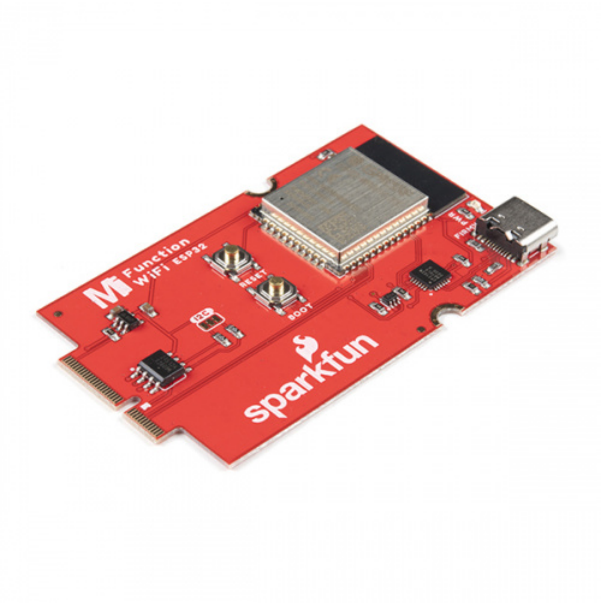
MicroMod WiFi Function Board - ESP32 Hookup Guide

Introduction

The SparkFun MicroMod ESP32 Function Board adds additional wireless options to MicroMod Processor Boards that do not have that capability. This special function board acts as a coprocessor that takes advantage of Espressif's ESP32 WROOM to add WiFi and Bluetooth® to your applications.



SparkFun MicroMod WiFi Function Board - ESP32
WRL-18430

Product Showcase: SparkFun MicroMod Main and F...

Required Materials

To follow along with this tutorial, you will need the following materials at a minimum. You may not need everything though depending on what you have. Add it to your cart, read through the guide, and adjust the cart as necessary.

SparkFun MicroMod Main Board - Single
DEV-18575

SparkFun MicroMod WiFi Function Board - ESP32
WRL-18430

Reversible USB A to C Cable - 2m
CAB-15424

SparkFun MicroMod Artemis Processor
DEV-16401

MicroMod Main Board

To hold the processor board and function board, you will need one Main board. Depending on your application, you may choose to have one or two additional function boards.

SparkFun MicroMod Main Board - Single
DEV-18575

SparkFun MicroMod Main Board - Double
DEV-18576

MicroMod Processor Board

There are a variety of MicroMod Processor Boards available to choose from. You will probably want to avoid having the same Processor and Function Board since there is an ESP32 on both types of boards.

SparkFun MicroMod Artemis Processor
DEV-16401

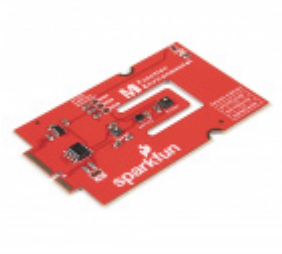
SparkFun MicroMod Teensy Processor
DEV-16402

SparkFun MicroMod STM32 Processor
DEV-17713

SparkFun MicroMod RP2040 Processor
DEV-17720

MicroMod Function Board

To add additional functionality to your Processor Board, you'll want to include one or two function boards when connecting them to the Main Board.



SparkFun MicroMod Environmental Function Board
SEN-18632

SparkFun MicroMod WiFi Function Board - ESP32
WRL-18430

Tools

You will need a screw driver to secure the Processor and Function boards.

SparkFun Mini Screwdriver
TOL-09146

Suggested Reading

If you aren't familiar with the MicroMod ecosystem, we recommend reading here for an overview.

MicroMod Ecosystem

If you aren’t familiar with the following concepts, we also recommend checking out a few of these tutorials before continuing. Make sure to check the respective hookup guides for your processor board and function board to ensure that you are installing the correct USB-to-serial converter. You may also need to follow additional instructions that are not outlined in this tutorial to install the appropriate software.

What is an Arduino?

What is this 'Arduino' thing anyway? This tutorials dives into what an Arduino is and along with Arduino projects and widgets.

Installing Arduino IDE

A step-by-step guide to installing and testing the Arduino software on Windows, Mac, and Linux.

How to Install CH340 Drivers

How to install CH340 drivers (if you need them) on Windows, Mac OS X, and Linux.

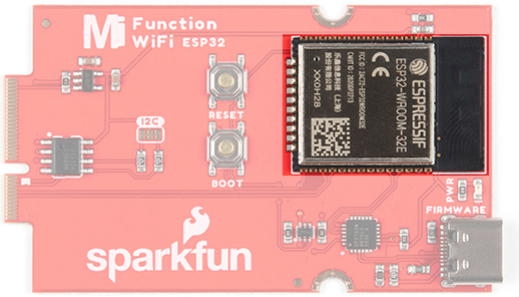
Getting Started with MicroMod

Dive into the world of MicroMod - a compact interface to connect a microcontroller to various peripherals via the M.2 Connector!

Hardware Overview

ESP32

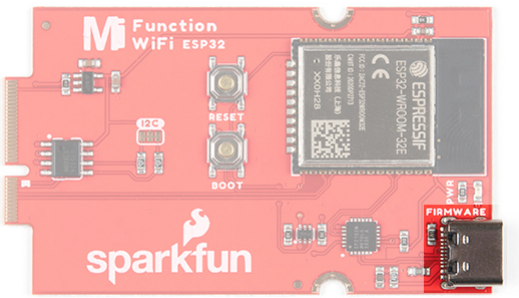
The MicroMod WiFi Function Board includes the ESP32-WROOM module with AT command firmware. The module can be accessed through the serial UART pins.



USB

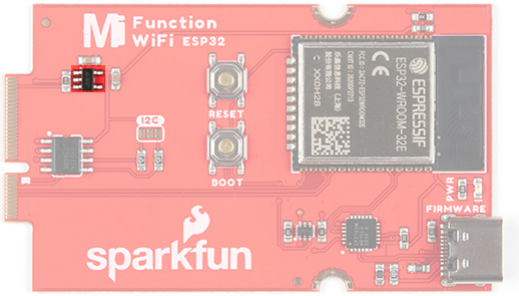
> **Note:** The CP2101X is powered through the Main Board's VIN pin. Make sure to connect a second USB cable to the Main Board.

The board includes a USB Type C connector on the board to update ESP32's firmware. You will need a Main Board and a second USB cable to update the firmware.



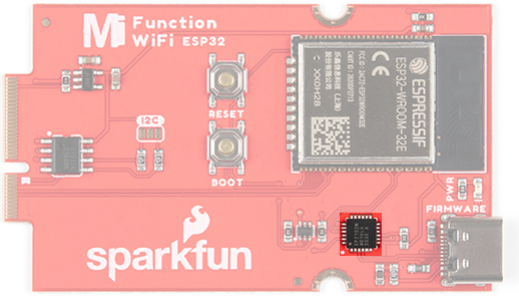
Power

To power the board, you will need to apply power to a SparkFun Main Board. Power applied will connect to the Function Board's VIN pin, which will be regulated down for the rest of the board with the AP2112 3.3V/600mA voltage regulator. Users can control the 3.3V voltage regulator using a Processor Board's I/O pin. For more information, check out the MicroMod Main Board Examples to toggle the pin.



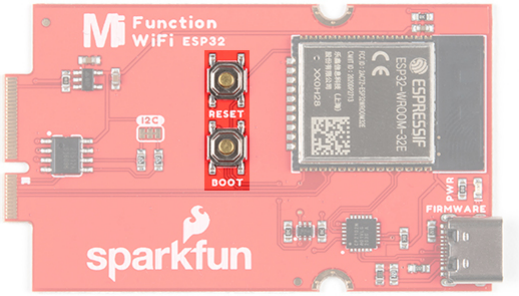
CP2102

The board is populated with the CP2102 USB-to-Serial converter to update firmware on the ESP32 through its USB Type C connector. This allows the board to show up as a device on the serial (or COM) port of the computer. You will need a Main Board and a second USB cable to update the firmware.



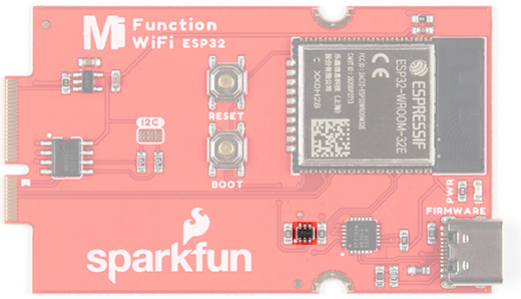
Reset and Boot Buttons

The reset button allows users to reset the program running on the ESP32 module without unplugging the board. To boot button allows users to manually flash new firmware to the ESP32.



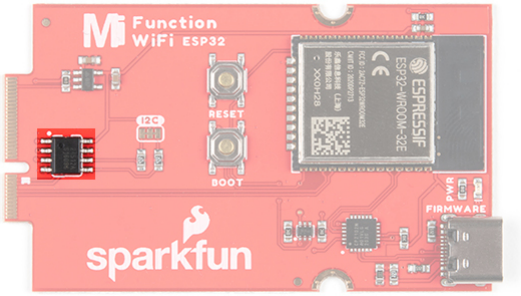
Transistor

The IC next to the USB-to-Serial converter includes two transistors. This is used by the USB-to-Serial Converter to auto-reset the ESP32 when updating its firmware.



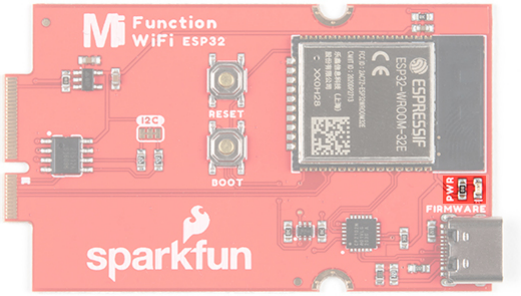
EEPROM

The board includes an I^{2}C EEPROM. Unfortunately, this is not available for the user and was meant to hold board specific information.



LED

There is only one LED available which is the PWR LED. The LED lights up to indicate when available for the ESP32 and CP2102 from the 3.3V voltage regulator. You can disable it by cutting the jumper on the back of the board.

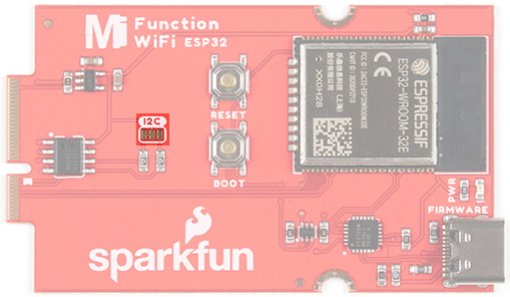


Jumpers

> **Note:** If this is your first time working with jumpers, check out the How to Work with Jumper Pads and PCB Traces tutorial for more information.

The following jumpers are included to configure the board.

- **PWR** - By default, the jumper with the label `PWR` is closed. This jumper connects the 3.3V line and LED. Cutting this jumper will disable the LED.
- **I^{2}C Pull-up Resistors** - By default, this three way jumper labeled `I2C` is closed and connects two pull-up resistors to the I^{2}C data lines. If you have many devices on your I^{2}C data lines, then you may consider cutting these two jumpers.

	
I²C Pull-up Resistor Jumpers	*PWR LED Jumper*

Hardware Pinout

Depending on your window size, you may need to use the horizontal scroll bar at the bottom of the table to view the additional pin functions. Note that the M.2 connector pins on opposing sides are offset from each other as indicated by the bottom pins where it says (Not Connected)*. There is no connection to pins that have a "-" under the primary function.

MICROMOD WIFI FUNCTION BOARD - ESP32 PINOUT TABLE

MICROMOD GENERAL PROCESSOR PINOUT TABLE

MICROMOD GENERAL PIN DESCRIPTIONS

AUDIO	UART	GPIO/BUS	I²C	SDIO	SPI0	Dedicated

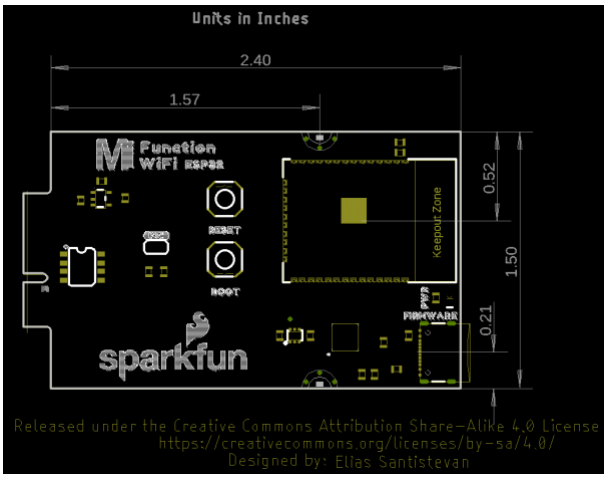
Alternative Function	Primary Function	Bottom Pin	Top Pin	Primary Function	Alternative Function
	(Not Connected)		**75**	GND	
	VIN	**74**	**73**	3.3V	
	VIN	**72**	**71**	Power EN	
	-	**70**	**69**	-	
	-	**66**	**65**	-	
	-	**64**	**63**	-	
	-	**62**	**61**	-	
	-	**60**	**59**	-	
	-	**58**	**57**	-	

	-	**56**	**55**	-	
	-	**54**	**53**	-	
	-	**52**	**51**	-	
	-	**50**	**49**	-	
	-	**48**	**47**	-	
	-	**46**	**45**	GND	
	-	**44**	**43**	-	
	-	**42**	**41**	-	
	-	**40**	**39**	GND	
	-	**38**	**37**	-	
	EEPROM_A0	**36**	**35**	-	
	EEPROM_A1	**34**	**33**	GND	
	EEPROM_A2	**32**	**31**	Module Key	
	Module Key	**30**	**29**	Module Key	
	Module Key	**28**	**27**	Module Key	
	Module Key	**26**	**25**	Module Key	
	Module Key	**24**	**23**	-	
	-	**22**	**21**	I2C_SCL	
	-	**20**	**19**	I2C_SDA	
	-	**18**	**17**	-	
	-	**16**	**15**	UART_RX	
	-	**14**	**13**	UART_TX	
	-	**12**	**11**	-	
	-	**10**	**9**	-	
	-	**8**	**7**	-	
	-	**6**	**5**	-	

	-	**4**	**3**	-	
	-	**2**	**1**	GND	

Board Dimensions

The board uses the standard MicroMod Function Board size which measures about 1.50"x2.56".



Hardware Hookup

If you have not already, make sure to check out the Getting Started with MicroMod: Hardware Hookup for information on inserting your Processor and Function Boards to the Main Board.

Getting Started with MicroMod

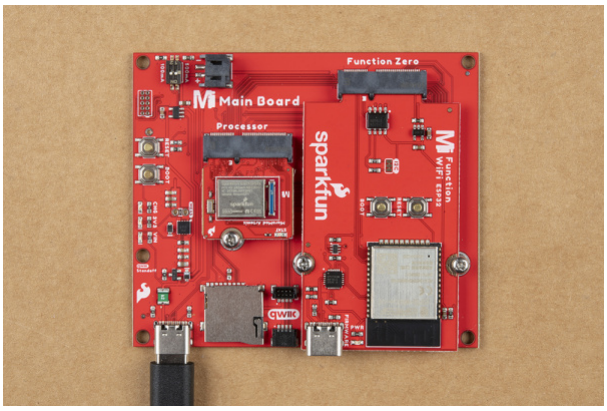
OCTOBER 21, 2020

Dive into the world of MicroMod - a compact interface to connect a microcontroller to various peripherals via the M.2 Connector!

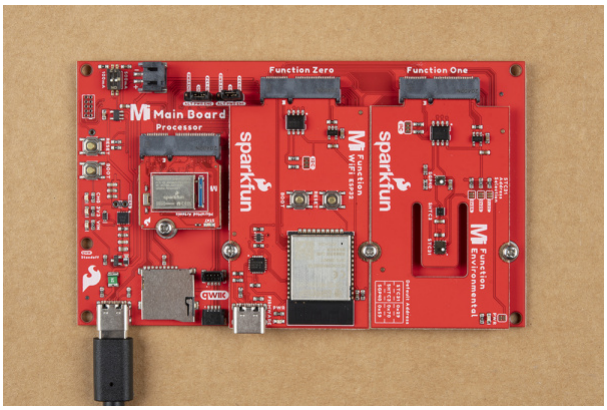
Adding a Function Board to the Main Board

We'll assume that you have inserted a Processor Board into the Main Board already. The process is the same for adding a Function Board. The only difference is that you will be adding two screws to hold the Function board down.

Align the Function Board's key into its M.2 connector's socket. Insert the board at an angle (~25°), push down, and tighten one of the screw to hold the board down. Attach the second screw on the other side of the board. Once the board is aligned, tighten both screws fully to secure the board. In this case, we had the WiFi Function Board secured in the M.2 connector socket. Depending on your application, you may have a different Function Board.

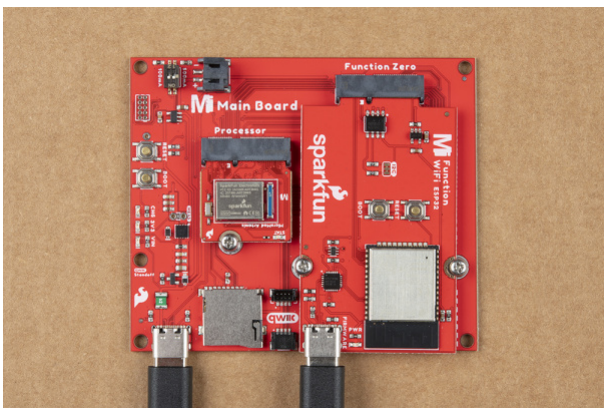


If you decide to have two function boards attached to the Main Board - Double, we recommend tightening the screw between the two Function Boards first to hold them down before attaching the remaining screws on either side of the Function Boards. In this case, we had the WiFi Function Board and the Environmental Function Board secured in the M.2 connector socket. Depending on your application, you may have different function boards.



ESP32 Firmware Update

To update the firmware you will need to connect the USB C cable to the MicroMod WiFi Function Board (ESP32) to a computer's COM port. An additional Main Board with a second USB C cable is also needed to power the Main Board and MicroMod WiFi Function Board.



Software Installation

Note: This example assumes you are using the latest version of the Arduino IDE on your desktop. If this is your first time using Arduino, please review the following tutorials.

- Installing the Arduino IDE
- Installing Board Definitions in the Arduino IDE

Arduino Board Definitions and Driver

We'll assume that you installed the necessary board files and drivers for your Processor Board. In this case, we used the MicroMod Artemis Processor Board which uses the CH340 USB-to-serial converter. If you are using a Processor Board, make sure to check out its hookup guide for your Processor Board.

Installing Board Definitions in the Arduino IDE

SEPTEMBER 9, 2020

How do I install a custom Arduino board/core? It's easy! This tutorial will go over how to install an Arduino board definition using the Arduino Board Manager. We will also go over manually installing third-party cores, such as the board definitions required for many of the SparkFun development boards.

MicroMod Artemis Processor Board Hookup Guide

OCTOBER 21, 2020

Get started with the Artemis MicroMod Processor Board in this tutorial!

How to Install CH340 Drivers

AUGUST 6, 2019

How to install CH340 drivers (if you need them) on Windows, Mac OS X, and Linux.

CP2102 Drivers

For users looking to update the AT Command Firmware, you will need to install a the separate Silicon Labs CP210X Driver for the WiFi Function Board - ESP32. The latest can be found from Silicon Labs: USB to UART Bridge VCP Driver.

DOWNLOAD WINDOWS VCP DRIVER (ZIP)

DOWNLOAD MAC OSX VCP DRIVER (ZIP)

Note: If applicable, make sure you are using the proper driver files for your CPU architecture. This is usually indicated by a folder or file name with "*x86*" for 32-bit processors or "*x64*" for 64-bit processors.

Arduino Examples

Example 1: Connecting to WiFi

This example shows you how to send AT commands from your Processor Board to scan and connect to a WiFi Router. Note that this example runs once in the `setup()` function.

If you have not already, select your Board (in this case the **MicroMod Artemis**), and associated COM port. Copy and paste the code below in your Arduino IDE. Make sure to modify the SSID (`YOUR_NETWORK_HERE`) and password (`YOUR_PASSWORD_HERE`) for your wireless router. Hit the upload button and set the serial monitor to **115200** baud.

```
const char* newLineCarriageReturn = "\r\n";
// Used at beginning of code to clear out anything in buffer
const char* toSend = "AT+GMR\r\n";
// Check version information.
const char* enableSys = "AT+SYSLOG=1\r\n";
// Enable AT error code prompt
const char* wifiMode = "AT+CWMODE=3\r\n";
// Set the WiFi mode of ESP devices
const char* whatWifi = "AT+CWLAP\r\n";
// List available APs
const char* connectTo = "AT+CWJAP=\"YOUR_NETWORK_HERE\",\"YOUR_PASSWORD_HERE\"\r\n";
// Connect an ESP station to a targeted AP, where YOUR_NETWORK_HERE is your network SSID, and YO
UR_PASSWORD_HERE.
const char* wifiInfo = "AT+CWSTATE?\r\n";
// Query the Wi-Fi state and Wi-Fi information
const char* atReset = "AT+RST\r\n";
// Restart module
const char* whatStandard = "AT+CWAPPROTO?\r\n";
// Sets the 802.11 b/g/n protocol standard of SoftAP mode
//const char* sendLight = "AT+HTTPCLIENT=1,3,192.168.1.116/TEMP86";
// Send HTTP Client Request

//String composedMess = "";
//uint8_t powerEnableZero = A1;
//uint8_t powerEnableOne = 34;

void setup() {

  //  pinMode(powerEnableOne, OUTPUT);
  // pinMode(powerEnableZero, OUTPUT);

  Serial.begin(115200);  //Arduino Serial Monitor
  Serial1.begin(115200); //Hardware Serial Port connected to ESP32


  //Let user know that we are ready to begin sending AT commands
  Serial.println("We up.");

  Serial1.write(newLineCarriageReturn);
  delay(1000);//wait for ESP32

  Serial1.write(toSend);
  delay(1000);//wait for ESP32

  //check on ESP32 response
  while (Serial1.available()) {
    Serial.print(char(Serial1.read()));
  }

  Serial1.write(enableSys);
  delay(1000);//wait for ESP32

  //check on ESP32 response
```

```
  while (Serial1.available()) {
    Serial.print(char(Serial1.read()));
  }

  Serial1.write(wifiMode);
  delay(2000);//wait for ESP32

  //check on ESP32 response
  while (Serial1.available()) {
    Serial.print(char(Serial1.read()));
  }

  Serial1.write(whatWifi);
  delay(5000);//wait for ESP32

  //check on ESP32 response
  while (Serial1.available()) {
    Serial.print(char(Serial1.read()));
  }

  Serial1.write(connectTo);
  delay(5000);//wait for ESP32

  //check on ESP32 response
  while (Serial1.available()) {
    Serial.print(char(Serial1.read()));
  }

  Serial1.write(wifiInfo);
  delay(5000);//wait for ESP32

  //check on ESP32 response
  while (Serial1.available()) {
    Serial.print(char(Serial1.read()));
  }

  Serial.println("Done.");
  while (1);
  delay(2000);
}

void loop()
{
  //  digitalWrite(powerEnableZero, LOW);
  //  digitalWrite(powerEnableOne, LOW);
  while (1);

}
```

If all goes well, your ESP32 be configured for each AT command. At one point, the ESP32 will see what other wireless routers (if there are any) are in range before connecting to your WiFi router and providing a status on the connection to your network.

Example 2: Serial Passthrough

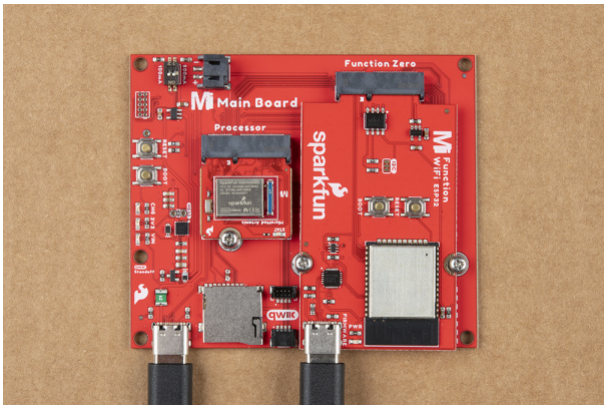
This example allows you to use your Processor Board as a serial passthrough to send characters to and from the ESP32 and the USB-to-serial converter. This is useful for testing different AT commands from the Arduino Serial Monitor or terminal window.

If you have not already, select your Board (in this case the **MicroMod Artemis**), and associated COM port. Copy and paste the code below in your Arduino IDE. Hit the upload button and set the serial monitor to **115200** baud.

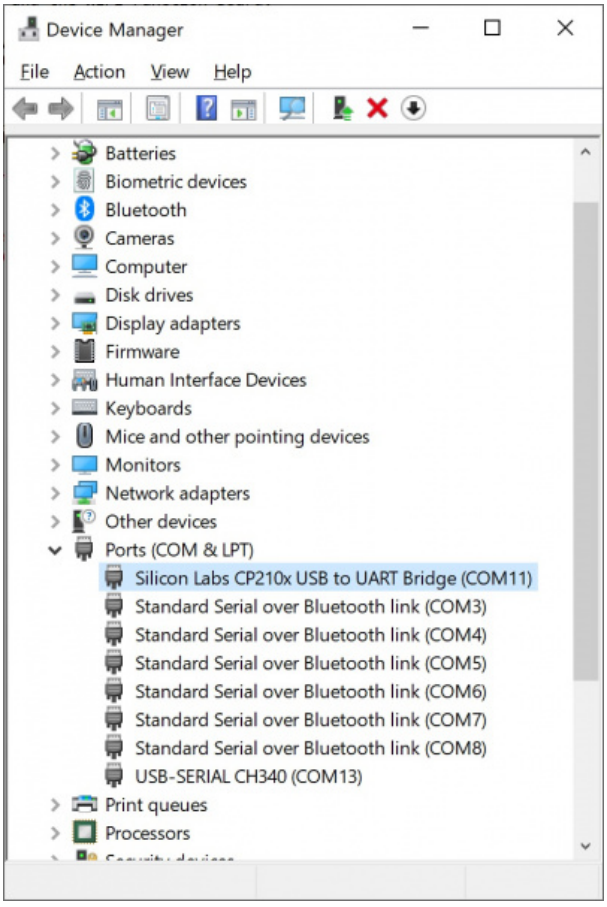
```
char val; //init global var for serial characters being sent from ESP32

void setup()
{

  Serial.begin(115200); //Set up Serial Monitor
  Serial1.begin(115200); //Set up hardware UART to pipe data from the ESP32

}

void loop()
{

  if (Serial.available())
  {
    //If data comes in from Serial Monitor:
    //1.) echo the character back to the Serial Monitor
    //2.) send it to Hardware UART.

    val  = Serial.read(); //save character from Arduino's buffer to a variable

    //Serial.print(val); //display serial data back on the Arduino's Serial Monitor, disabled th
is line if using a Terminal Window
    Serial1.write(val); //send serial data to Processor Board's Hardware UART
  }

  if (Serial1.available())
  { // If data comes in from ESP32 connected to hardware UART,
    //display it on the Serial Monitor or Terminal Window
    Serial.write(Serial1.read());//display serial data received from
  }

}
```

Firmware Update

If you decide to update the firmware, make sure to have the ESP32 connected to the Main Board. Then insert a USB cable to the Main Board and the WiFi Function Board.



When updating firmware for the ESP32, you will need to make sure you select the port that the WiFi Function Board is connected on. It should be the port that is connected to the CP2102. In this case, the port was named as **Silicon Labs CP210x USB to UART Bridge** under **COM11** under the Windows Device Manager.



Head over to Espressif's user guide for instructions, tools, and the latest firmware to update the ESP32. You'll want to use the ESP32 factory binary. Depending on your needs, you could download multiple binaries or generate your own for the ESP32.

READTHEDOCS: ESP-AT USER GUIDE - DOWNLOADING GUIDE

Troubleshooting

Not working as expected and need help?

If you need technical assistance and more information on a product that is not working as you expected, we

recommend heading on over to the SparkFun Technical Assistance page for some initial troubleshooting.

SPARKFUN TECHNICAL ASSISTANCE PAGE

If you don't find what you need there, the SparkFun Forums: MicroMod are a great place to find and ask for help. If this is your first visit, you'll need to create a Forum Account to search product forums and post questions.

SPARKFUN FORUMS: MICROMOD

Resources and Going Further

Now that you've successfully got your MicroMod ESP Function Board up and running, it's time to incorporate it into your own project! For more information, check out the resources below:

- Schematic (PDF)
- Board Files (ZIP)
- Board Dimensions (PNG)
- Silicon Labs CP210X Drivers
  - Windows
  - Max OSX
- Datasheet (ESP32-WROOM-32E)
- ReadTheDocs: ESP32 AT Command Set
  - AT Firmware Downloading Guide
  - ESP32-WROOM AT Firmware
- GitHub Hardware Repo
- SFE Product Showcase

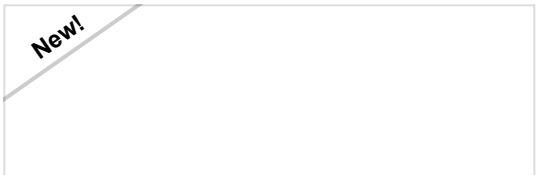
Looking for more inspiration? Check out these other tutorials related to MicroMod.

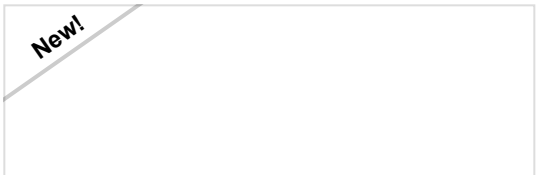
Getting Started with MicroMod

Dive into the world of MicroMod - a compact interface to connect a microcontroller to various peripherals via the M.2 Connector!

MicroMod Teensy Processor Hookup Guide

Add the processing power and versatility of the Teensy to your MicroMod project following this guide for the SparkFun MicroMod Teensy Processor.





1W LoRa MicroMod Function Board

Everything you need to get started with the 1W LoRa MicroMod function board; a MicroMod function board that provides LoRa capabilities for your MicroMod project. Must be used in conjunction with a MicroMod main board and processor.

MicroMod Environmental Function Board Hookup Guide

The SparkFun MicroMod Environmental Function Board adds additional sensing options to the MicroMod Processor Boards. This function board includes three sensors to monitor air quality (SGP40), humidity & temperature (SHTC3), and CO2 concentrations (STC31) in your indoor environment. To make it even easier to use, all communication is over the MicroMod's I2C bus! In this tutorial, we will go over how to connect the board and read the sensors.