
SunFounder Pironman

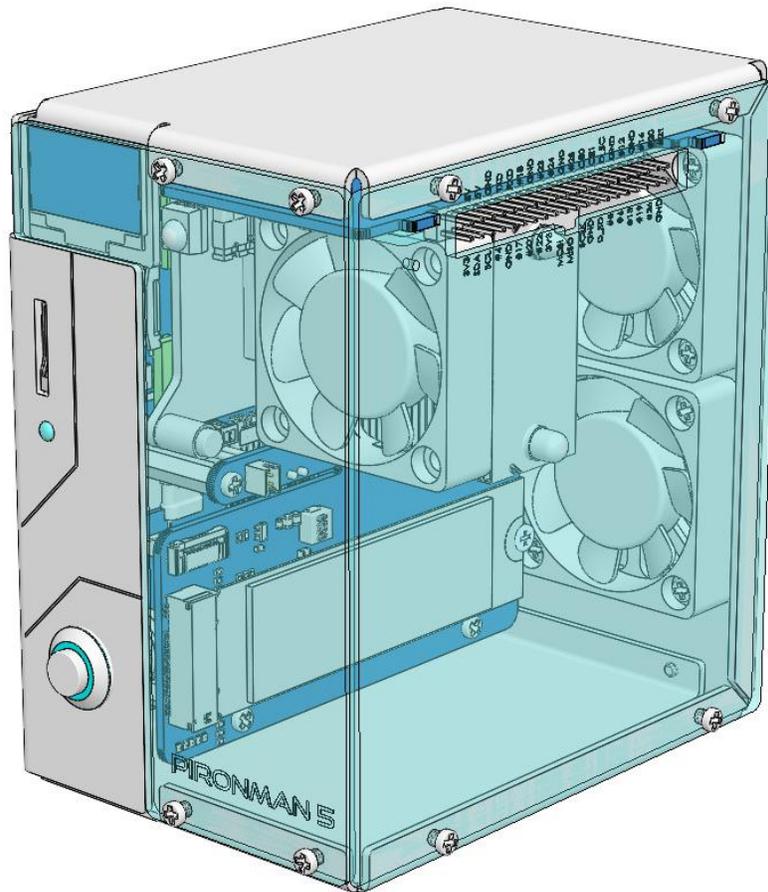
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Thanks for choosing our Pironman 5.



Elevate your Raspberry Pi 5 with the Pironman 5, our top-tier case designed for unmatched style and functionality. It's the perfect blend of aesthetics and performance:

- Raspberry Pi 5 mini PC
- 0.96" OLED Display showing Raspberry Pi's CPU usage, temperature, disk usage, IP address, RAM usage etc.
- Tower cooler can cool a 100% CPU load Pi to 39°C at 25°C room temperature
- 2 RGB Fans, with GPIO control
- 1 PWM Fan on the Tower Cooler is controlled by the Raspberry Pi system.
- Supports four (PCIe2.0 / PCIe 3.0) NVMe M.2 SSD sizes: 2230, 2242, 2260, and 2280.
- 4 WS2812 Addressable RGB LED light up the whole case with cool light effect
- IR Receiver for multi-media center like Kodi or Volumio
- Retro metal power button for safe shut down
- External GPIO extender with pin name label, for easy access.
- Equipped with a spring-loaded socket for easy card removal.
- Aluminum main body with clear Acrylic side panel

The Pironman 5 is not just a case; it's an upgrade that transforms your Raspberry Pi 5 into a powerful, efficient, and stylish device. Get yours now and experience the future of Raspberry Pi cases!

Note: Pironman 5 compatible systems are shown below. If you have other systems installed, some of the Pironman 5 components may not be available.

- Raspberry Pi OS (bookworm 64 desktop / lite)
 - Ubuntu Desktop 23.1
 - Ubuntu Server 23.1
-

If you have any questions, please send an email to service@sunfounder.com and we will respond as soon as possible.

COMPITABLE NVME SSD

1.1 Compitable NVME SSD

- ADATA Legend 700
- ADATA Legend 800
- AData XPG SX8200 Pro
- Axe Memory Generic Drive
- Crucial P2 M.2
- Crucial P3 M.2
- Crucial P3 Plus M.2
- Inland PCIe NVMe SSD
- KIOXIA EXCERIA NVME SSD
- KIOXIA EXCERIA G2 NVME SSD
- Kingston KC3000
- Kingston NV2
- Lexar NM710
- Lexar NM620
- Netac NV3000 NVMe SSD
- Netac NV2000 NVMe SSD
- Origin Inception TLC830 Pro NVMe SSD
- Pineberry Pi Pinedrive (2280)
- PNY CS1030
- Sabrent Rocket 4.0
- Sabrent Rocket Nano
- Samsung 970 EVO Plus
- Samsung 980
- Samsung 980 Pro
- Team MP33
- Western Digital SN850

- Western Digital SN740
- Western Digital SN570
- Western Digital SN530
- Western Digital Black SN750 SE (Phison Controller)
- Western Digital Blue SN550/SN580 series (If you know how to install latest rpi-eprom-updates, pieeprom-2024-01-24.bin fixed the Western Digital Blue SN550 nvme boot issue Refer to <https://forums.raspberrypi.com/viewtopic.php?t=364327>.)
- XPG GAMMIX S70 BLADE
- XPG SX8200 Pro

1.2 Uncompatible NVME SSD

We recommend avoiding the following NVMe SSD drives which is equipped with a Phison controller due to their proven incompatibility:

- Western Digital Green SN350 series
- Western Digital Black SN850 series
- Western Digital Black SN770
- Inland tn446 nvme drive
- Corsair MP600 SSD
- Samsung PM991
- Kingston OM8SEP4256Q-A0
- Transcend 110Q (TS500GMTE110Q)
- SN350 and SN570 prevented the RPi 5 from booting at all especially.
- Other NVMe SSD drivers equipped with the same Phison controller

1. WHAT ELSE SHOULD WE PREPARE?

Essential Components

- Raspberry Pi 5 Model B

The Pironman is fully compatible with the Raspberry Pi 5 Model B.

- 5V/5A Power Adapter

A 5V/5A power adapter is required to power the Pironman 5 and its components.

- Micro SD Card

It is recommended to use an SD card with a minimum of 16GB of storage for Raspberry Pi OS. For Raspberry Pi OS Lite, a minimum of 4GB is advised.

Optional Components

- M.2 NVMe SSD

The Pironman 5 features an NVMe PIP with an M.2 SSD connector, accommodating four NVMe M.2 SSD sizes: 2230, 2242, 2260, and 2280. It supports both PCIe2.0 and PCIe 3.0 NVMe M.2 SSDs.

- Screen

To access the Raspberry Pi's desktop environment, a screen such as a TV or a computer monitor is required.

- HDMI Cable

The Raspberry Pi 5's HDMI ports have been adapted to standard HDMI Type A interfaces via a USB HDMI adapter. Therefore, a standard HDMI to HDMI cable is needed to connect the Pironman 5 to a display.

- Mouse & Keyboard

Any USB port on the Pironman 5 can be used to connect a wired keyboard and mouse, or a USB Bluetooth receiver for wireless peripherals.

2. ASSEMBLY INSTRUCTIONS

Before assembling the Pironman, please first verify that all parts and components have been included. If there are any missing or damaged components, please contact SunFounder immediately at service@sunfounder.com to resolve the issue as soon as possible.

Tips

- It is recommended to follow the paper installation instructions step by step.
- Before installation, sort and stack the components to find them more quickly.
- Repeatedly check the connections of FFC and FPC cables to avoid poor contact.

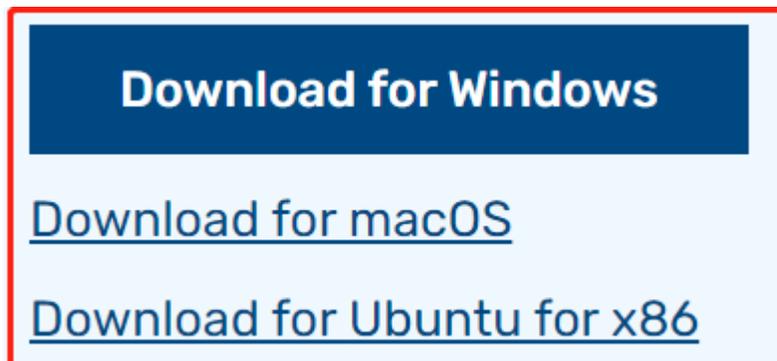
3. INSTALLING THE OS

Required Components

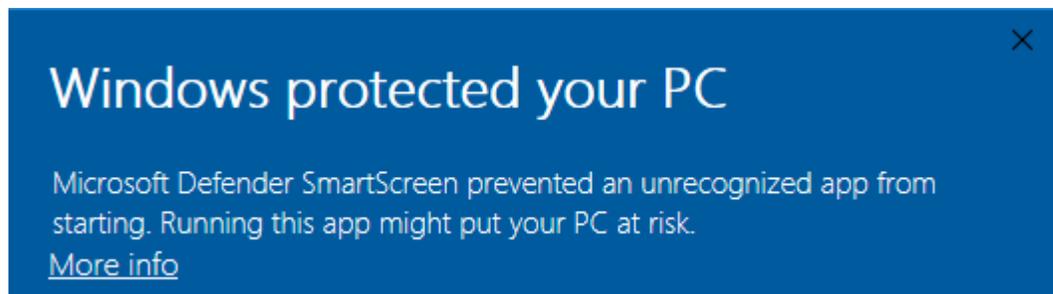
- Raspberry Pi 5B
- A Personal Computer
- A Micro SD card

Installation Steps

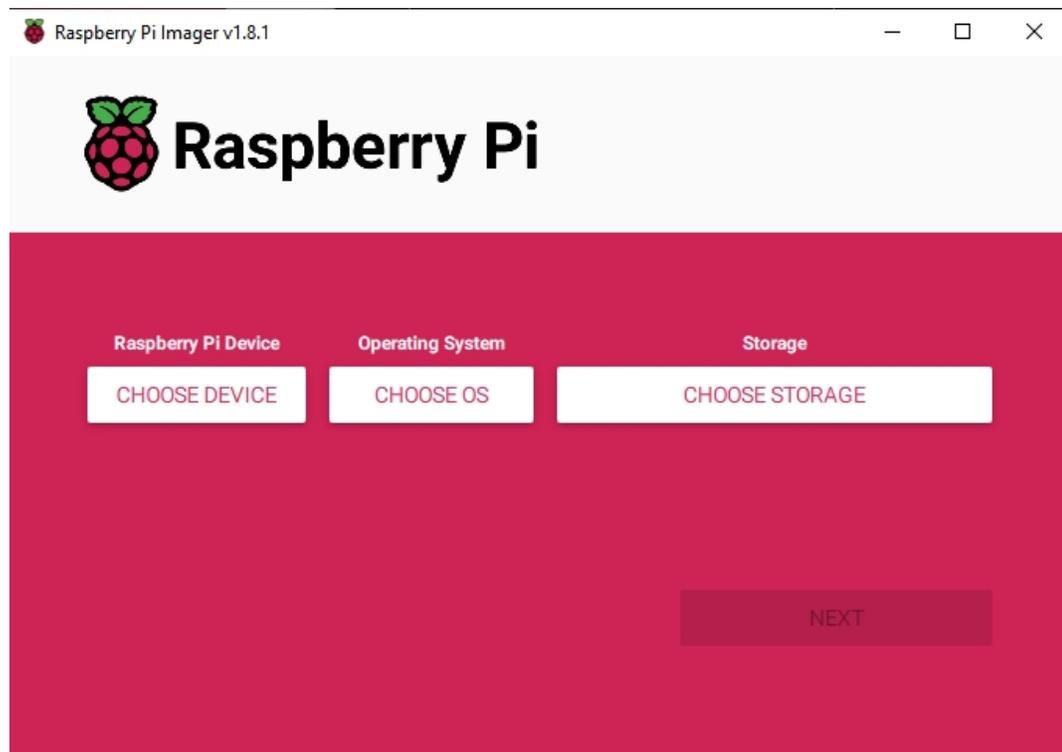
1. Visit the Raspberry Pi software download page at [Raspberry Pi Imager](#). Choose the Imager version compatible with your operating system. Download and open the file to initiate installation.



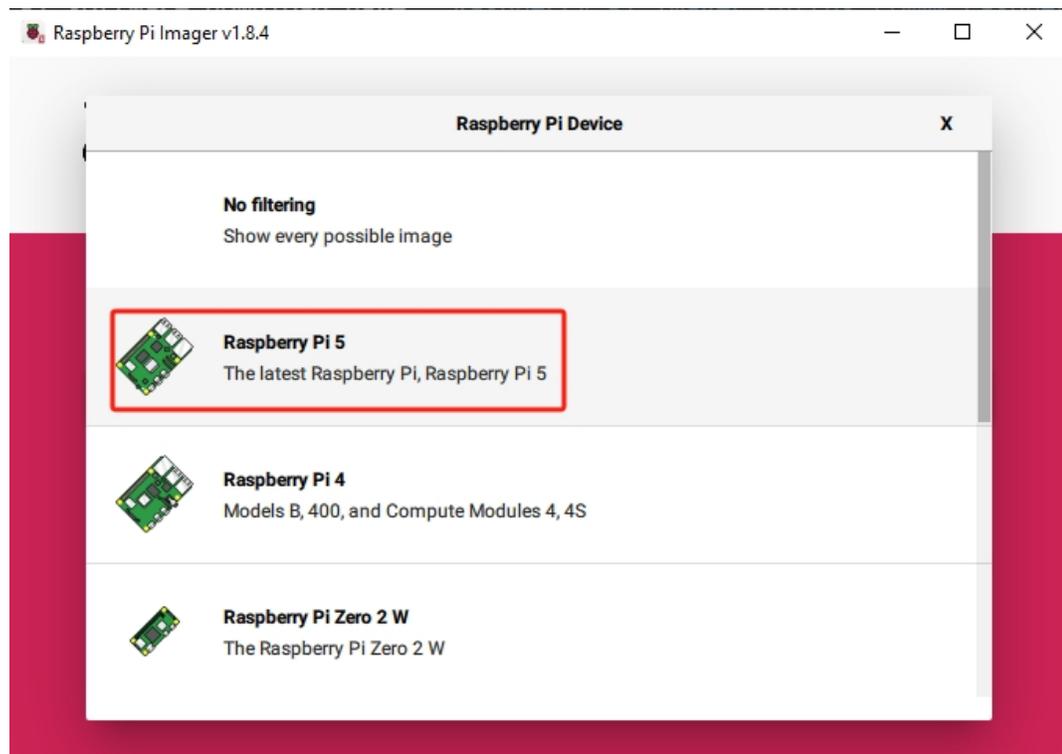
2. A security prompt may appear during installation, depending on your operating system. For example, Windows might display a warning message. In such cases, select **More info** and then **Run anyway**. Follow the on-screen guidance to complete the installation of the Raspberry Pi Imager.



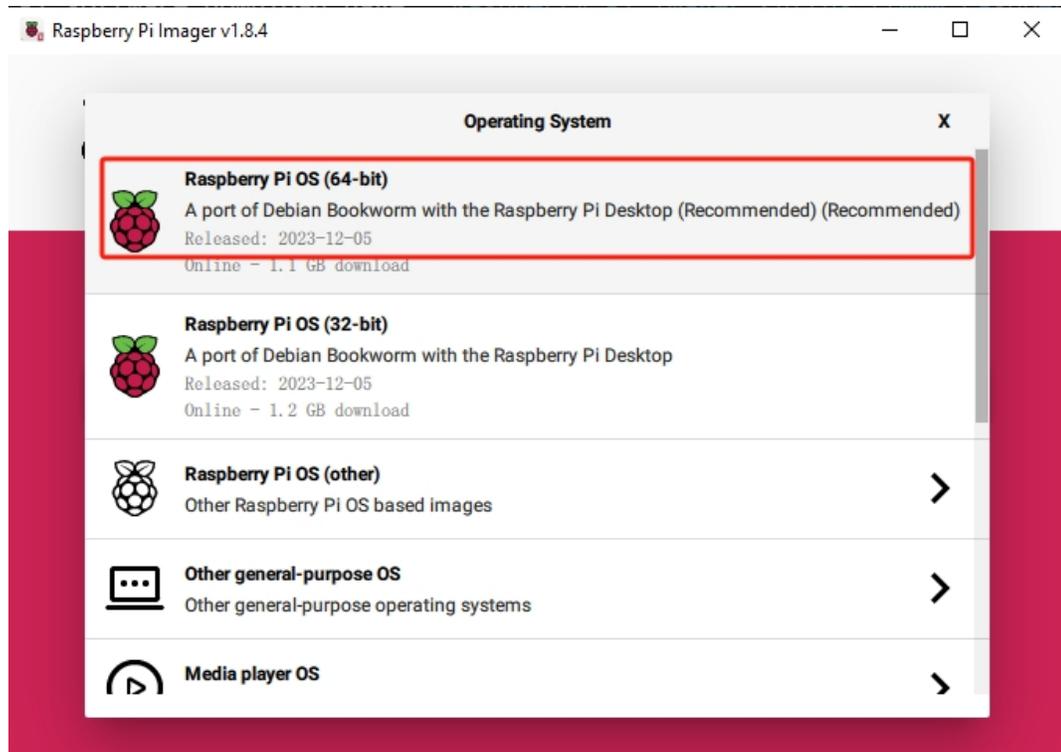
3. Insert your SD card into your computer or laptop's SD card slot.
4. Launch the Raspberry Pi Imager application by clicking its icon or typing `rpi-imager` in your terminal.



5. Within the Imager, click **CHOOSE DEVICE** and select the **Raspberry Pi 5** model from the dropdown list.

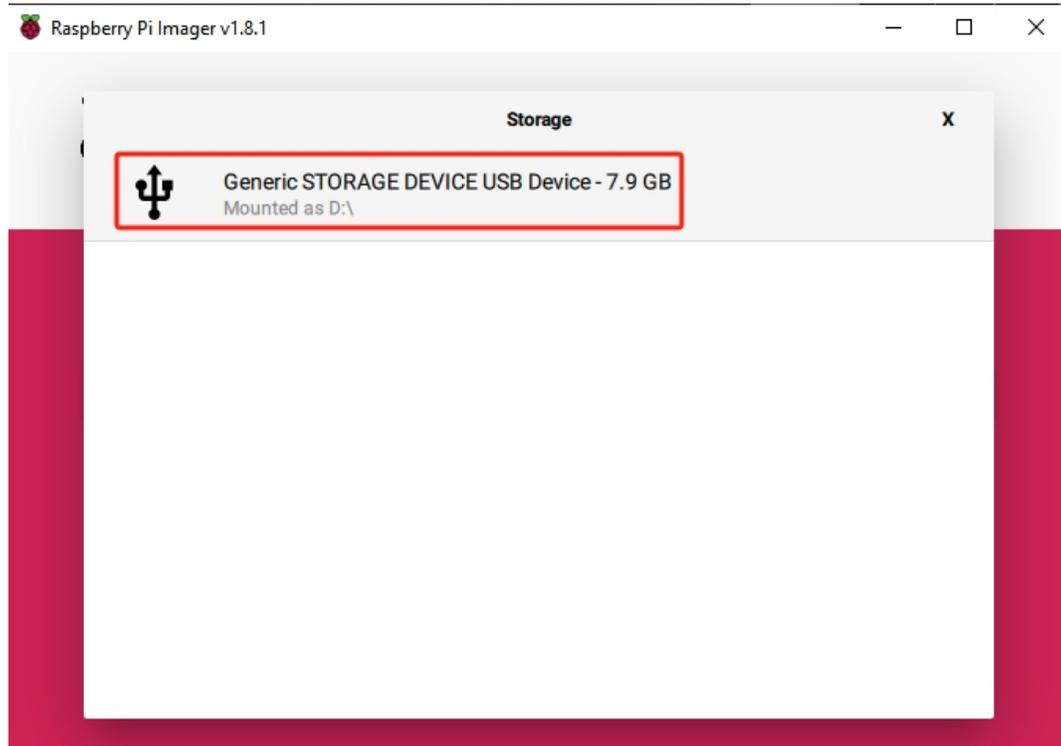


6. Select **CHOOSE OS** and opt for the recommended operating system version.

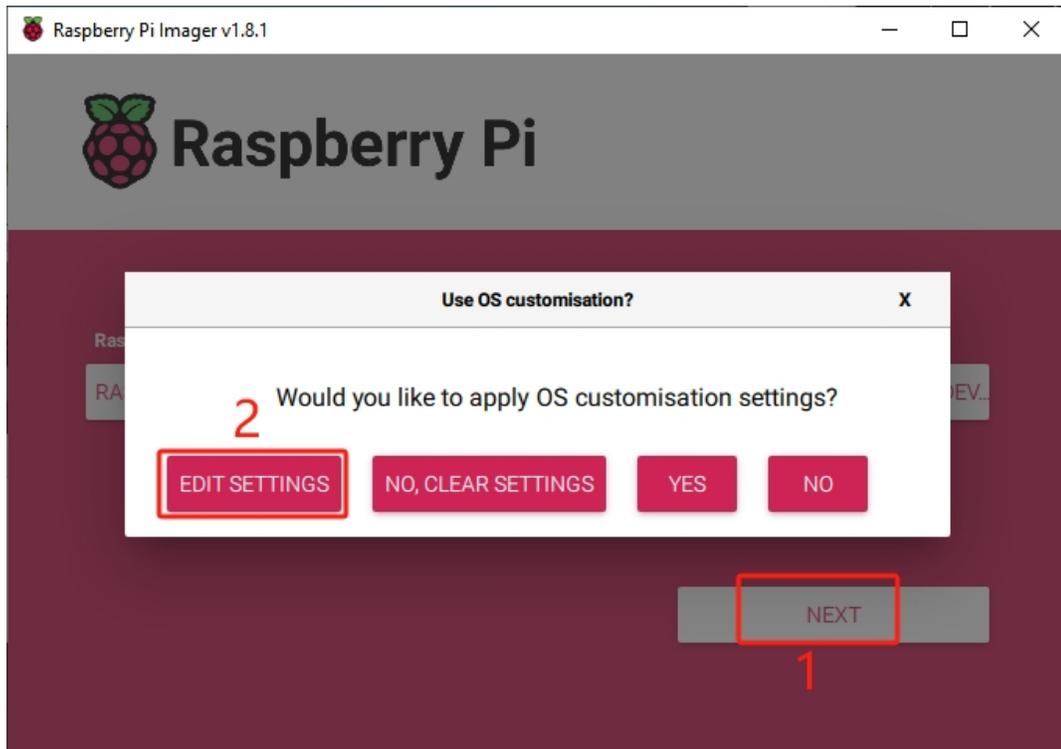


7. Click **Choose Storage** and select the appropriate storage device for the installation.

Note: Ensure you select the correct storage device. To avoid confusion, disconnect any additional storage devices if multiple ones are connected.

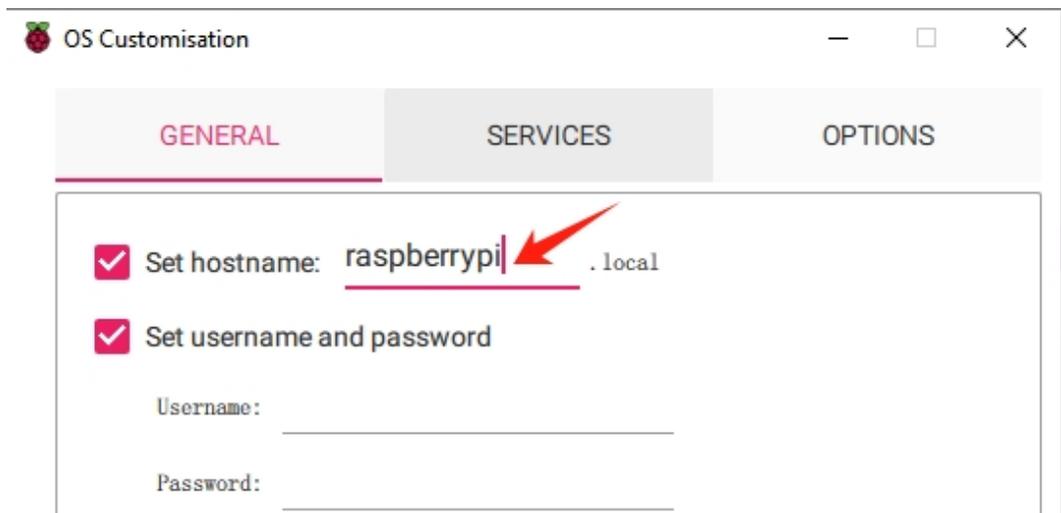


- Click **NEXT** and then **EDIT SETTINGS** to tailor your OS settings.



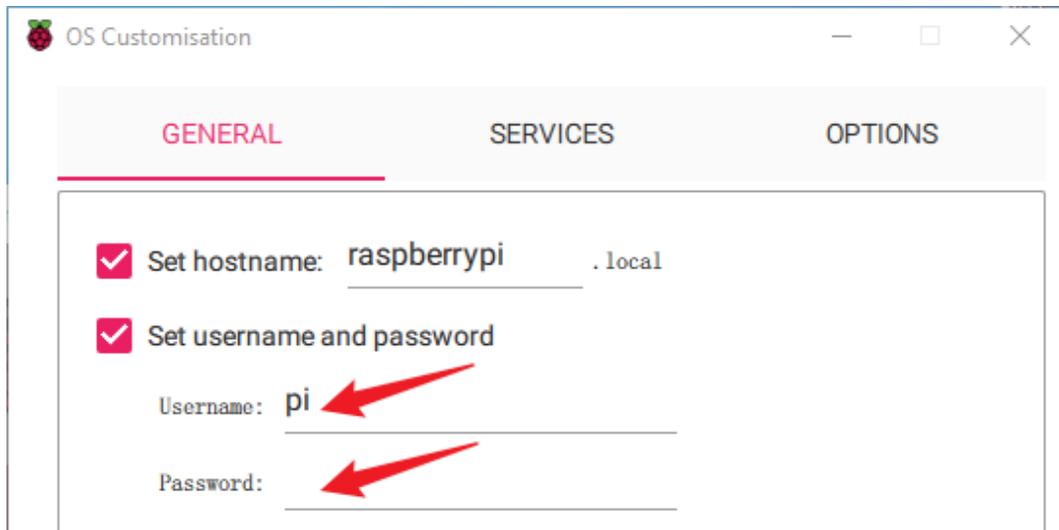
- Define a **hostname** for your Raspberry Pi.

Note: The hostname is your Raspberry Pi's network identifier. You can access your Pi using `<hostname>.local` or `<hostname>.lan`.



- Create a **Username** and **Password** for the Raspberry Pi's administrator account.

Note: Establishing a unique username and password is vital for securing your Raspberry Pi, which lacks a default password.



OS Customisation

GENERAL SERVICES OPTIONS

Set hostname: raspberrypi .local

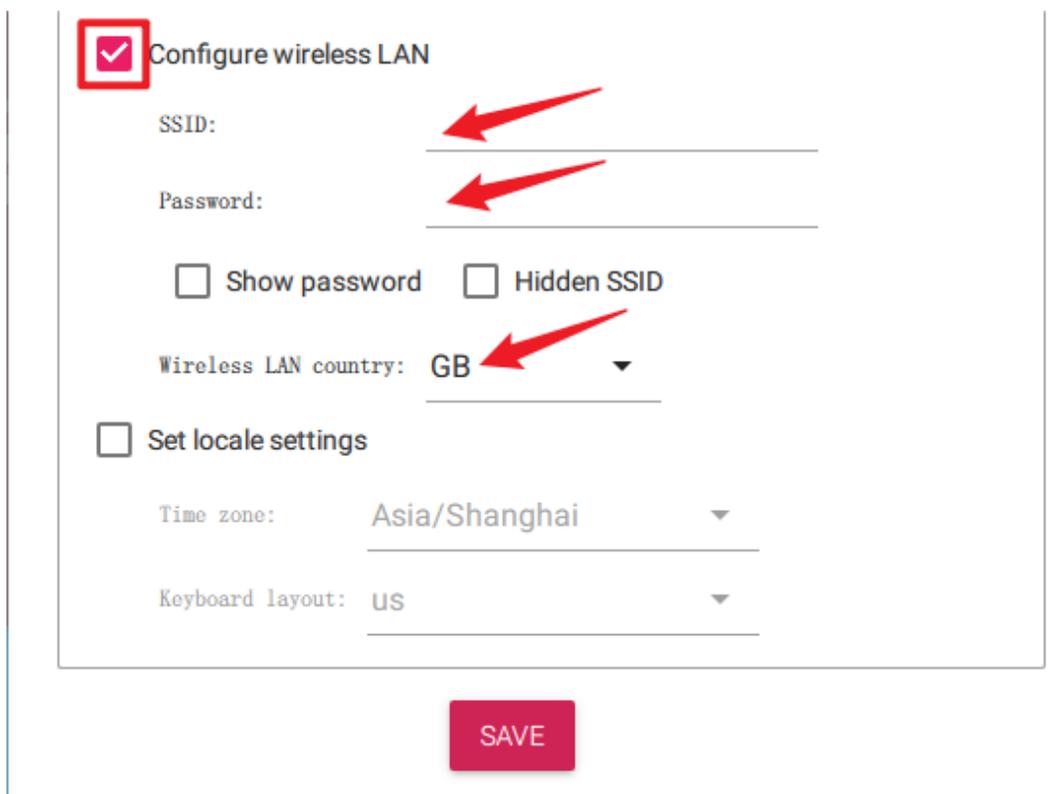
Set username and password

Username: pi

Password: _____

11. Configure the wireless LAN by providing your network's **SSID** and **Password**.

Note: Set the Wireless LAN country to the two-letter ISO/IEC alpha2 code corresponding to your location.



Configure wireless LAN

SSID: _____

Password: _____

Show password Hidden SSID

Wireless LAN country: GB

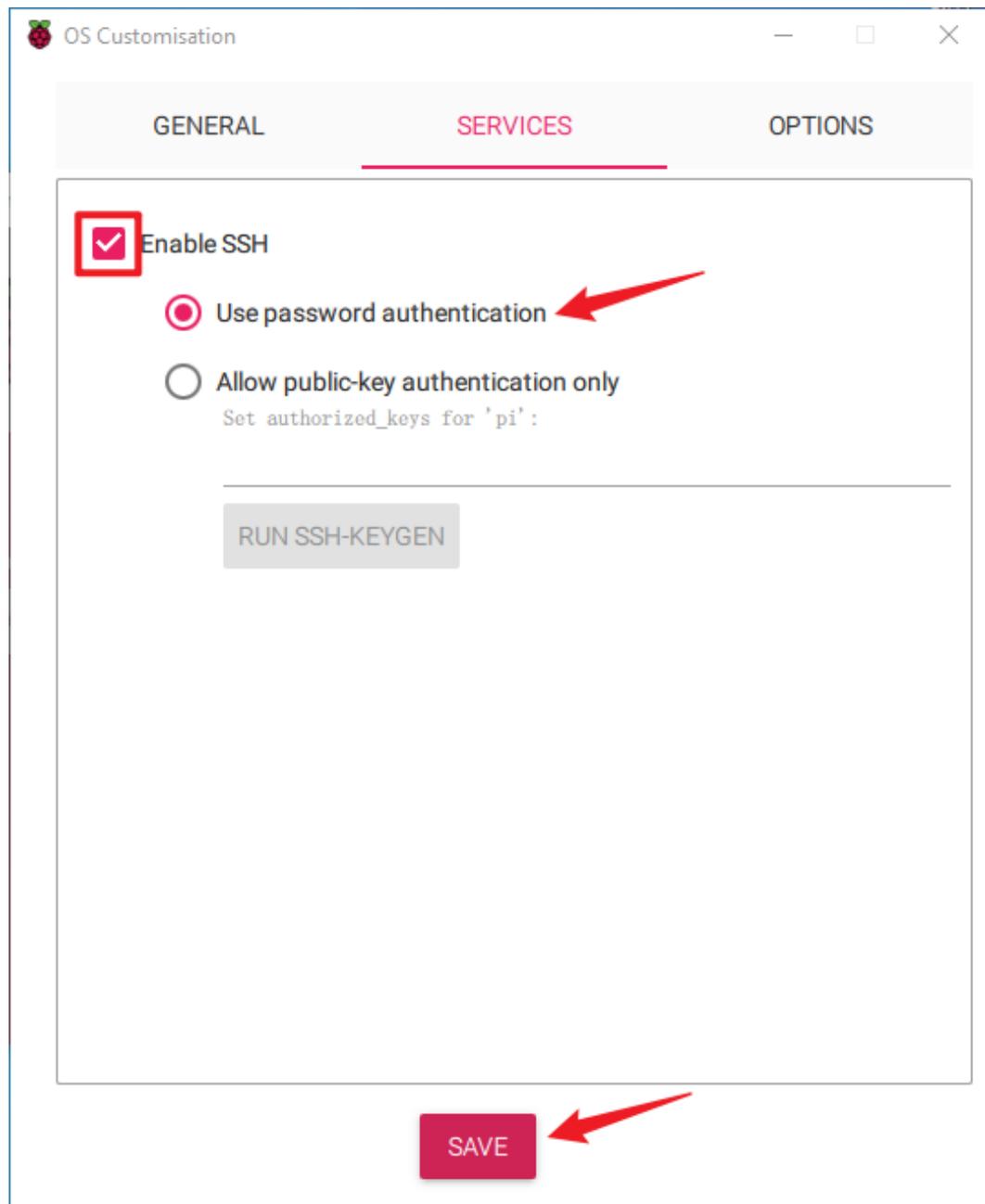
Set locale settings

Time zone: Asia/Shanghai

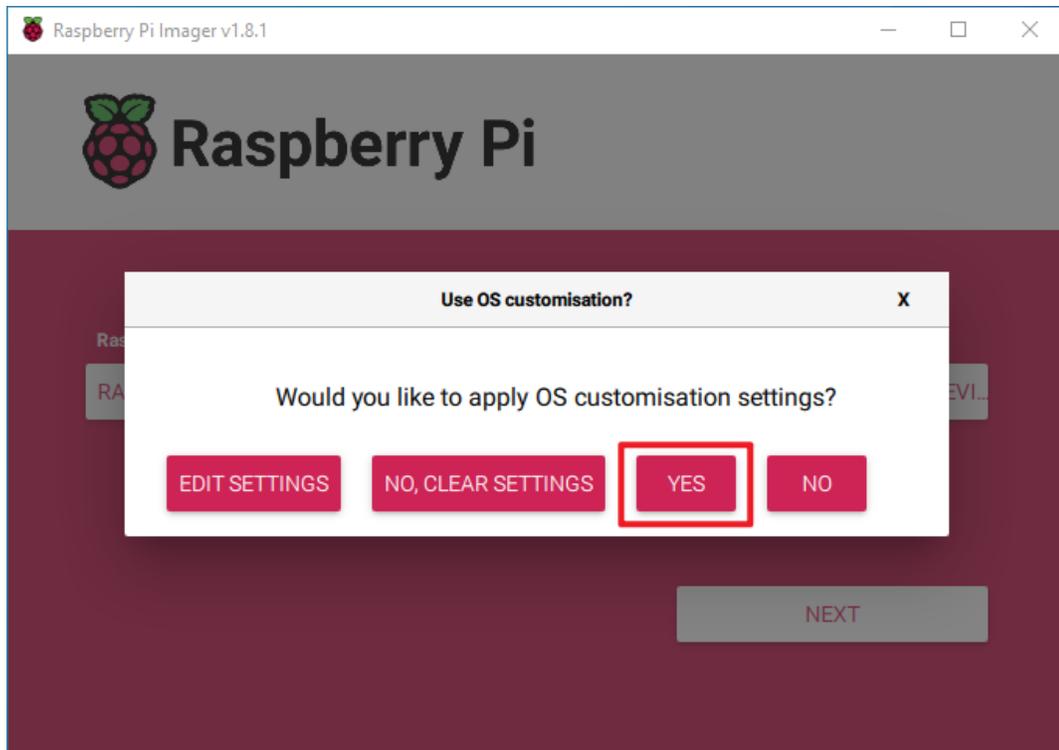
Keyboard layout: US

SAVE

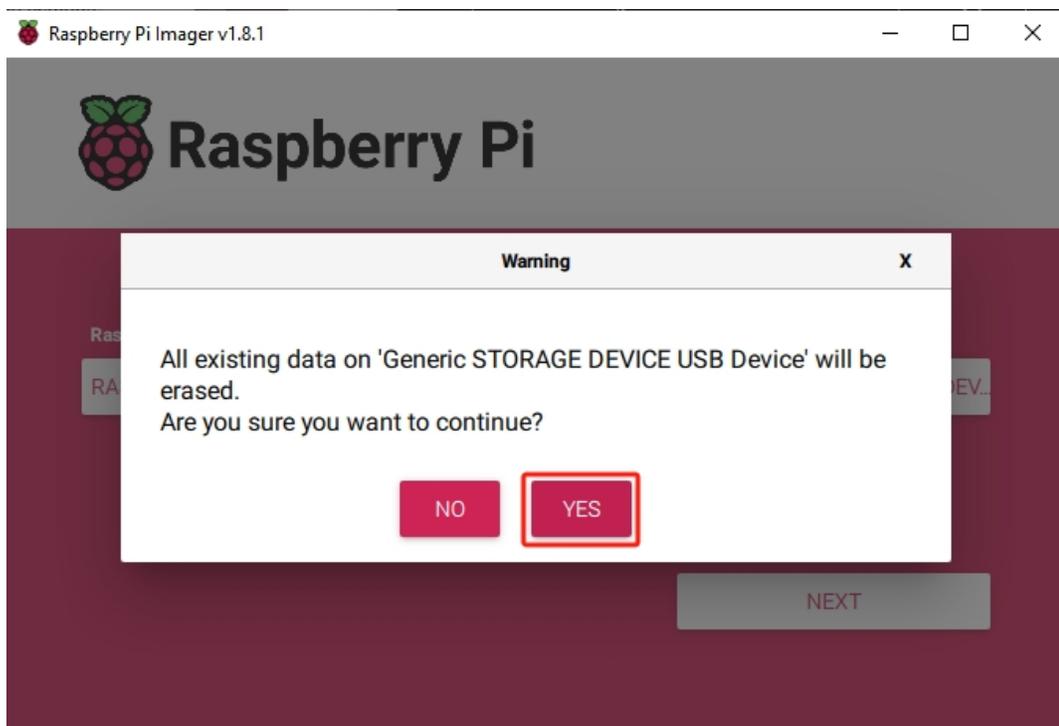
12. Click **SERVICES** and activate **SSH** for secure, password-based remote access. Remember to save your settings.



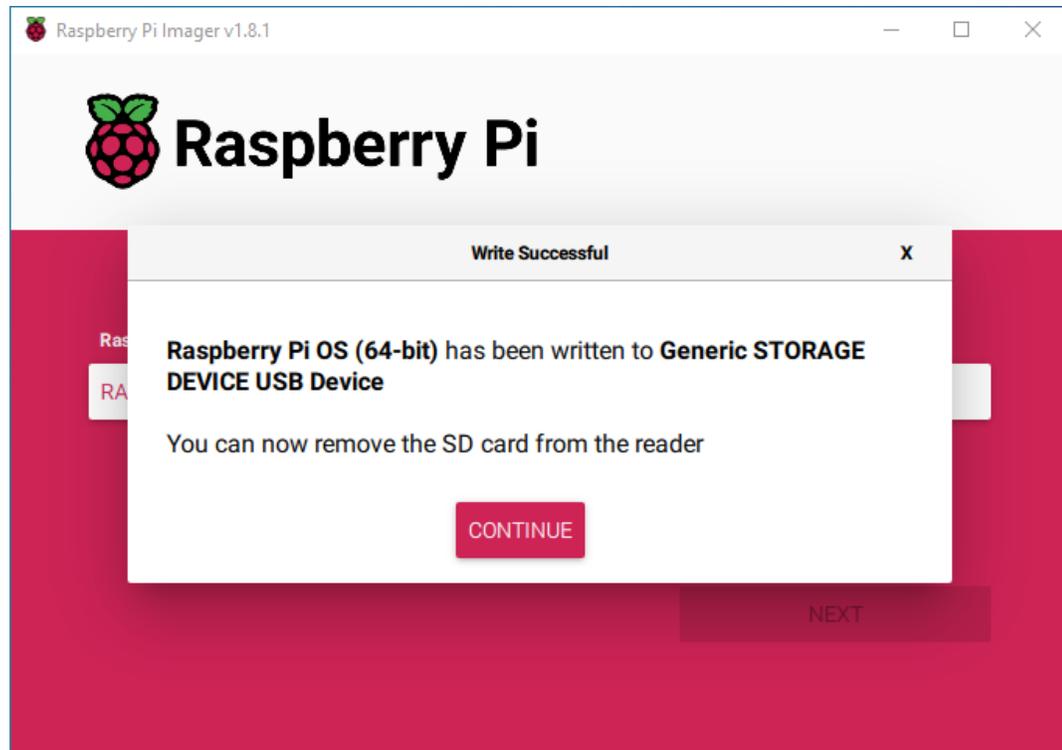
13. Confirm your selected settings by clicking **Yes**.



14. If the SD card contains existing data, ensure you back it up to prevent data loss. Proceed by clicking **Yes** if no backup is needed.



15. The OS installation process will commence on the SD card. A confirmation dialog will appear upon completion.



4. SETTING UP YOUR RASPBERRY PI

5.1 Setting Up with a Screen

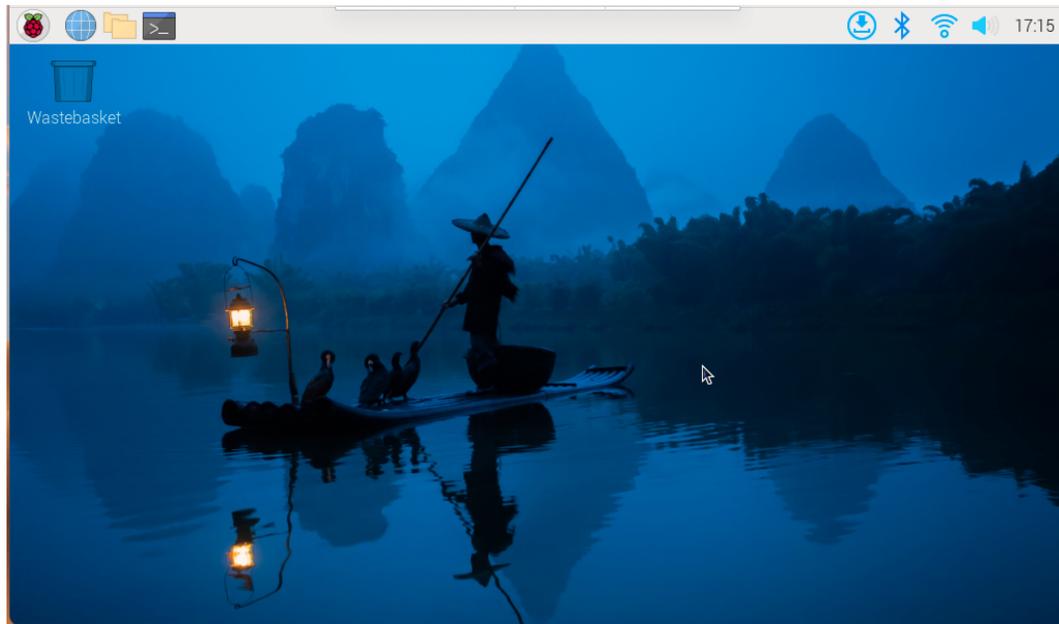
Having a screen simplifies the process of working with your Raspberry Pi.

Required Components

- Raspberry Pi 5 Model B
- Power Adapter
- Micro SD card
- Screen Power Adapter
- HDMI cable
- Screen
- Mouse
- Keyboard

Steps:

1. Insert the Micro SD card with Raspberry Pi OS installed into the Pironman 5.
2. Connect the Mouse and Keyboard to the Pironman 5.
3. Use the HDMI cable to connect the screen to the Pironman 5's HDMI port. Ensure the screen is plugged into a power source and turned on.
4. Power the Pironman 5 using the power adapter. The Raspberry Pi OS desktop should appear on the screen after a few seconds.



5.2 Setting Up Without a Screen

If you don't have a monitor, remote login is a viable option.

Required Components

- Raspberry Pi 5 Model B
- Power Adapter
- Micro SD card

Using SSH, you can access the Raspberry Pi's Bash shell, which is the default Linux shell. Bash offers a command-line interface for performing various tasks.

For those preferring a graphical user interface (GUI), the remote desktop feature is a convenient alternative for managing files and operations.

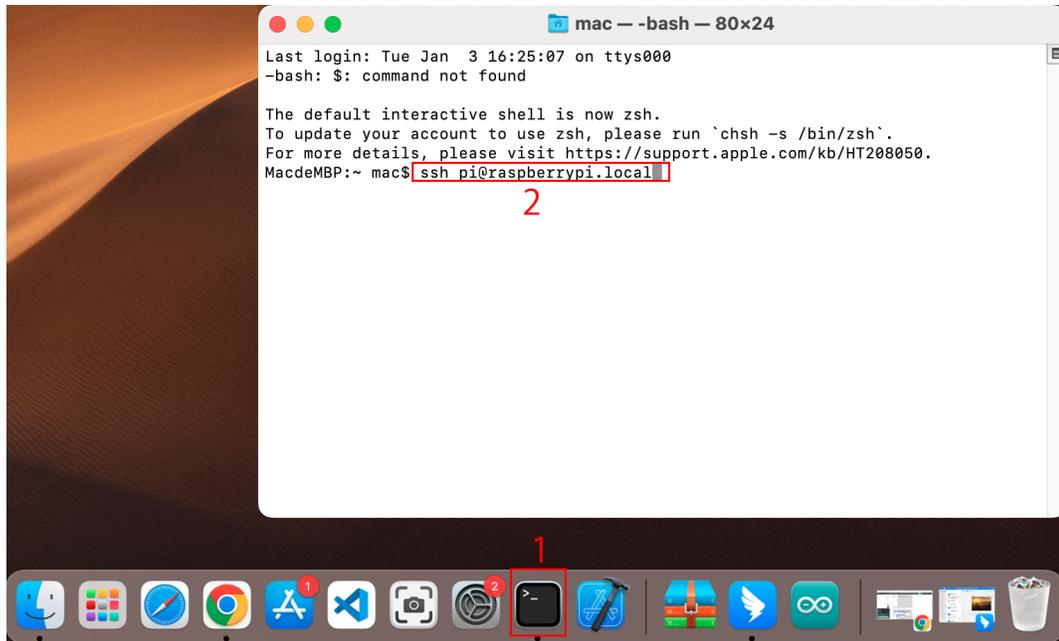
For detailed setup tutorials based on your operating system, refer to the following sections:

5.2.1 For Mac OS X Users

For Mac OS X users, SSH (Secure Shell) offers a secure and convenient method to remotely access and control a Raspberry Pi. This is particularly handy for working with the Raspberry Pi remotely or when it's not connected to a monitor. Using the Terminal application on a Mac, you can establish this secure connection. The process involves an SSH command incorporating the Raspberry Pi's username and hostname. During the initial connection, a security prompt will ask for confirmation of the Raspberry Pi's authenticity.

1. To connect to the Raspberry Pi, type the following SSH command:

```
ssh pi@raspberrypi.local
```



2. A security message will appear during your first login. Respond with **yes** to proceed.

```
The authenticity of host 'raspberrypi.local
↳(2400:2410:2101:5800:635b:f0b6:2662:8cba)' can't be established.
ED25519 key fingerprint is SHA256:oo7x3ZSgAo032wD1tE8eW0fFM/
↳kmewIvRwkBys6XRwg.
Are you sure you want to continue connecting (yes/no/[fingerprint])?
```

3. Input the password for the Raspberry Pi. Be aware that the password won't display on the screen as you type, which is a standard security feature.

```
pi@raspberrypi.local's password:
Linux raspberrypi 5.15.61-v8+ #1579 SMP PREEMPT Fri Aug 26 11:16:44 BST
↳2022 aarch64

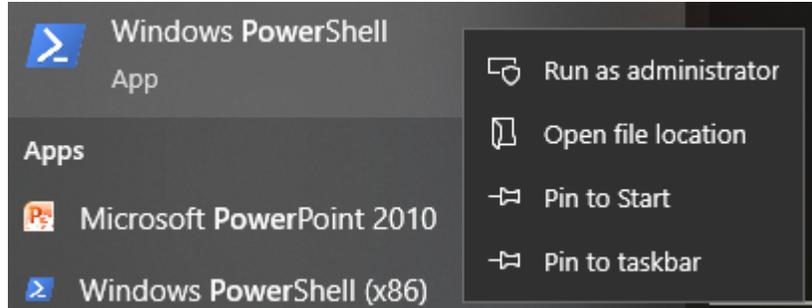
The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Thu Sep 22 12:18:22 2022
pi@raspberrypi:~ $
```

5.2.2 For Windows Users

For Windows 10 or higher users, remote login to a Raspberry Pi can be achieved through the following steps:

1. Search for powershell in your Windows search box. Right-click on Windows PowerShell and select Run as administrator.



2. Determine your Raspberry Pi's IP address by typing `ping -4 <hostname>.local` in PowerShell.

```
ping -4 raspberrypi.local
```

```
Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.

PS C:\Users\Daisy> ping -4 raspberrypi.local

Pinging raspberrypi.local [192.168.6.143] with 32 bytes of data:
Reply from 192.168.6.143: bytes=32 time<1ms TTL=64

Ping statistics for 192.168.6.143:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms
PS C:\Users\Daisy>
```

The Raspberry Pi's IP address will be displayed once it's connected to the network.

- If the terminal displays Ping request could not find host pi.local. Please check the name and try again., verify the hostname you've entered is correct.
 - If the IP address still isn't retrievable, check your network or WiFi settings on the Raspberry Pi.
3. Once the IP address is confirmed, log in to your Raspberry Pi using `ssh <username>@<hostname>.local` or `ssh <username>@<IP address>`.

```
ssh pi@raspberrypi.local
```

Warning: If an error appears stating The term 'ssh' is not recognized as the name of a cmdlet..., your system may not have SSH tools pre-installed. In this case, you need to manually install OpenSSH following *Install OpenSSH via Powershell*, or use a third-party tool as described in *PuTTY*.

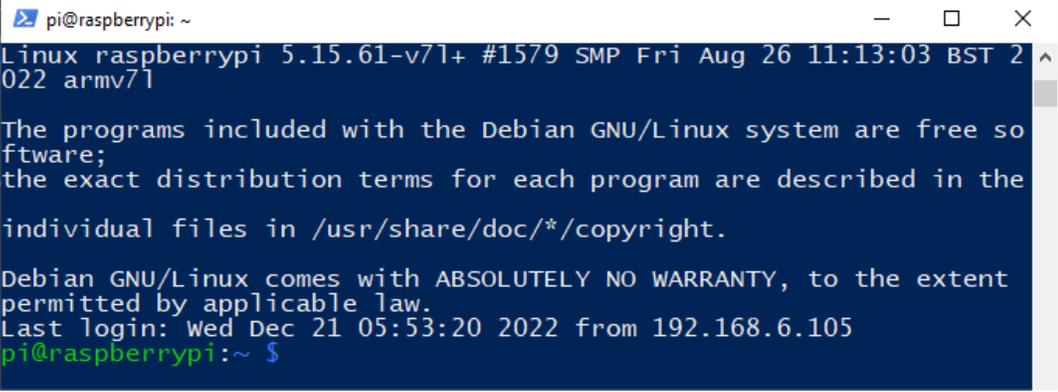
4. A security message will appear on your first login. Enter yes to proceed.

```
The authenticity of host 'raspberrypi.local
↳(2400:2410:2101:5800:635b:f0b6:2662:8cba)' can't be established.
ED25519 key fingerprint is SHA256:oo7x3ZSgAo032wD1tE8eW0fFM/
↳kmewIvRwkBys6XRwg.
Are you sure you want to continue connecting (yes/no/[fingerprint])?
```

5. Enter the password you previously set. Note that the password characters won't be displayed on the screen, which is a standard security feature.

Note: The absence of visible characters when typing the password is normal. Ensure you input the correct password.

6. Once connected, your Raspberry Pi is ready for remote operations.



```
pi@raspberrypi: ~
Linux raspberrypi 5.15.61-v7l+ #1579 SMP Fri Aug 26 11:13:03 BST 2022 armv7l
The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.
Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Wed Dec 21 05:53:20 2022 from 192.168.6.105
pi@raspberrypi:~ $
```

5.2.3 For Linux/Unix Users

1. Locate and open the **Terminal** on your Linux/Unix system.
2. Ensure your Raspberry Pi is connected to the same network. Verify this by typing `ping <hostname>.local`. For example:

```
ping raspberrypi.local
```

You should see the Raspberry Pi's IP address if it's connected to the network.

- If the terminal shows a message like Ping request could not find host pi.local. Please check the name and try again., double-check the hostname you've entered.
 - If you're unable to retrieve the IP address, inspect your network or WiFi settings on the Raspberry Pi.
3. Initiate an SSH connection by typing `ssh <username>@<hostname>.local` or `ssh <username>@<IP address>`. For instance:

```
ssh pi@raspberrypi.local
```

4. On your first login, you'll encounter a security message. Type yes to proceed.

```
The authenticity of host 'raspberrypi.local
(2400:2410:2101:5800:635b:f0b6:2662:8cba)' can't be established.
ED25519 key fingerprint is SHA256:oo7x3ZSgAo032wD1tE8eW0fFM/
kmewIvRwkBys6XRwg.
Are you sure you want to continue connecting (yes/no/[fingerprint])?
```

5. Enter the password you previously set. Note that for security reasons, the password won't be visible as you type.

Note: It's normal for the password characters not to display in the terminal. Just ensure to enter the correct password.

6. Once you've successfully logged in, your Raspberry Pi is now connected, and you're ready to proceed to the next step.

5.2.4 Remote Desktop Access for Raspberry Pi

For those preferring a graphical user interface (GUI) over command-line access, the Raspberry Pi supports remote desktop functionality. This guide will walk you through setting up and using VNC (Virtual Network Computing) for remote access.

We recommend using [VNC® Viewer](#) for this purpose.

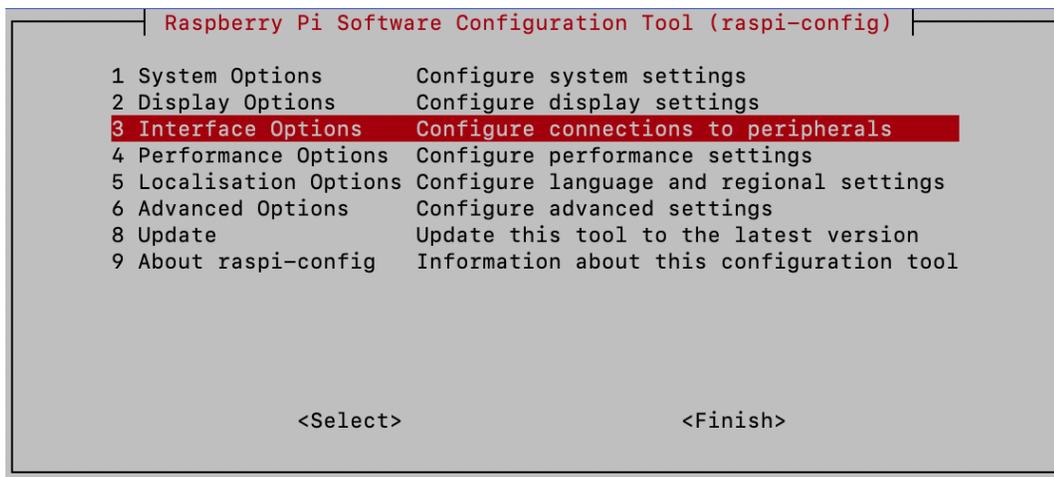
Enabling VNC Service on Raspberry Pi

VNC service comes pre-installed in the Raspberry Pi OS but is disabled by default. Follow these steps to enable it:

1. Enter the following command in the Raspberry Pi terminal:

```
sudo raspi-config
```

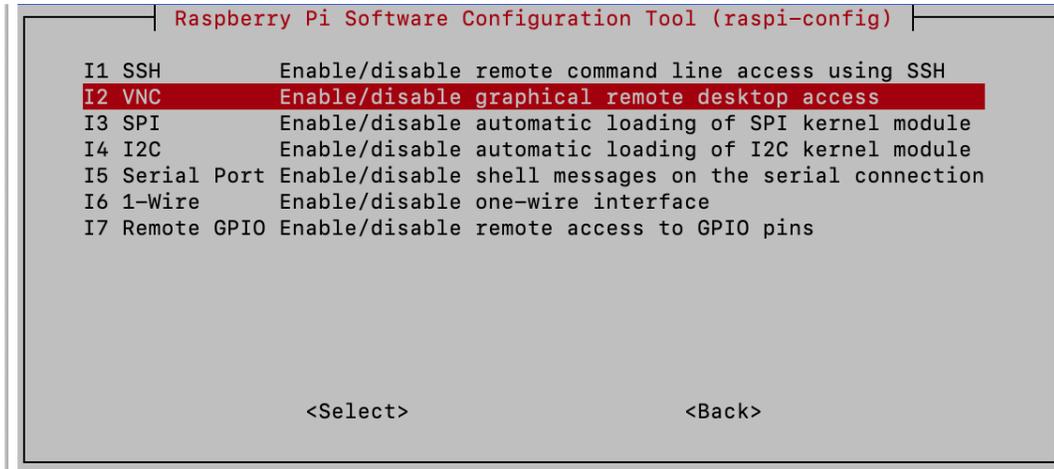
2. Navigate to **Interfacing Options** using the down arrow key, then press **Enter**.



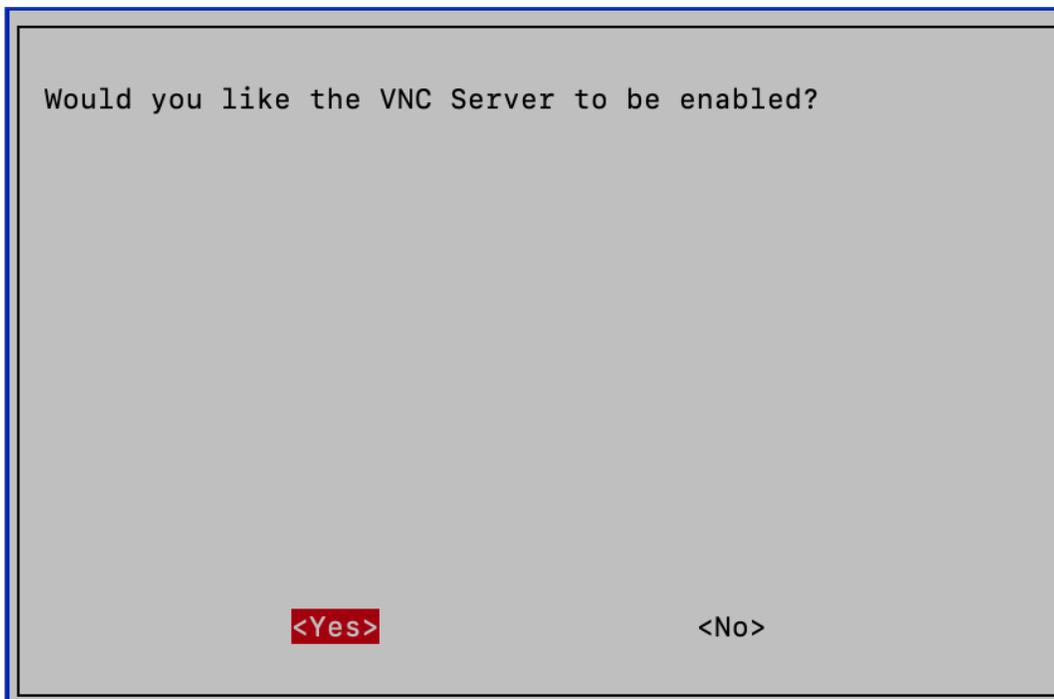
```
Raspberry Pi Software Configuration Tool (raspi-config)
1 System Options          Configure system settings
2 Display Options        Configure display settings
3 Interface Options       Configure connections to peripherals
4 Performance Options    Configure performance settings
5 Localisation Options   Configure language and regional settings
6 Advanced Options       Configure advanced settings
8 Update                  Update this tool to the latest version
9 About raspi-config     Information about this configuration tool

<Select>                  <Finish>
```

3. Select **VNC** from the options.

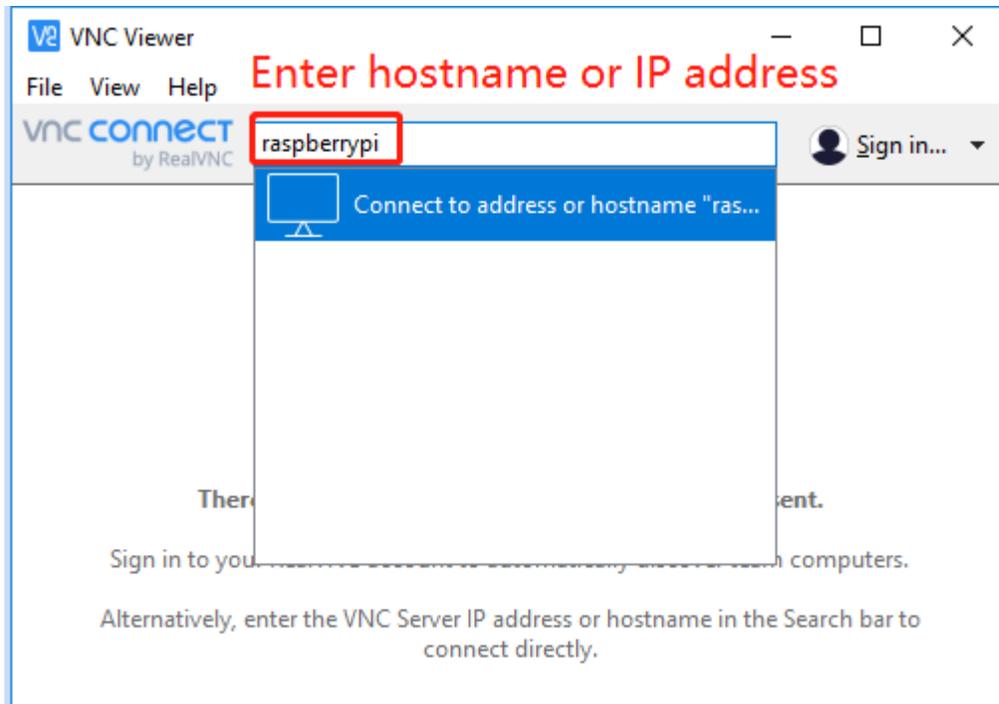


4. Use the arrow keys to choose **<Yes>** -> **<OK>** -> **<Finish>** and finalize the VNC service activation.

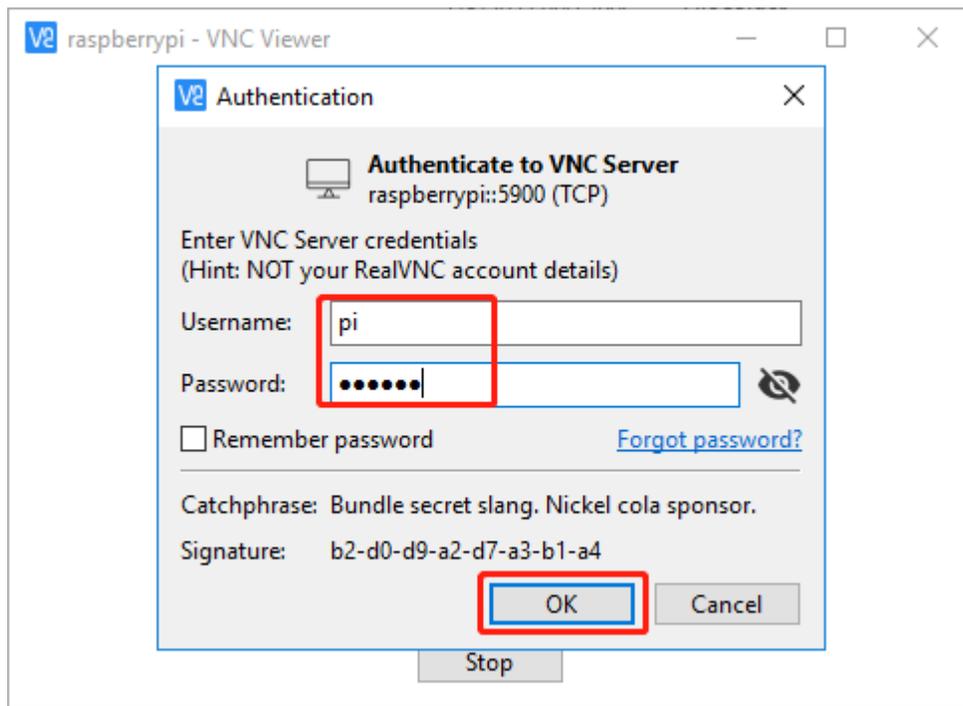


Logging in via VNC Viewer

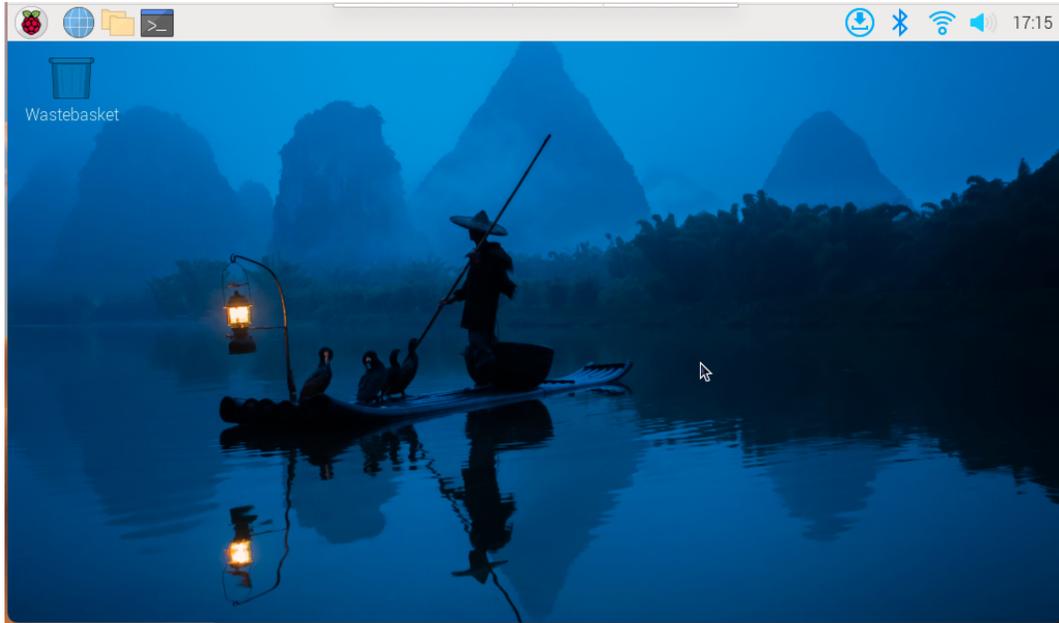
1. Download and install [VNC Viewer](#) on your personal computer.
2. Once installed, launch VNC Viewer. Enter the hostname or IP address of your Raspberry Pi and press Enter.



3. When prompted, enter your Raspberry Pi's username and password, then click **OK**.



4. You'll now have access to your Raspberry Pi's desktop interface.



5. SETTING UP THE PIRONMAN

6.1 Configuring Shutdown to Deactivate GPIO Power

To prevent the OLED screen and RGB fans, powered by the Raspberry Pi GPIO, from remaining active post-shutdown, it's essential to configure the Raspberry Pi for GPIO power deactivation.

- Manually edit the EEPROM configuration file with this command:

```
sudo rpi-eeprom-config -e
```

- Modify the `POWER_OFF_ON_HALT` setting in the file to 1. For instance:

```
BOOT_UART=1  
POWER_OFF_ON_HALT=1  
BOOT_ORDER=0xf416
```

6.2 Downloading and Installing the Software

Note: For lite systems, initially install tools like `git`, `python3`, `pip3`, `setuptools`, etc.

```
sudo apt-get update  
sudo apt-get install git -y  
sudo apt-get install python3 python3-pip python3-setuptools -y
```

Proceed to download and install the source code from GitHub.

```
cd ~  
git clone https://github.com/sunfounder/pironman5.git  
cd ~/pironman5  
sudo python3 install.py
```

A system reboot is required to activate the installation. Follow the on-screen reboot prompt.

Here are the primary configurations for Pironman 5:

- The OLED screen displays CPU, RAM, Disk Usage, CPU Temperature, and the Raspberry Pi's IP Address.
- If you run Raspberry Pi Desktop, you can press the power button twice in quick succession to shutdown. If you run Raspberry Pi OS Lite without a desktop, press the power button a single time to initiate a shutdown.

- To force a hard shutdown, press and hold the power button.
- Four WS2812 RGB LEDs will light up in blue with a breathing mode.

6.3 Modifying the Configuration

The `pironman5` module offers basic configurations for Pironman, which you can review with the following command.

```
sudo pironman5 -c
```

The standard configurations appear as follows:

```
config file:/opt/pironman5/config.txt

temp_unit = C
rgb_enable = True
rgb_num = 4
rgb_style = breath
rgb_color = 0a1aff
rgb_blink_speed = 50
rgb_freq = 1000
rgb_pin = 10
```

Customize these configurations to fit your needs.

Use `sudo pironman5`, `sudo pironman5 -h`, or `sudo pironman5 --help` for instructions.

```
config file:/opt/pironman5/config.txt

Usage:
pironman5 <OPTION> <input>

Options:
start          start pironman5 service
stop          stop pironman5 service
restart       restart pironman5 service
-h,--help    help, show this help
-c,--check   show all configurations
-a,--auto    [ on ],enable auto-start at boot
             [ off ], disable auto-start at boot
-u,--unit    [ C/F ], set the unit of temperature,
             C or F (Celsius/Fahrenheit)
-re|--rgb_enable [on/true/off/false], whether enable rgb strip,
-rn|--rgb_num  the number of rgb lamp beads, default 4
-rs,--rgb_style rgb strip display style, default: breath,
             in [breath / leap / flow / colorful / colorful_leap]
-rc,--rgb_color [(HEX)color], set the color of rgb strip,
             default: 0a1aff
-rb,--rgb_speed [speed], rgb blink speed (0 ~ 100, default 50)
-fq,--rgb_freq [frequency], rgb signal frequency (400 ~ 1600, default 1000 kHz)
-rp,--rgb_pin  [pin], rgb signal pin, could be [10 / spi/ SPI / 12 / pwm/ PWM] or
             [21 / pcm / PCM], default 10
-F,--foreground run in foreground
```

Note: The `-rp` command is currently unavailable, please disregard it for now.

- Verify the `pironman5` program status using the `systemctl` tool.

```
sudo systemctl status pironman5.service
```

- Alternatively, inspect the program-generated log files.

```
cat /opt/pironman5/log
```

- To deactivate automatic program execution at boot:

```
sudo pironman5 -a off
```

- To reset the RGB LEDs' color:

```
sudo pironman5 -rc ff8a40
```

- You can directly modify configurations in `/opt/pironman5/config.txt`.

```
sudo nano /opt/pironman5/config.txt
```

Press `Ctrl+X` -> `Y` -> `Enter` to save and exit.

Note: For a detailed introduction and configuration of Pironman 5 components, refer to: [6. About Hardware](#).

6. ABOUT HARDWARE

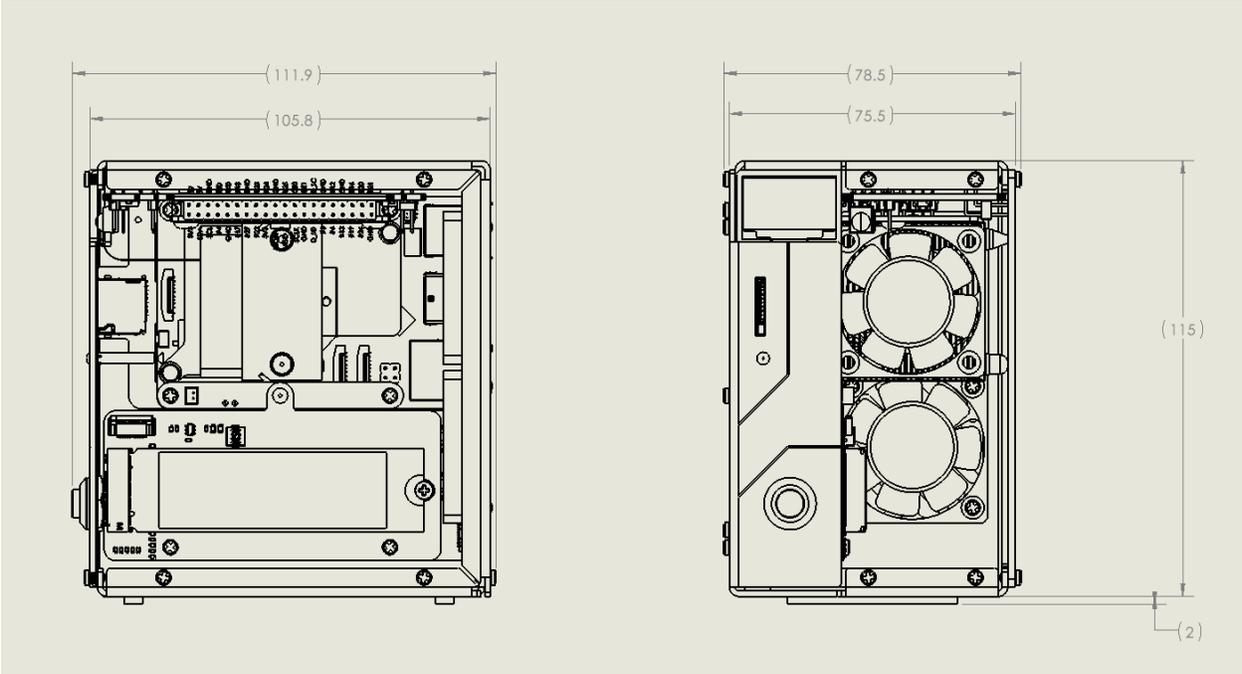
This chapter is a detailed description of all the components in Pironman, as well as the associated software configuration.

7.1 Features

Parameters

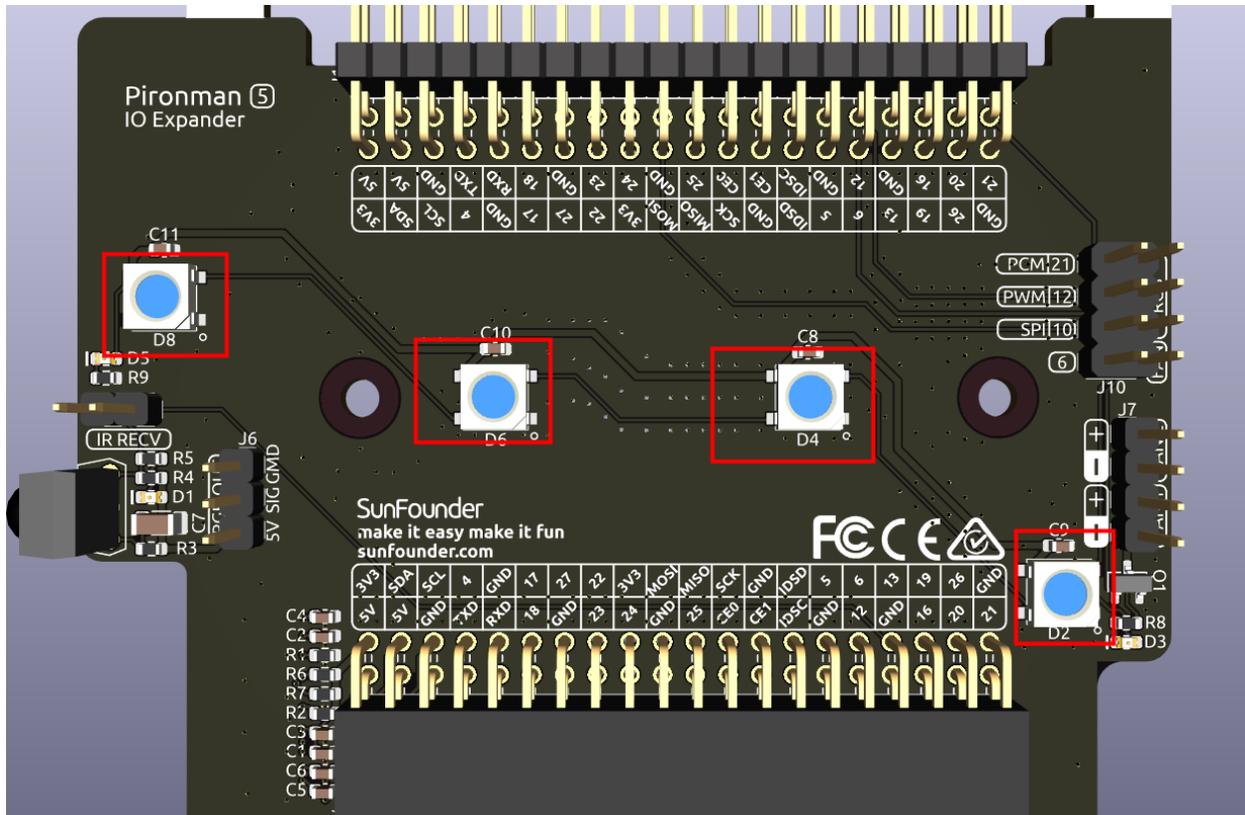
- Dimension: 111.9x78.5x117mm
- **Material**
 - Main body: aluminum alloy
 - Two side panel: acrylic
- Support Platform: Raspberry Pi 5B
- Power Input: USB Type C, 5V/5A
- **Interfaces**
 - Raspberry Pi standard 40-Pin GPIO
 - spring-loaded Micro SD socket
 - USB Type C power input
 - 2 x USB 2.0
 - 2 x USB 3.0
 - Gigabit LAN port
 - 2 x 4Kp60 HDMI Type A
- Metal Power button
- OLED screen: 0.96" 128x64 resolution
- 1 x PWM Fan, 2 x RGB Fans: 40x40x10mm
- 4 x WS2812-5050 RGB LED
- 38KHz IR Receiver
- Tower Cooler
- PCIe 3.0 x1 M.2 M key 2230, 2242, 2260, 2280 for NVMe SSD
- 1220 Battery for RTC

Dimensional Drawing



7.2 IO Expander

7.2.1 RGB LEDs



The board features 4 WS2812 RGB LEDs, offering customizable control. Users can turn them on or off, change their color (default set to blue), adjust display modes, and modify the change rate.

- To turn on the RGB LEDs:

```
sudo pironman5 -re on
```

- To turn them off:

```
sudo pironman5 -re off
```

- To change their color, input the desired hexadecimal color values:

```
sudo pironman5 -rc fe1a1a
```

- To switch display modes, choose from 5 options: `breath` / `leap` / `flow` / `colorful` / `colorful_leap`:

```
sudo pironman5 -rs leap
```

- To adjust the RGB signal frequency (range: 400 ~ 1600, default 1000 kHz):

```
sudo pironman5 -fq 1600
```

- To modify the speed of change (range: 0 ~ 100%):

```
sudo pironman5 -rb 80
```

- For custom RGB LED effects, modify and run the script `/opt/pironman5/ws2812_RGB.py`:

- Edit the script:

```
sudo nano /opt/pironman5/ws2812_RGB.py
```

- Save and exit with `Ctrl+X`, `Y`, then `Enter`.

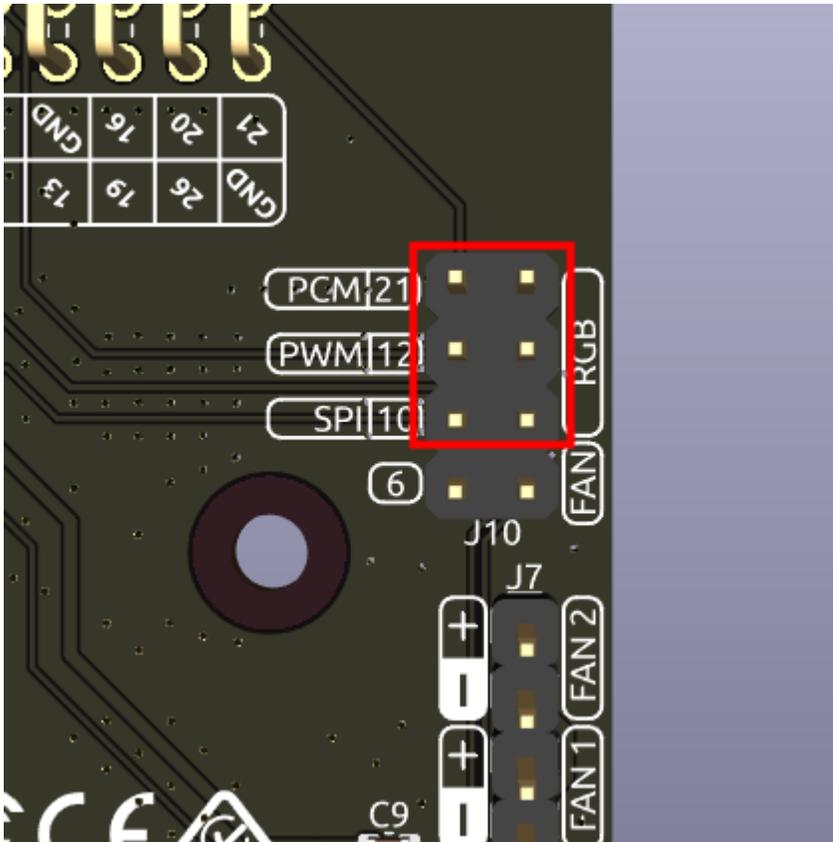
- Execute the script:

```
sudo python3 /opt/pironman5/ws2812_RGB.py
```

7.2.2 RGB Select Pins

Warning: As of now, only **SPI (IO10)** can drive the RGB LEDs. Other pins are not operational.

- The Raspberry Pi supports three high-speed signal driving modes for RGB LEDs: SPI (IO10), PWM (IO12), and PCM (IO21). Note that using these for RGB LEDs will disable their primary functions.

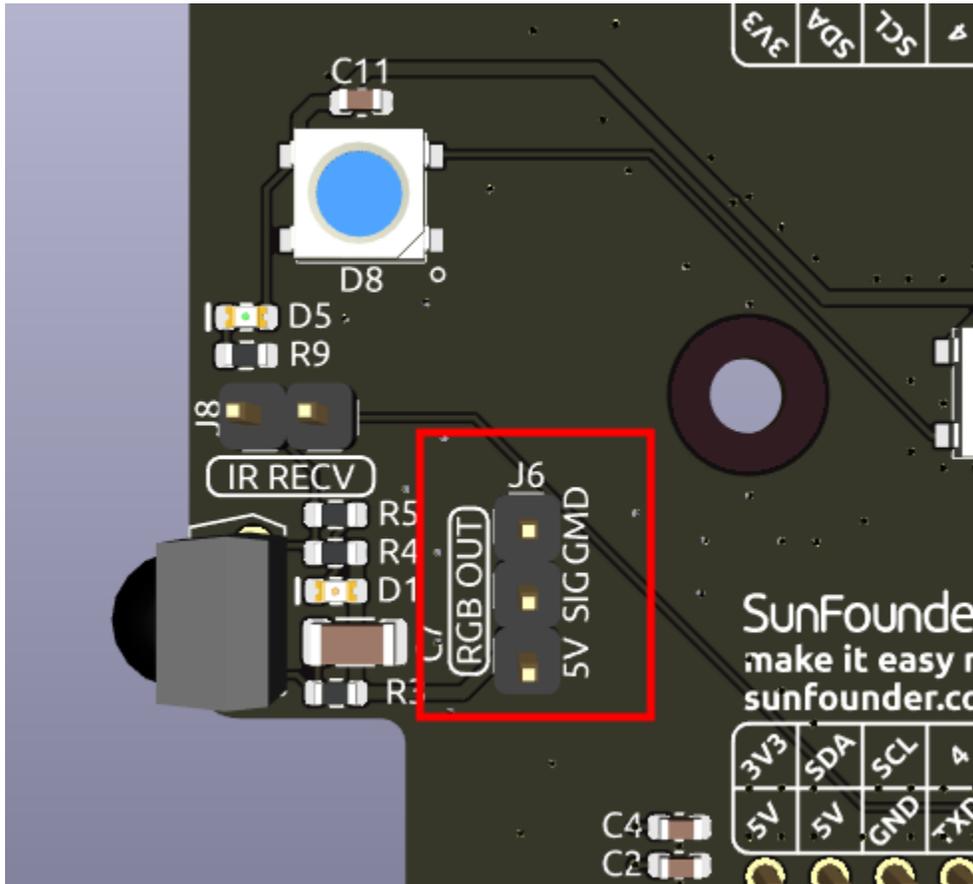


- SPI (IO10) is generally used for the SPI interface.
- PWM (IO12) is typically for analog audio.
- PCM (IO21) is often for digital audio.

- By default, **SPI (IO10)** is selected for RGB LED control. If you opt for a different pin during assembly, adjust the configuration accordingly:

```
sudo pironman5 -rp 21
```

7.2.3 RGB OUT Pins



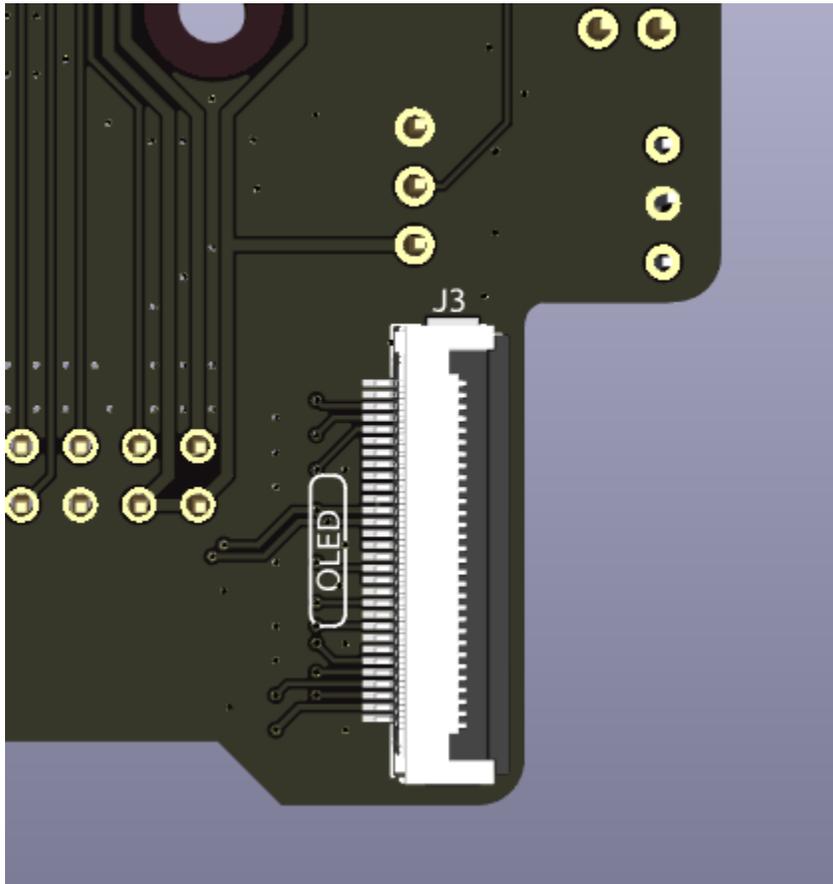
The WS2812 RGB LEDs support serial connection, allowing for the attachment of an external RGB LED strip. Connect the **SIG** pin to the external strip's **DIN** pin for expansion.

The default setup includes 4 RGB LEDs. Connect additional LEDs and update the count using:

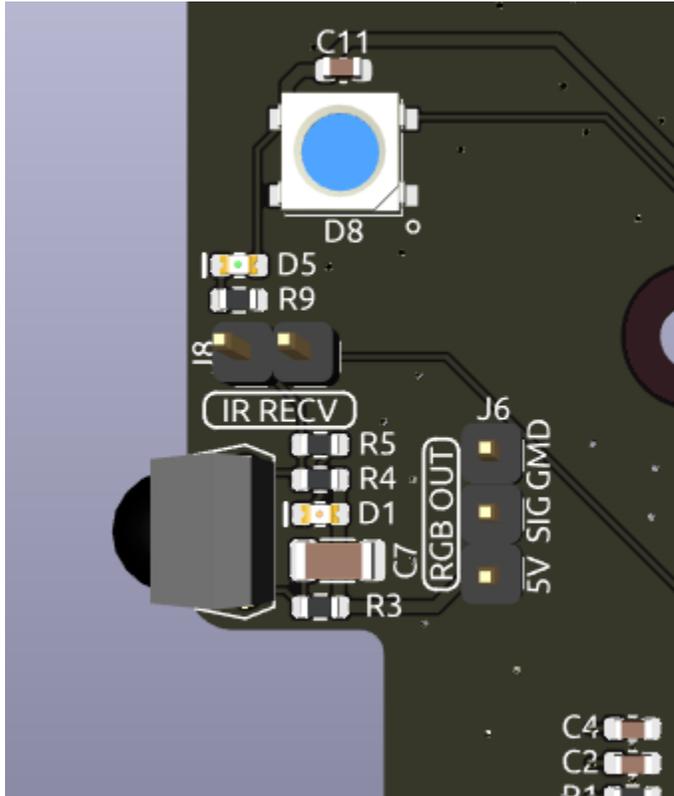
```
sudo pironman5 -rn 8
```

7.2.4 OLED Screen Connector

The OLED screen connector, with an address of 0x3C, is a key feature.



7.2.5 Infrared Receiver



- **Model:** IRM-56384, operating at 38KHz.
- **Connection:** The IR receiver connects to **GPIO13**.
- **D1:** An infrared reception indicator that blinks upon signal detection.
- **J8:** A pin for enabling the infrared function. By default, a jumper cap is inserted for immediate functionality. Remove the cap to free GPIO13 if the IR receiver is not in use.

To utilize the IR receiver, verify its connection and install the necessary module:

- Test the connection:

```
sudo ls /dev |grep lirc
```

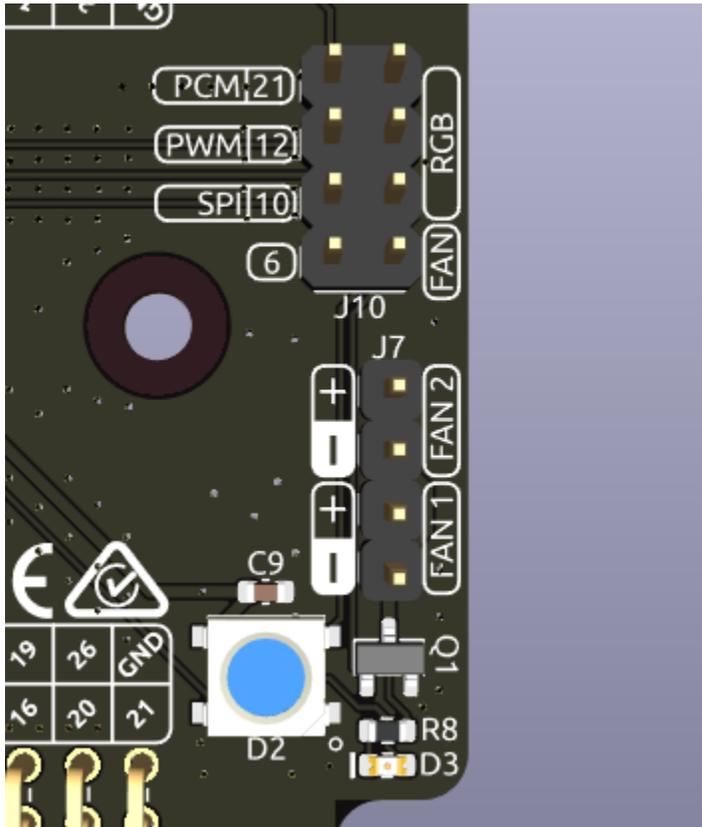
- Install the lirc module:

```
sudo apt-get install lirc -y
```

- Now, test the IR Receiver by running the following command. After running the command, press a button on the remote control, and the code of that button will be printed.

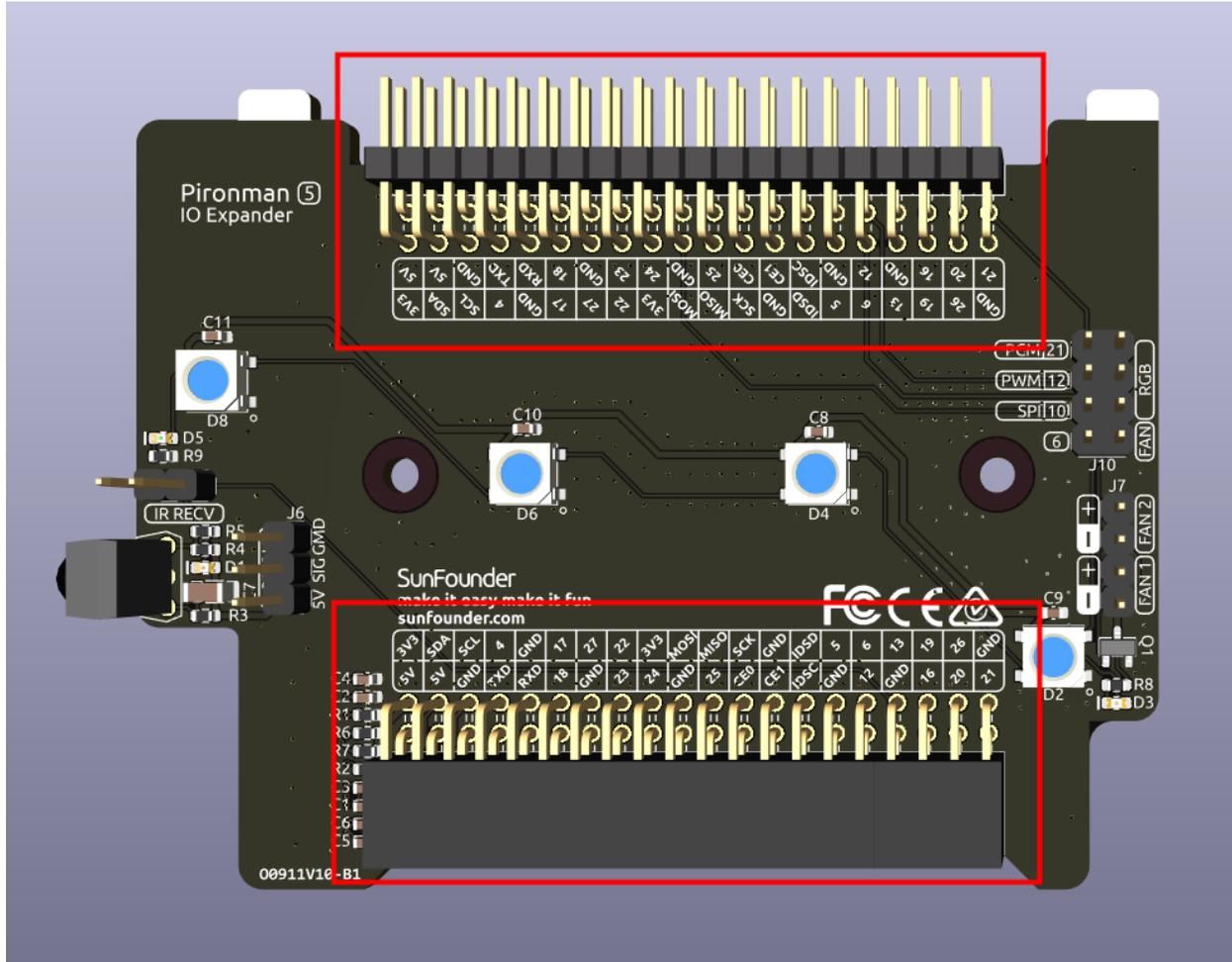
```
mode2 -d /dev/lirc0
```

7.2.6 Fans Pins



- **FAN1 and FAN 2:** Two sets of fan pins.
- **FAN:** The enable pins for RGB fans. By default, a jumper is inserted on these pins, allowing control of the fans' on and off state using GPIO6. If the fan operation is not desired, the jumper can be removed to free GPIO6.
- **D3:** A fan signal indicator that lights up when the fan is active.

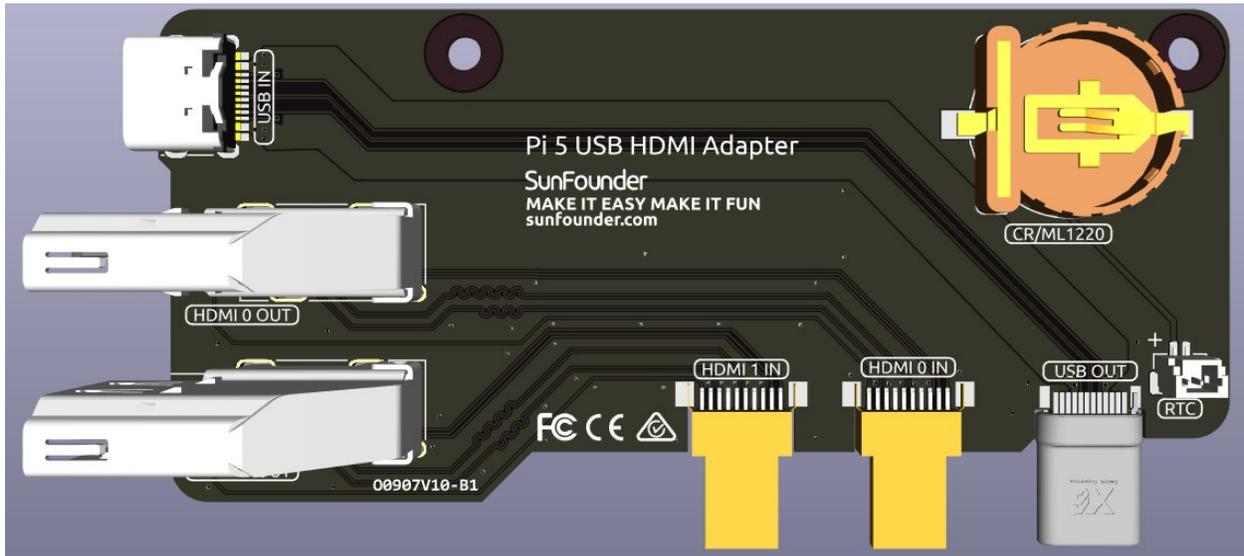
7.2.7 Pin Headers



Two right-angle header connectors extend the Raspberry Pi's GPIO, but note that the IR receiver, RGB LED, and fan occupy some pins. Remove the corresponding jumper caps to utilize these pins for other functions.

Pironman 5	Raspberry Pi 5
IR Receiver(Optional)	GPIO13
OLED SDA	SDA
OLED SCL	SCL
FAN(Optional)	GPIO6
RGB(Optional)	GPIO10
RGB(Optional)	GPIO12
RGB(Optional)	GPIO21

7.3 USB HDMI Adapter



This USB HDMI adapter board is specifically designed for the Raspberry Pi 5. Its primary function is to reposition the USB and HDMI connections to align with the USB interface side of the Raspberry Pi, enhancing accessibility and cable management.

Additionally, the HDMI port is converted to a standard HDMI Type A interface, offering broader compatibility.

A 1220RTC battery holder is incorporated for convenient installation of an RTC battery. It connects to the Raspberry Pi's RTC interface via an SH1.0 2P reverse cable. The battery holder is compatible with both CR1220 and ML1220 batteries. If using an ML1220 (Lithium Manganese Dioxide battery), charging can be configured directly on the Raspberry Pi. Note that the CR1220 is not rechargeable.

Enabling Trickle Charging

By default, the trickle charging feature for the battery is disabled. The `sysfs` files indicate the current trickle charging voltage and limits:

```
pi@raspberrypi:~ $ cat /sys/devices/platform/soc/soc:rpi_rtc/rtc/rtc0/charging_voltage
0
pi@raspberrypi:~ $ cat /sys/devices/platform/soc/soc:rpi_rtc/rtc/rtc0/charging_voltage_
->max
4400000
pi@raspberrypi:~ $ cat /sys/devices/platform/soc/soc:rpi_rtc/rtc/rtc0/charging_voltage_
->min
1300000
```

To enable trickle charging, add `rtc_bbat_vchg` to `/boot/firmware/config.txt`:

- Open the `/boot/firmware/config.txt`.

```
sudo nano /boot/firmware/config.txt
```

- Add `rtc_bbat_vchg` to `/boot/firmware/config.txt`.

```
dtparam=rtc_bbat_vchg=3000000
```

After rebooting, the system will display:

```

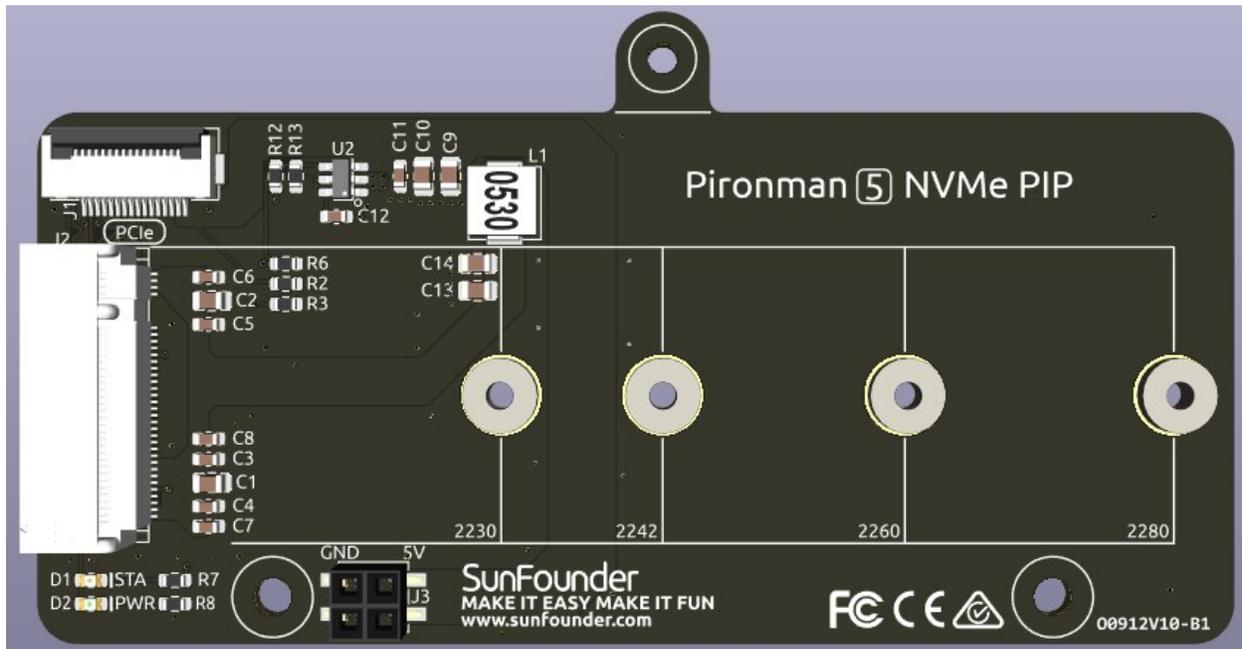
pi@raspberrypi:~ $ cat /sys/devices/platform/soc/soc:rpi_rtc/rtc/rtc0/charging_voltage
3000000
pi@raspberrypi:~ $ cat /sys/devices/platform/soc/soc:rpi_rtc/rtc/rtc0/charging_voltage_
↩max
4400000
pi@raspberrypi:~ $ cat /sys/devices/platform/soc/soc:rpi_rtc/rtc/rtc0/charging_voltage_
↩min
1300000

```

This confirms the battery is now under trickle charging. To disable this feature, simply remove the dtparam line from config.txt.

7.4 Pi5 NVMe PIP

The Pi5 NVMe PIP (PCIe Peripheral Board), as defined by the Raspberry Pi Foundation, is a PCIe adapter board designed specifically for NVMe solid-state drives. It supports four different sizes of NVMe SSDs: 2230, 2242, 2260, and 2280, all fitting into an M.2 M key slot.



- The board connects through a 16P 0.5mm reverse FFC (Flexible Flat Cable) or a custom impedance-matched FPC (Flexible Printed Circuit) cable.
- **STA**: A Status LED indicator.
- **PWR**: A Power LED indicator.
- The onboard 3.3V power supply can support up to 3A output. However, since the Raspberry Pi PCIe interface is limited to providing 5V/1A output (equivalent to 5W), additional power for 3.3V/3A usage can be supplied through the J3 connector from a 5V source.

7.4.1 Configure PCIe

Enabling PCIe

By default the PCIe connector is not enabled.

- To enable it you should open the `/boot/firmware/config.txt` file.

```
sudo nano /boot/firmware/config.txt
```

- Then add the following line to the file.

```
# Enable the PCIe External connector.  
dtparam=pciex1
```

- A more memorable alias for `pciex1` exists, so you can alternatively add `dtparam=nvme` to the `/boot/firmware/config.txt` file.

```
dtparam=nvme
```

Note: Enumeration of PCIe devices behind a switch is not currently supported.

PCIe Gen 3.0

- The connection is certified for Gen 2.0 speeds (5 GT/sec), but you can force it to Gen 3.0 (10 GT/sec) if you add the following lines to your `/boot/firmware/config.txt`.

```
# Force Gen 3.0 speeds  
dtparam=pciex1_gen=3
```

Warning: The Raspberry Pi 5 is not certified for Gen 3.0 speeds, and connections to PCIe devices at these speeds may be unstable.

- You should then reboot your Raspberry Pi for these settings to take effect.

```
sudo reboot
```

7.4.2 About the Model

M.2 SSDs, known for their compact size, come in various types mainly differentiated by their keying (notch design on the connector) and the interface they use. Here are the primary types:

- **M.2 SATA SSDs:** These use the SATA interface, similar to 2.5-inch SATA SSDs but in the smaller M.2 form factor. They are limited by the SATA III maximum speeds of around 600 MB/s. These SSDs are compatible with M.2 slots keyed for B and M keys.
- **M.2 NVMe SSDs:** These SSDs use the NVMe protocol over PCIe lanes and are significantly faster than M.2 SATA SSDs. They are suitable for applications requiring high read/write speeds like gaming, video editing, and data-intensive tasks. These SSDs typically require M-keyed slots. These drives utilize the PCIe (Peripheral Component Interconnect Express) interface, with different versions like 3.0, 4.0, and 5.0. Each new version of PCIe effectively doubles the data transfer speed of its predecessor. However, the Raspberry Pi 5 uses a PCIe 3.0 interface, capable of delivering transfer speeds up to 3,500 MB/s.

M.2 SSDs come in three key types: B key, M key, and B+M key. However, later on, the B+M key was introduced, combining the functionalities of the B key and M key. As a result, it replaced the standalone B key. Please refer to the image below.

6 contacts wide



Socket for "B key" edge connector

5 contacts wide



Socket for "M key" edge connector

6 pins wide



"B key" edge connector

5 pins wide



"M key" edge connector



"B & M key" edge connector

picture from Wikipedia

In general, M.2 SATA SSDs are B+M-keyed (can fit in sockets for B-keyed and M-keyed modules), while M.2 NVMe SSDs for PCIe 3.0 x4 lane are M-keyed.



M.2 NVME SSD

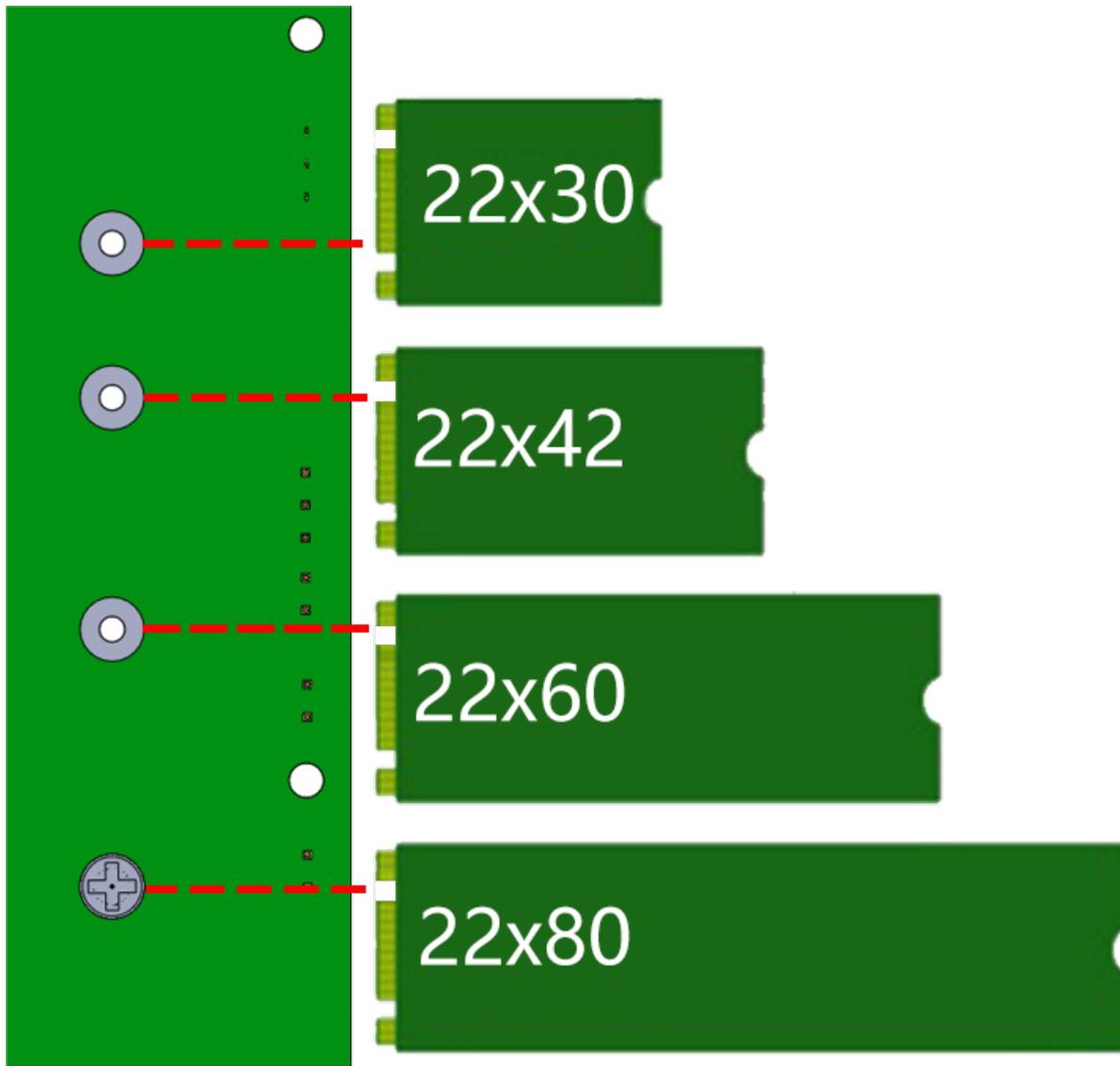


M.2 SATA SSD

7.4.3 About the Length

M.2 modules come in different sizes and can also be utilized for Wi-Fi, WWAN, Bluetooth, GPS, and NFC.

Pironman 5 supports four (PCIe2.0 / PCIe 3.0 NVMe M.2 SSD sizes based on their names: 2230, 2242, 2260, and 2280. The “22” is the width in millimeters (mm), and the two following numbers are the length. The longer the drive, the more NAND flash chips can be mounted; therefore, the more capacity.



7.4.4 Booting from the SSD

After you install the SSD into the Pironman 5 and reboot, an NVMe disk connected through the PCIe should be visible. If you want to boot your Raspberry Pi from the SSD, you need to do some configurations and install an operating system on the SSD.

1. Configure boot from the SSD

- To enable boot support, you need to change the `BOOT_ORDER` in the bootloader configuration. Edit the EEPROM configuration by:

```
sudo rpi-eeprom-config --edit
```

- Then, change the `BOOT_ORDER` line to be as below.

```
BOOT_ORDER=0xf416
```

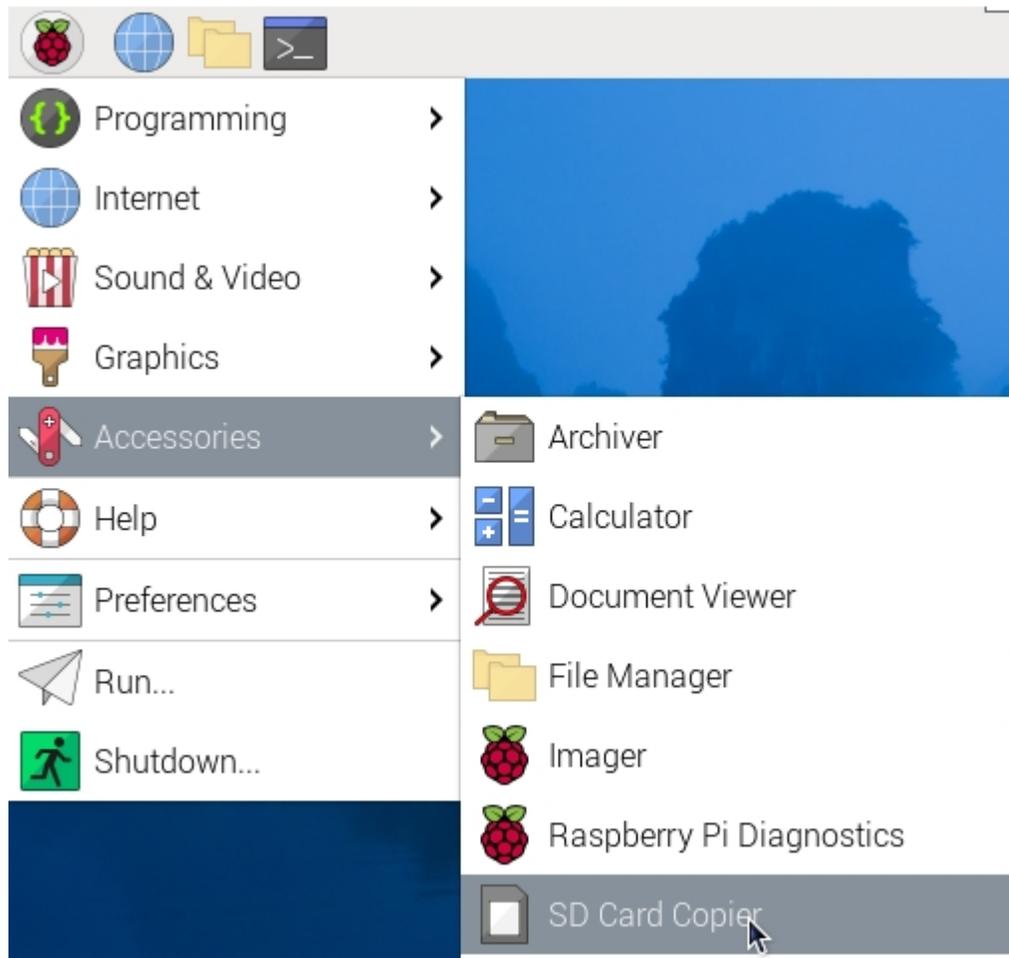
2. Install an Operating System on the SSD

There are two ways to install an operating system on the SSD:

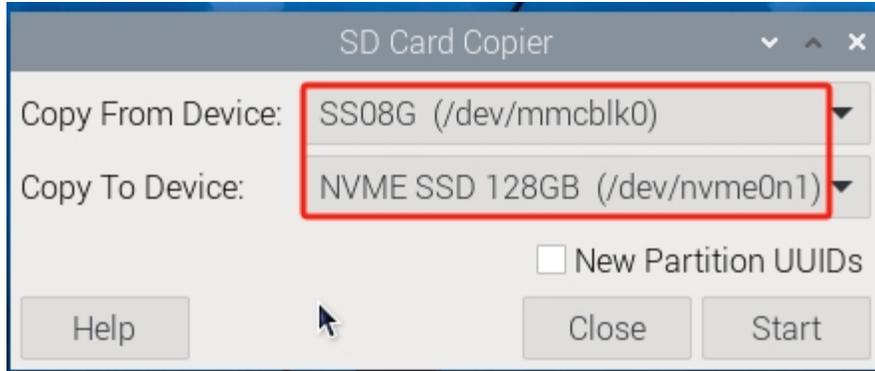
- **Copy the system from the Micro SD to the SSD:** This method is simpler, and your previous configurations can also be directly copied.
- **Install via Raspberry Pi Imager:** If your Raspberry Pi uses a desktop version of the operating system, you can use an imaging tool (like Raspberry Pi Imager) to burn the system to the SSD. This example uses Raspberry Pi OS bookworm, but other systems might require installing the imaging tool first. However, this method requires you to reinstall the prionman module, and other configurations need to be redone as well.

Copying the System from the Micro SD Card to the SSD

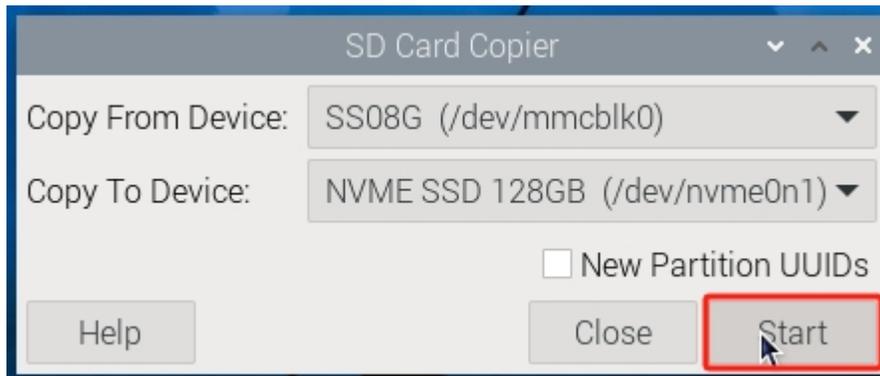
1. Connect a display or access the Raspberry Pi desktop through VNC Viewer. Then click **Raspberry Pi logo** -> **Accessories** -> **SD Card Copier**.



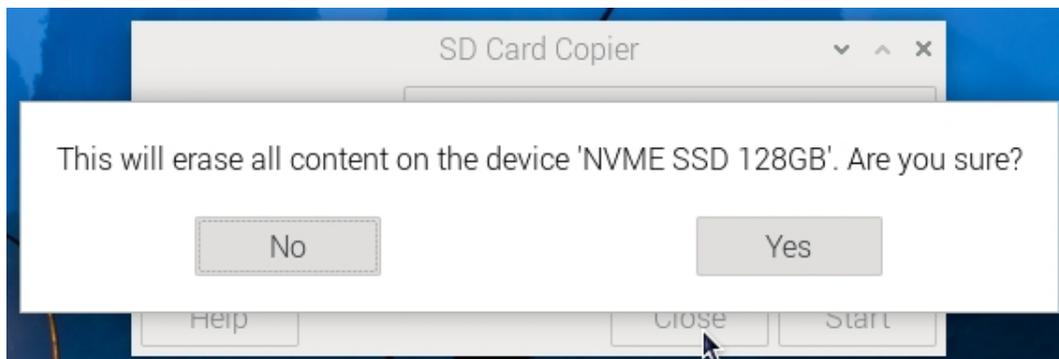
2. Make sure to select the correct **Copy From** and **Copy To** devices. Be careful not to mix them up.



3. After selection, click **Start**.



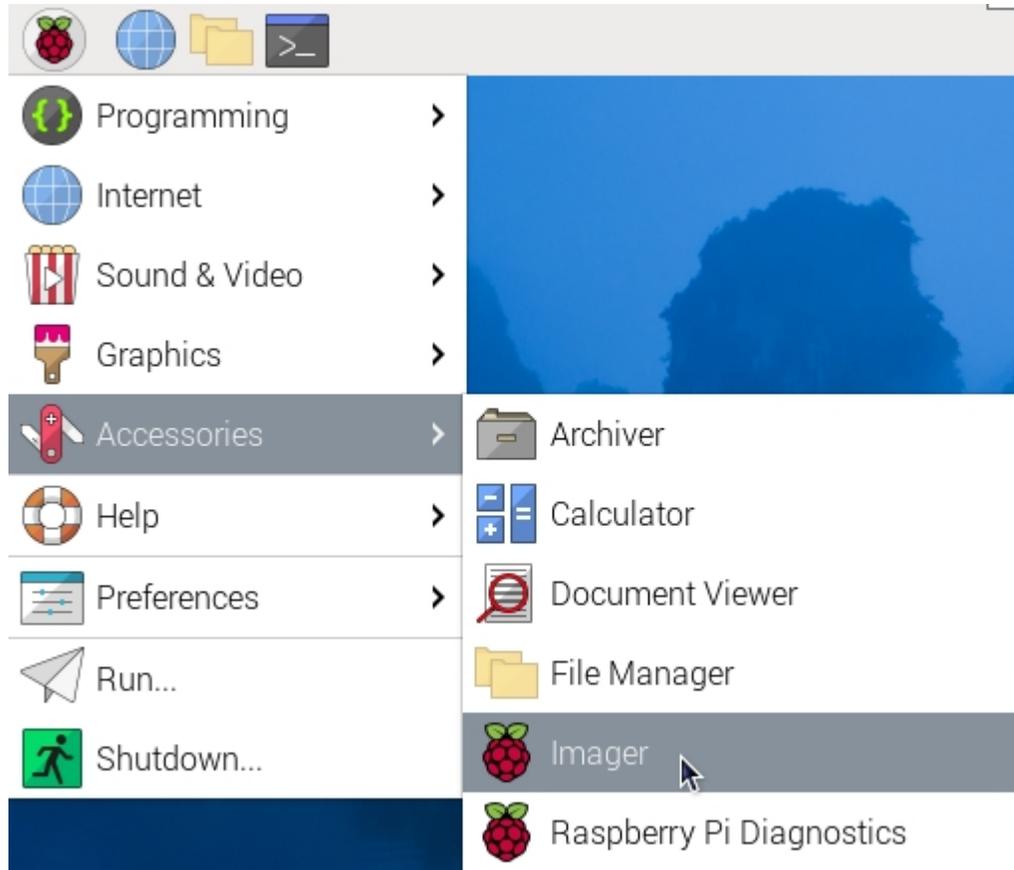
4. You will be prompted that the content on the SSD will be erased. Make sure to back up your data before clicking Yes.



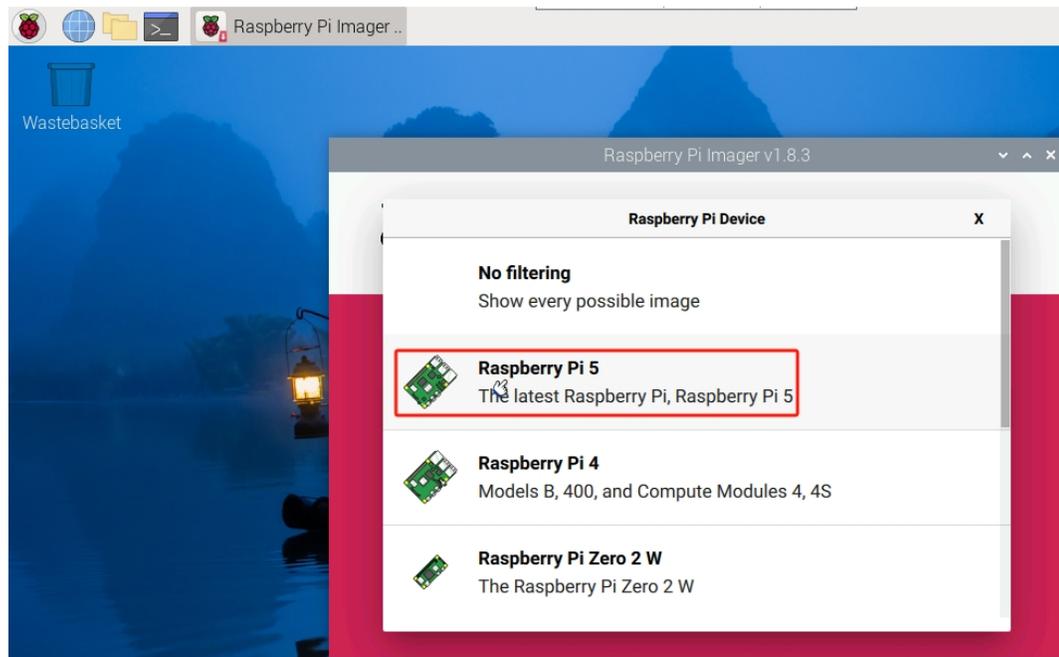
5. Wait for some time, and the copying will be completed.

Installing the System with Raspberry Pi Imager

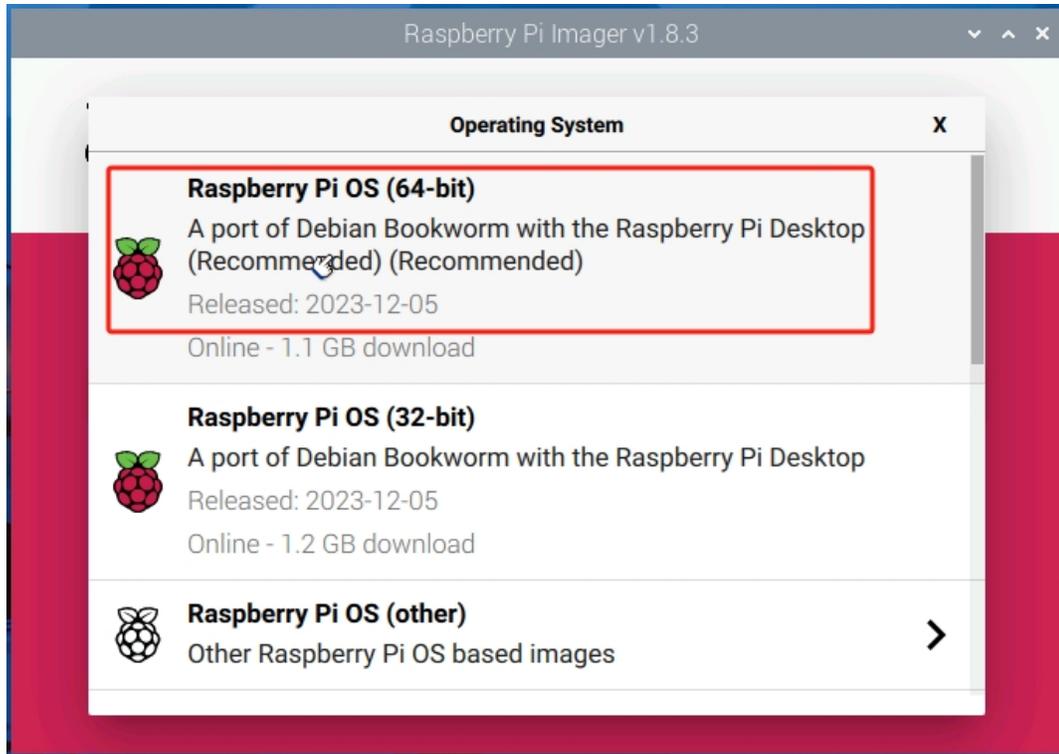
1. If your MicroSD card has a desktop version of the system installed, you can use an imaging tool (like Raspberry Pi Imager) to burn the system to the SSD. This example uses Raspberry Pi OS bookworm, but other systems might require installing the imaging tool first.



2. Select Pi 5.



3. Choose an operating system.



4. Select the NVMe SSD card.
5. After configuration, click Yes.

3. Restart Pironman 5

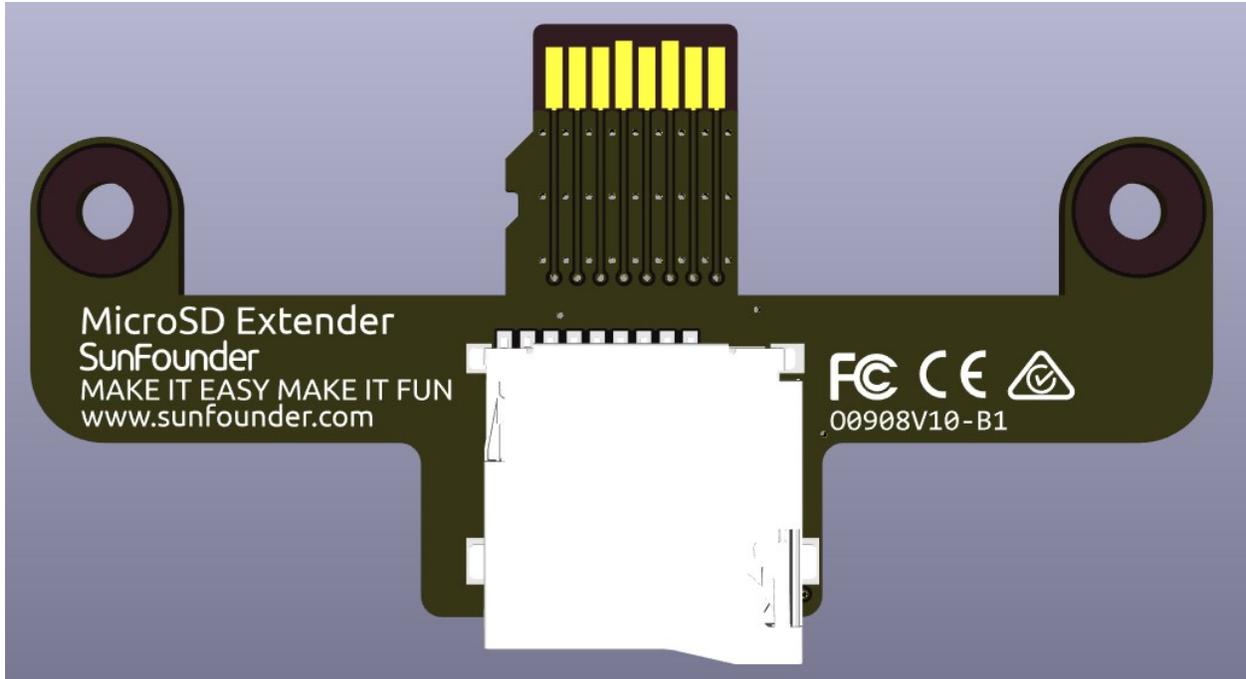
After restarting the Raspberry Pi, it will boot from the SSD.

```
sudo reboot
```

Note: If you are using the **Raspberry Pi Imager** to install the system on the SSD, you will need to reconfigure the setup after the Raspberry Pi boots up by following the steps to [5. Setting Up the Pironman](#).

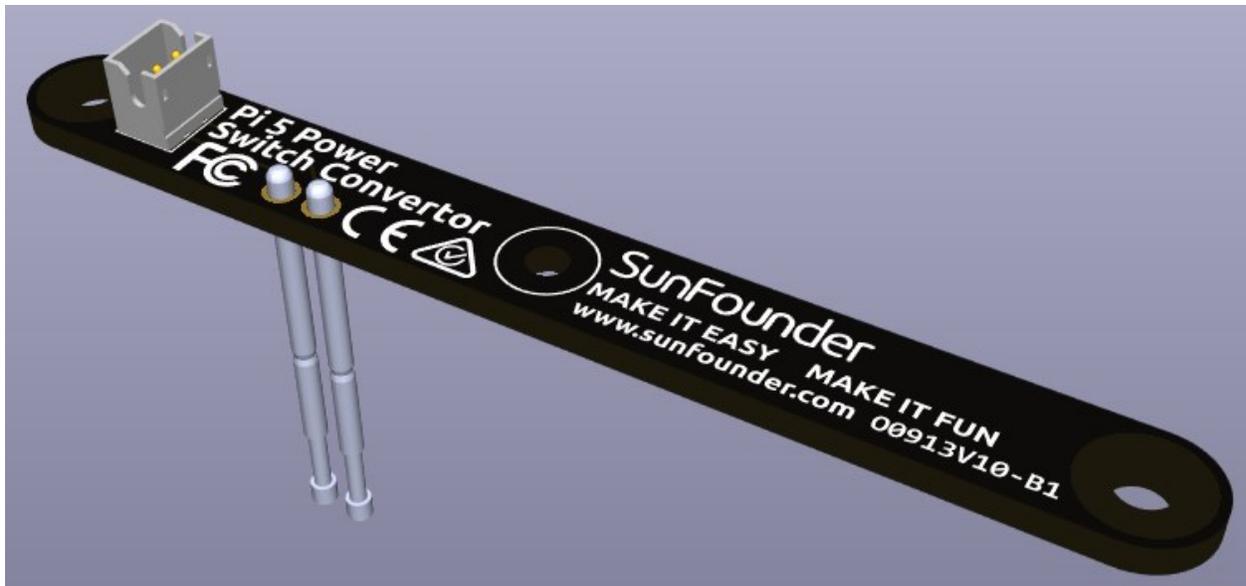
7.5 MicroSD Extender

This is a Micro SD card expansion board, which extends the Raspberry Pi's MicroSD card slot to the outside and adds a spring-loaded card slot.



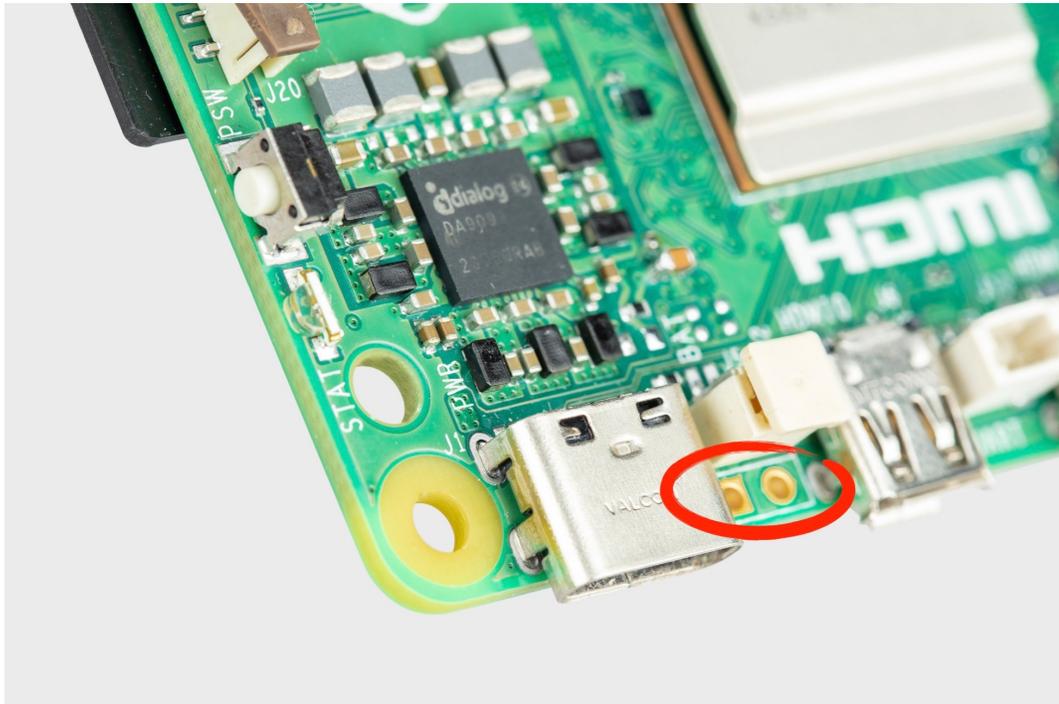
7.6 Power Switch Conventor

This is a module that expands the Raspberry Pi 5 power switch to the outside.

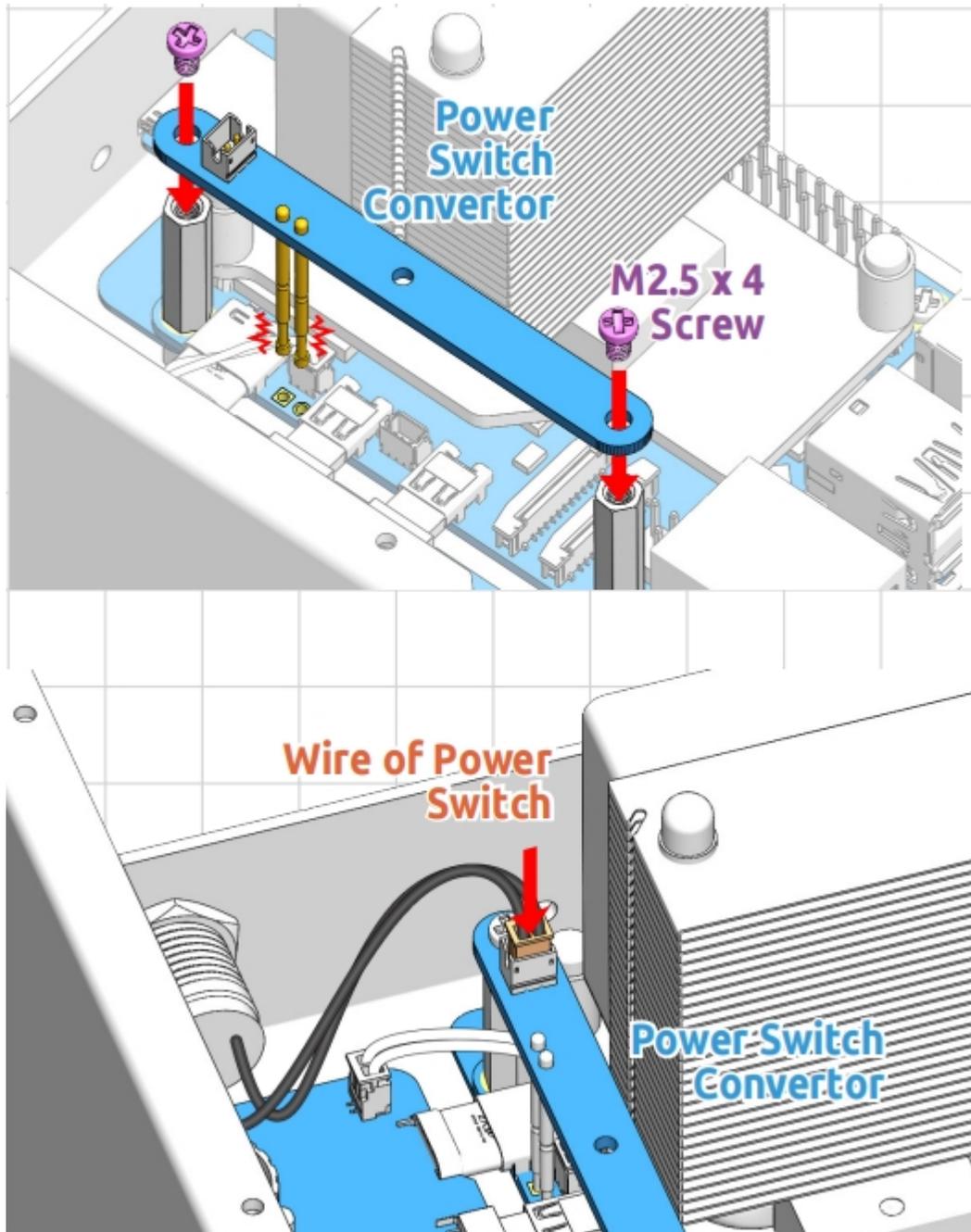


Adding the Power Button

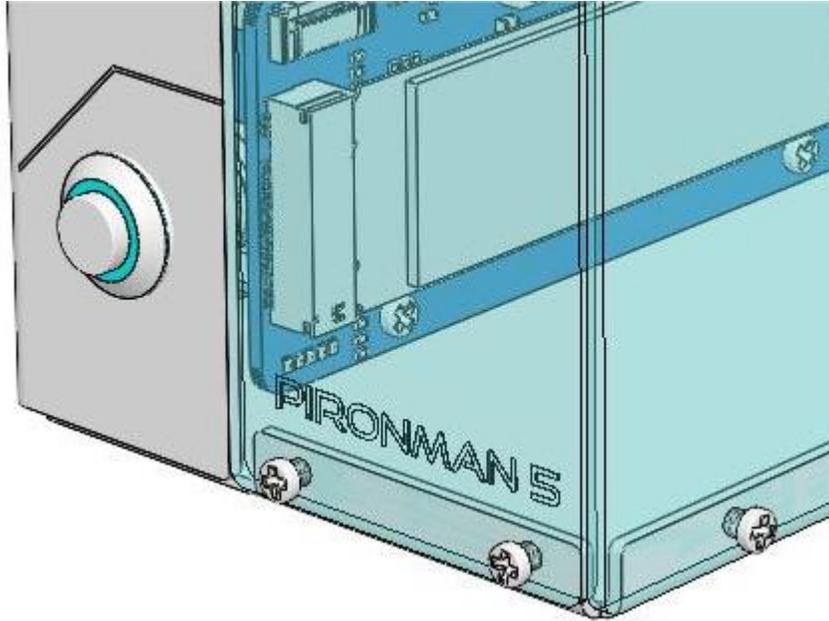
- The Raspberry Pi 5 features a **J2** jumper, situated between the RTC battery connector and the board edge. This breakout enables the addition of a custom power button to the Raspberry Pi 5 by connecting a Normally Open (NO) momentary switch across the two pads. Briefly engaging this switch mimics the onboard power button's functionality.



- On the Pironman 5, there's a **Power Switch Converter** that extends the **J2** jumper to an external power button using two Pogo pins.



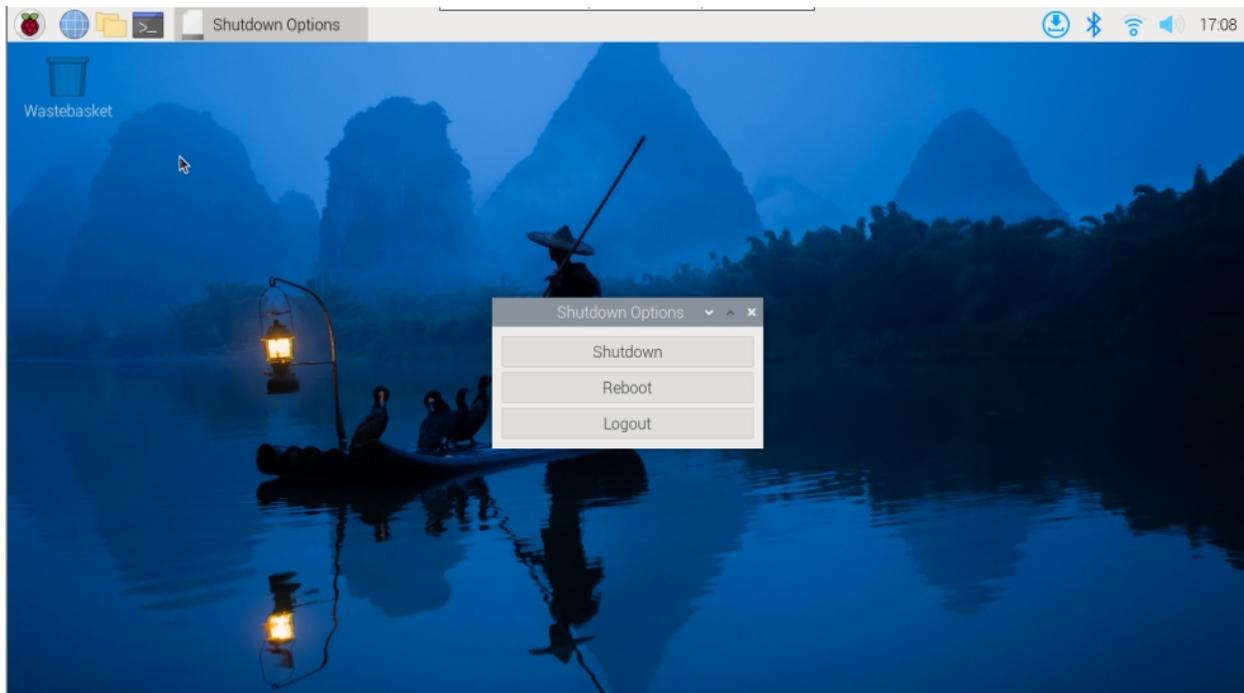
- Now, the Raspberry Pi 5 can be powered on and off using the Power Button.



Power Cycling

Upon initially powering your Raspberry Pi 5, it will automatically turn on and boot into the operating system without the need to press the button.

If running the Raspberry Pi Desktop, a brief press of the power button initiates a clean shutdown process. A menu will appear, offering options to shutdown, reboot, or logout. Selecting an option or pressing the power button again will start a clean shutdown.



Shutdown Operations

- For the **bookworm** system

- If you run Raspberry Pi Desktop, you can press the power button twice in quick succession to shutdown.
- If you run Raspberry Pi OS Lite without a desktop, press the power button a single time to initiate a shutdown.
- To force a hard shutdown, press and hold the power button.
- If the Raspberry Pi board is shut down, but still powered, pressing the power button will restart the board.
- For other systems
 - Hold for 5 seconds to force a hard shutdown, and single-click to power on from a shutdown state.

7.7 Tower Cooler

Warning

Do not touch the blades, or let the power wires wrap around the fan, or pull the power wires with force to avoid damaging the fan.

Do not use in environments with flammable gases or any danger.

When the fan is working, please do not try to lock the fan for a long time. If you do so, the fan will burn out due to the high heat generated by the continuous stoppage.

When assembling the fan, please pay special attention to the noise generated by resonance or vibration.

Do not drop the Icecube Tower Cooler from height, as this may affect the balance of the fan's blades.

7.8 OLED Screen



- **Size:** 0.96"
- **Material:** PM OLED
- **Color:** White light
- **Driver:** SSD1306
- **Voltage:** 3.3V
- **Resolution:** 128*64
- **Display Area:** 21.74x10.86mm
- **Panel Size:** 26.70x19.26x1.42mm
- **Pixel Pitch:** 0.17x0.17mm

- **Pixel Size:** 0.154x0.154mm
- **Viewing Angle:** Full view
- **Operating Temperature:** -20~70°C
- **Communication Method:** IIC/SPI/Parallel
- **Connection Method:** 0.5mm pitch plug-in type FPC

7.9 Fans

7.9.1 PWM Fan

The PWM fan on the Pironman 5 is controlled by the Raspberry Pi system, and its operation influences the two additional RGB fans. These RGB fans activate and deactivate in sync with the PWM fan.

Regarding cooling solutions for the Raspberry Pi 5, especially under heavy load, the design of the Pironman 5 incorporates a smart cooling system. It features a primary PWM fan and two supplementary RGB fans. The cooling strategy is closely integrated with the Raspberry Pi 5's thermal management system.

The PWM fan's operation is based on the Raspberry Pi 5's temperature:

- Below 50°C, the PWM fan remains off (0% speed).
- At 50°C, the fan starts at a low speed (30% speed).
- Reaching 60°C, the fan increases to a medium speed (50% speed).
- At 67.5°C, the fan ramps up to a high speed (70% speed).
- At 75°C and above, the fan operates at full speed (100% speed).

This temperature-to-speed relationship also applies when the temperature decreases, with a 5°C hysteresis. The fan speed reduces when the temperature falls 5°C below each of these thresholds.

- Commands to monitor the PWM fan. To check the PWM fan's status:

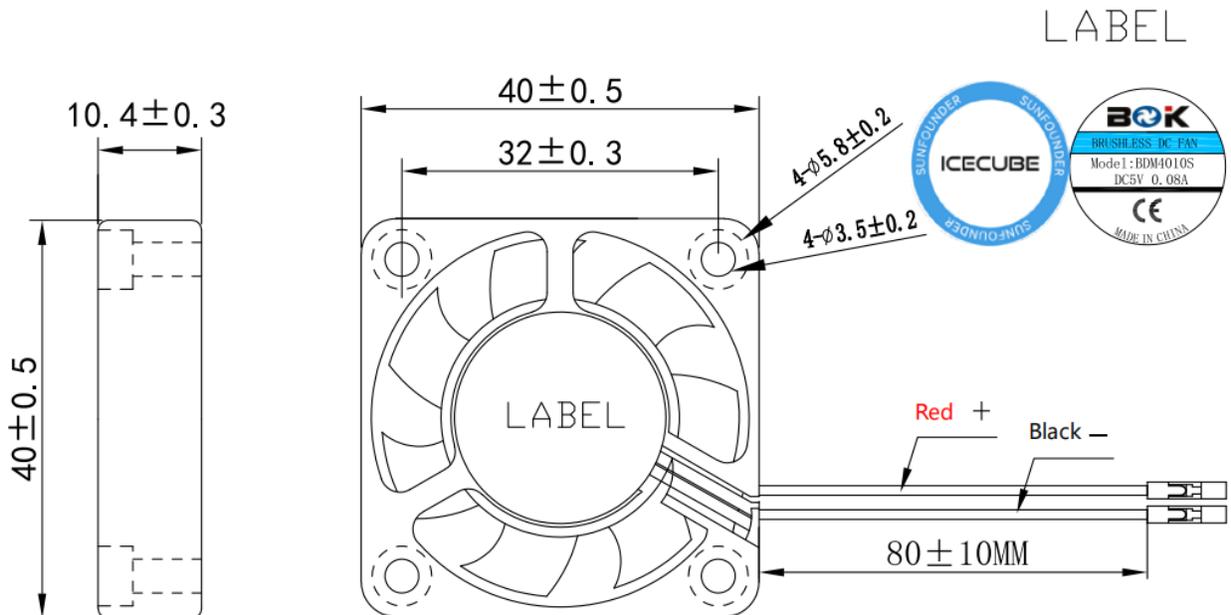
```
cat /sys/class/thermal/cooling_device0/cur_state
```

- To view the PWM fan's speed:

```
cat /sys/devices/platform/cooling_fan/hwmon/*/fan1_input
```

In the Pironman 5, the PWM fan is a critical component for maintaining optimal operating temperatures, particularly during intensive tasks, ensuring the Raspberry Pi 5 runs efficiently and reliably.

7.9.2 RGB Fans



- **External dimension:** 40*40*10MM
- **Weight:** 13.5±5g/pcs
- **Life:** 40,000 hours (room temperature 25°C)
- **Maximum Air Flow:** 2.46CFM
- **Max.Air Pressure:** 0.62mm-H2O
- **Accoustic Sound:** 22.31dBA
- **Rated Input power:** 5V/0.1A
- **Rated Speed:** 3500±10%RPM
- **Operating Temperature:** -10°C~+70°C
- **Storage Temperature:** -30°C~+85°C

7. APPENDIX

8.1 Get the IP address

There are many ways to know the IP address, and two of them are listed as follows.

Checking via the router

If you have permission to log in the router(such as a home network), you can check the addresses assigned to Raspberry Pi on the admin interface of router.

The default hostname of the Raspberry Pi OS is raspberrypi, and you need to find it. (If you are using ArchLinuxARM system, please find alarmpi.)

Network Segment Scanning

You can also use network scanning to look up the IP address of Raspberry Pi. You can apply the software, **Advanced IP scanner** and so on.

Scan the IP range set, and the name of all connected devices will be displayed. Similarly, the default hostname of the Raspberry Pi OS is raspberrypi, if you haven't modified it.

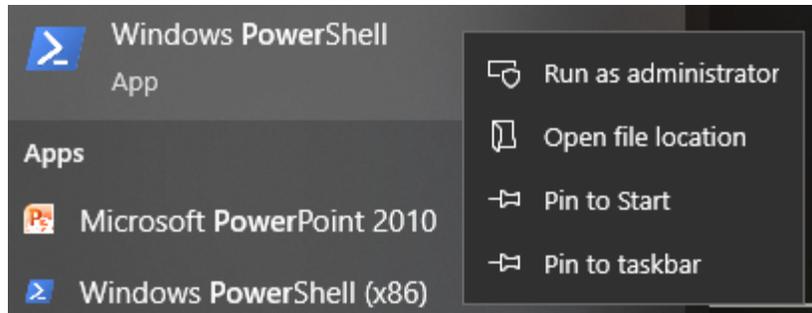
8.2 Install OpenSSH via Powershell

When you use `ssh <username>@<hostname>.local` (or `ssh <username>@<IP address>`) to connect to your Raspberry Pi, but the following error message appears.

```
ssh: The term 'ssh' is not recognized as the name of a cmdlet, function,
↵script file, or operable program. Check the
spelling of the name, or if a path was included, verify that the path is
↵correct and try again.
```

It means your computer system is too old and does not have [OpenSSH](#) pre-installed, you need to follow the tutorial below to install it manually.

1. Type `powershell` in the search box of your Windows desktop, right click on the Windows PowerShell, and select `Run as administrator` from the menu that appears.



2. Use the following command to install OpenSSH.Client.

```
Add-WindowsCapability -Online -Name OpenSSH.Client~~~~0.0.1.0
```

3. After installation, the following output will be returned.

```
Path          :  
Online        : True  
RestartNeeded : False
```

4. Verify the installation by using the following command.

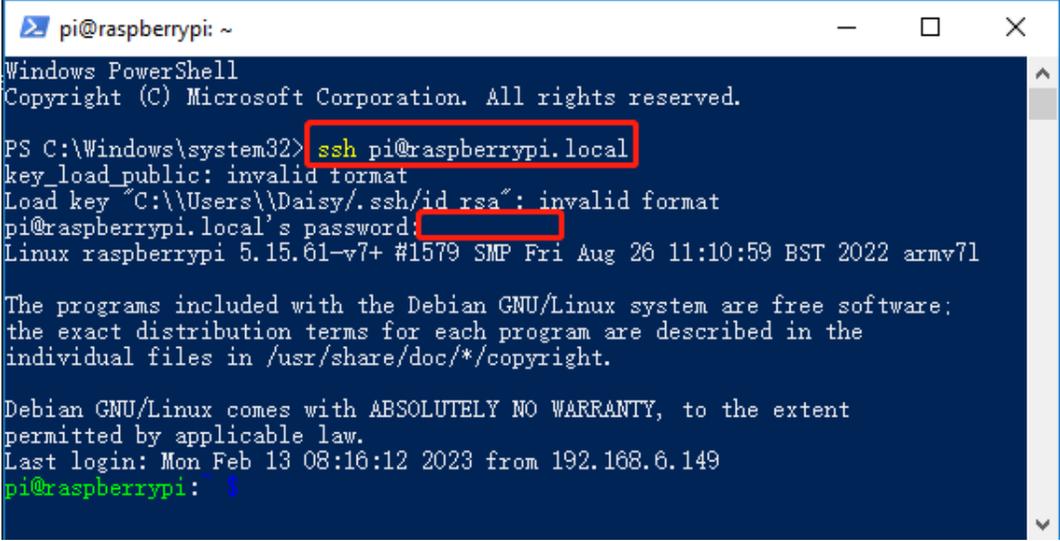
```
Get-WindowsCapability -Online | Where-Object Name -like 'OpenSSH*'
```

5. It now tells you that OpenSSH.Client has been successfully installed.

```
Name : OpenSSH.Client~~~~0.0.1.0  
State : Installed  
  
Name : OpenSSH.Server~~~~0.0.1.0  
State : NotPresent
```

Warning: If the above prompt does not appear, it means that your Windows system is still too old, and you are advised to install a third-party SSH tool, like *PuTTY*.

6. Now restart PowerShell and continue to run it as administrator. At this point you will be able to log in to your Raspberry Pi using the ssh command, where you will be prompted to enter the password you set up earlier.



```
pi@raspberrypi: ~
Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.

PS C:\Windows\system32> ssh pi@raspberrypi.local
key_load_public: invalid format
Load key "C:\\Users\\Daisy\\.ssh\\id_rsa": invalid format
pi@raspberrypi.local's password:
Linux raspberrypi 5.15.61-v7+ #1579 SMP Fri Aug 26 11:10:59 BST 2022 armv7l

The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Mon Feb 13 08:16:12 2023 from 192.168.6.149
pi@raspberrypi: $
```

8.3 PuTTY

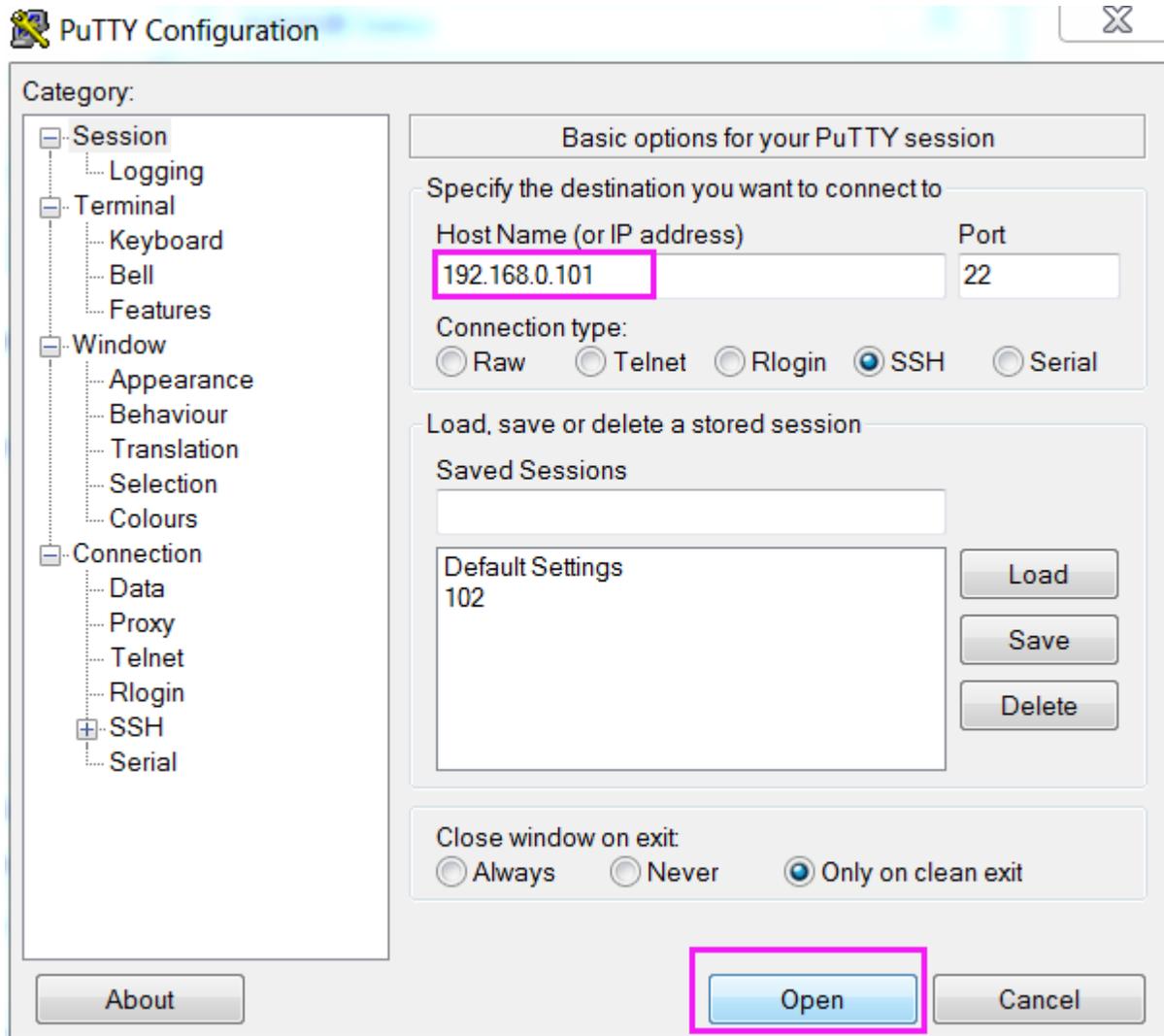
If you are a Windows user, you can use some applications of SSH. Here, we recommend PuTTY.

Step 1

Download PuTTY.

Step 2

Open PuTTY and click **Session** on the left tree-like structure. Enter the IP address of the RPi in the text box under **Host Name (or IP address)** and **22** under **Port** (by default it is 22).



Step 3

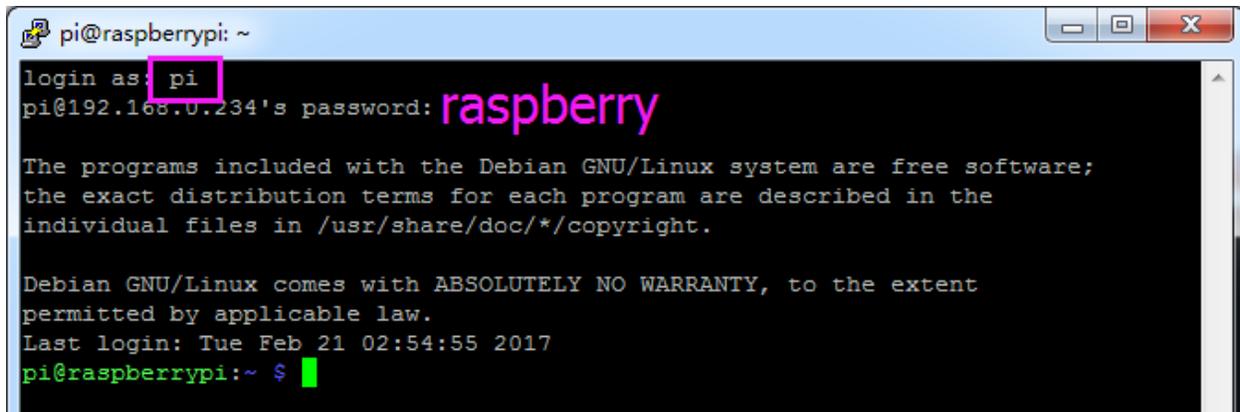
Click **Open**. Note that when you first log in to the Raspberry Pi with the IP address, there prompts a security reminder. Just click **Yes**.

Step 4

When the PuTTY window prompts "**login as:**", type in "**pi**" (the user name of the RPi), and **password:** "raspberrry" (the default one, if you haven't changed it).

Note: When you input the password, the characters do not display on window accordingly, which is normal. What you need is to input the correct password.

If inactive appears next to PuTTY, it means that the connection has been broken and needs to be reconnected.



```
pi@raspberrypi: ~
login as: pi
pi@192.168.0.234's password: raspberry

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individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Tue Feb 21 02:54:55 2017
pi@raspberrypi:~ $
```

Step 5

Here, we get the Raspberry Pi connected and it is time to conduct the next steps.

9.1 OLED Screen Not Working?

If the OLED Screen is not displaying or displaying incorrectly, you can follow these steps to troubleshoot the issue:

Check if the FPC cable of the OLED Screen is properly connected.

1. Use the following command to view the program's run logs and check for error messages.

```
cat /opt/pironman5/log
```

2. Alternatively, use the following command to check if the OLED's i2c address 0x3C is recognized:

```
sudo i2cdetect -y 1
```

3. If the first two steps don't reveal any issues, try restarting the pironman5 service to see if that resolves the problem.

```
sudo pironman5 restart
```

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