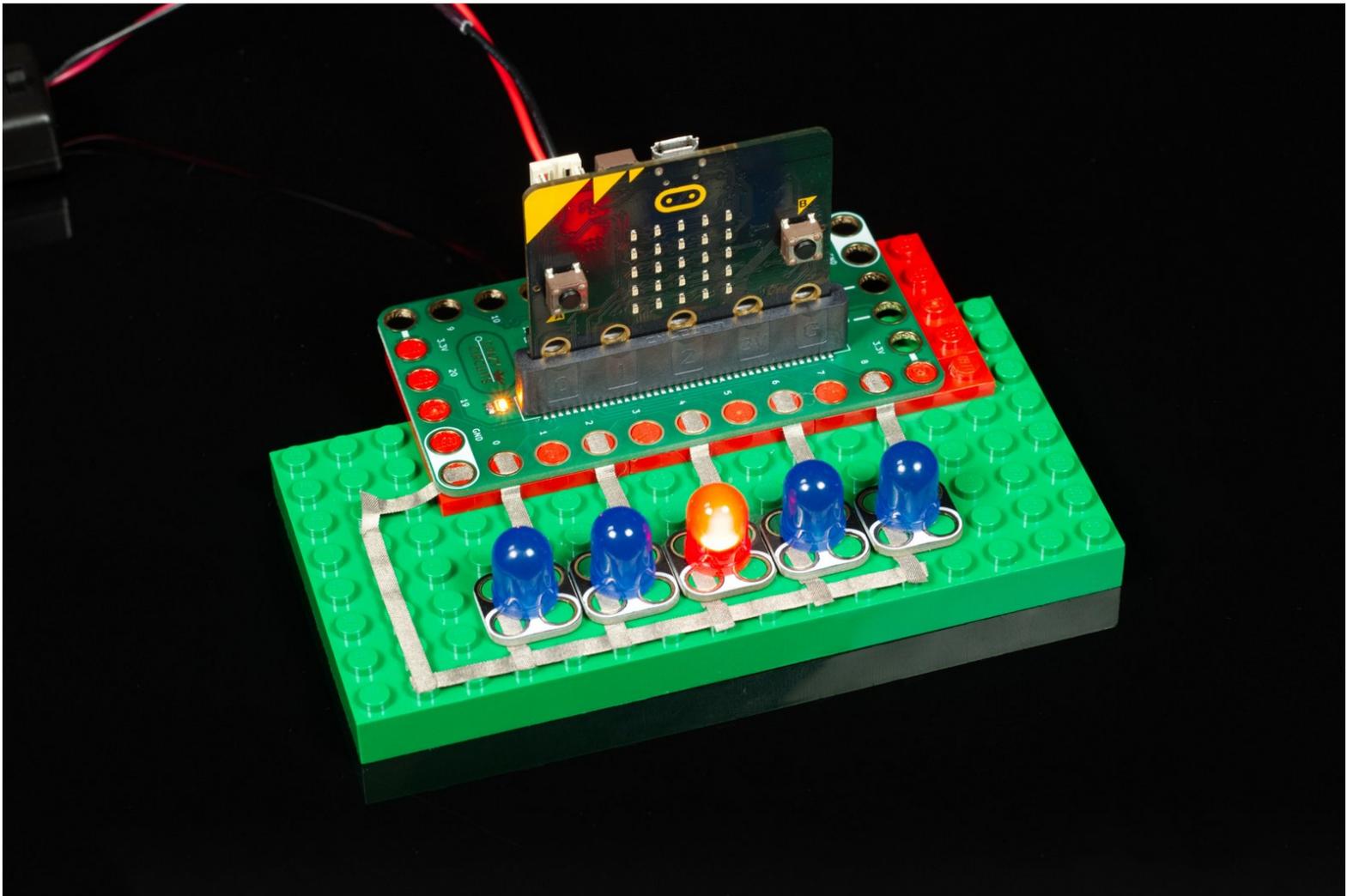




# Simple Level

Build a simple level using a micro:bit, a Bit Board, and some LEDs.

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## INTRODUCTION

The micro:bit has a built in accelerometer which we can use with a Bit Board, a LEGO baseplate, and a few LEDs to create a simple electronic level.

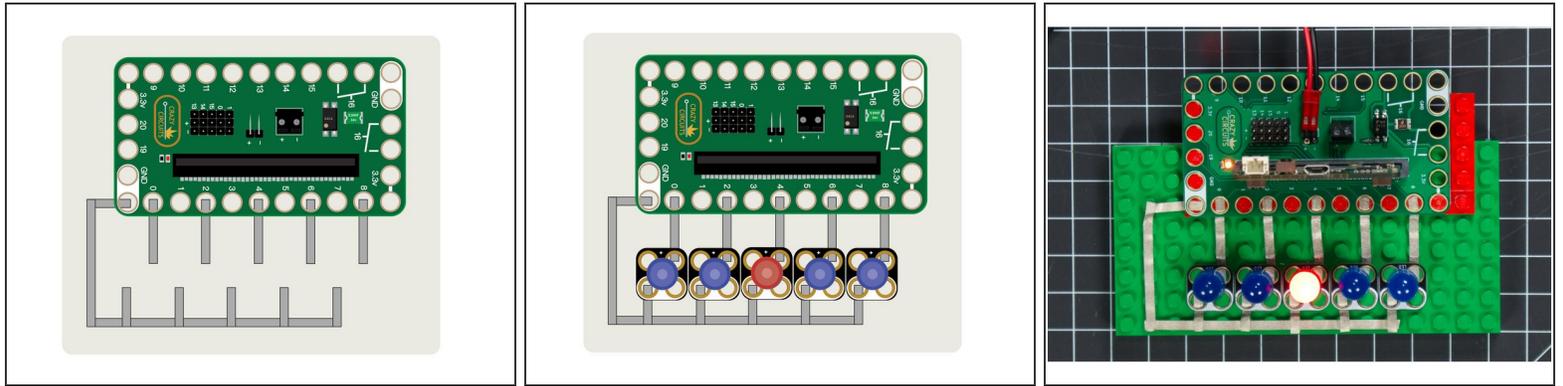
### **TOOLS:**

- [Scissors](#) (1)
- [Computer](#) (1)

### **PARTS:**

- [micro:bit](#) (1)
  - [Crazy Circuits Bit Board](#) (1)
  - [Crazy Circuits LED Chip](#) (5)
  - [Maker Tape](#) (1)
- 1/8"

## Step 1 — Build your Circuit

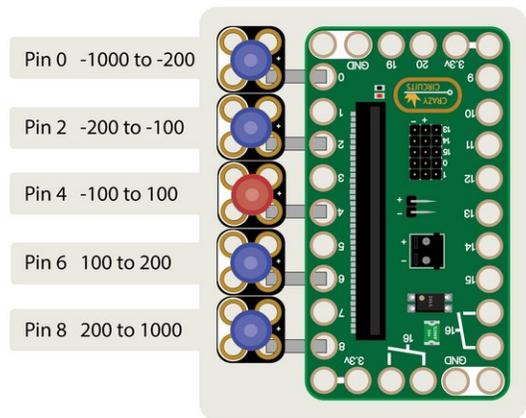


- Build your circuit on a LEGO baseplate using the Crazy Circuits Bit Board, Maker Tape and 5 LEDs.
- 🔗 You can use as few as 3 LEDs or use more than 5 if you like.
- 📄 We used a few 1 x 4 LEGO plates so our Bit Board would fit level on the baseplate and not hang off the back.

## Step 2 — Load the Code

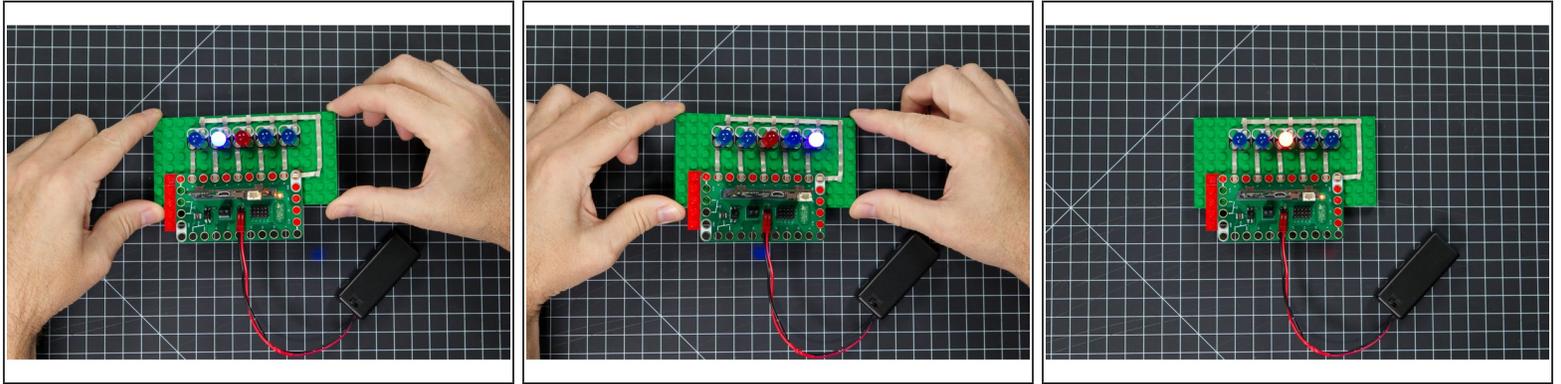
```

on start
  test awake - false =
  forever
    if acceleration (deg) > x >= 1000 and = acceleration (deg) < x <= -200 then
      digital write pin P0 = to 1
    else
      digital write pin P0 = to 0
    if acceleration (deg) > x >= 200 and = acceleration (deg) < x <= -100 then
      digital write pin P2 = to 1
    else
      digital write pin P2 = to 0
    if acceleration (deg) < x <= 100 and = acceleration (deg) > x >= 100 then
      digital write pin P4 = to 1
    else
      digital write pin P4 = to 0
    if acceleration (deg) < x <= 100 and = acceleration (deg) > x >= 200 then
      digital write pin P6 = to 1
    else
      digital write pin P6 = to 0
    if acceleration (deg) < x <= 200 and = acceleration (deg) > x >= 1000 then
      digital write pin P8 = to 1
    else
      digital write pin P8 = to 0
  
```



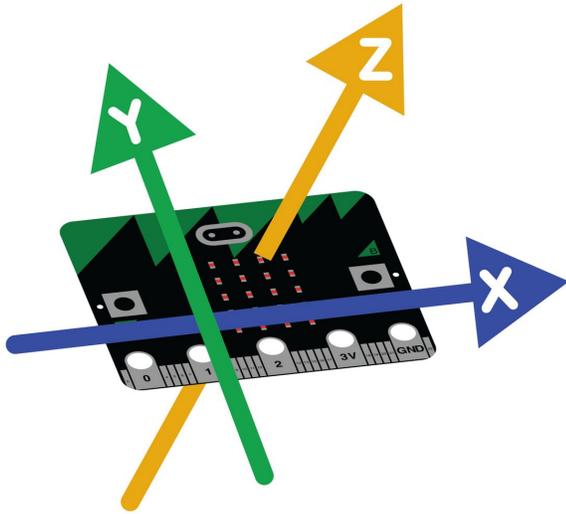
- Insert the micro:bit into the Bit Board and connect a USB cable that is plugged into your computer.
- 📌 We'll be using [makecode.microbit.org](https://makecode.microbit.org) to program our board. It uses a simple drag and drop block interface. We'll also provide all the example code you need.
- We're going to load the following code for our **Simple Level** program:  
[https://makecode.microbit.org/\\_asufxbbTz...](https://makecode.microbit.org/_asufxbbTz...)
- Once the code is loaded and running you should be able to tilt the board left or right while it is powered by the USB cable and it should work.

### Step 3 — Test it Out!



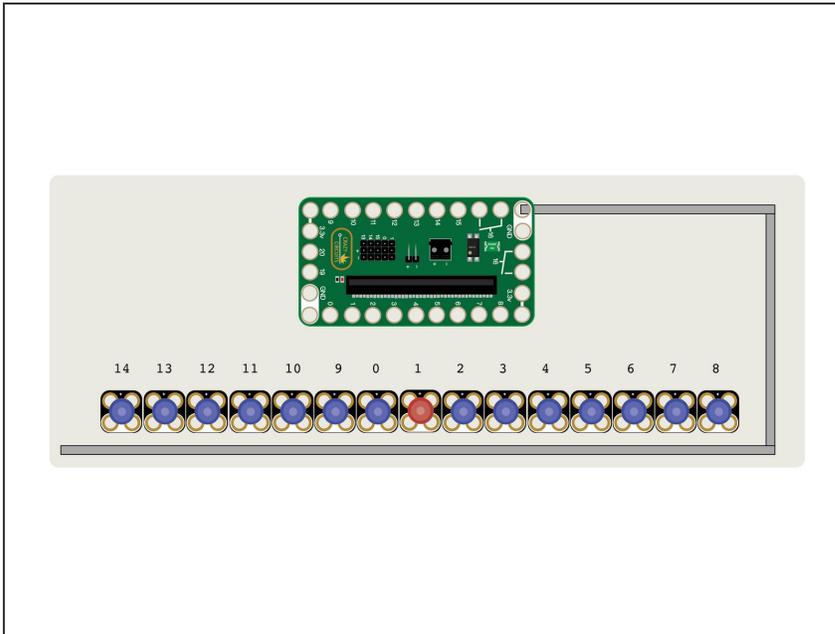
- You can power your level by using a 2 AAA battery pack plugged into the Bit Board or by plugging a USB cable into the micro:bit
- Try picking up the level and tilting left, and then right, and then trying to keep it level. If you get it level the center LED should light up.

## Step 4 — The Accelerometer



- The micro:bit measures movement along three axes: X - tilting from left to right. Y - tilting forwards and backwards. Z - moving up and down.
- An accelerometer measures "proper acceleration" which is **physical acceleration** (the rate of change of velocity) of a body in its own instantaneous rest frame. This is different from **coordinate acceleration**, which is acceleration within a fixed coordinate system.
- While our simple level can show us the tilt or angle of a surface, sliding it back and forth rapidly can also measure the physical acceleration (velocity) of the device.

## Step 5 — Take it Further



- While our Simple Level uses 5 LEDs you could easily add more. How about 15 LEDs? Can you figure out how to arrange your Maker Tape so you don't overlap any of it when designing a larger circuit?
- The diagram shows where each LED should be routed to on the Bit Board with a suggestion of how Ground might connect to each LED.
- If you build a larger level you'll want to adjust the code to deal with it. Can you break the range from -1000 to 1000 equal amounts based on how many LEDs you have?