



## How to connect a buzzer or an LED

We can use the rings at the bottom of your micro:bit to connect things to it. These are labelled 0, 1 and 2. We can connect a buzzer or an LED to the rings.

### Connecting a buzzer or an LED to the micro:bit.

Buzzers and LEDs are connected in the same way. They must be connected to one of the rings (P0, P1 or P2) and the GND ring.

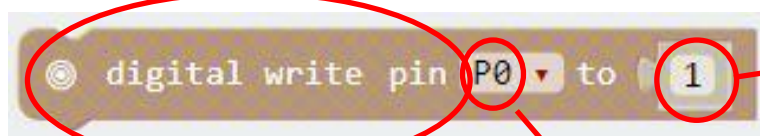
**To connect a buzzer** – connect the red wire to the output ring (either P0, P1 or P2) and the black wire to GND.

**To connect an LED** – connect the longer leg to the output ring (either P0, P1 or P2) and the short leg to GND.

### Using a buzzer or LED with the micro:bit

To make the buzzer sound or the LED light up we use the same code.

This line of code turns the buzzer or the LED on:



This tells the micro:bit to turn the buzzer/LED on.

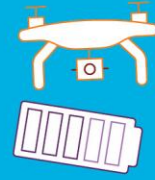
What number would we use instead to turn the buzzer off?

This command line can be found by typing 'digital' in the search bar. This tells the BBC micro:bit to send voltage to the ring labelled '0'

This tells it to send power to the ring labelled '0' You could use P1 or P2

You will need to work out what input you want to use to make your buzzer sound or LED light otherwise they would be on all the time. You will also need to ensure you have a line of code which turns the buzzer/LED off at some point.





## How to count on your micro:bit

We can use the micro:bit to count up or down on an input or to set a timer which will count up or count down.

### Example 1 – creating a count code on an input.

In this example pressing button A will count up by 1 and pressing button B will count down by 1. You could use this to keep score in a game or to count the number of people coming entering a building.

```

on button A pressed
  change count by 1
  show number count

on button B pressed
  change count by -1
  show number count
  
```

You can change the input on when the BBC micro:bit adds to the score or when it takes a point away.

You can also change the number at which the count up starts.

### Example 2 – A count up code.

This code will count from 0 to 9 when you press button A. You could use it to count up to another event such as a buzzer sounding.

```

on button A pressed
  for index from 0 to 9
  do
    show number index
  
```

You can change the input for when this count up starts or change the number it will count to.

You can also change the speed at which the number scrolls across the screen.

Can you work out how to do a countdown code?





## How to play music on your micro:bit

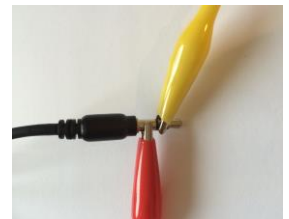
You can use the micro:bit to play sounds or even create music.

### Connecting the micro:bit to a speaker or headphones

Although the music tone will play on your laptop they will not play on the micro:bit unless you connect it to a speaker or headphones.

To do this you will need to use two crocodile leads. Connect one to the '0' ring and the other to the GND ring.

Now connect the other end of the crocodile leads to the headphone or speaker jack as shown in the picture.



You will now be able to play any music you create through the speaker or headphones.

**Important note:** If you have your own headphones use these until you have developed your code. You can then ask the challenge leader to help you try it through the speakers. You **will not** be able to take the speakers back to your table.

### Using music on the micro:bit

To make music we use the music menu. This line of code makes a tone when we press Button A

This tells the micro:bit when you want it to play a note.

This command can be found in the Music menu

This tells the micro:bit which note to play

This tells the micro:bit how long to play the note

You can change the input to something else, such as acceleration or temperature, if you want.





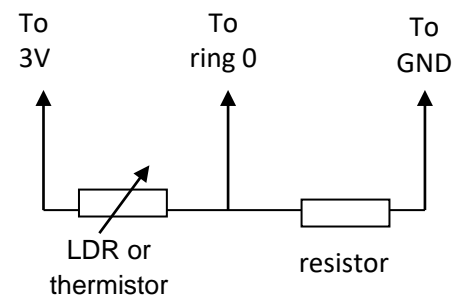
# How to use a Light Dependent Resistor (LDR)

## Connecting an LDR to the micro:bit

1. Get three crocodile leads.
2. Twist together one leg of the LDR and one leg of the resistor to make a connection as in the photograph



3. Connect the crocodile leads as shown in the diagram. You can use the 0, 1 or 2 ring but this diagram shows the connection between the LDR and the resistor connected to the 0 ring (P0).
4. Write your code (see the examples below) and download it to the micro:bit. You will need to cover the LDR to alter the light level.



## Using an LDR with the micro:bit

Use this example to help you develop your own code. You will gain more marks if you adapt this example rather than just repeating it.

```

    forever
    set light to ( analog read pin P0 )
    if ( light > 400 )
    then
    show icon [Smiley Face]
    else
    show icon [Frowny Face]
  
```

In this example the micro:bit will tell us when it is above a set light level by showing a smiley face. If you cover the LDR the frowny face appears to show us the light level has dropped.

You can change the light level at which the output would alter.

What happens if you swap round the crocodile clips attached to the GND and 3V rings?



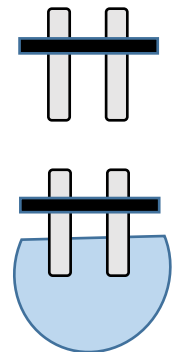


## How to use a moisture sensor

A moisture sensor can be used to alert you when there is too much or too little water in a certain place, where ever you put the moisture sensor!

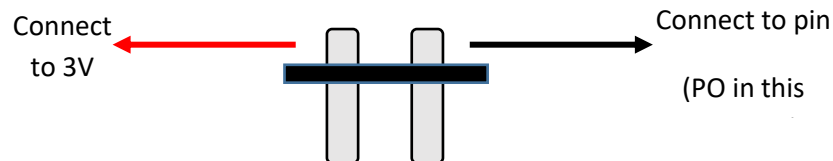
The moisture sensor is made from two pieces of metal which are held a certain distance apart, this is connected as part of a circuit.

- The gap between the two pieces of metal acts as a break in the circuit.
- When the two pieces of metal are submerged in water or in a wet material this completes the circuit.



### Connecting the moisture sensor to the micro:bit

The moisture sensor needs to have one crocodile lead connected to 3V and the other to a pin, in this case P0.



### Using the moisture sensor with the micro:bit

```

    forever
    set moisture to (digital read pin P0)
    if (moisture = 1)
    then
    else
  
```

Use this example to help you develop your own code.

You will need to decide what you want to happen when the moisture sensor is dry or wet.





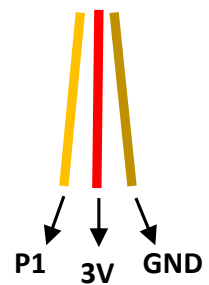
## How to use a servo motor

A servo motor is a motor whose angular motion can be controlled, the position of the servo motor can be controlled using the micro:bit. This may be useful if you have something that needs to be moved to a specific position at a certain time as part of your prototype design.

### Connecting the servo motor to the micro:bit

The servo motor has three wires, these are connected to the micro:bit pins as shown below.

- The red wire needs to be attached to the 3V pin using a crocodile lead.
- The yellow wire needs to be attached to a pin, in this example connect it to pin P1 using a crocodile lead.
- The brown wire needs to be attached to the GND pin using a crocodile lead.



### Controlling the servo motor using the micro:bit

Use this example to help you develop your own code. You will gain more marks if you adapt this example rather than just repeating it.

```

on button A pressed
  servo write pin P0 to 0

on button B pressed
  servo write pin P0 to 180
  
```





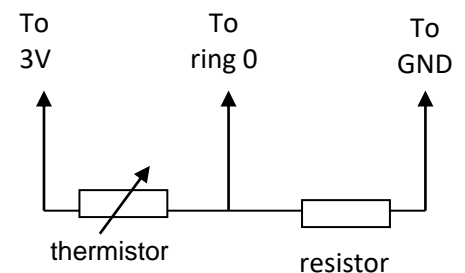
## How to use a thermistor

**Note:** Don't forget that the micro:bit has an in-built temperature sensor which you may prefer to use. See the sheet 'How to use the temperature sensor on your micro:bit' if you want to use this instead.

If you want to take the temperature at a location away from the micro:bit then you will need to use a thermistor.

### Connecting a thermistor to the micro:bit

- Get three crocodile leads.
- Twist together one leg of the thermistor and one leg of the resistor to make a connection as in the photograph
- Connect the crocodile leads as shown in the diagram. You can use the 0, 1 or 2 ring but this diagram shows the connection between the thermistor and the resistor connected to the 0 pin (P0).
- Write your code (see the examples below) and flash it to the micro:bit. You will need to hold the thermistor with your hand to alter the temperature.



### Using the thermistor with the micro:bit

Try this example first and then adapt it to develop your own product.

```

    forever
    set temperature to [analog read pin P0]
    if [temperature] > [400]
    then
        show icon [frowny face]
        show number [temperature]
    else
        show icon [smiley face]
    
```

In this example the micro:bit will tell us when the room is too cold by showing the frowny face. As you hold the thermistor the temperature increases and the smiley face will light up letting you know the room is warmer.

If the room is very cold or very warm you may need to try a different number than '> 325' (or more than 325) until you can adjust to the temperature of the room.

What happens if you swap round the crocodile clips attached to the GND and 3V rings?

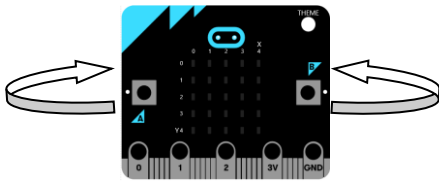




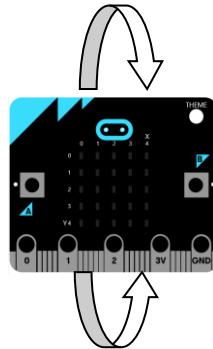
## How to use the accelerometer

The accelerometer detects movement of the micro:bit in three directions:

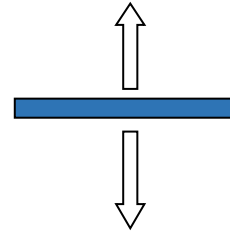
**On the X axis**



**On the Y axis**



**or on the Z axis**



The accelerometer can be coded from the input keyboard where you can decide which axis you want to use.

This line of code tells the micro:bit to do something when you tilt it over 400 millig to the left.

You need to use an 'if' code to make something happen

This tells the micro:bit when to respond

This tells the micro:bit which axis to use

The micro:bit would have to move more than 400 millig to the left for something to happen. This number could be between 0 and 1024

You will need to put this code in a 'forever' loop and you will also need to add lines of code to tell the micro:bit what to do when it is tilted to the left and what to do when it is not.

You can change the axis or you can code the micro:bit to do something when it is moved in different directions. Look at the example below.

```

forever
  if (acceleration (mg) X < -400 or acceleration (mg) X > 400)
  then show icon [grid]
  else clear screen
  
```







## How to use the flex sensor

The flex sensor is used to sense changes in bend or flex in materials or objects. The flex sensor will change when it is flexed, which changes the reading from the pin to which it is attached.

You need to be very careful with the flex sensor as these are fragile. If you bend it too much it will break. Try not to bend it too close to the base as this may also damage it.

### Connecting the flex sensor

You will need to connect one of the arms of the flex sensor to Pin 0 and the other to the 3V pin.

**BE CAREFUL** – don't let the crocodile leads touch or go onto the other arm as you may short circuit the sensor and the micro:bit may get very hot.

### Controlling the flex sensor

```

    forever
    | show number (analog read pin P0)
  
```

To use the flex sensor you need to know what the reading to the pin is before you can get it to do something when you bend it. Use this code to find out what the readings are when the flex sensor is straight and when it is bent. You will need to do this for each flex sensor as they vary.

**GENTLY** bend the sensor from the tip and look at the numbers on the micro:bit to see how they change.

You should then be able to decide what number you need to use as the threshold in your final code for the flex sensor as in the example below:

```

    on start
    | set threshold to 780

    forever
    | set reading to (analog read pin P0)
    | if (reading < threshold)
    |   then
    |     show leds
    |   else
    |     show leds
  
```

Setting the threshold means the pin would need to read less than 700 for something to happen

This tells the micro:bit to respond from the output at Pin 0. You can use the other pins.

These lines tell the micro:bit what to do when the flex sensor is bent beyond the threshold - or when it is not. You can use other outputs.





## How to use the BBC micro:bit compass

The BBC micro:bit has an inbuilt compass. This can be used to tell the user which direction they are facing.

The compass records the angle between 0° and 360° that the BBC micro:bit is at. Three examples from the online simulator are shown below.



**IMPORTANT NOTE:** The first time you use the compass function the words 'Draw a circle' will scroll across your micro:bit. Move the micro:bit around to get a circle of LEDs. Once you have done this you will see a smiley face. Now you can start using your compass.

### 1. Using the compass heading in degrees

You can tell your BBC micro:bit to display the degrees of the compass angle using the following script



To begin with you will need to tell the BBC micro:bit to show the reading forever. To do this use the Basic command and choose 'show number'.

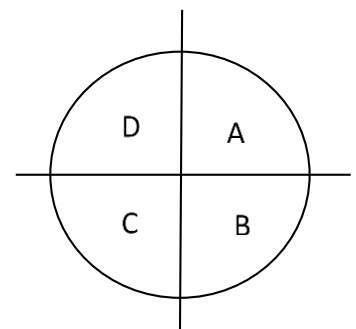
Then choose Input and select compass heading. Move the blocks together and your simulator will start to show the compass reading. Now try it on your BBC micro:bit. Remember you should hold your BBC micro:bit horizontally like a compass.

### 2. Using the compass heading for direction

Rather than displaying the compass heading in degrees you can display a symbol or letter e.g. N, S, E, W when the compass heading is between certain values. We can split a circle into sections and then assign each section a symbol or letter, for example:

The code on the next page shows how you could display the letter A depending on which direction the BBC micro:bit is heading.

Notice the use of > (greater than), < (less than) and greater than or equal to and less than or equal to signs in this code.





```
forever
  set degrees to compass heading (°)
  if (degrees ≥ 0 and degrees ≤ 90)
    then show string "A"
  else clear screen
```

This code will only show the letter 'A' when the compass is between 0° and 90°. At all other times the screen will be blank. How could you develop the code to show all the letters or show the points on a compass?





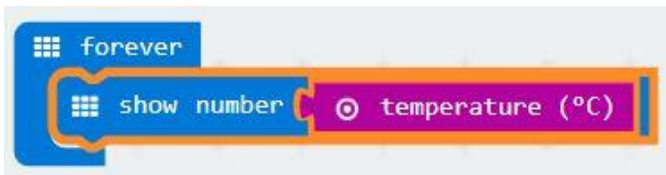
## How to use the micro:bit temperature sensor

The micro:bit can detect the temperature of its surroundings. This is not the same as using a thermistor so do not confuse the two codes.

It is often useful to write a code first to find out what the temperature is in the room. This will help you set the temperature levels more accurately when you are developing your own code.

Start by coding the micro:bit to give you a numerical temperature reading.

### Getting a numerical temperature reading.



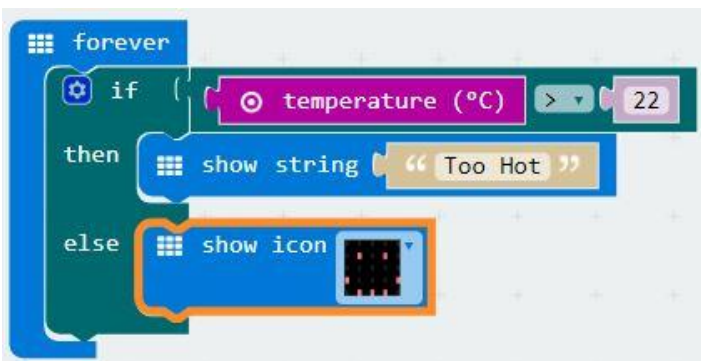
If you leave the BBC micro:bit on your table the temperature of the room will show on the screen in degrees Celsius.

Try holding the BBC micro:bit in your hands to warm it up. What do you notice about the numbers on the screen?

How long does it take to cool down again?

You can now use this reading to set a temperature level for something to happen, such as the example below.

### Developing a temperature warning programme.



You will need to adapt this code to suit your own product. Remember, you will gain more marks if you create your own code rather than simply copying this one.

Try to set the temperature level to the room you are working in so that the judges will be able to see a change when you present your product.





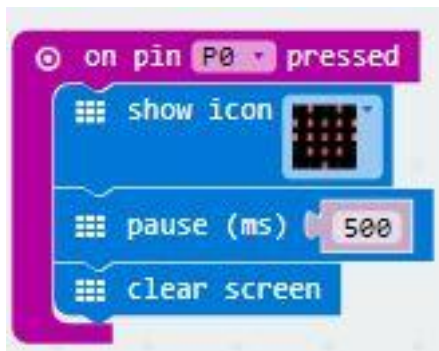
## How to use the pins

There are three rings at the bottom of your micro:bit, labelled 0, 1 and 2. We can use these to make something happen such as an animation or a buzzer sounding.

The simplest way to do this is simply to hold one of the output rings and GND with your fingers. You can also connect these using a crocodile lead.

Try coding this example:

### Touching the rings.



In this example the input is ourselves. When you touch Ring '0' (known as P0) and the ground button (GND) the smiley face will show, when we let go it disappears.

This could be developed to make an alarm. You would need to add a buzzer connected to a different pin (e.g. P1 or P2) and also to the GND pin. See the 'How to ...' sheet on connecting a buzzer to help you do this.

