SIYEENOVE

mShield expansion board for Microbit

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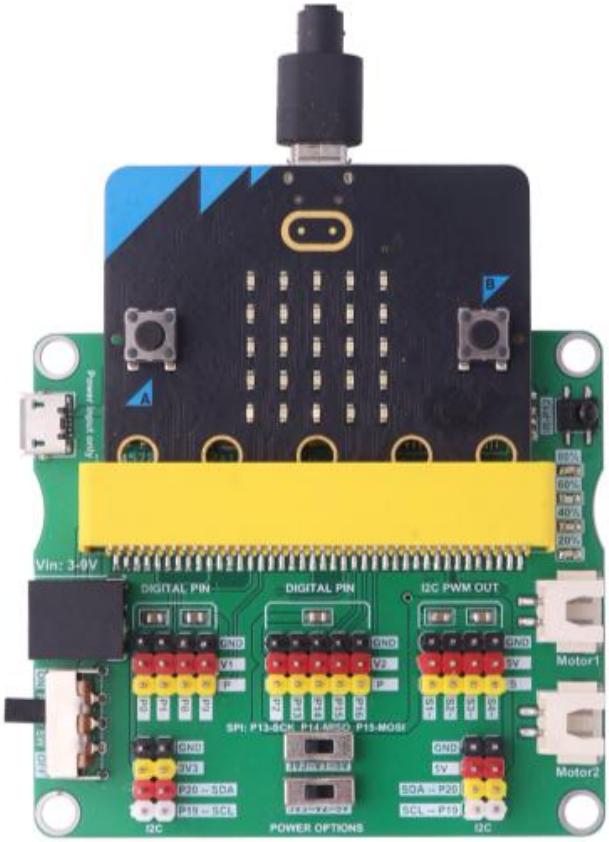
1. Overview

The mShield expansion board is an easy to use micro:bit shield, integrating powerful features such as dual motor drivers, infrared reception, battery level reading, four servo drivers, four PWM signal outputs, LED indicators, and optional 3V or 5V power output.

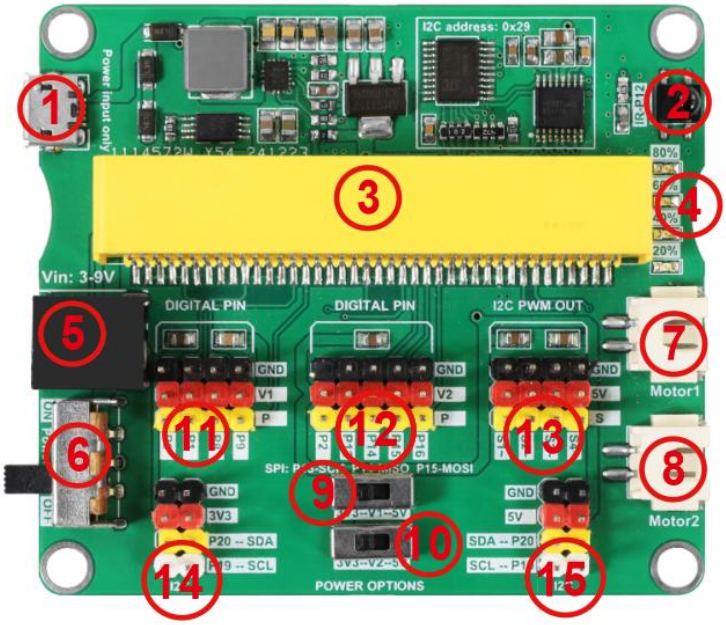
The board extends the commonly used pins of the micro:bit in the form of pin headers, allowing for the connection of additional sensors. It supports two types of multi-cell batteries and includes a micro USB port for external power banks, enhancing power adaptability and safety. To facilitate installation on other devices, the expansion board is equipped with four 4MM mounting holes, which are also compatible with universal building blocks, making it highly convenient for use in building block projects.



2. Specification parameter

Shield	
Name	mShield expansion board for Microbit
SKU	M1E0002
USB	**Applicable motherboard**
Micro USB	Micro:bit
Pins	
Digital I/O Pins	9 (P0, P1, P2, P8, P9, P13, P14, P15, P16)
Analog read pins	3 (P0, P1, P2)
Analog write pins	9 (P0, P1, P2, P8, P9, P13, P14, P15, P16)
PWM pins	4 (S1~, S2~, S3~, S4~), period: 2ms.
Servo pins	4 (S1~, S2~, S3~, S4~)
Communication	
UART	Yes
I2C	Yes
SPI	Yes
IR receiver	Yes (NEC)
Power	
Input voltage (nominal)	3--9V
DC Current for 3.3V Pin	500 mA
DC Current for 5V Pin	2000 mA
Motors	
Connectors	Motor1, Motor2 (XH2.54 2P)
Output voltage	3--9V
LEDs	
Number	4 (20%, 40%, 60%, 80%)
Dimensions	
Width	62 mm
Length	73 mm
Height	14mm
Weight	29.16 g

3. Interface specification



Number	Description
1	Micro USB port, only used for external power supply(5V)
2	Infrared receiver, using P12 pin
3	Micro:bit slot
4	LED Indicator, controlled by an internal I2C chip.
5	Power socket, accepts input voltage of 3-9V, can be connected to 3, 4, 5, or 6 AA batteries, or 1 or 2 lithium batteries, with reverse connection protection
6	Power socket switch
7、8	Motor interface, can connect to 3-9V DC motors, the motor voltage equals the power socket voltage. Controlled by an internal I2C chip
9、10	V1 and V2 pin header output voltage selection switch
11、12	Microbit IO expansion port
13	mShield internal expansion por, controlled by an internal I2C chip.
14	3.3V power I2C interface，P19(SCL), P20(SDA)。
15	5V power I2C interface, P19(SCL), P20(SDA)。

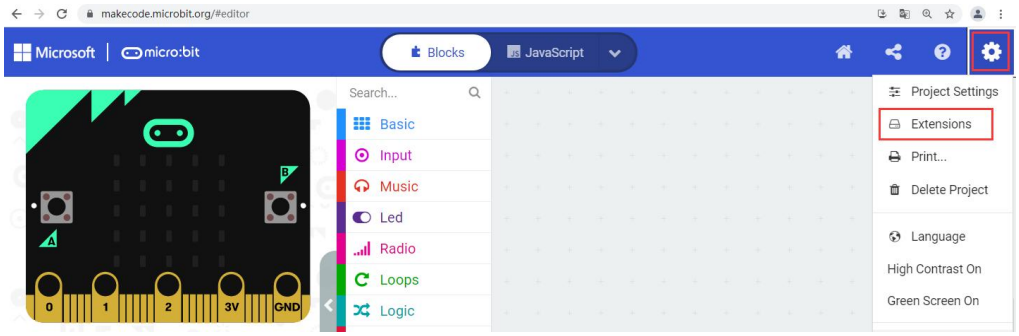
4. MakeCode Extension for mShield

We have developed an extension for mShield expansion board, which makes it easier for us to use MakeCode to program mShield.

4.1 Add mShield extension

The steps to add the extension to the Makecode are as follows:

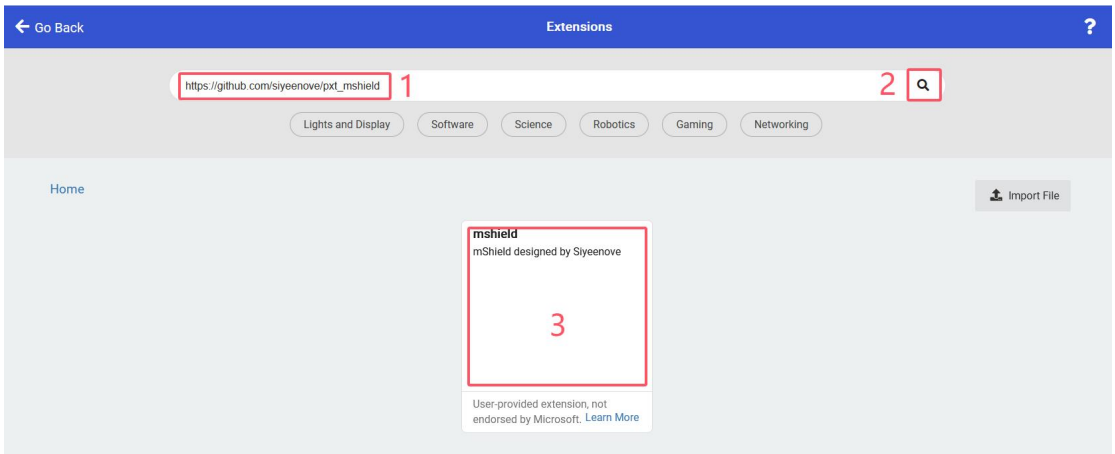
Click the **Settings** button in the upper right corner of the interface and click "**Extensions**"



Extension link for mShield：**https://github.com/siyeenove/pxt_mshield**

Copy the above link into the search box on the extension page and click the search button on the right.

Click on the extension named **mshield** in the search results.



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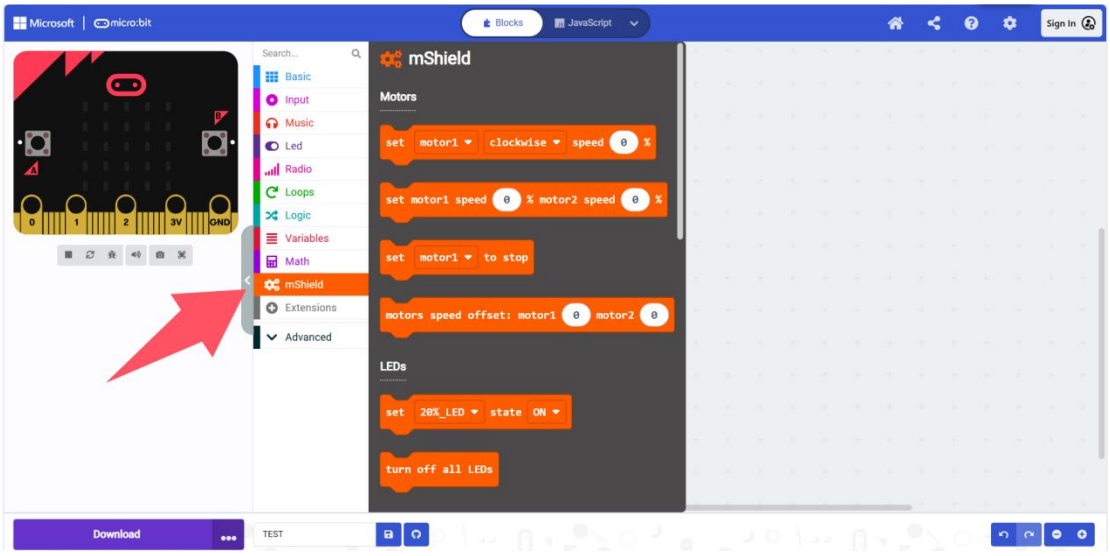
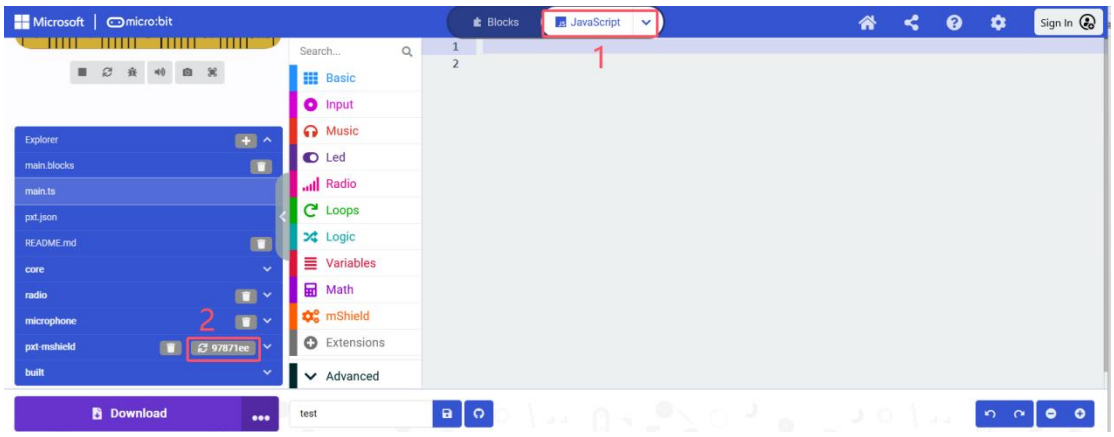
After a few seconds the page will jump to the Makecode main interface, and you will see the added **mShield** extension in the toolbox list.



4.2 Refresh mShield extension

Open the project with the mCar extension added, and switch to the JavaScript programming interface to refresh the extension:



After refreshing, switch back to the "Blocks" interface.

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4.3 Parsing of mShield extension statement

All Makecode statements based on mShield are integrated in the mShield extension package. The statement analysis is as follows:

Motors	 Set the mShield's motors to turn clockwise or counterclockwise, and at what speed.
	 Set the speed and direction of the left and right motors of the mShield.
	 Set the mShield motors to stop turning.
	 Adjust the speed of the motor1 and motor2 of mShield and save them permanently inside mShield. This statement can be used to adjust the speed of motors.
LEDs	 Turn ON the LED of the mShield.
	 Turn off all LEDs of mShield.
Infrared sensor	 Infrared receiving loop function, this function has been processing the received infrared data.
	 Determine whether the data received by the infrared receiver is equal to the key value in the Statement tab.

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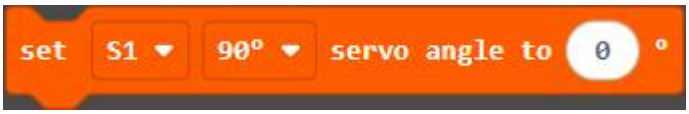
Infrared sensor	 Read the data received by the infrared receiver. Before using this statement, use the "if" statement to determine when the return value is not 0, and then the data will be valid.
PWM port	 Set the operation mode of S1, S2, S3 and S4 ports.
	 The statement used to make S1, S2, S3 and S4 output PWM signals.
	 To drive the servo statement, which can drive 90, 180, and 270 degree servos; the interface is the S1, S2, S3, and S4 expansion port on the mShield.
	 The driving statement of 360-degree servo; the interface is S1, S2, S3 and S4 expansion port on mShield.
Baterry	 Statement to sets the battery model and reads the battery voltage, returning the battery level between 0 and 100%. **It is recommended to execute this statement once when the machine is turned on.**
Others	 Read the version number of mCar and return a string value.

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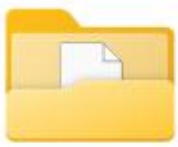
5. Example code

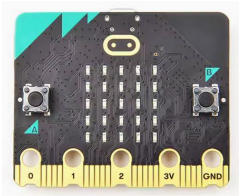
All sample codes are saved in the "sample code" folder.



sample code

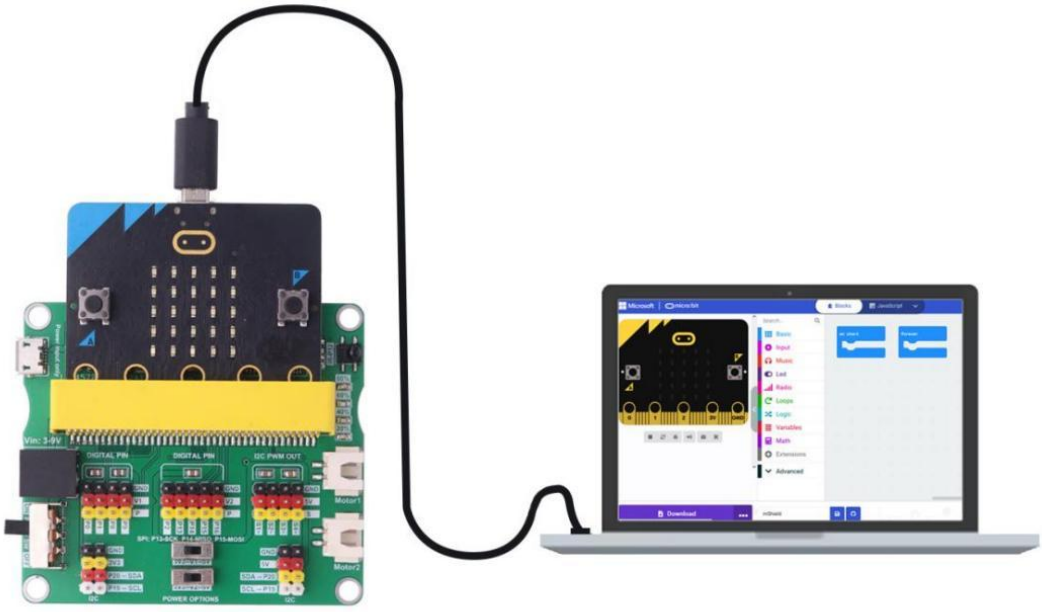
5.1 Firmware version

Prepare:

PC	Micro:bit V2.x.x	USB cable
		

Wiring:

Insert the Micro:bit V2 into the mShield expansion board with the LED matrix facing upwards, then connect the Micro:bit V2 to the computer using a USB cable.



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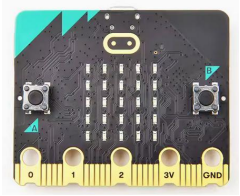
Code:

Result:

The mShield expansion board integrates an 8-bit microcontroller for driving motors, LEDs and S1-S4 ports. We have burned the firmware into it before leaving the factory. Through the above code, you can read the firmware version and display the version number in the microbit LED dot matrix.

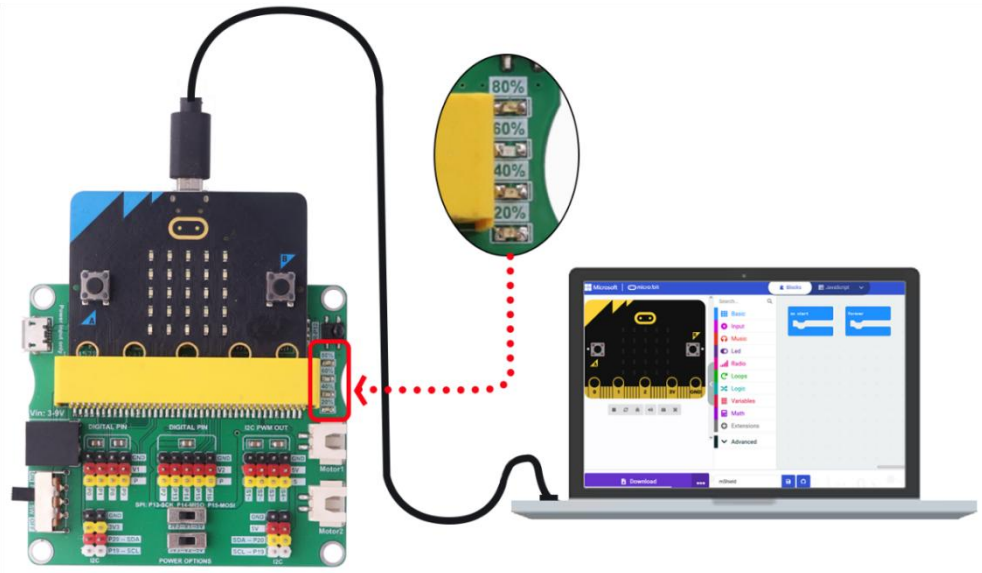
5.2 LEDs

Prepare:

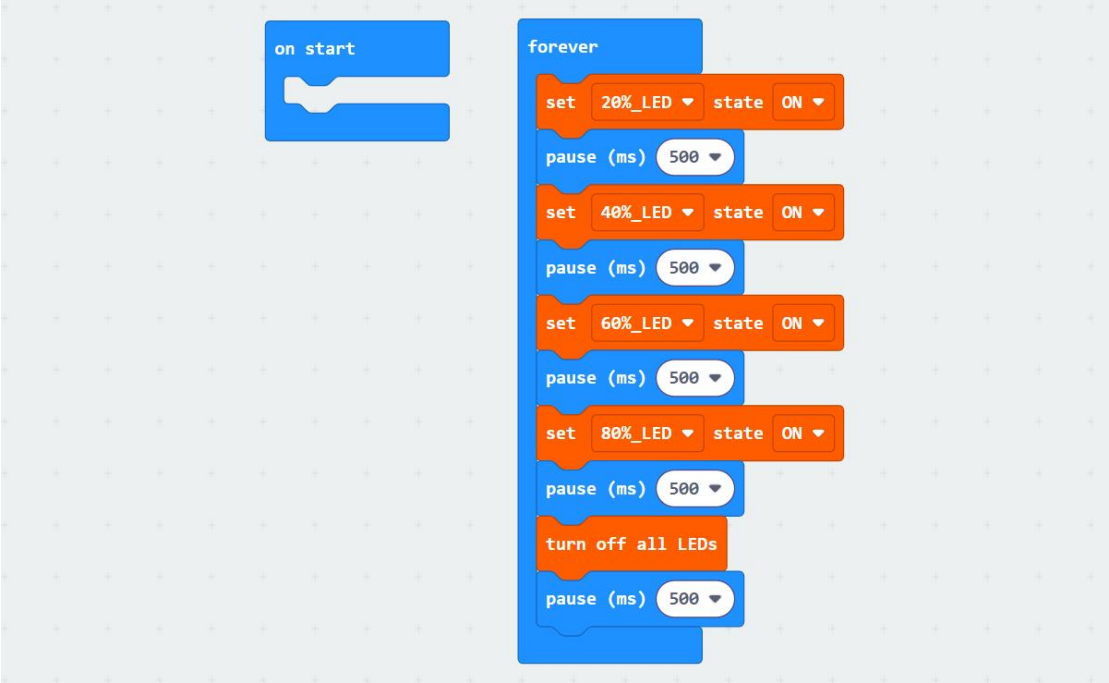
PC	Micro:bit V2.x.x	USB cable
		

Wiring:

Insert the Micro:bit V2 into the mShield expansion board with the LED matrix facing upwards, then connect the Micro:bit V2 to the computer using a USB cable.



Code：

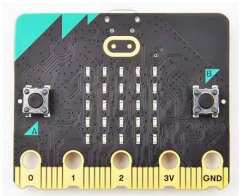


Result:

It will cycle through lighting each LED.

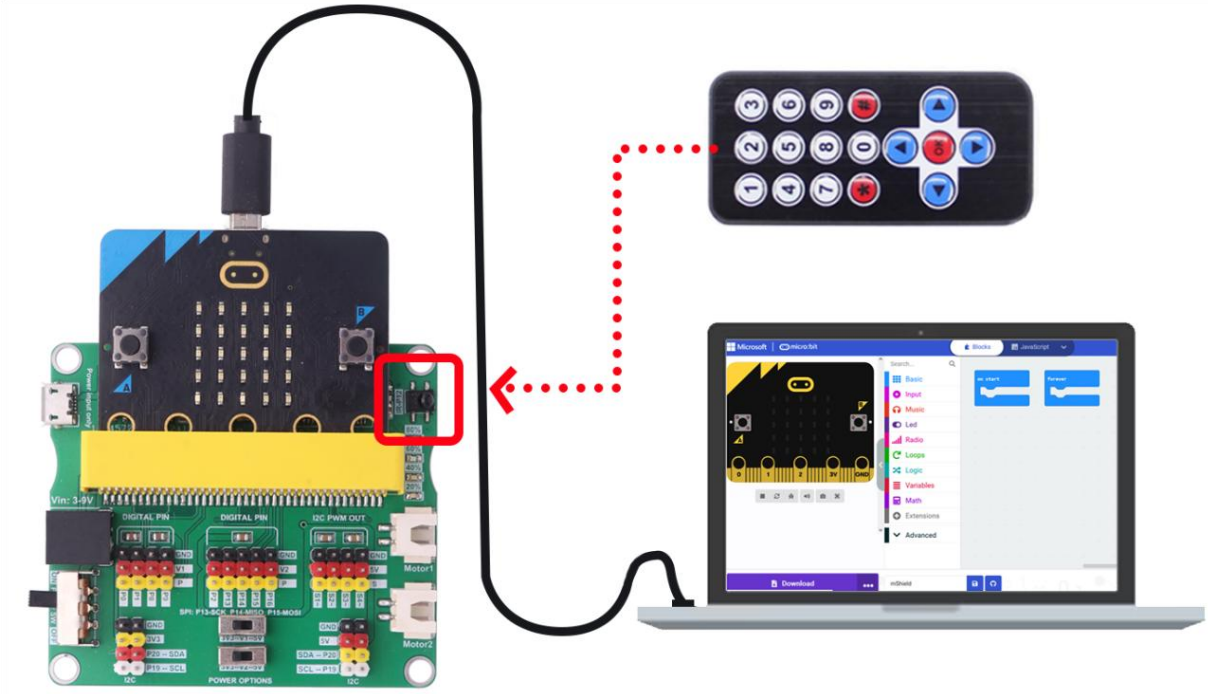
5.3 IR receiver

Prepare:

PC	Micro:bit V2.x.x	USB cable	IR remote
			

Wiring:

Insert the Micro:bit V2 into the mShield expansion board with the LED matrix facing upwards, then connect the Micro:bit V2 to the computer using a USB cable.



Code:

Result:

Point the remote control at the infrared receiver sensor on the expansion board and press any key; the corresponding key value will be displayed on the Micro:bit's LED matrix.

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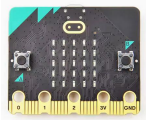
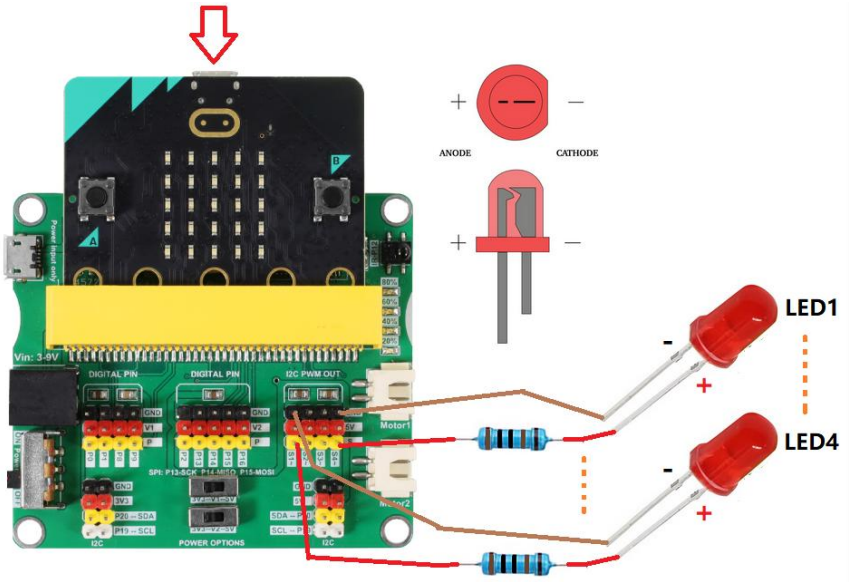
5.4 PWM

Prepare:

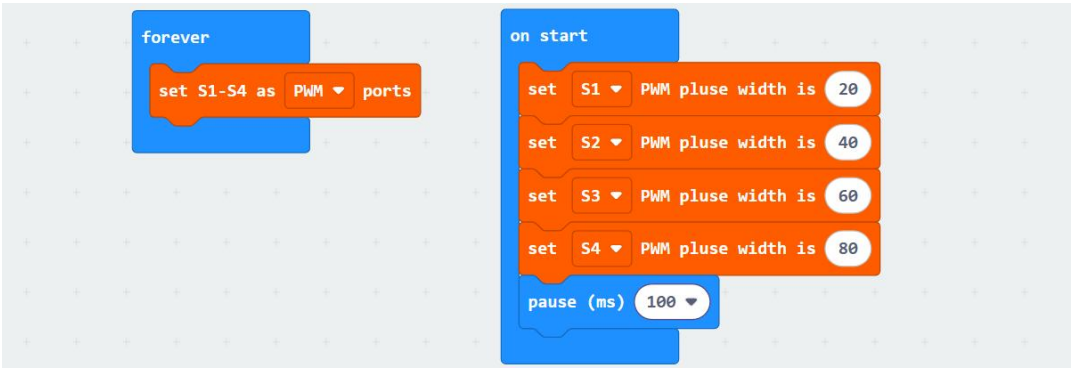
PC	Micro:bit V2.x.x	USB cable	LED
			
1K resistor	Female-to-female Dupont wires		
			

Wiring:

Connect to computer with usb cable



Code:



Result:

The S1, S2, S3, and S4 pins output PWM signals with duty cycles of 20%, 40%, 60%, and 80% respectively, resulting in the following LED brightness levels: LED1 < LED2 < LED3 < LED4.

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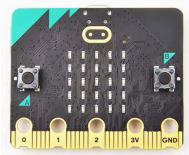
5.5 Battery voltage

Prepare:

PC	Micro:bit V2.x.x	USB cable	3xAA battery power
			

Wiring:

Insert the Micro:bit V2 into the mShield expansion board with the LED matrix facing upwards, then connect the Micro:bit V2 to the computer using a USB cable.

Connect an external DC 3-9V power supply to the shield and turn on its power switch.

Code:

Result:

When the mShield is connected to three AA batteries in series, the micro:bit can read the voltage ratio of the batteries (0-100%) and display this value on the micro:bit LED matrix.

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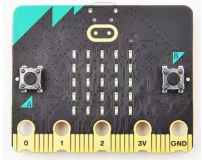
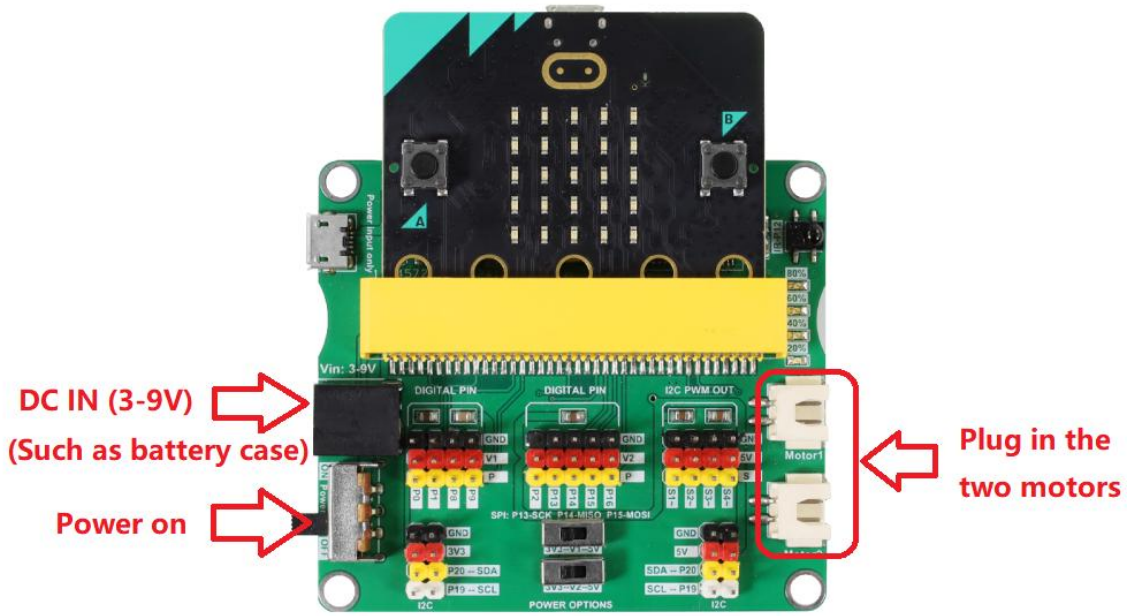
5.6 Motors

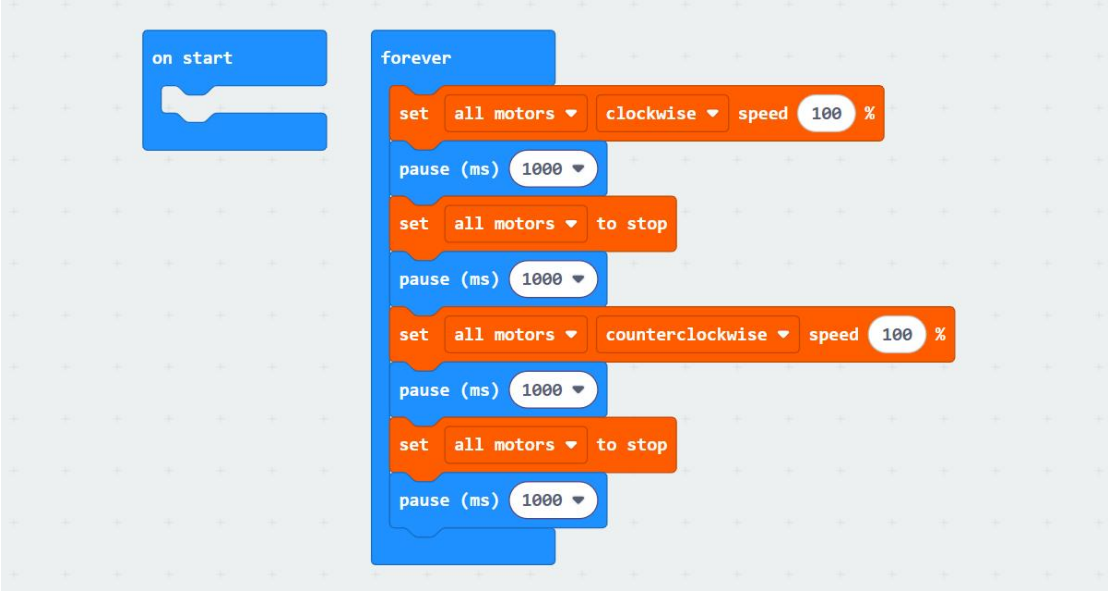
Prepare:

PC	Micro:bit V2.x.x	USB cable	
			
3xAA battery power			
			

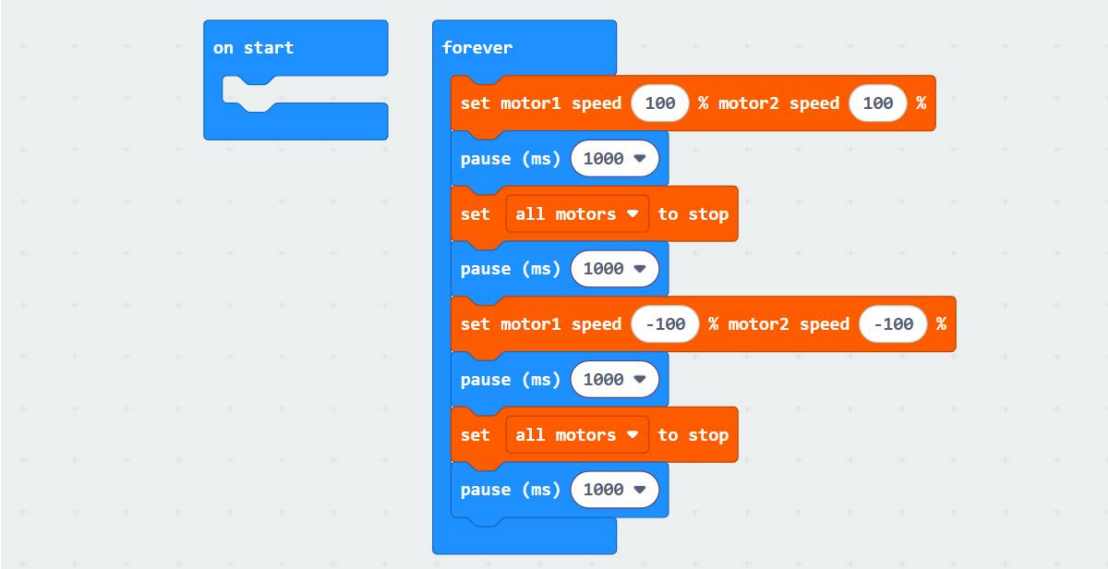
Wiring::



Code1：



Code2：



The results of these two codes are the same:

When external motors are connected to the Motor1 and Motor2 interfaces, Motor 1 and Motor 2 will first rotate clockwise for 1 second, then stop for 1 second; next, they will rotate counterclockwise for 1 second, and then stop for 1 second, repeating this cycle continuously.

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Additional：

If, due to hardware differences in the motors, the two motors connected to the expansion board's motor interfaces have varying speeds despite being given the same speed value, we can address this discrepancy using the following statements. The compensated speed parameters can then be permanently saved in the mShield.

Motor speed compensation is achieved by reducing the speed of one motor to align the speeds of both motors. The compensation value ranges from -10 to 0. This statement only needs to be executed once during program runtime to permanently save the compensated speed parameters in the mShield. Subsequent code implementations do not require the inclusion of this statement unless further adjustments to the motor compensation speed are desired.

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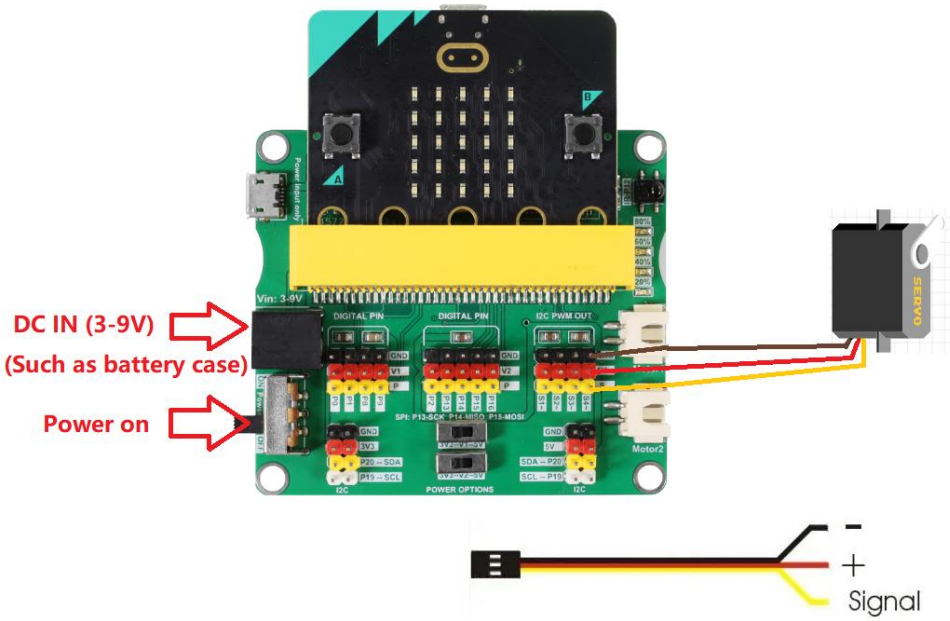
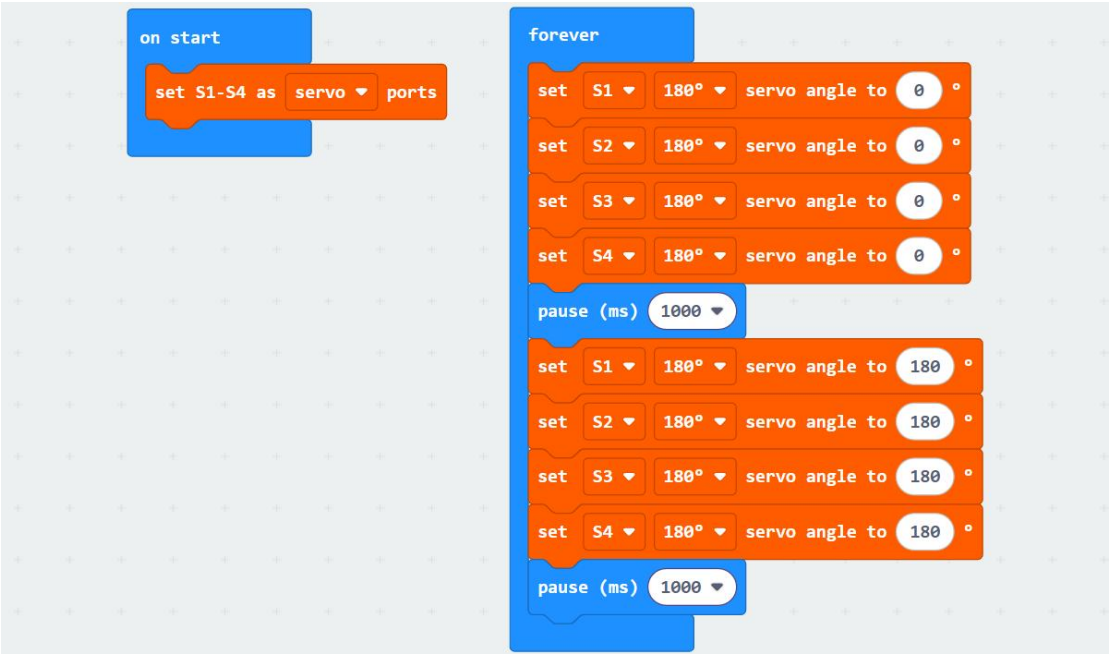
5.7 180 degree Servo

Wiring:



Code:



Result:

When the S1, S2, S3, and S4 pins are connected to an external 180-degree servo, the servo swings between 0 and 180 degrees at intervals of 1 second.

Note: The usage of a 90-degree servo is similar to the above code.

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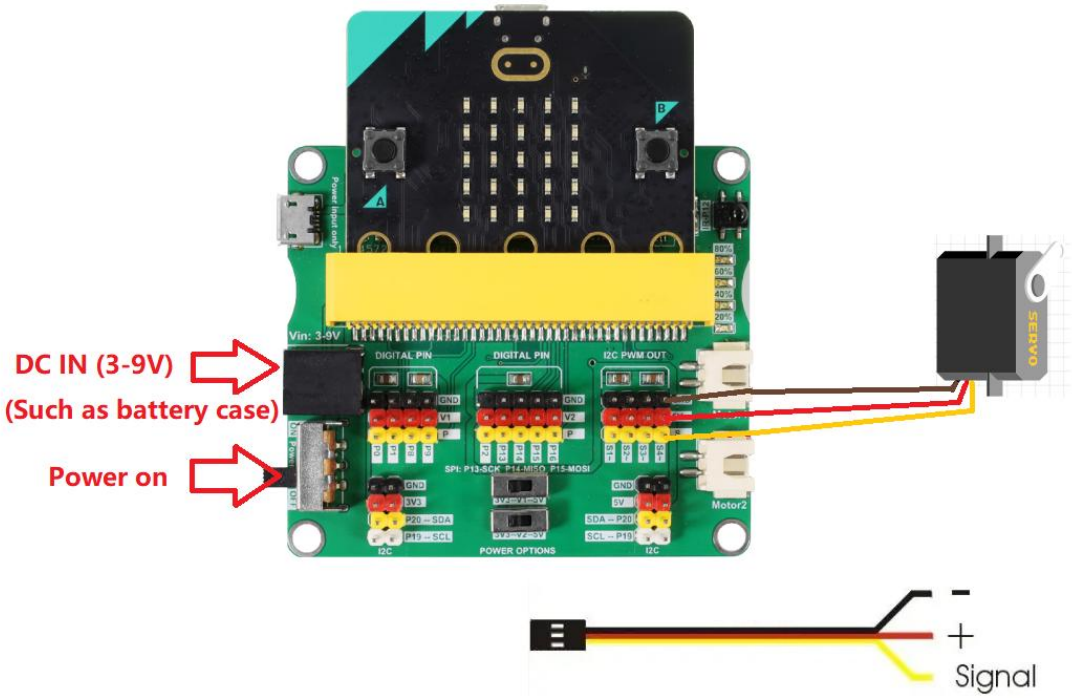
5.8 360 degree Servo

Wiring:



Code:

Result:

When the S1, S2, S3, and S4 pins are connected to an external 360-degree servo, the servo will rotate forward and reverse at the maximum speed at an interval of 1 second.

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