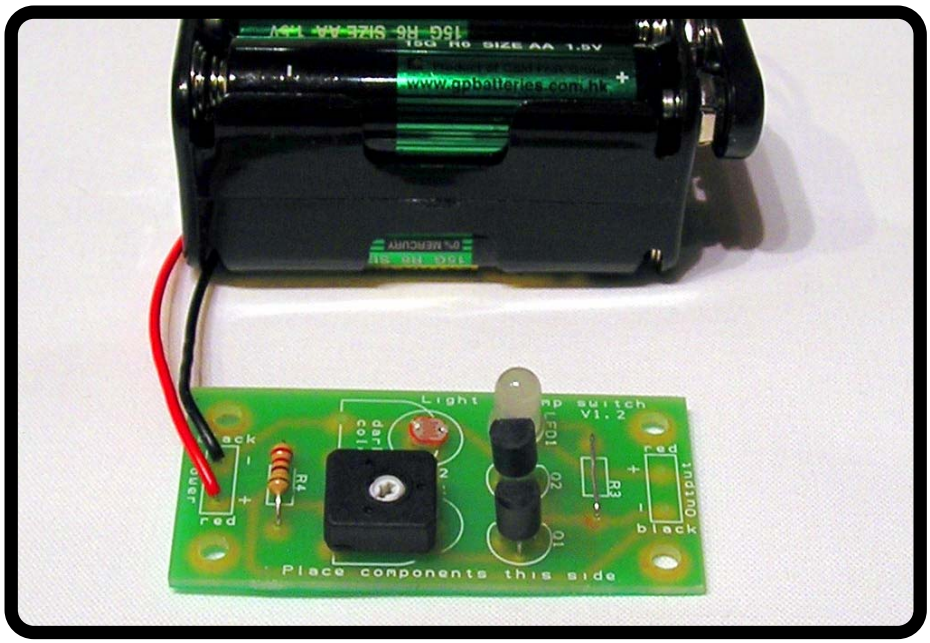
Dark activated colour changing LED kit

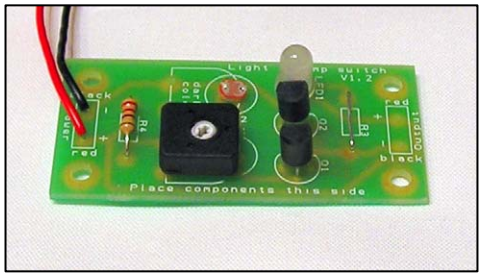


Build Instructions

Issue 1.1

Build Instructions

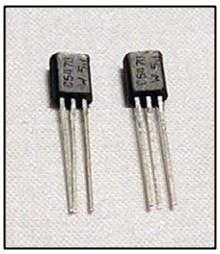
Before you put any components in the board or pick up the soldering iron, just take a look at the Printed Circuit Board (PCB). The components go in the side with the writing on and the solder goes on the side with the tracks and silver pads.



You will find it easiest to start with the small components and work up to the taller larger ones. If you've not soldered before get your soldering checked after you have done the first few joints.

Step 1
Start with the resistor shown left. This is a 220Ω resistor (colour bands red, red, brown), solder this into the board where it is labeled R4.

Step 2
The two transistors (shown right) should be placed into Q1 and Q2. It is important that they are inserted in the correct orientation. Ensure the shape of the device matches the outline printed on the PCB. Once you are happy solder the devices into place.



Step 3
Solder the variable resistor (shown left) into R1. It will only fit in the holes in the board when it is the correct way around.

Step 4
Solder the LDR (shown right) in to the circle indicated by the text R2. This is next to the 'dark' text. It does not matter which way around it is inserted.

Step 5
The colour changing LED used in this kit doesn't need a current limit resistor as it is a 5V LED. **Therefore we need to add a wire link.** Take a piece of wire (the lead you have just cut off the LDR is perfect) and solder it into the board where it is marked R3.

Step 6
Solder the Light Emitting Diode (LED - shown left) in to LED1. The LED won't work if it doesn't go in the right way around. If you look carefully one side of the LED has a flat edge, which must line up with the flat edge on the lines on the PCB.

Step 7
Now you must attach the battery clip (shown right). It needs to be connected to the terminals marked 'Power'. The red lead should be soldered to the '+' terminal also marked 'red' and the black lead should be soldered to the '-' terminal also marked 'black'.

Checking Your Circuit

Check the following before you connect power to the board:

Check the bottom of the board to ensure that:

- All these leads are soldered.
- Pins next to each other are not soldered together.

Check the top of the board to ensure that:

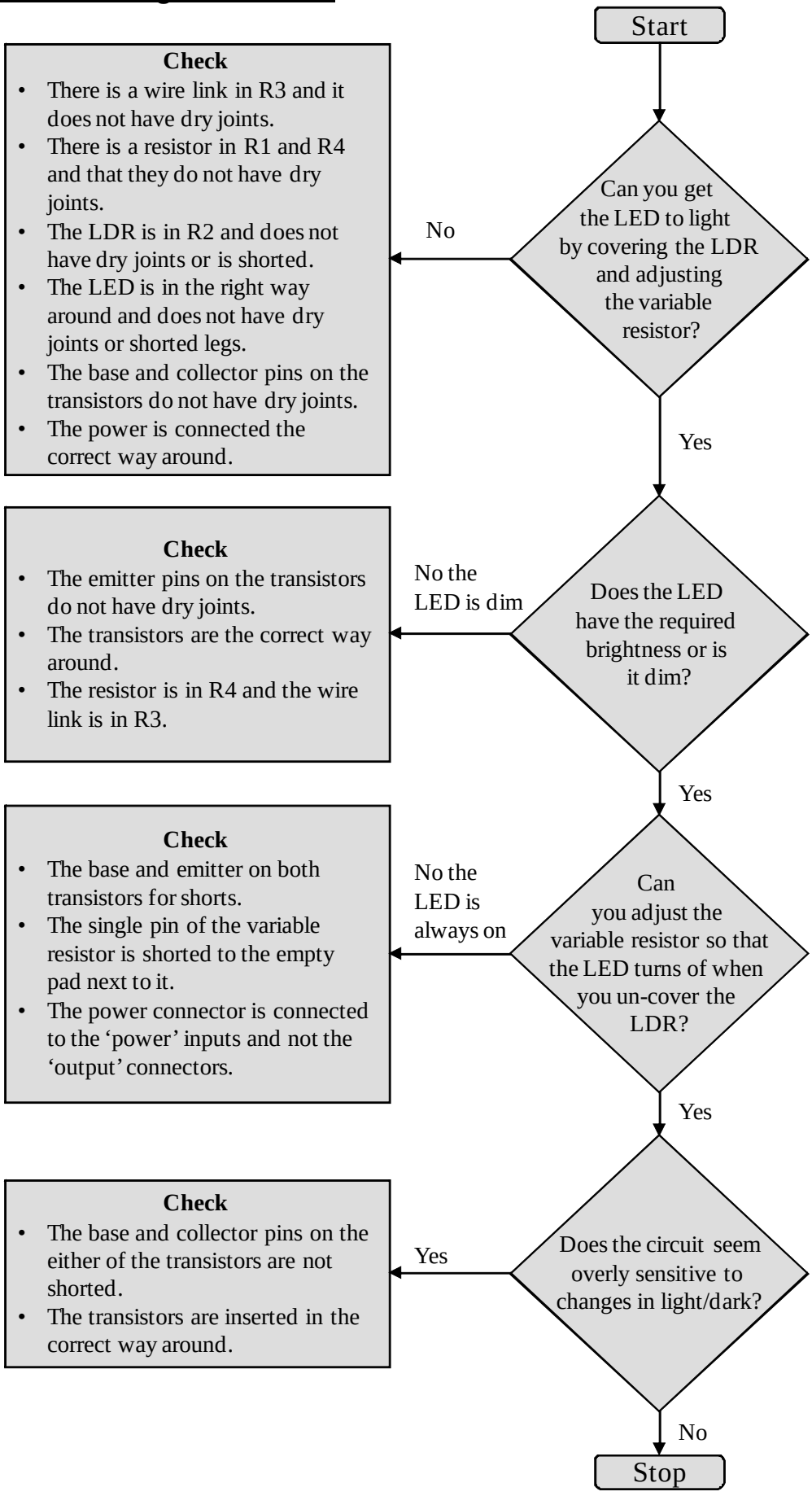
- The body of the two transistors matches the outline on the PCB.
- The flat edge on the LED lines matches the outline on the PCB.
- The power clip is attached where it is marked 'Power'.
- The red wire on the power clip goes to the connection marked 'red' and the black wire to the connection marked 'black'.

Testing the PCB

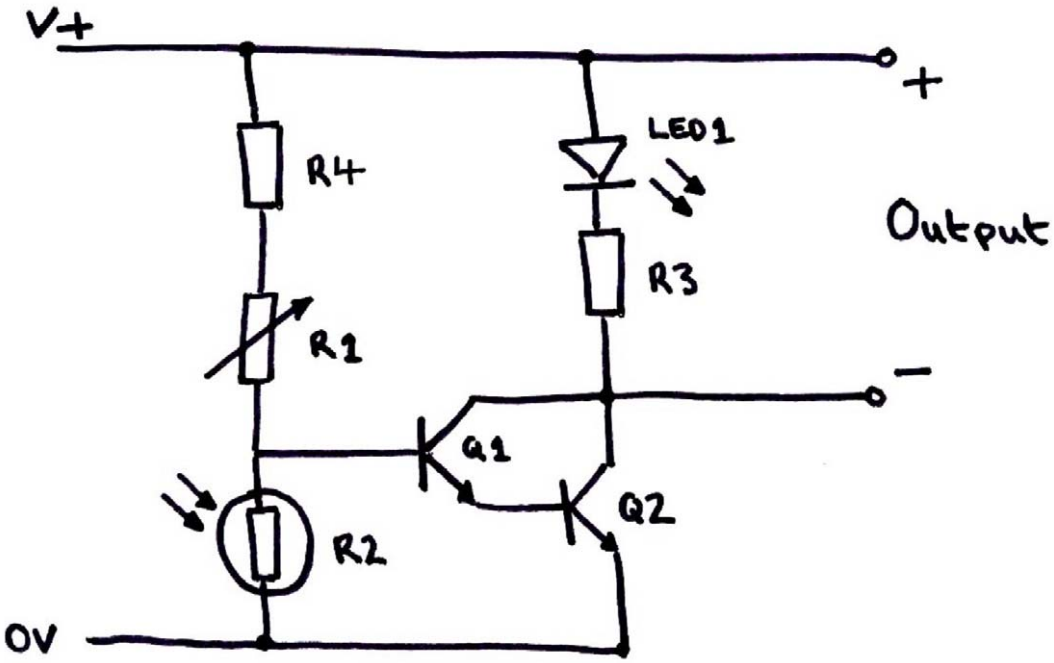
You might need to adjust the variable resistor R1. It won't be far wrong if you start with the resistor pointing at the middle of the text 'components'.

When the sensor is covered (so it is dark) the LED should be on.
When the sensor is light the LED should be off.
If this is not the case recheck your board following the instructions at the top of this page.

Fault finding flow chart



How the Dark Activated Switch Circuit Works



The circuit operation is very simple. When the input to the transistor Q1, which is fed from the connecting point of R1 and R2, is greater than 1.4V the output (LED) is turned on. The voltage at the join of R1 and R2 is determined by the ratio of the two resistors. This is known as potential divider.

Voltage at joint of R1 and R2 = The supply Voltage x $\frac{R2}{R1+R2}$

Normally it requires 0.7V to turn on a transistor but this circuit uses two resistors in a Darlington Pair meaning it requires 2 x 0.7V = 1.4V to turn on both transistors.

It is also worth noting that the output, when turned on, will be around 0.9V lower than the supply voltage V+. This is because of the voltage drop across the collector and emitter pins of the Darlington Pair of transistors. Therefore if the supply voltage is 5V then the output voltage will be around 4.1V.

R4 is present to protect the transistor should the variable resistor be set to zero.

Adjusting the trigger level

The point at which the circuit is triggered is set by the 100KΩ variable resistor. By varying the value of this resistor the ratio of the resistance of R1 and R2 can be varied to a point where a centre voltage (trip point) of 1.4V is achieved at the desired light level.

LED

When the board switches on the output the LED will turn on. With a normal LED you would need a resistor to limit the current flowing into the LED to ensure it isn't damaged and to control the brightness. This would be resistor R3. With the colour changing LED this is built in to the LED itself. This is why when you built the kit R3 has been replaced with a simple wire link.