# SparkFun RP2040 mikroBUS Starter Kit

**KIT-19936**

The SparkFun RP2040 mikroBUS™ Starter Kit is designed to give you just what you need to start using the Click and Qwiic ecosystems side-by-side powered by Raspberry Pi! The core of this kit is designed around the SparkFun RP2040 mikroBUS™ Development Board, the SparkFun Micro OLED Breakout (Qwiic), and the MIKROE Weather Click. Additionally, to connect everything together we also include a 100mm Qwiic Cable, and a USB A-C cable!

The SparkFun RP2040 mikroBUS™ Development Board is a low-cost, high performance platform with flexible digital interfaces featuring the Raspberry Pi Foundation's RP2040 microcontroller. Besides the Thing Plus or *Feather* PTH pin layout, the board also includes a microSD card slot, 16MB (128Mbit) flash memory, a JST single cell battery connector (with a charging circuit and fuel gauge sensor), an addressable WS2812 RGB LED, JTAG PTH pins, four (4-40 screw) mounting holes, our signature Qwiic connectors, and a mikroBUS™ socket.

The RP2040 is supported with both C/C++ and MicroPython cross-platform development environments, including easy access to runtime debugging. It has UF2 boot and floating-point routines baked into the chip. While the chip has a large amount of internal RAM, the board includes an additional 16MB of external QSPI flash memory to store program code. The RP2040 contains two ARM Cortex-M0+ processors (up to 133MHz) and features:

- 264kB of embedded SRAM in six banks
- 6 dedicated IO for SPI Flash (supporting XIP)
- 30 multifunction GPIO:
    - Dedicated hardware for commonly used peripherals
    - Programmable IO for extended peripheral support
    - Four 12-bit ADC channels with internal temperature sensor (up to 0.5 MSa/s)
- USB 1.1 Host/Device functionality

For the mikroBUS™ socket we include the MIKROE Weather Click. MIKROE Weather Click carries BME280 integrated environmental unit from Bosch. It's a sensor that detects humidity, pressure, and temperature, specifically designed for low current consumption and long-term stability. The click is designed to work on a 3.3V power supply. It communicates with the target microcontroller over SPI or I2C interface.

For the Qwiic port we include the SparkFun Micro OLED Breakout (Qwiic). The SparkFun Qwiic Micro OLED Breakout is a Qwiic-enabled version of our popular Micro OLED display! The small monochrome, blue-on-black OLED screen presents incredibly clear images for your viewing pleasure. It's "micro," but it still packs a punch --- the OLED display is crisp, and you can fit a deceivingly large amount of graphics on there. This breakout is perfect for adding graphics to your next project and displaying diagnostic information without resorting to a serial output, all with the ease of use of our own Qwiic Connect System!

*The SparkFun Qwiic Connect System is an ecosystem of I²C sensors, actuators, shields and cables that make prototyping faster and less prone to error. All Qwiic-enabled boards use a common 1mm pitch, 4-pin JST connector. This reduces the amount of required PCB space, and polarized connections mean you can't hook it up wrong.*

## INCLUDES

- 1x SparkFun RP2040 mirkoBUS™ Development Board
- 1x MIKROE Weather Click
- 1x SparkFun Micro OLED Breakout (Qwiic)
- 1x Flexible Qwiic Cable - 100mm
- 1x USB 3.1 Cable A to C - 3 Foot

## FEATURES

### SparkFun RP2040 mikroBUS Dev. Board Features

- Raspberry Pi Foundation's RP2040 microcontroller
  - 18[1] Multifunctional GPIO Pins[2]
    - Four available 12-bit ADC channels with internal temperature sensor (500kSa/s)
    - Up to eight 2-channel PWM
    - Up to two UARTs
    - Up to two I²C buses
    - Up to two SPI buses
- Thing Plus (or Feather) Pin Layout:
  - 28 PTH Pins
  - USB-C Connector:
    - USB 1.1 Host/Device functionality
  - 2-pin JST Connector for a LiPo Battery *(not included)*:
    - 500mA charging circuit
  - 4-pin JST Qwiic Connector
- LEDs:
  - `PWR` - Red 3.3V power indicator
  - `CHG` - Yellow battery charging indicator

    - `25` - Blue status/test LED (`GPIO 25`)
    - `WS2812` - Addressable RGB LED (`GPIO 08`)
- Buttons:
    - `Boot`
    - `Reset`
- JTAG PTH Pins
- 16MB QSPI Flash Memory
- µSD Card Slot
- mikroBUS Socket
- Dimensions: 3.7" x 1.2"
- Four Mounting Holes:
    - 4-40 screw compatible

**RP2040 General Features**:

- Dual Cortex M0+ processors, up to 133 MHz
- 264 kB of embedded SRAM in 6 banks
- 6 dedicated IO for QSPI flash, supporting execute in place (XIP)
- 30 programmable IO for extended peripheral support
- SWD interface
- Timer with 4 alarms
- Real time counter (RTC)
- USB 1.1 Host/Device functionality
- Supported programming languages
    - MicroPython
    - C/C++

1. **Note:** `GPIO 08` is not included in this count, as it passes through the WS2812 addressable RGB LED first. `GPIO 07` and `GPIO 23` are counted as a single GPIO because they are tied together.

2. **Note:** The GPIO pins are programmable so you can reconfigure the pins! Check out the RP2040 datasheet for more information on the GPIO functionality.

## DOCUMENTS

### RP2040 Dev Board

- Schematic
- Eagle Files
- Board Dimensions
- Hookup Guide
- Qwiic Info Page
- GitHub Hardware Repository
- Software (SDK) Documentation:
    - Online SDK Documentation
    - Raspberry Pi Pico C/C++ SDK - A guide on the libraries and tools for C++ development on RP2040 microcontrollers
    - Raspberry Pi Pico Python SDK - A guide on the MicroPython environment for RP2040 microcontrollers
- Hardware Component Information:
    - Raspberry Pi RP2040 Datasheet
    - 16MB Flash (W25Q128) Datasheet

    - Low Dropout (LOD) Voltage Regulator (AP2112) Datasheet
    - Linear Charge Management Controller (MCP73831) Datasheet
    - RGB LED (WS2812C) Datasheet
    - Fuel Gauge (MAX17048) Datasheet
    - SparkFun Qwiic Connect System
    - mikroBUS Standard
- Software Development Platforms for the RP2040:
    - MicroPython
        - Example code to accompany the Get Started with MicroPython on Raspberry Pi Pico book
    - Pico C/C++ SDK
        - Example codes
        - Beta Libraries
            - Example code for the beta libraries
    - Tools and Resources:
        - RP2040 Boot ROM - Source code for the USB mass storage device emulation
        - Picotool - Inspecting RP2040 binaries in BOOTSEL mode
        - Debugging Probe Configuration
        - OpenOCD Debugger
        - pico-project-generator - GUI tool to automatically generate a Pico C/C++ SDK project
    - **UF2 Files**- Just drag-and-drop onto your RP2040 board
        - C/C++ Files:
            - Blink binary
            - Hello World binary
        - MicroPython Files:
            - MicroPython firmware (build date: 05-Feb-2021)
        - Utility Files: microcontroller
            - Debugging w/ picoprobe - Debugging with another RP2040 microcontroller
            - Reset flash memory - Clears flash memory from board

**MIKROE Weather Click**

- Schematic
- Datasheet (BME280)
- GitHub

**Micro OLED**

- Schematic
- Eagle Files
- Qwiic Info Page
- Hookup Guide
- Datasheet (SSD1306)
- Qwiic Micro OLED Python Package Repo
- GitHub