illumination reaching it falls. This allows the base of Q1 to move positive so that it conducts. Q1 emitter and Q2 base also move positive, so that Q2 collector current rises. This current flows through the relay windings, closing the relay contacts.

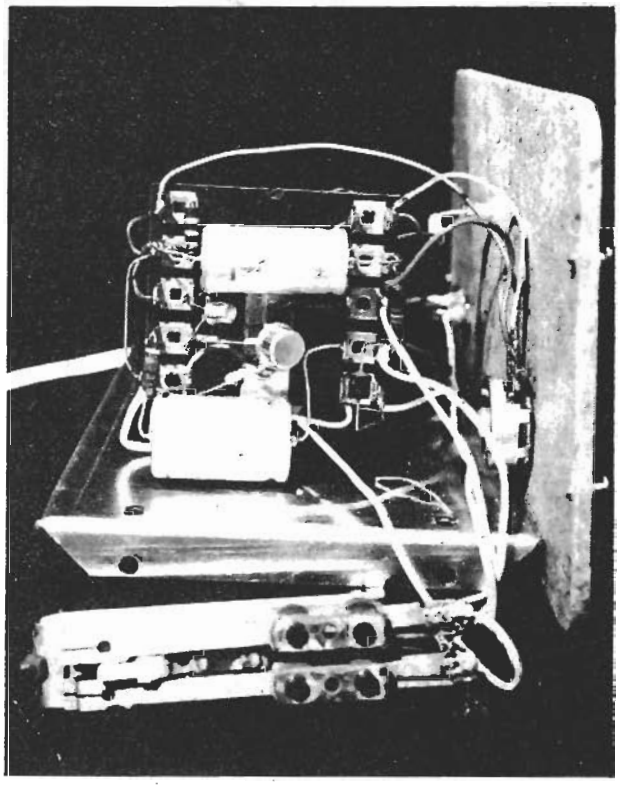
RV1 is the sensitivity control, so that the device can be set to work at the desired light intensity. Spare contacts on the relay close to bring R5 into circuit, providing additional current through the winding. This means that the relay release current through Q2 is lower than the pull-on current, and avoids vibration or flicking on and off of the relay when darkness slowly comes and light has fallen to a level where the unit is about to operate.

A bell transformer or similar transformer T1 provides current, and the operating voltage is not very critical. The second set of relay contacts result in 5V a.c. being available at the extension sockets EX, which does well for a child's night light equipped with a 6V 3 watt or similar bulb. By changing the connections to T1 secondary, 3V or 8V may be obtained instead, if required.

To switch on a mains-voltage lamp, it is necessary either to use a mains-voltage relay here, or to employ the extension circuit to control a relay which in turn switches on the mains-voltage equipment. Normally, however, a 3 watt or 6 watt low voltage lamp will provide enough light for the purposes for which the unit will be used.

TAG BOARD

The small components are assembled on a tag board as in Fig. 2. This also shows the positions of the leads of the semiconductors. A bracket bolted to the board allows it to be mounted vertically, and also forms the negative or metal chassis return.



Layout of the major components.

taken by adding further alarm microswitches. For example microswitches may be fitted to the suspension such that if anyone tries to lift the car, in order to tow it away, the alarm will go off. If such switches are used they should be connected between terminal 2 or 3 of the alarm (see Fig 1 and 2), depending on whether the vehicle has a positive or negative earth system, and earth.

CONSTRUCTION

Construction of the alarm is extremely simple and anyone capable of using a soldering iron should not have any difficulty. All components, including the relay, are mounted on a small PC board as shown in the component overlay diagram.

Note the polarity of electrolytic capacitors, the IC and diodes. In particular make sure that the germanium diode D2 is mounted in the correct position and with the correct orientation. When soldering use a small, light-weight iron and preferably small gauge solder. Solder quickly and cleanly. Only apply the iron for sufficient time to cause the solder to flow around the joint. These precautions will ensure that components are not damaged by excessive heat. The unit should then be mounted in a small plastic, or metal, box.

Two different switching systems may be used to enable the alarm. Use either an external key switch mounted in a convenient, but not obviously seen location, or a two way system of concealed switches – one inside and one outside. The switch inside is used to enable the alarm (after opening the door) and the external one to disable the alarm before entering the car. This latter system has the advantage that anyone watching will not see where the external disable switch is located.

PARTS LIST – ETI 313

R1,2	Resistor	1k ½watt 10%
R3	"	10k ½watt 10%
R4,5	"	100k ½watt 10%
R6	"	1M ½watt 10%
RV1	Potentiometer	2.2 meg
C1	Capacitor	25µF 25 volt electrolytic
C2,3	"	1µF 25 volt electrolytic
C4,5	"	0.1µF polyester
IC1	Integrated Circuit	NE556

D1	Diode	IN914 or similar
D2	Diode	OA95 (must be germanium)
RL2	Relay	12V 100–470 ohm coil, 6A min. contacts.
PC board ETI 313		
SW1	Switch	SPST key operated
SW2,3	"	SPDT toggle (see text)
metal or plastic box to suit.		

NOTE: After this article was published, a number of readers experienced problems with the triggering being too sensitive. Two solutions are possible; increasing the value of R4 to 2.2Mohm and changing the value of C5 from 0.1uF to 10uF. On the main circuit, pin 14 of the IC should be shown connected to pin 4, this is correct on the PCB however.

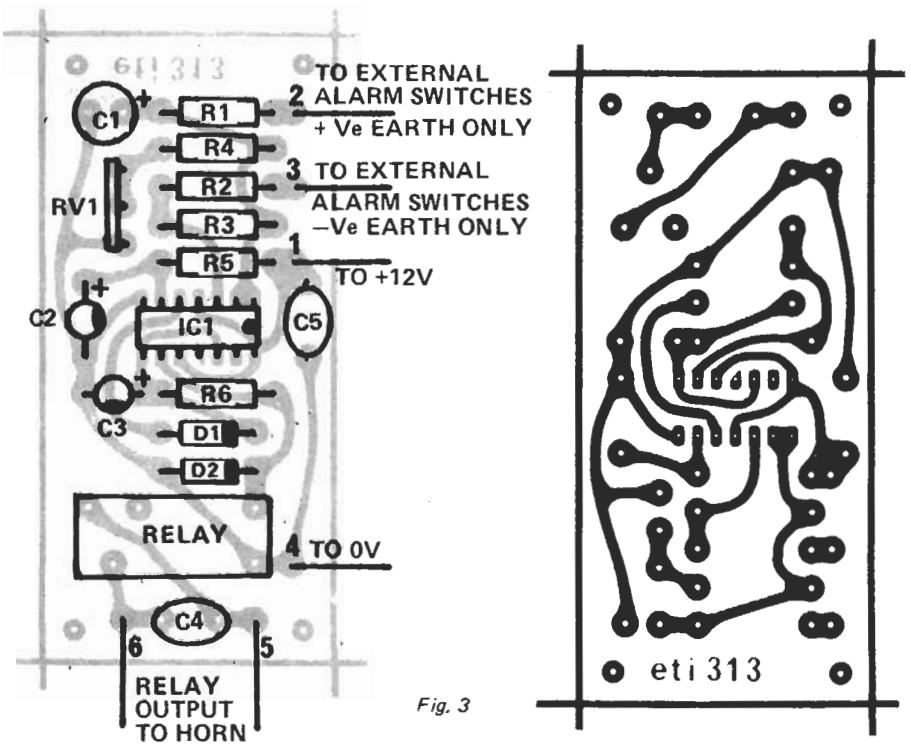


Fig. 3

This PCB will probably have to be altered to suit the particular relay used. (Electrovalue do a 12V 110Ω relay but this will not fit the PCB as shown).

HOW IT WORKS

When a load, especially an incandescent lamp, is switched onto a battery the battery voltage will drop instantaneously and then return to normal. The amplitude and duration of this negative going spike in the supply is dependant on the size of the lamp used but is of sufficient amplitude, even with small bulbs, to trigger an alarm circuit.

The NE556 IC contains two NE555 timer ICs in a single case. One of the timer sections is used to detect the supply spike and to gate on the second timer which produces a one Hz output to the relay and horn.

Each timer section contains two comparators, a LOW comparator set at 1/3 supply and a HIGH comparator set at 2/3 supply. These comparators set a flip-flop which provides an output.

When the power is first applied, the voltage at pin 6 (input to the low comparator) is initially low for about half a second whilst C2 charges via R5. This sets the output of the flip-flop to a high state where it will remain regardless of further excursion in the voltage at pin 6.

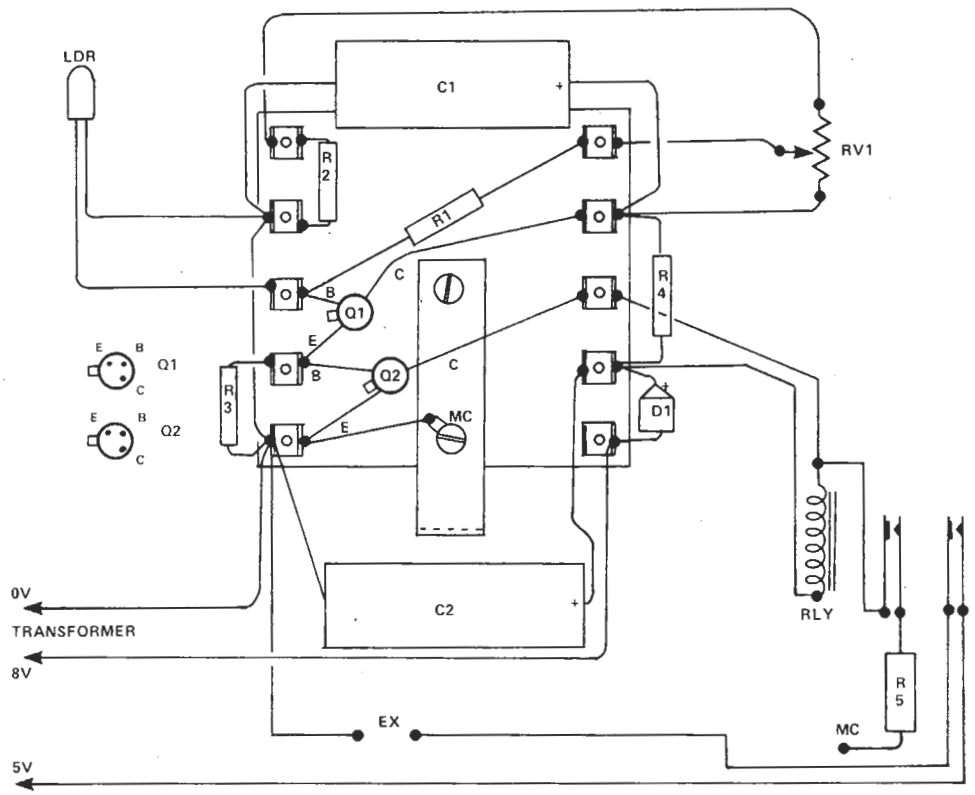
The only way that the output may be set low again is for the input to the high comparator (pin 2) to be taken past its threshold. This threshold voltage is available at pin 3, and by using a voltage divider (R3, R4 and RV1) a slightly lower voltage is derived from it. This is used as a reference level to the HIGH comparator input (pin 2) Capacitor C1 is used to bypass any fast transients which may appear at the input (pin 2).

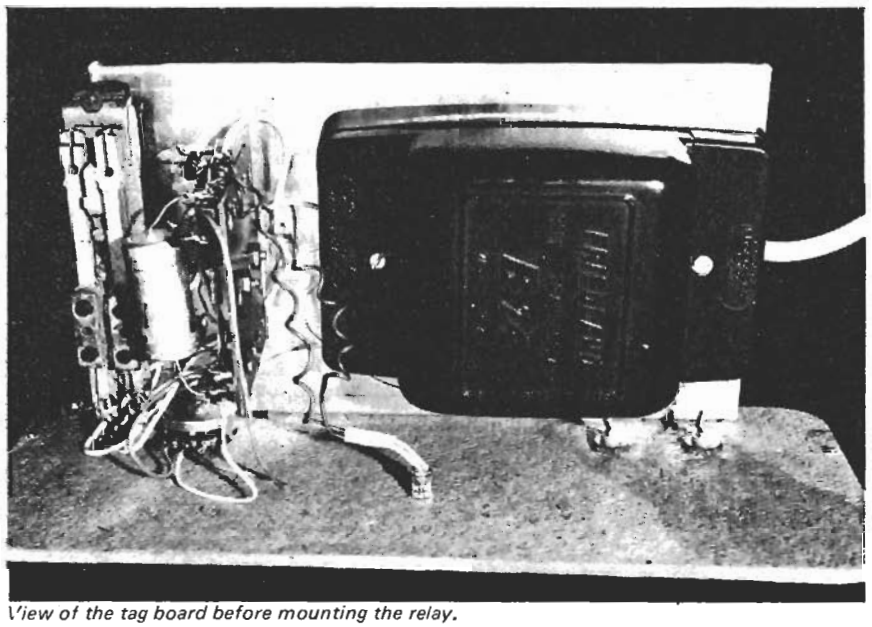
If the supply falls, the voltage on pin 3 will also fall. If it falls below the voltage at pin 2, the output will fall again to a low state and will stay there. The capacitor C1 will also be discharged via pin 1.

The second half of the IC is connected as a free-running multivibrator having a frequency determined by R6 and C3, of about 1 Hz. If the output of the first stage is high, the diode D1 will force the multivibrator to lock into the low state. When the output of the first stage goes low the multivibrator is freed to oscillate.

This one hertz output switches a relay which in turn controls the horn, or any other suitable device. The diodes across the relay prevent reverse voltages being generated which could damage the IC. This must be a germanium type for correct operation.

Positioning of the components on the tag board.





View of the tag board before mounting the relay.

Leads run from various tags to the relay and other components, and these connections are most easily added after the board is fitted in position.

Construction can be completed on a shallow chassis 7 x 4 in. in dimensions, which will take the transformer, tag-board, and relay. The unit illustrated has a 9 x 4 in. panel, fitting a case 9 x 4 x 4 in. The extension circuit sockets, sensitivity control RV1, and LDR are fitted to the panel. The LDR is cemented in a small hole, and its leads are extended to reach to the tags shown. All connections can be seen from Fig. 2.

SETTING UP

The unit and lamp controlled must be placed so that light from the lamp does not operate the LDR. The Auto-Lume is best placed near a window when to be controlled by daylight, or at a position near the room main light, when it is to take over automatically as the room light is switched off. The extension circuit can then run to the bulb to be controlled, situated clear of the Auto-Lume. The disposition of unit and bulb is in no way critical, provided they are sufficiently separated.

RV1 is then set so that the controlled must be placed so that light LDR is shaded with the hand, and sensitive control over a wide range of illumination values should be obtained.

When a low-voltage 3 watt, 6 watt or similar lamp is to be used with a conventional type table lamp, the latter should be fitted with a small bayonet cap or miniature Edison screw holder to suit, and a mains-type plug should *not* be used for connecting to the Auto-Lume extension sockets. This will avoid any chance of someone eventually plugging the lamp into a mains voltage outlet. Various small night-light lamps and similar lamps can also be easily adapted to take a suitable bulb. ●

COMPONENTS

R1	470k	¼W
R2	15k	¼W
R3	1k	¼W
R4	2.7 k	¼W
R5	470 ohm	½W
RV1	100k linear pot.	
C1	1000μF	16V
C2	1000μF	16V or 25V
LDR	ORP60	
Q1	BC109	
Q2	BFY51	

Relay, 100 ohm coil, double pole switch.
SR1 Selenium rectifier, 50V 1A or similar.
T1 Bell transformer, 200/250V, 3/5/8V secondary, 1 ampere, or 8VA, or as required for lamp.
Case, internal dimensions approx. 9 x 4 x 4in.
7 x 4in. chassis (Universal Chassis flanged side, Home Radio).
Tag-board, knob, sockets, 3-core mains lead, etc.