Activity 1: Getting off the ground

In this section of the Live Lesson we'll learn how your BBC micro:bit can be used to test and improve on practical, real world designs.

We'll be testing different model rocket cars in the studio using the BBC micro:bit, and seeing how different designs can impact on the cars' speeds.

Which of these designs do you think will be the best?

Using what you know already about the shapes of rockets, can you evaluate which of the following three model cars will be fastest? Why?

Send us your thoughts at live.lessons@bbc.co.uk and they could be featured on the Live Lesson on Tuesday, 7th June. Find out if your instincts are right by tuning into the Live Lesson.

Speed and the BBC micro:bit

The speed is the rate at which something, in this case, a rocket car, moves. The speed of a moving object is calculated by the distance the object covers divided by the time it takes to cover that distance.

Speed = Distance / Time

In the rocket car experiment we'll be using a timing gate to calculate the speed at which the car is going.

The timing gate is set up with two points, a metre apart. Each point is wired up to an IRDA transceiver connected to Pin 1 and Pin 2 respectively, with a 3V laser lined up directly opposite it.

When the car crosses the first point, the timer starts, and when it crosses the second point, the timer ends. The BBC micro:bit then displays the time it took for the car to cover that 1m distance in milliseconds.

Using the speed equation, you can then convert that time into the car's speed. For example, if the time displayed is 35 milliseconds:

Speed = Distance / Time
Speed = 1 / 35
Speed = 0.028 metres per millisecond

You can then use that speed and convert it to the units that you want.

0.028 metres per millisecond = 28 metres per second
1 mile = 1609.34 metres
1 hour = 3600 seconds
28 metres per seconds = 28/1609.34 x 3600 = 62.63 miles per hour

Understanding the code and circuit

This is the code that you can download on to your timing gate, wired up as per the diagram below.

```
script Bloodhound Timing Gates v 4.0
function main ()
    var starttime := 0
    var endtime := 0
    var x := 0
    var y := 0
    while true do
        if pins → analog read pin(P2) - x > 512 then
            starttime := game → current time
            led → plot(2, 2)
            x := 513
        else add code here end if
        if pins → analog read pin(P1) - y > 512 then
            endtime := game → current time - starttime
            led → plot(3, 3)
            y := 513
            for 0 ≤ i < 2 do
                basic → show number(endtime, 150)
                x := 0
                y := 0
            end for
        else add code here end if
    end while
end function
```

Setting up the starting conditions

Here the code introduces four **variables** – **starttime**, **endtime**, **x** and **y**.

The while... true loop

This introduces a **loop** which keeps the program running forever, or until the micro:bit is reset.

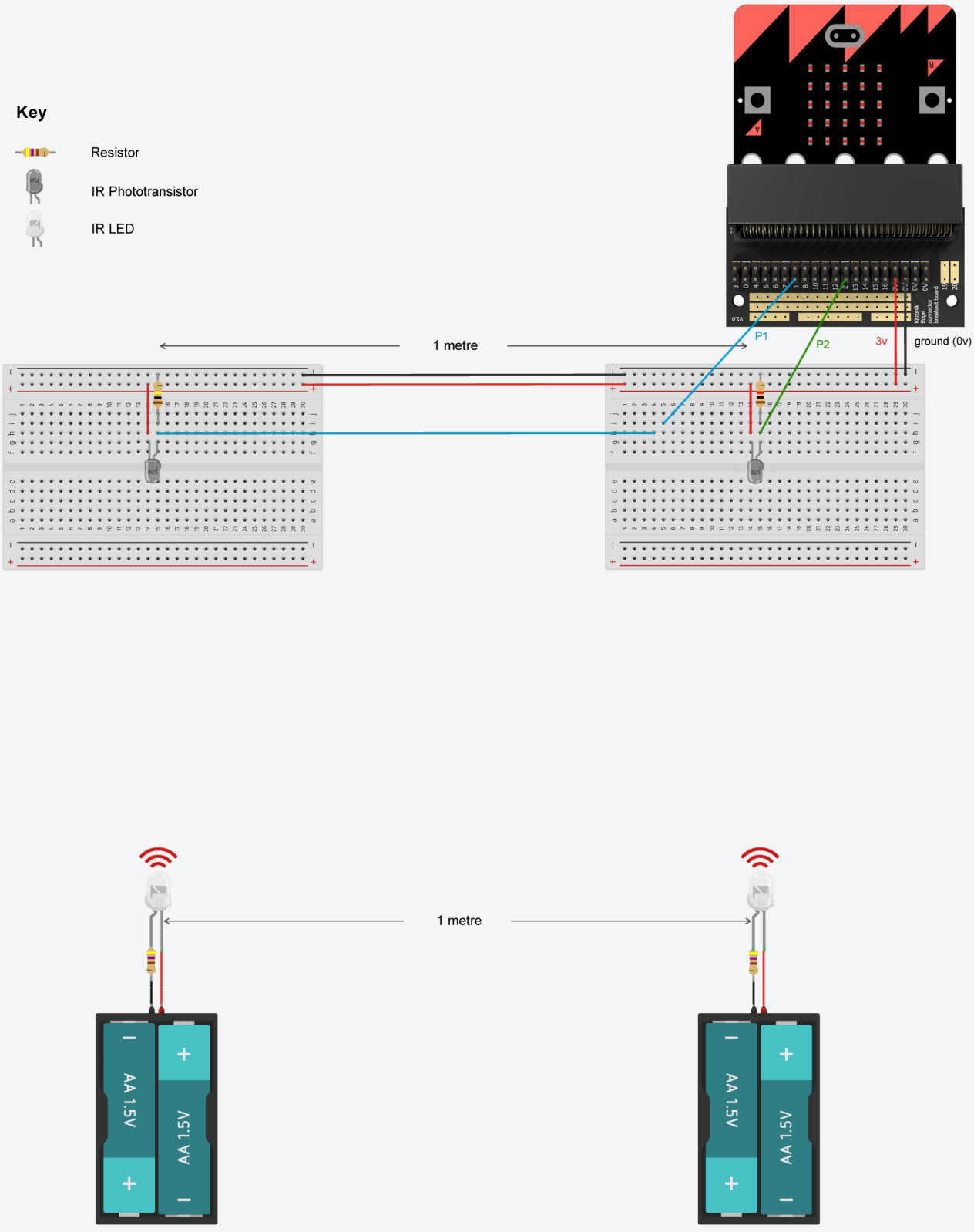
Conditional statements

This statement retrieves the information from the pins, and state that if the value read by the pin minus the **variable x** or **y** is more than 512 – when the light signal from the laser to the LDR is interrupted – then the **variable starttime** and **endtime** registers the time currently on the program.

The program then subtracts the starttime from endtime and displays the number on the micro:bit, to display the time taken in milliseconds to cover the 1m distance.

The program then resets the **variables x** and **y** to 0.

BBC micro:bit timing gate circuit



You can use this set up to test the speed of any object travelling a set distance – not just a rocket car! Why not try creating the circuit and testing it with your hand or by running between the points on the timing gate?