

DIY Kit 14 - 110V. MAINS STROBOSCOPIC LIGHT

INTRODUCTION

This kit contains the circuit to trigger a xenon flashtube. This flashtube is exactly the same as those seen on aircraft and signal beacons and as those contained in camera flash units, fast passport photo kiosks and at discos. Other uses include endoscopes, laser pumps, high speed photocopiers and typesetting. The frequency of flash can be adjusted from about once every 3 seconds to about 3 per second.

(Actually the kit contains TWO flashtubes. The xenon filled tube is the one that makes all the light. However there is another flashtube which contains neon gas. It flashes as well but provides a different function as will be explained later.)

Caution: The kit connects directly to 110V mains power supply. It must be put in a suitable enclosed box before using. Note also that some people who have epilepsy can be affected by regular, strong flashing lights.

The kit is constructed on a single-sided printed circuit board (PCB). Protel Autotrax and Schematic were used to design the boards.

ASSEMBLY INSTRUCTIONS

Assembly is straight forward - just follow the component overlay on the PCB. Add the lowest height components first to aid in assembly. Note that the back metal part of the SCR (silicon controlled rectifier) C106D is high-lighted on the overlay. The xenon flashtube is a non-polarised type and can be inserted either way around. Take extra care when inserting the tube into the PCB so that the thick leads at each end are not bent apart too much. If so then the tube can break. The neon tube can also be fitted either way around.

The electrolytic capacitors must be fitted with the positive lead going into the positive marked hole shown on the PCB overlay.

Put the 680 ohm 10W resistor 2 to 3 mm above the PCB. It can get quite hot when the kit operates at the maximum flash rate so putting it above the PCB aids in cooling it. The xenon flashtube can be located some distance away from the PCB - it does not to be located on the PCB itself.

CIRCUIT DESCRIPTION

The rated life of the xenon flashtube supplied with this kit is two million flashes, which is over 100 hours if left on at the maximum flash rate. When a potential difference of about 6000 volts is applied to the trigger electrode painted on the OUTSIDE glass of the U-tube then the xenon gas inside the tube will ionize and current will flow between the electrodes at either end of the tube. This produces the characteristic bright flash. It is the transformer coil which provides the step up voltage to produce the 6000 volt trigger pulse. It has a primary winding of 10 turns and a secondary winding of 500 turns.

The switch which "closes" to give the pulse of energy to trigger the xenon flashtube is the neon tube. Let us discuss the operation of the neon tube in general before we look at the circuit in particular.

The neon is connected as a relaxation oscillator as shown in Figure 1. The neon tube itself can be seen simply to contain two electrodes in parallel to each other in a small glass bulb. The air has been replaced by neon gas. When a potential difference (PD) below a critical value is applied across the electrodes the neon gas will ionize but conduct almost no current. As the PD approaches the critical value the neon gas glows with its characteristic orange/pink colour. At about 70V (called the striking voltage) current will flow across the electrodes. The PD must drop to about 60V (the extinction voltage) for current to stop flowing.

The operation of the relaxation oscillator circuit in Fig. 1 can now be seen. When power is applied the capacitor starts to charge.

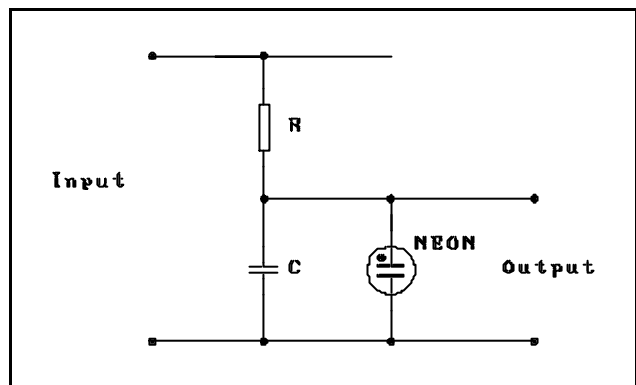


Figure 1.

When it reaches the striking voltage the neon will conduct and draw current from the capacitor. The voltage across the capacitor will fall. When the voltages fall to the extinction voltage the neon will stop conducting and the capacitor will start to recharge. Thus the cycle will continue as long as a PD is kept across the circuit.

Now we look at the circuit of the kit itself. The first part of the circuit is a voltage doubling circuit. It is connected directly to the mains power supply and alternately charges C2 and C3 on each half cycle of the mains supply via the 680 ohm resistor. The diodes provide half-wave rectification, so each capacitor is charged to 1.414 times the mains voltage (about 155V). This gives a total voltage across the two electrolytics of about 310V. The charging time must be fast enough to keep up with the fastest flash rate.

Next comes a potential divider ladder. The potential divider circuit determines the rate at which C1 will charge.

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C1 and the neon are connected in a relaxation circuit as just described. When the neon 'strikes' it triggers the triac and C1 discharges through the trigger coil. This produces a 5 - 6kV pulse to the xenon flashtube and the xenon flashtube 'strikes'. After the flash all capacitors C1, C2 and C3 are discharged and the cycle starts again as long as power is applied to the circuit.

WHAT TO DO IF IT DOES NOT WORK

Poor soldering is the most likely reason that the circuit does not work. Check all solder joints carefully under a good light. Next check that all the components are in their correct position on the PCB, especially the triac, diode, electrolytic capacitor and the trigger coil. Thirdly, CAREFULLY follow the track with a voltmeter to check the potential differences at various parts of the circuit. **Remember you are dealing with mains voltage which can kill you.**

PARTS LIST - KIT 14 - 110V

Resistors (1/2W, 5% carbon unless specified)

| | |
|-----------------------------------|---|
| 1K (brown, black, red)..... | 1 |
| 220K (red, red, yellow) | 1 |
| 390K (orange, white, yellow)..... | 1 |

| | |
|----------------------------------|---|
| 680 ohm 10W cement resistor..... | 1 |
|----------------------------------|---|

Capacitors

| | |
|------------------------------|---|
| 2.2 or 3.3uF/100V..... | 1 |
| 100uF/400V electrolytic..... | 2 |

Miscellaneous

| | |
|----------------------------------|---|
| Xenon flashtube, U-0661 | 1 |
| Trigger coil, TTC-1050 | 1 |
| Neon tube, NE2..... | 1 |
| SCR, C106D..... | 1 |
| 1M potentiometer..... | 1 |
| Knob for potentiometer..... | 1 |
| 1N4007 diode..... | 2 |
| Fuse holder..... | 1 |
| 250mA fuse..... | 1 |
| Screw terminal strip, 2 way..... | 1 |
| Kit 14-110 PCB..... | 1 |

