

SenseCAP Indicator

User Manual



Brief Introduction

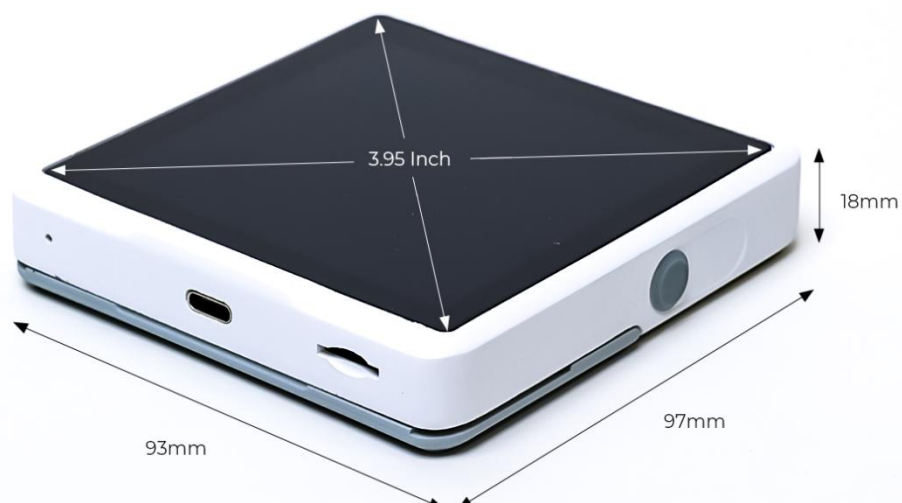
SenseCAP Indicator is a 4-inch touch screen driven by ESP32 and RP2040 dual-MCU and supports Wi-Fi/BLE/LoRa communication. It is a fully open source powerful IoT development platform for developers. One-stop ODM Fusion service is also available for customization and quick scale-up.

Product Video: https://youtu.be/IOdl5_MGbCw

Content

Introduction	4
Features	4
Hardware Version	7
Specification	8
Part List	8
ODM Service	9
Get Started with SenseCAP Indicator	10
Hardware Overview	10
Button Function	10
Grove Interfaces	10
SX1262 LoRa Chip	11
Native Firmware	12
Wi-Fi Configuration	12
Data Viewing	13
Setting	15
Development Tutorial	17
ESP32 Firmware Flashing	18
RP2040 Firmware Flashing	23
Resource	29
FCC Regulatory Conformance:	30





Introduction

SenseCAP Indicator is a 4-inch touch screen driven by ESP32 and RP2040 dual-MCU and supports Wi-Fi/BLE/LoRa communication.

The board comes with Type-C and Grove interfaces, supports ADC and IIC transmission protocols, and can easily connect to other peripherals with rich GPIOs.

SenseCAP Indicator is a fully open source powerful IoT development platform for developers. One-stop ODM Fusion service is also available for customization and quick scale-up.

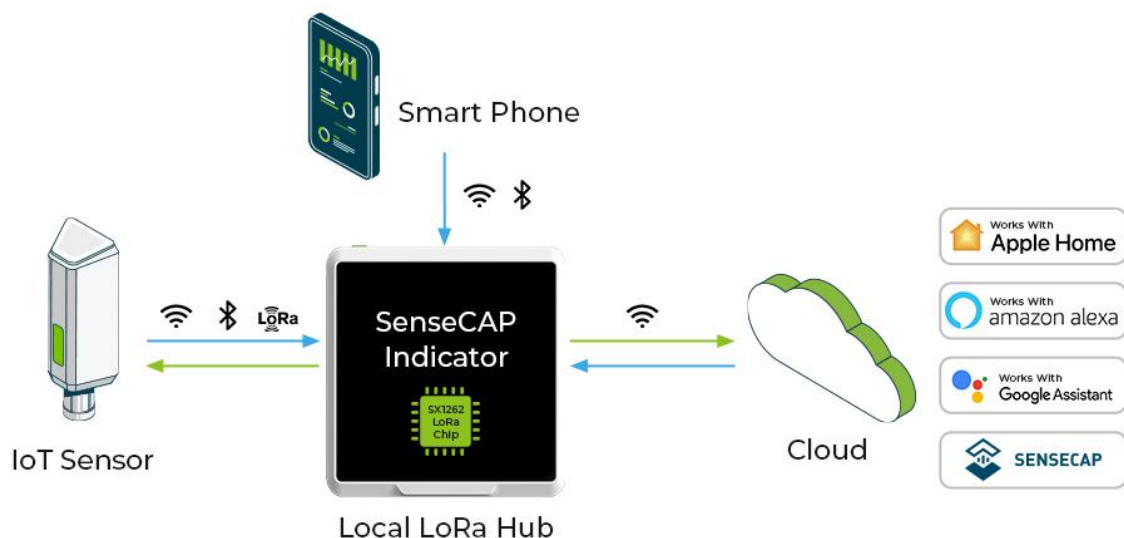
Features

- **Dual MCUs and Rich GPIOs:** Equipped with powerful ESP32S3 and RP2040 dual MCUs and over 400 Grove-compatible GPIOs for flexible expansion options.
- **Real-time Air Quality Monitoring:** Built-in tVOC and CO2 sensors, and an external Grove AHT20 temperature and humidity sensor for more precise readings.
- **Local LoRa Hub for IoT Connectivity:** Integrated Semtech SX1262 LoRa chip (optional) for connecting LoRa devices to popular IoT platforms such as Matter via Wi-Fi, without the need for additional compatible devices.
- **Fully Open Source Platform:** Leverage the extensive ESP32 and Raspberry Pi open source ecosystem for infinite application possibilities.
- **Fusion ODM Service Available:** Seeed Studio also provides one-stop ODM service for quick customization and scale-up to meet various needs.

SenseCAP Indicator native firmware enables you to use it as a desktop air quality detector or you could customize one of your own styles. There are built-in tVOCs and CO2 sensors, and a Grove TH sensor is provided to connect externally to reduce heat interference to get more accurate temperature and humidity results.



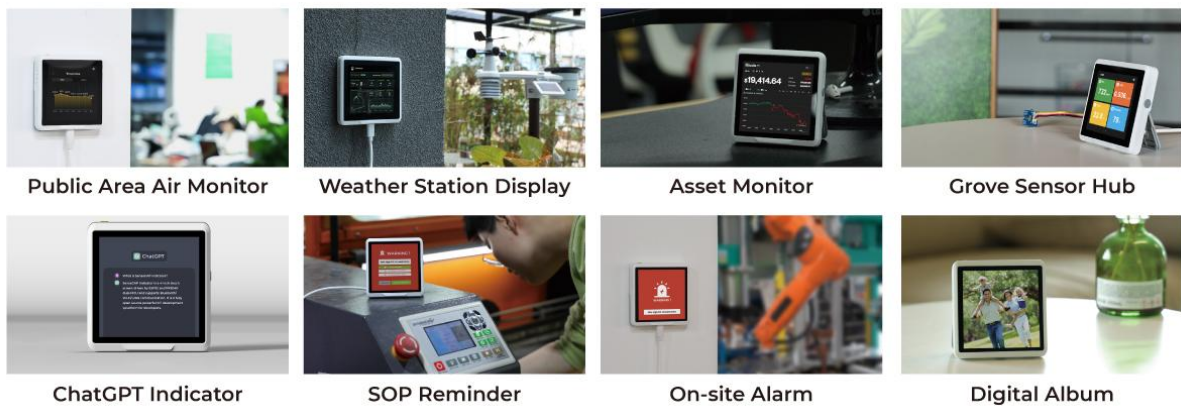
The embedded SX1262 LoRa module enables you to build the LoRa application and connect your local LoRa sensors to the Cloud via Wi-Fi. For example, you could build a LoRa hub device to connect your LoRa sensors to your smart home ecosystem to implement Matter over Wi-Fi. In this way, the LoRa devices could be connected to the Matter ecosystem via Wi-Fi, without the need to buy a new Matter-compatible device.



The software of SenseCAP Indicator is open source. Developers could create various IoT applications such as:

- Air Quality Monitor
- Weather Station Display
- Sensor Data Dashboard
- Smart Home Assistant
- Mini Sensor Hub
- Stock Price Indicator
- Digital Album
- SOP Reminder

...



It can also be used to develop various exciting applications integrating with third-party platforms, such as: AWS / ChatGPT / Matter / NodeRED / IoTeX ...



Note: This sketch shows the development possibilities for the related IoT ecosystem, developers need to develop the firmware based on need.

SenseCAP Indicator is an interactive display and control terminal for various IoT applications. It provides developers with a powerful and interface-rich development platform powered by ESP32-S3 and RP2040 dual-MCU.

Don't wait anymore, start your wonderful development journey with SenseCAP Indicator now!

Hardware Version

The SenseCAP Indicator series offers four different versions: D1, D1S, D1L, and D1Pro. Each version is designed to meet different application needs without any extra cost from unnecessary hardware. Here are the differences between the versions:

Model	D1	D1S	D1L	D1Pro
tVOC sensor	/	⊙	/	⊙
CO2 sensor	/	⊙	/	⊙
Grove TH Sensor	/	⊙	/	⊙
LoRa (SX1262)	/	/	⊙	⊙
Wi-Fi	⊙	⊙	⊙	⊙
Bluetooth	⊙	⊙	⊙	⊙



Specification

Screen	3.95 Inch, Capacitive RGB Touch Screen	
Screen Resolution	480 x 480 pixels	
Power Supply	5V DC, 1A	
Operation Temperature	-10°C~50°C	
Battery	N/A	
Processor	ESP32-S3: Xtensa® dual-core 32-bit LX7 microprocessor, up to 240 MHz RP2040: Dual ARM Cortex-M0+ up to 133MHz	
Flash	ESP32S3: 8MB RP2040: 2MB	
External Storage	Support up to 32GB Micro SD Card (not included)	
Wi-Fi	802.11b/g/n, 2.4GHz	
Bluetooth	Bluetooth 5.0 LE	
LoRa(SX1262)	LoRaWAN/(G)FSK, 21dBm Max Transmitted Power Sensitivity/-136dBm@SF12 BW=125KHz RX Sensitivity, Up to 5km (depending on gateway antenna and environments)	
Sensors(Optional)	CO2 (SCD41)	Range: 0-40000ppm Accuracy: 400ppm - 5000ppm ±(50ppm+5% of reading)
	TVOC (SGP40)	Range: 1-500 VOC Index Points
	Grove Temperature and Humidity Sensor (AHT20)	Range: -40 ~ + 85 °C/± 0.3 °C; 0 ~ 100% RH/± 2% RH (25 °C)
Buzzer	MLT-8530, Resonant Frequency: 2700Hz	

Part List

Products	Quantity
SenseCAP Indicator	*1
Grove TH Sensor(For D1Pro and D1S)	*1
Type-C Cable	*1

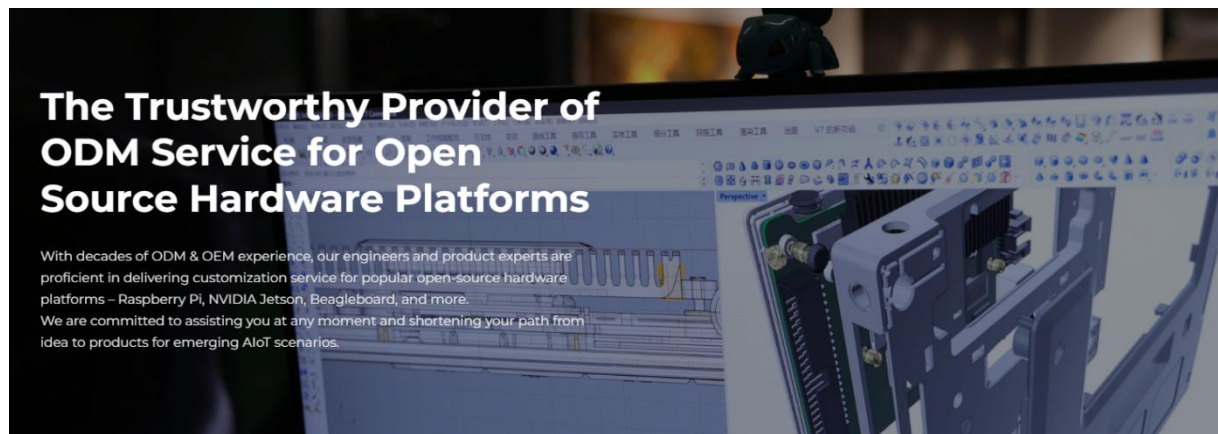
ODM Service

Note:

If you want to customize your own SenseCAP Indicator, Seeed Studio provides one-stop [ODM](#) service for quick customization and scalp-up. Please contact iot@seeed.cc if you have large quantity customization need.

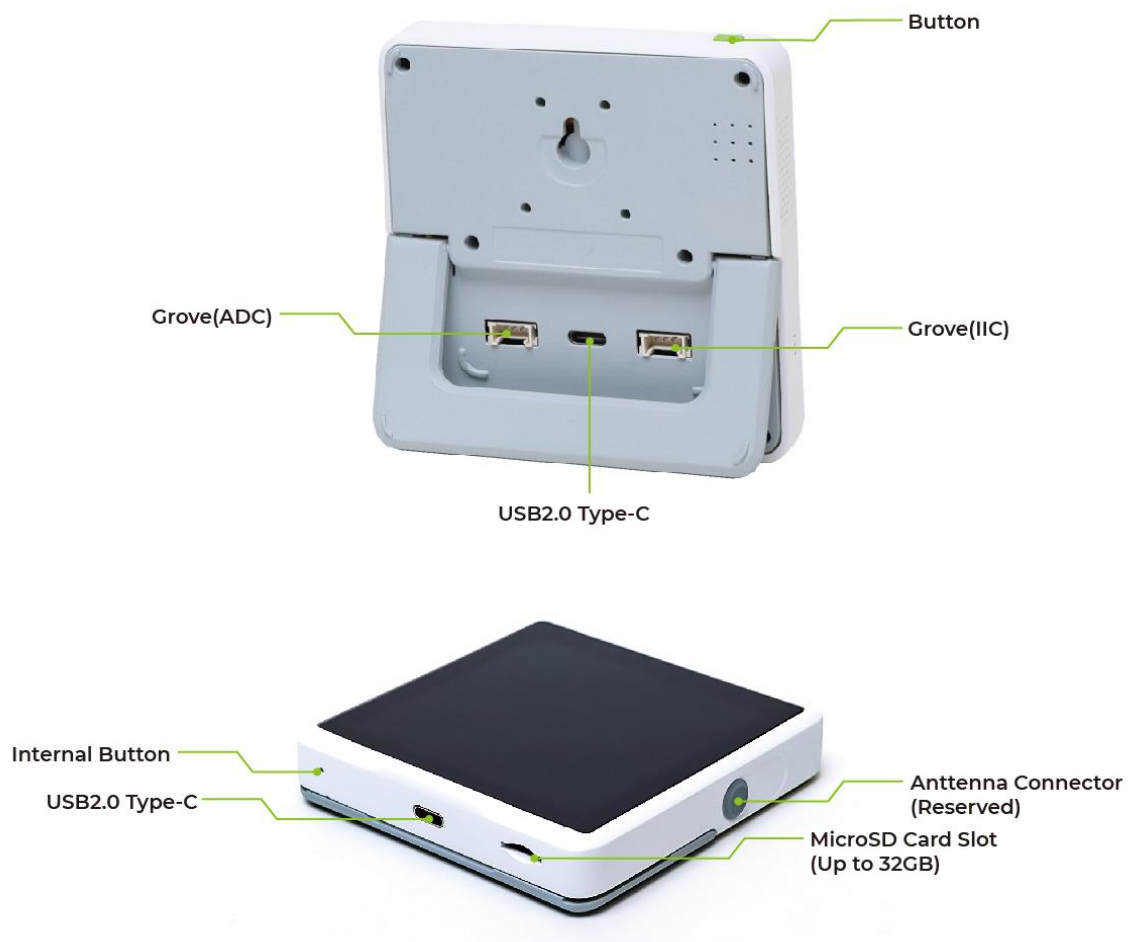
With over 10 years of ODM & OEM experience, our engineers and product experts are proficient in delivering customization service for popular open-source hardware platforms, such as: Raspberry Pi, NVIDIA Jetson, Beagleboard, ESP32, and more.

We are committed to assisting you at any moment and shortening your path from idea to products for emerging AIoT scenarios.



Get Started with SenseCAP Indicator

Hardware Overview



Button Function

Short press: Turn off /wake up the screen

Long press for 3s: Switch on/switch off the device

Long press for 10s: Factory reset

Grove Interfaces

There are two Grove interfaces for connecting Grove modules, providing more possibilities for developers.

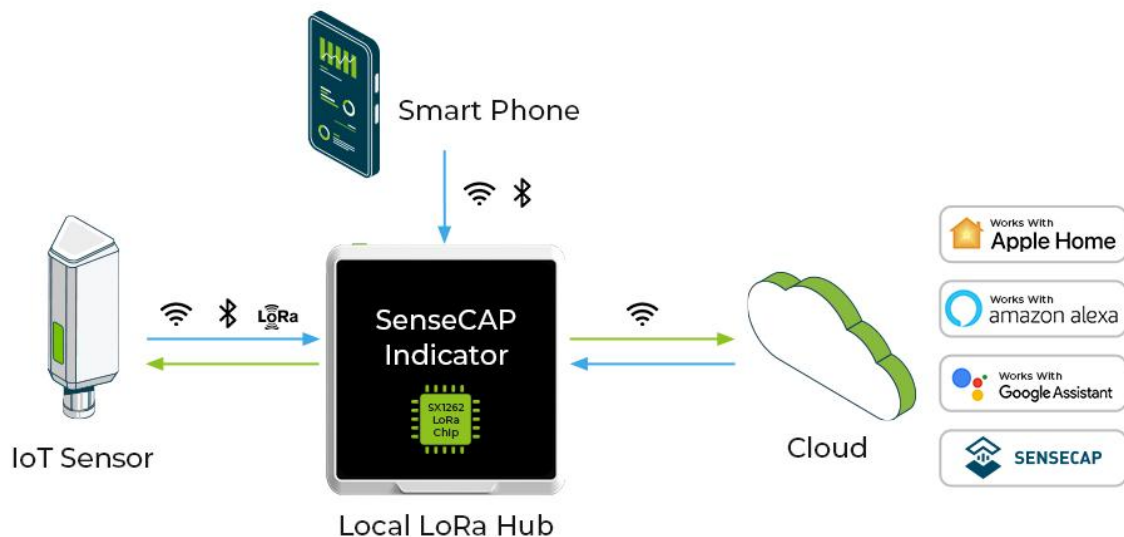
Grove is a modular, standardized connector prototyping system and a strong open source

hardware ecosystem. (Click [Grove - Seeed Studio](#) to learn more) [Grove - Seeed Studio](#)



SX1262 LoRa Chip

The embedded SX1262 LoRa module enables you to build the LoRa application and connect your local LoRa sensors to the Cloud via Wi-Fi. For example, you could build a LoRa hub device to connect your LoRa sensors to your smart home ecosystem to implement Matter over Wi-Fi. In this way, the LoRa devices could be connected to the Matter ecosystem via Wi-Fi, without the need to buy a new Matter-compatible device.



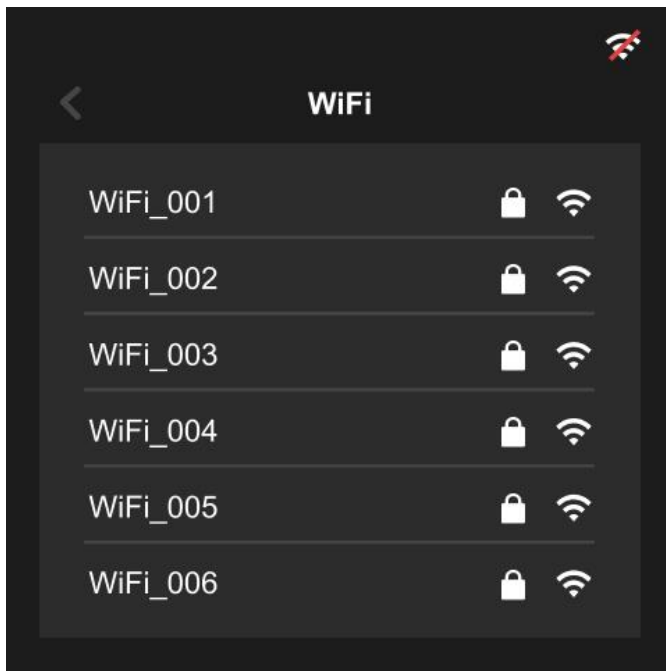
Native Firmware

SenseCAP Indicator native firmware enables you to use it as a desktop air quality detector, just a few simple steps to enjoy.

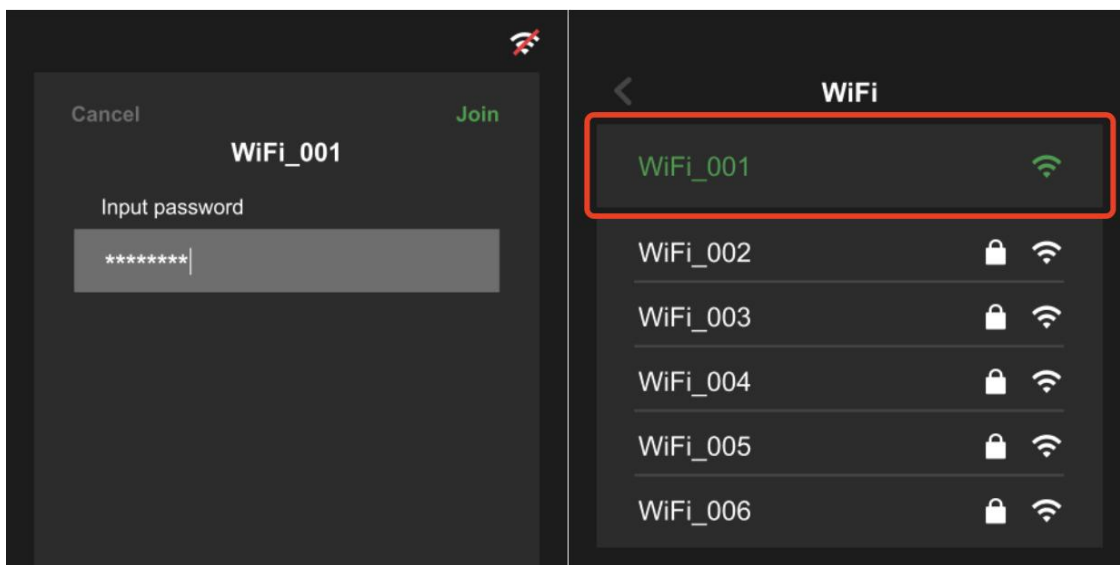


Wi-Fi Configuration

Plug the 5V power adaptor into the USB type-C power connector, the device will power on automatically, then the display will show the WiFi setting page.



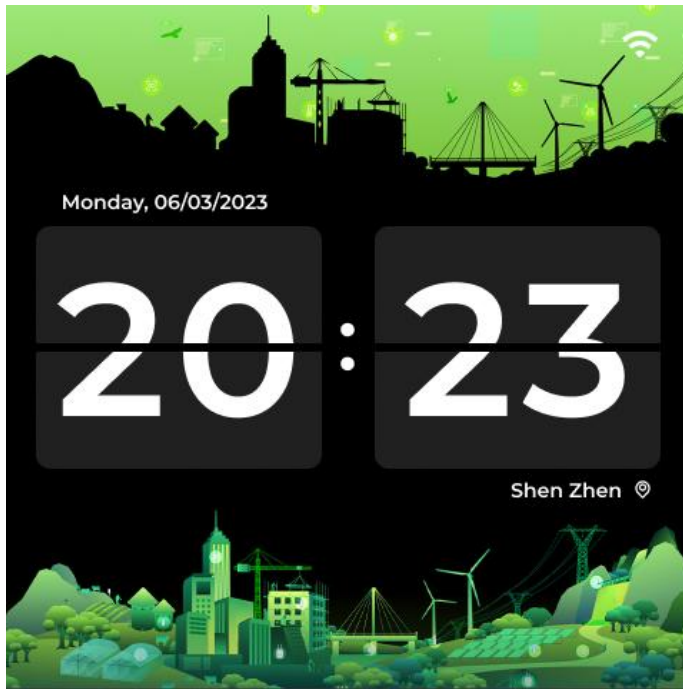
Select the WiFi you need, input the password and connect.



Data Viewing

- **Home page**

Including the time, date, location info.

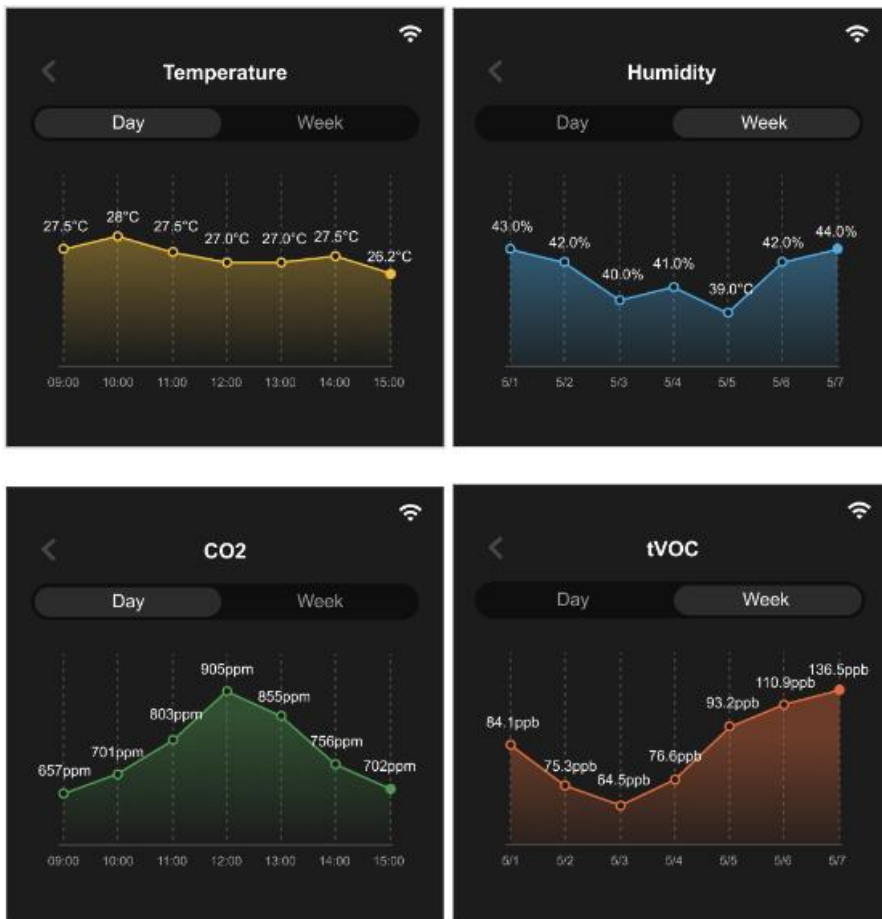


- **Sensor data**

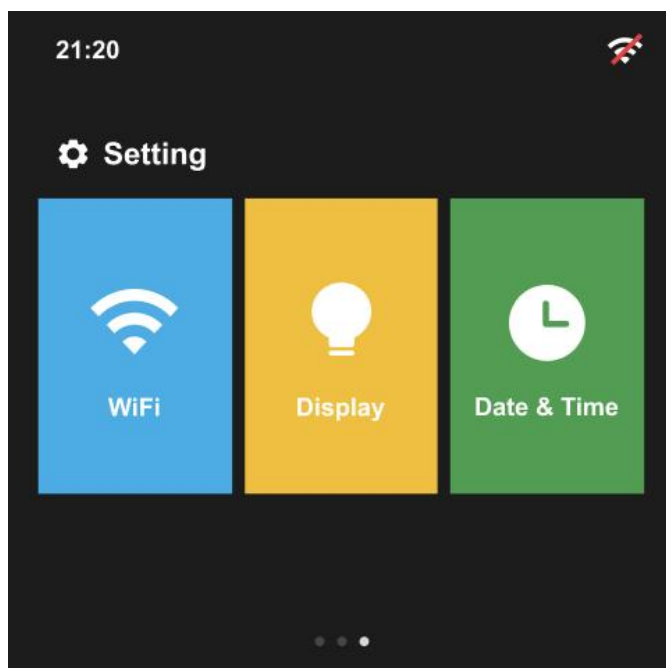
Built-in tVOC and CO₂ sensors, and an external Grove AHT20 TH sensor for more precise temperature and humidity readings.



Click the specified sensor to enter the detailed information page, and you can choose to display the value of 24h or a week.



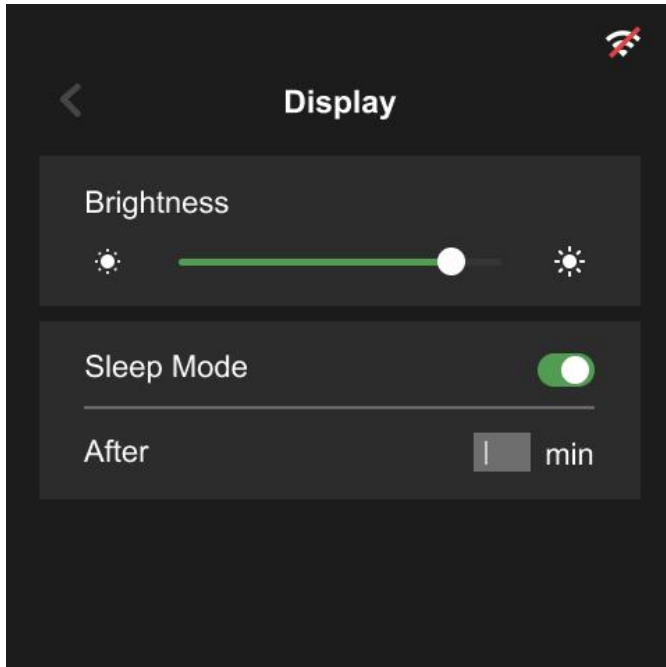
Setting



Display Setting

Brightness: Adjust screen brightness

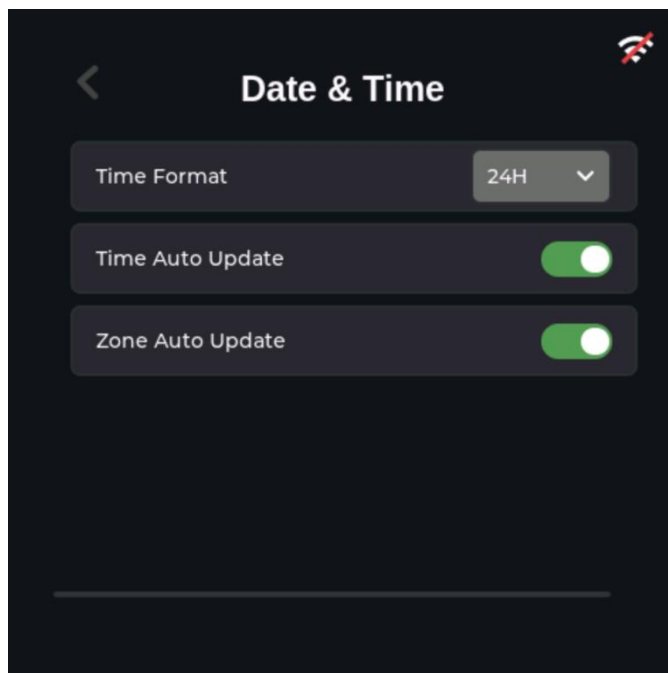
Sleep Mode: Turn off the screen according to the interval you set



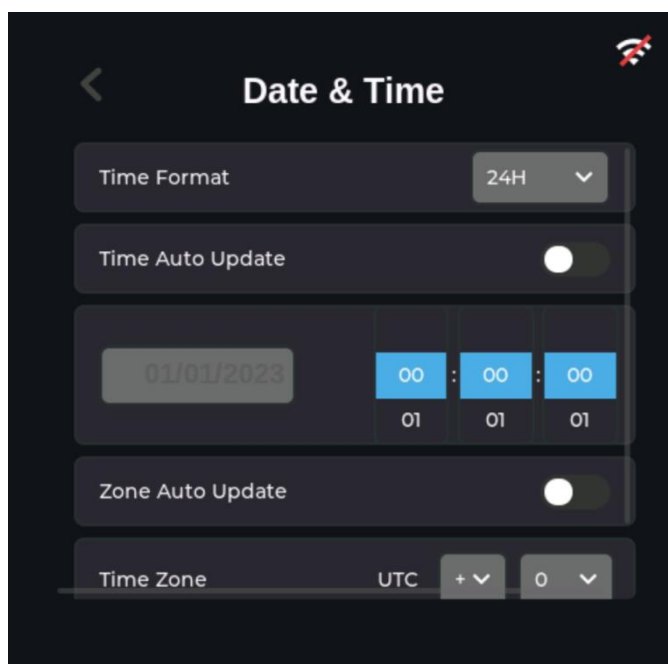
Date & Time Setting

Time Format: You can set 24H or 12H format.

Time Auto Update/Zone Auto Update: When the device is connected to WiFi, it will automatically obtain the corresponding time zone and date.



Manual setting: If the time obtained through the time zone cannot automatically identify the winter time or device is offline, then you can manually set the time zone



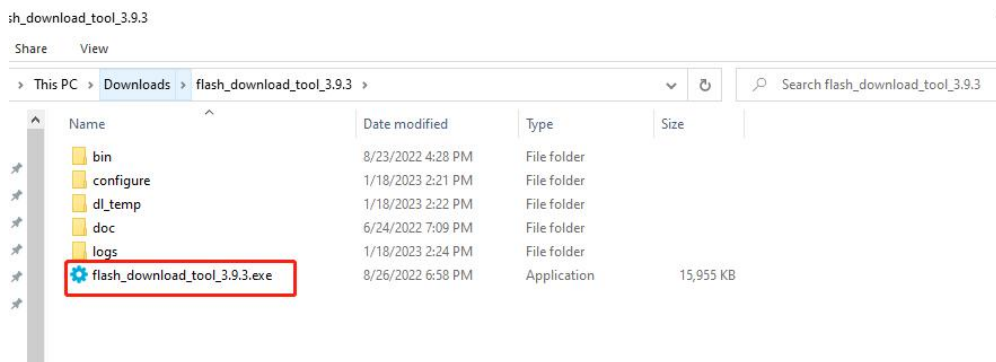
Development Tutorial

ESP32 Firmware Flashing

Flash by Flash Download Tools (For Windows only)

- **Step 1:** Connect the device to your PC with the provided USB type-C cable.
- **Step 2:** Install the Flash Download Tools

[Flash Download Tools for Windows](#)



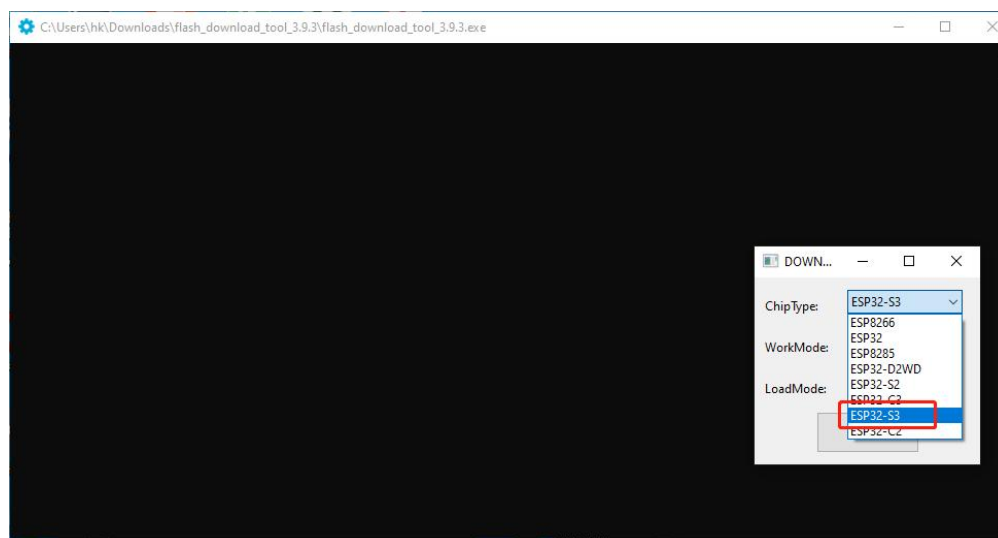
- **Step 3:** User interface setting

Double-click the .exe file to enter the main interface of the tool.

Chip Type: ESP32-S3

WorkMode: Develop

LoadMode: UART



- **Step 4:** SPI Download Tab Configure

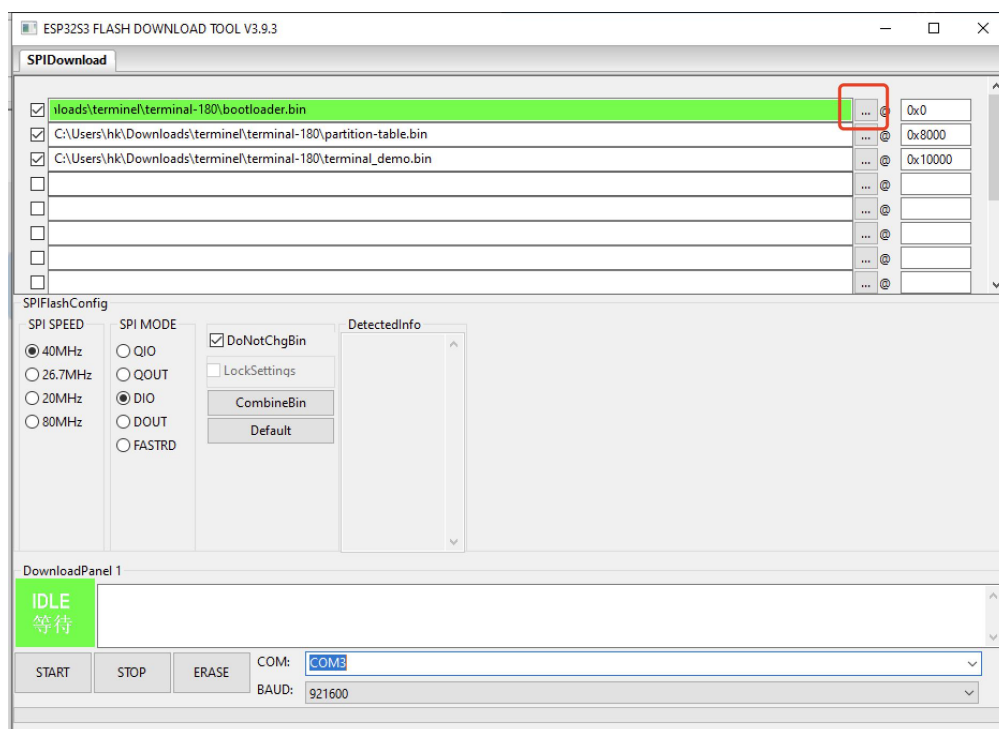
Click "...". and select the .bin file in the firmware file to configure the loading path.

There should be 3 .bin files in the firmware , they correspond to 3 different downloading addresses:

bootloader.bin - 0x0

partition-table.bin - 0x8000

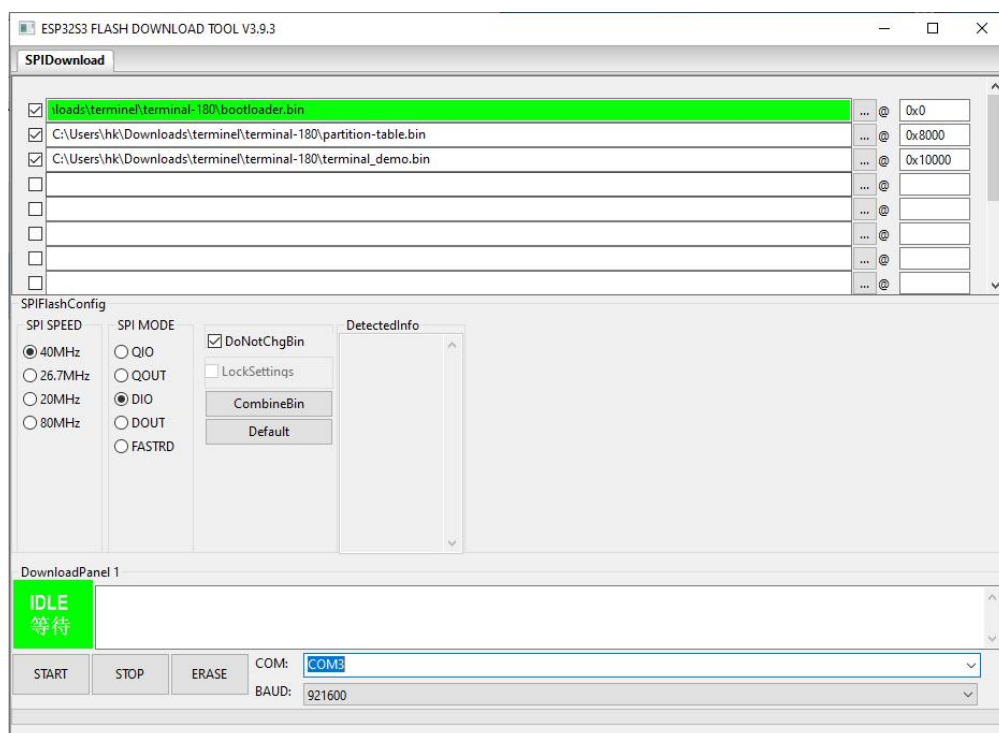
terminal.bin - 0x10000



● Step 5: SPI Flash Configure

SPI SPEED: 40MHz

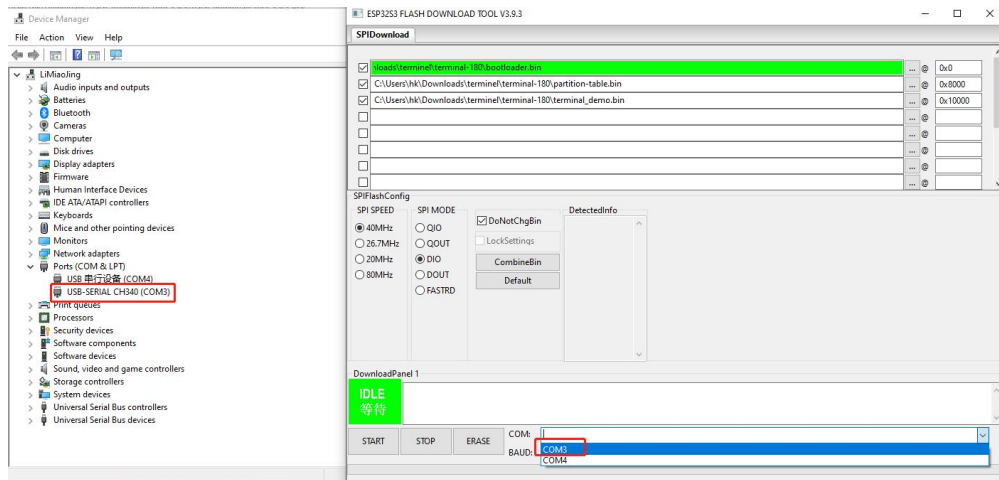
SPI MODE: DIO



● Step 6: Download Panel Configure

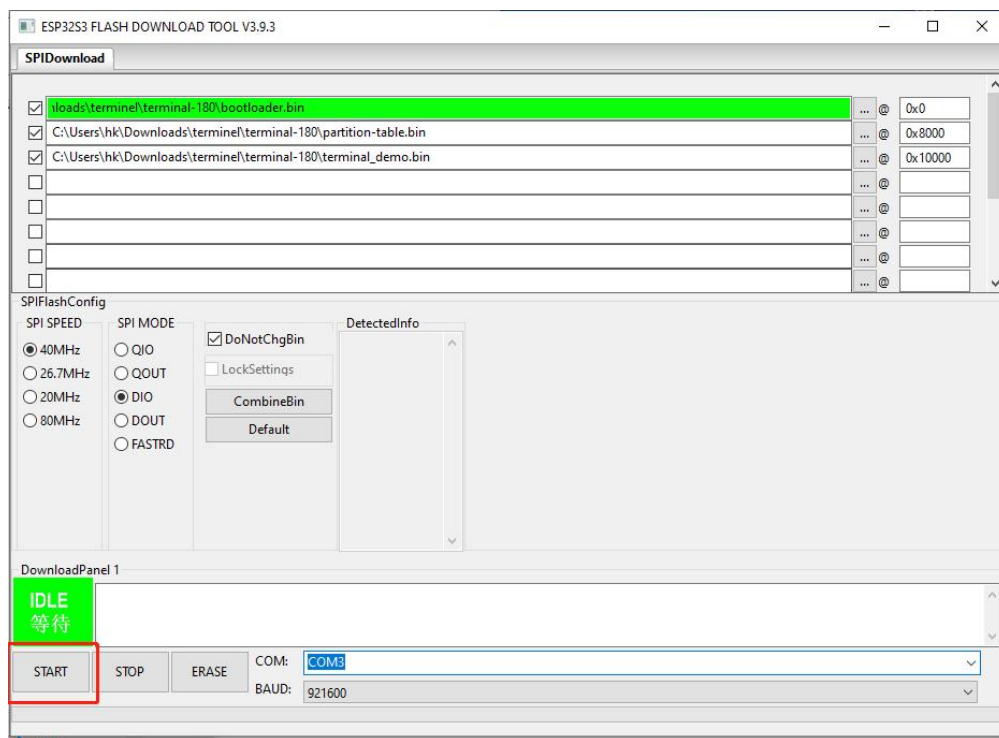
COM: Check the ports on your Device Manager, the USB-SERIAL is the correct one.

Baud: 921600(recommended value)

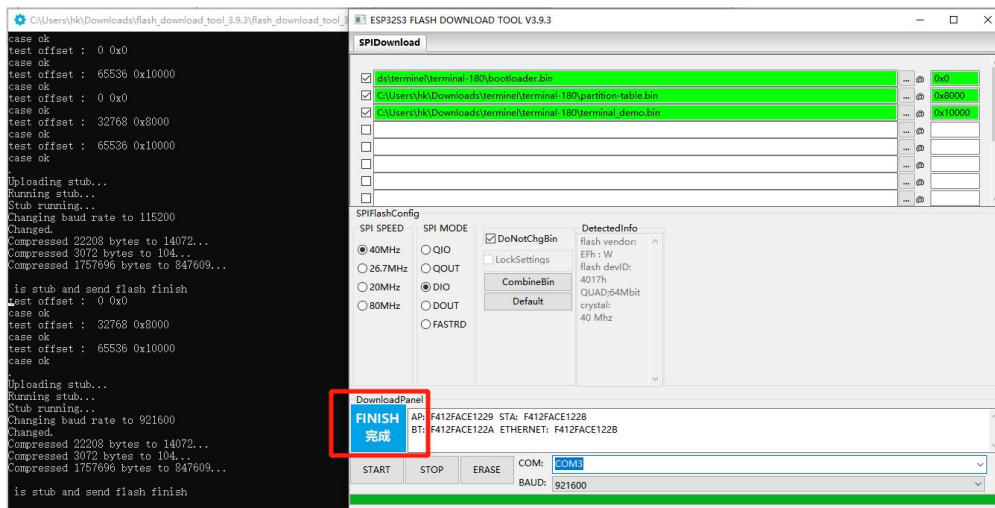


● Step 6: Start Downloading

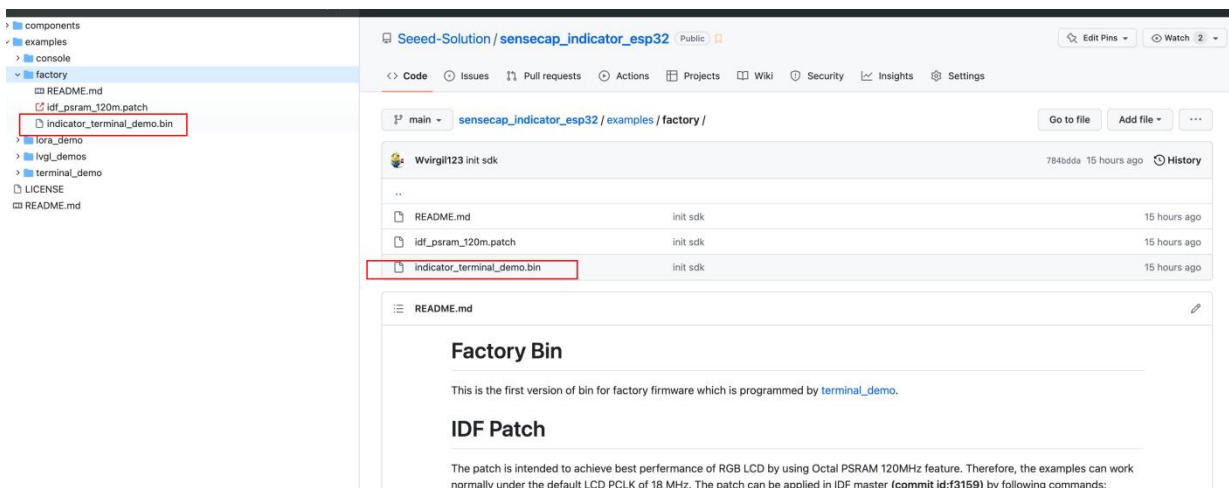
Then click "START" to start the downloading.

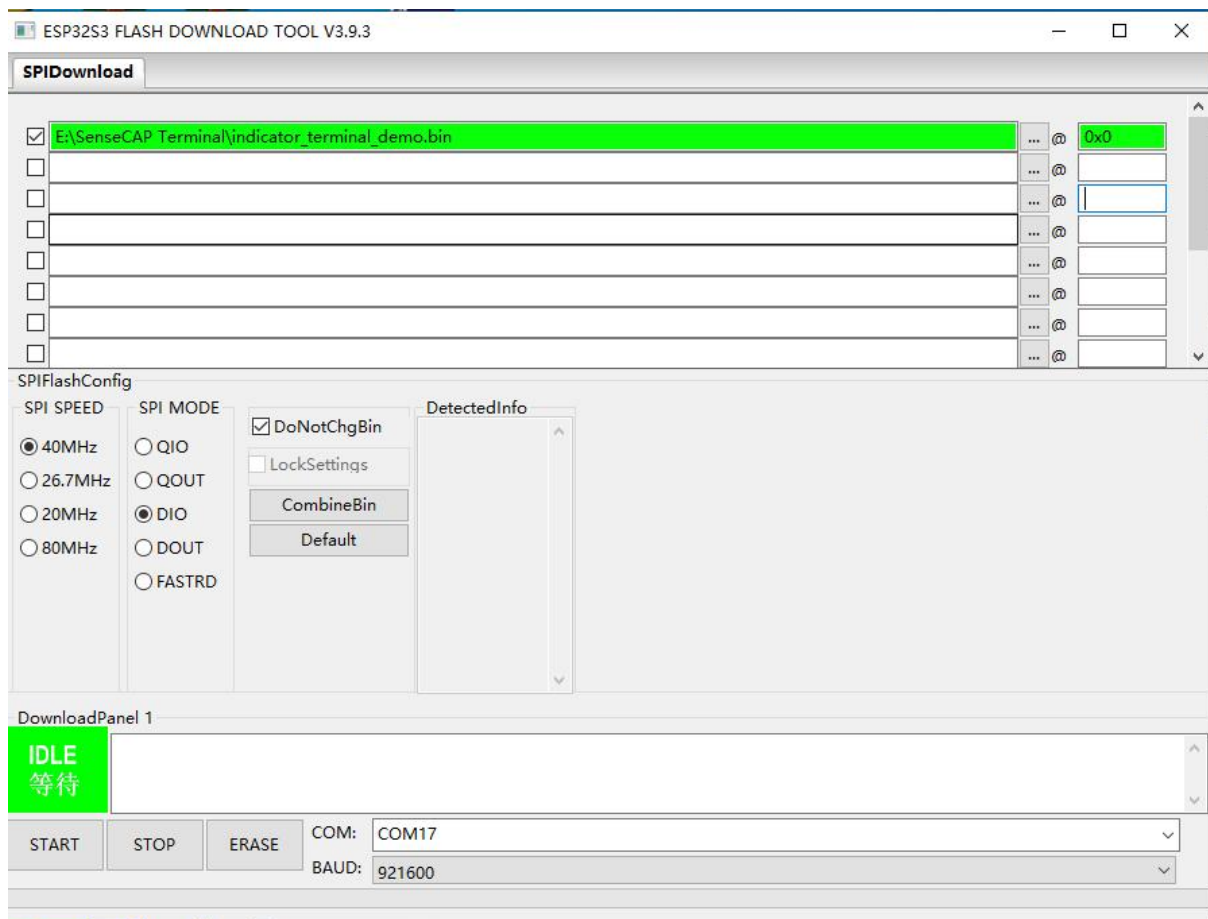


When it shows "FINISH", the flash has been completed.



There is "indicator_terminal_demo.bin" firmware (allinone) in the [sdk](#) . you can flash it to esp32.





Flash by IDF

For Linux and MacOS: [Standard Toolchain Setup for Linux and macOS](#)

For Windows: [Standard Setup of Toolchain for Windows](#)

There is "indicator_terminal_demo.bin" firmware (allinone) in the [sdk](#) . you can flash it by idf.

```
cd <sdk>/examples/factory/  
esptool.py write_flash 0x0 indicator_terminal_demo.bin
```

also you can **build, flash and monitor** the project.

```
cd <sdk>/examples/terminal_demo/  
idf.py -p PORT build flash monitor
```

RP2040 Firmware Flashing

Flash by .uf2 file

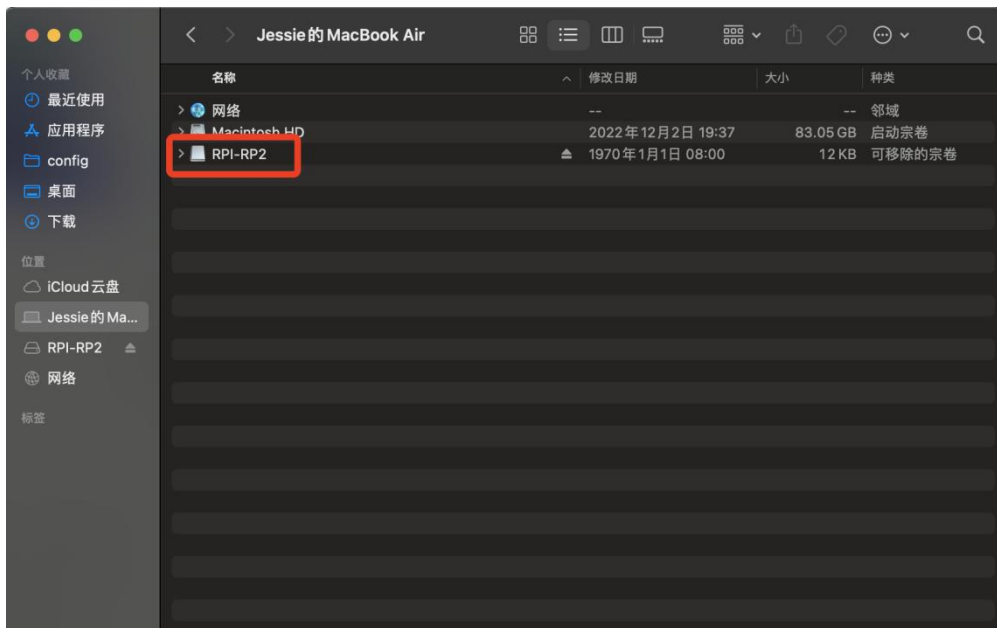
- **Step 1:** Connect the device to your PC

Long press this **internal button**, then connect the device to your PC by the provided USB type-C cable, release the button once connected.



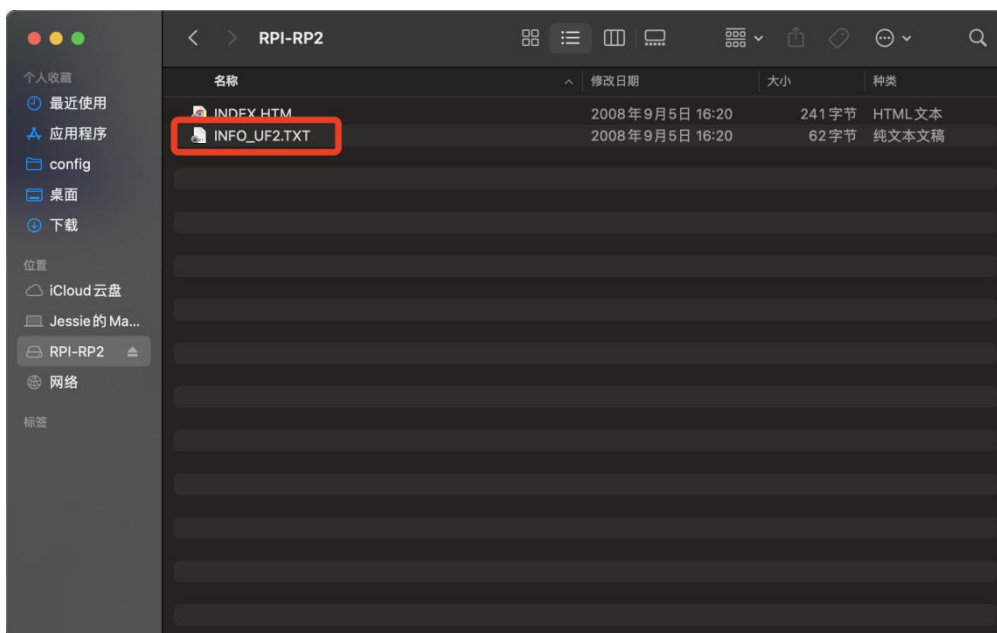
- **Step 2:** Firmware Flash

After the connection is successful, your PC will show a disk.



Copy the .uf2 file in the firmware package to the disk, then the disk will log out.

The upgrade will run automatically.



Flash by Arduino IDE

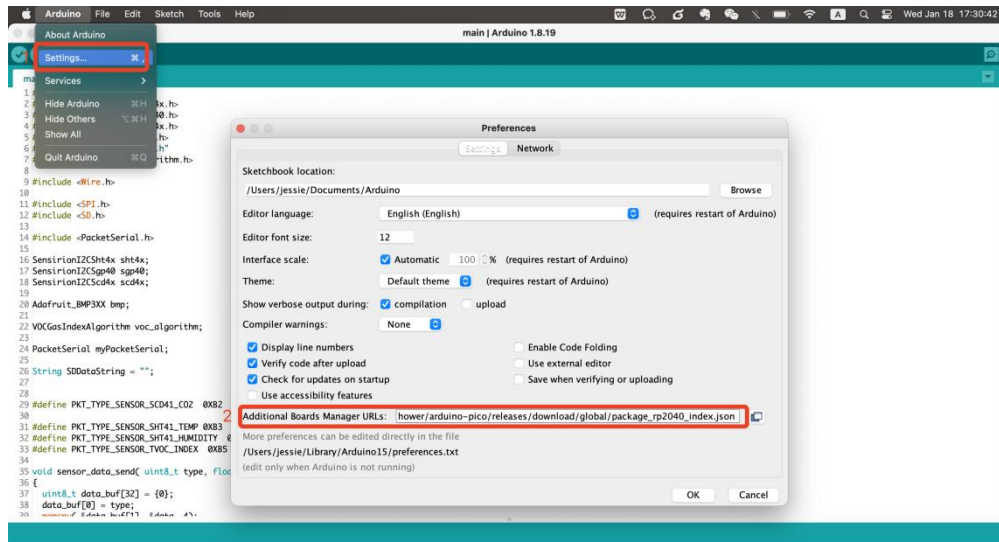
- **Step 1:** Install Arduino IDE

[Arduino IDE](#)

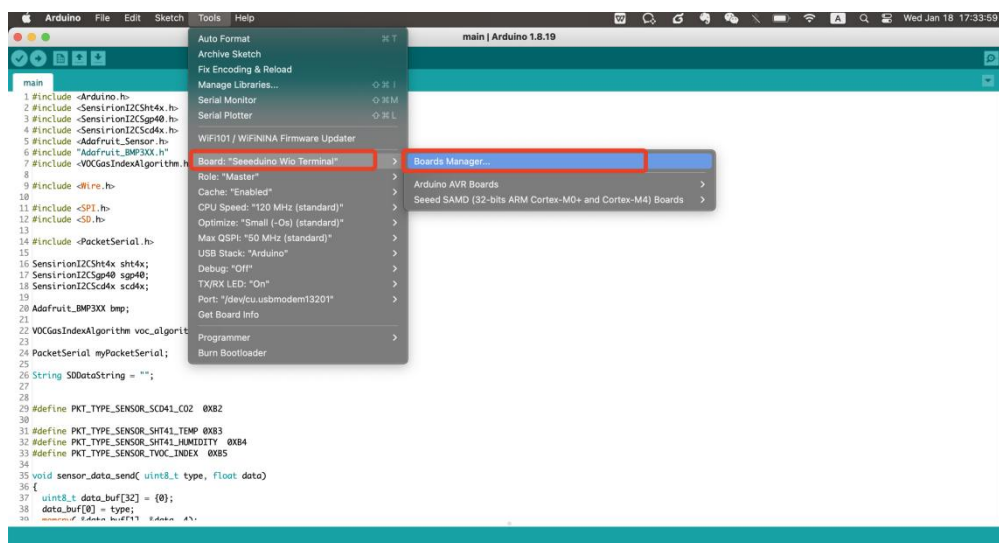
- **Step 2:** Add the Raspberry Pi Pico Board

Open your Arduino IDE, click on **Arduino > Settings**, and copy the below URL to **Additional Boards Manager URLs**:

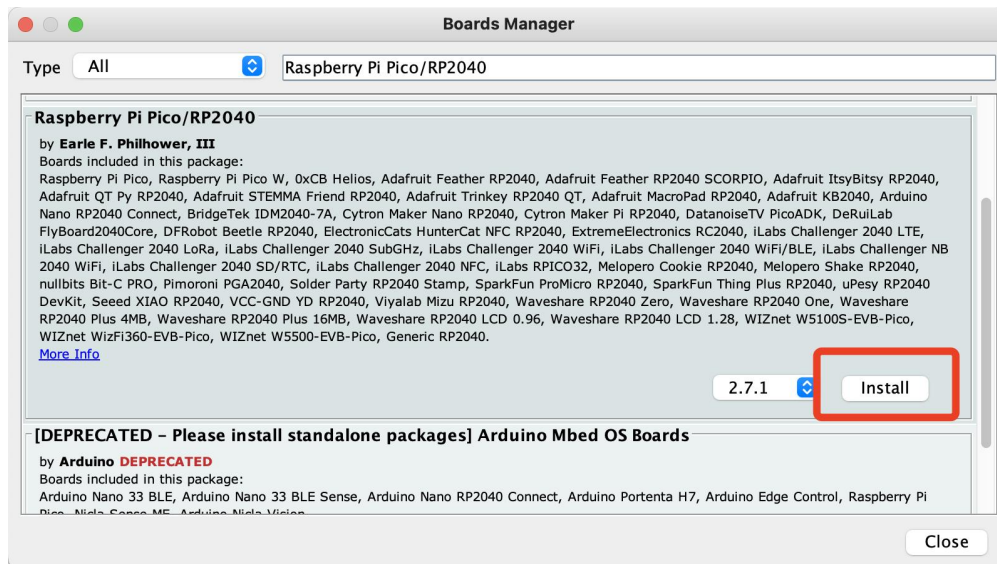
https://github.com/earlephilhower/arduino-pico/releases/download/global/package_rp2040_index.json



Click on **Tools > Board > Board Manager**.



Search and install "Raspberry Pi Pico/RP2040" in the Boards Manager



● Step 3: Add Libraries

Download these libraries we need:

[Serial communication protocol](#)

[SGP40 TVOC sensor library](#)

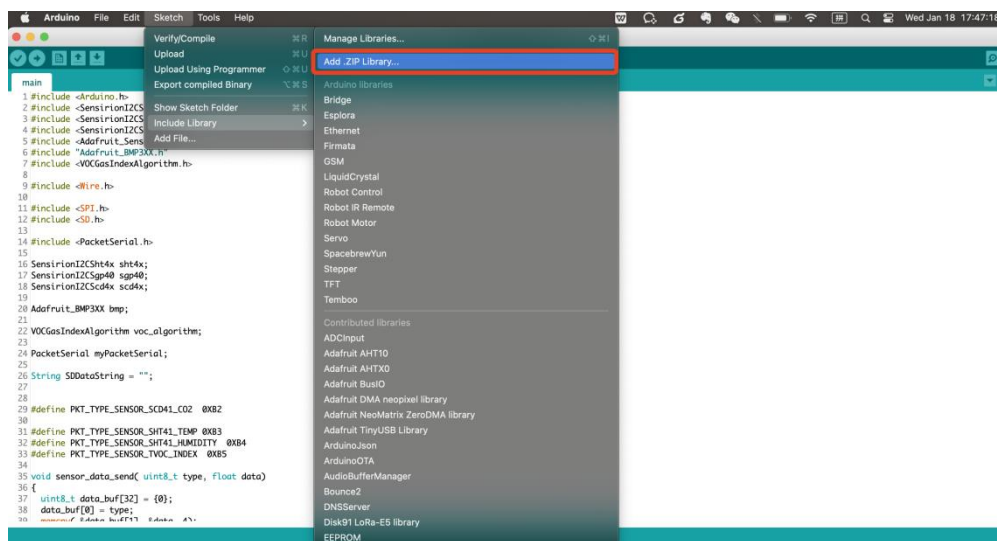
[Transfer index library: Sensirion Gas Index Algorithm](#)

[SCD41 CO2 sensor library](#)

[AHT20 temperature and humidity sensor library](#)

[Sensirion Arduino Core library](#)

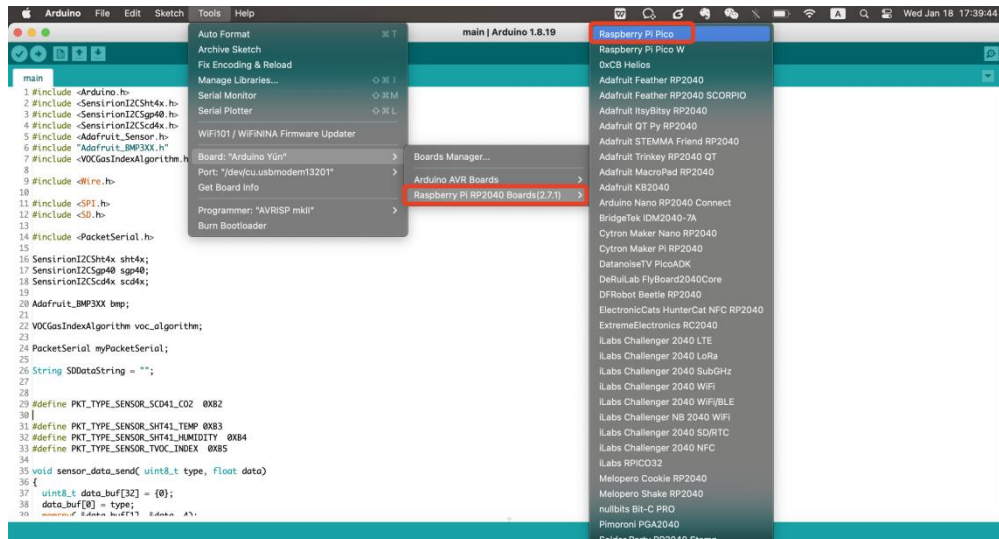
Navigate to **Sketch -> Include Library -> Add .ZIP Library**, then select the libraries you download.



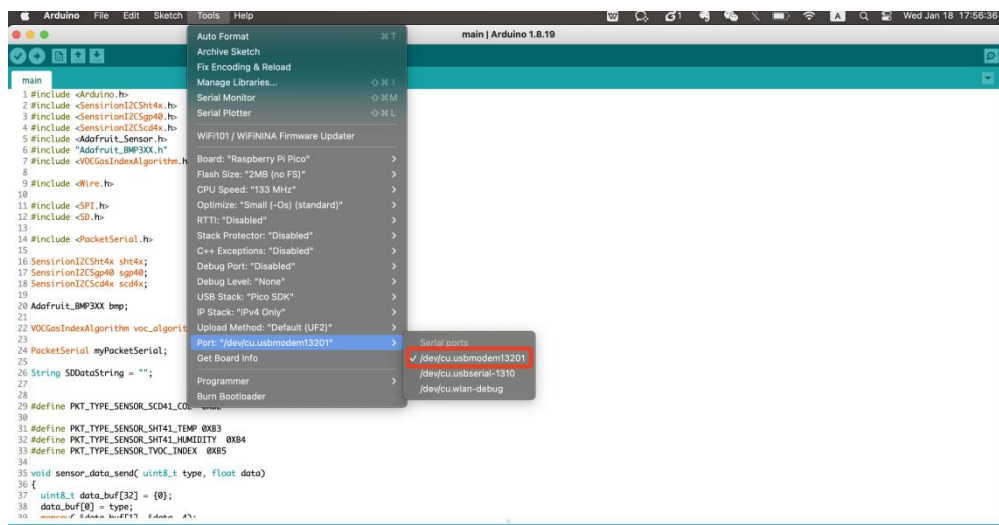
- Step 4: Connect the device to your PC with the provided USB Typc-C cable.

- Step 5: Select the board

Tools > Board > Raspberry Pi PR2040 Boards > Raspberry Pi Pico



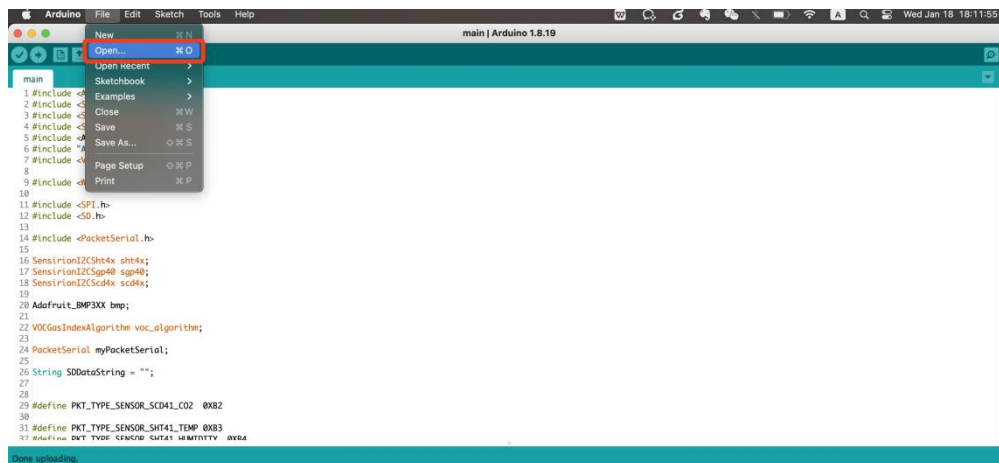
Port: Select the "usbmodem" one



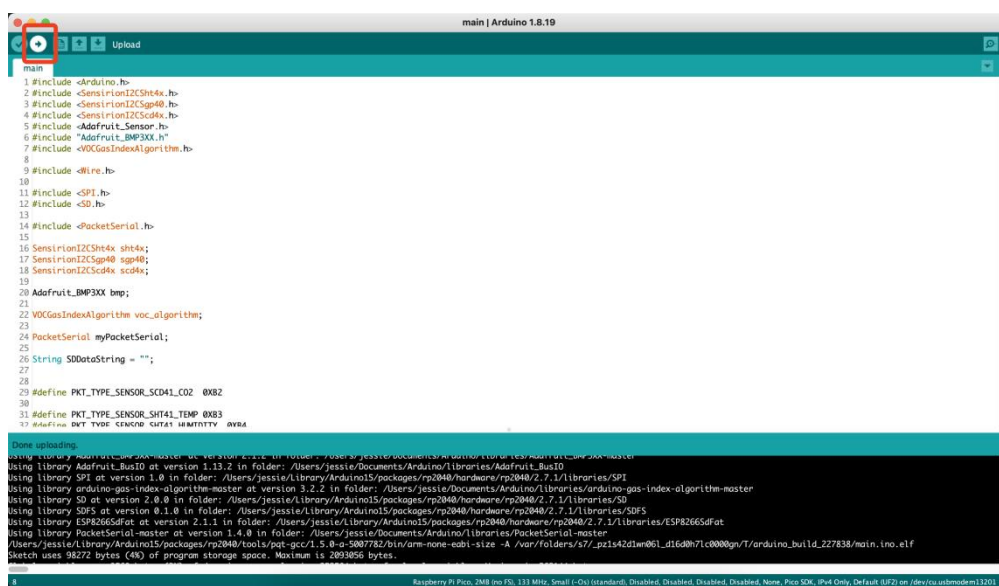
- Step 6: Open the example code file

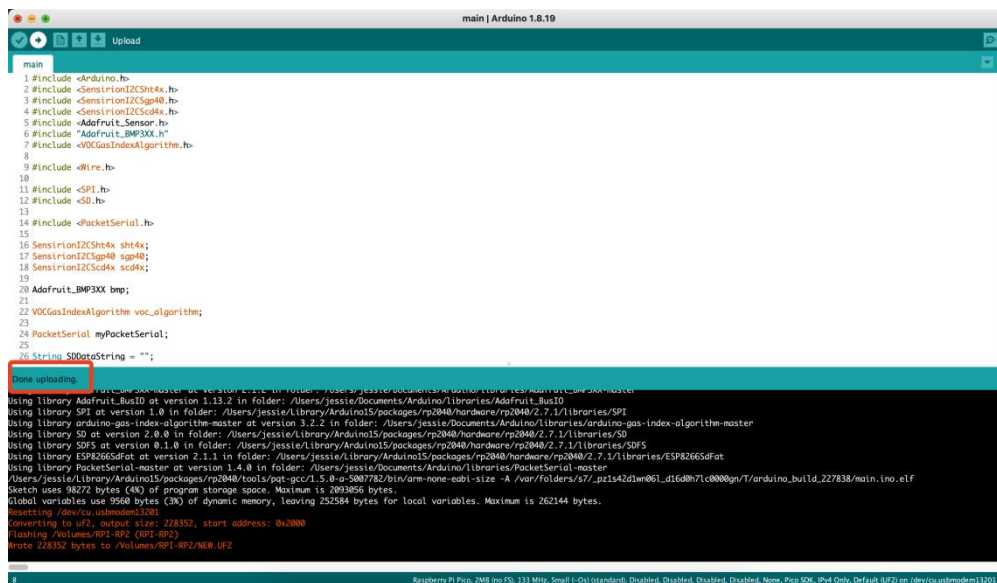
File > Open, then select the example code file (.ino file).

We provide an example code file, you can modify the code according to your needs.



● Step 7: Verify and Upload the file.





```
main | Arduino 1.8.19
Upload

main
1 #include <Arduino.h>
2 #include <SensirionI2CSH4x.h>
3 #include <SensirionI2CSgp40.h>
4 #include <SensirionI2CScd4x.h>
5 #include <Adafruit_Sensor.h>
6 #include <Adafruit_BMP3XX.h>
7 #include <VOCGasIndexAlgorithm.h>
8
9 #include <Wire.h>
10
11 #include <SPI.h>
12 #include <SD.h>
13
14 #include <PacketSerial.h>
15
16 SensirionI2CSH4x sh4x;
17 SensirionI2CSgp40 sgp40;
18 SensirionI2CScd4x scd4x;
19
20 Adafruit_BMP3XX bmp;
21
22 VOCGasIndexAlgorithm voc_algorithm;
23
24 PacketSerial myPacketSerial;
25
26 String SDdataString = "";
27
Done uploading
Using library PacketSerial-master at version 1.4.0 in folder: /Users/jessie/Documents/Arduino/libraries/Adafruit_BusIO
Using library Adafruit_BusIO at version 1.13.2 in folder: /Users/jessie/Documents/Arduino/libraries/Adafruit_BusIO
Using library SPI at version 1.0 in folder: /Users/jessie/Library/Arduino15/packages/rp2040/hardware/rp2040/2.7.1/libraries/SPI
Using library arduino-gas-index-algorithm-master at version 3.2.2 in folder: /Users/jessie/Documents/Arduino/libraries/arduino-gas-index-algorithm-master
Using library SD at version 2.0.0 in folder: /Users/jessie/Library/Arduino15/packages/rp2040/hardware/rp2040/2.7.1/libraries/SD
Using library SDfs at version 0.1.0 in folder: /Users/jessie/Library/Arduino15/packages/rp2040/hardware/rp2040/2.7.1/libraries/SDfs
Using library ESP8266SDfat at version 2.1.1 in folder: /Users/jessie/Library/Arduino15/packages/rp2040/hardware/rp2040/2.7.1/libraries/ESP8266SDfat
Using library PacketSerial-master at version 1.4.0 in folder: /Users/jessie/Documents/Arduino/libraries/PacketSerial-master
/Users/jessie/Library/Arduino15/packages/rp2040/tools/pat-gcc/1.5.0-a-5007782/bin/arm-none-eabi-size -A /var/folders/s7/pz1s42d1w061_d16d0b71c0000gv/T/arduino_build.227838/main.ino.elf
Sketch uses 94272 bytes (48) of program storage space. Maximum is 2093056 bytes.
Global variables use 9560 bytes (30) of dynamic memory, leaving 252584 bytes for local variables. Maximum is 262144 bytes.
Resetting /dev/cu.usbmodem13201
Converting to uF2, output size: 228352, start address: 0x2000
Flashing RP2040s (RP2040) (RP2040)
Wrote 228352 bytes to /Volumes/RP1-0P2-NEW_UF2
8 Raspberry Pi Pico, 2MB (no FS), 133 MHz, Small (-O) (standard), Disabled, Disabled, Disabled, Disabled, Name, Pico SDK, (Pv4 Only, Default 0.67) on /dev/cu.usbmodem13201
```

Resource

IDF Download: [Standard Toolchain Setup for Linux and macOS](#)

[Standard Setup of Toolchain for Windows](#)

SenseCAP Indicator ESP32 SDK: [SenseCAP Indicator SDK for esp32](#)

SenseCAP Indicator RP2040 Examples: [SenseCAP Indicator examples for rp2040](#)

FCC Regulatory Conformance:

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- (1) This device may not cause harmful interference.
- (2) This device must accept any interference received, including interference that may cause undesired operation.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help

NOTE: The manufacturer is not responsible for any radio or TV interference caused by unauthorized modifications to this equipment. Such modifications could void the user's authority to operate the equipment.

RF Exposure

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance of 20 cm between the radiator and your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.