MicroMod Artemis Processor Board Hookup Guide

Introduction

Leveraging the ultra powerful Artemis Module, the SparkFun MicroMod Artemis Processor is the brain board of your dreams. With a Cortex-M4F with BLE 5.0 running up to 96MHz and with as low power as 6uA per MHz (less than 5mW), the M.2 MicroMod connector allows you to plug in a MicroMod Carrier Board with any number of peripherals. Let's have a look at what this processor board has to offer!

SparkFun MicroMod Artemis Processor
◉ DEV-16401

Product Showcase: SparkFun MicroMod Ecosystem

▶

Required Materials

In addition to your MicroMod Artemis Processor Board, you'll need a carrier board to get started. Here we use the Machine Learning Carrier Board, but there are a number of others you can choose from.

SparkFun MicroMod Machine Learning Carrier Board
◉ DEV-16400

SparkFun MicroMod Data Logging Carrier Board
◉ DEV-16829

SparkFun MicroMod ATP Carrier Board
◉ DEV-16885

You'll also need a USB-C cable to connect the Carrier to your computer and if you want to add some Qwiic breakouts to your MicroMod project you'll want at least one Qwiic cable to connect it all together. Below are some options for both of those cables:

SparkFun Qwiic Cable Kit
◉ KIT-15081

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

USB 3.1 Cable A to C - 3 Foot
◉ CAB-14743

Depending on which Carrier Board you choose, you may need a few extra peripherals to take full advantage of them. Refer to the Carrier Boards' respective Hookup Guides for specific peripheral recommendations.

Suggested Reading

The SparkFun MicroMod ecosystem is a unique way to allow users to customize their project to their needs. Do you want to send your weather data via a wireless signal (eg. Bluetooth or WiFi)? There's a MicroMod processor for that. Looking to instead maximize efficiency and processing powere? You guessed it, there's a MicroMod processor for that. If you are not familiar with the MicroMod system, take a look here:

MicroMod Ecosystem

We also recommend taking a look through the following tutorials if you are not familiar with the concepts covered in them:

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!

Designing with MicroMod
This tutorial will walk you through the specs of the MicroMod processor and carrier board as well as the basics of incorporating the MicroMod form factor into your own PCB designs!

MicroMod Machine Learning Carrier Board
Hookup Guide
Get hacking with this tutorial on our Machine Learning
Carrier Board!

Hardware Overview

While the Artemis module is pretty self-contained, let's have a look at a few of the unique features of this MicroMod Processor Board.

Power

Power is supplied by the carrier board, but it should be noted that all pins are **3.3V**.

> ⚡ **Warning:** All pins are **3.3V**. DO NOT expose the pins to 5V.
>
> The ADC on the Artemis is **0-2V**. Exposing an ADC pin to 3.3V will not harm the device but the ADC will saturate returning 16,383 (14-bit) for voltages greater than 2V.

M.2 Connector

All of our MicroMod Processor boards come equipped with the **M.2 MicroMod Connector**, which leverages the M.2 standard and specification to allow you to install your MicroMod Processor board on your choice of carrier board.
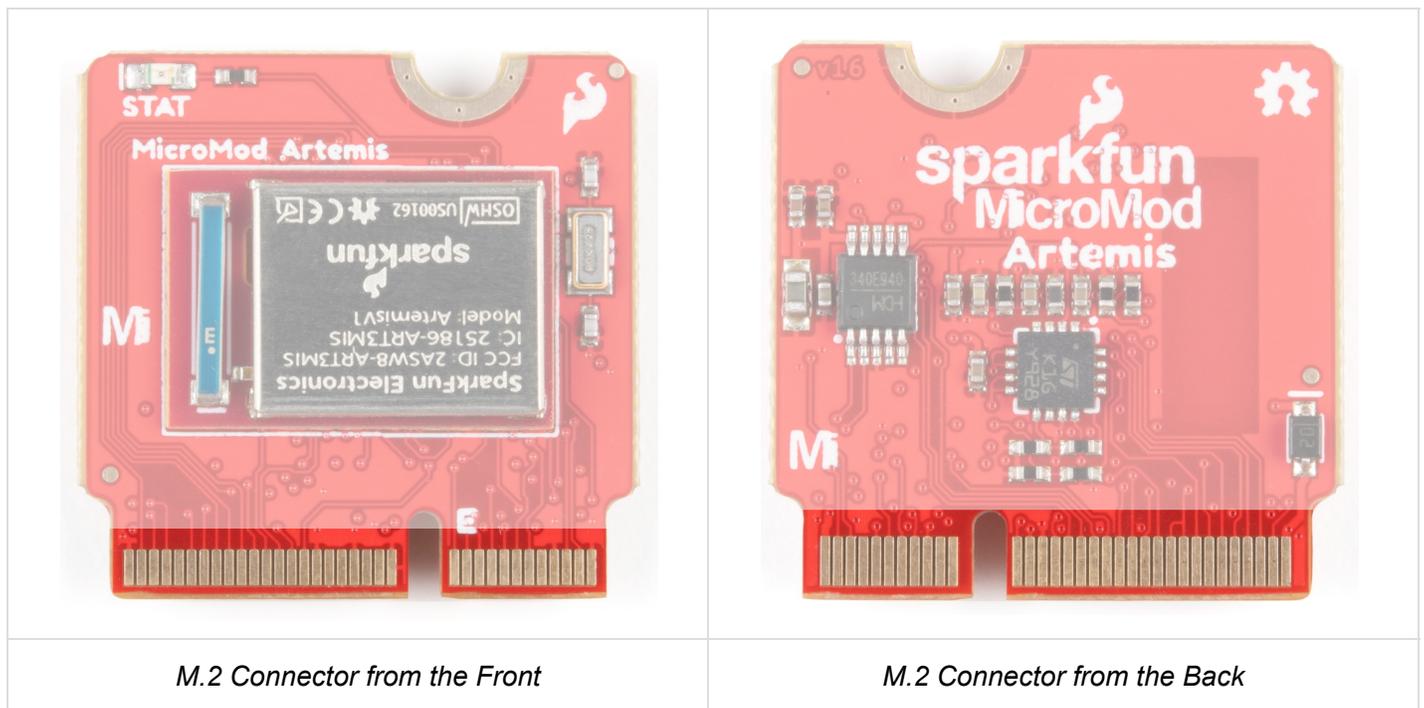
| M.2 Connector from the Front | M.2 Connector from the Back |

Artemis Processor

The SparkFun Artemis Processor provides a Cortex-M4F with BLE 5.0 running up to 96MHz and with as low power as 6uA per MHz (less than 5mW). This module is powerful enough to run TensorFlow, Machine Learning, and all sorts of voice recognition software. A deep dive into all of Artemis's delightful features can be found in the Designing with the SparkFun Artemis tutorial.

Op Amp

Incoming analog voltages over **2V** will saturate the Artemis's analog to digital converter. We've integrated an OpAmp to scale the incoming **0-3.3V** voltages down to the **0-2V** range that the Artemis can handle.

RTC

An onboard RTC crystal has been integrated.

Status LED

We've also included a Status LED for all your blinky needs.

Artemis MicroMod Processor Pin Functionality

> **Note:** You may not recognize the COPI/CIPO labels for SPI pins. SparkFun is working to move away from using MISO/MOSI to describe signals between the controller and the peripheral. Check out this page for more on our reasoning behind this change.

ARTEMIS PROCESSOR BOARD PINOUT TABLE

MICROMOD GENERAL PINOUT TABLE

MICROMOD GENERAL PIN DESCRIPTIONS

AUDIO	UART	GPIO/BUS	I^{2}C	SDIO	SPI0	Dedicated

Alternate Function	Primary Function	Bottom Pin	Top Pin		Primary Function	Alternate Function
			73		G5	
			71		G6	
QSPI3	SPI_CS	70	69		G7	
	QSPI2	68				
	QSPI1	66	65		TX1	ADC_D-
QSPI0	SPI_CIPO	64	63		ADC_D+	
QSPI_CS	SPI_COPI	62	61		SPI_CIPO1	

QSPI_SCK	SPI_SCK	60	59	SPI_COPI1	
	CAM_MCLK	58	57	SPI_SCK1	
	CAM_MCLK	56	55	SPI_CS1	
	CAM_PCLK	54	53	SCL1	
	PDM_DATA	52	51	SDA1	
	PDM_CLK	50	49	BATT_VIN3	
	G4	48	47	PWM1	
	G3	46			
	G2	44			
	G1	42			
	G0	40	39	GND	
	ADC1	38			
	ADC0	34			
	PWM0	32			
			23	SWDIO	
			21	SWDCK	
			19	RX1	
	D1	18	17	TX1	ADC_D-
	I^2C_Interrupt	16	15	CTS1	
	SCL	14	13	RTS1	
	SDA	12	11	BOOT	
	D0	10	9		
			7	GND	
	RESET	6	5	USB_D-	
			3	USB_D+	
	3.3V	2	1	GND	

Board Dimensions

The board measures 22mm x 22mm, with 15mm to the top notch and 12mm to the E key. For more information regarding the processor board physical standards, head on over to the Getting Started with MicroMod tutorial and check out the Hardware Overview section.
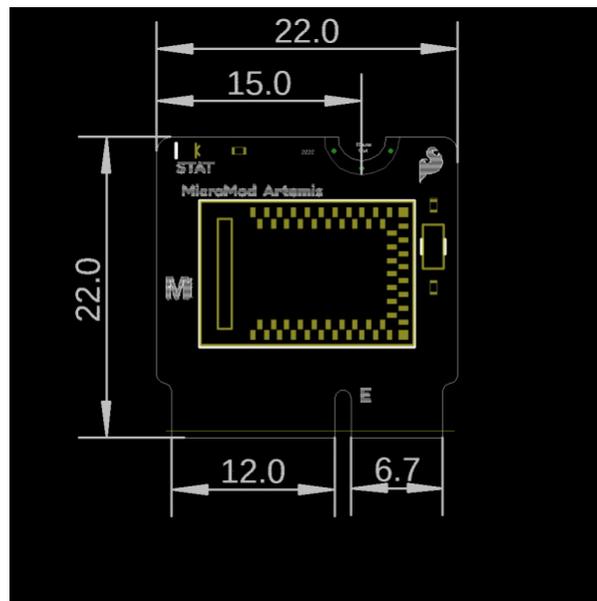
Hardware Hookup

To get started with the Artemis MicroMod Processor Board, you'll need a carrier board. Here we are using the Machine Learning Carrier Board. Align the top key of the MicroMod Artemis Processor Board to the screw terminal of the Machine Learning Carrier Board and angle the board into the socket. Insert the board at an angle into the M.2 connector.

> **Note:** There is no way to insert the processor backward since the key prevents it from mating with the M.2 connector and as an extra safeguard to prevent inserting a processor that matches the key, the mounting screw is offset so you will not be able to secure an improperly connected processor board.
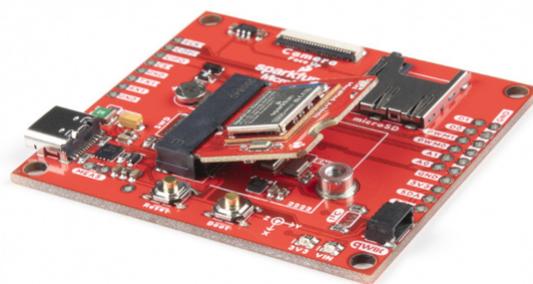
The Processor Board will stick up at an angle, as seen here:
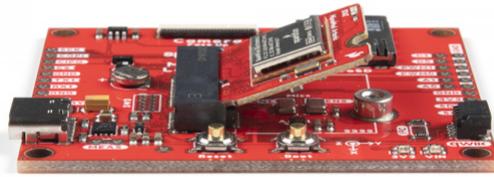
Once the board in the socket, gently push the MicroMod Processor Board down and tighten the screw with a Phillip's head.
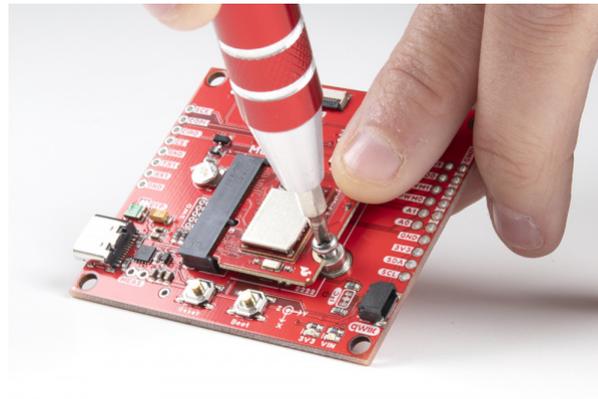
Once the board is secure, your assembled MicroMod system should look similar to the image below!
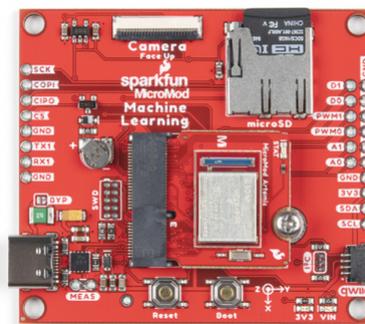
Connecting Everything Up

With your processor inserted and secured it's time to connect your carrier board to your computer using the USB-C connector on the Carrier. Depending on which carrier you choose and which drivers you already have installed, you may need to install drivers.

Note: If you've never connected a **CH340** device to your computer before, you may need to install drivers for the USB-to-serial converter. Check out our section on "How to Install CH340 Drivers" for help with the installation.

How to Install CH340 Drivers

AUGUST 6, 2019

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

Software Setup

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 our tutorial on installing the Arduino IDE.

Installing the Arduino Core for Apollo3

To get started with the Artemis MicroMod Processor Board, you'll need to install the SparkFun Apollo3 Arduino Core. Open the Arduino IDE (must be v1.8.13 or later) and navigate to **File**->**Preferences**, like so:
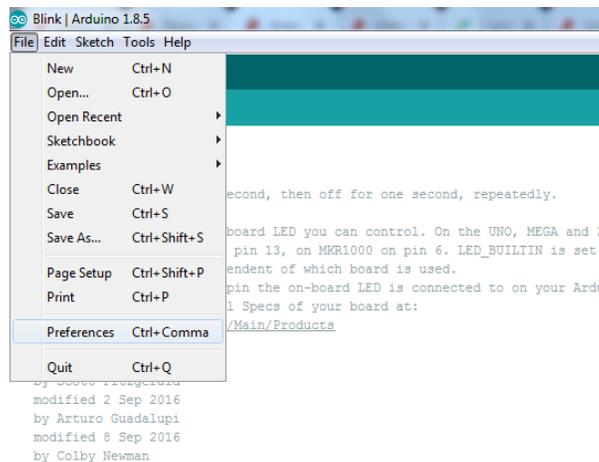
Having a hard time seeing? Click the image for a closer look.

In the "Additional Board Manager URL" box, make sure you have the following json file:

```
https://raw.githubusercontent.com/sparkfun/Arduino_Boards/master/IDE_Board_Manager/package_spark
fun_index.json
```

If you have more than one json file, you can click on the button outlined in red and add the json link at the end. It'll look something like the following:
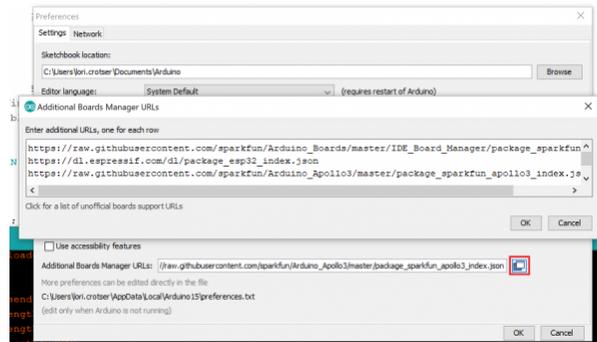
Having a hard time seeing? Click the image for a closer look.

- Go to **Tools** -> **Board** and select the **Boards Manager**
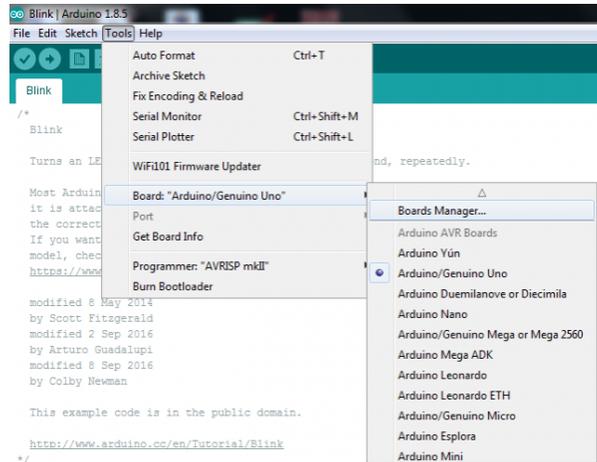
Having a hard time seeing? Click the image for a closer look.

Search for "Apollo3", and you should find the **SparkFun Apollo3 Boards** board package. Make sure the **Version 1.2.1** is selected and click **Install**.
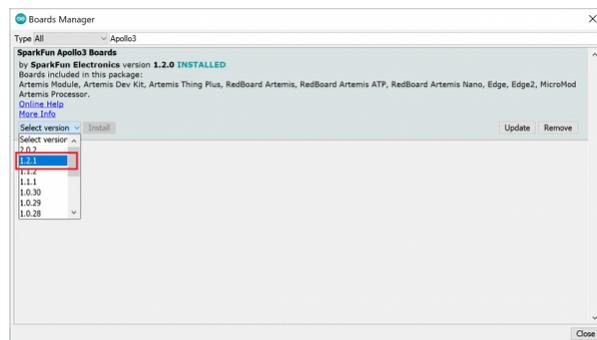
Having a hard time seeing? Click the image for a closer look.

Installation may take a few minutes -- included in the install are all necessary source files for the Arduino core and Apollo3 libraries, plus all of the compiler and software-upload tools you'll need to use the Artemis with Arduino.

Once the board definitions have been installed, you should see the Artemis MicroMod Processor board under your **Tools -> Board -> SparkFun Apollo3** menu.
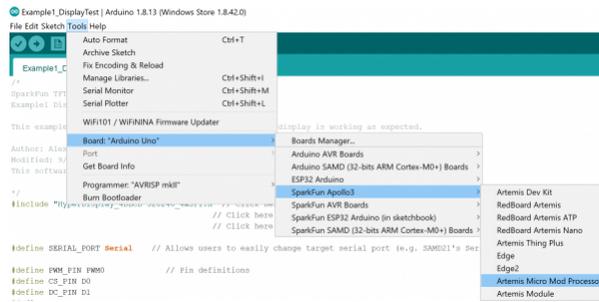
Having a hard time seeing? Click the image for a closer look.

Example 1: Blink

> **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 our tutorial on installing the Arduino IDE. If you have not previously installed an Arduino library, please check out our installation guide.

To get started uploading code and working with your Machine Learning Carrier Board, make sure you have the Artemis MicroMod board definition selected under your **Tools** > **Board** menu (or whatever processor you've chosen to use).
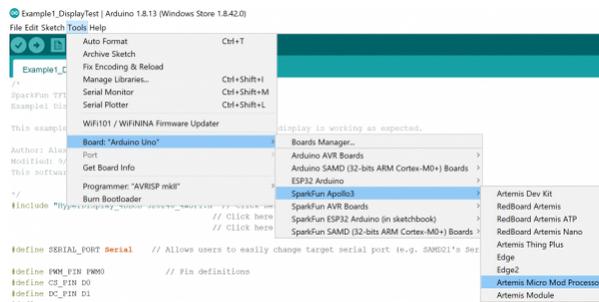
Having a hard time seeing? Click the image for a closer look.

Then select your serial port under the **Tools** > **Port** menu.
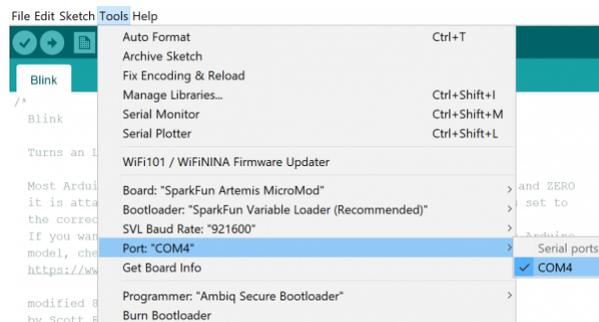
Loading Blink

Let's start with something basic - let's blink an LED. Go to **File**->**Examples**->**01.Basics**->**Blink**.
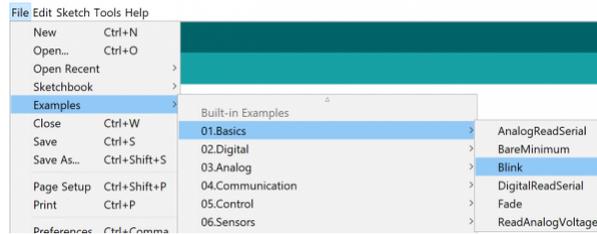
Having a hard time seeing? Click the image for a closer look.

With everything setup correctly, upload the code! Once the code finishes transferring, you should see the STAT LED on the Artemis Processor Board begin to blink!

> If the blue LED remains off, it's probably still sitting in the bootloader. After uploading a sketch, you may need to **tap the reset button** to get your Artemis MicroMod to run the sketch.

Look at all the blinks!

Example 2: PDM

We've built the Arduino core for Artemis from the ground up and a large number of our built-in examples will work out of the box with the Artemis MicroMod Processor Board. You'll find them under **File->Examples->'Examples for SparkFun Artemis MicroMod'**.

Let's run a quick one from the examples here and take advantage of the two built in microphones on the Machine Learning Carrier Board we're using. Go to **File->Examples->PDM->Example1_MicrophoneOutput**
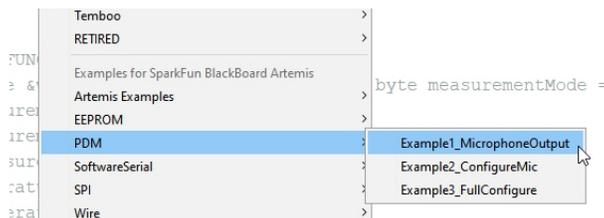
Click above image for full menu context

Make sure you have the correct board and port selected, and then upload the code. Once the code finishes transferring, **open the serial monitor** and set the baud rate to **115200**. You should see something like the following:

Having a hard time seeing? Click the image for a closer look.

Notice that if you hoot and holler, the output changes.

Within the 'Examples for SparkFun Artemis Micromod' menu, we've got examples for setting up multiple I^{2}C ports (it's amazingly easy), writing to EEPROM, using SoftwareSerial (all 48 pins can be serial!), using the the onboard microphone, and using servos (up to 32!). We're adding more all the time so be sure to keep your core up to date.

Further Examples

With the MicroMod system, the possibilities for examples with all the processor/carrier board are endless, and we just can't cover them all. You'll notice that in this tutorial, we've selected the Machine Learning Carrier Board, but have focused our examples on the Artemis Processor Board. If you're interested in examples specifically for our carrier board, head on over to our Machine Learning Carrier Board Hookup Guide.

Troubleshooting

❷ **Need help?**

If your product is not working as you expected or you need technical assistance or information, head on over to the SparkFun Technical Assistance page for some initial troubleshooting.

If you don't find what you need there, the SparkFun Forums 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 MicroMod Forums

Resources and Going Further

Want more information on the Artemis MicroMod Processor Board? Check out these links!

- Schematic (PDF)
- Eagle Files (ZIP)
- Apollo3 Datasheet
- GitHub Hardware Repo

MicroMod Documentation:

- Getting Started with MicroMod
- Designing with MicroMod
- MicroMod Info Page
- MicroMod Forums

Artemis Documentation:

- Artemis Integration Guide
- Designing with the SparkFun Artemis
- Artemis Development with Arduino
- Arduino Core
- Apollo3 Pin Map

Looking for some project inspiration using your Artemis Processor Board? The tutorials below can help you get started!
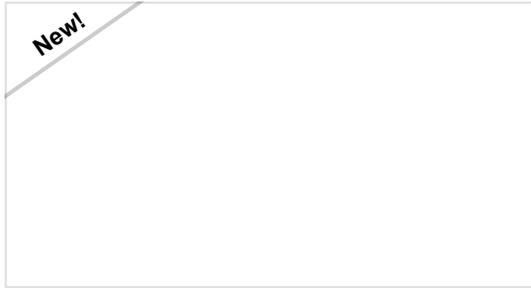
Designing with MicroMod
This tutorial will walk you through the specs of the MicroMod processor and carrier board as well as the basics of incorporating the MicroMod form factor into your own PCB designs!

MicroMod SAMD51 Processor Board Hookup Guide
This tutorial covers the basic functionality of the MicroMod SAMD51 and highlights the features of the ARM Cortex-M4F development board.

MicroMod All The Pins (ATP) Carrier Board
Access All The Pins (ATP) of the MicroMod Processor Board with the Carrier Board!

MicroMod Data Logging Carrier Board Hookup Guide
Get started with some customizable MicroMod data logging with the Data Logging Carrier Board.