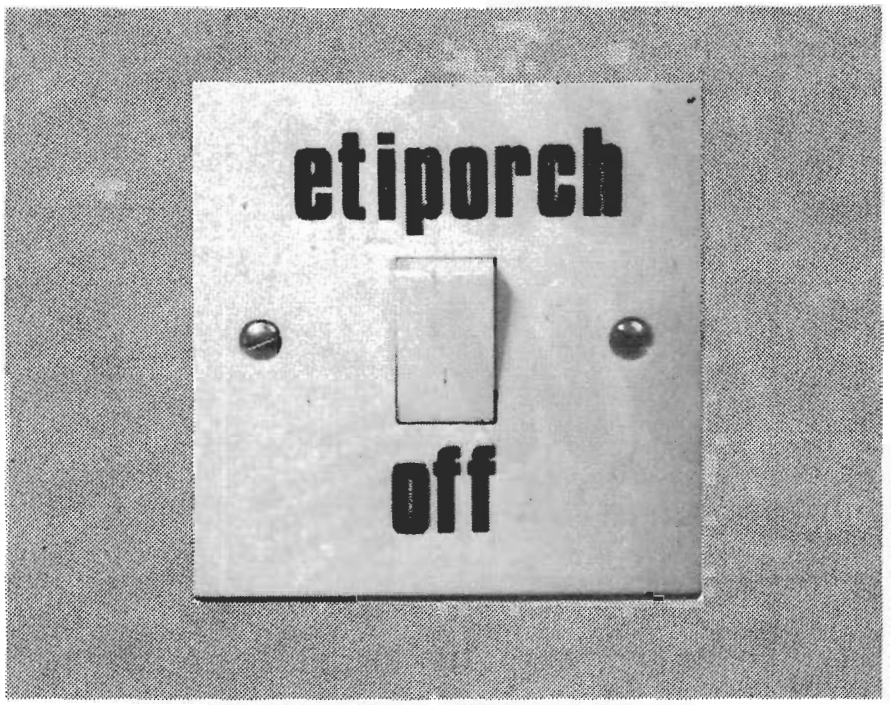
PORCH LIGHT

An attractive project that should banish winter gloom from the front door step.



WHEN RETURNING HOME on a dark winter's night, with gusting winds and pouring rain making the thought of gaining the inner warmth of home very appealing, it is no fun when the front door proves difficult to find in the gloom. The solution is to install a porch light to banish the all prevailing gloom forever. Things being what they are, however, in order to ensure that this guiding light is present whenever it is required would mean an extortionate demand from your friendly local Electricity Board.

The answer is the circuit presented here. It arranges for the porch to be lit for a short time when required, and here's the clever bit, it uses the bell push to turn it on — No need to install a separate switch.

The unit will only operate when it is dark enough to require it — you choose the level, and turns off automatically unless latched on from inside the house. Flicking the internal switch also operates the light.

As well as saving money the circuit is also a valuable addition to the domestic security arrangements. Thus, while friends will soon realise that just because the porch light comes on you need not be at home, the light should put off any unwelcome callers.

Taking the . . . .

Nowadays it seems almost obligatory to think of a witty acronysm to grace the launch of anything from the latest in Frying Pans to the most sophisticated of ICBMs. We at ETI were beginning to feel left out, as we do not often play this game — this project was to be an exception.

The first idea we came up with emphasised the economies that the circuit can realise, but Miser's Porch Unit was not thought to be a flattering handle. A second reason to reject this attempt was that the initials MPU might mean that our circuit is confused with another component that is making a name for itself.

The second attempt brought out the increased security that the circuit affords, but Porch Integrated Security System was rejected for reasons that we leave you to work out.

The names finally chosen, Porch Orientated Circuit for the House, are not as colourful as some, cheating a bit, but at least conveying the spirit of the project and getting past the editor's red pen.

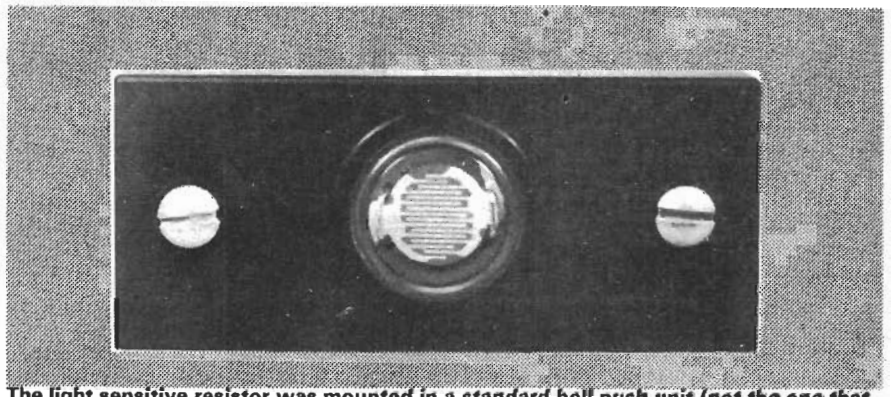
Constructive Thinking

Construction of the project should pose no problems if the PCB shown is used and the component overlay followed carefully. Take care to ensure that the components are mounted close to the board as space is at a premium in the MK box we used.

Putting It In

When installing the unit note that the bulb is powered by a DC voltage and thus if an existing porch light is used care must be taken when installing the unit as two separate wires are required from the porch unit to the bulb.

The other points to note are the connections to the bell push. If the bell circuit is operated with an AC supply there will be no problem. If a



The light sensitive resistor was mounted in a standard bell push unit (not the one that operates the bell!)

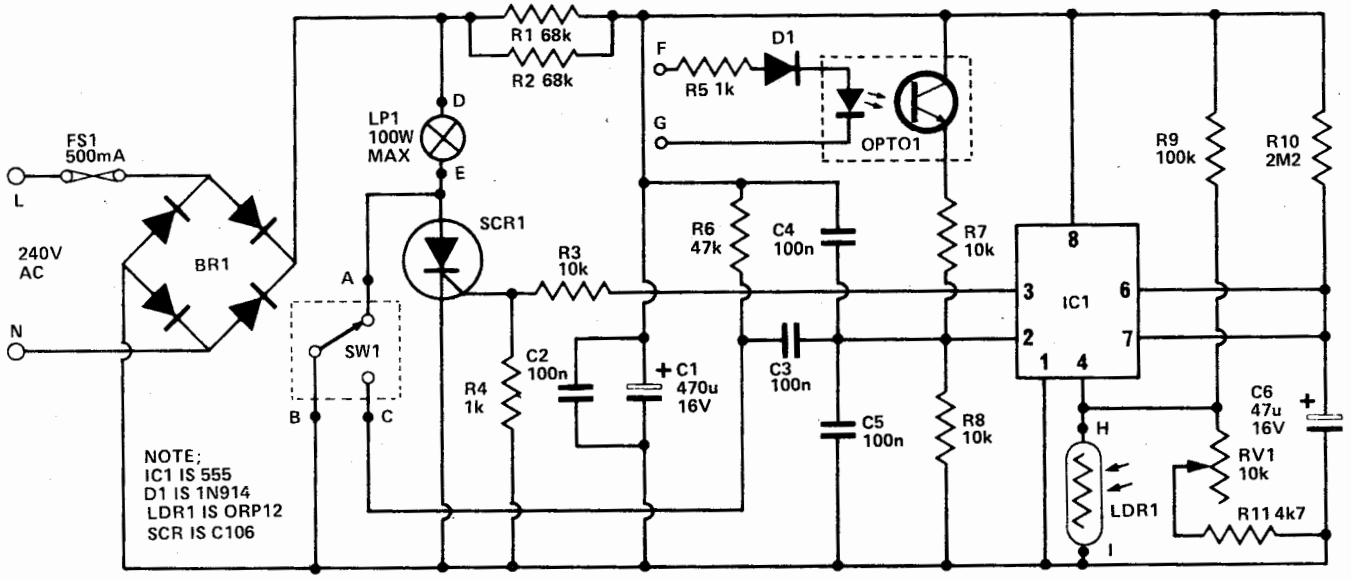
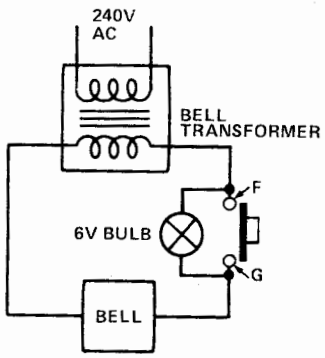
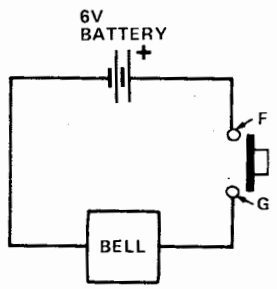


Fig. 1. The full circuit diagram of the Porch Light is shown above.

Fig. 2. The diagrams below show two of the most common bell circuits. In each case the diagrams indicate the points that should be connected to the Porch Light circuit.





DC supply is used take care to ensure that the positive side of the push is connected to point F

When installed the unit can be operated in three different ways. It will be activated when the bell push is operated, if the interior switch is turned on briefly. The porch light can also be turned on for as long as is required by moving the interior switch to the on position. ETI

HOW IT WORKS

THE porch light circuit is formed by a timer, based on IC1, with an isolated trigger circuit formed by OPTO 1, circuitry to control the lamp, and finally a power supply section.

The timer is formed by a 555 configured in the monostable mode. Under quiescent conditions the output of this device (pin 3) is low. If, however, the voltage at the trigger input (pin 2) is taken below one third of supply voltage, the output at pin 3 will go high for a period of time determined by the timing components R10, C6.

The voltage at this trigger input is usually held high by the action of the opto-isolator, OPTO 1. This device consists of an optically coupled infra-red Gallium Arsenide LED and silicon photo-transistor encapsulated in a six pin DIL package.

The action of the photo-transistor is similar to that of other transistors, except that collector current flow can be initiated (the device turned "on") either by biasing the base in the usual manner, or by illuminating the exposed semiconductor junction with light. In our application, with the base open circuit, device operation is controlled solely by the amount of light falling on the junction, which in turn is controlled by the current flowing in the infra-red LED.

This current, derived from the voltage applied to points F and G, is limited by R5. D1 is included to protect the LED from any reverse bias voltage. The voltage referred to above is supplied by the external bell circuit. This circuit must supply a voltage to this point at all times except for the period of time when the bell push is pressed. Thus the photo transistor is turned on, maintaining a high voltage at the 555's trigger pin until the bell is operated, when R8 pulls pin 2 low to activate the timer.

The time period may also be initiated by a negative pulse applied to the trigger input via C3. This pulse is derived from S1 which, in normal operation, connects point B to point C. By momentarily operating this switch a negative pulse is generated to activate the timer.

The potential divider network formed by R9, R11, RV1 and LDR1, which is connected to the 555's reset pin (pin 4), also controls timer operation. If the reset pin is held below OV4 the timer's action is inhibited. The LDR's resistance varies between 10 m and 130R, the more light incident upon it the lower the resistance, and with the values shown this ensures that the circuit is inoperative during daylight hours.

The output of the 555 is fed, via the potential divider R3 and R4, to the gate of the thyristor SCR1. This is a sensitive gate device which is triggered by an OV8, 0.2mA gate pulse.

The thyristor is connected in series with the porch light and is powered by the 100 Hz mains voltage derived from the bridge BR1. Thus the lamp is on at all times when the 555's output is high.

Power to the rest of the circuit is derived via R1 and R2.

The circuit is protected from spurious triggering by components C1, C2, C4 and C5.

BUYLINES

Most of the components used in this project will be familiar. Note, however, that SCR1 is a sensitive gate type and the device specified should be used to ensure satisfactory performance. The device is available from RS stockists.

PARTS LIST

RESISTORS (all ¼ W 5% unless stated)

R1,2	68k 2 W
R3,7,8	10k
R4,5	1k
R6	47k
R9	100k
R10	2M2
R11	4k7

POTENTIOMETER

RV1	10k preset

LIGHT DEPENDENT RESISTOR

LDR1	ORP 12

CAPACITORS

C1	470u 16 V electrolytic
C2,3,4,5	100n polyester
C6	47u 16 V tantalum

SEMICONDUCTORS

IC1	555
D1	1N914
SCR1	C106
BR1	0.9 A 400 V
OPTO 1	Opto-Isolator (Doram 65-670-0)

SWITCH

SW1	MK SPDT Switch

MISCELLANEOUS

MK surface mounting 13 A box,
500 mA 20 mm fuse plus holder,
PCB as pattern.

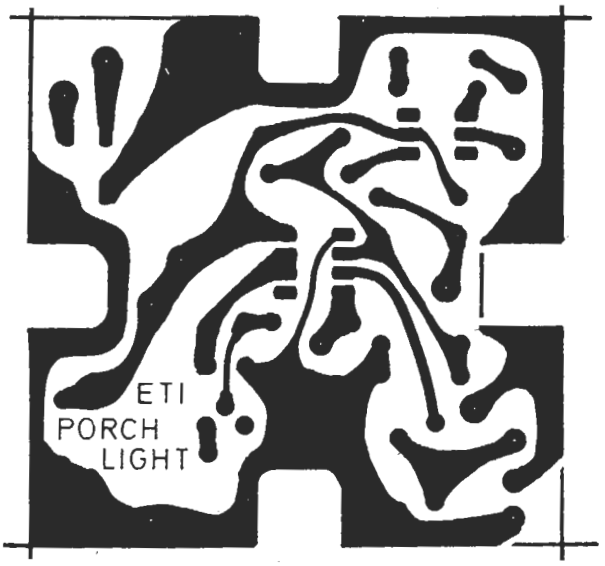
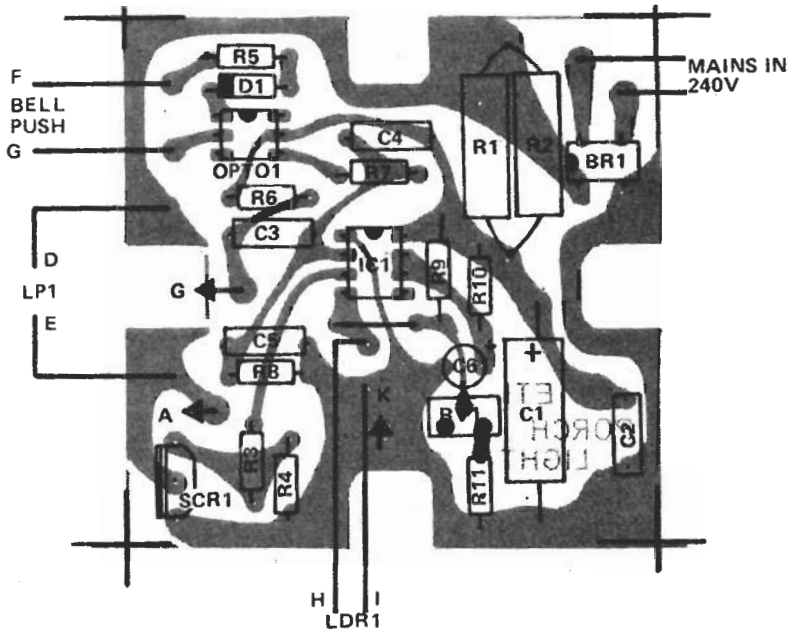


Fig. 3. The foil pattern for the Porch Light is shown full-size (70 x 70 mm).

Fig. 4. (below) shows the component overlay for the Porch Light project.



Photograph showing the internal layout of the project. Note — a set of ventilation holes should be drilled in the mounting box above and below resistors R1 and R2. These holes will also allow access to RV1.