LEVEL CROSSING LIGHTS

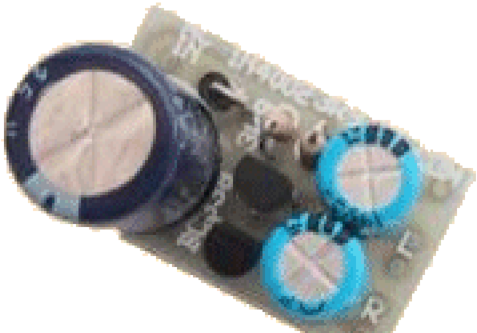
This kit is available from:

Talking Electronics

email Colin Mitchell:

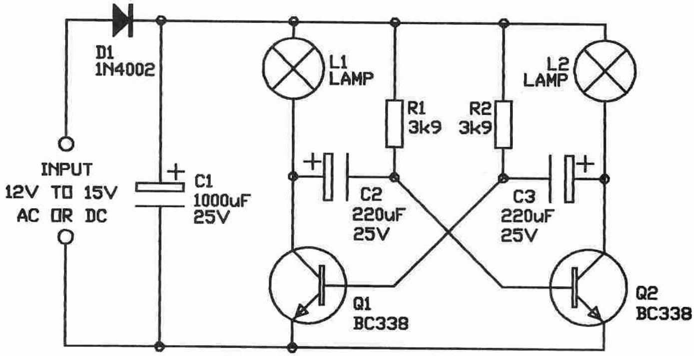
talking@tpg.com.au

for pricing and postage.



LEVEL CROSSING LIGHTS

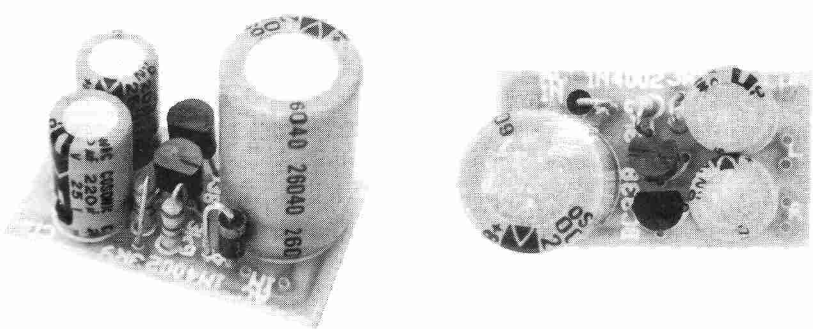
Every model railway has a place where road and rail meet, and where it does, some form of warning is needed. Flashing lights work well, but something is needed to drive them. And that is where this circuit comes in. All it does is flash lights, and it is so simple anyone could build it!



LEVEL CROSSING CIRCUIT.

Its beauty is in its simplicity. Apart from the lamps, there are only eight components. Behind the simplicity of the transistor multivibrator is an ingenious design. The details of how it works are given in the text.

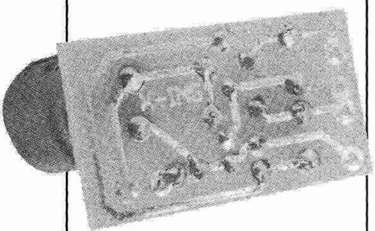
Often the first electronic accessory added to a model railway is the circuit used to drive the flashing lights at a level crossing. And that is because without electronics, crossing lights cannot be made to operate. I know, it was the first circuit I attempted as a youngster, for my model railway. The first one I built used three ex-PMG slow release relays, making it somewhat cumbersome and very noisy. I had seen one like it at an exhibition, and bought the relays on the spot. Back at home, with soldering iron in hand, it took me several hours to work out the switching circuit, but I eventually did. There was one major problem with it. It was simply too big to hide on the layout. It was eventually banished to switching Christmas tree lights. Of course a simple transistor multivibrator would have done the job just as easily, without either the space or noise problems.



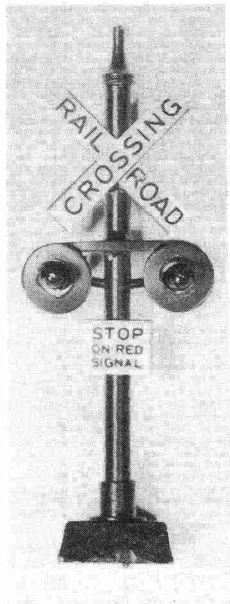
These photographs show the true simplicity of construction. The printed circuit board holds all eight components required to make the level crossing lamp flasher. The lamps themselves are the final components required to make this tiny module work.

This is a commercial set of level crossing lights. The ones sold as being HO scale are really a bit over-scale. The N scale ones are just about the right size for using on HO. Most real level crossings use more than two sets of flashing lights, but due to the cost of scale crossing lights, modellers often limit their crossings to just two.

If you look closely at the photograph, you will notice that the lamps can be seen from both sides of the sign. Painting the back of the lamp helps reduce the light visible from behind.



If this is the first project you have built, take special care with the soldering. When you have finished, this is what the back of the board should look like. Don't expect it to work if there are solder bridges and dry joints. These two soldering faults, along with incorrectly placed components, are the biggest cause of projects not working properly. Rarely is it actually a faulty component.



PARTS LIST

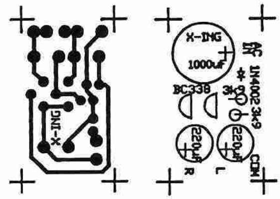
2- 3k9 1/4 resistors

2- 220uF 25V electrolytics
1- 1000uF 25V electrolytic

1- 1N4002 Diode

2- BC338 Transistors

1- Crossing PCB (X-ING)



Construction of the actual PCB is possible if you wish to use this artwork. However, due to the amount of effort that is needed to make your own printed circuit boards, it is both easier and cheaper to buy a ready made one from a kit supplier.

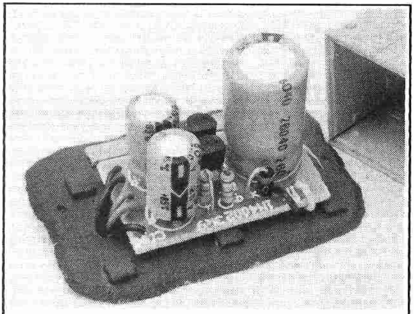
I never make my own boards, preferring to have even prototypes professionally etched. The result is always a lot neater and more reliable.

This is the plastic relay box in which I mounted my crossing lamp flasher. It came in a kit that contained a maintenance shed, a track inspection car, and an assortment of small tools.

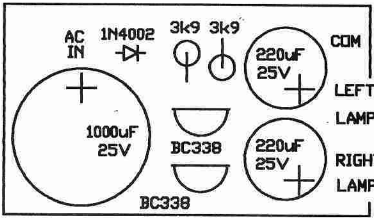
In Electronics for Model Railways volume #1, I presented a fully automatic level crossing circuit capable of handling multi-track crossings. It featured an electronic twin bell sound generator, and if required, was capable of opening and closing motorized boom gates. It used four printed circuit boards, allowing it to be configured to various layouts. While I still think that it is a great project, some people are daunted by its complexity. All they want is a simple circuit to flash the lights.

So this time I am presenting a circuit from the opposite end of the scale. It uses only eight components, all of them cheap and is very easy to build, making it an ideal beginners project. And all it does is flash lights. Switching it on and off must be done either by another circuit, or a simple switch.

It is a completely stand alone project. It runs directly off the 12V to 15V AC or DC accessory outputs provided on the back of some train controllers, making it unnecessary to build a special power supply. The whole unit is small enough to be built into a track-side shed or relay box, making it very easy to hide on your layout. If you refer to the photographs, you will see the plastic relay box in which I installed mine.



The printed circuit board fits nicely into the bottom of the relay box. There is ample room inside for the electrolytic capacitors. Wires can be run through a hole drilled in the plastic base of the box.



This enlarged overlay clearly shows the location and orientation of the components on the printed circuit board. If you follow this and the overlay on the printed circuit board itself, you should have no trouble assembling the unit correctly.

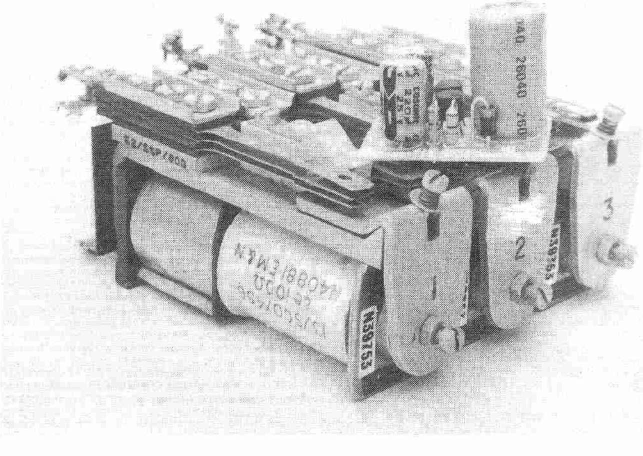
ABOUT THE CIRCUIT

The circuit is simply a two transistor astable multivibrator fed by a half wave rectifier. The lamps form the outer legs of the circuit. Without the lamps in the circuit, it won't work.

Only the positive half cycle of the AC is passed by D1. It charges the 1000uF capacitor C1 as well as supplying power to the rest of the circuit. Then when the negative half cycle is being blocked by D1, the rest of the circuit runs off the charge held in C1.

Let us say that initially lamp L1 is lit. Q2 is off, allowing R2 to pull the base of Q1 high. Q1 is therefore switched on, which is why L1 is lit. C3 is being charged through L2 and the base-emitter junction of Q1. A single lamp when switched off, is about thirty ohms (30R).

Meanwhile, C2, which was charged last time Q2 was on, has had its positive end pulled down to about 0.3 volts by Q1. This means that the other end of C2 is actually negative with respect to the zero volt rail and the emitter of Q2. C2 is now discharged by R1. In fact R1 is really trying to charge the capacitor the other way around! This



The old meets the new. The ex-PMG relays dwarf the tiny printed circuit board.

will continue until the negative end of C2 reaches about 0.6 volts taking the base of Q2 with it. At this point, Q2 will turn on and lamp L2 will light. It will also pull the positive end of C3 to about 0.3 volts. As C3 is now holding a charge of 12 to 15 volts, the negative end of it will be 12 to 15 volts below the zero volt rail. Thus the base of Q1 will also be at this negative potential, meaning that Q1 is now very definitely switched off. Lamp L1 will extinguish.

The whole process will now repeat itself, except the other way around. When the negative end of C3 reaches 0.6 volts, Q1 will again switch on, switching Q2 off. This "battle" will continue until the power is switched off.

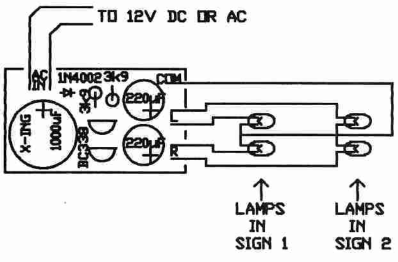
The circuit's behavior depends on the power supply used, and the number or lamps connected to it. Varying the number of lamps will change the flash rate. Changing the supply voltage also effects it. If you have the choice of either AC or DC, connecting it to the DC supply will give better results. As some train controllers don't even mark the positive and negative terminals, you will have to try it out to find the right way to connect it. If nothing happens when you first connect it, reverse the connections and try again. You cannot damage the circuit if you get it backwards as D1 will block the DC and protect the components.

If you find the lamp brightness too great, there are three possible solutions. The first is to reduce the voltage to the unit. If you can't do that, try running your lamps in series.

Refer to the diagram opposite to see how this is done. This will only work properly if all of the lamps are of the same type. If they are not, you will have to use the third method, and that is to put a resistor in line with each pair of lamps. The value of the resistor should be either 10R or 22R.

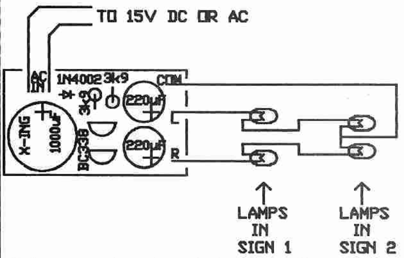
CONSTRUCTION

Construction is quite simple as there are only eight components. The resistors and diode have all been stood on end to save space. Take particular care with the orientation of the diode. It is very easy to solder a diode in backwards when it is stood on end. The orientation of the capacitors is also critical. If you put one in backwards, at best the circuit will not function correctly, the lamps fading in and out or just staying either on or off, at worst, you'll spend the next hour wiping electrolyte from the walls.

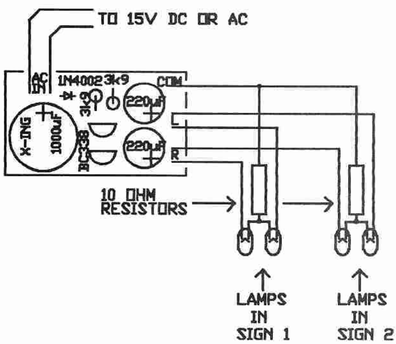


This diagram shows how the lamps would normally be wired. Each lamp from one crossing sign is parallelled with the corresponding lamp in the other sign. All four lamps share the same common wire. If one lamp blows, the circuit will continue to work.

Refer to the diagrams for the way to wire the lamps to the board. As mentioned earlier, the board is small enough to fit into a track-side hut if it is impractical for you to mount it under the layout. Just keep the wires tidy. On my old HO layout (the one I built as a youngster), I used to make fences out of my wiring. Using match sticks as posts, I would run fine enamelled winding wire between them. The fences didn't look bad, and it sure beat trying to hide the wires on the flat sheet of chipboard. In those days I wasn't allowed to make scenery from plaster, or anything else for that matter, so it was a case of making the best of what I had. As you won't have these restrictions, your efforts will undoubtedly be neater.



This diagram shows how the lamps could be wired if the lamps are too bright. All lamps must be identical. The lamps from one crossing sign are wired in series with the corresponding lamps in the other sign. Each string of two lamps is taken to the board common. If one lamp blows, the circuit will stop working.



This diagram shows another way the lamps could be wired if they are too bright. The circuit is similar to the first diagram, except for the addition of a resistor in line with the common return from each sign. The resistors should be 10 to 22 ohms depending on the lamps used. Start with 10R resistors. If it is still too bright, replace them with 22R resistors. If one lamp blows, the circuit will continue to work.