UNIBOARDS

SIMPLE INTEGRATED CIRCUIT DESIGNS

iC 1

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NO ENTRY INDICATOR

THIS project was designed initially for photographers carrying out their own developing in a domestic darkroom. The unit comprises a small case which is placed outside the door of the darkroom; on the case is a small indicator lamp designated NO ENTRY and, by operating a switch within the darkroom, the indicator can be made to flash on and off.

This forms a courteous reminder that developing is in progress and so the darkroom should not be entered. This is a more professional means of keeping people out than nailing a sign to the door or locking it altogether!

Other applications however soon came to mind. By suitably re-lettering the lamp, the device could be used for other purposes. For example, in offices: "Interview in Progress" or "Engaged". Anyone who regularly uses a tape recorder may find this design useful if the indicator is designated "Recording in Progress" or similar. In fact, the device forms a very simple general purpose signalling system.

Batteries have been chosen to power the project. This reduces the complexity and cost of construction.

CIRCUIT DESCRIPTION

As with all designs in this series, a single integrated circuit is used, see Fig. 1. The heart of the unit is IC1, a 555 timer chip. It can be made to perform several functions, including, in its astable mode, turning a load (for example, an indicator lamp) on and off continuously.

When wired as an astable multivibrator (a circuit having no stable state and so oscillating freely), a stream of pulses is produced at pin 3, the output pin. The frequency, or number of pulses per second, of the output waveform is controlled by three external components, R3, R4 and C2.

Upon initial application of power, C2 will start to charge up through R3 and R4 until the voltage at pin 6 (the "threshold pin") equals two-thirds of the supply voltage. At this point, the i.c. will switch over internally and force the capacitor to discharge through R4 into the "discharge" terminal, pin 7. When the voltage on this pin has dropped to one third supply, C2 will then charge up again, and then the process repeats itself.

The relatively slow charging and discharging action of the capacitor is transformed by the i.c. into a very sharp on-off action at the output, where a stream of square waves is produced. The square wave when "high" is almost at 9V and when "low" about 0V.

FREQUENCY

By adjusting R3, R4 and/or C2, the frequency of operation can be altered. Here values have been chosen which give an "on" time of about 0·5 seconds and an "off" time of roughly 0·2 seconds, implying a frequency of approximately 1·4Hz. However, the timing components do have manufacturing tolerances, and so this frequency may not be exact. In particular the tolerance on C2 is quite large.

Connected across the output are two light-emitting diodes, D1 and D2, each with a current-limiting resistor. When the output is high, the l.e.d.s are illuminated, and so the indicators flash on and off. Small l.e.d.s were chosen rather than ordinary light bulbs in order to improve current consumption.

One of the indicators is mounted externally in a separate case and forms the actual NO ENTRY indicator, whilst the other l.e.d. is just a repeater lamp which reminds the user that the unit is in operation.

POWER SUPPLY

A 9V rail is derived from a series of dry batteries. In fact six 1·5V HP7 cells are wired in series to provide the necessary power supply. This ensures that the device does not flatten the batteries if used regularly. Occasional use only of the Indicator means that a PP3 battery may be employed instead, however.

Capacitor C3 decouples the power supply. As the batteries start to age they will become less able to supply current peaks demanded when the l.e.d.s illuminate. The result is that the supply rail voltage drops as the current drawn increases; this produces ripple.

C3 acts as a reservoir which provides the extra current required to maintain stable operation of the flasher. The Indicator is switched on and off at S1.

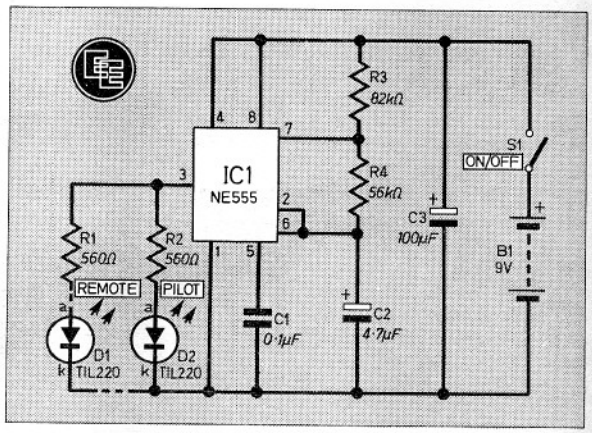


Fig. 1. Complete circuit diagram of the No Entry Indicator.

STRIPBOARD

The circuit can be assembled on a piece of 0·1 inch stripboard measuring 10 strips × 24 holes, see Fig. 2.

Take the stripboard and drill two 6BA clearance holes in the positions shown. Then make all the breaks (ten in all) in the copper strips using a twist drill or a spot face cutting tool.

An 8-pin d.i.l. socket should be used for IC1, and this should be soldered into place first of all. Continue by soldering in the solid jumper wires.

There are five of various lengths and they can be made from 22 s.w.g. tinned copper wire.

Follow on with the miniature resistors and finally the capacitors. The electrolytic capacitors are polarised and must be orientated correctly. Fit IC1 the right way round into the d.i.l. socket: a notch or dot identifies pin 1 of the i.c.

CASE

The circuit board is encased in a plastic box of dimensions 120×80×35mm. On this box are mounted S1, and also one of the l.e.d.s. The circuit board is bolted on one side of the box using 6BA spacers and hardware.

There is just enough room in the case to accommodate the 9V (6×HP7) battery holder, although if a lower-capacity PP3 battery is used then there is ample room inside for this. Note that a PP6 battery will *not* fit within the specified box.

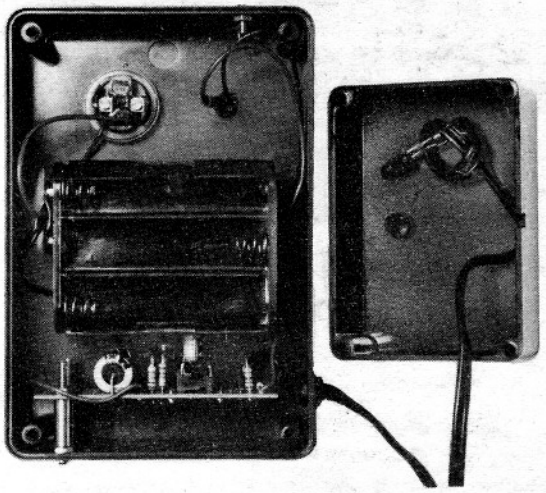
A small matching box is used to mount the other light-emitting diode. This box measures 71×49×24mm, and is connected to the main unit with twin-core flex of suitable length.

FINISHING OFF

The larger case can be lettered as necessary, with the smaller case being labelled NO ENTRY or whatever is required. Lettering can be applied with rub-down dry transfers, and can then be protected with a few coats of aerosol lacquer.

The necessary interwiring is also given in Fig. 2; general - purpose stranded insulated wire can be used. The only point to watch is that the l.e.d. indicators are wired the right way round, and if there is a chance of the l.e.d. connections shorting together, 2mm p.v.c. sleeving can be employed to eliminate this possibility.

No setting up is required, so once construction is complete, snap on the battery holder and switch on. Both l.e.d.s should be flashing regularly. If this is so the unit is finished and ready for use.



Interior view of both boxes showing the main unit on the left and the smaller box housing D1 on the right.

INSTALLATION

The smaller case is positioned at the door (or where required), preferably where sunlight will not fall onto the l.e.d. Bright light like this may cancel the flashing effect of the indicator.

The main unit can be located in any convenient position in the darkroom. Bear in mind the eventual need to replace the batteries, so do not fix the main unit permanently to the wall, but preferably leave it on a table top or in a similar place. ⌑

COMPONENTS

Resistors
R1,2 560Ω (2 off)
R3 82kΩ
R4 56kΩ
All ¼W 5% carbon

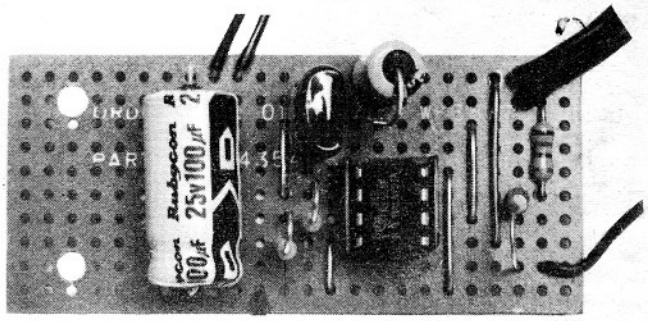
See Shop Talk page 792

Capacitors
C1 0·1μF mylar
C2 4·7μF 63V elect.
C3 100μF 10V elect.

Semiconductors
IC1 NE555V timer i.c., 8-pin d.i.l.
D1,2 TIL220 0·2 inch red l.e.d. (2 off)

Miscellaneous
S1 Single pole switch, Hekla rocker type or similar.
Verobox 75-2860J, 120 × 80 × 35mm; Verobox 75-1413E, 71 × 49 × 24mm, or similar; stripboard 10 strips × 24 holes 0·1 inch matrix; 8-pin d.i.l. socket for IC1; battery clip; 9V HP7 battery holder (see text); clips for D1 & D2 (2 off); twin-core flex to suit.

Guidance only Approx. cost £6 complete



Above left. Close-up view of the top-side of the circuit board.

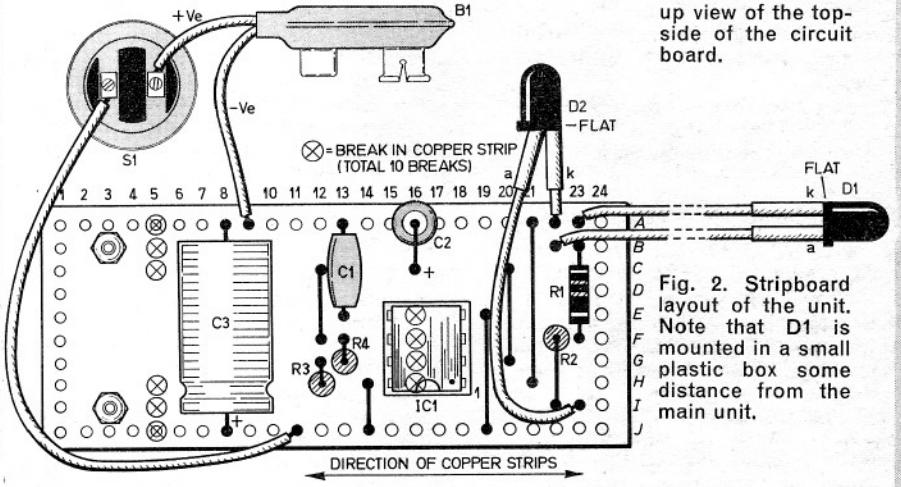


Fig. 2. Stripboard layout of the unit. Note that D1 is mounted in a small plastic box some distance from the main unit.