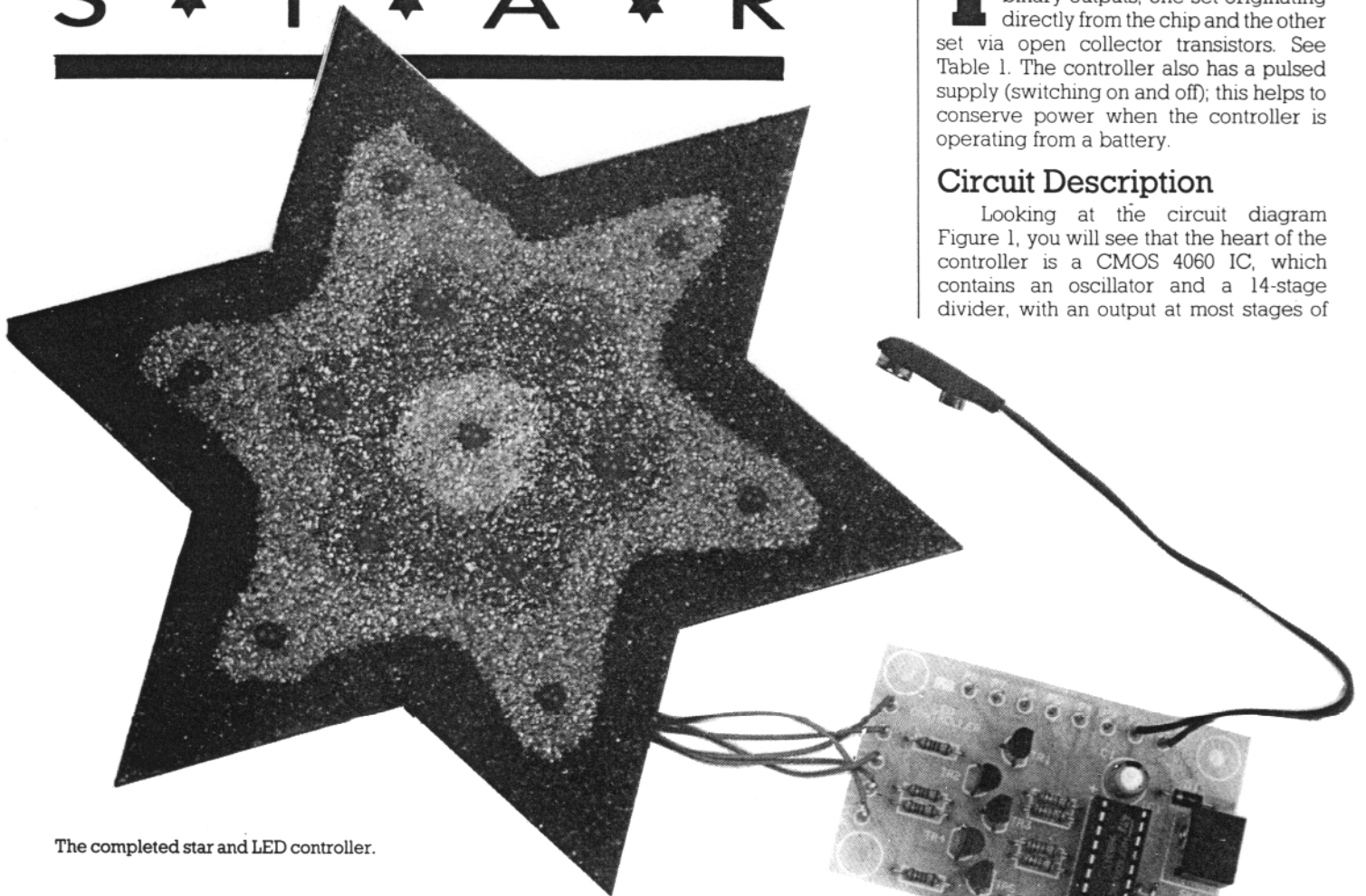


XMAS

S ★ T ★ A ★ R



The completed star and LED controller.

by Alan Williamson

This novelty project is a festive star with lots of flashing LED's to sit upon your Christmas tree. The LED's are switched on and off at different rates by an LED controller.

The controller has two sets of 4-bit binary outputs, one set originating directly from the chip and the other set via open collector transistors. See Table 1. The controller also has a pulsed supply (switching on and off); this helps to conserve power when the controller is operating from a battery.

Circuit Description

Looking at the circuit diagram Figure 1, you will see that the heart of the controller is a CMOS 4060 IC, which contains an oscillator and a 14-stage divider, with an output at most stages of

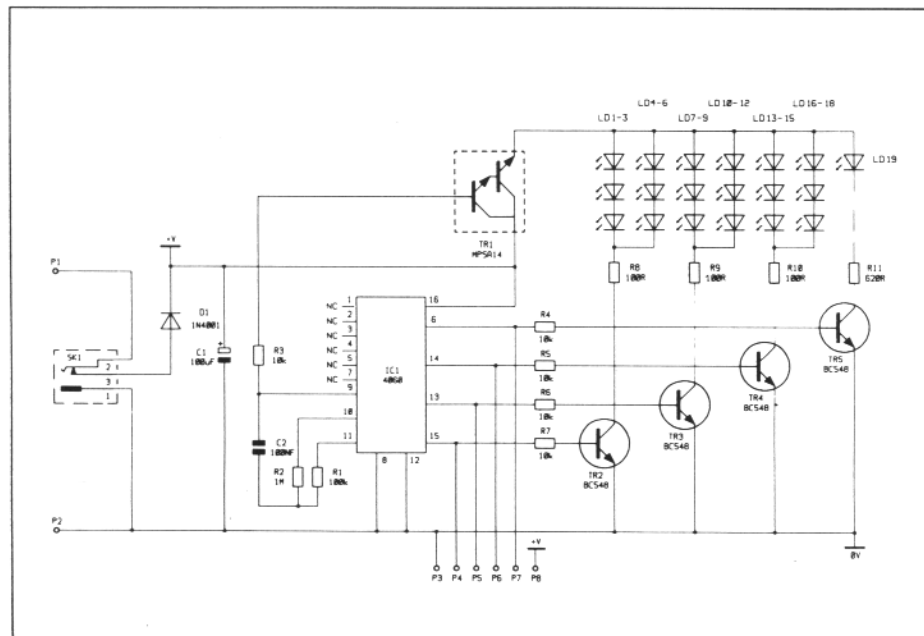


Figure 1. Circuit diagram.

Pin	Description
Pin 1.	+V Battery
Pin 2.	0V Battery
Pin 3.	0V
Pin 4.	Direct output D1 (MSB)
Pin 5.	" " D2
Pin 6.	" " D3
Pin 7.	" " D4 (LSB)
Pin 8.	+V
Pin 9.	Pulsed supply output
Pin 10.	Open collector D1 (MSB)
Pin 11.	" " D2
Pin 12.	" " D3
Pin 13.	" " D4 (LSB)

Table 1. Pin description.

division. Stages 7, 8, 9 and 10 (IC pins 6, 14, 13 and 15 respectively) are used to drive transistors TR2 - TR5 via 10kΩ resistors, the LED's being the collector load of each transistor. A direct output of stages 7 through 10 is available at pins 7, 6, 5 and 4. The switching transistor TR1 is connected to the oscillator, using the highest available frequency and therefore avoiding visible flicker in the LED's. The oscillator frequency is determined by the components R2 and C2, and the frequency can be calculated using the formula:

$$F_{osc} = 1 / 2.3 \times R_2 \times C_2$$

Battery Life

The peak current consumption of the LED controller with all the LED's lit is approximately 70mA, but due to the switching transistor this figure is reduced by half, making the expected life from a PP6 battery around 20 hours. It is therefore

recommended that a 6 to 9V DC mains adaptor is used for prolonged use, and a 300mA unregulated supply would be ideal for this application, for example Maplin stock code XX09K.

Construction

Please refer to the Constructors' Guide for hints and tips on soldering and constructional techniques.

Referring to the PCB component legend, Figure 2, assemble the PCB as follows.

Begin by finding the MPSA14 transistor and put it to one side so that it will not be placed into the wrong position.

Insert, solder and crop each component starting with the resistors. The veropins are fitted from the track side, remember that C1 and D1 are polarised devices and must be correctly fitted.

Having completed the PCB it should be now cleaned with alcohol, Ultracene or PCB cleaner (Maplin stock code

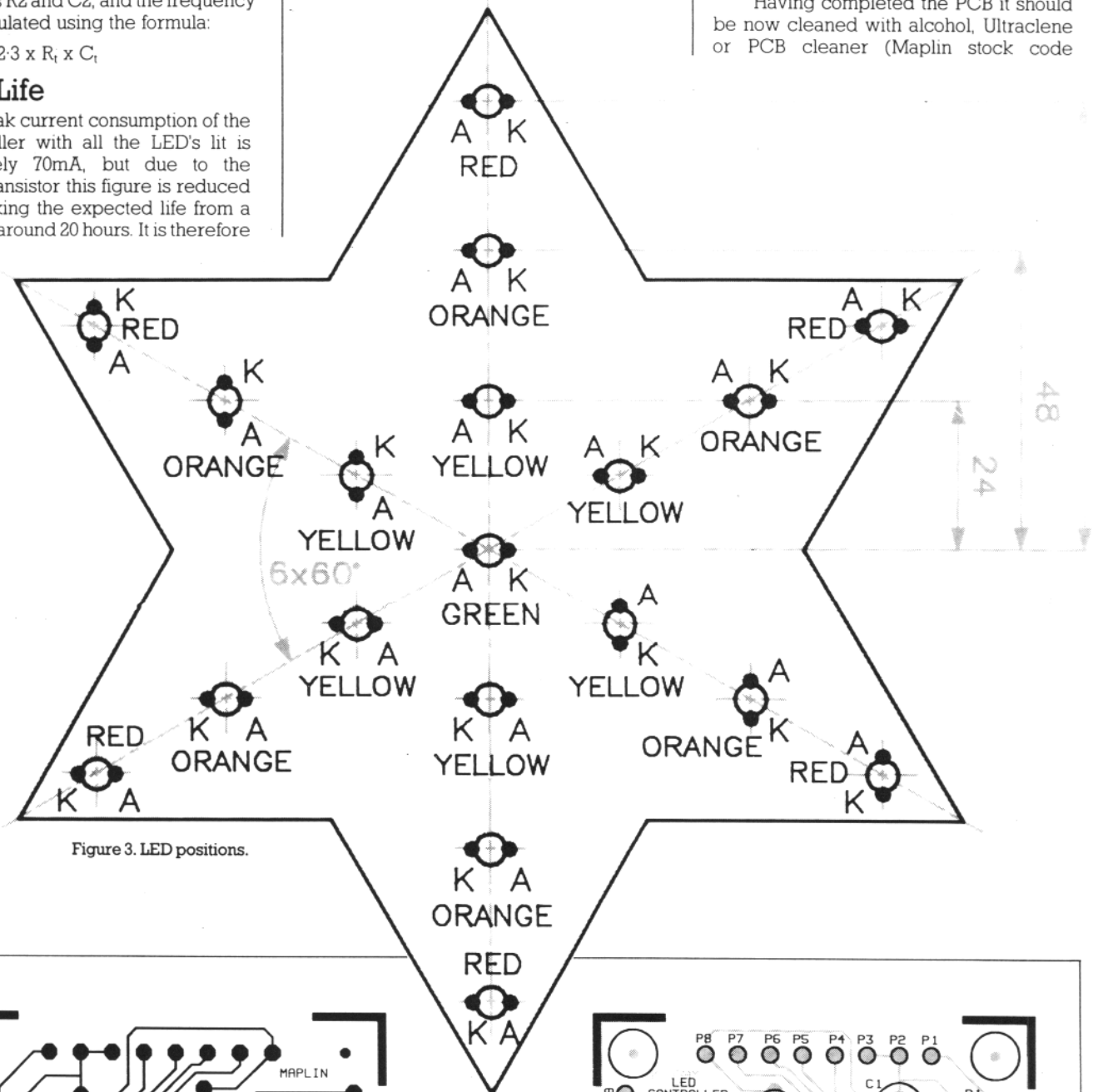


Figure 3. LED positions.

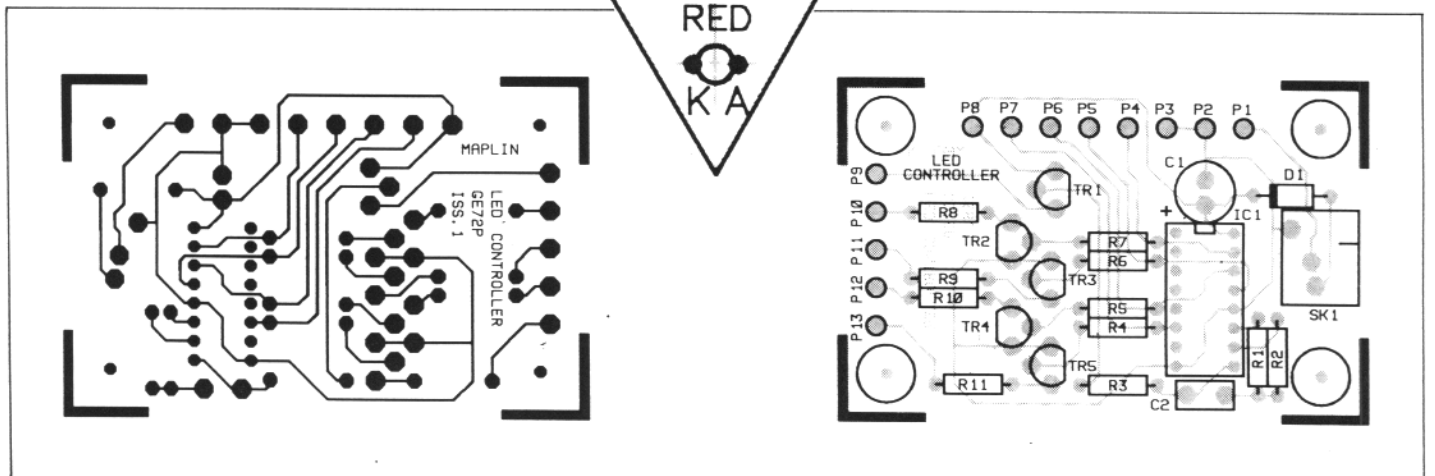


Figure 2. Component legend.

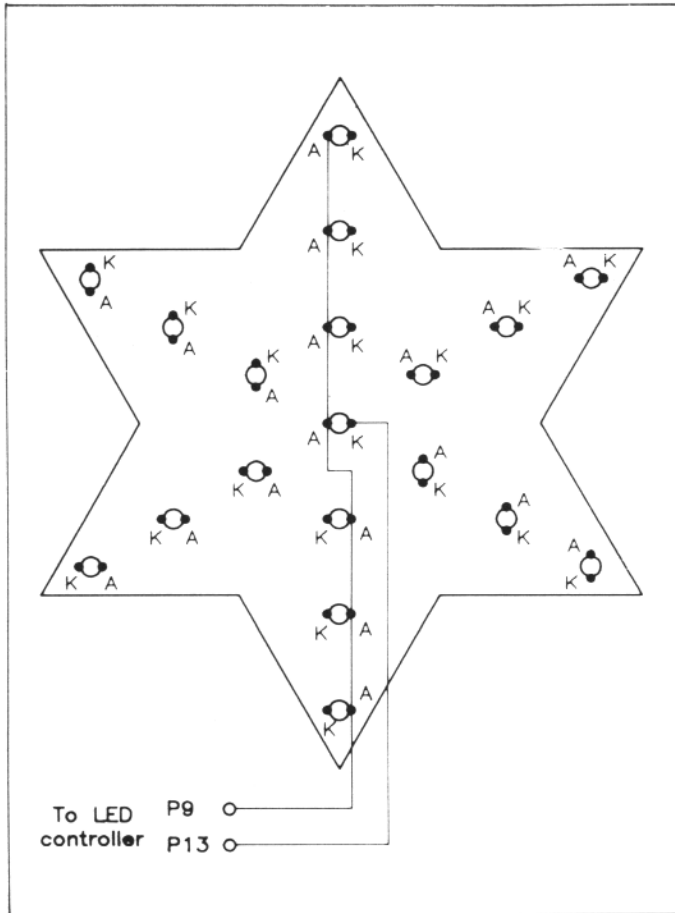


Figure 4. Common supply and centre LED.

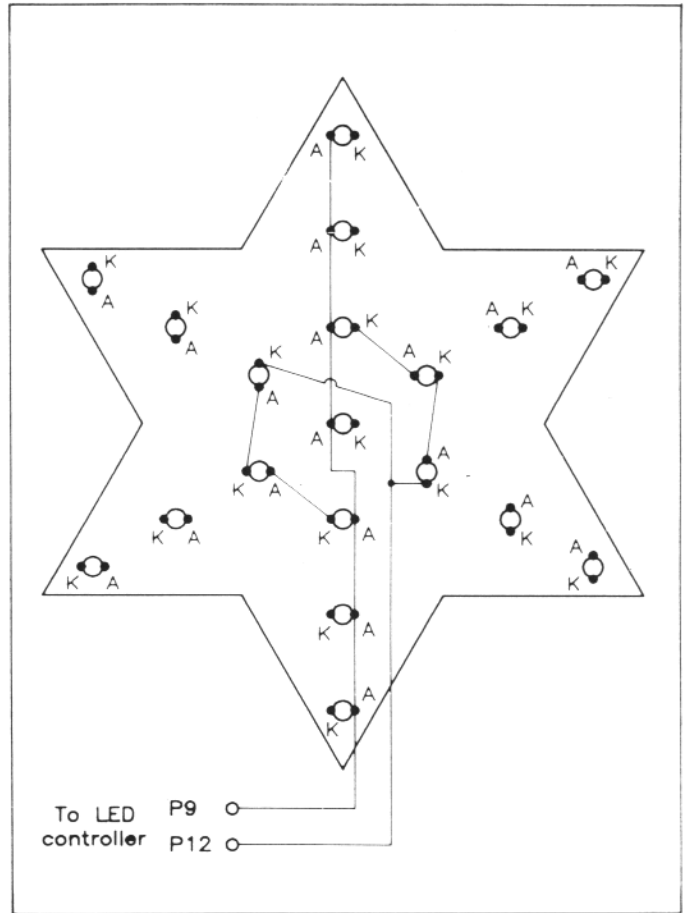


Figure 5. Inner LED group wiring.

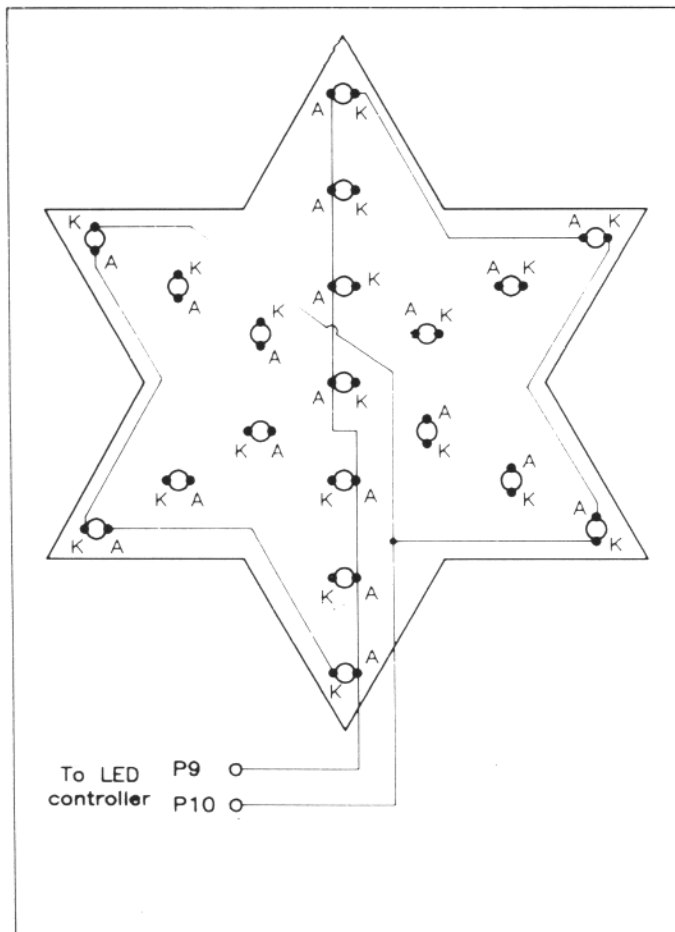


Figure 6. Outer LED group wiring.

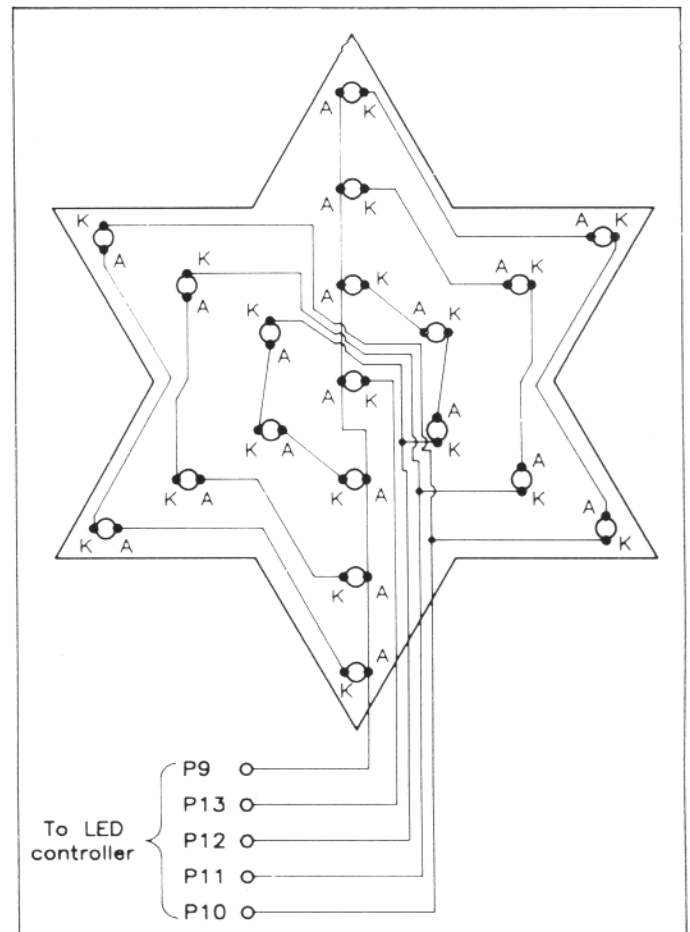


Figure 7. Completed LED wiring.

YT66W and YJ45Y), then put it to one side so as not to damage it while you are building the festive star.

Building the Festive Star

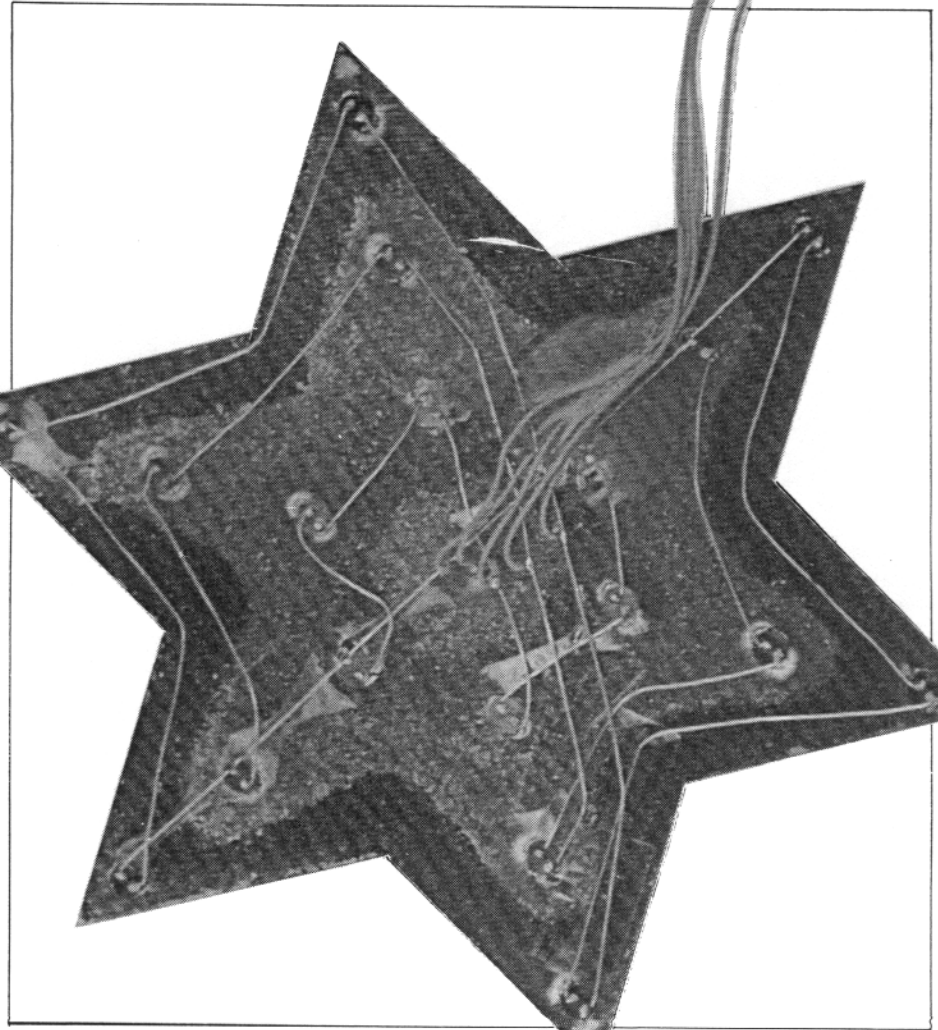
Begin by taking a photostat or trace around the star printed on the previous page to use as a template, make a star (or any other shape you may fancy) from any material handy e.g. thin plywood, hard-board, perspex or thick card. Metal and other conductive materials should not be used, otherwise the LED's could become short circuited. Alternatively a decorative star could be purchased from your local Christmas decoration supplier.

Once the star has been cut out and the 5mm holes drilled for the LED's, cover the face of the star with baking foil or aluminium laminate (Maplin stock code XY19V), or alternatively some silver or coloured glitter to make it look pretty. The next job is to glue the LED's into the star in the positions shown in Figure 3. Allow the glue to set before attempting to wire up the LED's.

Connect the LED's using the cable supplied as shown in Figures 4, 5, 6 and 7, the cathode being the shorter of the two leads. Figure 4 shows the common supply to the top anode of each group of LED's, and the lead to the cathode of the centre LED. Figure 5 shows the first group of LED's away from the centre, Figure 6 shows the outer group of LED's which is wired in the same way as the inner group and Figure 7 shows all the LED's wired up. Having now completed the wiring, the LED legs should be trimmed as short as possible.

Testing

To test the controller, connect the leads from the star as shown in Figure 1, and connect a PP6 battery to the battery clip or apply 6 to 9 volts DC to the power



LED wiring on rear of completed star.

socket, the pin of the socket being 0V. The LED's will start to flash, if any group of LED's fail to light, check to see if one of the LED's has been inadvertently fitted the wrong way round.

*Merry
Christmas!*

LED CONTROLLER PARTS LIST

RESISTORS: All 0.6W 1% Metal Film

R1	1M	1	(M1M)
R2	100k	1	(M100K)
R3-7	10k	5	(M10K)
R8-10	100Ω	3	(M100R)
R11	620Ω	1	(M620R)

CAPACITORS

C1	100μF 16V Minelect	1	(RA55K)
C2	68nF Monores	1	(RA48C)

SEMICONDUCTORS

D1	1N4001	1	(QL73Q)
LD1-6	LED Red	6	(WL27E)
LD7-12	LED Orange	6	(WL29G)
LD13-18	LED Yellow	6	(WL30H)
LD19	LED Green	1	(WL28F)
TR1	MPSA14	1	(QH60Q)
TR2-5	BCS48	4	(QB73Q)
IC1	4060BE	1	(QW40T)

MISCELLANEOUS

P1-13	Pin 2145	13 Pins	(FL24B)
	DIL Socket 16-Pin	1	(BL19V)
	PC Mtg Power Socket	1	(RK37S)
	PP3 Battery Clip	1	(HF28F)
	PC Board	1	(GE72P)
	Constructors' Guide	1	(XH79L)
	Instruction Leaflet	1	(XK37S)

OPTIONAL (not in kit)

PP6 Battery	1	(FM03D)
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The above items, excluding Optional, are available as a kit:
Order As LP54J (LED Xmas Star Kit)

The following item is also available separately
but is not shown in our 1991 catalogue:
LED Controller PCB Order As GE72P

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