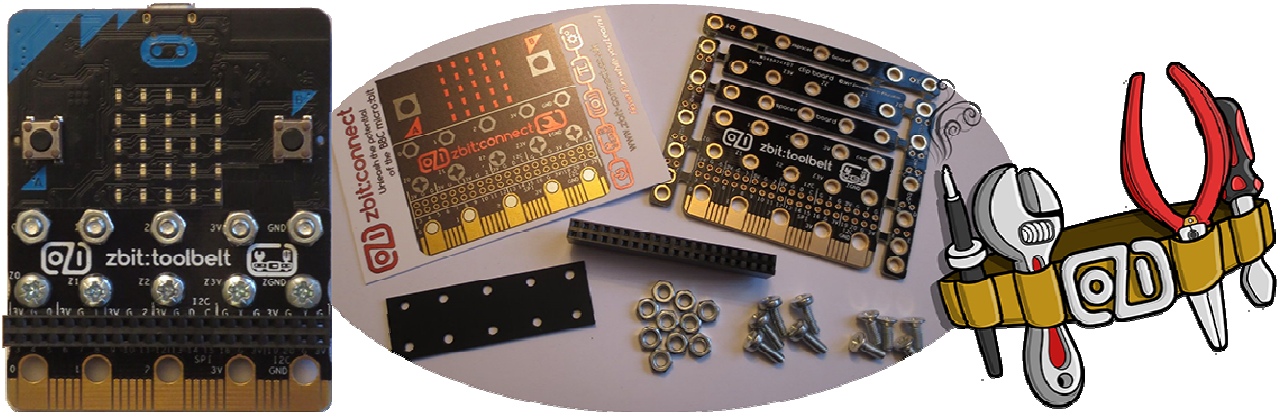
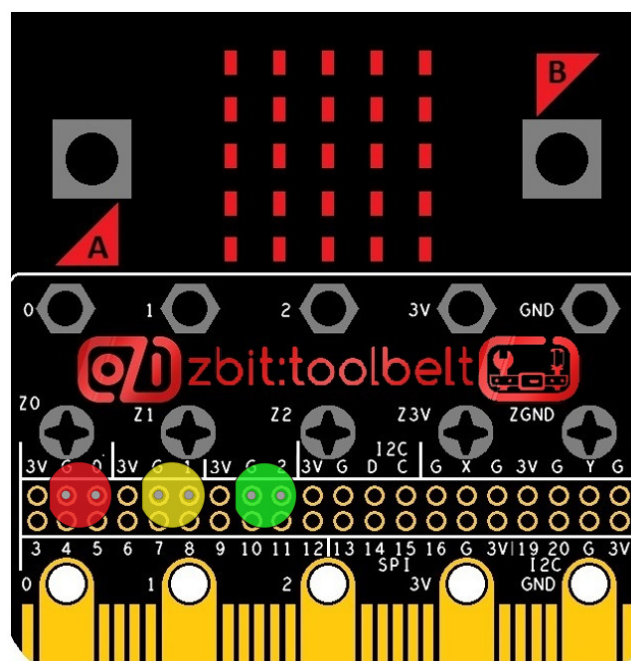


# zbit:toolbelt

for the BBC micro:bit



## Example T1 – LED Traffic Lights plugged into zbit:toolbelt

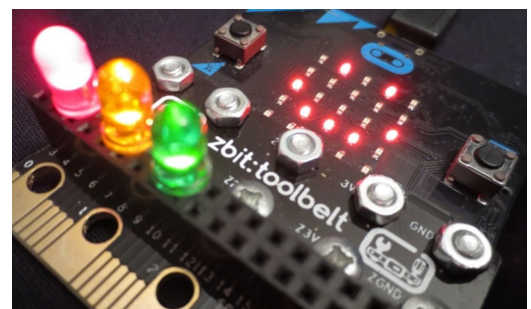


*This zbit:toolbelt example shows you how LED's can be plugged into zbit:toolbelt to create a set of LED Traffic Lights which can be controlled by sensors on the micro:bit*

### Parts required

- 1 x zbit:toolbelt
- 1 x zbit:connector (Optional - see page 2 for details)
- 1 x Red 5mm LED \*
- 1 x Amber (or Yellow) 5mm LED \*
- 1 x Green 5mm LED \*
- 1 x BBC micro:bit !!!

\* LED's with coloured lenses and a 'flat' on the package to indicate the cathode are recommended. 5mm LED's have pins that are spaced about 2.5mm apart. Ideal for plugging into the zbit:toolbelt between adjacent pins.



## Plugging LED's into zbit:toolbelt

LED's can be connected directly between a micro:bit GPIO pin and GND\* (or between a GPIO pin and 3V). zbit:toolbelt gives you numerous places where LED's can be plugged in to adjacent pins and directly driven in this way. (These pins might be horizontally adjacent, vertically adjacent or diagonally adjacent).

\* **Directly Driving LED's** - Normally it is 'good practice' when connecting an LED to a computer's GPIO to use a current limiting resistor. However to tolerate the short circuits that can occur when attaching crocodile clips, etc the micro:bit has GPIO with built-in current limiting. This feature limits the maximum current that can be drawn from a single GPIO to about 5mA. So when LED's are connected directly a maximum current of about 5mA will flow through the LED. Plenty to illuminate the LED, but well within the capability of the GPIO pin.

**Directly Driving multiple LED's** - Whilst having 3 LED's each drawing about 5mA is within the capability of the micro:bit, if more and more LED's are attached and all are turned 'on' simultaneously, it can cause the micro:bit's processor to fail to run correctly. (This can also occur if you short pins with crocodile clips but once the 'short' is removed the processor resumes running normally). Typically the micro:bit won't have a problem driving 5 or 6 LED's, but when 7, 8 or 9 LED's are attached the processor may fail to run correctly. If this occurs reduce the number of LED's fitted and normal code execution should resume!

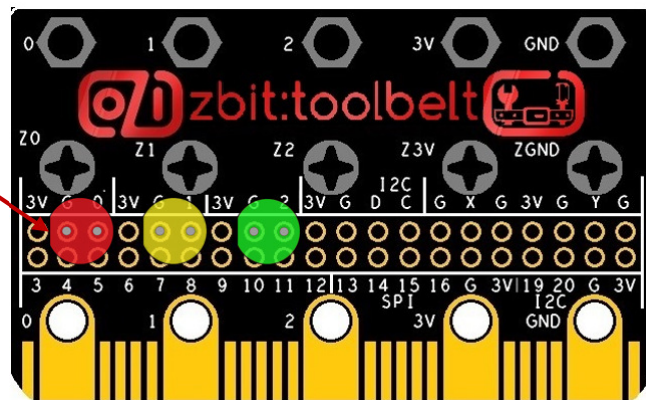
## LED 'Traffic Lights' Assembly Instructions

- Cut the legs of the Red, Amber and Green LED's to a length of about 8mm
- Plug the LED's into zbit:toolbelt in the positions shown. Ensure that the 'flat' side of the LED's plug into the pins marked 'G' (GND)

'Flat' on LED's Plastic indicates the 'cathode' which must be connected to GND

### Controlling the LED's

- The Red is controlled by GPIO P0
- The Amber is controlled by GPIO P1
- The Green is controlled by GPIO P2
- A Digital Write of '1' to P0 will turn the Red LED 'on'
- A Digital Write of '0' to P0 will turn the Red LED 'off'



### Traffic Lights Coding Challenge

Write Code in Block, Java Script and/or Python to turn the LED's 'on' in this sequence:-

- Red (for 3 seconds)
- Red + Amber for (1 second)
- Green (for 3 seconds)
- Amber for (1 second)
- **back to Red**

### Tilt Controlled Traffic Lights Coding Challenge

Write Code in Block, Java Script and/or Python so Traffic Lights only turn from Red to **Green** when **tilted right**. Then only turn back to **Red** when **tilted left**.

### Other Traffic Lights Coding Challenges

- Write Code to control the Traffic Lights using the Magnetometer (Compass), Light and/or Temperature Sensor
- Send Radio Commands from a second micro:bit to control the Traffic Lights on this micro:bit
- Read the accelerometer's X,Y,Z values and use them to control the brightness of the 3 LED's using 'Write Analog'
- And invent your own coding challenges!

For this project  
the use of the  
zbit:connector...



...is optional as it only connect to  
'large pad' GPIO P0, P1 & P2

See 'zbit:connect family guide' for more details

For updates follow [Twitter @ZbitConnect](#)

*Have Fun while you Learn!*



[www.zbit-connect.co.uk](http://www.zbit-connect.co.uk)