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# **Adafruit SimpleIO Library Documentation**

***Release 1.0***

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SimpleIO features a number of helpers to simplify hardware interactions. Many of the functions and classes are inspired by Arduino APIs to make it easier to move to CircuitPython from Arduino.



# CHAPTER 1

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## Dependencies

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This driver depends on:

- [Adafruit CircuitPython](#)

Please ensure all dependencies are available on the CircuitPython filesystem. This is easily achieved by downloading the [Adafruit library and driver bundle](#).





## CHAPTER 2

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### Usage Example

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See the examples in the *Simple tests* folder for usage.



## CHAPTER 3

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### Contributing

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Contributions are welcome! Please read our [Code of Conduct](#) before contributing to help this project stay welcoming.



## CHAPTER 4

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### Building locally

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To build this library locally you'll need to install the `circuitpython-build-tools` package.

```
python3 -m venv .env
source .env/bin/activate
pip install circuitpython-build-tools
```

Once installed, make sure you are in the virtual environment:

```
source .env/bin/activate
```

Then run the build:

```
circuitpython-build-bundles --filename_prefix adafruit-circuitpython-simpleio --
↳library_location .
```

### 4.1 Sphinx documentation

Sphinx is used to build the documentation based on rST files and comments in the code. First, install dependencies (feel free to reuse the virtual environment from above):

```
python3 -m venv .env
source .env/bin/activate
pip install Sphinx sphinx-rtd-theme
```

Now, once you have the virtual environment activated:

```
cd docs
sphinx-build -E -W -b html . _build/html
```

This will output the documentation to `docs/_build/html`. Open the `index.html` in your browser to view them. It will also (due to `-W`) error out on any warning like Travis will. This is a good way to locally verify it will pass.



## 5.1 Simple tests

Ensure your device works with these simple tests.

Listing 1: examples/tone\_demo.py

```
1  """
2  'tone_demo.py'.
3
4  =====
5  a short piezo song using tone()
6  """
7  import time
8  import board
9  import simpleio
10
11
12  while True:
13      for f in (262, 294, 330, 349, 392, 440, 494, 523):
14          simpleio.tone(board.A0, f, 0.25)
15      time.sleep(1)
```

Listing 2: examples/shift\_in\_out\_demo.py

```
1  """
2  'shift_in_out_demo.py'.
3
4  =====
5  shifts data into and out of a data pin
6  """
7
8  import time
9  import board
```

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```

10 import digitalio
11 import simpleio
12
13 # set up clock, data, and latch pins
14 clk = digitalio.DigitalInOut(board.D12)
15 data = digitalio.DigitalInOut(board.D11)
16 latch = digitalio.DigitalInOut(board.D10)
17 clk.direction = digitalio.Direction.OUTPUT
18 latch.direction = digitalio.Direction.OUTPUT
19
20 while True:
21     data_to_send = 256
22     # shifting 256 bits out of data pin
23     latch.value = False
24     data.direction = digitalio.Direction.OUTPUT
25     print('shifting out...')
26     simpleio.shift_out(data, clk, data_to_send, msb_first=False)
27     latch.value = True
28     time.sleep(3)
29
30     # shifting 256 bits into the data pin
31     latch.value = False
32     data.direction = digitalio.Direction.INPUT
33     print('shifting in...')
34     simpleio.shift_in(data, clk)
35     time.sleep(3)

```

Listing 3: examples/map\_range\_demo.py

```

1 """
2 'map_range_demo.py'.
3
4 =====
5 maps a number from one range to another
6 """
7 import time
8 import simpleio
9
10 while True:
11     sensor_value = 150
12
13     # Map the sensor's range from 0<=sensor_value<=255 to 0<=sensor_value<=1023
14     print('original sensor value: ', sensor_value)
15     mapped_value = simpleio.map_range(sensor_value, 0, 255, 0, 1023)
16     print('mapped sensor value: ', mapped_value)
17     time.sleep(2)
18
19     # Map the new sensor value back to the old range
20     sensor_value = simpleio.map_range(mapped_value, 0, 1023, 0, 255)
21     print('original value returned: ', sensor_value)
22     time.sleep(2)

```



## 5.2 simpleio - Simple, beginner friendly IO.

The `simpleio` module contains classes to provide simple access to IO.

- Author(s): Scott Shawcroft

**class** `simpleio.DigitalIn` (*pin*, *\*\*kwargs*)

Simple digital input that is valid until reload.

**param pin** `microcontroller.Pin` input pin

**param pull** `digitalio.Pull` pull configuration for the input

**value**

The digital logic level of the input pin.

**class** `simpleio.DigitalOut` (*pin*, *\*\*kwargs*)

Simple digital output that is valid until reload.

**param pin** `microcontroller.Pin` output pin

**param value** `bool` default value

**param drive\_mode** `digitalio.DriveMode` drive mode for the output

**value**

The digital logic level of the output pin.

`simpleio.bitWrite` (*x*, *n*, *b*)

Based on the Arduino `bitWrite` function, changes a specific bit of a value to 0 or 1. The return value is the original value with the changed bit. This function is written for use with 8-bit shift registers

### Parameters

- **x** – numeric value
- **n** – position to change starting with least-significant (right-most) bit as 0
- **b** – value to write (0 or 1)

`simpleio.map_range` (*x*, *in\_min*, *in\_max*, *out\_min*, *out\_max*)

Maps a number from one range to another. Note: This implementation handles values < *in\_min* differently than arduino's `map` function does.

**Returns** Returns value mapped to new range

**Return type** `float`

`simpleio.shift_in` (*data\_pin*, *clock*, *msb\_first=True*)

Shifts in a byte of data one bit at a time. Starts from either the LSB or MSB.

**Warning:** Data and clock are swapped compared to other CircuitPython libraries in order to match Arduino.

### Parameters

- **data\_pin** (`DigitalInOut`) – pin on which to input each bit
- **clock** (`DigitalInOut`) – toggles to signal *data\_pin* reads
- **msb\_first** (`bool`) – True when the first bit is most significant

**Returns** returns the value read

**Return type** `int`

`simpleio.shift_out(data_pin, clock, value, msb_first=True)`

Shifts out a byte of data one bit at a time. Data gets written to a data pin. Then, the clock pulses hi then low

**Warning:** Data and clock are swapped compared to other CircuitPython libraries in order to match Arduino.

#### Parameters

- **data\_pin** (*DigitalInOut*) – value bits get output on this pin
- **clock** (*DigitalInOut*) – toggled once the data pin is set
- **msb\_first** (*bool*) – True when the first bit is most significant
- **value** (*int*) – byte to be shifted

Example for Metro M0 Express:

```
import digitalio
import simpleio
from board import *
clock = digitalio.DigitalInOut(D12)
data_pin = digitalio.DigitalInOut(D11)
latchPin = digitalio.DigitalInOut(D10)
clock.direction = digitalio.Direction.OUTPUT
data_pin.direction = digitalio.Direction.OUTPUT
latchPin.direction = digitalio.Direction.OUTPUT

while True:
    valueSend = 500
    # shifting out least significant bits
    # must toggle latchPin.value before and after shift_out to push to IC chip
    # this sample code was tested using
    latchPin.value = False
    simpleio.shift_out(data_pin, clock, (valueSend>>8), msb_first = False)
    latchPin.value = True
    time.sleep(1.0)
    latchPin.value = False
    simpleio.shift_out(data_pin, clock, valueSend, msb_first = False)
    latchPin.value = True
    time.sleep(1.0)

    # shifting out most significant bits
    latchPin.value = False
    simpleio.shift_out(data_pin, clock, (valueSend>>8))
    latchPin.value = True
    time.sleep(1.0)
    latchPin.value = False
    simpleio.shift_out(data_pin, clock, valueSend)
    latchPin.value = True
    time.sleep(1.0)
```

`simpleio.tone(pin, frequency, duration=1, length=100)`

Generates a square wave of the specified frequency on a pin

#### Parameters

- **Pin** (*Pin*) – Pin on which to output the tone
- **frequency** (*float*) – Frequency of tone in Hz

- **length** (*int*) – Variable size buffer (optional)
- **duration** (*int*) – Duration of tone in seconds (optional)



## CHAPTER 6

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