LIGHT OPERATED SWITCH

HAVE you ever wished that you could have some electrical appliance switched on automatically when darkness falls. It could be the light in the porch, dark room, or sick room or anywhere; it could be a single bar 1 kilowatt fire. No doubt readers will have their own ideas.

This simple device can be made up on the sample piece of printed wiring board given free with this issue. Details of the housing is omitted deliberately because the constructor will probably wish to incorporate it either in a plain box or in some existing installation.

TRIGGER SWITCH

The circuit uses three transistors in a Schmitt trigger and switch configuration (Fig. 1). The light sensitive device XI is a light dependent resistor (l.d.r.) or cadmium sulphide cell. During full daylight conditions the l.d.r. will be of low resistance, about 75 ohms; in darkness it will be as much as 10 megohms.

The potentiometer VR1 is set to determine the ambient lighting conditions that will operate the trigger circuit. During daylight transistor TR1 conducts, the low resistance of the l.d.r. having little effect on the base bias supplied via VR1 to TR1.

Transistors TR2, and hence TR3, will remain in a non-conducting state, so the relay will be in the neutral non-operative condition. Relay contacts RLA1 and RLA2 remain open-circuit and the mains supply is unable to reach the appliance.

Potentiometer VR1 can be set so that at dusk or darkness, the high resistance of the l.d.r. influences the bias supplied to TR1, switching this transistor off. As it does so, TR1 collector voltage goes more negative and biases TR2 into a state of conduction. The third transistor has been chosen as an *npn* type deliberately, so that the positive going voltage on TR2 collector biases TR3 into conduction.

The relay is connected into the collector circuit of TR3, is energised, and changes over the contacts, switching on the appliance. The capacitor C1 is a "commutating" capacitor inserted to speed up the switching process and avoid relay chatter. Diode D1 suppresses transient spikes due to back e.m.f. from the relay coil, which would otherwise possibly damage TR3.

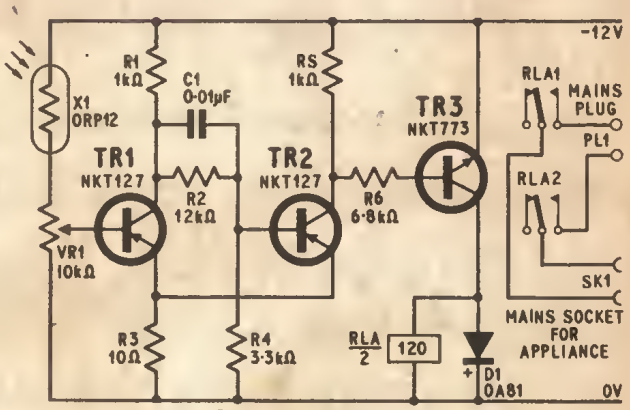


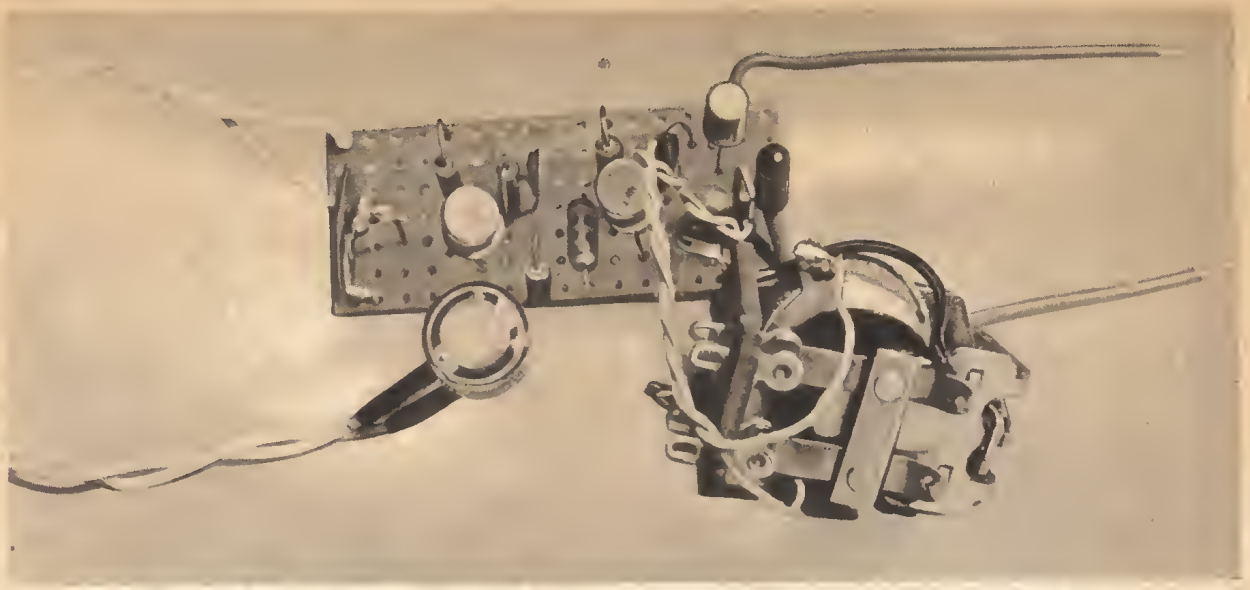
Fig. 1. Complete circuit of the Light Operated Mains Switch

The maximum current rating of the NKT773 is 300mA so it should be able to handle the maximum 100mA, which the relay could take, without resorting to the use of a heat sink. If a metal case is used to house the device, it might be a good idea to use this as a heat sink for TR3 just to be on the safe side. In this case, no other wire or connection should be taken to the case.

Do not exceed a 1 kilowatt rated appliance on the 5A relay contacts.

CONSTRUCTION

Construction work is very simple if the basic rules outlined in the special article on printed wiring board (elsewhere in this issue) are followed. The component layout on the board is given in Fig. 2 with the plan of copper strip breaks and connections on the underside.



Prototype layout of light operated switch showing externally connected l.d.r. and relay. Note that l.d.r. is sleeved at soldered connections to board flying leads

COMPONENTS . . .

Resistors

R1 1kΩ	R3 10Ω	R5 1kΩ
R2 12kΩ	R4 3·3kΩ	R6 6·8kΩ

All 10%, ½ watt carbon

Potentiometer

VR1 10kΩ skeleton preset

Capacitor

C1 0·01μF polyester

Transistors

TR1 NKT127
TR2 NKT127 } (Newmarket)
TR3 NKT773

Diode

D1 OA81

Light Dependent Resistor

X1 ORP12 (Mullard)

Relay

RLA 120Ω, 12V (Radiospares type II) with two sets of heavy duty changeover contacts rated at 5A for 250V a.c. minimum

Miscellaneous

Printed wiring board, free in this issue
PL1 Mains plug to suit house wiring and appliance
SK1 Mains socket to suit appliance (see text)
Battery 12V with clips, on-off toggle switch, case to house all components

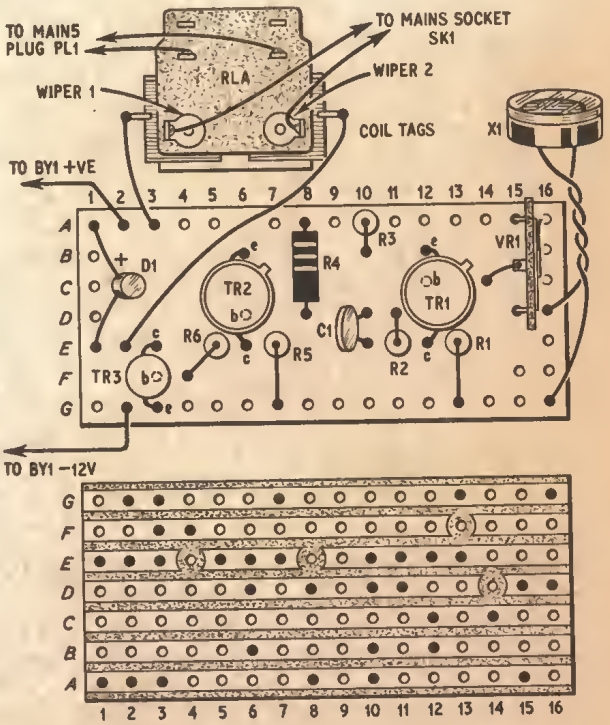


Fig. 2a. Component layout on the board with connection details to other components

Fig. 2b. Underside view of the board showing the breaks in the copper strips and connections

The l.d.r. is push fitted in a rubber grommet fitted in the case. Obviously the relay cannot be mounted on the board; it can be fitted to the case by means of the single hole nut fixing. Make sure that none of the copper strips or tags touch the case or disaster will result. The board can have small pieces of foam plastics or rubber glued to the underside for subsequent fitting in the case. Arrange the board so that a hole in the case corresponds with the screwdriver slot in VR1 for easy adjustment. Bring out the relay wiper contact connections to a mains socket SK1 (preferably 3-pin, 13A) mounted on the case so that the appliance can be directly plugged in. A flying lead with a mains plug PL1 is connected to the relay contacts.

All that is needed now is a small 12V battery to supply the electronic ciruit, and a toggle switch to switch off the battery when not in use. ★