

Introduction to Embedded Systems (IES)

Course kit documentation



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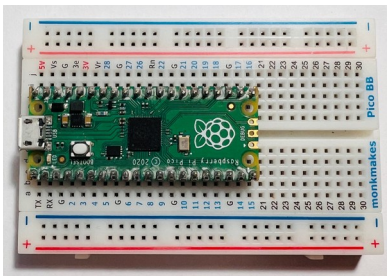
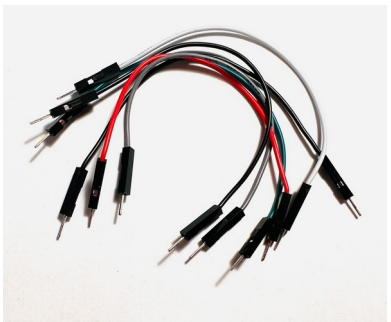
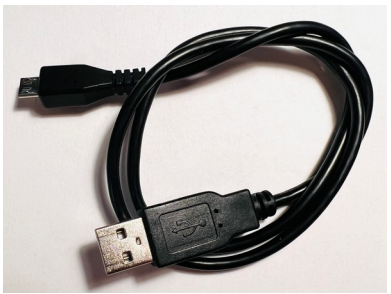
*The teaching kit is based on and has been inspired by
Monk Makes Electronics kit for Pico*

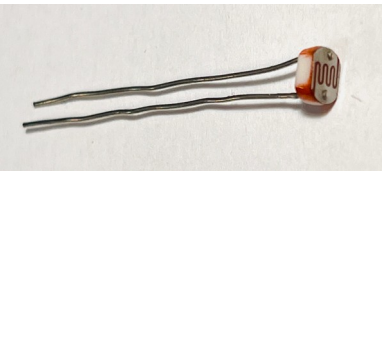
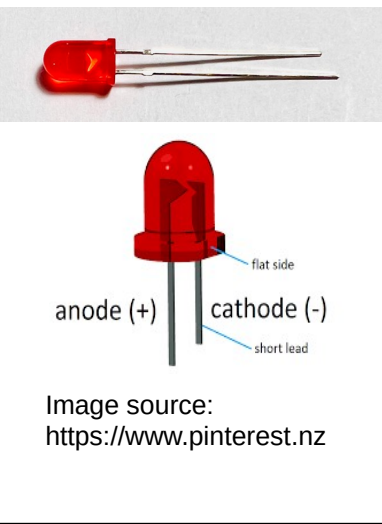
Important instructions

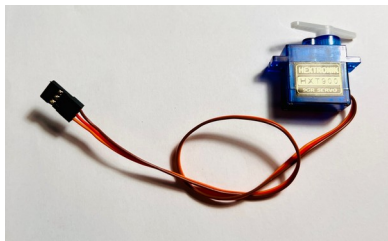
We aim to use only the best teaching materials. This requires that all students take good care of the materials. Please observe the following:

- **Keep the electronics safe** – disconnect the USB cable before modifying the circuit. Double check everything before connecting the USB cable. Please read information at the end of this document carefully.
- **No tools, no soldering, no wire cutting** - all exercises can be conducted with the materials in the kit and the prerequisites defined for the course. Tools are not needed and should not be used.
- **Return in same condition** - please return the kit in the same condition as you received it. Before returning please remove any surplus materials and make a full inventory check. Please inform the teacher if something is defective or missing.

Course kit content

Raspberry Pi Pico on breadboard Please do not remove the Pico from the breadboard	 A Raspberry Pi Pico microcontroller board is shown plugged into a white breadboard. The board is green with a black Raspberry Pi logo. The breadboard has red and blue power rails on the sides.
10 x Jumper wires Used to build circuits on the breadboard	 Ten jumper wires of various colors (red, black, white, green, blue) are shown. Each wire has a male pin on one end and a female pin on the other.
Micro USB cable	 A black Micro USB cable is shown. It has a standard USB-A connector on one end and a Micro USB-B connector on the other.
2 x Push buttons When pushed, the two pins are short circuited.	 A single push button is shown. It has a black plastic body with a circular button on top and two metal pins extending from the bottom.

Potentiometer 10 kOhm	
Light Dependent Resistor (LDR, Photoresistor) Should be connected in series with a 1 kOhm resistor.	
2 x Light Emitting Diode (LED) The longest pin is the positive pin Should be connected in series with a 470 Ohm resistor.	 Image source: https://www.pinterest.nz
RGB LED The longest pin is the negative pin The three other positive pins produce red, green and blue light. Each positive pin should be	

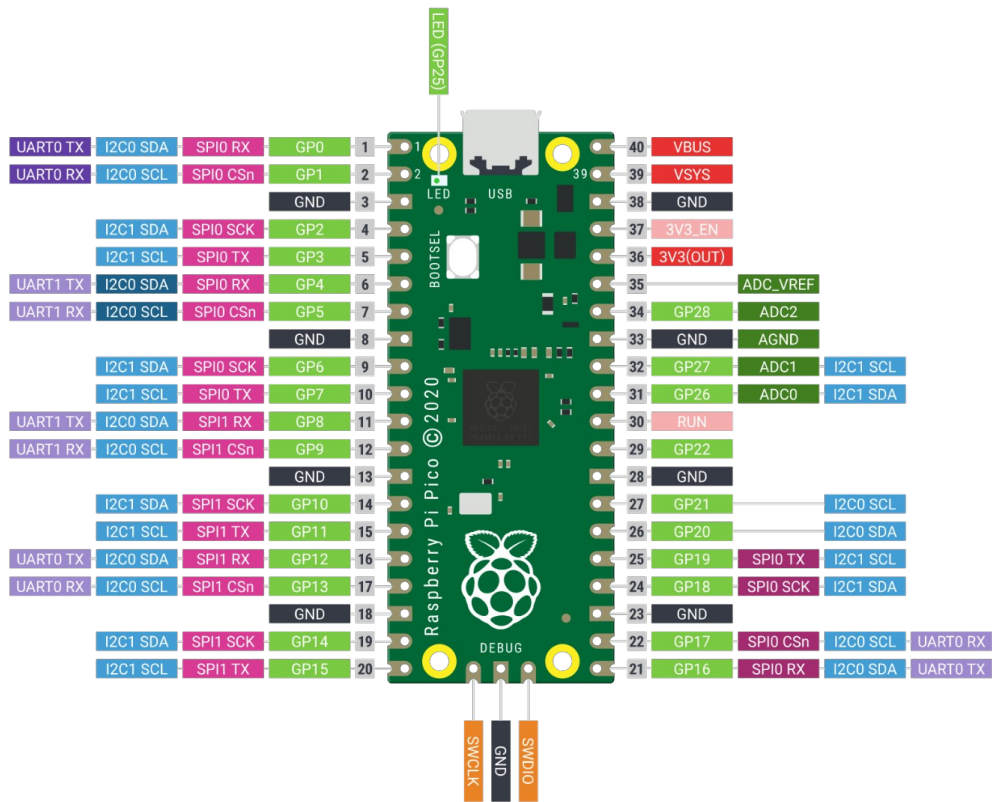
connected in series with a 470 Ohm resistor.			
Piezo buzzer			
Should be connected in series with a 470 Ohm resistor.			
Servo motor			
Wire	Type	Pico pin	
Orange	Signal	GPIO	
Red	+5V	5V	
Brown	GND	G	
Signal should be connected to GPIO pin through a 10 kOhm resistor.			
5 x 470 Ohm resistor			
Color code: yellow-violet-brown			
2 x 1 kOhm resistor			
Color code: brown-black-red			

4.7 MOhm resistor

Color code: yellow-violet-green



Raspberry Pi Pico pinout



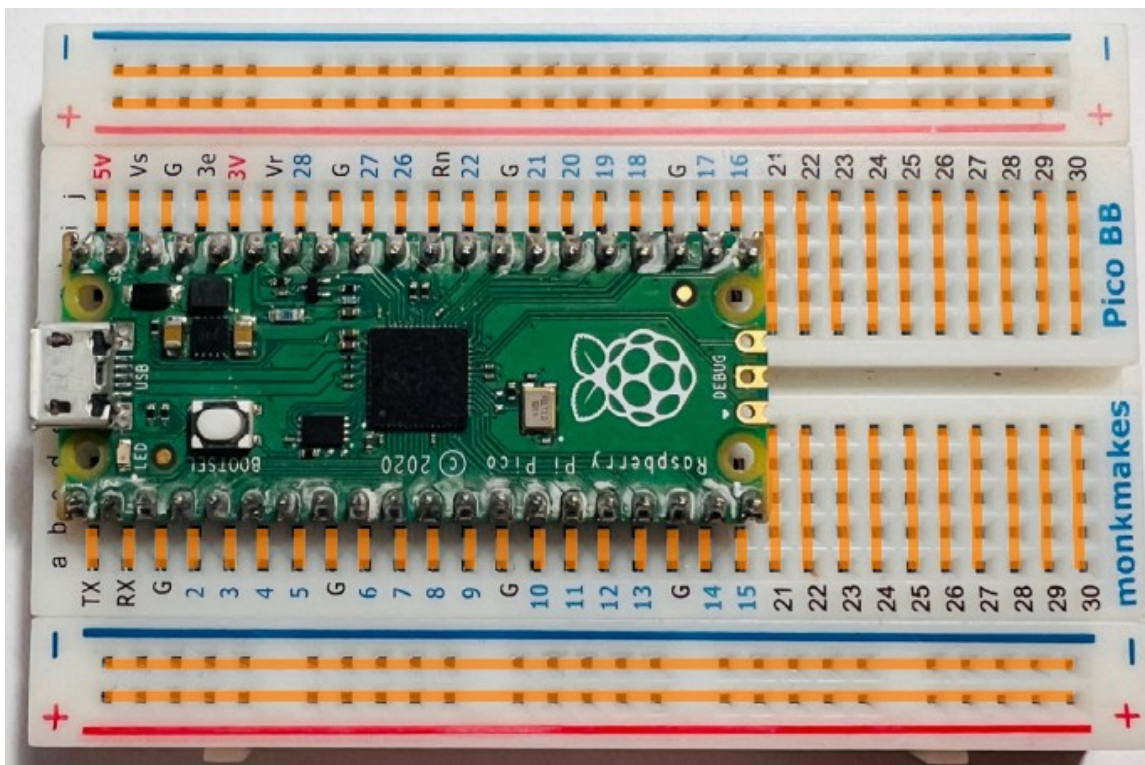
Power	Ground	UART / UART (default)	GPIO, PIO, and PWM	ADC	SPI / SPI (default)	I2C / I2C (default)	System Control	Debugging
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The Pico documentation is available at:

<https://www.raspberrypi.com/documentation/microcontrollers/raspberry-pi-pico.html>

Breadboard

The orange lines on the picture below shows how the pinholes are connected. These connections facilitate building up the experimental circuits using jumper wires.



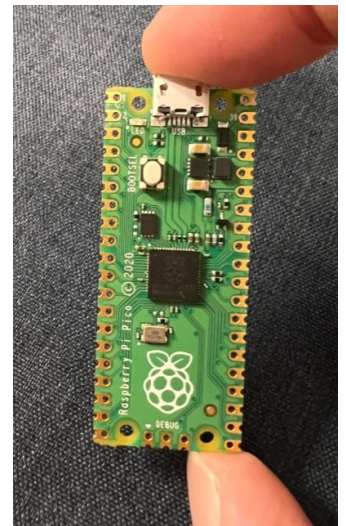
Please do not remove the Pico from the breadboard.



Keeping the electronics safe

The highest risk is erroneously connected circuits. We all make mistakes, and it happens often in electronics. Please double check your circuit before connecting the USB cable, otherwise the electronics and maybe your computer may become defective.

When you handle a PCB please try to touch as little of the PCB as possible as shown in the picture. This lowers the risk of an electrostatic discharge (ESD) from your fingers destroying the electronics.



Please keep the electronics away from any liquids and food.

Please keep your hands clean while working with electronics, otherwise your hands may carry small residues of acid (e.g. from fruits) or other destructive substances.