

Mi:Node Kit User Manual

Make creative 'things' with micro:bit

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TOC

Mi:Node Kit User Manual

Introduction

Features

What is the Kit?

What is it include?

How it works

E-brick Connector

E-brick Connector - Analog In/PWM Type

E-brick Connector - Digital IO Type

E-brick Connector - IIC Type

Conversation on Remaping Micro:bit Edge Pin

How to use it

Programming with the kit

Work with our library

Steps

Work without our library

Modules Usage & API Reference

Light Sensor

Block API

Get the light level

Parameters

Light Sensor event

Parameters

Example

Show the light level

Light level change event

DHT11(Temperature and Humidity Sensor)

Block API

Get the temperature

Parameters

Get humidity

Parameters

Temperature change event

Parameters

Example

Use button to get the temperature and humidity

Temperature change event

Sound Sensor

Block API

Get sound level

Parameters

Sound Sensor event

Parameters

Example

Show the sound level
Sound level change event

Rotary Module

Block API

Get the percentage
Parameters

Light Sensor event
Parameters

Example

Show the percentage
Rotary control the LED show
Rotary change event

Mini Fan Module

Block API

Control the motor speed
Parameters

Example

Use button to control the motor's speed.

Speaker Module

Example

Let your speaker make a sound

PIR Module

Block API

Check the PIR status
Parameters

PIR event
Parameters

Example

Detecting the movement

RGB LED

Block API

Choose a RGB color
Parameters

Set a specific RGB color by setting rgb gray value
Parameters

Example

Use button to show different color.
Set specific color

Switch Module

Block API

Check the switch's status
Parameters

Switch event
Parameters

Example

Switch control the screen show

Show the switch module's status

Relay Module

Block API

Set relay status(open/close)

Parameters

Example

Control the relay by button

Appendix

Microsoft PXT

Support

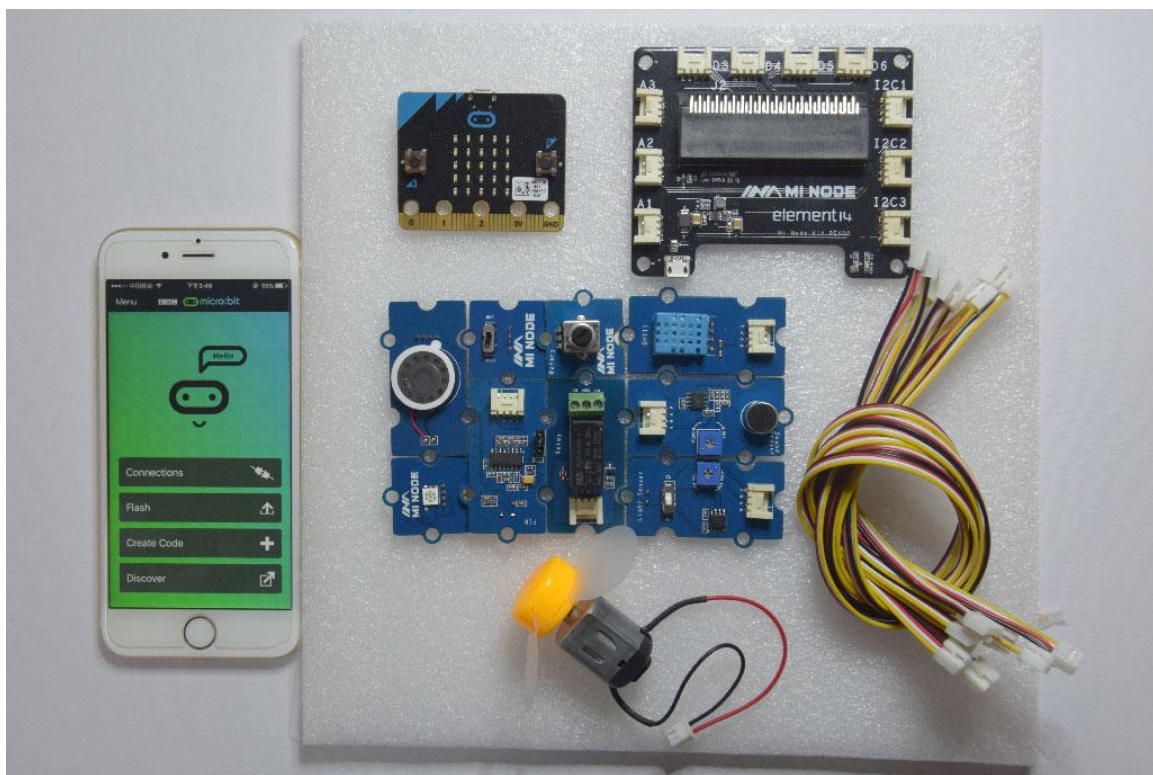
Introduction

The Mi:Node kit is a modular, safe and easy to use group of items that allow kids to minimize the effort required to get started with IOT learning with Micro:bit.

For this kit, there is no need for soldering, plug then use, the construction of the working circuit can be done within one minute.

Features

- It is modular, safe and ready-to-use just like Lego
- 10 sensor modules include environmental monitoring, user interface and physical monitoring can be built a lot of cool projects include wearable device and smart home, etc.
- It is expandable and reusable
- Rich education guide document and many project stories



What is the Kit?

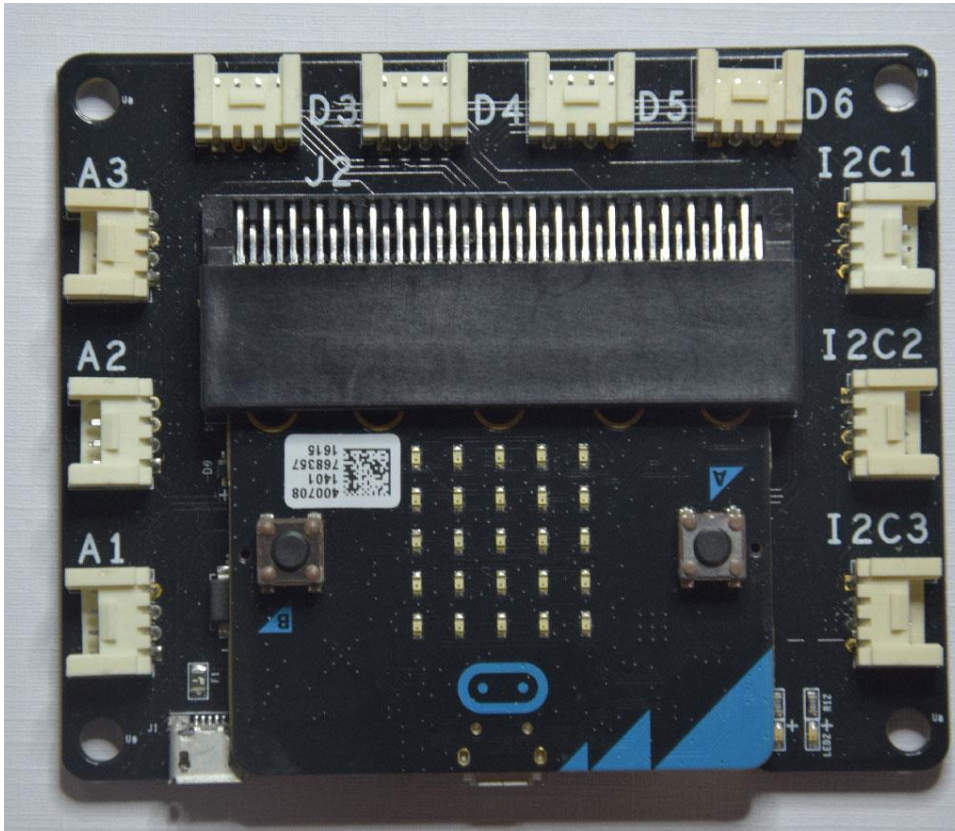
What is it include?

Category	Module	Quantity	Conector Type	Description
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Micro:bit	Micro:bit Main Board	0	NA	The Micro:bit is not include in the kit
Connect Board	Connect Board	1	NA	This a bridge between the micro:bit and sensor modules
Sensor Module (10)	Light Sensor	1	Analog Input	It can be used to detect the intensity of light in the environment
	Temperature and Humidity Sensor	1	Analog Input	It can get temperature and humidity in the environment
	Sound Sensor	1	Analog Input	It can detect the sound strength of the environment
	Rotary Angle	1	Analog Input	It can produce analog output between 0 and Vcc by adjust the angular range from 0 ~ 300.
	Mini Fan	1	Analog Output/PWM	A DC motor + orbit fan
	Speaker	1	Analog Output/PWM	Voice output speaker
	PIR Motion Sensor	1	Digital Input	It allows user to sense motion, usually human movement in its range
	RGB LED	1	Digital Output	A colorful LED. The color and brightness can be programable
	Switch	1	Digital Input	It can used to switch ON/OFF
	Relay	1	Digital Output	It is an digital switch can be used to control high-votage electrical devices. (maximum 250V)
Cables	Universal 4 Pin Buckled Cable	8	NA	20cm cable x 2, 10cm cable x 6
	Micro-B USB cable	2	NA	1 for power input, 1 for micro:bit program upload

How it works

The kit is composed of a connect board and several sensor modules. The connect board is a bridge between the micro:bit main board and the sensor modules. It converts the micro:bit edge connector into several E-brick connector. The sensor modules can be attached to it by cable.



E-brick Connector

The E-brick connectors are compatible with the standard Grove from Seeed. It's a 2.0mm 1x4 connector. With signals include: 1 VCC, 1GND, 2 analog / digital signal.

An E-brick connector have 4 pins:

Pin ID	Pin Name	Description
Pin#1	Signal#1	Connect to a micro:bit pin with analog in / digital io / i2c function
Pin#2	Signal#2	Same to Signal#1. The Signal#2 is often not used, because 1 signal pin is enough for most sensor modules
Pin#3	VCC	Power pin

Pin#4 GND Power pin

There are 3 types of the connector:

- 3 analog input connectors
- 3 I2C connectors
- 4 digital IO connectors

E-brick Connector - Analog In/PWM Type

Pin ID	Pin Name	Remark
Pin#1	A1	Connect to a micro:bit pin with analog input/PWM function
Pin#2	A2	Same to A1, but most sensor module may not use the A2 pin

E-brick Connector - Digital IO Type

Pin ID	Pin Name	Remark
Pin#1	D1	Connect to a micro:bit pin with digital io function
Pin#2	D2	Same to D1, but most sensor module may not use the D2 pin

E-brick Connector - IIC Type

IIC (Inter-Integrated Circuit), pronounced I-squared-C, is a multi-master, multi-slave, single-ended, serial computer bus invented by Philips Semiconductor (now NXP Semiconductors). It is typically used for attaching lower-speed peripheral to microcontrollers in short-distance, intra-board communication.

There are some sensor modules based on the IIC bus. We can attach several modules on the same bus, Because they can be identified by different addresses.

Pin ID	Pin Name	Remark
Pin#1	IIC SCL	IIC clock signal. Connect to micro:bit pin19
Pin#2	IIC SDA	IIC data signal. Connect to micro:bit pin20

Conversation on Remapping Micro:bit Edge Pin

Please note the Connector Name. There is a convention in the connector name. A connector name can be indicated the mapped micro:bit signal name.

For example: Connector D12 means: The Signal#1 is remapped to micro:bit pin 12, and Signal#2 is remapped to micro:bit pin 13(12+1)

It's useful for us to position the micro:bit pin quickly when develop code.

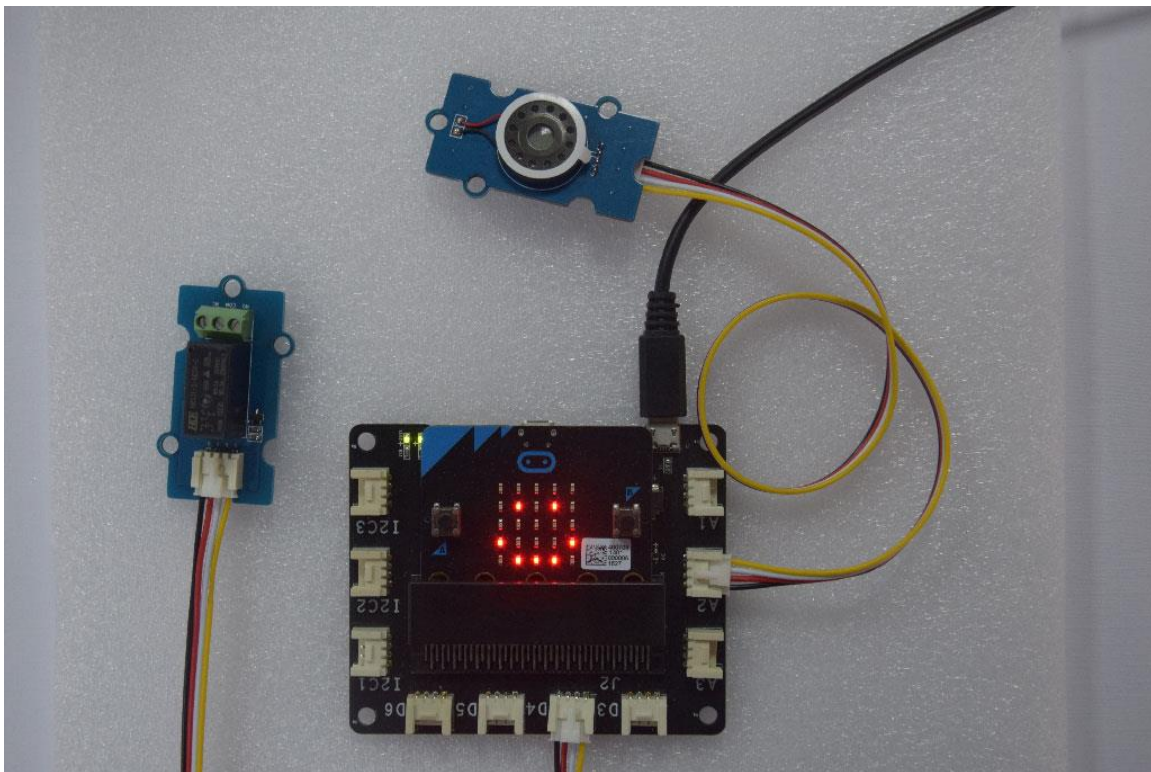
Connector Type	Connector Name	Micro:bit Pin Name(Signal#1, Signal#2)
Analog Input /	A0	pin0, pin1
Digital IO	A1	pin1, pin2

	A2	pin2, pin3
Digital IO	D12	pin12, pin13
	D13	pin13, pin14
	D14	pin14, pin15
	D15	pin15, pin16
IIC	IIC	pin19, pin20
	IIC	pin19, pin20
	IIC	pin19, pin20

- We usually use A0, A1, A2 as a analog input connector, but it can also be used as a digital io connector.
- D12, D13, D14, D15 can be only used as digital IO connector.
- 3 IIC can be only used as IIC connector.

How to use it

Just plug then use it, That's easy.



Programming with the kit

As you know, There are 5 editors we can chose on micro:bit official website.

- Microsoft PXT
- Code Kingdoms JavaScript
- Microsoft Block Editor
- Microsoft Touch Develop
- python

We'll focus more on the **Microsoft PXT**.

Work with our library

We'll develop the libraries for the sensor modules. This can reduce your effort on using the modules. You don't have to study the technical details of the modules. For example, The RGB LED is based on the IIC bus, We just need to call the library function to control the color and brightness. We don't care the IIC bus itself.

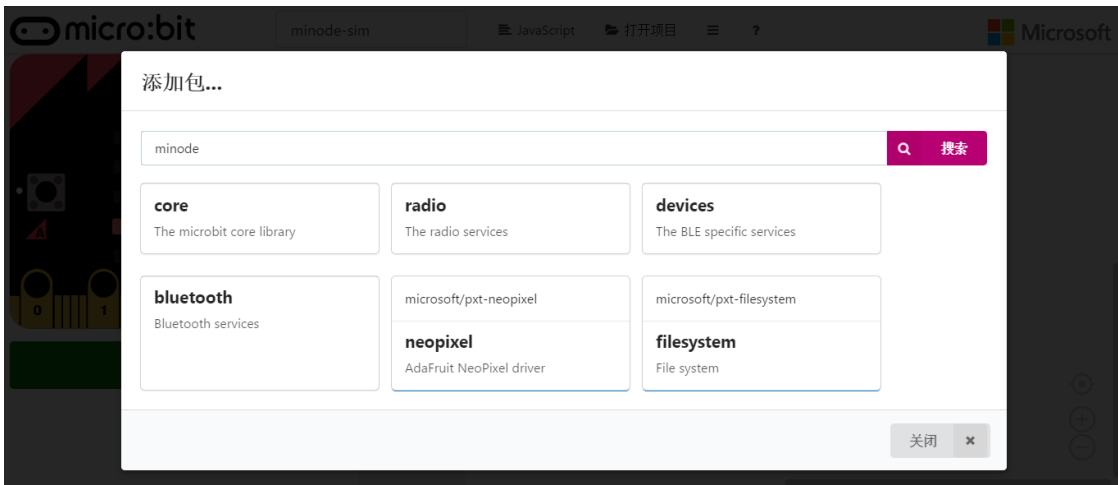
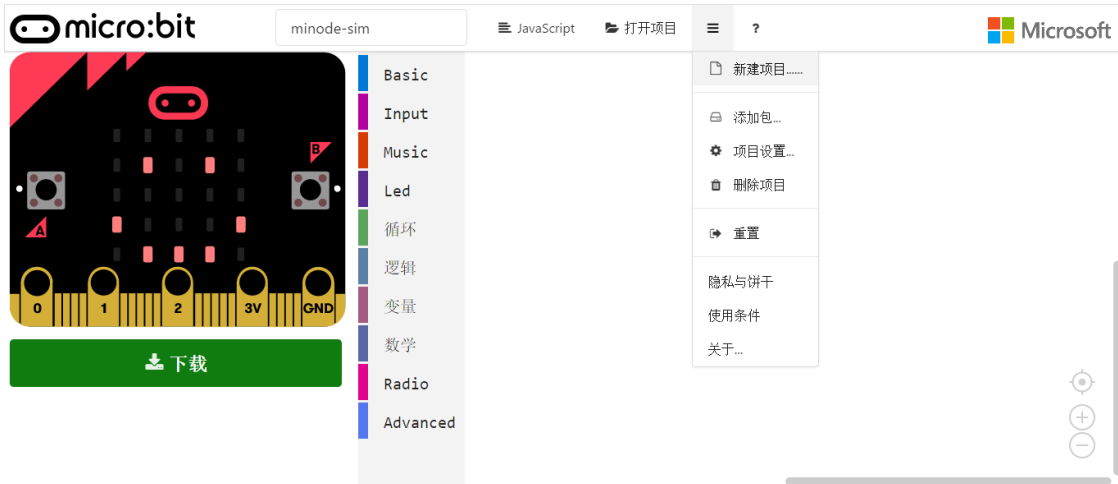
With the library, you don't need to care which pin a module connects to, You just need to know what E-brick connector is used.

NOTE

The library is based on Microsoft PXT.

Steps

- Step 1: Add our library to your code
- Step 2: Refer to the API reference or example code
- Step 3: Drag the library blocks.





Work without our library

You can also use the micro:bit pin library to control the sensor modules directly. In this situation, We can get the micro:bit pin ID by the E-brick connector ID. For example, We connect a sensor module to D12. Then We can get that the corresponding Micro:bit pin is pin12.

Modules Usage & API Reference

Light Sensor

The Light Sensor module can be used to detect the intensity of light in the environment. We divide the brightness into 5 levels. This module can only be plugged into **Analog connector(A0, A1 and A2)**.



Module	Connect Type	Available Connectors
Light Sensor	Analog	A0, A1, A2

Block API

Get the light level

Get current light level, we divide the light intensity into 5 levels, from 1 to 5, which 1 represents brightest and 5 represents darkness.

A screenshot of a block API call. The text 'light' is followed by a dropdown menu showing 'A0' and a downward arrow, followed by the text 'get level'. The entire block is highlighted with a purple background.

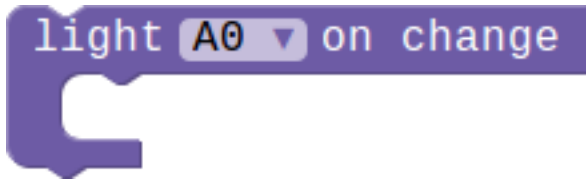
```
function LightSensorGetLevel(connName: AnalogConnName): number;
```

Parameters

- **connName** is the analog connector's name. This module can only be plugged into analog connector A0, A1, and A2.

Light Sensor event

Configure the MCU check the light level periodically, and then execute the associated code block whenever the light level changes.



```
function onLightSensorEvent(connName: AnalogConnName, body: () => void): void;
```

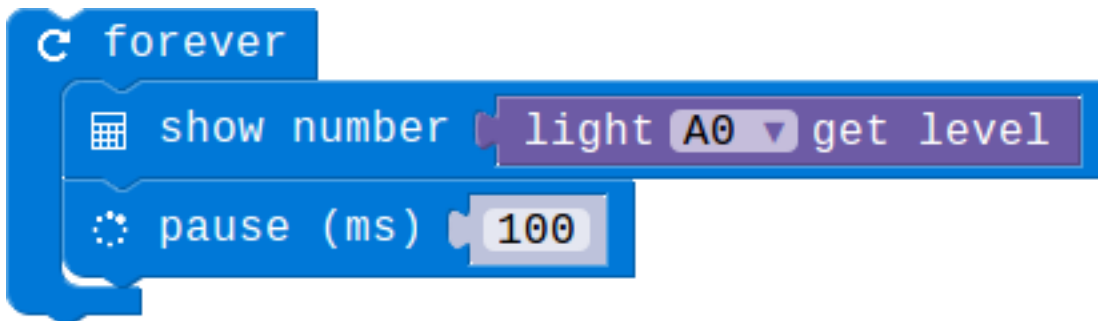
Parameters

- **connName** is the analog connector's name. this module can only be plugged into analog connector A0, A1 and A2.

Example

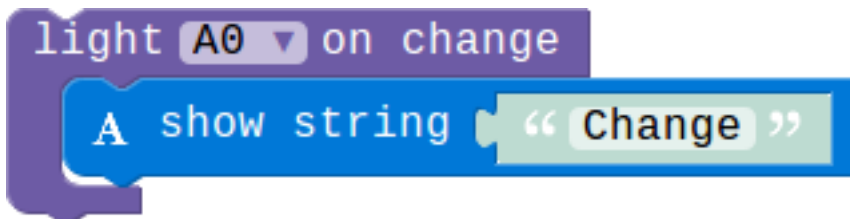
Show the light level

This example show you how to get the current light level, and show it on the LED screen.



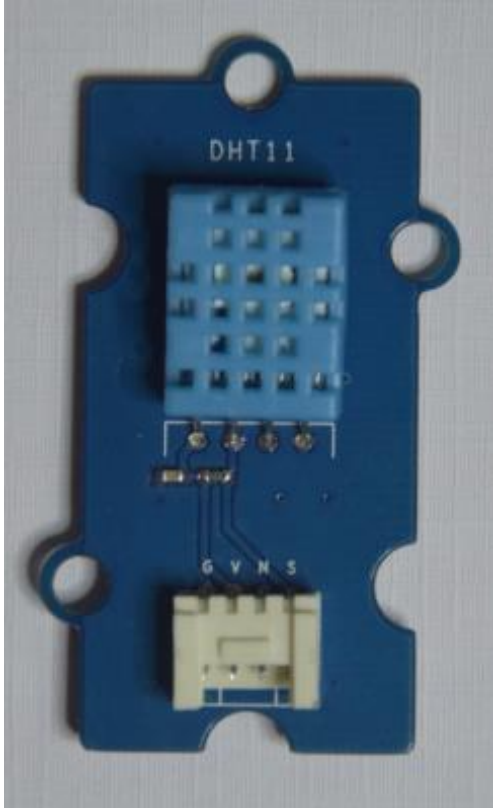
Light level change event

When the light level changes there will show a string on the screen.



DHT11(Temperature and Humidity Sensor)

This DHT11 Temperature & Humidity Sensor features a temperature & humidity sensor complex with a calibrated digital signal output. It can get temperature and humidity in the environment



Module	Connect Type	Available Connectors
DHT11	Digital IO	D12, D13, D14, D15

TODO

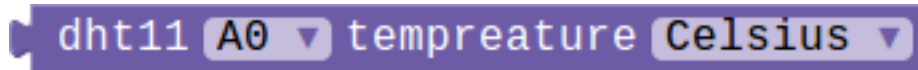
Need hardware engineers to confirm this module's specific parameters.

Module	Measurement Range	Humidity Accuracy	Temperature Accuracy
DHT11	20-90%RH / 0-50 °C	±5%RH	±2°C

Block API

Get the temperature

Get current temperature, you can configure the format of the temperature in Celsius or Fahrenheit.



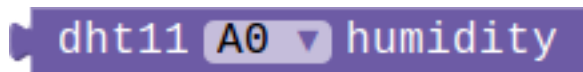
```
function DHTGetTemperature(connName: ConnName, style: DHTTemStyle): number;
```

Parameters

- **connName** is the connector's name. this module can be plugged into both analog connector and digital connector.
- **style** is the format of the temperature. you can choose Celsius or Fahrenheit.

Get humidity

Get current humidity.



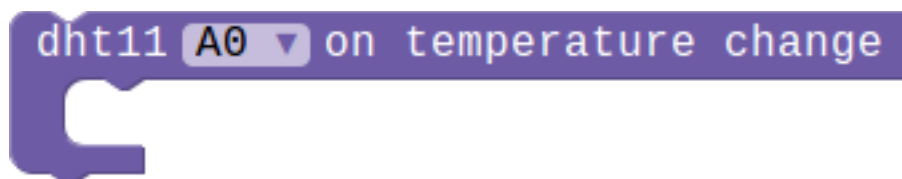
```
function DHTGetHumidity(connName: ConnName): number;
```

Parameters

- **connName** is the connector's name. this module can be plugged into both analog connector and digital connector.

Temperature change event

Configure the MCU check the temperature periodically, and then execute the associated code block whenever the temperature changes. The smallest unit of changing is 1 degrees Celsius.



```
function onDHTEvent(connName: ConnName, body: () => void): void;
```

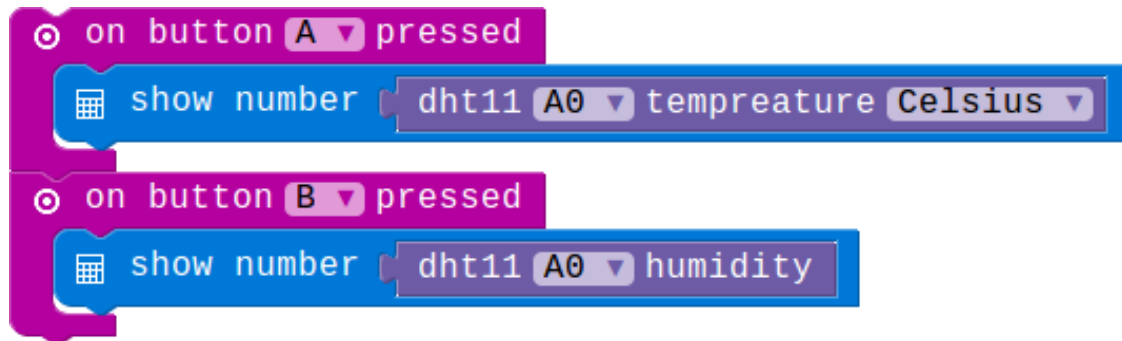

Parameters

- **connName** is the analog connector's name.this module can be plugged into both analog connector and digital connector.

Example

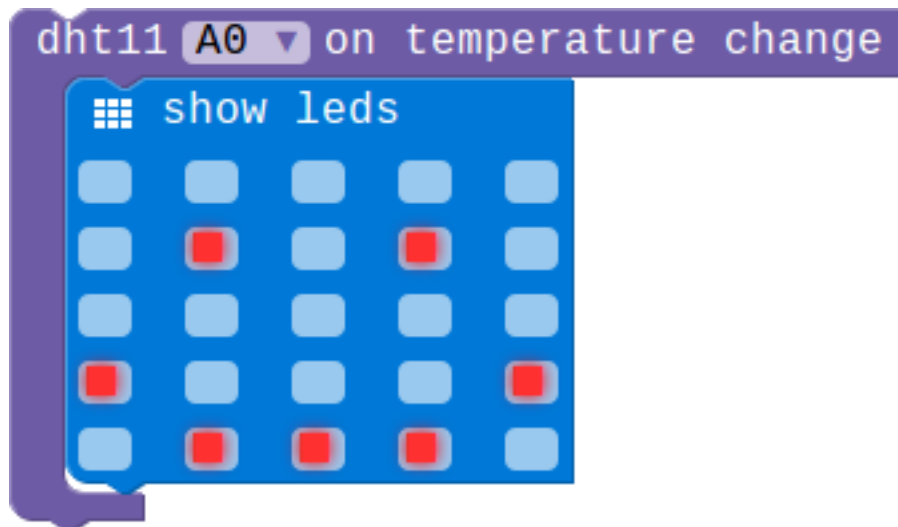
Use button to get the temperature and humidity

This example show you how to use the button A and B to get the temperature and humidity.When you press the button A the screen will show the current temperature,if the button is B it will show the humidity.



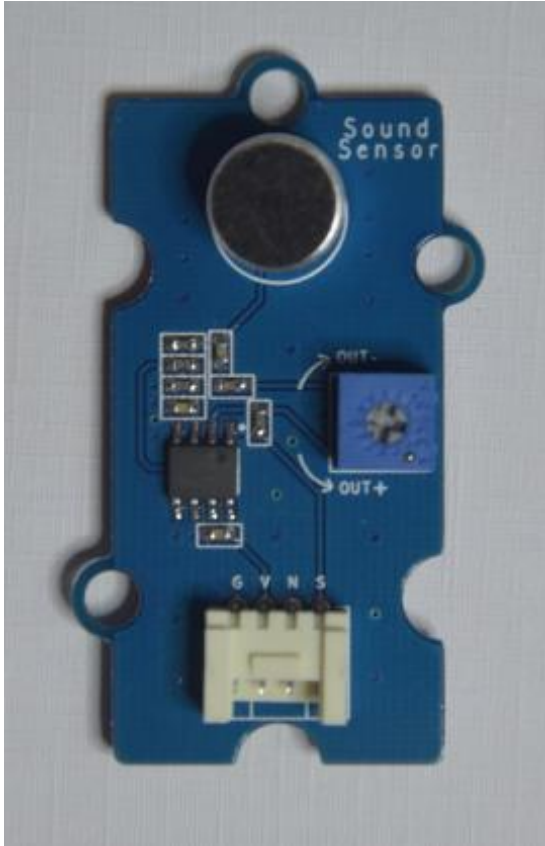
Temperature change event

When the temperature changes the screen will show a smile face!



Sound Sensor

The Sound Sensor Module can be used to detect the sound strength of the environment. We divide the sound into 5 levels, you can use our block to get the current level. This module can only be plugged into analog connector (A0, A1 and A2).



Module	Connect Type	Available Connectors
Sound Sensor	Analog	A0, A1, A2

Block API

Get sound level

Get current sound level, we divide the sound into 5 levels, range from 1 to 5, which 1 represents quiet and 5 represents noisy.

A purple Scratch block with a microphone icon on the left, the text "mic A0" in a dropdown menu, and "get level" on the right.

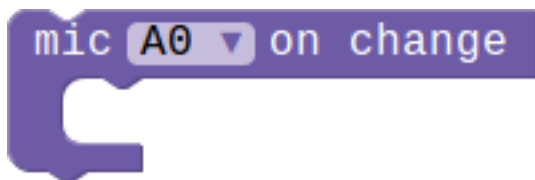
```
function MICGetLevel(connName: AnalogConnName): number;
```

Parameters

- **connName** is the analog connector's name.this module can only be plugged into analog connector A0,A1 and A2.

Sound Sensor event

Configure the mcu check the sound level periodically, and then execute the associated code block whenever the sound level change.

A purple Scratch block with a microphone icon on the left, the text "mic A0" in a dropdown menu, and "on change" on the right.

```
function onMICEvent(connName: AnalogConnName, body: () => void): void;
```

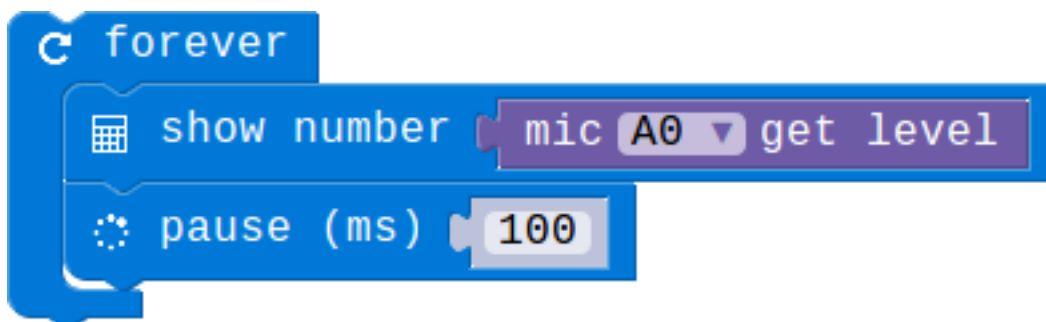
Parameters

- **connName** is the analog connector's name.this module can only be plugged into analog connector A0,A1 and A2.

Example

Show the sound level

This example show you how to get the current sound level,and show the level number on the LED screen.

A blue Scratch "forever" loop block containing three sub-blocks: "show number" with a calculator icon, "mic A0 get level" in a purple block, and "pause (ms)" with a value of "100".

Sound level change event

When the sound level changes a string will show on the screen.

```
mic A0 ▾ on change
  A show string "Change"
```

Rotary Module

The Rotary can produce analog output between 0 and Vcc by adjust the angular range from 0 ~ 300. This module can only be plugged into analog connector (A0, A1 and A2).



Module	Connect Type	Available Connectors
Rotary Sensor	Analog	A0, A1, A2

Block API

Get the percentage

Get the current rotary percentage. This value means how much you have rotated the rotary module.

A Scratch code block with a purple header and a white body. The header contains the text "rotary" followed by a dropdown menu showing "A0" and a downward arrow. The body contains the text "get Percentage".

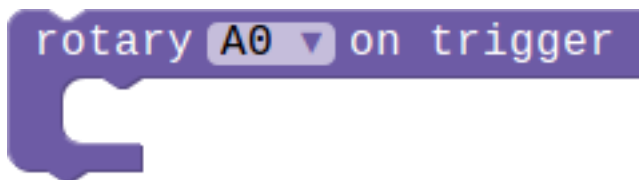
```
function RotaryGetPercentage(connName: AnalogConnName): number;
```

Parameters

- **connName** is the analog connector's name.this module can only be plugged into analog connector A0,A1 and A2.

Light Sensor event

Configure the mcu check the rotary AD value periodically, and then execute the associated code block whenever the AD value changes.

A Scratch code block with a purple header and a white body. The header contains the text "rotary" followed by a dropdown menu showing "A0" and a downward arrow. The body contains the text "on trigger".

```
function onRotaryEvent(connName: AnalogConnName, body: () => void): void;
```

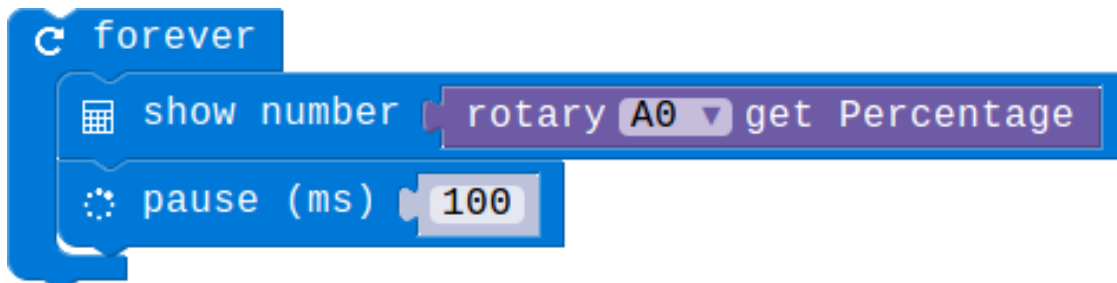
Parameters

- **connName** is the analog connector's name.this module can only be plugged into analog connector A0,A1 and A2.

Example

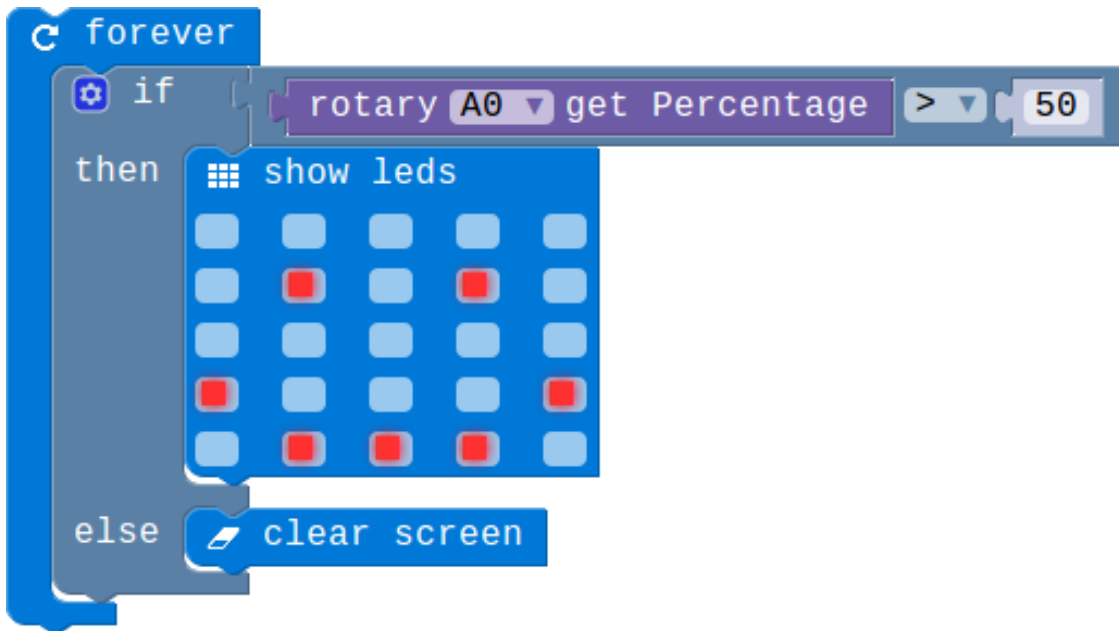
Show the percentage

This example show you how to get the current percentage,and show it on the LED screen.

A Scratch code block with a blue header and a white body. The header contains the text "forever" with a circular arrow icon. The body contains three code blocks: "show number" with a calculator icon, "rotary A0 get Percentage" with a purple header and white body, and "pause (ms)" with a clock icon and the number "100" in a grey box.

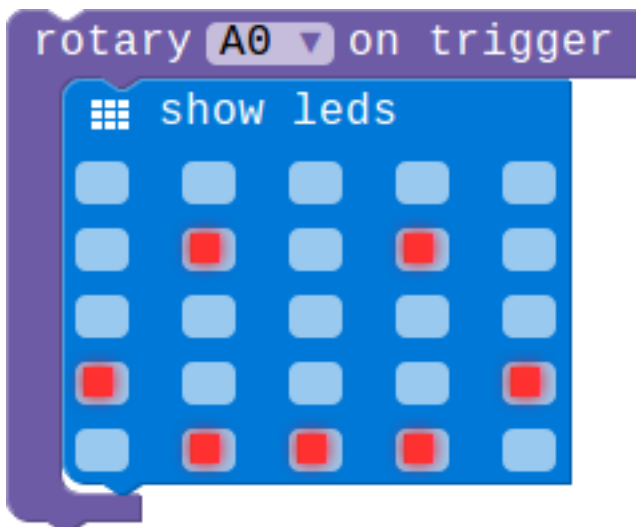
Rotary control the LED show

When the percentage is smaller than 50 the screen will show nothing, otherwise there will be a smile face on the screen.



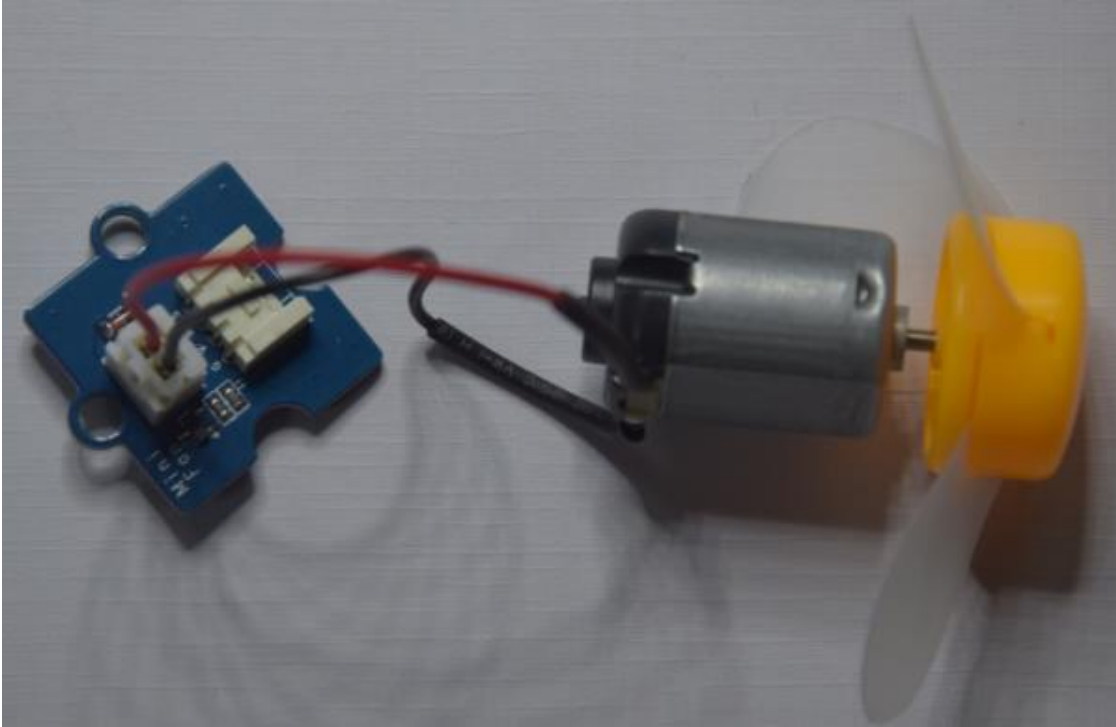
Rotary change event

When you rotating the potentiometer's knob ,the LED screen will show a smile face.



Mini Fan Module

The mini fan module contains a DC motor and orbit fan. we can control the speed of the motor according to different situations.

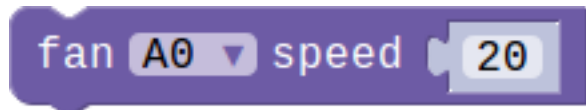


Module	Connect Type	Available Connectors
Mini Fan Module	Analog	A0, A1, A2

Block API

Control the motor speed

We use this block to control the motor's speed. you can change the speed by adjusting the second parameter, range from 0 to 100.



```
function FanControl_1(connName:AnalogConnName , speed:number): void
```

Parameters

- **connName** is the analog connector's name.this module can only be plugged into analog connector and digital connector.
- **speed** is the speed of the motor.The adjustment range is from 0 to 100.which 0 means the motor is shutting down and 100 means the fastest speed.

Example

Use button to control the motor's speed.

This example show you how to use the button A and B control the motor speed .
Button A control the motor to speed up, button B control the motor to deceleration.


```
set speed to 10
on button A pressed
  set speed to speed + 10
  if speed > 100
    then set speed to 100
on button B pressed
  set speed to speed - 10
  if speed < 10
    then set speed to 10
forever
  fan A0 speed speed
  pause (ms) 100
```

The image shows a Scratch script for controlling a fan's speed. It starts with a 'set speed to 10' block. Then, there are two event-driven blocks: 'on button A pressed' and 'on button B pressed'. The 'on button A pressed' block contains a 'set speed to speed + 10' block, followed by an 'if speed > 100 then set speed to 100' conditional block. The 'on button B pressed' block contains a 'set speed to speed - 10' block, followed by an 'if speed < 10 then set speed to 10' conditional block. Finally, there is a 'forever' loop containing a 'fan A0 speed speed' block and a 'pause (ms) 100' block.

Speaker Module

The Speaker can be used to make a sound by using the Music blocks.

NOTE

As the default music is speaking through **pin P0**, so we need to connect our speaker module to **connector A0**.



Module	Connect Type	Available Connectors
Speaker Module	Analog	A0

Example

Let your speaker make a sound

The speaker will circle the sound of the three beat.

```
forever loop containing:  
  play tone D for 1 beat  
  pause (ms) 100  
  play tone E for 1 beat  
  pause (ms) 100  
  play tone F for 1 beat  
  pause (ms) 100
```

The image shows a Scratch script starting with a 'forever' loop block. Inside the loop, there are six blocks: three 'play tone' blocks and three 'pause (ms)' blocks. The first 'play tone' block is set to 'D' for '1 beat'. The first 'pause (ms)' block is set to '100'. The second 'play tone' block is set to 'E' for '1 beat'. The second 'pause (ms)' block is set to '100'. The third 'play tone' block is set to 'F' for '1 beat'. The third 'pause (ms)' block is set to '100'.

PIR Module

The PIR Motion Sensors allows user to sense motion, usually human movement in its range. When this module detects that there is an object moving, the PIR signal line will jump from the low level to the high level, and keep the high level for 3 seconds.



Module	Connect Type	Available Connectors
PIR Module	Digital IO	D12, D13, D14, D15

Block API

Check the PIR status

Check whether the switch is triggered or not. when the pir module is triggered the status signal which was detected will be in high level.

```
pir A0 is triggered
```

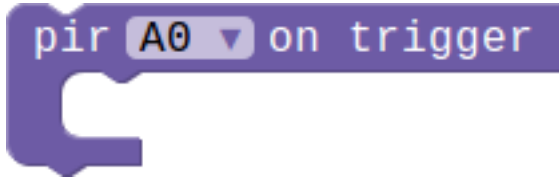
```
function PIRIsTriggered(connName: ConnName): boolean;
```

Parameters

- **connName** is the connector's name. this module can be plugged into both analog connector and digital connector.

PIR event

Configure the specified pin for digital input, and then execute the associated code block whenever the pin in rising edge which means the PIR has detected movement.



```
function onPIREvent(connName: ConnName, body: () => void): void;
```

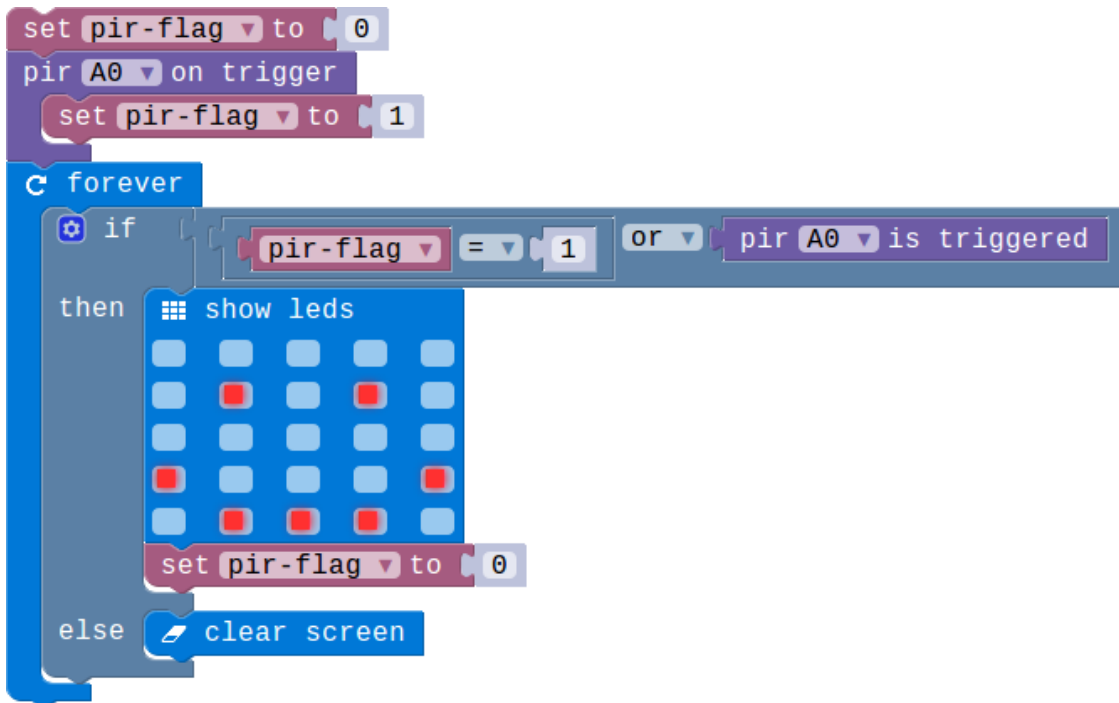
Parameters

- **connName** is the connector's name. this module can be plugged into both analog connector and digital connector.

Example

Detecting the movement

When the PIR detected the moving objects, the screen will show a smile face. when there are no moving things in its range the screen will show nothing.



RGB LED

A colorful LED. The color and brightness can be programable. And the color and brightness is controled by the gray value of red, green and blue.



Module	Connect Type	Available Connectors
RGB LED	Digital IO	D12, D13, D14, D15

TODO [HW Team] Need hardware engineers to add this module's specific parameters.

Block API

Choose a RGB color

You can choose a given color to show.



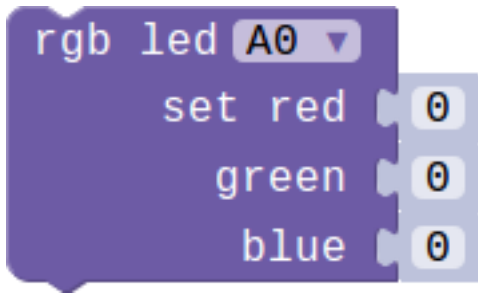
```
function RGBChooseColor(connName: ConnName, color: MiNodeColor): void;
```

Parameters

- **connName** is the analog connector's name.this module can be plugged into both analog connector and digital connector.
- **color** is set of colors.That is red,green,blue,yellow,pink,cyan and white.you can choose one color from the given color to light up you RGB module.

Set a specific RGB color by setting rgb gray value

You can change the color of the RGB by setting the three gray values.



```
function RGBSetColor(connName: ConnName, red: number, green: number, blue: number): void;
```

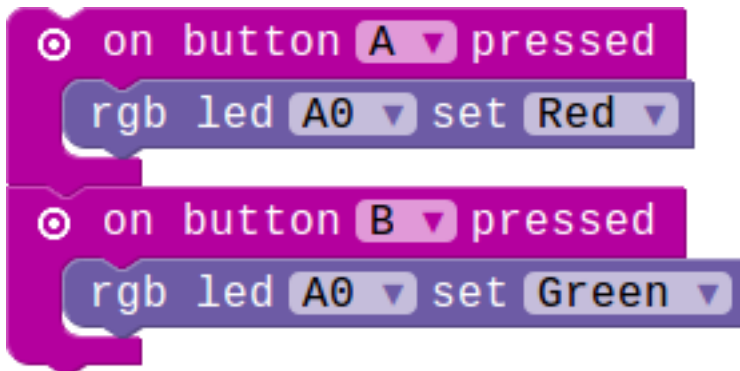
Parameters

- **connName** is the analog connector's name.this module can be plugged into both analog connector and digital connector.
- **red** is the gray value of red,range from 0 to 255.
- **green** is the gray value of green,range from 0 to 255.
- **blue** is the gray value of blue,range from 0 to 255.

Example

Use button to show different color.

When you press button A the RGB module will show red,if you press button B the color will be green.



Set specific color

This example show you how to set a specific color.There are two different color controlled by button A and B.press the two button you will get the corresponding color.

```
on button A pressed
  rgb led A0
    set red 255
    green 0
    blue 255
on button B pressed
  rgb led A0
    set red 127
    green 255
    blue 0
```

Switch Module

The switch module can be used to switch ON/OFF.



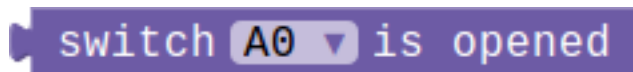
Module	Connect Type	Available Connectors
Switch Module	Digital IO	D12, D13, D14, D15

TODO [HW Team] Need hardware engineers to add this module's specific parameters.

Block API

Check the switch's status

Check whether the switch is opened or not.



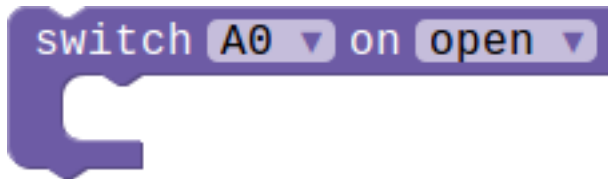
```
function switchIsOpened(connName: ConnName): boolean;
```

Parameters

- **connName** is the connector's name. this module can be plugged into both analog connector and digital connector.

Switch event

Configure the specified pin for digital input, and then execute the associated code block whenever the switch is opened or closed.



```
function onSwitchEvent(connName: ConnName, event: SwitchEvent, body: () => void): void;
```

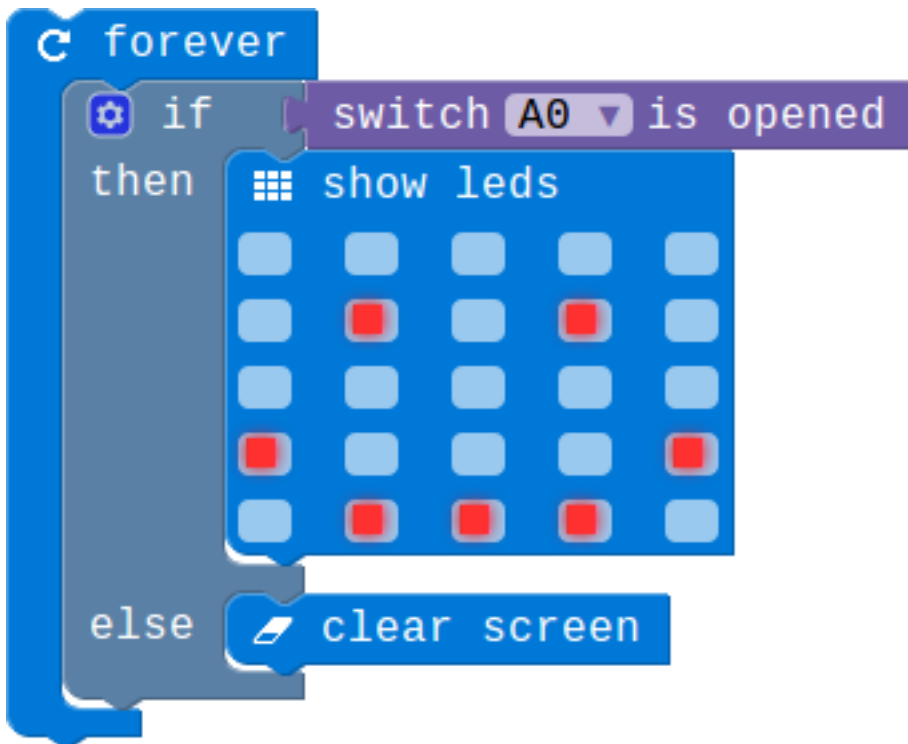
Parameters

- **connName** is the analog connector's name. this module can be plugged into both analog connector and digital connector.
- **event** represent two status of switch, open and close.

Example

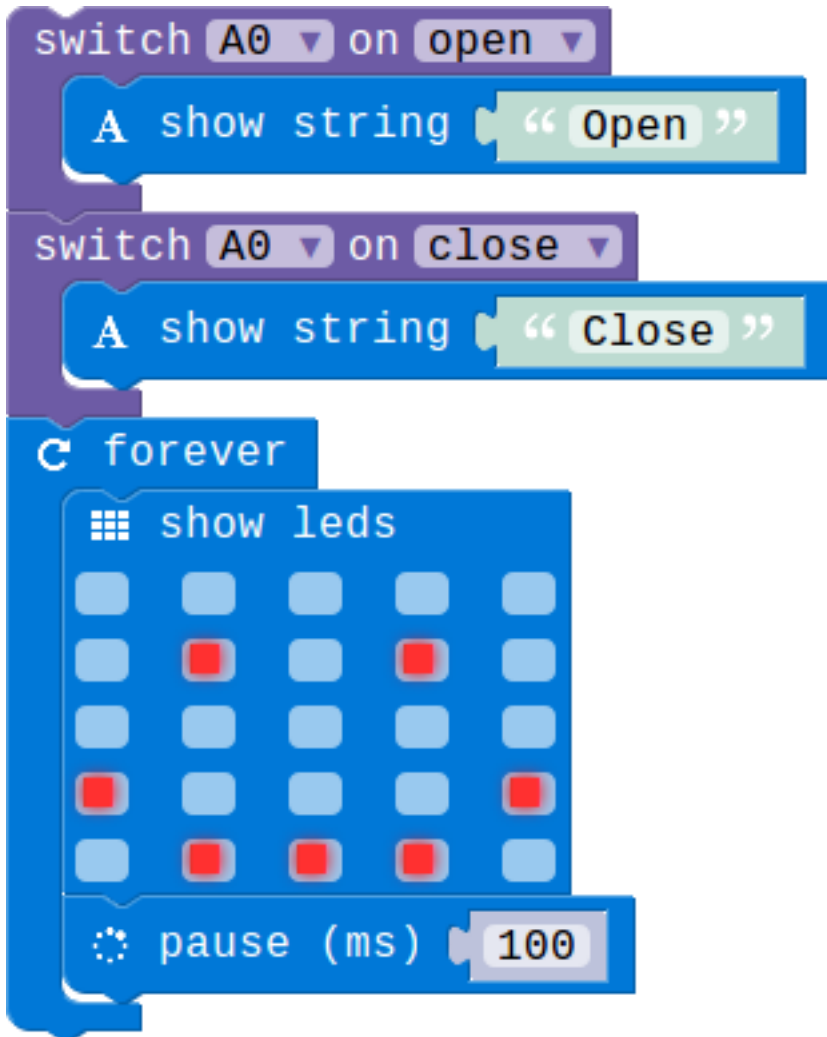
Switch control the screen show

If the switch is opened the screen will show a smile face, otherwise it will show nothing.



Show the switch module's status

In this example we use the switch event to show the switch's status. When the switch is opened, the led screen will show a string 'Open', otherwise the led screen will show 'Close'.

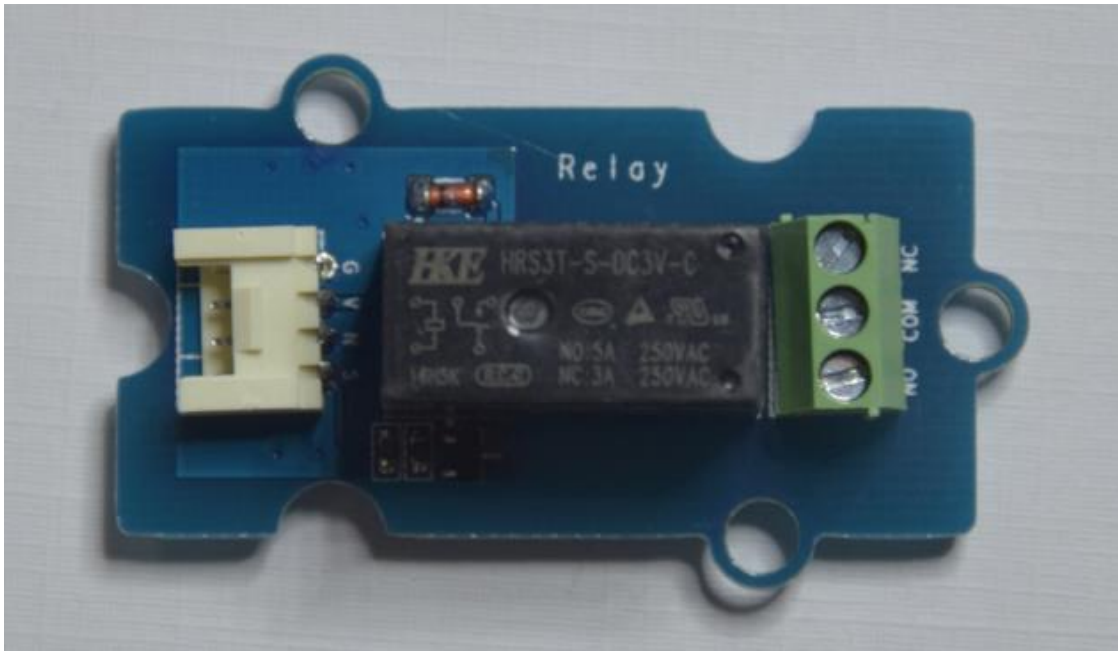


Relay Module

The relay is an electrically operated switch. It is a digital switch that can be used to control high-voltage electrical devices, such as some home appliances. (maximum 250V)

Danger

It's dangerous for a kid to attach the relay module to a AC(110V/220V) device. Our purpose for this module is just showing how to control home appliances. You can hear some sound when you switch the relay **ON/OFF**. You do not have to connect to a real appliance.



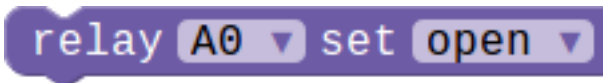
Module	Connect Type	Available Connectors
Relay Module	Digital IO	D12, D13, D14, D15

TODO [HW Team] Need hardware engineers to add this module's specific parameters.

Block API

Set relay status(open/close)

Set the relay module's status open/close.



```
function RelayControl(connName:ConnName , status:FanStatus): void
```

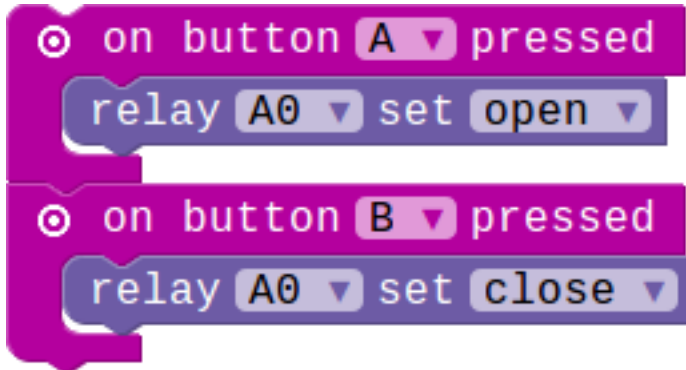
Parameters

- **connName** is the connector's name.this module can be plugged into both analog connector and digital connector.
- **status** is the status of the relay open or close.

Example

Control the relay by button

Button A and B control the open and close of the relay module.



Appendix

Microsoft PXT

- Home: <https://pxt.microbit.org/>
- Getting Started: <https://pxt.microbit.org/getting-started>
- Reference Manual: <https://pxt.microbit.org/reference/>

Support

- Email: support@embest-tech.com
- Website: <http://minode.embest-tech.com>
- Github repo: <http://github.com/minodekit>

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