

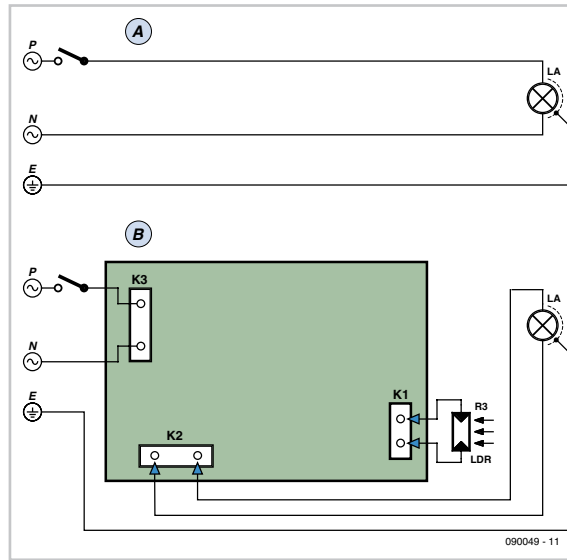
# Daylight Switch



Mickael Bulet (France)

This project was originally designed for lighting up an illuminated sign for a wine-grower. The sign was originally controlled by a simple time-switch, which had to be reprogrammed every day to avoid the sign's lighting up while it was still daylight. This is time-consuming, and can lead to wastage of electricity and other resources. A better solution would be an automatic switch capable of detecting the transition between daylight and night-time. In addition to that fundamental requirement, the specifications also demanded a very compact unit that would be easy to install and not require major modifications to the existing electrical installation.

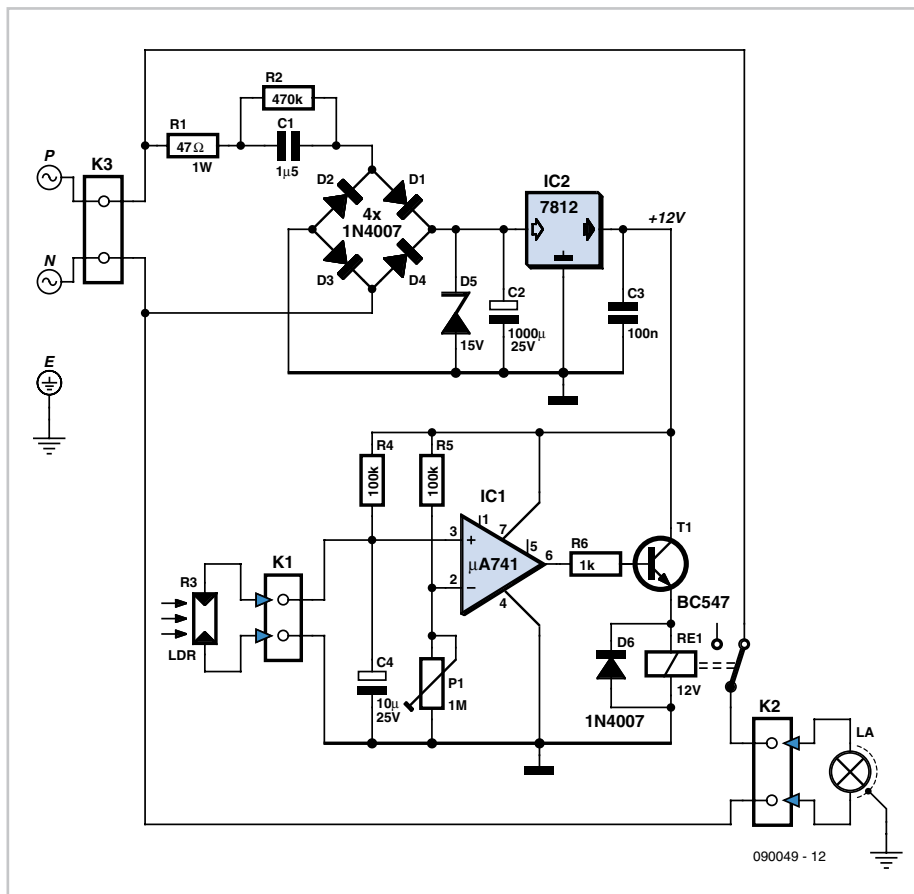
The project described here is compact enough, fitting into an 80x80 mm (inter-



nal dimensions) IP55 junction box, for example, the Plexo® range from Legrand. It is easy to install; all you have to do is cut into the cable leading to the light and wire it in series.

The circuit is AC powered, without using a transformer. The impedance of a capacitor is used to drop the 230 VAC power voltage and limit the current. Resistor R1 protects the capacitor (C1) against surge currents when power is applied at lighting-up time, and R2 ensures that it is discharged at turn-off. Readers on 120 VAC, 60 Hz power should change component values as follows: R1 = 2x 100 Ω in parallel (stacked) or 1x 47 Ω, 2 watts; C1 = 2.2 μF. Also note P = phase, N = neutral, P (PE) = protective earth.

Rectification is achieved using a bridge rectifier, which makes it possible to double



## COMPONENT LIST

### Resistors

- R1 = 47Ω 1W
- R2 = 470kΩ
- R3 = LDR
- R4, R5 = 100kΩ
- R6 = 1kΩ
- P1 = 1MΩ multturn preset, vertical

### Capacitors

- C1 = 1μF 500V MKT
- C2 = 1000μF 25V axial
- C3 = 100nF LCC 63V
- C4 = 10μF 25V radial

### Semiconductors

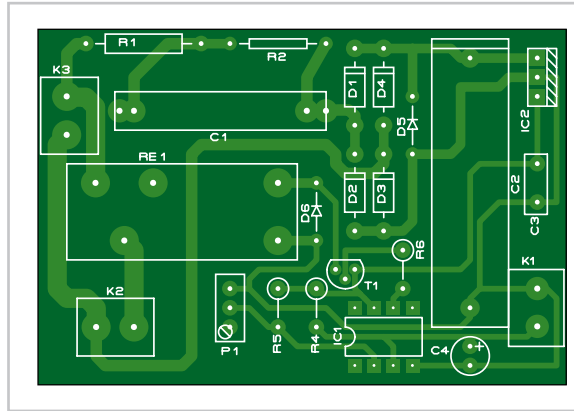
- D1–D4, 6 = 1N4007
- D5 = 15V 1.3W zener diode
- T1 = BC547 or equivalent
- IC1 = μA741 or equivalent
- IC2 = 7812, or low-drop equivalent

### Miscellaneous

- RE1 = relay, 12V coil, 1x 10A, 250V c/o contact
- K1, K2, K3 = 2-way PCB terminal block, 5mm (0.2") lead pitch
- Type IP55 electricity junction box, internal dimensions 80 x 80 mm (3.15" x 3.15") e.g. plexo LEGRAND # 922-06
- 20 mm length of electricity conduit, diam. 20 mm (0.8")

the usable current compared with the conventional rectification often encountered in this sort of power supply. A zener diode of around 15 V (minimum, as the 12 V regulator needs to be allowed enough headroom to do its job properly) limits the voltage in the first instance; it is then smoothed by C2, then more accurately regulated by IC2 and finally decoupled by C3. The stable 12 V supply is required above all for the voltage divider that acts as a reference for the comparator.

The darkness is detected by an LDR, which in conjunction with R4 forms a voltage divider, the output voltage of which is inversely proportional to the intensity of the light falling on the LDR. Capacitor C4 absorbs rapid changes in this voltage, in order to avoid unwanted triggering. R5 and P1 form a voltage divider for the comparator (IC1) reference voltage — this is what determines the threshold for the light to be turned on. When the voltage on pin 3 of IC2 is higher than the voltage on pin 2, the comparator activates the relay via T1, and the sign is lit up.



A printed circuit board has been designed (the design is available free from [1]) to make building the switch easier. Don't forget to tin the tracks switched by relay RE1 so they can carry as much current as possible to the light to be controlled. In some cases, it may be necessary to beef up the tracks with pieces of solid copper wire.

The circuit fits into a sealed IP55 box, like an electricity junction box, for example. Drill a hole in the lid of the box to allow the leads

to pass through from the LDR, which you will need to glue to the lid. In front of the LDR, fit a piece of 20 mm diameter plastic conduit about 20 mm long as a shield, so that the LDR won't be affected by the light coming from the light you are trying to control. Install the switch as far away as possible from the light it is operating, to avoid ending up with a flasher!

Last of all, adjust P1 for the light level at which you want the relay to switch on.

### Cautionary Notice

When you're handling the circuit for testing etc., be really careful to avoid getting a shock, as there is live AC power present over most of the PCB. Never connect the circuit's internal ground rail to the protective earth (E) line.

(090049-1)

### Internet link

[1] [www.elektor.com/090049](http://www.elektor.com/090049)