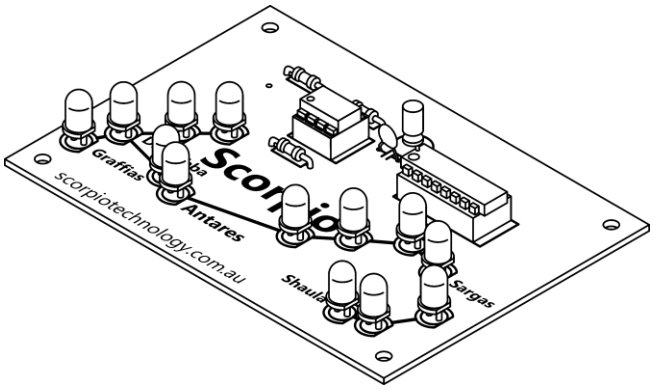
Project sheet - SCORPIO CHRISTMAS TREE

CONTENTS:

DESCRIPTION

This Project sheet describes how to make a Christmas tree with flashing LEDs, by using the *SCORPIO CONSTELLATION*. Making up the *SCORPIO CONSTELLATION* also allows you to practice your soldering skills.

Note: instead of the 13 LEDs supplied in the kit, the PCB can be used to control up to 20 LEDs by connecting the LEDs using hook-up wires.



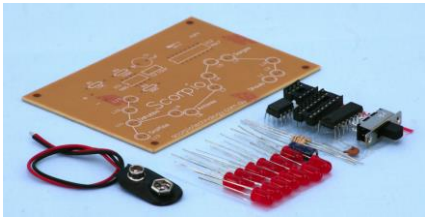
SECTION 1: COMPONENTS & MATERIAL REQUIRED

1.1 COMPONENTS SUPPLIED

The following is a list of the components required:

1.1.1 The following are available from Scorpio:

- ☐ 1 x *SCORPIO CONSTELLATION* kit
- ☐ 20 x Clear body LEDs refer Design Section) - *these are substituted for the coloured body LEDs supplied to provide a multi-coloured effect*



1.2 ADDITIONAL REQUIREMENTS

The following additionalitems are required and are available from Scorpio Technology, but need to be ordered separately:

- ☐ Multi strand hook up wire
- ☐ Hot glue or double-sided foam tape
- ☐ 1 x 9V Battery

The following material is to be supplied by the student / designer:

- ☐ Material for the Christmas tree
- ☐ A base for mounting the tree onto

1.3 TOOLS REQUIRED

The following tools are required:

- ☐ Soldering equipment and solder: a good quality soldering iron, with a fine tip and the use of 0.71mm 60/40 solder is recommended
- ☐ PCB holder (Third hand) – preferably with a magnifier
- ☐ Small side cutters

- ☐ Wire strippers
- ☐ Cutting equipment to make the tree and base

SECTION 2: DESIGN - GENERAL

2. DESIGN CONSIDERATIONS

2.1 GENERAL

This project can be used to make a Christmas tree with 20 twinkling Christmas tree lights. You can design and cut out a Christmas tree shape and drill 20 holes for the LEDs (10 groups of 2 LEDs) and then wire them together. See the end of the Teaching Unit for a template.

NOTES:

- The *SCORPIO CONSTELLATION* kit has 13 red LEDs supplied, to suit 13 positions on the PCB.
- LED positions 9, 11 and 13 will not be used for this project. Make sure you do not to insert wires into these holes. If these are used you will overload the output of the 4017and may damage it permanently.

2.2 THE LEDS

You can connect a maximum of 2 LEDs in parallel to each pair of RED and BLACK wires. This means you can have a maximum of 20 LEDs.

NOTES:

- Each LED connected to a pair of RED and BLACK wires must be the same colour. You cannot mix two different coloured LEDs as only one colour will light up.
- You can, however, use a different coloured set of LEDs for the other pairs of RED and BLACK wires.

Start by choosing what colour the LEDs will be for each LED position. Eg L1 RED, L2 Blue, L3 Green, etc. Once you have determined the quantities and colours of the LEDs, you can then order them – remembering you already have 13 red LEDs.

2.3 DESIGNING THE TREE

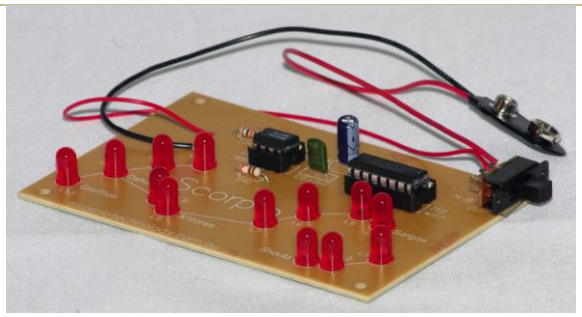
The Christmas tree design and size is up to the designer – for example it could be made from plywood which is painted and decorated, or a photograph glued to heavy card or plywood. Otherwise a sample design is available at the end of this unit.

If you want to make a bigger Christmas tree with more LEDs, you can do this by using a second kit to control another 20 LEDs. A second kit will give a slightly different speed at which the LEDs will light. This is due to the tolerance of each component, which will give a slightly different speed of operation.

The base will also need to be made and the upright attached to the base.

SECTION 3: MAKING AND MODIFYING THE *SCORPIO PCB*

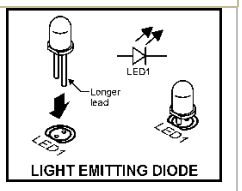
☐ Assemble the *SCORPIO CONSTELLATION PCB* as specified in the supplied Teaching unit, except for the (supplied) LEDs.



☐ **Wiring up the PCB**

LEDs are polarised components and must be mounted correctly. The negative lead can be identified in different ways:

1. The flag (the larger connection inside the body) identifies the negative lead. This is visible when the LED is held up to the light
2. The short leg is negative
3. A flat on the ridge, around the base of the LED is on the negative side.



The negative connection of the LED is marked by a flat on the LED artwork on the PCB.

☐ *Cut a RED and BLACK wire for each of 10 LED positions marked on the PCB.*
- *Make sure the wires are long enough to reach to where you will be mounting your PCB and the LEDs.*
- *Remove about 10mm of plastic from one end of the BLACK and RED wires.*
- *Twist the bare end of each wire together very tightly.*

☐ *Insert the BLACK wire into the hole next to the flat.*

☐ *Connect RED to the second hole.*

NOTE: LEDs 9, 11 and 13 will not be used for this project. Make sure you do not to insert wires into these holes. If these are used you will overload the output of the 4017and may damage it permanently.

3.1 SOLDERING THE LEDS AND WIRES IN PLACE

☐ Apply the soldering iron tip to the lead or wire and track pad at the same time. Heat the joint for 2-3 seconds and then apply the solder to the heated lead and pad on the opposite side to the soldering iron tip. Melt the solder onto the hot pad and lead, not onto the soldering iron.

☐ Check the solder for poor joints or solder bridges between tracks. Solder bridges are most likely to occur between tracks that are close together, so pay careful attention to the solder tracks where the IC socket and transistors are mounted.

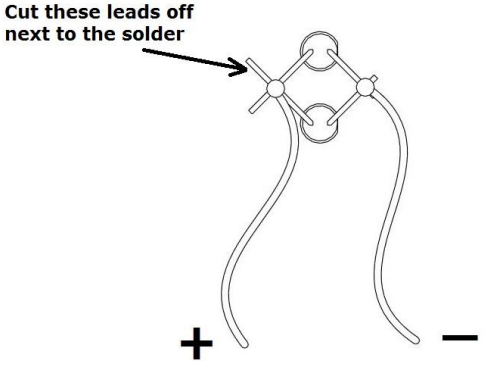
☐ Once all the components have been soldered and the soldering inspected, use a pair of side cutters to cut off the ends of the leads and wires as close as possible to the PCB.

3.2 CONNECTING THE LEDs AND SOLDERING THEM IN PLACE

You can connect a maximum of 2 LEDs in parallel to each pair of RED and BLACK wires. This means you can have a maximum of 20 LEDs.

NOTES:

- Each LED connected to a pair of RED and BLACK wires must be the same colour. You cannot mix two different coloured LEDs as only one colour will light up.
- You can, however, use a different coloured set of LEDs for the othe pairs of RED and BLACK wires.

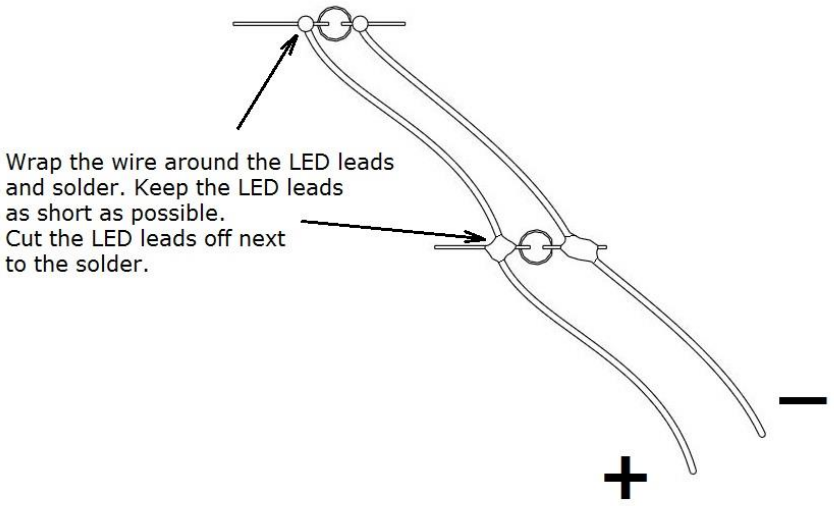


If the LEDs are situated near each other then you may be able to connect them as shown in the picture opposite.

The Positive (+) leads must connect together and the Negative (-) must also be connected together.

Connecting a Positive and Negative lead together will mean only one LED will light up.

If the LEDs are situated further apart then you will need to use extra wires to connect them together as shown.



NOTE: If you are mounting the LEDs in a piece of plywood or plastic. You will need to drill 4.9mm holes to make the LEDs a press fit. Not all LEDs are exactly the same size so some LEDs will fit snugly while others will require some force to fit them into the hole. Do not drill the holes closer than 10mm apart or you may experience material between the holes breaking when you insert the LEDs.

SECTION 4: CHRISTMAS TREE TEMPLATE

This template can be reduced or enlarged as you desire.