UNIBOARDS

SIMPLE TRANSISTOR DESIGNS

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OPTO ALARM

The start of a new series of six easy-to-build transistor-based projects. All use a standard size piece of stripboard, 10 strips by 24 holes.

THIS simple single-transistor circuit is designed to sound a miniature audible warning device when light falls on to a photocell. The photocell is normally mounted in a dark room and the alarm is triggered when either the room lights are switched on or possibly when light from an intruder's torch falls directly on to the photocell.

The circuit will operate satisfactorily from a 9 volt battery but as it is probable that the device will come in for regular use the device described here can be wired to operate from the "9 Volt Power Pack" project to be described later in this series.

CIRCUIT DESCRIPTION

The circuit diagram of the Opto Alarm appears in Fig. 1. The photocell, PCC1 is an ORP12 light-dependent resistor which is located in the room to be protected, and is connected by means of PL1 and SK1. Together with R1, PCC1 forms a potential divider: the voltage at the junction of R1 and PCC1 varies with the amount of light striking the l.d.r.

In absolute darkness the resistance of an ORP12 is at least 10 megohms, and so the voltage at the junction of R1/PCC1 is very nearly that of the supply rail, 9V. Transistor TR1 is therefore firmly switched off as its base is not biased.

When light falls on PCC1, its resistance drops (albeit relatively slowly) and this causes TR1 to switch on. A triggering pulse is therefore delivered to the gate of CSR1 and this component conducts. The audible warning device (WD1) will therefore sound.

The thyristor will now remain in this low impedance state even if the triggering signal is removed. The only way to reset CSR1 and mute the alarm is in this case to switch off the mains power supply, or switch off the battery if dry cells are used instead. Resistor R5 will ensure that a minimum holding current is flowing in the anode-cathode circuit of the triggered thyristor, and so preventing any undesirable resetting.

BUZZER

It is important to note that conventional electromechanical buzzers should not be used in this circuit. They feature a very high current consumption normally, and apart from destroying the specified thyristor such a unit could greatly reduce battery life if the circuit is powered by conventional batteries. The miniature audible warning device used here has a current consumption of only 15-20mA.

Whilst the response time of the l.d.r. is relatively slow, experimentation with resistor values enabled a design to be produced which reacts quickly to a change in light: the alarm is triggered, for example, by a torch beam skimming over the photo-resistor in a darkened room.

Finally, C1 and C2 decouple the power supply and prevent triggering of the thyristor during initial switch-on. A 9 volt supply is connected via SK2, the tip of the jack plug being +9V as usual.

CONSTRUCTION starts here

The prototype was built into an ABS "Bimbox" type 4003. This measures approximately 85 x 55 x 35mm and has a steel front panel. The circuit can be accommodated neatly on a piece of 0·1 inch matrix stripboard, 10 strips by 24 holes.

There should be no problems with the construction of the circuit; Fig. 2 illustrates the recommended arrangement of components. As usual note carefully the connections to the semiconductors and in particular ensure the correct polarity of C1.

The metal panel of the box is drilled to carry the miniature buzzer and also the two jack sockets. A small hole is also required to enable the leadouts from the bleeper to pass through the metal panel to the circuit board inside.

All interconnections between the component board and front panel can be completed with stranded flexible hook-up wire. Make quite certain that both jack sockets are wired the right way round. Both sockets must be wired exactly as shown: note that the metal panel will in fact be connected to 0V through the jack sockets.

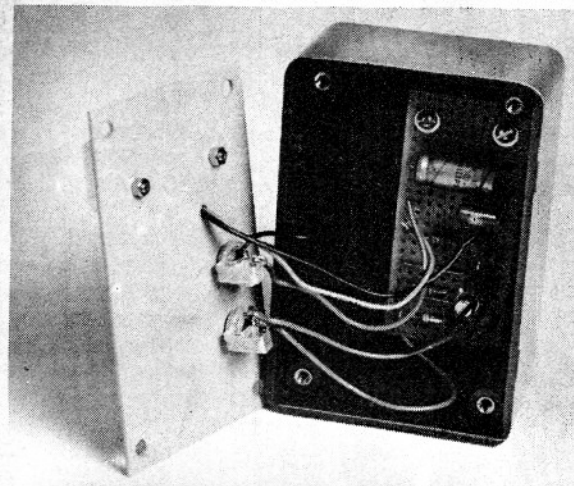
LIGHT SENSOR

The photocell arrangement in the prototype is shown in Fig. 2. The ORP12 is mounted upon a small piece of tagstrip and connected to its respective jack socket using twin-core flex terminated with a 3·5mm jack plug. The length of the flex can be in excess of 5 metres.

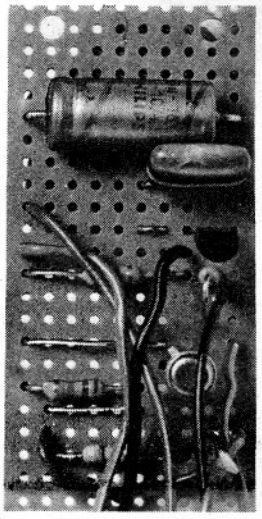
No setting up is required, simply mount the l.d.r. in the room to be monitored. Obviously it should not be obscured by any object in the room.

One final point is to remember to connect up all jack sockets *before* switching on the power. If this is not done then there is the possibility that the "9 Volt Power Supply" (if used) could be shorted out when the jack plug connecting it is being inserted into the jack socket.

If battery operation is required, the power input socket SK2 should be replaced by an on/off switch located so as to allow a PP3 battery to sit in the case.



The completed Opto Alarm showing positioning of the circuit board and wiring to the jack sockets.



Completed circuit board.

COMPONENTS

Resistors

R1	22kΩ
R2	4·7kΩ
R3	680Ω
R4	2·2kΩ
R5	1kΩ

All ¼W carbon ± 5%

See Shop Talk page 742

Capacitors

C1	150μF/16V elect.
C2	0·1μF polyester C280 or similar

Semiconductors

TR1	BC178 silicon *pnp*
CSR1	MCR102 thyristor rated 30V 0·8A or similar
PCC1	ORP12 or similar light dependent resistor

Miscellaneous

SK1, 2	3·5mm jack socket (2 off)—see text
PL1	3·5mm jack plug
WD1	miniature 9V audible warning device

Stripboard: 0·1 inch matrix, 10 strips × 24 holes*; case BIM4003 or similar; tagstrip; twin-core flex; stranded connecting wire; 6BA fixings including 5mm spacers; *Optional components*, 9 volt battery and connector; on/off switch.

* Available in packs of five boards.

Approx. cost Guidance only
£2.00 excluding case

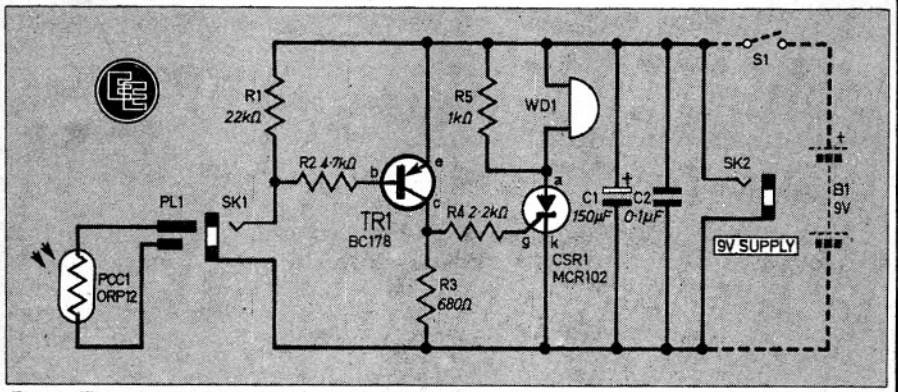
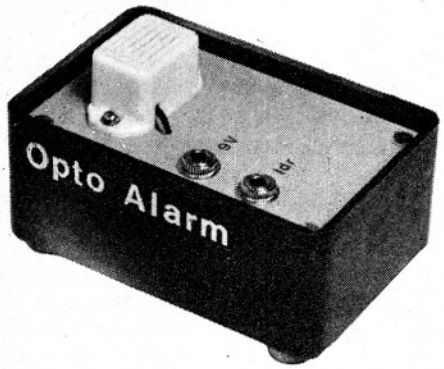
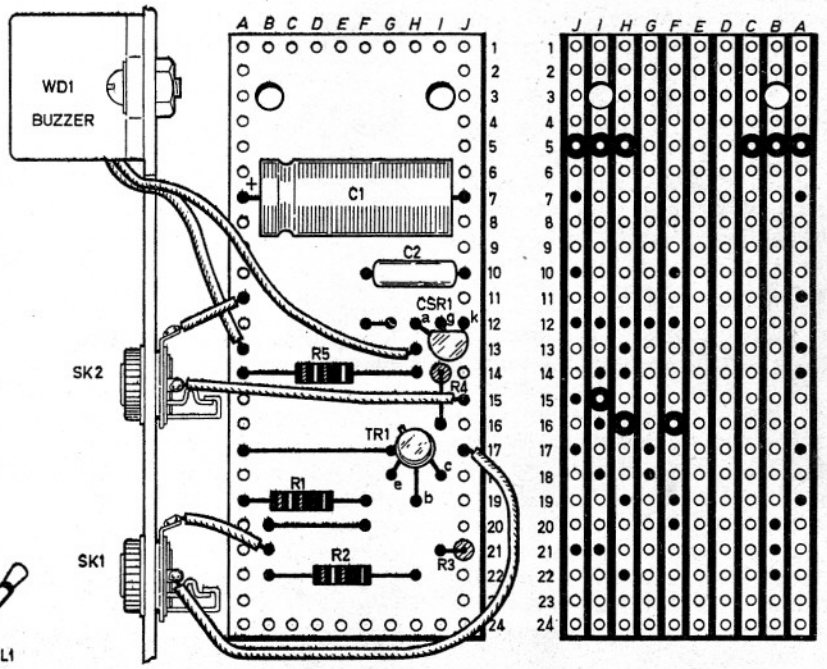


Fig. 1. The circuit diagram of the Opto Alarm. The dotted components replace SK2 for an integral battery version.





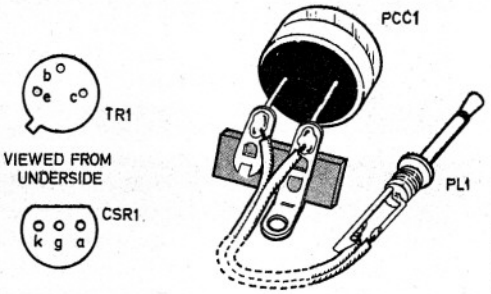


Fig. 2. The layout of the components on the topside of the stripboard and the breaks to be made along the copper strips on the underside and interwiring between board and panel mounted components. Left shows the l.d.r. fixed to a tag strip enabling the l.d.r. to be mounted and connected to a jack plug to suit SK1.