Pico Python SDK

A MicroPython environment for the RP2040 microcontroller

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Table of Contents

Chapter 1. The MicroPython Environment

TO DO: Talk about C vs Micro Python here? Need to mention how to use the stuff in the BootRom from Python here.

MicroPython implements the entire Python 3.4 syntax (including exceptions, `with`, `yield from`, etc., and additionally `async` /`await` keywords from Python 3.5). The following core datatypes are provided: `str` (including basic Unicode support), `bytes`, `bytearray`, `tuple`, `list`, `dict`, `set`, `frozenset`, `array.array`, `collections.namedtuple`, classes and instances. Builtin modules include `sys`, `time`, and `struct`, etc. Select ports have support for `_thread` module (multithreading). Note that only a subset of Python 3 functionality is implemented for the data types and modules.

MicroPython can execute scripts in textual source form or from precompiled bytecode, in both cases either from an on-device filesystem or "frozen" into the MicroPython executable.

1.1. Getting MicroPython for the RP2040

IMPORTANT

The following instructions assume that you are using a Raspberry Pi Pico and some details may differ if you are using a different RP2040-based board. They also assume you are using Raspberry Pi OS running on a Raspberry Pi 4, or an equivalent Debian-based Linux distribution running on another platform.

Start by creating a pico directory to keep all pico related checkouts in. These instructions create a pico directory at `/home/pi/pico`.

```
$ cd ~/
$ mkdir pico
$ cd pico
```

Then clone the `micropython` git repository.

```
$ git clone -b pico git@github.com:raspberrypi/micropython.git
```

To build the Raspberry Pi Pico MicroPython port you'll also need to install some extra tools. To build projects you'll need CMake, a cross-platform tool used to build the software, and the GNU Embedded Toolchain for Arm. You can install both these via `apt` from the command line. Anything you already have installed will be ignored by `apt`.

```
$ sudo apt update
$ sudo apt install cmake gcc-arm-none-eabi
```

TO DO: Talk about **which versions of Linux** this works on, including Raspberry Pi

1.2. Building MicroPython for the RP2040

To build the port, cd into `micropython` directory and,

```
$ cd micropython
$ git submodule update --init --recursive
$ make -C mpy-cross
$ cd ports/pico
$ make
```

Amongst other targets, we have now built:

- `firmware.elf`, which is used by the debugger
- `firmware.uf2`, which can dragged onto the RP2040 USB Mass Storage Device

you can find these in the `ports/pico/build/` directory.

1.3. Installing MicroPython on the Raspberry Pi Pico

The simplest method to load software onto a RP2040-based board is by mounting it as a USB Mass Storage Device. Doing this allows you to drag the `firmware.uf2` onto the board to program the flash. Go ahead and connect the Raspberry Pi Pico to your Raspberry Pi using a micro-USB cable, making sure that you hold down the `BOOTSEL` button to force it into USB Mass Storage Mode.

NOTE

If you are not following these instructions on a Raspberry Pi Pico, you may not have a `BOOTSEL` button. If this is the case, you should check if there is some other way of grounding the flash CS pin, such as a jumper, to tell RP2040 to enter the USB boot mode on boot. If there is no such method, you can load code using the Serial Wire Debug interface (see the "Learning Raspberry Pi Pico" book for more details).

Chapter 2. Connecting to the MicroPython REPL

The MicroPython port for Raspberry Pi Pico and other RP2040-based boards supports Serial-over-USB.

2.1. Connecting from a Raspberry Pi over USB

Once the MicroPython port has been installed, you can install `minicom`:

```
$ sudo apt install minicom
```

and then open the serial port:

```
$ minicom -b 115200 -o -D /dev/ttyACM0
```

Toggling the power to Raspberry Pi Pico you should see,

```
MicroPython v1.12-725-g315e7f50c-dirty on 2020-08-21; Raspberry Pi PICO with
cortex-m0plus
Type "help()" for more information.
>>>
```

printed to the console when the Raspberry Pi Pico is first powered on.

TIP

`CTRL-A` followed by `U` will add carriage returns to the serial output so that each print will end with a newline. To exit minicom, use `CTRL-A` followed by `X`.

2.2. Connecting from a Raspberry Pi using GPIO

The MicroPython port for RP2040 also provides the REPL over the Raspberry Pi Pico `UART0`, so alternatively you can connect to the REPL via this mechanism. The first thing you'll need to do is to enable UART serial on the Raspberry Pi. To do so, run `raspi-config`,

```
$ sudo raspi-config
```

and go to `Interfacing Options` -> `Serial` and select "No" when asked "Would you like a login shell to be accessible over serial?" and "Yes" when asked "Would you like the serial port hardware to be enabled?" You should see something like Figure 1.

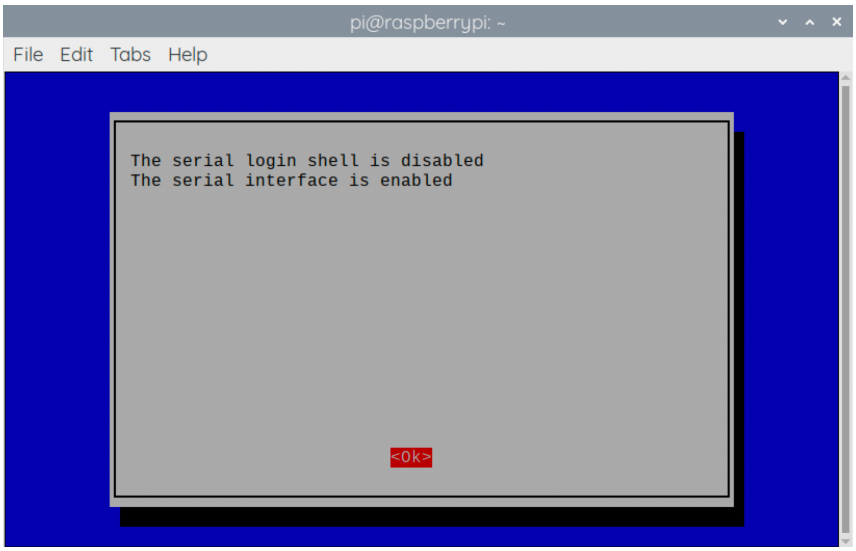

Figure 1. Enabling a serial UART using `raspi-config` on the Raspberry Pi.

Leaving `raspi-config` you should choose "Yes" and reboot your Raspberry Pi to enable the serial port.

You should then wire the the Raspberry Pi and the Raspberry Pi Pico together with the following mapping:

Raspberry Pi	Raspberry Pi Pico
GND	GND
GPIO15 (UART_RX0)	GPIO0 (UART0_TX)
GPIO14 (UART_TX0)	GPOI1 (UART0_RX)

See Figure 2.

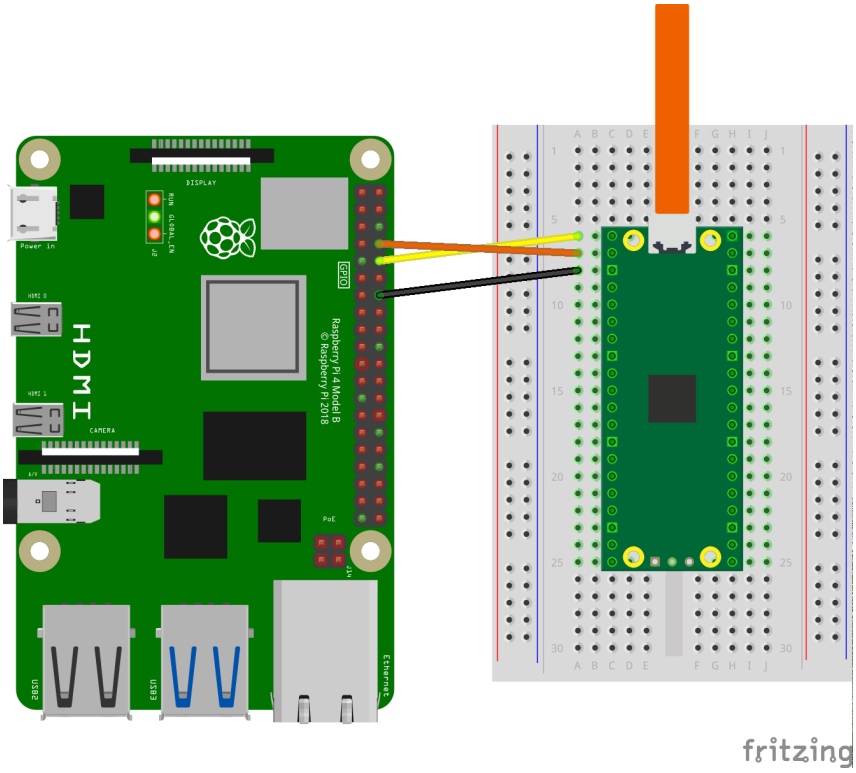

Figure 2. A Raspberry Pi 4 and the Raspberry Pi Pico with UART0 connected together.

then connect to the board using `minicom` connected to `/dev/serial0`,

```
$ minicom -b 115200 -o -D /dev/serial0
```

2.3. Connecting from a Mac using USB

So long as you're using a recent version of macOS like Catalina, drivers should already be loaded. Otherwise see the manufacturers' website for FTDI Chip Drivers. Then you should use a Terminal program, e.g. Serial or similar to connect to the serial port.

NOTE

Serial also includes driver support if needed.

The Serial-over-USB port will show up as `/dev/tty.usbmodem0000000000001`. If you're using Serial this will be shown as "Board in FS mode — CDC" in the port selector window when you open the application. Connect to this port and hit Return and you should see the REPL prompt.

2.4. Saying "Hello World" from REPL

Once connected you can check that everything is working by typing a simple "Hello World" into the REPL,

```
>>> print('hello pico!')
hello pico!
>>>>
```

Chapter 3. The RP2040 Port

TO DO: Is there any way to pull in MicroPython documentation directly?

Currently supported features include:

- REPL over USB and UART (on GP0/GP1).
- 128k filesystem using `littlefs2` on the internal flash.
- `utime` module with sleep and ticks functions.
- `machine` module with some basic functions.
- `machine.Pin` class.
- `machine.Timer` class.

TO DO: Talk about the chip-specific features

3.1. Blinking an LED in MicroPython

The on-board LED on the Raspberry Pi Pico is connected to GPIO pin 25. You can blink this on and off from the REPL. When you see the REPL prompt enter the following,

```
>>> from machine import Pin
>>> led = Pin(25, Pin.OUT)
```

then you can turn the LED on with,

```
>>> led.value(1)
```

and off again with,

```
>>> led.value(0)
```

Alternatively you can use a timer to blink the on-board LED.

```
from machine import Pin, Timer

led = Pin(25, Pin.OUT)
tim = Timer(3)
def tick(timer):
    global led
    led.toggle()

tim.init(freq=2.5, mode=Timer.PERIODIC, callback=tick)
```

3.2. Interrupts

You can set an IRQ like this:

```
from machine import Pin

p2 = Pin(2, Pin.IN, Pin.PULL_UP)
p2.irq(lambda pin: print("IRQ with flags:", pin.irq().flags()),
Pin.IRQ_FALLING)
```

It should print out something when GP2 has a falling edge.

3.3. Multicore Support

Example usage:

```
import time, _thread, machine

def task(n, delay):
    led = machine.Pin(25, machine.Pin.OUT)
    for i in range(n):
        led.high()
        time.sleep(delay)
        led.low()
        time.sleep(delay)
    print('done')

_thread.start_new_thread(task, (10, 0.5))
```

Only one thread can be started/running at any one time, because there is no `RTOS` just a second core. The `GIL` is not enabled so both `core0` and `core1` can run Python code concurrently, with care to use locks for shared data.

3.4. I2C

Example usage:

```
from machine import Pin, I2C

i2c = I2C(0, scl=Pin(9), sda=Pin(8), freq=100000)
i2c.scan()
i2c.writeto(76, b'123')
i2c.readfrom(76, 4)

i2c = I2C(1, scl=Pin(7), sda=Pin(6), freq=100000)
i2c.scan()
i2c.writeto_mem(76, 6, b'456')
i2c.readfrom_mem(76, 6, 4)
```

I2C can be constructed without specifying the frequency, if you just want all the defaults.

```
from machine import I2C

i2c = I2C(0)  # defaults to SCL=Pin(9), SDA=Pin(8), freq=400000
```

WARNING

There may be some bugs reading/writing to device addresses that do not respond, the hardware seems to lock up in some cases.

3.5. SPI

Example usage:

```
from machine import SPI

spi = SPI(0)
spi = SPI(0, 100_000)
spi = SPI(0, 100_000, polarity=1, phase=1)

spi.write('test')
spi.read(5)

buf = bytearray(3)
spi.write_readinto('out', buf)
```

NOTE

The chip select must be managed separately using a `machine.Pin`.

3.6. PIO Support

> **The current status of PIO support**
>
> The current development status of PIO support can be found in this Github issue. Support for PIO is preliminary and may be unstable.

Current support allows you to define Programmable IO (PIO) Assembler blocks and using them in the PIO peripheral, more documentation around PIO can be found in Chapter 3 of the **RP2040 Datasheet** and Chapter 5 of the **Pico SDK** book.

The Raspberry Pi Pico MicroPython por a new `@pico.asm_pio` decorator, along with a `pico.PIO` class. The definition of a PIO program, and the configuration of the state machine, into 2 logical parts:

- The program definition, including how many pins are used and if they are in/out pins. This goes in the `@pico.asm_pio` definition. This is close to what the `pioasm` tool from the Pico SDK would generate from a `.pio` file (but here it's all defined in Python).

- The program instantiation, which sets the frequency of the state machine and which pins to bind to. These get set when setting a SM to run a particular program.

The aim was to allow a program to be defined once and then easily instantiated multiple times (if needed) with different GPIO. Another aim was to make it easy to basic things without getting weighed down in too much PIO/SM configuration.

Example usage, to blink the on-board LED connected to GPIO 25.

```
import time
from pico import PIO, asm_pio
from machine import Pin

# Define the blink program.  It has one GPIO to bind to on the set instruction, which is an output pin.
# Use lots of delays to make the blinking visible by eye.
@asm_pio(set=PIO.OUT)
def blink():
    wrap_target()
    set(pins, 1, delay=31)
    nop(delay=31)
    nop(delay=31)
    nop(delay=31)
    nop(delay=31)
    set(pins, 0, delay=31)
    nop(delay=31)
    nop(delay=31)
    nop(delay=31)
    nop(delay=31)
    wrap()

# Instantiate the PIO.
pio = PIO(0)

# Make sure all programs are removed, and load blink.
pio.remove_program()
pio.add_program(blink)

# Instantiate a state machine with the blink program, at 1000Hz, with set bound to Pin(25) (LED on the pico board)
sm = pio.state_machine(0, blink, freq=1000, set=Pin(25))

# Run the state machine for 1 second.  The LED should blink.
sm.active(1)
time.sleep(1)
sm.active(0)
```

There is also support for PIO IRQs, e.g.

```
import time
import pico

@pico.asm_pio()
def irq_test():
    wrap_target()
```

```
    nop(delay=31)
    nop(delay=31)
    nop(delay=31)
    nop(delay=31)
    irq(0)
    nop(delay=31)
    nop(delay=31)
    nop(delay=31)
    nop(delay=31)
    irq(1)
    wrap()

pico.PIO(0).irq(lambda pio: print(pio.irq().flags()))

sm = pico.StateMachine(0, irq_test, freq=1000)
sm.active(1)
time.sleep(1)
sm.active(0)
```

An example program that blinks at 1Hz and raises an IRQ at 1Hz to print the current millisecond timestamp,a

```
import time
from machine import Pin
import pico


@pico.asm_pio(set_pins=pico.PIO.OUT_LOW)
def blink_1hz():
    wrap_target()

    # Cycles: 1 + 1 + 6 + 32 * (30 + 1) = 1000
    irq(0)
    set(pins, 1)
    set(x, 31, delay=5)
    label("delay_high")
    nop(delay=29)
    jmp(x_dec, "delay_high")

    # Cycles: 1 + 7 + 32 * (30 + 1) = 1000
    set(pins, 0)
    set(x, 31, delay=6)
    label("delay_low")
    nop(delay=29)
    jmp(x_dec, "delay_low")

    wrap()


pico.PIO(0).irq(lambda p: print(time.ticks_ms()))
sm = pico.StateMachine(0, blink_1hz, freq=2000, set_pins=Pin(25))
sm.active(1)
```

While a WS2812 LED (NeoPixel) can be driven via the following program,

```
 1 import time
 2 from machine import Pin
 3 import pico
 4
 5 @pico.asm_pio(sideset_pins=pico.PIO.OUT_LOW, out_shiftdir=0, autopull=True,
   pullthresh=24)
 6 def ws2812():
 7     wrap_target()
 8     label("bitloop")
 9     out(x, 1)               [3] .set(0)
10     jmp(not_x, "do_zero")   [2] .set(1)
11     jmp("bitloop")          [3] .set(1)
12     label("do_zero")
13     nop()                   [3] .set(0)
14     wrap()
15
16 sm = pico.StateMachine(0, ws2812, freq=8_800_000, sideset_pins=Pin(22))
17 sm.active(1)
18
19 # Set some pixels on the WS2812
20 for c in range(256):
21     sm.put((c & 63) << 8)
22     sm.put((c & 63) << 16)
23     sm.put((c & 63) << 24)
24     time.sleep(0.01)
```

Some points to note,

- All program configuration (eg autopull) is done in the `@asm_pio` decorator. Only the frequency and base pins are set in the StateMachine constructor.
- `[n]` is used for delay, `.set(n)` used for sideset
- The assembler will automatically detect if sideset is used everywhere or only on a few instructions, and set the `SIDE_EN` bit automatically

The idea is that for the 4 sets of pins (`in`, `out`, `set`, `sideset`, excluding `jmp`) that can be connected to a state machine, there's the following that need configuring for each set:

1. base GPIO
2. number of consecutive GPIO
3. initial GPIO direction (in or out pin)
4. initial GPIO value (high or low)

In the design of the Python API for PIO these 4 items are split into "declaration" (items 2-4) and "instantiation" (item 1). In other words, a program is written with items 2-4 fixed for that program (eg a WS2812 driver would have 1 output pin) and item 1 is free to change without changing the program (eg which pin the WS2812 is connected to).

So in the `@asm_pio` decorator you declare items 2-4, and in the `StateMachine` constructor you say which base pin to use (item 1). That makes it easy to define a single program and instantiate it multiple times on different pins (you can't really change items 2-4 for a different instantiation of the same program, it doesn't really make sense to do that).

And the same keyword arg (in the case about it's `sideset_pins`) is used for both the declaration and instantiation, to show that they are linked.

To declare multiple pins in the decorator (the count, ie item 2 above), you use a tuple/list of values. And each item in the tuple/list specified items 3 and 4. For example:

```
@asm_pio(set_pins=(PIO.OUT_LOW, PIO.OUT_HIGH, PIO.IN_LOW), sideset_pins=PIO
.OUT_LOW)
def foo():
    ....

sm = StateMachine(0, foo, freq=10000, set_pins=Pin(15), sideset_pins=Pin(22))
```

In this example:

- there are 3 set pins connected to the SM, and their initial state (set when the StateMachine is created) is: output low, output high, input low (used for open-drain)
- there is 1 sideset pin, initial state is output low
- the 3 set pins start at Pin(15)
- the 1 sideset pin starts at Pin(22)

The reason to have the constants `OUT_LOW`, `OUT_HIGH`, `IN_LOW` and `IN_HIGH` is so that the pin value and dir are automatically set before the start of the PIO program (instead of wasting instruction words to do `set(pindirs, 1)` etc at the start).

3.6.1. UART TX

A UART TX example,

```
UART_BAUD = 115200
PIN_TX = 10

@pico.asm_pio(sideset_init=pico.PIO.OUT_HIGH, out_init=pico.PIO.OUT_HIGH,
out_shiftdir=1)
def uart_tx():
    wrap_target()
    # Block with TX deasserted until data available
    pull()
    # Initialise bit counter, assert start bit for 8 cycles
    set(x, 7)  .side(0)       [7]
    # Shift out 8 data bits, 8 execution cycles per bit
    label("bitloop")
    out(pins, 1)              [6]
    jmp(x_dec, "bitloop")
    # Assert stop bit for 8 cycles total (incl 1 for pull())
    nop()      .side(1)       [6]
    wrap()

sm_tx = pico.StateMachine(0, uart_tx, freq=8*UART_BAUD, sideset_base=Pin(
PIN_TX), out_base=Pin(PIN_TX))
sm_tx.active(1)

def pio_uart_print(sm, s):
    for c in s:
        sm.put(ord(c))

pio_uart_print(sm_tx, "Hello, world from PIO!")
```

NOTE

You need to specify an intial OUT pin state in your program in order to be able to pass OUT mapping to your SM instantiation, even though in this program it is redundant because the mappings overlap.

3.6.2. SPI

An SPI example.

TO DO: 8 bit only for now because we need to set pullthresh per **program** not per SM

```
from machine import Pin

@pico.asm_pio(out_shiftdir=0, autopull=True, pullthresh=8, autopush=True, pushthresh=8, sideset_init=(pico.PIO.OUT_LOW, pico.PIO.OUT_HIGH), out_init=pico.PIO.OUT_LOW)
def spi_cpha0():
    # Note X must be preinitialised by setup code before first byte, we reload after sending each byte
    # Would normally do this via exec() but in this case it's in the instruction memory and is only run once
    set(x, 6)
    # Actual program body follows
    wrap_target()
    pull(ifempty)           .side(0x2)   [1]
    label("bitloop")
    out(pins, 1)            .side(0x0)   [1]
    in_(pins, 1)            .side(0x1)
    jmp(x_dec, "bitloop")   .side(0x1)

    out(pins, 1)            .side(0x0)
    set(x, 6)               .side(0x0) # Note this could be replaced with mov x, y for programmable frame size
    in_(pins, 1)            .side(0x1)
    jmp(not_osre, "bitloop") .side(0x1) # Fallthru if TXF empties

    nop()                   .side(0x0)   [1] # CSn back porch
    wrap()


class PIOSPI:

    def __init__(self, sm_id, pin_mosi, pin_miso, pin_sck, cpha=False, cpol=False, freq=1000000):
        assert(not(cpol or cpha))
        self._sm = pico.StateMachine(sm_id, spi_cpha0, freq=4*freq, sideset_base=Pin(pin_sck), out_base=Pin(pin_mosi), in_base=Pin(pin_sck))
        self._sm.active(1)

    # Note this code will die spectacularly cause we're not draining the RX FIFO
    def write_blocking(wdata):
        for b in wdata:
            self._sm.put(b << 24)

```

```
    def read_blocking(n):
        data = []
        for i in range(n):
            data.append(self._sm.get() & 0xff)
        return data

    def write_read_blocking(wdata):
        rdata = []
        for b in wdata:
            self._sm.put(b << 24)
            rdata.append(self._sm.get() & 0xff)
        return rdata
```

NOTE

This SPI program supports programmable frame sizes (by holding the reload value for X counter in the Y register) but currently this can't be used, because the autopull threshold is associated with the program, instead of the SM instantiation.

3.6.3. PWM

A PWM example,

```
from machine import Pin
from time import sleep

@rp2.asm_pio(sideset_init=rp2.PIO.OUT_LOW, autopull=False)
def pwm_prog():
    pull(noblock) .side(0)
    mov(x, osr) # Keep most recent pull data stashed in X, for recycling by noblock
    mov(y, isr) # ISR must be preloaded with PWM count max
    label("pwmloop")
    jmp(x_not_y, "skip")
    nop()         .side(1)
    label("skip")
    jmp(y_dec, "pwmloop")


class PIOPWM:

    def __init__(self, sm_id, pin, max_count, count_freq):
        self._sm = rp2.StateMachine(sm_id, pwm_prog, freq=2*count_freq, sideset_base=Pin(pin))
        # Preload counter top value stored in SM's ISR
        self._sm.put(max_count)
        self._sm.exec("pull()")
        self._sm.exec("mov(isr, osr)")
        self._sm.active(1)
        self._max_count = max_count

    def set(self, value):
```

```
28          # Minimum value is -1 (completely turn off), 0 actually still produces
    narrow pulse
29          value = max(value, -1)
30          value = min(value, self._max_count)
31          self._sm.put(value)
```

3.6.4. Using `pioasm`

As well as writing PIO code inline in your MicroPython script you can use the `pioasm` tool from the C/C++ SDK to generate a Python file.

```
$ pioasm -o python input (output)
```

For more information on `pioasm` see the **Pico SDK** book which talks about the C/C++ SDK.

Chapter 4. Using an Integrated Development Environment (IDE)

The MicroPython port to Raspberry Pi Pico and other RP2040-based boards works with commonly used development environments.

4.1. Using Thonny

> **The current status of Thonny**
>
> The current development status of Thonny can be found in the shared Google Doc.

Thonny can be downloaded from thonny.org, and runs on Linux, MS Windows and Apple macOS. After installation, using the Thonny development environment is the same across all three platforms.

You can install the Linux version of Thonny from the command line,

```
$ sudo apt install thonny
```

this will add a Thonny icon to the Rapsberry Pi desktop menu. Go ahead and select Raspberry Pi -> Programming -> Thonny Python IDE to open the development environment.

WARNING

See this Gtihub issue. For now you may want to install Thonny using `pip3` rather than `apt`,

```
$ pip3 install -U --pre thonny
```

as you might want to be running the latest beta, v3.3.0b3.

WARNING

Thonny is working with the Raspberry Pi Pico under both Linux and macOS. However there are currently some issues on Windows 10, and it does **not** work under Windows 7 as there is not (yet) a suitable USB driver to connect to the board.

Once it's opened you should leave Thonny's Simple mode by clicking on "Select Regular Mode" button in the top right hand of the window, afterwards you should quit and restart Thonny.

4.1.1. Connecting to the Raspberry Pi Pico from Thonny

Connect your computer and the Raspberry Pi Pico together, see Chapter 2. Then open up the Run menu and select Run -> Select Interpreter, picking "MicroPython (generic)" from the drop down, see Figure 3.

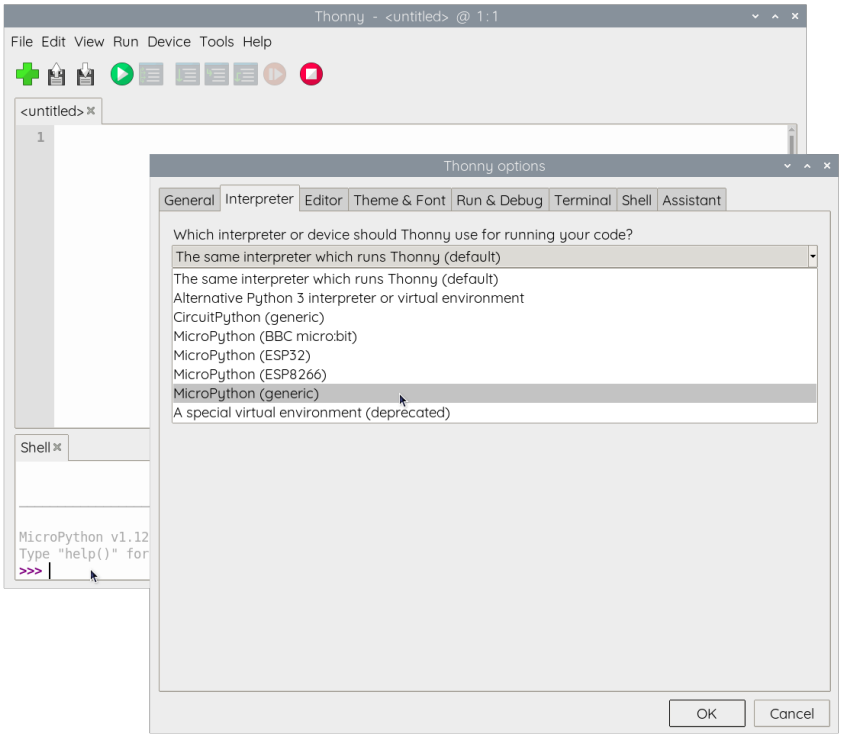

Figure 3. Selecting the correct MicroPython interpreter inside the Thonny environment.

Hit "OK" and then go to the Tools -> Options menu to open a select your serial port in the drop down, on the Raspberry Pi the serial port will be "Board in FS Mode — Board CDC (/dev/ttyACM0)" this should automatically connect you to the REPL of your Raspberry Pi Pico. Afterwards go to the View menu and select the "Variables" option to open the variables panel.

You can now access the REPL from the Shell panel,

```
>>> print('Hello Pico!')
Hello Pico!
>>>
```

see Figure 3.

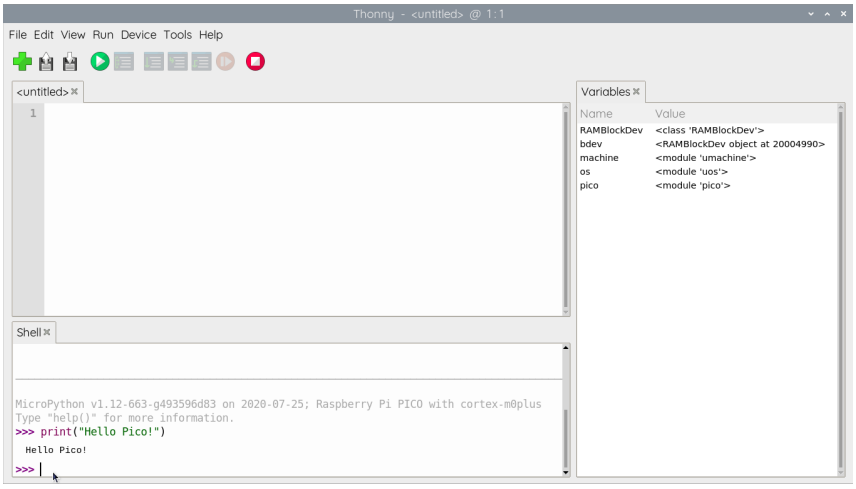

Figure 4. Saying "Hello Pico!" from the MicroPython REPL inside the Thonny environment.

4.1.2. Blinking the LED from Thonny

You can use a timer to blink the on-board LED.

```
from machine import Pin, Timer
led = Pin(25, Pin.OUT)
tim = Timer(3)
def tick(timer):
    global led
    led.toggle()

tim.init(freq=2.5, mode=Timer.PERIODIC, callback=tick)
```

Enter the code in the main panel, then click on the green run button. Thonny will present you with a popup, click on "MicroPython device" and enter "test.py" to save the code to the Raspberry Pi Pico, see Figure 5.

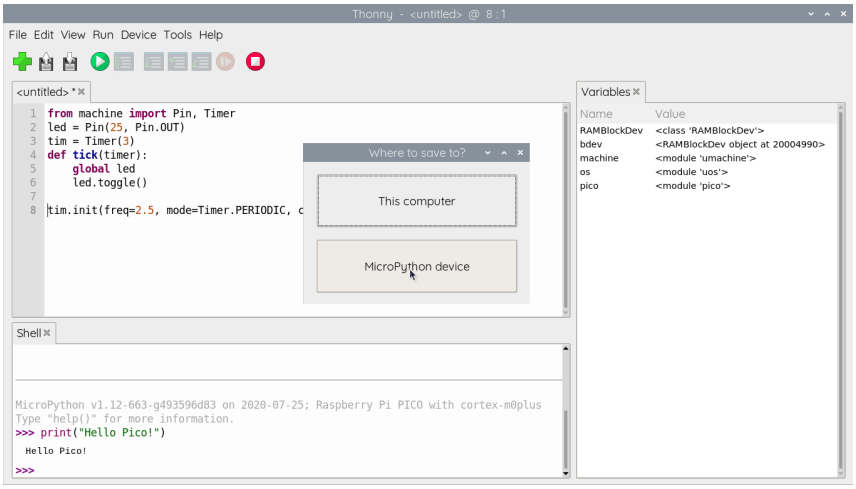

Figure 5. Saving code to the Raspberry Pi Pico inside the Thonny environment.

The program should uploaded to the Raspberry Pi Pico using the REPL, and automatically start running. You should see the onboard LED start blinking, connected to GPIO pin 25, and the variables change in the Thonny variable window, see Figure 6.

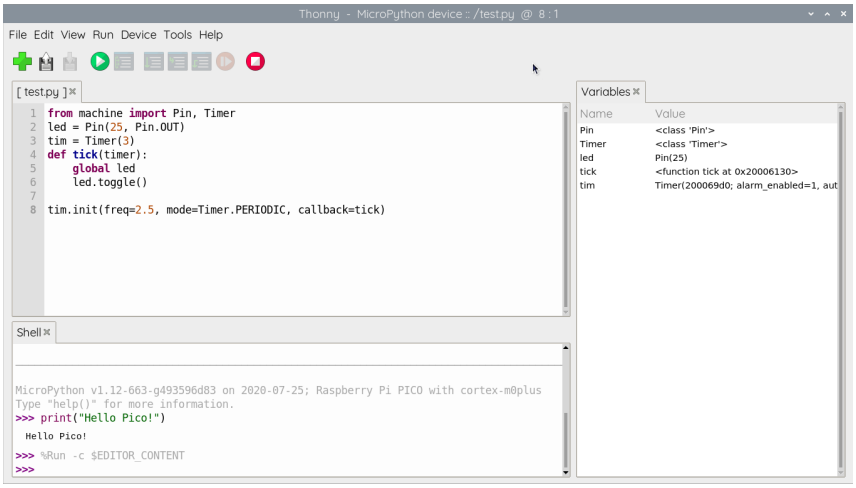

Figure 6. Blinking an LED using a timer from the Thonny environment.

4.2. Using `rshell`

The Remote Shell for MicroPython (`rshell`) is a simple shell which runs on the host and uses MicroPython's REPL to send python code to the Raspberry Pi Pico in order to get filesystem information, and to copy files to and from MicroPython's own filesystem.

You can install rshell using,

```
$ sudo apt install python3-pip
$ sudo pip3 install rshell
```

Assuming that the UART is connected to your Raspberry Pi, see Section 2.1, then you can connect to Raspberry Pi Pico using,

```
$ rshell -p /dev/serial0
Connecting to /dev/serial0 (buffer-size 512)...
Trying to connect to REPL  connected
Testing if sys.stdin.buffer exists ... N
Retrieving root directories ...
Setting time ... Aug 21, 2020 15:35:18
Evaluating board_name ... pyboard
Retrieving time epoch ... Jan 01, 2000
Welcome to rshell. Use Control-D (or the exit command) to exit rshell.
/home/pi>
```

Full documentation of `rshell` can be found on the project's Github repository.

4.3. Other Environments

TO DO: Should we talk about the Mu editor as Adafruit supports it?

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