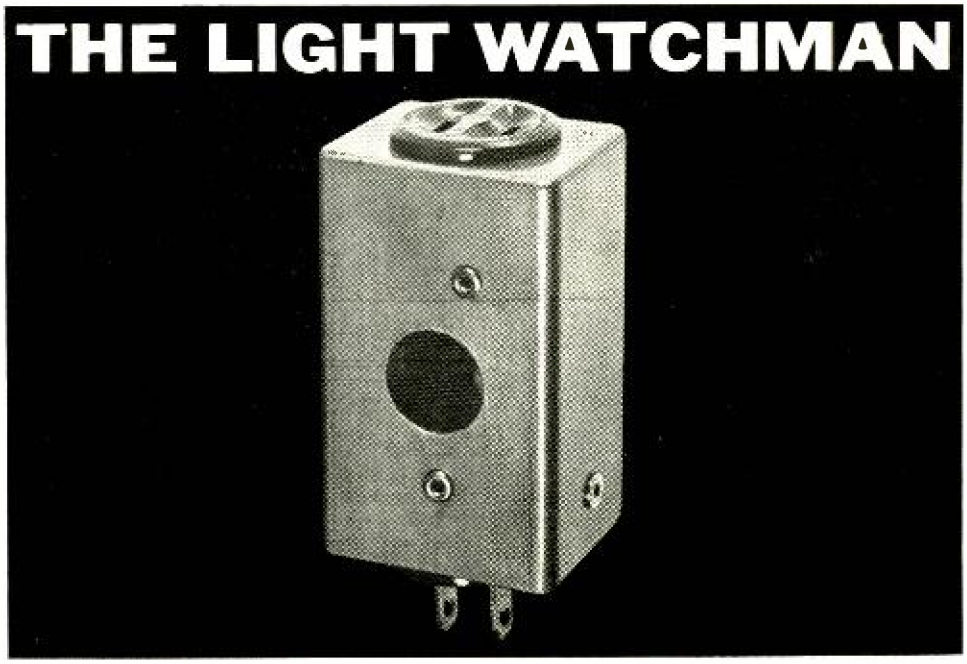
BUILD THE LI'L DUSKER

THE LIGHT WATCHMAN



This light sensor turns your lights on at dusk, and off at dawn, automatically—without a timer

By DONALD E. LANCASTER

HERE'S A CLEVER, useful, and economical photoelectric controller you will want to build. Li'l Dusker, the "light watchman," will earn its keep turning on lights for you in dark driveways, stairways, and halls at night, and then turning them off at dawn when they are no longer needed. And while you are away from home, Li'l Dusker will turn on that important "there's somebody home" light that will deter *all* but the most persistent intruder.

But Li'l Dusker has many more talents. It can serve as an automatic door opener, or a light-operated relay. And if you want an automatic flasher with adjustable frequency, or a low-cost touch control for a desk or table lamp, call on Li'l Dusker.

About the Circuit. Although Li'l Dusker acts like a magician, the circuit is really a simple one, as Fig. 1 shows. It is just a d.c. power supply (*R1*, *D1*, and *C1*), and a limiting resistor (*R2*), a cadmium sulfide photocell (*PC1*), and a d.c. relay (*K1*), all connected in series.

The cadmium sulfide photocell has a low resistance in the presence of light and a high resistance in darkness. This characteristic enables the Dusker to tell night from day. Therefore, as light increases with the break of dawn, the photocell resistance decreases, increasing the current in the relay coil, and causing the relay to pick up.

The relay sensitivity—the light intensity that will cause the relay to pick up—is established by the value chosen for the current-limiting resistor (*R2*). The circuit application determines which set of relay contacts is used. For dusk-to-dawn control, the *NC* (normally closed)

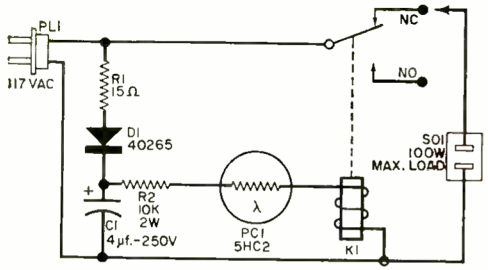


Fig. 1. For dusk-to-dawn control, connect load circuit to the NC relay contacts; for photocell relay application, connect load to the NO contacts.

PARTS LIST

C1—4-μf., 250-volt electrolytic capacitor
D1—130-ma., 400-PIV rectifier (RCA 40265 or equivalent)
K1—S.p.d.t. relay, 24 volts d.c., 1 amp contacts (Newark 60 F 1749 or equivalent)
PC1—Sigma 5HC2 photocell, 0.6 watt, 300 volts (Allied 9 E 307 or equivalent)
PL1—100-volt, 2-pole standard plug (Amphenol 61-M or equivalent)
R1—15-ohm, ½-watt resistor
R2—10,000-ohm, 2-watt resistor
SO1—110-volt, 2-pole universal receptacle (Amphenol 61-F or equivalent)
1—Case made from Millen 74400 octal base and shield (Newark 40 F 734)
Misc.—"Pop" rivets (4), 1¾"-square piece of 1/16" single-sided PC board, funnel eyelets for PC board (24), ½" x ⅞" aluminum sheet (2), 2" x 1½" plastic sheet or film, glue or sealant, wire, solder

contacts are used; for door-opening operation, the *NO* (normally open) contacts are employed instead.

Construction Pointers. Li'l Dusker can be encased for mounting on a windowsill or anywhere outdoors, and can be plugged into a standard wall receptacle or octal socket. In Fig. 2(A), the Dusker has its own line cord and is mounted on a windowsill where it can "look" outside. For general outdoor use, BX, ROMEX, or other approved wiring can be brought in through the top of the unit. To make the Dusker weatherproof, the outlet can be recessed and the entire unit mounted as shown in Fig. 2(B) in a sheltered area.

If Li'l Dusker is to serve as a door opener, the case is used as it comes, with only slight modification. You can then make a companion light source, perhaps with a 6.3-volt filament transformer and an automobile 6-volt lamp bulb and socket. You might want to add a low-cost

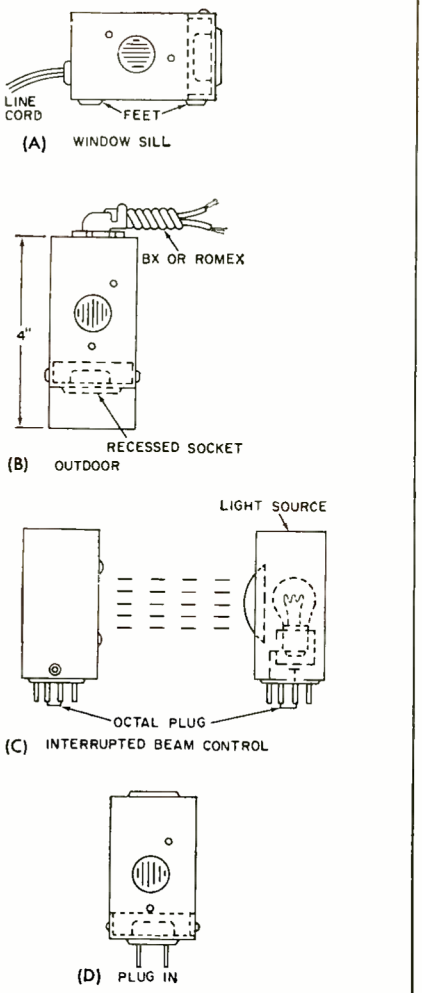


Fig. 2. Select one of these four case configurations for the Dusker. For table or desk lamp touch control applications, the outer casing is not used.

lens to focus the beam and thus provide for greater separation between the Dusker and the light source.

For touch control applications, you can omit the case altogether and mount the circuit directly inside the base of a table or desk lamp.

Construction Details. Using a Millen #74400 octal base and shield, cut the case for the plug-in configuration following the details given in Fig. 3. In addition, two mounting brackets will be required. These can be made out of a small strip of aluminum sheet cut as shown in Fig. 3(D). Drill the holes first, then

bend the bracket into shape using long-nose pliers, or a vise, if one is available.

You will also need a piece of tough plastic film to serve as a protective window for the photocell. Acetate, Mylar, or anything similar will do. Avoid using brittle material that will crack or break.

The parts are mounted on a small (1¾-inch-square) printed circuit board laid out, drilled, and cut as shown in Fig. 4. Eyelets are used in the holes where shown to give the circuit board some extra ruggedness. The aluminum brackets are riveted to the circuit board

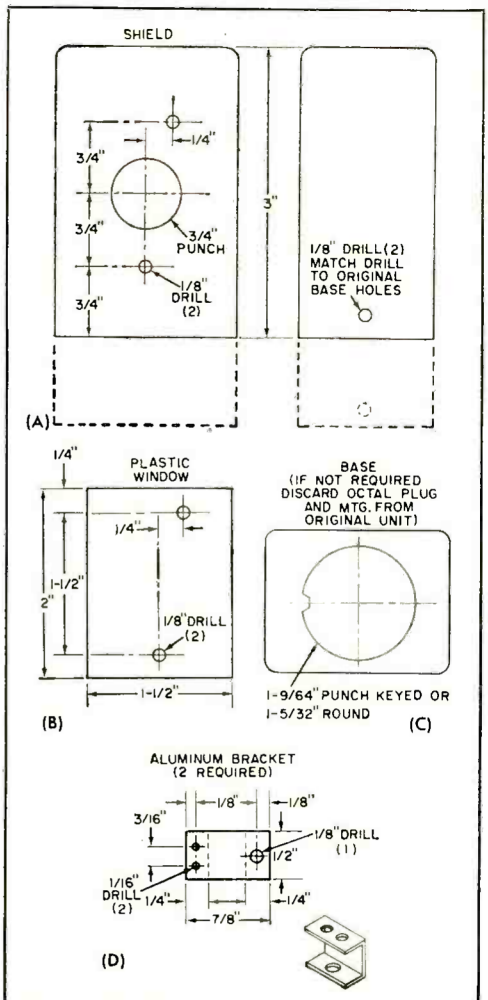


Fig. 3. The base and shield of case are cut and punched as shown. Then they are finished with lacquer or paint, or are anodized. The two brackets at bottom are made from 1/32-inch aluminum sheet. Window is made from heavy plastic film such as Mylar; avoid using brittle material.

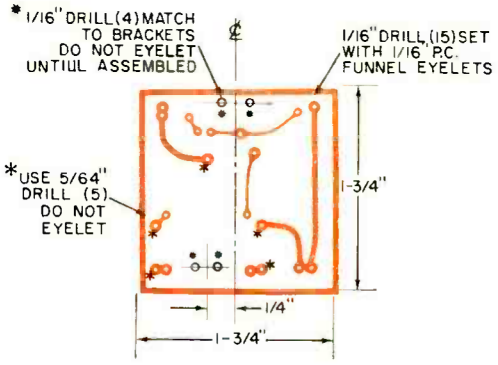


Fig. 4. This is foil side of printed circuit board. Numbers in parentheses indicate holes required.

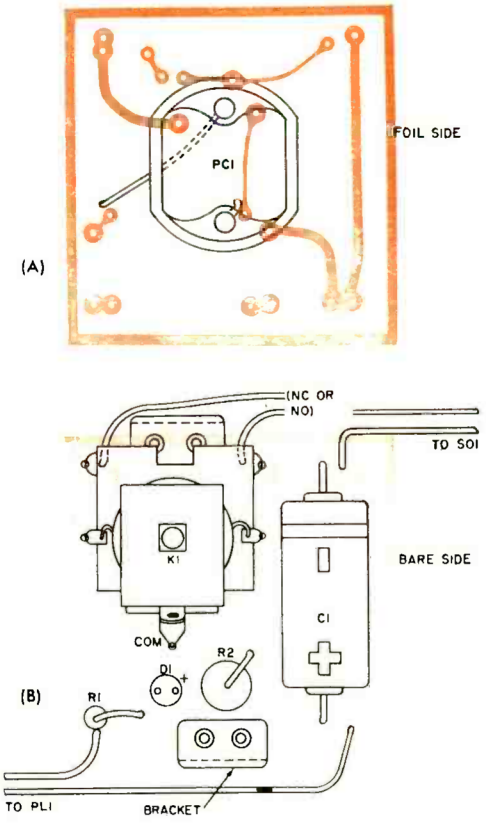


Fig. 5. Here's the component layout. Photocell PC1 is mounted on the foil side of the circuit board as shown in (A). All of the other parts are mounted on the bare side of the board as shown in (B).

in the locations indicated in Fig. 5, again using eyelets.

The photocell is glued to the back of the printed circuit board with silicone

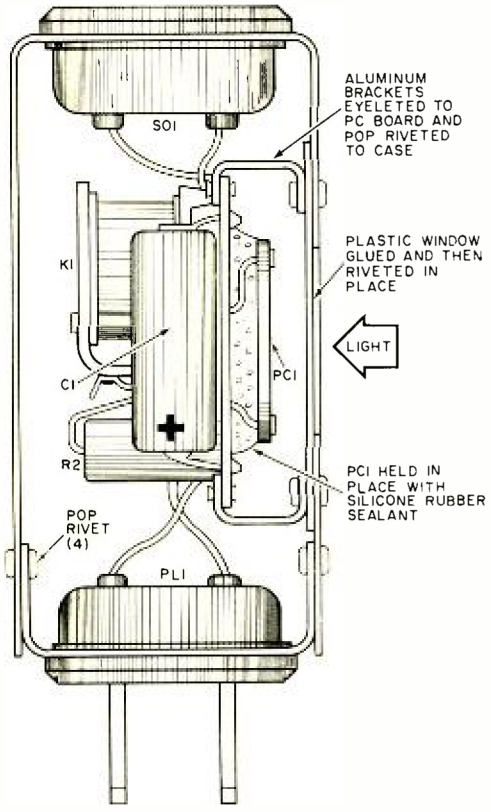


Fig. 6. After all the parts are preassembled on the circuit board, and the unit has been fully wired and tested, install the plastic window and pop-rivet the aluminum brackets to the case shield.

rubber sealant (Fig. 6). The plastic window is glued in place and allowed to dry before the aluminum brackets are riveted on.

Before making connections to the relay, refer to the Special Applications section at the end of this article to determine the proper relay terminals to employ. In general, the *NC* contacts are used when decreasing light must energize the load, and the *NO* contacts are used when increasing light is to energize the load.

Checkout and Final Assembly. Before final assembly, you will want to check out the circuit to make sure it works the way you want it to. For this you can use a flashlight or other suitable light source. If it becomes necessary to change the sensitivity of the unit, change the value of *R2* as necessary. But you can decrease the sensitivity by merely reducing the amount of light reaching the photocell. A filter made of colored cellophane, Polaroid material, or tinted acetate placed over the light window will work well.

Once you have obtained just the right sensitivity for the particular application, complete the assembly by "pop"-riveting the circuit board and bottom plate to the case. Once pop-riveted, the Dusker becomes tamperproof and there's no way to take the case apart without using an electric drill. If it becomes necessary to open the case again, use a ⅛" high-speed bit to drill out the rivets.

Once assembled, operation of the Dusker is a snap. Just plug it into a convenience outlet, plug the load or lamp into its receptacle, and away you go.

Special Applications. For operation as a light flasher, the Dusker must be wired as a dusk-to-dawn control. This makes it essentially an oscillator with negative feedback. The Dusker must be positioned

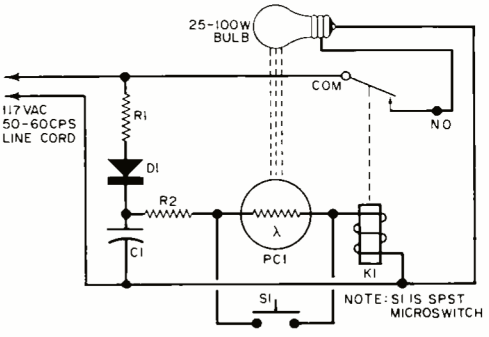


Fig. 7. This low-cost touch control circuit can easily be wired to any desk or table lamp by adding a microswitch across PC1. To turn on lamp, touch S1 gently. To turn off lamp, bring hand near PC1, shielding it from light. For proper operation, PC1 must be shielded from other strong light sources.

in such a way that the light shines in its "eyes." Initially, when the light is *off*, the photocell turns it *on*: the Dusker "sees" it and turns it *off* again. This cycle can go on as long as the unit is plugged in. To adjust the *on-off* rate (frequency), adjust the amount of light that gets fed back. Changing the bulb size will usually do the trick.

For "touch control" operation, mount the circuit board (less case) in the base of a lamp so that only the lamp light—

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DO'S AND DON'TS IN BREADBOARDING

DO watch for exposed terminals and leads, especially when working with vacuum-tube circuits which may carry very high voltages.

DO avoid accidental shorts. These can easily occur between exposed component leads. Before applying power, check to see that bare leads are not touching each other.

DO use rubber-covered alligator clips on all test lead connections to avoid short-circuiting components.

DON'T make circuit changes at random just to see what happens. You may damage an expensive part.

DON'T leave parts dangling loose. Mount all parts securely on the board, unless you are merely "jumping" the part for test purposes.

and choose to his heart's content to meet individual tastes or needs.

Many experimenters may prefer to obtain two or three different kits to handle a variety of projects. Where cost is a factor, one can budget the smallest kit offered of the type desired, and later purchase additional components and terminals as needed. Refer to the table on page 71, which lists the kits currently available from the various manufacturers, for pricing information and other details. -30-

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(*Continued from page 76*)

and no other room light—shines on it. Add a microswitch across the photocell, and connect the relay so that increasing light energizes the load (Fig. 7). The microswitch will short out the photocell when pressed.

Here's how the touch control works: While the light is out, the photocell "sees" no light and the relay is not activated. A gentle touch of the switch energizes the relay and the light goes on. The photocell "sees" the light and holds the relay energized. The light stays on. Now, how do you turn the light back off? Just pass your hand between the bulb and the photocell to create a shadow. Presto! The lamp goes out and stays out. -30-