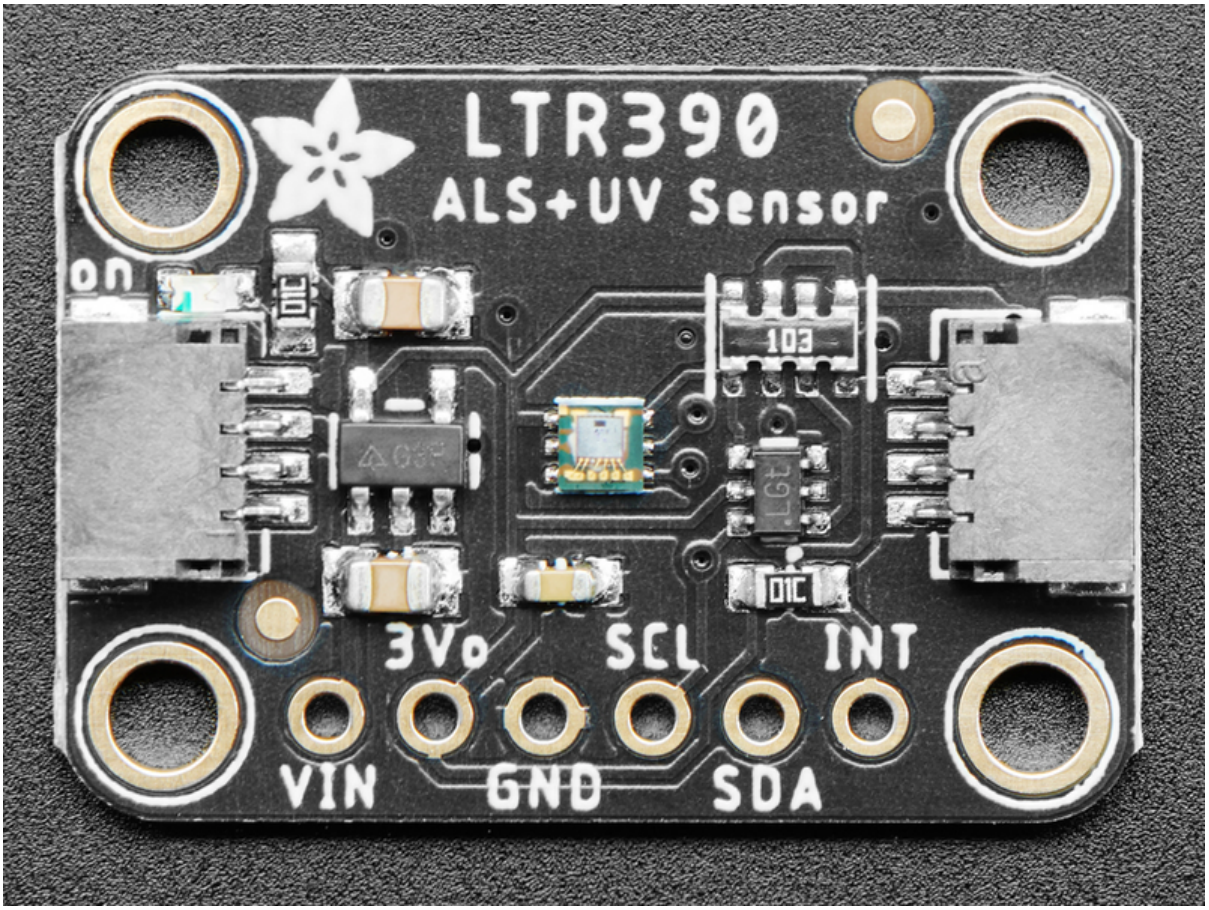
Adafruit LTR390 UV Sensor

Created by Bryan Siepert



https://learn.adafruit.com/adafruit-ltr390-uv-sensor

Last updated on 2024-06-03 03:18:30 PM EDT

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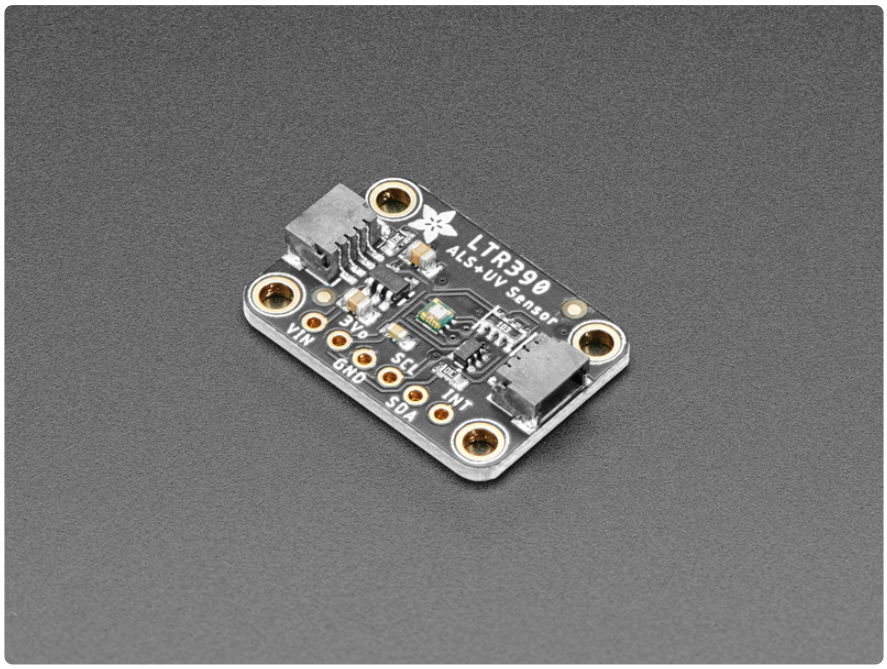
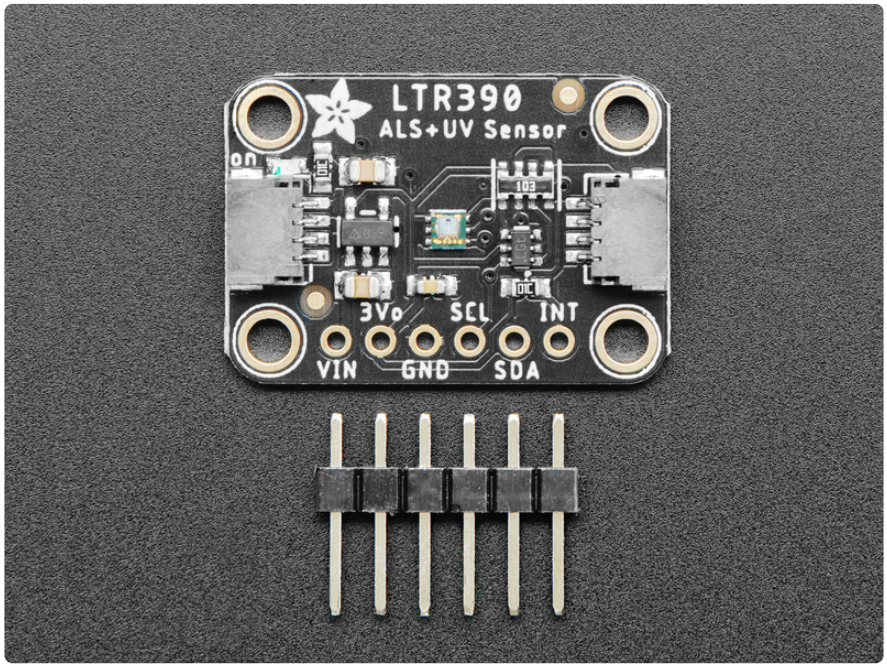
Overview



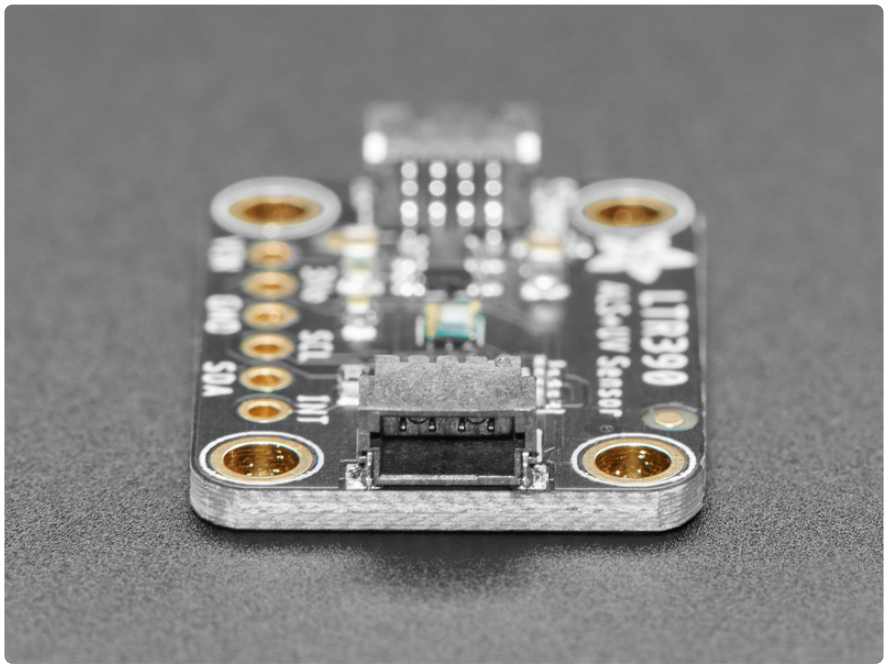
The LTR390 (http://adafru.it/4831) is one of the few low-cost UV sensors available, and it's a pretty nice one! With both ambient light and UVA sensing with a peak spectral response between 300 and 350nm. You can use it for measuring how much sun you can get before needing to covering up.



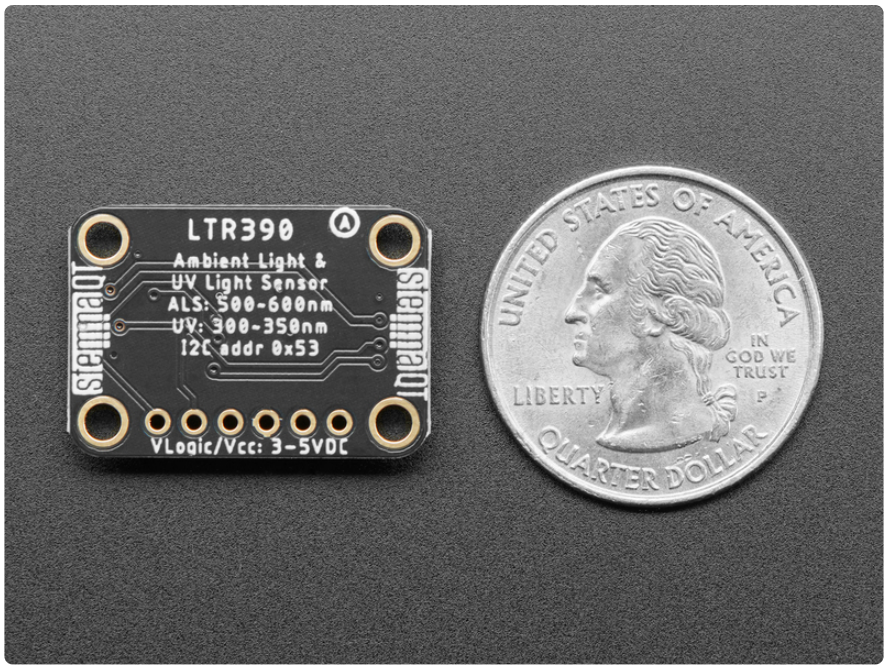
Unlike sensors that estimate UV Index readings from visible and IR light levels such as the Si1145 (http://adafru.it/1777), the LTR390 incorporates two sensors, one for visible and another specifically designed to measure UV light levels. The sensor's

CircuitPython library includes routines to derive the UV Index value from raw UV measurements as well as calculating the ambient light Lux level.

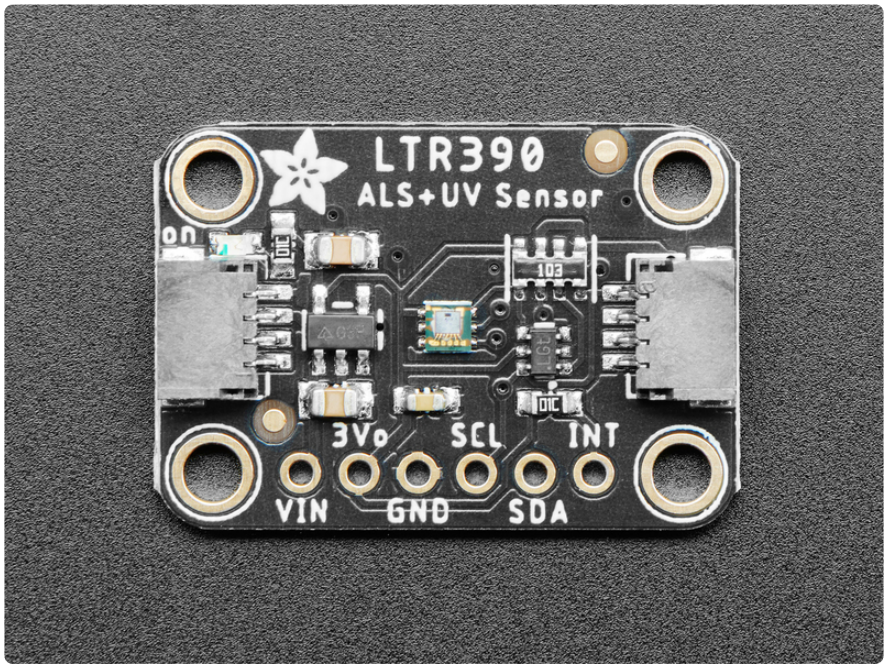
The LTR390 also has a much much simpler I2C interface so you can run it on the Arduino or Python microcontrollers/microcomputers with ease. Unlike the GUVA analog sensor (http://adafru.it/1918), the biasing and ADC is all internal so you don't need an ADC.



To make using it as easy as possible, we've put the LTR390 on a breakout PCB in our Stemma QT form factor (https://adafru.it/19gF) with a sprinkle of support circuitry to give you options when testing. You can either use a breadboard or the **SparkFun qwiic** (https://adafru.it/Fpw) compatible **STEMMA QT** (https://adafru.it/Ft4) connectors, and compatibility with 5V voltage levels as commonly found on Arduinos (https://adafru.it/P4a), as well as 3.3V logic used by many other boards like the Raspberry Pi or our Feathers. **QT Cable is not included**, but we have a variety in the shop (https://adafru.it/17VE) for quick plug-and-play support



Pinouts



Power Pins

- **VIN** - this is the power pin. Since the sensor chip uses 3 VDC, we have included a voltage regulator on board that will take 3-5VDC and safely convert it down. To power the board, give it the same power as the logic level of your microcontroller - e.g. for a 5V microcontroller like Arduino, use 5V
- **3Vo** - this is the 3.3V output from the voltage regulator, you can grab up to 100mA from this if you like

- **GND** - common ground for power and logic

I2C Logic Pins

- **SCL** - I2C clock pin, connect to your microcontroller I2C clock line. This pin is level shifted so you can use 3-5V logic, and there's a **10K pullup** on this pin.
- **SDA** - I2C data pin, connect to your microcontroller I2C data line. This pin is level shifted so you can use 3-5V logic, and there's a **10K pullup** on this pin.
- **STEMMA QT** (https://adafru.it/Ft4) - These connectors allow you to connectors to dev boards with **STEMMA QT** connectors or to other things with various associated accessories (https://adafru.it/Ft6)

Other Pins

INT -This is the primary interrupt pin. You can setup the LTR390 to pull this low when certain conditions are met such as new measurement data being available. Consult the datasheet (https://adafru.it/PBw) for usage

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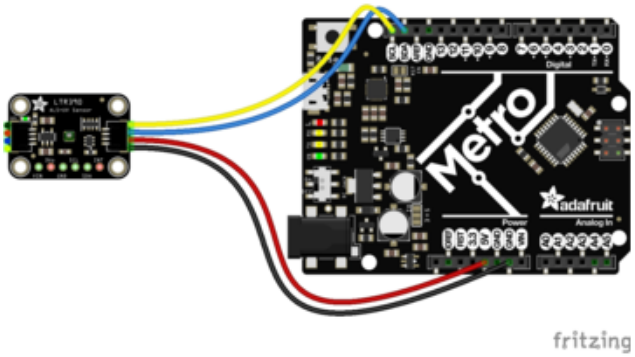
Arduino

Using the LTR390 with Arduino is a simple matter of wiring up the sensor to your Arduino-compatible microcontroller, installing the Adafruit LTR390 (https://adafru.it/PBx) library we've written, and running the provided example code.

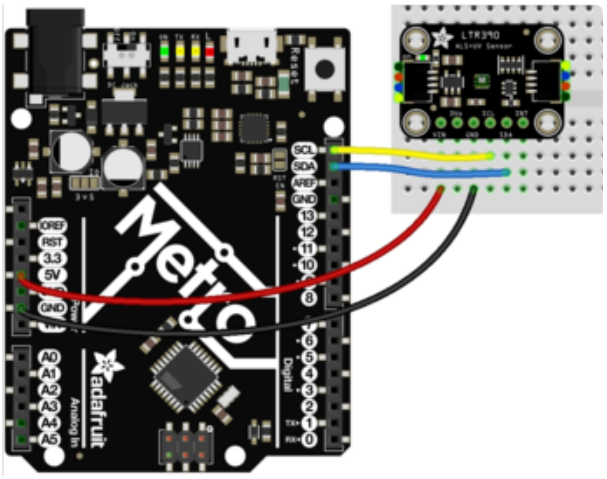
I2C Wiring

Here is how to wire up the sensor using one of the **STEMMA QT** (https://adafru.it/Ft4) connectors. The examples show a Metro but wiring will work the same for an Arduino or other compatible board.



Connect **board VIN (red wire)** to **Arduino 5V** if you are running a **5V** board Arduino (Uno, etc.). If your board is **3V,** connect to that instead.
Connect **board GND (black wire)** to **Arduino GND**
Connect **board SCL (yellow wire)** to **Arduino SCL**
Connect **board SDA (blue wire)** to **Arduino SDA**

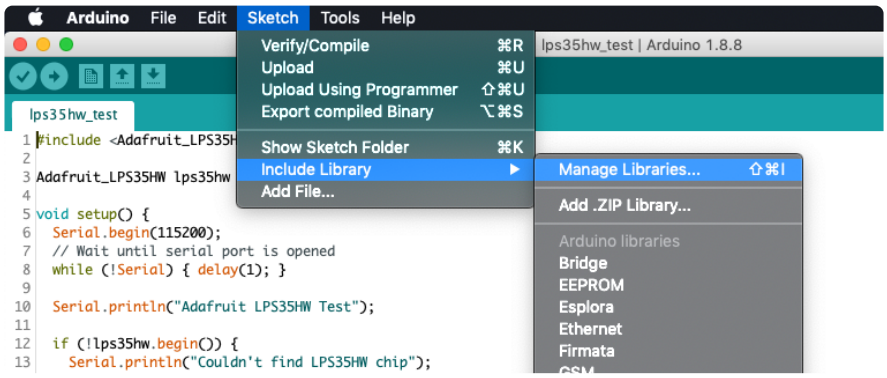
Here is how to wire the sensor to a board using a solderless breadboard:



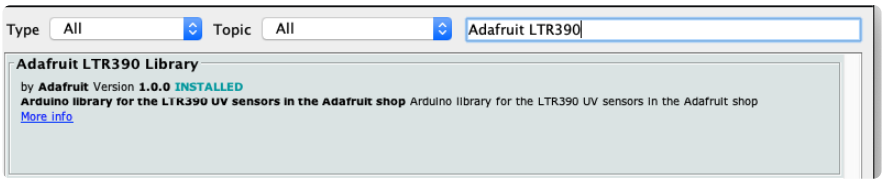
Connect **board VIN (red wire)** to **Arduino 5V** if you are running a **5V** board Arduino (Uno, etc.). If your board is **3V,** connect to that instead.
Connect **board GND (black wire)** to **Arduino GND**
Connect **board SCL (yellow wire)** to **Arduino SCL**
Connect **board SDA (blue wire)** to **Arduino SDA**

Library Installation

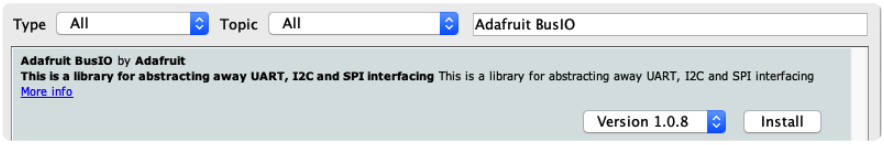
You can install the **Adafruit LTR390 l**ibrary for Arduino using the Library Manager in the Arduino IDE.



Click the **Manage Libraries ...** menu item, search for **Adafruit LTR390** , and select the **Adafruit LTR390** library:

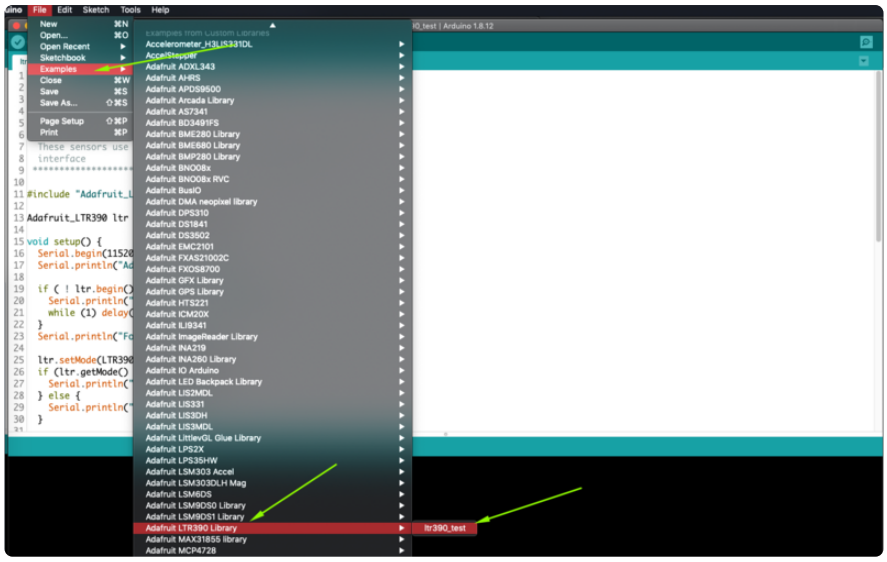


Next, follow the same process for the **Adafruit BusIO** library.



Load Example

Open up **File -> Examples -> Adafruit LTR390 -> LTR390_test**



After opening the demo file, upload to your Arduino wired up to the sensor. Once you upload the code, you will see the **UV data** values being printed when you open the Serial Monitor (**Tools->Serial Monitor**) at **115200 baud**, similar to this:

```
Adafruit LTR-390 test
Found LTR sensor!
In UVS mode
Gain : 3
Resolution : 16
UV data: 142
UV data: 143
UV data: 143
```

Example Code

```
/***************************************************
  This is an example for the LTR390 UV Sensor

  Designed specifically to work with the LTR390 UV sensor from Adafruit
  ----> https://www.adafruit.com
```

```
  These sensors use I2C to communicate, 2 pins are required to
  interface
 ***************************************************/

#include "Adafruit_LTR390.h"

Adafruit_LTR390 ltr = Adafruit_LTR390();

void setup() {
  Serial.begin(115200);
  Serial.println("Adafruit LTR-390 test");

  if ( ! ltr.begin() ) {
    Serial.println("Couldn't find LTR sensor!");
    while (1) delay(10);
  }
  Serial.println("Found LTR sensor!");

  ltr.setMode(LTR390_MODE_UVS);
  if (ltr.getMode() == LTR390_MODE_ALS) {
    Serial.println("In ALS mode");
  } else {
    Serial.println("In UVS mode");
  }

  ltr.setGain(LTR390_GAIN_3);
  Serial.print("Gain : ");
  switch (ltr.getGain()) {
    case LTR390_GAIN_1: Serial.println(1); break;
    case LTR390_GAIN_3: Serial.println(3); break;
    case LTR390_GAIN_6: Serial.println(6); break;
    case LTR390_GAIN_9: Serial.println(9); break;
    case LTR390_GAIN_18: Serial.println(18); break;
  }

  ltr.setResolution(LTR390_RESOLUTION_16BIT);
  Serial.print("Resolution : ");
  switch (ltr.getResolution()) {
    case LTR390_RESOLUTION_13BIT: Serial.println(13); break;
    case LTR390_RESOLUTION_16BIT: Serial.println(16); break;
    case LTR390_RESOLUTION_17BIT: Serial.println(17); break;
    case LTR390_RESOLUTION_18BIT: Serial.println(18); break;
    case LTR390_RESOLUTION_19BIT: Serial.println(19); break;
    case LTR390_RESOLUTION_20BIT: Serial.println(20); break;
  }

  ltr.setThresholds(100, 1000);
  ltr.configInterrupt(true, LTR390_MODE_UVS);
}

void loop() {
  if (ltr.newDataAvailable()) {
      Serial.print("UV data: ");
      Serial.print(ltr.readUVS());
  }

  delay(100);
}
```

If you are not getting the data you expect, please post to https://forums.adafruit.com/ with your project information for assistance.

Arduino Docs

Arduino Docs (https://adafru.it/Pta)

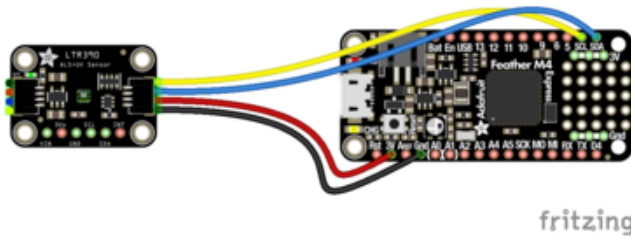
Python & CircuitPython

It's easy to use the **LTR390** with Python or CircuitPython, and the Adafruit CircuitPython LTR390 (https://adafru.it/PBy) module. This module allows you to easily write Python code that reads uv and ambient light from the **LTR390** sensor.

You can use this sensor with any CircuitPython microcontroller board or with a computer that has GPIO and Python thanks to Adafruit_Blinka, our CircuitPython-for-Python compatibility library (https://adafru.it/BSN).

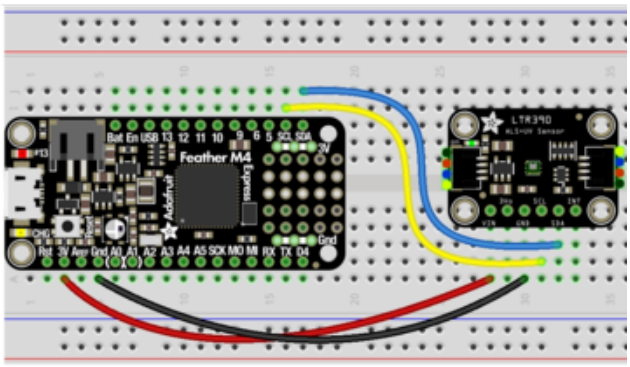
CircuitPython Microcontroller Wiring

First wire up a LTR390 to your board exactly as shown below. Here's an example of wiring a Feather M4 to the sensor with I2C using one of the handy **STEMMA QT** (https://adafru.it/Ft4) connectors:



Board 3V to **sensor VIN (red wire)**
Board GND to **sensor GND (black wire)**
Board SCL to **sensor SCL (yellow wire)**
Board SDA to **sensor SDA (blue wire)**

You can also use the standard **0.100" pitch** headers to wire it up on a breadboard:

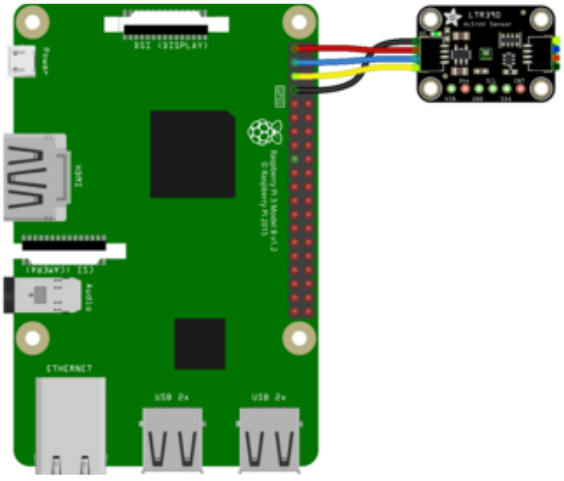


Board 3V to **sensor VIN (red wire)**
Board GND to **sensor GND (black wire)**
Board SCL to **sensor SCL (yellow wire)**
Board SDA to **sensor SDA (blue wire)**

Python Computer Wiring

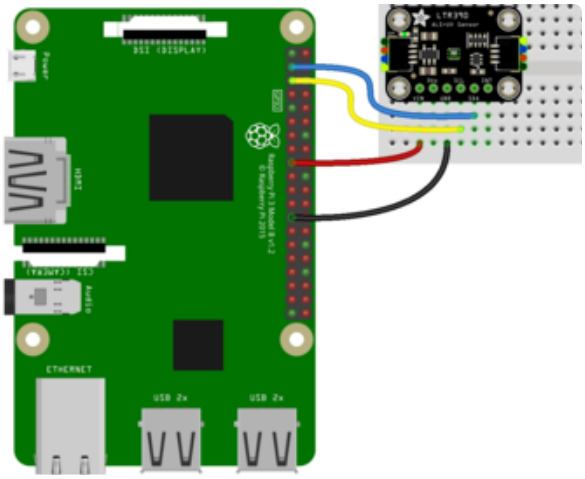
Since there's dozens of Linux computers/boards you can use, we will show wiring for Raspberry Pi. For other platforms, please visit the guide for CircuitPython on Linux to see whether your platform is supported (https://adafru.it/BSN).

Here's the Raspberry Pi wired to the sensor using I2C and a **STEMMA QT** (https://adafru.it/Ft4) connector:



Pi 3V to **sensor VCC (red wire)**
Pi GND to **sensor GND (black wire)**
Pi SCL to **sensor SCL (yellow wire)**
Pi SDA to **sensor SDA (blue wire)**

Finally here is an example of how to wire up a Raspberry Pi to the sensor using a solderless breadboard



Pi 3V to **sensor VCC (red wire)**
Pi GND to **sensor GND (black wire)**
Pi SCL to **sensor SCL (yellow wire)**
Pi SDA to **sensor SDA (blue wire)**

CircuitPython Installation of LTR390 Library

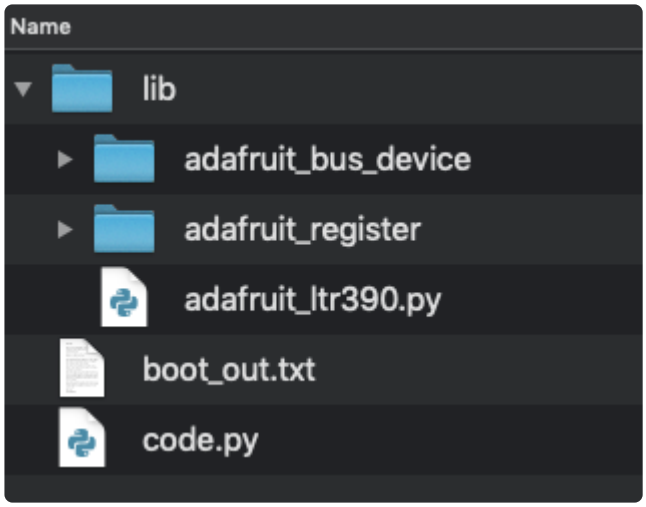
You'll need to install the Adafruit CircuitPython LTR390 (https://adafru.it/PBy) library on your CircuitPython board.

First make sure you are running the latest version of Adafruit CircuitPython (https://adafru.it/Amd) for your board.

Next you'll need to install the necessary libraries to use the hardware--carefully follow the steps to find and install these libraries from Adafruit's CircuitPython library bundle (https://adafru.it/ENC). Our CircuitPython starter guide has a great page on how to install the library bundle (https://adafru.it/ABU).

Before continuing make sure your board's **lib** folder or root filesystem has the **adafruit_LTR390.mpy** file and the **adafruit_register** and **adafruit_bus_device** folders copied over.

When done, your CIRCUITPY drive should look like this:



Next connect to the board's serial REPL (https://adafru.it/Awz)so you are at the CircuitPython >>> prompt.

Python Installation of LTR390 Library

You'll need to install the **Adafruit_Blinka** library that provides the CircuitPython support in Python. This may also require enabling I2C on your platform and verifying you are running Python 3. Since each platform is a little different, and Linux changes often, please visit the CircuitPython on Linux guide to get your computer ready (https://adafru.it/BSN)!

Once that's done, from your command line run the following command:

- `sudo pip3 install adafruit-circuitpython-ltr390`

If your default Python is version 3 you may need to run 'pip' instead. Just make sure you aren't trying to use CircuitPython on Python 2.x, it isn't supported!

CircuitPython & Python Usage

To demonstrate the usage of the sensor we'll initialize it and read the UV and ambient light measurements from the board's Python REPL.

Run the following code to import the necessary modules and initialize the I2C connection with the sensor:

```
import board
import busio
import adafruit_ltr390

i2c = busio.I2C(board.SCL, board.SDA)

ltr = adafruit_ltr390.LTR390(i2c)
```

Now you're ready to read values from the sensor using these properties:

- **uvs** - The raw UV light measurement.
- **light** - The raw ambient light measurement.
- **uvi** - The calculated UV Index value.
- **lux** - The calculated Lux ambient light value.

```
>>> import board
>>> import busio
>>> import adafruit_ltr390
>>>
>>> i2c = busio.I2C(board.SCL, board.SDA)
>>>
>>> ltr = adafruit_ltr390.LTR390(i2c)
```

```
print("UV:", ltr.uvs, "\t\tAmbient Light:", ltr.light)
```

```
>>> print("UV:", ltr.uvs, "\t\tAmbient Light:", ltr.light)
UV: 2          Ambient Light: 2040
```

```
print("UV Index:", ltr.uvi, "\t\tLux:", ltr.lux)
```

```
>>> print("UV Index:", ltr.uvi, "\t\tLux:", ltr.lux)
UV Index: 0.0834783          Lux: 1628.0
```

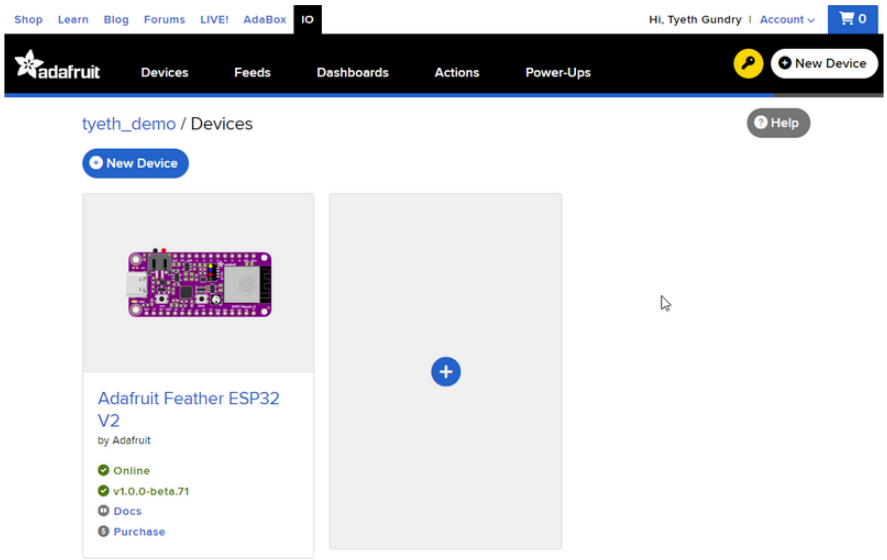
Example Code

```
# SPDX-FileCopyrightText: 2021 by Bryan Siepert, written for Adafruit Industries
#
# SPDX-License-Identifier: Unlicense
import time
import board
import adafruit_ltr390

i2c = board.I2C()  # uses board.SCL and board.SDA
# i2c = board.STEMMA_I2C()  # For using the built-in STEMMA QT connector on a
microcontroller
ltr = adafruit_ltr390.LTR390(i2c)

while True:
    print("UV:", ltr.uvs, "\t\tAmbient Light:", ltr.light)
    print("UVI:", ltr.uvi, "\t\tLux:", ltr.lux)
    time.sleep(1.0)
```

Python Docs

Python Docs (https://adafru.it/PBp)

WipperSnapper



What is WipperSnapper

WipperSnapper is a firmware designed to turn any WiFi-capable board into an Internet-of-Things device without programming a single line of code. WipperSnapper connects to Adafruit IO (https://adafru.it/fsU), a web platform designed (by Adafruit! (https://adafru.it/Bo5)) to display, respond, and interact with your project's data.

Simply load the WipperSnapper firmware onto your board, add credentials, and plug it into power. Your board will automatically register itself with your Adafruit IO account.

From there, you can add components to your board such as buttons, switches, potentiometers, sensors, and more! Components are dynamically added to hardware, so you can immediately start interacting, logging, and streaming the data your projects produce without writing code.

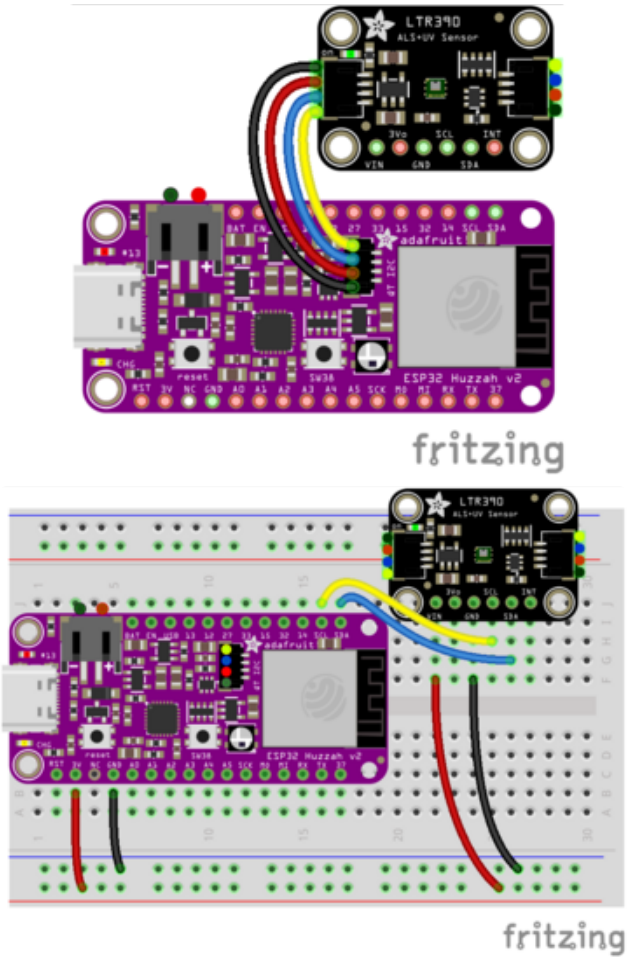
If you've never used WipperSnapper, click below to read through the quick start guide before continuing.

Quickstart: Adafruit IO WipperSnapper

https://adafru.it/Vfd

Wiring

First, wire up an LTR390 to your board exactly as follows. Here is an example of the LTR390 wired to an Adafruit ESP32 Feather V2 (http://adafru.it/5400) using I2C with a STEMMA QT cable (no soldering required) (http://adafru.it/4210)

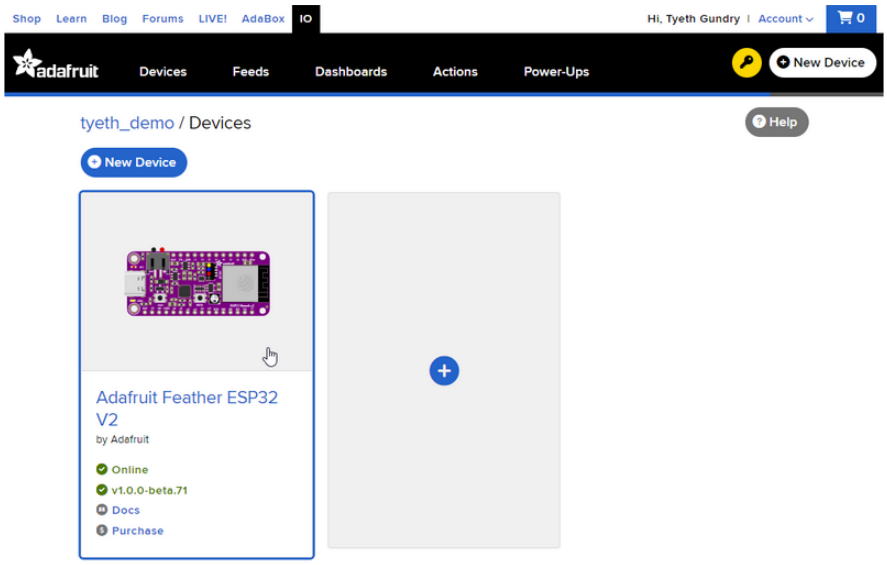


Board 3V to **sensor VIN (red wire on STEMMA QT)**
Board GND to **sensor GND (black wire on STEMMA QT)**
Board SCL to **sensor SCL (yellow wire on STEMMA QT)**
Board SDA to **sensor SDA (blue wire on STEMMA QT)**

Usage

Connect your board to Adafruit IO Wippersnapper and navigate to the WipperSnapper board list **(https://adafru.it/TAu)**.

On this page, **select the WipperSnapper board you're using** to be brought to the board's interface page.



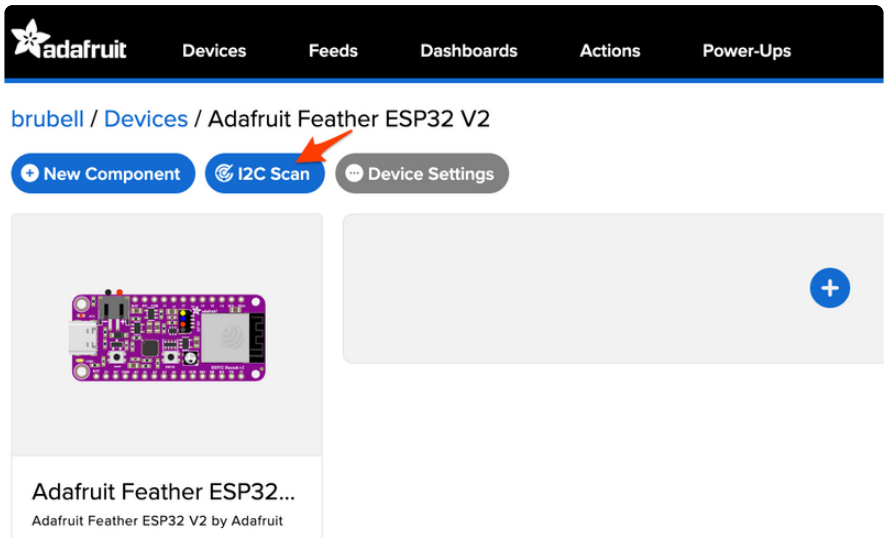
If you do not see your board listed here - you need to connect your board to Adafruit IO (https://adafru.it/Vfd) first.

On the device page, quickly **check that you're running the latest version of the WipperSnapper firmware**.

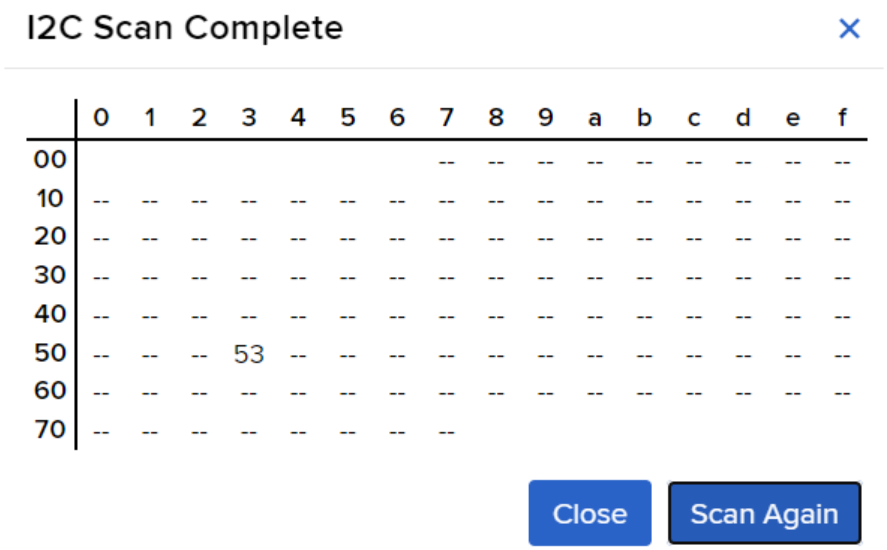
The device tile on the left indicates the version number of the firmware running on the connected board.

If the firmware version is green with a checkmark - continue with this guide.
If the firmware version is red with an exclamation mark "!" - update to the latest WipperSnapper firmware (https://adafru.it/Vfd) on your board before continuing.

Next, make sure the sensor is plugged into your board and click the **I2C Scan** button.



You should see the LTR390's default I2C address of `0x53` pop-up in the I2C scan list.



I don't see the sensor's I2C address listed!

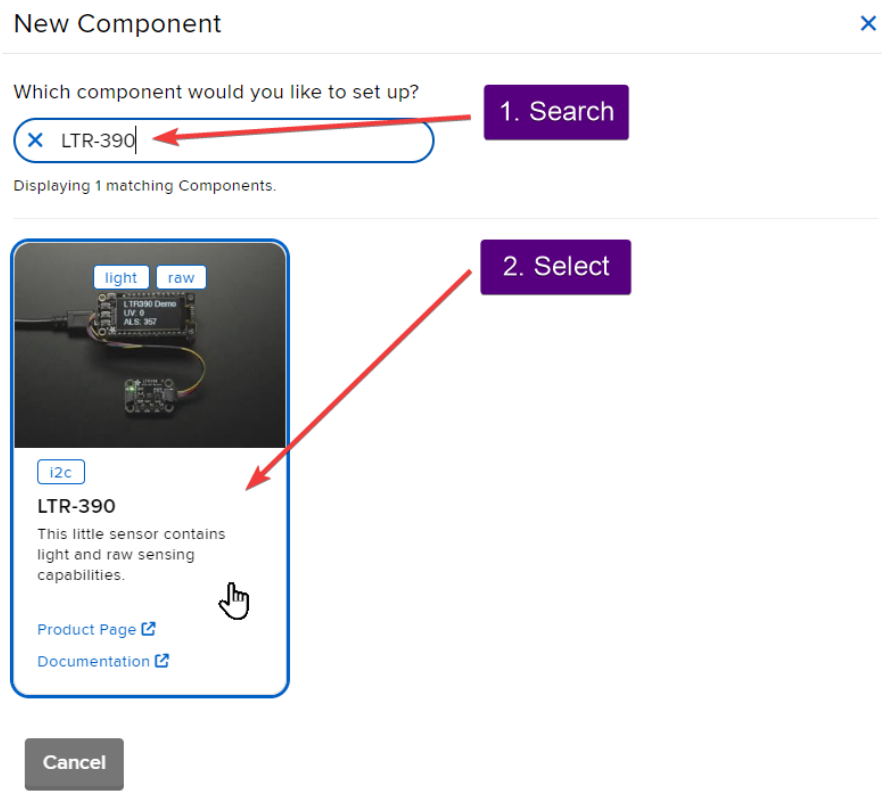
First, double-check the connection and/or wiring between the sensor and the board.

Then, reset the board and let it re-connect to Adafruit IO WipperSnapper.

With the sensor detected in an I2C scan, you're ready to add the sensor to your board.

Click the New Component button or the + button to bring up the component picker.

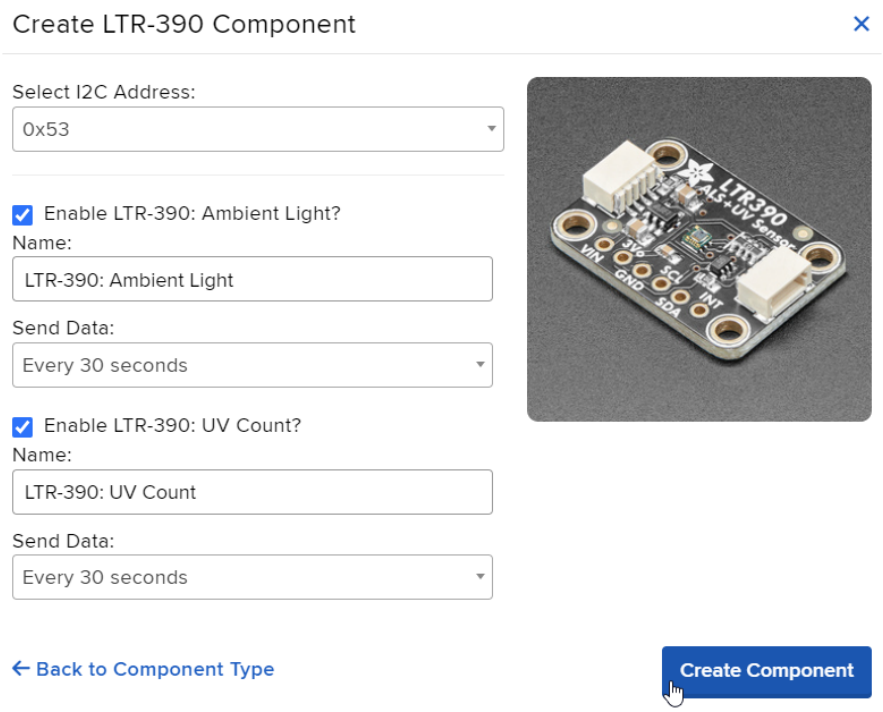
Adafruit IO supports a large amount of components. To quickly find your sensor, type `LTR-390` into the search bar, then select the **LTR-390** from the component picker.



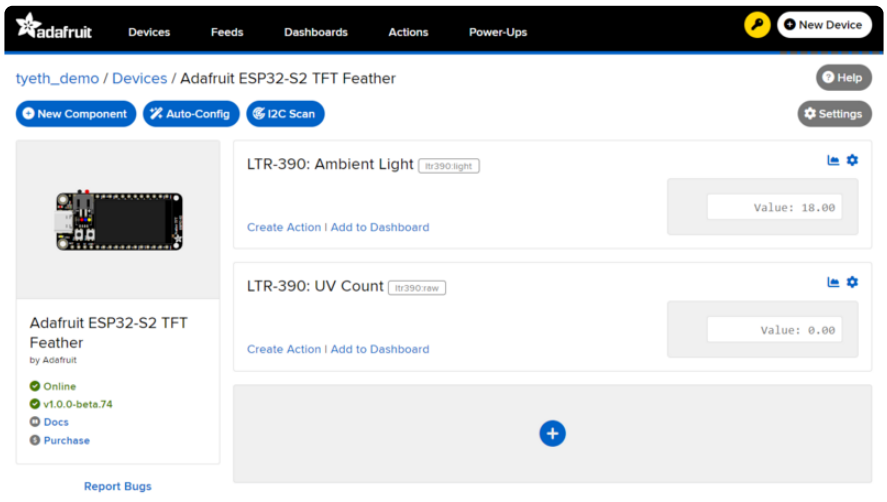
On the component configuration page, the **LTR390**'s sensor address should be listed along with the sensor's settings.

The **Send Every** option is specific to each sensor's measurements. This option will tell the Feather how often it should read from the **LTR390** sensor and send the data to Adafruit IO. Measurements can range from every 30 seconds to every 24 hours.

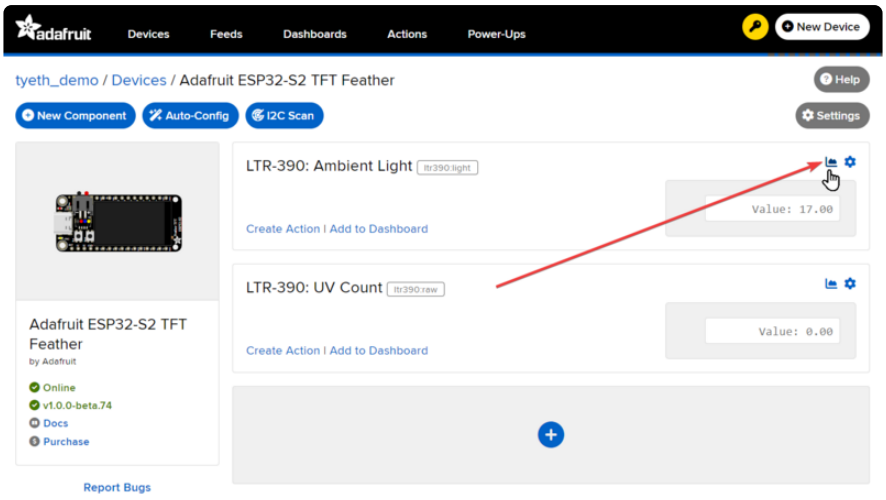
For this example, set the **Send Every** interval to every 30 seconds.



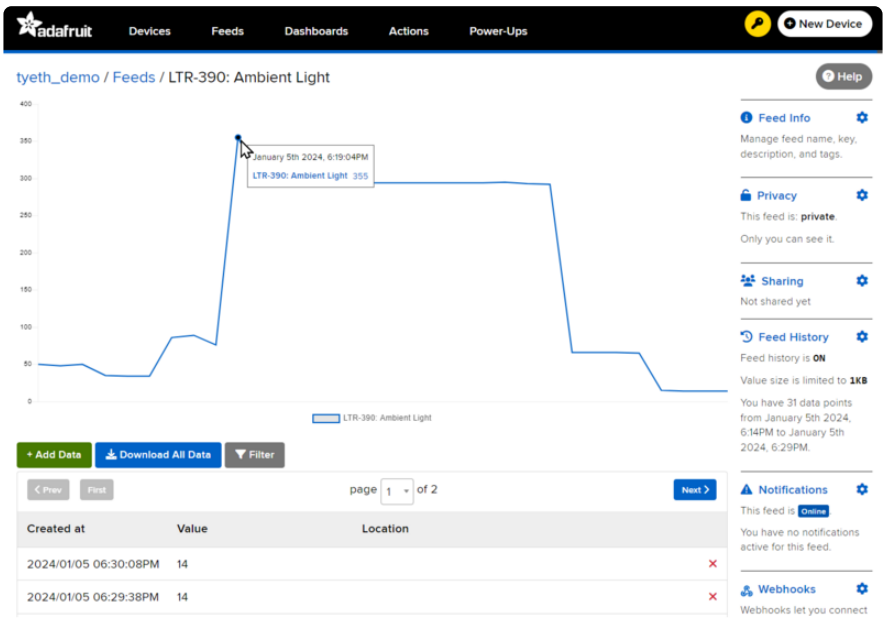
Your device interface should now show the sensor components you created. After the interval you configured elapses, WipperSnapper will automatically read values from the sensor(s) and send them to Adafruit IO.



To view the data that has been logged from the sensor, click on the graph next to the sensor name.



Here you can see the feed history and edit things about the feed such as the name, privacy, webhooks associated with the feed and more. If you want to learn more about how feeds work, check out this page (https://adafru.it/10aZ).

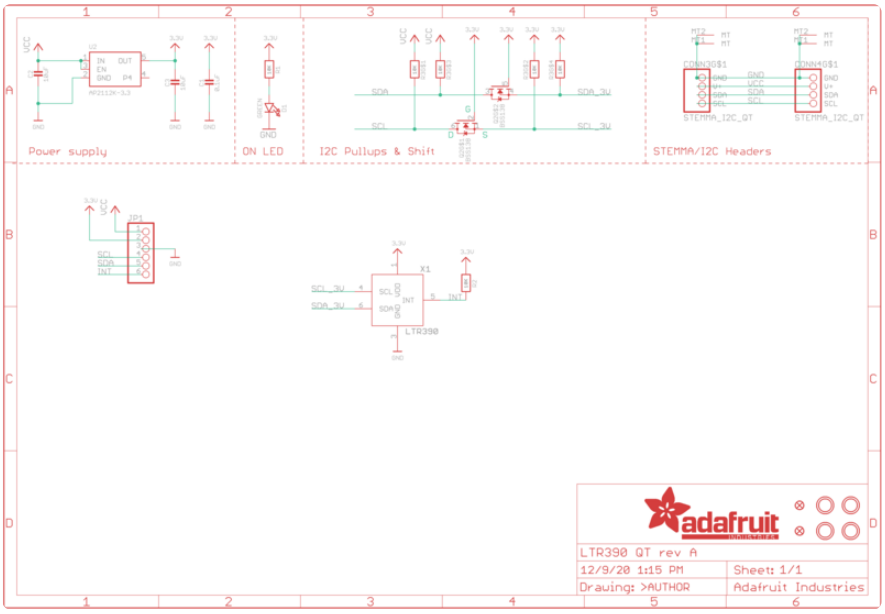


Downloads

Files

- LTR390 Datasheet (https://adafru.it/PBw)
- EagleCAD files on GitHub (https://adafru.it/PBz)
- Fritzing object in the Adafruit Fritzing Library (https://adafru.it/PBA)
- LTR390 Datasheet (https://adafru.it/PBw)

Schematic



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