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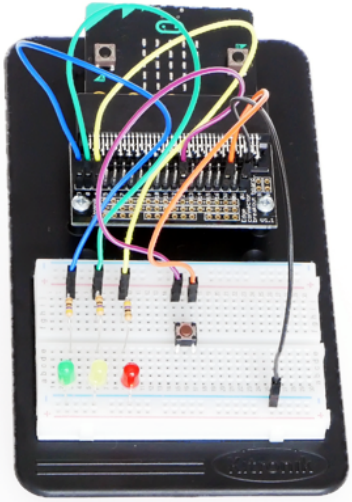
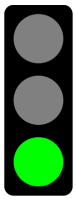
Traffic light circuit



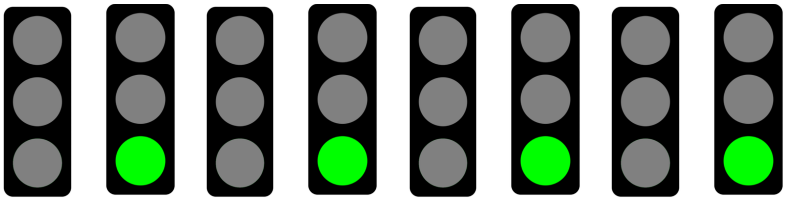
Goal:	**Programming of a traffic light circuit**
Conten	**pedestrian-controlled circuit** **traffic-controller time phases**

LESSON 1

Discussing of traffic light phases
Observation and comparison of traffic systems in road traffic

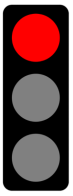


Phase: green

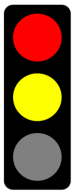


Phase: flashing green 4x

Phase: yellow



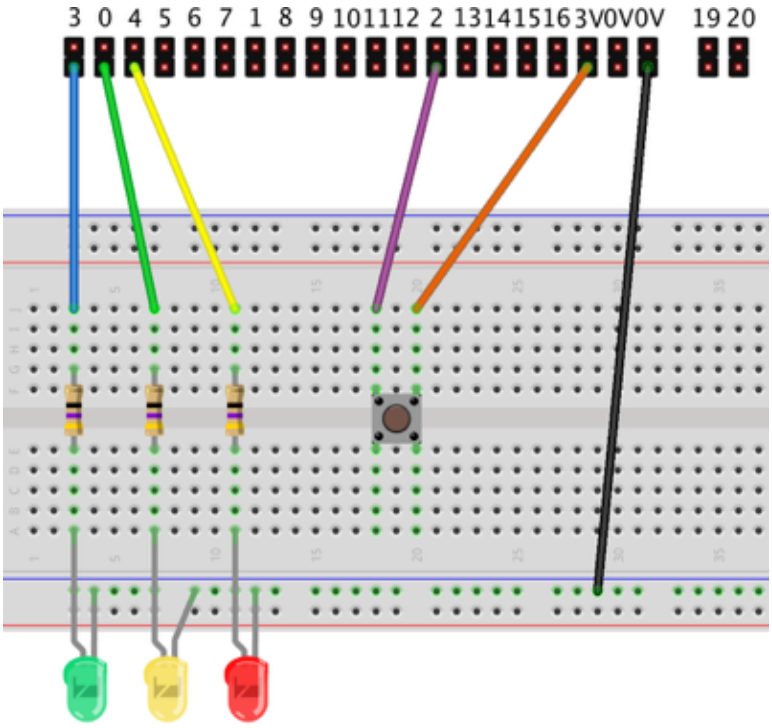
Phase: red

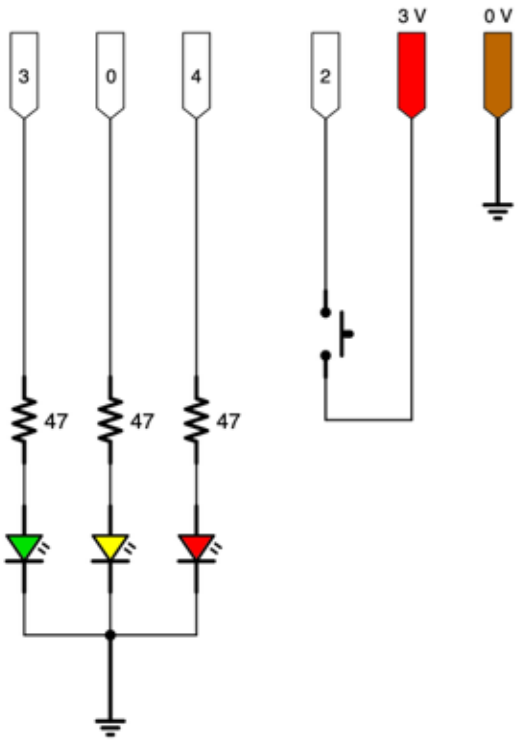


Phase: red - yellow

LESSON 2

Circuit set-up





- Position the LEDs as illustrated. The long pins (anodes) face upwards towards the series resistors.
- The short pins (cathodes) are routed to the common Gnd (pole).
- The long pins are routed to the output pins of the Micro Bit via series resistors (47 Ohm).
  [**Blue cable – Pin3** | **Green cable – Pin0** | **Yellow cable – Pin4**]
- Position the button on the breadboard in such a way that two close pins are over and under the notch (see figure). One connection of the button is routed to the 3V pin, the other to pin 2.
- In the end, the ground bar (Gnd – 0V) is connected to the Micro Bit.
  [**Black cable – 0V**]

Info

Detailed information on the terms "**series resistor and pullup**" will be the topic of other lessons.

LESSON 3

Block code of pedestrian-controlled traffic light circuit

Information on block code

As the used pins 3 and 4 are also used by the LED matrix, it must be deactivated on program start.

After the button is pressed, the green LED starts flashing 4x every second after a pause of 1s (off – on)

The green LED goes off and the yellow LED is lit for one second.

Afterwards, the traffic light switches from yellow to red. Do not forget to "clear" the lit LED beforehand.

After a pause of 3s, the traffic light switches to red-yellow. This means, both LEDs are lit at the same time

At the end of the block, yellow and red go off. The green LED does not need to be switched on as this is done anyways in the "otherwise" block

As long as the button is not pressed, only this line is executed (LED green On). In this case, the "if" block is not executed as the button is not pressed.

LESSON 4

Optional:
Calculation of series resistors of LEDs

Ohm's law → R = U / I

LEDs must not be directly connected to the voltage source as this would destroy it.
Series resistors limit the voltage as well as the current flow through the LED.
The admissible voltage and current rating of the LED can be found in the data sheet.

Example

Voltage source: 5V

LED: U = 2V
I = 20mA

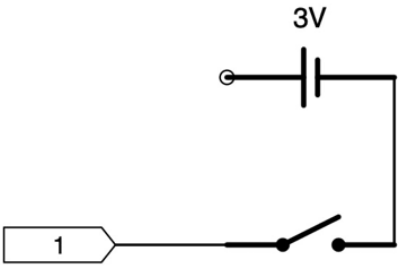
The voltage, which has to "get rid of", is converted into heat => 5V – 2V = 3V

R[Ohm] = U[V] / **I**[A]

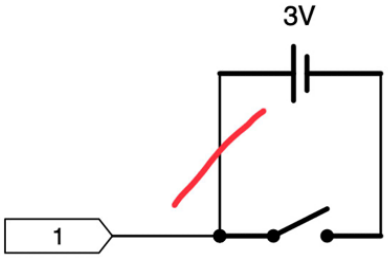
R = 3 / 0,02 = 300 / 2 = **150**

Optional:
What are pullups and why are they used?

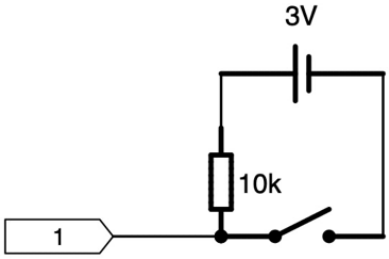
To ensure that the Micro Bit (or any other microcontroller) can recognise whether a button is pressed or not, a defined voltage (3V or 01V) must be applied at the input pin (e.g. pin 1).
In our case, 0V are to be applied at pin 1 if the button is pressed.



In the first figure, the required 0V are applied at pin 1 if the button is pressed.
If it is not pressed, however, the pin is "up in the air", i.e. no defined voltage potential is applied.



If the input pin is connected to the positive voltage supply (3V), the required 3V are applied while the button is not pressed, however, if the button is then pressed, a **SHORT CIRCUIT** occurs!!!



This short circuit is prevented by means of pullup "raising" the potential of the input pin (3V). If the button is pressed, the short circuit is prevented by the resistance of usually 10kOhm and the required 0V are applied.

Info

At most microcontrollers, these pullups are already integrated and can be applied on the software side.
This way, costs (components and time)
can be saved and the size of PCBs be reduced.