

DesignNews

DC Motor Controls with the RP2040 Pico

DAY 2: RP2040 Pico and MicroPython Basics Part 1









Webinar Logistics

- Turn on your system sound to hear the streaming presentation.
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Dr. Don Wilcher

Visit 'Lecturer Profile' in your console for more details.



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Agenda:



- A Brief MicroPython Introduction
- Accessing and Installing MicroPython Firmware
- MicroPython Controls Lab Activities
- Lab: MicroPython Transistor Relay DC Motor Controller



Raspberry Pi RP2040 :



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"Raspberry Pi RP2040 SoC, a surprisingly powerful yet radically low-cost microcontroller packing dual Arm Cortex-M0+ processors, the most energy-efficient Arm processor available" (Adams, 2021).



A Brief MicroPython Introduction

MicroPython is a small and efficient implementation of:

- Python 3 programming language.
- A subset of the Python standard library.
- An optimized Python standard library

Additional Notes:



- MicroPython can run on microcontrollers.
- Can run in constrained environments.





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A Brief MicroPython Introduction...

Creator of MicroPython





Logo



Additional Notes:

- Initial Release Date: May 3, 2014.
- Stable Release Date: September 2, 2020.
- Sources: https://en.wikipedia.org/wiki/MicroPython

https://micropython.org/



Question 1



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Who is the creator of MicroPython?
a) Neil Gernshenfeld
b) Seymour Papert
c) George Damien
d) Damien George



Accessing and Installing MicroPython Firmware...



- Insert the micro-USB cable into the micro-USB port on your Raspberry Pi Pico board.
- Hold down the BOOTSEL button on the top of the Raspberry Pi Pico board.
- While pressing the BOOTSEL button, insert the other end of the micro-USB into your development system's USB port.
- After a few seconds, the RP2040 Pico should appear as a remote drive.



By DIGI-KOU

Accessing and Installing MicroPython Firmware...







Accessing and Installing MicroPython Firmware...



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NOTE:

In the File Manager window, 2 files will be present on the RP2040 Pico drive

- a) INDEX.HTM: A Raspberry Pi Documentation and information web page. Information presented includes:
 - i. Raspberry Pi Computers
 - ii. microcontrollers

b) INFO_UF2.TXT: RP2040 Pico information on the bootloader version



By DIGLEGRPORATION

Accessing and Installing MicroPython Firmware...



NOTE: INDEX.HTM

Web page providing Raspberry Pi Documentation

Raspberry Pi Documentation				
		Q Search		
Com	puters	Accessories	Microcontrollers	
Microcontrollers	Raspber	ry Pi Pico and Pico V	V	
RP2040 Patchami Bi Pice and Pice W				
mapping rinks and rice w	The famil	v		
The famoy	Edit this on GitHub	3		
Diagram and design files				
Rasheru Pi Pinn W			A A A A A A A A A A A A A A A A A A A	
Pinout and design files	Surf-		Sant Pro	
Documentation				
RP2040 Device				
Raspberry Pi Pico				
Raspberry Pi Pico W	📮 💷		a state the second state at	
Software Development				
Software Utilities	28 - 22			
What is on your Pico?				
Debugging using another Raspberry Pi Pico		Resolverry P)		
Resetting Flash memory	5 (CO)	G 2021		
MicroPython				
The C/C++ SDK	20111		<u>80 - 08</u>	
	The Raspberry Pi P	ico family consists of Raspberry Pi Pico (left), P	Noo H (middle), and Pico W (right).	
Raspberry Pi Pico and Pico H				
	Raspberry Pl Pico is	Raspberry PI Pico is a low-cost, high-performance microcontroller board with flexible digital interfaces. Key features include:		
	 RP2040 mice 	ocontroller chip designed by Raspberry Pl in the	e United Kinadom	
Dual-core 2/m Corex MC+ processor. Revible clock - unning up to 133 MHz 25448 of SD4M, and 2M8 of on-board flash memory USB 1.1 with device and host support			in to 133 MHz	
	 Low-power sl 	leep and dormant modes		
	Drag-and-dro	p programming using mass storage over USB		

https://www.raspberrypi.com/documentati on/microcontrollers/raspberry-pi-pico.html



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Accessing and Installing MicroPython Firmware...



NOTE: INFO_UF2.TXT. RP2040 Pico information on the bootloader version





Accessing and Installing MicroPython Firmware...

Installation instructions

Flashing via UF2 bootloader

To get the board in bootloader mode ready for the firmware update, execute machine.bootloader() at the MicroPython REPL. Alternatively, hold down the BOOTSEL button while plugging the board into USB. The uf2 file below should then be copied to the USB mass storage device that appears. Once programming of the new firmware is complete the device will automatically reset and be ready for use.

Firmware

Releases

v1.19.1 (2022-06-18) .uf2 [Release notes] (latest) v1.18 (2022-01-17) .uf2 [Release notes] v1.17 (2021-09-02) .uf2 [Release notes] v1.16 (2021-06-18) .uf2 [Release notes] v1.15 (2021-04-18) .uf2 [Release notes] v1.14 (2021-02-02) .uf2 [Release notes]

Nightly builds

v1.19.1-367-g203dae41f (2022-09-05) .uf2 v1.19.1-365-g5852fd770 (2022-09-05) .uf2 v1.19.1-358-g0b26efe73 (2022-08-31) .uf2 v1.19.1-357-gaf100b702 (2022-08-31) .uf2

https://micropython.org/download/rp2-pico/







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Accessing and Installing MicroPython Firmware...





Question 2



Which file provides Raspberry Pi documentation? a) INDEX.HMT b) INDEX.XML c) INDEX.DOC d) INDEX.HTM



MicroPython Controls Lab Activities



To conduct the MicroPython Controls Lab Activities, the Mu Editor

will be used.

NOTE:

Download Mu (codewith.mu)







MicroPython Controls Lab Activities... Selection Mode



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MicroPython Controls Lab Activities... Mu Editor



P Download About Tutorials How to..? Discuss Developers Language -

Code with Mu: a simple Python editor for beginner programmers.





MicroPython Controls Lab Activities...

Read-Eval-Loop-Print (REPL)

According to the python programming language:

REPL is the language shell, **the Python Interactive Shell**. The REPL acronym is short for Read, Eval, Print and Loop.

The Python interactive interpreter can be used to easily check Python commands. To start the Python interpreter, type the command python without any parameter and hit the "return" key. The process is:

- 1.Read: take user input.
- **2. Eval:** evaluate the input.
- **3. Print:** shows the output to the user.
- 4. Loop: repeat.





MicroPython Controls Lab Activities...

Read-Eval-Loop-Print (REPL)



```
MicroPython v1.19.1 on 2022-09-05; Raspberry Pi Pico with RP2040
Type "help()" for more information.
>>>
>>> print ("Hello World")
Hello World
>>> a=5
>>> b=6
>>> print (a+b)
11
>>> print (a*b)
30
>>> print (a-b)
-1
>>> print (a/b)
0.8333333
>>>
```



Question 3



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When using the Raspberry Pi Pico board, which Mu Editor mode to use?

- a) Python3
- **b) Pyboard MicroPython**
- c) Raspberry Pi Pico
- d) RP2040



Read-Eval-Loop-Print (REPL)

RP2040 REPL

```
MicroPython v1.19.1 on 2022-09-05; Raspberry Pi Pico with RP2040
Type "help()" for more information.
>>>
>>> help()
Welcome to MicroPython!
For online help please visit https://micropython.org/help/.
For access to the hardware use the 'machine' module. RP2 specific commands
are in the 'rp2' module.
Quick overview of some objects:
 machine.Pin(pin) -- get a pin, eg machine.Pin(0)
 machine.Pin(pin, m, [p]) -- get a pin and configure it for IO mode m, pull mode p
   methods: init(..), value([v]), high(), low(), irq(handler)
 machine.ADC(pin) -- make an analog object from a pin
    methods: read_u16()
 machine.PWM(pin) -- make a PWM object from a pin
   methods: deinit(), freq([f]), duty_u16([d]), duty_ns([d])
 machine.I2C(id) -- create an I2C object (id=0.1)
```





Read-Eval-Loop-Print (REPL)



- >>> import machine
- >>> Transistor_relay_module = machine.Pin(2, machine.Pin.OUT)
- >>> Transistor_relay_module.value(1)
- >>> Transistor_relay_module = machine.Pin(1, machine.Pin.OUT)
- >>> Transistor_relay_module.value(1)





Read-Eval-Loop-Print (REPL)

- >>> import machine
- >>> Transistor_relay_module = machine.Pin(2, machine.Pin.OUT)
- >>> Transistor_relay_module.value(1)
- >>> Transistor_relay_module = machine.Pin(1, machine.Pin.OUT)
- >>> Transistor_relay_module.value(1)
- >>> Transistor_relay_module.value(0)







Question 4



What MicroPython library is needed to assign input and output pins of the RP2040 microcontroller?

- a) import machines
- b) import machine
- c) import utime
- d) none of the above





Read-Eval-Loop-Print (REPL)



>>> print(pushbutton_switch.value())
1
>>> print(pushbutton_switch.value())
0
>>>





Lab: MicroPython Transistor Relay DC Motor Controller







Lab: MicroPython Transistor Relay DC Motor Controller. . .

Big IDEAS (Learning Objectives):

- 1. The participant will be able to wire a transistor-based electromechanical relay DC Motor Controller.
- 2. The participant will be able to create a DC motor controller code using MicroPython.
- 3. The participant will be able to test a transistor relay DC motor controller using MicroPython.



















by **Digi-Key**







ay **DIGI-KEU**

Lab: MicroPython Transistor Relay DC Motor Controller. . .





RP2040 Transistor Relay DC Motor Controller Circuit Schematic Diagram









By DIGLEKPUT

Lab: MicroPython Transistor Relay DC Motor Controller. . .

RP2040 Transistor Relay DC Motor Controller in Operation



Watch Video Clip <u>https://youtu.be/cdqp-6-Sq81</u>





Question 5



What MicroPython library is needed to create delays?

- a) import delay
- b) import pause
- c) import utime
- d) none of the above





Thank you for attending

Please consider the resources below:

Adams, J. (2021, February 1). *Raspberry pi rp2040: Our microcontroller for the masses*. <u>https://www.arm.com/blogs/blueprint/raspberry-pi-rp2040</u>

RP2040 Datasheet. (2022). RP2040 datasheet: A microcontroller by raspberry pi. <u>https://datasheets.raspberrypi.com/rp2040/rp2040-datasheet.pdf</u>

Raspberry Pi Pico Resources: Raspberry Pi Documentation - Raspberry Pi Pico and Pico W



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Thank You



