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/lOdI5_MGbCw

Content

Introduction 4

Features 4

Hardware Version 7

Specification 8

ODM Service 10

Get Started with SenseCAP Indicator 11

Hardware Overview 11

Button Function 11

Grove Interfaces 12

SX1262 LoRa Chip 12

System Diagram 13

Native Firmware 14

Wi-Fi Setting 15

Data Viewing 16

Setting 18

Development Tutorial 20

ESP32 Firmware Flashing 20

RP2040 Firmware Flashing 25

Resource 32

Temperature
Day
Week
27.5°C
28°C
27.5°C
27.0°C
27.0°C
27.5°C
26.2°C

SENSECAP
SenseCAP Indicator
ESP32 4-Inch Open-source Touch Screen
20:23

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

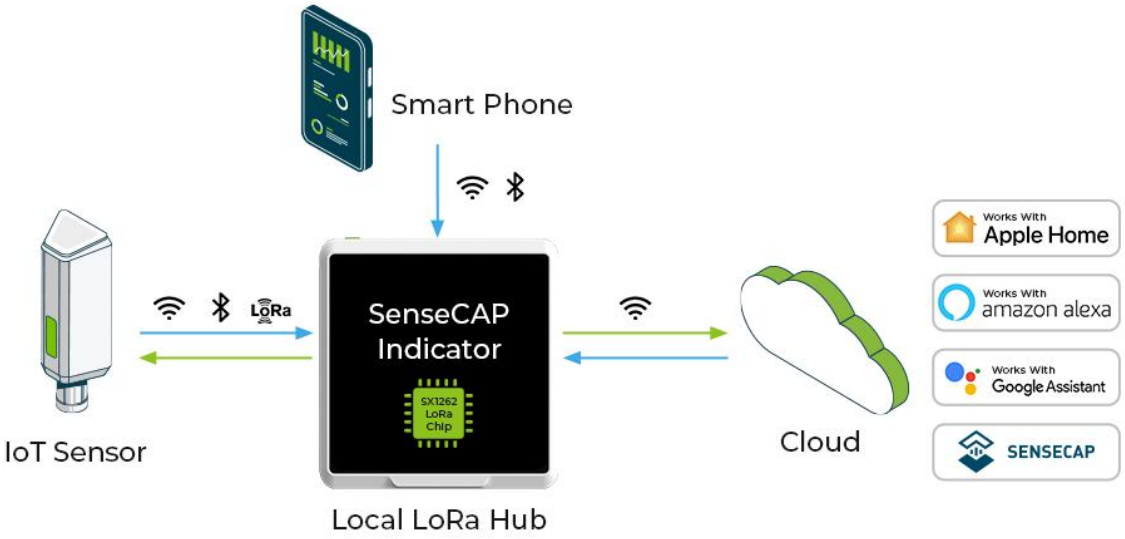
Grove AHT20 temperature and humidity sensor for more precise readings.

- **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
Battery	N/A
Processor	ESP32-S3: Xtensa® dual-core 32-bit LX7 microprocessor, up to 240

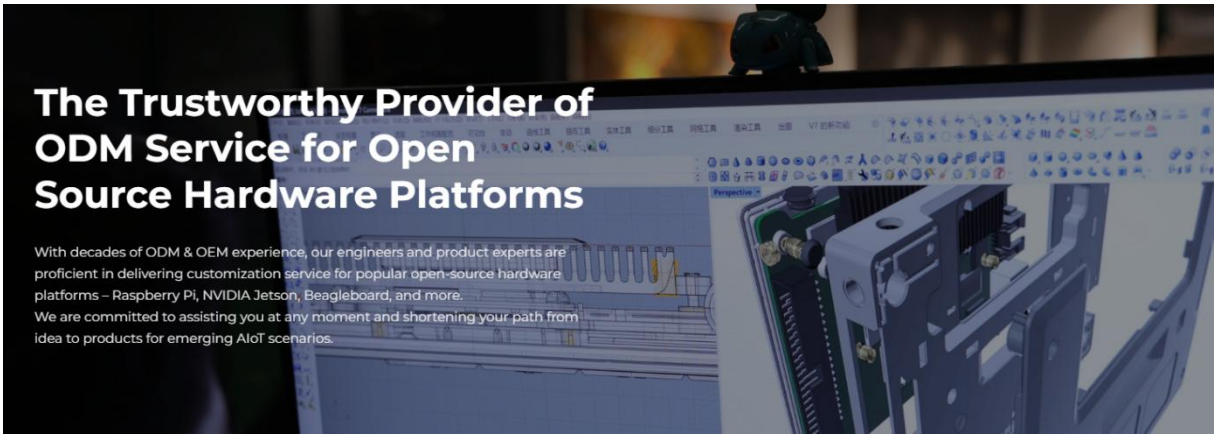
	MHz RP2040: Dual ARM Cortex-M0+ up to 133MHz	
Flash	ESP32S3: 8MB RP2040: 2MB	
External Storage	Support up to 32GB Micro SD Card (not included)	
Wi-Fi	802.11b/g/n, 2.4GHz	
Bluetooth	Bluetooth 5.0 LE	
LoRa(SX1262)	LoRaWAN/(G)FSK, 21dBm Max Transmitted Power Sensitivity/-136dBm@SF12 BW=125KHz RX Sensitivity, Up to 5km (depending on gateway antenna and environments)	
Sensors(Optional)	Built-in CO2 (SCD41)	Range: 0-40000ppm Accuracy: 400ppm - 5000ppm ±(50ppm+5% of reading)
	Built-in TVOC (SGP40)	Range: 1-500 VOC Index Points
	External Temperature and Humidity Sensor	Grove TH Sensor (AHT20) Sensor Range: -40 ~ + 85 ℃/± 0.3 ℃; 0 ~ 100% RH/± 2% RH (25 ℃)
Buzzer	MLT-8530, Resonant Frequency：2700Hz	

ODM Service

Note:

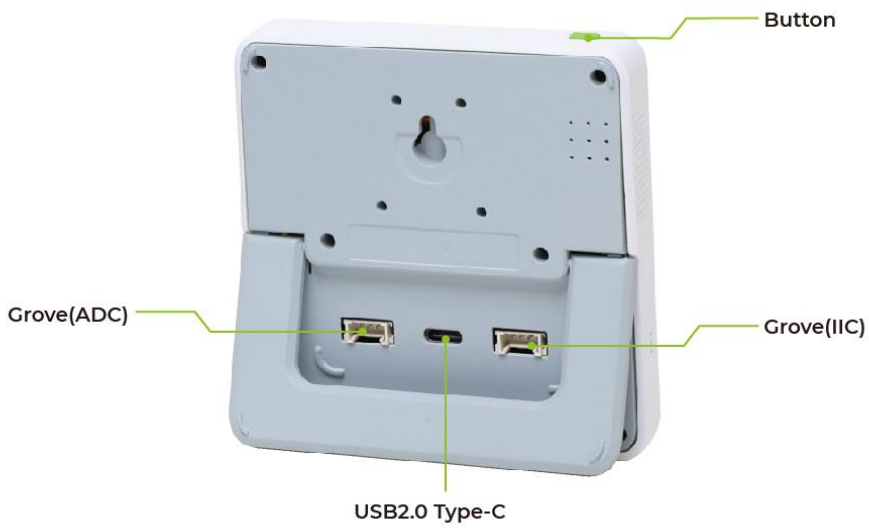
If you want to customize your own SenseCAP Indicator, Seeed Studio provides one-stop ODM service for quick customization and scalp-up. Please contact iot@seeed.cc if you have large quantity customization need.

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

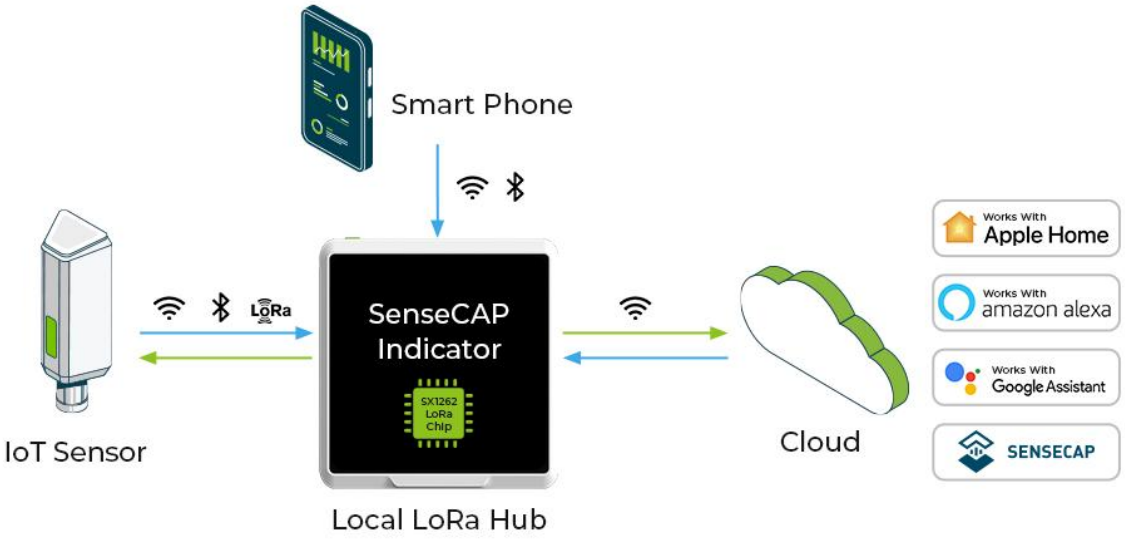
Grove Interfaces

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

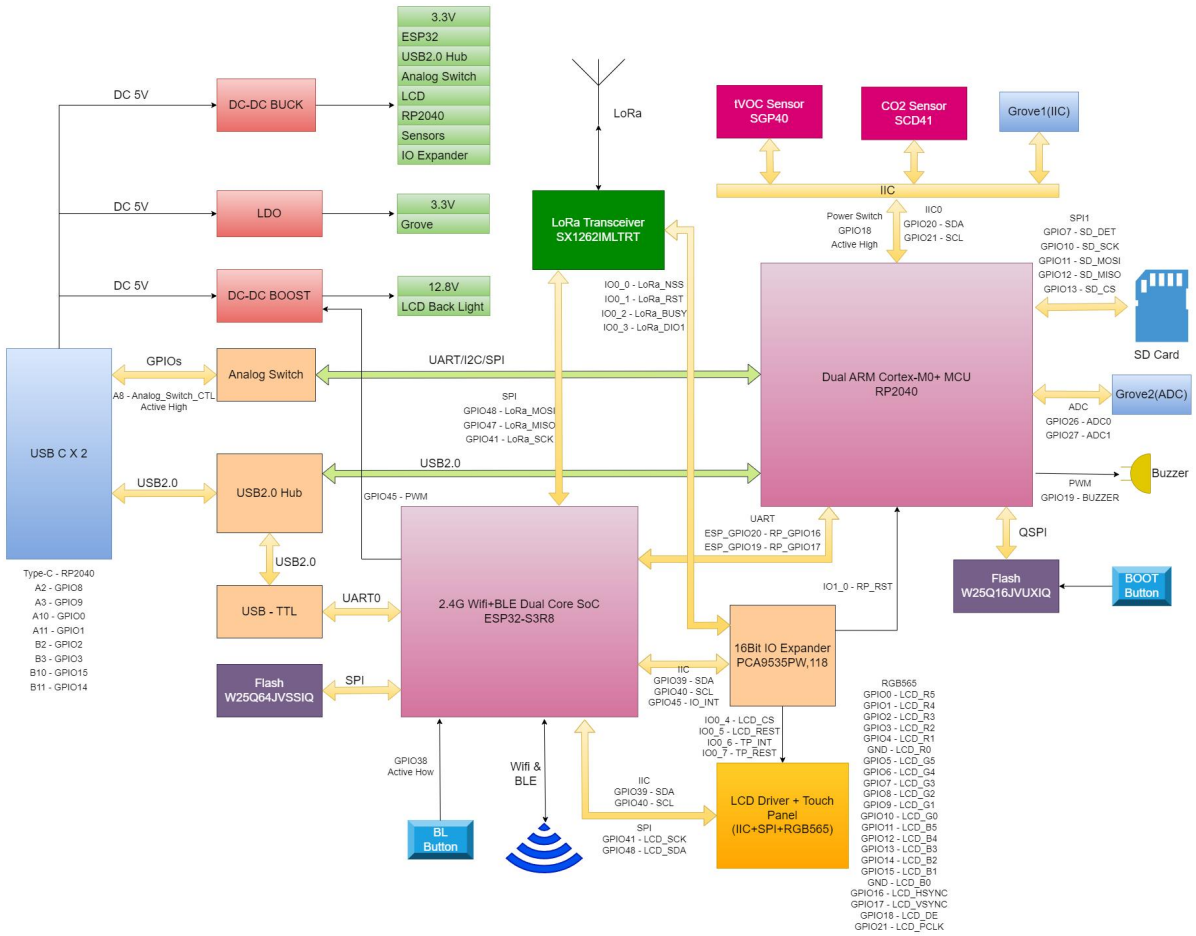
Grove is a modular, standardized connector prototyping system and a strong open source hardware ecosystem. （Click Grove – Seeed Studio to learn more）

SX1262 LoRa Chip

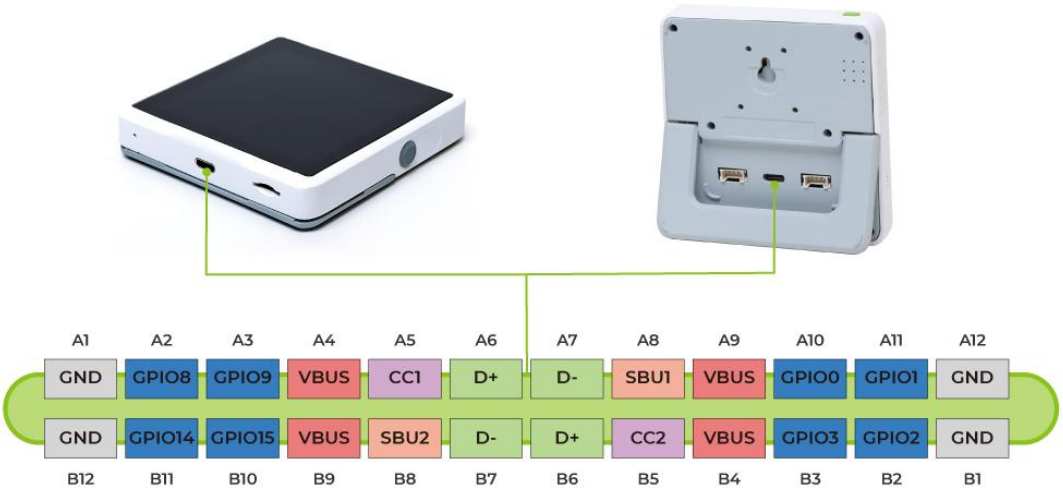
The embedded SX1262 LoRa module enables you to build the LoRa application and connect your local LoRa sensors to the Cloud via Wi-Fi. For example, you could build a LoRa hub device to connect your LoRa sensors to your smart home ecosystem to implement Matter over Wi-Fi. In this way, the LoRa devices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



System Diagram



USB2.0 Type-C Pinout



Note: A2, A3, A10, A11, B2, B3, B10, B11 connect to RP2040 GPIO8, GPIO9, GPIO0, GPIO1, GPIO2, GPIO3, GPIO15, GPIO14

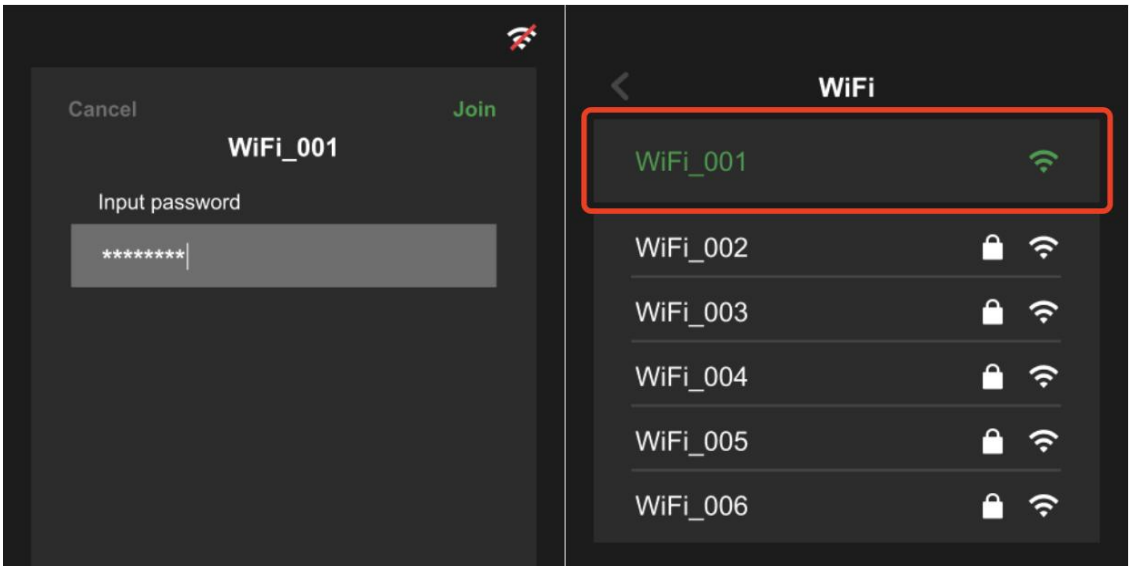
Native Firmware

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.



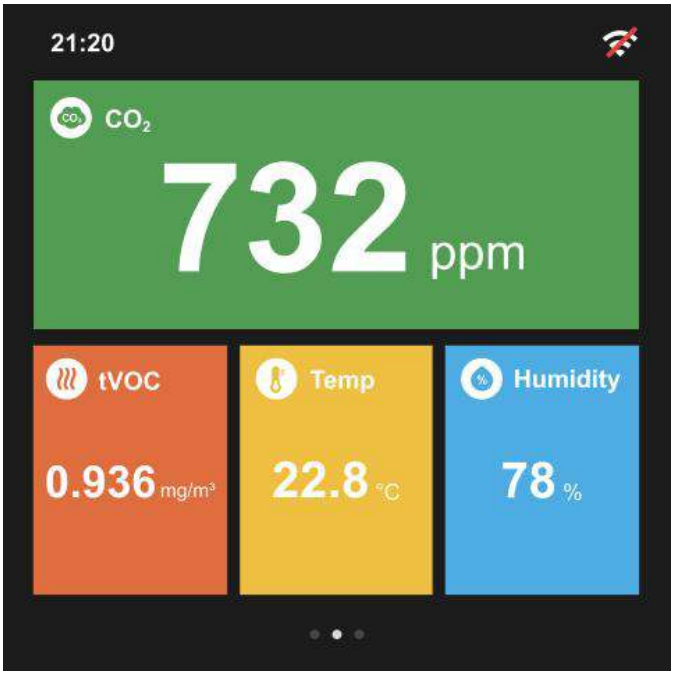
Data Viewing

- **Home page**

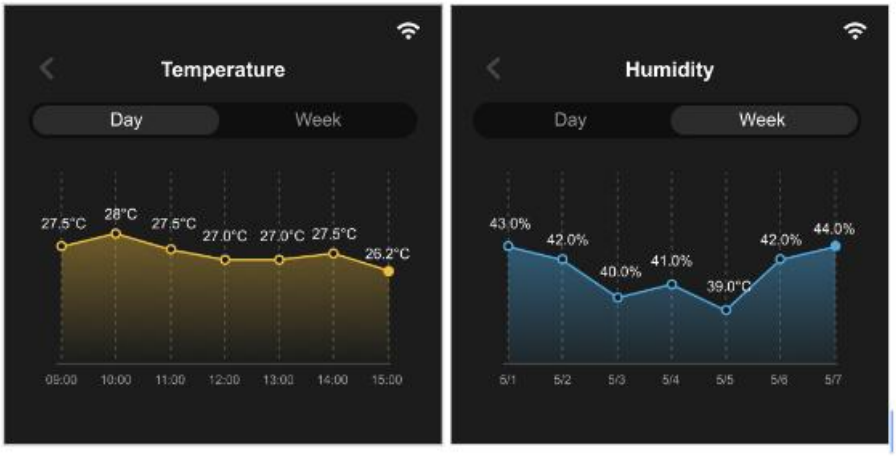
Including the time, date, location info.

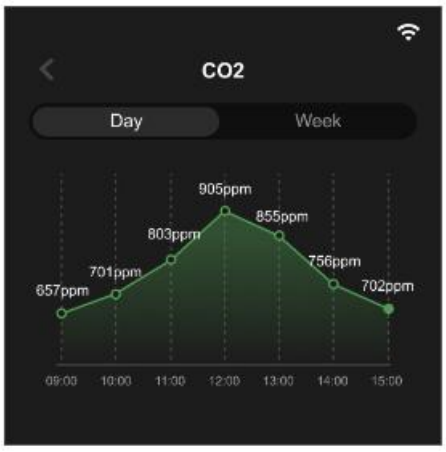
- **Sensor data**

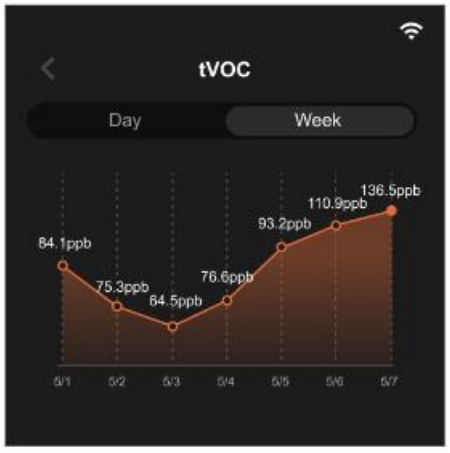
Built-in tVOC and CO2 sensors, and an external Grove AHT20 TH sensor for more precise temperature and humidity readings.



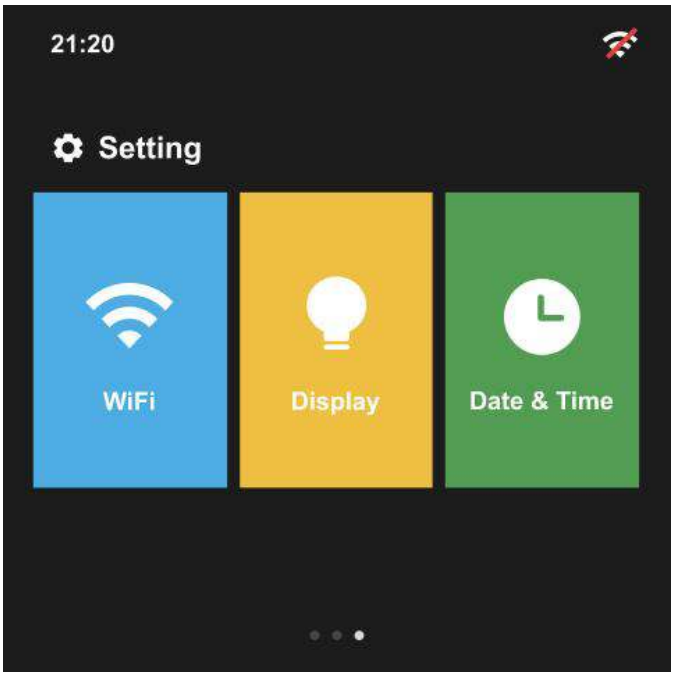
Click the specified sensor to enter the detailed information page, and you can choose to display the value of 24h or a week.







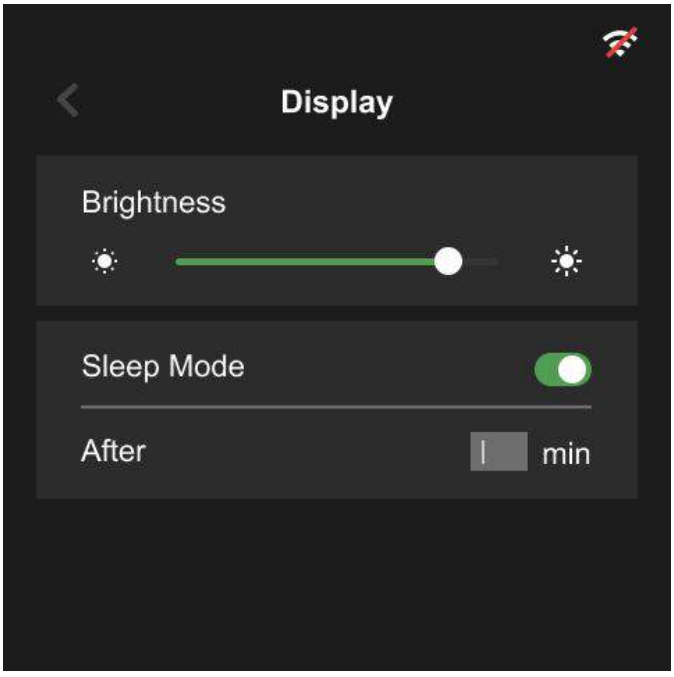
Setting



Display Setting

Brightness: Adjust screen brightness

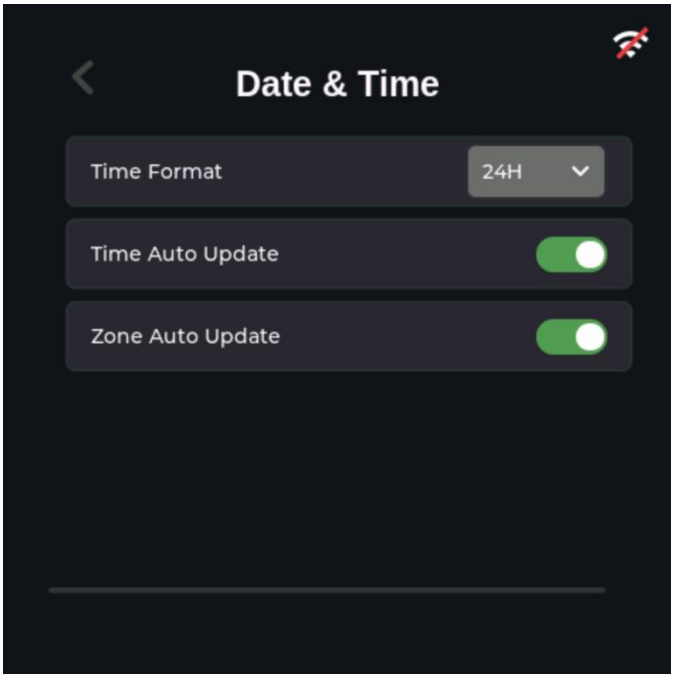
Sleep Mode: Turn off the screen according to the interval you set



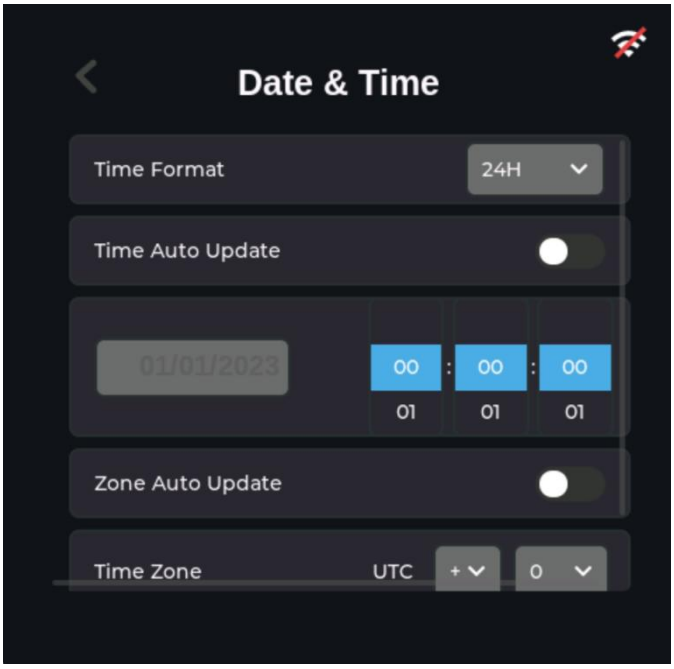
Date & Time Setting

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



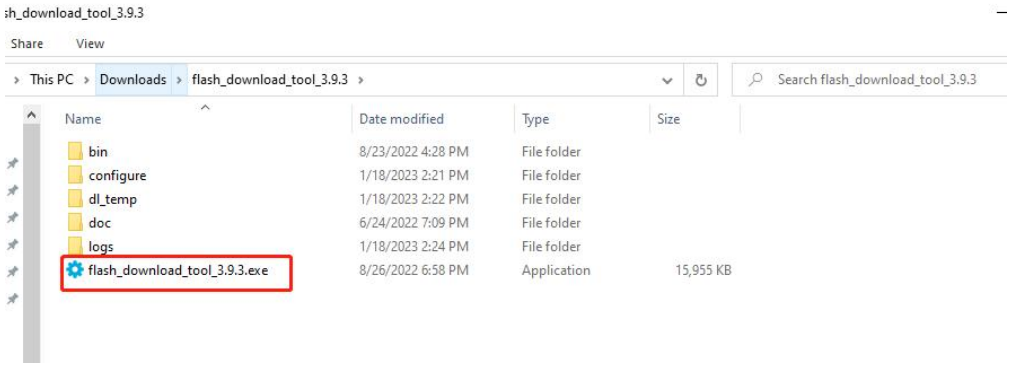
Development Tutorial

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



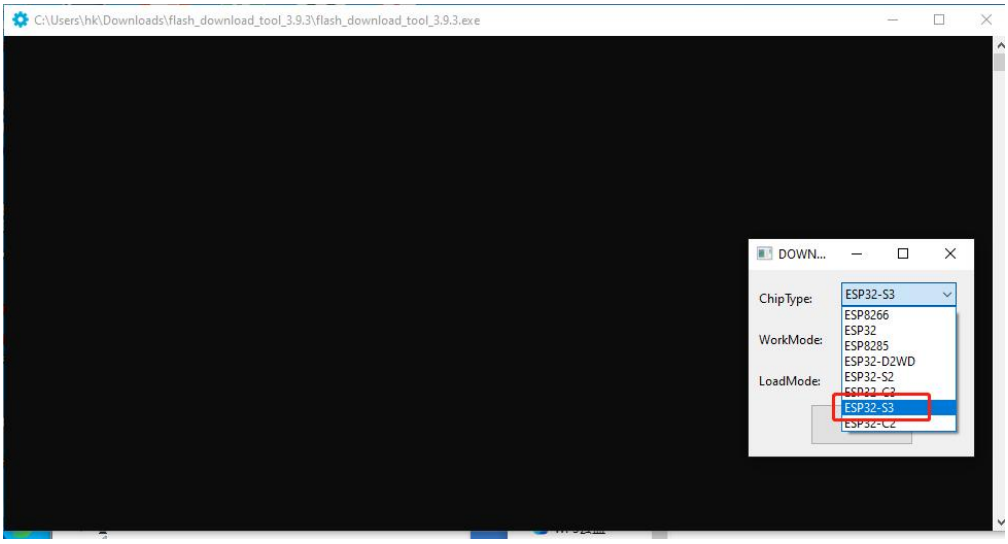
- **Step 3**: User interface setting

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

Chip Type: ESP32-S3

WorkMode: Develop

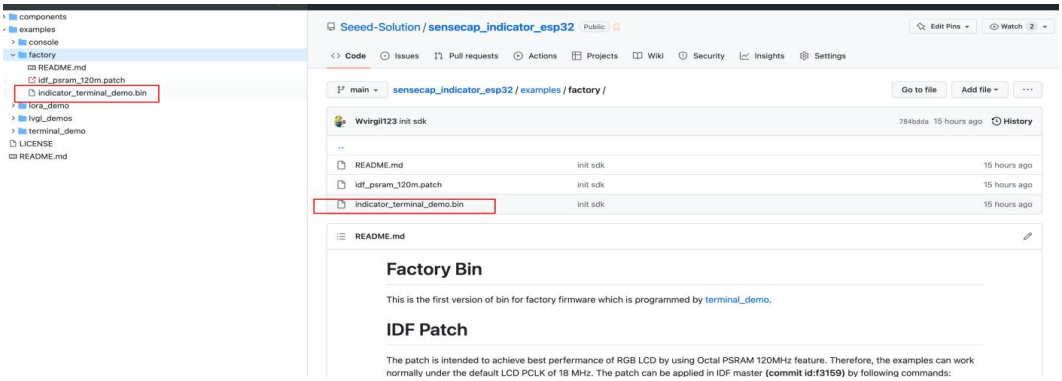
LoadMode: UART



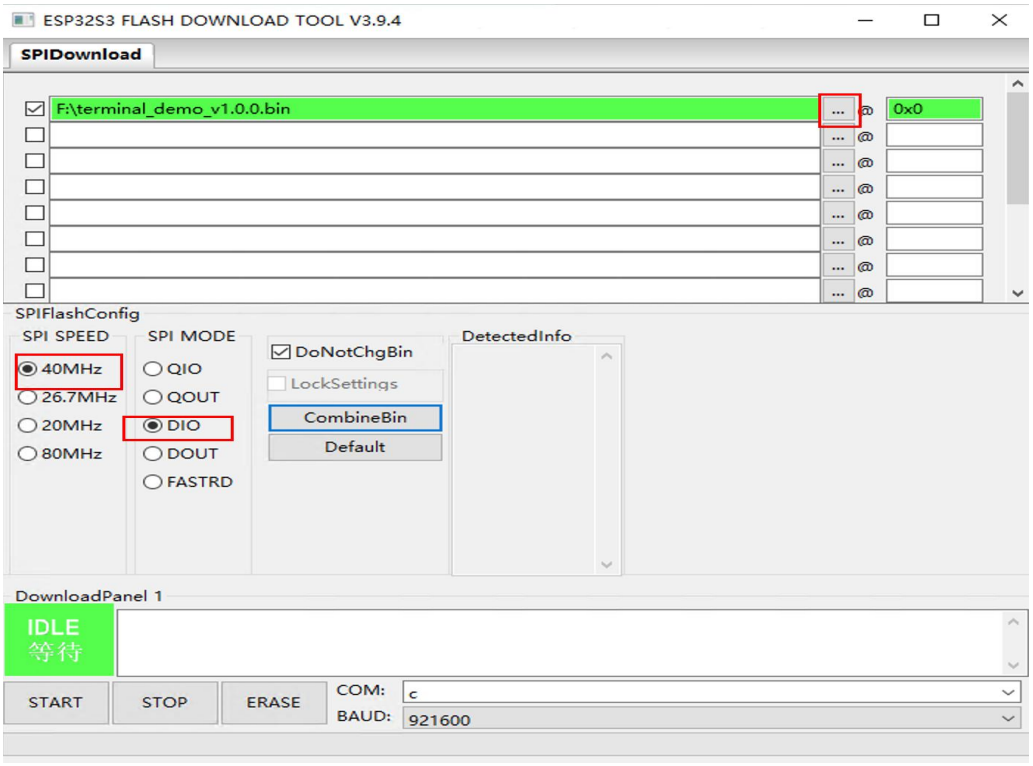
- **Step 4**: SPI Download Tab Configure

Download the Esp32 firmware file.

Example–factory–indicator_terminal_demo.bin



Click "..." and select the .bin file, downloading addresses:0x0



- **Step 5**: SPI Flash Configure

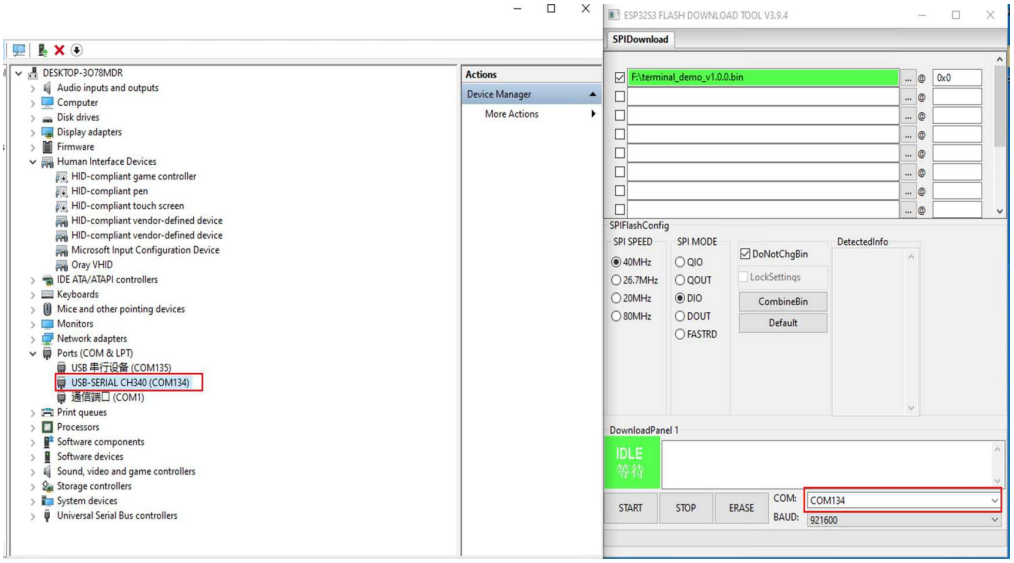
SPI SPEED: 40MHz

SPI MODE: DIO

- **Step 6**: Download Panel Configure

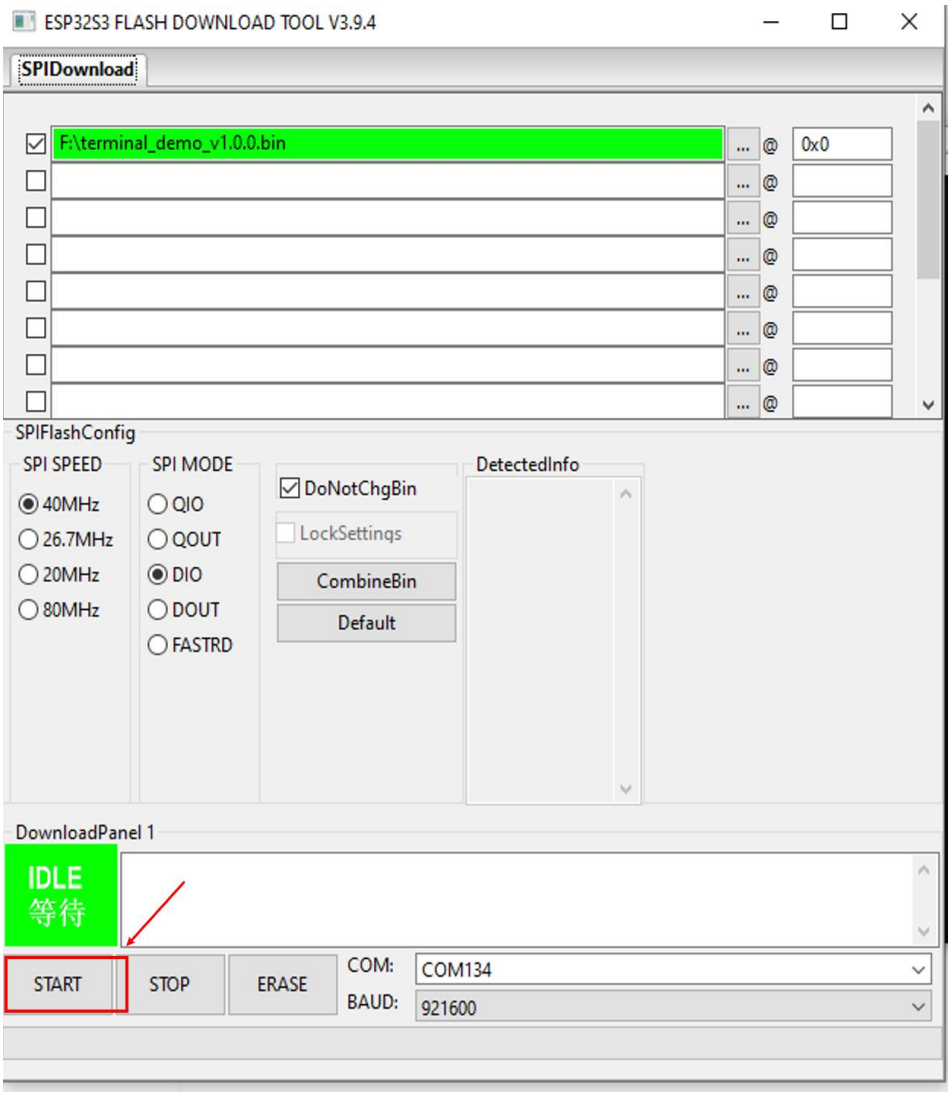
COM: Check the ports on your Device Manage, the USB-SERIAL is the correct one.

Baud: 921600(recommended value)

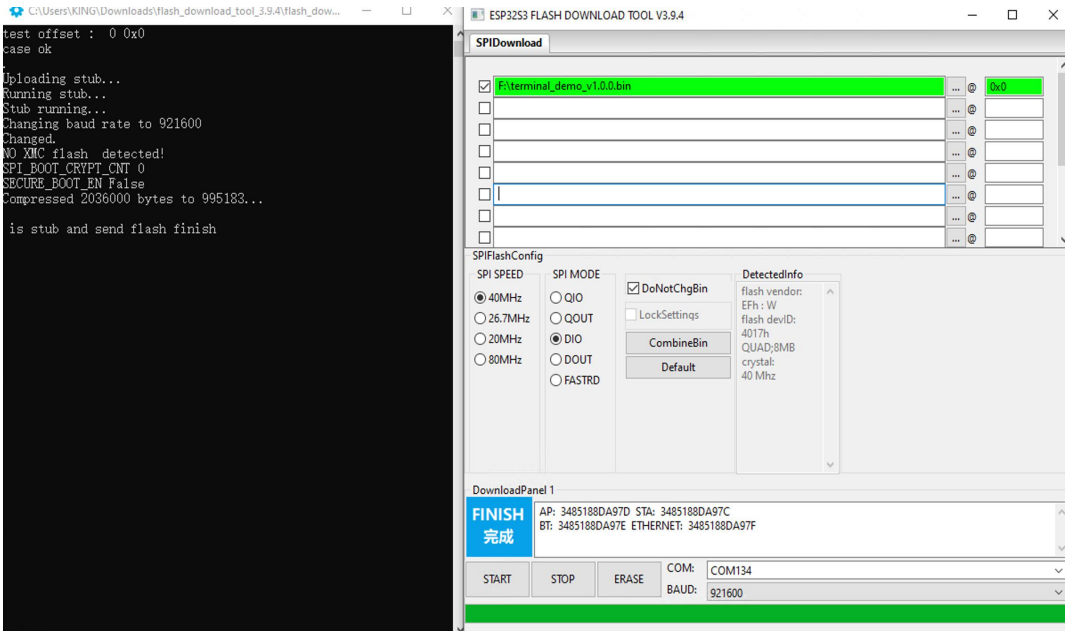


- **Step 6**: Start Downloading

Then click "START" to start the downloading.



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



Flash by IDF

For Linux and MacOS: Standard Toolchain Setup for Linux and macOS

For Windows: Standard Setup of Toolchain for Windows

After you have installed the IDF environment, you can flash it by IDF.

```
esptool.py write_flash 0x0 terminal_demo_v1.0.0.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

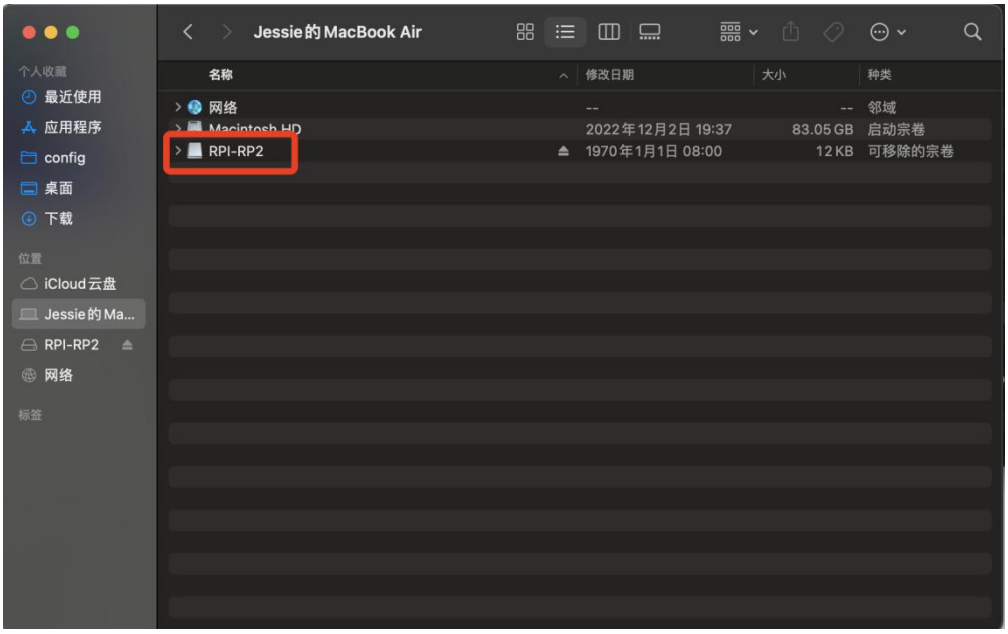
Flash by .uf2 file

- **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.

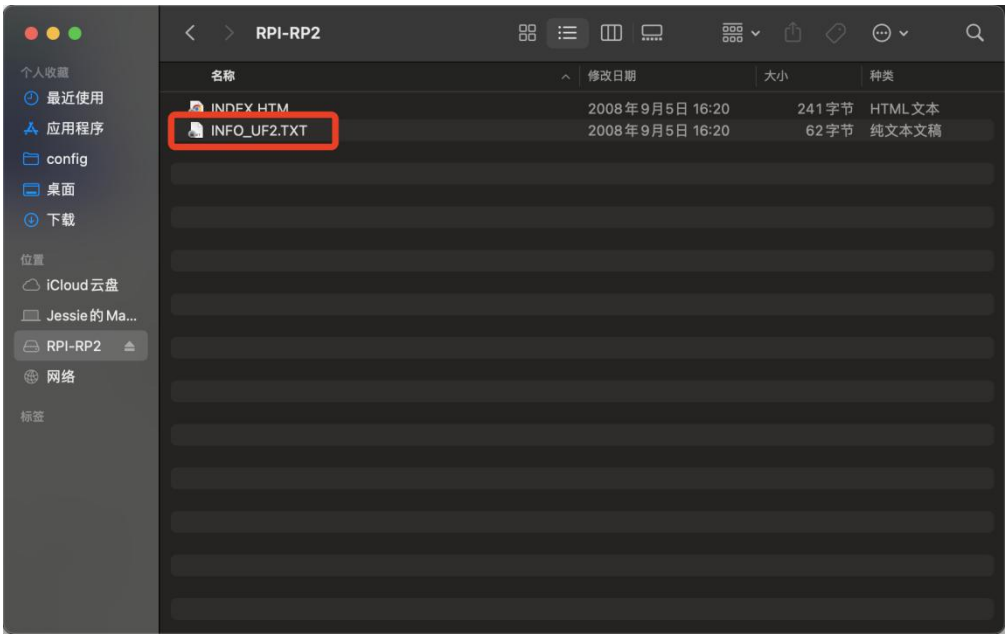
- **Step 2**: Firmware Flash

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



Download rp2040 uf2 ,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

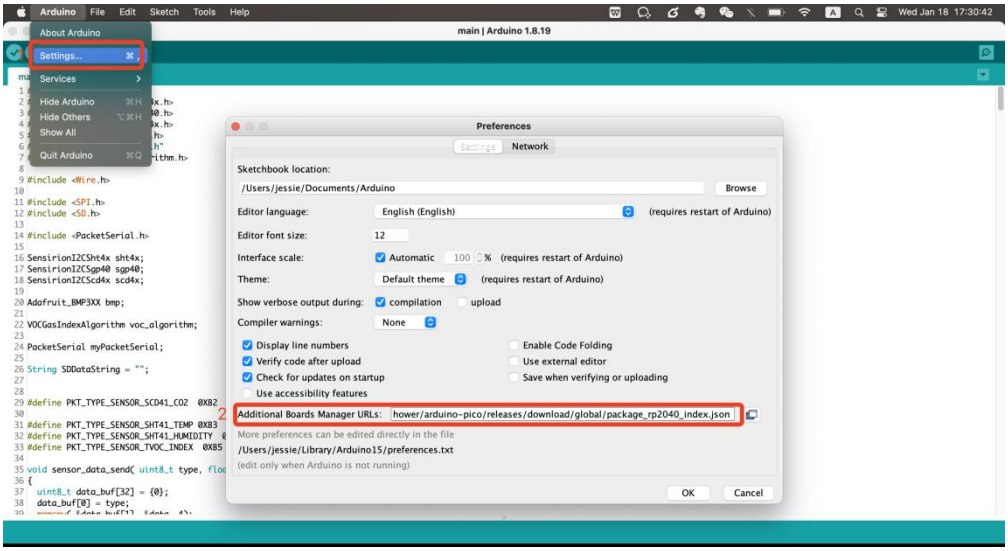
- **Step 1**: Install Arduino IDE

Arduino IDE

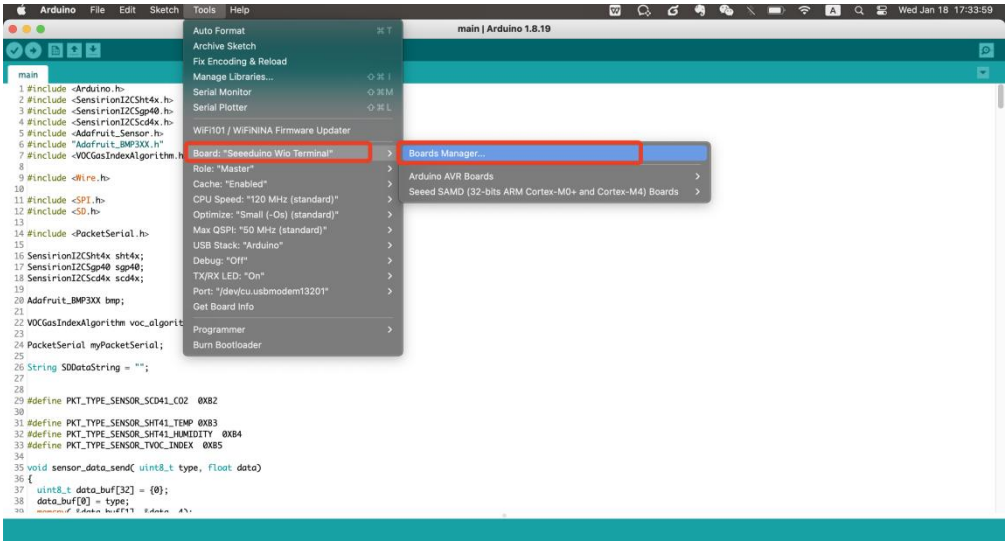
- **Step 2**: Add the Raspberry Pi Pico Board

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

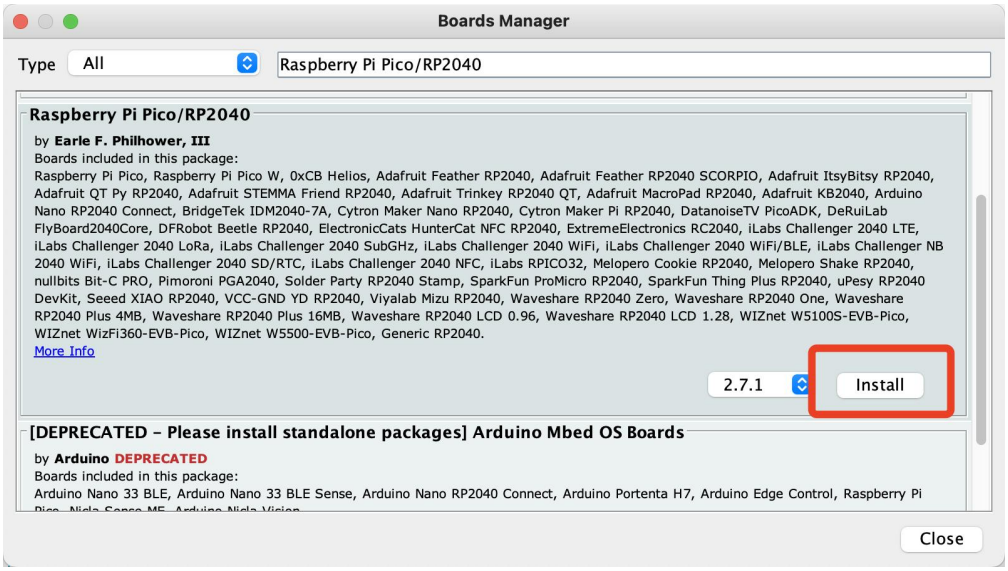
https://github.com/earlephilhower/arduino-pico/releases/download/global/package_rp2040_index.json



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

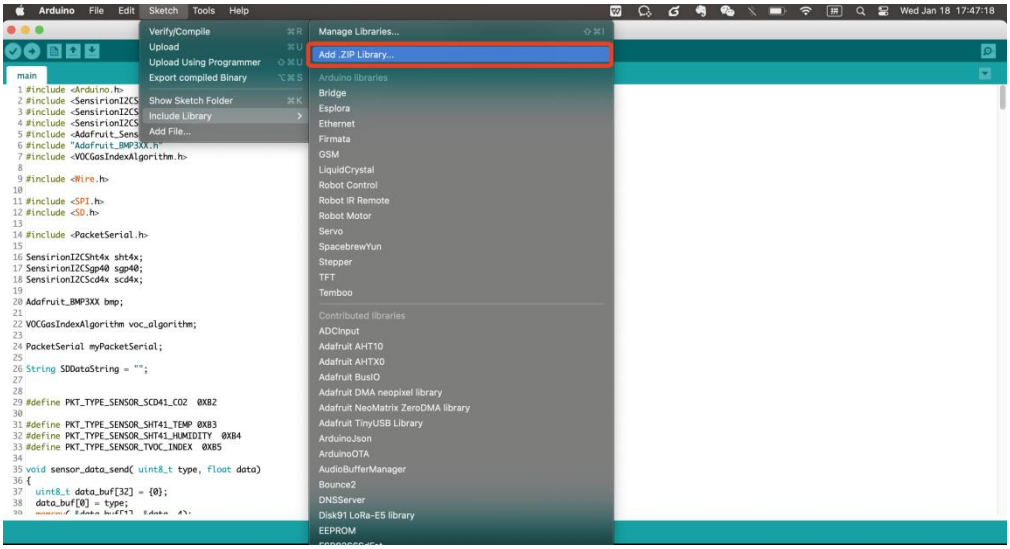
Transfer index library: Sensirion Gas Index Algorithm

SCD41 CO2 sensor library

AHT20 temperature and humidity sensor libray

Sensirion Arduino Core library

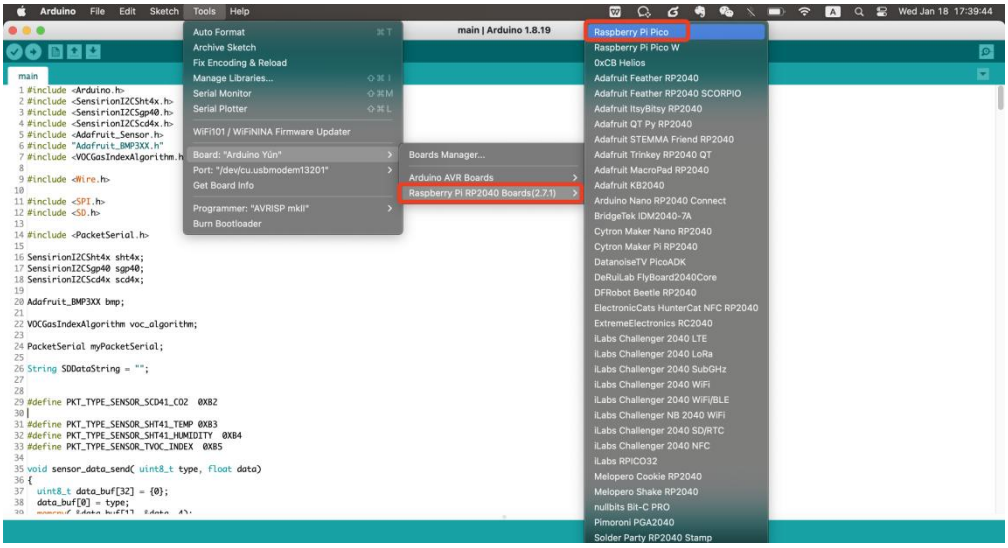
Navigate to **Sketch** –> **Include Library** –> **Add .ZIP Library**, then select the libraries you download.



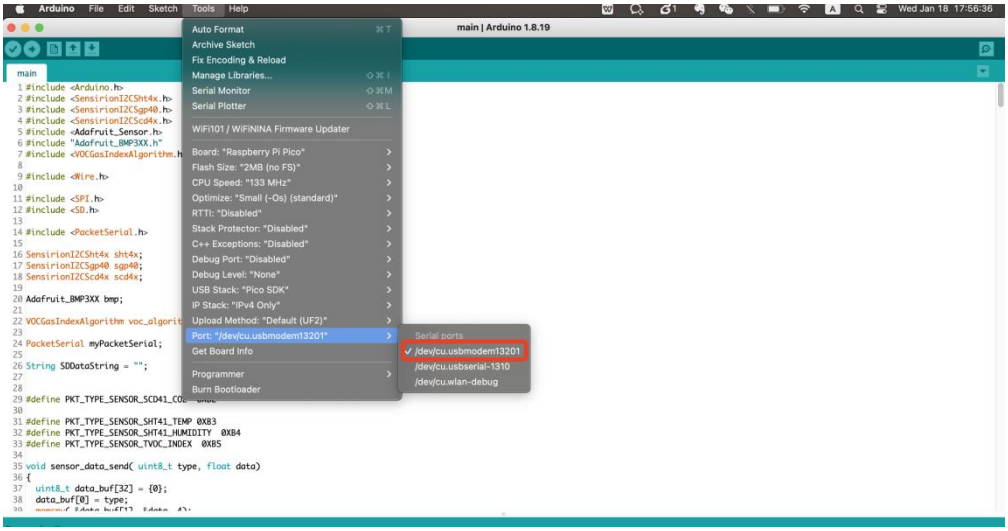
- **Step 4**: Connect the device to your PC with the provided USB Typc–C cable.

- **Step 5**: Select the board

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



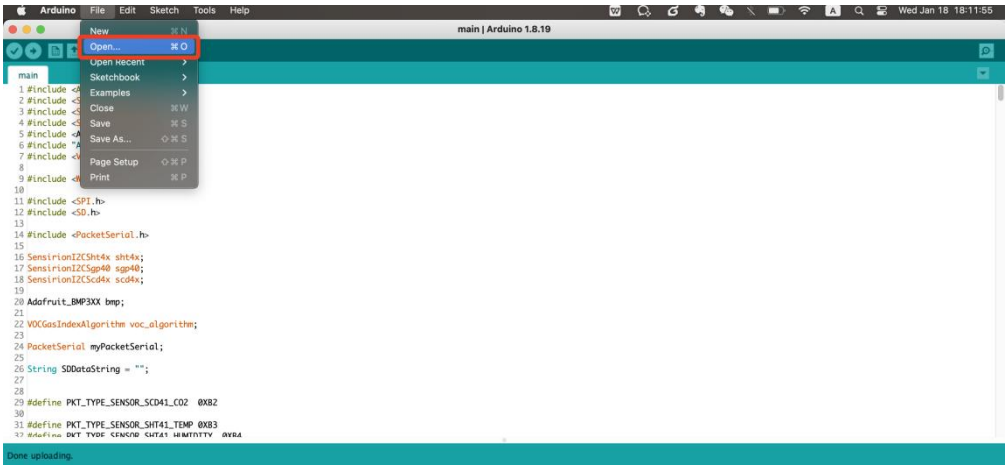
Port: Select the "usbmodem" one



- **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
Verify
main
Done uploading.

main | Arduino 1.8.19
Upload
main
Done uploading.

main | Arduino 1.8.19
Upload
main
Done uploading.
Resetting /dev/cu.usbmodem13201
Converting to uf2, output size: 228352, start address: 0x2000
Flashing /Volumes/RPI-RP2 (RPI-RP2)
Wrote 228352 bytes to /Volumes/RPI-RP2/NEW.UF2

Resource

IDF Downloard: 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