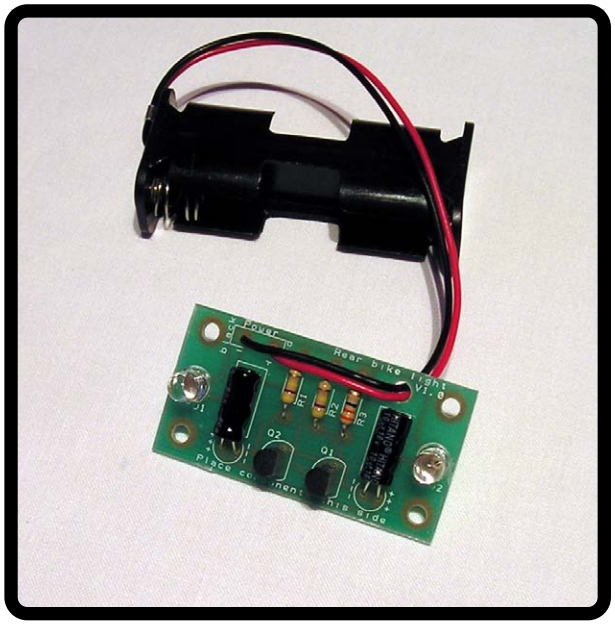
Rear Bike Light



Build Instructions

Issue 1.3

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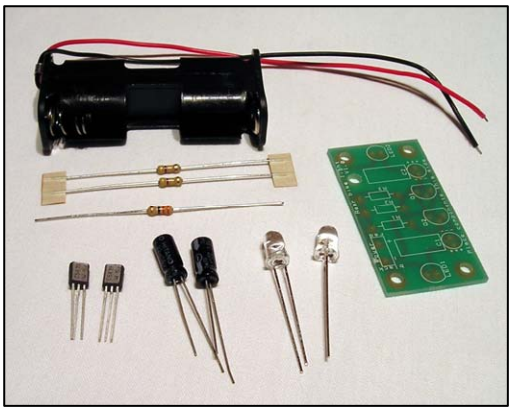
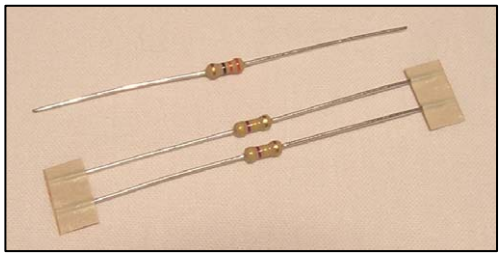


The complete set of bike light parts are shown in the picture on the left.

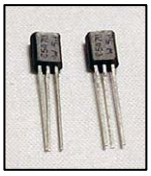
Before you put any components in the board or pick up the soldering iron, just take a look at the Printed Circuit Board (PCB). The components go in the side with the writing on and the solder goes on the side with the tracks and silver pads.

You will find it easiest to start with the small components and work up to the taller larger ones.

Step 1
Start with the three resistors (shown right):
R1 and R2 are 470KΩ (yellow, purple, yellow coloured bands)
R3 is a 33Ω (orange, orange, black coloured bands)

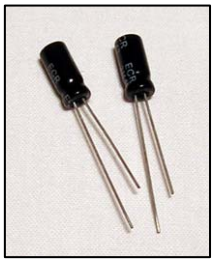


The text on the PCB shows where R1, R2, etc go. Make sure that you put the resistors in the right place.



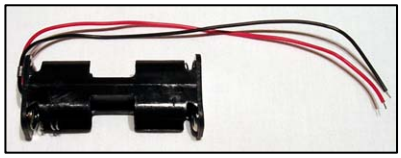
Step 2
Place the two transistors (shown left) in to the board where it is labeled Q1 and Q2. Make sure the device is the correct way around. The shape of the device should match the outline on the PCB.

Step 3
Place the two capacitors (shown right) in to the board where it is labeled C1 and C2. Make sure the device is the correct way around. The capacitors have a '-' sign marked on them which should match the same sign on the PCB. Once the legs have been pushed through the board the capacitor should be folded flat against the PCB before it is soldered into place.

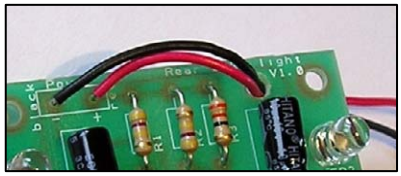


Step 4
Place the two Light Emitting Diodes (LEDs - shown left) in to LED1 and LED2. It does not matter which goes where, but the light won't work if they don't go in the right way around. If you look carefully one side of the LED has a flat edge, which must line up with the flat edge on the lines on the PCB. You may want to solder them in at a specific height depending upon how you have designed your enclosure (if you are making one). Once you are happy solder them into place.

Step 5
Finally you must attach the battery holder (shown right). Start by feeding the leads through the strain relief hole near R3. The wire should be fed in from the rear of the board (see below & right).



The red lead should be soldered to the '+' terminal (also marked with the text 'red') and the black lead should be soldered to the '-' terminal (also marked with the text 'black').



Adding an on / off switch

To add a power switch, don't solder both ends of the battery cage directly into the board, instead:

- Solder one end of the battery cage to the PCB, either black to '-' or red to '+'.
- Solder the other end of the battery cage to the on / off switch.
- Using a piece of wire, solder the remaining terminal on the on / off switch to the remaining power connection on the PCB.

Checking Your Bike PCB

Check the following before you insert the batteries:

Check the bottom of the board to ensure that:

- All holes (except the 4 large (3 mm) holes in the corners) are filled with the lead of a component.
- All these leads are soldered.
- Pins next to each other are not soldered together.

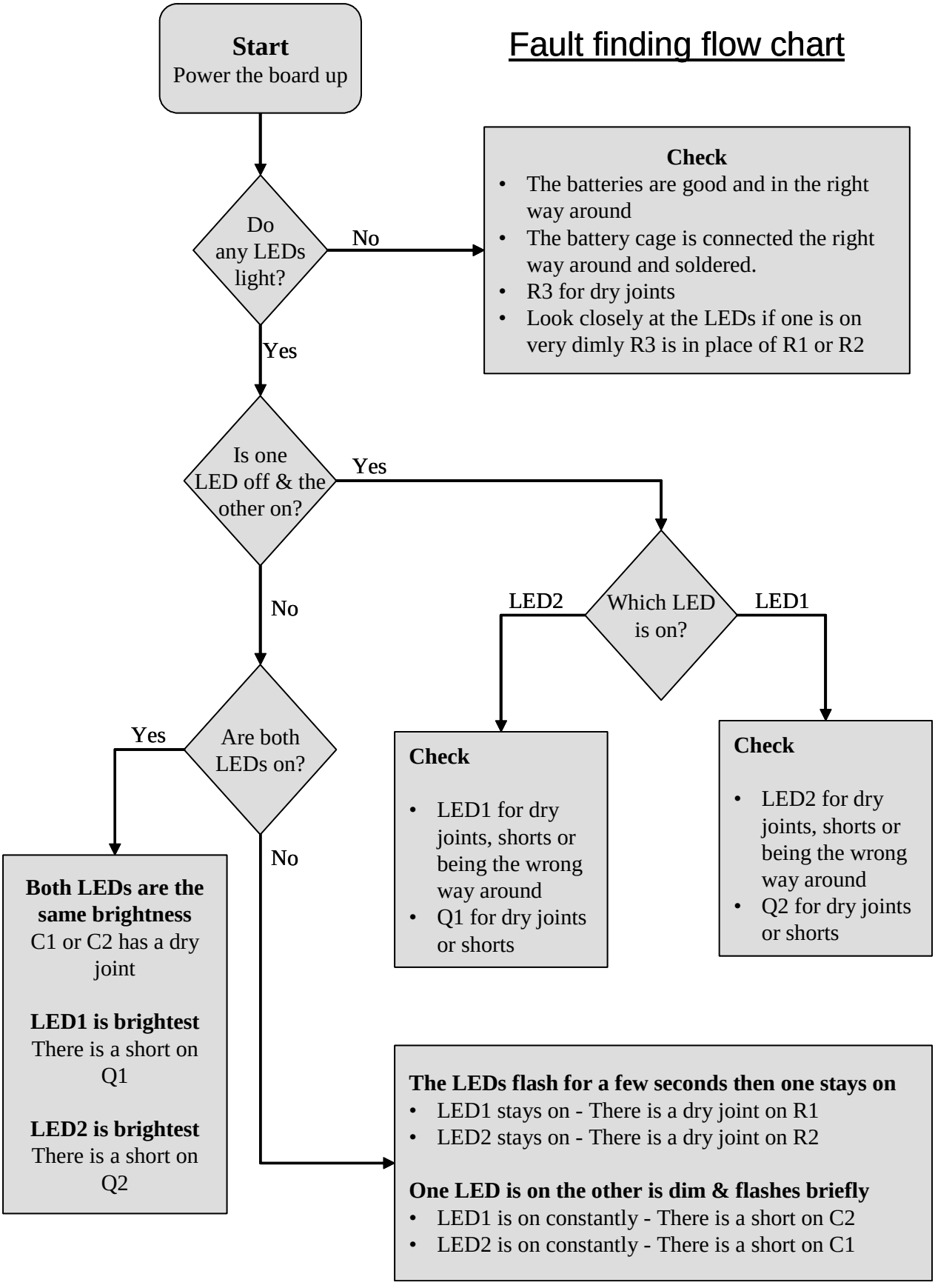
Check the top of the board to ensure that:

- The shape of the transistors match the outline on the PCB.
- The flat edge of each of the LEDs matches the outline on the PCB.
- The '-' on the capacitors match the same marks on the PCB.
- The colour bands on R3 are orange, orange and black.
- The battery cage red and black wires match the red & black text on the PCB.

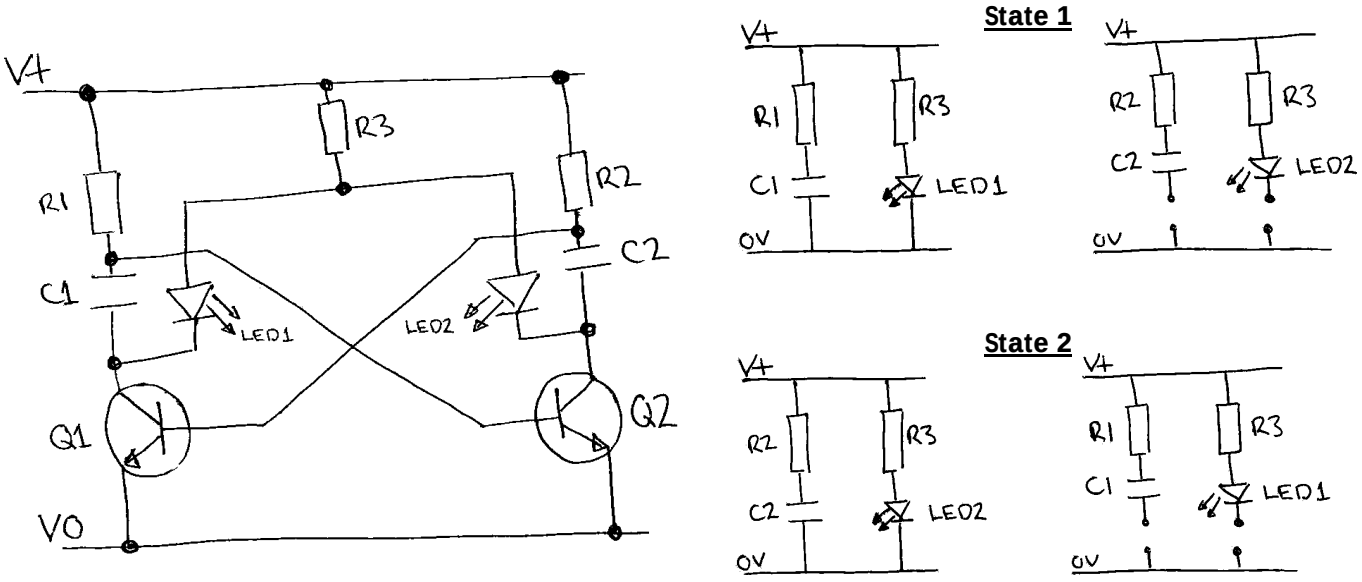
Power Up

On inserting the batteries the LED's should start flashing in an alternating pattern. If this does not happen use the fault finding sheet to find the fault.

Fault finding flow chart



How the Bike Light Works



The circuit has two states which it alternates between. In each of the states one of the LEDs is on while the other is off.

State 1 (see picture above right):

- Q1 is turned on which connects LED1 and C1 to 0V. This turns LED1 on and C1 starts to charge through the resistor R1 causing the voltage across it to increase (it starts at less than 0.7V). The voltage at the base of Q2 starts to rise as C1 charges as they are both connected to each other.
- As C1 has less than 0.7V across it Q2 is turned off. This means LED2 is not connected to 0V and is therefore turned off. C2 (which has more than 0.7V across it) is gradually discharging into the base of Q1.

This continues until the C1 has sufficient charge to produce a voltage >0.7V on the base of Q2, which causes it to turn on.

State 2 (see picture above right):

- Q2 is now turned on which connects LED2 and C2 to 0V. This turns LED2 on. This connection of C2 to 0V causes the voltage across it to drop below 0.7V turning off Q1. Now C2 starts to charge through the resistor R2 causing the voltage across it to increase. The voltage at the base of Q1 starts to rise as C2 charges as they are both connected to each other.
- As C2 has less than 0.7V across it Q1 is turned off. This means LED1 is not connected to 0V and is therefore turned off. C1 (which has more than 0.7V across it) is gradually discharging into the base of Q2.

The right hand side of the circuit is in the same state that the left hand side started in Stage 1, but with C2 charging instead of C1. When the charge gets high enough the circuit flips back to Stage 1.

R3 is needed to limit the amount of current flowing through the LED. The transistors aren't turned fully on so also contribute to the limiting of current flowing through the LED. This means the current limit resistor is smaller than it would otherwise be.