Light trigger for slave flashguns

Uses a low-cost silicon solar cell!

The way to get professional-looking flash shots is to use two flash units, for improved modelling and controlled filling-in of shadows. Here is an improved slave flash trigger unit which will operate the second flash automatically. It's very sensitive, yet much cheaper than commercial slave units.

by IAN POGSON

Photographic shots taken with a single flash gun tend to either look very "flat", due to front-on lighting, or very contrasty due to excessive shadows. The best way to avoid these problems is to use two flash guns, with the second gun used to fill in the shadows from the first and provide good modelling. This is the technique used by professionals, and it can easily be used by amateurs to give the same results.

It is possible to trigger the second flash gun from the camera shutter contacts, like the main gun, but this requires a splitter unit and involves an extra cable. Rather than do this, the more usual approach is to use a photoelectric "slave trigger" unit for the second gun.

The completed prototype. A thin piece of glass should be glued over the cutout to protect the solar cell.

Pointed towards the main gun, it automatically triggers the second gun a few microseconds after the main flash. From a photographic point of view, this is near enough to "simultaneous" not to worry about.

Photoelectric slave trigger units have been described previously in the magazine, in the May 1975 and March 1977 issues. Both were and are capable of doing a good job, but like similar relatively simple units available commercially they have some limitations.

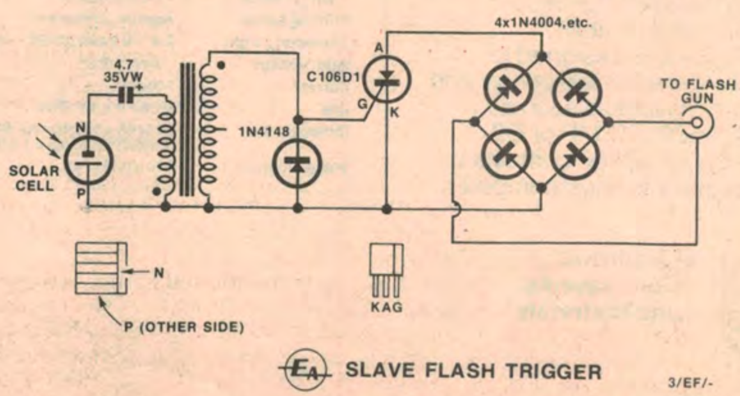
One problem is that they are DC coupled, and this makes them sensitive to ambient lighting. In fact if the ambient light level is high enough, it can trigger the flash directly. In any case it tends to affect the triggering sensitivity.

Apart from this problem the 1975 design uses an LASCS (light activated silicon controlled switch) device which is rather expensive. And the 1977 design used an LASCR (light activated silicon controlled rectifier), which now seems to be unavailable.

With the above points in mind, we set out to produce a new unit which was not DC coupled, had adequate sensitivity for all likely situations and could be made from readily available components.

The approach we first tried used a type MEL12 photo Darlington transistor, AC coupled to the gate of a C106D1 SCR. When the Darlington device was supplied with 9V DC from a battery, it worked very well. However when we tried to derive the required DC supply from the flash gun trigger circuit itself via a voltage divider, success was not ours. This was due to the leakage current through the MEL12 photo Darlington transistor. It was possible to make it work, but only under conditions approaching total darkness!

So we decided to try using a photovoltaic device to trigger the SCR. After much searching, we decided to try a silicon solar cell which is listed in the current Dick Smith catalog. The next question was how we could couple between the solar cell and the gate of the SCR. At this stage we had the opportunity of examining a high quality commercial device, and this provided

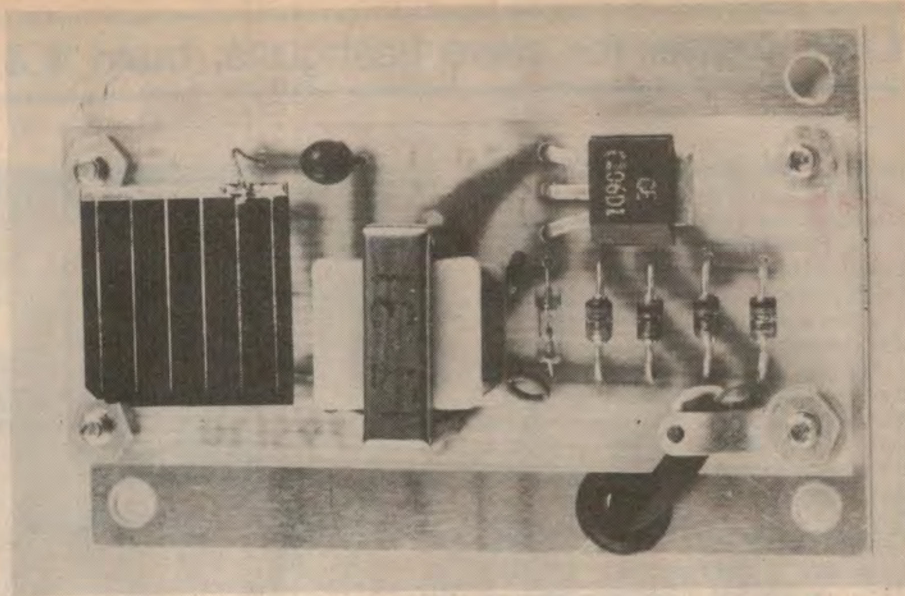


The circuit uses a low-cost solar cell as the light sensor.

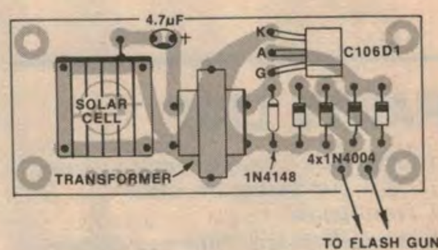
We estimate that the current cost of parts or this project is approximately.

$11.50

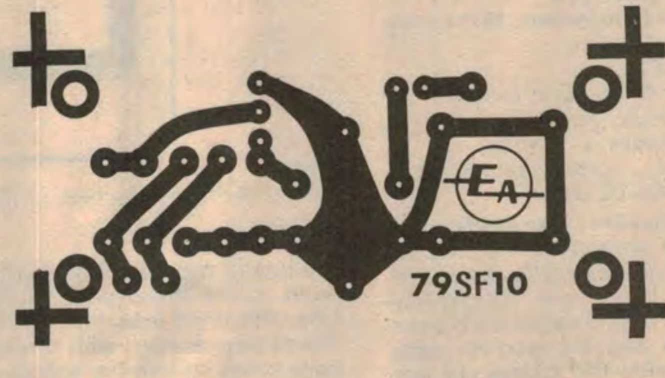
This includes sales tax.



ABOVE: view showing the assembled PC board. The board is fixed to the aluminium lid of the zippy box.



RIGHT: The component overlay for the PC board. See text for solar cell mounting details.



Here is the PC artwork, reproduced actual size.

the answer: a step-up transformer.

One of the very small transistor output coupling transformers seemed a possibility, so we tried one with a 1000 ohm primary to an eight ohm secondary, a turns ratio of about 11 to 1. Using it back-to-front and with appropriate phasing, we were rewarded with conspicuous success.

A second transformer was also tried, the one which appears in the picture of the prototype. This is a type LT-31 with an impedance ratio of 200k to 1k, or a turns ratio of about 14 to 1. This transformer worked just as well as the first one, suggesting that the type of transformer required is not unduly critical.

After several test firings, we were convinced that the arrangement had very good possibilities. The sensitivity was very high indeed, being helped along by the rather large area of the solar cell when compared with other light sensitive devices. We even tried it with the cell in subdued sunlight and it still triggered the slave flash gun!

The final circuit we evolved is not as simple as the previously described units but it is still quite straightforward. First of all, there is the solar cell performing as the light sensitive device. This looks into the low impedance winding of the transformer. You will also see that we have introduced a capacitor in series with the cell. This has been added as a precaution against possible saturation of the transformer, in extreme cases where the unit is used in very bright ambient light. The capacitor used is a 4.7uF 35VW tantalum.

The transformer steps up the voltage pulse from the cell, to a level which will ensure reliable firing of the gate of the SCR. The diode across the transformer secondary is also added as a precaution against any possible reverse spike from the transformer which may cause spurious triggering.

The SCR is effectively across the trigger circuit of the slave flash gun and it takes the place of the camera flash contacts. Interposed between the SCR and the trigger circuit are four silicon power diodes in a bridge arrangement. This has been added to make the device suitable for use with trigger circuits of either polarity. Most units we have checked have the centre contact positive, but there are probably exceptions to this. Both the SCR and the diodes must be able to withstand the full voltage at the trigger terminals. This is normally about 225 volts, but it may be either higher or lower than this value.

The unit is housed in a small zippy box which is readily available. There is nothing critical about the housing, so long as it protects the components from damage — particularly the solar cell.

All of the components are mounted on a small printed circuit board, which measures 77 x 32mm and is coded 79SF10.

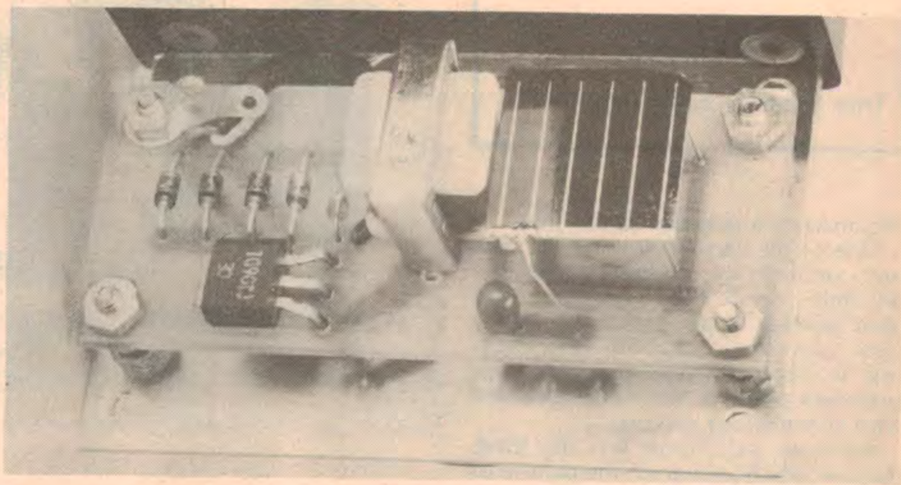
As mentioned earlier, we used a solar cell from Dick Smith Electronics and we understand that they have adequate stocks. Since making the slave flash unit, we have also obtained a solar cell from Davred Electronics Pty Ltd of 104-106 King Street, Newtown, NSW 2042, who can supply them for $2.40 each. These cells are virtually the same size as the one used on the prototype. We have tested one in the prototype and it seems to do the job very satisfactorily.

A lead is required to go from the printed circuit board output to the flash gun to be triggered. We bought an extension flash gun lead and cut off the unwanted socket, leaving the plug on the other end which will mate with the flash gun lead.

While the construction of the slave flash unit is quite a small job, there are at the same time a few points which are worthy of comment.

The printed board has been made so that it will take either of the transformers which we have mentioned. The C106D1 SCR does not need the heat sink flag built into it; indeed, its size is a small embarrassment so we cut it off, as may be seen in the picture. The leads were then bent over so that the body of the SCR is parallel with the board. In order to anchor the lead from the board to the flash gun, we clamped it under a solder lug which is fixed under the adjacent board fixing screw.

Possibly the most important part of the construction and that which requires the most care, is mounting the solar cell on the board. We stood it off the board, so that its surface was at the same height as the transformer. To do this, we used two pieces of 26 gauge tinned copper wire. The two pieces were bent in the form of a "U", with sharp corners. The dimensions are such that the middle part of the wire is a little shorter than the metal backed dimension of the cell. The two pieces are soldered at each corner of the cell, leaving it with four "legs", so spaced as to fit the mating holes on the board.

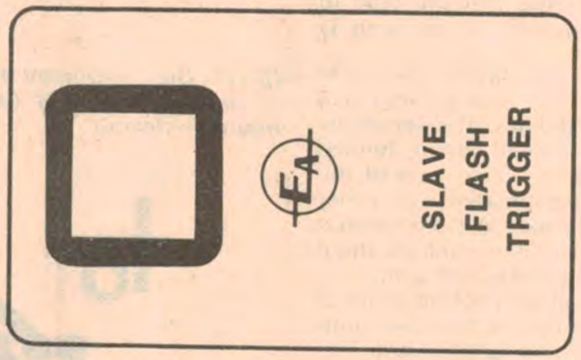


Another view inside the prototype. Note how the solar cell is stood off the PC board.

PARTS LIST

1 Zippy box 83mm x 54mm x 28mm
1 Flash gun extension cable
1 Front panel
1 Printed board 76mm x 32mm, code 79SF10
1 Solar cell (see text)
1 Miniature transformer, 10-1 to 14-1 (see text)
1 C106D1 SCR
1 4.7uF 35VW tantalum capacitor
1 1N4148 diode, or similar
4 1N4004 diodes, or similar
Screws, nuts, solder lug, rubber grommet, 26g TC wire.

NOTE: Ratings are those used on the prototype. Components with higher ratings may generally be used providing they are physically compatible. Components with lower ratings may also be used in some cases, provided the ratings are not exceeded.



Actual size reproduction of the front panel artwork.

Great care must be taken with this operation, as any rough or careless handling may result in fracture of the cell. The flexibility of the 26 gauge wire will allow some judicious bending where necessary, to position the cell in the proper position over the board. With the four legs soldered and adjusted, another piece of 26 gauge TC wire is then used to make the connection from the board to the contact strip on the front face of the cell. The same care should be exercised and as little solder as possible should be used here.

With the components mounted on the board, the assembly now has to be fixed to the metal plate of the zippy box. We used four ⅛in Whitworth x 13mm long screws, with three nuts on each screw so that the screws may also double as stand-offs. The height of the stand-offs must be adjusted so that the face of the solar cell clears the opposite face of the zippy box by about 1.5mm.

So that light may reach the cell when the board assembly is mounted in its zippy box, a hole must be cut in the box centred over the cell. We cut out a hole 17mm square. This masks off a little of the cell right around its edges, but this still leaves more than ample sensitivity. If you prefer, you may drill a number of holes about 5 or 6mm in diameter over the area instead of cutting a square hole. This allows somewhat less light into the cell, but for most purposes it should still be adequate.

Whether you settle for a cutout or a group of holes for the solar cell "window" the cell should be protected from accidental damage by fixing a piece of clear plastic between the cell and the opening(s). A suitable piece of clear plastic sheet may be glued into place. Or a thin piece of glass could be used if available.

We made a front panel for the prototype using Scotchcal and this gives quite a nice professional finish. Up until recent times, if readers wished to make a similar front panel for any of the projects, they were usually left to their own devices. However, we understand that Radio Despatch Service are taking steps to make and supply Scotchcal panels for our projects. Readers who are interested should contact Radio Despatch for further details; their address is 868 George Street, Sydney.

To check the unit, connect it to a flash gun. Then with a second flash gun to act as the primary unit, activate both guns and fire the primary one. The slave gun should also fire. A series of tests may be carried out by moving the slave flash trigger unit to various positions with respect to the primary flash gun, to check the sensitivity and possibilities offered by the slave flash trigger. We think that you will be surprised at just how well the trigger will do the job.