

Orange Pi 5 Pro User Manual



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1. Basic features of Orange Pi 5 Pro

1.1. What is Orange Pi 5 Pro

The Orange Pi 5 Pro adopts the new generation of 8-core 64 bit ARM processors from the Ruixin Micro RK3588S, specifically the quad core A76 and quad core A55. It adopts the Samsung 8nm LP process technology, with a large core main frequency of up to 2.4GHz. It integrates the ARM Mali-G610 MP4 GPU, embedded with high-performance 3D and 2D image acceleration modules, and an AI accelerator NPU with up to 6 Tops of computing power. It has 4GB/8GB/16GB (LPDDR5) memory and up to 8K display processing capabilities.

The Orange Pi 5 Pro offers a wide range of interfaces, including HDMI output, Wi Fi 5, M.2 PCIe 2.0x1, Gigabit Ethernet ports, support for PoE+(requiring PoE+HAT), USB2.0, USB3.1 interfaces, and 40pin expansion pins. It can be widely used in high-end tablet, edge computing, artificial intelligence, cloud computing, AR/VR, intelligent security, smart home and other fields, covering all AIoT industries.

Orange Pi 5 Pro supports the official operating system Orange Pi OS developed by Orange Pi, as well as operating systems such as Android 12.1, Debian11, Debian12, Ubuntu 20.04, and Ubuntu 22.04.

1.2. Purpose of Orange Pi 5 Pro

We can use it to achieve:

- A Linux desktop computer
- A Linux network server
- Android tablet
- Android game consoles, etc

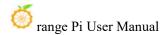
Of course, there are also many other features. With a powerful ecosystem and a variety of expansion accessories, Orange Pi can help users easily achieve delivery from creativity to prototype and then to mass production. It is an ideal creative platform for makers, dreamers, and hobbyists.

1.3. Hardware features of Orange Pi 5 Pro

| | Introduction to Hardware Features |
|-----------------|--|
| | • Rockchip RK3588S (8nm LP process) |
| | • 8-core 64 bit processor |
| CPU | • 4-core Cortex-A76 and 4-core Cortex-A55 large and small |
| CPU | core architectures |
| | • The maximum frequency of the large core is 2.4GHz, while |
| | the maximum frequency of the small core is 1.8GHz |
| GPU | Integrated ARM Mali-G610 |
| | OpenGL ES1.1/2.0/3.2、 OpenCL 2.2 and Vulkan 1.2 |
| | • An AI accelerator NPU with built-in computing power of |
| NPU | up to 6 Tops |
| | Supports mixed operations of INT4/INT8/INT16 |
| | • HDMI 2.1, Maximum support 8K @60Hz |
| Video output | • HDMI 2.0, Maximum support 4K@60Hz |
| | 1* MIPI D-PHY TX 4Lane |
| Memory | 4GB/8GB/16GB (LPDDR5) |
| comera | • 1 * MIPI CSI 4Lane |
| camera | • 1 * MIPI D-PHY RX 4Lane |
| PMU | RK806-1 |
| | • EMMC socket, can be connected to external eMMC |
| | modules |
| Onboard storage | • 16MB QSPI No FLASH (default empty patch, reused with |
| Onooard storage | eMMC) |
| | MicroSD (TF) Card slot |
| | • PCIe 2.0x1 M.2 M-KEY (SSD) slot |
| Ethernet | 10/100/1000Mbps Ethernet, supports PoE+(requires |
| | PoE+HAT) |
| audio frequency | • 3.5mm headphone jack audio input/output |
| | On board MIC input |

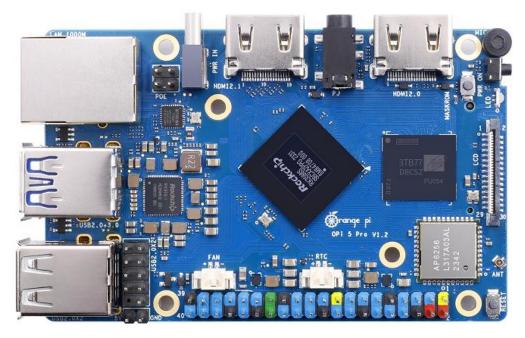


| | • 2 * HDMI output |
|--|---|
| PCIe M.2 M-KEY | Supports SSD |
| | 1 * USB3.0 Supports Device or HOST mode |
| USB interface | 3 * USB2.0 HOST |
| USB Interface | 2 * USB2.0 HOST (Lead out through 9-pin pin pin |
| | arrangement) |
| 40pin Extended needle | Used to expand UART, PWM, I2C, SPI, CAN, and GPIO |
| arrangement | interfaces |
| Debug UART | Included in the 40PIN expansion port |
| LED lamp | RGB LED Three color indicator light |
| Keys | 1 * MaskROM key, 1 * RESET key, 1 * On/Off key |
| power supply | Type-C interface power supply 5V/5A; |
| Supported operating | Orange Pi OS (Droid), Orange Pi OS (Arch), Android12.1, |
| systems | Debian11、Debian12、Ubuntu20.04 and Ubuntu22.04 etc |
| Introduction to appearance specifications | |
| Product size | 89mm*56mm |
| weight | 58g |
| ⁶ range Pi [™] is a registered trademark of Shenzhen Xunlong Software Co., Ltd | |

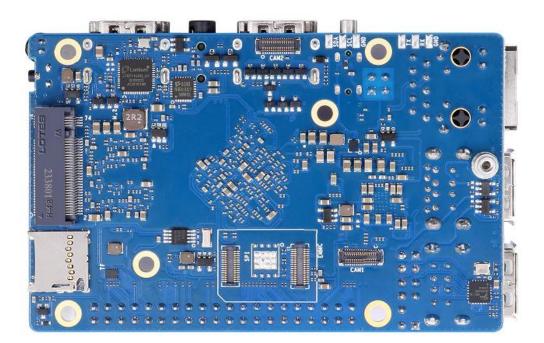


1.4. Top and Bottom Views of Orange Pi 5 Pro

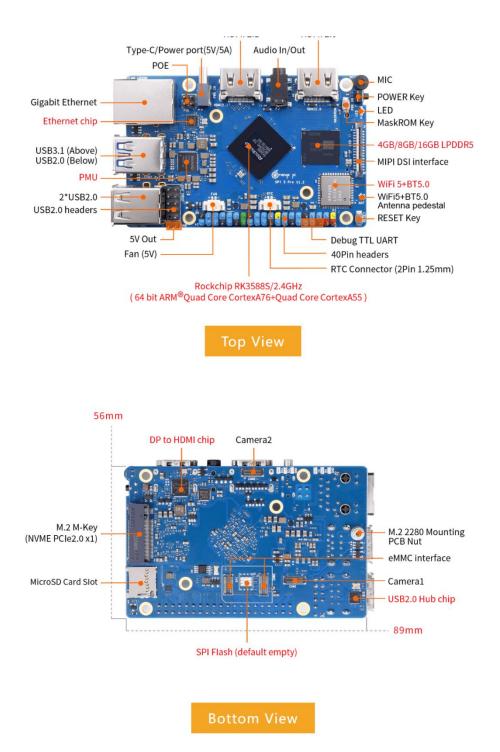
Top view:

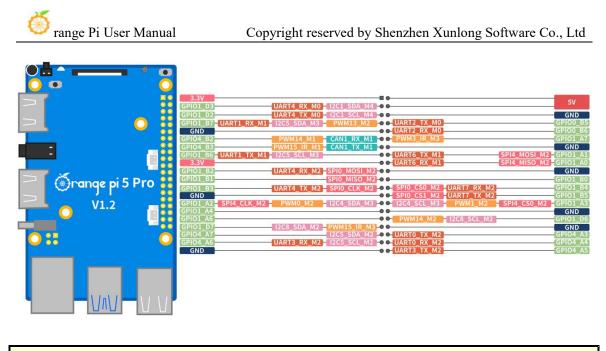


Bottom view:



1.5. **1.5. Interface Details of Orange Pi 5 Pro**





The diameter of all four positioning holes is 3.0mm.

2. Introduction to using the development board

2.1. Prepare the necessary accessories

1) TF card, a **class10** or above high-speed SanDisk card with a minimum capacity of 8GB (32GB or above is recommended)



2) TF card reader, used to burn images into TF cards



3) HDMI interface display



4) HDMI to HDMI connection cable, used to connect the development board to an HDMI monitor or TV for display



Note that if you want to connect to a 4K or 8K monitor, please ensure that the HDMI cable supports 4K or 8K video output.

5) 10.1-inch MIPI screen, used to display the system interface of the development board (this screen includes adapter board and OPi5Plus/OPi5B/OPi5/OPi5Pro universal)



6) Power adapter, Orange Pi 5 Pro recommends using a 5V/5A Type-C power supply for power supply



The Type-C power interface of the development board does not support PD negotiation function and only supports fixed 5V voltage input.

7) USB interface mouse and keyboard, as long as it is a standard USB interface mouse and keyboard, can be used to control the Orange Pi development board



8) USB camera

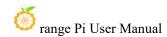


9) 5V cooling fan. As shown in the following figure, there are interfaces on the development board for connecting the cooling fan. The specifications of the interfaces are **2pin 1.25mm spacing**

The fan on the development board can be adjusted for speed and switch through PWM.



10) 100Mbps or Gigabit Ethernet cable, used to connect the development board to the Internet





11) USB 2.0 corporate to corporate data cable, used for burning images to eMMC, NVMe SSD, and other functions



12) OV13850 camera with 13 million MIPI interface



13) OV13855 camera with 13 million MIPI interface



14) When using the serial port debugging function, a **3.3V** USB to TTL module and DuPont cable are required to connect the development board and computer with the USB to TTL module and DuPont cable





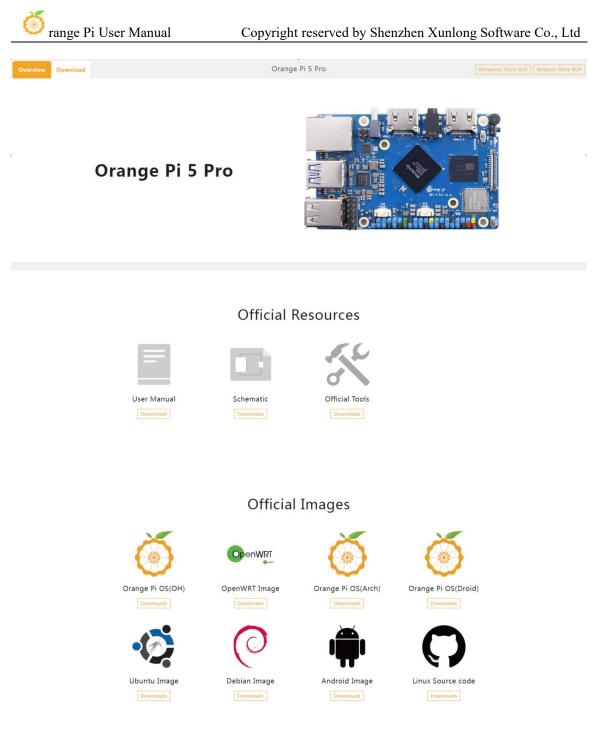
15) Personal computers with Ubuntu and Windows operating systems installed

| 1 | Ubuntu22.04 PC | Optional, used to compile Linux source code |
|---|----------------|---|
| 2 | Windows PC | Used to burn Android and Linux images |

2.2. Download the image of the development board and related materials

1) The website for downloading the English version:

http://www.orangepi.org/html/hardWare/computerAndMicrocontrollers/service-and -support/Orange-Pi-5-Pro.html



- 2) The information mainly includes
 - a. Android source code: saved on Google Drive
 - b. Linux source code: saved on Github
 - c. User manual and schematic diagram: saved on Google Drive
 - d. **Official tools**: mainly include the software that needs to be used during the use of the development board
 - e. Android image: saved on Google Drive
 - f. Ubuntu image: saved on Google Drive

- g. Debian image: saved on Google Drive
- h. Orange Pi OS image: saved on Google Drive
- i. **OpenWRT** image: saved on Google Drive

2. 3. How to burn Linux image to TF card based on Windows PC

Note that the Linux image referred to here specifically refers to Linux distribution images such as Debian, Ubuntu, OpenWRT, or OPi OS Arch downloaded from the Orange Pi download page.

2. 3. 1. How to use balenaEtcher to burn Linux

1) First prepare a TF card with a capacity of 16GB or more. The transmission speed of the TF card must be **class 10** or above. It is recommended to use a TF card of SanDisk and other brands

2) Then use the card reader to insert the TF card into the computer

3) Download the Linux operating system image file compression package that you want to burn from the **Orange Pi data download page**, and then use the decompression software to decompress it. Among the decompressed files, the file ending with ".img" is the image file of the operating system. The size is generally more than 2G

Note that if you are downloading an OpenWRT image, you will see the following three types of images in the download link of the OpenWRT image. Please select the image file in the "TF Card, eMMC, and NVME SSD Boot Image" folder.



 4) Then download the Linux image burning software - balenaEtcher, from: https://www.balena.io/etcher/

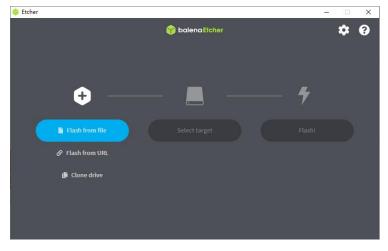
5) After entering the BalenaEtcher download page, clicking the green download button will redirect you to the software download location



6) Then you can choose to download the Portable version of BalenaEtcher software. The Portable version does not need to be installed, and can be opened by double clicking to use it

| DOWNLOAD | | | |
|--|---------------|---------|------------------------------------|
| Download Etc | her | | |
| ASSET ETCHER FOR WINDOWS (X86 X64) (INSTALLER) | OS WINDOWS | ARCH | Download |
| ETCHER FOR WINDOWS (X86 X64) (INSTALLER) | WINDOWS | X86 X64 | Download |
| ETCHER FOR WINDOWS (LEGACY 32 BIT) (X86 X64) (PORTABLE) | WINDOWS | X86 X64 | Download |
| ETCHER FOR MACOS | MACOS | X64 | Download |
| ETCHER FOR LINUX X64 (64-BIT) (APPIMAGE) | LINUX | X64 | Download |
| ETCHER FOR LINUX (LEGACY 32 BIT) (APPIMAGE) | LINUX | X86 | Download |
| Looking for Debian (.deb) packages or Red Hat (.rpm) packages? | | 🕻 oss | hosting by <mark>cloudsmith</mark> |

7) If you are downloading a version of BalenaEtcher that requires installation, please install it before using it. If you download the Portable version of balenaEtcher, simply double-click to open it. The interface of balenaEtcher after opening is shown in the following figure:



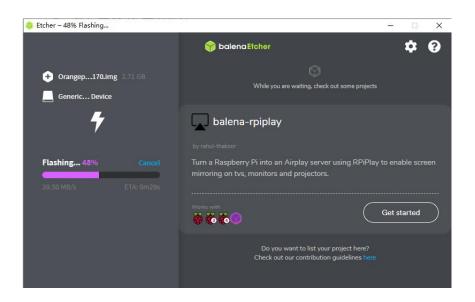
If the following error is prompted when opening balenaEtcher:



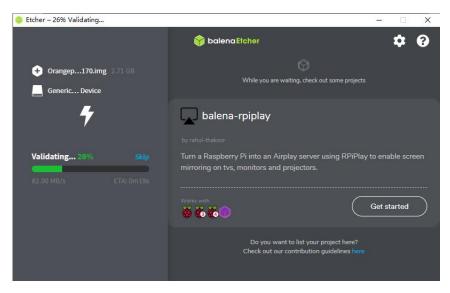
- 8) The specific steps to use balenaEtcher to burn the Linux image are aa follow
 - a. First select the path of the Linux image file to burned
 - b. Then select the drive letter of the TF card
 - c. Finally, click Flash to start burning the Linux image to the TF card



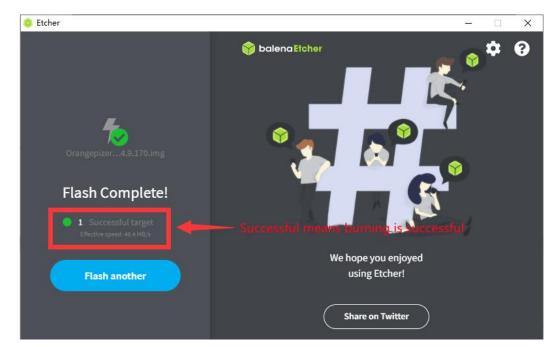
9) The interface displayed in the process of burning the Linux image by balenaEtcher is shown in the figure below, and the progress bar displays purple, indicating that the Linux image is being burned into the TF card



10) After burning the Linux image, balenaEtcher will also verify the image burned into the TF card by default to ensure that there is no problem in the burning process. As shown in the figure below, a green progress bar indicates that the image has been burnt, and balenaEtcher is verifying the burnt image



11) After successful burning, the display interface of balenaEtcher is shown in the figure below. If a green indicator icon is displayed, it means that the image burning is successful. At this time, you can exit balenaEtcher, and then pull out the TF card and insert it into the TF card slot of the development board for use up



2. 3. 2. How to use RKDevTool to burn Linux image to TF card

1) Please select balenaEtcher, right-click, and then select Run as administrator.



2) You also need to prepare a 16GB or larger TF card. The transmission speed of the TF card must be **class 10** or above. It is recommended to use a TF card of SanDisk and other brands

3) Then insert the TF card into the card slot of the development board

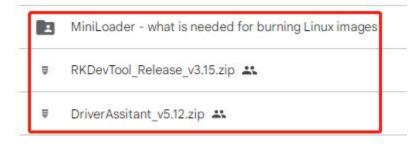


4) Then download the Ruixin micro driver **DriverAssitant_v5.12.zip**. zip and MiniLoader, as well as the burning tool **RKDevTool_Release_v3.15.zip**, from **Orange Pi's data download page**

a. On the Orange Pi data download page, first select the **official tool** and then enter the folder below



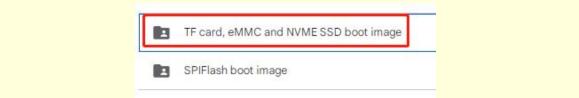
b. Then download all the files below



Note that the "MiniLoader - something needed to burn Linux images" folder is hereinafter referred to as the MiniLoader folder.

5) Then download the Linux operating system image file compression package that you want to burn from the **Orange Pi data download page**, and then use the decompression software to decompress it. Among the decompressed files, the file ending with "**.img**" is the image file of the operating system , the size is generally above 2GB

Note that if you are downloading an OpenWRT image, you will see the following three types of images in the download link of the OpenWRT image. Please select the image file in the "TF Card, eMMC, and NVME SSD Boot Image" folder.



6) Then use the decompression software to unzip **DriverAssitant_v5.12.zip**. zip, and then find the **DriverInstall.exe** executable file in the unzipped folder and open it

| 🏐 range Pi User Manual | Copyright reserved | by Shenzhen | Xunlong Software Co | o., Ltd |
|------------------------|--------------------|-------------|---------------------|---------|
| 名称 ^ | 修改日期 | 类型 | 大小 | |
| ADBDriver | 2022/12/1 15:07 | 文件夹 | | |
| bin | 2022/12/1 15:07 | 文件夹 | | |
| Driver | 2022/12/1 15:07 | 文件夹 | | |
| config | 2014/6/3 15:38 | 配置设置 | 1 KB | |
| le DriverInstall | 2022/2/28 14:11 | 应用程序 | 491 KB | |
| Readme | 2018/1/31 17:44 | 文本文档 | 1 KB | |
| revison | 2022/2/28 14:14 | 文本文档 | 1 KB | |
| | | | | |

7) After opening **DriverInstall.exe**, the steps to install the Rockchip driver are as follows

a. Click the "Driver Installation" button

| 驱动安装 | |
|------|--|
| | |

b. After waiting for a while, a pop-up window will prompt "driver installed successfully", and then click the "OK" button.

| | DriverInstall X | 7 |
|-------|-----------------|----|
| NZ运力学 | | 印载 |
| | 安装驱动成功. | |
| | | |

8) Then decompress **RKDevTool_Release_v3.15.zip**. This software does not need to be installed. You can find **RKDevTool** in the unzipped folder and open it

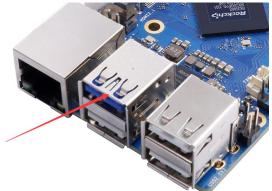
| 名称 ^ | 修改日期 | 类型 | 大小 |
|-----------------|------------------|-----------------|----------|
| bin . | 2022/12/1 15:07 | 文件夹 | |
| Language | 2022/12/1 15:07 | 文件夹 | |
| 🗋 config.cfg | 2022/3/23 9:11 | CFG 文件 | 7 KB |
| 🔄 config | 2021/11/30 11:04 | 配置设置 | 2 KB |
| revision | 2022/5/27 9:09 | 文本文档 | 3 KB |
| 🔀 RKDevTool | 2022/5/27 9:06 | 应用程序 | 1,212 KB |
| ☑ 开发工具使用文档_v1.0 | 2021/8/27 10:28 | Foxit PDF Reade | 450 KB |

9) After opening the **RKDevTool** burning tool, because the computer has not been connected to the development board through the Type-C cable at this time, the lower left

corner will prompt "No device found"

| * | | 存储 | 地址 | 名字 | 路径 | |
|----------|---|----|------------|-----------|----|---|
| | Г | | 0x00000000 | Loader | | |
| 2 | | | 0x00000000 | Faraneter | | |
| 3 | Г | | 0x00000000 | Uboot | | 2 |
| 1 | Г | | 0x00000000 | trust | | |
| | | | 0x00000000 | Misc | | |
| | | | 0x00000000 | Resource | | |
| | | | 0x00000000 | Kernel | | |
| <u>e</u> | | | 0x00000000 | Boot | | - |
| 1 | Г | | 0x00000000 | Recovery | | |
| 10 | Г | | 0x00000000 | System | | |
| 11 | | | 0x00000000 | Backup | | |

- 10) Then start burning the Linux image to the TF card
 - a. Firstly, connect the development board to the Windows computer through a USB male to female data cable. The location of the USB flash port on the development board is shown in the following figure



- b. Then insert the TF card into the development board and ensure that the board is not connected to a power source
- c. Then hold down the MaskROM button on the development board and hold it down. The position of the MaskROM button on the development board is shown in the following figure:



d. Then connect the Type-C interface power supply to the development board and power it on, then you can release the MaskROM button



e. If the previous steps are successful, the development board will enter the **MASKROM** mode at this time, and the interface of the burning tool will prompt "found a MASKROM device"

| • | | 存储 | 地址 | 名字 | 路径 | |
|----|------|----|------------|-----------|----------|--|
| | Г | | 0x00000000 | Loader | | |
| 2 | Г | | 0x00000000 | Parameter | | |
| 3 | | | 0x00000000 | Uboot | | |
| 1 | | | 0x00000000 | trust | | |
| 5 | | | 0x00000000 | Misc | | |
| ŝ | | | 0x00000000 | Resource | | |
| 7 | Г | | 0x00000000 | Kernel | | |
| 3 | Г | | 0x00000000 | Boot | | |
| 3 | Г | | 0x00000000 | Recovery | | |
| 10 | Г | | 0x00000000 | System | | |
| 11 | Г | | 0x00000000 | Backup | | |
| | ler: | | 执行 | 切换 | 设备分配表 清空 | |

f. Then place the mouse cursor in the area below

| # | | 存储 | 地址 | 名字 | 路径 | | |
|------|-------|----|-------------|-----------|----------|--------|------------------------------------|
| 1 | | | 0x00000000 | Loader | | | |
| 2 | | | 0x00000000 | Parameter | | | |
| 3 | | | 0x00000000 | Vboot | | | |
| 4 | Г | | 0x00000000 | trust | | 1 | |
| 5 | | | 0x00000000 | Misc | | 11 T | |
| 6 | Г | | 0x00000000 | Resource | | | |
| 7 | Г | | 0x00000000 | Kernel | | 1 | |
| 8 | | | 0x00000000 | Boot | | 10.000 | |
| 9 | | | 0x00000000 | Recovery | | | |
| 10 | | | 0x00000000 | System | | | |
| 11 | | | 0x00000000 | Backup | | | |
| Load | ler : | | 执行 □ 强制按地址写 | 切换 | 设备分区表 清空 | | Place the mouse cursor in this are |

g. Then click the right mouse button and the selection interface shown in the figure below will pop up

🧐 range Pi User Manual

| : | | 存储 地址 | 名字 | 路径 | | | | |
|------|------|--------------|--------------|-----|----------------------|--|--|--|
| 1 | Г | 0x00000 | 00 Loader | | | | | |
| 2 | Г | 0x00000 | 00 Parameter | | | | | |
| 3 | Г | 0x00000 | 00 Vboot | | | | | |
| 4 | | 0x00000 | 00 trust | | 添加项 | | | |
| 5 | | 0x00000 | 00 Misc | | | | | |
| 6 | | 0x00000 | 00 Resource | | 删除项 | | | |
| 7 | Г | 0x00000 | 00 Kernel | | 清空所有项 | | | |
| 8 | Г | 0x00000 | 00 Boot | | 上移 | | | |
| 9 | Г | 0x00000 | 00 Recovery | | | | | |
| 10 | Г | 0x00000 | 00 System | | 下移 | | | |
| 11 | Г | 0x00000 | 00 Backup | | 导入配置 | | | |
| Load | ler: | 执行 □ 强制技地 | 切换 | 设备分 | 导出配置 区表 清空 | | | |

h. Then select the **import configuration** option

| ; | | 存储 | 地址 | 名字 | 路径 | | | | | |
|-----|-----|----|----------------|-----------|------|-------------------------|---|--|--|--|
| | Г | | 0x00000000 | Loader | | | | | | |
| | Г | | 0x00000000 | Parameter | | | | | | |
| | Г | | 0x00000000 | Uboot | | | | | | |
| | | | 0x00000000 | trust | | 添加项 | | | | |
| | | | 0x00000000 | Misc | | 删除项 | | | | |
| | | | 0x00000000 | Resource | | | | | | |
| | Г | | 0x00000000 | Kernel | | 清空所有项 | | | | |
| | | | 0x00000000 | Boot | | 上移 | | | | |
| | | | 0x00000000 | Recovery | | 下移 | | | | |
| 0 | Г | | 0x00000000 | System | | | | | | |
| 1 | | | 0x00000000 | Backup | | 导入配置 | | | | |
| oad | er: | | 执行 □ 强制按地址写 | 切换 | 设备分[| 导出配置 Z表 清空 |] | | | |

i. Then select the rk3588_linux_tfcard.cfg configuration file in the MiniLoader folder downloaded earlier, and click **Open**

| 🏦 🔀 打开 | | | | × |
|-------------|---|-----|-------------------|--------|
| ← → < 1 | 📙 « orangepi → MiniLoader-烧录Linux镜像才需要用到的东西 | ٽ ~ | | 录Linux |
| | 建文件夹 | | BB 💌 | • • |
| 此电脑 | rk3588_linux_emmc.cfg | | | |
| 🧊 3D 对象 | rk3588 linux pcie.cfg | | | |
| 📕 视频 | rk3588_linux_tfcard.cfg | | | |
| ■ 图片 | | | | |
| 🖹 文档 | 1 | | | |
| 🕹 下載 | | | | |
| ▶ 音乐 | | | | |
| 直桌 📃 | | | | |
| · 本地磁盘 | M | | | |
| ler an area | | | ConfigFile(*.cfg) | ~ |
| der 🦔 🗠 📼 🗠 | 文件名(N): rk3588_linux_tfcard.cfg | ~ | | |

j. Then click **OK**

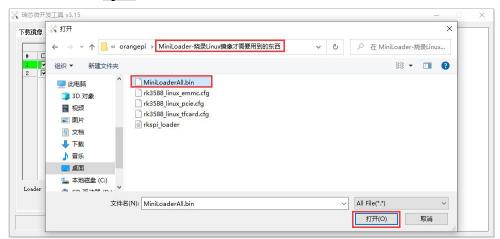
orange Pi User Manual

| # | | 存储 | 地址 | 名字 | 路径 | | |
|---|---|-------|------------|--------|---------------------------------|---|--|
| 1 | ~ | 12.04 | 0x00000000 | Loader | C:\Users\Administrator\Desktop\ | | |
| 2 | ~ | SD | 0x00000000 | linux | C:\Users\Administrator\Desktop\ | and the second se | |
| | | | | | 1 寻入配置成功 确定 | t. | |
| | | | 执行 | 切换 | 设备分区表 清空 | | |

k. Then click the position shown in the figure below

| 試 镜1 | | | | | |
|-------------|---|----|------------|--------|---------------------------------|
| # | | 存储 | 地址 | 名字 | 路径 |
| 1 | ~ | | 0x00000000 | Loader | C:\Users\Administrator\Desktop\ |
| 2 | ~ | SD | 0x00000000 | linux | C:\Users\Administrator\Desktop\ |
| | | | | | |
| oade | | | 执行 | 切换 | 设备分区表 清空 |

1. Select MiniLoaderAll.bin in the MiniLoader folder downloaded earlier, and then click to open



m. Then click on the location shown in the following image

💮 range Pi User Manual

| | 地址 | 名字 | 路径 | |
|----------|--------------------------|-----------------|---|--|
| v | 0x00000000 0x00000000 | Loader linux | C:\Users\lee\Desktop\Android和L C:\Users\Administrator\Desktop\ | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

n. Then select the path to the Linux image you want to burn, and click open

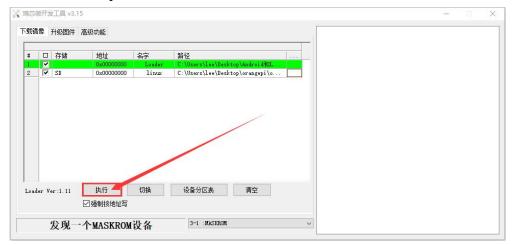
Before burning the image, it is recommended to rename the Linux image to orangepi.img or other shorter names, so that the percentage of burning progress can be seen when burning the image.

| 镜像 🔀 打开 | | × |
|--|---|-------------------|
| ← → * ↑ | → 此电脑 → 桌面 → orangepi → | ✓ ひ |
| ● 组织 ▼ 新建文 | (件夹 | ## - 11 () |
| □ 此电脑 ③ 3D 对象 圖 视频 圖 则片 劒 文档 ↓ 下號 〕 音乐 ■ 桌面 二 本地磁盘 (C: | ↑ MiniLoader-探录Linux镜像才需要用到的东 ◎ orangepi | 西 |
| | | ✓ All File(*.*) ✓ |

o. Then please check the option to force writing by address

| 专心将 | 数开发 | 江具 v3. | 15 | | | | | | | - | > |
|------|-------|------------|------------------|--------------|--------------------|---------------|----------|--|--|---|---|
| 载镜 | 像 | 升级固件 | 高级功能 | | | | | | | | |
| # | | 存储 | 地址 0x00000000 | 名字 Loader | 路径 C:\Users\lee | Desktop\Andro | | | | | |
| 2 | • | SD | 0x00000000 | linux | C:\Users\lee' | Desktop\orang | gepi\o | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | / | | | | | |
| Load | er Ve | er:1.11 | 执行 | 切换 | 设备分区表 | 青空 | 5 | | | | |
| Load | er Ve | er : 1. 11 | した 「図録制技術」に写 | 切换 | 设备分区表 | 清空 | <u>5</u> | | | | |

p. Clicking the execute button again to start burning the Linux image to the TF card of the development board



q. The displayed log after burning the Linux image is shown in the following figure

| | | | | | | 等待Maskrom开始 | |
|------|-------|----------|------------|--------|---------------------------------|---|--|
| # | | | 地址 | 名字 | 路径 | 等待Maskrom成功 | |
| 1 | | | 0x00000000 | Loader | Desktop\orangepi\orangepi\MiniL | 测试设备开始 | |
| 2 | | SD | 0x00000000 | linux | Desktop\orangepi\orangepi\orang | 测试设备成功 | |
| | | | | | | 校验芯片开始 | |
| | | | | | | 校验芯片成功 获取FlashInfo开始 | |
| | | | | | | 获取FlashInfo成功 | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | 准备IDB开始 | |
| | | | | | | 准备IDB开始 准备IDB成功 | |
| | | | | | | 准备IDB开始 准备IDB成功 下载IDB开始 | |
| | | | | | | 准备IDB开始 准备IDB成功 下载IDB开始 下载IDB开始 | |
| | | | | | | 准备100开始 准备1005成功 下载100开始 下载100成功 等待Ma.skron开始 | |
| | | | | | | 准备IDB开始 准备IDB成功 下载IDB开始 下载IDB成功 等待Maskron开始 等待Maskron开始 | |
| | | | | | | 准备IDB开始 准备IDB成功 下载IDB成功 等待Maskron开始 等待Maskron成功 测试设备开始 | |
| | | | | | | 准备 100开始 准备 100玩功 下载100玩动 等待100元的 等待100元100元功 等待114.200元功 则试设备开始 则试试会无力的 | |
| | | | | | | 准备 100开始 准备 100开始 下载100开动 下载100开动 等待Maskron开始 等待Maskron成功 测试设备开始 测试设备开始 测试设备成功 开始切损存储到50 | |
| Load | er Ve | 'er:1.11 | 执行 | 切换 | 设备分区表 清空 | 准备 100开始 准备 100玩功 下载100玩动 等待100元的 等待100元100元功 等待114.200元功 则试设备开始 则试试会无力的 | |

r. After burning the Linux image to the TF card, the Linux system will automatically start.

2. 3. 3. How to use Win32Diskimager to burn Linux image

1) First prepare a TF card with a capacity of 16GB or more. The transmission speed of the TF card must be **class 10** or above. It is recommended to use a TF card of SanDisk and other brands

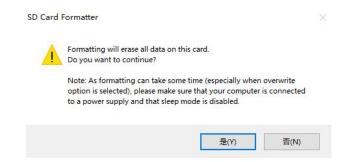
- 2) Then use the card reader to insert the TF card into the computer
- 3) Then format the TF
 - a. **SD Card Formatter** can be used to format the TF card. The download address is:

https://www.sdcard.org/downloads/formatter/eula_windows/SDCardFormatterv5_WinEN.zip

- b. After downloading, unzip and install directly, and then open the softwar
- c. If only a TF card is inserted into the computer, the drive letter of the TF card will be displayed in the "**Select card**" column. If multiple USB storage devices are inserted into the computer, you can select the corresponding drive letter of the TF card through the drop-down box.

| Select card | | |
|------------------|----------------|---------|
| F:\ | | ~ |
| | | Refresh |
| Card information | 1 | |
| Туре | SDHC | 53 |
| Capacity | 14.84 GB | |
| Formatting optic | ns | |
| Quick format | | |
| Overwrite for | mat | |
| CHS format s | ize adjustment | |
| Volume label | | |
| | | |
| 1. | | |
| | | |

d. Then click "Format", a warning box will pop up before formatting, and formatting will start after selecting "Yes (Y) "

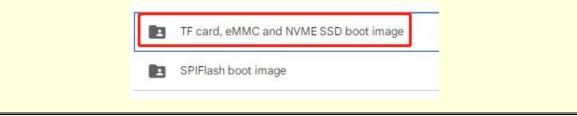


e. After formatting the TF card, the information shown in the figure below will pop up, click OK



4) Then download the Linux operating system image file compression package that you want to burn from the **Orange Pi data download page**, and then use the decompression software to decompress it. Among the decompressed files, the file ending with "**.img**" is the image file of the operating system , the size is generally above 2GB

Note that if you download an OpenWRT image, you will see the following three types of images in the download link of the OpenWRT image. Please select the "TF card boot image" folder.



- 5) Use Win32Diskimager to burn the Linux image to the TF Card
 - a. The download page of Win32Diskimager is

http://sourceforge.net/projects/win32diskimager/files/Archive/

- b. After downloading, install it directly. The interface of **Win32Diskimager** is as follows
 - a) First select the path of the image
 - b) Then confirm that the drive letter of the TF card is consistent with that displayed in the "**Device**" column
 - c) Finally click "Write" to start burn

| 映像文件 | | | | 设备 [F:\] · |
|--|-----------|---------|----------|---------------|
| 校验值 无 ▼ 生成 复制 | | | | 1 |
| Select | the image | file Se | elect th | e TF cai |
| Select 仅读取已分配分区 任务进度 | the image | ine | elect th | e TF cai |

c. After the image writing is completed, click the "Exit" button to exit, and then you can pull out the TF card and insert it into the development board to start

2.4. How to burn Linux image to TF card based on Ubuntu

Note that the Linux image referred to here specifically refers to Linux distribution images such as Debian, Ubuntu, OpenWRT, or OPi OS Arch downloaded from the Orange Pi download page. Ubuntu PC refers to a personal computer with the Ubuntu system installed.

1) First prepare a TF card with a capacity of 16GB or more. The transmission speed of the TF card must be **class 10** or above. It is recommended to use a TF card of SanDisk and other brand

2) Then use the card reader to insert the TF card into the computer

 Download the balenaEtcher software, the download address is: https://www.balena.io/etcher/

4) After entering the BalenaEtcher download page, clicking the green download button will redirect you to the software download location



5) Then choose to download the Linux version of the software

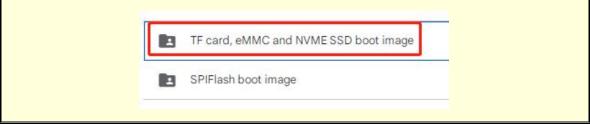


Download Etcher

| ASSET | OS | ARCH | |
|---|---------|---------|----------|
| ETCHER FOR WINDOWS (X86 X64) (INSTALLER) | WINDOWS | X86 X64 | Download |
| ETCHER FOR WINDOWS (X86 X64) (PORTABLE) | WINDOWS | X86 X64 | Download |
| ETCHER FOR WINDOWS (LEGACY 32 BIT) (X86 X64) (PORTABLE) | WINDOWS | X86 X64 | Download |
| ETCHER FOR MACOS | MACOS | X64 | Download |
| ETCHER FOR LINUX X64 (64-BIT) (APPIMAGE) | LINUX | X64 | Download |
| ETCHER FOR LINUX (LEGACY 32 BIT) (APPIMAGE) | LINUX | X86 | Download |

6) Download the compressed file of the Linux operating system image that you want to burn from **Orange Pi's information download page**, and then use decompression software to extract it. In the extracted file, the file ending in "**.img**" is the operating system image file, which is generally over 2GB in size

Note that if you are downloading an OpenWRT image, you will see the following three types of images in the download link of the OpenWRT image. Please select the image file in the "TF Card, eMMC, and NVME SSD Boot Image" folder.



| The decompression command for the compressed file ending in 7z is as follows |
|--|
| test@test:~\$ 7z x Orangepi5propro_1.0.0_debian_bullseye_desktop_xfce_linux5.10.160.7z |
| test@test:~\$ ls Orangepi5pro_1.0.0_debian_bullseye_desktop_xfce_linux5.10.160.* |
| Orangepi5pro_1.0.0_debian_bullseye_desktop_xfce_linux5.10.160.7z |
| Orangepi5pro_1.0.0_debian_bullseye_desktop_xfce_linux5.10.160.sha #Checksum |
| file |
| Orangepi5pro_1.0.0_debian_bullseye_desktop_xfce_linux5.10.160.img #Image file |

If you are downloading an OpenWRT image and the compressed file ends in gz, the decompression command is as follows

| test@test:~\$ gunzip openwrt-aarch64-opi5pro-24.03-linu | ıx-6.1.43-ext4.img.gz |
|--|-----------------------|
| test@test:~\$ ls openwrt-aarch64-opi5pro-24.03-linux-6.1 | .43-ext4.img |
| openwrt-aarch64-opi5pro-24.03-linux-6.1.43-ext4.img | #Image file |

7) After decompressing the image, you can first use the **sha256sum -c *.sha** command to calculate whether the checksum is correct. If the prompt is **successful**, it indicates that the downloaded image is not incorrect. You can rest assured to burn it to the TF card. If the prompt is that the **checksum does not match**, it indicates that there is a problem with the downloaded image. Please try downloading again

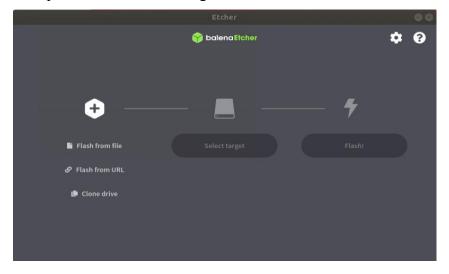
test@test:~\$ sha256sum -c *.sha

Orangepi5pro_1.0.0_debian_bullseye_desktop_xfce_linux5.10.160.img: OK

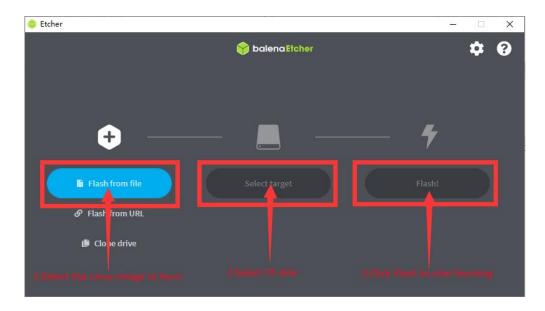
If you are downloading an OpenWRT image, you need to verify the compressed file instead of decompressing it before verifying it

test@test:~\$ **sha256sum -c openwrt-aarch64-opi5pro-24.03-linux-6.1.43-ext4.img.gz.sha** openwrt-aarch64-opi5pro-24.03-linux-6.1.43-ext4.img.gz: OK

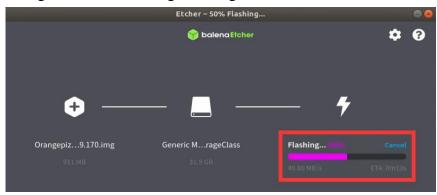
8) Then double-click **balenaEtcher-1.5.109-x64.AppImage** on the graphical interface of Ubuntu PC to open balenaEtcher (**no installation required**), and the interface after balenaEtcher is opened is shown in the figure belobalenaEtcher



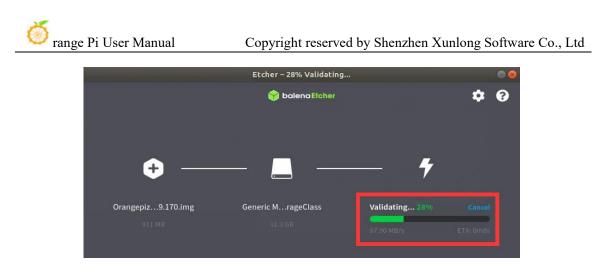
- 9) The specific steps to use balenaEtcher to burn the Linux image are as follows
 - a. First select the path of the Linux image file to be burned
 - b. Then select the drive letter of the TF Card
 - c. Finally, click Flash to start burning the Linux image to the TF Card



10) The interface displayed during the process of burning a Linux image with BalenaEtcher is shown in the following figure. In addition, the progress bar displays purple, indicating that the Linux image is being burned to the TF card



12) After burning the Linux image, balenaEtcher will also verify the image burned into the TF card by default to ensure that there is no problem in the burning process. As shown in the figure below, a green progress bar indicates that the image has been burnt, and balenaEtcher is verifying the burnt image.



13) The display interface of Balenaetcher after the successful record is completed. If the green indicator icon is displayed in the figure below, the image burning is successful, then you can exit Balenaetcher, then unplug the TF card into the TF card slot in the development board and use it.



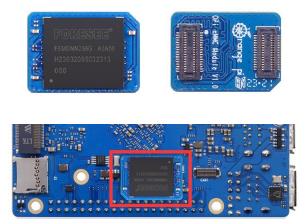
2.5. The method of burning Linux images into eMMC

2. 5. 1. Method of burning Linux images into eMMC using RKDevTool Note that all the operations below are performed on a Windows computer.

Note that the Linux image referred to here specifically refers to Linux distribution images such as Debian, Ubuntu, OpenWRT, or OPi OS Arch downloaded from the Orange Pi download page.

1) The development board has reserved an extension interface for the eMMC module.

Before burning the system to eMMC, it is necessary to first purchase an eMMC module that matches the eMMC interface of the development board. Then install the eMMC module onto the development board. The eMMC module and the method of inserting the development board are as follows:



2) Also need to prepare a good quality USB2.0 public to public data cable

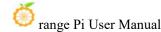


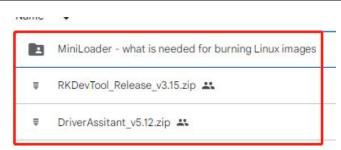
3) Then download the Ruixin micro driver **DriverAssitant_v5.12.zip** and **MiniLoader**, as well as the burning tool **RKDevTool_Release_v3.15.zip**, from **Orange Pi's data download page**

a. On the Orange Pi data download page, first select the official tool and then enter the folder below



b. Then download all the files below

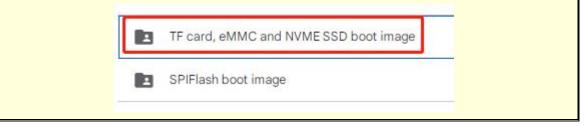




Note that the "MiniLoader - something needed to burn Linux images" folder is hereinafter referred to as the MiniLoader folder.

4) Then download the compressed file of the Linux operating system image that you want to burn from **Orange Pi's information download page**, and use decompression software to extract it. In the extracted file, the file ending in "**.img**" is the operating system image file, which is generally over 2GB in size

Note that if you are downloading an OpenWRT image, you will see the following two types of images in the download link of the OpenWRT image. Please download the image files from the "TF Card, eMMC, and NVME SSD Boot Images" folder.



5) Then use the decompression software to unzip **DriverAssitant_v5.12.zip**, and then find the **DriverInstall.exe** executable file in the unzipped folder and open it

| 名称 | 修改日期 | 类型 | 大小 |
|-----------------|-----------------|------|--------|
| ADBDriver | 2022/12/1 15:07 | 文件夹 | |
| 📙 bin | 2022/12/1 15:07 | 文件夹 | |
| Driver | 2022/12/1 15:07 | 文件夹 | |
| 🔄 config | 2014/6/3 15:38 | 配置设置 | 1 KB |
| 🥞 DriverInstall | 2022/2/28 14:11 | 应用程序 | 491 KB |
| Readme | 2018/1/31 17:44 | 文本文档 | 1 KB |
| revison | 2022/2/28 14:14 | 文本文档 | 1 KB |

6) After opening **DriverInstall.exe**, the steps to install the Rockchip driver are as follows

a. Click the "Driver Installation" button

| 驱动安装 | 驱动卸载 | |
|-----------|------|--|
| 364015235 | | |

b. After waiting for a while, a pop-up window will prompt "driver installed successfully", and then click the "OK" button.

| | | DriverInstall | × | 1 | |
|---|------|--|---|----|--|
| | 弘区之力 | The second s | ^ | 印载 | |
| | | 安装驱动成功. | | | |
| [| | 1 | | | |

7) Then unzip **RKDevTool_Release_v3.15.zip**. This software does not need to be installed. You can find **RKDevTool** in the unzipped folder and open it

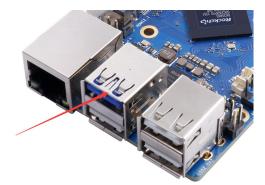
| 名称 | 修改日期 | 类型 | 大小 |
|-----------------|------------------|-----------------|----------|
| bin | 2022/12/1 15:07 | 文件夹 | |
| 📙 Language | 2022/12/1 15:07 | 文件夹 | |
| 🗋 config.cfg | 2022/3/23 9:11 | CFG 文件 | 7 KB |
| 🔄 config | 2021/11/30 11:04 | 配置设置 | 2 KB |
| revision | 2022/5/27 9:09 | 文本文档 | 3 KB |
| KKDevTool | 2022/5/27 9:06 | 应用程序 | 1,212 KB |
| ◎ 开发工具使用文档_v1.0 | 2021/8/27 10:28 | Foxit PDF Reade | 450 KB |

8) After opening the **RKDevTool** burning tool, because the computer has not been connected to the development board through the Type-C cable at this time, the lower left corner will prompt "**No device found**"

orange Pi User Manual

| | 0x00000000 0x00000000 | Loader Parameter | | | | | | | | | | |
|---|--------------------------|--|--|---|---|---|--|---|---|---|---|--|
| | 0x00000000 | Parameter | | | | | | | | | | |
| | | | | | | | | | | | | |
| | 0x00000000 | Vboot | | | | | | | | | | |
| | 0x00000000 | trust | | | | | | | | | | |
| | 0x00000000 | Misc | | | | | | | | | | |
| | 0x00000000 | Resource | 1 | | | | | | | | | |
| | 0x00000000 | Kernel | | | | | | | | | | |
| 1 | 0x00000000 | Boot | | | | | | | | | | |
| 7 | 0x00000000 | Recovery | | | | | | | | | | |
| | 0x00000000 | System | | | | | | | | | | |
| | 0x00000000 | Backup | | | | | | | | | | |
| | | 0x00000000 0x00000000 0x00000000 0x000000 | 0x0000000 Misc 0x0000000 Resource 0x0000000 Kernel 0x00000000 Boot 0x00000000 Boot 0x00000000 Recovery 0x00000000 System | 0x00000000 Misc 0x00000000 Resource 0x0000000 Resnal 0x0000000 Boct 0x00000000 Boct 0x00000000 Boct 0x00000000 Boct 0x00000000 System | 0x0000000 Misc 0x00000000 Resource 0x0000000 Kernal 0x00000000 Boot 0x00000000 Boot 0x00000000 System | 0x00000000 Misc 0x00000000 Resource 0x0000000 Resnal 0x0000000 Boot 0x00000000 Boot 0x00000000 Resourcery 0x00000000 System | 0x00000000 Nixc 0x00000000 Resource 0x00000000 Resnal 0x00000000 Bot 0x00000000 Bot 0x00000000 Resvery 0x00000000 System | 0x00000000 Mise 0x00000000 Resurve 0x00000000 Resurel 0x00000000 Beet 0x00000000 Beet 0x00000000 System | 0x00000000 Miss 0x00000000 Resource 0x00000000 Resnal 0x00000000 Best 0x00000000 Best 0x00000000 Resovery 0x00000000 System | 0x00000000 Nisc 0x00000000 Resource 0x00000000 Kernel 0x00000000 Boot 0x00000000 Recovery 0x00000000 System | 0x00000000 Nisc 0x00000000 Resource 0x00000000 Kernal 0x00000000 Boot 0x00000000 Boot 0x00000000 System | 0x0000000 Nisc 0x0000000 Resource 0x0000000 Kernel 0x0000000 Bot 0x0000000 Recovery 0x0000000 System |

- 9) Then start burning Linux images into eMMC
 - a. Firstly, connect the development board to the Windows computer through the USB2.0 public-to-public data cable. The location of the USB burning port on the development board is shown in the figure below



- b. Ensure that the development board is not inserted with a TF card or connected to a power source
- c. Then hold down the MaskROM button on the development board and hold it down. The position of the MaskROM button on the development board is shown in the following figure:



d. Then connect the Type-C interface power supply to the development board and power it on, then you can release the MaskROM button



e. If the previous steps are successful, the development board will enter MASKROM mode and the interface of the burning tool will prompt "Found a MASKROM device"

| # | | 存储 | 地址 | 名字 | 路径 | |
|-----|-----|----|------------|-----------|----------|--|
| | Г | | 0x00000000 | Loader | | |
| 2 | Г | | 0x00000000 | Parameter | | |
| 3 | Г | | 0x00000000 | Uboot | | |
| 1 | | | 0x00000000 | trust | | |
| 5 | | | 0x00000000 | Misc | | |
| 5 | | | 0x00000000 | Resource | | |
| 7 | Г | | 0x00000000 | Kernel | | |
| 3 | Г | | 0x00000000 | Boot | | |
| 3 | Г | | 0x00000000 | Recovery | | |
| 0 | Г | | 0x00000000 | System | | |
| 1 | | | 0x00000000 | Backup | | |
| oad | er: | | 执行 | 切换 | 设备分历表 清空 | |

f. Then place the mouse cursor in the area below

| # | | 存储 | 地址 0x00000000 | 名字 Loader | 路径 | | |
|------|-----|----|------------------|--------------|----------|-------|----------------------------------|
| 2 | - | | 0x00000000 | Parameter | | | |
| 3 | 亡 | | 0x00000000 | Uboot | | - | |
| 4 | T. | | 0x00000000 | trust | | | |
| 5 | Ē | | 0x00000000 | Misc | | | |
| 6 | Г | | 0x00000000 | Resource | | | |
| 7 | Г | | 0x00000000 | Kernel | | 22 12 | |
| 8 | Г | | 0x00000000 | Boot | | 11 | |
| 9 | | | 0x00000000 | Recovery | | | |
| 10 | | | 0x00000000 | System | | | |
| 11 | | | 0x00000000 | Backup | | | |
| Load | er: | [| 执行 | 切换 | 设备分区表 清空 |] | Place the mouse cursor in this a |

g. Then, clicking the right mouse button will pop up the selection interface shown in the following figure

| # | | 存储 | 地址 | 名字 | 路径 | | | | | |
|------|------|----|----------------|-----------|-----|--------------|-----|--|--|--|
| 1 | Г | | 0x00000000 | Loader | | | | | | |
| 2 | | | 0x00000000 | Parameter | | | | | | |
| 3 | | | 0x00000000 | Uboot | | | | | | |
| 4 | | | 0x00000000 | trust | | 添加项 | | | | |
| 5 | | | 0x00000000 | Misc | | | | | | |
| 6 | Г | | 0x00000000 | Resource | | 删除项 | | | | |
| 7 | | | 0x00000000 | Kernel | | 清空所有项 | | | | |
| 8 | Г | | 0x00000000 | Boot | | 上移 | | | | |
| 9 | Г | | 0x00000000 | Recovery | | 下移 | | | | |
| 10 | Г | | 0x000000000 | System | | | 1.1 | | | |
| 11 | | | 0x00000000 | Backup | | 导入配置 | | | | |
| Load | er : | | 执行 □ 强制按地址写 | 切换 | 设备分 | - 导出配置 区表 | | | | |

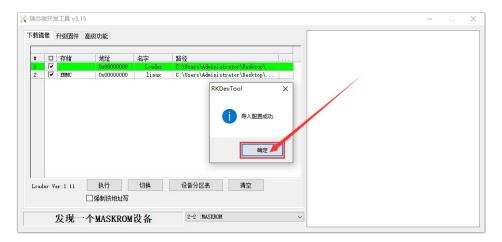
h. Then select the **import configuration** option

| # | | 存储 | 地址 | 名字 | 路径 | | | | | | | |
|------|------|----|------------|-----------|------|-----------------|-------|---|--|--|--|--|
| 1 | Г | | 0x00000000 | Loader | | | | | | | | |
| 2 | Г | | 0x00000000 | Parameter | | | | | | | | |
| 3 | | | 0x00000000 | Uboot | | | | | | | | |
| 4 | | | 0x00000000 | trust | | 添加项 | | | | | | |
| 5 | | | 0x00000000 | Misc | | 删除项 | | | | | | |
| 6 | | | 0x00000000 | Resource | | | | | | | | |
| 7 | | | 0x00000000 | Kernel | | 清空所有项 | | | | | | |
| 3 | | | 0x00000000 | Boot | | 上移 | 1.1 | ~ | | | | |
| 3 | | | 0x00000000 | Recovery | | 下移 | | | | | | |
| 10 | | | 0x00000000 | System | | | 1 - 1 | | | | | |
| 11 | | | 0x00000000 | Backup | | 导入配置 | | | | | | |
| .oad | er : | | 执行 | 切换 | 设备分区 | <u>与出配置</u> | | | | | | |

i. Then select the **rk3588_linux_emmc.cfg** configuration file from the **MiniLoader** folder downloaded earlier, and click to **open**

| 芯微开发工具 v3.15 《 打开 | | | × |
|---|-------------------------------------|-------------|----|
| ← → ◇ ↑ 📙 > 此电脑 > 桌面 > orangepi > MiniLoader-烧景Linux镜像才需要用到的东西 | ✔ ひ 2 在 MiniLo | oader-烧录Lin | ux |
| 组织▼ 新建文件夹 | | 88 • 🔳 | ? |
| ■ 此电脑 ③ 3D 对象 ■ 视频 ■ 刷片 ◎ 可片 ○ 方指 ▼ 木坊 ● 音乐 ■ 重面 ■ 本地磁盘 (C:) | | | |
| * co ™→** co `` 文/牛名(N): rk3588_linux_emmc.cfg | ConfigFile(*.cf | g) | ~ |
| | 打开(0) | 取消 | |

j. Then click **OK**



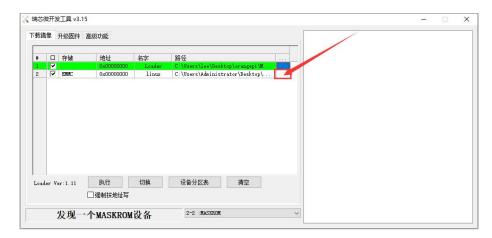
k. Then click on the location shown in the following image

| 131 | 改开发 | 工具 v3.15 | 8 | | | |
|--------|--|-----------|--------------------------|------------------|--|--|
| 截镇 | 像 | 升级固件 | 高级功能 | | | |
| ŧ | | 存储 | 地址 | 名字 | 路径 | |
| 1 2 | <td>EMMC</td><td>0x00000000 0x00000000</td><td>Loader linux</td><td>C:\Users\Administrator\Desktop\ C:\Users\Administrator\Desktop\</td><td></td> | EMMC | 0x00000000 0x00000000 | Loader linux | C:\Users\Administrator\Desktop\ C:\Users\Administrator\Desktop\ | |
| | | | 12 | 12 | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | V. | er:1.11 | 执行 | 切换 | 设备分区表 清空 | |
| 1 | | er. 1. 11 | 1/411 | W/I M | (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) | |
| bad | | | | | | |
| ad | | | □ 强制按地址写 | | | |
| oad | | | □ 强制按地址写 个 MASKROM | 沿久 | 2-2 :MASKROM | |

1. Select MiniLoaderAll.bin from the MiniLoader folder downloaded earlier, and then click open

| 打开 | | > |
|---|-----------------------------------|---------------|
| | 要用到的东西 v ひ の在 MiniLo | oader-烧录Linux |
| 组织 ▼ 新建文件夹 | 1 | 18 - 🔳 🕐 |
| 此电脑 3D 对象 叶k3588 [inux_emmc.cfg rk3588 [inux_therac.cfg <li< th=""><th></th><th></th></li<> | | |
| 文件名(N): | All File(*.*) | ~ |

m. Then click on the location shown in the following image



n. Then select the path to the Linux image you want to burn, and click open

Before burning the image, it is recommended to rename the Linux image to orangepi.img or other shorter names, so that the percentage of burning progress can be seen when burning the image.

| 遺像 🔀 打开 | | × |
|---|--|----------------------|
| ← → * ↑ | <mark></mark> > 此电脑 > 桌面 > orangepi > | ✓ ひ ク 在 orangepi 中搜索 |
| ● 组织 ▼ 新疆 | 主 文件夹 | EE - 🔟 🕐 |
| 此电脑 3D 对象 颲 规频 > 图片 ⑦ 文档 ◆ 下戦 → 音乐 ■ 桌面 | ▲ MiniLoader-烧录Linux镜象才需要用到的东 orangepi (C:) | |
| ader ADE WOR | 2/0 | |

o. Then please check the option to force writing by address

| 尚芯谷 | 数开发 | 江具 v3.15 | | | | - |) |
|------|-------|----------|------------------|--------------|---------------------------------------|---|---|
| 载镜 | 像 | 升级固件高 | 级功能 | | | | |
| # | | 存储 | 地址 0x00000000 | 名字 Loader | 路径 C:\Users\lee\Desktop\orangepi\M | | |
| 2 | V | EMMC | 0x00000000 | linux | C:\Users\lee\Desktop\orangepi\o | | |
| | | | | | | | |
| .oad | er Ve | er:1.11 | 执行 | 切换 | 设备分区表 清空 | | |
| | | | 强制按地址写 | | | | |

p. Clicking the execute button again will start burning the Linux image to the eMMC of the development board



q. The displayed log after burning the Linux image is shown in the following figure

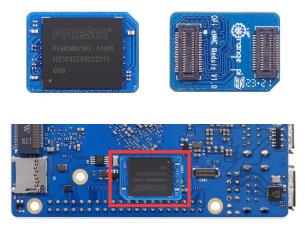
| | | 1.661 | 1.4.4 | 1.41.78 | | ——— 下载Boot成功 等待Maskrom开始 | |
|-----|--------------|--------|-----------------|----------------------------------|-----------|--------------------------------|--|
| # | □.存储 ▼ | 地址 | 名字 | 路径 C:\Users\bb177\Deckton\ora | | 等待 Maskrom 成功 | |
| 2 | EMMC | 0x0000 | Loader linux | C:\Users\hh177\Desktop\ora | | 测试设备开始 | |
| | | | | | - Lunnard | 测试设备成功 | |
| | | | | | | 校验芯片开始 | |
| | | | | | | 校验芯片成功 | |
| | | | | | | 获取FlashInfo开始 获取FlashInfo成功 | |
| | | | | | | 准备IDB开始 | |
| | | | | | | 准备 IDB所 知 准备 IDB成功 | |
| | | | | | | 下载IDB开始 | |
| | | | | | | 下载IDB成功 | |
| | | | | | | 等待Maskron开始 | |
| | | | | | | 等待Maskrom成功 | |
| | | | | | | 测试设备开始 | |
| | | 44.7- | | | + | 测试设备成功 开始切换存储到EDDAC | |
| .0a | der Ver:1.11 | 执行 | 切: | 换设备分区表 | 清空 | 开始功典符曲到Ender 开始下载orangepi | |
| | | ☑强制按地 | 址写 | | | 正在下载 orangepi(100%) | |
| | | | | | | 下载完成 | |

r. After burning the Linux image into eMMC, the Linux system will automatically start.

2. 5. 2. The method of burning Linux images into eMMC using the dd command

Note that the Linux image referred to here specifically refers to Linux distribution images such as Debian, Ubuntu, OpenWRT, or OPi OS Arch downloaded from the Orange Pi download page.

1) The development board reserves the expansion interface of the eMMC module. Before burning the system to the eMMC, you first need to purchase an eMMC module that matches the eMMC interface of the development board. Then install the eMMC module to the development board. The eMMC module and the method of plugging into the development board are as follows:



2) Using the dd command to burn the linux image to eMMC needs to be done with a TF card, so first you need to burn the linux image to the TF card, and then use the TF card to start the development board to enter the linux system. For the method of burning the Linux image to the TF card, please refer to the instructions in the two sections of the method of burning the Linux image to the TF card based on the Windows PC and the method of burning the Linux image to the TF card based on the Ubuntu PC.

3) After using the TF card to start the linux system, we first upload the decompressed linux image file (Debian, Ubuntu image or OPi Arch image downloaded from the official website) to the TF card. For the method of **uploading the linux image file to the development board**, please refer to the description in the section of the method of uploading files to the development board Linux system.

4) After uploading the image to the linux system of the development board, we enter the storage path of the image file in the command line of the linux system of the development board. For example, I store the linux image of the development board in the /home/orangepi/Desktop directory Download it, and then enter the /home/orangepi/Desktop directory to see the uploaded image file.

orangepi@orangepi:~\$ cd /home/orangepi/Desktop

orangepi@orangepi:~/Desktop\$ ls

Orangepi5pro_x.x.x_debian_bullseye_desktop_xfce_linux5.10.160.img

How to enter the command line of the Linux system on the development board?

1. For the method of using the serial port to log in to the terminal, please refer to the instructions in the section on how to use the debugging serial port.

2. Use ssh to remotely log in to the Linux system, please refer to the instructions in the section of SSH remote login to the development board.

3. If a display screen such as HDMI or LCD is connected, you can open a command line terminal on the desktop.

5) Next, we first use the following command to confirm the device node of eMMC orangepi@orangepi:~/Desktop\$ ls /dev/mmcblk*boot0 | cut -c1-12 /dev/mmcblk1

6) Then we can use the dd command to clear the eMMC. Note that after the **of**= parameter, please fill in the output result of the above command

orangepi@orangepi:~/Desktop\$ sudo dd bs=1M if=/dev/zero of=/dev/mmcblk1 count=1000 status=progress orangepi@orangepi:~/Desktop\$ sudo sync

7) Then you can use the dd command to burn the linux image of the development board into the eMMC

- a. In the following command, the if= parameter is followed by the full path where the linux image is stored + the name of the Linux image (such as the name of /home/orangepi/Desktop/Linux image). Because we have entered the path of the linux image above, we only need to fill in the name of the Linux image.
- b. Please do not copy the linux image name in the following command, but replace it with the actual image name (because the version number of the image may be updated).

sudo dd bs=1M if=Orangepi5pro_x.x.x_debian_bullseye_desktop_xfce_linux5.10.160.img of=/dev/mmcblk1 status=progress

sudo sync

Note, if you upload a .7z or .xz linux image compressed file, please remember to decompress it before using the dd command to burn.

The detailed description of all parameters of the dd command and more usage can be viewed by executing the man dd command in the linux system.

8) After successfully burning the linux image of the development board to the eMMC, you can use the **poweroff** command to shut down. Then please pull out the TF card, and then short press the power button to turn on, and then the linux system in the eMMC will be started.

2. 6. Method of burning Linux image to TF card+NVMe SSD

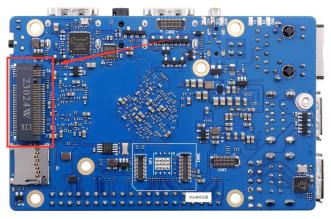
Note that the Linux image referred to here specifically refers to Linux distribution images such as Debian, Ubuntu, OpenWRT, or OPi OS Arch downloaded from the Orange Pi download page.

The method introduced in this chapter requires burning the Bootloader file into a TF card. In this way, even if the development board does not have SPI Flash attached, the system in NVMe can still be booted through the TF card.

1) Firstly, it is necessary to prepare an NVMe SSD solid-state drive. The development board M.2 slot supports PCIe 2.0x1, with a theoretical maximum speed of 500MB/s. NVMe SSDs for PCIe 3.0 and PCIe 4.0 are also usable, but the maximum speed is only PCIe 2.0x1.



2) Then insert the NVMe SSD into the M.2 PCIe interface of the development board and secure it in place



3) Burning a Linux image to a TF card+NVMe SSD requires the use of a TF card, so the

first step is to burn the Linux image to the TF card, and then use the TF card to launch the development board and enter the Linux system. The method of burning Linux images to TF cards can be found in the user manual's two sections: the method of burning Linux images to TF cards based on Windows PC and the method of burning Linux images to TF cards based on Ubuntu PC.

4) Then upload the Linux image file (Debian, Ubuntu, or OpenWRT image downloaded from the official website) to the TF card. For the method of uploading Linux image files to the development board, please refer to the instructions in the section on **uploading** files to the development board Linux system in the user manual.

5) After uploading the image to the Linux system of the development board, we can enter the storage path of the image file in the command line of the Linux system of the development board. For example, I stored the Linux image of the development board in the **/home/orangepi/Desktop** directory, and then enter the **/home/orangepi/Desktop** directory to see the uploaded image file.

orangepi@orangepi:~\$ cd /home/orangepi/Desktop

orangepi@orangepi:~/Desktop\$ ls

Orangepi5pro_x.x.x_debian_bullseye_desktop_xfce_linux5.10.160.img

How to enter the command line of the Linux system on the development board? 1. For the method of using serial port to log in to the terminal, please refer to the instructions in the section on debugging serial port usage in the user manual.

2. For remote login to Linux system using SSH, please refer to the instructions in the SSH remote login development board section of the user manual.

3. If an HDMI, LCD or other display screen is connected, a command line terminal can be opened on the desktop.

6) Next, let's confirm that the NVMe SSD has been properly recognized by the linux development board. If the NVMe SSD recognizes it properly, using the **sudo fdisk -l** command can display information related to **nvme**

orangepi@orangepi:~/Desktop\$ **sudo fdisk -l | grep "nvme0n1"** Disk /dev/nvme0n1: 1.86 TiB, 2048408248320 bytes, 4000797360 sectors

Using the lspci command, you can see an NVMe related PCI device

orangepi@orangepi:~/Desktop\$ lspci

0004:40:00.0 PCI bridge: Fuzhou Rockchip Electronics Co., Ltd Device 3588 (rev 01) 0004:41:00.0 Non-Volatile memory controller: MAXIO Technology (Hangzhou) Ltd. NVMe SSD Controller MAP1202 (rev 01)

7) Then we can use the dd command to clear the NVMe SSD (optional)

orangepi@orangepi5pro:~/Desktop\$ sudo dd bs=1M if=/dev/zero of=/dev/nvme0n1 count=2000 status=progress orangepi@orangepi5pro:~/Desktop\$ sudo sync

8) Then you can use the dd command to burn the Linux image of the development board to NVMe SSD

- a. In the following command, after the **if=** parameter, you need to fill in the complete path where the Linux image is stored+the name of the Linux image (such as /home/orangepi/Desktop/Linux image name). Because we have already entered the path of the Linux image above, we only need to fill in the name of the Linux image.
- b. Please do not copy the Linux image name in the following command, replace it with the actual image name (as the version number of the image may be updated).

sudo dd bs=1M if=Orangepi5pro_x.x.x_debian_bullseye_desktop_xfce_linux5.10.160.img of=/dev/nvme0n1 status=progress

sudo sync

Note that if you are uploading a . 7z,. xz, or. gz Linux image compressed file, please remember to decompress it before using the dd command to burn.

The detailed description and more usage of all parameters of the dd command can be viewed by executing the man dd command in a Linux system.

9) Then download rkspi_loader.img from Orange Pi's data download page and upload it to the development board



10) After successfully burning the Linux image of the development board to the NVMe SSD, you need to use the following command to burn **rkspi_loader.img** to the TF card. Note that after the burning is completed, the TF card will only boot with uboot, and the kernel and file system will be destroyed. At this time, it is impossible to start the system with only the TF card inserted.

sudo dd if=rkspi_loader.img of=\$(findmnt -n -o SOURCE / | sed 's/..\$//')

11) Then use the **poweroff** command to shut down the device, and briefly press the power button to turn it on. This will start the Linux system in TF Card+NVMe SSD.

12) After starting the system in NVMe SSD, you can use the **df** -**h** command to see the actual hard disk capacity

| a. 128GB N | IVMe SS | SD | | | |
|-----------------|-------------------|-------------|--------------|-------------------|--|
| orangepi@orange | pi:~ \$ df | -h | | | |
| Filesystem | Size U | Jsed Av | ail Use% | Mounted on | |
| udev | 3.8G | 8.0K | 3.8G | 1% /dev | |
| tmpfs | 769M | 1.4M | 768M | 1% /run | |
| /dev/nvme0n1p2 | 118G | 5.8G | 111 G | 5% / | |
| tmpfs | 3.8G | 0 | 3.8G | 0% /dev/shm | |
| tmpfs | 5.0M | 4.0K | 5.0M | 1% /run/lock | |
| tmpfs | 3.8G | 16K | 3.8G | 1% /tmp | |
| /dev/nvme0n1p1 | 256M | 90N | 1 166N | 1 36% /boot | |
| /dev/zram1 | 194M | 9.9M | 170M | 6% /var/log | |
| tmpfs | 769M | 60K | 769M | 1% /run/user/1000 | |
| tmpfs | 769M | 48K | 769M | 1% /run/user/0 | |
| b. 2TB NVI | Me SSD | | | | |
| orangepi@orange | pi:~\$ df | -h | | | |

| Filesystem | Size U | sed Ava | ail Use% | Mounted on |
|----------------|-------------|-------------|-------------|-------------------|
| udev | 3.8G | 8.0K | 3.8G | 1% /dev |
| tmpfs | 769M | 1.4M | 768M | 1% /run |
| /dev/nvme0n1p2 | 1.9T | 4.1G | 1.8T | 1% / |
| tmpfs | 3.8G | 0 | 3.8G | 0% /dev/shm |
| tmpfs | 5.0M | 4.0K | 5.0M | 1% /run/lock |
| /dev/zram2 | 3.7G | 76K | 3.5G | 1% /tmp |
| /dev/nvme0n1p1 | 256M | 90N | I 166N | 1 36% /boot |
| /dev/zram1 | 194M | 15M | 165M | 9% /var/log |
| tmpfs | 769M | 60K | 769M | 1% /run/user/1000 |
| tmpfs | 769M | 48K | 769M | 1% /run/user/0 |

2.7. Method of burning Linux images to SPIFlash+NVMe SSD

Note that the Linux image referred to here specifically refers to Linux distribution images such as Debian, Ubuntu, OpenWRT, or OPi OS Arch downloaded from the Orange Pi download page.

Note that even without the SPI Flash chip attached, the TF card can still be used to boot the system in NVMe. For specific methods, please refer to 2.6. Method of burning Linux images to TF card+NVMe SSD

The method introduced in this chapter requires burning the Bootloader file into SPI Flash. Before starting to burn the image, it is necessary to ensure that the development board has already attached the SPI Flash chip, because the development board does not have an SPI Flash chip attached at the factory, so it needs to be purchased and soldered on. We recommend using the SPI Flash chip model XM25QU128CW1QT08Q

Due to SPI Flash and eMMC reusing the same pins, eMMC cannot be used with SPI Flash attached

Note that all the following operations are performed on a Windows computer.

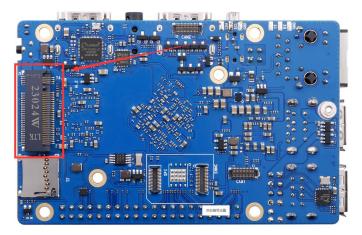
2. 7. 1. The method of burning using RKDevTool

1) Firstly, it is necessary to prepare an NVMe SSD solid-state drive. The development

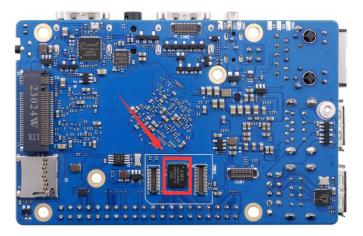
board M.2 slot supports PCIe 2.0x1, with a theoretical maximum speed of 500MB/s. NVMe SSDs for PCIe 3.0 and PCIe 4.0 are also usable, but the maximum speed is only PCIe 2.0x1.



2) Then insert the NVMe SSD into the M.2 PCIe interface of the development board and secure it in place



3) Please ensure that the development board has already been labeled with SPI Flash. The position of SPI Flash on the development board is shown in the following figure, and no other settings are required before starting the burning process

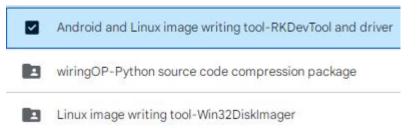


4) Then you need to prepare a high-quality USB 2.0 corporate data cable

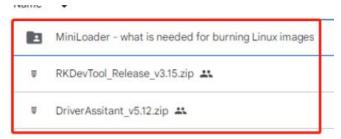


5) Then download the Ruixin micro driver **DriverAssitant_v5.12.zip** and MiniLoader, as well as the burning tool **RKDevTool_Release_v3.15.zip**, from **Orange Pi's data** download page

a. On the Orange Pi data download page, first select the official tool and then enter the folder below



b. Then download all the files below



Note that the "MiniLoader - something needed to burn Linux images" folder is hereinafter referred to as the MiniLoader folder.

6) Then download the compressed file of the Linux operating system image that you want to burn from **Orange Pi's information download page**, and use decompression software to extract it. In the extracted file, the file ending in "**.img**" is the operating system image file, which is generally over 2GB in size

Note that if you are downloading an OpenWRT image, you will see the following three types of images in the download link of the OpenWRT image. Please select the

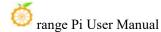


image file in the "TF Card, eMMC, and NVME SSD Boot Image" folder.

TF card, eMMC and NVME SSD boot image
SPIFlash boot image

7) Then use the decompression software to unzip **DriverAssitant_v5.12.zip**, and then find the **DriverInstall.exe** executable file in the unzipped folder and open it

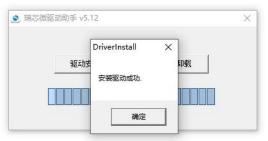
| 名称 ^ | 修改日期 | 类型 | 大小 |
|-----------------|-----------------|------|--------|
| ADBDriver | 2022/12/1 15:07 | 文件夹 | |
| 📙 bin | 2022/12/1 15:07 | 文件夹 | |
| Driver | 2022/12/1 15:07 | 文件夹 | |
| 🔄 config | 2014/6/3 15:38 | 配置设置 | 1 KB |
| S DriverInstall | 2022/2/28 14:11 | 应用程序 | 491 KB |
| Readme | 2018/1/31 17:44 | 文本文档 | 1 KB |
| revison | 2022/2/28 14:14 | 文本文档 | 1 KB |
| | | | |

8) The steps to install the Ruixin micro driver after opening **DriverInstall.exe** are as follows

a. Click on the "Driver Installation" button

| 驱动安装 | 驱动卸载 | |
|------|------|--|
| | | |

b. After waiting for a period of time, a pop-up window will prompt "Driver installation successful", and then click the "OK" button to proceed



9) Then unzip RKDevTool_Release_v3.15.zip. This software does not need to be

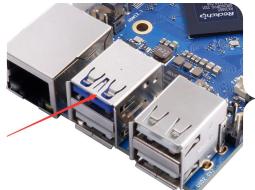
| 名称 ^ | 修改日期 | 类型 | 大小 |
|-----------------|------------------|-----------------|----------|
| bin | 2022/12/1 15:07 | 文件夹 | |
| Language | 2022/12/1 15:07 | 文件夹 | |
| config.cfg | 2022/3/23 9:11 | CFG 文件 | 7 KB |
| 🔄 config | 2021/11/30 11:04 | 配置设置 | 2 KB |
| revision | 2022/5/27 9:09 | 文本文档 | 3 KB |
| 🔀 RKDevTool | 2022/5/27 9:06 | 应用程序 | 1,212 KB |
| ▲ 开发工具使用文档_v1.0 | 2021/8/27 10:28 | Foxit PDF Reade | 450 KB |

installed. You can find **RKDevTool** in the unzipped folder and open it

10) After opening the **RKDevTool** burning tool, because the computer has not yet been connected to the development board through a USB 2.0 male to female data cable, the bottom left corner will prompt "**No device found**"

| | | 存储 地址 | 名字 | 路径 |
|---|---|-------|-------------|----------|
| | | 0x000 | | |
| 2 | | 0x000 | | r |
| 3 | | 0x000 | | |
| | | 0x000 | | |
| 5 | | 0x000 | | |
| 3 | | 0x000 | | |
| | | 0x000 | | |
| | | 0x000 | | |
| | | 0x000 | | <i>i</i> |
| | | 0x000 | | |
| 1 | Γ | 0x000 | 0000 Backup | |

- 11) Then start burning the Linux image to the SSD
 - a. Firstly, connect the development board to the Windows computer through a USB2.0 male to female data cable. The location of the USB flash port on the development board is shown in the following figure



- b. Ensure that the development board is not connected to a power source or inserted with a TF card
- c. Then hold down the MaskROM button on the development board and hold it down. The position of the MaskROM button on the development board is shown in the following figure:



d. Then connect the Type-C interface power supply to the development board and power it on, then you can release the MaskROM button



e. If the previous steps are successful, the development board will enter MASKROM mode and the interface of the burning tool will prompt "Found a MASKROM device"

| # | | 存储 | 地址 | 名字 | 路径 | | | |
|--------|-----|----|--------------------------|--------------------|----------|------|--|--|
| 1 | 1 | | 0x00000000 | Loader | | | | |
| 2 | 1 | | 0x00000000 | Parameter Uboot | | | | |
| 3 | 늗 | | 0x00000000 0x00000000 | trust | | | | |
| 4 5 | 1 | | 0x00000000 | Misc | | | | |
| 5 6 | 놑 | | 0x00000000 | Resource | - | | | |
| 7 | 늗 | | 0x00000000 | Kernel | | | | |
| 3 | 1 | | 0x00000000 | Boot | | | | |
| 3 | i'r | | 0x00000000 | Recovery | | | | |
| 10 | 1 | | 0x00000000 | System | | | | |
| 11 | i'r | | 0x00000000 | Backup | / | | | |
| .0 a d | er: | | 执行 | 切换 | 设备分区表 清空 | | | |

f. Then place the mouse cursor in the area below

| # | | 存储 地 | 址 | 名字 | 路径 | | |
|------|-----|------------|----------|-----------|----------|------------------------|--|
| 1 | Г | 0xl | 00000000 | Loader | | | |
| 2 | Г | 0xt | 00000000 | Parameter | | | |
| 3 | | Oxt | 00000000 | Vboot | | | |
| 4 | | 0x1 | 00000000 | trust | | | |
| 5 | | 0x1 | 00000000 | Misc | | | |
| 6 | | Oxi | 00000000 | Resource | | | |
| 7 | Γ | Oxt | 00000000 | Kernel | | | |
| 8 | Г | Oxt | 00000000 | Boot | | | |
| 9 | Г | Oxt | 00000000 | Recovery | | Place the mouse cursor | |
| 10 | Г | 0x1 | 00000000 | System | | over this area | |
| 11 | | 0x1 | 00000000 | Backup | | over this area | |
| .oad | er: | 执; □ 强制 | 行 | 切换 | 设备分区表 清空 | | |

g. Then, clicking the right mouse button will pop up the selection interface shown

in the following figure

| : | | 存储 | 地址 | 名字 | 路径 | | | | | | |
|--------|-------|----|--------------------------|--------------------|------|--------------|-----|--|--|--|--|
| 1 | - | | 0x00000000 | Loader | | | | | | | |
| 2 | 1 | | 0x00000000 0x00000000 | Parameter Uboot | | | | | | | |
| 4 | ÷ | | 0x00000000 | trust | - | | _ | | | | |
| 4 5 | ÷ | | 0x0000000 | Misc | | 添加项 | | | | | |
| 5 6 | i Fr | | 0x00000000 | Resource | | 删除项 | | | | | |
| 7 | Ē | | 0x00000000 | Kernel | | 清空所有项 | | | | | |
| 8 | Ē | | 0x00000000 | Boot | | | | | | | |
| 9 | Ē | | 0x00000000 | Recovery | | 上移 | | | | | |
| 10 | Г | | 0x00000000 | System | | 下移 | 1.1 | | | | |
| 11 | Г | | 0x00000000 | Backup | | 导入配置 | | | | | |
| Loai | ler : | | 执行]]强制按地址写 | 切换 | 设备分区 | 导出配置 表 清空 | | | | | |

h. Then select the **import configuration** option

| # | | 存储 | 地址 | 名字 | 路径 | | | | | | | |
|------|-----|----|----------------|-----------|------|--------------|---|------------|--|--|--|--|
| 1 | Г | | 0x00000000 | Loader | | | | | | | | |
| 2 | Г | | 0x00000000 | Parameter | | | | 5. B. (16) | | | | |
| 3 | | | 0x00000000 | Uboot | | | | | | | | |
| 4 | | | 0x00000000 | trust | | 添加项 | | | | | | |
| 5 | | | 0x00000000 | Misc | | 删除项 | | | | | | |
| 6 | | | 0x00000000 | Resource | | | | | | | | |
| 7 | | | 0x00000000 | Kernel | | 清空所有项 | | | | | | |
| 8 | | | 0x00000000 | Boot | | 上移 | | - | | | | |
| 9 | | | 0x00000000 | Recovery | | 下移 | | | | | | |
| 10 | Г | | 0x00000000 | System | | | | | | | | |
| 11 | | | 0x00000000 | Backup | | 导入配置 | | | | | | |
| .oad | er: | | 执行 □ 强制按地址写 | 切换 | 设备分区 | 导出配置 法 清空 |] | | | | | |

i. Then enter the MiniLoader folder downloaded earlier, select the rk3588_linux_pcie.cfg configuration file, and click open

| < 打开 | × |
|--|--|
| ← → ~ ↑ 📙 > 此电脑 → 桌面 > orangepi → MiniLoader-烧录Linux魄象才器 | 要用到的东西 V O C 在 MiniLoader-焼泉Linux |
| 组织 ▼ 新建文件夹 | BB - 🛄 😗 |
| 此电脑 3D 对象 通 叔须 一 rk3588_linux_tfcard.cfg 一 rk3588_linux_tfcard.cfg 一 rk3588_linux_tfcard.cfg 一 市場 一 音乐 重 本地磁盘 (C:) | |
| 文件名(N): rk3588_linux_pcie.cfg | ✓ ConfigFile(*.cfg) ✓ |
| | 打开(O) 取消 |

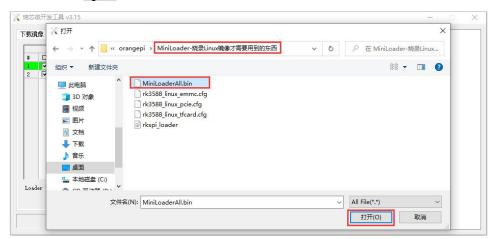
j. Then click **OK**

| # C |] 存储 | 地址 | 名字 | 路径 | |
|-----|--------|----------|----------|---------------------------------|--|
| | - | 0x000000 | 0 Loader | C:\Users\Administrator\Desktop\ | |
| | SPINOF | 0x000000 | | C:\Users\Administrator\Desktop\ | |
| 3 🔽 | PCIE | 0x000000 | 0 linux | C:\Users\Administration | |
| | | | | ●入配置成功. | |

k. Then click on the location shown in the following image

| □ 存储 ▼ ▼ SPINOR ▼ PCIE | 地址 0x00000000 0x00000000 | 名字 Loader | 路径 C:\Users\Administrator\Desktop\ | |
|---------------------------------|--------------------------------|--------------|---------------------------------------|--|
| SPINOR | | | | |
| | 0x00000000 | | | |
| DOTE | | uboot | C:\Users\Administrator\Desktop\ | |
| ATOL A | 0x00000000 | linux | C:\Users\Administrator\Desktop\ | |
| | | | | |

1. Select MiniLoaderAll.bin from the MiniLoader folder downloaded earlier, and then click open



m. Then click on the location shown in the following image

🥮 range Pi User Manual

| | | 地址 | 名字 | |
|-----|-------|--------------------------|-----------------|--|
| | | 0x00000000 0x00000000 | Loader uboot | C:\Users\lee\Desktop\orangepiVM C:\Users\Administrator\Desktop\ |
| | | 0x00000000 | | C: \Users\Administrator\Desktop\ |
| , , | TLATE | 0x0000000 | linux | C. (Users(Administrator(Desktop)) |
| | | | | |

n. Then enter the **MiniLoader** folder downloaded earlier, select **rkspi_loader.img**, and click **open**

| < 打开 | > |
|---|--|
| ← → ∽ ↑ 📙 → 此电脑 → 桌面 → orangepi → MiniLoader-烧录Lin | nux鏡像才需要用到的东西 v Ö の 在 MiniLoader-烧录Linux |
| 组织 ▼ 新建文件夹 | BB - 🔟 💡 |
| ● 此电脑 ③ 3D 对象 ◎ 3D 对象 ◎ 40.5% ◎ 40.5% ○ 74.3588_linux_emmc.cfg ○ rk3588_linux_pcie.cfg ○ rk3588_linux_tfcard.cfg ○ rkspi_loader | |
| 文件名(N): | ✓ All File(*,*) ✓ |
| | 打开(O) 取消 |

o. Then click on the location shown in the following image

| | | 存储 | 地址 | 名字 | 路径 | | |
|-----|-----|--------|------------|--------|---------------------------------|--|--|
| | ✓ | | 0x00000000 | Loader | C:\Users\lee\Desktop\orangepi\M | | |
| | | SPINOR | 0x00000000 | uboot | C:\Users\lee\Desktop\orangepi\M | | |
| з Г | ✓ : | PCIE | 0x00000000 | linux | C:\Users\Administrator\Desktop\ | | |
| | | | | | | | |

p. Then select the path to the Linux image you want to burn, and click open

Before burning the image, it is recommended to rename the Linux image to

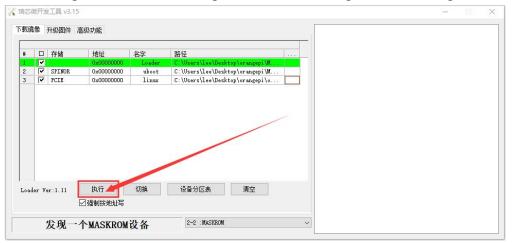
orangepi.img or other shorter names, so that the percentage of burning progress can be seen when burning the image.

| 橡 🔀 打开 | | | × |
|--|---|-------|---|
| $\leftrightarrow \rightarrow \star \uparrow$ | → 此电脑 → 桌面 → orangepi → | ٽ ~ | |
| | (件夹 | | 0 |
| ■ 此电脑 ③ 3D 对象 圖 视频 ■ 图片 晉 文档 ◆ 下载 | MiniLoader·探索Linux領象才需要用到的东 orangepi | 5 | |
| ♪ 音乐 | | | |

q. Then please check the option to force writing by address

| 記律 | 研发 | 之工具 v3.15 | | | | | | - | × |
|----|--------------|-----------|------------|--------|---------------------------------|--|--|---|------|
| 载镜 | 像 | 升级固件 高 | 級功能 | | | | | | |
| # | | 存储 | 地址 | 名字 | 路径 | | | | |
| 1 | | | 0x00000000 | Loader | C:\Users\lee\Desktop\orangepi\M | | | | |
| 2 | ~ | SPINOR | 0x00000000 | uboot | C:\Users\lee\Desktop\orangepi\M | | | | |
| 3 | \checkmark | PCIE | 0x00000000 | linux | C:\Users\lee\Desktop\orangepi\o | | | | |
| | | | | | | | | | |
| | | er:1.11 | 执行 | 切换 | 设备分区表 清空 | | | | |

r. Clicking the execute button again will start burning the Linux image to the SSD



s. The displayed log after burning the Linux image is shown in the following figure

| | | | | | | 测试设备成功 | |
|-----|--------------|--------|-----------------|--|----|--|--|
| | 口,存储 | 地址 | 名字 | 路径 | | 校验芯片开始 校验芯片成功 | |
| | SPINOR | 0x0000 | Loader uboot | C:\Users\hh177\Desktop\ora C:\Users\hh177\Desktop\ora | | 获取FlashInfo开始 | |
| | PCIE | 0x0000 | linux | C:\Users\hh177\Desktop\ora | | 获取FlashInfo成功 | |
| | | | | | | 准备IDB开始 | |
| | | | | | | 准备IDB成功 | |
| | | | | | | 下载IDB开始 | |
| | | | | | | | |
| | | | | | | 下载IDB成功 | |
| | | | | | | 等待Maskron开始 | |
| | | | | | | 等待Maskron开始 等待Maskron成功 | |
| | | | | | | 等待Maskron开始 | |
| | | | | | | 等待Maskron开始 等待Maskron成功 测试设备开始 | |
| | | | | | | 等待Maskron开始 等待Maskron即功 测试设备开始 测试设备成功 | |
| | | | | | | 等待Maskron开始 等待Maskron成功 测试设备开始 测试设备标动 开始订购存储到SFINOR 开始下载rkspi_loader 正在下载 rkspi_loader(100%) | |
| | | | | | | 等待Maskron开始 等待Maskron取功 测试设备元功 开始切换存储到SFINOR 开始订载rkspi_loader 正在下载 rkspi_loader(100%) 等待Loader开始 | |
| bad | ler Ver:1.11 | 执行 | 切 | 與 设备分区表 | 清空 | 等待Maskron开始 等待Maskron成功 测试设备开始 测试设备标动 开始订购存储到SFINOR 开始下载rkspi_loader 正在下载 rkspi_loader(100%) | |

If there is a problem with burning, please clear SPIFlash first and then try burning again. For the method of clearing SPIFlash, please refer to the instructions in the section on clearing SPIFlash using RKDevTool.

t. After the image is burned, the Linux system in SPIFlash+PCIe SSD will automatically start. If it does not start properly, please power on again and try again.

2. 7. 2. How to use the dd command to burn

1) Firstly, it is necessary to prepare an NVMe SSD solid-state drive. The development board M.2 slot supports PCIe 2.0x1, with a theoretical maximum speed of 500MB/s. NVMe SSDs for PCIe 3.0 and PCIe 4.0 are also usable, but the maximum speed is only PCIe 2.0x1.

a. The M.2 2230 SSD is as follow

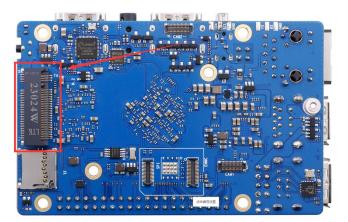


b. The M.2 2242 SSD is as follow

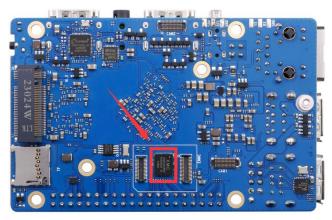


2) Then insert the NVMe SSD into the M.2 PCIe interface of the development board and

fix it



3) Please ensure that the development board has already been labeled with SPI Flash. The position of SPI Flash on the development board is shown in the following figure, and no other settings are required before starting the burning process



4) Burning the linux image to SPIFlash+NVMe SDD needs to be completed with the help of a TF card, so first you need to burn the linux image to the TF card, and then use the TF card to start the development board to enter the linux system. For the method of burning the Linux image to the TF card, please refer to the instructions in the two sections of the method of burning Linux images to TF cards based on Windows PC and the method of burning Linux images to TF cards based on Ubuntu PC.

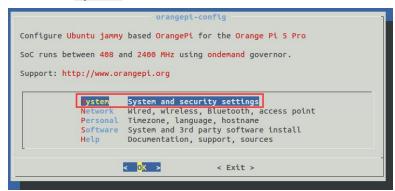
5) After starting the Linux system with a TF card, we first burn the u-boot image to SPI Flash

- a. In Linux systems, the default SPI Flash feature is turned off and needs to be manually turned on to use. The detailed steps are as follows:
 - a) First, run orange pi configuration. ordinary users remember to add sudo

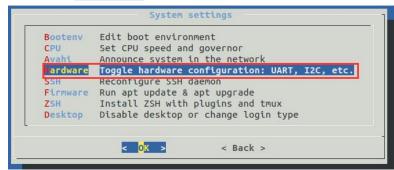
permission

orangepi@orangepi:~\$ sudo orangepi-config

b) Then select System



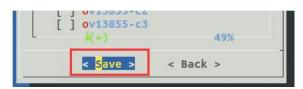
c) Then select Hardware



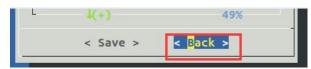
d) Then use the arrow keys on the keyboard to navigate to **opi5pro-sfc**, and use a space to select it

| | epi5pro-sfc |
|----|-------------|
| [] | ov13850-c1 |
| [] | ov13850-c2 |
| [] | ov13850-c3 |

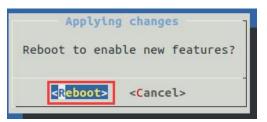
e) Then select<Save>to save



f) Then select<Back>



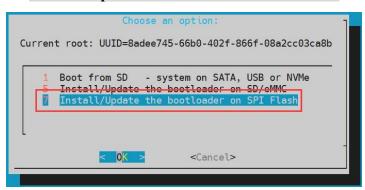
g) Then select < **Reboot**> to restart the system for the configuration to take effect



b. Then run nand-sata-install, ordinary users remember to add sudo permission

orangepi@orangepi:~\$ sudo nand-sata-install

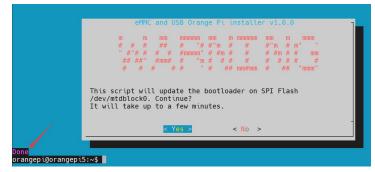
c. Then select 7 Install/Update ther bootloader on SPI Flash



d. Then select <Yes>

| | eMMC and USB Orange Pi installer v1.0.0 |
|--------|--|
| | m m mm mmmmm mm m mmmmmm mm m mmm # # # ## # "# #"m # # #"m # m" " " #"# # # # #mmmm" # #m # # # # # # mm ## ##" #mm# # "m # # # # # # # # # # # # # # # " # ## mm#mm # ## "mmm" |
| /dev/r | script will update the bootloader on SPI Flash mtdblock0. Continue? ll take up to a few minutes. |
| | < Yes > < No > |
| | |

e. Then please be patient and wait for the burning to complete. After the burning is completed, it will display as follows (a **Done** will be displayed in the bottom left corner):



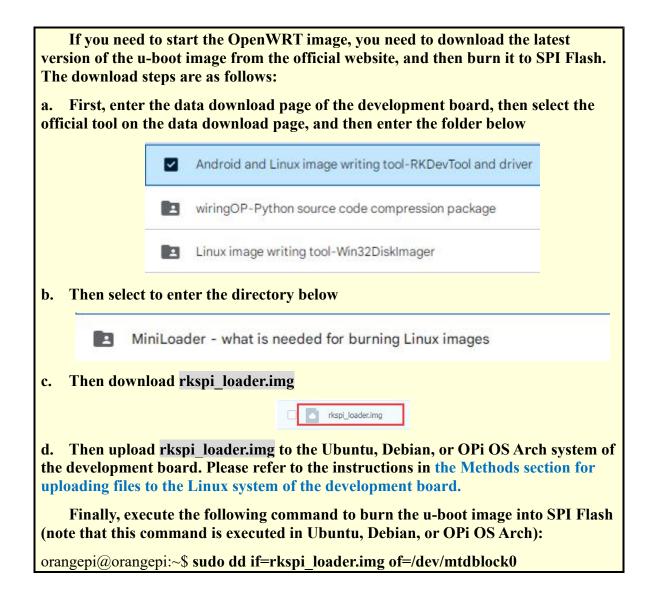
The OPi OS Arch system does not have SPI Flash enabled by default and needs to be manually opened. Please add the following configuration in/boot/extLinux/extlinuxconf and restart the system to recognize SPI Flash

[orangepi@orangepi~]\$ sudo vim /boot/extlinux/extlinux.conf

FDTOVERLAYS /dtbs/rockchip/overlay/rk3588-opi5pro-sfc.dtbo

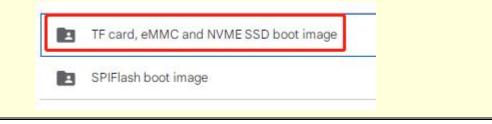
The nand data install script is not available in the OPi OS Arch system. Please use the following command to mirror u-boot to SPI Flash:

[orangepi@orangepi~]\$ sudo dd if=/boot/rkspi_loader.img of=/dev/mtdblock0



6) Then upload the Linux image file (Debian, Ubuntu, or OpenWRT image downloaded from the official website) to the TF card. For the method of uploading Linux image files to the development board, please refer to the instructions in **the Methods section of uploading files to the Linux system of the development board**.

Note that if you are downloading an OpenWRT image, you will see the following three types of images in the download link of the OpenWRT image. Please select the image file in the "TF Card, eMMC, and NVME SSD Boot Image" folder.



7) After uploading the image to the Linux system of the development board, we can enter the storage path of the image file in the command line of the Linux system of the development board. For example, I stored the Linux image of the development board in the **/home/orangepi/Desktop** directory, and then enter the **/home/orangepi/Desktop** directory to see the uploaded image file.

orangepi@orangepi:~\$ cd /home/orangepi/Desktop

orangepi@orangepi:~/Desktop\$ ls

Orangepi5pro_x.x.x_debian_bullseye_desktop_xfce_linux5.10.160.img

How to enter the command line of the development board linux system?
1. For the method of using the serial port to log in to the terminal, please refer to the instructions in the section on how to use the debugging serial port
2. Use ssh to remotely log in to the Linux system, please refer to the instructions in the section of SSH remote login to the development board.
3. If HDMI, LCD and other display screens are connected, you can open a command line terminal on the desktop.

8) Next, let's confirm that the NVMe SSD has been recognized by the development board's linux. If the NVMe SSD is recognized normally, use the **sudo fdisk -l** command to see **nvme** related information.

orangepi@orangepi:~/Desktop\$ sudo fdisk -l | grep "nvme0n1" Disk /dev/nvme0n1: 1.86 TiB, 2048408248320 bytes, 4000797360 sectors Use the **lspci** command to see an NVMe-related PCI device

orangepi@orangepi:~/Desktop\$ lspci

0004:40:00.0 PCI bridge: Fuzhou Rockchip Electronics Co., Ltd Device 3588 (rev 01) 0004:41:00.0 Non-Volatile memory controller: MAXIO Technology (Hangzhou) Ltd. NVMe SSD Controller MAP1202 (rev 01)

9) Then we can use the dd command to clear the NVMe SSD(Optional)

orangepi@Orangepi5pro:~/Desktop\$ sudo dd bs=1M if=/dev/zero of=/dev/nvme0n1 count=2000 status=progress orangepi@Orangepi5pro:~/Desktop\$ sudo sync

10) Then you can use the dd command to burn the linux image of the development board to the NVMe SSD.

- a. In the following command, the if= parameter is followed by the full path where the linux image is stored + the name of the Linux image (such as the name of /home/orangepi/Desktop/Linux image). Because we have entered the path of the linux image above, we only need to fill in the name of the Linux image.
- b. Please do not copy the linux image name in the following command, but replace it with the actual image name (because the version number of the image may be updated)

sudo dd bs=1M if=Orangepi5pro_x.x.x_debian_bullseye_desktop_xfce_linux5.10.160.img of=/dev/nvme0n1 status=progress

sudo sync

Note, if you upload a .7z or .xz linux image compressed file, please remember to decompress it before using the dd command to burn.

The detailed description of all parameters of the dd command and more usage can be viewed by executing the man dd command in the linux system.

11) After successfully burning the linux image of the development board to the NVMe SSD, you can use the **poweroff** command to shut down. Then please pull out the TF card, and then short press the power button to turn on, and then the linux system in SPIFlash+NVMe SSD will be started.

12) After starting the system in the NVMe SSD, use the **df -h** command to see the actual hard disk capacityNVMe SSD.

| orangepi@orange | orangepi@orangepi:~\$ df -h | | | | |
|--|-----------------------------|-------------|-------------|--------------------|--|
| Filesystem Size Used Avail Use% Mounted on | | | | | |
| udev | 3.8G | 8.0K | 3.8G | 1% /dev | |
| tmpfs | 769M | 1.4M | 768M | 1% /run | |
| /dev/nvme0n1p2 | 118G | 5.8G | 111G | 5% / | |
| tmpfs | 3.8G | 0 | 3.8G | 0% /dev/shm | |
| tmpfs | 5.0M | 4.0K | 5.0M | 1% /run/lock | |
| tmpfs | 3.8G | 16K | 3.8G | 1% /tmp | |
| /dev/nvme0n1p1 | 256M | 90N | I 166N | 1 36% /boot | |
| /dev/zram1 | 194M | 9.9M | 170M | 6% /var/log | |
| tmpfs | 769M | 60K | 769M | 1% /run/user/1000 | |
| tmpfs | 769M | 48K | 769M | 1% /run/user/0 | |
| b. 2TB NVI | Me SSD | | | | |
| orangepi@orange | pi:~\$ df | -h | | | |
| Filesystem | Size U | Ised Av | ail Use% | Mounted on | |
| udev | 3.8G | 8.0K | 3.8G | 1% /dev | |
| tmpfs | 769M | 1.4M | 768M | 1% /run | |
| /dev/nvme0n1p2 | 1.9T | 4.1G | 1.8T | 1% / | |
| tmpfs | 3.8G | 0 | 3.8G | 0% /dev/shm | |
| tmpfs | 5.0M | 4.0K | 5.0M | 1% /run/lock | |
| /dev/zram2 | 3.7G | 76K | 3.5G | 1% /tmp | |
| /dev/nvme0n1p1 | 256M | 90N | I 166N | 1 36% /boot | |
| /dev/zram1 | 194M | 15M | 165M | 9% /var/log | |
| tmpfs | 769M | 60K | 769M | 1% /run/user/1000 | |
| tmpfs | 769M | 48K | 769M | 1% /run/user/0 | |

13) When the TF card and NVMe SSD are programmed with exactly the same system, if both the TF card and NVMe SSD are inserted into the development board, power on the development board at this time, and u-boot will give priority to starting the system in the TF card. However, since the systems in the TF card and NVMe SSD are exactly the same, the UUIDs of the /boot partition and the rootfs partition in the two storage devices are also the same, which may cause the partition in the NVMe SSD to be loaded when the TF card starts. Running the script below resolves this issue orangepi@orangepi:~\$ sudo fix_mmc_ssd.sh

Exactly the same system means that the image name is exactly the same. Even if they are all Debian11 systems, the versions are different

There is no fix_mmc_ssd.sh script in OPi OS Arch system.

2.7.3. The method of burning using BalenaEtcher software Please do not use this method for OPi OS Arch and OpenWRT systems.

1) First, you need to prepare an NVMe SSD. The PCIe supported by the M.2 slot of the development board is PCIe2.0x1, and the theoretical maximum speed is 500MB/s. PCIe3.0 and PCIe4.0 NVMe SSDs are also available, but the highest speed is only PCIe2.0x1.

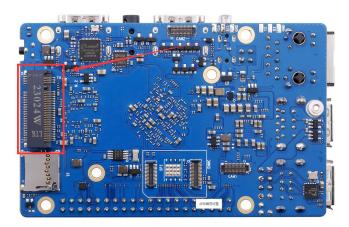
a. The M.2 2230 SSD is as follows



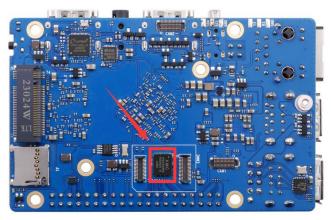
b. The M.2 2242 SSD is as follows



2) Then insert the NVMe SSD into the M.2 PCIe interface of the development board and fix it



3) Please ensure that the development board has already been labeled with SPI Flash. The position of SPI Flash on the development board is shown in the following figure, and no other settings are required before starting the burning process



4) Burning the linux image to SPIFlash+NVMe SDD needs to be completed with the help of a TF card, so first you need to burn the linux image to the TF card, and then use the TF card to start the development board to enter the linux system. For the method of burning the Linux image to the TF card, please refer to the instructions in the two sections of the method of burning the Linux image to the TF card based on the Windows PC and the method of burning the Linux image to the TF card based on the Ubuntu PC.

5) After booting into the linux system in the TF card, please confirm that the NVMe SSD has been properly recognized by the linux of the development board. If the NVMe SSD is recognized normally, use the **sudo fdisk -l** command to see **nvme**-related information. orangepi@orangepi:~/Desktop\$ **sudo fdisk -l** | **grep "nvme0n1"** Disk /dev/nvme0n1: 1.86 TiB, 2048408248320 bytes, 4000797360 sectors

Use the lspci command to see an NVMe-related PCI device

orangepi@orangepi:~/Desktop\$ lspci 0004:40:00.0 PCI bridge: Fuzhou Rockchip Electronics Co., Ltd Device 3588 (rev 01) 0004:41:00.0 Non-Volatile memory controller: MAXIO Technology (Hangzhou) Ltd. NVMe SSD Controller MAP1202 (rev 01)

6) The balenaEtcher has been pre-installed in the linux image, and the opening method is as follows:



If it is not pre installed, please refer to the instructions in the section on downloading and installing the arm64 version of balenaEtcher.

7) The interface after balenaEtcher is opened is as follows:

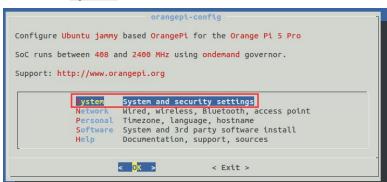


8) The method of burning u-boot into SPI Flash on the development board using balenaEtcher is as follows:

- a. In Linux systems, the default SPI Flash feature is turned off and needs to be manually turned on to use. The detailed steps are as follows:
 - a) First, run orange pi configuration, ordinary users remember to add sudo permissions

orangepi@orangepi:~\$ sudo orangepi-config

b) Then select **System**



c) Then select Hardware

| Bootenv | Edit boot environment |
|----------|--|
| CPU | Set CPU speed and governor |
| Avahi | Announce system in the network |
| lardware | Toggle hardware configuration: UART, I2C, etc. |
| SSH | Reconfigure SSH daemon |
| Firmware | Run apt update & apt upgrade |
| ZSH | Install ZSH with plugins and tmux |
| Desktop | Disable desktop or change login type |

 d) Then use the arrow keys on the keyboard to navigate to opi5pro-sfc, and use a space to select it

| | pi5pro-sfc | |
|-------|------------|--|
| [] | ov13850-c1 | |
| [] | ov13850-c2 | |
| [[] | ov13850-c3 | |

e) Then select<**Save**>to save

| [] ov13855-c3 (+) | | |
|----------------------|----------|--|
| < Save > | < Back > | |

f) Then select **<Back>**



g) Then select < **Reboot**> to restart the system for the configuration to take effect

| Applyin | g changes |
|-------------------|-------------------|
| Reboot to ena | ble new features? |
| <reboot></reboot> | <cancel></cancel> |
| | <cancet></cancet> |

b. Then open the balenaEtcher software and click on Flash from file

| | balenaEtcher | ★ - × |
|---|-----------------|--------|
| | 🜍 balena Etcher | ¢ 0 |
| e — | | - 4 |
| Flash from file | | Flash! |
| Flash from URL Clone drive | | |

c. Then enter the /usr/lib/linux-u-boot-legacy-orangepi5pro_1.0.0_arm64/ directory, select rkspi loader.img, and click Open to open it

| 😣 Cancel | | Q 🐸 Open |
|-----------|--|-------------------------------|
| 🔿 Recent | Usr lib linux-u-boot-legacy-orangepi5pro_1.0.0_arm64 | |
| 🔂 Home | Name | ▼ Size Type Modified |
| - | 🗋 idbloader.img | 303.1 kB Raw disk image 12:06 |
| Desktop | 📑 rkspi_loader.img | 4.2 MB Raw disk image 12:06 |
| Documents | | |

d. The interface after opening **rkspi_loader.img** is as follows:



e. Then click Select target



f. Then click on Show 2 hidden to open more storage device options

| ↑ - × | |
|-------|--|
| 8 | |
| | |
| | |
| | |
| | |
| | |

g. Then select the device name /dev/mtdblock0 for SPI Flash and click Select

| Warning! Selecting | your system drive | is dangerous and will erase your drivel | \$ |
|------------------------------------|-------------------|---|----|
| Select target 3 found | | | |
| - Name | Size | Location | |
| (opi_boot, opi_root) | 15.9 GB | /dev/mmcblk1 Source drive | |
| A | 16.8 MB | /dev/mtdblock0 System drive | |
| Fanxiang \$500PRboot, opi_root) | 2.05 TB | /dev/nvme0n1 System drive | |
| | | | |
| | | | |
| Car | icel | Select (1) | |
| | | | |

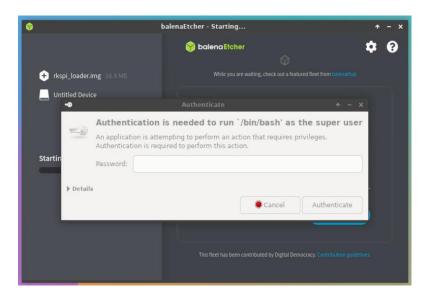
h. Then click Flash



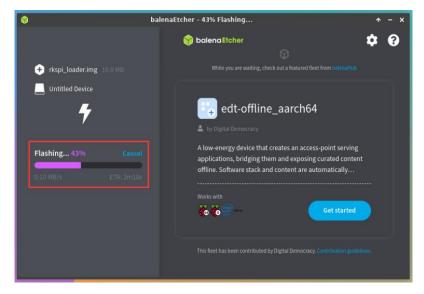
i. Then click Yes, I'm sure

| 0 | balenaEtcher | ★ - × |
|-----|---|-------------|
| | 😵 balena Etcher | \$ 0 |
| | WARNING! | |
| · · | You are about to erase your computer's drives | |
| | 16.8 MB System drive | - 1 |
| | Are you sure you want to flash your system drive? | |
| | Yes, I'm sure Change target | |

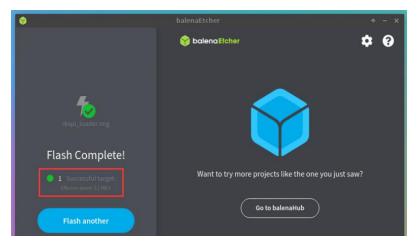
j. Then enter the password **orangepi** for the Linux system on the development board, and you will start burning the u-boot image to SPI Flash



k. The display of the burning process is as follows:



1. The display after burning is completed is as follows:



9) The method of burning Linux system from TF card to NVMe SSD (this method is equivalent to cloning the system from TF card to NVMe SSD)

a. First click Clone drive



b. Then select the device name of the TF card /dev/mmcblk1

| 9 | balenaEtch | er | ↑ - × |
|------------------------|------------|---------------------------|-------|
| | 😚 balen | aElcher | ¢ 0 |
| Select source 3 found | | | |
| Name | Size | Location | |
| 🧭 (opi_boot, opi_root) | 15.9 GB | /dev/mmcblk1 Source drive | |
| ♥ Show 2 hidden | Cancel | Select (1) | |

c. The interface after opening the TF card is as follows:



d. Then click Select target



e. Then click on **Show 2 hidden** to open more storage device options

| | 😚 bale | naEtcher | | \$ 8 |
|-----------------------|---------|--------------|--------------|---------|
| Select target 3 found | | | | |
| Name | Size | Location | | |
| (opi_boot, opi_root) | 15.9 GB | /dev/mmcblk1 | Source drive | |

f. Then select the device name /dev/nvme0n1 for the NVMe SSD and click Select

| Size | Location | | |
|---------|----------------|--|--|
| 15.9 GB | /dev/mmcblk1 | Source drive | |
| 16.8 MB | /dev/mtdblock0 | Too small | |
| 2.05 TB | /dev/nvme0n1 | System drive | |
| | | | |
| | 16.8 MB | 15.9 GB /dev/mmcblk1 16.8 MB /dev/mtdblock0 | 15.9 GB /dev/mmcblk1 Source drive 16.8 MB /dev/mtdblock0 Too small |

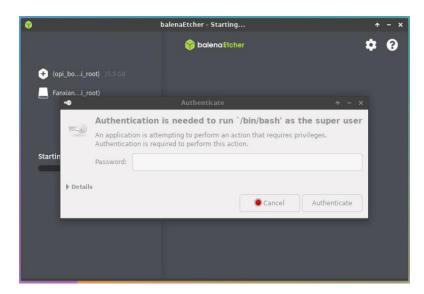
g. Then click Flash



h. Then click Yes, I'm sure

| 8 | balenaEtcher | + - × |
|---|---|-------------|
| | 🌍 balena Etcher | \$ 0 |
| | WARNING! | |
| | You are about to erase your computer's drives | |
| | Fanxiang S500ot, opi_root) 2.05 TB System drive | |
| | Are you sure you want to flash your system drive? | |
| | Yes, I'm sure Change target | |

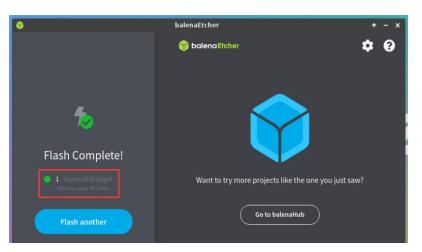
i. Then enter the password orange pi for the Linux system on the development board, and it will start burning the Linux image to the SSD



j. The display of the burning process is as follows:

| 9 | balenaEtcher - 13% Flashing | |
|---|---|--------------|
| | 😚 balena Etcher | ¢ 0 |
| ↔ (opi_boi_root) 15.9 GB Fanxiani_root) | | |
| 4 | screenly-ose-pi4 | |
| | 👗 by screenly-ose | |
| Flashing 13% Cancel | The most popular digital signage project on GitHub | |
| 44.90 MB/s ETA: 4m40s | Works with | |
| | Get started | |
| | | |
| 0 | balenaEtcher - 82% Validating | + - × |
| 0 | balenaEtcher - 82% Validating ờ balenaEtcher | •-× ¢0 |
| | | •-× ¢0 |
| ♥ (opi_boi_root) 15.9.68 ■ Fanxiani_root) | SelenaEtcher | |
| | SelenaEtcher | × ¢0 |
| E Fanxiani_root) | SolenoEfcher | • - × ♥ Ø |
| Fanxiani_root) | ★ balenoEtcher Image: Streenly-ose Image: Streenly-ose | , - × ✿ Ø |
| Fanxiani_root) | Screenly-ose | , - × ♥ |

k. The display after burning is completed is as follows:



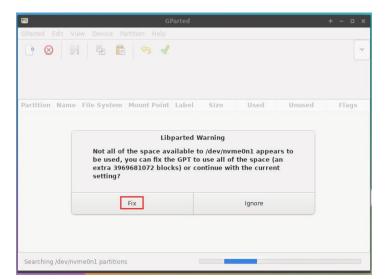
- 1. Then it is necessary to expand the capacity of the rootfs partition in the NVMe SSD, as follows:
 - a) First, open **GParted**. If the system does not have Gparted pre installed, please use the apt command to install it



b) Then enter the password for the Linux system, orangepi, and click on Authenticate

| | Au | thenticate |) | * - | × |
|-----------|--|--|---|---|---|
| | | | to run the GP | arted | |
| | | | | equires privileges. | |
| Password: | ••••• | • | | | |
| 5 | | | | | |
| | | | Cancel | Authenticate | |
| | Partition An applicat Authenticat Password: | Authentication is re Partition Editor as An application is attempti Authentication is required Password: | Partition Editor as root An application is attempting to perfo Authentication is required to perform Password: | Authentication is required to run the GP Partition Editor as root An application is attempting to perform an action that r Authentication is required to perform this action. Password: | Authentication is required to run the GParted Partition Editor as root An application is attempting to perform an action that requires privileges. Authentication is required to perform this action. Password: |

c) Then click **Fix**



d) Then select NVMe SSD

| | | /dev/n | nmcblk1 - GPar | ted | | | ب ا | - 0 X |
|---|--------|--------------|--------------------------|----------------------|--------------------------------------|----------|----------------------------|-----------|
| GParted Edit View | Device | Partition He | elp | | | | | |
| P 😣 🔊 | | 6 | 1 | | | /dev/mm | cblk1 (14 | 4.84 GiB) |
| | | | /dev/mmcl 14.41 GiB | blk1p2 | | /dev/nvm | neOnl (1. | 86 TiB) |
| Partition | Name | File System | Mount Point | Label | Size | Used | Unused | Flags |
| unallocated /dev/mmcblk1p1 /dev/mmcblk1p2 | bootfs | | /boot /, /var/log.hdd | opi_boot opi_root | 30.00 MiB 256.00 MiB 14.41 GiB | | 165.78 MiB 9.50 GiB | bls_boo |
| unallocated | 1 | unallocated | | (100 m) (100 m) | 153.50 MiB | | | |

e) The display interface after selecting NVMe SSD is as follows:

| | | /dev/n | vme0n1 - GPar | ted | | | * | - • × |
|--------------------------|--------|----------------|----------------------|-------------------|-------------------|----------|-------------|-------------------|
| GParted Edit View | Device | e Partition He | elp | | | | | |
| 🕑 🔕 🔊 | | | 1 | | | /dev/nvn | ne0nl (1.86 | TiB) 🔻 |
| | | | unallo 1.85 T | | | | | |
| | | | | | | | | |
| Partition | Name | File System | Mount Point | Label | Size | Used | Unused | Flags |
| Partition unallocated | Name | File System | Mount Point | Label | Size 30.00 MiB | Used | Unused | Flags |
| | | unallocated | Mount Point /boot | Label opi_boot | 30.00 MiB | | | Flags bls_boot |
| unallocated | | unallocated | | | 30.00 MiB | | | |

f) Then select the /dev/nvme0n1p2 partition, right-click, and select Resize/Move

| GParted Edit View | Device | | ivme0n1 - GPar | tea | | | * | > |
|----------------------|--------|-------------|------------------|----------|-------------|----------|-------------|----------|
| | | | lp | | | | | |
| P 😣 🔊 | | | 2 | | 6 | /dev/nvr | ne0n1 (1.86 | 6 TiB) 🔻 |
| | | | unallo 1.85 T | | | | | |
| Partition | Name | File System | Mount Point | Label | Size | Used | Unused | Flags |
| unallocated | | unallocated | | | 30.00 MiB | | | |
| /dev/nvme0n1p1🛕 | bootfs | fat16 | /boot | opi_boot | 256.00 MiB | | | bls_boot |
| /dev/nvme0n1p2 | | ext4 | | opi_root | New | COD CID | Insert | |
| unallocated | | unallocated | | | 😣 Delete | | Delete | |
| | | | | | 🔊 Resize/M | ove | | |
| | | | | | Ē Copy | 10 | Ctrl+C | |
| | | | | | 💼 Paste | | Ctrl+V | |
| | | | | | Format to | 0 | • | |
| | | | | | Open End | ryption | | |
| | | | | | Mount | | | |
| | | | | | Name Pa | rtition | | |
| 0 operations pending | | | | | Manage I | lags | | |
| | | | | | Check | | | _ |
| | | | | | Label File | e System | | |
| | | | | | New UUI | D | | |
| | | | | | 💡 Informati | on | | |

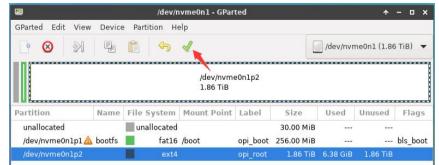
g) Then drag the capacity to its maximum position as shown in the following figure

| | Resize/Move /dev/nv | /me0n1p2 | | | | • | × |
|---|-----------------------------|------------|-------|-------|--------|-------|----|
| | | | | | | | |
| | tinimum size: 6529 MiB | 4aximum si | ze: 1 | 95322 | 8 MiB | | |
| 6 | Free space preceding (MiB): | ٥ | - | + | | | |
| | New size (MiB): | 14754 | - | + | | | |
| | Free space following (MiB): | 1938474 | - | + | | | |
| | Align to: | Мів | | • | | | |
| | | Canc | el | | Resize | e/Mov | /e |

h) Then click **Resize/Move**



i) Then click on the green \checkmark in the position shown below



j) Then click Apply

| GParted Edit View D | /dev/nvme0n1 - GI Device Partition Help | Parted | + - □ × |
|--|---|---|--|
| | ų 🖡 🥱 🖌 | /de | ev/nvme0n1 (1.86 TiB) 👻 |
| | /dev/nv 1.86 Ti | rme0n1p2 B | |
| Partition unallocated /dev/nvme0n1p1 /dev/nvme0n1p2 | Apply operation Are you sure you to pending operation Editing partitions has the pote You are advised to backup you | vant to apply the s? ntial to cause LOSS of DATA. | Unused Flags bls_boot 3 1.86 TiB |
| | Cancel | 🖌 Apply | |
| Grow /dev/nvme0n1p2 | from 14.41 GiB to 1.86 TiB | | |

k) Then click **Close** to close it

| | /dev/nvme0n1 - GParted | | ↑ - □ |
|---------------------------------------|---|-----------|------------------|
| GParted Edit View Device Pa | rtition Help | | |
| 🕒 😣 🔊 🗄 🖺 | (5) d | /dev/nv | me0n1 (1.86 TiB) |
| | /dev/nvme0n1p2 1.86 TiB | | |
| | Applying pending operations | | + = × = |
| Part un Depending on the number ar | d type of operations this might take a lo | ong time. | ig |
| /di | | - | 00 |
| /d Completed Operations: /d | All operations successfully completed | | |
| Details | | | |
| , becans | | | |
| | | | |
| | | | |
| ≫l Gi | | | |
| | | | X Close |

m. At this point, you can use the **sudo poweroff** command to shut down. Then please unplug the TF card and briefly press the power button to turn on the Linux system in SPIFlash+NVMe SSD.

10) Step **9)** is to clone the system from the TF card to the NMVe SSD, and we can also directly burn the Linux image file to the NVMe SSD. Here is an overview of the following steps:

- a. Upload Linux image files to the Linux system of the development board
- b. Then use balenaEtcher to burn it

| (| | balenaEtcher | + - × | |
|----------|---|---|----------|--|
| | | 🌍 balena Etcher | ¢ 9 | |
| | • — | | 7 | |
| | Orangepi50.110.img Remove 6.55 GB | ▲ Fanxiangopi_root) Change 2.05 TB | Flash! | |
| | | | | |
| | | cting your system drive is dangerous and will | | |

c. After burning the image using this method, there is no need to manually expand it. It will automatically expand on the first startup.

2.8. The method of burning Linux images to SPIFlash+SATA SSDs

Note that the Linux image referred to here specifically refers to Linux distribution images such as Debian, Ubuntu, OpenWRT, or OPi OS Arch downloaded from the Orange Pi download page.

Before starting to burn the image, it is necessary to ensure that the development board has already attached the SPI Flash chip, as the development board does not have an SPI Flash chip attached at the factory, so it needs to be purchased and soldered on by oneself. We recommend using the XM25QU128CWIQT08Q SPI

Flash chip model

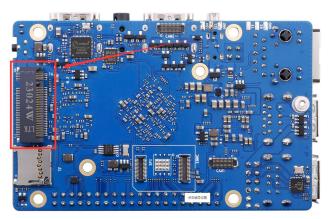
Due to SPI Flash and eMMC reusing the same pins, eMMC cannot be used with SPI Flash attached

2.8.1. The method of burning using the dd command

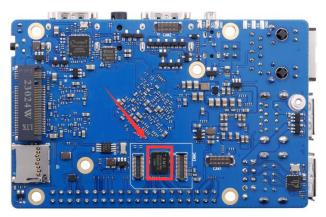
1) First, you need to prepare a SATA SSD solid-state drive



2) Then insert the SSD into the M.2 interface of the development board and secure it in place



3) Please ensure that the development board has already been labeled with SPI Flash. The position of SPI Flash on the development board is shown in the following figure, and no other settings are required before starting the burning process



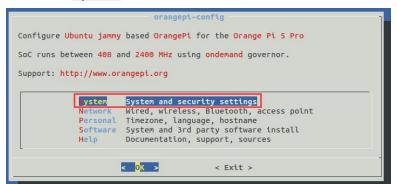
4) Burning the linux image to SPIFlash+SDD needs to be completed with the help of a TF card, so first you need to burn the linux image to the TF card, and then use the TF card to start the development board to enter the linux system. For the method of burning the Linux image to the TF card based on the two sections of the method of burning the Linux image to the TF card based on the Windows PC and the method of burning the Linux image to the TF card based on the on the Ubuntu PC.

5) After booting the Linux system with a TF card, we first burn the u-boot image dedicated to Sata SSD to SPI Flash

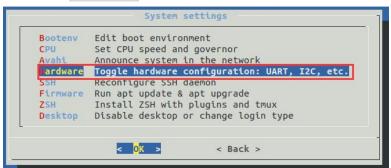
- a. In Linux systems, the default SPI Flash feature is turned off and needs to be manually turned on to use. The detailed steps are as follows:
 - a) First run orangepi-config, **normal users remember to add sudo permission**

orangepi@orangepi:~\$ sudo orangepi-config

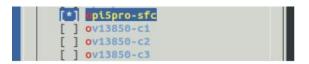
b) Then select **System**



c) Then select Hardware



 d) Then use the arrow keys on the keyboard to navigate to opi5pro-sfc, and use a space to select it



e) Then select **<Save>** to save



f) Then select <Back>

| L | 4(+) | 49% | | |
|---|----------|----------|--|--|
| | < Save > | < Back > | | |

g) Then select **<Reboot>** to restart the system for the configuration to take effect

| Reboot to enable new features? | Applyin | g changes |
|-------------------------------------|-------------------|-------------------|
| | Reboot to ena | ble new features? |
| <reboot> <cancel></cancel></reboot> | <reboot></reboot> | <cancel></cancel> |

b. The dedicated u-boot image storage path for sata ssd startup is:

/usr/share/orangepi5pro/rkspi_loader_sata.img

c. Make sure that **rkspi_loader_sata.img** exists in the Linux system, and then use the following command to burn it into the SPIFlash of the development board

orangepi@orangepi:~\$ cd /usr/share/orangepi5pro/

orangepi@orangepi:~\$ sudo dd if=rkspi_loader_sata.img of=/dev/mtdblock0 orangepi@orangepi:~\$ sudo sync

OPi OS Arch system does not have SPI Flash enabled by default and needs to be manually opened. Please add the following configuration in /boot/extLinux/extlinuxconf and restart the system to recognize SPI Flash

[orangepi@orangepi~]\$ sudo vim /boot/extlinux/extlinux.conf

FDTOVERLAYS /dtbs/rockchip/overlay/rk3588-opi5pro-sfc.dtbo

The storage path of the u-boot image of the OPi OS Arch system is somewhat different, as shown below:

a. OPi OS Arch system sata ssd boot dedicated u-boot image storage path is: /boot/rkspi loader sata.img

b. Make sure rkspi_loader_sata.img exists in the OPi OS Arch system, and then use the following command to burn it into the SPIFlash of the development board:

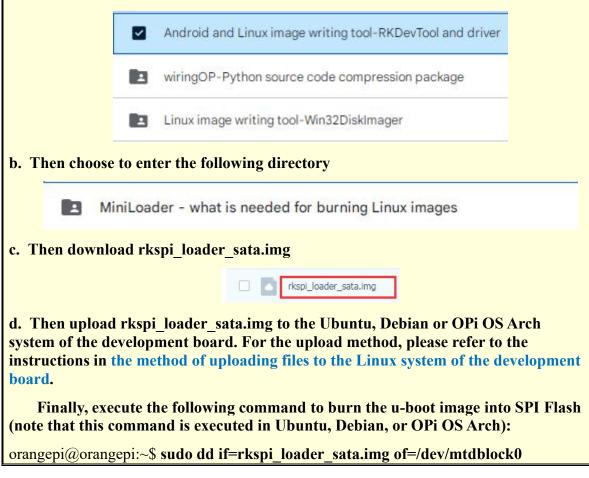
[orangepi@orangepi boot]\$ cd /boot/

[orangepi@orangepi boot]\$ sudo dd if=rkspi_loader_sata.img of=/dev/mtdblock0

[orangepi@orangepi boot]\$ sudo sync

If you need to start the OpenWRT image, you need to download the latest version of u-boot image from the official website, and then burn it into SPI Flash. The download steps are as follows:

a. First enter the data download page of the development board, then select the official tool on the data download page, and then enter the folder below



6) Then upload the Linux image file (Debian or Ubuntu image downloaded from the

official website, OPi OS Arch image, or OpenWRT image) to the TF card. For the method of uploading Linux image files to the development board, please refer to the instructions in the Methods section of **uploading files to the Linux system of the development board**.

Note that if you download an OpenWRT image, you will see the following three types of images in the download link of the OpenWRT image. Please select the image file in the "SPIFlash+SATA SSD boot image" folder.

| · · · · · · · · · · · · · · · · · · · | K 1 selected | |
|---------------------------------------|-------------------------|--------------------|
| Na | ame 1 | Owner |
| | SD Card Image | ⁶ ₩r me |
| | SPIFlash-NVME SSD Image | ⁶ ₩r me |
| | SPIFlash-SATA SSD Image | 🖙 me |

7) After uploading the image to the linux system of the development board, we enter the storage path of the image file in the command line of the linux system of the development board. For example, I store the linux image of the development board in the **/home/orangepi/Desktop** directory Download it, and then enter the **/home/orangepi/Desktop** directory to see the uploaded image file.

orangepi@orangepi:~\$ cd /home/orangepi/Desktop

orangepi@orangepi:~/Desktop\$ ls

Orangepi5pro_x.x.x_debian_bullseye_desktop_xfce_linux5.10.160.img

How to enter the command line of the development board linux system?

1. For the method of using the serial port to log in to the terminal, please refer to the instructions in the section on how to use the debugging serial port.

2. Use ssh to remotely log in to the Linux system, please refer to the instructions in the section of SSH remote login to the development board.

3. If HDMI, LCD and other display screens are connected, you can open a command line terminal on the desktop.

8) Then please refer to the instructions in the section of **the method of using SATA SSD to open the sata ssd** configuration to ensure that the system can recognize the ssd normally.

OPi OS Arch For the method of opening the sata ssd configuration in the OPi OS Arch system, please refer to the instructions in the section of the method of using

SATA SSD in the OPi OS Arch system.

9) Then we can use the dd command to empty the SSD (Optional)

sudo dd bs=1M if=/dev/zero of=/dev/sda count=2000 status=progress

sudo sync

10) Then you can use the dd command to burn the linux image of the development board into the SSD

- a. In the following command, the if= parameter is followed by the full path where the linux image is stored + the name of the Linux image (such as the name of /home/orangepi/Desktop/Linux image). Because we have entered the path of the linux image above, we only need to fill in the name of the Linux image.
- b. Please do not copy the linux image name in the following command, but replace it with the actual image name (because the version number of the image may be updated)

sudo dd bs=1M if=Orangepi5pro_x.x.x_debian_bullseye_desktop_xfce_linux5.10.160.img of=/dev/sda status=progress

sudo sync

Note, if you upload a linux image compressed file ending in .7z or xz, please remember to decompress it before using the dd command to burn

The detailed description of all parameters of the dd command and more usage can be viewed by executing the man dd command in the linux system.

11) After successfully burning the linux image of the development board to the SATA SSD, it cannot be used directly at this time. Because the default setting of the linux image is to only recognize NVMe SSDs, but not SATA SSDs, the following settings need to be done:

Note that if it is a burned OpenWRT image, the following steps can be ignored, as the SATA image of OpenWRT has SATA SSD configuration enabled by default.

a. First mount the boot partition of the SATA SSD to the /mnt directory of the TF card card Linux system.

orangepi@orangepi:~/Desktop\$ sudo mount /dev/sda1 /mnt/

b. Then open the SATA SSD configuration in the **orangepiEnv.txt** file in the boot partition of the SATA SSD (**please note that it is not /boot/orangepiEnv.txt in the TF card**)

orangepi@orangepi:~/Desktop\$ sudo vim /mnt/orangepiEnv.txt overlays=ssd-sata2

Note that this step is somewhat different for the OPi OS Arch system, please add the following configuration in /boot/extlinux/extlinux.conf:

[orangepi@orangepi~]\$ sudo vim /boot/extlinux/extlinux.conf FDTOVERLAYS /dtbs/rockchip/overlay/rk3588-ssd-sata2.dtbo

c. Then uninstall the boot partition of the SATA SSD

orangepi@orangepi:~/Desktop\$ sudo umount /mnt/

12) At this point, you can use the **poweroff** command to shut down. Then please pull out the TF card, and then short press the power button to turn on, and then the linux system in SPIFlash+SATA SSD will be started

13) After starting the system in the SATA SSD, use the **df -h** command to see the actual hard disk capacity

| 1 5 | | | | | |
|-----------------------------|-------------|-------------|----------|-------------------|--|
| orangepi@orangepi:~\$ df -h | | | | | |
| Filesystem | Size U | Jsed Av | ail Use% | Mounted on | |
| udev | 3.8G | 8.0K | 3.8G | 1% /dev | |
| tmpfs | 769M | 1.4M | 768M | 1% /run | |
| /dev/sda2 | 233G | 4.3G | 226G | 2% / | |
| tmpfs | 3.8G | 0 | 3.8G | 0% /dev/shm | |
| tmpfs | 5.0M | 4.0K | 5.0M | 1% /run/lock | |
| /dev/zram2 | 3.7G | 76K | 3.5G | 1% /tmp | |
| /dev/sda1 | 256M | 90M | 166M | 36% /boot | |
| /dev/zram1 | 194M | 10M | 170M | 6% /var/log | |
| tmpfs | 769M | 60K | 769M | 1% /run/user/1000 | |

14) When the same system is burned in the TF card and SSD, if both the TF card and SSD are inserted into the development board, and the development board is powered on at this time, u-boot will give priority to starting the system in the TF card. However, since the systems in the TF card and the SSD are exactly the same, the UUIDs of the /boot partition and the rootfs partition in the two storage devices are also

the same, which may cause the partition in the SSD to be loaded when the TF card starts. Running the script below resolves this issue

orangepi@orangepi:~\$ sudo fix_mmc_ssd.sh

Exactly the same system means that the image name is exactly the same. Even if they are all Debian11 systems, different versions are different.

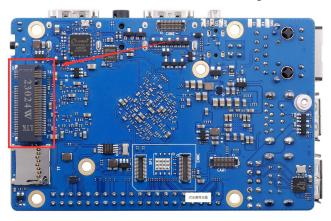
There is no fix_mmc_ssd.sh script in OPi OS Arch system.

2. 8. 2. The method of burning using BalenaEtcher software Please do not use this method for OPi OS Arch and OpenWRT systems.

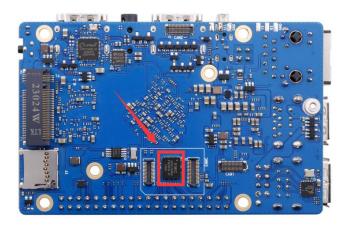
1) First, you need to prepare a SATA SSD solid state drive



2) Then insert the SSD into the M.2 interface of the development board and fix it.



3) Please ensure that the development board has already been labeled with SPI Flash. The position of SPI Flash on the development board is shown in the following figure, and no other settings are required before starting the burning process

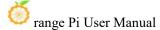


4) Burning the linux image to SPIFlash+SDD needs to be completed with the help of a TF card, so first you need to burn the linux image to the TF card, and then use the TF card to start the development board to enter the linux system. For the method of burning the linux image to the TF card, please refer to the instructions in the two sections of the method of burning the Linux image to the TF card based on the Windows PC and the method of burning the Linux image to the TF card based on the Ubuntu PC.

5) Then please refer to the instructions in the section of **the method of using SATA SSD** to open the sata ssd configuration to ensure that the system can recognize the ssd normally.

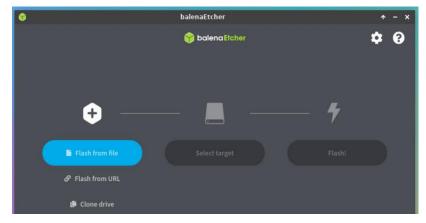
6) The balenaEtcher has been pre-installed in the linux image, and the opening method is as follows:





If it is not pre-installed, for how to download and install the arm64 version of balenaEtcher, please refer to the instructions in the section on **how to download and install the arm64 version of balenaEtcher.**

7) The interface after balenaEtcher is opened is as follow:

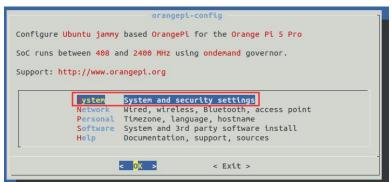


8) The method of burning u-boot into SPI Flash on the development board using balenaEtcher is as follows:

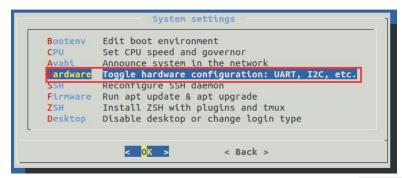
- a. In Linux systems, the default SPI Flash feature is turned off and needs to be manually turned on to use. The detailed steps are as follows:
 - a) First, run orange pi configuration, ordinary users remember to add sudo permissions

orangepi@orangepi:~\$ sudo orangepi-config

b) Then select **System**



c) Then select Hardware



 d) Then use the arrow keys on the keyboard to navigate to opi5pro-sfc, and use a space to select it

| | pi5pro-sfc | |
|-------|------------|--|
| [[] | ov13850-c1 | |
| [] | ov13850-c2 | |
| [] | ov13850-c3 | |

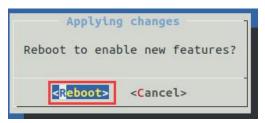
e) Then select **<Save>** to save



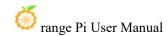
f) Then select **<Back>**

| 49% |
|----------|
| < Back > |
| |

g) Then select **<Reboot>** to restart the system for the configuration to take effect



b. Then select Flash from file





c. Then enter the /usr/share/orangepi5pro/ directory, select rkspi_loader_sata.img, and click Open to open it

| ⊗ Cancel | | | | Q | Dpen 🎬 |
|-----------------|------------------------------|---|--------|----------------|-----------|
| 🔿 Recent | ✓ Ø usr share orangepi5pro ▶ | | | | |
| 🔂 Home | Name | ~ | Size | Туре | Modified |
| 🛅 Desktop | 💼 rkspi_loader_sata.img | | 4.2 MB | Raw disk image | Yesterday |
| Documents | | | | | |

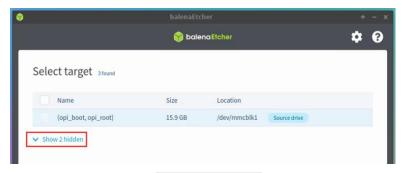
d. The interface after opening **rkspi loader.img** is as follows:



e. Then select Select target



f. Then click on Show 2 hidden to open more storage device options



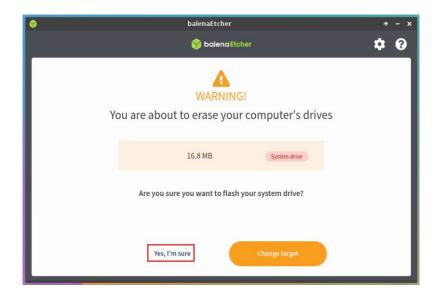
g. Then select the device name /dev/mtdblock0 for SPI Flash and click Select

| • | | + - × | | | |
|---|-----------------------------------|---------|----------------|--------------|---|
| | Warning! Selecting yo | ¢ 😯 | | | |
| Γ | Select target 3 found | | | | |
| | - Name | Size | Location | | |
| | (opi_boot, opi_root) | 31.9 GB | /dev/mmcblk1 | Source drive | |
| | Δ | 16.8 MB | /dev/mtdblock0 | System drive | |
| | ATA Fanxiang_S2boot, opi_root) | 256 GB | /dev/sda | System drive | _ |
| | | | | | |
| | Cance | | Select | t (1) | |

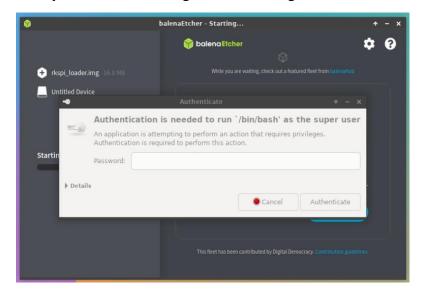
h. Then click Flash



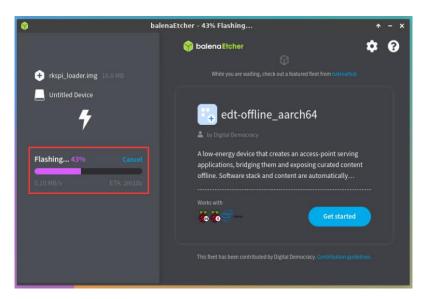
i. Then click Yes, I'm sure



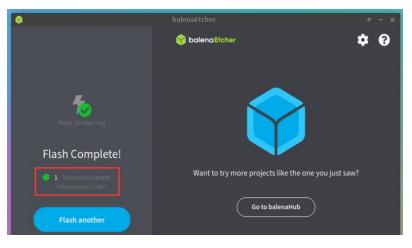
j. Then enter the password orange pi for the Linux system on the development board, and you will start burning the u-boot image to SPI Flash



k. The display of the burning process is as follows:

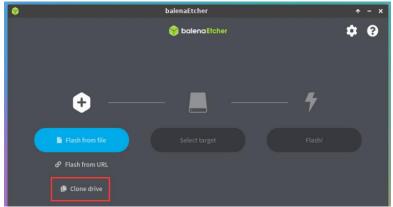


1. The display after burning is completed is as follows:



9) The method of burning Linux system from TF card to SSD (this method is equivalent to cloning the system from TF card to SSD)

a. First click Clone drive



b. Then select the device name of the TF card /dev/mmcblk1

| | balenaEtch | | |
|-----------------------------------|------------|---------------------------|-----------|
| | 🌍 balen | aEtcher | \$ |
| Select source 3 found | | | |
| Select Source 3 found | | | |
| Name | Size | Location | |
| 📀 (opi_boot, opi_root) | 15.9 GB | /dev/mmcblk1 Source drive | |
| Show 2 hidden | | | |
| | | | |
| | | | |

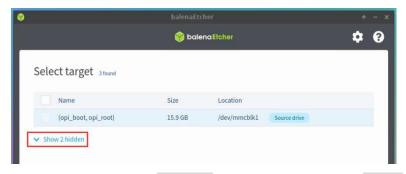
c. The interface after opening the TF card is as follows:

| 😌 balenaEtcher | ↑ - X |
|--------------------------------------|-------|
| balenaEtcher Edit View Window Help | |
| 😭 balena Efcher | ¢ 0 |
| ▲ ■ | 4 |
| | / |
| (opi_boot, opi_root) Select target F | lashl |
| 15.9 GB | |

d. Then click Select target



e. Then click on **Show 2 hidden** to open more storage device options



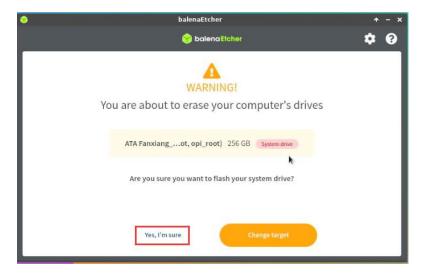
f. Then select the device name /dev/sda for the SSD, and click Select

| ۲ | | balenaEto | her | | ↑ - × |
|---|--------------------------------|-------------------|-------------------------|------------------|-------|
| | Warning! Selecting | your system drive | is dangerous and will e | rase your drivel | ¢ 0 |
| Γ | Select target 3 found | | | | |
| | - Name | Size | Location | | |
| | (opi_boot, opi_root) | 31.9 GB | /dev/mmcblk1 | Source drive | |
| | A | 16.8 MB | /dev/mtdblock0 | Too small | |
| | ATA Fanxiang_S2boot, opi_root) | 256 GB | /dev/sda | System drive | |
| | | | | | |
| | | | | | |
| | | | | | |
| | Car | ncel | Select | t (1) | |
| | | | | | |

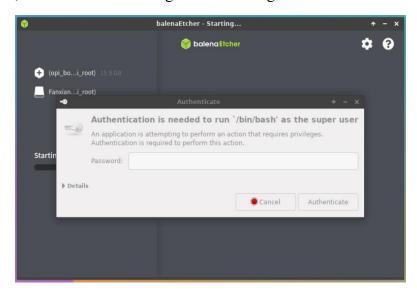
g. Then click Flash



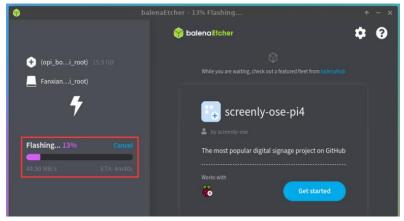
h. Then click Yes, I'm sure

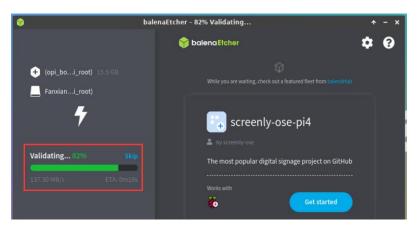


i. Then enter the password **orangepi** for the Linux system on the development board, and it will start burning the Linux image to the SSD

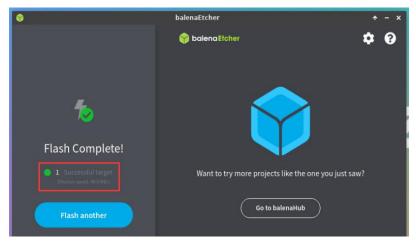


j. The display of the burning process is as follows:





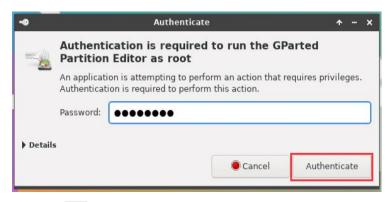
k. The display after burning is completed is as follows:



- 1. Then it is necessary to expand the capacity of the rootfs partition in the SSD, as follows:
 - a) First, open **GParted**. If the system does not have Gparted pre installed, please use the apt. command to install it



b) Then enter the password **orangepi** of the linux system, and click **Authenticate**



c) Then click Fix

| GParted Edit Vo | ew Device Pi | irtition Help | arted | | | | * - ¤ × |
|-------------------|--------------|--|----------------------|------------|----------------------------|----------|---------|
| Partition Name | File System | Mount Point | Label | Size | Used | Unused | Flags |
| | used, | l of the space you can fix th 4240 blocks) (| availabl e GPT to | use all of | sda appears the space (| an extra | |
| | | Fix | | | Ignore | | |
| Searching /dev/sd | a partitions | | 0 | | | _ | 9 |

d) Then select SSD

| /dev/sda2 29.14 GiB | | | | unallo 209.0 | | | | |
|--------------------------|--------|-------------|-------------|----------------------|-------------------------|---------------|-----------|---------|
| Partition | Name | File System | Mount Point | Label | Size | Used | Unused | Flags |
| unallocated | bootfs | unallocated | | | 30.00 MiB | | | LL L. |
| /dev/sda1 🛕 /dev/sda2 | bootts | ext4 | 1 | opi_boot opi_root | 256.00 MiB 29.14 GiB | 13.69 GiB | 15.46 GiB | bls_boo |
| unallocated | | unallocated | | | 209.05 GiB | | | |
| | | | | | | | | |

e) The display interface after selecting SSD is as follow:

| 5 | /dev/sda - GP | arted | | | Ť | > |
|--|-------------------------|---------|-------------------|----------|---------|-------------------|
| GParted Edit View D | evice Partition Help | | | | | |
| | 4 6 5 🗸 | | | /dev/so | la (23) | 8.47 GiB▼ |
| /dev/sda2 | | unalloc | ated | | | |
| 29.14 GiB | | 209.05 | GiB | | | |
| 29.14 GiB | File System Mount Point | | | Used | Unused | Flags |
| 29.14 GiB | File System Mount Point | | | | Unused | Flags |
| 29.14 GiB Partition Name | | | Size | Used | | Flags bls_boot |
| 29,14 GiB Partition Name unallocated | unallocated | Label | Size 30.00 MiB | Used | | |

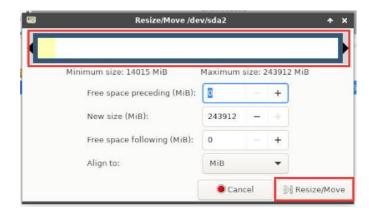
f) Then select the /dev/sda2 partition, then right-click, and then select Resize/Move

| 2 | | /dev/sda - GP | arted | | | | * | - ¤ × |
|--------------------------------------|-----------------|--------------------------|----------|-------------------|-------|-----------|-----------|-----------|
| GParted Edit View D | evice Partition | n Help | | | | | | |
| 💽 😣 🔊 | | 5 1 | | | | /dev/se | da (238 | 8.47 GiB▼ |
| <mark>/dev</mark> /sda2 29.14 GiB | | | | located 05 GiB | | | | |
| Partition Name | File System | Mount Point | Label | Siz | e | Used | Unused | Flags |
| unallocated | unallocated | | | 30.00 | 0 MiB | (515) | | |
| /dev/sda1 🛕 bootfs | fat16 | | opi_boot | 256.00 | D MiB | 222 | | bls_boot |
| /dev/sda2 | ext4 | New | | Insert | 4 GiB | 13.69 GiB | 15.46 GiB | |
| unallocated | unallocated | 🔞 Delete | | Delete | 5 GiB | | | |
| | | 📎 Resize/Mov | /e | | | | | |
| | 1. | 문) Copy | | Ctrl+C | | | | |
| | | Paste | | Ctrl+V | | | | |
| | | Format to | | - F | | | | |
| | | Open Encry Mount on | ption | | | | | |
| | | Name Parti | tion | | | | | |
| 0 operations pending | | Manage Fla Check | ags | | | | | |
| | | Label File S New UUID | iystem | | | | | |
| | | 💡 Information | n | | | | | |

g) Then drag the capacity to the maximum at the position shown in the figure below

| | Resize/Move /de | v/sda2 | | - | | * | × |
|----|--|------------|---------|-------|----------|-----|---|
| 1_ | Minimum size: 14015 MiB Free space preceding (MiB): | Maximum : | size: 2 | 43912 | MiB | | |
| | New size (MiB): | 29842 | - | + | | | |
| | Free space following (MiB): | 214070 | - | + | | | |
| | Align to: 🦻 | MiB Can | cel | | Resize/M | lov | e |

h) Then click Resize/Move



i) Then click the green \checkmark

| 10 | | /dev/sda - GP | arted | | | * | > |
|--------------------|------------------|---------------|-----------------------|------------|-----------|------------|-----------|
| GParted Edit View | Device Partition | n Help | | | | | |
| ◎ ⊗ ≥ | ų 🔒 · | 69 🗹 | | | /dev/s | da (238 | 8.47 GiB▼ |
| | 5 | | lev/sda2 38.20 GiB | | | | |
| Partition Name | File System | Mount Point | Label | Size | Used | Unused | Flags |
| unallocated | unallocated | | | 30.00 MiB | | 1999 | 4 |
| /dev/sda1 🛕 bootfs | fat16 | | opi_boot | 256.00 MiB | | | bls_boot |
| /dev/sda2 | ext4 | 1 | opi_root | 238.20 GiB | 13.69 GiB | 224.51 GiB | |

j) Then click Apply

| GParted Edit View D | evice Partition Help | | |
|---|--|---|--|
| . ⊗ ≥ | 9 6 5 1 | Jd | ev/sda (238.47 GiB 🔻 |
| | | /sda2 20 GiB | |
| Partition Nam unallocated /dev/sda1 🙆 boot /dev/sda2 | Apply operation Are you sure you we pending operations Editing partitions has the pote You are advised to backup you | want to apply the s? ntial to cause LOSS of DATA. | Unused Flags bls_bool 224.51 GiB |
| | Cancel | 🖌 Apply | |
| Grow /dev/sda2 from 2 | © Cancel 9.14 GiB to 238.20 GiB | 🖌 Apply | |

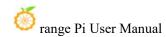
k) Then click Close

| | /dev/sda - GParted | | | n x |
|-----------------------|----------------------------|---|----------------------------|---|
| : View Device Part | ition Help | | | |
| | ← √ | /dev/s | da (238,47 C | SiB▼ |
| | | | | |
| | Applying pending oper | ations | * □ × | |
| ing on the number and | type of operations this mi | ght take a long time. | | gs |
| | | | | oot |
| eted Operations: | All operations successful | ly completed | | |
| ils | | | 3 | |
| | | | | |
| | | | | |
| | | | | |
| | | Constant Constant | | |
| | | Save Details | X Close | |
| |) - | View Device Partition Help View Device Partition Help Image: Constraint of the partition of the part | View Device Partition Help | View Device Partition Help Image: Second s |

m. At this point, you can use the **sudo poweroff** command to shut down. Then please pull out the TF card, and then short press the power button to turn on, and then the linux system in SPIFlash+STAT SSD will be started.

10) Step **9**) is to clone the system in the TF card to the SSD. We can also directly burn the linux image file to the SSD. Here are the steps:

- a. Upload the linux image file to the linux system of the development board
- b. Then use balenaEtcher to burn



| 0 | | balenaEtcher | * - × |
|---|------------------------------|--|--------|
| | | 🌍 balena Etcher | ¢ 9 |
| | + | | - 4 |
| | Orangepi50.110.img Remove | Fanxiangopi_root) Change 2.05 TB | Flash! |
| | | | |
| | | ting your system drive is dangerous and will e | |

- c. After using this method to burn the image, there is no need to manually expand the capacity, and it will automatically expand the capacity at the first startup.
- d. After successfully burning the linux image of the development board to the SATA SSD, it cannot be used directly at this time. Because the default setting of the linux image is to only recognize NVMe SSDs, but not SATA SSDs, the following settings need to be done:
 - a) First mount the boot partition of the SATA SSD to the /mnt directory of the TF card Linux system

orangepi@orangepi:~/Desktop\$ sudo mount /dev/sda1 /mnt/

b) Then open the SATA SSD configuration in the orangepiEnv.txt file in the boot partition of the SATA SSD (note that it is not /boot/orangepiEnv.txt in the TF card)

orangepi@orangepi:~/Desktop\$ sudo vim /mnt/orangepiEnv.txt overlays=ssd-sata2

c) Then unmount the boot partition of the SATA SSD

orangepi@orangepi:~/Desktop\$ sudo umount /mnt/

e. At this point, you can use the **sudo poweroff** command to shut down. Then please pull out the TF card, and then short press the power button to turn on, and

then the linux system in SPIFlash+STAT SSD will be started.

2.9. How to burn Linux image into SPI Flash+USB storage device

Note that the Linux image mentioned here specifically refers to the Linux distribution image such as Debian, Ubuntu, OpenWRT or OPi OS Arch downloaded from the Orange Pi information download page.

Before starting to burn the image, it is necessary to ensure that the development board has been equipped with an SPI Flash chip. The development board does not come with an SPI Flash chip attached from the factory, so it needs to be purchased and soldered on separately. We recommend using the XM25QU128CWIQT08Q model for the SPI Flash chip.

It should be noted that since the SPI Flash and eMMC share the same pins, attaching the SPI Flash will render the eMMC unusable.

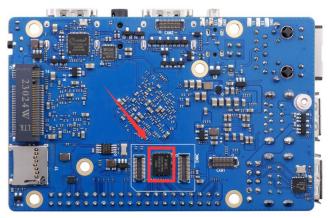
1) First you need to prepare a USB storage device, such as a U disk

2) Next, please refer to the sections "Method for Burning Linux Image to TF Card Based on Windows PC" and "Method for Burning Linux Image to TF Card Based on Ubuntu PC" for instructions on burning the Linux image to a USB storage device. There is no difference between burning the Linux image to a USB storage device and burning it to a TF card (when the TF card is inserted into a card reader, it functions like a USB flash drive).

3) Then insert the USB storage device with the burned Linux system into the USB port of the development board. Note that only the three USB 2.0 ports shown in the figure below support booting the Linux system, while the blue USB 3.0 port does not support it.



4) The location of PI Flash on the development board is shown in the figure below. No other settings are required before starting burning.



5) Burning the u-boot image to the SPIFlash requires the assistance of a TF card, so first, it is necessary to burn the Linux image to the TF card, and then use the TF card to boot the development board into the Linux system. Please refer to the sections "Method for Burning Linux Image to TF Card Based on Windows PC" and "Method for Burning Linux Image to TF Card Based on Ubuntu PC" for instructions on burning the Linux image to a TF card.

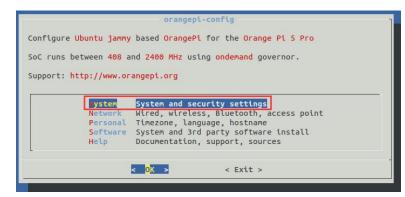
6) After using the TF card to start the Linux system, you can burn the u-boot image into SPI Flash.

a. In Linux systems, the SPI Flash function is turned off by default and needs to be turned on manually to use it. Detailed steps are as follows:

h) First run orangepi-config. Ordinary users remember to add sudo permissions.

orangepi@orangepi:~\$ sudo orangepi-config

i) And then select **System**



j) And select Hardware

| Bootenv | Edit boot environment |
|--------------|--|
| CPU Avahi | Set CPU speed and governor Announce system in the network |
| ardware | Toggle hardware configuration: UART, I2C, etc. |
| SSH | Reconfigure SSH daemon |
| Firmware | Run apt update & apt upgrade |
| ZSH | Install ZSH with plugins and tmux |
| Desktop | Disable desktop or change login type |

k) Then use the keyboard's arrow keys to locate opi5pro-sfc, and then use the space to select it.

| | pi5pro-sfc | |
|---|------------|--|
| | ov13850-c1 | |
| [| ov13850-c2 | |
| | ov13850-c3 | |

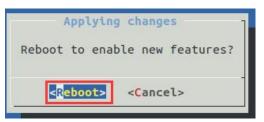
1) Then select<Save> to save



m) Select <Back>



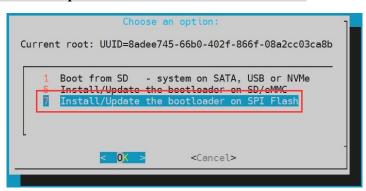
n) Then select **<Reboot>** to restart the system to make the configuration take effect.



b. Then run nand-sata-install. Ordinary users remember to add sudo permissions.

orangepi@orangepi:~\$ sudo nand-sata-install

c. Select 7 Install/Update ther bootloader on SPI Flash



d. And then select **<Yes>**

| | m m | | | | m mmmmm | mm r | | |
|------|------------|------|--------|------|----------|--------|--------------|--|
| | # # # | | | | | | * m" " | |
| | " #"# # | # # | #mmmm" | # #m | # # | # #m # | ŧ# mm | |
| | ## ##" | #mm# | # "m | # # | # # | # # # | t # # | |
| | # # | # # | # " | # : | ## mm#mm | # # | I manager II | |
| Thic | script wil | | | | | | | |

e. Then please wait patiently for the burning to be completed. After the burning is completed, the display will be as follows (a **Done** will be displayed in the lower left corner):



OPi OS Arch system does not have the configuration to open SPI Flash by default. It needs to be opened manually. Please add the following configuration to /boot/extlinux/extlinux.conf and restart the system to recognize SPI Flash.

[orangepi@orangepi~]\$ sudo vim /boot/extlinux/extlinux.conf

FDTOVERLAYS /dtbs/rockchip/overlay/rk3588-opi5pro-sfc.dtbo

| There is no nand-sata-install script in OPi OS Arch system. Please use the following command to mirror u-boot to SPI Flash: |
|--|
| [orangepi@orangepi~]\$ sudo dd if=/boot/rkspi_loader.img of=/dev/mtdblock0 |
| If you need to start the OpenWRT image, you need to download the latest version of u-boot image from the official website, and then burn it into SPI Flash. The download steps are as follows: |
| a. First enter the data download page of the development board, then select the official tool on the data download page, and then enter the folder below |
| Android and Linux image writing tool-RKDevTool and driver |
| wiringOP-Python source code compression package |
| Linux image writing tool-Win32DiskImager |
| b. Then choose to enter the directory below |
| MiniLoader - what is needed for burning Linux images |
| c. And Download rkspi_loader.img |
| rkspi_loader.img |
| d. Then upload rkspi_loader.img to the Ubuntu, Debian or OPi OS Arch system of the development board. For the upload method, please refer to the instructions in the method of uploading files to the Linux system of the development board. |
| Finally, execute the following command to burn the u-boot image into SPI Flash (note that this command is executed in Ubuntu, Debian, or OPi OS Arch): |
| orangepi@orangepi:~\$ sudo dd if=rkspi_loader.img of=/dev/mtdblock0 |

7) At this point, you can use the **poweroff** command to shut down the computer. Then

please pull out the TF card and short press the power button to turn on the computer. At this time, the Linux system in the SPIFlash+USB storage device will be started.

8) After starting the system in the USB storage device, use the **df -h** command to see the actual capacity of the USB storage device.

| orangepi@orange | pi:~ \$ df | -h | | | |
|-----------------|-------------------|-------------|------------|-------------------|--|
| Filesystem | Size L | Jsed Av | ail Use% | Mounted on | |
| udev | 3.8G | 8.0K | 3.8G | 1% /dev | |
| tmpfs | 769M | 588K | 769M | 1% /run | |
| /dev/sda2 | 15G | 1.6G | 13G | 11% / | |
| tmpfs | 3.8G | 0 | 3.8G | 0% /dev/shm | |
| tmpfs | 5.0M | 4.0K | 5.0M | 1% /run/lock | |
| /dev/zram2 | 3.7G | 60K | 3.5G | 1% /tmp | |
| /dev/sda1 | 256M | 111M | 146M | 44% /boot | |
| /dev/zram1 | 194M | 9.0M | 171M | 5% /var/log | |
| tmpfs | 769M | 0 | 769M | 0% /run/user/1000 | |

2. 10. Method of burning OpenWRT image into SPI FLASH

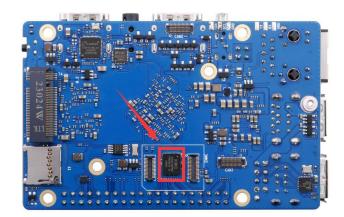
This section describes the method of burning the entire OpenWRT image into the SPI Flash, eliminating the need for an SSD or USB drive. This means that u-boot, kernel, and rootfs are all stored in the SPI Flash.

Before starting the image burning process, it is essential to ensure that the development board is equipped with an SPI Flash chip. Since the development board does not come with an SPI Flash chip attached from the factory, it needs to be purchased and soldered on separately. We recommend using the XM25QU128CWIQT08Q model for the SPI Flash chip.

It should be noted that since the SPI Flash and eMMC share the same pins, attaching the SPI Flash will render the eMMC unusable.

2. 10. 1. How to burn using RKDevTool

1) The location of SPI Flash on the development board is as shown in the picture below. No other settings are required before starting programming.



2) Then you need to prepare a good quality USB male-to-male data cable



3) Then download the Rockchip microdriver **DriverAssitant_v5.12.zip and MiniLoader** and the burning tool **RKDevTool_Release_v3.15.zip** from the Orange Pi download page

a. On the Orange Pi data download page, first select the official tool, and then enter the folder below

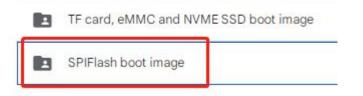


b. Then download all the files below



Note that the "MiniLoader-things needed to burn Linux images" folder will be referred to as the MiniLoader folder below.

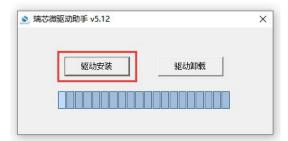
4) Then download the OpenWRT image that can be booted from SPIFlash from the Orange Pi download page. Due to the capacity of SPIFlash, the image is less than 16MB. After opening the download link, you can see the following three types of OpenWRT images. Please select the image in the SPIFlash startup image folder.



5) Then use decompression software to decompress **DriverAssitant_v5.12.zip**, then find the **DriverInstall.exe** executable file in the decompressed folder and open it.

| 名称 | 修改日期 | 类型 | 大小 |
|-----------------|-----------------|------|--------|
| ADBDriver | 2022/12/1 15:07 | 文件夹 | |
| 📑 bin | 2022/12/1 15:07 | 文件夹 | |
| Driver | 2022/12/1 15:07 | 文件夹 | |
| 🔄 config | 2014/6/3 15:38 | 配置设置 | 1 KB |
| 🥞 DriverInstall | 2022/2/28 14:11 | 应用程序 | 491 KB |
| Readme | 2018/1/31 17:44 | 文本文档 | 1 KB |
| revison | 2022/2/28 14:14 | 文本文档 | 1 KB |
| | | | |

- 6) Open **DriverInstall.exe** and install the Rockchip microdriver as follows:
 - a. Click the "Driver Installation" button



b. After waiting for a period of time, a window will pop up prompting "Driver installation successful", then click the "OK" button.

| | DriverInstall | × |] |
|-----|---------------|---|----|
| 驱动家 | | | 印载 |
| | 安装驱动成功. | | |
| | | | |

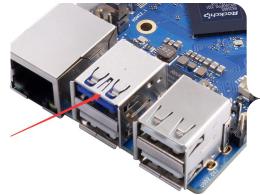
7) Then unzip **RKDevTool_Release_v3.15.zip**. This software does not need to be installed. Just find **RKDevTool** in the unzipped folder and open it.

| 名称 ^ | 修改日期 | 类型 | 大小 |
|-----------------|------------------|-----------------|----------|
| bin | 2022/12/1 15:07 | 文件夹 | |
| Language | 2022/12/1 15:07 | 文件夹 | |
| config.cfg | 2022/3/23 9:11 | CFG 文件 | 7 KB |
| 🔊 config | 2021/11/30 11:04 | 配置设置 | 2 KB |
| revision | 2022/5/27 9:09 | 文本文档 | 3 KB |
| 🔀 RKDevTool | 2022/5/27 9:06 | 应用程序 | 1,212 KB |
| 📓 开发工具使用文档_v1.0 | 2021/8/27 10:28 | Foxit PDF Reade | 450 KB |

8) After opening the **RKDevTool** burning tool, because the computer has not yet been connected to the development board through the Type-C cable, a message "**No device found**" will be displayed in the lower left corner.

| * | | 存储 | 地址 | 名字 | 路径 | | |
|---------|-----|----|---------------|--------------------|-------|----|--|
| | - | | 0::000000000 | Loader | | | |
| 2 | - | - | 0x00000000 | Parameter Uboot | | | |
| | - | | 0x0000000 | Uboot | | | |
| 4 5 | - | | 0x0000000 | Misc | | | |
| 6 6 | - | | 0x00000000 | Resource | | | |
| 0 7 | - | | 0x0000000 | Kernel | | | |
| 7 8 | - | | 0x0000000 | Boot | | | |
| o 9 | 1 | | 0x00000000 | Recovery | | | |
| 9 10 | - | - | 0x0000000 | System | 2 | | |
| 10 | - | | 0x00000000 | Backup | | | |
| | | | 0.0000000 | Dativap | | | |
| | | | | | | | |
| .oad | er: | | 执行 | 切换 | 设备分区表 | 清空 | |
| | | | 19 Miletinium | | | | |
| | | l |] 强制按地址写 | | | | |

- 9) Then start burning the OpenWRT image into SPI FLASH
 - a. First, connect the development board to the Windows computer through a USB male-to-male data cable. The location of the USB burning port on the development board is as shown in the figure below.



- b. Make sure the development board is not connected to the power supply and the TF card is not inserted.
- c. Then press and hold the MaskROM button on the development board. The position of the MaskROM button on the development board is as shown in the figure below:



d. Then connect the development board to the power supply of the Type-C interface, power it on, and then release the MaskROM button.



e. If the previous steps go well, the development board will enter MASKROM mode, and the interface of the burning tool will prompt "A MASKROM device was found"

🥮 range Pi User Manual

| # | | 存储 | 地址 | 名字 | 路径 | |
|------|-----|----|---------------|-----------|----------|--|
| 1 | | | 0x00000000 | Loader | | |
| 2 | Г | | 0x00000000 | Parameter | | |
| 3 | | | 0x00000000 | Uboot | | |
| 4 | | | 0x00000000 | trust | | |
| 5 | | | 0x00000000 | Misc | | |
| 6 | | | 0x00000000 | Resource | | |
| 7 | | | 0x00000000 | Kernel | | |
| 8 | Г | | 0x00000000 | Boot | | |
| 9 | | | 0x00000000 | Recovery | | |
| 10 | Г | | 0x00000000 | System | | |
| 11 | | | 0x00000000 | Backup | | |
| .0ad | er: | | 执行 □强制按地址写 | 切换 | 设备分配表 清空 | |

f. Then place the mouse cursor in the area below

| # | | 存储 | 地址 0x0000000 | 名字 Loader | 路径 | |
|------|-----|----|-----------------|--------------|----------|------------------------------------|
| 2 | - | | 0x00000000 | Parameter | | |
| 3 | Ē | | 0x00000000 | Uboot | | |
| 4 | F | | 0x00000000 | trust | | |
| 5 | Г | | 0x00000000 | Misc | | |
| 6 | Г | | 0x00000000 | Resource | | |
| 7 | Г | | 0x00000000 | Kernel | | |
| 8 | Г | | 0x00000000 | Boot | | |
| 9 | | | 0x00000000 | Recovery | | |
| 10 | | | 0x00000000 | System | | |
| 11 | | | 0x00000000 | Backup | | |
| Load | er: | | 执行]强制按地址写 | 切换 | 设备分区表 清空 | Place the mouse cursor in this are |

g. Then click the right button of the mouse and the selection interface shown below will pop up.

| 日本のの00000000000000000000000000000000000 |
|---|
| □ 0x0000000 Wbot □ 0x0000000 trust 添加项 □ 0x0000000 Miso 動砂項 □ 0x0000000 Riso 動砂項 □ 0x0000000 Resource 動砂項 □ 0x00000000 Henal 清空所有項 □ 0x00000000 Boot 上修 □ 0x00000000 System 下修 |
| □ 0x00000000 trust 添加項 □ 0x00000000 trust 添加項 □ 0x00000000 Resource 翻線項 □ 0x00000000 Kernal 清空所有項 □ 0x00000000 Recovery 下移 □ 0x00000000 System 下移 |
| ○ 0x0000000 Nisc 冷切現 ○ 0x0000000 Resource 割除項 ○ 0x00000000 Kernal 清空所有項 ○ 0x00000000 Boot 上都 ○ 0x00000000 Recovery 下移 |
| 0xx0000000 Raso 0xx0000000 Resource 1 0xx0000000 0xx0000000 Kernel 1 法空所有项 1 0xx0000000 0xx0000000 Resource 1 1 1 < |
| 0x0000000 Kernel 清空所有項 0x0000000 Boot 上修 0x00000000 Recovery 下修 |
| □ 0x0000000 Boot 148 □ 0x0000000 Reovery 148 □ 0x0000000 System 下後8 |
| 0x0000000 Recovery 上形 0x0000000 System 下修 |
| □ 0x00000000 Recovery □ 0x00000000 System 下移 |
| System System |
| 0x00000000 Backup 导入配置 |
| |
| 导出配置 |

h. Then select the Import Configuration option

🧼 range Pi User Manual

| # | | 存储 | 地址 | 名字 | 路径 | | | | | |
|------|-----|--|------------|-----------|------|--|--|--|--|--|
| 1 | Γ | | 0x00000000 | Loader | | | | | | |
| 2 | Г | 1991 - 1992 - 19 | 0x00000000 | Parameter | | | | | | |
| 3 | Г | | 0x00000000 | Vboot | | | | | | |
| 4 | | | 0x00000000 | trust | | 添加项 | | | | |
| 5 | | | 0x00000000 | Misc | | | | | | |
| 6 | | | 0x00000000 | Resource | | 删除项 | | | | |
| 7 | Г | | 0x00000000 | Kernel | | 清空所有项 | | | | |
| 8 | Г | | 0x00000000 | Boot | | 上移 | | | | |
| 9 | Г | | 0x00000000 | Recovery | | 下移 | | | | |
| 10 | Г | | 0x00000000 | System | | and the second sec | | | | |
| 11 | | | 0x00000000 | Backup | | 导入配置 | | | | |
| Loui | er: | | 执行 | 切换 | 设备分区 | 与出配置 | | | | |

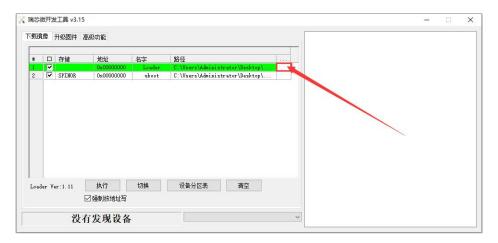
i. Then select the **rk3588_linux_spiflash.cfg** configuration file in the **MiniLoader** folder downloaded earlier, and then click Open

| 瑞芯微开发工具 v3.15 | | - 🗆 🗙 |
|--|-------|---------------------|
| - ※ 打开 | | × - |
| ← → ~ ↑ 📙 > 此电脑 > 桌面 → orangepi > MiniLoader-烧录Linux镜像才需要用到的东西 | 5 v Č | |
| 组织 ▼ 新建文件夹 | | 88 - 💷 🕐 |
| 此电脑 3D 对象 3D 对象 1k3588_linux_prie.cfg 1k3588_linux_spiflash.cfg 1k3588_linux_tfcard.cfg 1k3588_linux_tfcard.cfg 1k3588_linux_tfcard.cfg | | |
| 文件名(N): rk3588_linux_spiflash.cfg | ~ | ConfigFile(*.cfg) ~ |
| | | 打开(O) 取消 |

j. Click YES

| | 存储 | 地址 | 名字 | 路径 | |
|---|--------|------------|--------|---------------------------------|--|
| ~ | | 0x00000000 | Loader | C:\Users\Administrator\Desktop\ | |
| • | SPINOR | 0x00000000 | uboot | C:\Users\Administrator\Desktop\ | |
| | | | | 日日の日本 | |
| | | | | ● 令人配置成功. | |
| | | | | ● 导入配置成功. 确定 | |
| | | | | | |

k. Then click the location shown in the picture below



1. Then select MiniLoaderAll.bin in the MiniLoader folder downloaded earlier, and then click Open

| 个 📙 > 此电脑 > 桌面 > orangepi > MiniLoader-烧录Linu | ux鏡像才需要用到的东西 v O C 在 MiniLoader-烧录Linux |
|--|---|
| 组织 ▼ 新建文件夹 | 88 - 💷 🤇 |
| 此电脑 3D 对象 所inux_emmc.cfg 水3588_linux_pcie.cfg rk3588_linux_pcie.cfg rk3588_linux_spilash.cfg rk3588_linux_tford.cfg rk3588_linux_tford.cfg rk3588_linux_tford.cfg rk3588_linux_fford.cfg rk3588_linux_tford.cfg rk3588_linux_tford.cfg<!--</th--><th></th> | |
| 文件名(N): MiniLoaderAll.bin | ✓ All File(*.*) ✓ |

m. Then click the location shown in the picture below

| 截镜作 | 像 | 升级固件 | 高级功能 | | |
|------|-------|---------|------------------|-----------------|--|
| # | | 存緒 | 地址 0x00000000 | 名字 | 路径 |
| 2 | | SPINOR | 0x00000000 | Loader uboot | C:\Users\Lee\Desktop\orangepiVL C:\Users\Administrator\Desktop\ |
| | | | | | |
| | | | | | N |
| | | | | | |
| | | | | | |
| | | | | | |
| oade | or Ve | er:1.11 | 执行 | 切换 | 设备分区表 清空 |

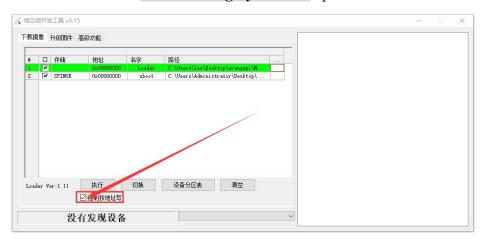
n. Then select the path of the OpenWRT image you want to burn, and then click Open

Before burning the image, it is recommended to rename the OpenWRT image to

something short like "orangepi.img" or another concise name. This way, during the image burning process, you can see the percentage progress of the burn.

| 像 入打开 | × - |
|--|--------------------------------|
| | rangepi > v ひ の 在 orangepi 中搜索 |
| ▲ 组织 ▼ 新建文件夹 | BB - 🔟 📀 |
| ■ 此电脑 ③ 3D 对象 ■ 役须 ■ 優須 ■ 資格 ◆ 下载 ◆ 百兆 ■ 桌面 ● 本地磁盘(C:) | 烧录Linux镜像才需要用到的东西 |
| | All File(*.*) |
| 文件名(N): orangepi | |

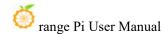
o. Then make sure the **Force writing by address** option is checked.



p. Click the **Execute** button again to start burning the OpenWRT image into SPIFlash.

| | а <u>лт</u> 2 | 设工具 v3.15 | | | | |
|-------|---------------|-----------|------------------|-----------------|--|--|
| 载豄 | 像 | 升级固件幕 | 高級功能 | | | |
| | - | Laur | | 1.6.5 | | |
| \$ | | 存储 | 地址 0x00000000 | 名字 | 路径 | |
| 2 | 1 | SPINOR | 0x00000000 | Loader uboot | C:\Users\lee\Desktop\orangepi\M C:\Users\Administrator\Desktop\ | |
| | 1 | | | 20001 | P | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| and | er Vi | ar-1 11 | 执行 | 切檢 | 设备分区表 查空 | |
| oad | er Vo | er:1.11 | 执行 | 切换 | 设备分区表 清空 | |
| oad | er Ve | L | 执行 一强制按地址写 | 切换 | 设备分区表 有空 | |
| .o ad | er Ve | 1 | | | 设备分区表 清空 | |

q. The display log after the OpenWRT image is burned is as shown below



| 1 | 口,存储 | 地址 | 名字 | 路径 | | 等待Maskron成功 | |
|-----|--------------|---|-----------------|--|----|------------------------------------|--|
| 2 | SPINOR | 0x0000 | Loader uboot | C:\Users\hh177\Desktop\ora C:\Users\hh177\Desktop\ora | | 测试设备开始 | |
| | DI LIION | 010000000000000000000000000000000000000 | aboot | er (osers (all r (besk top (or all r | d | 测试设备成功 | |
| | | | | | | 校验芯片开始 | |
| | | | | | | 校验芯片成功 | |
| | | | | | | 获取FlashInfo开始 | |
| | | | | | | 获取FlashInfo成功 准备IDB开始 | |
| | | | | | | 准备IDB成功 | |
| | | | | | | 下载IDB开始 | |
| | | | | | | 下载IDB成功 | |
| | | | | | | 等待Maskron开始 | |
| | | | | | | 等待Maskron成功 | |
| | | | | | | 测试设备开始 | |
| | | 执行 | 1.71 | | .+ | 测试设备成功 IIIté kuté ze Mizienzmen | |
| | | | 切 | 與 设备分区表 | 清空 | 开始切换存储到SPINOR | |
| oad | ler Ver:1.11 | 1411 | | | | 开始下载orangepi | |

If there is a problem with burning, please clear SPIFlash first and then try burning again. For the method of clearing SPIFlash, please refer to the instructions in the section "How to clear SPIFlash using RKDevTool".

r. The OpenWRT image will start automatically after burning. If it does not start normally, please power on again and try again.

2.11. Method of burning Android image to TF card

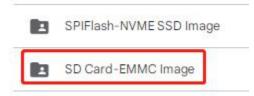
2.11.1. How to burn using RKDevTool

1) First you need to prepare a good quality USB2.0 male-to-male data cable



2) Then download the Rockchip microdriver **DriverAssitant_v5.12.zip** and burning tool **RKDevTool Release v3.15.zip** from the Orange Pi data download page

- 3) Then download the Android image from the Orange Pi download page.
 - a. After opening the download link of the Android image, you can see the following three types of Android images. Please select the image in the TF card and eMMC boot image folder to download.



b. After entering the **TF card and eMMC boot image** folders, you can see the following three images. Their differences are:

a) The first image is specially used for HDMI display and supports 8K display. If you do not use an LCD screen, please download the image without LCD.

b) If you want to use an LCD screen, please choose the mirror with LCD

c) The image with box is an image dedicated to TV box



 Then use decompression software to decompress DriverAssitant_v5.12.zip, then find the DriverInstall.exe executable file in the decompressed folder and open it.

| 名称 ^ | 修改日期 | 类型 | 大小 |
|-----------------|-----------------|------|--------|
| ADBDriver | 2022/12/1 15:07 | 文件夹 | |
| 🔜 bin | 2022/12/1 15:07 | 文件夹 | |
| Driver | 2022/12/1 15:07 | 文件夹 | |
| onfig | 2014/6/3 15:38 | 配置设置 | 1 KB |
| 🅞 DriverInstall | 2022/2/28 14:11 | 应用程序 | 491 KB |
| Readme | 2018/1/31 17:44 | 文本文档 | 1 KB |
| revison | 2022/2/28 14:14 | 文本文档 | 1 KB |
| | | | |

- 5) Open **DriverInstall.exe** and install the Rockchip microdriver as follows:
 - a. Click the "Driver Installation" button

| ▲ 瑞芯微驱动助手 v5.12 | × |
|-----------------|------|
| 驱动安装 | 驱动卸载 |
| | |
| | |

b. After waiting for a period of time, a window will pop up prompting "Driver

installation successful", then click the "OK" button.

| | | DriverInstall | × | 1 | |
|---|--------|---------------|---|----|--|
| | 30Zz力3 | 1 | | 印载 | |
| Γ | | 安装驱动成功. | | | |
| | | | _ | | |

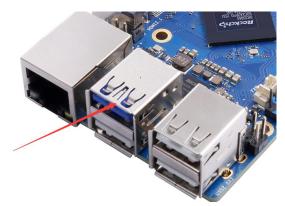
6) Then unzip **RKDevTool_Release_v3.15.zip**. This software does not need to be installed. Just find **RKDevTool** in the unzipped folder and open it.

| 名称 ^ | 修改日期 | 类型 | 大小 |
|-----------------|------------------|-----------------|----------|
| bin | 2022/12/1 15:07 | 文件夹 | |
| Language | 2022/12/1 15:07 | 文件夹 | |
| 🗋 config.cfg | 2022/3/23 9:11 | CFG 文件 | 7 KB |
| 🔄 config | 2021/11/30 11:04 | 配置设置 | 2 KB |
| revision | 2022/5/27 9:09 | 文本文档 | 3 KB |
| 🔀 RKDevTool | 2022/5/27 9:06 | 应用程序 | 1,212 KB |
| ☑ 开发工具使用文档_v1.0 | 2021/8/27 10:28 | Foxit PDF Reade | 450 KB |

7) After opening the **RKDevTool**burning tool, because the computer has not yet connected to the development board through the USB2.0 male-to-male data cable, a message "**No device found**" will appear in the lower left corner.

| * | | 存储 | 地址 | 名字 | 路径 | | | | |
|------|------|----|------------|-----------|-------|----|------|--|--|
| 1 | Г | | 0x00000000 | Loader | | | | | |
| 2 | Г | | 0x00000000 | Parameter | | | | | |
| 3 | | | 0x00000000 | Uboot | | | | | |
| 4 | | | 0x00000000 | trust | | | | | |
| 5 | | | 0x00000000 | Misc | | | | | |
| 6 | | | 0x00000000 | Resource | | | | | |
| 7 | Г | | 0x00000000 | Kernel | | | | | |
| 8 | | | 0x00000000 | Boot | | | 2.15 | | |
| 9 | Г | | 0x00000000 | Recovery | | | | | |
| 10 | Г | | 0x00000000 | System | | | | | |
| 11 | | | 0x00000000 | Backup | | | | | |
| Load | ler: | | 执行 | 切换 | 设备分区表 | 清空 | | | |

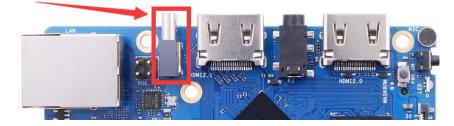
- 8) Then start burning the Android image to the TF card
 - a. First, connect the development board to the Windows computer through a USB2.0 male-to-male data cable. The location of the development board's USB programming port is as shown in the figure below.



- b. Then insert the TF card into the development board and make sure that the development board is not connected to the power supply.
- c. Then press and hold the MaskROM button on the development board. The position of the MaskROM button on the development board is as shown in the figure below:



d. Then connect the development board to the power supply of the Type-C interface, power it on, and then release the MaskROM button.



e. If the previous steps go well, the development board will enter MASKROM mode, and the interface of the burning tool will prompt "A MASKROM device was found"

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| # | | 存储 | 地址 | 名字 | 路径 | | |
|------|-------|----|------------|-----------|----------|---|--|
| 1 | | | 0x00000000 | Loader | | | |
| 2 | Г | | 0x00000000 | Parameter | | | |
| 3 | Г | | 0x00000000 | Uboot | | | |
| 4 | | | 0x00000000 | trust | | | |
| 5 | | | 0x00000000 | Misc | | / | |
| 6 | | | 0x00000000 | Resource | | | |
| 7 | Г | | 0x00000000 | Kernel | | | |
| 8 | Г | | 0x00000000 | Boot | | | |
| 9 | | | 0x00000000 | Recovery | | | |
| 10 | Г | | 0x00000000 | System | | | |
| 11 | Г | | 0x00000000 | Backup | | | |
| Load | ler : | | 执行 □强制按地址写 | 切换 | 设备分回表 清空 | | |

f. Then please select Advanced Features

| | | 工具 v3.15 升级固件 | | | | | |
|----|---|------------------|------------|-----------|----|--|--|
| | | - TRAINIT | | | | | |
| # | | 存储 | 北北 | 名字 | 路径 | | |
| 1 | Г | | 0:0000000 | Loader | | | |
| 2 | | | 0x00000000 | Parameter | | | |
| 3 | | | 0x00000000 | Uboot | | | |
| 4 | Г | | 0x00000000 | trust | | | |
| 5 | | | 0x00000000 | Misc | | | |
| 6 | | | 0x00000000 | Resource | | | |
| 7 | | | 0x00000000 | Kernel | | | |
| 8 | Г | | 0x00000000 | Boot | | | |
| 9 | Г | | 0x00000000 | Recovery | | | |
| 10 | | | 0x00000000 | System | | | |
| 11 | | | 0x00000000 | Backup | | | |

g. Then click the location shown in the picture below

| 镜像 升级固件 | ‡ 高级功能 | | | | |
|-----------|---|-----------|--------------|-----------------------------------|--|
| oot: | | | | 下载 | |
|]件: | | | | 解包 | |
| 读取FlashID | 读取Flash信息 | 读取Chip信息 | 读取Capability | 1. FlASH 2. EMMC 3. SD | |
| 测试设备 | 重启设备 | 进入Maskron | 切换存储 | 5. SPINOR 6. SPINAND 7. RAM | |
| 清空序列号 | 检测安全模式 | 导出串口日志 | 获取当前存储 | 9. SATA | |
| 导出镜像 | ····· ··· ··· ·· | | | | |
| 2始扇区: | | | | | |
| 嗣区数: | | | | | |

h. Then select **MiniLoaderAll.bin** in the **MiniLoader**r folder downloaded earlier, and then click Open

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| 〈打开 | > |
|---|--|
| | x鏡像才需要用到的东西 V O C 在 MiniLoader-烧录Linux |
| 组织 ▼ 新建文件夹 | 88 - 🔳 👔 |
| 此电脑 3D 对象 MiniLoaderAll.bin rk3588_linux_emmc.cfg rk3588_linux_poie.cfg rk3588_linux_poie.cfg rk3588_linux_tfard.cfg rk3588_linux_tfard.cfg< | |
| 文件名(N): MiniLoaderAll.bin | ✓ All File(*.*) ✓ |
| | 打开(0) 取消 |

i. Then click **Download**

| 寬像 升级固件 | 高级功能 | op\orangepi\Mini | .oader-焼 | 下载 | |
|--|----------|------------------|--------------|-----------------------------------|--|
| 機像 升级固件 高级功能 C:\Uzerz\hhl??\Desktop\orangepi\UiniLoader.% 下载 Bft: 解包 读取Flash团 读取Flash信息 读取Capability 1. FIASH 2. EBBC 遗选择 量 值没备 进入Maskroa 切接存储 动 4. SD1 测试设备 重信设备 进入Maskroa 切接存储 SATA 导出编像 攝除療区 摄影所有 | | | | | |
| 圖件: 解包 读取FlashID 读取Flash信息 读取Chip信息 读取Capability 1. FlASH 演戏音 重启设备 进入Maskroa 切换存储 5. STUADO 测试设备 重启设备 进入Maskroa 切换存储 6. STUADO 清空序列号 检测安全模式 导出串口日志 获取当前存储 9. STRADO 导出境像 捕除;南区 振除所有 1. PlaSH 起始南区: | | | | | |
| 则试设备 | 重启设备 | 进入Maskron | 切换存储 | 5. SPINOR 6. SPINAND 7. RAM | |
| 清空序列号 | 检测安全模式 | 导出串口日志 | 获取当前存储 | 9. SATA | |
| 导出镜像 | 擦除扇区 | 擦除所有 | l | | |
| 林鏡像 升级图件 高级功能 Boot: C:\Users\bhl7\Desktop\orangepi\UninLoader.換 下载 圖件: 解包 读取Flash团 读取Flash信息 读取Capability 1. FlASH 测试设备 重启设备 进入Maskroa 切换存储 0. FRU 5. SD 滑空序列号 检测安全模式 导出串口目志 获取当前存储 1. FUE 导出镜像 描脉: 原公衡区: 原因数: | | | | | |
| ⊠数: | | | | | |
| 发现 | 一个MASKRO | M设备 | 1-2-3 :MASKR | M v | |

j. After downloading MiniLoaderAll.bin, the display is as shown below

| 戦镜像 升级固件 | ‡ 高级功能 | 備包 信息 读取Chip信息 读取Chip信息 : PlASH 3.50 : SDI 进入Mashron 切换存结 5.5711NAD 7.8AM 10.FCLE 增添所有 | | | |
|---|---|--|--|-------------------|--|
| Boot: C:\ | Users\csy\Desktop | \orangepi\MiniLo | ader 烧录 | 下载 | 下载 下载Boot开始 下载Boot成功 F1ASH ZMWC SJ0 SJ1 SJ1 SJ1 SJ1 SJ1 SJ1 SJ1 SJ1 |
| 固件: | | 能 Wesktoplorangepi MiniLaader 按录 下载 white with a share many state of the st | | | |
| 读取FlashID | 读取Flash信息 | 读取Chip信息 | 读取Capability | 2. EMMC | |
| 测试设备 | H 新聞件 高級功能 C: Utsers\csylbesktop\orangepi\MiniLoader-披录 下載 T 載 C: Utsers\csylbesktop\orangepi\MiniLoader-披录 解也 Flash John John | | | | |
| 清空序列号 | 检测安全模式 | 导出串口日志 | 获取当前存储 | 8. USB 9. SATA | 下载Boot开始 下载Boot开始 |
| 导出镜像 | 擦除扇区 | 擦除所有 | gepi MiniLoader-按录 下载 彩包 和Chip信题 读和Capability 1. FLASH 2. SDC 3. SD A Maskron 初独存储 6. STINARD 6. STINARD 6. STINARD 6. STINARD 7. MAM 6. STINARD 7. MAM 6. STINARD 7. MAM 7. SATA 10. FCIZ | | |
| Boot: C:\Users\csy\Desktop\orangepi\linitoaler-/使录 下载 Bit: 解包 读取FlashID 读取Flash值度 读取Chip信度 演取FlashID 读取Flash值度 读取Chip信度 解试设备 重自设备 进入Maskrom 方子FINAD 57110AD 方子FINAD 57110AD | | | | | |
| 扇区数: | | | | | |

k. Then select the storage device as **SD**, and then click to switch storage

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| 、 瑞芯微开发工具 v3 下载镜像 升级固件 | 15 : 高級功能 | | | | | 下載Boot开始 | - | × |
|---------------------------|--------------------|-----------------|--------------|---|---|----------|---|---|
| | Users\osy\Desktop' | orangepi MiniLo | ader-烧录 | 下载 |] | 下载Boot成功 | | |
| 固件: 读取FlashID | 读取Flash信息 | 读取Chip信息 | 读取Capability | 解包 1. Flash 2. EMMC 3. SD | | | | |
| 测试设备 | 重启设备 | 进入Maskrom | 切换存储 | 4. SD1 5. SPINOR 6. SPINAND 7. RAM | | | | |
| 清空序列号 | 检测安全模式 | 导出串口日志 | 获取当前存储 | 8. USB 9. SATA 10. PCIE | X | | | |
| 导出镜像 | 擦除扇区 | 擦除所有 | | | | | | |
| 起始扇区: 扇区数: | | | | | | | | |
| 发现 | 一个MASKRO | M设备 | 2-3 :MASKROM | t | ~ | | | |

1. The successful switching is displayed as shown below

| Boot: C:\ | Vsers\csy\Desktop | Plorangepi WiniLoader 焼汞 下载 「「教授oot床伯」」」 下式 「「教授oot床伯」」」 File 「「教授oot床伯」」」 File 「「教授oot床伯」」」 File 「「教授oot床伯」」」 File 「「教授oot床伯」」」 File 「「教授oot床伯」」」 File 「「「教授oot床伯」」」 File 「「」」 File 「」」 「」」 「」」 File 「」」 「」」 「」」 「」」 「」」 「」」 「」」 「」」 「」」 「」」 「」」 「」」 「」」 「」」 「」」 「」」 「」」 「」」 「」」 「」」 「」」 「」」 「」」 「」」 「」」 「」」 「」」 「」」 「」」 「」」 「」」 「」」 「」」 「」」 「」」 「」」 「」」 | | | | | | | |
|-----------|-------------------|--|----------------|-------------------------|-----------|-------|-----------|--|--|
| 固件: | | | | 解包 | | | ot成功 次 | | |
| 读取FlashID | 读取Flash信息 | 读取Chip信息 | 读取Capability | 1. FLASH 2. EMMC | RKDevTool | × | | | |
| 测试设备 | 重启设备 | 进入Maskrom | 切换存储 | 5. SPINOR 6. SPINAND | | | | | |
| 清空序列号 | 检测安全模式 | 导出串口日志 | 获 取当前存储 | 8. USB 9. SATA | 切換 | 存储成功. | | | |
| 导出镜像 | 擦除扇区 | 擦除所有 | | | | 确定 | | | |
| 起始扇区: | | | | | | | | | |
| 扇区数 | | | | | | | | | |

m. Then click the "Upgrade Firmware" column of the burning tool

| 續像 升级固件 高级功能 | | | |
|-----------------|-------|--|--|
| 固件 升级 切换 | | | |
| 固件版本: Loader版本: | 芯片信息: | | |
| 固件: | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

n. Then click the "**Firmware**" button to select the path of the Android image that needs to be burned.

🦻 range Pi User Manual

| 送 瑞芯微开发工具 v3.15 | | - | - | × |
|-----------------|------------------|---|---|---|
| 下載鏡像「升级固件」高级功能 | | | | |
| 固件 升级 切换 | | | | |
| 固件版本: Loader版本: | 芯片信息: | | | |
| 固件: | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| 发现一个MASKROM设备 | 1-2-3 :MASKROM ~ | | | |

o. Finally, click the "**Upgrade**" button to start burning. The log during the burning process is as shown below. After the burning is completed, the Android system will automatically start.

| 镜像 升级国 | 固件 高级功能 | 6 | | | | | 测试设备开始 测试设备成功 | | _ |
|---------------|------------|----------------|---------------|-----------|---------|---|----------------------------------|--|---|
| 固件 | 升级 | 切换 | | | | | 校验芯片开始 校验芯片成功 | | |
| 固件版本: | 12.0.00 | Loader版本: | 1.11 | 芯片信息: | RK3588 | | 获取FlashInfo开始 获取FlashInfo成功 | | |
| 四十版本。 | | | | | | | 准备IDB开始 准备IDB成功 | | |
| 固件: | C:\Users\o | rangepi\Deskto | p MiniLoader⊣ | 院录Linux镜像 | 象才需要用到的 | | 下载IDB开始 下载IDB成功 | | |
| | | | | | | | 下载固件开始 正在下载固件(100%) 下载固件成功 | | |
| | | | | | | | 1.929901.1.166643 | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | 没有发 | 见设备 | | | | ~ | | | |

2. 11. 2. How to burn using SDDiskTool tool

This method is not recommended. Some TF cards are prone to stuck on the boot logo and cannot be started.

1) First prepare a TF card with 8GB or larger capacity. The transmission speed of the TF card must be class10 or above. It is recommended to use TF cards from SanDisk and other brands.

2) Then use the card reader to insert the TF card into the computer

3) Then download the SDDiskTool programming tool from the Orange Pi download page. Please ensure that the version of the SDDiskTool tool is the latest v1.72

- 4) Then download the Android12 image from the Orange Pi download page
 - a. After opening the download link of the Android image, you can see the following three types of Android images. Please select the image in the TF card and eMMC boot image folder to download.

| SPIFlash-NVMESSD Image | |
|------------------------|--|
| SD Card-EMMC Image | |

b. After entering the **TF card and eMMC boot image** folders, you can see the following two images. The difference between them is:
a) The first image is specially used for HDMI display and supports 8K display. If you do not use an LCD screen, please download the image without LCD.
b) If you want to use an LCD screen, please choose the mirror with lcd
c) The image with box is an image dedicated to TV box

| | OrangePi5Pro_RK3588S_Android12_lcd_v1.0.0.tar.gz |
|--|--|
| | OrangePi5Pro_RK3588S_Android12-box_v1.0.0.tar.gz |

5) Then use decompression software to decompress the compressed package of the downloaded Android image. In the decompressed file, the file ending with ".img" is the Android image file, with a size of more than 1GB.

6) Then use decompression software to decompress **SDDiskTool_v1.72.zip**. This software does not need to be installed. Just find **SD_Firmware_Tool.exe** in the decompressed folder and open it.

| 2022/9/5 15:04 | 文件夹 | |
|-----------------|--|--|
| 2020/3/18 17:27 | 配置设置 | 2 KB |
| 2021/4/21 18:01 | 文本文档 | 1 KB |
| 2014/9/3 9:52 | CONFIG 文件 | 1 KB |
| 2021/4/21 17:57 | 应用程序 | 698 KB |
| 2015/9/29 17:13 | BIN 文件 | 149 KB |
| | 2020/3/18 17:27 2021/4/21 18:01 2014/9/3 9:52 2021/4/21 17:57 | 2020/3/18 17:27 配置设置 2021/4/21 18:01 文本文档 2014/9/3 9:52 CONFIG 文件 2021/4/21 17:57 应用程序 |

7) After opening SDDiskTool, if the TF card is recognized normally, the inserted disk device will be displayed in the "Select Removable Disk Device" column. Please make sure that the displayed disk device is consistent with the drive letter of the TF card you want to burn. Yes, if there is no display, you can try to remove the TF card.

| | - 法择可移动磁盘设备 | 1000 0 1 00 00 | SDBoot:2.1 |
|-----|----------------|----------------------|------------|
| | | ass USB Device 29.7G | ~ |
| 第二步 | 5:选择功能模式 | | |
| | □ 固件升级 | PCBA则试 | ☑SD启动 |
| 第三步 | ⇒:选择升级固件 | | □修复 |
| | | | 选择固件 |
| 第四步 | ≂:选择Demo数据(可选) | | |
| | | | 选择Demo |
| | | | |
| | | | 开始创建 |
| | | | 并如心理 |

8) After confirming the drive letter, you can format the TF card first and click the **Recover Disk** button in **SDDiskTool**. You can also use the **SD Card Formatter** mentioned earlier to format the TF card.

| | Generic MassSto | rageClass USB Device 29.7G | SDBoot:2.12 |
|-----|-----------------|----------------------------|-------------|
| 第二步 | :选择功能模式 | | |
| | □固件升级 | рсвалліц | ☑ऽ□启动 |
| 第三步 | :选择升级固件 | SD_Firmware_Tool | × □修复 |
| | | 作复磁盘成功 。 | 选择固件 |
| 第四步 | :选择Demo数据(| | |
| | | | 选择Demo |
| | | 确定 | |
| | | | 开始创建 |

9) Then start writing the Android image to the TF card

a. First check "SD boot" in "Select function mode"

b. Then select the path to the Android image in the "Select upgrade firmware" column

c. Finally, click the "Start Creating" button to start burning the Android image to the TF card.

| 第一步:选择可移动磁盘设 | | SDBoot:2.1 |
|----------------------|-------------------------|------------|
| Generic MassStorag | eClass USB Device 29.7G | ~ |
| 第二步:选择功能模式 | | |
| 固件升级 | PCBA测试式 | ☑SD启动 |
| 第三步:选择升级固件 | | □修复 |
| | | 选择固件 |
| 。 第四步:选择Demo数据(可j | 先) | |
| | | 选择Demo |
| | | |
| | | 开始创建 |
| | | 71 XH CSSE |

10) After burning, you can exit the SDDiskTool software, and then you can pull out the TF card from the computer and insert it into the development board to start.



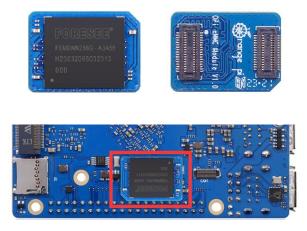
2.12. Method of burning Android image into eMMC

2. 12. 1. How to burn using **RKDevTool**

Note that all operations below are performed on a Windows computer.

1) The development board has reserved eMMC expansion interface. Before burning the system to eMMC, you first need to purchase an eMMC module that matches the eMMC interface of the development board. Then install the eMMC module to the development

board. The eMMC module and the method of inserting the development board are as follows:



2) You also need to prepare a good quality USB2.0 male-to-male data cable



3) Then download the Rockchip microdriver **DriverAssitant_v5.12.zip** and burning tool **RKDevTool_Release_v3.15.zip** from the Orange Pi data download page

- 4) Then download the Android image from the Orange Pi download page.
 - a. After opening the download link of the Android image, you can see the following two types of Android images. Please select the image in the TF card and eMMC boot image folder to download.



b. After entering the TF card and eMMC boot image folders, you can see the following three images. Their differences are:

a) The first image is specially used for HDMI display and supports 8K display. If you do not use an LCD screen, please download the image without LCD.

b) If you want to use an LCD screen, please choose the mirror with LCD

c) The image with box is an image dedicated to TV box



5) Then use decompression software to decompress **DriverAssitant_v5.12.zip**, then find the **DriverInstall.exe** executable file in the decompressed folder and open it.

| 名称 | 修改日期 | 类型 | 大小 |
|-----------------|-----------------|------|--------|
| ADBDriver | 2022/12/1 15:07 | 文件夹 | |
| 📙 bin | 2022/12/1 15:07 | 文件夹 | |
| Driver | 2022/12/1 15:07 | 文件夹 | |
| 🔊 config | 2014/6/3 15:38 | 配置设置 | 1 KB |
| 🥞 DriverInstall | 2022/2/28 14:11 | 应用程序 | 491 KB |
| Readme | 2018/1/31 17:44 | 文本文档 | 1 KB |
| revison | 2022/2/28 14:14 | 文本文档 | 1 KB |
| | | | |

- 6) Open **DriverInstall.exe** and install the Rockchip microdriver as follows:
 - a. Click the "Driver Installation" button

| 驱动安装 | 驱动卸载 |
|---------|----------|
| 11100女装 | 9位四月正月李以 |

b. After waiting for a period of time, a window will pop up prompting "Driver installation successful", then click the "OK" button.



7) Then unzip **RKDevTool_Release_v3.15.zip**. This software does not need to be installed. Just find **RKDevTool** in the unzipped folder and open it.

in ange Pi User Manual

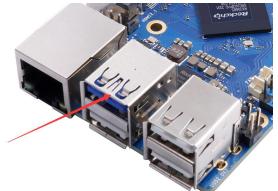
Copyright reserved by Shenzhen Xunlong Software Co., Ltd

| | 修改日期 | 类型 | 大小 |
|----------------|------------------|-----------------|----------|
| bin | 2022/12/1 15:07 | 文件夹 | |
| Language | 2022/12/1 15:07 | 文件夹 | |
|] config.cfg | 2022/3/23 9:11 | CFG 文件 | 7 KB |
| config | 2021/11/30 11:04 | 配置设置 | 2 KB |
| revision | 2022/5/27 9:09 | 文本文档 | 3 KB |
| KDevTool | 2022/5/27 9:06 | 应用程序 | 1,212 KB |
| 計开发工具使用文档_v1.0 | 2021/8/27 10:28 | Foxit PDF Reade | 450 KB |

8) After opening the **RKDevTool** burning tool, because the computer has not yet connected to the development board through the USB2.0 male-to-male data cable, a message "**No device found**" will appear in the lower left corner.

| 8日件 高级功能 地址 0x0000000000000000000000000000000000 | 名字 | 路径 | | | _ | | | |
|--|--|---|--|--|--|--|--|---|
| | | 路径 | | | | | | |
| 0x00000000 | | | | | | | | |
| | Loader | | | | | | | |
| 0x00000000 | Parameter | | | | | | | |
| 0x00000000 | Uboot | | | | | | | |
| 0x00000000 | trust | | | | | | | |
| 0x00000000 | Misc | | | | | | | |
| 0x00000000 | Resource | | | | | | | |
| 0x00000000 | Kernel | | | | | | | |
| 0x00000000 | Boot | | | | | | | |
| 0x00000000 | Recovery | | | | | | | |
| 0x00000000 | System | | | | | | | |
| 0x00000000 | Backup | | | | | | | |
| | 0x00000000 0x00000000 0x00000000 0x000000 | 0x00000000 Ubost 0x0000000 trust 0x0000000 Misc 0x0000000 Resource 0x0000000 Resource 0x0000000 Bost 0x0000000 Resource 0x0000000 Resource 0x0000000 Resource 0x0000000 Resource 0x0000000 Resource | 0x00000000 Ubeet 0x000000000 trust 0x00000000 Miso 0x00000000 Resource 0x00000000 Resource 0x00000000 Resource 0x00000000 Resource 0x00000000 Recovery 0x00000000 System | 0x0000000 Ubest 0x0000000 trust 0x0000000 Mise 0x0000000 Resource 0x0000000 Resource 0x0000000 Resource 0x0000000 Resource 0x0000000 Resource 0x0000000 Resource 0x00000000 Resource 0x00000000 Resource | 0x0000000 Ubest 0x0000000 trust 0x0000000 Mise 0x0000000 Resource 0x0000000 Resource 0x0000000 Resource 0x0000000 Resource 0x0000000 Resource 0x0000000 Resource 0x00000000 Resource 0x00000000 Resource | 0x00000000 West 0x00000000 trust 0x00000000 Mise 0x00000000 Resource 0x00000000 Kernal 0x00000000 Best 0x00000000 Recovery 0x00000000 System | 0x00000000 West 0x00000000 trust 0x00000000 Kise 0x00000000 Resource 0x00000000 Besource 0x00000000 Besource 0x00000000 Besource 0x00000000 Besource 0x00000000 System | 0x0000000 Ubest 0x0000000 trust 0x0000000 Kise 0x0000000 Resource 0x0000000 Kernal 0x0000000 Best 0x0000000 Bestvery 0x0000000 System |

- 9) Then start burning the Android image into eMMC
 - a. First, connect the development board to the Windows computer through a USB2.0 male-to-male data cable. The location of the development board's USB programming port is as shown in the figure below.



- b. Make sure the development board is not connected to the power supply and the TF card is not inserted.
- c. Then press and hold the MaskROM button on the development board. The position of the MaskROM button on the development board is as shown in the figure below:



d. Then connect the development board to the power supply of the Type-C interface, power it on, and then release the MaskROM button.



e. If the previous steps go well, the development board will enter MASKROM mode, and the interface of the burning tool will prompt "A MASKROM device was found"

f. Then click the "Upgrade Firmware" column of the burning tool

| 芯微开发工具 v3.15 | | | - 0 |
|--------------|------------|------------------|-----|
| 續像 升级固件 高 | 級功能 | | |
| 固件 升级 | 切换 | | |
| 固件版本: | Loader版本: | 芯片信息: | |
| 固件: | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | 个MASKROM设备 | 1-2-3 :NASERON ~ | |

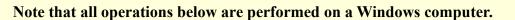
g. Then click the "**Firmware**" button to select the path of the Android image that needs to be burned.



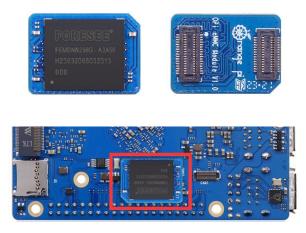
h. Finally, click the "**Upgrade**" button to start burning. The log during the burning process is as shown below. After the burning is completed, the Android system will automatically start.

| 着芯微开发工具 :載讀像 升级 | 固件 高级功能 | 测试设备开始 | - 0 |
|--------------------|--|--------------------|-----|
| 固件 固件版本: 固件: | <u> 刊級</u> 12.0.00 Leader版本: 1.11 芯片倫 C:\Vsers\orangepi\DesktopWiniLoader 境录Linu | 准备IDB玩功 准备IDB成功 | |
| | 没有发现设备 | ~ | |

2. 12. 2. How to burn using SDDiskTool tool



1) The development board has reserved eMMC expansion interface. Before burning the system to eMMC, you first need to purchase an eMMC module that matches the eMMC interface of the development board. Then install the eMMC module to the development board. The eMMC module and the method of inserting the development board are as follows:



2) You also need to prepare a TF card with a capacity of 8GB or larger. The transmission speed of the TF card must be class10 or above. It is recommended to use TF cards from SanDisk and other brands.

3) Then use the card reader to insert the TF card into the computer

4) Then download the SDDiskTool burning tool from the Orange Pi data download page. Please ensure that the version of the SDDiskTool tool is the latest v1.72

5) Then download the Android image from the Orange Pi download page.

a. After opening the download link of the Android image, you can see the following two types of Android images. Please select the image in the TF card and eMMC boot image folder to download.



- b. After entering the TF card and eMMC boot image folders, you can see the following three images. Their differences are:
 a) The first image is specially used for HDMI display and supports 8K display. If you do not use an LCD screen, please download the image without LCD.
 b) If you want to use an LCD screen, please choose the mirror with LCD
 - c) The image with box is an image dedicated to TV box

6) Then use decompression software to decompress the compressed package of the downloaded Android image. In the decompressed file, the file ending with ".img" is the Android image file, with a size of more than 1GB.

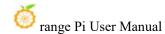
7) Then use decompression software to decompress **SDDiskTool_v1.72.zip** This software does not need to be installed. Just find **SD_Firmware_Tool.exe** in the decompressed folder and open it.

| 길 Language | 2022/9/5 15:04 | 文件夹 | |
|------------------------|-----------------|-----------|--------|
| config | 2020/3/18 17:27 | 配置设置 | 2 KB |
| revision | 2021/4/21 18:01 | 文本文档 | 1 KB |
| sd_boot_config.config_ | 2014/9/3 9:52 | CONFIG 文件 | 1 KB |
| 船 SD_Firmware_Tool | 2021/4/21 17:57 | 应用程序 | 698 KB |
| SDBoot.bin | 2015/9/29 17:13 | BIN 文件 | 149 KB |

8) After opening **SDDiskTool**, if the TF card is recognized normally, the inserted disk device will be displayed in the "Select **Removable Disk Device**" column. **Please make sure that the displayed disk device is consistent with the drive letter of the TF card you want to burn.** Yes, if there is no display, you can try to remove the TF card.

| | 语条 | SDBoot:2.1 |
|------------------|---------------------------|------------|
| Generic MassStor | ageClass USB Device 29.7G | ~ |
| 第二步:选择功能模式 | | |
| □ 固件升级 | — РСВА刑行式 | ☑SD启动 |
| 第三步:选择升级固件 | | □修复 |
| | | 选择固件 |
| 钙四步:选择Demo数据(司 |]选) | |
| | | 选择Demo |
| | | 开始创建 |
| | | |

9) After confirming the drive letter, you can format the TF card first and click the **Recover Disk** button in **SDDiskTool**. You can also use the **SD Card Formatter** mentioned earlier to format the TF card.



| 弗一步 | 选择可移动磁盘设备 | • | | SDBoot:2.12 |
|-----|---------------------|------------------------|-----|-------------|
| | Generic MassStorage | Class USB Device 29.7G | ~ | |
| 第二步 | 选择功能模式 | | | |
| | □ 固件升级 | PCBA测试 | | SD启动 |
| 第三步 | :选择升级固件 SD | Firmware_Tool | × 🗆 | 修复 |
| | | 6 恢复磁曲成功。 | | 选择固件 |
| 第四步 | :选择Demo数据(同 | | | |
| | | | | 选择Demo |
| | | 确定 | | |
| | | | | 开始创建 |

10) Then start writing the Android image to the TF card

a. First, confirm that the drive letter displayed under "Select Removable Disk Device" is the drive letter corresponding to the TF card.

b. Then select "Firmware Upgrade" in "Select Function Mode"

c. Then select the path to the Android firmware in the "Select upgrade

firmware" column

d. Finally, click the "Start Creating" button to start burning.

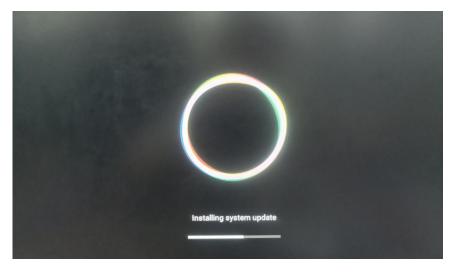
| 第一步 | :选择可移动磁盘设备 | SDBoot:2.1 |
|-----|-----------------------------------|------------|
| | NORELSYS 1081CS0 USB Device 14.8G | |
| 第二步 | 选择功能模式 | |
| [| ☑ 固件升级 | □SD启动 |
| 第三步 | :选择升级固件 | 修复 |
| | | 选择固件 |
| 第四步 | :选择Demo数据(可选) | |
| | | 选择Demo |
| | | _ |
| | | 开始创建 |
| | | - |
| | | 恢复磁盘 |

11) After the burning is completed, the display is as shown below, and then you can exit SDDiskTool

| 第一步:选择可移动磁盘设备 | 1 1 | SDBoot:2.12 |
|------------------|--------------|-------------|
| NORELSYS SD_Firm | nware_Tool X | ~ |
| 第二步:选择功能模 | | |
| 🛛 固件升级 | 创建升级磁盘成功. | □SD启动 |
| 第三步:选择升级固 | | 修复 |
| i\orangepi\(| | img 选择固件 |
| 第四步:选择Demo数 | 确定 | |
| | | 选择Demo |
| | | 开始创建 |
| | | 71 XH GIRE |
| | ☆拷贝固件 | |

12) Then pull out the TF card from the computer and insert it into the development board. After the development board is powered on, it will automatically start burning the Android image in the TF card into the eMMC of the development board.

13) If the development board is connected to an HDMI display, you can also see the progress bar of burning the Android image to the eMMC from the HDMI display.



14) When the HDMI display shows the following information, it indicates that the burning of the Android image to the eMMC has been completed. At this point, you can remove the TF card, and the Android system in the eMMC will begin to boot.

| <pre>vbmeta writing RKA_File_Download entry.name=vbmeta RKA_File_Download entry.name=vbmeta DONE! boot writing RKA_File_Download entry.name=boot DONE! recovery writing RKA_File_Download entry.name=recovery RKA_File_Download entry.name=recovery DONE! baseparameter writing RKA_File_Download entry.name=baseparameter RKA_File_Download entry.name=baseparameter RKA_SparseFile_Download entry.name=super RKA_SparseFile_Download entry.name=super INPO:ErasePartition super_offset=0x1da000,size=3263168512 INPO:ErasePartition super_offset=0x1da000,size=3263168512, part_size=0x614000 INPO:RKA_SparseFile_Download entry.name=super DONE! super writing RKA_SparseFile_Download entry.name=super DONE! super writing RKA_SparseFile_Download entry.name=super DONE! RKA_SparseFile_Download entry.name=super DONE! parameter checking uboot checking uboot checking RKA_File_Check entry.name=uboot RKA_File_Check entry.name=uboot RKA_File_Check entry.name=uboot DONE!</pre> | |
|---|--|
| RKA_File_Check entry.name=uboot | |
| NN_FILE_CHECK BUTY.name=super RKA_SparseFile_Check entry.name=super INFO:Start to check super.offset=0x1da000.size=I64u RKA_SparseFile_Check entry.name=super Done! Finish to upgrade firmware. SD upgrade ok. prksdboot->do_rk_mode_update Successful! Doing Actions succeeded.please remove the sdcard | |

2.13. Method of burning Android image into SPIFlash+NVMe

SSD

Note that all operations below are performed on a Windows computer.

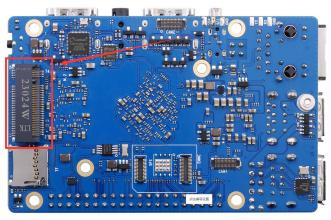
Before starting to burn the image, you must ensure that the development board has been attached with the SPI Flash chip. Because the development board does not have the SPI Flash chip attached when it leaves the factory, you need to purchase and solder it on by yourself. The SPI Flash chip model we recommend is **XM25QU128CWIQT08Q**.

Since SPI Flash and eMMC reuse the same pins, eMMC cannot be used if SPI Flash is attached. XM25QU128CWIQT08Q

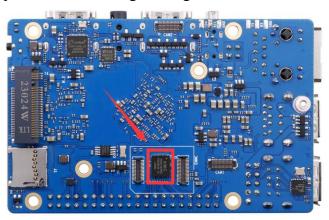
1) First you need to prepare an NVMe SSD solid state drive



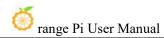
2) Then insert the NVMe SSD into the M.2 PCIe interface of the development board and secure it



3) Please make sure that the development board has been attached with SPI Flash. The location of SPI Flash on the development board is as shown in the picture below. No other settings are required before starting burning.



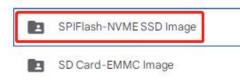
4) You also need to prepare a good quality USB2.0 male-to-male data cable





5) Then download the Rockchip microdriver **DriverAssitant_v5.12.zip** and burning tool **RKDevTool_Release_v3.15.zip** from the Orange Pi data download page

- 6) Then download the image of Android12
 - a. After opening the download link of the Android image, you can see the following three types of Android images. Please select the image in the SPIFlash-NVME SSD folder to download.



b. After entering the **SPIFlash-NVME SSD** folder, you can see the following three images. Their differences are:

a) The first image is specifically for HDMI display, supporting 8K display. If you're not using an LCD screen, please download the image without LCD support.

b) If you intend to use an LCD screen, please select the image with LCD support.

c) Images with "box" designation are specifically for TV boxes.



 Then use decompression software to decompress DriverAssitant_v5.12.zip, then find the DriverInstall.exe executable file in the decompressed folder and open it.

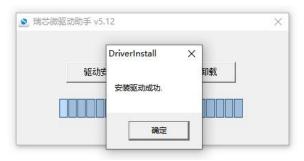
| 🥯 range Pi User Manual | Copyright reserved | l by Shenzhe | en Xunlong Softwar | e Co., Ltd |
|------------------------|--------------------|--------------|--------------------|------------|
| 名称 个 | 修改日期 | 类型 | 大小 | |
| ADBDriver | 2022/12/1 15:07 | 文件夹 | | |
| bin | 2022/12/1 15:07 | 文件夹 | | |
| Driver | 2022/12/1 15:07 | 文件夹 | | |
| config | 2014/6/3 15:38 | 配置设置 | 1 KB | |
| S DriverInstall | 2022/2/28 14:11 | 应用程序 | 491 KB | |
| Readme | 2018/1/31 17:44 | 文本文档 | 1 KB | |
| revison | 2022/2/28 14:14 | 文本文档 | 1 KB | |
| | | | | |

8) After opening **DriverInstall.exe**, the steps to install the Rockchip microdriver are as follows:

a. Click the "Driver Installation" button

| 驱动安装 | 驱动卸载 | |
|------------|------------|--|
| 36.40.×.40 | 35.0000494 | |

b. After waiting for a period of time, a window will pop up prompting "Driver installation successful", then click the "OK" button.



9) Then unzip **RKDevTool_Release_v3.15.zip**. This software does not need to be installed. Just find **RKDevTool** in the unzipped folder and open it.

| 修改日期 | 类型 | 大小 |
|------------------|--|---|
| 2022/12/1 15:07 | 文件夹 | |
| 2022/12/1 15:07 | 文件夹 | |
| 2022/3/23 9:11 | CFG 文件 | 7 KB |
| 2021/11/30 11:04 | 配置设置 | 2 KB |
| 2022/5/27 9:09 | 文本文档 | 3 KB |
| 2022/5/27 9:06 | 应用程序 | 1,212 KB |
| 2021/8/27 10:28 | Foxit PDF Reade | 450 KB |
| | 2022/12/1 15:07 2022/12/1 15:07 2022/3/23 9:11 2021/11/30 11:04 2022/5/27 9:09 2022/5/27 9:06 | 2022/12/1 15:07 文件夹 2022/12/1 15:07 文件夹 2022/3/23 9:11 CFG 文件 2021/11/30 11:04 配置设置 2022/5/27 9:09 文本文档 2022/5/27 9:06 应用程序 |

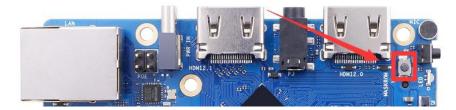
10) After opening the **RKDevTool** burning tool, because the computer has not yet connected to the development board through the USB2.0 male-to-male data cable, a message "**No device found**" will be displayed in the lower left corner.

| * | | 存储 | 地址 | 名字 | 路径 | |
|----|---|----|-------------|-----------|----|-----|
| | Г | | 0x00000000 | Loader | | |
| 2 | Г | | 0x00000000 | Paraneter | | C 8 |
| 3 | Г | | 0x00000000 | Uboot | | |
| 1 | Г | | 0x00000000 | trust | | |
| 5 | Γ | | 0x00000000 | Miso | | |
| 3 | | | 0x00000000 | Resource | | |
| 1 | Γ | | 0x00000000 | Kernel | | |
| 3 | Г | | 0x0000000x0 | Boot | | |
| 9 | Г | | 0x00000000 | Recovery | | |
| 10 | Г | | 0x00000000 | System | | |
| 11 | | | 0x0000000x0 | Backup | | |

- 11) Then start burning the Android image to SPIFlash+NVMe SSD
 - a. First, connect the development board to the Windows computer through a USB2.0 male-to-male data cable. The location of the development board's USB programming port is as shown in the figure below.



- b. Make sure that the TF card is not inserted into the development
- c. Then press and hold the MaskROM button on the development board. The position of the MaskROM button on the development board is as shown in the figure below:



d. Then connect the development board to the power supply of the Type-C interface, power it on, and then release the MaskROM button.



e. e. If the previous steps go well, the development board will enter MASKROM mode, and the interface of the burning tool will prompt "A MASKROM device was found"

| 0x00000000 0x00000000 0x00000000 0x000000 | Loader Parameter Uboot trust | | |
|--|--|---|--|
| 0x00000000 0x00000000 | Uboot | | |
| 0x00000000 | 2017-01-01-01-01-01-01-01-01-01-01-01-01-01- | | |
| | Annual I | | |
| | trust | | |
| 0x00000000 | Misc | | |
| 0x000000x0 | Resource | | |
| 0x00000000 | Kernel | | |
| 0x000000x0 | Boot | | |
| 0x00000000 | Recovery | | |
| 0x000000x0 | System | | |
| 0x00000000 | Backup | | |
| | 0x00000000 0x00000000 0x00000000 0x000000 | 0x00000000 Kernel 0x00000000 Boot 0x00000000 Recovery 0x00000000 System | 0x0000000 Kernel 0x0000000 Boot 0x00000000 Beovery 0x00000000 System |

f. Then click the "Upgrade Firmware" column of the burning tool

| 5微开发工具 v3.15 | | - 0 |
|-----------------|----------------|-----|
| 鏡像 开痰固件 高级功能 | | |
| 固件 升级 切换 | | |
| 固件版本: Loader版本: | 芯片信息: | |
| 固件: | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| 发现一个MASKROM设备 | 1-2-3 :MASEROM | |

g. Then click the "**Firmware**" button to select the Android image that needs to be burned.

🦻 range Pi User Manual

| 端芯微开发工具 v3.15 | | - 0 |
|-----------------|-------|-----|
| 說鏡像 升级固件 高级功能 | | |
| 固件 升级 切换 | | |
| 固件版本: Loader版本: | 芯片信息: | |
| 固件: | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

h. Finally, click the "**Upgrade**" button to start burning. The burning process is shown in the figure below. You can see that the firmware will be burned into SPIFlash first, and then the firmware will be burned into PCIE. After the burning is completed, the Android system will automatically start.

| 芯微开发工具 | v3.15 | | | | <u></u> | × |
|----------|---------------------------|---------------------------|--------------|---|---------|-------|
| (鏡像) 升級[| 固件 高级功能 | | | 获取FlashInfo开始 获取FlashInfo成功 准备IDB开始 | | ' |
| 固件 | 升级切换 | | | 准面IDB开始 准备IDB成功 下载IDB开始 | | |
| 固件版本: | 12.0.00 Loader版本: | 1.11 芯片信息: | RK3588 | 下载IDB成功 下载固件开始 正在下载固件(100%) | | |
| 固件: | C:\Users\orangepi\Desktop | \RKDevTool_Release_v3.15\ | DrangePi5Pr(| 正在下载回针(100%) 下载固件成功 等待Loader开始 | | |
| | | | | 等待Loader成功 正在下载PCIE固件 | | |
| | | | | 测试设备开始 测试设备成功 校验芯片开始 | | |
| | | | | 校验芯片成功 获取FlashInfo开始 | | |
| | | | | 获取FlashInfo成功 准备IDB开始 | | |
| | | | | 准备IDB成功 下载IDB开始 | | |
| | | | | 下载IDB成功 下载固件开始 | | |
| | 没有发现设备 | | | ✓ 正在下载固件(100%) 下载固件成功 | | |

2.14. Method of burning Android image into SPIFlash+SATA SSD

Note that all operations below are performed on a Windows computer.

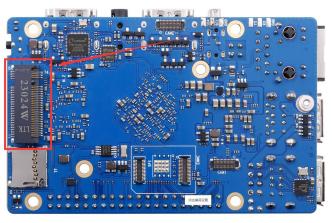
Before starting to burn the image, you must ensure that the development board has been attached with the SPI Flash chip. Because the development board does not have the SPI Flash chip attached when it leaves the factory, you need to purchase and solder it on by yourself. The SPI Flash chip model we recommend is XM25QU128CWIQT08Q.

Since SPI Flash and eMMC reuse the same pins, eMMC cannot be used if SPI Flash is attached.

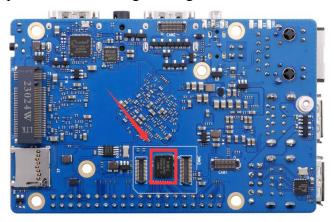
1) First you need to prepare a SATA SSD solid state drive



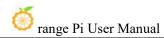
2) Then insert the SSD into the M.2 PCIe interface of the development board and secure it



3) Please make sure that the development board has been attached with SPI Flash. The location of SPI Flash on the development board is as shown in the picture below. No other settings are required before starting burning.



4) You also need to prepare a good quality USB2.0 male-to-male data cable





5) Then download the Rockchip microdriver **DriverAssitant_v5.12.zip** and the burning tool **RKDevTool_Release_v3.15.zip** from the Orange Pi data download page

- 6) Then download the image of Android12
 - a. After opening the download link of the Android image, you can see the following three types of Android images. Please select the image in the SPIFlash-SATA SSD folder to download.



b. After entering the **SPIFlash-SATA SSD** folder, you can see the following two images. The difference between them is:

a) The first image is specially used for HDMI display and supports 8K display. If you do not use an LCD screen, please download the image without LCD.

- b) If you want to use an LCD screen, please choose the mirror with lcd
- c) The image with box is an image dedicated to TV box



 Then use decompression software to decompress DriverAssitant_v5.12.zip, then find the DriverInstall.exe executable file in the decompressed folder and open it.

| range Pi User Manual | Copyright reserved | by Shenzhen | Xunlong Software Co., Ltd |
|----------------------|--------------------|-------------|---------------------------|
| 名称 ^ | 修改日期 | 类型 | 大小 |
| ADBDriver | 2022/12/1 15:07 | 文件夹 | |
| 📙 bin | 2022/12/1 15:07 | 文件夹 | |
| Driver | 2022/12/1 15:07 | 文件夹 | |
| 🔄 config | 2014/6/3 15:38 | 配置设置 | 1 KB |
| tiverInstall | 2022/2/28 14:11 | 应用程序 | 491 KB |
| Readme | 2018/1/31 17:44 | 文本文档 | 1 KB |
| revison | 2022/2/28 14:14 | 文本文档 | 1 KB |

8) After opening **DriverInstall.exe**, the steps to install the Rockchip microdriver are as follows:

a. Click the "Driver Installation" button

| 驱动安装 | 驱动卸载 |
|------|-------------|
| 把幼女表 | 3623/16145% |

b. After waiting for a period of time, a window will pop up prompting "Driver installation successful", then click the "OK" button.

| | DriverInstall | × | 1 | |
|--------|---------------|---|----|--|
| 90Zz力5 | \$ | | 印载 | |
| - | 安装驱动成功. | | | |
| | | | | |

9) Then unzip **RKDevTool_Release_v3.15.zip**. This software does not need to be installed. Just find **RKDevTool** in the unzipped folder and open it.

| 名称 | 修改日期 | 类型 | 大小 |
|-----------------|------------------|-----------------|----------|
| 📙 bin | 2022/12/1 15:07 | 文件夹 | |
| Language | 2022/12/1 15:07 | 文件夹 | |
| 📄 config.cfg | 2022/3/23 9:11 | CFG 文件 | 7 KB |
| 🔄 config | 2021/11/30 11:04 | 配置设置 | 2 KB |
| revision | 2022/5/27 9:09 | 文本文档 | 3 KB |
| 🔀 RKDevTool | 2022/5/27 9:06 | 应用程序 | 1,212 KB |
| ▲ 开发工具使用文档_v1.0 | 2021/8/27 10:28 | Foxit PDF Reade | 450 KB |

10) After opening the **RKDevTool**burning tool, because the computer has not yet connected to the development board through the USB2.0 male-to-male data cable, a

message "No device found" will be displayed in the lower left corner.

| # | | 存储 | 地址 | 名字 | 路径 | |
|-----|----------|----|------------|-----------|----|----------|
| | Γ. | | 0x00000000 | Loader | | 1.1 |
| 2 | <u>_</u> | | 0x00000000 | Parameter | | |
| 3 | | | 0x00000000 | Uboot | | <u> </u> |
| 0 | Γ | | 0x00000000 | trust | | |
| | Γ | | 0x00000000 | Miso | | - L |
| ×. | | | 0x00000000 | Resource | | |
| r - | Γ | | 0x00000000 | Kernel | | |
| 3 | Г | | 0x00000000 | Boot | | |
|) | | | 0x00000000 | Recovery | | |
| 10 | Γ | | 0x00000000 | System | | |
| 11 | Γ | | 0x00000000 | Backup | | |

- 11) Then start burning the Android image to SPIFlash+SATA SSD
 - a. First, connect the development board to the Windows computer through a USB2.0 male-to-male data cable. The location of the development board's USB programming port is as shown in the figure below.



- b. Ensure that the development board does not have a TF card inserted and is not connected to power.
- c. Then, press and hold the MaskROM button on the development board. The location of the MaskROM button on the development board is as shown in the diagram below:



d. Next, connect the development board to the Type-C power interface, and power it on. Then, you can release the MaskROM button.



e. If the previous steps are successful, at this point, the development board will enter MASKROM mode. The burning tool's interface will prompt "Found a MASKROM device."

| | | 存储 | 地址 | 名字 | 路径 | |
|--------|-------|----|---------------|-----------|----------|--|
| | | | 0x00000000 | Loader | | |
| 2 | Г | | 0x00000000 | Parameter | 11 | |
| 3 | Г | | 0x00000000 | Vboot | | |
| 4 | | | 0x00000000 | trust | | |
| 5 | | | 0x00000000 | Misc | | |
| 3 | | | 0x00000000 | Resource | | |
| 1 | Г | | 0x00000000 | Kernel | | |
| 3 | Г | | 0x00000000 | Boot | | |
| 3 | Г | | 0x00000000 | Recovery | | |
| 10 | Г | | 0x00000000 | System | | |
| 1 | Г | | 0x00000000 | Backup | | |
| .0 4 0 | ler : | | 执行 □强制按地址写 | 切换 | 设备分互表 清空 | |

f. Then, click on the "Upgrade Firmware" option in the burning tool.

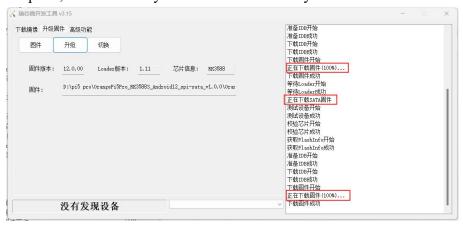
| 芯微开发工具 v3.15 | | - 0 |
|-----------------|-------|-----|
| 續像 开级固件 高级功能 | | |
| 固件 升级 切换 | | |
| 固件版本: Loader版本: | 芯片信息: | |
| 固件: | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

g. Next, click on the "**Firmware**" button to select the Android image that needs to be burned.

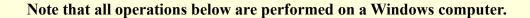
🦻 range Pi User Manual

| 毒芯微开发工具 v3.15 | | |
|-----------------|-------|--|
| 載鏡像「升级固件」高級功能 | | |
| 固件 升级 切换 | | |
| 固件版本: Loader版本: | 芯片信息: | |
| 固件: | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

h. Finally, click on the "Upgrade" button to start the burning process. The burning process will proceed as shown in the diagram below. You can see that it will first burn the firmware to the SPIFlash, then to the SATA SSD. After burning is complete, the Android system will automatically start.



2.15. How to burn Orange Pi OS (Droid) image to TF card

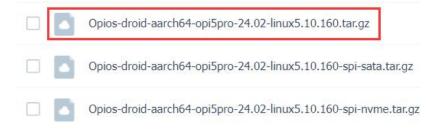


1) First prepare a TF card with 8GB or larger capacity. The transmission speed of the TF card must be class10 or above. It is recommended to use TF cards from SanDisk and other brands.

2) Then use the card reader to insert the TF card into the computer

3) Then download the SDDiskTool programming tool from the **Orange Pi download page. Please ensure that the version of the SDDiskTool tool is the latest v1.72**

4) Then download the Orange Pi OS (Droid) image from the **Orange Pi information download page**. After opening the download link of the Orange Pi OS (Droid) image, you can see the following three types of images. Please select the image below.



5) Then use decompression software to decompress the compressed package of the downloaded Orange Pi OS (Droid) image. In the decompressed file, the file ending with ".img" is the Orange Pi OS (Droid) image file, with a size of more than 1GB.

6) Then use decompression software to decompress **SDDiskTool_v1.72.zip**. This software does not need to be installed. Just find **SD_Firmware_Tool.exe** in the decompressed folder and open it.

| 길 Language | 2022/9/5 15:04 | 文件夹 | |
|-----------------------|-----------------|-----------|--------|
| 🗊 config | 2020/3/18 17:27 | 配置设置 | 2 KB |
| revision | 2021/4/21 18:01 | 文本文档 | 1 KB |
| sd_boot_config.config | 2014/9/3 9:52 | CONFIG 文件 | 1 KB |
| 船 SD_Firmware_Tool | 2021/4/21 17:57 | 应用程序 | 698 KB |
| SDBoot.bin | 2015/9/29 17:13 | BIN 文件 | 149 KB |

7) After opening **SDDiskTool**, if the TF card is recognized normally, the inserted disk device will be displayed in the "Select **Removable Disk Device**" column. **Please make sure that the displayed disk device is consistent with the drive letter of the TF card you want to burn.** Yes, if there is no display, you can try to remove the TF card.

| 用一节 | - 法择司称制能争设备 | SDBoot:2.12 |
|-----|---|-------------|
| _ 1 | Generic MassStorageClass USB Device 29.7G | ~ |
| 第二步 | :选择功能模式 | |
| | □ 固件升级 □ PCBA测试 | ☑SD启动 |
| 第三步 | :选择升级固件 | □修复 |
| | | 选择固件 |
| 第四步 | :选择Demo数据(可选) | |
| | | 选择Demo |
| | | |
| | | 开始创建 |

8) After confirming the drive letter, you can format the TF card first and click the **Recover Disk** button in SDDiskTool. You can also use the **SD Card Formatter** mentioned earlier to format the TF card.

| | Generic MassStor | ageClass USB | Device 29.70 | G V | |
|-------|------------------|--------------|--------------|-----|--------|
| 第二步:j | 选择功能模式 | | | | |
| | 固件升级 | | PCBA测试 | | ☑SD启动 |
| 第三步:) | 选择升级固件 | SD_Firmwa | re_Tool | × [| □修复 |
| Γ | | | | | 选择固件 |
| 第四步:j | 选择Demo数据(ī | | 恢复磁盘成功 | | |
| [| | | | _ | 选择Demo |
| L | | | 确定 | | , |
| Г | | L | | | 开始创建 |

9) Then start writing the Orange Pi OS (Droid) image to the TF card

c. First check "SD boot" in "Select function mode"

d. Then select the path to the Orange Pi OS (Droid) image in the "**Select Upgrade** Firmware" column

e. Finally, click the "**Start Creating**" button to start burning the Orange Pi OS (Droid) image to the TF card.

| 第一步 | 选择可移动磁盘设备 Generic MassStorageClass USB Device 29.7G | SDBoot:2.1 |
|-----|--|------------|
| 第二步 | 选择功能模式 | <u> </u> |
| | □ 固件升级 □ PCBA测试 | ☑SD启动 |
| 第三步 | 选择升级固件 | □修复 |
| | | 选择固件 |
| 第四步 | 选择Demo数据(可选) | |
| | | 选择Demo |
| | | _ |
| | | 开始创建 |

10) After burning, you can exit the SDDiskTool software, and then you can pull out the TF card from the computer and insert it into the development board to start.



2. 16. Burn Orange Pi OS (Droid) image to SPIFlash+NVMe SSD

Note that all operations below are performed on a Windows computer.

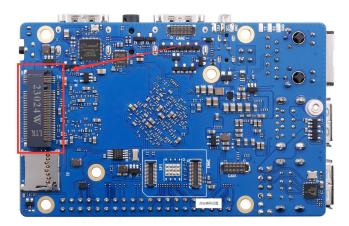
Before starting to burn the image, you must ensure that the development board has been attached with the SPI Flash chip. Because the development board does not have the SPI Flash chip attached when it leaves the factory, you need to purchase and solder it on by yourself. The SPI Flash chip model we recommend is XM25QU128CWIQT08Q.

Since SPI Flash and eMMC reuse the same pins, eMMC cannot be used if SPI Flash is attached.

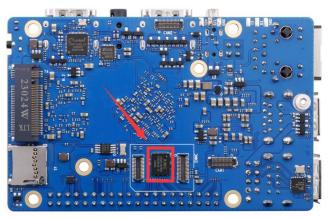
1) First you need to prepare an NVMe SSD solid state drive



2) Then insert the NVMe SSD into the M.2 PCIe interface of the development board and secure it



3) Please make sure that the development board has been attached with SPI Flash. The location of SPI Flash on the development board is as shown in the picture below. No other settings are required before starting burning.



4) You also need to prepare a good quality USB2.0 male-to-male data cable



5) Then download the Rockchip microdriver **DriverAssitant_v5.12.zip** and burning tool **RKDevTool_Release_v3.15.zip** from the Orange Pi data download page

6) Then download the Orange Pi OS (Droid) image. After opening the download link of the Orange Pi OS (Droid) image, you can see the following three types of images. Please

🍈 range Pi User Manual

select the image with **spi-nvme** to download.

| | Opios-droid-aarch64-opi5pro-24.02-linux5.10.160.tar.gz |
|---|---|
| ٥ | Opios-droid-aarch64-opi5pro-24.02-linux5.10.160-spi-sata.tar.gz |
| | Opios-droid-aarch64-opi5pro-24.02-linux5.10.160-spi-nvmetar.gz |

7) Then use decompression software to decompress **DriverAssitant_v5.12.zip**, then find the **DriverInstall.exe** executable file in the decompressed folder and open it.

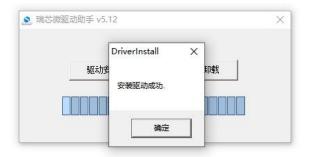
| 名称 | 修改日期 | 类型 | 大小 |
|-----------------|-----------------|------|--------|
| ADBDriver | 2022/12/1 15:07 | 文件夹 | |
| 📙 bin | 2022/12/1 15:07 | 文件夹 | |
| Driver | 2022/12/1 15:07 | 文件夹 | |
| 🔄 config | 2014/6/3 15:38 | 配置设置 | 1 KB |
| 😫 DriverInstall | 2022/2/28 14:11 | 应用程序 | 491 KB |
| Readme | 2018/1/31 17:44 | 文本文档 | 1 KB |
| revison | 2022/2/28 14:14 | 文本文档 | 1 KB |
| | | | |

8) After opening **DriverInstall.exe**, the steps to install the Rockchip microdriver are as follows:

a. Click the "Driver Installation" button

| - ANDICMAKS | 驱动助手 v5.12 | | Î |
|-------------|------------|------|---|
| | 驱动安装 | 驱动卸载 | |
| | | | |

b. After waiting for a period of time, a window will pop up prompting "Driver installation successful", then click the "OK" button.



9) Then unzip **RKDevTool_Release_v3.15.zip**. This software does not need to be installed. Just find **RKDevTool** in the unzipped folder and open it.

| 名称 ^ | 修改日期 | 类型 | 大小 |
|-----------------|------------------|-----------------|----------|
| bin | 2022/12/1 15:07 | 文件夹 | |
| Language | 2022/12/1 15:07 | 文件夹 | |
| 🗋 config.cfg | 2022/3/23 9:11 | CFG 文件 | 7 KB |
| Config | 2021/11/30 11:04 | 配置设置 | 2 KB |
| revision | 2022/5/27 9:09 | 文本文档 | 3 KB |
| 🔀 RKDevTool | 2022/5/27 9:06 | 应用程序 | 1,212 KB |
| ◎ 开发工具使用文档_v1.0 | 2021/8/27 10:28 | Foxit PDF Reade | 450 KB |

10) After opening the **RKDevTool**burning tool, because the computer has not yet connected to the development board through the USB2.0 male-to-male data cable, a message "**No device found**" will be displayed in the lower left corner.

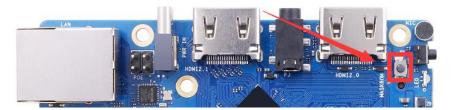
| | 口存储 | 地址 | 名字 | 路径 | | |
|----|-----|------------|-----------|----|--|--|
| 1 | | 0x00000000 | Loader | | | |
| 2 | - | 0x00000000 | Paraneter | | | |
| 3 | | 0x00000000 | Uboot | | | |
| 4 | | 0x00000000 | trust | | | |
| 5 | | 0x00000000 | Miso | | | |
| 6 | | 0x00000000 | Resource | | | |
| 7 | | 0x00000000 | Kernel | | | |
| 8 | | 0x000000x0 | Boot | | | |
| 9 | | 0x00000000 | Recovery | | | |
| 10 | | 0x00000000 | System | | | |
| 11 | | 0x000000x0 | Backup | | | |

- 11) Then start burning the Orange Pi OS (Droid) image to SPIFlash+NVMe SSD
 - a. First, connect the development board to the Windows computer through a USB2.0 male-to-male data cable. The location of the USB2.0 programming port on the development board is as shown in the figure below.

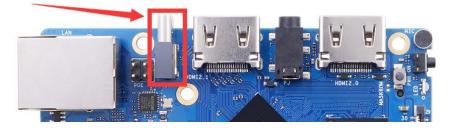


- b. Make sure that the TF card is not inserted into the development board and the power supply is not connected.
- c. Then press and hold the MaskROM button on the development board. The position of the MaskROM button on the development board is as shown in the

figure below:



d. Then connect the development board to the power supply of the Type-C interface, power it on, and then release the MaskROM button.



e. If the previous steps go well, the development board will enter MASKROM mode, and the interface of the burning tool will prompt "A MASKROM device was found"

| ader aneter | 0x00000000 | | |
|----------------|-------------|---|---------------|
| | | Г | 1 |
| | 0x00000000 | Г | 2 |
| boot | 0x00000000 | Г | 3 |
| rust | 0x000000000 | | 4 |
| lise | 0x00000000 | | 5 |
| ource | 0x0000000x0 | | 6 |
| rnel | 0x00000000 | Г | 7 |
| ioot | 0x00000000 | Г | 8 |
| overy | 0x0000000x0 | Г | 9 |
| stem | 0x00000000 | Г | 10 |
| ickup | 0x00000000 | Г | 11 |
| stem | 0x00000000 | | 9 10 11 |

f. Then click the "Upgrade Firmware" column of the burning tool

| 芯微开发工具 v3.15 | | - 0 |
|---------------------------|-------|-----|
| 續像 <mark>升级固件</mark> 高级功能 | | |
| 固件 升级 切换 | | |
| 固件版本: Loader版本: | 芯片信息: | |
| 固件: | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

g. Then click the "Firmware" button to select the Orange Pi OS (Droid) image that needs to be burned.



h. Finally, click the "**Upgrade**" button to start burning. The burning process is shown in the figure below. You can see that the firmware will be burned into SPIFlash first, and then the firmware will be burned into PCIE. After the burning is completed, the Orange Pi OS (Droid) system will automatically start.

| × 瑞芯微开发工具 v3.15 | - 🗆 X |
|-------------------------------|--|
| IIIIIIIIIIIIIIIIIIIIIIIIIIIII | 現別1 aklnfo开始 現別1 aklnfo成功 皆面0所均 當面0所約 繁10時方 第10時方 第10時方 第10時代的 第10時代の 第110時代の 第110 |
| NI - 6 (1) 71 NI - 6 | 「戦固件开始 - 在下戦固件(100%) - 戦固件成功 イン |

2.17. Burn Orange Pi OS (Droid) image to SPIFlash+SATA SSD

Note that all operations below are performed on a Windows computer.

Before starting to burn the image, you must ensure that the development board has been attached with the SPI Flash chip. Because the development board does not have the SPI Flash chip attached when it leaves the factory, you need to purchase and solder it on by yourself. The SPI Flash chip model we recommend is XM25QU128CWIQT08Q.

Since SPI Flash and eMMC reuse the same pins, eMMC cannot be used if SPI

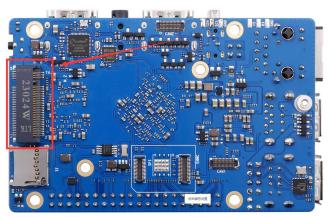


Flash is attached.

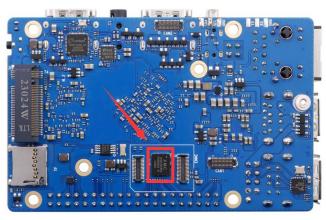
1) First you need to prepare a SATA SSD solid state drive



2) Then insert the SSD into the M.2 PCIe interface of the development board and secure it



3) Please make sure that the development board has been attached with SPI Flash. The location of SPI Flash on the development board is as shown in the picture below. No other settings are required before starting burning.

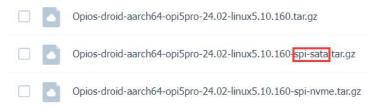


4) You also need to prepare a good quality USB2.0 male-to-male data cable



5) Then download the Rockchip microdriver **DriverAssitant_v5.12.zip** and the burning tool **RKDevTool_Release_v3.15.zip** from the Orange Pi data download page

6) Then download the Orange Pi OS (Droid) image. After opening the download link of the Orange Pi OS (Droid) image, you can see the following three types of images. Please select the image with **spi-sata** to download.



7) Then use decompression software to decompress **DriverAssitant_v5.12.zip**, then find the **DriverInstall.exe** executable file in the decompressed folder and open it.

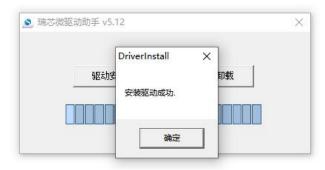
| 名称 | 修改日期 | 类型 | 大小 |
|-----------------|-----------------|------|--------|
| ADBDriver | 2022/12/1 15:07 | 文件夹 | |
| 📙 bin | 2022/12/1 15:07 | 文件夹 | |
| Driver | 2022/12/1 15:07 | 文件夹 | |
| 🔄 config | 2014/6/3 15:38 | 配置设置 | 1 KB |
| 🧕 DriverInstall | 2022/2/28 14:11 | 应用程序 | 491 KB |
| Readme | 2018/1/31 17:44 | 文本文档 | 1 KB |
| revison | 2022/2/28 14:14 | 文本文档 | 1 KB |
| | | | |

8) After opening **DriverInstall.exe**, the steps to install the Rockchip microdriver are as follows:

a. Click the "Driver Installation" button



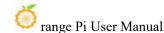
b. After waiting for a period of time, a window will pop up prompting "Driver installation successful", then click the "OK" button.



9) Then unzip **RKDevTool_Release_v3.15.zip**. This software does not need to be installed. Just find**RKDevTool** in the unzipped folder and open it.

| 名称 ^ | 修改日期 | 类型 | 大小 |
|-----------------|------------------|-----------------|----------|
| bin | 2022/12/1 15:07 | 文件夹 | |
| Language | 2022/12/1 15:07 | 文件夹 | |
| 🗋 config.cfg | 2022/3/23 9:11 | CFG 文件 | 7 KB |
| 🔄 config | 2021/11/30 11:04 | 配置设置 | 2 KB |
| revision | 2022/5/27 9:09 | 文本文档 | 3 KB |
| 🔀 RKDevTool | 2022/5/27 9:06 | 应用程序 | 1,212 KB |
| ▲ 开发工具使用文档_v1.0 | 2021/8/27 10:28 | Foxit PDF Reade | 450 KB |

10) After opening the **RKDevTool** burning tool, because the computer has not yet connected to the development board through the USB2.0 male-to-male data cable, a message "**No device found**" will be displayed in the lower left corner.



| : | | 存储 | 地址 | 名字 | 路径 | | | | |
|-----|------|----|---------------|-----------|-------|----|--|--|--|
| L | Г | | 0x00000000 | Loader | | | | | |
| 2 | Г | | 0x00000000 | Parameter | | | | | |
| 3 | Г | | 0x00000000 | Uboot | | | | | |
| | | | 0x00000000 | trust | | | | | |
| 5 | | | 0x00000000 | Misc | | | | | |
| 3 | | | 0x00000000 | Resource | | | | | |
| 83 | Г | | 0x00000000 | Kernel | | | | | |
| 3 | Г | | 0x00000000 | Boot | | | | | |
|) | Г | | 0x00000000 | Recovery | | | | | |
| 0 | Г | | 0x00000000 | System | | | | | |
| 1 | | | 0x000000x0 | Backup | | | | | |
| oad | ler: | | 执行 □强制按地址写 | 切换 | 设备分区表 | 清空 | | | |

- 11) Then start burning the Orange Pi OS (Droid) image to SPIFlash+SATA SSD
 - a. First, connect the development board and Windows computer through the Type-C data cable. The location of the Type-C interface of the development board is as shown in the figure below.



- b. Make sure that the TF card is not inserted into the development board and the power supply is not connected.
- c. Then press and hold the MaskROM button on the development board. The position of the MaskROM button on the development board is as shown in the figure below:



d. Then connect the development board to the power supply of the Type-C interface, power it on, and then release the MaskROM button.



e. If the previous steps go well, the development board will enter MASKROM mode, and the interface of the burning tool will prompt "A MASKROM device was found"

| 口存 | | 址 名字 | 路径 | | | | | |
|----|----|----------------|-----|---|------|--|--|--|
| 21 | | | | | | | | |
| _ | | 00000000 Loa | | | | | | |
| | | 00000000 Paran | | | | | | |
| | 01 | 00000000 Vba |)t | | | | | |
| | 01 | 00000000 tru | | | | | | |
| | 0; | 00000000 Mi | c | | | | | |
| | 01 | 00000000 Reso | rce | | | | | |
| | 01 | 00000000 Ker | el | | | | | |
| | 01 | 00000000 Bo | t | | | | | |
| | 01 | 00000000 Reco | ery | | | | | |
| | 01 | 00000000 Sys | em | / | | | | |
| | 03 | 00000000 Bac | up | | 1.11 | | | |
| | 03 | 00000000 Sys | em | | | | | |

f. Then click the "Upgrade Firmware" column of the burning tool



g. Then click the "Firmware" button to select the Orange Pi OS (Droid) image that needs to be burned.

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| 需芯微开发工具 v3.15 | | - • × |
|----------------------|-------|-------|
| 载镜像「升级固件」高级功能 | | |
| 固件 升级 切换 | | |
| 固件版本: Loader版本: | 芯片信息: | |
| 固件: | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

h. Finally, click the "**Upgrade**" button to start burning. The burning process is shown in the figure below. As you can see, the firmware will be burned into SPIFlash first, and then the firmware will be burned into SATA SSD. After the burning is completed, the Orange Pi OS (Droid) system will automatically start.

| - | 固件 高级功能 | | | 获取FlashInfo成功 | | |
|-------|------------------------|--------------------------|------------------|---|--|--|
| 固件 | 升级 切换 | | | 准备IDB开始 准备IDB成功 | | |
| - | | | | 下载IDB开始 | | |
| 固件版本: | 12.0.00 Loader版团 | k: 1.11 芯片信 | 息: RK3588 | 下载IDB成功 | | |
| | () | | | 正在下载固件(100%) | | |
| 固件: | 1.0.6_beta\OrangePi=OS | _Droid_orangepi_spi-sata | _v0.0.6_beta.ing | 下载回往成功 | | |
| | | | | 等待Loader开始 | | |
| | | | | 正在下载SATA固件 | | |
| | | | | | | |
| | | | | 观试设备开始 | | |
| | | | | and the second second | | |
| | | | | 测试设备开始 测试设备成功 校验芯片开始 校验芯片成功 | | |
| | | | | 開催设备开始 預试设备开始 校验芯片开始 校验芯片成功 研測1aaLinfo开始 | | |
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| | | | | 新成金 豊子 並 所成後 豊 所成功 特徴認定片 开始 特徴認定片 成功 研究 1 a a b a f a f a f a f a f a f a f a f a | | |
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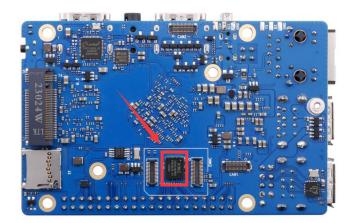
2.18. How to clear SPIFlash using RKDevTool

The development board does not have an SPI Flash chip attached when it leaves the factory, so you need to attach it yourself. The SPI Flash chip model we recommend is XM25QU128CWIQT08Q.

Since SPI Flash and eMMC reuse the same pins, eMMC cannot be used if SPI Flash is attached.

1) The location of SPI Flash on the development board is as shown in the figure below

b.

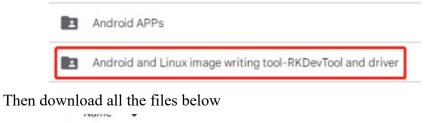


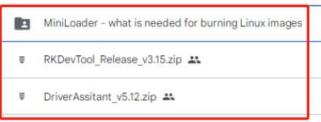
2) First you need to prepare a good quality USB2.0 male-to-male data cable



3) Then download the Rockchip microdriver **DriverAssitant_v5.12.zip** and MiniLoader and the burning tool **RKDevTool_Release_v3.15.zip** from the Orange Pi download page

a. On the Orange Pi data download page, first select the official tool, and then enter the folder below





Note that the "MiniLoader-things needed to burn Linux images" folder will be referred to as the MiniLoader folder below. 4) Then use decompression software to decompress DriverAssitant_v5.12.zip, then find

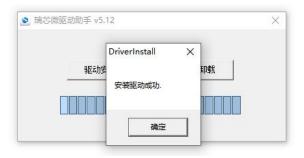
the DriverInstall.exe executable file in the decompressed folder and open it.

| 名称 ^ ^ ^ ^ ^ | 修改日期 | 类型 | 大小 |
|------------------|-----------------|------|--------|
| ADBDriver | 2022/12/1 15:07 | 文件夹 | |
| 📙 bin | 2022/12/1 15:07 | 文件夹 | |
| Driver | 2022/12/1 15:07 | 文件夹 | |
| 📓 config | 2014/6/3 15:38 | 配置设置 | 1 KB |
| le DriverInstall | 2022/2/28 14:11 | 应用程序 | 491 KB |
| Readme | 2018/1/31 17:44 | 文本文档 | 1 KB |
| revison | 2022/2/28 14:14 | 文本文档 | 1 KB |

- 5) Open **DriverInstall.exe** and install the Rockchip microdriver as follows:
 - a. Click the "Driver Installation" button

| 驱动安装 | 驱动卸载 | |
|------|------|--|
| | | |

b. After waiting for a period of time, a window will pop up prompting "Driver installation successful", then click the "OK" button.



6) Then unzip **RKDevTool_Release_v3.15.zip**. This software does not need to be installed. Just find **RKDevTool** in the unzipped folder and open it.

| range Pi User Manual | Copyright reserved by Shenzhen Xunlong Software C | | | | | | |
|----------------------|---|-----------------|----------|--|--|--|--|
| 名称 | 修改日期 | 类型 | 大小 | | | | |
| 📙 bin | 2022/12/1 15:07 | 文件夹 | | | | | |
| Language | 2022/12/1 15:07 | 文件夹 | | | | | |
| 📄 config.cfg | 2022/3/23 9:11 | CFG 文件 | 7 KB | | | | |
| 🔊 config | 2021/11/30 11:04 | 配置设置 | 2 KB | | | | |
| revision | 2022/5/27 9:09 | 文本文档 | 3 KB | | | | |
| 🔀 RKDevTool | 2022/5/27 9:06 | 应用程序 | 1,212 KB | | | | |
| ◎ 开发工具使用文档_v1.0 | 2021/8/27 10:28 | Foxit PDF Reade | 450 KB | | | | |

7) After opening the **RKDevTool**burning tool, because the computer has not yet connected to the development board through the USB2.0 male-to-male data cable, a message "No device found" will appear in the lower left corner.

| 0x0000000 0x0000000 0x00000000 0x0000000 | Loader Parameter Uboot | | | - | | | | | | | |
|---|--|--|--|--|--|--|--|---|--|--|---|
| 0x00000000 | Uboot | | | | | | | | | | |
| | | | | | | | | | | | |
| 0x00000000 | | | | | | | | | | | |
| | trust | | | | | | | | | | |
| 0x00000000 | Miso | | | | | | | | | | |
| | Resource | | | | | | | | | | |
| 0x00000000 | Kernel | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | - | | | | | | | |
| 0x00000000 | Backup | | | | | | | | | | |
| | 0x00000000 0x00000000 0x00000000 0x000000 | 0x0000000 Kernel 0x00000000 Boot 0x00000000 Recovery 0x00000000 System | 0x00000000 Kernel 0x00000000 Boot 0x000000000 Recovery 0x00000000 System | 0x00000000 Kernel 0x00000000 Boot 0x00000000 Recovery 0x00000000 System | 0x00000000 Kernel 0x00000000 Beot 0x00000000 Recovery 0x00000000 System | 0x0000000 Kernel 0x0000000 Boot 0x0000000 Recovery 0x0000000 System | 0x00000000 Kernel 0x00000000 Beot 0x00000000 Recovery 0x00000000 System | 0x00000000 Kernel 0x00000000 Beot 0x00000000 Beovery 0x00000000 System | 0x00000000 Kernel 0x00000000 Boot 0x00000000 Recovery 0x00000000 System | 0x00000000 Kernel 0x00000000 Boot 0x00000000 Recovery 0x00000000 System | Dx00000000 Kernel Dx00000000 Boot Dx00000000 Beovery Dx000000000 System |

- 8) Then you can start clearing the contents of SPI FLASH
 - a. irst, connect the development board and Windows computer through the Type-C data cable. The location of the Type-C interface of the development board is as shown in the figure below.



- b. Make sure that the TF card is not inserted into the development board and the power supply is not connected.
- c. Then press and hold the MaskROM button on the development board. The position of the MaskROM button on the development board is as shown in the figure below:



d. Then connect the development board to the power supply of the Type-C interface, power it on, and then release the MaskROM button.



e. If the previous steps go well, the development board will enter MASKROM mode, and the interface of the burning tool will prompt "A MASKROM device was found"

f. Then please select Advanced Features

| | 11家 升级固件 | 高级功能 | | | | |
|----|------------|------------|-----------|----|---|--|
| # | 口存储 | 1. 北 | 名字 | 路径 | | |
| 1 | | 0:0000000 | Loader | | | |
| 2 | | 0x0000000 | Parameter | | | |
| 3 | | 0x0000000 | Vboot | | | |
| 4 | Г | 0x0000000 | trust | | | |
| 5 | | 0x00000000 | Misc | | | |
| 6 | | 0x00000000 | Resource | | | |
| 7 | | 0x00000000 | Kernel | | | |
| 8 | | 0x00000000 | Boot | | | |
| 9 | Г | 0x00000000 | Recovery | | | |
| 10 | | 0x00000000 | System | | | |
| 11 | | 0x00000000 | Backup | | _ | |

g. Then click the location shown in the picture below

| 3 瑞芯微开发工具 v3 | .15 | | | | - 0 X |
|--------------------|-----------|-----------|--------------|--|-------|
| 下载镜像 升级固件 Boot: | 高级功能 | | | 下载 | |
| 固件: | | | | 解包 | |
| 读取FlashID | 读取Flash信息 | 读取Chip信息 | | 1. FlASH 2. EMMC 3. SD 4. SD1 | |
| 测试设备 | 重启设备 | 进入Maskron | 切换存储 | 5. SPINOR 6. SPINAND 7. RAM | |
| 清空序列号 | 检测安全模式 | 导出串口日志 | 获取当前在储 | 8. USB 9. SATA 10. PCIE | |
| 导出镜像 | 擦除扇区 | 擦除所有 | | | |
| 起始扇区: 扇区数: | | | | | |
| 发现 | -^MASKRO | M设备 | 1-2-3 :MASKR | <u>m</u> ~ | |

h. Then select MiniLoaderAll.bin in the MiniLoader folder downloaded earlier, and then click Open

| ← → ✓ 个 🔜 → 此电脑 → 眞面 → orangepi → MiniLoader-烧录Linux镜像: | オ 需要用到的东西 ∨ ♂ ク 在 MiniLoader-烧录Linux |
|--|---|
| 组织 ▼ 新建文件夹 | BB - 🔳 🔮 |
| ● 此电脑 ● 3D 对象 ● 水3588 linux_peic.cfg ● 水3588 linux_spiflash.cfg ● 水5588 linux_tteard.cfg | |
| 文件名(N): MiniLoaderAll.bin | All File(*.*) |

i. Then click Download

| oot: C:\ | : 高级功能 Users\hh177\Deskt | op\orangepi\Nini | Loader-烧 | 下载 | | |
|-----------|-----------------------------|------------------|--------------|---|--|--|
|]件: | | | | 解包 | | |
| 读取FlashID | 读取Flash信息 | 读取Chip信息 | 读取Capability | 1. FlASH 2. ENOIC 3. SD | | |
| 测试设备 | 重启设备 | 进入Maskron | 切换存储 | 4. SD1 5. SPINOR 6. SPINAND 7. RAM | | |
| 清空序列号 | 检测安全模式 | 导出串口日志 | 获取当前存储 | 8. USB 9. SATA 10. PCIE | | |
| 导出镜像 | 擦除扇区 | 攔除所有 | | | | |
| 起始扇区: | | | | | | |

j. After downloading MiniLoaderAll.bin the display is as shown below

🧼 range Pi User Manual

| 端芯微开发工具 v3 | 3.15 | | | | | | - 0 |
|------------|-------------------|-------------------|----------|----------------------|-----------------------------|----------------------|-----|
| 說镜像 升级固件 | = 高级功能 | | | | | 下载Boot开始 下载Boot成功 | |
| Boot: C:\ | Users\hh177\Deskt | op\orangepi\Minil | Loader-烧 | (| 下载 | 1 | |
| 固件: | | | |] | 解包 | | |
| 读取FlashID | 读取Flash信息 | 读取Chip信息 | 读取Capabi | 1. 2. 3. 4. | FLASH ENDIC SD SD1 | | |
| 测试设备 | 重启设备 | 进入Maskron | 切换存储 | | SPINOR SPINAND RAM | | |
| 清空序列号 | 检测安全模式 | 导出串口日志 | 获取当前有 | 存储 9. | SATA D. PCIE | | |
| 导出镜像 | 擦除扇区 | 擦除所有 | | | | | |
| 起始扇区: | | | | | | | |
| 扇区数: | | | | | | 1 | |
| 发现。 | 一个MASKRO | W沿久 | 1-2-3 : | :MASKROM | | ~ | |

k. Then select the storage device as **SPINOR**

| 裁遺像 升级固件 | 高级功能 | | | | 下載Boot开始 下载Boot成功 | |
|------------|-------------------|-------------------|--------------|---|----------------------|--|
| Boot: C:\1 | Jsers\hh177\Deskt | op\orangepi\Minil | .oader-烧 | 下载 | | |
| 固件: | | | | 解包 | | |
| 读取FlashID | 读取Flash信息 | 读取Chip信息 | 读取Capability | 1. Flash 2. EUMC 3. SD 4. SD1 | | |
| 测试设备 | 重启设备 | 进入Maskron | 切换存储 | 5. SPINOR 6. SPINAND 7. RAM 8. USB | | |
| 清空序列号 | 检测安全模式 | 导出串口日志 | 获取当前存储 | 9. SATA 10. PCIE | | |
| 导出镜像 | 攔除扇区 | 擦除所有 | | | | |
| 起始扇区: | | | | | | |
| 扇区数: | | | | | | |
| 42.15 | 一个MASKRO | N D A | 1-2-3 :MASK | PON | ~ | |

1. Then click Switch Storage

| 微镜像 升级固件 | : 高级切能 | | | | | | 下载Boot开始 下载Boot成功 | |
|-----------|-------------------|-------------------|---------|---------------------|--------------------------|---|----------------------|--|
| Boot: C:\ | Users\hh177\Deskt | op\orangepi\MiniL | oader-烧 |] | 下载 | | - | |
| 固件: | | | | | 解包 | / | T | |
| 读取FlashID | 读取Flash信息 | 读取Chip信息 | 读取Capab | ility 1. 2. 3 | Flash EDUC SD | | | |
| 测试设备 | 重启设备 | 进入Maskron | 切换存 | 4. | SD1 SPINOR SPINAND | | | |
| 清空序列号 | 检测安全模式 | 导出串口日志 | 获取当前 | 8. 存储 9. | USB SATA PCIE | | | |
| 导出镜像 | 攔除扇区 | 擲除所有 | | | | | | |
| 起始扇区: | | | | | | | | |
| 扇区数: | | | | | | | | |

m. Then click Erase All to start erasing SPIFlash.

| 🔀 瑞芯微开发工 | 具 v3.15 | | | | | | | - | × |
|----------|----------------------|-------------------|----------|--------|---|---|----------------------|---|---|
| 下载镜像 升级 | 過件 高级功能 | | | | | | 下载Boot开始 下载Boot成功 | | |
| Boot: | C:\Users\hh177\Deskt | op\orangepi\Minil | .oader-烧 | | 下载 | | | | |
| 固件: | | | | | 解包 | | | | |
| 读取Flash | hID 读取Flash信息 | 读取Chip信息 | 读取Capa | bility | 1. FLASH 2. EMMC 3. SD | | | | |
| 测试设备 | 重启设备 | 进入Maskron | 切换有 | 宇储 | 4. SD1 5. SPINOR 6. SPINAND 7. RAM 8. USB | | | | |
| 清空序列 | 号 检测安全模式 | 导出串口日志 | 获取当前 | 前存储 | 8. USB 9. SATA 10. PCIE | - | | | |
| 导出镜像 | 擲徐扇区 | 擦除所有 | | | | | | | |
| 起始扇区: | | | | | | | | | |
| 扇区数: | | | | | | | | | |
| 发 | 现一个MASKRO | M设备 | 1-2-3 | :MASKB | non | ~ | | | |

n. The display log after erasing SPIFlash is as shown below

| | : 高级功能 Users\hh177\Deskt | op\orangepi\WiniI | oader-悖 | | 下载 | 正在攔除(100%) 擦除扇区成功 | |
|---------------|-----------------------------|---|---------|-----|--|----------------------|--|
| 14: | | ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,, | | | 解包 | | |
| 读取FlashID | 读取Flash信息 | 读取Chip信息 | 读取Capa | | 1. Flash 2. EMMC 3. SD 4. SD1 | | |
| 测试设备 | 重启设备 | 进入Maskron | 切换有 | 销 | 5. SPINOR 6. SPINAND 7. RAM | | |
| 清空序列号 | 检测安全模式 | 导出串口日志 | 获取当前 | 前存储 | 8. USB 9. SATA 10. PCIE | | |
| 导出镜像 | 擲除扇区 | 擦除所有 | | L | | | |
| 已始扇区: 扇区数: | | | | | | | |

2. 19. Start the Orange Pi development board

1) Insert the TF card with the burned image into the TF card slot of the Orange Pi development board. If the image of SPIFlash+NVMe SSD has been burned, there is no need to insert the TF card. Just make sure that the NVMe SSD is inserted into the development board normally.

2) The development board has an HDMI interface, and you can connect the development board to a TV or HDMI monitor through an HDMI-to-HDMI cable. If you purchase an LCD screen, you can also use the LCD screen to display the system interface of the development board.

3) Connect a USB mouse and keyboard to control the Orange Pi development board.

4) The development board has an Ethernet port, which can be used to connect to the Internet by plugging in a network cable.

5) Connect a high-quality power adapter with a 5V/5A USB Type-C interface.

Please remember not to use a power adapter with an output voltage greater than 5V, as it can damage the development board.

Many unstable phenomena during the system's power-on startup process are mainly caused by power supply issues, so a reliable power adapter is crucial. If you encounter continuous rebooting during the startup process, please try changing the power supply or the Type-C data cable.

Please note that the Type-C power interface does not support PD negotiation.

Also, please do not use a USB port on a computer to power the development board.

6) Then turn on the power adapter. If everything is normal, you can see the system startup screen on the HDMI monitor or LCD screen.

7) If you want to view the output information of the system through the debugging serial port, please use the serial port cable to connect the development board to the computer. For the serial port connection method, please refer to **the section on how to use the debugging serial port**.

2. 20. How to use the debugging serial port

2. 20. 1. Debug serial port connection instructions

1) First, you need to prepare a 3.3V USB to TTL module, and then insert one end of the USB interface of the USB to TTL module into the USB interface of the computer.

For better compatibility, it is recommended to use the CH340 USB to TTL module. Please do not use CP2102 and PL2303 type USB to TTL modules.

Before purchasing a USB to TTL module, please confirm that the module supports a baud rate of 1,500,000.



2) The corresponding relationship between the GND, RXD and TXD pins of the development board's debugging serial port is as shown in the figure below



3) The GND, TXD and RXD pins of the USB to TTL module need to be connected to the debugging serial port of the development board through Dupont lines.

a. Connect the GND of the USB to TTL module to the GND of the development board

b. Connect the **RX of the USB to TTL module to the TX of the development board**

c. Connect the TX of the USB to TTL module to the RX of the development board

4) The schematic diagram of connecting the USB to TTL module to the computer and Orange Pi development board is as shown below



Schematic diagram of connecting the USB to TTL module to the computer and the Orange Pi development board

The TX and RX pins of the serial port need to be cross-connected. If you prefer not to carefully distinguish the order of TX and RX, you can initially connect the TX and RX of the serial port randomly. If there is no output during testing, then swap the TX and RX pins' order. This way, there will always be one correct order.

2. 20. 2. How to use the debugging serial port on Ubuntu platform

There are many serial port debugging software that can be used under Linux, such as putty, minicom, etc. The following demonstrates how to use putty.

1) First insert the USB to TTL module into the USB interface of the Ubuntu computer. If the USB to TTL module is connected and recognized normally, you can see the corresponding device node name under /dev of the Ubuntu PC. Remember this node name and set the serial port later. software will be used

test@test:~\$ **ls** /**dev/ttyUSB*** /dev/ttyUSB0

2) Then use the following command to install putty on Ubuntu PC

test@test:~\$ sudo apt-get update

test@test:~\$ sudo apt-get install -y putty

Then run putty, remember to add sudo permissions
 test@test:~\$ sudo putty

4) After executing the putty command, the following interface will pop up

| | PuTTY Configuration | - 🛛 🔇 |
|--|--|-----------------------|
| Category: Session Logging Terminal | Basic options for your PuTTY sess Specify the destination you want to connect to Host <u>N</u> ame (or IP address) | Port |
| Keyboard Bell Features | Connection type: ○ Ra <u>w</u> Ielnet Rlogin SSH Load, save or delete a stored session | ⊖ Se <u>r</u> ial |
| Window Appearance Behaviour Translation Selection Colours | Sav <u>e</u> d Sessions | Load Sa <u>v</u> e |
| Fonts Connection Data Proxy Telnet Rlogin | Close window on exit: Always Never Only on clea | <u>D</u> elete |
| ► SSH | | |
| About | Open | <u>C</u> ancel |

5) First select the serial port setting interface

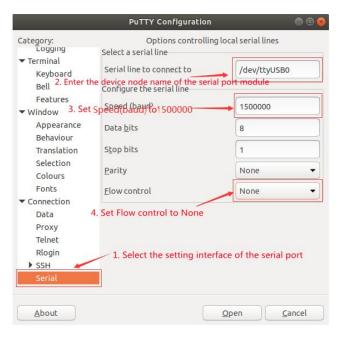
| | PuTTY Configuration | ⊜ @ 🧕 |
|---|---|----------------------|
| Category: Logging ▼ Terminal | Options controllin Select a serial line Serial line to connect to | g local serial lines |
| Keyboard Bell Features | Configure the serial line | 1500000 |
| Window Appearance Behaviour | Data <u>b</u> its | 8 |
| Translation Selection Colours | S <u>t</u> op bits <u>P</u> arity | 1 None |
| Fonts ▼ Connection Data | <u>E</u> low control | None 🗸 |
| Proxy Telnet Rlogin | | |
| ▶ SSH Serial | | |
| About | | Open Cancel |

6) Then set the parameters of the serial port

a. Set the Serial line to connect to to /dev/ttyUSB0 (modify to the corresponding node name, usually /dev/ttyUSB0)

b. Set Speed(baud) to 1500000 (the baud rate of the serial port)

c. Set Flow control to None



7) After completing the settings in the serial port setting interface, return to the Session interface.

- a. Serial First select Connection type as Serial
- b. Then click the Open button to connect to the serial port

| | PuTTY Configuration | • • • |
|---|---|-------------------|
| Category: 🖌 1. (| Go back to the Session interface | sion |
| Session | Specify the destination you want to connect | |
| Logging | Serial li <u>n</u> e | Speed |
| Terminal | /dev/ttyUSB0 | 1500000 |
| Keyboard Bell | 2. Select Serial Connection type: Raw Raw Telnet Rlogin SSH | • Se <u>r</u> ial |
| Features Window Appearance | Load, save or delete a stored session Sav <u>e</u> d Sessions | |
| Behaviour Translation Selection | Default Settings | Load |
| Colours | | Sa <u>v</u> e |
| Fonts | | Delete |
| Connection Data Proxy | | |
| Telnet Rlogin | Close window on e <u>x</u> it: Always Never Only on cle | an exit |
| ▶ ссн | 3. Finally click the Open button | |
| | | ć |
| About | <u>O</u> pen | Cancel |

8) After starting the development board, you can see the Log information output by the system from the open serial terminal.

| | /d | ev/tty | USBO | - PuTT | Y | | 000 |
|----------------------------|-----------|--------|---------|----------|-------------|---|-----|
| R0=0×18 | | | | | | | |
| MR4=0×1 | | | | | | | |
| MR5=0×1 | | | | | | | |
| MR8=0x8 MR12=0x72 | | | | | | | |
| MR12=0x72 MR14=0x72 | | | | | | | |
| MR18=0x0 | | | | | | | |
| MR19=0x0 | | | | | | | |
| MR24=0x8 | | | | | | | |
| MR25=0x0 | | | | | | | |
| R0=0×18 | | | | | | | |
| MR4=0×1 | | | | | | | |
| MR5=0×1 | | | | | | | |
| MR8=0×8 | | | | | | | |
| MR12=0×72 | | | | | | | |
| MR14=0x72 | | | | | | | |
| MR18=0x0 MR19=0x0 | | | | | | | |
| MR19=0x0 MR24=0x8 | | | | | | | |
| MR25=0x0 | | | | | | | |
| channel 0 training pass! | | | | | | | |
| channel 1 training pass! | | | | | | | |
| change freq to 416MHz 0,1 | | | | | | | |
| Channel 0: LPDDR4,416MHz | | | | | | | |
| Bus Width=32 Col=10 Bank=8 | Row=15/15 | CS=2 D | ie Bus- | Width=16 | Size=2048ME | 3 | |
| Channel 1: LPDDR4,416MHz | | | | | | | |
| Bus Width=32 Col=10 Bank=8 | Row=15/15 | CS=2 D | ie Bus- | Width=16 | Size=2048ME | } | |
| 256B stride PO-O-19 | | | | | | | |

2. 20. 3. How to use the debugging serial port on Windows platform

There are many serial port debugging software that can be used under Windows, such as SecureCRT, MobaXterm, etc. The following demonstrates how to use MobaXterm. This software has a free version and can be used without purchasing a serial number.

- 1) Download MobaXterm
 - a. The download URL of MobaXterm is as follows

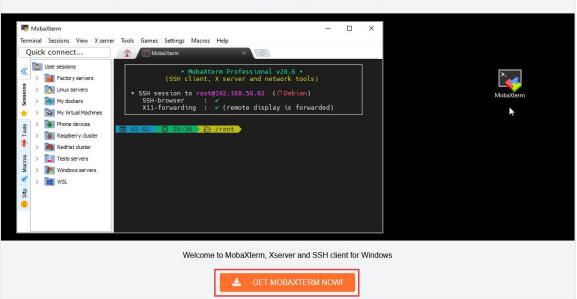
https://mobaxterm.mobatek.net

b. Enter the MobaXterm download webpage and click GET XOBATERM NOW!

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Enhanced terminal for Windows with X11 server, tabbed SSH client, network tools and much more



c. Then choose to download the Home version

| Home Edition | Professional Edition |
|---|---|
| Free | \$69 / 49€ per user* |
| Full X server and SSH support Remote desktop (RDP, VNC, Xdmcp) | * Excluding tax. Volume discounts available |
| Remote terminal (SSH, telnet, rlogin, Mosh) | Every feature from Home Edition + |
| X11-Forwarding | Customize your startup message and logo |
| Automatic SFTP browser | Modify your profile script |
| Master password protection | Remove unwanted games, screensaver or tools |
| Plugins support | Unlimited number of sessions |
| Portable and installer versions | Unlimited number of tunnels and macros |
| Full documentation | Unlimited run time for network daemons |
| Max. 12 sessions | Enhanced security settings |
| Max. 2 SSH tunnels | 12-months updates included |
| Max. 4 macros | Deployment inside company |
| Max, 360 seconds for Tftp, Nfs and Cron | Lifetime right to use |

d. Then select the Portable version. There is no need to install it after downloading. You can open it directly and use it.

| 🔘 _{range} Pi U | Jser Manual Copyrig | ght reserved by Shenzhen Xunlong Software Co., Ltd |
|-------------------------|--|--|
| MobaXterm Home | Edition | |
| Download Moba> | (term Home Edition (current version): | |
| | MobaXterm Home Edition v22.2 (Portable edition) | MobaXterm Home Edition v22.2 (Installer edition) |
| Download previou | us stable version: <u>MobaXterm Portable v22.1</u> | MobaXterm Installer v22.1 |
| By downloading I | NobaXterm software, you accept MobaXterm tern | ms and conditions |
| You can downloa | d the third party plugins and components source | s <u>here</u> |
| give you version | | ider subscribing to <u>MobaXterm Professional Edition</u> : your subscription will zer" software. This customizer will allow you to generate personalized t settings and your welcome message. |

2) After downloading, use decompression software to decompress the downloaded compressed package to get the MobaXterm executable software, and then double-click to open it.

| 名称 | 修改日期 | 类型 | 大小 |
|-------------------------|------------------|-----------|-----------|
| CygUtils.plugin | 2022/9/24 20:16 | PLUGIN 文件 | 17,484 KB |
| MobaXterm_Personal_22.2 | 2022/10/22 16:53 | 应用程序 | 16,461 KB |

3) After opening the software, the steps to set up the serial port connection are as follows:

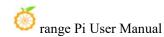
a. Open the settings interface for the session.

b. Select the type of serial port.

c. Choose the port number for the serial port (select the appropriate port number based on the actual situation). If you cannot see the port number, please use a driver scanning tool like "360 Driver Master" to scan and install the driver for the USB to TTL serial port chip.

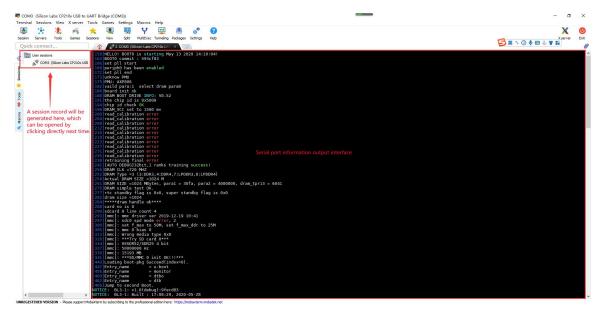
d. Set the baud rate of the serial port to 1500000.

e. Finally, click the "OK" button to complete the settings.



| ion | Servers | N Tools | Games | 📩 Sessions | View | Split | Y MultiExec | Tunneling | Packages | settings | Help | | | | | |
|-----|-------------|-------------------|-------------|--------------------------|------|------------|-----------------------|-----------|-------------|-----------------------|------------|------------|------|--------------|-----|--|
| - [| connect | | | | | | | | | | | | | | | |
| S | Session set | ttings | | | | | | | | | | | | | | |
| | SSH | Telnet | Rsh | Xdmcp | RDP | VNC | S FTP | SFT | Seria | and the second second | Shell | Browser | Mosh | SS Aws S3 | WSL | |
| | 💉 Ba | asic Seria | al settings | | | | | | | - | 2. Select | the serial | port | | | |
| | | Serial p | _ | ose at ses ose at ses | | | | ~ | | Speed (I | ops) * 150 | 0000 ~ | | | | |
| | . M A. | diamage of 6 | | ИЗ (Silicor | | 210x US | | | rk setting: | | 1 | | | | | |
| | | avanceu | / | ect the po | | - | | | | 1 | aud rate | as 150000 | 0 | | | |
| | | | | | | Serial (| (COM) s | session | | | | | | N | ľ | |
| | | | | | | | | | | | | | | | | |
| | | | | | 5. F | inally cli | ck OK | | | | | | | | | |

4) After clicking the "OK" button, you will enter the following interface. At this time, start the development board and you can see the output information of the serial port.



2. 21. Instructions for using the 5v pin in the 40pin interface of the development board for power supply

The recommended power supply method for our development board is to use a 5V/4A Type-C power cable plugged into the Type-C power interface of the development board. If you need to power the development board using the 5V pin in the 40-pin interface, please ensure that the power cable and adapter you are using can meet the power supply requirements of the development board. If there are any stability issues, please switch back to using the Type-C power supply.

1) First you need to prepare a power cord as shown in the picture below



The power cord shown in the picture above can be purchased online, please search and purchase it yourself.

2) To power the development board using the 5V pin in the 40-pin interface, follow these steps for connecting the power cable:

a. The USB A end of the power cable, as shown in the diagram, needs to be plugged into a 5V/4A power adapter (do not plug it into a USB prt on a computer).

b. The red DuPont wire needs to be inserted into the 5V pin of the development board's 40-pin interface.

c. The black DuPont wire needs to be inserted into the GND pin of the 40-pin interface.

d. The positions of the 5V and GND pins in the 40-pin interface on the development board are as shown in the diagram. Be sure not to connect them incorrectly.



3. Ubuntu/Debian Server and Xfce Desktop System Instructions

The content of this chapter is based on the Linux server version image and the xfce desktop version image.

If you are using the OPi OS Arch image, please check the Orange Pi OS Arch System Instructions chapter.

3.1. Supported Linux image types and kernel versions

| Linux image type | Kernel version | Server version | desktop version |
|----------------------|----------------|----------------|-----------------|
| Debian 11 - Bullseye | Linux5.10 | support | support |
| Debian 12 - Bookworm | Linux5.10 | support | support |
| Ubuntu 20.04 - Focal | Linux5.10 | support | support |
| Ubuntu 22.04 - Jammy | Linux5.10 | support | support |

3.2. Linux system adaptation situation

| Function | Debian11 | Debian12 | Ubuntu20.04 | Ubuntu22.04 |
|----------------|----------|----------|-------------|-------------|
| HDMI 2.1 Video | ОК | OK | ОК | ОК |
| HDMI 2.1 Audio | ОК | OK | ОК | ОК |
| HDMI 2.0 Video | ОК | OK | ОК | ОК |
| HDMI 2.0 Audio | ОК | OK | ОК | ОК |

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| OK | ОК | ОК | ОК |
|----|--|--|--|
| OK | ОК | ОК | ОК |
| OK | ОК | ОК | ОК |
| OK | ОК | ОК | ОК |
| | | | |
| OK | ОК | ОК | ОК |
| OK | ОК | ОК | ОК |
| OK | ОК | ОК | ОК |
| OK | ОК | ОК | ОК |
| OK | ОК | ОК | ОК |
| OK | ОК | ОК | ОК |
| OK | ОК | ОК | ОК |
| OK | ОК | ОК | ОК |
| OK | ОК | ОК | ОК |
| OK | ОК | ОК | ОК |
| OK | ОК | ОК | ОК |
| OK | ОК | ОК | ОК |
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| OK | ОК | ОК | ОК |
| OK | ОК | ОК | ОК |
| OK | ОК | ОК | ОК |
| OK | ОК | ОК | ОК |
| OK | ОК | ОК | OK |
| ОК | ОК | ОК | ОК |
| OK | ОК | ОК | ОК |
| OK | ОК | ОК | OK |
| OK | ОК | ОК | OK |
| ОК | ОК | ОК | ОК |
| | OK OK | OK OK OK < | OK |

3. 3. Linux command format description in this manual

1) All commands that need to be entered in the Linux system in this manual will be enclosed in the following boxes

As shown below, the content in the yellow box indicates content that requires special attention, except for the commands inside.

- 2) Description of the prompt type before the command
 - a. The prompt in front of the command refers to the red part in the box below. This part is not part of the Linux command. Therefore, when entering commands in the Linux system, please do not also enter the content in the red font.

orangepi@orangepi:~\$ sudo apt update root@orangepi:~# vim /boot/boot.cmd test@test:~\$ ssh root@192.168.1.xxx root@test:~# ls

- b. **root@orangepi:~**\$ The prompt indicates that this command is entered in the Linux system of the development board. The \$ at the end of the prompt indicates that the current user of the system is an ordinary user. When executing a privileged command, **sudo** needs to be added.
- c. root@orangepi:~# The prompt indicates that this command is entered in the Linux system of the development board. The # at the end of the prompt indicates that the current user of the system is the root user and can execute any command you want to execute.
- d. test@test:~\$ The prompt indicates that the command was entered in the Ubuntu PC or Ubuntu virtual machine, not the Linux system of the development board. The \$ at the end of the prompt indicates that the current user of the system is an ordinary user. When executing a privileged command, you need to add sudo
- e. root@test:~# The prompt indicates that the command was entered in the Ubuntu PC or Ubuntu virtual machine, not the Linux system of the development board. The # at the end of the prompt indicates that the current user of the system is the root user and can execute any command you want to execute.
- 3) What are the commands that need to be entered?

a. As shown below, the bold black part is the command that needs to be entered, and the content below the command is the output content (some commands have output, some may not output), this part of the content does not need to be input

root@orangepi:~# cat /boot/orangepiEnv.txt verbosity=7 bootlogo=false console=serial

b. As shown below, some commands that cannot be written in one line will be placed on the next line. As long as the black and bold parts are the commands that need to be entered. When these commands are entered into one line, the "\" at the end of each line needs to be removed. This is not part of the command. In addition, different parts of the command have spaces, please don't miss them.

orangepi@orangepi:~\$ echo \

"deb [arch=\$(dpkg --print-architecture) \

```
signed-by=/usr/share/keyrings/docker-archive-keyring.gpg] \
```

https://download.docker.com/linux/debian \

\$(lsb_release -cs) stable" | sudo tee /etc/apt/sources.list.d/docker.list > /dev/null

3. 4. Linux system login instructions

3. 4. 1. Linux system default login account and password

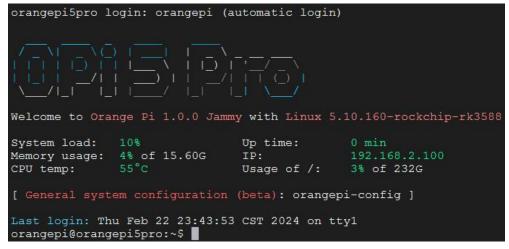
| Account | Password |
|----------|----------|
| root | orangepi |
| orangepi | orangepi |

Please note that when entering the password, the specific content of the password will not be displayed on the screen. Do not mistake this for a malfunction. Simply input the password and press Enter directly.

When encountering password-related errors or issues with SSH connections, please note that as long as you are using the Linux image provided by Orange Pi, do not doubt the correctness of the password. Instead, explore other potential reasons for the error or connection problem.

3. 4. 2. How to set up automatic login of Linux system terminal

1) The Linux system automatically logs in to the terminal by default. The default login user name is **orangepi**



2) Use the following command to set the root user to automatically log in to the terminal. orangepi@orangepi:~\$ sudo auto login cli.sh root

3) Use the following command to disable automatic login to the terminal orangepi@orangepi:~\$ sudo auto_login_cli.sh -d

4) Use the following command to set the orangepi user to automatically log in to the terminal again

orangepi@orangepi:~\$ sudo auto_login_cli.sh orangepi

3. 4. 3. Linux desktop version system automatic login instructions

1) The desktop version system will automatically log in to the desktop after startup, without entering a password.



2) Run the following command to prevent the desktop system from automatically logging into the desktop.

orangepi@orangepi:~\$ sudo disable_desktop_autologin.sh

3) Then restart the system and a login dialog box will appear. At this time, you need to enter a password to enter the system.



3. 4. 4. Setting method for automatic login of root user in Linux

desktop system

1) Execute the following command to set the desktop version of the system to automatically log in using the root user

orangepi@orangepi:~\$ sudo desktop_login.sh root

2) Then restart the system and you will automatically log in to the desktop as the root user.



Please note that if you log in as the root user on the desktop system, you will be unable to use the pulseaudio tool in the top right corner to manage audio devices. Additionally, please be aware that this is not a bug, as pulseaudio inherently does not allow running under the root user.

3) Execute the following command to set up the desktop system again to use the orangepi user to automatically log in

orangepi@orangepi:~\$ sudo desktop_login.sh orangepi

3. 4. 5. How to disable the desktop in Linux desktop system

1) First enter the following command on the command line, **please remember to add sudo permissions**

orangepi@orangepi:~\$ sudo systemctl disable lightdm.service

2) Then restart the Linux system and you will find that the desktop will not be displayed.

orangepi@orangepi:~\$ sudo reboot

- 3) The steps to reopen the desktop are as follows
 - a. 首 First enter the following command on the command line, please remember to add sudo permissions

orangepi@orangepi:~\$ sudo systemctl start lightdm.service orangepi@orangepi:~\$ sudo systemctl enable lightdm.service

b. After selecting, the monitor will display the desktop.

3. 5. **Onboard LED light test instructions**

1) There is a red, green and blue light on the development board, and its location is as shown in the picture below:



2) As long as the development board is powered on, the red LED light will remain constantly illuminated. This behavior is hardware-controlled and cannot be turned off by software. The constant illumination of the red LED light serves as an indicator that the development board's power supply is functioning properly.

3) The green and blue LED lights will keep flashing after the kernel is started, which is controlled by software.

4) The method of setting the green light to turn on and off and flash is as follows

Note that the following operations should be performed under the root user.

a. First enter the settings directory of the green light

root@orangepi:~# cd /sys/class/leds/green led

b. The command to set the green light to stop flashing is as follows:

root@orangepi:/sys/class/leds/green_led# echo none > trigger

c. The command to set the green light to be always on is as follows:

root@orangepi:/sys/class/leds/green_led# echo default-on > trigger

d. The command to set the green light flashing is as follows:

root@orangepi:/sys/class/leds/green_led# echo heartbeat > trigger

5) The method of using commands to set the blue light on and off and flashing is as follows:

Note that the following operations should be performed under the root user.

a. First enter the settings directory of the blue light

root@orangepi:~# cd /sys/class/leds/blue_led

b. The command to set the blue light to stop flashing is as follows:

root@orangepi:/sys/class/leds/blue_led# echo none > trigger

c. The command to set the blue light to always be on is as follows:

root@orangepi:/sys/class/leds/blue_led# echo default-on > trigger

d. The command to set the blue light flashing is as follows:

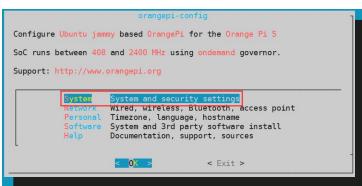
root@orangepi:/sys/class/leds/blue_led# echo heartbeat > trigger

6) If you don't need the LED light to flash after powering on, you can use the following method to turn off the green and blue lights.

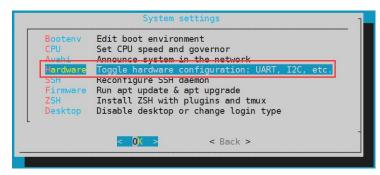
a. First run orangepi-config. Ordinary users remember to add sudo permissions.

orangepi@orangepi:~\$ sudo orangepi-config

b. Select System



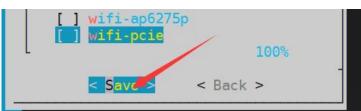
c. Select Hardware



d. Then use the keyboard's arrow keys to locate the position shown in the picture below, and then use the space to select the **opi5pro-disable-leds** configuration



e. Select <Save>



f. Select <Back>

| wifi-ap6275p wifi-pcie | 100% | |
|---------------------------|----------|--|
| < Save > | < Back > | |

g. Then select **<Reboot>** to restart the system to make the configuration take effect.

| Applying changes | 1 |
|--|---|
| Reboot to enable new features? | |
| <pre><reboot> <cancel></cancel></reboot></pre> | |
| Kebbook Cancers | |

h. After restarting, you can see that only the red light on the development board is always on, and the green and blue lights will no longer flash.

3. 6. Network connection test

3. 6. 1. Ethernet port test

1) First, plug one end of the network cable into the Ethernet interface of the development board, and the other end of the network cable into the router, and make sure the network is open.

2) After the system starts, it will automatically assign an IP address to the Ethernet card through **DHCP**, and **no other configuration is required**.

3) The command to view the IP address in the Linux system of the development board is as follows:

orangepi@orangepi:~\$ ip addr show 1: lo: <LOOPBACK,UP,LOWER UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000 link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00 inet 127.0.0.1/8 scope host lo valid 1ft forever preferred 1ft forever inet6 ::1/128 scope host valid 1ft forever preferred 1ft forever 2: enP4p65s0: <BROADCAST,MULTICAST,UP,LOWER UP> mtu 1500 qdisc mq state UP group default qlen 1000 link/ether 00:e0:4c:68:00:0f brd ff:ff:ff:ff:ff:ff inet 10.31.2.249/16 brd 10.31.255.255 scope global dynamic noprefixroute enP4p65s0 valid 1ft 42670sec preferred 1ft 42670sec inet6 fe80::d5aa:9a6:cd41:942e/64 scope link noprefixroute valid_lft forever preferred_lft forever 3: wlan0: <NO-CARRIER,BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state DORMANT group default qlen 1000 link/ether 50:41:1c:f1:0f:7e brd ff:ff:ff:ff:ff:ff

When using ifconfig to check the IP address, if the following information is prompted, it is caused by not adding sudo. The correct command is sudo ifconfig

orangepi@orangepi:~\$ ifconfig

Command 'ifconfig' is available in the following places

* /sbin/ifconfig

* /usr/sbin/ifconfig

The command could not be located because '/sbin:/usr/sbin' is not included in the PATH environment variable.

This is most likely caused by the lack of administrative privileges associated with your user account.

ifconfig: command not found

1. Connect an HDMI display and log in to the system to use the ip addr show command to view the IP address.

2. Use the **ip addr show** command in a debugging serial terminal to check the IP address.

3. If there is no debugging serial port or HDMI display available, you can still check the IP address through the router's management interface. However, this method often results in people being unable to view the development board's IP address properly. If this occurs, follow these debugging steps:

A) First, check if the Linux system has started correctly. If the green LED on the development board is flashing, it generally indicates that the system has started correctly. If only the red LED is lit, it means the system has not started correctly.

B) Check if the Ethernet cable is securely plugged in or try using a different cable.

C) Try using a different router. Router issues are common and may include problems like the router not assigning IP addresses properly or the assigned IP address not being visible in the router's settings.

D) If changing the router is not an option, the only way to view the IP address is by connecting an HDMI display or using a debugging serial port.

Additionally, it's important to note that the development board's DHCP automatic IP address assignment requires no additional configuration.

4) The **ping** command can be interrupted by pressing the **Ctrl+C** shortcut key.

orangepi@orangepi:~\$ **ping www.baidu.com -I enP4p65s0** PING www.a.shifen.com (183.2.172.185) from 10.31.2.249 enP4p65s0: 56(84) bytes of data. 64 bytes from 183.2.172.185 (183.2.172.185): icmp_seq=1 ttl=53 time=39.5 ms 64 bytes from 183.2.172.185 (183.2.172.185): icmp_seq=2 ttl=53 time=33.1 ms 64 bytes from 183.2.172.185 (183.2.172.185): icmp_seq=3 ttl=53 time=32.4 ms 64 bytes from 14.215.177.38 (14.215.177.38): icmp_seq=4 ttl=56 time=7.27 ms ^C

--- www.a.shifen.com ping statistics ---

4 packets transmitted, 4 received, 0% packet loss, time 3002ms rtt min/avg/max/mdev = 6.260/6.770/7.275/0.373 ms

3. 6. 2. WIFI connection test

Please refrain from connecting to Wi-Fi networks by modifying the /etc/network/interfaces configuration file, as this method may lead to issues with connecting to Wi-Fi networks.

$3.\ 6.\ 2.\ 1.$ Connect the server version image to WIFI through

commands

When the development board is not connected to Ethernet and HDMI display, and only the serial port is connected, it is recommended to use the commands demonstrated in this section to connect to Wi-Fi networks. This is because `nmtui` may not display graphical interfaces properly in some serial port software like Minicom, only showing characters. However, if the development board is connected to Ethernet or an HDMI display, you can still use the commands demonstrated in this section to connect to Wi-Fi networks.

1) First log in to the Linux system, there are three ways:

a. If the development board is connected to a network cable, you can remotely log in to the Linux system through ssh.

b. If the development board is connected to the debugging serial port, you can use the serial port terminal to log in to the Linux system.

c. If the development board is connected to an HDMI display, you can log in to the Linux system through the HDMI display terminal.

First use the **nmcli dev wifi** command to scan the surrounding WIFI hotspots orangepi@orangepi:~\$ nmcli dev wifi



| root@or | angepi:~# nmcli dev | wifi | | 4423.08 | (Declarity) | | | 10100202000000 |
|---------|---------------------|---------------|-------|---------|-------------|--------|------|----------------|
| IN-USE | BSSID | SSID | MODE | CHAN | RATE | SIGNAL | BARS | SECURITY |
| | 28:6C:07:6E:87:2E | orangepi | Infra | | 260 Mbit/s | 97 | | WPA1 WPA2 |
| | D8:D8:66:A5:BD:D1 | | Infra | 10 | 270 Mbit/s | 90 | | WPA1 WPA2 |
| | A0:40:A0:A1:72:20 | | Infra | | 405 Mbit/s | 82 | | WPA2 |
| | 28:6C:07:6E:87:2F | orangepi 5G | Infra | 149 | 540 Mbit/s | 80 | | WPA1 WPA2 |
| | CA:50:E9:89:E2:44 | Chinates TC15 | Infra | 1 | 130 Mbit/s | 79 | | WPA1 WPA2 |
| | A0:40:A0:A1:72:31 | NETOEMEN | Infra | 100 | 405 Mbit/s | 67 | | WPA2 |
| | D4:EE:07:08:A9:E0 | | Infra | | 130 Mbit/s | 55 | _ | WPA1 WPA2 |
| | 88:C3:97:49:25:13 | | Infra | | | 52 | - | WPA1 WPA2 |
| | 00:BD:82:51:53:C2 | | Infra | | 130 Mbit/s | | | WPA1 WPA2 |
| | C0:61:18:FA:49:37 | | Infra | 149 | 270 Mbit/s | 47 | | WPA1 WPA2 |
| | 04:79:70:8D:0C:B8 | | Infra | 153 | 270 Mbit/s | 47 | | WPA2 |
| | 04:79:70:FD:0C:B8 | | Infra | 153 | | 47 | | WPA2 |
| | 9C:A6:15:DD:E6:0C | | Infra | | 270 Mbit/s | 45 | | WPA1 WPA2 |
| | B4:0F:3B:45:D1:F5 | | Infra | | 270 Mbit/s | 45 | | WPA1 WPA2 |
| | E8:CC:18:4F:7B:44 | | Infra | 157 | 135 Mbit/s | 45 | | WPA1 WPA2 |
| | B0:95:8E:D8:2F:ED | | Infra | 11 | 405 Mbit/s | | _ | WPA1 WPA2 |
| | C0:61:18:FA:49:36 | | Infra | 11 | 270 Mbit/s | 24 | | WPA1 WPA2 |
| root@or | angepi:~# | | | | | | | |

- 2) Then use the **nmcli** command to connect to the scanned WIFI hotspot, where:
 - a. **wifi_name** needs to be replaced with the name of the WIFI hotspot you want to connect to.
 - b. **wifi_passwd** needs to be replaced with the password of the WIFI hotspot you want to connect to.

orangepi@orangepi:~\$ sudo nmcli dev wifi connect wifi_name password wifi_passwd Device 'wlan0' successfully activated with 'cf937f88-ca1e-4411-bb50-61f402eef293'.

3) You can check the IP address of the wifi through the **ip addr show wlan0** command

orangepi@orangepi:~\$ ip addr show wlan0

11: wlan0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP group default qlen 1000

link/ether 23:8c:d6:ae:76:bb brd ff:ff:ff:ff:ff:ff

inet **192.168.1.11**/24 brd 192.168.1.255 scope global dynamic noprefixroute wlan0 valid_lft 259192sec preferred_lft 259192sec

inet6 240e:3b7:3240:c3a0:c401:a445:5002:ccdd/64 scope global dynamic noprefixroute

valid_lft 259192sec preferred_lft 172792sec

inet6 fe80::42f1:6019:a80e:4c31/64 scope link noprefixroute

valid_lft forever preferred_lft forever

4) Use the **ping** command to test the connectivity of the wifi network. The **ping** command can be interrupted by pressing the **Ctrl+C** shortcut key.

orangepi@orangepi:~\$ **ping www.orangepi.org -I wlan0** PING www.orangepi.org (182.92.236.130) from 192.168.1.49 wlan0: 56(84) bytes of data. 64 bytes from 182.92.236.130 (182.92.236.130): icmp_seq=1 ttl=52 time=43.5 ms 64 bytes from 182.92.236.130 (182.92.236.130): icmp_seq=2 ttl=52 time=41.3 ms 64 bytes from 182.92.236.130 (182.92.236.130): icmp_seq=3 ttl=52 time=44.9 ms 64 bytes from 182.92.236.130 (182.92.236.130): icmp_seq=4 ttl=52 time=45.6 ms 64 bytes from 182.92.236.130 (182.92.236.130): icmp_seq=5 ttl=52 time=45.6 ms 64 bytes from 182.92.236.130 (182.92.236.130): icmp_seq=5 ttl=52 time=48.8 ms ^C --- www.orangepi.org ping statistics ---5 packets transmitted, 5 received, 0% packet loss, time 4006ms rtt min/avg/max/mdev = 41.321/44.864/48.834/2.484 ms

3. 6. 2. 2. Server version image connects to WIFI graphically

1) First log in to the Linux system, there are three ways:

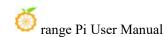
a. If the development board is connected to a network cable, you can remotely log in to the Linux system through ssh.

b. If the development board is connected to the debugging serial port, you can use the serial port terminal to log in to the Linux system (please use MobaXterm for the serial port software, the graphical interface cannot be displayed using minicom)c. If the development board is connected to an HDMI display, you can log in to the Linux system through the HDMI display terminal.

2) Then enter the nmtui command in the command line to open the wifi connection interface

orangepi@orangepi:~\$ sudo nmtui

3) Enter the nmtui command to open the interface as shown below





4) Select Activate a connect and press Enter

| 👔 🧳 4 COM9 (Silicon Lats CP210x U.) × 🧿 | | |
|---|--|--|
| | NetworkManager TUI Please select an option Edit a connection Activate a connection Set system hostname Quit | |
| | <0K> | |

5) Then you can see all the searched WIFI hotspots

| Wired * Wired connection 1 | † | <deactivate></deactivate> |
|-------------------------------|---------------|---------------------------|
| orangepi * | ** | |
| č - ** | ** ** * | Searched WiFi sign |

6) Select the WIFI hotspot you want to connect to, then use the Tab key to position the cursor on **Activate** and press Enter.

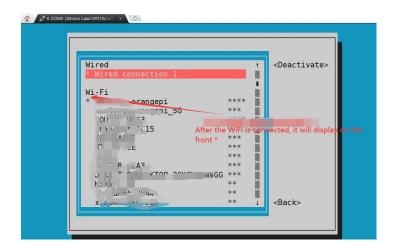
| 2. Use the Tab key to move the | | | |
|--------------------------------|------------------------|-----------------------|-----|
| Wired | Ť | <activate></activate> | |
| * Wired connection | 1 | | |
| | | | |
| Wi-Fi | | | |
| orangepi | 5G *** | | |
| | **** | | |
| Jrangepi | **** | | |
| (' le le ID | | | |
| C c ve 11 1. Sele | ct the WiFi yo | want to connect t | o l |
| S C | *** @ | | |
| 5 4 10.4 | *** *** ** ** | | |
| N AR 2 | *** | | |
| | ** | | |
| E V F | ** | | |
| (| | | |
| 1 1 101 | ** ↓ | <back></back> | |

7) Then a dialog box for entering the **Password** will pop up. Enter the corresponding password in Password and press Enter to start connecting to WIFI.

| Wired t <activate> Wired connection 1 Wi-Fi Authentication required by wireless network Passwords or encryption keys are required to access the vireless network 'orangepi'. 1. Enter WiFi password Password 2. Press the Enter key</activate> |
|--|
| ETWIFI ** + <back></back> |

8) After the WIFI connection is successful, a "*" will be displayed in front of the connected WIFI name.

| Wired | t | <deactivate></deactivate> |
|----------------------|----------------------------|---------------------------|
| * Wired connection 1 | | |
| | | |
| Wi-Fi | Ē | |
| * orangepi | **** | |
| | *** | |
| 00 SC 19 OC | = 连接好后会 | 在前面显示 * |
| | | |
| | *** *** 6G *** ** | |
| | *** 🞆 | |
| A R LAR | *** 💥 | |
| | G *** 📓 | |
| | ** | |
| un - May | ** | |
| X, É JII 151 CUIV | ** ↓ | <back></back> |



9) You can check the IP address of the wifi through the **ip addr show wlan0** command orangepi@orangepi:~\$ **ip addr show wlan0**

11: wlan0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP group default qlen 1000

link/ether 24:8c:d3:aa:76:bb brd ff:ff:ff:ff:ff:ff

inet **192.168.1.11**/24 brd 192.168.1.255 scope global dynamic noprefixroute wlan0 valid_lft 259069sec preferred_lft 259069sec

inet6 240e:3b7:3240:c4a0:c401:a445:5002:ccdd/64 scope global dynamic noprefixroute

valid_lft 259071sec preferred_lft 172671sec

inet6 fe80::42f1:6019:a80e:4c31/64 scope link noprefixroute

valid_lft forever preferred_lft forever

10) Use the **ping** command to test the connectivity of the wifi network. The **ping** command can be interrupted by pressing the **Ctrl+C** shortcut key.

orangepi@orangepi:~\$ ping www.orangepi.org -I wlan0

PING www.orangepi.org (182.92.236.130) from 192.168.1.49 wlan0: 56(84) bytes of data.

64 bytes from 182.92.236.130 (182.92.236.130): icmp_seq=1 ttl=52 time=43.5 ms 64 bytes from 182.92.236.130 (182.92.236.130): icmp_seq=2 ttl=52 time=41.3 ms 64 bytes from 182.92.236.130 (182.92.236.130): icmp_seq=3 ttl=52 time=44.9 ms 64 bytes from 182.92.236.130 (182.92.236.130): icmp_seq=4 ttl=52 time=45.6 ms 64 bytes from 182.92.236.130 (182.92.236.130): icmp_seq=5 ttl=52 time=48.8 ms

^C

-- www.orangepi.org ping statistics ---

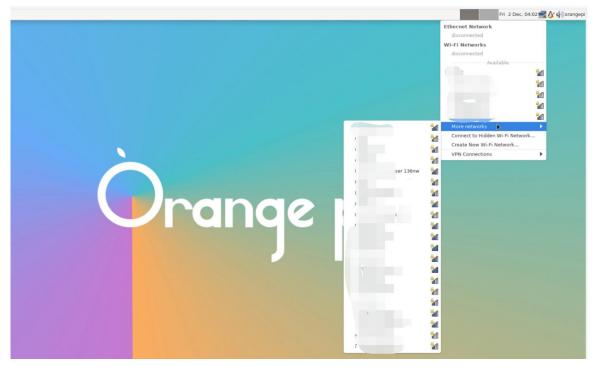
5 packets transmitted, 5 received, 0% packet loss, time 4006ms rtt min/avg/max/mdev = 41.321/44.864/48.834/2.484 ms

3. 6. 2. 3. Testing method of desktop image

1) Click the network configuration icon in the upper right corner of the desktop (please do not connect the network cable when testing WIFI)



2) Click **More networks** in the pop-up drop-down box to see all scanned WIFI hotspots, and then select the WIFI hotspot you want to connect to.



3) Then enter the password of the WIFI hotspot and click **Connect** to start connecting to WIFI



4) After connecting to WIFI, you can open the browser to check whether you can access the Internet. The browser entrance is as shown below

| or Applications | | | |
|------------------|-----|------------------|--|
| 🔍 Run Program | | | |
| 🔪 Terminal Emula | tor | | |
| 📑 File Manager | | | |
| 🙀 Mail Reader | | | |
| 🕥 Web Browser | | | |
| 1989 Settings | • | | |
| 🔀 Accessories | • | | |
| 🖉 Development | • | | |
| oraphics | • | | |
| 🔶 Help | | | |
| 🕃 Internet | • • | Chromium Browser | |
| Multimedia | ->- | | |
| 🗑 Office | • | | |
| 🖗 System | • | | |
| 🕒 Log Out | | | |

5) If you can open other web pages after opening the browser, it means the WIFI connection is normal.



3. 6. 3. How to set a static IP address

Please do not set a static IP address by modifying the/etc/network/interfaces configuration file.

3. 6. 3. 1. Use nmtui command to set static IP address

1) First run the **nmtui** command

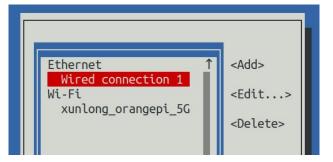
orangepi@orangepi:~\$ sudo nmtui

2) Then select **Edit a connection** and press the Enter key

| NetworkManager TUI |
|--|
| Please select an option |
| Edit a connection |
| Activate a connection Set system hostname |
| Quit |
| <0K> |
| |
| |

3) Then select the network interface for which a static IP address needs to be set. For

example, to set the static IP address of the **Ethernet**interface, select **Wired connection 1**



4) Then select **Edit** via the **Tab** key and press Enter.

| Ethernet Wired connection 1 <add> Wi-Fi <edit< td=""> xunlong_orangepi_5G <delete></delete></edit<></add> |
|--|
|--|

5) Then use the Tab key to move the cursor to the **<Automatic>** position shown in the figure below to configure IPv4

| Edit Connection | |
|--|---------------------------------|
| Profile name Wired connection 1 Device enP4p65s0 (00:E0:4C:68:00:0F) | |
| = ETHERNET | <show></show> |
| <pre>= IPv4 CONFIGURATION <automatic> = IPv6 CONFIGURATION <automatic></automatic></automatic></pre> | <show> <show></show></show> |
| <pre>[X] Automatically connect [X] Available to all users</pre> | |
| | <cancel> <ok></ok></cancel> |

6) Then press Enter, select **Manual**through the up and down arrow keys, and then press Enter to confirm.

| | Edit Connection Wired connection 1 enP4p65s0 (00:E0:4C:68:0 | 90:0F) |
|--|---|-----------------------------|
| = ETHERNET | Disabled | <show></show> |
| = IPv4 CONFIGURATION | Automatic | <show></show> |
| = IPv6 CONFIGURATION | Link-Local Manual | <show></show> |
| [X] Automatically co [X] Available to all | Shared | |
| | | <cancel> <ok></ok></cancel> |

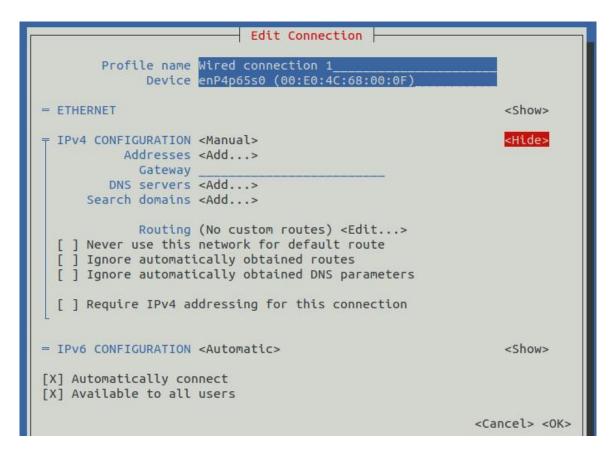
7) The display after selection is as shown below

| Edit Connection | |
|--|---------------------------------|
| Profile name Wired connection 1 Device enP4p65s0 (00:E0:4C:68:00:0F) | |
| = ETHERNET | <show></show> |
| <pre>= IPv4 CONFIGURATION <<u>Manual></u> = IPv6 CONFIGURATION <automatic></automatic></pre> | <show> <show></show></show> |
| <pre>[X] Automatically connect [X] Available to all users</pre> | |
| | <cancel> <ok></ok></cancel> |

8) Then move the cursor to **<Show>**



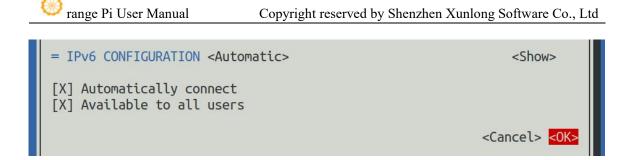
9) Then press Enter. After pressing Enter, the following setting interface will pop up.



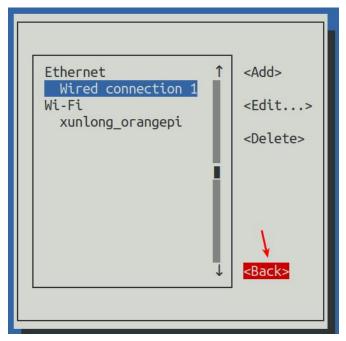
10) Then you can set the IP address (Addresses), gateway (Gateway) and DNS server address as shown in the figure below (there are many other setting options, please explore by yourself), **please set according to your specific needs. The values set in the image below are just an example**

| | Edit Connection | | t I |
|---------------------------------|--|-------------------|---------------|
| | Wired connection 1 enP4p65s0 (00:E0:4C:68:0 | 0:0F) | |
| = ETHERNET | | | <show></show> |
| IPv4 CONFIGURATION Addresses | <manual> 192.168.1.177/24</manual> | <remove></remove> | <hide></hide> |
| | <add> 192.168.1.1</add> | | |
| DNS servers | <add></add> | <remove></remove> | |
| Search domains | <add></add> | | |

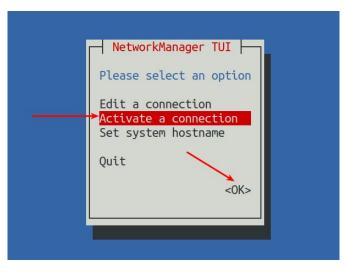
11) After setting, move the cursor to **<OK>** in the lower right corner, and then press Enter to confirm.



12) Then click **Back** to return to the previous level selection interface

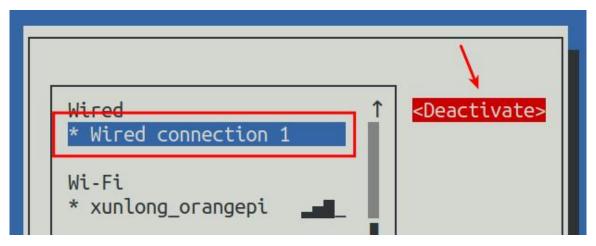


13) Then select **Activate a connection**, then move the cursor to **<OK>**, and finally click Enter



14) Then select the network interface that needs to be set, such as <Deactivate>, then

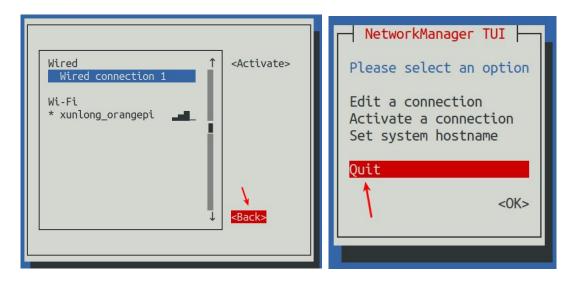
move the cursor to **<Deactivate>**, and then press the Enter key to disable **Wired** connection 1



15) Then please do not move the cursor, and then press the Enter key to re-enable **Wired connection 1**, so that the static IP address set previously will take effect.

| Wired Wired connection 1 | <pre>↑ <activate></activate></pre> |
|-----------------------------|------------------------------------|
| Wi-Fi * xunlong_orangepi | |

16) Then you can exit nmtui through the **<Back>** and **Quit** buttons



17) Then use **ip addr show enP4p65s0** to see that the IP address of the network port has become the static IP address set previously.

orangepi@orangepi:~\$ **ip addr show enP4p65s0** 2: enP4p65s0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc mq state UP group default qlen 1000 link/ether 00:e0:4c:68:00:0f brd ff:ff:ff:ff:ff inet **192.168.1.177**/24 brd 192.168.1.255 scope global noprefixroute enP4p65s0 valid_lft forever preferred_lft forever inet6 fe80::d5aa:9a6:cd41:942e/64 scope link noprefixroute valid_lft forever preferred_lft forever

18) Then you can test the network connectivity to check whether the IP address is configured OK. The **ping** command can be interrupted by using the **Ctrl+C** shortcut key.

```
orangepi@orangepi:~$ ping 192.168.1.47 -I enP4p65s0
PING 192.168.1.47 (192.168.1.47) from 192.168.1.188 eth0: 56(84) bytes of data.
64 bytes from 192.168.1.47: icmp_seq=1 ttl=64 time=0.233 ms
64 bytes from 192.168.1.47: icmp_seq=2 ttl=64 time=0.263 ms
64 bytes from 192.168.1.47: icmp_seq=3 ttl=64 time=0.273 ms
64 bytes from 192.168.1.47: icmp_seq=4 ttl=64 time=0.269 ms
64 bytes from 192.168.1.47: icmp_seq=5 ttl=64 time=0.275 ms
^C
--- 192.168.1.47 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4042ms
```

rtt min/avg/max/mdev = 0.233/0.262/0.275/0.015 ms

3. 6. 3. 2. Use nmcli command to set static IP address

1) If you want to set a static IP address for the network port, please plug the network cable into the development board first. If you need to set a static IP address for WIFI, please connect to WIFI first, and then start setting the static IP address.

2) Then you can view the name of the network device through the **nmcli con show** command, as shown below

- a. **orangepi** is the name of the WIFI network interface (the names may not be the same)
- b. Wired connection 1 is the name of the Ethernet interface

| orangepi@orangepi:~ | \$ nmcli con show | | |
|---------------------|--------------------------------------|----------|--------|
| NAME | UUID | TYPE | DEVICE |
| orangepi | cfc4f922-ae48-46f1-84e1-2f19e9ec5e2a | wifi | wlan0 |
| Wired connection 1 | 9db058b7-7701-37b8-9411-efc2ae8bfa30 | ethernet | eth0 |

3) Then enter the following command

- a. "Wired connection 1" Indicates setting the static IP address of the Ethernet port. If you need to set the static IP address of WIFI, please change it to the name corresponding to the WIFI network interface (can be obtained through thenmcli con show command)
- b. **ipv4.addresses** is the static IP address to be set, which can be modified to the value you want to set.
- c. **ipv4.gateway** represents the address of the gateway

```
orangepi@orangepi:~$ sudo nmcli con mod "Wired connection 1" \
ipv4.addresses "192.168.1.110" \
ipv4.gateway "192.168.1.1" \
ipv4.dns "8.8.8.8" \
ipv4.method "manual"
```

4) Then restart the linux system

orangepi@orangepi:~\$ sudo reboot

5) Then re-enter the Linux system and use the **ip addr show eth0** command to see that the IP address has been set to the desired value.

```
orangepi@orangepi:~$ ip addr show enP4p65s0

3: enP4p65s0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc

pfifo_fast state UP group default qlen 1000

link/ether 5e:ae:14:a5:91:b3 brd ff:ff:ff:ff:ff

inet 192.168.1.110/32 brd 192.168.1.110 scope global noprefixroute eth0

valid_lft forever preferred_lft forever

inet6 240e:3b7:3240:c3a0:97de:1d01:b290:fe3a/64 scope global dynamic

noprefixroute

valid_lft 259183sec preferred_lft 172783sec

inet6 fe80::3312:861a:a589:d3c/64 scope link noprefixroute
```

valid_lft forever preferred_lft forever

3. 6. 4. Method to create WIFI hotspot through create_ap

create_ap is a script that helps quickly create WIFI hotspots on Linux, and supports bridge and NAT modes. It can automatically combine hostapd, dnsmasq and iptables to complete the setting of WIFI hotspots, avoiding users from making complicated configurations. The github address is as follows:

https://github.com/oblique/create_ap

If you are using the latest image, the create_ap script has been pre-installed. You can use the create_ap command to create a WIFI hotspot. The basic command format of create ap is as follows:

create_ap [options] <wifi-interface> [<interface-with-internet>] [<access-point-name> [<passphrase>]]

* options: You can use this parameter to specify the encryption method, frequency band of WIFI hotspot, bandwidth mode, network sharing method, etc. You can get the options through create_ap -h.

* wifi-interface: the name of the wireless network card

* interface-with-internet: The name of the network card that can be connected to the Internet, usually eth0

* access-point-name: hotspot name

* passphrase: Password of hotspot

3. 6. 4. 1. create_ap method to create WIFI hotspot in NAT mode

1) Enter the following command to create a WIFI hotspot with the name **orangepi** and password **orangepi** in NAT mode

orangepi@orangepi:~\$ sudo create_ap -m nat wlan0 enP4p65s0 orangepi orangepi

2) If the following information is output, it means that the WIFI hotspot is successfully created.

orangepi@orangepi:~\$ sudo create_ap -m nat wlan0 enP4p65s0 orangepi orangepi Config dir: /tmp/create_ap.wlan0.conf.Ks6HobEw PID: 5405 Network Manager found, set ap0 as unmanaged device... DONE Creating a virtual WiFi interface... ap0 created. Sharing Internet using method: nat hostapd command-line interface: hostapd_cli -p /tmp/create_ap.wlan0.conf.Ks6HobEw/hostapd_ctrl ap0: interface state UNINITIALIZED->ENABLED ap0: AP-ENABLED

3) At this time, take out your mobile phone and find the WIFI hotspot named **orangepi** created by the development board in the searched WIFI list. Then you can click **orangepi** to connect to the hotspot. The password is **orangepi** the one set above.



4) The display after successful connection is as shown below



5) In NAT mode, the wireless device connected to the development board's hotspot requests an IP address from the development board's DHCP service, so there will be two different network segments. For example, the development board's IP here is 192.168.1.X

```
orangepi@orangepi:~$ ifconfig enP4p65s0
enP4p65s0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
inet 192.168.1.150 netmask 255.255.255.0 broadcast 192.168.1.255
inet6 fe80::938f:8776:5783:afa2 prefixlen 64 scopeid 0x20<link>
ether 4a:a0:c8:25:42:82 txqueuelen 1000 (Ethernet)
RX packets 25370 bytes 2709590 (2.7 MB)
RX errors 0 dropped 50 overruns 0 frame 0
TX packets 3798 bytes 1519493 (1.5 MB)
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
device interrupt 83
```

By default, the DHCP service of the development board will assign the IP address of **192.168.12.0/24** to the device connected to the hotspot. At this time, click on the connected WIFI hotspot **orangepi**, and then you can see that the IP address of the mobile phone is **192.168.12.X**





6) If you want to specify a different network segment for the connected device, you can specify it through the -g parameter. For example, use the -g parameter to specify the network segment of the access point AP as 192.168.2.1.

| 1 | orangepi@orangepi:~\$ sudo create_ap -m nat wlan0 enP4p65s0 orangepi orangepi -g 192.168.2.1 |
|---|---|
| | orangepi@orangepi.~\$ sudo create_ap -in nat wiano en 4posso orangepi orangepi -g 192.106.2.1 |

At this time, after connecting to the hotspot through the mobile phone, click on the connected WIFI hotspot **orangepi**, and then you can see that the IP address of the mobile phone is **192.168.2.X**



7) Without specifying the --freq-band parameter, the hotspot created by default is in the 2.4G frequency band. If you want to create a hotspot in the 5G frequency band, you can specify it through the --freq-band 5 parameter. The specific command is as follows
 orangepi@orangepi:~\$ sudo create_ap -m nat wlan0 enP4p65s0 orangepi orangepi --freq-band 5

8) If you need to hide the SSID, you can specify the **--hidden** parameter. The specific command is as follows

orangepi@orangepi:~\$ sudo create_ap -m nat wlan0 enP4p65s0 orangepi orangepi --hidden

At this time, the mobile phone cannot search for WIFI hotspots. You need to manually specify the WIFI hotspot name and enter the password to connect to the WIFI hotspot.

| | 输入网络信息 | |
|-----|----------|-------|
| 取消 | 其他网络 | 加入 |
| 名称 | orangepi | |
| 安全性 | ŧ | WPA > |
| 密码 | | |

3. 6. 4. 2. create_ap method to create WIFI hotspot in bridge mode

1) Enter the following command to create a WIFI hotspot with the name **orangepi** and password **orangepi** in bridge mode

orangepi@orangepi:~\$ sudo create_ap -m bridge wlan0 enP4p65s0 orangepi orangepi

2) If the following information is output, it means that the WIFI hotspot is successfully created.

orangepi@orangepi:~\$ sudo create_ap -m bridge wlan0 enP4p65s0 orangepi orangepi [sudo] password for orangepi:

Config dir: /tmp/create ap.wlan0.conf.fg9U5Xgt

PID: 3141

Network Manager found, set ap0 as unmanaged device... DONE

Creating a virtual WiFi interface... ap0 created.

Sharing Internet using method: bridge

Create a bridge interface... br0 created.

hostapd command-line interface: hostapd cli -p

/tmp/create_ap.wlan0.conf.fg9U5Xgt/hostapd_ctrl

ap0: interface state UNINITIALIZED->ENABLED ap0: AP-ENABLED

3) At this time, take out your mobile phone and find the WIFI hotspot named **orangepi** created by the development board in the searched WIFI list. Then you can click **orangepi** to connect to the hotspot. The password is **orangepi** set above.



4) The display after successful connection is as shown below



5) In bridge mode, the wireless device connected to the hotspot of the development board also requests an IP address from the DHCP service of the main router (the router to which the development board is connected). For example, the IP of the development board here is **192.168.1.X**

| orangepi@orangepi:~\$ ifconfig enP4p65s0 |
|--|
| enP4p65s0: flags=4163 <up,broadcast,running,multicast> mtu 1500</up,broadcast,running,multicast> |
| inet 192.168.1.150 netmask 255.255.255.0 broadcast 192.168.1.255 |
| inet6 fe80::938f:8776:5783:afa2 prefixlen 64 scopeid 0x20 <link/> |
| ether 4a:a0:c8:25:42:82 txqueuelen 1000 (Ethernet) |
| RX packets 25370 bytes 2709590 (2.7 MB) |
| RX errors 0 dropped 50 overruns 0 frame 0 |
| TX packets 3798 bytes 1519493 (1.5 MB) |

TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0 device interrupt 83

The IP of the device connected to the WIFI hotspot is also assigned by the main router, so the mobile phone connected to the WIFI hotspot and the development board are in the same network segment. At this time, click on the connected WIFI hotspot **orangepi**, and then you can see the IP address of the mobile phone. Too **192.168.1.X**.



6) Without specifying the --freq-band parameter, the hotspot created by default is in the 2.4G frequency band. If you want to create a hotspot in the 5G frequency band, you can specify it through the--freq-band 5parameter. The specific command is as follows orangepi@orangepi:~\$ sudo create_ap -m bridge wlan0 enP4p65s0 orangepi orangepi --freq-band 5

7) If you need to hide the SSID, you can specify the **--hidden** parameter. The specific command is as follows

orangepi@orangepi:~\$ sudo create_ap -m bridge wlan0 enP4p65s0 orangepi orangepi --hidden

At this time, the mobile phone cannot search for WIFI hotspots. You need to manually specify the WIFI hotspot name and enter the password to connect to the WIFI hotspot.

| 🍏 range Pi User Manual | Co | opyright reserved | d by Shenzhe | en Xunlong Sof | tware Co., Ltd |
|------------------------|--------|-------------------|--------------|----------------|----------------|
| | | 输入网络信息 | | | |
| | 取消 | 其他网络 | 加入 | | |
| | | | | | |
| | 名称 ora | ngepi | | | |
| | 安全性 | | WPA > | | |
| | 密码 | | WFA / | | |
| | | | | | |

3.7. SSH Remote Login to Development Board

Linux systems enable ssh remote login by default and allow root users to log in to the system. Before ssh login, you first need to ensure that the Ethernet or wifi network is connected, and then use the ip addr command or obtain the IP address of the development board by checking the router.

3. 7. 1. SSH Remote Login to Development Board on Ubunt

1) Obtain the IP address of the development board

2) Then you can remotely log in to the Linux system through the ssh command

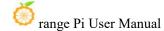
test@test:~\$ ssh root@192.168.1.xxx (Need to be replaced with the IP address of the development board)

root@192.168.1.xx's password: (Enter your password here, the default password is orangepi)

Note that when entering a password, the specific content of the entered password will not be displayed on the screen. Please do not think that there is any malfunction. Just press Enter after entering the password.

If you are prompted to refuse the connection, as long as you are using the image provided by Orange Pi, please do not doubt whether the orangepi password is incorrect, but look for other reasons.

3) After successfully logging into the system, the display is as shown below



| | / _ _ \ <u></u> / | | | |
|----------------------------------|-------------------------|------------|---------------|-----|
| Welcome to <mark>Orange</mark> P | Pi 1.0.0 Jammy with Lir | | ockchip-rk358 | |
| System load: 1% | Up time: | 8 min | Local users | : 3 |
| Memory usage: 4% c | of 15.60G IP: | 192.168 | .2.100 | |
| CPU temp: 55°C | Usage of | /: 3% of 2 | 32G | |

If ssh cannot log in to the Linux system normally, first check whether the IP address of the development board can be pinged. If there is no problem with pinging, you can log in to the Linux system through the serial port or HDMI display and enter the following command on the development board before trying again. Can it be connected:

root@orangepi:~# reset_ssh.sh

If it still doesn't work, please try restarting the system.

3. 7. 2. SSH remote login development board under Windows

1) First get the IP address of the development board

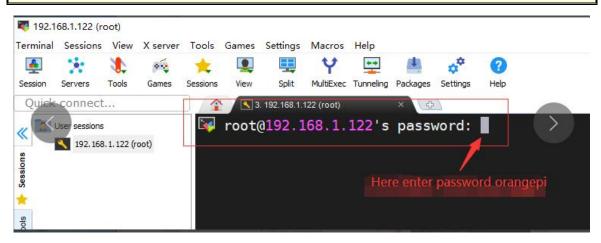
2) You can use MobaXterm to remotely log in to the development board under Windows. First create a new ssh session

- a. Open Session
- b. Then select SSH in Session Setting
- c. Then enter the IP address of the development board in **Remote host**
- d. Then enter the username root or orangepi of the linux system in Specify username
- e. Finally click **OK**

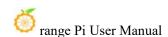
| - MobaXterm | ٥ | × |
|---|--------|----|
| Terminal Sessions View X server Tools Games Settings Macros Help | | |
| B → ★ ★ ★ ★ B B ↓ ↓ B → A → C → B → C → C → C → C → C → C → C → C | X | O |
| | | 10 |
| The server the server the set Nullice Turneling Reduce Setting: 2. Select SSH 1. Open Session 2. Select SSH Image: Setting Setting Setting Setting Terminal setting: 2. Select SSH Basic Set settings 3. Enter the IP address of the development board 4. Enter the username of the linux system, orangepi or root Secure Shell (SSH) setsion Secure Shell (SSH) setsion Secure Shell (SSH) setsion | server | |

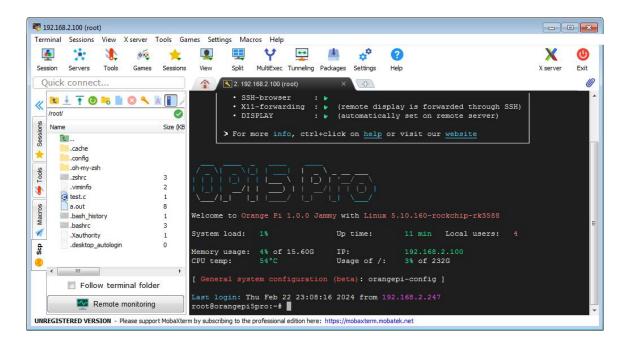
3) You will then be prompted to enter a password. The default passwords for both root and orangepi users are orangepi

Note that when entering a password, the specific content of the entered password will not be displayed on the screen. Please do not think that there is any malfunction. Just press Enter after entering the password.



4) After successfully logging into the system, the display is as shown below





3.8. How to use ADB

3. 8. 1. How to use network adb

1) After the system starts, please confirm that **adbd** has been started

| orangepi@orangep | oi:~\$ I | os -ax grep "adbd" | |
|------------------|-----------------|--------------------------|--|
| 808 ? | S1 | 0:00 /usr/bin/adbd | |
| 3707 ttyFIQ0 | S+ | 0:00 grepcolor=auto adbd | |

2) Then check the IP address of the development board and write it down

3) Then install adb tool on Ubuntu PC

| test@test:~\$ sudo apt-get update | |
|---|--|
| test@test:~\$ sudo apt-get install -y adb | |

4) Then use the following command to connect to the network adb

| test@test:~\$ adb connect 192.168.1.xx:5555 | #Please replace the IP address with |
|--|--|
| the IP address of the development board | |
| * daemon not running; starting now at tcp:5037 | |
| * daemon started successfully | |
| connected to 192.168.1.xx:5555 | |

test@test:~\$ adb devices List of devices attached 192.168.1.xx:5555 device

5) Then use the following command to log in to the Linux system of the development board

test@test:~\$ adb shell

root@orangepi5pro:/# <--- After seeing this prompt, it means you have successfully logged in to the development board

6) The command to use adb to upload files to the development board is as follows

test@test:~\$ adb push filename /root

filename: 1 file pushed. 3.7 MB/s (1075091 bytes in 0.277s)

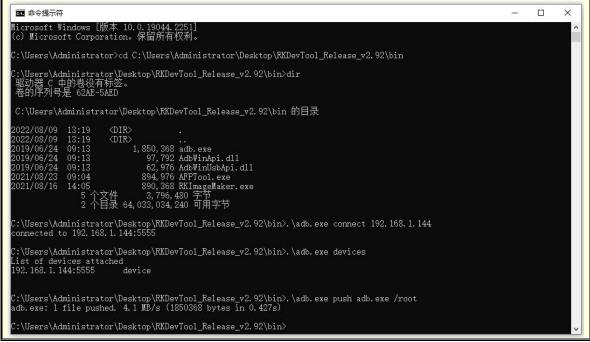
7) The command to restart the development board using adb is as follows

test@test:~\$ adb reboot

If you do not have the adb tool in your Windows system, you can use the adb program in the RKDevTool software (this software is useful in the method of burning the Android image to SPIFlash+NVMe SSD)

| 名称 | 修改日期 | 类型 | 大小 |
|----------------------|-----------------|--------|----------|
| 🖉 🔳 adb | 2019/6/24 9:13 | 应用程序 | 1,807 KB |
| AdbWinApi.dll | 2019/6/24 9:13 | 应用程序扩展 | 96 KB |
| 🕺 🗟 AdbWinUsbApi.dll | 2019/6/24 9:13 | 应用程序扩展 | 62 KB |
| AFPTool | 2021/8/23 9:04 | 应用程序 | 874 KB |
| RKImageMaker | 2021/8/16 14:05 | 应用程序 | 870 KB |

An example of using adb in Windows looks like this:



3. 8. 2. Use USB2.0 male-to-male data cable to connect ad

1) First prepare a good quality USB2.0 male-to-male data cable



2) Then connect the development board and Ubuntu PC through the USB2.0 male-to-male data cable. The location of the USB2.0 interface of the development board that supports the device function is as shown in the figure below:



3) Then run the following command to set the USB2.0 interface to device mode

orangepi@orangepi:~\$ sudo set_device.sh

If the **set_device.sh** script does not exist in the Linux system, please use the following command directly:

orangepi@orangepi:~\$ sudo bash -c "echo device > /sys/kernel/debug/usb/fc000000.usb/mode" orangepi@orangepi:~\$ sudo systemctl restart usbdevice

4) Then please confirm that adbd has been started

| orangepi@orangep | oi:~\$ | ps -ax grep "adbd" |
|------------------|--------|--------------------------|
| 808 ? | S1 | 0:00 /usr/bin/adbd |
| 3707 ttyFIQ0 | S+ | 0:00 grepcolor=auto adbd |

5) Then install the adb tool on Ubuntu PC

test@test:~\$ sudo apt-get update test@test:~\$ sudo apt-get install -y adb

6) Then use the following command to check whether the adb device is recognized

test@test:~\$ adb devices

List of devices attached

e0f9f71bc343c305 device

8) Then use the following command to log in to the Linux system of the development board

test@test:~\$ adb shell

root@orangepi5pro:/# <--- Upon seeing this prompt, it indicates that the development board has been successfully logged in

9) The command to use adb to upload files to the development board is as follows

test@test:~\$ adb push filename /root

filename: 1 file pushed. 3.7 MB/s (1075091 bytes in 0.277s)

If you do not have the adb tool in your Windows system, you can use the adb program in the RKDevTool software (this software is useful in the method of burning the Android image to SPIFlash+NVMe SSD)



| | 名称 | 修改日期 | 类型 | 大小 | |
|--|---|------------------------|--------------|----------|-----|
| | adb | 2019/6/24 9:13 | 应用程序 | 1.807 KB | |
| | AdbWinApi.dll | 2019/6/24 9:13 | 应用程序扩展 | 96 KB | |
| | AdbWinUsbApi.dll | 2019/6/24 9:13 | 应用程序扩展 | 62 KB | |
| | AFPTool | 2021/8/23 9:04 | 应用程序 | 874 KB | |
| | RKImageMaker | 2021/8/16 14:05 | 应用程序 | 870 KB | |
| 令提示符 soft Windows [版本 icrosoft Corporatic ərs\Administrator>< | 10.0.19044.2251] on。保留所有权利。 cd C:\Users\Administrator\Des | sktop\RKDevToo1_Re1eas | se_v2.92\bin | | - 0 |
| |)agkton \ PKDowTool Roloada #2 | 09\bin\din | | | |
| 器 C 中的卷没有标签 序列号是 62AE-5AED sers\Administrator [\] | \Desktop\RKDevToo1_Release_v? | | | | |
| 器 C 中的卷没有标签 予列号是 62AE-5AED sers\Administrator)8/09 13:19 <d)8/09 13:19 <d)8/24 09:13 06/24 09:13 06/24 09:13 06/24 09:13 08/23 09:04 08/16 14:05 5 个文件</d </d | So \Desktop\RKDevTool_Release_v! IR> . | 2.92\bin 的目录 1 | | | |
| 器 C 中的卷没有标签 予列号是 62AE-5AED sers\Administrator\)8/09 13:19 ①)8/09 13:19 ①)6/24 09:13)6/24 09:13)6/24 09:13)8/23 09:04)8/26 14:05 5 个文件 2 个目录 | Loesktop\RKDevTool_Release_v2 (R> 1, 850, 368 adb.exe 97, 792 AdbWinApi. dl1 62, 976 AdbWinUsbApi. dl1 894, 976 AfPTool.exe 890, 368 RKImagMaker.exu 3, 796, 480 字节 63, 988, 027, 392 可用字节 Desktop\RKDevTool_Release_v2. | 2.92\bin 的目录 1 9 | | | |

3.9. Method of uploading files to the development board Linux system

3. 9. 1. Method to upload files to the development board Linux system in Ubuntu PC

3. 9. 1. 1. How to upload files using scp command

1) Use the scp command to upload files to the Linux system of the development board in Ubuntu PC. The specific command is as follows

- a. **file_path:** Needs to be replaced with the path of the file to be uploaded
- b. **orangepi:** This is the user name of the development board's Linux system. It can also be replaced with something else, such as root
- c. **192.168.xx.xx:** This is the IP address of the development board. Please modify it according to the actual situation

d. /home/orangepi: The path in the development board Linux system can also be modified to other paths

test@test:~\$ scp_file_path_orangepi@192.168.xx.xx:/home/orangepi/

2) If you want to upload a folder, you need to add the -r parameter

test@test:~\$ scp -r dir_path orangepi@192.168.xx.xx:/home/orangepi/

3) There are more usages of scp, please use the following command to view the man manual

test@test:~\$ man scp

3. 9. 1. 2. How to upload files using filezilla

1) First install filezilla in Ubuntu PC

test@test:~\$ sudo apt install -y filezilla

2) Then use the following command to open filezilla

test@test:~\$ filezilla

3) The interface after opening filezilla is as shown below. At this time, the remote site on the right is empty

orange Pi User Manual

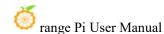
Copyright reserved by Shenzhen Xunlong Software Co., Ltd

| | | | FileZ | illa | - • > |
|-------------------------------------|-------------------|----------------------------|----------|--------------------------------|-------------|
| 文件(F) 编辑(E) 查考 | 看(V) 传输(T) 服务器(S) | 书签(B) 帮助(H) | | | |
| # • RT | |) 🗽 🔍 🏛 🔍 🦉 | 8 | | |
| E机(H): | 用户名(U): | 密码(W): | 端口 | (P): 快速连接(Q) ▼ | |
| ▶地站点: | | | | 远程站点: | ~ |
| <pre>> bin > boot cdrom</pre> | | | | | |
| 文件名 へ | 文件大小 文件类型 | 最近修改 | | | |
| lib32 | 目录 | 2022年11月06… | | | |
| lib64 | 目录 | 2022年08月09… | | | |
| libx32 | 目录 | 2022年11月06… | | 文件名 へ 文件大小 文件类型 最近修改 权限 | 图 所有者/组 |
| lost+found media | 目录 | 2022年11月05… | | | (I/IHH/H/H |
| mnt | 目录目录 | 2022年12月03… 2022年08月09… | | | |
| opt | 日求 目录 | 2022年08月09… 2022年11月06… | | 没有连接到任何服务器 | |
| proc | 日求 | 2022年11月08… 2022年12月03… | | | |
| root | 日录 | 2022年12月03… | | | |
| run | 日录 | 2022年12月03… | | | |
| 个文件和 26 个日录。 | | | _ | 未 连接。 | |
| | 方向 远程文件 | 大小 优先级 | | 大件接。 | |
| 服务器/本地文件 | | | | | |

4) The method of connecting the development board is as shown in the figure below

| FileZilla 3.Password: orangepi 5.Click Quick Connect | - • × |
|--|-------|
| 文件(F) 编辑(E) 查看(V) 传输(T) 服务器(S) 书签(B) 帮助(H) | |
| 22 · 2 · · · · · · · · · · · · · · · · | |
| 主机(H): 192.168.1.100 用户名(U): root 密码(W): 端口(P): 22 快速连接(Q) - | |
| 1.IP address 2.Username 4.Port number 22 | |

5) Then choose to save the password and click OK



| | 记住密码? | × |
|--------------------|-----------------------|----------|
| 您想让 FileZilla 记住密码 | 吗? | |
| 如果允许 FileZilla 记住密 | 码,重启 FileZilla 后重新连接无 | 需再次输入密码。 |
| ● 保存密码(E) | | |
| ○ 不要保存密码(O) | | |
| 〇保存主密码保护的密码 | 马(V) | |
| 主密码(M): | | |
| 再次输入密码(R): | | |
| 主密码一旦丢失无法恢 | v复!请牢记您的密码。 | |
| | 取消 | 确定(O) |
| | | |

6) Then select Always trust this host and click OK

| | 未定义的快捷键 | | |
|---|--|------|----|
| 1 | 该服务器的主机密匙是未知的。不能保证该服务器 认定的那台计算机。 详细资料 主机: 主机密匙算法: 指纹: | 就是您所 | |
| | 信任该主机并继续连接? | 取消 | 确定 |

7) After the connection is successful, you can see the directory structure of the development board's Linux file system on the right side of the filezilla software

| | | srtp://roo | t@192.168. | 31.11 - FileZill | d | | | | - | |
|--|---|--|------------|---|---------|--|---|--|---|--------------------------|
| 文件(F) 编辑(E) 查看(V | /) 传输(T) 服务器(S) | 书签(B) 帮助(H) | | | | | | | | |
| | ⊐ # Ø ∦% € |) 🗼 步 🔳 🔍 🥵 | o 🔥 | | | | | | | |
| 主机(H): tp://192.168.31 | I.11 用户名(U): root | 密码(W): •••••• | 端口(P |): | 快速连接(Q) | • | | | | |
| 式态: Connected to 192. 式态: 读取目录列表 式态: Listing directory / 式态: 列出"/root"的目录 | root | | | | | | | | | |
| 本地站点: / | | | ~ ž | 远程站点: /roo | t | | | | | |
| | | | | ~ 🔋 / > 📒 root | | | | | | |
| 文件名 へ lib32 | 文件大小 文件类型 目录 | 最近修改 2022年11月06… 2023年08月00… | | | | | | | | |
| 2件名 へ lib32 lib64 | 目录 目录 | 2022年11月06… 2022年08月09… | | | | | | | | |
| 2件名 へ lib32 lib64 libx32 | 目录 | 2022年11月06… | | | 文件大小 | 文件类型 | 最近修改 | 权限 | 所有者 | [/组 |
| C件名 へ lib32 lib64 libx32 lost+found | 目录 目录 目录 | 2022年11月06… 2022年08月09… 2022年11月06… | | > ■ root | 文件大小 | | | | | |
| 2件名 へ lib32 lib64 libs2 lost+found media | 目录 目录 目录 目录 | 2022年11月06… 2022年08月09… 2022年11月06… 2022年11月05… | | 〉 root | 文件大小 | 目录 | 2022年12月… | drwx | rootro | oot |
| 文件名 ▲ lib32 lib64 libx32 lost+found media mnt | 目录 目录 目录 目录 目录 | 2022年11月06… 2022年08月09… 2022年11月06… 2022年11月05… 2022年11月05… 2022年12月03… | | 〉 root // 个名 へ .cache .config | 文件大小 | 目录 目录 | 2022年12月… 2022年12月… | drwx drwxr-xr-x | root ro | oot |
| 文件名 へ lib32 lib64 libx32 lost-found media mnt opt | 目目目目目目目目目目目目目目目目目目目目目目目目目目目目目目目目目目目目目 | 2022年11月06… 2022年08月09… 2022年11月06… 2022年12月03… 2022年12月03… 2022年11月06… 2022年11月06… 2022年11月06… | | 〉 root .cache .config .oh-my-zsh | 文件大小 | 目录 目录 目录 | 2022年12月… 2022年12月… 2022年12月… | drwx drwxr-xr-x drwxr-xr-x | root ro root ro root ro | oot oot |
| 文件名 へ lib32 lib64 libx32 lost+found media mnt opt proc | 目目目目目目目目目目目目目目目目目目目目目目目目目目目目目目目目目目目目目 | 2022年11月06… 2022年08月09… 2022年11月06… 2022年11月05… 2022年12月03… 2022年08月09… 2022年11月06… | | 〉 root .cache .config .oh-my-zsh .pip | | 目录 目录 目录 目录 | 2022年12月… 2022年12月… 2022年12月… 2022年12月… | drwx drwxr-xr-x drwxr-xr-x drwxr-xr-x | root ro root ro root ro root ro | oot oot oot |
| 文件名 へ ibi32 ib64 ibix32 iost+found media mnt opt proc root run | 目目目目目目目目目目目目目目目目目目目目目目目目目目目目目目目目目目目目目目目 | 2022年11月06… 2022年08月09… 2022年11月06… 2022年12月03… 2022年12月03… 2022年12月03… 2022年12月03… 2022年12月03… 2022年12月03… 2022年12月03… | | > root · · · · · · · · · · · · · | 55 B | 目录 目录 目录 目录 文件 | 2022年12月… 2022年12月… 2022年12月… 2022年12月… 2022年12月… | drwx drwxr-xr-x drwxr-xr-x drwxr-xr-x | root ro root ro root ro root ro root ro | oot oot oot oot |
| | 目目目目目目目目目目目目目目目目目目目目目目目目目目目目目目目目目目目目目目目 | 2022年11月06… 2022年08月09… 2022年11月06… 2022年11月05… 2022年12月03… 2022年08月09… 2022年11月06… 2022年11月06… 2022年11月03… | 3 | > root .cache .config .oh-my-zsh .pip .Xauthority .bash history | 55 B | 目录 目录 目录 目录 日录 文件 文件 | 2022年12月… 2022年12月… 2022年12月… 2022年12月… | drwx drwxr-xr-x drwxr-xr-x drwxr-xr-x | root ro root ro root ro root ro | oot oot oot oot |

8) Then select the path to be uploaded to the development board on the right side of the

filezilla software, select the file to be uploaded in Ubuntu PC on the left side of the filezilla software, right-click the mouse, and then click the upload option to start uploading the file to the development board

| | | sftp://root@ | 192.1 | 68.31.11 - FileZilla | | | 9 | | × |
|---|---------------------|---------------|--------|---|-----------------------------|---------------------------------------|-------|-----|---|
| 文件(F) 编辑(E) 查看(V) 传输 | i(T) 服务器(S) 书签(B) 君 | 帮助(H) | | | | | | | |
| # - • • • | 0 🕸 🕄 📜 |) T Q 🧕 | * | | | | | | |
| 主机(H): tp://192.168.31.11 月 | 自户名(U): root 密 | 码(w): | 端口 |](P): 快; | 速连接(Q) ▼ | | | | |
| 初出"/home"的目录成功 (态: 读取"/home/orangepi"的) (态: Listing directory /home/o (态: 列出"/home/orangepi"的) | rangepi | | | | | | | | |
| 本地站点: /home/test/Download | ds/test/ | | ~ | 远程站点: /home/d | orangepi | | | | , |
| test Music Pictures Public Templates Videos VirtualBox VMs | | | | 2 boot 2 dev 2 etc bome orangep cache conna | mon | | | | |
| ● bin 文件名 へ 文件大 | 小 文件类型 最近修 | 8.247 | - | ************************************* | - 文件大小 文件类型 | 最近修改 权限 | 所有者 | 5/组 | - |
| | | | | .bashrc | 3.6 KB 文件 | 2022年12月··· -rw-rr | orang | | |
| nomachine_8.2.3_3 | 上传(U) | 12月03… | | .profile | 807 B 文件 3.5 KB 文件 | 2022年12月··· -rw-rr 2022年12月··· -rw | orang | | |
| L | 添加文件到队列(A) | | | .xscreensaver | 3.5 KB 文件 20 B 文件 | 2022年12月···· -rw-rw-r | orang | - | |
| | 打开(0) | | | .xsession-errors | 7.6 KB 文件 | 2022年12月··· -rw | orang | | |
| | | | | .xsession-errors | | 2022年12月··· -rw | orang | | |
| 先择了1个文件。大小总共:0B | 编辑(<u>E</u>) | | | .zshrc 13 个文件 和 16 个日 | 4.0 KB 文件 录。大小总计: 6.2 GB | 2022年12月rw-rw-r- | orang | ері | |
| 服务器/本地文件 方[| 创建目录(<u>C</u>) | 大小 优先级 | 状态 | | | | | - | - |
| | 创建目录并进入(Y) | 7 C 3 007 04A | P (IDI | | | | | | |
| | 刷新(E) | | | | | | | | |
| | 删除(<u>D</u>) | | | | | | | | |
| | 重命名(<u>R</u>) | | | | | | | | |
| |) | | | | | | | | |
| 列队的文件 「传输失败」成功的(| 专输 | | | | | | | | |
| | | | | | | 🔒 🔍 队列: 空 | | - | |

9) After the upload is completed, you can go to the corresponding path in the development board Linux system to view the uploaded file

10) The method of uploading a folder is the same as the method of uploading a file, so I won't go into details here

3. 9. 2. How to upload files from Windows PC to development board in Linux system

3. 9. 2. 1. How to upload files using filezilla

1) First download the installation file of the Windows version of the filezilla software. The download link is as follows

https://filezilla-project.org/download.php?type=client

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

-

Select

Yes

Select

EFileZilla

| ion . | | FZ Fil | eZilla [®] Pro lest FTP Solution | | GET IN N |
|---|-------------------|----------------------------------|--|---------------------------------|----------|
| Download FileZilla Client for Window | rs (64bit x86) | | | | |
| The latest stable version of FileZilla Client is 3.62.2 | | | | | |
| Please select the file appropriate for your platform below. | | | | | |
| 😔 Windows (64bit x86) 🕰 | | | | | |
| Download FileZilla Client 点击这! | | | | | |
| the 64bit versions of Windows 8.1, 10 and 11 are supported. | | | | | |
| More download options | | | | | |
| Other platforms: 🥰 🖁 🛆 🙆 | | | | | |
| Not what you are looking for? | | | | | |
| Show additional download options cts | | | | | |
| Please selec | t your ed | ition of Fil | eZilla (| Client | 1 |
| | FileZilla | FileZilla with manual | FileZilla F | Pro FileZilla I + CLI | Pro |
| Standard FTP | FileZilla Yes | | FileZilla F | | Pro |
| Standard FTP FTP over TLS | | with manual | | ro + CLI | Pro |
| | Yes | with manual Yes | Yes | Yes | Pro |
| FTP over TLS SFTP | Yes Yes | with manual Yes Yes Yes | Yes Yes Yes | Yes Yes Yes Yes | Pro |
| FTP over TLS SFTP Comprehensive PDF manual | Yes Yes Yes | with manual Yes Yes | Yes Yes Yes Yes | Yes Yes Yes Yes Yes | Pro |
| FTP over TLS SFTP | Yes Yes Yes | with manual Yes Yes Yes | Yes Yes Yes | Yro + CLI Yes Yes Yes | Pro |

2) The downloaded installation package is as shown below, then double-click to install it directly

Download

Select

FileZilla Server 1.5.1 win64-setup.exe

Dropbox

Microsoft OneDrive

Google Drive

Google Cloud Storage

Microsoft Azure Blob + File Storage

WebDAV

OpenStack Swift

Box

Site Manager synchronization

Command-line interface

Batch transfers

然后选择这里下载

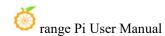
During the installation process, please select Decline on the following installation interface, and then select Next>



3) The interface after opening filezilla is as shown below. At this time, the remote site on the right is empty

| Ω(H): | | | | | | | | |
|--------------------|---|---|--------|---------|-----------|-------|----|-------|
| | 用户名(U): | 密码(W): | 鎊口(P): | 快速连接(Q) | * | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| 鼓点点: C:\Users\test | t | | ~ | 远程站点: | | | | |
| 重 卓面 | | | ^ | | | | | |
| 一體 文档 | | | | | | | | |
| 白 🛄 此电脑 | | | | | | | | |
| 0 🏪 C: | | | | | | | | |
| | | | | | | | | |
| | and the second se | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | ~ | | | | | |
| * * | 文件大小 文件类型 | 最近修改 | ^ | 文件名 | 文件大小 文件类型 | 最近修改 | 权限 | 所有者/组 |
| | 文件夹 | 2022/12/3 20:06: | | | | | | |
| | | 2022/11/6 0:23:28 | | 1 | | | | |
| | | | | | | | | |
| | 文件夹 | | - 11 | | 没有连接到 | 任何服务器 | | |
| | 文件夹 | 2022/11/19 1:30: | - 1 | | 没有连接到 | 任何服务器 | | |
| | 文件 实 文件夹 | 2022/11/19 1:30: 2022/12/3 15:40: | 1 | | 没有连接到 | 任何服务器 | | |
| | 文件夹 文件夹 文件夹 | 2022/11/19 1:30: 2022/12/3 15:40: 2022/12/3 19:41: | | | 没有连接到 | 任何服务器 | | |
| | 文件 实 文件夹 | 2022/11/19 1:30: 2022/12/3 15:40: | | | 没有连接到 | 任何服务器 | | |
| | 文件夹 文件夹 文件夹 文件夹 | 2022/11/19 1:30: 2022/12/3 15:40: 2022/12/3 19:41: 2022/12/3 20:05: | | | 没有注接到 | 任何服务器 | | |
| | 文件夹 文件夹 文件夹 文件夹 文件夹 文件夹 | 2022/11/19 1:30: 2022/12/3 15:40: 2022/12/3 19:41: 2022/12/3 20:05: 2022/11/6 0:23:28 | | | 没有注册到 | 任何服务體 | | |
| | 文件夹 文件夹 文件夹 文件夹 文件夹 文件夹 文件夹 | 2022/11/19 1:30 2022/12/3 15:40 2022/12/3 19:41 2022/12/3 20:05 2022/11/6 0:23:28 2022/11/6 0:23:28 | | | 没有连接到 | 任何服务體 | | |
| | 文件夹 文件夹 文件共 文件共 文件夹 文件夹 文件夹 | 2022/11/19 1:30 2022/12/3 15:40 2022/12/3 19:41 2022/12/3 20:05 2022/11/6 0:23:28 2022/11/6 0:23:28 2022/11/3 20:06 | | | 没有连接到 | 任何服务器 | | |
| | 交件夹 交件夹 文件夹 文件夹 文件夹 文件夹 文件夹 文件夹 | 2022/11/19 1:30 2022/12/3 15:40 2022/12/3 19:41 2022/12/3 20:05 2022/11/6 0:23:28 2022/11/6 0:23:28 2022/12/3 20:06 2022/11/6 0:23:28 | | | 没有法律到 | 任何服务器 | | |
| | 文件共 文件共 文件共 文件共 文件共 文件共 文件共 文件共 文件共 | 2022/11/19 1:30 2022/12/3 15:40 2022/12/3 19:41 2022/12/3 19:41 2022/11/6 0:23:28 2022/11/6 0:23:28 2022/11/6 0:23:28 2022/11/6 0:23:28 2022/11/6 0:23:28 | | | 设有法规列 | 任何服务器 | | |
| È. | 交件夹 文体夹 文体夹 文体夹 文件夹 文件夹 文件夹 文体夹 文件夹 文件夹 文件夹 | 2022/11/19 1:30 2022/12/3 1540 2022/12/3 1541 2022/12/3 20.05: 2022/11/6 06328 2022/11/6 06328 2022/12/3 20.06: 2022/11/6 06328 2022/12/3 1941 2019/12/1 17:14 | | | 设有法规列 | 任何服务器 | | |
| È. | 交体夹 交体夹 文体夹 文体夹 文体夹 文体夹 文体夹 文体夹 文体夹 | 2022/11/19 1:30 2022/12/3 1540 2022/12/3 1541 2022/12/3 20.05: 2022/11/6 06328 2022/11/6 06328 2022/12/3 20.06: 2022/11/6 06328 2022/12/3 1941 2019/12/1 17:14 | ~ | 未连接。 | 设有法规研 | 任何服务器 | | |
| È. | 交件夹 文体夹 文体夹 文体夹 文件夹 文件夹 文件夹 文体夹 文件夹 文件夹 文件夹 | 2022/11/19 1:30 2022/12/3 1540 2022/12/3 1541 2022/12/3 20.05: 2022/11/6 06328 2022/11/6 06328 2022/12/3 20.06: 2022/11/6 06328 2022/12/3 1941 2019/12/1 17:14 | ~ 梁 状态 | 1 | 设有法规列 | 任何服务器 | | |

4) The method of connecting the development board is as shown in the figure below:



| | FileZilla 3.Password: orangepi | 5.Click Quick Connect | - D × |
|-----------------------------------|-----------------------------------|-----------------------|-------|
| 文件(F) 编辑(E) 查看(V) 传输(T) 服务器(S) = | 5签(B) 帮助(H) | | |
| # • • • • • • • • • | 🕵 🗐 🎟 🖉 🤗 🧄 | | |
| 主机(H): 192.168.1.100 用户名(U): root | 密码(W): 端口(P): 22 | 快速连接(Q) ▼ | |
| | | | |
| 1.IP address | 4 Port | number 22 | |
| 2.Userna | me 4.Port | humber 22 | |

5) Then choose to save the password and click OK

| 记住密码? | | × |
|-----------------------|--------------------|----------|
| 您想让 FileZilla 记住密码吗? | | |
| 如果允许 FileZilla 记住密码,重 | 启 FileZilla 后重新连接无 | 需再次输入密码。 |
| ● 保存密码(E) | | |
| ○不要保存密码(O) | | |
| ○保存主密码保护的密码(V) | | |
| 主密码(M): | | |
| 再次输入密码(R): | | |
| 主密码一旦丢失无法恢复! 🕌 | 事牢记您的密码。 | |
| | 确定(O) | 取消 |
| | | |

6) Then select Always trust this host and click OK

| 0 | 该服务器的: 机。 | E机密匙是未知的。不能保证该服 | 务器就是您所认定的那 | 台计算 |
|---|--------------|----------------------|--------------------|--------------|
| | 详细资料 | | | |
| | 主机: | 192.168.31.11:22 | | |
| | 主机密匙算 | 戰法: ssh-ed25519 255 | | |
| | 指纹: | SHA256:cHNLFRmncAMrQ | oietFlAyEfdRQcewhW | pgodyPsILw3w |
| | 信任该主机 | +继续连接? | | |
| | 12.18是信任 | 该主机,并将该密钥加入缓存(A) | | |
| | | | - | |

7) After the connection is successful, you can see the directory structure of the development board's Linux file system on the right side of the filezilla software

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| (whe free/1922103.1) 用户名(U) [root | | 🗮 🖸 比 🛛 📜 🏋 | Q 🤗 👪 | | | | | | | | |
|--|---------------------|--|--|----------|--|---|---|--|---|---|------|
| a: 就電見到源 注: Using directory /root 3: 列ビ/root*Di目最成功 DBASE 0 | 几(H): sftp://192.16 | 8.31. 用户名(U): root | 密码(W): •••••• 講[| □(P): | 快速连接(Q) ▼ | | | | | | |
| Listing directory /root July /roo July /roo July /root Ju | 5: Connected to 1 | 92.168.31.11 | | | | | | | | | |
| a 列出/root*前目最成功 | : 读取目录列表 | | | | | | | | | | |
| BBAR CA 運程紙 /rot ・・・・・・・・・・・・・・・・・・・・・・・・・・・・・ | E Listing directory | /root | | | | | | | | | |
| * C ・ ・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・ | 。列出"/root"的目前 | 录成功 | | | | | | | | | |
| Part Proof Control Contro Control Control Control Control Control Control | 站点: C:\ | | | ~ | 远程站点: /root | | | | | | |
| | C: | - | | ^ | é- <mark>_</mark> , root | | | | | | |
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| 文件共 2022/12/3 19:57:) bashrc 3.523 BASHRC 2022/12/3 4: -rw-r-r root root 文件共 2022/11/26 19:2) desktop_autologin 0 DESKTOP 2022/12/3 4: -rw-rw-r root root 文件共 2022/12/3 10: '/' '/' '/' '/' -rw-rw-r root root 文件共 2022/12/3 10: '/' '/' '/' '/' '/' '/' 文件共 2022/12/3 10: '/' '/' '/' '/' '/' '/' '/' '/' 文件共 2022/12/3 10: '/' '/' '/' '/' '/' '/' '/' '/' '/' 文件共 2022/12/3 10: '/' '/' '/' '/' '/' '/' '/' '/' '/' '/' 文件共 2022/12/10 10:3 '/ '/' '/' '/' '/' '/' '/' '/' '/' '/' '/' '/' '/' '/' '/' '/' 文件共 2022/11/10 10:3 '/' '/' '/' '/' '/' '/' '/' '/' '/' '/' 文件 2022/11/10 10:3 <td></td> <td>文件夹</td> <td>2022/12/3 18:57: 2022/11/11 1:48:</td> <td></td> <td>.config</td> <td></td> <td>文件夹</td> <td>2022/12/3 4:</td> <td>drwxr-xr-x</td> <td>root root</td> <td></td> | | 文件夹 | 2022/12/3 18:57: 2022/11/11 1:48: | | .config | | 文件夹 | 2022/12/3 4: | drwxr-xr-x | root root | |
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| 文件共 2022/12/3 20:06: 小mininfo 1.375 VIMINFO 2022/12/3 17 -rw root root 文件共 2019/12/7 17.14 小wget-htis 169 WGET-HS 2022/12/3 16 -rwr root root 文件共 2022/12/3 16.55 199 WGET-HS 2022/12/3 16 -rwr root root 文件共 2022/11/10 10:3 1.375 Xauthoriny 55 XAUTHOR 2022/12/3 18 -rwr root root 文件共 2022/11/10 16:20 * 7 25HRC 文件 2022/12/3 5 -rwr root root 文件和 11 个目录、大小总计: 1,744.838.656 字市 * 7 7 7 7 9.994 字市 | | 文件夹 文件夹 文件夹 | 2022/12/3 18:57: 2022/11/11 1:48: 2022/12/3 18:55: 2022/12/3 0:17:04 | | .config .oh-my-zsh .pip | 793 | 文件夹 文件夹 文件夹 | 2022/12/3 4: 2022/12/3 5: 2022/12/3 16 | drwxr-xr-x drwxr-xr-x drwxr-xr-x | root root root root root root | |
| 文件类 2019/12/7 17:14 ・weet-hsts 169 WGET-HS 2022/12/3 16 row-rr root root ズ件类 2022/12/3 18.55 文件类 2022/11/10 10.3 文件类 2022/11/10 10.3 文件类 2022/11/10 10.3 文件类 2022/11/10 16.20 v 文件共 2022/11/10 10.3 文件类 2022/11/10 10.3 マー・マー・ root root アパー・アー・ root root 次件类 2022/11/10 10.3 文件类 2022/11/10 10.3 アパー・ root root アパー・ root root アパー・ root root アパー・ アの・ アパー・ root root アパー・ アパー・ root root アパー・ アパー・ root root アパー・ アパー・ アパー・ アパー・ アパー・ アパー・ アパー・ アパー・ アパー・ アパー・ アパー・ アパー・ アパー・ アパー・ アパー・ アパー・ アパー・ | | 文件夹 文件夹 文件夹 文件夹 文件夹 文件夹 | 2022/12/3 18:57: 2022/11/11 1:48: 2022/12/3 18:55: 2022/12/3 0:17:04 2022/11/13 0:14: | | .config .oh-my-zsh .pip .bash_history .bashrc | 3,523 | 文件夹 文件夹 文件夹 BASH_HIS BASHRC | 2022/12/3 4: 2022/12/3 5: 2022/12/3 16 2022/12/3 18 2022/12/3 4: | drwxr-xr-x drwxr-xr-x drwxr-xr-x -rw-rr | root root root root root root root root | |
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| 文件夹 2022/11/6 16:20: 文件和 11 个目录、大小总计: 1,744,838,656 字节 7 个文件和 4 个目录。大小总计: 9,894 字节 | | 文件夹 文件夹 文件夹 文件夹 文件夹 文件夹 文件夹 文件夹 | 2022/12/3 18:57: 2022/11/11 148: 2022/11/1 148: 2022/12/3 18:55: 2022/12/3 0:17:04 2022/11/3 0:14: 2022/11/26 19:2 2022/12/3 20:06: | | .config .oh-my-zsh .pip .bash_history .bashrc .desktop_autologin .viminfo .wget-hsts | 3,523 0 1,375 | 文件夹 文件夹 文件夹 BASH_HIS BASHRC DESKTOP VIMINFO | 2022/12/3 4: 2022/12/3 5: 2022/12/3 16 2022/12/3 18 2022/12/3 4: 2022/12/3 4: 2022/12/3 17 | drwxr-xr-x drwxr-xr-x drwxr-xr-x -rw-r -rw-r -rw-r | root root root root root root root root root root root root root root | |
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8) Then select the path to be uploaded to the development board on the right side of the filezilla software, select the file to be uploaded in the Windows PC on the left side of the filezilla software, right-click the mouse, and then click the upload option to start uploading the file to the development board

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| 杰: Connected to 192,168.5 | | | | | | | | | | |
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| | 31.11 | | | | | | | | | |
| 态: 读取目录列表 | | | | | | | | | | |
| 态: Listing directory /root | | | | | | | | | | |
| 态:列出"/root"的目录成功 | | | | | | | | | | |
| ¤地站点: C:\ | | | | ~ 远程站点: /root | | | | | | |
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| | | | | | 文件大小 | ☆仕巻型 | 最近核改 | *▽6日 | 所有者/汨 | |
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| | 文件大小 文件类型 | 最近修改 | | × | 文件大小 | | | | 1 | |
| 2件名 | 文件大小 文件类型 文件夹 | | | Cache | 文件大小 | 文件夹 | 2022/12/3 16 | drwx | root root | |
| 文件名 ★ 上传(U) | | 最近修改 2022/11/11 1:48 2022/12/3 18:55 | | · | 文件大小 | 文件夹 文件夹 | 2022/12/3 16 2022/12/3 4: | drwx drwxr-xr-x | root root root root | |
| 文件名 ▲ 上传(U) ▲ 添加文件到队列(A) | 文件夹 | 2022/11/11 1:48: | | Config | 文件大小 | 文件夹 文件夹 文件夹 | 2022/12/3 16 2022/12/3 4: 2022/12/3 5: | drwx drwxr-xr-x drwxr-xr-x | root root root root root root | |
| 文件名 ★ 上传(U) | <u>文件</u> 夹 文件夹 | 2022/11/11 1:48: 2022/12/3 18:55: | | ,cache ,config ,oh-my-zsh ,pip | | 文件夹 文件夹 文件夹 文件夹 | 2022/12/3 16 2022/12/3 4: 2022/12/3 5: 2022/12/3 16 | drwx drwxr-xr-x drwxr-xr-x drwxr-xr-x | root root root root root root root root | |
| 文件名 ▲ 上传(U) ▲ 添加文件到队列(A) | 文件夹 文件夹 文件夹 文件夹 | 2022/11/11 1:48: 2022/12/3 18:55: 2022/12/3 0:17:04 | | .cache .config .oh-my-zsh .pip .bash_history | 793 | 文件夹 文件夹 文件夹 文件夹 BASH_HIS | 2022/12/3 16 2022/12/3 4: 2022/12/3 5: 2022/12/3 16 2022/12/3 18 | drwx drwxr-xr-x drwxr-xr-x drwxr-xr-x | root root root root root root root root root root | |
| ☆(件名 | 文件夹 文件夹 文件夹 文件夹 文件夹 文件夹 | 2022/11/11 1:48: 2022/12/3 18:55: 2022/12/3 0:17:04 2022/11/13 0:14: | | .cache .config .oh-my-zsh .pip .bash_history .bashrc | 793 3,523 | 文件夹 文件夹 文件夹 BASH_HIS BASHRC | 2022/12/3 16 2022/12/3 4: 2022/12/3 5: 2022/12/3 16 2022/12/3 18 2022/12/3 4: | drwx drwxr-xr-x drwxr-xr-x drwxr-xr-x -rw | root root root root root root root root root root root root | |
| ☆(#名 上传(U) ※ 添加文件到队列(A) 进入目录(N) 打开(O) 编唱(E) | 文件夹 | 2022/11/11 1:48 2022/12/3 18:55 2022/12/3 0:17:04 2022/11/13 0:14: 2022/12/3 19:57 2022/11/26 19:2 | | | 793 3,523 0 | 文件夹 文件夹 文件夹 BASH_HIS BASHRC DESKTOP | 2022/12/3 16 2022/12/3 4: 2022/12/3 5: 2022/12/3 16 2022/12/3 18 2022/12/3 4: 2022/12/3 4: | drwx drwxr-xr-x drwxr-xr-x drwxr-xr-x -rw-rr -rw-rr -rw-rr | root root root root root root root root root root root root root root | |
| 2(H名 文(H名 文(H名 本徳(U) 通知文件到队列(A) 進入目录(N) 打开(O) 蝙蝠(E) 创建目录(C) | 文件夹 | 2022/11/11 1348 2022/12/3 18:55 2022/12/3 0:17:04 2022/12/3 19:57 2022/12/3 19:57 2022/11/6 19:2 2022/12/3 20:06 | | | 793 3,523 0 1,375 | 文件夹 文件夹 文件夹 BASH_HIS BASHRC DESKTOP VIMINFO | 2022/12/3 16 2022/12/3 4 2022/12/3 5 2022/12/3 16 2022/12/3 18 2022/12/3 4 2022/12/3 4 2022/12/3 17 | drwx drwxr-xr-x drwxr-xr-x drwxr-xr-x -rwr -rw-r -rw-rw-r -rw | root root root root root root root root root root root root root root root root | |
| (A) (A) (A) (A) (A) (A) (A) (A) | 文件共 | 2022/11/11 148: 2022/12/3 18:55 2022/12/3 0:17:04 2022/11/3 0:14: 2022/12/3 19:57: 2022/12/3 19:57: 2022/12/3 20:06 2019/12/7 17:14: | | | 793 3,523 0 1,375 169 | 文件夹 文件夹 文件夹 BASH_HIS BASHRC DESKTOP VIMINFO WGET-HS | 2022/12/3 16 2022/12/3 4 2022/12/3 5 2022/12/3 16 2022/12/3 18 2022/12/3 4 2022/12/3 4 2022/12/3 16 | drwx drwxr-xr-x drwxr-xr-x drwxr-xr-x -rw-r-x- -rw-r -rw-rw-r -rw -rw | root root root root root root root root root root root root root root root root root root | |
| 2(件名 文件名 文件名 本待(U) 並入目录(N) 打开(O) 编辑(E) 创建目录(C) | 文件类 文件类 | 2022/11/11 1:48 2022/12/3 18:55 2022/12/3 0:17:04 2022/11/3 0:14 2022/12/3 19:57 2022/12/3 20:66 2019/12/7 17:14 2022/12/3 18:55 | | | 793 3,523 0 1,375 169 55 | 文件夹 文件夹 文件夹 BASH_HIS BASHRC DESKTOP VIMINFO WGET-HS XAUTHOR | 2022/12/3 16 2022/12/3 4 2022/12/3 5 2022/12/3 16 2022/12/3 18 2022/12/3 4 2022/12/3 4 2022/12/3 17 2022/12/3 16 2022/12/3 18 | drwx drwxr-xr-x drwxr-xr-x -rw-r-x -rw-rw-r -rw-rw-r -rw -rw | root | |
| | 文/4共 | 2022/11/11 1-48 2022/12/3 18:55 2022/12/3 01794 2022/11/3 0:174 2022/11/3 0:14 2022/11/3 19:57 2022/12/3 19:57 2019/12/1 7:1714 2022/12/3 18:55 2022/11/10 10:3 | | | 793 3,523 0 1,375 169 55 | 文件夹 文件夹 文件夹 BASH_HIS BASHRC DESKTOP VIMINFO WGET-HS XAUTHOR | 2022/12/3 16 2022/12/3 4 2022/12/3 5 2022/12/3 16 2022/12/3 18 2022/12/3 4 2022/12/3 4 2022/12/3 16 | drwx drwxr-xr-x drwxr-xr-x -rw-r-x -rw-rw-r -rw-rw-r -rw -rw | root root root root root root root root root root root root root root root root root root | |
| 2(件名 | 文件类 文件类 | 2022/11/11 1:48 2022/12/3 18:55 2022/12/3 0:17:04 2022/11/3 0:14 2022/12/3 19:57 2022/12/3 20:66 2019/12/7 17:14 2022/12/3 18:55 | | v config config .oh-my-zsh .pip bash_history .bashrc desktop_autologin .wimifo .wimof .xauthority .zshrc | 793 3,523 0 1,375 169 55 3,979 | 文件夹 文件夹 文件夹 BASH_HIS BASHRC DESKTOP VIMINFO WGET-HS XAUTHOR ZSHRC 文件 | 2022/12/3 16 2022/12/3 4 2022/12/3 5 2022/12/3 16 2022/12/3 18 2022/12/3 4 2022/12/3 4 2022/12/3 17 2022/12/3 16 2022/12/3 18 | drwx drwxr-xr-x drwxr-xr-x -rw-r-x -rw-rw-r -rw-rw-r -rw -rw | root | |
| 2(片名 ▼ 上传(1) ● 上传(1) ● 近日(1) 一 上传(1) ● 近日(1) ● 近日 | 文/4共 | 2022/11/11 1-48 2022/12/3 18:55 2022/12/3 01794 2022/11/3 0:174 2022/11/3 0:14 2022/11/3 19:57 2022/12/3 19:57 2019/12/1 7:1714 2022/12/3 18:55 2022/11/10 10:3 | | | 793 3,523 0 1,375 169 55 3,979 | 文件夹 文件夹 文件夹 BASH_HIS BASHRC DESKTOP VIMINFO WGET-HS XAUTHOR ZSHRC 文件 | 2022/12/3 16 2022/12/3 4 2022/12/3 5 2022/12/3 16 2022/12/3 18 2022/12/3 4 2022/12/3 4 2022/12/3 17 2022/12/3 16 2022/12/3 18 | drwx drwxr-xr-x drwxr-xr-x -rw-r-x -rw-rw-r -rw-rw-r -rw -rw | root | |
| 2(件名 | 文/4共 | 2022/11/11 1:48 2022/12/3 18:55 2022/12/3 18:55 2022/12/3 19:57 2022/11/3 0:17:04 2022/11/3 19:27 2022/12/3 19:57 2022/12/3 18:55 2022/11/10 10:3 2022/11/10 10:3 | | v config config .oh-my-zsh .pip bash_history .bashrc desktop_autologin .wimifo .wimof .xauthority .zshrc | 793 3,523 0 1,375 169 55 3,979 | 文件夹 文件夹 文件夹 BASH_HIS BASHRC DESKTOP VIMINFO WGET-HS XAUTHOR ZSHRC 文件 | 2022/12/3 16 2022/12/3 4 2022/12/3 5 2022/12/3 16 2022/12/3 18 2022/12/3 4 2022/12/3 4 2022/12/3 17 2022/12/3 16 2022/12/3 18 | drwx drwxr-xr-x drwxr-xr-x -rw-r-x -rw-rw-r -rw-rw-r -rw -rw | root | |

9) After the upload is completed, you can go to the corresponding path in the development board Linux system to view the uploaded file

10) The method of uploading a folder is the same as the method of uploading a file, so I won't go into details here

3.10. HDMI Test

3. 10. 1. HDMI display test

2) Use HDMI to HDMI cable to connect Orange Pi development board and HDMI display



3) After starting the Linux system, if there is image output on the HDMI display, it means that the HDMI interface is working normally

Note that although many laptops have HDMI interfaces, the HDMI interface of the laptop generally only has the output function and does not have the HDMI in function, which means that the HDMI output of other devices cannot be displayed on the laptop screen.

When you want to connect the HDMI of the development board to the HDMI interface of your laptop, please first confirm that your laptop supports the HDMI in function.

When HDMI does not display, please first check whether the HDMI cable is plugged in tightly. After confirming that the wiring is OK, you can try a different screen to see if there is a display.

3. 10. 2. HDMI to VGA display test

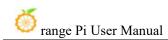
- 1) First you need to prepare the following accessories
 - a. HDMI to VGA converter



b. A VGA Cable



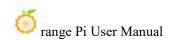
- c. A monitor or TV that supports VGA interface
- 2) HDMI to VGA display test is as follows

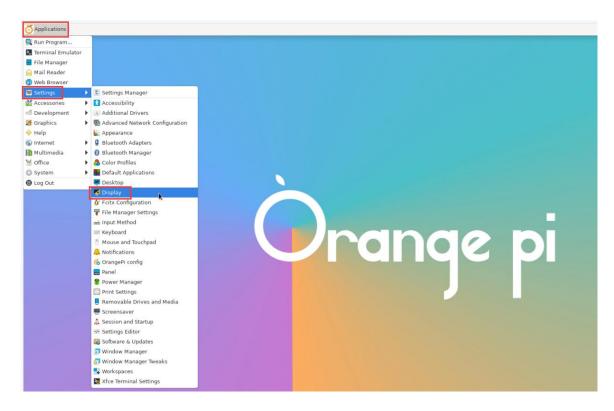




When using HDMI to VGA display, the development board and the Linux system of the development board do not need to make any settings. You only need the HDMI interface of the development board to display normally. So if there is a problem with the test, please check whether there is a problem with the HDMI to VGA converter, VGA cable and monitor.

- 3. 10. 3. HDMI resolution setting method
- 1) First open **Display** in **Settings**

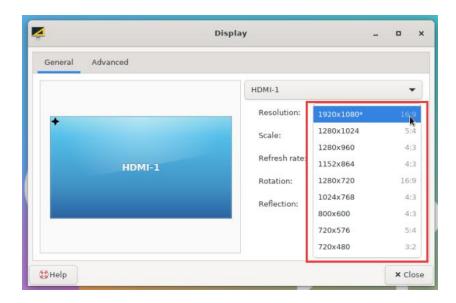




2) Then you can see the current resolution of the system

| | HDMI-1 | | |
|----------|---------------|------------|---------|
| * | Resolution: | 1920×1080* | 16:9 🔻 |
| | Scale: | lx | |
| HDMI-1 | Refresh rate: | 60.0 Hz | |
| TDM-1 | Rotation: | None | |
| | Reflection: | None | |
| | | | ✓ Apply |

3) Click the drop-down box of Resolution to see all the resolutions currently supported by the monitor



4) Then select the resolution you want to set and click Apply

| 4 | Display | | _ = × |
|------------------|---------------|-----------|---------|
| General Advanced | | | |
| | HDMI-1 | | • |
| | Resolution: | 1280x1024 | 5:4 🕶 |
| | Scale: | lx | • |
| HDMI-1 | Refresh rate: | 60.0 Hz | • |
| | Rotation: | None | • |
| | Reflection: | None | • |
| | | | ✓ Apply |
| t Help | | | × Close |
| <u>ы</u> негр | | | × CIO |

5) Wait until the new resolution is set and then select Keep the configuration

| 👌 Applications 🛛 💆 Display | Confirmation | | -S Fri | 2 Dec, 01:13 | ∆ r ∰)orangepi |
|----------------------------|-------------------|---|---------------|--------------|-----------------------|
| 17 MB | | | | | |
| | | | | | |
| | | Display | | | × |
| | | General Advanced | | | |
| | | - | HDMI-1 | | Ŧ |
| | | | Resolution: | 1280×1024 | 5:4 💌 |
| | | | Scale: | lx | Ŧ |
| | | Confirmation + - | Refresh rate: | 60.0 Hz | Ŧ |
| | Would you like to | keep this configuration? | lotation: | None | * |
| | | on will be restored in 1 seconds if you do not reply to this question | Leflection: | None | w |
| | Кеер | this configuration Restore the previous configuration | | | ✓ Apply |
| | | ₩Help | | | × Close |

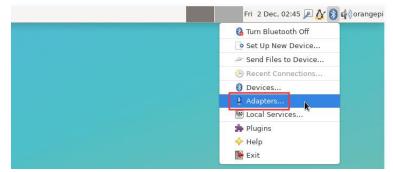
3.11. How to use Bluetooth

3. 11. 1. Testing method of desktop version image

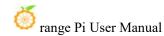
1) Click the Bluetooth icon in the upper right corner of the desktop



2) Then select the adapter

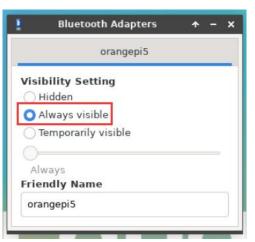


3) If prompted with the following interface, please select Yes

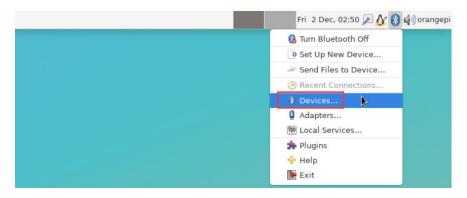




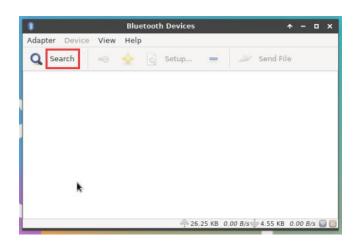
4) Then set the **Visibility Setting** to **Always visible** in the Bluetooth adapter settings interface, and then turn it off



5) Then open the configuration interface of the Bluetooth device



6) Click Search to start scanning for surrounding Bluetooth devices



6) Then select the Bluetooth device you want to connect to, and then right-click the mouse. The operation interface for the Bluetooth device will pop up. Select **Pair** to start pairing. The demonstration here is pairing with an Android phone

| Adapter Device View H 🔍 Search 🛛 🗠 🚽 | elp 🛃 Setup 💻 🥔 | Send File |
|--|---|-------------------------|
| OPPO K9 5G Smart phone B0:46:92:C1:8D:D8 | | |
| Xiaomi 12S Pro Smart phone 44:71:47:09:4F:64 | Connect Connect To: | |
| | © Info ⊗ Send note | |
| | E Send a File | 8/s∛ 5.68 KB 0.00 B/s 💭 |
| | Create pairing with the device Rename device | |
| and the second second | Remove | |

7) When pairing, a pairing confirmation box will pop up in the upper right corner of the desktop. Just select **Confirm** to confirm. At this time, you also need to confirm on the mobile phone



8) After pairing with the mobile phone, you can select the paired Bluetooth device, then right-click and select **Send a File** to start sending a picture to the mobile phone

| 8 | 10000000 | h Devices | | + - | • × |
|--------|----------------------------------|---------------|-----------|------------|-----|
| Adapte | er Device View Help | | | | |
| Q | Search 🛛 🧠 🔶 🗟 Se | itup 💻 🥔 | Send File | | |
| - | Xiaomi 12S Pro | | | | |
| | Smart phone 44:71:47:09:4F:64 | 0 | | | |
| | and and the second state | Oconnect | | | |
| | | Connect To: | | | |
| | | Network Acce | ess Point | | |
| | | 💡 Info | | | |
| | | 💡 Send note | 1 | | |
| | | 📲 Send a File | | | |
| | | Pair | | | |
| | | 🔶 Trust | | | |
| | | Setup | 92 | KB 0.00 B/ | -00 |
| | | Rename devi | ce | KB 0.00 B/ | |
| | | 8 Remove | | | |
| | | -] | | | |

9) The interface for sending pictures is as follows



3. 12. USB interface test

The USB interface can be connected to a USB hub to expand the number of USB interfaces

3. 12. 1. Connect USB mouse or keyboard to test

1) Plug the USB keyboard into the USB port of the Orange Pi development board

2) Connect the Orange Pi development board to the HDMI display

3) If the mouse or keyboard can operate the operating system normally, it means that the USB interface is working normally (the mouse can only be used in the desktop version of the system)

3. 12. 2. Connect USB storage device for testing

1) First insert the U disk or USB mobile hard disk into the USB interface of the Orange Pi development board

2) Execute the following command. If you can see the output of sdX, it means the USB disk is successfully recognized

| orangepi@orangepi:~\$ cat /proc/partitions grep "sd*" | | |
|---|------|---------------|
| major minor | #blc | cks name |
| 8 | 0 | 30044160 sda |
| 8 | 1 | 30043119 sda1 |

3) Use the mount command to mount the U disk to /**mnt**, and then you can view the files in the U disk

orangepi@orangepi:~\$ sudo mount /dev/sda1 /mnt/ orangepi@orangepi:~\$ ls /mnt/ test.txt

4) After mounting, you can check the capacity usage and mount point of the U disk through the **df** -h command

| orangepi@orange | pi:~\$ d | f -h gre | ep "sd" | |
|-----------------|----------|------------|---------|---------|
| /dev/sda1 | 29G | 208K | 29G | 1% /mnt |

3. 12. 3. USB wireless network card test

The usable USB wireless network cards that have been tested so far are as follows. Please test other models of USB wireless network cards by yourself. If it cannot be used, you need to transplant the corresponding USB wireless network card driver

| serial number | model | |
|---------------|-------------------------|------------------|
| 1 | RTL8723BU | |
| | Support 2.4G WIFI+BT4.0 | With Longertal 2 |

| 2 | RTL8811 Support 2.4G +5G WIFI | GRIS |
|---|--|----------|
| 3 | RTL8821CU Support 2.4G +5G WIFI Support BT 4.2 | Chic ste |

3. 12. 3. 1. **RTL8723BU test**

1) First insert the RTL8723BU wireless network card module into the USB interface of the development board

2) Then the Linux system will automatically load the RTL8723BU Bluetooth and WIFI related kernel modules. Through the lsmod command, you can see that the following kernel modules have been automatically loaded

| orangepi@ora | orangepi@orangepi:~\$ lsmod | | |
|--------------|-----------------------------|--|--|
| Module | Size Used by | | |
| rfcomm | 57344 16 | | |
| rtl8xxxu | 106496 0 | | |
| rtk_btusb | 61440 0 | | |

3) You can see the loading information of the RTL8723BU module through the dmesg command

orangepi@orangepi:~\$ dmesg

•••••

83.438901] usb 2-1: new high-speed USB device number 2 using ehci-platform

[83.588375] usb 2-1: New USB device found, idVendor=0bda, idProduct=b720, bcdDevice= 2.00

83.588403] usb 2-1: New USB device strings: Mfr=1, Product=2, SerialNumber=3

83.588422] usb 2-1: Product: 802.11n WLAN Adapter

83.588443] usb 2-1: Manufacturer: Realtek

83.588460] usb 2-1: SerialNumber: 00e04c000001

83.601974] Bluetooth: hci0: RTL: examining hci_ver=06 hci_rev=000b lmp_ver=06

lmp subver=8723 83.603894] Bluetooth: hci0: RTL: rom version status=0 version=1 83.603920] Bluetooth: hci0: RTL: loading rtl bt/rtl8723b fw.bin 83.610108] Bluetooth: hci0: RTL: loading rtl bt/rtl8723b config.bin 83.611274] Bluetooth: hci0: RTL: cfg sz 68, total sz 22564 83.658494] rtk btusb: Realtek Bluetooth USB driver ver 3.1.6d45ddf.20220519-142432 83.658651] usbcore: registered new interface driver rtk btusb 83.667124] usb 2-1: This Realtek USB WiFi dongle (0x0bda:0xb720) is untested! 83.667137] usb 2-1: Please report results to Jes.Sorensen@gmail.com 83.890140] usb 2-1: Vendor: Realtek 83.890153] usb 2-1: Product: 802.11n WLAN Adapter 83.890159] usb 2-1: rtl8723bu parse efuse: dumping efuse (0x200 bytes): 83.890412] usb 2-1: RTL8723BU rev E (SMIC) 1T1R, TX queues 3, WiFi=1, BT=1, GPS=0, HI PA=0 83.890417] usb 2-1: RTL8723BU MAC: 00:13:ef:f4:58:ae 83.890421] usb 2-1: rtl8xxxu: Loading firmware rtlwifi/rtl8723bu nic.bin 83.895289] usb 2-1: Firmware revision 35.0 (signature 0x5301) 84.050893] Bluetooth: hci0: RTL: fw version 0x0e2f9f73 84.266905] Bluetooth: RFCOMM TTY layer initialized 84.266949] Bluetooth: RFCOMM socket layer initialized 84.266999] Bluetooth: RFCOMM ver 1.11 84.884270] usbcore: registered new interface driver rtl8xxxu 84.912046] rtl8xxxu 2-1:1.2 wlx0013eff458ae: renamed from wlan0

4) Then you can see the RTL8723BU WIFI device node through the **sudo ifconfig** command. For WIFI connection and test methods, please refer to the **WIFI connection test** section, which will not be described here

```
orangepi@orangepi:~$ sudo ifconfig wlx0013eff458ae
wlx0013eff458ae: flags=4099<UP,BROADCAST,MULTICAST> mtu 1500
ether 00:13:ef:f4:58:ae txqueuelen 1000 (Ethernet)
RX packets 0 bytes 0 (0.0 B)
RX errors 0 dropped 0 overruns 0 frame 0
TX packets 0 bytes 0 (0.0 B)
```



TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

| 5) The | 5) Then you can see the USB Bluetooth device through the hciconfig command | | | | |
|---|---|--|--|--|--|
| orangepi@orangepi:~\$ sudo apt update && sudo apt install bluez | | | | | |
| oranger | orangepi@orangepi:~\$ hciconfig | | | | |
| hci0: | Type: Primary Bus: USB | | | | |
| | BD Address: 00:13:EF:F4:58:AE ACL MTU: 820:8 SCO MTU: 255:16 | | | | |
| | DOWN | | | | |
| | RX bytes:1252 acl:0 sco:0 events:125 errors:0 | | | | |
| | TX bytes:23307 acl:0 sco:0 commands:125 errors:0 | | | | |

6) You can also see the Bluetooth icon appearing on the desktop. Bluetooth is not turned on at this time, so a red \mathbf{x} will be displayed



7) Click Turn Bluetooth On to turn on Bluetooth

| Fri 2 Dec, 02:36 🔎 <u>人</u> 🚷 🏟 orangepi |
|--|
| 🕴 Turn Bluetooth On 📡 |
| 💿 Set Up New Device |
| 🖉 Send Files to Device |
| 🖲 Recent Connections |
| Ø Devices |
| Adapters |
| ໝ Local Services |
| 🌲 Plugins |
| 🔶 Help |
| 🕞 Exit |

8) The display after turning on Bluetooth is as follows



9) For the Bluetooth test method, please refer to the section on **Bluetooth usage** and will not be repeated here

3. 12. 3. 2. **RTL8811 test**

1) First insert the RTL8811 wireless network card module into the USB interface of the development board

2) Then the Linux system will automatically load the kernel modules related to RTL8811 WIFI. Through the lsmod command, you can see that the following kernel modules have been automatically loaded

| orangepi@orangepi:~\$ lsmod | | | | |
|-----------------------------|---------|---------|--|--|
| Module | Size | Used by | | |
| 8821cu | 1839104 | 0 | | |

3) You can see the loading information of the RTL8811 module through the dmesg command

orangepi@orangepi:~\$ dmesg

118.618194] usb 2-1: new high-speed USB device number 2 using ehci-platform

[118.767152] usb 2-1: New USB device found, idVendor=0bda, idProduct=c811, bcdDevice= 2.00

[118.767181] usb 2-1: New USB device strings: Mfr=1, Product=2, SerialNumber=3

118.767199] usb 2-1: Product: 802.11ac NIC

118.767219] usb 2-1: Manufacturer: Realtek

118.767235] usb 2-1: SerialNumber: 123456

119.500530] usbcore: registered new interface driver rtl8821cu

119.525498] rtl8821cu 2-1:1.0 wlx1cbfced9d260: renamed from wlan0

4) Then you can see the WIFI device node through the **sudo ifconfig** command. For WIFI connection and testing methods, please refer to the **WIFI connection test** section. I will not go into details here

| orangepi@orangepi:~\$ sudo ifconfig wlx1cbfced9d260 |
|--|
| wlx1cbfced9d260: flags=4099 <up,broadcast,multicast> mtu 1500</up,broadcast,multicast> |
| ether 1c:bf:ce:d9:d2:60 txqueuelen 1000 (Ethernet) |
| RX packets 0 bytes 0 (0.0 B) |
| RX errors 0 dropped 0 overruns 0 frame 0 |
| TX packets 0 bytes 0 (0.0 B) |
| TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0 |

3. 12. 3. 3. **RTL8821CU test**

1) First insert the rtl8821cu wireless network card module into the USB interface of the development board

2) Then use the **lsusb** command to see the device information of the rtl8821cu usb wifi module. Please ensure that the USB module is not in Driver CDROM Mode

orangepi@orangepi:~\$ lsusb | grep "Realtek" Bus 002 Device 003: ID 0bda:c820 Realtek Semiconductor Corp. 802.11ac NIC

orangepi@orangepi:~\$ lsusb | grep "Realtek" Bus 002 Device 002: ID 0bda:1a2b Realtek Semiconductor Corp. RTL8188GU 802.11n WLAN Adapter (Driver CDROM Mode)

If the USB WIFI module seen by the lsusb command is in Driver CDROM Mode, please unplug and unplug the USB WIFI module again. If it still doesn't work, please manually execute the following command to switch the mode:

orangepi@orangepi:~\$ sudo usb_modeswitch -KW -v 0bda -p 1a2b

3) The Linux system will automatically load the rtl8821cu Bluetooth and WiFi related kernel modules. Through the lsmod command, you can see that the following kernel modules have been automatically loaded

| | and Clamod |
|--------------------------|---------------------------|
| orangeni(<i>u</i>)oran | $\sigma ent \sim s ismod$ |
| orangepi@oran | Sept. 4 Istillea |

| Module | Size Used by |
|-----------|--------------|
| 8821cu | 1839104 0 |
| rtk_btusb | 61440 0 |

4) You can see the loading information of the rtl8821cu module through the dmesg command

orangepi@orangepi:~\$ dmesg

.....

57.083693] usb 2-1: new high-speed USB device number 2 using ehci-platform

[57.231888] usb 2-1: New USB device found, idVendor=0bda, idProduct=1a2b, bcdDevice= 2.00

57.231916] usb 2-1: New USB device strings: Mfr=1, Product=2, SerialNumber=0

57.231937] usb 2-1: Product: DISK

57.231956] usb 2-1: Manufacturer: Realtek

57.242594] usb-storage 2-1:1.0: USB Mass Storage device detected

57.245674] scsi host0: usb-storage 2-1:1.0

58.069172] usb 2-1: USB disconnect, device number 2

58.440025] usb 2-1: new high-speed USB device number 3 using ehci-platform

[58.587819] usb 2-1: New USB device found, idVendor=0bda, idProduct=c820, bcdDevice= 2.00

58.587827] usb 2-1: New USB device strings: Mfr=1, Product=2, SerialNumber=3

58.587833] usb 2-1: Product: 802.11ac NIC

58.587838] usb 2-1: Manufacturer: Realtek

58.587844] usb 2-1: SerialNumber: 123456

[58.610463] rtk_btusb: Realtek Bluetooth USB driver ver 3.1.6d45ddf.20220519-142432

58.610656] usbcore: registered new interface driver rtk_btusb

[58.634631] Bluetooth: hci0: RTL: examining hci_ver=08 hci_rev=000c lmp_ver=08 lmp_subver=8821

58.636729] Bluetooth: hci0: RTL: rom_version status=0 version=1

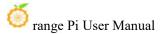
58.636740] Bluetooth: hci0: RTL: loading rtl_bt/rtl8821c_fw.bin

58.664190] Bluetooth: hci0: RTL: loading rtl_bt/rtl8821c_config.bin

58.664746] Bluetooth: hci0: RTL: cfg_sz 10, total sz 31990

59.122471] Bluetooth: hci0: RTL: fw version 0x829a7644

59.265513] usbcore: registered new interface driver rtl8821cu



59.280119] rtl8821cu 2-1:1.2 wlx90de80521825: renamed from wlan0

5) Then you can see the device node of rtl8821cu wifi through the **sudo ifconfig** command. For wifi connection and test methods, please refer to the **WIFI connection test** section, which will not be repeated here

| orangepi@orangepi:~\$ sudo ifconfig wlx90de80521825 |
|--|
| wlx90de80521825: flags=4099 <up,broadcast,multicast> mtu 1500</up,broadcast,multicast> |
| ether 00:13:ef:f4:58:ae txqueuelen 1000 (Ethernet) |
| RX packets 0 bytes 0 (0.0 B) |
| RX errors 0 dropped 0 overruns 0 frame 0 |
| TX packets 0 bytes 0 (0.0 B) |
| TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0 |

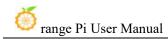
6) Then you can see the USB Bluetooth device through the hciconfig command

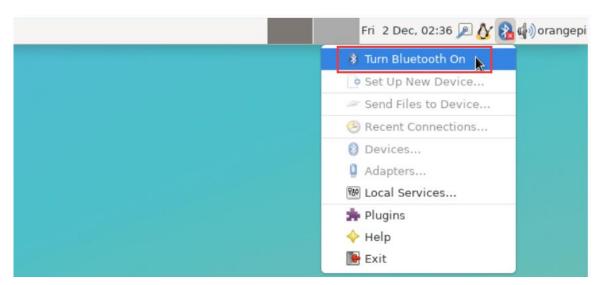
| orange | orangepi@orangepi:~\$ sudo apt-get update && sudo apt-get install -y bluez | | | | | | | | | |
|--------|--|--|--|--|--|--|--|--|--|--|
| orange | orangepi@orangepi:~\$ hciconfig | | | | | | | | | |
| hci0: | Type: Primary Bus: USB | | | | | | | | | |
| | BD Address: 00:13:EF:F4:58:AE ACL MTU: 820:8 SCO MTU: 255:16 | | | | | | | | | |
| | DOWN | | | | | | | | | |
| | RX bytes:1252 acl:0 sco:0 events:125 errors:0 | | | | | | | | | |
| | TX bytes:23307 acl:0 sco:0 commands:125 errors:0 | | | | | | | | | |

7) You can also see the Bluetooth icon appearing on the desktop. Bluetooth is not turned on at this time, so a red \mathbf{x} will be displayed



8) Click Turn Bluetooth On to turn on Bluetooth





9) The display after turning on Bluetooth is as follows

| Fri 2 Dec, 02:37 🔎 💦 🗿 🏟 orangepi |
|-----------------------------------|
| |
| |
| |
| |
| |
| |

10) For the Bluetooth test method, please refer to the **Bluetooth usage section** and will not be repeated here

3. 12. 4. USB camera test

1) First, you need to prepare a USB camera as shown in the picture below or similar that supports UVC protocol, and then insert the USB camera into the USB interface of the Orange Pi development board



2) Through the v412-ctl command, you can see that the device node information of the

USB camera is /dev/video0

orangepi@orangepi:~\$ v4l2-ctl --list-devices Q8 HD Webcam: Q8 HD Webcam (usb-fc880000.usb-1): /dev/video0 /dev/video1 /dev/media0

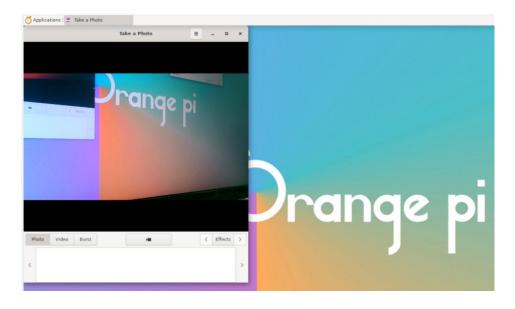
Note that the l in v4l2 is a lowercase letter l, not the number 1

In addition, the serial number of the video may not always be video0, please refer to what you actually see

3) In the desktop system, you can use Cheese to directly open the USB camera. The method of opening Cheese is as shown in the figure below:



The interface after Cheese turns on the USB camera is as shown below:



- 4) How to use fswebcam to test USB camera
 - a. Install fswebcam

orangepi@orangepi:~\$ sudo apt update orangepi@orangepi:~\$ sudo apt-get install -y fswebcam

- b. After installing fswebcam, you can use the following command to take pictures
 - a) The -d option is used to specify the device node of the USB camera
 - b) --no-banneris used to remove watermarks from photos
 - c) -r option is used to specify the resolution of the photo
 - d) The -S option is used to skip the previous number of frames
 - e) ./image.jpg is used to set the name and path of the generated photo

orangepi@orangepi:~\$ sudo fswebcam -d /dev/video0 \

--no-banner -r 1280x720 -S 5 ./image.jpg

c. In the server version of Linux system, after taking the picture, you can use the scp command to transfer the taken picture to the Ubuntu PC for mirror viewing

orangepi@orangepi:~\$ scp image.jpg test@192.168.1.55:/home/test (Modify the IP address and path according to the actual situation)

d. In the desktop version of Linux system, the captured pictures can be viewed directly through the HDMI display

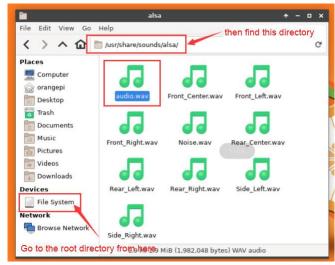
3.13. Audio test

3. 13. 1. Test audio methods on desktop systems

1) First open the file manager



2) Then find the following file (if there is no such audio file in the system, you can upload an audio file to the system yourself)

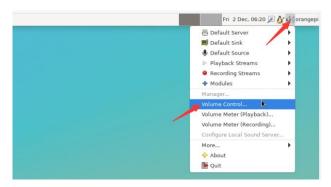


3) Then select the audio.wav file, right-click and select open with vlc to start playing

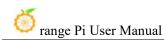
| 1 | alsa | + - u > |
|---|---|----------------|
| File Edit View Go | Help | |
| < > ^ 企 | 👕 /usr/share/sounds/alsa/ | c |
| Places Computer orangepi Desktop | audio 2 Open With "VLC media pla | |
| Trash | Open With | b _ |
| Documents | Send To | > a |
| Music | Front Rigi | way |
| Pictures | P Copy | |
| Videos | Paste | |
| Downloads | 🔵 🌗 📅 Move to Trash | |
| Devices | Rear_Cent Rear_Cent | ht.wav |
| File System File System 17 MB Volume 403 MB Volume | Side_Left.way | |
| Network | | |
| Browse Network | Use "VLC media player" to open the sele | ected file |

4) How to switch between different audio devices such as HDMI playback and headphone playback

a. First open the volume control interface



b. When playing audio, the audio device options that can be used by the **playback** software will be displayed in Playback, as shown in the figure below. Here you can set which audio device needs to be played



| Applications : 🗂 Volume Control | 🛅 alsa | 🛓 audio.way | v - VLC media | | | | | Fri 2 Dec, 06:24 | P 🛓 🕅 4 |
|--|-------------------------|---|---------------|---------|-------------|-----------------------------|----------------------|---|------------|
| | 👗 Media Playback (| laudio, wav - VLC m Judio Video Subtiție 1 | | + - ¤ × | | | | | |
| | | | | | | Volume | Control | + - ¤ × | |
| | | | <u> </u> | | Playback | Recording Output Devices | Input Devices Con | figuration | |
| | | | | | System Sou | unds | | ද්ෂ 160% (0.00 dB) | |
| | | | | | silence | | 100% (0 dB) | | |
| | | | | | 🛓 VLC media | a player (LibVLC 3.0.17.4): | audio stream on Buil | t-in Audio unun de 18 | 4 Caroline |
| | | | | | silence | | | Built-in Audio Headphones Built-in Audio HDMI | + speaker |
| | 00:02 | | | 00:11 | Silence | | 100% (0 dB) | | |
| | | 0111 = 5 X | | 4 | | | | | |
| | alsa | * • | - u x | | | | | | |
| ile Edit View Go Help | | | | | | | | | |
| < > ^ 🏠 🛅 /usr/sha | re/sounds/alsa/ | | C. | | | | | | |
| Places | | | | | | | | | |
| 🚆 Computer | 9 99 | 99 | | | | | | | |
| Desktop audi | o.wav Front_Center.wav | Front_Left.wav | | | | Show: | Applications | * | |
| Trash | | | | | - | | - | | |
| Documents | | | | | | | | | |
| Front_R | light.wav mute.wav | Noise.wav | | | | | | | |
| | | _ | | | | | | | |
| Videos | | | | | | | | | |
| | d dd | | | | | | | | |
| | enter.wav Rear_Left.wav | Rear_Right.wav | | | | | | | |
| Downloads evices Rear_Ce | enter.wav Rear_Left.wav | Rear_Right.wav | | | | | | | |
| Downloads Contraction Contract | enter.wav Rear_Left.wav | Rear_Right.wav | | | | | | | |

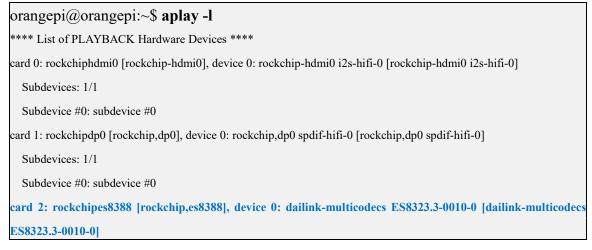
3. 13. 2. How to use commands to play audio

3. 13. 2. 1. Headphone interface playback audio test

1) First, insert the headphones into the headphone jack of the development board



2) Then you can use the aplay -l command to check the sound card devices supported by the Linux system. From the output below, it can be seen that card 2 is the sound card device of es8388, which is the sound card device of the headset



Subdevices: 1/1

Subdevice #0: subdevice #0

3) Then use the **aplay** command to play the audio file that comes with the system. If the headset can hear the sound, it means the hardware can be used normally

orangepi@orangepi:~\$ aplay -D hw:2,0 /usr/share/sounds/alsa/audio.wav Playing WAVE 'audio.wav' : Signed 16 bit Little Endian, Rate 44100 Hz, Stereo

3. 13. 2. 2. HDMI Audio playback test

1) First use an HDMI to HDMI cable to connect the Orange Pi development board to the TV (other HDMI displays need to ensure that they can play audio)

2) Then check the HDMI sound card serial number. From the output below, you can know that the HDMI sound card is **card 0**

```
orangepi@orangepi:~$ aplay -l
**** List of PLAYBACK Hardware Devices ****
card 0: rockchiphdmi0 [rockchip-hdmi0], device 0: rockchip-hdmi0 i2s-hifi-0 [rockchip-hdmi0 i2s-hifi-0]
Subdevices: 1/1
Subdevice #0: subdevice #0
card 1: rockchipdp0 [rockchip,dp0], device 0: rockchip,dp0 spdif-hifi-0 [rockchip,dp0 spdif-hifi-0]
Subdevices: 1/1
Subdevice #0: subdevice #0
card 2: rockchipes8388 [rockchip,es8388], device 0: dailink-multicodecs ES8323.3-0010-0 [dailink-multicodecs
ES8323.3-0010-0]
Subdevices: 1/1
Subdevices: 1/1
Subdevices: 1/1
```

3) Then use the **aplay** command to play the audio file that comes with the system. If the sound can be heard on the HDMI display or TV, it means that the hardware can be used normally.

orangepi@orangepi:~\$ aplay -D hw:0,0 /usr/share/sounds/alsa/audio.wav

3. 13. 3. How to test recording using commands

1) There is an onboard MIC on the development board, and its location is as follows:



2) Running the **test_record.sh main** command will record a piece of audio through the onboard MIC and then play it to HDMI and headphones

orangepi@orangepi:~\$ test_record.sh main

Start recording: /tmp/test.wav

Recording WAVE '/tmp/test.wav' : Signed 16 bit Little Endian, Rate 44100 Hz, Stereo Start playing

Playing WAVE '/tmp/test.wav' : Signed 16 bit Little Endian, Rate 44100 Hz, Stereo Playing WAVE '/tmp/test.wav' : Signed 16 bit Little Endian, Rate 44100 Hz, Stereo

3) HDMI 和 In addition to the onboard MIC, we can also record audio through headphones with MIC function. After inserting the headset with MIC function into the development board, running the **test_record.sh headset** command will record an audio through the headset and then play it to HDMI and headset

orangepi@orangepi:~\$ test_record.sh headset

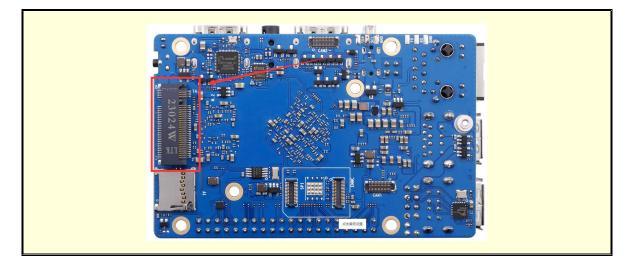
Start recording: /tmp/test.wav

Recording WAVE '/tmp/test.wav' : Signed 16 bit Little Endian, Rate 44100 Hz, Stereo Start playing

Playing WAVE '/tmp/test.wav' : Signed 16 bit Little Endian, Rate 44100 Hz, Stereo Playing WAVE '/tmp/test.wav' : Signed 16 bit Little Endian, Rate 44100 Hz, Stereo

3. 14. How to use SATA SSD

The m.2 interface shown in the figure below can use either nvme ssd or sata ssd. Since the pcie2.0 controller and the sata controller are optional, only one of the configurations can be opened at the same time. The Linux image released by Orange Pi opens the pcie configuration by default, so it can only recognize nvme ssd by default. If you want to use sata ssd, you need to open the corresponding configuration



1) First you need to prepare a SATA SSD solid state drive



2) Then insert the SSD into the M.2 interface of the development board and secure it



- 3) There are two main ways to use sata ssd:
 - a. The Linux system is placed in the TF card, and then the SATA SSD is inserted as an external storage device. This section mainly explains this usage
 - b. Burn the linux system into the sata ssd, and then start the linux system in the sata ssd. For this usage, please see the instructions in the method of burning Linux image into SPIFlash+SATA SSD

4) After using the TF card to start the Linux system, we first burn the sata ssd-specific u-boot image into the TF card

a. The dedicated u-boot image storage path for sata ssd startup is:

/usr/share/orangepi5pro/u-boot-sata.itb

b. Make sure that **u-boot-sata.itb** exists in the Linux system, and then use the following command to burn it to the TF card or eMMC of the development board

orangepi@orangepi:~\$ cd /usr/share/orangepi5pro/

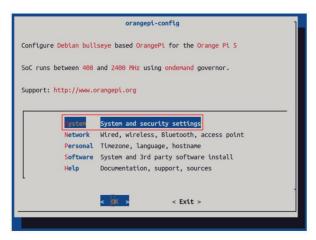
orangepi@orangepi:~\$ sudo dd if=u-boot-sata.itb of=\$(findmnt -n -o SOURCE / | sed 's/..\$//') seek=16384

orangepi@orangepi:~\$ sudo sync

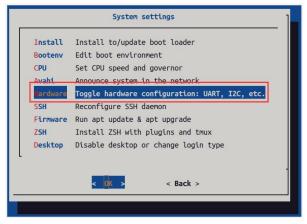
5) Then run orangepi-config. Ordinary users remember to add sudo permissions

orangepi@orangepi:~\$ sudo orangepi-config

6) Then Choose System



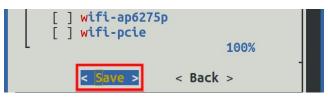
7) Then Choose Hardware



8) Then use the keyboard arrow keys to locate **ssd-sata2**, and then use the **space** to select it



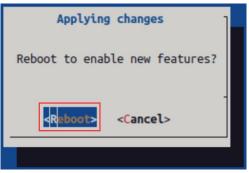
9) Then select **<Save>** to save



10) Then Choose <Back>

| L | įį | wifi-pcie | 100% |
|---|----|-----------|----------|
| 1 | | < Save > | < Back > |

11) Then Choose **<Reboot>**to restart the system to make the configuration take effect



The above settings will eventually add the overlays=ssd-sata2 line configuration to /boot/orangepiEnv.txt. You can check it first after setting it up. If this line of configuration does not exist, there is something wrong with the settings

If you find it troublesome to use orangepi-config, you can also open /boot/orangepiEnv.txt and add the line configuration overlays=ssd-sata2

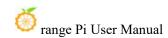
orangepi@orangepi:~\$ cat /boot/orangepiEnv.txt | grep ssd overlays=ssd-sata2 12) If everything is normal, use the **sudo fdisk -l** command after the system restarts to see the sata ssd information

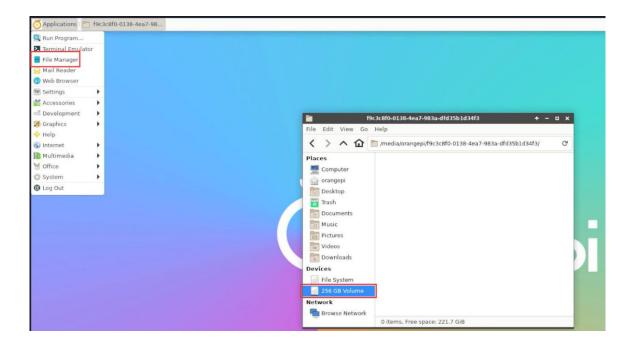
| orangepi@orangepi:~\$ sudo fdisk -l |
|--|
| |
| Disk /dev/sda: 238.47 GiB, 256060514304 bytes, 500118192 sectors |
| Disk model: Fanxiang S201 25 |
| Units: sectors of $1 * 512 = 512$ bytes |
| Sector size (logical/physical): 512 bytes / 512 bytes |
| I/O size (minimum/optimal): 512 bytes / 512 bytes |
| Disklabel type: gpt |
| Disk identifier: 43FFB292-340D-654C-8C30-6C64AEDAA0F4 |
| |
| Device Start End Sectors Size Type |
| /dev/sda1 2048 500117503 500115456 238.5G Linux filesystem |
| |

13) Then use GParted to format or partition the sata ssd



14) Then you can see the sata ssd device in the file management





15) In the server version of the system, you can use the **mount** command to mount the sata ssd to the required directory

| orangepi@orange | orangepi@orangepi:~\$ sudo mount /dev/sda1 /mnt | | | | | | | | |
|-----------------|---|------------|----------|-------------------|--|--|--|--|--|
| orangepi@orange | orangepi@orangepi:~\$ df -h | | | | | | | | |
| Filesystem | Size U | Ised Ava | ail Use% | Mounted on | | | | | |
| udev | 3.8G | 8.0K | 3.8G | 1% /dev | | | | | |
| tmpfs | 769M | 1.4M | 768M | 1% /run | | | | | |
| /dev/mmcblk1p2 | 29G | 5.9G | 23G | 21% / | | | | | |
| tmpfs | 3.8G | 0 | 3.8G | 0% /dev/shm | | | | | |
| tmpfs | 5.0M | 4.0K | 5.0M | 1% /run/lock | | | | | |
| tmpfs | 3.8G | 16K | 3.8G | 1% /tmp | | | | | |
| /dev/mmcblk1p1 | 256M | 90M | 166M | 36% /boot | | | | | |
| /dev/zram1 | 194M | 27M | 154M | 15% /var/log | | | | | |
| tmpfs | 769M | 60K | 769M | 1% /run/user/1000 | | | | | |
| /dev/sda1 | 234G | 28K | 222G | 1% /mnt | | | | | |

3.15. Temperature sensor

1) The command to view the system temperature sensor is:

orangepi@orangepi:~\$ sensors

```
gpu thermal-virtual-0
Adapter: Virtual device
temp1:
                +47.2°C
littlecore thermal-virtual-0
Adapter: Virtual device
                +47.2°C
temp1:
bigcore0 thermal-virtual-0
Adapter: Virtual device
                +47.2°C
temp1:
tcpm source psy 6 0022-i2c-6-22
Adapter: rk3x-i2c
in0:
                 0.00 V (min = +0.00 V, max = +0.00 V)
curr1:
                0.00 \text{ A} \text{ (max} = +0.00 \text{ A)}
npu thermal-virtual-0
Adapter: Virtual device
                +47.2°C
temp1:
center thermal-virtual-0
Adapter: Virtual device
temp1:
                +47.2°C
bigcore1 thermal-virtual-0
Adapter: Virtual device
                +47.2°C
temp1:
soc thermal-virtual-0
Adapter: Virtual device
temp1:
                +47.2°C
                           (crit = +115.0^{\circ}C)
```

2) The command to check the current temperature of nvme ssd solid state drive is: orangepi@orangepi:~\$ sudo smartctl -a /dev/nvme0 | grep "Temperature:" Temperature:

40 Celsius

3. 16. 40 Pin interface pin description

1) Please refer to the picture below for the order of the 40-pin interface pins of the Orange Pi 5 Pro development board



2) The functions of the 40-pin interface pins of the Orange Pi 5 Pro development board are as shown in the table below

a. Below is the complete pin diagram of 40pin

| 复用功能 | 复用功能 | 复用功能 | GPIO | GPIO序号 | 引脚序号 | 引脚序号 | GPIO序号 | GPIO | 复用功能 | 复用功能 | 复用功能 |
|-------------|------------------------|------------------------|----------|---------------|------|------|---------------|----------|-----------------------|--------------------|--------------|
| | | | 3. 3V | | 1 | 2 | | 57 | | | |
| | UART4_RX_MO | I2C1_SDA_N4 | GPI01_D3 | 59 | 3 | 4 | | 57 | | | |
| | UART4_TX_MO | 12C1_SCL_M4 | GPI01_D2 | 58 | 5 | 6 | | GND | | | |
| UART1_RX_M1 | I2C5_SDA_M3 | PWM13_M2 (febf0010) | GPI01_B7 | 47 | 7 | 8 | 13 | GPI00_B5 | UART2_TX_NO | | |
| | | | GND | | 9 | 10 | 14 | GPIO0_B6 | UART2_RX_MO | | |
| | PWM14_M1 (febf0020) | CAN1_RX_M1 | GPI04_B2 | 138 | 11 | 12 | 39 | GPI01_A7 | PWN3_IR_N3 (fd8b0030) | | |
| | PWN15_IR_N1 (febf0030) | CAN1_TX_M1 | GPI04_B3 | 139 | 13 | 14 | | GND | | | |
| UART1_TX_M1 | 12C5_SCL_M3 | | GPI01_B6 | 46 | 15 | 16 | 33 | GPI01_A1 | UART6_TX_N1 | | SPI4_MOSI_M2 |
| | | | 3. 3V | | 17 | 18 | 32 | GPI01_A0 | UART6_RX_M1 | | SPI4_HISO_H2 |
| | UART4_RX_M2 | SPI0_NOSI_N2 | GPI01_B2 | 42 | 19 | 20 | | GND | | | |
| | | SPI0_MISO_M2 | GPI01_B1 | 41 | 21 | 22 | 40 | GPI01_B0 | | | |
| | UART4_TX_M2 | SPI0_CLK_M2 | GPI01_B3 | 43 | 23 | 24 | 44 | GPI01_B4 | SPI0_CS0_M2 | UART7_RX_N2 | |
| | | | GND | | 25 | 26 | 45 | GPI01_B5 | SPI0_CS1_M2 | UART7_TX_N2 | |
| SPI4_CLK_M2 | PWN0_H2 (fd8b0000) | I2C4_SDA_M3 | GPI01_A2 | 34 | 27 | 28 | 35 | GPI01_A3 | 12C4_SCL_N3 | PWM1_M2 (fd8b0010) | SPI4_CS0_M2 |
| | | | GPI01_A4 | 36 | 29 | 30 | | GND | | | |
| | | | GPI01_A6 | 38 | 31 | 32 | 62 | GPIO1_D6 | PWM14_M2 (febf0020) | 12C8_SCL_112 | |
| | 12C8_SDA_M2 | PWN15_IR_N3 (febf0030) | GP101_D7 | 63 | 33 | 34 | | GND | | | |
| | | 12C5_SDA_M2 | GPIO4_A7 | 135 | 35 | 36 | 131 | GPI04_A3 | UARTO_TX_M2 | | |
| | UART3_RX_M2 | 12C5_SCL_M2 | GPIO4_A6 | 134 | 37 | 38 | 132 | GPIO4_A4 | UARTO_RX_M2 | | |
| | | | GND | | 39 | 40 | 133 | GPI04_A5 | | UART3_TX_N2 | |

b. The table below is a picture of the left half of the complete table above, so you can see it clearly

| 复用功能 | 复用功能 | 复用功能 | GPIO | GPIO序号 | 引脚序号 |
|-------------|------------------------|------------------------|----------|---------------|------|
| | | | 3.37 | | 1 |
| | UART4_RX_MO | I2C1_SDA_M4 | GPIO1_D3 | 59 | 3 |
| | UART4_TX_MO | I2C1_SCL_M4 | GPIO1_D2 | 58 | 5 |
| UART1_RX_M1 | I2C5_SDA_M3 | PWM13_M2 (febf0010) | GPI01_B7 | 47 | 7 |
| | | | GND | | 9 |
| | PWM14_M1 (febf0020) | CAN1_RX_M1 | GPIO4_B2 | 138 | 11 |
| | PWM15_IR_M1 (febf0030) | CAN1_TX_M1 | GPIO4_B3 | 139 | 13 |
| UART1_TX_M1 | I2C5_SCL_M3 | | GPIO1_B6 | 46 | 15 |
| | | | 3. 3V | | 17 |
| | UART4_RX_M2 | SPIO_MOSI_M2 | GPI01_B2 | 42 | 19 |
| | | SPIO_MISO_M2 | GPIO1_B1 | 41 | 21 |
| | UART4_TX_M2 | SPI0_CLK_M2 | GPIO1_B3 | 43 | 23 |
| | | | GND | | 25 |
| SPI4_CLK_M2 | PWM0_M2 (fd8b0000) | I2C4_SDA_M3 | GPIO1_A2 | 34 | 27 |
| | | | GPIO1_A4 | 36 | 29 |
| | | | GPIO1_A6 | 38 | 31 |
| | I2C8_SDA_M2 | PWM15_IR_M3 (febf0030) | GPIO1_D7 | 63 | 33 |
| | | I2C5_SDA_M2 | GPIO4_A7 | 135 | 35 |
| | UART3_RX_M2 | 12C5_SCL_M2 | GPIO4_A6 | 134 | 37 |
| | | | GND | | 39 |

c. The table below is a picture of the right half of the complete table above, so you can see it clearly

| 引脚序号 | GPIO序号 | GPIO | 复用功能 | 复用功能 | 复用功能 |
|------|--------|----------|-----------------------|--------------------|--------------|
| 2 | | 5V | | | |
| 4 | | 57 | | | |
| 6 | | GND | | | |
| 8 | 13 | GPIO0_B5 | UART2_TX_MO | | |
| 10 | 14 | GPIO0_B6 | UART2_RX_MO | - | |
| 12 | 39 | GPI01_A7 | PWM3_IR_M3 (fd8b0030) | | |
| 14 | | GND | | | |
| 16 | 33 | GPIO1_A1 | UART6_TX_M1 | | SPI4_MOSI_M2 |
| 18 | 32 | GPI01_A0 | UART6_RX_M1 | | SPI4_MISO_M2 |
| 20 | | GND | | | |
| 22 | 40 | GPIO1_B0 | | | |
| 24 | 44 | GPIO1_B4 | SPI0_CS0_M2 | UART7_RX_M2 | |
| 26 | 45 | GPIO1_B5 | SPI0_CS1_M2 | UART7_TX_M2 | |
| 28 | 35 | GPI01_A3 | I2C4_SCL_M3 | PWM1_M2 (fd8b0010) | SPI4_CSO_M2 |
| 30 | | GND | | | |
| 32 | 62 | GPIO1_D6 | PWM14_M2 (febf0020) | 12C8_SCL_M2 | |
| 34 | | GND | | | |
| 36 | 131 | GPIO4_A3 | UARTO_TX_M2 | | |
| 38 | 132 | GPIO4_A4 | UARTO_RX_M2 | | |
| 40 | 133 | GPIO4_A5 | | UART3_TX_M2 | |

In the above table, pwm has marked the base address of the corresponding register, which is useful when checking which pwmchip in /sys/class/pwm/ corresponds to which pwm pin in the 40pin header..

3) There are a total of **28** GPIO ports in the 40pin interface, and the voltage of all GPIO ports is **3.3v**

3. 17. How to install wiringOP

Note that wiringOP is already pre-installed in the linux image released by Orange Pi. Unless the wiringOP code is updated, there is no need to re-download, compile and install, you can just use it directly

The storage path of the compiled wiringOP deb package in orangepi-build is: orangepi-build/external/cache/debs/arm64/wiringpi_x.xx.deb

After entering the system, you can run the gpio readall command. If you can see the following output, it means that wiringOP has been pre-installed and can be used normally

| GPIO | wPi | Name | Mode | V | Phys | ical | V | Mode | Name | wPi | GPIO |
|------|-----|----------|------|---|------|------|---|-------|----------|-----|------|
| | 1 | 3.3V | | | | 2 | | | 5V | | |
| 59 | 0 | SDA.1 | IN | 1 | 3 | 4 | | 1 | 5V | | |
| 58 | 1 | SCL.1 | IN | 1 | 5 | 6 | | | GND | | |
| 47 | 2 | PWM13 | IN | 1 | 7 | 8 | 1 | ALT10 | TXD.2 | 3 | 13 |
| | i i | GND | | | 9 | 10 | 1 | ALT10 | RXD.2 | 4 | 14 |
| 138 | 5 | CAN1 RX | IN | 1 | 11 | 12 | 1 | IN | GPI01_A7 | 6 | 39 |
| 139 | 7 | CAN1 TX | IN | 1 | 13 | 14 | | | GND | | |
| 46 | 8 | GPI01_B6 | IN | 1 | 15 | 16 | 0 | IN | TXD.6 | 9 | 33 |
| | 1 | 3.3V | | | 17 | 18 | 0 | IN | RXD.6 | 10 | 32 |
| 42 | 11 | SPI0_TXD | IN | 0 | 19 | 20 | | | GND | | |
| 41 | 12 | SPI0_RXD | IN | 0 | 21 | 22 | 1 | IN | GPI01_B0 | 13 | 40 |
| 43 | 14 | SPI0_CLK | IN | 0 | 23 | 24 | 1 | IN | SPI0_CS0 | 15 | 44 |
| | 1 | GND | | | 25 | 26 | 1 | IN | SPI0_CS1 | 16 | 45 |
| 34 | 17 | SDA.4 | IN | 0 | 27 | 28 | 0 | IN | SCL.4 | 18 | 35 |
| 36 | 19 | GPI01_A4 | IN | 0 | 29 | 30 | | | GND | | |
| 38 | 20 | GPI01_A6 | IN | 0 | 31 | 32 | 1 | IN | PWM14 | 21 | 62 |
| 63 | 22 | PWM15 | IN | 1 | 33 | 34 | | | GND | | |
| 135 | 23 | GPIO4_A7 | IN | 0 | 35 | 36 | 0 | IN | TXD.0 | 24 | 131 |
| 134 | 25 | GPI04_A6 | IN | 0 | 37 | 38 | 0 | IN | RXD.0 | 26 | 132 |
| | 1 | GND | | | 39 | 40 | 0 | IN | GPI04_A5 | 27 | 133 |
| GPIO | wPi | Name | Mode | V | Phys | ical | V | Mode | Name | wPi | GPIO |

1) Download the code of wiringOP

orangepi@orangepi:~\$ sudo apt update

orangepi@orangepi:~\$ sudo apt install -y git

orangepi@orangepi:~\$ git clone https://github.com/orangepi-xunlong/wiringOP.git -b next

Note that Orange Pi 5 Pro needs to download the code of wiringOP next branch, please don' t miss the -b next parameter

If there is a problem downloading the code from GitHub, you can directly use the wiringOP source code that comes with the Linux image. The storage location is: /usr/src/wiringOP

Compile and install wiringOP
 orangepi@orangepi:~\$ cd wiringOP
 orangepi@orangepi:~/wiringOP\$ sudo ./build clean
 orangepi@orangepi:~/wiringOP\$ sudo ./build

| GPIO | wPi | Name | Mode | I V | Phys | sical | V | Mode | Name | wPi | GPIO |
|------|------------|----------------|------|----------|-------------|-------|----------|-------------|----------|------------|------|
| | + | ++ | | + | ++ | ++ | + | + | + | + | + |
| | | 3.3V | - | | | 2 | | | [5V | | |
| 59 | 0 | SDA.1 | IN | | 3 | 4 | | ļ | 5V | | |
| 58 | 1 | SCL.1 | IN | 1 | 5 | 6 | | | GND | | |
| 47 | 2 | PWM13 | IN | 1 | 7 | 8 | 1 | ALT10 | TXD.2 | 3 | 13 |
| | | GND | | | 9 | 10 | 1 | ALT10 | RXD.2 | 4 | 14 |
| 138 | 5 | CAN1_RX | IN | 1 | 11 | 12 | 1 | IN | GPI01_A7 | 6 | 39 |
| 139 | 7 | CAN1_TX | IN | 1 | 13 | 14 | | | GND | 1000 | |
| 46 | 8 | GPI01_B6 | IN | 1 | 15 | 16 | 0 | IN | TXD.6 | 9 | 33 |
| | | 3.3V | | | 17 | 18 | 0 | IN | RXD.6 | 10 | 32 |
| 42 | 11 | SPI0_TXD | IN | 0 | 19 | 20 | | | GND | | 1 |
| 41 | 12 | SPI0_RXD | IN | 0 | 21 | 22 | 1 | IN | GPI01 B0 | 13 | 40 |
| 43 | 14 | SPI0 CLK | IN | 0 | 23 | 24 | 1 | IN | SPI0 CS0 | 15 | 44 |
| | i i | GND | | | 25 | 26 | 1 | IN | SPI0 CS1 | 16 | 45 |
| 34 | 17 | SDA.4 | IN | 0 | 27 | 28 | 0 | IN | SCL.4 | 18 | 35 |
| 36 | 19 | GPIO1 A4 | IN | 0 | 29 | 30 | | | GND | | i |
| 38 | 20 | GPI01 A6 | IN | 0 | 31 | 32 | 1 | IN | PWM14 | 21 | 62 |
| 63 | 22 | PWM15 | IN | 1 | 33 | i 34 | 1 | | GND | | i |
| 135 | 23 | GPIO4 A7 | IN | 0 | 35 | 36 | 0 | IN | TXD.0 | 24 | 131 |
| 134 | 25 | GPIO4 A6 | IN | 0 | 37 | 38 | 0 | IN | RXD.0 | 26 | 132 |
| | | GND | | | 39 | 40 | 0 | IN | GPI04_A5 | 27 | 133 |
| GPIO | + wPi | ++ I Name I | Mode | + V | + I Phvs | sical | + I V | + I Mode | + | + wPi | + |

3) The output of testing the gpio readall command is as follows

3.18. 40pin interface GPIO, I2C, UART, SPI, CAN and PWM testing

3. 18. 1. **40pin GPIO port test**

The Linux system released by Orange Pi comes pre-installed with a blink_all_gpio program. This program will set all 28 GPIO ports in 40pin to

continuously switch between high and low levels.

After running the blink_all_gpio program, when using a multimeter to measure the level of the GPIO port, you will find that the GPIO pin will continuously switch between 0 and 3.3v. Using this program we can test whether the GPIO port can work normally

The way to run the blink_all_gpio program is as follows:

orangepi@orangepi5pro:~\$ sudo blink_all_gpio #Remember to add sudo permissions [sudo] password for orangepi: #You need to enter your password here

1) There are a total of 28 GPIO ports in the 40-pin development board that can be used. The following uses pin No. 7 - the corresponding GPIO is GPIO1_B7 - the corresponding wPi serial number is 2 - as an example to demonstrate how to set the high and low levels of the GPIO port

| GPIO | wPi | Name | Mode | V | | Physical | I V | Mode | Name | wPi | GPI0 |
|------|-----|---------|------|---|-----|----------|-----|-------|----------|-----|------|
| | + | + | | + | -+- | ++ | + | + | + | + | + |
| 50 | | 3.3V | | | | 1 2 | | | 5V | | |
| 59 | 0 | SDA.1 | IN | 1 | | 3 4 | | | 5V | | L. |
| 58 | 1 | SCL.1 | IN | 1 | | 5 6 | | | GND | | k |
| 47 | 2 | PWM13 | IN | 1 | | 7 8 | 1 | ALT10 | TXD.2 | 3 | 13 |
| | | GND | | 1 | 1 | 9 10 | 1 | ALT10 | RXD.2 | 4 | 14 |
| 138 | 5 | CAN1 RX | IN | 1 | Ĩ. | 11 12 | 1 | IN | GPIO1 A7 | 6 | 39 |
| 139 | 7 | CAN1 TX | IN | 1 | i. | 13 14 | | i l | GND | | |

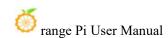
2) First set the GPIO port to output mode, and the third parameter needs to be the serial number of the wPi corresponding to the input pin

root@orangepi:~/wiringOP# **gpio mode 2 out**

3) Then set the GPIO port to output a low level. After setting, you can use a multimeter to measure the voltage value of the pin. If it is 0v, it means the low level is set successfully

root@orangepi:~/wiringOP# **gpio write 2 0**

Using gpio readall, you can see that the value (V) of pin 7 becomes 0



| GPIO | wPi | Name | Mode | V | Physi | cal | V | Mode | Name | wPi | GPIO |
|------|-------|---------|------|-----|-------|-----|---|-------|----------|-------|------|
| | 1 1 | 3.3V | | 1 1 | 1 | 2 | | + | 5V | + | |
| 59 | 0 | SDA.1 | IN | 11 | 3 | 4 | | i | 5V | i | 1 |
| 58 | j 1 j | SCL.1 | IN | 11 | 5 | б | | Ì | GND | i i | 1 |
| 47 | 2 | PWM13 | OUT | 0 | 7 | 8 | 1 | ALT10 | TXD.2 | 3 | 13 |
| | 1 1 | GND | | i i | 9 | 10 | 1 | ALT10 | RXD.2 | 4 | 14 |
| 138 | 5 | CAN1_RX | IN | 1 | 11 | 12 | 1 | IN | GPI01_A7 | 6 | 39 |
| 139 | 7 | CAN1 TX | IN | 11 | 13 | 14 | | | GND | | |

4) Then set the GPIO port to output a high level. After setting, you can use a multimeter to measure the voltage value of the pin. If it is 3.3v, it means the setting of the high level is successful.

root@orangepi:~/wiringOP# gpio write 2 1

Using gpio readall, you can see that the value (V) of pin 7 changes to 1

| GPIO | wPi | Name I | Mode | IVI | PI5 Phys | | | i | Mode | Name | wPi | GPI0 |
|------|-----|---------|------|-----|-------------|----|---|-----|-------|----------|-----|------|
| | ++- | + | | ++ | + | | | -+- | | | + | |
| | i i | 3.3V | | 1 | 1 | 2 | | Ì | | 5V | | |
| 59 | 0 | SDA.1 | IN | 11 | 3 | 4 | | 1 | | 5V | | |
| 58 | 1 | SCL.1 | IN | 11 | 5 | 6 | 1 | 1 | | GND | | |
| 47 | 2 | PWM13 | OUT | 1 | 7 | 8 | 1 | | ALT10 | TXD.2 | 3 | 13 |
| | | GND | | | 9 | 10 | 1 | | ALT10 | RXD.2 | 4 | 14 |
| 138 | 5 | CAN1_RX | IN | 11 | 11 | 12 | 1 | | IN | GPI01_A7 | 6 | 39 |
| 139 | 7 | CAN1 TX | IN | 111 | 13 I | 14 | 1 | i | | GND | | 1 |

5) The setting method for other pins is similar. You only need to modify the serial number of wPi to the serial number corresponding to the pin

3. 18. 2. How to set the pull-down resistor of the 40pin GPIO port

Note that the four GPIO pins below Orange Pi 5 Pro have external 3.3V pull-ups, so the pull-down settings are invalid

| GPIO | wPi | Name | Mode | V | Phys | ical | V | Mode | Name | wPi | GPIC |
|------|-----|----------|------|-----|--------|------|-----|-------|----------|-----|------|
| | | 3.3V | | | 1 | 2 | | + | 5V | | |
| 59 | 0 | SDA.1 | IN | 1 | 3 | 4 | i i | 1 | 5V | i | 1 |
| 58 | 1 | SCL.1 | IN | 1 | 5 | 6 | | 1 | GND | | 1 |
| 47 | 2 | PWM13 | IN | 1 | 7 | 8 | 1 | ALT10 | TXD.2 | 3 | 13 |
| | | GND | | | 9 | 10 | 1 | ALT10 | RXD.2 | 4 | 14 |
| 138 | 5 | CAN1_RX | IN | 1 | 11 | 12 | 1 | IN | GPI01_A7 | 6 | 39 |
| 139 | 7 | CAN1_TX | IN | 1 | 13 | 14 | | 1 | GND | | 1 |
| 46 | 8 | GPI01_B6 | IN | 1 | 15 | 16 | 0 | IN | TXD.6 | 9 | 33 |
| | | 3.3V | | | 17 | 18 | 0 | IN | RXD.6 | 10 | 32 |
| 42 | 11 | SPI0_TXD | IN | 0 | 19 | 20 | | 1 | GND | | 1 |
| 41 | 12 | SPI0_RXD | IN | 0 | 21 | 22 | 1 | IN | GPI01_B0 | 13 | 40 |
| 43 | 14 | SPI0_CLK | IN | 0 | 23 | 24 | 1 | IN | SPI0_CS0 | 15 | 44 |
| | | GND | | | 25 | 26 | 1 | IN | SPI0_CS1 | 16 | 45 |
| 34 | 17 | SDA.4 | IN | 0 | 27 | 28 | 0 | IN | SCL.4 | 18 | 35 |
| 36 | 19 | GPI01_A4 | IN | 0 | 29 | 30 | | 1 | GND | | |
| 38 | 20 | GPI01_A6 | IN | 0 | 31 | 32 | 1 | IN | PWM14 | 21 | 62 |
| 63 | 22 | PWM15 | IN | 1 | 33 | 34 | | | GND | | 1 |
| 135 | 23 | GPI04_A7 | IN | 0 | 35 | 36 | 0 | IN | TXD.0 | 24 | 131 |
| 134 | 25 | GPI04_A6 | IN | 0 | 37 | 38 | 0 | IN | RXD.0 | 26 | 132 |
| | | GND | | | 39 | 40 | 0 | IN | GPI04_A5 | 27 | 133 |
| GPIO | wPi | Name | Mode | I V | l Phvs | ical | l v | Mode | Name | wPi | GPIC |

1) The following uses pin No. 11 - the corresponding GPIO is GPIO4_B2 - the corresponding wPi serial number is 5 - as an example to demonstrate how to set the pull-up and pull-down resistors of the GPIO port

| GPIO | wPi | Name | Mode | V | Phys | ical | I V | Mode | Name | wPi | GPIC |
|------|-----|---------|------|---|--------------|------|-----|-------|----------|-----|------|
| | | 3.3V | | | 1 | 2 | T. | 1 | 5V | 1 | |
| 59 | 0 | SDA.1 | OUT | 0 | 3 | 4 | 1 | Î. | 5V | 1 | |
| 58 | 1 | SCL.1 | OUT | 0 | 5 | 6 | | | GND | i i | |
| 47 | 2 | PWM13 | OUT | 0 | 7 | 8 | 0 | OUT | TXD.2 | 3 | 13 |
| | ĹĹ | GND I | | | <u>i 9 i</u> | 10 | 0 | OUT | RXD.2 | 4 | 14 |
| 138 | 5 | CAN1_RX | OUT | 0 | 11 | 12 | 0 | I OUT | GPI01_A7 | 6 | 39 |
| 139 | 7 | CAN1 TX | OUT | 0 | 13 | 14 | 1 | Î. | GND | 1 | |

2) First, you need to set the GPIO port to input mode, and the third parameter needs to be the serial number of the wPi corresponding to the input pin

root@orangepi:~/wiringOP# gpio mode 5 in

3) After setting to input mode, execute the following command to set the GPIO port to pull-up mode

root@orangepi:~/wiringOP# **gpio mode 5 up**

4) Then enter the following command to read the level of the GPIO port. If the level is 1, it means that the pull-up mode is set successfully

root@orangepi:~/wiringOP# gpio read 5

5) Then execute the following command to set the GPIO port to pull-down mode root@orangepi:~/wiringOP# **gpio mode 5 down**

6) Then enter the following command to read the level of the GPIO port. If the level is 0, it means that the pull-down mode is set successfully

root@orangepi:~/wiringOP# gpio read 5

0

3. 18. 3. **40pin SPI Test**

1) As can be seen from the picture below, the spi available for Orange Pi 5 Pro is spi0 and spi4

| 复用功能 | 复用功能 | 复用功能 | GPIO | GPI0序号 | 引脚序号 | 引脚序号 | GPI0序号 | GPIO | 复用功能 | 复用功能 | 复用功能 |
|-------------|------------------------|------------------------|----------|---------------|------|------|---------------|----------|-----------------------|--------------------|--------------|
| | | | 3.3V | | 1 | 2 | | 57 | | | |
| | UART4_RX_NO | I2C1_SDA_H4 | GPI01_D3 | 59 | 3 | 4 | | 57 | | | |
| | UART4_TX_NO | I2C1_SCL_H4 | GPI01_D2 | 58 | 5 | 6 | | GND | | | |
| UART1_RX_M1 | 12C5_SDA_N3 | PWM13_M2 (febf0010) | GPI01_B7 | 47 | 7 | 8 | 13 | GPIO0_B5 | UART2_TX_HO | | |
| | | | GND | | 9 | 10 | 14 | GPIO0_B6 | UART2_RX_HO | | |
| | PWM14_M1 (febf0020) | CAN1_RX_H1 | GPI04_B2 | 138 | 11 | 12 | 39 | GPI01_A7 | PWM3_IR_M3 (fd8b0030) | | |
| | PWN15_IR_N1 (febf0030) | CAN1_TX_H1 | GPIO4_B3 | 139 | 13 | 14 | | GND | | | |
| UART1_TX_M1 | 12C5_SCL_N3 | | GPI01_B6 | 46 | 15 | 16 | 33 | GPI01_A1 | UART6_TX_H1 | | SPI4_MOSI_M2 |
| | | | 3.37 | | 17 | 18 | 32 | GPI01_A0 | UART6_RX_H1 | | SPI4_MISO_M2 |
| | UART4_RX_N2 | SPI0_MOSI_M2 | GPI01_B2 | 42 | 19 | 20 | | GND | | | |
| | | SPI0_MISO_M2 | GPI01_B1 | 41 | 21 | 22 | 40 | GPI01_B0 | | | |
| | UART4_TX_M2 | SPI0_CLK_II2 | GPI01_B3 | 43 | 23 | 24 | 44 | GPI01_B4 | SPI0_CS0_112 | UART7_RX_H2 | |
| | | | GND | | 25 | 26 | 45 | GPI01_B5 | SPI0_CS1_H2 | UART7_TX_H2 | |
| SPI4_CLK_M2 | PWN0_M2 (fd8b0000) | 12C4_SDA_H3 | GPI01_A2 | 34 | 27 | 28 | 35 | GPIO1_A3 | 12C4_SCL_II3 | PWM1_M2 (fd8b0010) | SPI4_CS0_M2 |
| | | | GPI01_A4 | 36 | 29 | 30 | 1 | GND | | | |
| | | | GPI01_A6 | 38 | 31 | 32 | 62 | GPI01_D6 | PWM14_M2 (febf0020) | 12C8_SCL_112 | |
| | 12C8_SDA_N2 | PWM15_IR_M3 (febf0030) | GPI01_D7 | 63 | 33 | 34 | | GND | | | |
| | | I2C5_SDA_H2 | GPI04_A7 | 135 | 35 | 36 | 131 | GPIO4_A3 | UARTO_TX_H2 | | |
| | UART3_RX_M2 | 12C5_SCL_112 | GPIO4_A6 | 134 | 37 | 38 | 132 | GPIO4_A4 | UARTO_RX_H2 | | |
| | | | GND | | 39 | 40 | 133 | GPIO4_A5 | | UART3_TX_H2 | |

2) The corresponding pins of SPI0 and SPI4 in 40pin are as shown in the table below

| | SPI0_M2 correspond 40pin | SPI4_M2 correspond 40pin |
|---------------|--------------------------|--------------------------|
| MOSI | Pin 19 | Pin 16 |
| MISO | Pin 21 | Pin 18 |
| CLK | Pin 23 | Pin 27 |
| CS0 | Pin 24 | Pin 28 |
| CS1 | Pin 26 | None |
| Dtbo | spi0-m2-cs0-spidev | spi4-m2-cs0-spidev |
| Configuration | spi0-m2-cs1-spidev | |
| | spi0-m2-cs0-cs1-spidev | |

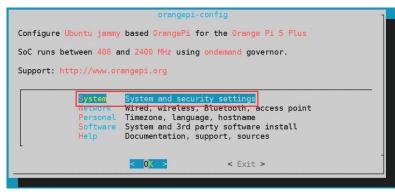
3) In Linux systems, the SPI in 40 pin is turned off by default and needs to be turned on manually to use it. Detailed steps are as follows:

🍈 range Pi User Manual

a. First run orangepi-config. Ordinary users remember to add sudo permissions

orangepi@orangepi:~\$ sudo orangepi-config

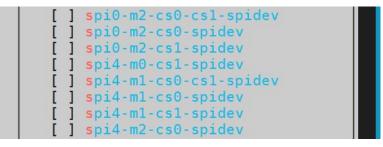
b. Then Select System



c. Then Select Hardware

| Bootenv | Edit boot environment |
|----------|--|
| CPU | Set CPU speed and governor |
| Avahi | Announce system in the network |
| Hardware | Toggle hardware configuration: UART, I2C, etc. |
| SSH | Reconfigure SSH daemon |
| Firmware | Run apt update & apt upgrade |
| ZSH | Install ZSH with plugins and tmux |
| Desktop | Disable desktop or change login type |
| | < OK > < Back > |

d. Then use the keyboard's arrow keys to locate the position shown in the picture below, and then use the **space** to select the SPI configuration you want to open



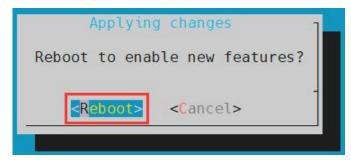
e. Then Select <**Save>** to save



f. Then select <Back>



g. Then select **<Reboot>** to restart the system to make the configuration take effect



4) After restarting, enter the system and check whether the device node of **spidevx.x** exists in the Linux system. If it exists, it means that the SPI has been set up and can be used directly

```
orangepi@orangepi:~$ ls /dev/spidev*
/dev/spidev0.0 /dev/spidev0.1 /dev/spidev4.0
```

The above is the result displayed after opening spi0-m2-cs0-cs1-spidev and spi4-m2-cs0-spidev

5) Without shorting the mosi and miso pins of SPI0 or SPI4, the output result of running spidev_test is as follows. You can see that the data of TX and RX are inconsistent

6) Then short-circuit the mosi and miso pins of SPI0 or SPI4 and then run spidev_test. The output is as follows. You can see that the data sent and received are the same.

orangepi@orangepi:~\$ sudo spidev_test -v -D /dev/spidev4.0

Or

orangepi@orangepi:~\$ sudo spidev_test -v -D /dev/spidev0.0

spi mode: 0x0

bits per word: 8

max speed: 500000 Hz (500 KHz)

3. 18. 4. **40pin I2C test**

1) As can be seen from the table below, the i2c available for Orange Pi 5 Pro is i2c1, i2c4, i2c5 and i2c8, a total of four groups of i2c buses

| 复用功能 | 复用功能 | 复用功能 | GPIO | GPI0序号 | 引脚序号 | 引脚序号 | GPI0序号 | GPIO | 复用功能 | 复用功能 | 复用功能 |
|-------------|------------------------|------------------------|----------|---------------|------|------|---------------|----------|-----------------------|--------------------|--------------|
| | | | 3.3₹ | | 1 | 2 | | 57 | | | |
| | UART4_RX_MO | I2C1_SDA_H4 | GPI01_D3 | 59 | 3 | 4 | | 57 | | | |
| | UART4_TX_NO | I2C1_SCL_II4 | GPI01_D2 | 58 | 5 | 6 | 1 | GND | | | |
| UART1_RX_M1 | I2C5_SDA_N3 | PWM13_M2 (febf0010) | GPI01_B7 | 47 | 7 | 8 | 13 | GPIO0_B5 | UART2_TX_NO | | |
| | | | GND | | 9 | 10 | 14 | GPIO0_B6 | UART2_RX_NO | | |
| | PWN14_N1 (febf0020) | CAN1_RX_H1 | GPIO4_B2 | 138 | 11 | 12 | 39 | GPI01_A7 | PWM3_IR_M3 (fd8b0030) | | |
| | PWM15_IR_M1 (febf0030) | CAN1_TX_H1 | GPIO4_B3 | 139 | 13 | 14 | | GND | | | |
| UART1_TX_M1 | 12C5_SCL_M3 | | GPI01_B6 | 46 | 15 | 16 | 33 | GPI01_A1 | UART6_TX_N1 | | SPI4_MOSI_M2 |
| | | | 3.37 | | 17 | 18 | 32 | GPI01_A0 | UART6_RX_N1 | | SPI4_MISO_M2 |
| | UART4_RX_M2 | SPI0_MOSI_M2 | GP101_B2 | 42 | 19 | 20 | | GND | | | |
| | | SPI0_HISO_M2 | GPI01_B1 | 41 | 21 | 22 | 40 | GPIO1_B0 | | | |
| | UART4_TX_N2 | SPI0_CLK_M2 | GPI01_B3 | 43 | 23 | 24 | 44 | GPI01_B4 | SPI0_CS0_M2 | UART7_RX_H2 | |
| | | | GND | | 25 | 26 | 45 | GPI01_B5 | SPI0_CS1_M2 | UART7_TX_H2 | |
| SPI4_CLK_M2 | PWN0_N2 (fd8b0000) | I2C4_SDA_H3 | GPI01_A2 | 34 | 27 | 28 | 35 | GPI01_A3 | 12C4_SCL_113 | PWM1_M2 (fd8b0010) | SPI4_CS0_M2 |
| | | | GPI01_A4 | 36 | 29 | 30 | | GND | | | |
| | | | GPI01_A6 | 38 | 31 | 32 | 62 | GPI01_D6 | PWH14_H2 (febf0020) | 12C8_SCL_112 | |
| | 12C8_SDA_112 | PWM15_IR_M3 (febf0030) | GPI01_D7 | 63 | 33 | 34 | | GND | | | |
| | | 12C5_SDA_112 | GPIO4_A7 | 135 | 35 | 36 | 131 | GPIO4_A3 | UARTO_TX_M2 | | |
| | UART3_RX_M2 | 12C5_SCL_112 | GPIO4_A6 | 134 | 37 | 38 | 132 | GPIO4_A4 | UARTO_RX_M2 | | |
| | | | GND | | 39 | 40 | 133 | GPIO4_A5 | | UART3_TX_H2 | |

2) The corresponding pins of the 4 sets of I2C buses in 40pin are as shown in the table below. I2C5_M2 and I2C5_M3 can only use one of them at the same time, not at the same time. They are the same I2C5, just connected to different pins. Please do not think that they are two different sets of I2C5 buses

| I2C bus | SDA correspond | SCL correspond | DtboCorresponding |
|---------|----------------|----------------|-------------------|
| | 40pin | 40pin | configuration |
| I2C1_M4 | Pin 3 | Pin 5 | i2c1-m4 |
| I2C4_M3 | Pin 27 | Pin 28 | i2c4-m3 |
| I2C5_M2 | Pin 35 | Pin 37 | i2c5-m2 |
| I2C5_M3 | Pin 7 | Pin 15 | i2c5-m3 |
| I2C8_M2 | Pin 33 | Pin 32 | i2c8-m2 |

3) In Linux systems, the I2C bus in 40 pin is closed by default and needs to be manually opened before it can be used. Detailed steps are as follows:

a. First run **orangepi-config**. Ordinary users remember to add **sudo** permissions orangepi@orangepi:~\$ **sudo orangepi-config**

b. Then Select System

| | orangepi-config | 1 |
|----------------------|--|---|
| Configure Ubuntu jan | my based OrangePi for the Orange Pi 5 Plus | |
| SoC runs between 408 | and 2400 MHz using ondemand governor. | |
| Support: http://www. | orangepi.org | |
| | | |
| System | System and security settings Wired, wireless, Bluetooth, access point | |
| Persona Softwar | l Timezone, language, hostname | |
| Help | Documentation, support, sources | |
| L | | _ |
| | < <mark>0K ></mark> < Exit > | |

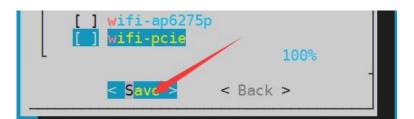
c. Then Selct Hardware

| Bootenv | Edit boot environment |
|----------|--|
| CPU | Set CPU speed and governor |
| Avahi | Announce system in the network |
| Hardware | Toggle hardware configuration: UART, I2C, etc. |
| SSH | Reconfigure SSH daemon |
| Firmware | Run apt update & apt upgrade |
| ZSH | Install ZSH with plugins and tmux |
| Desktop | Disable desktop or change login type |
| | < OK > < Back > |

d. Then use the keyboard's arrow keys to locate the position shown in the picture below, and then use the space to select the I2C configuration you want to open

| [] i2c1-m2 | |
|---------------------|--|
| [] i 2c1-m4 | |
| [] i2c2-m0 | |
| [] i2c2-m4 | |
| [] i2c3-m0 | |
| [] i2c4-m3 | |
| [] i2c5-m2 | |
| [] i2c5-m3 | |
| [] i2c6-m4 | |
| [] i 2c8-m2 | |

e. Then Select <Save> to save



f. Then Select <Back>



g. Then select **<Reboot>** to restart the system to make the configuration take effect

| Applyin | g changes |
|-------------------|-------------------|
| Reboot to ena | ble new features? |
| | |
| <reboot></reboot> | <cancel></cancel> |

4) After starting the Linux system, first confirm that there are device nodes that need to use I2C under /dev

orangepi@orangepi:~\$ ls /dev/i2c-*

5) Then connect an i2c device to the i2c pin of the 40pin connector

6) Then use the **i2cdetect -y** command. If the address of the connected i2c device can be detected, it means that i2c can be used normally

| orangepi@orangepi:~\$ sudo i2cdetect -y 1 | #i2c1 command |
|---|----------------|
| orangepi@orangepi:~\$ sudo i2cdetect -y 4 | #i2c4 commandc |
| orangepi@orangepi:~\$ sudo i2cdetect -y 5 | #i2c5 command |
| orangepi@orangepi:~\$ sudo i2cdetect -y 8 | #i2c8 command |

| | 0 | 1 | 2 | 3 | - 4 | 5 | б | 7 | 8 | 9 | a | b | С | d | e | f |
|-----|---|---|---|---|-----|---|---|---|-------------|---|---|-----|---|---|---|---|
| 00: | | | | | | | | | | | | | | | | |
| 10: | | | | | | | | | 12-12 | | | | | | | |
| 20: | | | | | | | | | | | | 7.7 | | | | |
| 30: | | | | | | | | | | | | | | | | |
| 40: | | | | | | | | | | | | | | | | |
| :0 | | | | |) | | | | <u> - 1</u> | | | | | | | |
| 50: | | | | | | | | | 68 | | | | | | | |
| 70: | | | | | | | | | | | | | | | | |

3. 18. 5. **40pin UART test**

1) As can be seen from the table below, the available uarts for Orange Pi 5 Pro are uart0, uart3, uart4, uart6 and uart7, a total of five groups of uart buses

| 复用功能 | 复用功能 | 复用功能 | GPIO | GPIO序号 | 引脚序号 | 引脚序号 | GPI0序号 | GPIO | 复用功能 | 复用功能 | 复用功能 |
|-------------|------------------------|------------------------|----------|---------------|------|------|---------------|----------|-----------------------|--------------------|--------------|
| | | | 3.37 | | 1 | 2 | | 57 | | | |
| | UART4_RX_NO | I2C1_SDA_H4 | GPI01_D3 | 59 | 3 | 4 | | 57 | | | |
| | UART4_TX_NO | I2C1_SCL_114 | GPI01_D2 | 58 | 5 | 6 | | GND | | | |
| UART1_RX_M1 | 12C5_SDA_M3 | PWH13_H2 (febf0010) | GPI01_B7 | 47 | 7 | 8 | 13 | GPIO0_B5 | UART2_TX_NO | | |
| | | | GND | | 9 | 10 | 14 | GPIO0_B6 | UART2_RX_NO | | |
| | PWM14_M1 (febf0020) | CAN1_RX_H1 | GPI04_B2 | 138 | 11 | 12 | 39 | GPIO1_A7 | PWM3_IR_M3 (fd8b0030) | | |
| | PWN15_IR_N1 (febf0030) | CAN1_TX_H1 | GPIO4_B3 | 139 | 13 | 14 | | GND | | | |
| UART1_TX_M1 | 12C5_SCL_N3 | | GPI01_B6 | 46 | 15 | 16 | 33 | GPI01_A1 | UART6_TX_H1 | | SPI4_MOSI_M2 |
| | | | 3.37 | | 17 | 18 | 32 | GPI01_A0 | UART6_RX_H1 | | SPI4_MISO_M2 |
| | UART4_RX_N2 | SPI0_MOSI_M2 | GPI01_B2 | 42 | 19 | 20 | | GND | | | |
| | | SPI0_MISO_M2 | GPI01_B1 | 41 | 21 | 22 | 40 | GPI01_B0 | | | |
| | UART4_TX_N2 | SPI0_CLK_H2 | GPI01_B3 | 43 | 23 | 24 | 44 | GPI01_B4 | SPI0_CS0_H2 | UART7_RX_H2 | |
| | | | GND | | 25 | 26 | 45 | GPI01_B5 | SPI0_CS1_H2 | UART7_TX_H2 | |
| SPI4_CLK_M2 | PWH0_M2 (fd8b0000) | 12C4_SDA_#3 | GPI01_A2 | 34 | 27 | 28 | 35 | GPI01_A3 | 12C4_SCL_H3 | PWM1_M2 (fd8b0010) | SPI4_CS0_M2 |
| | | | GPI01_A4 | 36 | 29 | 30 | 1 | GND | | | |
| | | | GPI01_A6 | 38 | 31 | 32 | 62 | GPI01_D6 | PWH14_H2 (febf0020) | 12C8_SCL_112 | |
| | 12C8_SDA_N2 | PWM15_IR_M3 (febf0030) | GPIO1_D7 | 63 | 33 | 34 | | GND | | | |
| | | 12C5_SDA_H2 | GPIO4_A7 | 135 | 35 | 36 | 131 | GPIO4_A3 | UARTO_TX_N2 | | |
| | UART3_RX_M2 | 12C5_SCL_112 | GPIO4_A6 | 134 | 37 | 38 | 132 | GPIO4_A4 | UARTO_RX_H2 | | |
| | | | GND | | 39 | 40 | 133 | GPIO4_A5 | | UART3_TX_N2 | |

2) The corresponding pins of the five sets of UART buses in 40pin are as shown in the table below. UART4_M0 and UART4_M2 can only use one of them at the same time, not at the same time. They are the same UART4, just connected to different pins. Please do not think that they are two different sets of UART4 buses

| UART Bus | RXcorrespond40pin | TX correspond40pin | dtbo Corresponding |
|----------|-------------------|--------------------|--------------------|
| | | | configuration |
| UART0_M2 | Pin 38 | Pin 36 | uart0-m2 |
| UART3_M2 | Pin 37 | Pin 40 | uart3-m2 |
| UART4_M0 | Pin 3 | Pin 5 | uart4-m0 |
| UART4_M2 | Pin 19 | Pin 23 | uart4-m2 |
| UART6_M1 | Pin 18 | Pin 16 | uart6-m1 |
| UART7_M2 | Pin 24 | Pin 26 | uart7-m2 |

3) In Linux systems, the UART in 40 pin is turned off by default and needs to be turned on manually before it can be used. Detailed steps are as follows:

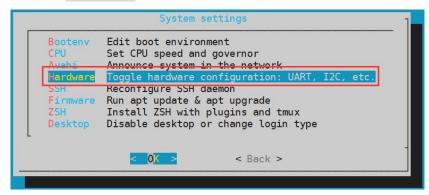
a. First run orangepi-config. Ordinary users remember to add sudo permissions

orangepi@orangepi:~\$ sudo orangepi-config

b. Then Select System



c. Then Select Hardware



d. Then use the keyboard's arrow keys to locate the position shown in the picture below, and then use the **space** to select the UART configuration you want to open

| | uart0-m2 |
|----|----------|
| | uart1-m1 |
| | uart2-m0 |
| [] | uart3-m0 |
| [] | uart3-m1 |
| [] | uart3-m2 |
| | uart4-m0 |
| [] | uart4-m2 |
| | uart6-m1 |
| | uart7-m2 |

e. Then Select <Save> to save



f. Then Select <Back>

| wifi-ap6275p wifi-pcie | 10% | |
|---------------------------|----------|--|
| < Save > | < Back > | |

g. Then select **<Reboot>** to restart the system to make the configuration take effect

| Applying changes | 1 |
|--|---|
| Reboot to enable new features? | |
| | - |
| <pre><reboot> <cancel></cancel></reboot></pre> | |
| | _ |

4) After entering the Linux system, first confirm whether there is a device node corresponding to uart under /dev

orangepi@orangepi:~\$ ls /dev/ttyS*

5) Then start testing the uart interface. First use Dupont wire to short-circuit the rx and tx of the uart interface to be tested

6) Use the **gpio serial** command to test the loopback function of the serial port as shown below. If you can see the following print, it means the serial port communication is normal (ttySX needs to be replaced with the node name corresponding to the uart, please do not copy it)

```
orangepi@orangepi:~$ sudo gpio serial /dev/ttySX
[sudo] password for orangepi: #Enter password here
Out: 0: -> 0
Out: 1: -> 1
```

| Out: | 2: | -> | 2 |
|------|----|----|-----|
| Out: | 3: | -> | 3 |
| Out: | 4: | -> | 4 |
| Out: | 5: | -> | 5^C |

3. 18. 6. How to test PWM using /sys/class/pwm

1) As can be seen from the table below, the available pwms for Orange Pi 5 Pro include pwm0, pwm1, pwm3, pwm13, pwm14 and pwm15, a total of six pwms

| 复用功能 | 复用功能 | 复用功能 | GPIO | GPI0序号 | 引脚序号 | 引脚序号 | GPI0序号 | GPIO | 复用功能 | 复用功能 | 复用功能 |
|-------------|------------------------|------------------------|----------|---------------|------|------|---------------|----------|-----------------------|--------------------|--------------|
| | | | 3.37 | | 1 | 2 | | 57 | | | |
| | UART4_RX_NO | I2C1_SDA_H4 | GPI01_D3 | 59 | 3 | 4 | | 57 | | | |
| | UART4_TX_MO | I 2C1_SCL_H4 | GPI01_D2 | 58 | 5 | 6 | | GND | | | |
| UART1_RX_M1 | 12C5_SDA_N3 | PWM13_M2 (febf0010) | GPI01_B7 | 47 | 7 | 8 | 13 | GPIO0_B5 | UART2_TX_NO | | |
| | | | GND | | 9 | 10 | 14 | GPIO0_B6 | UART2_RX_NO | | |
| | PWM14_M1 (febf0020) | CAN1_RX_H1 | GPIO4_B2 | 138 | 11 | 12 | 39 | GPIO1_A7 | PWM3_IR_M3 (fd8b0030) | | |
| | PWN15_IR_N1 (febf0030) | CAN1_TX_H1 | GPIO4_B3 | 139 | 13 | 14 | | GND | | | |
| UART1_TX_M1 | 12C5_SCL_H3 | | GPI01_B6 | 46 | 15 | 16 | 33 | GPI01_A1 | UART6_TX_H1 | | SPI4_MOSI_M2 |
| | | | 3.37 | | 17 | 18 | 32 | GPIO1_A0 | UART6_RX_M1 | | SPI4_MISO_M2 |
| | UART4_RX_M2 | SPI0_MOSI_M2 | GPI01_B2 | 42 | 19 | 20 | | GND | | | |
| | | SPI0_HISO_M2 | GPIO1_B1 | 41 | 21 | 22 | 40 | GPIO1_B0 | | | |
| | UART4_TX_N2 | SPI0_CLK_M2 | GPI01_B3 | 43 | 23 | 24 | 44 | GPI01_B4 | SPI0_CS0_112 | UART7_RX_H2 | |
| | | | GND | | 25 | 26 | 45 | GPI01_B5 | SPI0_CS1_12 | UART7_TX_M2 | |
| SPI4_CLK_M2 | PWN0_N2 (fd8b0000) | I2C4_SDA_H3 | GPI01_A2 | 34 | 27 | 28 | 35 | GPIO1_A3 | 12C4_SCL_#3 | PWM1_N2 (fd8b0010) | SPI4_CS0_M2 |
| | | | GPI01_A4 | 36 | 29 | 30 | | GND | | | |
| | | | GPI01_A6 | 38 | 31 | 32 | 62 | GPIO1_D6 | PWM14_M2 (febf0020) | 12C8_SCL_112 | |
| | 12C8_SDA_N2 | PWM15_IR_M3 (febf0030) | GPIO1_D7 | 63 | 33 | 34 | | GND | | | |
| | | 12C5_SDA_112 | GPIO4_A7 | 135 | 35 | 36 | 131 | GPIO4_A3 | UARTO_TX_M2 | | |
| | UART3_RX_M2 | 12C5_SCL_12 | GPIO4_A6 | 134 | 37 | 38 | 132 | GPIO4_A4 | UARTO_RX_H2 | | |
| | | | GND | | 39 | 40 | 133 | GPIO4_A5 | | UART3_TX_M2 | |

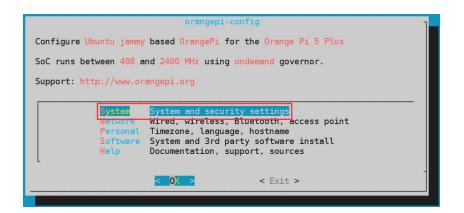
2) The corresponding pins of PWM in 40pin are as shown in the table below. PWM14_M1 and PWM14_M2, PWM15_M1 and PWM15_M3 can only use one of them at the same time, not at the same time. They are all the same PWM, just connected to different pins. Please do not think that they are two different PWM buses

| PWM Bus | correspond 40pin | DtboCorresponding |
|----------|------------------|-------------------|
| | | configuration |
| PWM0_M2 | Pin 27 | pwm0-m2 |
| PWM1_M2 | Pin 28 | pwm1-m2 |
| PWM3_M3 | Pin 12 | pwm3-m3 |
| PWM13_M2 | Pin 7 | pwm13-m2 |
| PWM14_M1 | Pin 11 | pwm14-m1 |
| PWM14_M2 | Pin 32 | pwm14-m2 |
| PWM15_M1 | Pin 13 | pwm15-m1 |
| PWM15_M3 | Pin 33 | pwm15-m3 |

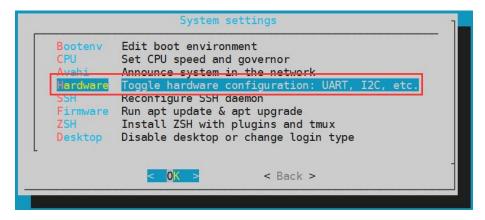
3) In Linux systems, the PWM in 40 pin is turned off by default and needs to be turned on manually to use it. Detailed steps are as follows:

a. First run **orangepi-config**. Ordinary users remember to add **sudo** permissions. orangepi@orangepi:~\$ **sudo orangepi-config**

b. Then Select System



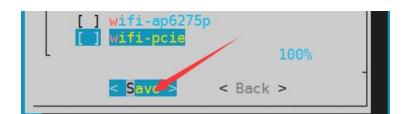
c. Then Select Hardware



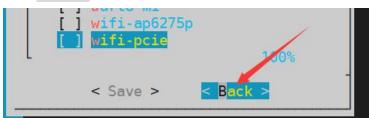
d. Then use the keyboard's arrow keys to locate the position shown in the picture below, and then use the **space** to select the configuration of the PWM you want to open

| | pwm0-m0 | |
|------|----------|--|
| | pwm0-m1 | |
| | pwm0-m2 | |
| | pwm10-m0 | |
| | pwm11-m0 | |
| | pwm12-m0 | |
| | pwm13-m0 | |
| | pwm13-m2 | |
| l [] | pwm14-m0 | |
| | pwm14-m1 | |
| | pwm14-m2 | |
| | pwm15-m1 | |
| | pwm15-m2 | |
| | pwm15-m3 | |
| | pwm1-m0 | |
| | pwm1-m1 | |
| | pwm1-m2 | |
| | pwm3-m0 | |
| | pwm3-m2 | |
| | pwm3-m3 | |

e. Then Select <Save> to save



f. Then Select <Back>



g. Then select **<Reboot>** to restart the system to make the configuration take effect

| Applying changes | 1 |
|--|---|
| Reboot to enable new features? | |
| <pre><reboot> <cancel></cancel></reboot></pre> | - |

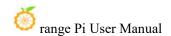
4) When a pwm is opened, there will be an additional pwmchipX (X is a specific number) in /sys/class/pwm/. For example, after opening pwm13, the pwmchipX under /sys/class/pwm/ will be Two became three

orangepi@orangepi:~\$ ls /sys/class/pwm/ pwmchip0 pwmchip1 pwmchip2

5) Which pwmchip above corresponds to pwm13? Let's first check the output of the **ls** /sys/class/pwm/-l command, as shown below:



6) From the following table, we can see that the base address of the pwm13 register is febf0010. Looking at the output of the **ls /sys/class/pwm/ -l** command, we can see that pwmchip2 is linked to febf0010.pwm, so the corresponding pwmchip of pwm13 is pwmchip2



| 复用功能 | 复用功能 | 复用功能 | 复用功能 | GPIO | GPIO序号 | 引脚序号 |
|---------------|-------------|------------------------|------------------------|----------|---------------|------|
| | | | | 3.37 | | 1 |
| | | UART4_RX_MO | I2C1_SDA_M4 | GPIO1_D3 | 59 | 3 |
| | | UART4_TX_MO | T2C1 SCL M4 | GPI01_D2 | 58 | 5 |
| | UART1_RX_M1 | I2C5_SDA_M3 | PWM13_M2 (febf0010) | GPIO1_B7 | 47 | 7 |
| | | | | GND | | 9 |
| I2C7_SCL_M3 | | PWM14_M1 (febf0020) | CAN1_RX_M1 | GPIO4_B2 | 138 | 11 |
| I2C7_SDA_M3 | | PWM15_IR_M1 (febf0030) | CAN1_TX_M1 | GPIO4_B3 | 139 | 13 |
| | UART1_TX_M1 | I2C5_SCL_M3 | | GPI01_B6 | 46 | 15 |
| | | | | 3.3V | | 17 |
| | | UART4_RX_M2 | SPIO_MOSI_M2 | GPI01_B2 | 42 | 19 |
| | | | SPIO_MISO_M2 | GPI01_B1 | 41 | 21 |
| | | UART4_TX_M2 | SPIO_CLK_M2 | GPI01_B3 | 43 | 23 |
| | | | | GND | | 25 |
| UART6_RTSN_M1 | SPI4_CLK_M2 | PWN0_M2 (fd8b0000) | I2C4_SDA_M3 | GPI01_A2 | 34 | 27 |
| | | | | GPI01_A4 | 36 | 29 |
| | | | | GPI01_A6 | 38 | 31 |
| UART1_CTSN_M1 | | I2C8_SDA_M2 | PWM15_IR_M3 (febf0030) | GPI01_D7 | 63 | 33 |
| SPI2_CS0_M1 | | | I2C5_SDA_M2 | GPIO4_A7 | 135 | 35 |
| SPI2_CLK_M1 | | UART3_RX_M2 | 12C5_SCL_M2 | GPIO4_A6 | 134 | 37 |
| | | | | GND | | 39 |

7) Then use the following command to make pwm13 output a 50Hz square wave (please switch to the root user first, and then execute the following command)

root@orangepi:~# echo 0 > /sys/class/pwm/pwmchip2/export root@orangepi:~# echo 20000000 > /sys/class/pwm/pwmchip2/pwm0/period root@orangepi:~# echo 1000000 > /sys/class/pwm/pwmchip2/pwm0/duty_cycle root@orangepi:~# echo 1 > /sys/class/pwm/pwmchip2/pwm0/enable



8) The test method of pwm13 demonstrated above is similar to other pwm test methods.

3. 18. 7. CAN test method

3. 18. 7. 1. How to open CAN

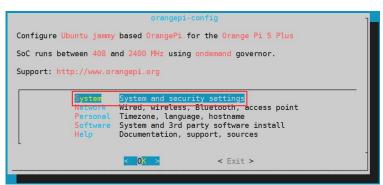
1) As can be seen from the table below, the CAN bus available for Orange Pi 5 Pro is CAN1

| 复用功能 | 复用功能 | 复用功能 | GPIO | GPIO序号 | 引脚序号 | 引脚序号 | GPIO序号 | GPIO | 复用功能 | 复用功能 | 复用功能 |
|-------------|------------------------|------------------------|----------|---------------|------|------|--------|----------|-----------------------|--------------------|--------------|
| | | | 3.37 | | 1 | 2 | | 57 | | | |
| | UART4_RX_NO | I2C1_SDA_H4 | GPI01_D3 | 59 | 3 | 4 | | 57 | | | |
| | UART4_TX_NO | I2C1_SCL_II4 | GPI01_D2 | 58 | 5 | 6 | l i i | GND | | | |
| UART1_RX_M1 | I2C5_SDA_N3 | PWM13_M2 (febf0010) | GPIO1_B7 | 47 | 7 | 8 | 13 | GP100_B5 | UART2_TX_NO | | |
| | | | GND | | 9 | 10 | 14 | CPIO0_B6 | UART2_RX_NO | | |
| | PWM14_M1 (febf0020) | CAN1_RX_H1 | GPIO4_B2 | 138 | 11 | 12 | 39 | GPIO1_A7 | PWM3_IR_M3 (fd8b0030) | | |
| | PWM15_IR_M1 (febf0030) | CAN1_TX_H1 | GPIO4_B3 | 139 | 13 | 14 | | GND | | | |
| UART1_TX_M1 | 12C5_SCL_M3 | | GPI01_B6 | 46 | 15 | 16 | 33 | GPI01_A1 | UART6_TX_H1 | | SPI4_MOSI_M2 |
| | | | 3.37 | | 17 | 18 | 32 | GPIO1_A0 | UART6_RX_M1 | | SPI4_MISO_M2 |
| | UART4_RX_M2 | SPI0_MOSI_M2 | GPI01_B2 | 42 | 19 | 20 | | GND | | | |
| | | SPI0_HISO_M2 | GPIO1_B1 | 41 | 21 | 22 | 40 | GPI01_B0 | | | |
| | UART4_TX_N2 | SPI0_CLK_M2 | GPI01_B3 | 43 | 23 | 24 | 44 | GPI01_B4 | SPI0_CS0_112 | UART7_RX_H2 | |
| | | | GND | | 25 | 26 | 45 | GPI01_B5 | SPI0_CS1_12 | UART7_TX_H2 | |
| SPI4_CLK_M2 | PWN0_M2 (fd8b0000) | I2C4_SDA_H3 | GPI01_A2 | 34 | 27 | 28 | 35 | CPIO1_A3 | 12C4_SCL_#3 | PWM1_M2 (fd8b0010) | SPI4_CS0_M2 |
| | | | GPI01_A4 | 36 | 29 | 30 | | GND | | | |
| | | | GPI01_A6 | 38 | 31 | 32 | 62 | GPI01_D6 | PWM14_M2 (febf0020) | 12C8_SCL_112 | |
| | 12C8_SDA_112 | PWM15_IR_M3 (febf0030) | GPIO1_D7 | 63 | 33 | 34 | | GND | | | |
| | | 12C5_SDA_112 | GPIO4_A7 | 135 | 35 | 36 | 131 | GPIO4_A3 | UARTO_TX_M2 | | |
| | UART3_RX_M2 | 12C5_SCL_12 | GPIO4_A6 | 134 | 37 | 38 | 132 | GPIO4_A4 | UARTO_RX_H2 | | |
| | | | GND | | 39 | 40 | 133 | GPIO4_A5 | | UART3_TX_H2 | |

2) In the Linux system, the CAN in 40 pin is closed by default and needs to be manually opened before it can be used. Detailed steps are as follows:

a. First run **orangepi-config**. Ordinary users remember to add **sudo** permissions.

- orangepi@orangepi:~\$ sudo orangepi-config
 - b. Then Select System



c. Then Select Hardware

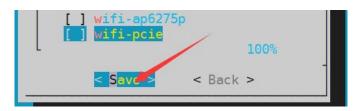
| Bootenv | Edit boot environment |
|----------|--|
| CPU | Set CPU speed and governor |
| Avahi | Announce system in the network |
| Hardware | Toggle hardware configuration: UART, I2C, etc. |
| SSH | Reconfigure SSH daemon |
| Firmware | Run apt update & apt upgrade |
| ZSH | Install ZSH with plugins and tmux |
| Desktop | Disable desktop or change login type |
| | < OK > < Back > |

d. Then use the keyboard's arrow keys to locate the position shown in the picture

below, and then use the space to select the configuration of CAN1



e. Then select **<Save>** to save



f. Then select **<Back>**

| | fi-ap6275p fi-pcie | 100% | |
|---|-----------------------|----------|--|
| < | Save > | < Back > | |

g. Then select **<Reboot>** to restart the system to make the configuration take effect.

| Applying changes | 1 |
|-------------------------------------|----|
| Reboot to enable new feature | s? |
| <reboot> <cancel></cancel></reboot> | - |
| <reboot> <cancet></cancet></reboot> | |

3) After entering the Linux system, use the **sudo ifconfig -a** command. If you can see the CAN device, it means that CAN has been opened correctly.

4) The corresponding pin of CAN1 is

| | CAN1 |
|--------|-------------------|
| TX Pin | Correspond Pin 13 |
| RX Pin | Correspond Pin 11 |

3. 18. 7. 2. Use CANalyst-II analyzer to test sending and receiving messages

1) The CANalyst-II analyzer used in the test is shown in the figure below



2) CANalyst-II analyzer data download link https://www.zhcxgd.com/3.html

3) First, install the USBCANToolSetup software



4) The shortcut after installation of USBCANToolSetup is



5) You also need to install the USB driver



6) The USB interface of the CANalyst-II analyzer needs to be connected to the USB interface of the computer



7) To test the CAN function, you also need to prepare a CAN transceiver as shown in the figure below. The main function of the CAN transceiver is to convert the TTL signal of the CAN controller into the differential signal of the CAN bus

- a. The 3.3V pin of the CAN transceiver needs to be connected to the 3.3V pin in the 40pin development board
- b. The GND pin of the CAN transceiver needs to be connected to the GND pin in the 40pin development board
- c. The GND pin of the CAN transceiver needs to be connected to the GND pin in

the 40pin development board

- d. The CAN RX pin of the CAN transceiver needs to be connected to the RX pin of the CAN bus in the 40pin development board
- e. The CANH pin of the CAN transceiver needs to be connected to the H interface of the analyzer
- f. The CANL pin of the CAN transceiver needs to be connected to the L interface of the analyzer



8) Then you can open the USB-CAN software

| USB-CAN Tool V9. | 02 - 创芯科技 | | | | 9 <u></u> | |
|---|---|-----------------|--------------------|-----------------|-----------|--------|
| 设备型号(D) 设备操作(| O) 参数设定(S) 信息(I) | 显示(V) 帮助(H) 语 | 言(し) | | | |
| CAN发送 帧格式:标准帧 V 数据:00 00 00 00 00 | | 00 00 00 01 CAN | 通道: 1 🗸 | 发送总帧数: 发送周期: | 1 | □ ID递增 |
| CAN中继状态 | 8 66 65 66 反反用题 接收滤波ID设置(直接II | 0号) | 保存总帧数: 0 | · 文区 冲舟1 · | 停止发送 | 发送文件 |
| Unused | ○使能 ◎关闭 ○1 02 | 设置 | ☑打开CAN接 | 枚 [| 清空 | |
| 统计数据:通道1 帧率R: 0 | 帧率T : 0 校验错 | 吴: 0 | 统计数据:通道2 帧率R: 0 | 帧 率 T: 0 | 校验错误 | ŧ: 0 |
| 序号 系统时间 | 时间标识 CAN通道 代 | 输方向 ID号 | 帧类型 帧格式 | 长度数据 | | ^ |
| | | | | | | |

9) Then click Start Device

| and the second state of the | Tool V9.02 - | | | | |
|-----------------------------|--------------------------------|---------------------------------------|---------------|---------|--------|
| | 设备操作(C) 参数设定(S) | 信息(L) 显示(V) 帮助(L) 语 | 狺(L) | | |
| CAN发送 | 启动设备(<u>S</u>) 关闭设备(T) | | | [] | |
| 帧格式:标准 | | • • • • • • • • • • • • • • • • • • • | 通道: 1 🚽 发送总帧数 | 1 | □ID递增 |
| 数据: 00 (| 寄存器信息(<u>R</u>) | 消息 | 发送周期 | : 10 ms | 🗌 数据递增 |
| CAN中继状系 | 波特率侦测(B) 中继模式选项(<u>O</u>) | <u>}置(直接</u> ID号) | 保存总帧数:0 | 停止发送 | 发送文件 |
| Ur | USBCAN测试工具① | 01 02 设置 | ☑打开CAN接收 | 清空 | □实时存储 |
| 统计数据:) | 甬道1 | | · 统计数据:通道2 | | |
| 帧 室 R: 0 | 帧率T: 0 | 校验错误: 0 | 帧率R: 0 帧率T: 0 | | 2 · n |

10) Then click OK

Č

| - 11 11 11 11 11 11 11 11 11 11 11 11 11 | | 据:通道2 × |
|--|----------------------------|-----------------|
| x [[]]] 117103 | DIXH | ^ |
| 设备名称: | 设备索引号0:序列号: 01701020B87, 固 | 件版本号: V3.24 🗸 🗸 |
| | 确定 | 取消 |

11) Set the baud rate to 1000k bps

| 设备索引号 | 0 ~ | 选择CAX通道号:通道1 🗸 |
|--------|-------------|---------------------|
| CAN参数 | | |
| 波特率: | 1000k bps 🗸 | BTRO/1: 00 14 (HEX) |
| 过濾验收码: | 0x80000000 | 滤波方式:接收所有类型 🗸 |
| 过滤屏蔽码: | OxFFFFFFFF | 滤波器配置工具 |
| | 正常工作 | ~ |

12) After successful opening, the USB-CAN software will display the serial number and other information

| 🥯 range Pi User Manual | Copyright reserved by Shenzhen Xu | nlong Software Co., Ltd |
|--|-------------------------------------|--------------------------------|
| USB-CAN Tool V9.02 - CANalyst-II - SN:序列号: 017 设备型号(D) 设备操作(O) 参数设定(S) 信息(I) 显示(CAN发送 | A | - 🗆 X |
| wh格式:标准帧 ✓ 帧类型:数据帧 ✓ 帧ID: 00 0 数据: 00 00 00 00 00 00 00 00 反送消息 | 00 00 01 CAN通道: 1 🗸 发送总帧数: 发送周期: | 1 □ ID递增 10 ms □ 数据递增 |
| CAN中维状态 接收滤波ID设置(直接ID号) Unused ○ 使能 ● 关闭 01 02 | 保存总帧数: 0 设置 ☑ 打开CAN接收 | 停止发送 发送文件 清 空 □ 实时存储 |
| 统计数据:通道1 帧室R: 0 帧室T: 0 校验错误: 0 | 统计数据:通道2 帧率R: 0 帧率T: 0 | 校验错误: 0 |
| 序号 系统时间 时间标识 CAD通道 传输方 | i向 ID号 帧类型 帧格式 长度 数据 | ^ |

13) Development board receives CAN message test

20

a. First set the baud rate of the CAN bus to **1000kbps** in the Linux system of the development board

orangepi@orangepi:~\$ sudo ip link set can0 down

orangepi@orangepi:~\$ sudo ip link set can0 type can bitrate 1000000

orangepi@orangepi:~\$ sudo ip link set can0 up

b. Then run the candump can0 command to prepare to receive messages

| c. Then s | end a message to the devel | lopment board in the U | JSB-CAN software |
|--------------------|------------------------------------|------------------------------|------------------|
| 🕷 USB-CAN Tool V9. | | - 87, 固件版本号: V3.24 - 创芯科技 | - 🗆 X |
| 备型号(D) 设备操作(| O) 参数设定(S) 信息(I) 显示(V) 帮助(| <u>H) 语言(L)</u> | |
| 帧格式:标准帧 🗸 | 帧类型: 数据帧 🗸 帧ID: 00 00 00 01 | CAN诵道: 1 🗸 发送点 | .帧数: 1 □ ID递增 |
| 数据: 01 02 03 04 0 | | | ⑤ ms □ 数据递增 |
| CAN中继状态 | 5 06 07 08 发送消息 接收滤波ID设置(直接ID号) | 发记 保存总帧数: 0 | |
| | 5 06 07 08 发送消息 接收滤波ID设置(直接ID号) | 发送 | 5周期:10 ms □数据递增 |

d. If the development board can receive messages sent by the analyzer, it means that the CAN bus can be used normally

| orangepi@ | orangep | pi5pro | :~\$ sudo candump can0 | |
|-----------|---------|--------|-------------------------|--|
| can0 | 001 | [8] | 01 02 03 04 05 06 07 08 | |

14) Development board sends CAN message test

a. First set the CAN baud rate to 1000kbps in the Linux system

orangepi@orangepi:~\$ sudo ip link set can0 down

```
orangepi@orangepi:~$ sudo ip link set can0 type can bitrate 1000000
```

orangepi@orangepi:~\$ sudo ip link set can0 up

b. Execute the **cansend** command in the development board to send a message

orangepi@orangepi:~\$ sudo cansend can0 123#1122334455667788

c. If the USB-CAN software can receive the message from the development board, the communication is successful

| 设备型号(CAN发 帧格式: | — 标准帧 🔽 🖣 | 2) 参数设定(前类型: 数据帧 | S) 信息(I) () 帧I | | 帮助(日) | 固件版本号: 语言(L) CAN通道: 1 | V3.24 - | 发 | 送总帧数 | | | × 递增 |
|-----------------------|----------------------|----------------------|--------------------------|-----------------------|--------|-----------------------------|-----------------------------------|------------|---------------|-------------------------|----|------------------|
| CAN中组 | Unused 据:通道1 | | 发送消息 支ID设置(直 01 02 | 接ID号) 错误: 0 | 设置 | | 急帧数: 0]打开CAN打 st: 通道2 0 | 多 收 | 发送周期 IT: 0 | 停止发送 清空 | 发送 | 据递增 文件 时存储 |
| 序号 ● 00000 | 系統时间 19:27:04.048 | 时间标识 OxE3BC2F | CAX通道 oh1 | 传输方向 接收 the in | 0x0123 | 帧类型 数据帧 ON Sen | 帧格式 标准帧 t by th | / | x 11 2: | 2 33 44 55 0 oment b | | |
| < | | | | | | | | | | | | ~ |

3. 19. How to install and use wiringOP-Python

wiringOP-Python is the Python language version of wiringOP library, which is used to operate the development board's GPIO, I2C, SPI, UART and other hardware resources in the Python program Also please note that all the following commands are operated under the root user

3. 19. 1. How to install wiringOP-Python

1) First install dependency packages

root@orangepi:~# sudo apt-get update

root@orangepi:~# sudo apt-get -y install git swig python3-dev python3-setuptools

2) Then use the following command to download the source code of wiringOP-Python

Note that the **git clone --recursive** command below will automatically download the source code of wiringOP, because wiringOP-Python depends on wiringOP. Please make sure that there are no errors during the download process due to network problems

If there is a problem downloading the code from GitHub, you can directly use the wiringOP-Python source code that comes with the Linux image. The storage location is: /usr/src/wiringOP-Python.

root@orangepi:~# git clone --recursive https://github.com/orangepi-xunlong/wiringOP-Python -b next

root@orangepi:~# cd wiringOP-Python

root@orangepi:~/wiringOP-Python# git submodule update --init --remote

3) Then use the following command to compile wiringOP-Python and install it into the Linux system of the development board

root@orangepi:~# cd wiringOP-Python

root@orangepi:~/wiringOP-Python# **python3 generate-bindings.py > bindings.i** root@orangepi:~/wiringOP-Python# **sudo python3 setup.py install**

4) Then enter the following command. If helpful information is output, wiring OP-Python is successfully installed. Press the \mathbf{q} key to exit the help information interface.

root@orangepi:~/wiringOP-Python# **python3 -c "import wiringpi; help(wiringpi)"** Help on module wiringpi:

NAME

wiringpi

DESCRIPTION

This file was automatically generated by SWIG (http://www.swig.org).

Version 4.0.2

#

Do not make changes to this file unless you know what you are doing--modify# the SWIG interface file instead.

5) The steps to test whether wiringOP-Python is installed successfully under the python command line are as follows:

a. First use the python3 command to enter the command line mode of python3 root@orangepi:~# python3

b. Then import the python module of wiringpi

>>> import wiringpi;

c. Finally, enter the following command to view the help information of wiringOP-Python. Press the q key to exit the help information interface

>>> help(wiringpi)

Help on module wiringpi:

NAME

wiringpi

DESCRIPTION

This file was automatically generated by SWIG (http://www.swig.org).

Version 4.0.2

#

Do not make changes to this file unless you know what you are doing--modify # the SWIG interface file instead.

CLASSES

builtins.object GPIO I2C Serial nes class GPIO(builtins.object) | GPIO(pinmode=0)

```
I
```

>>>

3. 19. 2. **40pin GPIO port test**

Like wiringOP, wiringOP-Python can also determine which GPIO pin to operate by specifying the wPi number. Because there is no command to view the wPi number in wiringOP-Python, you can only view the board's wPi number and physical properties through the gpio command in wiringOP. Correspondence of pins

| GPIO | wPi | Name | Mode | V | Phys | ical | V | Mode | Name | wPi | GPIO |
|------|--|----------|------|---|------|------|---|-------|----------|-----|------|
| | | 3.3V | | 1 | 1 | 2 | | | 5V | | |
| 59 | 0 | SDA.1 | IN | 1 | 3 | 4 | | | 5V | | |
| 58 | 1 | SCL.1 | IN | 1 | 5 | 6 | 1 | 1 | GND | 1 | 1 |
| 47 | 2 | PWM13 | IN | 1 | 7 | 8 | 1 | ALT10 | TXD.2 | 3 | 13 |
| | | GND | | | 9 | 10 | 1 | ALT10 | RXD.2 | 4 | 14 |
| 138 | 5 | CAN1_RX | IN | 1 | 11 | 12 | 1 | IN | GPI01_A7 | 6 | 39 |
| 139 | 7 | CAN1_TX | IN | 1 | 13 | 14 | 1 | | GND | | |
| 46 | 8 | GPI01_B6 | IN | 1 | 15 | 16 | 0 | IN | TXD.6 | 9 | 33 |
| | | 3.3V | | | 17 | 18 | 0 | IN | RXD.6 | 10 | 32 |
| 42 | 11 | SPI0_TXD | IN | 0 | 19 | 20 | | | GND | | |
| 41 | 12 | SPI0_RXD | IN | 0 | 21 | 22 | 1 | IN | GPI01_B0 | 13 | 40 |
| 43 | 14 | SPI0_CLK | IN | 0 | 23 | 24 | 1 | IN | SPI0_CS0 | 15 | 44 |
| | | GND | | | 25 | 26 | 1 | IN | SPI0_CS1 | 16 | 45 |
| 34 | 17 | SDA.4 | IN | 0 | 27 | 28 | 0 | IN | SCL.4 | 18 | 35 |
| 36 | 19 | GPI01_A4 | IN | 0 | 29 | 30 | | | GND | | |
| 38 | 20 | GPI01_A6 | IN | 0 | 31 | 32 | 1 | IN | PWM14 | 21 | 62 |
| 63 | 22 | PWM15 | IN | 1 | 33 | 34 | | | GND | | |
| 135 | 23 | GPIO4_A7 | IN | 0 | 35 | 36 | 0 | IN | TXD.0 | 24 | 131 |
| 134 | 25 | GPI04_A6 | IN | 0 | 37 | 38 | 0 | IN | RXD.0 | 26 | 132 |
| | an a | GND | | | 39 | 40 | 0 | IN | GPIO4_A5 | 27 | 133 |
| GPIO | wPi | Name | Mode | V | Phys | ical | V | Mode | Name | WPi | GPIC |

1) The following uses pin No. 7 - the corresponding GPIO is GPIO1_C6 - the corresponding wPi serial number is 2 - as an example to demonstrate how to set the high and low levels of the GPIO port.

| GPIO | wPi | Name | Mode | I V | F | hysical | | | Mode | | wPi | GPI0 |
|------|------|---------|------|-----|-----|---------|-----|-----|-------|----------|-----|------|
| | | 3.3V | | 1 | 1 | 1 2 | 1 | | | 5V | | |
| 59 | 0 | SDA.1 | IN | 1 | 1 | 3 4 | 1 | Í | | 5V | 1 | į . |
| 58 | 1 | SCL.1 | IN | 1 1 | | 5 6 | 1 | Ì | | GND | Í. | |
| 47 | 2 | PWM13 | IN | 1 | 1 | 7 8 | 1 1 | ιİ | ALT10 | TXD.2 | 3 | 13 |
| | 1 | GND | | | 1 | 9 10 | 1 1 | L İ | ALT10 | RXD.2 | 4 | 14 |
| 138 | 5 | CAN1 RX | IN | 1 | 1 1 | 1 1 12 | 11 | ιİ | IN | GPI01 A7 | 6 | 39 |
| 139 | 7 | CAN1 TX | IN | 1 | 1 1 | 3 1 14 | | Ĩ. | | | | |

- 2) The steps for testing directly with commands are as follows:
 - a. First set the GPIO port to output mode, where the first parameter of the **pinMode** function is the serial number of the wPi corresponding to the pin, and the second parameter is the GPIO mode.

root@orangepi:~/wiringOP-Python# python3 -c "import wiringpi; \ from wiringpi import GPIO; wiringpi.wiringPiSetup(); \ wiringpi.pinMode(2, GPIO.OUTPUT); "

b. Then set the GPIO port to output a low level. After setting, you can use a multimeter to measure the voltage value of the pin. If it is 0v, it means the low level is set successfully

root@orangepi:~/wiringOP-Python# **python3 -c "import wiringpi**; \

from wiringpi import GPIO; wiringpi.wiringPiSetup() ;\

wiringpi.digitalWrite(2, GPIO.LOW)"

c. Then set the GPIO port to output a high level. After setting, you can use a multimeter to measure the voltage value of the pin. If it is 3.3v, it means the setting of the high level is successful

root@orangepi:~/wiringOP-Python# python3 -c "import wiringpi; \ from wiringpi import GPIO; wiringpi.wiringPiSetup() ;\ wiringpi.digitalWrite(2, GPIO.HIGH)"

- 3) The steps for testing in the command line of python3 are as follows:
 - a. First use the python3 command to enter the command line mode of python3

root@orangepi:~# python3

b. Then import the python module of wiringpi

>>> import wiringpi

>>> from wiringpi import GPIO

c. Then set the GPIO port to output mode, where the first parameter of the **pinMode** function is the serial number of the wPi corresponding to the pin, and the second parameter is the GPIO mode

```
>>> wiringpi.wiringPiSetup()
```

0

>>> wiringpi.pinMode(2, GPIO.OUTPUT)

d. Then set the GPIO port to output a low level. After setting, you can use a multimeter to measure the voltage value of the pin. If it is 0v, it means the low

level is set successfully

>>> wiringpi.digitalWrite(2, GPIO.LOW)

e. Then set the GPIO port to output a high level. After setting, you can use a multimeter to measure the voltage value of the pin. If it is 3.3v, it means the setting of the high level is successful

>>> wiringpi.digitalWrite(2, GPIO.HIGH)

4) For the method of wiringOP-Python to set the GPIO high and low levels in the python code, you can refer to the **blink.py** test program in the examples. The **blink.py** test program will set the voltage of all GPIO ports in the 26 pin of the development board to continuously change high and low

root@orangepi:~/wiringOP-Python# cd examples

root@orangepi:~/wiringOP-Python/examples# ls blink.py

blink.py

root@orangepi:~/wiringOP-Python/examples# python3 blink.py

3. 19. 3. **40pin SPI test**

1) As can be seen from the picture below, the spi available for Orange Pi 5 Pro is spi0 and spi4

| 复用功能 | 复用功能 | 复用功能 | GPIO | GPIO序号 | 引脚序号 | 引脚序号 | GPIO序号 | GPIO | 复用功能 | 复用功能 | 复用功能 |
|-------------|------------------------|------------------------|----------|---------------|------|------|---------------|----------|-----------------------|--------------------|--------------|
| | | | 3.3₹ | | 1 | 2 | | 57 | | | |
| | UART4_RX_MO | I2C1_SDA_H4 | GPI01_D3 | 59 | 3 | 4 | | 57 | | | |
| | UART4_TX_NO | I2C1_SCL_H4 | GPI01_D2 | 58 | 5 | 6 | | GND | | | |
| UART1_RX_M1 | 12C5_SDA_#3 | PWM13_M2 (febf0010) | GPI01_B7 | 47 | 7 | 8 | 13 | GPIO0_B5 | UART2_TX_NO | | |
| | | | GND | | 9 | 10 | 14 | GPIO0_B6 | UART2_RX_NO | | |
| | PWN14_M1 (febf0020) | CAN1_RX_H1 | GPI04_B2 | 138 | 11 | 12 | 39 | GPIO1_A7 | PWM3_IR_M3 (fd8b0030) | | |
| | PWM15_IR_M1 (febf0030) | CAN1_TX_H1 | GPIO4_B3 | 139 | 13 | 14 | | GND | | | |
| UART1_TX_M1 | 12C5_SCL_#3 | | GPI01_B6 | 46 | 15 | 16 | 33 | GPI01_A1 | UART6_TX_N1 | | SPI4_MOSI_M2 |
| | | | 3.37 | | 17 | 18 | 32 | GPI01_A0 | UART6_RX_H1 | | SPI4_MISO_M2 |
| | UART4_RX_M2 | SPI0_MOSI_M2 | GPI01_B2 | 42 | 19 | 20 | | GND | | | |
| | | SPI0_MISO_M2 | GPI01_B1 | 41 | 21 | 22 | 40 | GPI01_B0 | | | |
| | UART4_TX_N2 | SPI0_CLK_H2 | GPI01_B3 | 43 | 23 | 24 | 44 | GPI01_B4 | SPI0_CS0_H2 | UART7_RX_H2 | |
| | | | GND | | 25 | 26 | 45 | GPI01_B5 | SPI0_CS1_H2 | UART7_TX_H2 | |
| SPI4_CLK_M2 | PWH0_M2 (fd8b0000) | 12C4_SDA_H3 | GPI01_A2 | 34 | 27 | 28 | 35 | GPI01_A3 | 12C4_SCL_113 | PWM1_M2 (fd8b0010) | SPI4_CS0_M2 |
| | | | GPI01_A4 | 36 | 29 | 30 | | GND | | | |
| | | | GPI01_A6 | 38 | 31 | 32 | 62 | GPI01_D6 | PWH14_H2 (febf0020) | 12C8_SCL_112 | |
| | 12C8_SDA_112 | PWM15_IR_M3 (febf0030) | GPI01_D7 | 63 | 33 | 34 | | GND | | | |
| | | 12C5_SDA_H2 | GPIO4_A7 | 135 | 35 | 36 | 131 | GPIO4_A3 | UARTO_TX_N2 | | |
| | UART3_RX_M2 | 12C5_SCL_12 | GPIO4_A6 | 134 | 37 | 38 | 132 | GPIO4_A4 | UARTO_RX_H2 | | |
| | | | GND | 1 | 39 | 40 | 133 | GPIO4_A5 | | UART3_TX_H2 | |

2) The corresponding pins of SPI0 and SPI4 in 40pin are as shown in the table below

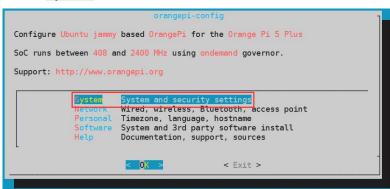
| | SPI0_M2 correspond 40pin | SPI4_M2 correspond 40pin |
|---------|--------------------------|--------------------------|
| MOSI | Pin 19 | Pin 16 |
| MISO | Pin 21 | Pin 18 |
| CLK | Pin 23 | Pin 27 |
| CS0 | Pin 24 | Pin 28 |
| CS1 | Pin 26 | None |
| dtbo 配置 | spi0-m2-cs0-spidev | spi4-m2-cs0-spidev |
| | spi0-m2-cs1-spidev | |
| | spi0-m2-cs0-cs1-spidev | |

3) In Linux systems, the SPI in 40 pin is closed by default and needs to be manually opened before it can be used. Detailed steps are as follows:

a. First run orangepi-config. Ordinary users remember to add sudo permissions

orangepi@orangepi:~\$ sudo orangepi-config

b. Then Select System



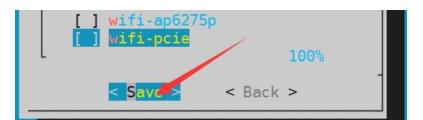
c. Then Select Hardware

| Bootenv | Edit boot environment |
|----------|--|
| CPU | Set CPU speed and governor |
| Avebi | Announce system in the network |
| Hardware | Toggle hardware configuration: UART, I2C, etc. |
| SSH | Reconfigure SSH daemon |
| Firmware | Run apt update & apt upgrade |
| ZSH | Install ZSH with plugins and tmux |
| Desktop | Disable desktop or change login type |
| | < OK > < Back > |

d. Then use the keyboard's arrow keys to locate the position shown in the picture below, and then use the space to select the SPI configuration you want to open.

```
[] spi0-m2-cs0-cs1-spidev
[] spi0-m2-cs0-spidev
[] spi0-m2-cs1-spidev
[] spi4-m0-cs1-spidev
[] spi4-m1-cs0-cs1-spidev
[] spi4-m1-cs0-spidev
[] spi4-m1-cs1-spidev
[] spi4-m2-cs0-spidev
```

e. Then select **<Save>** to save



f. Then Select <Back>

| wifi-ap6275p wifi-pcie | 10% | |
|---------------------------|----------|--|
| < Save > | < Back > | |

g. Then select **<Reboot>** to restart the system to make the configuration take effect

| Applying changes | 1 |
|--|---|
| Reboot to enable new features? | |
| <pre><reboot> <cancel></cancel></reboot></pre> | |
| < <u>Reboot></u> < <u>C</u> ancel> | |

4) After restarting, enter the system and check whether the device node of **spidevx.x** exists in the Linux system. If it exists, it means that the SPI has been set up and can be used directly

```
orangepi@orangepi:~$ ls /dev/spidev*
/dev/spidev0.0 /dev/spidev0.1 /dev/spidev4.0
```

The above is the result displayed after opening spi0-m2-cs0-cs1-spidev and spi4-m2-cs0-spidev

5) Then you can use the **spidev_test.py** program in examples to test the SPI loopback function. The **spidev_test.py** program needs to specify the following two parameters:

- a. --channel: Specify the channel number of SPI
- b. --port: Specify the SPI port number
- 6) Without shorting the mosi and miso pins of SPI, the output result of running

spidev_test.py is as follows. You can see that the data of TX and RX are inconsistent

The x after the -channel and --port parameters needs to be replaced with the specific SPI channel number and SPI port number

root@orangepi:~/wiringOP-Python# cd examples

root@orangepi:~/wiringOP-Python/examples# python3 spidev_test.py \

--channel x --port x

spi mode: 0x0

max speed: 500000 Hz (500 KHz)

Opening device /dev/spidev0.0

7) Then use Dupont wire to short-circuit the two pins of SPI txd (pin 19 in the 40pin interface) and rxd (pin 21 in the 40pin interface) and then run spidev_test.py. The output is as follows, you can see If the data sent and received are the same, it means that the SPI loopback test is normal

The x after the --channel and --port parameters needs to be replaced with the specific SPI channel number and SPI port number.

root@orangepi:~/wiringOP-Python# cd examples

root@orangepi:~/wiringOP-Python/examples# python3 spidev_test.py \

--channel x --port x

spi mode: 0x0

max speed: 500000 Hz (500 KHz)

Opening device /dev/spidev0.0

3. 19. 4. **40pin I2C test**

1) As can be seen from the table below, the i2c available for Orange Pi 5 Pro is i2c1, i2c4, i2c5 and i2c8, a total of four groups of i2c buses

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| 复用功能 | 复用功能 | 复用功能 | GPIO | GPI0序号 | 引脚序号 | 引脚序号 | GPI0序号 | GPIO | 复用功能 | 复用功能 | 复用功能 |
|-------------|------------------------|------------------------|----------|---------------|------|------|---------------|----------|-----------------------|--------------------|--------------|
| | | | 3.3₹ | | 1 | 2 | | 57 | | | |
| | UART4_RX_MO | I2C1_SDA_H4 | GPI01_D3 | 59 | 3 | 4 | | 57 | | | |
| | UART4_TX_NO | I2C1_SCL_II4 | GPI01_D2 | 58 | 5 | 6 | | GND | | | |
| UART1_RX_M1 | 12C5_SDA_M3 | PWM13_M2 (febf0010) | GPI01_B7 | 47 | 7 | 8 | 13 | GPIO0_B5 | UART2_TX_HO | | |
| | | | GND | | 9 | 10 | 14 | GPIO0_B6 | UART2_RX_NO | | |
| | PWM14_M1 (febf0020) | CAN1_RX_H1 | GPI04_B2 | 138 | 11 | 12 | 39 | GPIO1_A7 | PWM3_IR_M3 (fd8b0030) | | |
| | PWN15_IR_N1 (febf0030) | CAN1_TX_H1 | GPIO4_B3 | 139 | 13 | 14 | | GND | | | |
| UART1_TX_M1 | 12C5_SCL_N3 | | GPI01_B6 | 46 | 15 | 16 | 33 | GPI01_A1 | UART6_TX_H1 | | SPI4_MOSI_M2 |
| | | | 3.37 | | 17 | 18 | 32 | GPI01_A0 | UART6_RX_H1 | | SPI4_MISO_M2 |
| | UART4_RX_M2 | SPI0_MOSI_M2 | GPI01_B2 | 42 | 19 | 20 | | GND | | | |
| | | SPI0_MISO_M2 | GPI01_B1 | 41 | 21 | 22 | 40 | GPI01_B0 | | | |
| | UART4_TX_M2 | SPI0_CLK_H2 | GPI01_B3 | 43 | 23 | 24 | 44 | GPI01_B4 | SPI0_CS0_H2 | UART7_RX_M2 | |
| | | | GND | | 25 | 26 | 45 | GPI01_B5 | SPI0_CS1_H2 | UART7_TX_H2 | |
| SPI4_CLK_M2 | PWN0_M2 (fd8b0000) | 12C4_SDA_#3 | GPI01_A2 | 34 | 27 | 28 | 35 | GPI01_A3 | 12C4_SCL_113 | PWM1_M2 (fd8b0010) | SPI4_CS0_M2 |
| | | | GPI01_A4 | 36 | 29 | 30 | | GND | | | |
| | | | GPI01_A6 | 38 | 31 | 32 | 62 | GPI01_D6 | PWM14_M2 (febf0020) | 12C8_SCL_112 | |
| | 12C8_SDA_N2 | PWM15_IR_M3 (febf0030) | GPI01_D7 | 63 | 33 | 34 | | GND | | | |
| | | 12C5_SDA_H2 | GPIO4_A7 | 135 | 35 | 36 | 131 | GPIO4_A3 | UARTO_TX_N2 | | |
| | UART3_RX_M2 | 12C5_SCL_12 | GPIO4_A6 | 134 | 37 | 38 | 132 | GPIO4_A4 | UARTO_RX_H2 | | |
| | | | GND | | 39 | 40 | 133 | GPIO4_A5 | | UART3_TX_H2 | |

2) The corresponding pins of the 4 sets of I2C buses in 40pin are as shown in the table below. I2C5_M2 and I2C5_M3 can only use one of them at the same time, not at the same time. They are the same I2C5, just connected to different pins. Please do not think that they are two different sets of I2C5 buses

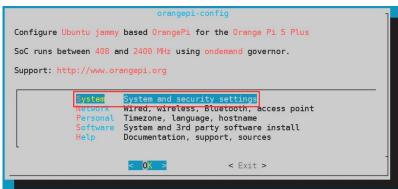
| I2C Bus | SDA correspond | SCL correspond | DtboCorresponding | | |
|---------|----------------|----------------|-------------------|--|--|
| | 40pin | 40pin | configuration | | |
| I2C1_M4 | Pin 3 | Pin 5 | i2c1-m4 | | |
| I2C4_M3 | Pin 27 | Pin 28 | i2c4-m3 | | |
| I2C5_M2 | Pin 35 | Pin 37 | i2c5-m2 | | |
| I2C5_M3 | Pin 7 | Pin 15 | i2c5-m3 | | |
| I2C8_M2 | Pin 33 | Pin 32 | i2c8-m2 | | |

3) In Linux systems, the I2C bus in 40 pin is closed by default and needs to be manually opened before it can be used. Detailed steps are as follows::

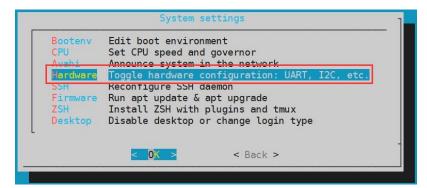
a. First run orangepi-config. Ordinary users remember to add sudo permissions.

orangepi@orangepi:~\$ sudo orangepi-config

b. Then Select System



c. Then Select Hardware



d. Then use the keyboard's arrow keys to locate the position shown in the picture below, and then use the **space** to select the I2C configuration you want to open

| [] i2c1-m2 | |
|---------------------|--|
| [] i 2c1-m4 | |
| [] i2c2-m0 | |
| [] i 2c2-m4 | |
| [] i 2c3-m0 | |
| [] i 2c4-m3 | |
| [] i2c5-m2 | |
| [] 12c5-m3 | |
| [] i 2c6-m4 | |
| [] i2c8-m2 | |

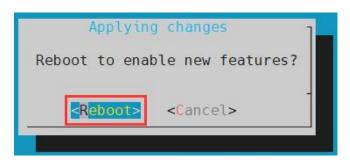
e. Then select **<Save>** to save

| [] wifi-ap6275p [] wifi-pcie | > | 100% |
|---------------------------------|--------|------|
| < Save > | < Back | > |

f. Then Select **<Back>**

| wifi-ap6275p wifi-pcie | 10% | |
|---------------------------|----------|---|
| < Save > | < Back > | - |

g. Then select **<Reboot>** to restart the system to make the configuration take effect.



4) After starting the Linux system, first confirm that there is an i2c device node under /dev

orangepi@orangepi:~\$ ls /dev/i2c-*

5) Then connect an i2c device to the i2c pin of the 40pin connector. Here we take the ds1307 RTC module as an example



6) Then use the **i2cdetect -y** command. If the address of the connected i2c device can be detected, it means that i2c can be used normally

| orangepi@orangepi:~\$ sudo i2cdetect -y 1 | #i2c1 command |
|---|---------------|
| orangepi@orangepi:~\$ sudo i2cdetect -y 4 | #i2c4 command |
| orangepi@orangepi:~\$ sudo i2cdetect -y 5 | #i2c5 command |
| orangepi@orangepi:~\$ sudo i2cdetect -y 8 | #i2c8 command |

| | 0 | 1 | 2 | 3 | - 4 | 5 | б | 7 | 8 | 9 | a | b | С | d | e | f |
|-----|---|---|---|---|-----|------|---|---|------------|---|---|---|---|---|---|---|
| 90: | | | | | | | | | | | | | | | | |
| 10: | | | | | | 12.2 | | | 12-12 | | | | | | | |
| 20: | | | | | | | | | | | | | | | | |
| 30: | | | | | | | | | | | | | | | | |
| 40: | | | | | | | | | | | | | | | | |
| 50: | | | | | | | | | 0 <u>-</u> | | | | | | | |
| 50: | | | | | | | | | 68 | | | | | | | |
| 70: | | | | | | | | | | | | | | | | |

7) Then you can run the ds1307.py test program in examples to read the RTC time

root@orangepi:~/wiringOP-Python# cd examples

root@orangepi:~/wiringOP-Python/examples# python3 ds1307.py --device \

"/dev/i2c-1"

Thu 2023-01-05 14:57:55 Thu 2023-01-05 14:57:56 Thu 2023-01-05 14:57:57 ^C

exit

3. 19. 5. **40pin UART test**

1) As can be seen from the table below, the available uarts for Orange Pi 5 Pro are uart0,

| uart3, uart4, ua | rt6 and uart7, a | a total of five | groups of uart buses. |
|------------------|------------------|-----------------|-----------------------|
|------------------|------------------|-----------------|-----------------------|

| 复用功能 | 复用功能 | 复用功能 | GPIO | GPIO序号 | 引脚序号 | 引脚序号 | GPI0序号 | GPIO | 复用功能 | 复用功能 | 复用功能 |
|-------------|------------------------|------------------------|----------|---------------|------|------|---------------|----------|-----------------------|--------------------|--------------|
| | | | 3.3V | | 1 | 2 | | 57 | | | |
| | UART4_RX_NO | 12C1_SDA_H4 | GPI01_D3 | 59 | 3 | 4 | | 57 | | | |
| | UART4_TX_NO | I2C1_SCL_II4 | GPI01_D2 | 58 | 5 | 6 | | GND | | | |
| UART1_RX_M1 | 12C5_SDA_N3 | PWM13_M2 (febf0010) | GPI01_B7 | 47 | 7 | 8 | 13 | GPIO0_B5 | UART2_TX_NO | | |
| | | | GND | | 9 | 10 | 14 | GPIO0_B6 | UART2_RX_NO | | |
| | PWN14_M1 (febf0020) | CAN1_RX_H1 | GPI04_B2 | 138 | 11 | 12 | 39 | GPI01_A7 | PWM3_IR_M3 (fd8b0030) | | |
| | PWM15_IR_M1 (febf0030) | CAN1_TX_H1 | GPI04_B3 | 139 | 13 | 14 | | GND | | | |
| UART1_TX_M1 | 12C5_SCL_M3 | | GPI01_B6 | 46 | 15 | 16 | 33 | GPI01_A1 | UART6_TX_N1 | | SPI4_MOSI_M2 |
| | | | 3.37 | | 17 | 18 | 32 | GPIO1_A0 | UART6_RX_H1 | | SPI4_MISO_M2 |
| | UART4_RX_M2 | SPI0_MOSI_M2 | GPI01_B2 | 42 | 19 | 20 | | GND | | | |
| | | SPI0_HISO_M2 | GPI01_B1 | 41 | 21 | 22 | 40 | GPIO1_B0 | | | |
| | UART4_TX_N2 | SPI0_CLK_M2 | GPI01_B3 | 43 | 23 | 24 | 44 | GPI01_B4 | SPI0_CS0_M2 | UART7_RX_H2 | |
| | | | GND | | 25 | 26 | 45 | GPI01_B5 | SPI0_CS1_M2 | UART7_TX_M2 | |
| SPI4_CLK_M2 | PWH0_M2 (fd8b0000) | I2C4_SDA_H3 | GPI01_A2 | 34 | 27 | 28 | 35 | GPI01_A3 | 12C4_SCL_113 | PWM1_M2 (fd8b0010) | SPI4_CS0_M2 |
| | | | GPI01_A4 | 36 | 29 | 30 | | GND | | | |
| | | | GPI01_A6 | 38 | 31 | 32 | 62 | GPI01_D6 | PWM14_M2 (febf0020) | 12C8_SCL_112 | |
| | 12C8_SDA_112 | PWM15_IR_M3 (febf0030) | GPI01_D7 | 63 | 33 | 34 | | GND | | | |
| | | 12C5_SDA_112 | GPIO4_A7 | 135 | 35 | 36 | 131 | GPIO4_A3 | UARTO_TX_M2 | | |
| | UART3_RX_M2 | 12C5_SCL_12 | GPIO4_A6 | 134 | 37 | 38 | 132 | GPIO4_A4 | UARTO_RX_H2 | | |
| | | | GND | | 39 | 40 | 133 | GPIO4 A5 | | UARTS TX M2 | |

2) The corresponding pins of the five sets of UART buses in 40pin are as shown in the table below:

| UART Bus | RX correspond | TX correspond | dtboCorresponding |
|----------|----------------------|---------------|-------------------|
| | 40pin | 40pin | configuration |
| UART0_M2 | Pin 38 | Pin 36 | uart0-m2 |
| UART3_M2 | Pin 37 | Pin 40 | uart3-m2 |

| UART4_M0 | Pin 3 | Pin 5 | uart4-m0 |
|----------|--------|--------|----------|
| UART4_M2 | Pin 19 | Pin 23 | uart4-m2 |
| UART6_M1 | Pin 18 | Pin 16 | uart6-m1 |
| UART7_M2 | Pin 24 | Pin 26 | uart7-m2 |

3) In Linux systems, the UART in 40 pin is turned off by default and needs to be turned on manually before it can be used. Detailed steps are as follows:

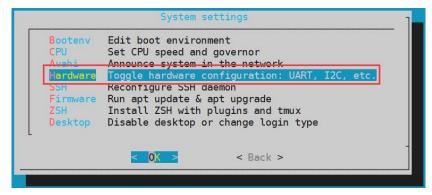
a. First run orangepi-config. Ordinary users remember to add sudo permissions.

orangepi@orangepi:~\$ sudo orangepi-config

b. Then Select System

| | orangepi-config |
|------------------------|--|
| Configure Ubuntu jammy | / based OrangePi for the Orange Pi 5 Plus |
| SoC runs between 408 a | and 2400 MHz using ondemand governor. |
| Support: http://www.or | angepi.org |
| | |
| System | System and security settings Wired, wireless, Bluetooth, access point |
| | Timezone, language, hostname |
| Software | |
| Help | Documentation, support, sources |
| - | |
| | < 0K > < Exit > |
| | |

c. Then Select Hardware



d. Then use the keyboard's arrow keys to locate the location shown in the picture below, and then use the space to select the UART configuration you want to open

🥮 range Pi User Manual

| | uart0-m2 | |
|----|----------|--|
| | uarti-mi | |
| | uart2-m0 | |
| [] | uart3-m0 | |
| [] | uart3-m1 | |
| [] | uart3-m2 | |
| [] | uart4-m0 | |
| [] | uart4-m2 | |
| [] | uart6-m1 | |
| | uart7-m2 | |

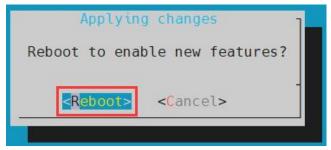
e. Then select **<Save>** to save

| wifi-ap6275 wifi-pcie | p | 100% |
|--------------------------|--------|------|
| < Save > | < Back | - |

f. Then Select <Back>

| | wifi-ap6275p wifi-pcie | 10% | |
|---|---------------------------|----------|--|
| » | < Save > | < Back > | |

g. Then select **<Reboot>** to restart the system to make the configuration take effect.



4) After entering the Linux system, first confirm whether there is a device node corresponding to uart under /dev

orangepi@orangepi:~\$ ls /dev/ttyS*

5) Then start testing the uart interface. First use Dupont wire to short-circuit the rx and tx of the uart interface to be tested

6) Use the **serialTest.py** program in examples to test the loopback function of the serial port as shown below. If you can see the following print, it means the serial port communication is normal.

/dev/ttySX needs to be replaced with the serial number of the specific uart device node.

root@orangepi:~/wiringOP-Python/examples# python3 serialTest.py --device \ "/dev/ttySX" Out: 0: -> 0 Out: 1:-> 1 2: -> 2 Out: Out: 3: -> 3 4:^C Out: exit

3. 20. Hardware watchdog test

The watchdog_test program is pre-installed in the Linux system released by Orange Pi and can be tested directly

The method to run the watchdog_test program is as follows:

- a. The second parameter 10 represents the counting time of the watchdog. If the dog is not fed within this time, the system will restart.
- b. We can feed the dog by pressing any key on the keyboard (except ESC). After feeding the dog, the program will print a line of keep alive to indicate that the dog feeding is successful.

| orangepi@orangepi:~\$ sudo watchdog_test 10 |
|---|
| open success |
| options is 33152, identity is sunxi-wdt |
| put_usr return, if 0, success:0 |
| The old reset time is: 16 |
| return ENOTTY, if -1, success:0 |
| return ENOTTY, if -1, success:0 |
| put_user return, if 0, success:0 |
| put_usr return, if 0, success:0 |
| |

| keep alive | | |
|------------|--|--|
| keep alive | | |
| keep alive | | |

3. 21. Check the serial number of the RK3588S chip

The command to view the serial number of the RK3588S chip is as follows. The serial number of each chip is different, so the serial number can be used to distinguish multiple development boards

orangepi@orangepi:~\$ cat_serial.sh Serial : 1404a7682e86830c

3. 22. How to install Docker

1) The linux image provided by Orange Pi has Docker pre-installed, but the Docker service is not turned on by default.

2) Use the **enable_docker.sh** script to enable the docker service, and then you can start using the docker command, and the docker service will be automatically started the next time you start the system.

orangepi@orangepi:~\$ enable_docker.sh

3) Then you can use the following command to test docker. If hello-world can be run, docker can be used normally.

orangepi@orangepi:~\$ docker run hello-world

Unable to find image 'hello-world:latest' locally

latest: Pulling from library/hello-world

256ab8fe8778: Pull complete

Digest:

sha256:7f0a9f93b4aa3022c3a4c147a449ef11e0941a1fd0bf4a8e6c9408b2600777c5 Status: Downloaded newer image for hello-world:latest

Hello from Docker! This message shows that your installation appears to be working correctly. •••••

3. 23. How to download and install arm64 version balenaEtcher

- 1) The download address of balenaEtcher arm64 version is
 - a. The download address of the a.deb installation package is as follows. It needs to be installed before it can be used

https://github.com/Itai-Nelken/BalenaEtcher-arm/releases/download/v1.7.9/balena-e tcher-electron 1.7.9+5945ab1f arm64.deb

b. The download address of the AppImage version that does not require installation is as follows:

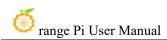
https://github.com/Itai-Nelken/BalenaEtcher-arm/releases/download/v1.7.9/balenaE tcher-1.7.9+5945ab1f-arm64.AppImage

| May 1 ryanfortner v1.7.9 | Update and rename compile-etcher_v1.7.3.sh to compile-etcher_v1.7.3. | 9. sh | |
|-------------------------------------|--|---------|-------|
| - o - 9529280 📀 Compare 👻 | • Assets 10 | | |
| | Øbalena-etcher-electron-1.7.9+5945ab1f.aarch64.rpm | 64.3 MB | May 1 |
| | 𝔅balena-etcher-electron-1.7.9+5945ab1f.armv7l.rpm | 58.4 MB | May 1 |
| | Salena-etcher-electron_1.7.9+5945ab1f_arm64.deb | 87.9 MB | May 1 |
| | | 76.5 MB | May 1 |
| | SolenaEtcher-1.7.9+5945ab1f-arm64.AppImage | 97.3 MB | May 1 |
| | DelenaEtcher-1.7.9+5945ab1f-armv7l.AppImage | 80.9 MB | May 1 |

- 2) How to install and use deb version balenaEtcher:
 - a. The installation command for the a.deb version of balenaEtcher is as follows:

| orangepi@orangepi:~\$ sudo apt install -y \ | |
|---|--------------------|
| fix-broken ./balena-etcher-electron_1.7.9+; | 5945ab1f_arm64.deb |

b. After the b.deb version of balenaEtcher is installed, it can be opened in Application



| Run Program | | |
|------------------|----|---------------------------|
| Terminal Emulate | or | |
| File Manager | | |
| 🗟 Mail Reader | | |
| 🗿 Web Browser | | |
| 🕮 Settings | • | |
| 🖄 Accessories | Þ | Q Application Finder |
| d Development | • | 🜼 balenaEtcher |
| 🥻 Graphics | + | 🚏 Bulk Rename |
| 🔶 Help | | & Fcitx |
| 🕥 Internet | • | |
| 谢 Multimedia | • | E Fonts |
| 😸 Office | • | Midnight Commander |
| System | • | Midnight Commander editor |
| C Log Out | | 🛃 Mousepad |
| | | 🔯 Screenshot |
| | | 🔽 Terminator |
| | | 🚏 Thunar File Manager |
| | | 🗽 Xarchiver |

c. The interface after opening balenaEtcher is as follows:

| 9 | balenaEtcher | ★ - × |
|---|------------------------------------|-------|
| | 😚 balena Etcher | ¢ 0 |
| | + + | |
| | Flash from file Select target Flas | ht |
| | 𝔗 Flash from URL | |
| | 🕒 Clone drive | |

- 3) How to use the AppImage version of balenaEtcher:
 - a. First add permissions to balenaEtcher

orangepi@orangepi:~/Desktop\$ chmod +x balenaEtcher-1.7.9+5945ab1f-arm64.AppImage

b. Then select the AppImage version balenaEtcher, right-click the mouse, and click Execute to open balenaEtcher

| | § Execute |
|-------|-----------------------------|
| her-1 | Open With Other Application |
| | Cut |
| rm64 | Сору |
| 1 | Move to Trash |
| 6 | Delete |
| | <u>R</u> ename |
| 6 | Properties |
| 24 | Applications |

3. 24. How to install the Pagoda Linux panel

Pagoda Linux panel is a server management software that improves operation and maintenance efficiency. It supports more than 100 server management functions such as one-click LAMP/LNMP/cluster/monitoring/website/FTP/database/JAVA (excerpted from Pagoda official website)

The recommended order for Pagoda Linux system compatibility is
 Debian11 > Ubuntu 22.04 > Debian12

2) Then enter the following command in the linux system to start the installation of the pagoda

orangepi@orangepi:~\$ sudo install_bt_panel.sh

3) Then the Pagoda installation program will prompt whether to install **Bt-Panel** to the /www folder. At this time, enter y

+-----

Bt-WebPanel FOR CentOS/Ubuntu/Debian

+-----

Copyright © 2015-2099 BT-SOFT(http://www.bt.cn) All rights reserved.

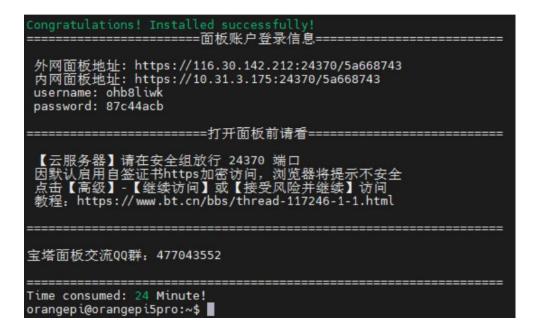
+-----

The WebPanel URL will be http://SERVER_IP:8888 when installed.

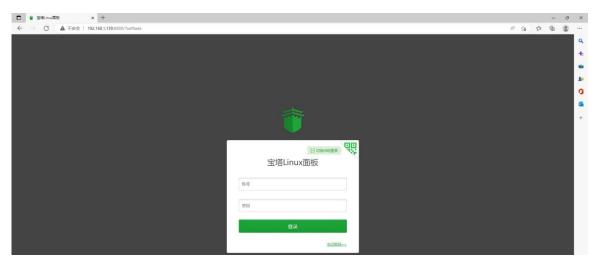
+-----

Do you want to install Bt-Panel to the /www directory now?(y/n): y

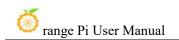
4) The next thing to do is to wait patiently. When you see the terminal outputting the following print information, it means that the Pagoda has been installed. The entire installation process takes about 12 minutes. There may be some differences depending on the network speed.



5) At this time, enter the **panel address** shown above in the browser to open the login interface of the Pagoda Linux panel, and then enter the **username** and **password** shown above in the corresponding positions to log in to the Pagoda



6) After successfully logging into the Pagoda, the following welcome interface will pop up. First, please drag the user instructions in the middle to the bottom after reading them. Then you can select "I have agreed and read the User Agreement", and then click "Enter Panel" You can enter the pagoda





7) After entering the pagoda, you will first be prompted to bind an account on the pagoda's official website. If you don't have an account, you can go to the pagoda's official website (https://www.bt.cn) to register one.

| □ ● 通先规定主体帐号 x + | | | | | - | 0 | × |
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| ** 192.168.1.139 | | | | | | Î | ۹ |
| ③ 首页 | 大教于皆何,终定仅符于大您提供更好的南极服务在验,不该及您服务奉任何敬爱信息,请放心便用。 | | | | | | + |
| 网站 | NALT MUST INVERTIGATION CONTRACTOR NEED INTO CONTRACTOR PROVIDED IN INVERTIGATION | | | | | | * |
| 金 FTP | 绑定宝塔帐号 | | | | | I | * |
| ◎ 数据库 | 学机局 | | | | | | a |
| 👜 Docker | 구하다 | | | | | | 0 |
| | (2015) | | | | | L | + |
| ⊘ \$\overline\$\$ | | | | | | L | |
| ● 防火塔 | 未有账号、免缴注册 | | | | | L | |
| □ 文件 | • 为了您能更好的体验置物功能,请先常定量爆张号: | | | | | | |
| 函 终端 | 单个宝堆帐号支持多台级振器绑定; - 类无体导发有接管服务器的功能収录,请的心便用; | | | | | | |
| 计划任务 | 帐号师定过恒中编到问题通数系备报处理; 審探告语:0769-23030556 | | | | | | |
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| 前版设置 | | | | | | | ŝ |
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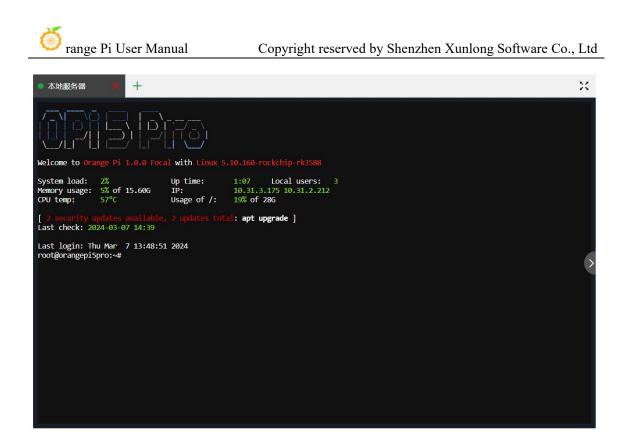
8) The final displayed interface is as shown in the figure below. You can intuitively see some status information of the development board's Linux system, such as load status, CPU usage, memory usage, storage space usage, etc

| × 一丁 不安全 192.168.1.139.8888 | | | | | | A* 16 14 1 | - : • |
|----------------------------------|---|---|--|--|--|--|----------|
| A 5 8555 2 | 新统: Orange Pi 1.0.0 Bullseye aarch64(Py | 3.7.8) 已不调新运行·0天 | | | | | |
| | | | | | | | |
| 立即升级 (学企业版优势) くち | 分钟极速响应 ✓ 15天无理由退款 ✓ 30 | +歌付费插件 🖌 20+企业版专掌功能 🖌 2HSSL | 商用证书(年付) ✓1000条免费短信(| 年付) イ 专享企业服务群(年付 | 5) | | |
| 状态 | | | | | | | |
| | | | | | | | |
| Statts () | CPU使用率 | 内存使用率 | | | | | |
| 1% | 2.1% | 9.1% | 35% | | | | |
| | \bigcirc | | | | | | |
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| 概號 | | | | | | | |
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| 网络 | FTP | 数据库 | 安全风险 | | | | |
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| 软件 | | | 流量 磁盘IO | | | 全部 | |
| | 70.9 | | • 16 | • Nit | 白溪法 | -18/7 | 客服 |
| >_ | | ~ ~ | 0.43 KB | 1.64 KB | 7.09 MB | 164.09 MB | 8 |
| 室塔\$\$H终语 1.0▶ | 做步本马检测 1.0▶ | 教法 购买 预选 购买 | 单位:KB/s | | | | 反馈 |
| 12.9 | 2 | | 30 | | | | |
| | A E ask A S00me P dridsdrift A | Fight 192.084.1399.000 R E RERE A ER: Orange R 10.0 bulkeys auchdely DIFFE I A ER: Orange R 10.0 bulkeys auchdely V00 IDDFE I A ER: Orange R 10.0 bulkeys auchdely V00 IDDFE I A ER: Orange R 10.0 bulkeys auchdely V00 IDDFE I A ER: Orange R 10.0 bulkeys auchdely V00 IDDFE I A ER: Orange R 10.0 bulkeys auchdely V00 IDDFE I A ER: Orange R 10.0 bulkeys auchdely IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII | Fact 122.103.1139.0303 R E 88582 A 585 Orange Fi 10.0 Julieys auchóktyly 2.0 E 7688201 0.0 IDERS IDERS V157.EERBAR V157.EERBAR V157.EERBAR V157.EERBAR IDERS </td <td>Rate: 192.081.1999000 R Rate: 0 State: 0 State:<!--</td--><td>Ref 1 192.08.1 199.083 R Ref 2 100 5.0 horps F1 10.0 5.0 horps ant/0409.17.2 ID CREATE 30.0 C Imme 4 datasets visionalized vi</td><td>Ref 1 122-123.129-000 R Extract 0 segre Fi 120 bulkeys antidetys 120 EXTREME (0.000 EXTREME (4.000) CODERENCE (4</td><td></td></td> | Rate: 192.081.1999000 R Rate: 0 State: 0 State: </td <td>Ref 1 192.08.1 199.083 R Ref 2 100 5.0 horps F1 10.0 5.0 horps ant/0409.17.2 ID CREATE 30.0 C Imme 4 datasets visionalized vi</td> <td>Ref 1 122-123.129-000 R Extract 0 segre Fi 120 bulkeys antidetys 120 EXTREME (0.000 EXTREME (4.000) CODERENCE (4</td> <td></td> | Ref 1 192.08.1 199.083 R Ref 2 100 5.0 horps F1 10.0 5.0 horps ant/0409.17.2 ID CREATE 30.0 C Imme 4 datasets visionalized vi | Ref 1 122-123.129-000 R Extract 0 segre Fi 120 bulkeys antidetys 120 EXTREME (0.000 EXTREME (4.000) CODERENCE (4 | |

- 9) Test Pagoda's SSH terminal login
 - a. After opening the SSH terminal of Pagoda, you will first be prompted to enter the password of the development board system. At this time, enter **orangepi** (the default password, if there is any modification, please fill in the modified one) in the password box.

| 宝塔终端 | 8 |
|-------------------------------|-----------------------|
| 账号或密码错误: Authentication faile | d.,root@127.0.0.1:22 |
| | |
| | |
| | |
| | 无法自动认证,请填写本地服务器的登录信息! |
| 服务器IP | 127.0.0.1 22 |
| SSH账号 | root |
| | |
| 验证方式 | 密码验证 私钥验证 |
| 密码 | orangepi |
| | 登录 |
| | |
| | |
| | |
| | |

b. The display after successful login is as shown below



10) In Pagoda' s software store, you can install software such as Apache, MySQL, and PHP, and you can also deploy various applications with one click. Please explore these functions by yourself, and I will not demonstrate them one by one here

| C AT | × + 家全 192,168.1.139:8888/soft | | | A 12 12 19 |
|--------------|--|--|---|--|
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| | _ | | | |
| | 应用搜索 支持应用名称、字 | 印模糊搜索 | | |
| | - | | | |
| | 应用分类 全部 E | 日安装 : | 新行环境 系统工具 宗塔描件 专业纸插件 企业纸插件 第三方应用 一頓部署 | 更新软件列表 / 支付状态 |
| : | | | | |
| r | 立即购买 | nux企业版优势 | | |
| | | 更接接权IP | ✓ 5分钟版過期点 ✓ 15元元理出通款 ✓ 30+款付繳給件 ✓ 20+企业版夸军功能 ✓ 1000基免繳經貨 (年付) ✓ 2张SSL咸用证书 (年付) ✓ 夸革企业服务群 (年付) | |
| | 最近使用入口 🚬 宝塔SSH线 | 108 | | |
| | 数体系统 | 开发意 | (2)月 | 18元 福作 |
| 1 | (w) Apache勠火槽 | 官方 | 有效防止sql注入xss/一切活大马等规见渗透攻击当前仅变持Apache2.4 > 数据 ¥1.66/天 未开直 | 預造 立即购买 |
| | Nginx防火地 | 官方 | 有效防止sql注入/xss/一句话术马,防梁渠等常见渗過攻击,符合GB/T 32917-2016标准。公安三所安全认证。>数程 > 由演算 型摄权 ¥1.66/天 未开通 | 預速 立即购买 |
| | (一) 网站监控报表 | 官方 | 实时分析网站运行。用户访问状况,辅助她计网站流量。IP、UV、PV、请求、做新等数据,网站SEO优化利摄。图交说明 ¥0.99/天 未开重 | 预选 立即购买 |
| 3 | · · · · · · · · · · · · · · · · · · · | 前方 | PHP内核吸防崩器块。可针对项目进行使屈过途,彻底社迪路站/临前防治达/临前防湿权。注意:不变持32位系统和Amm平台和PHP5.2 > 数程 ¥3.30/天 未开直 | 預送 立即购买 |
| | | | | |
| | 金ェのは加速 | 10.5 | 重构版,基于页面条件的网站加速插件,安装成升级到优版本,将会即数日版本,如果是Apache需要先安装Memcached > 教程 免费 | 预选 安装 |
| ra ra | ~ | | 推奪:内线/國際要次用于保护站在內容安全,脸上黑套半注传改网页,网站挂马等入侵行为,支持Centos/Debian/Ubuntu,注意:不能与其它热要改收 ¥2.200年 半五番 | |
| | 一 · · · · · · · · · · · · · · · · · · · | | ■書 内核品料語及用子師外紙合内容安全、設計調整体法療政内区、同社組石等入量分为、支持CentouDobian(Ubuntu、注意:不能利用な影響政策 ¥1.30)天 未开直 供用的使用→参理 | 预定 安装 |
| 店 | ~ | | 推奪:内线/國際要次用于保护站在內容安全,脸上黑套半注传改网页,网站挂马等入侵行为,支持Centos/Debian/Ubuntu,注意:不能与其它热要改收 ¥2.200年 半五番 | |
| 店 | 一 · · · · · · · · · · · · · · · · · · · | 前方 | ■書。内核品料整点用子簡約成点内容設立、設計業業将非常変現式、用料目目等入量行力、支持CentoxDobian/Ubunto、注意:不能均常な影響系数 年期間使用 → #確 | 立即购买 |
| 店 | □ A 像母企业取防装改 - 重构版 ② 主爆取描句が工具 | 官方 | 唐季、内核品料整定用于部分站在内容安全、設計業業総計整改同范、用総括马等入量行力、支持CentoryDobian/Ubunto、注意:不能均有空影要数数 | 立即時来 |
| 店 | → ▲ 御母企业取防禁政・重构版 ● 主導政旗目が工具 ● A 网络防禁政選手 | 官方 官方 官方 | 事業の株式計算な月子留か込め内容なよ、設上業業年齢非常成別に、用紙目毎か入留行力、支別Centox/Dobin/Ufunto,注意:不能時間な影響政部 非力速 非力速 毎月70月7日ままで 第二日の地方目的な内容なよ、防止業年は非常成別に、用紙目毎入留行力、支別Centox/Dobin/Ufunto,注意:不能時間な影響政部 ¥1300天 非力速 番子の小子記的文件指令工具、印法対応定対応対応になった規模新なり、同分の一般表示 単用 単価の ¥1300天 非力速 毎年後期の加速の中に使用をなり、同時目を建立の中の後の目前の ●1000東京王 ¥1300天 第二日 #二日 | 立即將天 立即將来 預克 立即將天 |
| 店 | | 官方 官方 官方 官方 | 事業 内地区計算法 日本売 キ売通 (相同物理)・w確 11.30元 第二30元 第二 | 立和時界 立即時界 死退 立即時界 死返 立即時界 |

11) Pagoda command line tool test

| orangepi@orangepi5pro:~\$ sudo bt | |
|--|---|
| (1)重启面板服务 (2)停止面板服务 (3)启动面板服务 (4)重载面板服务 (4)重载面板服务 (5)修改面板密码 (6)修改面板用户名 (7)强制修改MySQL密码 (22)显示面板错误日志 (23)关闭BasicAuth认证 (24)关闭动态口令认证 (25)设置是否保存文件历史副本 (26)关闭面板ssl (28)修改面板安全入口 (0)取消 ==================================== | ==宝塔面板命令行==================================== |
| 正在执行(14) ================================== | |
| BT-Panel default info! | |
| | |
| orangepi@orangepi5pro:~\$ | |

12) You can refer to the following information to explore more functions of the pagoda

Manual: http://docs.bt.cn Forum address: https://www.bt.cn/bbs GitHub Link: https://github.com/aaPanel/BaoTa

3. 25. Set up the Chinese environment and install the Chinese input method

Note, before installing the Chinese input method, please make sure that the Linux system used by the development board is the desktop version.

3. 25. 1. **Debian system installation method**

- 1) First set the default **locale** to Chinese
 - a. Enter the following command to start configuring locale

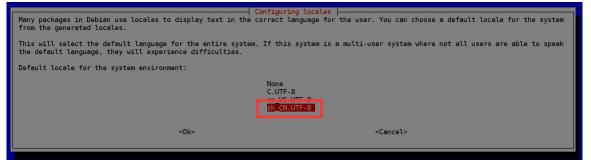
orangepi@orangepi:~\$ sudo dpkg-reconfigure locales

b. Then select zh_CN.UTF-8 UTF-8 in the pop-up interface (use the up and down

keys on the keyboard to move up and down, use the space bar to select, and finally use the Tab key to move the cursor to **<OK>**, and then return Car is enough)

| Locales are a framework to switch betw | een multiple languages and allow | | , characters, collation order, |
|--|----------------------------------|-------------------|--------------------------------|
| Please choose which locales to generat sets may be useful for backwards compa | | | stallations. Other character |
| Locales to be generated: | | | |
| <pre>[] xh_ZA ISO-8859-1 [] xh_ZA.UTF-8 UTF-8 [] yi_US cP1255 [] yi_US cUTF-8 UTF-8 [] yo_NG UTF-8 [] yuw_PG UTF-8 [] yuw_PG UTF-8 [] zh_CN.6818030 GB18030 [] zh_CN.UTF-8 UTF-8 [] zh_SG.68K G6K [] zh_SG.68F.68K [] zh_SG.68F.68K [] zh_TW.EUC-TW EUC-TW [] zh_TW.EUC-TW EUC-TW [] zh_TW.UTF-8 UTF-8 [] zu_ZA ISO-8859-1 [] zu_ZA.UTF-8 UTF-8</pre> | | | |
| | <0k> | <cancel></cancel> | |
| | | | |

c. Then set the default locale to zh_CN.UTF-8



d. After exiting the interface, the **locale** setting will begin. The output displayed on the command line is as follows:

orangepi@orangepi:~\$ sudo dpkg-reconfigure locales

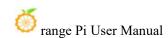
Generating locales (this might take a while)...

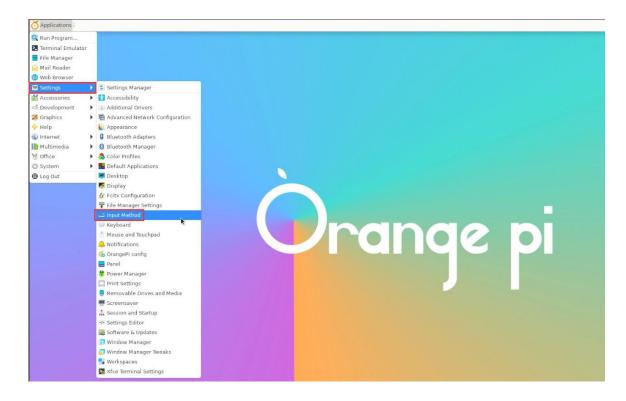
en_US.UTF-8... done

zh_CN.UTF-8... done

Generation complete.

2) Then open Input Method

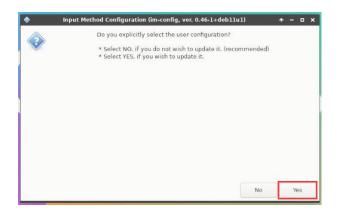




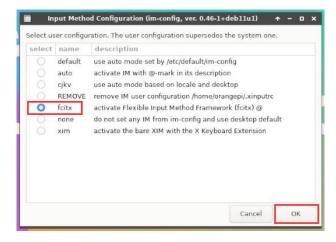
3) Then select **OK**

| Current co | nfiguration for th | e input method | : | | |
|------------|--|-------------------|-------------------|---------------------|----------|
| * Default | mode defined in | /etc/default/im- | config: 'auto' | | |
| * Active c | onfiguration: 'm | ssing' (normally | (missing) | | |
| * Normal | automatic choic | e: 'fcitx' (norma | lly ibus or fcitx | or uim) | |
| * Override | e rule: 'zh_CN,fci | tx5:zh_TW.fcitx | 5:zh_HK,fcitx5: | zh_SG,fcitx5' | |
| * Current | override choice: | " (Locale='en_ | US') | | |
| * Current | automatic choic | e: 'fcitx' | | | |
| * Number | of valid choices | : 1 (normally 1) | | | |
| * Desktop | environment: ') | (FCE' | | | |
| The config | uration set by in | n-config is activ | ated by re-star | ting the system. | |
| | lection is not red ault/auto/cjkv/m | | the automatic | configuration if th | e active |
| | | | | Cancel | ОК |

4) Then select Yes



5) Then select fcitx

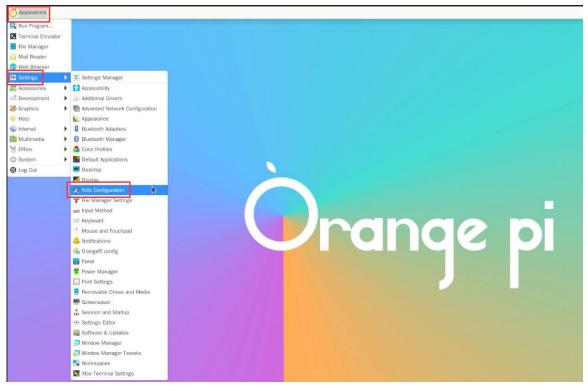


6) Then select **OK**

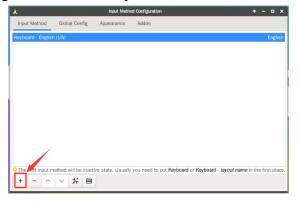
| 🍤 🛛 Input Method Configuration (im-con | fig, ver. 0.46-1+deb11u1) 🛛 🛧 – 🗆 🗙 |
|--|-------------------------------------|
| Setting the user configuration /home/orange | pi/.xinputrc to fcitx. |
| Manual configuration selects: fcitx | |
| Flexible Input Method Framework (fcitx) | |
| * Required for all: fcitx | |
| * Language specific input conversion support | rt: |
| * Simplified Chinese: fcitx-libpinyin or fcit | -sunpinyin or fcitx-googlepinyin |
| * Traditional Chinese / generic Chinese: fci | tx-rime |
| * Generic keyboard translation table: fcitx- | table* packages |
| * Application platform support: | |
| Installing fcitx-frontend-all will cover all G | UI platforms. |
| * GNOME/GTK: fcitx-frontend-gtk2 and fcit | x-frontend-gtk3 (both) |
| * KDE/Qt5: fcitx-frontend-qt5 | |
| The user configuration is modified by im-cor | fig. |
| Restart the session to activate the new user | configuration. |
| | Cancel OK |
| | |

7) Then restart the Linux system to make the configuration take effect.

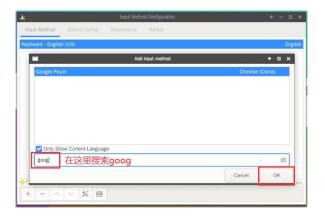
8) Then ope Fcitx configuration



9) Then click the + sign as shown in the picture below



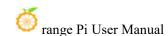
10) Then search Google Pinyin and click OK



11) Then put Google Pinyin on top

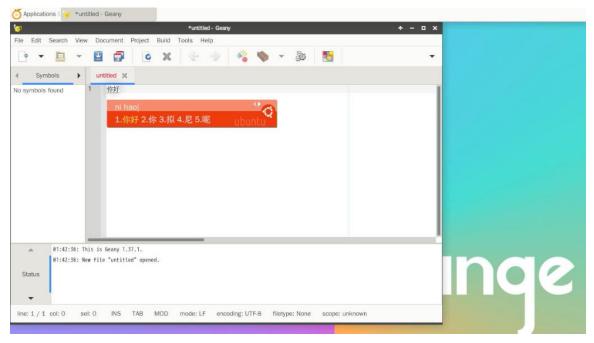


12) Then open the **Geany** editor to test the Chinese input method



| Run Program | | | | |
|------------------|---|------------|--|--|
| Terminal Emulato | r | | | |
| 📑 File Manager | | | | |
| 🗟 Mail Reader | | | | |
| 🕜 Web Browser | | | | |
| Settings | • | | | |
| 🔀 Accessories | • | | | |
| 🕌 Development | 1 | Geany | | |
| 🧭 Graphics | • | | | |
| 🔶 Help | | | | |
| 💿 Internet | • | b . | | |
| Multimedia | • | | | |
| office | • | | | |
| System | • | | | |
| C Log Out | | | | |

13) The Chinese input method test is as follows



14) You can switch between Chinese and English input methods through the Ctrl+Space shortcut key

15) If you need the entire system to be displayed in Chinese, you can set all variables in /etc/default/locale to zh_CN.UTF-8

orangepi@orangepi:~\$ sudo vim /etc/default/locale # File generated by update-locale LC_MESSAGES=zh_CN.UTF-8 LANG=zh_CN.UTF-8

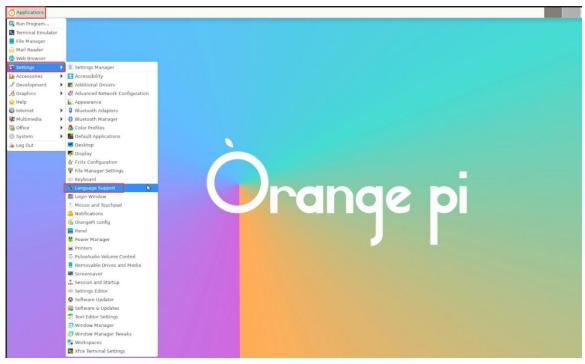
LANGUAGE=zh_CN.UTF-8

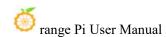
| 16) Then restart the system and you will see that the system is displayed in Chine | se. |
|--|-----|
|--|-----|



3. 25. 2. Installation method of Ubuntu 20.04 system

1) First open Language Support





2) Then find the **Chinese (China)** option

| | Language S | upport | | * | - 1 | |
|--|--|-------------------------|------------|---|-----|---|
| Language | Regional I | Formats | | | | |
| Language for me English (Canada | | WS: | | | | |
| English (United | Kingdom) | | | | | |
| 汉语 (中国) | | | | | | |
| 中文 (香港) | | | | | | |
| 中文 (臺灣) | | | | | | |
| Drag languages to Changes take effec | | | preference | | | |
| | t next time you k | | preference | | | |
| Changes take effec | t next time you k Wide | og in. | | | | |
| Changes take effect Apply System- Use the same langu | t next time you k Wide | og in. startup and t | | | | |
| Changes take effect Apply System- Use the same langu | Wide Wide lage choices for s ve Languages | og in. startup and t | | | | [|

3) Then please use the left button of the mouse to select **Chinese (China)** and hold it down, then drag it up to the starting position. After dragging, the display will be as shown below:

| | Language Sup | port | | * | - | • | × |
|--|--|----------------|-----------|----|---|---|---|
| Language | Regional For | mats | | | | | |
| Language for me | nus and windows: | | | | | | |
| 汉语 (中国) | | | | | | | |
| English (United | States) | | | | | | |
| English | | | | | | | |
| English (Austral | a) | | | | | | |
| English (Canada |) | | | | | | |
| Dena lan average t | and the second sec | and a soft and | £ | | | | |
| | o arrange them in t next time you log i Wide | | eference. | | | | |
| Changes take effect | t next time you log i | n. | | | | | |
| Changes take effect Apply System Use the same lang | t next time you log i Wide | n. | | | | | |
| Changes take effect Apply System Use the same lang | t next time you log i Wide uage choices for star ve Languages | n. | | 22 | | | |

Note that this step is not easy to drag, please be patient and try it a few times.

4) Then select **Apply System-Wide** to apply the Chinese settings to the entire system

| 6 | Language Support | ^ | | | × |
|---|---|----------|------|-----|---|
| | Language Regional Formats | | | | ľ |
| L | anguage for menus and windows: | | | | |
| | 又语 (中国) | | | | |
| 1 | English (United States) | | | | |
| 1 | English | | | | |
| 1 | English (Australia) | | | | |
| | English (Canada) | | | | |
| | hanges take effect next time you log in. Apply System-Wide se the same language choices for startup and the login screen. | | | | |
| | Install / Remove Languages | | | | |
| к | eyboard input method system: none 👻 | \$ | | | |
| (| Øнеlp | : | K Cl | ose | |

5) Then set the **Keyboard input method system** to **fcitx**

| | Language Su | pport | | ^ | - | • | × |
|--|---------------------|-------------|----------------|----------|------|-----|---|
| Language | Regional Fo | rmats | | | | | |
| Language for me | nus and windows | : | | | | | |
| 汉语 (中国) | | | | | | | |
| English (United | States) | | | | | | |
| English | | | | | | | |
| English (Australi | a) | | | | | | |
| English (Canada |) | | | | | | |
| Drag languages to Changes take effect Apply System | t next time you log | | preference. | | | | |
| Use the same langu | age choices for sta | rtup and t | he login scree | :n. | | | |
| Install / Remo | ve Languages | fcitx 📘 | 3 | | | | |
| Keyboard input n | nethod system: | XIM none | | | | | |
| () Help | | | | 4 | K cl | ose | |

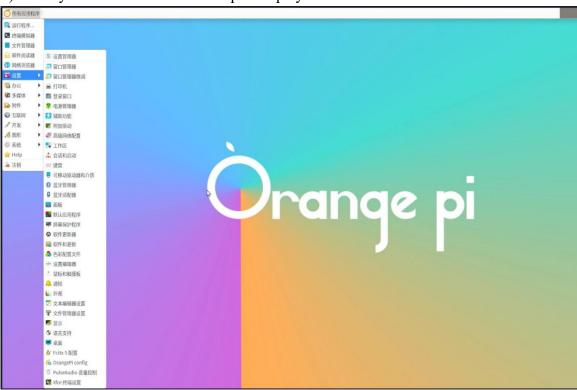
6) Then restart the Linux system to make the configuration take effect

7) After re-entering the system, please select **Do not ask me again** in the following interface, and then please decide according to your own preferences whether the standard

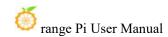
folder should also be updated to Chinese

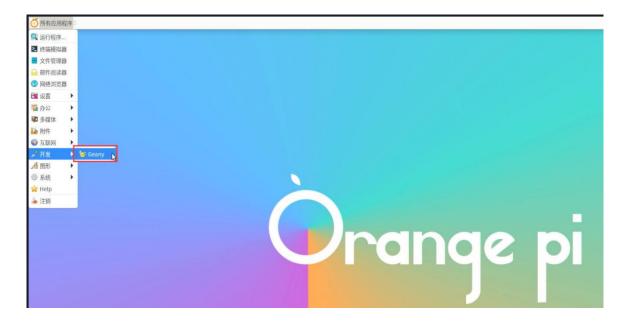


8) Then you can see that the desktop is displayed in Chinese



9) Then we can open **Geany** to test the Chinese input method. The opening method is as shown in the figure below

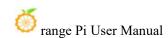


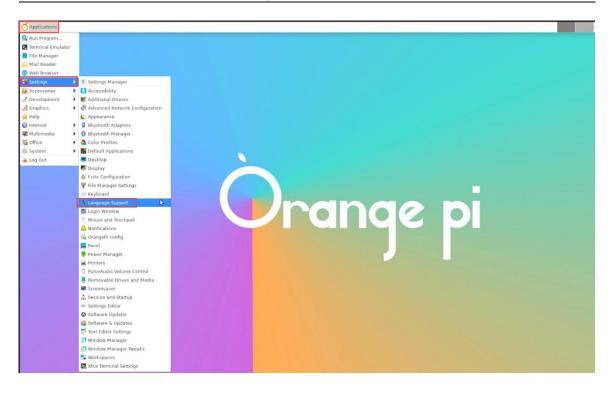


10) After opening **Geany**, the English input method is still the default. We can switch to the Chinese input method through the **Ctrl+Space** shortcut key, and then we can input Chinese.

| 🌀 所有应用程序 🤘 *未命名 - Geany | | |
|--|--|--|
| 1 | *未命名 - Geany | ★ - □ X |
| 文件(F) 编辑(E) 搜索(S) 查看(V) 文档(D) 项目(F | | |
| 🗋 🔹 🚔 - 💆 🔂 🍓 🗙 | < > 🐴 🗞 - 🐅 🛅 | Item is the second secon |
| 标记 文档 未命名 😫 | | |
| 未找到符号 1 你好 | | |
| + 19:12:28: ¥ 19:12:28: ↓ 19:12:28: ↓ | • • | |
| 状态 1.你好 2 3.你 4.尼 5.3 行: 1/1 列: 0 选择: 0 插入 制表符 已修改 | 尼 ubuntu 概式: LF 编码: UTF-8 文件类型: 没有 范围: 未知 | inde pl |
| | | |

- 3. 25. 3. Installation method of Ubuntu 22.04 system
- 1) First open Language Support





2) Then find the Chinese (China) option

| | Language Su | pport | | | * | - | ٥ | > |
|---|--|-------|-------------|----|---|---|---|---|
| Language | Regional Form | ats | | | | | | |
| Language for n | enus and window | s: | | | | | | |
| Português (Bra | isil) | | | | | | | |
| Português (Po | tugal) | | | | | | | |
| русский (Росс | ийская Федераці | (RN | | | | | | |
| slovenščina | | | | | | | | |
| THE OWNER AND ADDRESS | | | | | | | | |
| | to arrange them ir ect next time you log | | referenc | e. | | | | |
| Drag languages | ect next time you log | | reference | e. | | | | |
| Drag languages Changes take eff Apply System | ect next time you log | in. | | | | | | |
| Drag languages Changes take eff Apply System Use the same lar | ect next time you log n-Wide | in. | | | | | | |
| Drag languages Changes take eff Apply System Use the same lar Install / Rem | ect next time you log n-Wide guage choices for sta | in. | e login scr | | | | | |

3) Then please use the left button of the mouse to select **Chinese (China)** and hold it down, then drag it up to the starting position. After dragging, the display will be as shown below:

| Language Support | + | - | ۰ | × |
|---|---|------|-----|---|
| Language Regional Formats | | | | |
| Language for menus and windows: | | | | |
| 汉语 (中国) | | | | |
| English (United States) | | | | |
| English | | | | |
| Deutsch (Schweiz) | | | | |
| Deutsch (Deutschland) | | | | |
| Drag languages to arrange them in order of preference. Changes take effect next time you log in. | | | | |
| Apply System-Wide | | | | |
| Use the same language choices for startup and the login screen. | | | | |
| Install / Remove Languages | | | | |
| Keyboard input method system: Fcitx 5 🕶 | | | | |
| @Help | 1 | ¢ ci | ose | |
| | _ | _ | _ | - |

Note that this step is not easy to drag, please be patient and try it a few times.

4) Then select **Apply System-Wide** to apply the Chinese settings to the entire system

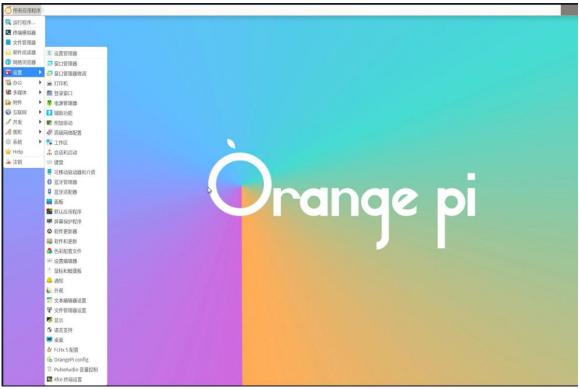
| | Language Suppor | t | | • | ۵ | > |
|--|---|------------|--------|---|---|---|
| Language | Regional Formats | | | | | |
| Language for n | nenus and windows: | | | | | |
| 汉语 (中国) | | | | | | |
| English (Unite | d States) | | | | | |
| English | | | | | | |
| Deutsch (Schw | veiz) | | | | | |
| Deutsch (Deut | schland) | | | | | |
| | to arrange them in orde ect next time you log in. | r of prefe | rence. | | | |
| | ect next time you log in. | r of prefe | rence. | | | |
| Changes take eff | ect next time you log in. | | | | | |
| Changes take eff Apply Syste Use the same lar | ect next time you log in. m-Wide | | | | | |
| Changes take eff Apply Syste Use the same lar Install / Rem | ect next time you log in. m-Wide nguage choices for startup a nove Languages | | | | | |

5) Then restart the Linux system to make the configuration take effect

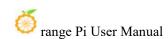
6) After re-entering the system, please select **Do not ask me again** on the following interface, and then please decide whether the standard folder should also be updated to Chinese according to your own preferences.

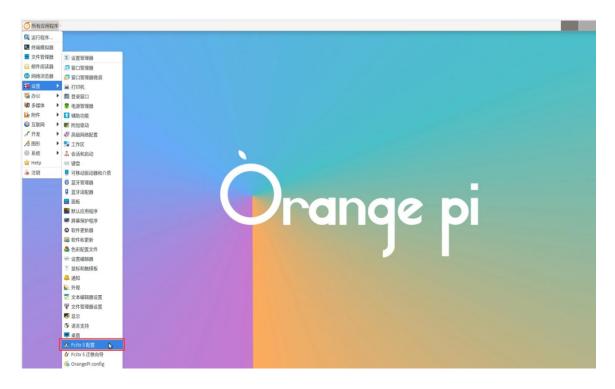
| Δ | 将标准文件夹更新到当前语言吗? | |
|--------------------------|---|--|
| | 以一种新语言登入。您可以将主文件夹下的某些标准文件夹名按照 推行自动更新。该更新将会更改以下文件夹: | |
| 当前文件夹名称 | 新的文件夹名称 | |
| /home/orangepi/Desktop | /home/orangepi/桌面 | |
| /home/orangepi/Downloads | /home/orangepi/下载 | |
| /home/orangepi/Templates | /home/orangepi/模板 | |
| /home/orangepi/Public | /home/orangepi/公共的 | |
| /home/orangepi/Documents | /home/orangepi/文档 | |
| /home/orangepi/Music | /home/orangepi/音乐 | |
| /home/orangepi/Pictures | /home/orangepi/图片 | |
| /home/orangepi/Videos | /home/orangepi/视频 | |
| 请注意,现有内容不会被移动。 | | |
| 不要再次询问我(D) | \$ | |
| 保留旧的名称(| K) 更新名称(U) | |

7) Then you can see that the desktop is displayed in Chinese



8) Then open the Fcitx5 configuration program





9) Then choose to use Pinyin input method

| Å. | | Fcitx 配】 | Ξ + − □ × |
|--------------------|---|------------|--|
| 输入法 | 全局选项 附加组件 | | |
| 当前输入 | (法: | | 可用输入法: |
| 分组: | Default | · + - | 搜索输入法 |
| 健盘 - 5 | そ 著(美闻) | | 健全:法语(加拿大)·英语(加拿大) ▲ 健全:法语:集留,器(3至:美国, Aucintosh) ▲ 健全:是你这些,美國(3里:美国) ▲ 健全:是你这些,美国,累高) ● 健全:是你这些,美国,累高) ● 健全:是你这些,美国,累高) ● 健全:是你这些,我们,我们,我们,我们,我们,我们,我们,我们,我们,我们,我们,我们,我们, |
| | 选择系统键盘布局 | | ✔ 仅显示当前语言(S) |
| 第- <u> 〈</u> 重置 | 一个输入法将为非激活状态。通常您需要将 (R) 恢复默认(<u>D</u>) | 键盘或键盘 - 布局 | 各称放在第一位。 ☆ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ |

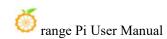
10) The interface after selection is as shown below, then click OK

| | Fcitx 配置 | ↑ - □ |
|-------------------------|----------------|--|
| 输入法 全局选项 附加组件 | | |
| 当前输入法: | | 可用输入法: |
| 分组: Default | - + - | 搜索输入法 |
| <u>谢贵</u> -英语(美国) 拼音 | | 汉语 键量 - 汉语 - Hanyu Pinyin (with AltGr dead keys) 键盘 - 汉语 简体中文 (中国) 自然网 |
| 选择系统键盘布局 | | ✔ 仅显示当前语言(S) |
| 第一个输入法将为非激活状态。通常您需要 | 将键盘或键盘 - 布局名称近 | 放在第一位。 |
| | M. | √ 应用(A) × 关闭(C) √确定(0) |

11) Then we can open **Geany** to test the Chinese input method. The opening method is as shown in the figure below



12) After opening **Geany**, the English input method is still the default. We can switch to the Chinese input method through the **Ctrl+Space** shortcut key, and then we can enter Chinese.



| 所有应用程序 🤘 *未命名 | - Geany | |
|-----------------------------|--|---------|
| 1 | *未命名 - Geany | + - □ × |
| 件(F) 编辑(E) 搜索(S) 3 | 查看(V) 文档(D) 项目(P) 生成(B) 工具(T) 帮助(H) | |
| 🍃 🕶 🖆 👻 🖉 | 🖬 🖻 🗙 < 👌 🐴 🗞 - 🎥 🛅 | • |
| 标记 文档 未 | 命名 🗶 | |
| 找到符号 1 | 1.你好 2.你 3.尼 4.泥 5.妮 6.逆 7.腻 ()) 】 | |
| ▲ 10:54:37: 这是 Ge | eany 1.38. | |
| 10:54:37: 新文件" 状态 | '未命名"已打开。 | |
| <u></u> ; 1/1 列: 0 选择: 0 插入 | 制表符 已修改 模式: LF 编码: UTF-8 文件类型: 没有 范围: 未知 | |

3. 26. How to remotely log in to the Linux system desktop

The Ubuntu Gnome Wayland image does not support remote login to the desktop using Nomachine and VNC as described here.

3. 26. 1. **Remote login using NoMachine**

Please ensure that the Ubuntu or Debian system installed on the development board is a desktop version of the system. In addition, NoMachine also provides detailed usage documentation. It is strongly recommended to read this document thoroughly to become familiar with the use of NoMachine. The document link is as follows:

https://knowledgebase.nomachine.com/DT10R00166

NoMachine supports Windows, Mac, Linux, iOS and Android platforms, so we can remotely log in and control the Orange Pi development board through NoMachine on a variety of devices. The following demonstrates how to remotely log in to the Linux system desktop of the Orange Pi development board through NoMachine in Windows. For installation methods on other platforms, please refer to NoMachine' s official documentation.

Before operating, please make sure that the Windwos computer and the development board are in the same LAN, and that you can log in to the Ubuntu or Debian system of the development board through ssh normally.

1) First download the installation package of the NoMachine software Linux **arm64** deb version, and then install it into the Linux system of the development board

a. Since RK3588S is an ARMv8 architecture SOC, the system we use is Ubuntu or Debian, so we need to download the NoMachine for ARM ARMv8 DEB installation package. The download link is as follows:

Note that this download link may change, please look for the Armv8/Arm64 version of the deb package.

https://downloads.nomachine.com/download/?id=114&distro=ARM

Home / Download / NoMachine for ARM - arm64

NoMachine for ARM - arm64



b. In addition, you can also download the **NoMachine** installation package from the official tool.

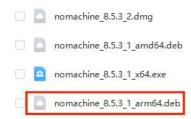
Download



First enter the remote login software-NoMachine folder

Remote Login Software-NoMachine

Then download the arm64 version of the deb installation package



- c. Then upload the downloaded **nomachine_x.x.x_arm64.deb** to the Linux system of the development board
- d. Linux 系 Then use the following command to install **NoMachine** in the Linux system of the development board

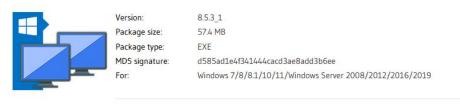
orangepi@orangepi:~\$ sudo dpkg -i nomachine_x.x.x_x_arm64_arm64.deb

2) Then download the installation package of the Windows version of the NoMachine software. The download address is as follows

Note that this download link may change.

https://downloads.nomachine.com/download/?id=9

NoMachine for Windows - 64bit



Download

3) Then install NoMachine in Windows. Please restart your computer after installation

4) Then open NoMachine in Window



5) After NoMachine is started, it will automatically scan other devices with NoMachine

installed on the LAN. After entering the main interface of NoMachine, you can see that the development board is already in the list of connectable devices, and then click on the location shown in the red box in the picture below You can now log in to the Linux system desktop of the development board.



6) Then click **OK**

| n and ee e | - 11 | |
|--------------------|--|--------------------------------|
| Host identificatio | n changed | NOMACHINI |
| ? | Remote host identification has changed. This can indicate that someone connection, or the SSL certificate has been replaced due to a reinstallati you want to proceed anyway and replace the old SSL certificate in the list | on of the NoMachine server. Do |
| | | |
| | | |
| | | Cancel OK |
| | | |
| | | |
| | | |

7) Then enter the username and password of the development board Linux system in the corresponding positions in the figure below, and then click **OK** to start logging in.

| orangepi, Ubuntu 22.04 | 4.2 LTS | NOMACH |
|-------------------------|---|-------------------------------------|
| Type username and pass | word to login using a system account or request access as a | guest usec |
| | Login as a system user on this server | |
| Y | Username Enter the account number of the o | levelopment board Linux system here |
| < i | Password Enter the password of the Linux sy | ystem of the development board here |
| | Save this password in the connection | file |
| | Request access as a guest for desktop sharing | |
| Always login using this | s method on this server | Cancel OK |
| | | |
| | | |

8) Then click OK in the next interface.



9) Finally you can see the desktop of the development board Linux system

3. 26. 2. **Remote login using VNC**

Before operating, please make sure that the Windwos computer and the development board are in the same LAN, and that you can log in to the Ubuntu or Debian system of the development board through ssh normally.

There are many problems with VNC testing in Ubuntu20.04, please do not use this method.

First run the set_vnc.sh script to set up vnc, remember to add sudo permissions
 orangepi@orangepi:~\$ sudo set_vnc.sh
 You will require a password to access your desktops.

Password: **#Set the vnc password here, 8 characters**

Verify: **#Set the vnc password here, 8 characters**

Would you like to enter a view-only password (y/n)? n

xauth: file /root/.Xauthority does not exist

New 'X' desktop is orangepi5pro:1

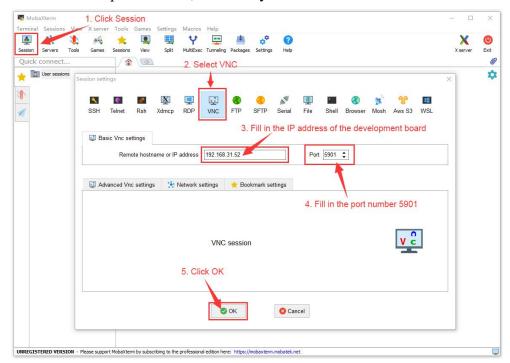
Creating default startup script /root/.vnc/xstartup Starting applications specified in /root/.vnc/xstartup Log file is /root/.vnc/Orangepi5pro:1.log Killing Xtightvnc process ID 3047

New 'X' desktop is orangepi5pro:1

Starting applications specified in /root/.vnc/xstartup Log file is /root/.vnc/orangepi5pro:1.log

2) The steps to use MobaXterm software to connect to the development board Linux system desktop are as follows::

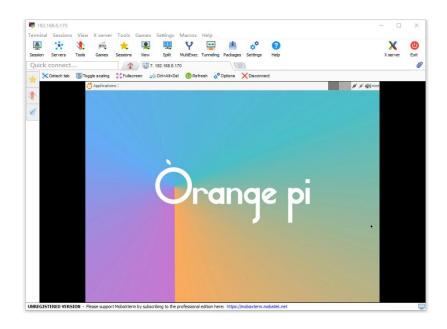
a. First click Session, then select VNC, then fill in the IP address and port of the development board, and finally click OK to confirm.



b. Then enter the VNC password set earlier

| Please enter your passw | ord for 192.168.31.46 |
|-------------------------|-----------------------|
| ******* | |
| Show password | 1 |
| | |
| 📀 ОК | 🙁 Cancel |

c. After successful login, the interface is displayed as shown below, and then you can remotely operate the desktop of the development board Linux system.



3. 27. Testing of some programming languages supported by Linux system

3. 27. 1. Debian Bullseye system

1) Debian Bullseye is installed with the gcc compilation tool chain by default, which can directly compile C language programs in the Linux system of the development board.

a. The version of a.gcc is as follows

orangepi@orangepi:~\$ gcc --version

gcc (Debian 10.2.1-6) 10.2.1 20210110

Copyright (C) 2020 Free Software Foundation, Inc.

This is free software; see the source for copying conditions. There is NO

warranty; not even for MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.

b. Write the **hello_world.c** program in C language

```
orangepi@orangepi:~$ vim hello_world.c
#include <stdio.h>
```

```
int main(void)
```

{

printf("Hello World!\n");

return 0;

c. Then compile and run **hello_world.c**

orangepi@orangepi:~\$ gcc -o hello_world hello_world.c

orangepi@orangepi:~\$./hello_world

Hello World!

2) Debian Bullseye has Python3 installed by default

a. The specific version of Python is as follows

orangepi@orangepi:~\$ python3

Python 3.9.2 (default, Feb 28 2021, 17:03:44)

[GCC 10.2.1 20210110] on linux

Type "help", "copyright", "credits" or "license" for more information.

>>>

b. Write the **hello_world.py** program in Python language

orangepi@orangepi:~\$ vim hello_world.py

print('Hello World!')

c. The result of running **hello_world.py** is as follows

orangepi@orangepi:~\$ python3 hello_world.py Hello World!

3) Debian Bullseye does not install Java compilation tools and operating environment by default.

a. You can use the following command to install openjdk. The latest version in Debian Bullseye is openjdk-17

orangepi@orangepi:~**\$ sudo apt install -y openjdk-17-jdk**

b. After installation, you can check the Java version

orangepi@orangepi:~\$ java --version

c. Write a **hello_world.java** of Java version

orangepi@orangepi:~\$ vim hello_world.java

public class hello_world

public static void main(String[] args)

{

System.out.println("Hello World!");

}

d. Then compile and run hello_world.java

orangepi@orangepi:~\$ javac hello_world.java

orangepi@orangepi:~\$ java hello_world

Hello World!

3. 27. 2. **Debian Bookworm system**

1) Debian Bookworm is installed with the gcc compilation tool chain by default, which can directly compile C language programs in the Linux system of the development board.

a. The version of gcc is as follows

orangepi@orangepi:~\$ gcc --version

gcc (Debian 12.2.0-14) 12.2.0

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This is free software; see the source for copying conditions. There is NO

warranty; not even for MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.

b. Write the **hello_world.c** program in C language

orangepi@orangepi:~\$ vim hello_world.c

#include <stdio.h>

int main(void)

{

printf("Hello World!\n");

return 0;

c. Then compile and run hello_world.c

orangepi@orangepi:~\$ gcc -o hello_world hello_world.c orangepi@orangepi:~\$./hello_world Hello World!

2) Debian Bookworm has Python3 installed by default

a. The specific version of Python is as follows

orangepi@orangepi:~\$ python3

Python 3.11.2 (main, Mar 13 2023, 12:18:29) [GCC 12.2.0] on linux

Type "help", "copyright", "credits" or "license" for more information.

Use the Ctrl+D shortcut key to exit python's interactive mode.

b. Write the **hello_world.py** program in Python language

orangepi@orangepi:~\$ vim hello_world.py print('Hello World!')

c. The result of running **hello_world.py** is as follows

orangepi@orangepi:~\$ python3 hello_world.py Hello World!

3) Debian Bookworm does not install Java compilation tools and operating environment by default.

a. You can use the following command to install openjdk. The latest version in Debian Bookworm is openjdk-17

orangepi@orangepi:~\$ sudo apt install -y openjdk-17-jdk

b. After installation, you can check the Java version.

orangepi@orangepi:~\$ java --version

c. Write a Java version of hello_world.java

```
orangepi@orangepi:~$ vim hello_world.java
```

```
public class hello_world
```

ł

```
public static void main(String[] args)
{
```

System.out.println("Hello World!");

```
d. Then compile and run hello world.java
```

orangepi@orangepi:~\$ javac hello_world.java

orangepi@orangepi:~\$ java hello world

Hello World!

3. 27. 3. Ubuntu Focal system

1) Ubuntu Focal is installed with the gcc compilation tool chain by default, which can directly compile C language programs in the Linux system of the development board.

a. The version of gcc is as follows

orangepi@orangepi:~\$ gcc --version

gcc (Ubuntu 9.4.0-1ubuntu1~20.04.1) 9.4.0

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warranty; not even for MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.

b. Write the **hello_world.c** program in C language

orangepi@orangepi:~\$ vim hello_world.c

#include <stdio.h>

```
int main(void)
```

{

printf("Hello World!\n");

return 0;

c. Then compile and run hello_world.c

orangepi@orangepi:~\$ gcc -o hello_world hello_world.c orangepi@orangepi:~\$./hello_world Hello World!

2) Ubuntu Focal has Python3 installed by default

a. The specific version of Python3 is as follows

orangepi@orangepi:~\$ python3

Python 3.8.10 (default, Nov 14 2022, 12:59:47)

[GCC 9.4.0] on linux

Type "help", "copyright", "credits" or "license" for more information.

>>>

b. Write the **hello_world.py** program in Python language

orangepi@orangepi:~\$ **vim hello_world.py** print('Hello World!')

c. The result of running **hello_world.py** is as follows

orangepi@orangepi:~\$ python3 hello_world.py Hello World!

3) Ubuntu Focal does not have Java compilation tools and running environment installed

by default.

| a. | You can use the following command to | o install openjdk-17 |
|----|--------------------------------------|----------------------|
|----|--------------------------------------|----------------------|

```
orangepi@orangepi:~$ sudo apt install -y openjdk-17-jdk
```

b. After installation, you can check the Java version.

orangepi@orangepi:~\$ java --version

openjdk 17.0.2 2022-01-18

OpenJDK Runtime Environment (build 17.0.2+8-Ubuntu-120.04)

OpenJDK 64-Bit Server VM (build 17.0.2+8-Ubuntu-120.04, mixed mode, sharing)

```
c. Write a Java version of hello world.java
```

orangepi@orangepi:~\$ vim hello_world.java

public class hello_world

{

}

```
public static void main(String[] args)
```

```
System.out.println("Hello World!");
```

```
}
```

d. Then compile and run hello_world.java

orangepi@orangepi:~\$ javac hello_world.java

orangepi@orangepi:~\$ java hello_world

Hello World!

3. 27. 4. Ubuntu Jammy system

4) Ubuntu Jammy is installed with the gcc compilation tool chain by default, which can directly compile C language programs in the Linux system of the development board.

a. The version of gcc is as follows

orangepi@orangepi:~\$ gcc --version

gcc (Ubuntu 11.2.0-19ubuntu1) 11.2.0

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warranty; not even for MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.

b. Write the **hello_world.c** program in C language

orangepi@orangepi:~\$ vim hello_world.c

#include <stdio.h>

```
int main(void)
{
printf("Hello World!\n");
return 0;
```

c. Then compile and run hello_world.c

orangepi@orangepi:~\$ gcc -o hello_world hello_world.c orangepi@orangepi:~\$./hello_world Hello World!

5) Ubuntu Jammy has Python3 installed by default

a. The specific version of Python3 is as follows

orangepi@orangepi:~\$ python3

Python **3.10.4** (main, Apr 2 2022, 09:04:19) [GCC 11.2.0] on linux

Type "help", "copyright", "credits" or "license" for more information.

>>>

b. Write the **hello_world.py** program in Python language

orangepi@orangepi:~\$ vim hello_world.py

print('Hello World!')

c. The result of running **hello_world.py** is as follows

orangepi@orangepi:~\$ python3 hello_world.py

Hello World!

6) Ubuntu Jammy does not install Java compilation tools and operating environment by default.

a. You can use the following command to install openjdk-18

orangepi@orangepi:~\$ sudo apt install -y openjdk-18-jdk

b. After installation, you can check the Java version.

orangepi@orangepi:~\$ java --version

openjdk 18-ea 2022-03-22

OpenJDK Runtime Environment (build 18-ea+36-Ubuntu-1)

OpenJDK 64-Bit Server VM (build 18-ea+36-Ubuntu-1, mixed mode, sharing)

c. Write a Java version of hello_world.java

orangepi@orangepi:~\$ vim hello_world.java

public class hello_world

```
public static void main(String[] args)
{
    System.out.println("Hello World!");
}
```

d. Then compile and run hello_world.java

```
orangepi@orangepi:~$ javac hello_world.java
orangepi@orangepi:~$ java hello_world
Hello World!
```

3. 28. **QT installation method**

1) Use the following script to install QT5 and QT Creator

orangepi@orangepi:~\$ install_qt.sh

2) After installation, the QT version number will be automatically printed.

a. The qt version that comes with Ubuntu20.04 is **5.12.8**

orangepi@orangepi:~\$ install_qt.sh

•••••

QMake version 3.1

Using Qt version **5.12.8** in /usr/lib/aarch64-linux-gnu

b. The QT version that comes with Ubuntu22.04 is **5.15.3**

orangepi@orangepi:~\$ install_qt.sh

.....

QMake version 3.1

Using Qt version **5.15.3** in /usr/lib/aarch64-linux-gnu

c. The QT version that comes with Debian11 is **5.15.2**

orangepi@orangepi:~\$ install_qt.sh

.....

QMake version 3.1

Using Qt version **5.15.2** in /usr/lib/aarch64-linux-gnu

d. The QT version that comes with Debian12 is **5.15.8**

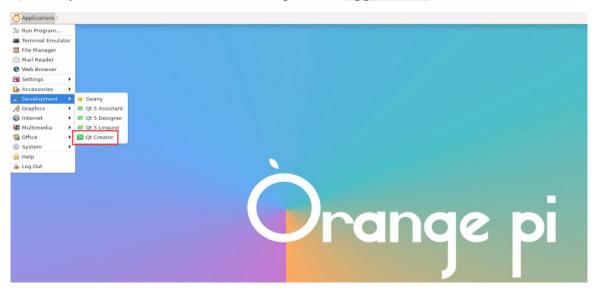
orangepi@orangepi:~\$ install_qt.sh

.

QMake version 3.1

Using Qt version **5.15.8** in /usr/lib/aarch64-linux-gnu

3) Then you can see the QT Creator startup icon in Applications



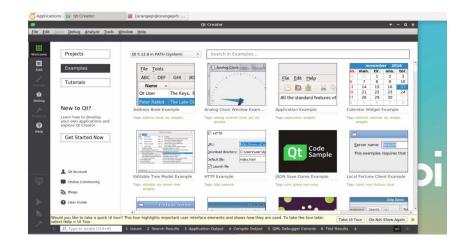
You can also use the following command to open QT Creator

orangepi@orangepi:~\$ qtcreator

During the startup process of QT and QT applications, if the following error is prompted, please ignore it. This error will not affect the operation of the application.

libGL error: failed to create dri screen libGL error: failed to load driver: rockchip libGL error: failed to create dri screen libGL error: failed to load driver: rockchip

4) The interface after QT Creator is opened is as follows



- 5) The version of QT Creator is as follows
 - a. The default version of QT Creator in Ubuntu20.04 is as follows

| dit Build Debug Analyze Too | ils <u>W</u> indow <u>H</u> elp | Qt Creator | | | + - B X |
|--|---|--|-----------------------------------|---|-------------------------------|
| Projects | Qt 5.12.8 in PATH (System) | Search in Examples | | | |
| Examples | <u>File</u> Tools | Analog Clock | 2 | november m. man. tir. or | ns. tor. |
| Tutorials | ABC DEF GHI JKI | About Qt Creator | File Edit Help | 6 7 8 9 3 14 15 1 0 21 22 2 | 2 3 9 10 16 17 23 24 |
| New to Qt? Learn how to develop your own applications and explore Qt Creator. | Address Tags: addr | ased on Qt 5.12.8 (GCC 9.3.0, 64 b opyright 2008-2019 The Qt Compa eserved. he program is provided AS IS with 1 F ANY KIND. INCLUDING THE WARR | it) h Example ion widgets | 5 5 6 Calendar Widget Exar Tags andreid calendar ios widgets | 7 8 mple |
| Get Started Now | - mm (| ESIGN, MERCHANTABILITY AND FIT ARTICULAR PURPOSE. Default file: index.html | Code Sample | Server name: | |
| L Ot Account | Editable Tree Model Example | Launch file | ISON Save Game Example | Local Fortune Client E | |
| Doline Community | Tags; editable ios model tree | Tags: http://etwork | Taga cere game jion save | Tags: client core fortune to | |
| D Blogs | widgets | | | | - |
| O User Guide | E Fortune Server | 0 _ 0 3 | | Ci Historia Corrict [][6] | Nip Dema |
| Would you like to take a quick to select Help > UI Tour. | Il tour? This tour highlights important user inte | rface elements and shows how the | are used. To take the tour later, | Take UI Tour Do Not Sho | w Again X |

b. The default version of QT Creator in Ubuntu22.04 is as follows

| dur 3 | giew Build Debug Analyze To | iz Munow Beh | |
|---------|--|--|------|
| me | Projects | Qt 5.15.3 in PATH (qt5) Search in Examples | |
| | Examples | File Tools | r. 1 |
| | Tutorials | ABC DEF GHI JKI Elle Edit Help 0 31 1 2 3 6 7 8 9 10 | 0 |
| | Marketplace | About Qt Creator + 3 4 1 <th1< th=""> 1 <th1< th=""></th1<></th1<> | |
| e | New to Ot? | Address Address Calendar Widget Example Calendar Widget Example Tags an Tag an | - |
|) Ip | Learn how to develop your own applications and explore Qt Creator. | The program is provided AS 5 with NO WARRANT OF AMERICANTRULY AND THE INVESTIGATION OF DATA MERICANTRULY AND THE INVESTIGAT AMERICAN PURPOSE. | |
| | Get Started Now | Slose to the state of the state | ĸ |
| | ⊥ Get Ot | - Building Bar | |
| 9 | Ot Account Online Community | Editable Tree Model Example HTTP Example JSON Save Game Example Local Fortune Client Example Tops: individ estable tos model tree stights: | ž |
| i. | Blogs | Fortune Server | |
| E. | Ø User Guide | The server is running. Rin the Fortune Client exam | 1 |

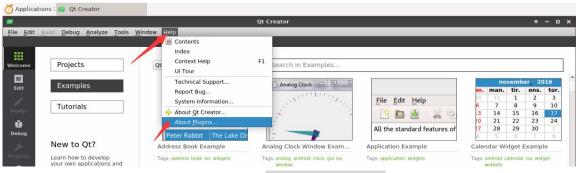
c. The default version of QT Creator in **Debian11** is as follows



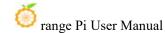
d. The default version of QT Creator in Debian12 is as follows

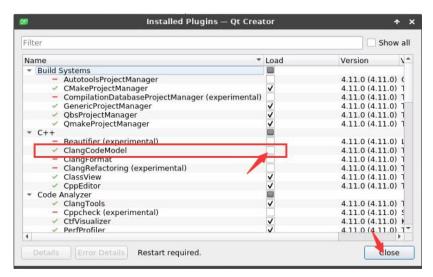
| QC W | elcome to Qt Creato | or | | | |
|---------------|--|--|---|---|------------|
| Create Projec | Qt 5.15.8 in PATH (qt5) | Search in Exa | imples | | |
| Open Project | | About Qt Create | or | ^ X | |
| - | He has an pro- | Qt Creator 9.0.2 | | international are provided by Dr. | |
| New to Qt | | Based on Qt 6.4.2 (GCC 12. | | Nex, Knoll Jame, and deals an extensions. These Enter-Stangard edition system: Star Residentian large in menu, term | |
| Get Started | | | t Company Ltd. All rights reserv | | |
| | | The program is provided AS INCLUDING THE WARRANTY FITNESS FOR A PARTICULAR | S IS with NO WARRANTY OF ANY I OF DESIGN, MERCHANTABILITY | AND | |
| | Addres | | , Qt Quick®, Built with Qt®, Boo | mple | |
| Projects | Tags: add | Ot 8. Ot Ouick Compiler 8. | Qt Enterprise®, Qt Mobile® and trademarks of The Qt Company | Ot dgets | |
| Examples | | | 30 <u>C</u> lo | ose | |
| Examples | | States and a | E arm | | |
| Tutorials | | 1 Die Generation Gard, 2 Generation Gard, 2 Generation Gard, 2 | to stread with Qr Designer | t speciae hadraniscothan ann rea | |
| | The second secon | The second secon | ng cing ang kana ang sebagai ang ang ang ang ang ang ang ang ang ang | | |
| Marketplac | Name of the Association | The second secon | tering angel angel and a beaute in alle retrieve to beaute in group angels supplier writing angels supplier with spale and alle. | factors and the second second | |
| | | Name 41 | | | |
| 4 | Get Ot | Ot Account | Online Community | Blogs | User Guide |

- 6) Then set up QT
 - a. Open first Help->About Plugins...



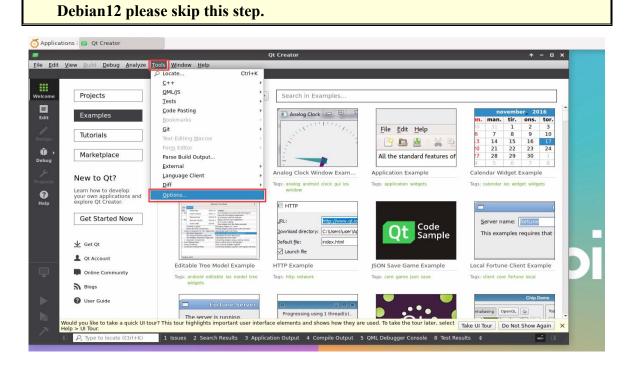
b. Then remove the check mark of ClangCodeModel

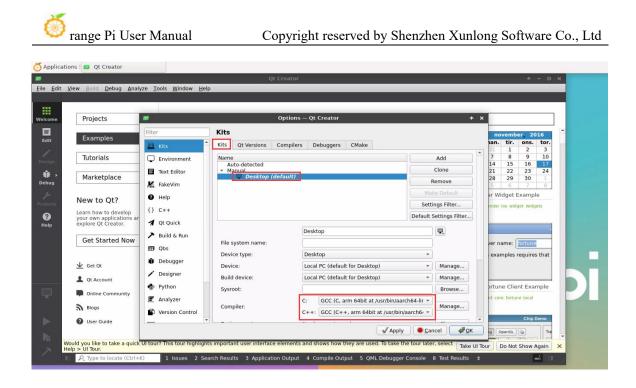




c. After setting up, you need to restart QT Creator

d. Then make sure the GCC compiler used by QT Creator. If the default is Clang, please change it to GCC.



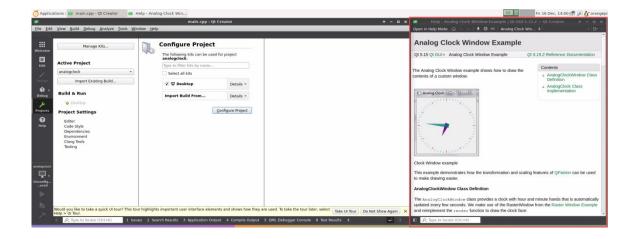


7) Then you can open a sample code

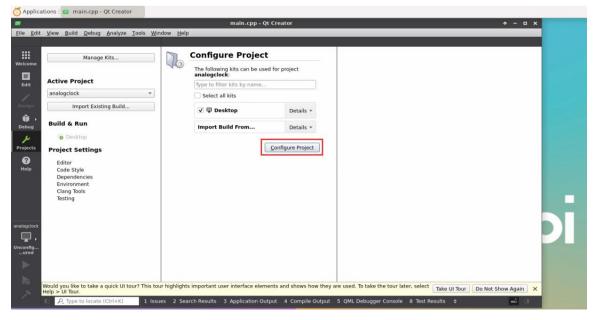
| | | .cpp - Qt Creator | | ↑ - □ | × |
|--|---|--|--|---|----|
| <u>View Build Debug Analyze T</u> | ools <u>W</u> indow <u>H</u> elp | | | | |
| | | | | | |
| Projects | Qt 5.15.2 in PATH (qt5) | Search in Examples | | | Î. |
| Examples | <u>File</u> <u>T</u> ools | Analog Clock 😐 🗵 🎗 | | november 2016 M. man. tir. ons. tor. | 1 |
| Tutorials | ABC DEF GHI JKL | Summer Providence | File Edit Help | 0 31 1 2 3 6 7 8 9 10 .3 14 15 16 17 | |
| Marketplace | Qt User The Keys, B Peter Rabbit The Lake Di: | | All the standard features of | 0 21 22 23 24 27 28 29 30 1 4 5 6 7 8 | |
| New to Qt? | Address Book Example | Analog Clock Wildow Exam | Application Example | Calendar Widget Example | |
| Learn how to develop your own applications and explore Qt Creator. | widgets | window | lags: application widgets | lags: calendal los winger wingers | |
| Get Started Now | Elizards Testerial a Elizards Testerial Elizards Elizards Testerial Elizards Eliza | HTTP URL: http://www.qt.io Download directory: C:Users/user/Ap | Ot Code | Server name: fortune | |
| 🛨 Get Qt | No Lings for the set of the | Default file: index.htm | QU Sample | This examples requires that | |
| L Qt Account | Editable Tree Model Example | HTTP Example | ISON Save Game Example | Local Fortune Client Example | |
| Online Community | Tags: android editable ios model tree widgets | Tags: http network | Tags: core game json save | Tags: client core fortune local | |
| Blogs | widgets | | | | |
| 🕜 User Guide | Fortune Server | 0 _ D X | | Chip Demo ntialiasino OpenGL Ala Top | |
| Would you like to take a quick UI tour Help > UI Tour. | ? This tour highlights important user interf | ace elements and shows how they are | e used. To take the tour later, select | ake UI Tour Do Not Show Again | × |

8) After clicking on the sample code, the corresponding instruction document will automatically open. You can read the instructions carefully.

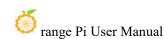




9) Then click Configure Project

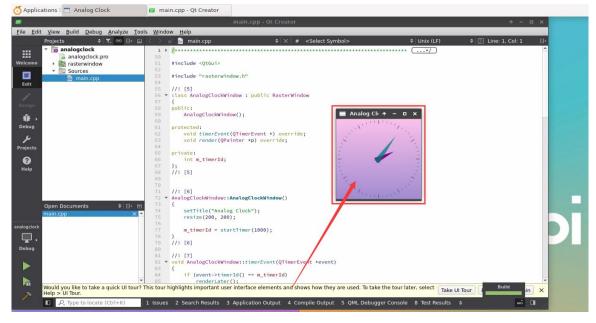


10) Then click the green triangle in the lower left corner to compile and run the sample code



| of Applications 💀 main.cpp - Qt Creator | | | |
|---|--|---|-------------------------|
| 80 | main.cpp - Qt Creator | | + - □ × |
| <u>File Edit View Build Debug Analyze Tools</u> | <u>W</u> indow <u>H</u> elp | | |
| Projects 🗢 🕇 📼 🖽 🖃 | < 🔿 🖆 👼 main.cpp 🔋 🗢 🗢 🗘 🗘 🗧 | vmbol> \$ Unix (LF) \$ | 🕈 🔄 Line: 1, Col: 1 🛛 🕀 |
| analogclock | 1 • X*********************************** | **************************** | ^ |
| Welcome | 51 #include <qtgui></qtgui> | | |
| - Sources | 52 53 #include "rasterwindow.h" | | |
| Edit | 54 | | |
| | 55 //! [5] 56 * class AnalogClockWindow : public RasterWindow | | |
| Design | 57 { | | |
| | <pre>58 public: 59 AnalogClockWindow();</pre> | | |
| | 60 | | |
| Debug | 61 protected: 62 void timerEvent(QTimerEvent *) override; | | |
| × | 63 void render(QPainter *p) override; 64 | | |
| Projects | 65 private: | | |
| 0 | <pre>66</pre> | | |
| Help | 68 //1 [5] | | |
| | 69 78 | | |
| | 71 //! [6] | | |
| Open Documents 🗢 🖨 🛒 | 73 AnalogClockWindow::AnalogClockWindow() 73 f | | |
| main.cpp | <pre>74 setTitle("Analog Clock");</pre> | | |
| analogctock | 75 resize(200, 200); 76 | | |
| | <pre>77 m_timerId = startTimer(1000); 78 }</pre> | | |
| . | 79 //! [6] | | |
| Debug | 80 81 //! [7] | | |
| | 82 * void AnalogClockWindow::timerEvent(QTimerEvent *event | ε) | |
| | <pre>83 { 84 if (event->timerId() == m_timerId)</pre> | | |
| Would you like to take a guick UI tour? T | 85 renderLater(); his tour highlights important user interface elements and shows how the | ware used. To take the tour later, colort | |
| Help > UI Tour. | is tour nightights important user interface elements and shows how the | Take UI Tour | Do Not Show Again × |
| P. Type to locate (Ctrl+K) | Issues 2 Search Results 3 Application Output 4 Compile Outpu | t 5 QML Debugger Console 8 Test Results 💠 | - |

11) After waiting for a period of time, the interface shown in the figure below will pop up, which means that QT can compile and run normally.



12) References

https://wiki.qt.io/Install_Qt_5_on_Ubuntu https://download.qt.io/archive/qtcreator https://download.qt.io/archive/qt

Recommended

3. 29. ROS installation method

3. 29. 1. How to install ROS 1 Noetic on Ubuntu20.04

1) The currently active version of ROS 1 is as follows, the recommended version is **Noetic Ninjemys**

Active ROS 1 distributions



DistroRelease datePosterTuturtle, turtle in tutorioEOL dateROS Noetle Ninjemys
(Recommended)May 23rd, 2020Image: Commended of the comme

http://docs.ros.org https://wiki.ros.org/Distributions

2) The link to the official installation documentation of ROS 1 **Noetic Ninjemys** is as follows:

http://wiki.ros.org/noetic/Installation/Ubuntu

3) In the official installation documentation of ROS Noetic Ninjemys, Ubuntu recommends using Ubuntu20.04, so please ensure that the system used by the

development board is **Ubuntu20.04 desktop system**.

http://wiki.ros.org/noetic/Installation

Select Your Platform Supported: Ubuntu Focal amd64 armhf arm64 Obbian Buster amd64 arm64 Source installation

4) Then use the script below to install ros1 orangepi@orangepi5pro:~\$ install ros.sh ros1

5) Before using the ROS tool, you first need to initialize rosdep. Then when compiling the source code, you can quickly install some system dependencies and some core components in ROS.

Note that when running the following command, you need to ensure that the development board can access github normally, otherwise an error will be reported due to network problems.

The install_ros.sh script will try to modify /etc/hosts and automatically run the following commands. However, this method cannot guarantee that github can be accessed normally every time. If install_ros.sh prompts the following error after installing ros1, please find other ways to allow the linux system of the development board to access github normally, and then manually run the following Order.

https://raw.githubusercontent.com/ros/rosdistro/master/rosdep/osx-homebrew.yaml Hit https://raw.githubusercontent.com/ros/rosdistro/master/rosdep/base.yaml ERROR: error loading sources list:

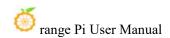
The read operation timed out

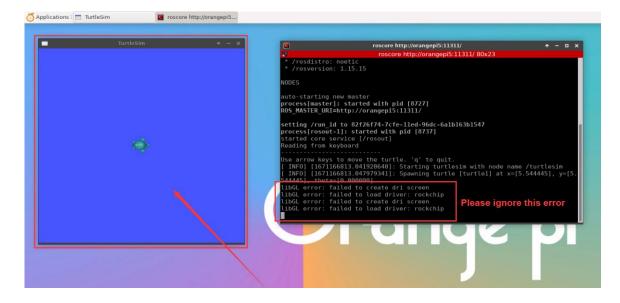
orangepi@orangepi:~\$ source /opt/ros/noetic/setup.bash orangepi@orangepi:~\$ sudo rosdep init Wrote /etc/ros/rosdep/sources.list.d/20-default.list Recommended: please run

rosdep update orangepi@orangepi:~\$ rosdep update reading in sources list data from /etc/ros/rosdep/sources.list.d Hit https://raw.githubusercontent.com/ros/rosdistro/master/rosdep/osx-homebrew.yaml Hit https://raw.githubusercontent.com/ros/rosdistro/master/rosdep/base.yaml Hit https://raw.githubusercontent.com/ros/rosdistro/master/rosdep/python.yaml Hit https://raw.githubusercontent.com/ros/rosdistro/master/rosdep/ruby.yaml Hit https://raw.githubusercontent.com/ros/rosdistro/master/releases/fuerte.yaml Query rosdistro index https://raw.githubusercontent.com/ros/rosdistro/master/index-v4.yaml Skip end-of-life distro "ardent" Skip end-of-life distro "bouncy" Skip end-of-life distro "crystal" Skip end-of-life distro "dashing" Skip end-of-life distro "eloquent" Add distro "foxy" Add distro "galactic" Skip end-of-life distro "groovy" Add distro "humble" Skip end-of-life distro "hydro" Skip end-of-life distro "indigo" Skip end-of-life distro "jade" Skip end-of-life distro "kinetic" Skip end-of-life distro "lunar" Add distro "melodic" Add distro "noetic" Add distro "rolling" updated cache in /home/orangepi/.ros/rosdep/sources.cache

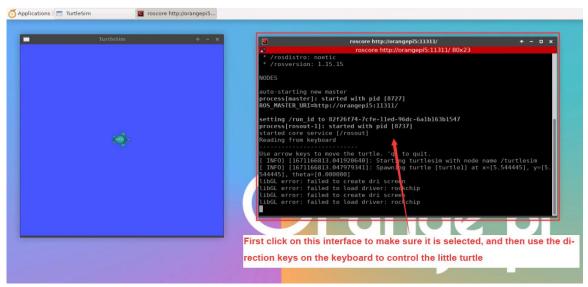
6) Then open a command line terminal window on the **desktop**, and then use the **test_ros.sh** script to start a small turtle routine to test whether ROS can be used normally. orangepi@orangepi:~\$ **test_ros.sh**

7) After running the **test_ros.sh** script, a small turtle as shown in the picture below will pop up.

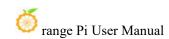


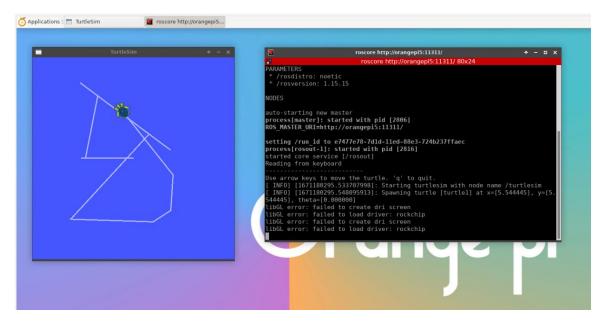


8) Then please keep the terminal window you just opened at the top



9) At this time, press the direction keys on the keyboard to control the little turtle to move up, down, left, and right.





3. 29. 2. How to install ROS 2 Galactic on Ubuntu20.04

1) The currently active version of ROS 2 is as follows, the recommended version is **Galactic Geochelone**

Active ROS 2 distributions

Recommended

Development



| Distro | Release date | Logo | EOL date |
|------------------|----------------|-----------------------|---------------|
| Humble Hawksbill | May 23rd, 2022 | | May 2027 |
| | May 23rd, 2021 | GALACTIC BOCHELONE | November 2022 |
| Foxy Fitzroy | June 5th, 2020 | | May 2023 |

http://docs.ros.org

http://docs.ros.org/en/galactic/Releases.html

2) The link to the official installation documentation of ROS 2 Galactic Geochelone is as follows:

docs.ros.org/en/galactic/Installation.html

http://docs.ros.org/en/galactic/Installation/Ubuntu-Install-Debians.html

3) In the official installation documentation of ROS 2 Galactic Geochelone, Ubuntu Linux recommends using Ubuntu20.04, so please ensure that the system used by the development board is the Ubuntu20.04 desktop system. There are several ways to install ROS 2. The following demonstrates how to install ROS 2 Galactic Geochelone through Debian packages.

4) Use the **install_ros.sh** script to install ros2

orangepi@orangepi:~\$ install_ros.sh ros2

5) The **install_ros.sh** script will automatically run the **ros2 -h** command after installing ros2. If you can see the following print, it means that the ros2 installation is complete.

usage: ros2 [-h] Call `ros2 <command> -h` for more detailed usage. ...

ros2 is an extensible command-line tool for ROS 2.

optional arguments:

-h, --help

show this help message and exit

Commands:

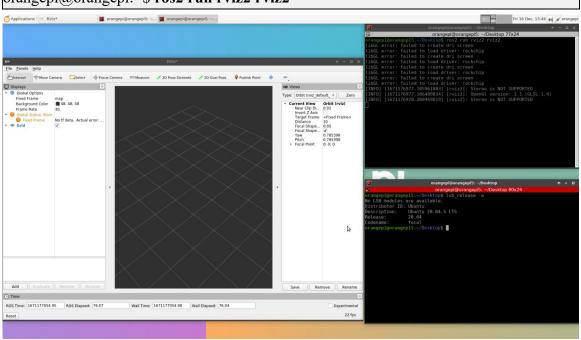
| action | Various action related sub-commands |
|------------|--|
| bag | Various rosbag related sub-commands |
| componer | nt Various component related sub-commands |
| daemon | Various daemon related sub-commands |
| doctor | Check ROS setup and other potential issues |
| interface | Show information about ROS interfaces |
| launch | Run a launch file |
| lifecycle | Various lifecycle related sub-commands |
| multicast | Various multicast related sub-commands |
| node | Various node related sub-commands |
| param | Various param related sub-commands |
| pkg | Various package related sub-commands |
| run | Run a package specific executable |
| security | Various security related sub-commands |
| service | Various service related sub-commands |
| topic | Various topic related sub-commands |
| wtf | Use `wtf` as alias to `doctor` |
| | |
| Call `ros2 | <command/> -h` for more detailed usage. |

6) Then you can use the **test_ros.sh** script to test whether ROS 2 is installed successfully. If you can see the following print, it means ROS 2 can run normally.

| orangepi@orangepi5pro:~\$ test_ros.sh |
|--|
| [INFO] [1671174101.200091527] [talker]: Publishing: 'Hello World: 1' |
| [INFO] [1671174101.235661048] [listener]: I heard: [Hello World: 1] |
| [INFO] [1671174102.199572327] [talker]: Publishing: 'Hello World: 2' |
| [INFO] [1671174102.204196299] [listener]: I heard: [Hello World: 2] |
| [INFO] [1671174103.199580322] [talker]: Publishing: 'Hello World: 3' |
| [INFO] [1671174103.204019965] [listener]: I heard: [Hello World: 3] |

7) Run the following command to open rviz2

orangepi@orangepi:~\$ source /opt/ros/galactic/setup.bash orangepi@orangepi:~\$ ros2 run rviz2 rviz2



8) For how to use ROS, please refer to the documentation of ROS 2.

http://docs.ros.org/en/galactic/Tutorials.html

3. 29. 3. How to install ROS 2 Humble on Ubuntu22.04

1) Use the **install_ros.sh** script to install ros2

orangepi@orangepi:~\$ install_ros.sh ros2

2) The **install_ros.sh** script will automatically run the **ros2 -h** command after installing ros2. If you can see the following print, it means that the ros2 installation is complete.

usage: ros2 [-h] Call `ros2 <command> -h` for more detailed usage. ...

ros2 is an extensible command-line tool for ROS 2.

optional arguments:

-h, --help show this help message and exit

Commands:

| action | Various action related sub-commands |
|--------|-------------------------------------|
| bag | Various rosbag related sub-commands |

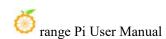
| componen | t Various component related sub-commands |
|------------|--|
| daemon | Various daemon related sub-commands |
| doctor | Check ROS setup and other potential issues |
| interface | Show information about ROS interfaces |
| launch | Run a launch file |
| lifecycle | Various lifecycle related sub-commands |
| multicast | Various multicast related sub-commands |
| node | Various node related sub-commands |
| param | Various param related sub-commands |
| pkg | Various package related sub-commands |
| run | Run a package specific executable |
| security | Various security related sub-commands |
| service | Various service related sub-commands |
| topic | Various topic related sub-commands |
| wtf | Use `wtf` as alias to `doctor` |
| | |
| Call `ros2 | <command/> -h` for more detailed usage. |

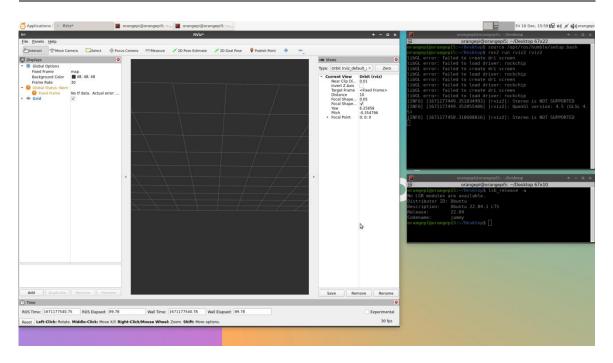
3) Then you can use the **test_ros.sh** script to test whether ROS 2 is successfully installed. If you can see the following print, it means ROS 2 can run normally.

| orangepi@orangepi5pro:~\$ test_ros.sh |
|--|
| [INFO] [1671174101.200091527] [talker]: Publishing: 'Hello World: 1' |
| [INFO] [1671174101.235661048] [listener]: I heard: [Hello World: 1] |
| [INFO] [1671174102.199572327] [talker]: Publishing: 'Hello World: 2' |
| [INFO] [1671174102.204196299] [listener]: I heard: [Hello World: 2] |
| [INFO] [1671174103.199580322] [talker]: Publishing: 'Hello World: 3' |
| [INFO] [1671174103.204019965] [listener]: I heard: [Hello World: 3] |

4) Run the following command to open rviz2

orangepi@orangepi:~\$ source /opt/ros/humble/setup.bash orangepi@orangepi:~\$ ros2 run rviz2 rviz2





5) Reference documentation

http://docs.ros.org/en/humble/index.html http://docs.ros.org/en/humble/Installation/Ubuntu-Install-Debians.html

3. 30. How to install kernel header files

1) The Linux image released by OPi comes with the deb package of the kernel header file by default, and the storage location is **/opt/**

orangepi@orangepi:~\$ ls /opt/linux-headers*

/opt/linux-headers-legacy-rockchip-rk3588_x.x.x_arm64.deb

2) Use the following command to install the deb package of the kernel header file

The name of the kernel header file deb package needs to be replaced with the actual name, please do not copy it.

orangepi@orangepi:~\$ sudo dpkg -i /opt/linux-headers-legacy-rockchip-rk3588_1.x.x_arm64.deb

3) After installation, you can see the folder where the kernel header file is located under **/usr/src**.

orangepi@orangepi:~\$ **ls /usr/src** linux-headers-5.10.160-rockchip-rk3588 4) Then you can write a hello kernel module to test the kernel header file

```
a. First write the code of hello kernel module, as shown below:
```

```
orangepi@orangepi:~$ vim hello.c
#include <linux/init.h>
#include <linux/module.h>
static int hello init(void)
         printk("Hello Orange Pi -- init\n");
         return 0;
static void hello exit(void)
         printk("Hello Orange Pi -- exit\n");
         return;
module init(hello init);
module exit(hello exit);
MODULE LICENSE("GPL");
        Then write the Makefile that compiles the hello kernel module, as shown below:
    b.
orangepi@orangepi:~$ vim Makefile
ifneq ($(KERNELRELEASE),)
obj-m:=hello.o
else
KDIR :=/lib/modules/$(shell uname -r)/build
PWD :=$(shell pwd)
all:
    make -C $(KDIR) M=$(PWD) modules
clean:
    rm -f *.ko *.o *.mod.o *.mod *.symvers *.cmd *.mod.c *.order
```

endif

c. Then use the make command to compile the hello kernel module. The output of the compilation process is as follows:

If you have problems compiling the code you copied here, please download the source code from the official tool and upload it to the Linux system of the development board for testing.

hello kernel module source code and Makefile

orangepi@orangepi:~\$ make

make -C /lib/modules/5.10.160-rockchip-rk3588/build M=/home/orangepi modules

make[1]: Entering directory '/usr/src/linux-headers-5.10.160-rockchip-rk3588'

CC [M] /home/orangepi/hello.o

MODPOST /home/orangepi/Module.symvers

CC [M] /home/orangepi/hello.mod.o

LD [M] /home/orangepi/hello.ko

make[1]: Leaving directory '/usr/src/linux-headers-5.10.160-rockchip-rk3588'

d. After compilation, the **hello.k** kernel module will be generated.

orangepi@orangepi:~\$ ls *.ko

hello.ko

e. Use the **insmod** command to insert the **hello.ko** kernel module into the kernel.

orangepi@orangepi:~\$ sudo insmod hello.ko

f. Then use the **demsg** command to view the output of the **hello.ko** kernel module. If you can see the following output, it means that the **hello.ko** kernel module is loaded correctly.

orangepi@orangepi:~\$ dmesg | grep "Hello"

[2871.893988] Hello Orange Pi -- init

g. Use the **rmmod** command to uninstall the **hello.ko** kernel module

orangepi@orangepi:~\$ sudo rmmod hello

orangepi@orangepi:~\$ dmesg | grep "Hello"

[2871.893988] Hello Orange Pi -- init

[3173.800892] Hello Orange Pi -- exit

3. 31. 10.1-inch MIPI LCD screen usage method

3. 31. 1. **10.1** inch MIPI screen assembly method

- 1) First prepare the necessary accessories
 - a. 10.1 inch MIPI LCD display + touch screen



b. Screen adapter board + 31pin to 40pin cable



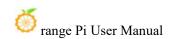
c. 30pin MIPI cable



d. 12pin touch screen cable



2) Connect the 12pin touch screen cable, 31pin to 40pin cable, and 30pin MIPI cable to the screen adapter board as shown below. **Note that the blue insulated side of the touch screen cable is facing down**, and the insulated side of the other two cables is facing up.,



if connected incorrectly, it will cause no display or inability to touch.



3) Place the adapter board connected with the cable on top of the MIPI LCD screen as shown below, and connect the MIPI LCD screen and the adapter board through a 31pin to 40pin cable.



4) Then connect the touch screen and the adapter board through the 12pin touch screen cable, paying attention to the orientation of the insulation surface



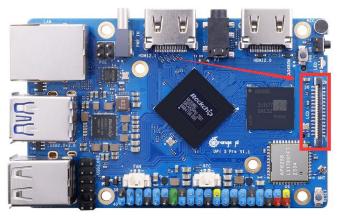
5) Finally, connect it to the LCD interface of the development board through a 30pin MIPI cable.



3. 31. 2. How to open the 10.1-inch MIPI LCD screen configuration

1) The Linux image does not have the configuration to open the mipi LCD screen by default. If you need to use the mipi LCD screen, you need to open it manually.

2) The location of the interface of the mipi lcd screen on the development board is as shown in the figure below

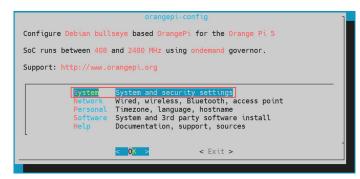


3) The steps to open mipi lcd configuration are as follows:

a. First run orangepi-config. Ordinary users remember to add sudo permissions.

orangepi@orangepi:~\$ sudo orangepi-config

b. Then select System



c. Then select Hardware

| Install Install to/update boot loader Bootenv Edit boot environment CPU Set CPU speed and governor Avahi Announce system in the network Herdware Toggle hardware configuration: UART, I2C, etc. SSH Reconfigure SSH daemon Firmware Run ant undate & ant ungrade | System settings | 1 |
|--|--|---|
| ZSH Install ZSH with plugins and tmux Desktop Disable desktop or change login type | Bootenv Edit boot environment CPU Set CPU speed and governor Avabi Announce system in the network Hardware Toggle hardware configuration: UART, I2C, etc. SSH Reconfigure SSH daemon Firmware Run apt update & apt upgrade ZSH Install ZSH with plugins and tmux | |
| < 0 <mark>K ></mark> < Back > | < O <mark>K ></mark> < Back > | - |

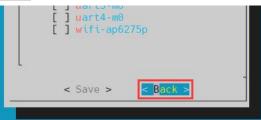
d. Then use the keyboard's arrow keys to locate **opi5pro-lcd** and then use the **space** to select it.

| [*] opi5pro-lcd |
|-----------------|
|-----------------|

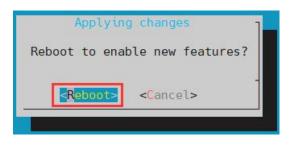
e. Then select **<Save>**to save



f. Then select <Back>



g. Then select **<Reboot>** to restart the system to make the configuration take effect.



The above settings will eventually add overlays=opi5pro-lcd to /boot/orangepiEnv.txt. You can check it first after setting it up. If this line of configuration does not exist, there is something wrong with the settings.

If you find it troublesome to use orangepi-config, you can also use the vim editor to open /boot/orangepiEnv.txt, and then add the line configuration overlays=opi5pro-lcd.

orangepi@orangepi:~\$ cat /boot/orangepiEnv.txt | grep "lcd" overlays=opi5pro-lcd #Example configuration

4) After startup, you can see the LCD screen display as follows (default is vertical screen):



3. 31. 3. How to rotate the display direction of the server version image

1) Add **extraargs=fbcon=rotate: the direction of rotation** to **/boot/orangepiEnv.txt** to set the direction displayed by the server version of Linux system, where **fbcon=rotate**: The following number can be set to:

- a. 0: Normal screen (default is vertical screen)
- b. 1:Turn clockwise 90 degrees
- c. 2:Flip 180 degrees
- d. 3:Rotate 270 degrees clockwise

orangepi@orangepi:~\$ **sudo vim /boot/orangepiEnv.txt** overlays=lcd1

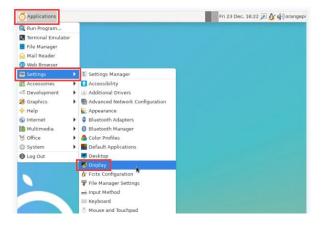
extraargs=cma=64M fbcon=rotate:3

Note that if the configuration line extraargs=cma=64M is included by default in /boot/orangepiEnv.txt, the configuration fbcon=rotate:3 can be added to the end of extraargs=cma=64M (need to be separated by spaces).

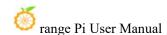
2) Then **restart** the Linux system and you will see that the direction of the LCD screen display has rotated.

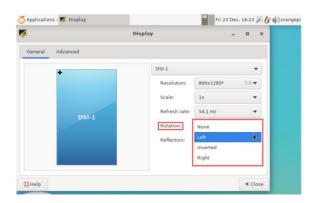
3. 31. 4. How to mirror the rotation display and touch direction of the desktop version

1) First open the **Display** settings in the linux system



- 2) Then select the direction you want to rotate in Rotation
 - a. None: No rotation
 - b. Left: Rotate 90 degrees to the left
 - c. **Inverted**: Flip up and down, equivalent to rotating 180 degrees
 - d. Right: Rotate 90 degrees to the right





3) Then click Apply

| | Display | _ • × |
|------------------|---------------|-----------------|
| General Advanced | | |
| | DSI-1 | • |
| + | Resolution: | 800x1280* 5:8 - |
| | Scale: | 1x 💌 |
| DSI-1 | Refresh rate: | 54.1 Hz 💌 |
| | Rotation: | Left |
| | Reflection: | None |
| | | Apply |
| | | |

4) Then select Keep this configuration

| pplications 🛛 🗾 Display | Sonfirm | ation | | | |
|---|------------------------|--------------------|-------------------|-------------------|---|
| | Display | | - | × | |
| eneral Advanced | | | | | |
| | E | DSI-1 | | • | |
| + | | Resolution: | 800x1280* | 5:8 🕶 | |
| | | Scale: | lx | Ŧ | |
| DSI-1 | | Refresh rate: | 54.1 Hz | Ŧ | |
| | | Rotation: | Left | • | |
| • | Confirmat | Rofloction: ion | Nono | * - | × |
| Would you like t The previous configur | - | | | γ to this questio | |
| ie Fr | eep this configuration | n B | estore the previo | us configuration | |

5) At this point, the screen display has been rotated, and then close the **Display** program.

6) The above steps will only select the display direction, and will not rotate the touch direction. Use the **set_lcd_rotate.sh** script to rotate the touch direction. After this script is set, it will automatically restart, and then you can test whether the touch can be used

normally

a. None: No rotation

orangepi@orangepi:~\$ set_lcd_rotate.sh none

b. Left: Rotate 90 degrees to the left

orangepi@orangepi:~\$ set_lcd_rotate.sh left

c. Inverted: Flip up and down, equivalent to rotating 180 degrees

orangepi@orangepi:~\$ set_lcd_rotate.sh inverted

d. **Right**: Rotate 90 degrees to the right

orangepi@orangepi:~\$ set_lcd_rotate.sh right

The set_lcd_rotate.sh script mainly does four things:

- 1. Rotate the direction of framebuffer display
- 2. Rotate the direction of touch
- 3. Turn off the startup logo
- 4. Restart the system

The direction of rotation touch is achieved by adding the Option "TransformationMatrix" "x x x x x x x x x x x" line configuration to /usr/share/X11/xorg.conf.d/40-libinput.conf. Among them, "x x x x x x x x x x" has different configurations in different directions.

7) Touch to rotate reference material

https://wiki.ubuntu.com/X/InputCoordinateTransformation

3. 32. Instructions for using the logo on and off the machine

1) The power on/off logo will only be displayed on the desktop version of the system by default.

2) Set the **bootlogo** variable to **false** in **/boot/orangepiEnv.txt** to turn off the switch logo.

orangepi@orangepi:~\$ vim /boot/orangepiEnv.txt verbosity=1 bootlogo=false

3) Set the **bootlogo** variable to **true** in **/boot/orangepiEnv.txt** to enable the power on/off logo.

orangepi@orangepi:~\$ vim /boot/orangepiEnv.txt verbosity=1

bootlogo=true

4) The location of the boot logo picture in the Linux system is

/usr/share/plymouth/themes/orangepi/watermark.png

5) After replacing the boot logo image, you need to run the following command to take effect

orangepi@orangepi:~\$ sudo update-initramfs -u

3.33. Testing methods for OV13850 and OV13855 MIPI cameras

Please note that in Linux systems, in order to ensure that the 3A service can run normally and obtain normal camera images, the Docker service needs to be disabled. If the Docker service is not disabled, the image captured by the camera will not contain the 3A effect and will appear as a dark image. The method to disable the Docker service is as follows:

orangepi@orangepi:~\$ sudo systemctl disable docker.socket docker.service containerd.service orangepi@orangepi:~\$ sudo reboot

Currently, the development board supports two MIPI cameras, OV13850 and OV13855. The specific pictures are as follows:

a. OV13850 camera with 13 million MIPI interface



b. OV13855 camera with 13 million MIPI interface

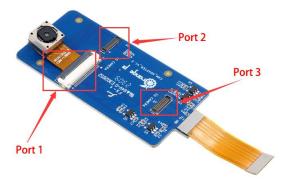


The adapter board and FPC cable used by the OV13850 and OV13855 cameras are the same, but the locations where the two cameras are connected to the adapter board are different. The FPC cable is shown in the figure below. Please note that the FPC cable has a direction. The end marked **TO MB** needs to be plugged into the camera interface of the development board, and the end marked **TO CAMERA** needs to be plugged into the camera adapter board.

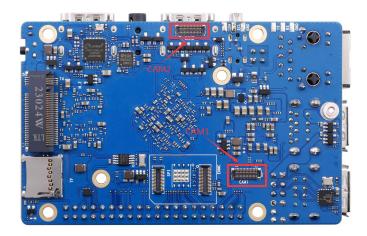


There are a total of 3 camera interfaces on the camera adapter board, and only one can be connected and used at the same time, as shown in the figure below, among which:

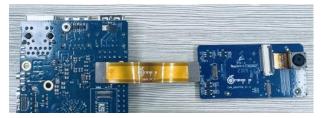
- a. Connect the OV13850 camera to interface 1
- b. Connect the OV13855 camera to interface 2
- c. Interface No. 3 is not used, just ignore it.



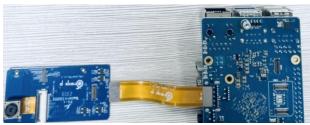
There are a total of 2 camera interfaces on the Orange Pi 5 Pro development board. We define the positions of Cam1 and Cam2 as shown in the figure below:



The method of plugging the camera into the Cam1 interface of the development board is as follows:



The method of plugging the camera into the Cam2 interface of the development board is as follows:

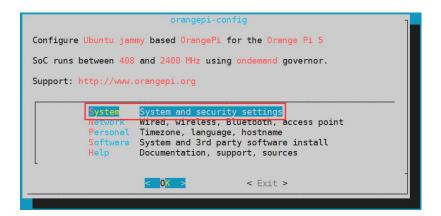


After connecting the camera to the development board, we can use the following method to test the camera:

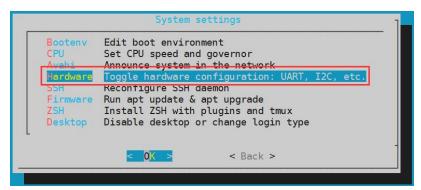
a. First run **orangepi-config**. Ordinary users remember to add **sudo** permissions.

orangepi@orangepi:~\$ sudo orangepi-config

b. Then select System



c. Then select Hardware



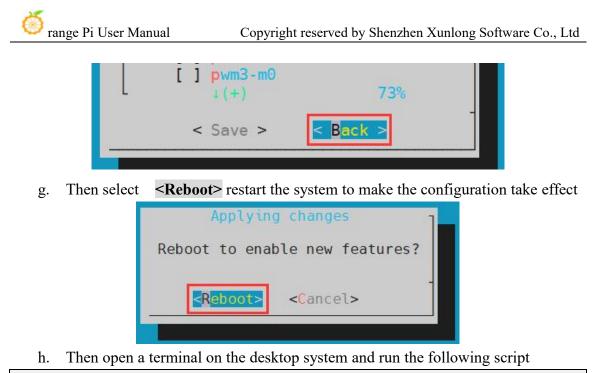
d. Then use the keyboard's arrow keys to locate the position shown in the figure below, and then use the space to select the camera you want to open, where **opi5pro-cam1** means using the ov13850 or ov13855 camera in the Cam1 interface of the development board, and **opi5pro-cam2** means Use the ov13850 or ov13855 camera in the Cam2 interface of the development board.

| opi5pro-cam1 opi5pro-cam2 |
|------------------------------|
| |

e. Then select <Save>to save

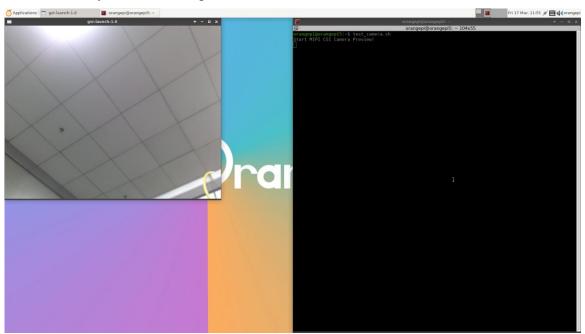
| <pre>[] pwm1-m1 [] pwm1-m2 [] pwm3-m0</pre> | 73% | |
|--|----------|---|
| < <mark>S</mark> ave > | < Back > | 1 |

f. Then select **<Back>**



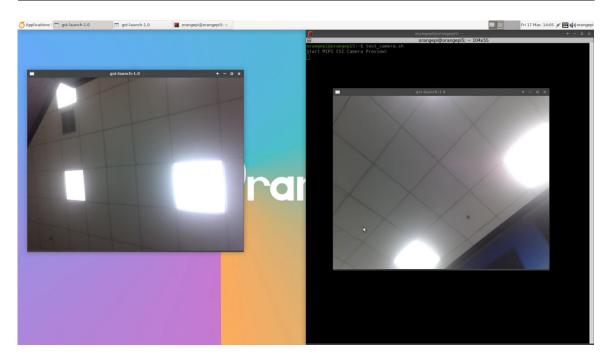
orangepi@orangepi:~\$ test_camera.sh

i. Then you can see the preview screen of the camera



In addition to a single camera, we can also use two cameras at the same time (supporting ov13850 and ov13855 mix and match). After connecting the dual cameras, open the configuration of Cam1+Cam2 through **orangepi-config** as in the previous steps, then restart the system, then open the terminal on the desktop and run the **test_camera.sh** script to see the previews of the two cameras, as follows As shown in the figure:





Please refer to the link below for camera dts configuration. You can modify it yourself if necessary;

https://github.com/orangepi-xunlong/linux-orangepi/blob/orange-pi-5.10-rk35xx/arc h/arm64/boot/dts/rockchip/rk3588s-orangepi-5-pro-camera1.dtsi

https://github.com/orangepi-xunlong/linux-orangepi/blob/orange-pi-5.10-rk35xx/arc h/arm64/boot/dts/rockchip/rk3588s-orangepi-5-pro-camera2.dtsi

The configuration of dt overlay is in the following directory:

https://github.com/orangepi-xunlong/linux-orangepi/tree/orange-pi-5.10-rk35xx/arc h/arm64/boot/dts/rockchip/overlay

3. 34. How to use the ZFS file system

3. 34. 1. How to install ZFS

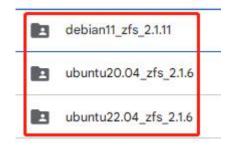
Before installing zfs, please make sure that the Linux image you are using is the latest version. In addition, if zfs is already installed in the system, there is no need to install it again.

Before installing zfs, you first need to install the kernel header files. For how to

install the kernel header files, please refer to the instructions in the section "How to Install the Kernel Header Files".

In Ubuntu20.04, Ubuntu22.04 and Debian11 systems, zfs cannot be installed directly through apt. This is because the zfs version in the default apt source is lower than 2.1.6 and is incompatible with the rk linux5.10 kernel. This problem is fixed in zfs 2.1.6 and later versions.

In order to solve this problem, we provide a deb package of zfs that can be installed normally, which can be downloaded from the **official tool** of the development board. Open the **official tool** and enter the **zfs related deb package folder used by Ubuntu and Debian systems**. You can see three types of deb packages for Ubuntu20.04, Ubuntu22.04 and Debian11. Please download the required version.



After downloading the corresponding version of the zfs deb package, please upload them to the Linux system of the development board. For the upload method, please refer to the instructions in the Methods of Uploading Files to the Development Board Linux System.

After the upload is completed, use the **cd** command on the command line of the development board Linux system to enter the directory of the deb package, and then use the following command to install the zfs deb package.

```
orangepi@orangepi:~$ sudo apt install ./*.deb
```

After the installation is complete, use the following command to see the zfs-related kernel modules:

orangepi@orangepi:~\$ ls /lib/modules/5.10.160-rockchip-rk3588/updates/dkms/ icp.ko spl.ko zavl.ko zcommon.ko zfs.ko zlua.ko znvpair.ko zunicode.ko zzstd.ko

Then restart the Linux system and you will see that the zfs kernel module will be

| orangepi@orangepi | ~\$ lsmod gre | p "zfs" |
|-------------------|-----------------|--------------------------------------|
| zfs | 2801664 | 0 |
| zunicode | 327680 | 1 zfs |
| zzstd | 471040 | 1 zfs |
| zlua | 139264 | 1 zfs |
| zcommon | 69632 | 2 1 zfs |
| znvpair | 61440 | 2 zfs,zcommon |
| zavl | 16384 | 1 zfs |
| icp | 221184 | 1 zfs |
| spl | 77824 | 6 zfs,icp,zzstd,znvpair,zcommon,zavl |

automatically loaded.:

In Debian12, the default version of zfs is 2.1.11, so we can install zfs directly through the following command. Again, before installation, you need to ensure that the system has installed the deb package of the kernel header file.

| orangepi@orangepi:~\$ sudo apt install -y zfsutils-linux zfs-dkms | | | | | | | |
|---|--------------------------|--|--|--|--|--|--|
| 3. 34. 2. | How to create a ZFS pool | | | | | | |

ZFS is based on storage pools. We can add multiple physical storage devices to the pool and then allocate storage space from this pool.

The following content is demonstrated based on the development board being connected to an NVMe SSD and a USB flash drive.

1) First, we can use the **lsblk** command to view all storage devices on the development board. Currently, the development board is connected to an NVMe SSD and a USB flash drive. The output is as follows:

| orangepi@ora | angepi:~ | \$ 19 | sblk | | | |
|--------------|----------|-------|--------|----|------|-------------------|
| NAME | MAJ:MIN | | | RO | TYPE | MOUNTPOINTS |
| sda | 8:0 | 1 | 28.8G | 0 | disk | |
| —sda1 | 8:1 | 1 | 28.8G | 0 | part | |
| └─sda9 | 8:9 | 1 | 8M | 0 | part | |
| mtdblock0 | 31:0 | 0 | 16M | 0 | disk | |
| mmcblk0 | 179:0 | 0 | 29.7G | 0 | disk | |
| -mmcblk0p1 | | 0 | 1G | | | /boot |
| └─mmcblk0p2 | 179:2 | 0 | 28.4G | 0 | part | /var/log.hdd / |
| zram0 | 254:0 | 0 | 7.7G | Θ | disk | [SWAP] |
| zram1 | 254:1 | 0 | 200M | 0 | disk | /var/log |
| n∨me0n1 | 259:0 | 0 | 476.9G | 0 | disk | |
| —n∨me0n1p1 | 259:3 | 0 | 476.9G | 0 | part | |
| └─n∨me0n1p9 | 259:4 | 0 | 8M | 0 | part | |
| orangepi@ora | angepi:~ | \$ | | | | |

2) Then enter the following command to create a ZFS pool, including two storage devices: NVMe SSD and USB flash drive.

orangepi@orangepi:~\$ sudo zpool create -f pool1 /dev/nvme0n1 /dev/sda

3) Then use the **zpool list** command to see that the system has created a ZFS pool named **pool1**, and the size of ZFS pool pool1 is the size of the NVME SSD plus the size of the USB flash drive.

| orangep | oi@oran | gepi:~\$ | zpool | list | | | | | | |
|---------|---------|----------|-------|---------|----------|------|-----|-------|--------|---------|
| NAME | SIZE | ALLOC | FREE | CKPOINT | EXPANDSZ | FRAG | CAP | DEDUP | HEALTH | ALTROOT |
| pool1 | 504G | 114K | 504G | | | 0% | 0% | 1.00x | ONLINE | |

4) Then execute **df -h** and you can see that **pool1** is mounted to the /**pool1** directory.

| orangepi@orangepi:~\$ df -h | | | | | | | | |
|-----------------------------|-------------|----------|----------|-------------------------|--|--|--|--|
| Filesystem | Size U | Jsed Ava | ail Use% | Mounted on | | | | |
| tmpfs | 1.6G | 18M | 1.6G | 2% /run | | | | |
| /dev/mmcblk0p2 | 29G | 6.0G | 22G | 22% / | | | | |
| tmpfs | 7.7G | 46M | 7.7G | 1% /dev/shm | | | | |
| tmpfs | 5.0M | 4.0K | 5.0M | 1% /run/lock | | | | |
| tmpfs | 7.7G | 944K | 7.7G | 1% /tmp | | | | |
| /dev/mmcblk0p1 | 1022M | 115M | 908M | 12% /boot | | | | |
| /dev/zram1 | 188M | 4.5M | 169M | 3% /var/log | | | | |
| tmpfs | 1.6G | 80K | 1.6G | 1% /run/user/1000 | | | | |
| pool1 | 489G | 9.3M | 489G | 1% / <mark>pool1</mark> | | | | |

5) Use the following command to see that the file system type of pool1 is zfs

orangepi@orangepi:~\$ mount | grep pool1

pool1 on /pool1 type zfs (rw,xattr,noacl)

6) Then we can test copying a file to the ZFS pool

orangepi@orangepi:~\$ sudo cp -v /usr/local/test.mp4 /pool1/

'/usr/local/test.mp4' -> '/pool1/test.mp4'

3. 34. 3. Test the data deduplication function of ZFS

1) The data deduplication function of ZFS is turned off by default. We need to execute the following command to turn it on.

orangepi@orangepi:~\$ sudo zfs set dedup=on pool1

2) Then do a simple test, first enter pool1, and then execute the following command to generate a random file of 1G size

orangepi@orangepi:~\$ cd /pool1/

root@orangepi:/pool1\$ sudo dd if=/dev/urandom of=test.1g bs=1M count=1024

1024+0 records in

1024+0 records out

1073741824 bytes (1.1 GB, 1.0 GiB) copied, 5.04367 s, 213 MB/s

3) Then use the following command to copy 1000 copies of a random file of 1G size root@orangepi:/pool1\$ for ((i=0; i<1000; i++)); do sudo cp test.1g \$i.test.1g; done

4) Then use **du -lh** to see that there is currently a total of 1002G of data in the pool, but in fact the size of the ZFS pool is only **504GB** (the total capacity of SSD + U disk), which cannot hold such large data.

root@orangepi:/pool1\$ **du -lh** 1002G

5) Then use the **zpool list** command to see that only 1.01G is actually occupied, because these 1001 files are duplicates, indicating that the data deduplication function is effective.

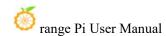
orangepi@orangepi:/pool1\$ zpool list NAME SIZE ALLOC FREE FRAG DEDUP EXPANDSZ CAP HEALTH ALTROOT CKPOINT 504G pool1 0% 6.00x ONLINE

3. 34. 4. Test the data compression function of ZFS

1) Because the stored data is different, the disk space saved by compression will also be different, so we choose to compress a relatively large plain text file for the compression test. Execute the following command to package the **/var/log/** and **/etc/** directories. into tarball

orangepi@orangepi:~\$ cd /pool1/ root@orangepi:/pool1\$ sudo tar -cf text.tar /var/log/ /etc/

2) Then the file size that can be seen through the **ls -lh** command and the space occupied in the ZFS pool are both **27M**



| total 2 -rw-r | 27M r 1 | | ot 27M | | :46 text.ta | ar | | | | |
|------------------|----------------------------|-------|--------|---------|-------------|------|-----|-------|--------|---------|
| NAME | SIZE | ALLOC | FREE | CKPOINT | EXPANDSZ | FRAG | CAP | DEDUP | HEALTH | ALTROOT |
| pool1 | 504G | 26.7M | 504G | | | 0% | 0% | 1.00x | ONLINE | - |
| orangep | orangepi@orangepi:/pool1\$ | | | | | | | | | |

3) Then we enable compression in ZFS pool pool1

root@orangepi:/pool1\$ sudo zfs set compression=lz4 pool1

4) Then execute the following command again to package the /var/log/ and /etc/ directories into a tar package

root@orangepi:/pool1\$ sudo tar -cf text.tar /var/log/ /etc/

5) At this time, you can see that the **text.tar** file size is still 27M, but it only occupies 9.47M space in the ZFS pool, indicating that the file is compressed.

| total | 9.2M | gepi:/po | | | •54 text t | ar | | | | |
|-------|---|----------|------|---------|------------|------|-----|-------|--------|---------|
| | -rw-rr 1 root root 27M Jun 1 14:54 text.tar orangepi@orangepi:/pool1\$ zpool list | | | | | | | | | |
| NAME | SIZE | ALLOC | FREE | CKPOINT | EXPANDSZ | FRAG | CAP | DEDUP | HEALTH | ALTROOT |
| pool1 | 504G | 9.47M | 504G | - | | 0% | 0% | 1.00x | ONLINE | |

3. 35. How to install and use CasaOS

CasaOS is an open source home cloud system based on the Docker ecosystem, which allows you to run a variety of home applications on your own development board, such as NAS, home automation, media servers, etc.

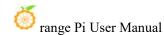
There are many problems with installing CasaOS in Debian12, please do not use this method to install.

3. 35. 1. CasaOS installation method

1) First you need to install docker. Docker is already pre-installed in the system released by Orangepi Pi. This step can be skipped. You can use the following command to check the version of docker installed.

orangepi@orangepi:~\$ docker --version Docker version 24.0.2, build cb74dfc # Output of Ubuntu Jammy system

2) Then enter the following command in the linux system to start the installation of



CasaOS

orangepi@orangepi:~\$ curl -fsSL https://get.casaos.io | sudo bash

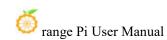
3) When you see the terminal outputting the following print information, it means that CasaOS has been installed.

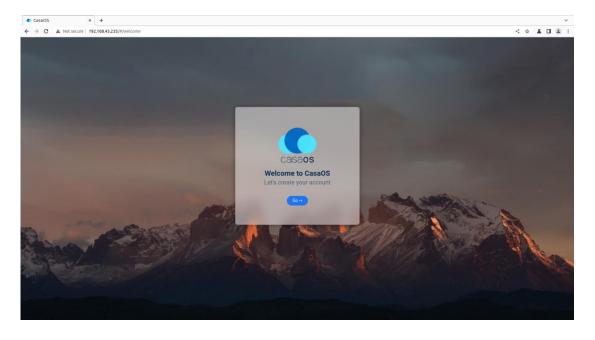
| CasaOS v0.4.4.2 | l is running at: |
|-----------------|--|
| Open your brows | er and visit the above address. |
| CasaOS Project | : https://github.com/IceWhaleTech/CasaOS |
| CasaOS Team | : https://github.com/IceWhaleTech/CasaOS#maintainers |
| CasaOS Discord | : https://discord.gg/knqAbbBbeX |
| Website | : https://www.casaos.io |
| Online Demo | : http://demo.casaos.io |
| Uninstall | : casaos-uninstall |

3. 35. 2. How to use CasaOS

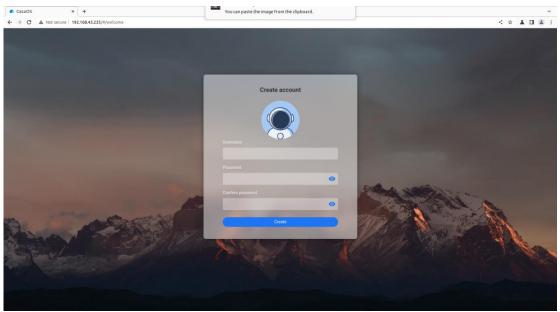
1) After installing CasaOS, enter http://the IP address of the development board in the browser to open CasaOS

2) After opening CasaO, the following welcome interface will pop up. Click "Go" to proceed to the next step.

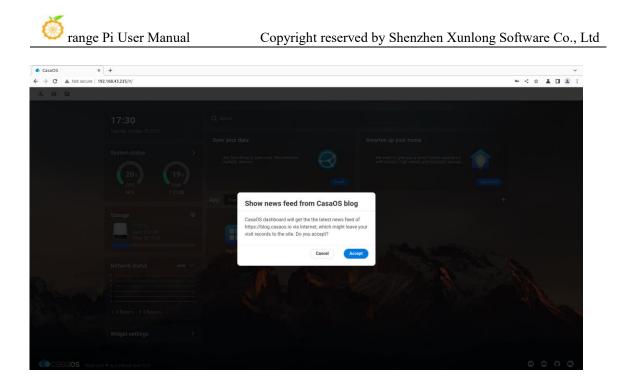




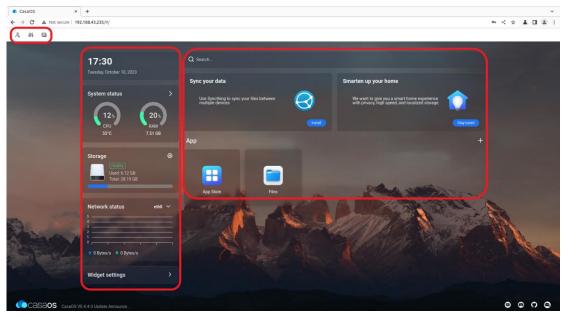
3) When you log in to CasaOS for the first time, the login interface is the interface for setting the account and password. When you log in again, only the interface for entering the account and password will appear. After setting the account and password, click "Create" to proceed to the next step.



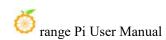
4) Click "Accept" directly in the interface below to proceed to the next step.

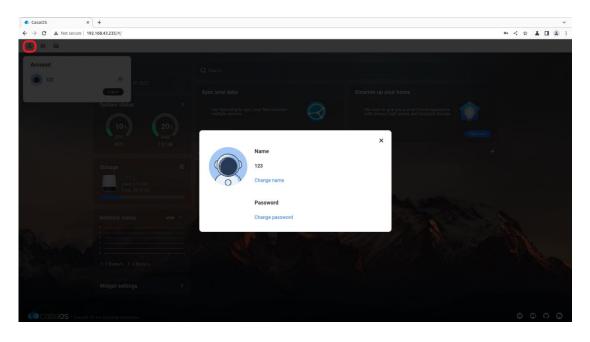


5) Now enter the main page of CasaOS. There are three icons in the upper left corner for function settings. On the left is the performance panel, which can display the current time and status information of CPU, RAM, storage, and network. On the right is the function panel. It has functions such as search, application recommendation, application store and file management.



6) You can click the first icon in the upper left corner to modify the account number and password

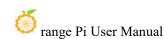


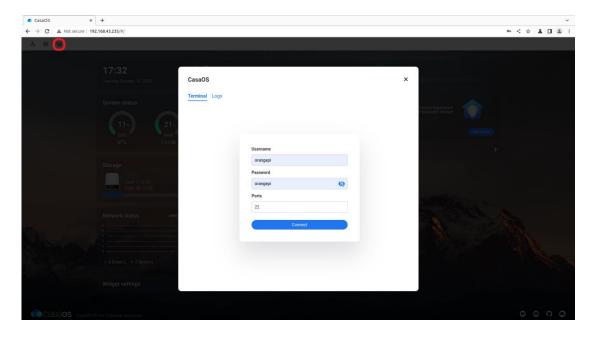


7) You can click the second icon to set basic functions

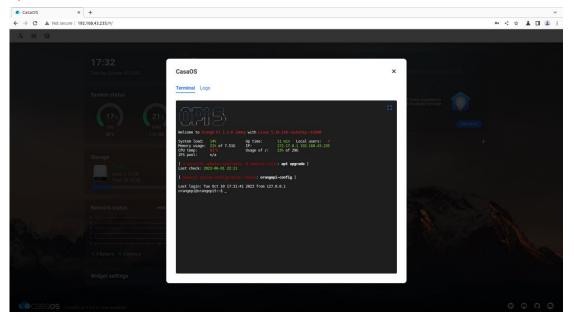


8) The third icon in the upper left corner mainly has two functions, namely switching to command line mode and printing log information. When switching to command line mode, you need to enter your account and password. The account and password here refer to the development board. Linux system account and password, the port system defaults to number 22

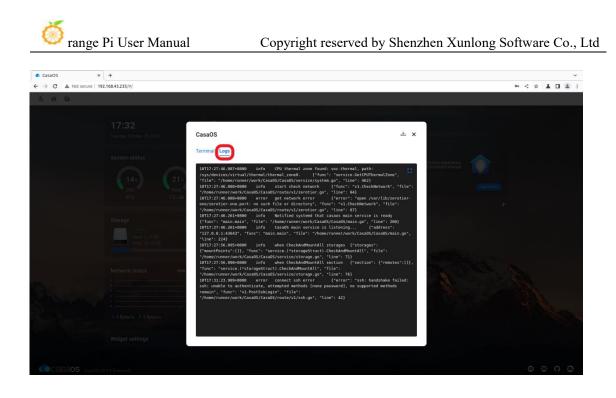




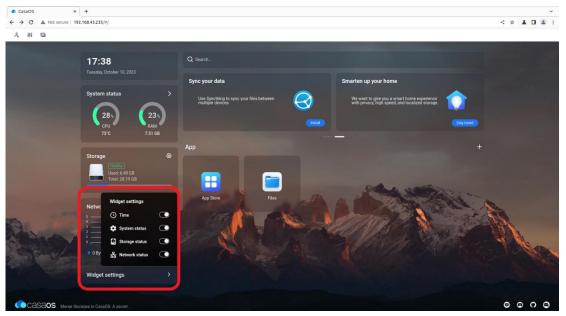
9) Then click "Connect" to enter the command line interface:



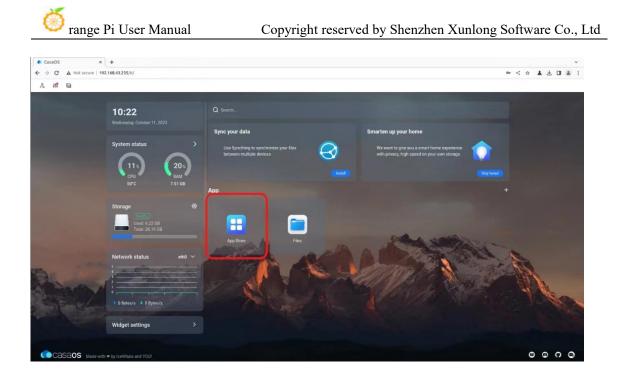
10) Another function under the third icon is to print CasaOS logs. Click "Logs" to enter. The interface is as follows:



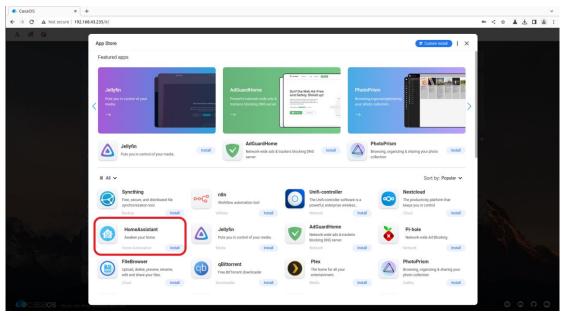
11) Click "Widget settings" in the lower left corner to set whether to display the widgets of the performance panel on the main page.



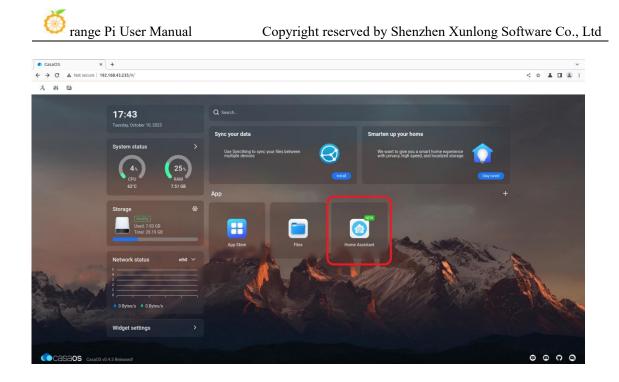
12) Click "APP Store" on the main interface to open the app store. Currently, there are a total of 70+ APPs available in the app store.



13) Here we take Home Assistant as an example to download, find Home Assistant in the APP Store, and then click the corresponding "install"



14) After the download is completed, HostAssitant will appear on the main page.



15) Click "Files" in the main interface to open the file system that comes with CasaOS, and then you can upload and save files.



| nzhen Xunlong Software Co., | ght reserved by Shenzl | byrig | Co | | /lanual | Pi User N | → range |
|-----------------------------|------------------------|-------|-------|----------------------------------|-----------|-----------------------------------|------------------|
| v | | | | | | + | CasaOS 3 |
| ∞ < ☆ 🛓 🖬 😩 | | | | | | 2.168.43.235/#/ | → C ▲ Not secure |
| Vpload or create | | | | | | Root > DATA | iles |
| 88 | | | | | | Total 5 items | Root |
| | | | | | | | DATA |
| | | | | $\mathbf{\overline{\mathbf{v}}}$ | | | Documents |
| | Media | | Galle | Downloads | Documents | AppData | Downloads |
| | | | | | | 10/10 05:27 | Gallery |
| | | | | | | | Media |
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16) When uploading files, you need to switch to the target folder, then drag the local file to the indicated area in the picture, or click "Upload or Create" in the upper right corner to select the file to upload.

| CasaOS 3 | × + | | × |
|--------------------|-----------------------------------|--|------------------|
| ← → C ▲ Not secure | 192.168.43.235/#/ | | < 🖈 👗 🖬 😩 🗄 |
| Files | Root > DATA > Media > TV Shows | | Upload or create |
| Root | Total 0 items | | 88 |
| DATA | | | |
| Documents | | | |
| Downloads | | | |
| No. Gallery | | | |
| Media | | | |
| Location + | | Drop your files here to upload | |
| | | or | |
| | | New file New folder Upload files Upload folder | |
| | | The provide the provide the second | |
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| | | | |
| | | | |
| PilesDrop | | | |
| Shared | | | |
| | | | |

17) If you want to uninstall CasaOS, you can use the following command:

orangepi@orangepi5pro:~\$ casaos-uninstall

3. 36. How to shut down and restart the development board

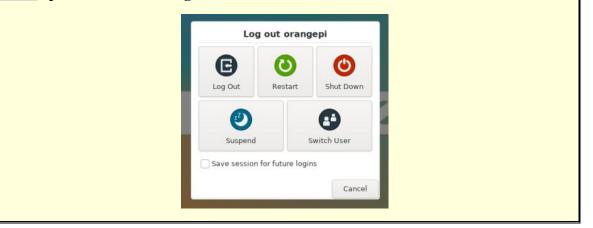
1) During the running of the Linux system, if you directly unplug the Type-C power supply and cut off the power, the file system may lose some data or be damaged. Therefore, please use the **poweroff** command to shut down the Linux system of the development board before cutting off the power. Then unplug the power supply.

orangepi@orangepi:~\$ sudo poweroff

2) In addition, the development board is equipped with a power on/off button, and you can also short press the power on/off button on the development board to shut down.



Note that after pressing the power button on the Linux desktop version, the confirmation box shown in the figure below will pop up. You need to click the Shut Down option before shutting down.



3) After shutting down, short press the power button on the development board to turn it on.



4) The command to restart the linux system is

orangepi@orangepi:~\$ sudo reboot

4. Orange Pi OS Arch System Instructions

4.1. Orange Pi OS Arch system adaptation status

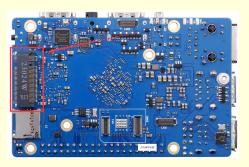
| Function | OPi OS Arch Gnome Wayland |
|----------------------|----------------------------------|
| HDMI 2.1 Video | ОК |
| HDMI 2.1 Video | ОК |
| HDMI 2.0 Audio | ОК |
| HDMI 2.0 Audio | ОК |
| USB2.0x3 | ОК |
| USB3.0x1 | ОК |
| Gigabit network port | ОК |

| Network port status light | ОК |
|------------------------------|----|
| WIFI | ОК |
| Bluetooth | ОК |
| Debug serial port | ОК |
| RTC | ОК |
| FAN interface | ОК |
| Emmc Extension ports | ОК |
| GPIO (40pin) | ОК |
| UART (40pin) | ОК |
| SPI (40pin) | ОК |
| I2C (40pin) | ОК |
| CAN (40pin) | ОК |
| PWM (40pin) | ОК |
| TF card boot | ОК |
| OV13850 Camera | ОК |
| OV13855 Camera | ОК |
| SPI+NVME start up | ОК |
| SPI+SATA start up | ОК |
| LCD | ОК |
| MIC | ОК |
| Headphone playback | ОК |
| Headphone recording | ОК |
| Tri-color LED light | ОК |
| GPU | ОК |
| NPU | NO |
| VPU | ОК |
| On/off button | ОК |
| watchdog test | ОК |
| Chromium Hard solution video | NO |
| MPV hard solution video | ОК |

4.2. How to use SATA SSD in OPi OS Arch system

The m.2 interface shown in the figure below can use either nyme ssd or sata ssd.

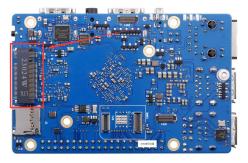
Since the pcie2.0 controller and the sata controller are optional, only one of the configurations can be opened at the same time. The OPi OS Arch image released by Orange Pi opens the pcie configuration by default, so it can only recognize nvme ssd by default. If you want to use sata ssd, you need to open the corresponding configuration.



1) First you need to prepare a SATA SSD solid state drive



2) Then insert the SSD into the M.2 interface of the development board and secure it



- 3) There are two main ways to use sata ssd:
 - a. The OPi OS Arch system is installed in the tf card, and then the sata ssd is inserted as an external storage device. This section mainly explains this usage.
 - Burn the OPi OS Arch system into the sata ssd, and then start the OPi OS Arch system in the sata ssd. For this usage, please see the instructions in the section "How to Burn Linux Image to SPIFlash+SATA SSD"

4) Then add the following configuration to /boot/extlinux/extlinux.conf
[orangepi@orangepi~]\$ sudo vim /boot/extlinux/extlinux.conf
LABEL Orange Pi
LINUX /Image
FDT /dtbs/rockchip/rk3588s-orangepi-5.dtb
FDTOVERLAYS /dtbs/rockchip/overlay/rk3588-ssd-sata2.dtbo #Configuration
that needs to be added

5) Then restart the OPi OS Arch system

6) If everything is normal, use the **sudo fdisk -1** command after the system restarts to see the sata ssd information

| [orangepi@ | orangepi ~]\$ | sudo fd | lisk -l | | | | | |
|---|---------------|-----------|---------------|--------------------------|--|--|--|--|
| | | | | | | | | |
| Disk /dev/sc | la: 238.47 Gi | B, 2560 | 605143041 | oytes, 500118192 sectors | | | | |
| Disk model: | Fanxiang S2 | 201 25 | | | | | | |
| Units: sector | rs of 1 * 512 | = 512 b | ytes | | | | | |
| Sector size (logical/physical): 512 bytes / 512 bytes | | | | | | | | |
| I/O size (mi | nimum/optim | nal): 512 | 2 bytes / 512 | 2 bytes | | | | |
| Disklabel ty | pe: gpt | | | | | | | |
| Disk identif | ier: 43FFB29 | 2-340D | -654C-8C3 | 0-6C64AEDAA0F4 | | | | |
| | | | | | | | | |
| Device | Start | End | Sectors | Size Type | | | | |
| /dev/sda1 | 2048 50011 | 7503 50 | 0115456 2 | 38.5G Linux filesystem | | | | |
| ••••• | | | | | | | | |

4.3. How to use the 10.1-inch MIPI LCD screen

4. 3. 1. **10.1-inch MIPI screen assembly method**

1) First prepare the necessary accessories

a. 10.1 inch MIPI LCD display + touch screen



b. Screen adapter board + 31pin to 40pin cable



c. 30pin MIPI cable



d. 12pin touch screen cable

| | - | VW-1 | | 00004 |
|-----|-----|------|-----|-------|
| 80C | 60V | VW-1 | AWM | 20024 |

2) Connect the 12pin touch screen cable, 31pin to 40pin cable, and 30pin MIPI cable to the screen adapter board as shown below. Note that **the blue insulated side of the touch screen cable is facing down**, and the insulated side of the other two cables is facing up. , if connected incorrectly, it will cause no display or inability to touch.



3) Place the adapter board connected with the cable on top of the MIPI LCD screen as shown below, and connect the MIPI LCD screen and the adapter board through a 31pin to 40pin cable.



4) Then connect the touch screen and the adapter board through the 12pin touch screen cable. Pay attention to the orientation of the insulation surface.



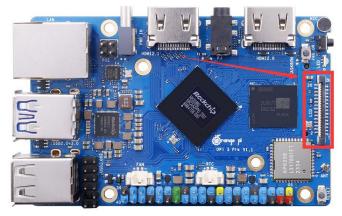
5) Finally, connect it to the LCD interface of the development board through a 30pin MIPI cable.



4. 3. 2. How to open the 10.1-inch MIPI LCD screen configuration

1) The OPi OS Arch image does not have the configuration to open the mipi LCD screen by default. If you need to use the mipi LCD screen, you need to open it manually.

2) The interface of the mipi lcd screen on the development board is as shown below:



3) The method to open mipi lcd configuration is as follows:

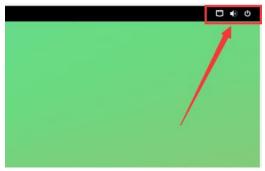
[orangepi@orangepi~]\$ sudo vim /boot/extlinux/extlinux.conf LABEL Orange Pi LINUX /Image FDT /dtbs/rockchip/rk3588s-orangepi-5-pro.dtb FDTOVERLAYS /dtbs/rockchip/overlay/rk3588-opi5pro-lcd.dtbo #Configuration that needs to be added

4) Then restart the OPi OS Arch system

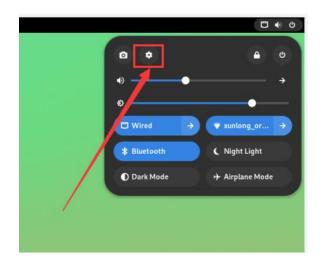
5) After restarting, you can see the LCD screen display as follows (default is vertical screen):



- 4. 3. 3. Methods of rotating display and touch direction
- 1) First click on the area in the upper right corner of the desktop



2) Then open settings



3) Then select **Displays**

| ٩ | Settings | : | | Displays | × |
|----|------------------|----------|--------------|----------------------|---|
| 0 | Multitasking | | Gamesia | | |
| 88 | Applications | <i>→</i> | Orientation | Landscape 👻 | |
| | Privacy | <i>→</i> | Resolution | 1920 × 1080 (16:9) 🝷 | |
| | Online Accounts | | Refresh Rate | 60.00 Hz 👻 | |
| < | Sharing | | Scale | 100 % 200 % | |
| ۲ | Sound | / | Carrier | | |
| 0 | Power | | Night Light | Off → | |
| | Displays | | | | |
| 0 | Mouse & Touchpad | | | | |
| • | Keyboard | | | | |
| ٠ | Printers | | | | |
| | Removable Media | | | | |
| | Color | | | | |

4) Then select the direction you want to rotate in the Orientation of Displays

orange Pi User Manual

| ۹ | Settings | : | Displays | × |
|----|------------------------------|---|-------------------|---------------------|
| Ю | Multitasking | | (market) | |
| 88 | Applications | ÷ | Orientation | Landscape 🗸 |
| ۲ | Privacy | ÷ | Resolution 1920 × | Portrait Right |
| @ | Online Accounts | | Refresh Rate | Portrait Left |
| 4 | Sharing | | Scale 100 9 | Landscape (flipped) |
| ۲ | Sound | | Night Light | Off → |
| - | Power | | - ngik ugik | 011 7 |
| | Displays | | | |
| | Mouse & Touchpad Keyboard | | | |
| | Printers | | | |
| | Removable Media | | | |
| | Color | | | |

5) Then select Apply

| ٩ | Settings | : | Cancel | Apply Changes? | Apply |
|----|------------------|----------|--------|--------------------------------|-------|
| 0 | Multitasking | | | | 1 |
| 88 | Applications | <i>→</i> | | Orientation Portrait Right | |
| ۲ | Privacy | ÷ | | Resolution 1920 × 1080 (16:30) | • |
| @ | Online Accounts | | | Refresh Rate 6600 Hz | - |
| 4 | Sharing | | | Scale 100% 200% | |
| ۲ | Sound | | | | 5 |
| 0 | Power | | | Night Light Off - | |
| ۵ | Displays | | | | |
| 0 | Mouse & Touchpad | | | | |
| | Keyboard | | | | |
| ٠ | Printers | | | | |
| | Removable Media | | | | |
| 4 | Color | | | | |

6) Then you can see that the screen has been rotated. At this time, you need to select **Keep Changes** to finalize the rotation.



7) The display after the LCD screen is rotated 90 degrees is as follows::



8) The touch function of the OPi OS Arch system LCD screen will rotate with the rotation of the display direction, no other settings are required.

4.4. Testing methods for OV13850 and OV13855 MIPI cameras

Currently, the development board supports two MIPI cameras, OV13850 and OV13855. The specific pictures are as follows:

a. OV13850 camera with 13 million MIPI interface



b. OV13855 camera with 13 million MIPI interface

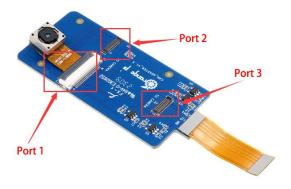


The adapter board and FPC cable used by the OV13850 and OV13855 cameras are the same, but the locations where the two cameras are connected to the adapter board are different. The FPC cable is shown in the figure below. Please note that the FPC cable has a direction. The end marked **TO MB** needs to be plugged into the camera interface of the development board, and the end marked **TO CAMERA** needs to be plugged into the camera adapter board.

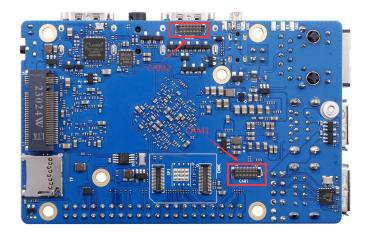


There are a total of 3 camera interfaces on the camera adapter board, and only one can be connected and used at the same time, as shown in the figure below, among which:

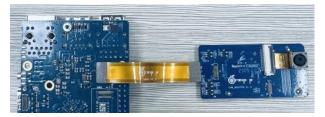
- d. Connect the OV13850 camera to interface 1
- e. Connect the OV13855 camera to interface 2
- f. Interface 3 is not used, so just ignore it.



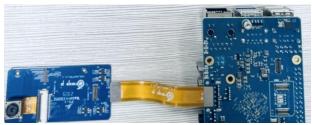
There are a total of 2 camera interfaces on the Orange Pi 5 Pro development board. We define the positions of Cam1 and Cam2 as shown in the figure below:



The method of plugging the camera into the Cam1 interface of the development board is as follows:



The method of plugging the camera into the Cam2 interface of the development board is as follows:



After connecting the camera to the development board, we can use the following method to test the camera:

a. First add the following configuration to /boot/extlinux/extlinux.conf [orangepi@orangepi ~]\$ sudo vim /boot/extlinux/extlinux.conf LABEL Orange Pi LINUX /Image FDT /dtbs/rockchip/rk3588s-orangepi-5.dtb FDTOVERLAYS /dtbs/rockchip/overlay/rk3588-opi5pro-cam1.dtbo #Configuration that needs to be added

The red font above demonstrates the configuration of opening the Cam1 interface.

The configuration of other interfaces is as shown in the following table. Just add the corresponding dtbo configuration after **FDTOVERLAYS**. If you want to add multiple configurations at the same time, separate them with spaces.

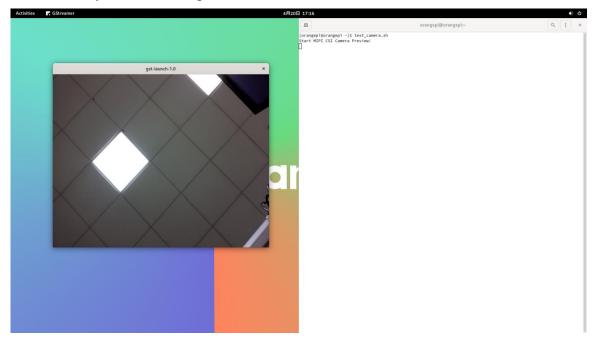
| Camera | dtbo configuration |
|--------|---|
| Cam1 | /dtbs/rockchip/overlay/rk3588-opi5pro-cam1.dtbo |
| Cam2 | /dtbs/rockchip/overlay/rk3588-opi5pro-cam2.dtbo |

b. Then restart the OPi OS Arch system

c. Then open a terminal on the desktop system and run the following script

orangepi@orangepi:~\$ test camera.sh

d. Then you can see the preview screen of the camera



4.5. How to set up the Chinese environment and install the Chinese input method

1) First click on the area in the upper right corner of the desktop



2) Then open settings

| | | | ● ● |
|---|--------------|----------------|----------------------------------|
| | • • | ۲ | Φ |
| | • | | ÷ |
| | 🗆 Wired 📑 | Wi-Fi | • |
| | \$ Bluetooth | C Night Light | |
| 1 | Dark Mode | + Airplane Mod | e |

3) Then find the Region & Language option

| ۹ | Settings | : | Region & Language | > |
|--------|-------------------|---|--|---|
| O Pow | | | The language setting is used for interface text and web pages. Formats are used for numbers, dates, and currencies. | |
| Disp | ise & Touchpad | | Your Account | |
| 🛛 Keyt | | | Language + | |
| Print | ters | | Formats | |
| Rem | ovable Media | | United States | |
| 🔓 Cold | ır | | | |
| 🛛 Regi | ion & Language | | | |
| Acce | essibility | | | |
| N User | rs | | | |
| Defa | ault Applications | | | |
| Date | e & Time | | | |
| Abo | | | | |

4) Then select Language

| 2 | Settings | : | Region & Language | × |
|-------|-------------------|---|--|---|
| 9 Pov | ver | | The language setting is used for interface text and web pages. Formats are used for numbers, dates, and currencies. | |
| Dis | plays | | | |
| Mo | use & Touchpad | | Your Account | |
| 🛢 Key | board | | Language | |
| Prir | nters | | Formats | |
| Ren | novable Media | | | |
| Col | or | 1 | | |
| 🛛 Reg | jion & Language | | | |
| Acc | essibility | | | |
| use | rrs | | | |
| 🖨 Def | ault Applications | | | |
| O Dat | e & Time | | | |
| Abo | | | | |

5) Then select Chinese

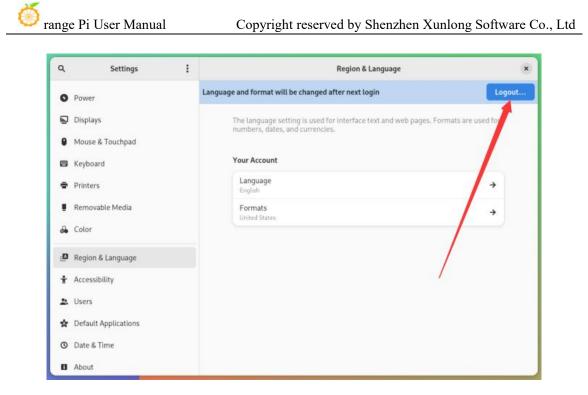
orange Pi User Manual

| Q, | Settings | : | Region & Language | × |
|----|------------------------------|------|--|------------------|
| 0 | Power Displays | | elect Language Select United States | ats are used for |
| • | Mouse & Touchpad Keyboard | 汉语 🖌 | 中国 | + |
| • | Printers Removable Media | | 1 | + |
| - | Color | | | |
| ø | Region & Language | | | |
| ŧ | Accessibility | | | |
| * | Users | | | |
| ŵ | Default Applications | | | |
| 0 | Date & Time | | | |
| | About | | | |

6) Then clickSelect

| ٩ | Settings | ÷ | | | Regi | ion & Language | | × |
|--------|-------------------------------|----|--------|--------------|------|----------------|-------------------------------|---|
| 0 | Power Displays | | The | lect Languag | | Select | b pages. Formats are used for | |
| 0 | Mouse & Touchpad | | nglish | | Uni | territatés | | |
| ٠ | Keyboard | 17 | 语 🗸 | | | 中国 | ÷ | |
| ÷ | Printers | | | ŧ | / | - | ÷ | |
| | Removable Media | | | | / | - 1 | | |
| * | Color | | | / | | | | |
| ۵ | Region & Language | | | / | | - 1 | | |
| + | Accessibility | | | / | | - 1 | | |
| ** | Users Default Applications | | | | | | | |
| × O | Date & Time | | | | | | | |
| 0 | About | | | | | | | |

7) Then click **Logout...** to log out of the system, and then log in again.



8) Then you can see that the desktop is displayed in Chinese

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| | | | | | | | | | |

9) Then install fcitx-im and fcitx-configtool

[orangepi@orangepi~]\$ sudo pacman -S fcitx-im fcitx-configtool

:: There are 3 members in group fcitx-im:

:: software warehouse community

1) fcitx 2) fcitx-qt5 3) fcitx-qt6

Enter a selection (default=all selected): 1

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- 10) Then open the Fcitx configuration program

11) Then add Google Pinyin input method

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| | 输入法 | 全 | 周配置 | 外现 | 时加组件 | | |
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| | | | | | | | |
| | 0第一个 | 输入法 | 将为非激 | 数活状态。 | 通常您需要将键盘或键盘 | - 布局名称放在第一位。 | |
| | | - 1 | 4 3 | • • | | | |

12) Then we can open a terminal to test the Chinese input method. After opening the terminal, if the English input method is still the default, we can switch to the Chinese input method through the **Ctrl+Space** shortcut key, and then we can enter Chinese.

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4.6. How to install wiringOP

Note that wiringOP is already pre-installed in the OPi OS Arch image released by Orange Pi. Unless the wiringOP code is updated, there is no need to re-download, compile and install it, you can just use it directly.

After entering the system, you can run the gpio readall command. If you can see the following output, it means that wiringOP has been pre-installed and can be used normally.

| GPIO | wPi | Name | Mode | V | Phys | ical | l V | Mode | Name | WPi | GPIO |
|------|-----|----------|------|-----|------|------|-----|-------|----------|-----|------|
| | 1 | 3.3V | | | 1 | 2 | 1 | | 5V | | |
| 59 | 0 | SDA.1 | IN | 1 | 3 | 4 | i i | 1 | 5V | | 1 |
| 58 | 1 | SCL.1 | IN | 1 | 5 | 6 | 1 | | GND | | |
| 47 | 2 | PWM13 | IN | 1 | 7 | 8 | 1 | ALT10 | TXD.2 | 3 | 13 |
| | i | GND | | 1 | 9 | 10 | 1 | ALT10 | RXD.2 | 4 | 14 |
| 138 | 5 | CAN1_RX | IN | 1 | 11 | 12 | 1 | IN | GPI01_A7 | 6 | 39 |
| 139 | 7 | CAN1_TX | IN | 1 | 13 | 14 | 1 | | GND | | |
| 46 | 8 | GPI01_B6 | IN | 1 | 15 | 16 | 0 | IN | TXD.6 | 9 | 33 |
| | i i | 3.3V | | i i | 17 | 18 | 0 | IN | RXD.6 | 10 | 32 |
| 42 | 11 | SPI0_TXD | IN | 0 | 19 | 20 | | | GND | | |
| 41 | 12 | SPI0_RXD | IN | 0 | 21 | 22 | 1 | IN | GPI01_B0 | 13 | 40 |
| 43 | 14 | SPI0_CLK | IN | 0 | 23 | 24 | 1 | IN | SPI0_CS0 | 15 | 44 |
| | 1 | GND | | | 25 | 26 | 1 | IN | SPI0_CS1 | 16 | 45 |
| 34 | 17 | SDA.4 | IN | 0 | 27 | 28 | 0 | IN | SCL.4 | 18 | 35 |
| 36 | 19 | GPI01_A4 | IN | 0 | 29 | 30 | 1 | | GND | | |
| 38 | 20 | GPI01_A6 | IN | 0 | 31 | 32 | 1 | IN | PWM14 | 21 | 62 |
| 63 | 22 | PWM15 | IN | 1 | 33 | 34 | | | GND | | |
| 135 | 23 | GPI04_A7 | IN | 0 | 35 | 36 | 0 | IN | TXD.0 | 24 | 131 |
| 134 | 25 | GPI04_A6 | IN | 0 | 37 | 38 | 0 | IN | RXD.0 | 26 | 132 |
| | | GND | | | 39 | 40 | 0 | IN | GPI04_A5 | 27 | 133 |
| GPIO | wPi | Name | Mode | V | Phys | ical | V | Mode | Name | wPi | GPIC |

1) Download the code of wiringOP

[orangepi@orangepi~]\$ sudo pacman -Syy git

[orangepi@orangepi~]\$ git clone https://github.com/orangepi-xunlong/wiringOP.git -b next

Note that Orange Pi 5 Pro needs to download the code of wiringOP next branch, please don' t miss the -b next parameter.

If there is a problem downloading the code from GitHub, you can download the source code compressed package of wiringOP.tar.gz from the official tool on the Orange Pi 5 Pro data download page.

wiringOP-Python source code compression package

wiringOP source code compression package

2) Compile and install wiringOP

[orangepi@orangepi ~]\$ sudo pacman -Syy make gcc [orangepi@orangepi ~]\$ cd wiringOP

[orangepi@orangepi wiringOP]\$ sudo ./build clean [orangepi@orangepi wiringOP]\$ sudo ./build

| GPI0 | wPi | Name | Mode | V | Phys | sical | I V | Mode | Name | wPi | GPI |
|------|-----|----------|------|---|------|-------|-----------|-------------|----------|------------|------------|
| | | + + | | + | + | ++ | -+ | + | + | + | + |
| | | 3.3V | | | 1 | 2 | | | 5V | | Ļ |
| 59 | 0 | SDA.1 | IN | 1 | 3 | 4 | | | 5V | | |
| 58 | 1 | SCL.1 | IN | 1 | 5 | 6 | | | GND | | |
| 47 | 2 | PWM13 | IN | 1 | 7 | 8 | 1 | ALT10 | TXD.2 | 3 | 13 |
| | | GND | | | 9 | 10 | 1 | ALT10 | RXD.2 | 4 | 14 |
| 138 | 5 | CAN1_RX | IN | 1 | 11 | 12 | 1 | IN | GPI01_A7 | 6 | 39 |
| 139 | 7 | CAN1_TX | IN | 1 | 13 | 14 | | | GND | | [|
| 46 | 8 | GPI01_B6 | IN | 1 | 15 | 16 | 0 | IN | TXD.6 | 9 | 33 |
| | | 3.3V | | | 17 | 18 | 0 | IN | RXD.6 | 10 | 32 |
| 42 | 11 | SPI0_TXD | IN | 0 | 19 | 20 | 1 | | GND | | 1 |
| 41 | 12 | SPI0_RXD | IN | 0 | 21 | 22 | 1 | IN | GPI01_B0 | 13 | 40 |
| 43 | 14 | SPI0_CLK | IN | 0 | 23 | 24 | 1 | IN | SPI0_CS0 | 15 | 44 |
| 1 | | GND | | | 25 | 26 | 1 | IN | SPI0_CS1 | 16 | 45 |
| 34 | 17 | SDA.4 | IN | 0 | 27 | 28 | 0 | IN | SCL.4 | 18 | 35 |
| 36 | 19 | GPI01_A4 | IN | 0 | 29 | 30 | 1 | 1 | GND | 1 | 1 |
| 38 | 20 | GPI01_A6 | IN | 0 | 31 | 32 | 1 | IN | PWM14 | 21 | 62 |
| 63 | 22 | PWM15 | IN | 1 | 33 | 34 | | | GND |] | 1 |
| 135 | 23 | GPIO4_A7 | IN | 0 | 35 | 36 | 0 | IN | TXD.0 | 24 | 131 |
| 134 | 25 | GPI04_A6 | IN | 0 | 37 | 38 | 0 | IN | RXD.0 | 26 | 132 |
| | | GND | | I | 39 | 40 | 0 | IN | GPIO4_A5 | 27 | 133 |
| GPIO | wPi | Name | Mode | + | Phv | sical | -+ V | + I Mode | + | + wPi | + GPI |

3) The output of the test gpio readall command is as follows

4.7. 40pin interface GPIO, I2C, UART, SPI, CAN and PWM testing

Note that if you need to set up fdt overlays to open multiple configurations at the same time, please separate them with spaces and write them on one line like the red font configuration below.

 $[orangepi@orangepi~] \$ \ \textbf{sudo vim /boot/extlinux/extlinux.conf}$

LABEL Orange Pi

LINUX /Image

FDT /dtbs/rockchip/rk3588s-orangepi-5-pro.dtb

FDTOVERLAYS /dtbs/rockchip/overlay/rk3588-i2c1-m4.dtbo /dtbs/rockchip/overlay/rk3588-uart0-m2.dtbo

4. 7. 1. **40pin GPIO port test**

1) There are a total of 28 GPIO ports in the 40-pin development board that can be used.

The following uses pin No. 7 - the corresponding GPIO is GPIO1_B7 - the corresponding wPi serial number is 2 - as an example to demonstrate how to set the high and low levels of the GPIO port.

| GPIO | wPi | Name | Mode | V | Phys | ical | V | Mode | Name | WPi | GPIO |
|------|---------|---------|------|---|------|------|---|-------|----------|-----|------|
| | ++- | 3.3V | | | 1 | 2 | 1 | | 5V | | |
| 59 | 0 | SDA.1 | IN | 1 | 3 | 4 | 1 | | 5V | 1 | |
| 58 | | SCL.1 | IN | 1 | 5 | 6 | 1 | | GND | 1 | |
| 47 | 2 | PWM13 | IN | 1 | 7 | 8 | 1 | ALT10 | TXD.2 | 3 | 13 |
| - | | GND | | | 9 | 10 | 1 | ALT10 | RXD.2 | 4 | 14 |
| 138 | 5 | CAN1 RX | IN | 1 | 11 | 12 | 1 | IN | GPI01 A7 | 6 | 39 |
| 139 | 7 | CAN1 TX | IN | 1 | 13 | 1 14 | 1 | | GND | | |

2) First set the GPIO port to output mode, and the third parameter needs to be the serial number of the wPi corresponding to the input pin.

[orangepi@orangepi ~]\$ gpio mode 2 out

3) Then set the GPIO port to output a low level. After setting, you can use a multimeter to measure the voltage value of the pin. If it is 0v, it means the low level is set successfully.

```
[orangepi@orangepi~]$ gpio write 2 0
```

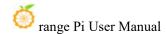
Using gpio readall, you can see that the value (V) of pin 7 becomes 0

| GPIO | wP | <i>'</i> i | Name | Mode | V | Physical | V | Mode | Name | wPi | GPIO |
|------|----|------------|---------|------|---|----------|-----|--|-----------|-----|------|
| | 1 | +- | 3.3V | | + | 1 2 | | | + 5V | | |
| 59 | i | 0 | SDA.1 | IN | 1 | 3 4 | 1 1 | li li li li li li li li li li li li li l | 5V | | |
| 58 | 1 | 1 | SCL.1 | IN | 1 | 5 6 | i i | 1 | GND | | |
| 47 | i | 2 | PWM13 | OUT | 0 | 7 8 | 1 | ALT10 | TXD.2 | 3 | 13 |
| | 1 | İ | GND | | | 9 10 | 1 | ALT10 | RXD.2 | 4 | 14 |
| 138 | i | 5 | CAN1 RX | IN | 1 | 11 12 | 1 | IN | GPI01 A7 | 6 | 39 |
| 139 | 1 | 7 | CAN1 TX | IN | 1 | 13 1 14 | | | GND | | |

4) Then set the GPIO port to output a high level. After setting, you can use a multimeter to measure the voltage value of the pin. If it is 3.3v, it means the setting of the high level is successful.

```
[orangepi@orangepi ~]$ gpio write 2 1
```

Using gpio readall, you can see that the value (V) of pin 7 changes to 1



| GPIO | wPi | Name | Mode | | Physical | V | Mode | Name | WPi | GPIC |
|------|-----|---------|------|-------|----------|---|-------|----------|-----|------|
| | 1 | 3.3V | | | 1 2 | 1 | | 5V | | |
| 59 | 0 | SDA.1 | IN | 11 | 3 4 | 1 | | 5V | | |
| 58 | 1 | SCL.1 | IN | 11 | 5 6 | 1 | | GND | i i | ĺ |
| 47 | 2 | PWM13 | OUT | 11 | 7 8 | 1 | ALT10 | TXD.2 | 3 | 13 |
| | i i | GND | | | 9 10 | 1 | ALT10 | RXD.2 | 4 | 14 |
| 138 | 5 | CAN1_RX | IN | 11 | 11 12 | 1 | IN | GPI01_A7 | 6 | 39 |
| 139 | 7 | CAN1 TX | IN | j 1 j | 13 14 | 1 | | GND | j | İ ı |

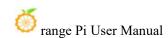
5) The setting method for other pins is similar. You only need to modify the serial number of wPi to the serial number corresponding to the pin.

4. 7. 2. How to set the pull-down resistor of the 40pin GPIO port

Note that the four GPIO pins below Orange Pi 5 Pro have external 3.3V pull-ups, so the pull-down settings are invalid.

| GPIO | wPi | Name | Mode | V | Phys | ical | V | Mode | Name | WPi | GPI |
|------|-----|-----------|------|----------|--------------|------|---|-------|-------------|-------|-----|
| | | 3.3V | | 1 | 1 | 2 | 1 | | 5V | | |
| 59 | 0 | SDA.1 | IN | 1 | 3 | 4 | | | j 5V | | i i |
| 58 | 1 | SCL.1 | IN | 1 | 5 | 6 | | | GND | | |
| 47 | 2 | PWM13 | IN | 1 | 7 | 8 | 1 | ALT10 | TXD.2 | 3 | 13 |
| | | GND | | Î I | 9 | 10 | 1 | ALT10 | RXD.2 | 4 | 14 |
| 138 | 5 | CAN1_RX | IN | 1 | 11 | 12 | 1 | IN | GPI01_A7 | 6 | 39 |
| 139 | 7 | CAN1_TX | IN | 1 | 13 | 14 | | | GND | | |
| 46 | 8 | GPI01_B6 | IN | 1 | 15 | 16 | 0 | IN | TXD.6 | 9 | 33 |
| | | 3.3V | | | 17 | 18 | 0 | IN | RXD.6 | 10 | 32 |
| 42 | 11 | SPI0_TXD | IN | 0 | 19 | 20 | | | GND | | |
| 41 | 12 | SPI0_RXD | IN | 0 | 21 | 22 | 1 | IN | GPI01_B0 | 13 | 40 |
| 43 | 14 | SPI0_CLK | IN | 0 | 23 | 24 | 1 | IN | SPI0_CS0 | 15 | 44 |
| | | GND | | | 25 | 26 | 1 | IN | SPI0_CS1 | 16 | 45 |
| 34 | 17 | SDA.4 | IN | 0 | 27 | 28 | 0 | IN | SCL.4 | 18 | 35 |
| 36 | 19 | GPI01_A4 | IN | 0 | 29 | 30 | | | GND | | |
| 38 | 20 | GPI01_A6 | IN | 0 | 31 | 32 | 1 | IN | PWM14 | 21 | 62 |
| 63 | 22 | PWM15 | IN | 1 | 33 | 34 | | | GND | | |
| 135 | 23 | GPIO4_A7 | IN | 0 | 35 | 36 | 0 | IN | TXD.0 | 24 | 131 |
| 134 | 25 | GPI04_A6 | IN | 0 | 37 | 38 | 0 | IN | RXD.0 | 26 | 132 |
| | | GND | | | 39 | 40 | 0 | IN | GPI04_A5 | 27 | 133 |
| GPIO | wDi | + Name | Mode | + I V | tt I Dhuc | ical | + | Mode | + Name | l wPi | |

1) The following uses pin No. 11 - the corresponding GPIO is GPIO4_B2 - the corresponding wPi serial number is 5 - as an example to demonstrate how to set the pull-up and pull-down resistors of the GPIO port.



| GPIO | wPi | Name | Mode | V | 1 | Physic | al | V | 1 | Mode | Name | wPi | GPIC |
|------|-----|---------|------|-----|----|--------|----|----|-----|-------|----------|-----|------|
| | ++- | | | + | -+ | ++- | | + | -+- | | + | + | + |
| | I I | 3.3V | | d L | 1 | 1 | 2 | | I. | | 5V | | 1 |
| 59 | 0 | SDA.1 | IN | 1 | | 3 | 4 | | Ì | | 5V | | |
| 58 | 1 | SCL.1 | IN | 1 | 1 | 5 | б | ί. | Ì | | GND | 1 | 1 |
| 47 | 2 | PWM13 | IN | 1 | | 7 | 8 | 1 | | ALT10 | TXD.2 | 3 | 13 |
| | | GND | | | | 9 | 10 | 1 | Ì | ALT10 | RXD.2 | 4 | 14 |
| 138 | 5 | CAN1 RX | IN | 1 | 1 | 11 | 12 | 1 | | IN | GPI01_A7 | 6 | 39 |
| 139 | 7 | CAN1 TX | IN | 1 | Ť | 13 | 14 | i | - İ | | GND | 1 | |

2) First, you need to set the GPIO port to input mode, and the third parameter needs to be the serial number of the wPi corresponding to the input pin.

[orangepi@orangepi ~]\$ gpio mode 5 in

3) After setting to input mode, execute the following command to set the GPIO port to pull-up mode.

[orangepi@orangepi ~]\$ gpio mode 5 up

4) Then enter the following command to read the level of the GPIO port. If the level is 1, it means that the pull-up mode is set successfully.

[orangepi@orangepi ~]\$ gpio read 5

5) Then execute the following command to set the GPIO port to pull-down mode [orangepi@orangepi~]\$ gpio mode 5 down

6) Then enter the following command to read the level of the GPIO port. If the level is 0, it means that the pull-down mode is set successfully.

[orangepi@orangepi ~]\$ **gpio read 5**

0

4. 7. 3. **40pin SPI test**

1) As can be seen from the picture below, the spi available for Orange Pi 5 Pro is spi0 and spi4

| 复用功能 | 复用功能 | 复用功能 | GPIO | GPI0序号 | 引脚序号 | 引脚序号 | GPI0序号 | GPIO | 复用功能 | 复用功能 | 复用功能 |
|-------------|------------------------|------------------------|----------|---------------|------|------|---------------|----------|-----------------------|--------------------|--------------|
| | | | 3.3₹ | | 1 | 2 | | 5¥ | | | |
| | UART4_RX_NO | I2C1_SDA_H4 | GPI01_D3 | 59 | 3 | 4 | | 57 | | | |
| | UART4_TX_NO | I2C1_SCL_II4 | GPI01_D2 | 58 | 5 | 6 | | GND | | | |
| UART1_RX_M1 | 12C5_SDA_N3 | PWM13_M2 (febf0010) | GPI01_B7 | 47 | 7 | 8 | 13 | GPIO0_B5 | UART2_TX_NO | | |
| | | | GND | | 9 | 10 | 14 | GPIO0_B6 | UART2_RX_NO | | |
| | PWN14_M1 (febf0020) | CAN1_RX_H1 | GPI04_B2 | 138 | 11 | 12 | 39 | GPIO1_A7 | PWM3_IR_M3 (fd8b0030) | | |
| | PWN15_IR_N1 (febf0030) | CAN1_TX_H1 | GPIO4_B3 | 139 | 13 | 14 | | GND | | | |
| UART1_TX_M1 | 12C5_SCL_N3 | | GPI01_B6 | 46 | 15 | 16 | 33 | GPI01_A1 | UART6_TX_H1 | | SPI4_MOSI_M2 |
| | | | 3.37 | | 17 | 18 | 32 | GPI01_A0 | UART6_RX_M1 | | SPI4_MISO_M2 |
| | UART4_RX_N2 | SPI0_MOSI_M2 | GPI01_B2 | 42 | 19 | 20 | | GND | | | |
| | | SPI0_MISO_M2 | GPI01_B1 | 41 | 21 | 22 | 40 | GPI01_B0 | | | |
| | UART4_TX_N2 | SPI0_CLK_H2 | GPI01_B3 | 43 | 23 | 24 | 44 | GPI01_B4 | SPI0_CS0_112 | UART7_RX_M2 | |
| | | | GND | | 25 | 26 | 45 | GPIO1_B5 | SPI0_CS1_II2 | UART7_TX_H2 | |
| SPI4_CLK_M2 | PWH0_M2 (fd8b0000) | 12C4_SDA_#3 | GPI01_A2 | 34 | 27 | 28 | 35 | GPI01_A3 | 12C4_SCL_113 | PWM1_M2 (fd8b0010) | SPI4_CS0_M2 |
| | | | GPI01_A4 | 36 | 29 | 30 | 1 | GND | | | |
| | | | GPI01_A6 | 38 | 31 | 32 | 62 | GPI01_D6 | PWH14_H2 (febf0020) | 12C8_SCL_112 | |
| | 12C8_SDA_N2 | PWM15_IR_M3 (febf0030) | GPI01_D7 | 63 | 33 | 34 | | GND | | | |
| | | 12C5_SDA_H2 | GPIO4_A7 | 135 | 35 | 36 | 131 | GPIO4_A3 | UARTO_TX_M2 | | |
| | UART3_RX_M2 | 12C5_SCL_12 | GPIO4_A6 | 134 | 37 | 38 | 132 | GPIO4_A4 | UARTO_RX_M2 | | |
| | | | GND | | 39 | 40 | 133 | GPIO4_A5 | | UART3_TX_M2 | |

2) The corresponding pins of SPI0 and SPI4 in 40pin are as shown in the table below.

| | SPI0_M2 correspond 40pin | SPI4_M2 correspond 40pin |
|---------|--------------------------|--------------------------|
| MOSI | Pin 19 | Pin 16 |
| MISO | Pin 21 | Pin 18 |
| CLK | Pin 23 | Pin 27 |
| CS0 | Pin 24 | Pin 28 |
| CS1 | Pin 26 | None |
| dtbo 配置 | spi0-m2-cs0-spidev | spi4-m2-cs0-spidev |
| | spi0-m2-cs1-spidev | |
| | spi0-m2-cs0-cs1-spidev | |

In the OPi OS Arch system, the spi function in 40pin is turned off by default and needs to be turned on manually to use it.

Add the configuration in red font below to /boot/extlinux/extlinux.conf, then restart the OPi OS Arch system to open spi0 and spi4. If you only need to open one, just fill in one.

[orangepi@orangepi~]\$ sudo vim /boot/extlinux/extlinux.conf

LABEL Orange Pi

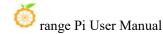
LINUX /Image

FDT /dtbs/rockchip/rk3588s-orangepi-5-pro.dtb

FDTOVERLAYS /dtbs/rockchip/overlay/rk3588-spi0-m2-cs0-cs1-spidev.dtbo /dtbs/rockchip/overlay/rk3588-spi4-m2-cs0-spidev.dtbo

3) First check whether the device node of spidevx.x exists in the OPi OS Arch system. If it exists, it means that SPI4 has been set up and can be used directly.

[orangepi@orangepi ~]\$ ls /dev/spidev*



/dev/spidev0.0 /dev/spidev0.1 /dev/spidev4.0

The above is the result displayed after opening spi0-m2-cs0-cs1-spidev and spi4-m2-cs0-spidev.

4) Without shorting the mosi and miso pins of SPI0 or SPI4, the output result of running spidev_test is as follows. You can see that the data of TX and RX are inconsistent.

5) Then short-circuit the mosi and miso pins of SPI0 or SPI4 and then run spidev_test. The output is as follows. You can see that the data sent and received are the same.

4. 7. 4. **40pin I2C test**

1) As can be seen from the table below, the i2c available for Orange Pi 5 is i2c1, i2c4, i2c5 and i2c8, a total of four groups of i2c buses.

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| 复用功能 | 复用功能 | 复用功能 | GPIO | GPIO序号 | 引脚序号 | 引脚序号 | GPI0序号 | GPIO | 复用功能 | 复用功能 | 复用功能 |
|-------------|------------------------|------------------------|----------|---------------|------|------|---------------|----------|-----------------------|--------------------|--------------|
| | | | 3.37 | | 1 | 2 | | 57 | | | |
| | UART4_RX_NO | I2C1_SDA_H4 | GPI01_D3 | 59 | 3 | 4 | | 57 | | | |
| | UART4_TX_NO | I2C1_SCL_114 | GPI01_D2 | 58 | 5 | 6 | | GND | | | |
| UART1_RX_M1 | 12C5_SDA_N3 | PWM13_M2 (febf0010) | GPI01_B7 | 47 | 7 | 8 | 13 | GPIO0_B5 | UART2_TX_NO | | |
| | | | GND | | 9 | 10 | 14 | GP100_B6 | UART2_RX_NO | | |
| | PWN14_M1 (febf0020) | CAN1_RX_H1 | GPI04_B2 | 138 | 11 | 12 | 39 | GPI01_A7 | PWM3_IR_M3 (fd8b0030) | | |
| | PWN15_IR_N1 (febf0030) | CAN1_TX_H1 | GPIO4_B3 | 139 | 13 | 14 | | GND | | | |
| UART1_TX_M1 | 12C5_SCL_N3 | | GPI01_B6 | 46 | 15 | 16 | 33 | GPI01_A1 | UART6_TX_H1 | | SPI4_MOSI_M2 |
| | | | 3.37 | | 17 | 18 | 32 | GPI01_A0 | UART6_RX_H1 | | SPI4_MISO_M2 |
| | UART4_RX_N2 | SPI0_MOSI_M2 | GPI01_B2 | 42 | 19 | 20 | | GND | | | |
| | | SPI0_MISO_M2 | GPI01_B1 | 41 | 21 | 22 | 40 | GPI01_B0 | | | |
| | UART4_TX_N2 | SPI0_CLK_M2 | GPI01_B3 | 43 | 23 | 24 | 44 | GPI01_B4 | SPI0_CS0_112 | UART7_RX_M2 | |
| | | | GND | | 25 | 26 | 45 | GPI01_B5 | SPI0_CS1_12 | UART7_TX_H2 | |
| SPI4_CLK_M2 | PWN0_M2 (fd8b0000) | 12C4_SDA_H3 | GPI01_A2 | 34 | 27 | 28 | 35 | GPI01_A3 | 12C4_SCL_#3 | PWM1_M2 (fd8b0010) | SPI4_CS0_M2 |
| | | | GPI01_A4 | 36 | 29 | 30 | | GND | | | |
| | | | GPI01_A6 | 38 | 31 | 32 | 62 | GPI01_D6 | PWH14_H2 (febf0020) | 12C8_SCL_112 | |
| | 12C8_SDA_N2 | PWM15_IR_M3 (febf0030) | GPI01_D7 | 63 | 33 | 34 | | GND | | | |
| | | 12C5_SDA_112 | GPI04_A7 | 135 | 35 | 36 | 131 | GPI04_A3 | UARTO_TX_H2 | | |
| | UART3_RX_M2 | 12C5_SCL_112 | GPI04_A6 | 134 | 37 | 38 | 132 | GPIO4_A4 | UARTO_RX_H2 | | |
| | | | GND | | 39 | 40 | 133 | GPIO4_A5 | | UART3_TX_H2 | |

2) The corresponding pins of the 4 sets of I2C buses in 40pin are shown in the table below. I2C5_M2 and I2C5_M3 can only use one of them at the same time, not at the same time. They are the same I2C5, just connected to different pins. Please do not think that they are two different sets of I2C5 buses.

| I2C bus | SDA corresponds to | SCL corresponds to | dtbo corresponding | |
|---------|--------------------|--------------------|--------------------|--|
| | 40pin | 40pin | configuration | |
| I2C1_M4 | Pin 3 | Pin 5 | i2c1-m4 | |
| I2C4_M3 | Pin 27 | Pin 28 | i2c4-m3 | |
| I2C5_M2 | Pin 35 | Pin 37 | i2c5-m2 | |
| I2C5_M3 | Pin 7 | Pin 15 | i2c5-m3 | |
| I2C8_M2 | Pin 33 | Pin 32 | i2c8-m2 | |

In the OPi OS Arch system, i2c in 40pin is turned off by default and needs to be turned on manually to use it.

Add the configuration in red font below to /boot/extlinux/extlinux.conf, and then restart the OPi OS Arch system to open i2c1, i2c4, i2c5 and i2c8 at the same time. If you only need to open one, just fill in one.

[orangepi@orangepi ~]\$ sudo vim /boot/extlinux/extlinux.conf LABEL Orange Pi LINUX /Image FDT /dtbs/rockchip/rk3588s-orangepi-5-pro.dtb FDTOVERLAYS /dtbs/rockchip/overlay/rk3588-i2c1-m4.dtbo /dtbs/rockchip/overlay/rk3588-i2c4-m3.dtbo /dtbs/rockchip/overlay/rk3588-i2c5-m2.dtbo /dtbs/rockchip/overlay/rk3588-i2c8-m2.dtbo The red font configuration above needs to be written on one line, and different configurations need to be separated by spaces.

3) After starting the OPi OS Arch system, first confirm that there is an i2c device node under /dev

[orangepi@orangepi ~]\$ ls /dev/i2c-* /dev/i2c-0 /dev/i2c-10 /dev/i2c-4 /dev/i2c-6 /dev/i2c-9 /dev/i2c-1 /dev/i2c-2 /dev/i2c-5 /dev/i2c-7 /dev/i2c-8

4) Then connect an i2c device to the i2c pin of the 40pin connector

Generally, only one of the 3.3v pin and the 5v pin can be connected. Please choose to connect the 3.3v pin or the 5v pin according to the specific i2c device connected.

5) Then use the **i2cdetect -y** command. If the address of the connected i2c device can be detected, it means that i2c can be used normally.

| orangepi@orangepi ~]\$ sudo pacman -Syy i2c-tools | | | | | | | |
|---|----------------|--|--|--|--|--|--|
| [orangepi@orangepi ~]\$ sudo i2cdetect -y 1 | #i2c1 commands | | | | | | |
| [orangepi@orangepi ~]\$ sudo i2cdetect -y 4 | #i2c4 commands | | | | | | |
| [orangepi@orangepi ~]\$ sudo i2cdetect -y 5 | #i2c5 commands | | | | | | |
| [orangepi@orangepi ~]\$ sudo i2cdetect -y 8 | #i2c8 commands | | | | | | |

4. 7. 5. **40pin UART test**

1) As can be seen from the table below, the available uarts for Orange Pi 5 Pro are uart0,

uart3, uart4, uart6 and uart7, a total of five groups of uart buses.

| 复用功能 | 复用功能 | 复用功能 | GPIO | GPIO序号 | 引脚序号 | 引脚序号 | GPI0序号 | GPIO | 复用功能 | 复用功能 | 复用功能 |
|-------------|------------------------|--|----------|---------------|------|------|---------------|----------|-----------------------|--------------------|--------------|
| | | | 3.3V | | 1 | 2 | | 57 | | | |
| | UART4_RX_NO | I2C1_SDA_H4 | GPI01_D3 | 59 | 3 | 4 | | 57 | | | |
| | UART4_TX_NO | I2C1_SCL_II4 | GPI01_D2 | 58 | 5 | 6 | | GND | | | |
| UART1_RX_M1 | I2C5_SDA_N3 | PWM13_M2 (febf0010) | GPI01_B7 | 47 | 7 | 8 | 13 | GPIO0_B5 | UART2_TX_NO | | |
| | | | GND | | 9 | 10 | 14 | GPIO0_B6 | UART2_RX_NO | | |
| | PWN14_M1 (febf0020) | CAN1_RX_H1 | GPI04_B2 | 138 | 11 | 12 | 39 | GPIO1_A7 | PWM3_IR_M3 (fd8b0030) | | |
| | PWN15_IR_N1 (febf0030) | CAN1_TX_H1 | GPIO4_B3 | 139 | 13 | 14 | | GND | | | |
| UART1_TX_M1 | 12C5_SCL_N3 | | GPI01_B6 | 46 | 15 | 16 | 33 | GPI01_A1 | UART6_TX_H1 | | SPI4_MOSI_M2 |
| | | | 3.37 | | 17 | 18 | 32 | GPI01_A0 | UART6_RX_M1 | | SPI4_MISO_M2 |
| | UART4_RX_N2 | SPI0_MOSI_M2 | GPI01_B2 | 42 | 19 | 20 | | GND | | | |
| | | SPI0_MISO_M2 | GPI01_B1 | 41 | 21 | 22 | 40 | GPI01_B0 | | | |
| | UART4_TX_N2 | SPI0_CLK_M2 | GPI01_B3 | 43 | 23 | 24 | 44 | GPI01_B4 | SPI0_CS0_H2 | UART7_RX_H2 | |
| | | | GND | | 25 | 26 | 45 | GPI01_B5 | SPI0_CS1_H2 | UART7_TX_H2 | |
| SPI4_CLK_M2 | PWH0_M2 (fd8b0000) | 12C4_SDA_#3 | GPI01_A2 | 34 | 27 | 28 | 35 | GPI01_A3 | 12C4_SCL_113 | PWM1_M2 (fd8b0010) | SPI4_CS0_M2 |
| | | le contra de la co | GPI01_A4 | 36 | 29 | 30 | 1 | GND | | | |
| | | | GPI01_A6 | 38 | 31 | 32 | 62 | GPI01_D6 | PWH14_H2 (febf0020) | 12C8_SCL_112 | |
| | 12C8_SDA_N2 | PWM15_IR_M3 (febf0030) | GPI01_D7 | 63 | 33 | 34 | | GND | | | |
| | | 12C5_SDA_H2 | GPIO4_A7 | 135 | 35 | 36 | 131 | GPIO4_A3 | UARTO_TX_M2 | | |
| | UART3_RX_M2 | 12C5_SCL_112 | GPIO4_A6 | 134 | 37 | 38 | 132 | GPIO4_A4 | UARTO_RX_M2 | | |
| | | | GND | | 39 | 40 | 133 | GPIO4 A5 | | UART3_TX_H2 | |

2) The corresponding pins of the five sets of UART buses in 40pin are as shown in the table below. UART4_M0 and UART4_M2 can only use one of them at the same time, not at the same time. They are the same UART4, just connected to different pins. Please do

| UART bus | RX corresponds to | TX corresponds to | dtbo corresponding |
|----------|-------------------|-------------------|--------------------|
| | 40pin | 40pin | configuration |
| UART0_M2 | Pin 38 | Pin 36 | uart0-m2 |
| UART3_M2 | Pin 37 | Pin 40 | uart3-m2 |
| UART4_M0 | Pin 3 | Pin 5 | uart4-m0 |
| UART4_M2 | Pin 19 | Pin 23 | uart4-m2 |
| UART6_M1 | Pin 18 | Pin 16 | uart6-m1 |
| UART7_M2 | Pin 24 | Pin 26 | uart7-m2 |

not think that they are two different sets of UART4 buses.

In the OPi OS Arch system, the uart in 40pin is turned off by default and needs to be turned on manually to use it.

Add the following configuration in red font to <mark>/boot/extlinux/extlinux.conf</mark>, and then restart the OPi OS Arch system to open uart0, uart3, uart4, uart6 and uart7 at the same time. If you only need to open one, then fill in one. .

[orangepi@orangepi~]\$ sudo vim /boot/extlinux/extlinux.conf

LABEL Orange Pi

LINUX /Image

FDT /dtbs/rockchip/rk3588s-orangepi-5-pro.dtb

FDTOVERLAYS /dtbs/rockchip/overlay/rk3588-uart0-m2.dtbo

/dtbs/rockchip/overlay/rk3588-uart3-m2.dtbo

/dtbs/rockchip/overlay/rk3588-uart4-m0.dtbo

/dtbs/rockchip/overlay/rk3588-uart6-m1.dtbo

/dtbs/rockchip/overlay/rk3588-uart7-m2.dtbo

The red font configuration above needs to be written on one line, and different configurations need to be separated by spaces.

3) After entering the Linux system, first confirm whether there is a device node corresponding to uart under /dev

[orangepi@orangepi ~]\$ ls /dev/ttyS* /dev/ttyS0 /dev/ttyS3 /dev/ttyS4 /dev/ttyS6 /dev/ttyS7 /dev/ttyS9 4) Then start testing the uart interface. First use Dupont wire to short-circuit the rx and tx of the uart interface to be tested.

5) Use the **gpio serial** command to test the loopback function of the serial port as shown below. If you can see the following print, it means the serial port communication is normal (ttySX needs to be replaced with the node name corresponding to the uart, please do not copy it)

| [orang | [orangepi@orangepi ~]\$ sudo gpio serial /dev/ttySX | | | | | | | | | |
|-------------------------------|---|----|---------------|----------------------|--|--|--|--|--|--|
| [sudo] password for orangepi: | | | for orangepi: | #Enter password here | | | | | | |
| | | | | | | | | | | |
| Out: | 0: | -> | 0 | | | | | | | |
| Out: | 1: | -> | 1 | | | | | | | |
| Out: | 2: | -> | 2 | | | | | | | |
| Out: | 3: | -> | 3 | | | | | | | |
| Out: | 4: | -> | 4 | | | | | | | |
| Out: | 5: | -> | 5^C | | | | | | | |

4. 7. 6. **PWM test method**

1) As can be seen from the table below, the available pwms for Orange Pi 5 Pro include pwm0, pwm1, pwm3, pwm13, pwm14 and pwm15, a total of six pwms.

| 复用功能 | 复用功能 | 复用功能 | GPIO | GPI0序号 | 引脚序号 | 引脚序号 | GPI0序号 | GPIO | 复用功能 | 复用功能 | 复用功能 |
|-------------|------------------------|------------------------|----------|---------------|------|------|---------------|----------|-----------------------|--------------------|--------------|
| | | | 3.3₹ | | 1 | 2 | | 57 | | | |
| | UART4_RX_NO | I2C1_SDA_H4 | GPI01_D3 | 59 | 3 | 4 | | 57 | | | |
| | UART4_TX_NO | I2C1_SCL_II4 | GPI01_D2 | 58 | 5 | 6 | | GND | | | |
| UART1_RX_M1 | 12C5_SDA_N3 | PWM13_M2 (febf0010) | GPI01_B7 | 47 | 7 | 8 | 13 | GPIO0_B5 | UART2_TX_NO | | |
| | | | GND | | 9 | 10 | 14 | GPIO0_B6 | UART2_RX_HO | | |
| | PWN14_N1 (febf0020) | CAN1_RX_H1 | GPIO4_B2 | 138 | 11 | 12 | 39 | GPI01_A7 | PWM3_IR_M3 (fd8b0030) | | |
| | PWN15_IR_N1 (febf0030) | CAN1_TX_H1 | GPIO4_B3 | 139 | 13 | 14 | | GND | | | |
| UART1_TX_M1 | 12C5_SCL_M3 | | GPI01_B6 | 46 | 15 | 16 | 33 | GPI01_A1 | UART6_TX_H1 | | SPI4_MOSI_M2 |
| | | | 3.37 | | 17 | 18 | 32 | GPIO1_A0 | UART6_RX_H1 | | SPI4_MISO_M2 |
| | UART4_RX_M2 | SPI0_MOSI_M2 | GPI01_B2 | 42 | 19 | 20 | | GND | | | |
| | | SPI0_HISO_M2 | GPI01_B1 | 41 | 21 | 22 | 40 | GPIO1_B0 | | | |
| | UART4_TX_N2 | SPI0_CLK_M2 | GPI01_B3 | 43 | 23 | 24 | 44 | GPI01_B4 | SPI0_CS0_H2 | UART7_RX_H2 | |
| | | | GND | | 25 | 26 | 45 | GPI01_B5 | SPI0_CS1_H2 | UART7_TX_M2 | |
| SPI4_CLK_M2 | PWH0_M2 (fd8b0000) | I2C4_SDA_H3 | GPI01_A2 | 34 | 27 | 28 | 35 | GPI01_A3 | 12C4_SCL_H3 | PWM1_M2 (fd8b0010) | SPI4_CS0_M2 |
| | | | GPI01_A4 | 36 | 29 | 30 | | GND | | | |
| | | | GPI01_A6 | 38 | 31 | 32 | 62 | GPI01_D6 | PWH14_H2 (febf0020) | 12C8_SCL_112 | |
| | 12C8_SDA_N2 | PWM15_IR_M3 (febf0030) | GPI01_D7 | 63 | 33 | 34 | | GND | | | |
| | | 12C5_SDA_112 | GPIO4_A7 | 135 | 35 | 36 | 131 | GPIO4_A3 | UARTO_TX_N2 | | |
| | UART3_RX_M2 | 12C5_SCL_12 | GPIO4_A6 | 134 | 37 | 38 | 132 | GPIO4_A4 | UARTO_RX_H2 | | |
| | | | GND | | 39 | 40 | 133 | GPIO4_A5 | | UART3_TX_H2 | |

9) The corresponding pins of PWM in 40pin are as shown in the table below. PWM14_M1 and PWM14_M2, PWM15_M1 and PWM15_M3 can only use one of them at the same time, not at the same time. They are all the same PWM, just connected to different pins. Please do not think that they are two different PWM buses.

| PWM bus | Corresponds to | dtbo corresponding |
|---------|----------------|--------------------|
| | 40pin | configuration |
| PWM0_M2 | Pin 27 | pwm0-m2 |
| PWM1_M2 | Pin 28 | pwm1-m2 |
| PWM3_M3 | Pin 12 | pwm3-m3 |

| PWM13_M2 | Pin 7 | pwm13-m2 |
|----------|--------|----------|
| PWM14_M1 | Pin 11 | pwm14-m1 |
| PWM14_M2 | Pin 32 | pwm14-m2 |
| PWM15_M1 | Pin 13 | pwm15-m1 |
| PWM15_M3 | Pin 33 | pwm15-m3 |

In the OPi OS Arch system, pwm in 40pin is turned off by default and needs to be turned on manually to use it.

Add the configuration in red font below to /boot/extlinux/extlinux.conf, and then restart the OPi OS Arch system to open pwm0, pwm1, pwm3, pwm13, pwm14 and pwm15 at the same time. If you only need to open one, then fill in one That's it.

[orangepi@orangepi~]\$ sudo vim /boot/extlinux/extlinux.conf LABEL Orange Pi LINUX /Image FDT /dtbs/rockchip/rk3588s-orangepi-5-pro.dtb FDTOVERLAYS /dtbs/rockchip/overlay/rk3588-pwm0-m2.dtbo /dtbs/rockchip/overlay/rk3588-pwm1-m2.dtbo /dtbs/rockchip/overlay/rk3588-pwm3-m3.dtbo /dtbs/rockchip/overlay/rk3588-pwm13-m2.dtbo

The red font configuration above needs to be written on one line, and different configurations need to be separated by spaces.

2) When a pwm is opened, there will be an additional pwmchipX (X is a specific number) in/sys/class/pwm/. For example, after opening pwm13, the pwmchipX under /sys/class/pwm/ will be Two became three

[orangepi@orangepi ~]\$ **ls /sys/class/pwm/** pwmchip0 pwmchip1 pwmchip2

3) Which pwmchip above corresponds to pwm13? Let's first check the output of the lsls /sys/class/pwm/-l command, as shown below:

[orangepi@orangepi ~]\$ ls /sys/class/pwm/ -l
total 0
lrwxrwxrwx 1 root root 0 Jan 1 2021 pwmchip0 -> ../../devices/platform/fd8b0020.pwm/pwm/pwmchip0
lrwxrwxrwx 1 root root 0 Jan 1 2021 pwmchip1 -> ../../devices/platform/febd0020.pwm/pwm/pwmchip1
lrwxrwxrwx 1 root root 0 Jan 1 2021 pwmchip2 -> ../../devices/platform/febf0010.pwm/pwm/pwmchip2
[orangepi@orangepi ~]\$

4) From the following table, we can see that the base address of the pwm13 register is febf0010. Looking at the output of the **Is /sys/class/pwm/ -l** command, we can see that pwmchip2 is linked to febf0010.pwm, so the corresponding pwmchip of pwm13 is pwmchip2

| 复用功能 | 复用功能 | 复用功能 | 复用功能 | GPIO | GPIO序号 | 引脚序号 |
|---------------|-------------|------------------------|------------------------|----------|---------------|------|
| | | | | 3. 3V | | 1 |
| | | UART4_RX_MO | I2C1_SDA_M4 | GPIO1_D3 | 59 | 3 |
| | | UART4_TX_MO | T2C1 SCL M4 | GPI01_D2 | 58 | 5 |
| | UART1_RX_M1 | I2C5_SDA_M3 | PWM13_M2 (febf0010) | GPIO1_B7 | 47 | 7 |
| | | | J | GND | | 9 |
| I2C7_SCL_M3 | | PWM14_M1 (febf0020) | CAN1_RX_M1 | GPIO4_B2 | 138 | 11 |
| I2C7_SDA_M3 | | PWM15_IR_M1 (febf0030) | CAN1_TX_M1 | GPIO4_B3 | 139 | 13 |
| | UART1_TX_M1 | 12C5_SCL_M3 | | GPI01_B6 | 46 | 15 |
| | | | | 3. 3V | | 17 |
| | | UART4_RX_M2 | SPI0_MOSI_M2 | GPI01_B2 | 42 | 19 |
| | | | SPIO_MISO_M2 | GPIO1_B1 | 41 | 21 |
| | | UART4_TX_M2 | SPI0_CLK_M2 | GPI01_B3 | 43 | 23 |
| | | | | GND | | 25 |
| UART6_RTSN_M1 | SPI4_CLK_M2 | PWM0_M2 (fd8b0000) | I2C4_SDA_M3 | GPI01_A2 | 34 | 27 |
| | | | | GPIO1_A4 | 36 | 29 |
| | | | | GPI01_A6 | 38 | 31 |
| UART1_CTSN_M1 | | I2C8_SDA_M2 | PWM15_IR_M3 (febf0030) | GPI01_D7 | 63 | 33 |
| SPI2_CS0_M1 | | | I2C5_SDA_M2 | GPIO4_A7 | 135 | 35 |
| SPI2_CLK_M1 | | UART3_RX_M2 | 12C5_SCL_M2 | GPIO4_A6 | 134 | 37 |
| | | | | GND | | 39 |

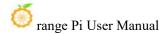
5) Then use the following command to make pwm13 output a 50Hz square wave (please switch to the root user first, and then execute the following command)

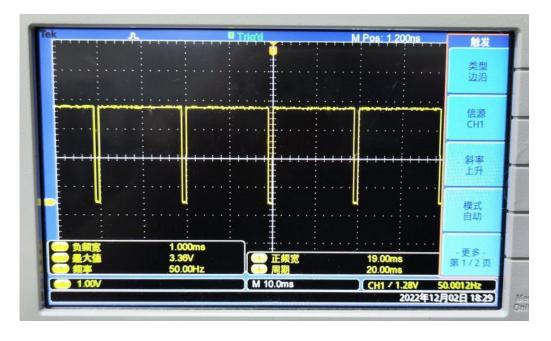
[root@orangepi orangepi]# echo 0 > /sys/class/pwm/pwmchip2/export

[root@orangepi orangepi]# echo 20000000 > /sys/class/pwm/pwmchip2/pwm0/period

[root@orangepi orangepi]# echo 1000000 > /sys/class/pwm/pwmchip2/pwm0/duty_cycle

[root@orangepi orangepi]# echo 1 > /sys/class/pwm/pwmchip2/pwm0/enable





6) The test method of pwm13 demonstrated above is similar to other pwm test methods.

4. 7. 7. CAN test method

1) As can be seen from the table below, the CAN bus available for Orange Pi 5 Pro is CAN1, a total of one CAN bus

| 复用功能 | 复用功能 | 复用功能 | GPIO | GPI0序号 | 引脚序号 | 引脚序号 | GPI0序号 | GPIO | 复用功能 | 复用功能 | 复用功能 |
|-------------|------------------------|------------------------|----------|---------------|------|------|---------------|----------|-----------------------|--------------------|--------------|
| | | | 3.37 | | 1 | 2 | | 57 | | | |
| | UART4_RX_NO | I2C1_SDA_H4 | GPI01_D3 | 59 | 3 | 4 | | 57 | | | |
| | UART4_TX_NO | I2C1_SCL_H4 | GPI01_D2 | 58 | 5 | 6 | | GND | | | |
| UART1_RX_M1 | 12C5_SDA_N3 | PWM13_M2 (febf0010) | GPI01_B7 | 47 | 7 | 8 | 13 | GPIO0_B5 | UART2_TX_NO | | |
| | | | GND | | 9 | 10 | 14 | GPIO0_B6 | UART2_RX_NO | | |
| | PWN14_M1 (febf0020) | CAN1_RX_H1 | GPI04_B2 | 138 | 11 | 12 | 39 | GPI01_A7 | PWM3_IR_M3 (fd8b0030) | | |
| | PWN15_IR_N1 (febf0030) | CAN1_TX_H1 | GPIO4_B3 | 139 | 13 | 14 | | GND | | | |
| UART1_TX_M1 | 12C5_SCL_N3 | | GPI01_B6 | 46 | 15 | 16 | 33 | GPI01_A1 | UART6_TX_H1 | | SPI4_MOSI_M2 |
| | | | 3.37 | | 17 | 18 | 32 | GPI01_A0 | UART6_RX_M1 | | SPI4_MISO_M2 |
| | UART4_RX_N2 | SPI0_MOSI_M2 | GPI01_B2 | 42 | 19 | 20 | | GND | | | |
| | | SPI0_MISO_M2 | GPI01_B1 | 41 | 21 | 22 | 40 | GPI01_B0 | | | |
| | UART4_TX_N2 | SPI0_CLK_H2 | GPI01_B3 | 43 | 23 | 24 | 44 | GPI01_B4 | SPI0_CS0_H2 | UART7_RX_M2 | |
| | | | GND | | 25 | 26 | 45 | GPI01_B5 | SPI0_CS1_H2 | UART7_TX_H2 | |
| SPI4_CLK_M2 | PWH0_M2 (fd8b0000) | 12C4_SDA_#3 | GPI01_A2 | 34 | 27 | 28 | 35 | GPI01_A3 | 12C4_SCL_113 | PWM1_M2 (fd8b0010) | SPI4_CS0_M2 |
| | | | GPI01_A4 | 36 | 29 | 30 | | GND | | | |
| | | | GPI01_A6 | 38 | 31 | 32 | 62 | GPI01_D6 | PWH14_H2 (febf0020) | 12C8_SCL_112 | |
| | 12C8_SDA_N2 | PWM15_IR_M3 (febf0030) | GPIO1_D7 | 63 | 33 | 34 | | GND | | | |
| | | 12C5_SDA_H2 | GPIO4_A7 | 135 | 35 | 36 | 131 | GPIO4_A3 | UARTO_TX_M2 | | |
| | UART3_RX_M2 | 12C5_SCL_12 | GPIO4_A6 | 134 | 37 | 38 | 132 | GPIO4_A4 | UARTO_RX_M2 | | |
| | | | GND | | 39 | 40 | 133 | GPIO4_A5 | | UART3_TX_H2 | |

In the OPi OS Arch system, CAN in 40pin is turned off by default and needs to be turned on manually to use it.

Add the configuration in red font below to /boot/extlinux/extlinux.conf, and then restart the OPi OS Arch system to open CAN1.

[orangepi@orangepi~]\$ sudo vim /boot/extlinux/extlinux.conf LABEL Orange Pi LINUX /Image FDT /dtbs/rockchip/rk3588s-orangepi-5-pro.dtb FDTOVERLAYS /dtbs/rockchip/overlay/rk3588-can1-m1.dtbo The red font configuration above needs to be written on one line, and different configurations need to be separated by spaces.

2) After entering the OPi OS Arch system, use the **sudo ifconfig -a** command. If you can see the CAN device node, it means that CAN has been opened correctly.

| [orangepi@orangepi ~]\$ sudo pacman -Syy net-tools |
|---|
| [orangepi@orangepi ~]\$ sudo ifconfig -a |
| can0: flags=128 <noarp> mtu 16</noarp> |
| unspec 00-00-00-00-00-00-00-00-00-00-00-00-00- |
| RX packets 0 bytes 0 (0.0 B) |
| RX errors 0 dropped 0 overruns 0 frame 0 |
| TX packets 0 bytes 0 (0.0 B) |
| TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0 |
| device interrupt 91 |
| |
| can1: flags=128 <noarp> mtu 16</noarp> |
| unspec 00-00-00-00-00-00-00-00-00-00-00-00-00- |
| RX packets 0 bytes 0 (0.0 B) |
| RX errors 0 dropped 0 overruns 0 frame 0 |
| TX packets 0 bytes 0 (0.0 B) |
| TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0 |
| device interrupt 92 |

3) The corresponding pin of CAN1 is

| | CAN1 |
|--------|----------------|
| TX pin | Corresponds to |
| | pin 13 |
| RX pin | Corresponds to |
| | pin 11 |

4) For the method of using CANalyst-II analyzer to test CAN sending and receiving messages, please refer to the section below using CANalyst-II analyzer to test sending and receiving messages.

5. Linux SDK——orangepi-build usage instructions

5.1. Compilation system requirements

We can cross-compile the Linux image of the development board in an x64 computer, or we can compile the Linux image of the development board in the Ubuntu22.04 system of the development board. Please choose one according to your preference.

If you use orangepi-build to compile the Linux image in the Ubuntu22.04 system of the development board, please dissipate heat (especially when the SSD is started). If heat dissipation is not done properly, file system runaway errors may easily occur.

5. 1. 1. Compile using the Ubuntu22.04 system of the development board

1) The Linux SDK, **orangepi-build**, supports running on **Ubuntu 22.04** on the development board (other systems have not been tested), so before downloading orangepi-build, please first ensure that the Ubuntu version installed on the development board is Ubuntu 22.04. The command to check the Ubuntu version installed on the development board is as follows. If the Release field does not display **22.04**, it means that the Ubuntu version currently used does not meet the requirements. Please change the system before performing the following operations.

| orangepi@orang | gepi:~\$ lsb_release -a |
|-----------------|-------------------------|
| No LSB module | es are available. |
| Distributor ID: | Ubuntu |
| Description: | Ubuntu 22.04.1 LTS |
| Release: | 22.04 |
| Codename: | jammy |

2) Since the source code such as kernel and U-boot are stored on GitHub, it is very important to ensure that the development board can download the code from GitHub normally when compiling the image.

5. 1. 2. Compile using x64 Ubuntu22.04 computer

The Linux SDK, orangepi-build, supports running on computers with Ubuntu
 22.04 installed. Therefore, before downloading orangepi-build, please first ensure that the

Ubuntu version installed on your computer is Ubuntu 22.04. The command to check the Ubuntu version installed on the computer is as follows. If the Release field does not display 22.04, it means that the Ubuntu version currently used does not meet the requirements. Please change the system before performing the following operations.

| test@test:~\$ lsb_ | release -a |
|--------------------|------------------|
| No LSB modules | are available. |
| Distributor ID: | Ubuntu |
| Description: | Ubuntu 22.04 LTS |
| Release: | 22.04 |
| Codename: | jammy |

2) If the computer is installed with a Windows system and there is no computer with Ubuntu 22.04 installed, you can consider using **VirtualBox** or **VMware** to install an Ubuntu 22.04 virtual machine in the Windows system. But please note, do not compile orangepi-build on the WSL virtual machine, because orangepi-build has not been tested in the WSL virtual machine, so there is no guarantee that orangepi-build can be used normally in WSL.

3) The installation image download address of Ubuntu 22.04 amd64 version is:

https://mirrors.tuna.tsinghua.edu.cn/ubuntu-releases/22.04/ubuntu-22.04.3-desktop-amd64.iso 或者

https://repo.huaweicloud.com/ubuntu-releases/22.04/ubuntu-22.04.3-desktop-amd64.iso

4) After installing Ubuntu 22.04 on the computer or virtual machine, please first set the software source of Ubuntu 22.04 to Tsinghua source, otherwise it is easy to make errors due to network reasons when installing the software later.

a. For the method of replacing Tsinghua source, please refer to the instructions on this page.

https://mirrors.tuna.tsinghua.edu.cn/help/ubuntu/

b. Note that the Ubuntu version needs to be switched to 22.04

Ubuntu 镜像使用帮助

Ubuntu 的软件源配置文件是 /etc/apt/sources.list。将系统自带的该文件做个备份,将该文件替换为下面内容,即可使用 TUNA 的软件源镜像。

选择你的ubuntu版本: 22.04 LTS

默认注释了源码镜像以提高 apt update 速度, 如有需要可自行取消注释

deb https://mirrors.tuna.tsinghua.edu.cn/ubuntu/ jammy main restricted universe multiverse
deb-src https://mirrors.tuna.tsinghua.edu.cn/ubuntu/ jammy main restricted universe multiverse
deb https://mirrors.tuna.tsinghua.edu.cn/ubuntu/ jammy-updates main restricted universe multiverse
deb-src https://mirrors.tuna.tsinghua.edu.cn/ubuntu/ jammy-updates main restricted universe multiverse
deb https://mirrors.tuna.tsinghua.edu.cn/ubuntu/ jammy-updates main restricted universe multiverse
deb-src https://mirrors.tuna.tsinghua.edu.cn/ubuntu/ jammy-updates main restricted universe multiverse
deb-src https://mirrors.tuna.tsinghua.edu.cn/ubuntu/ jammy-backports main restricted universe
deb-src https://mirrors.tuna.tsinghua.edu.cn/ubuntu/ jammy-backports main restricted universe
deb https://mirrors.tuna.tsinghua.edu.cn/ubuntu/ jammy-backports main restricted universe
deb https://mirrors.tuna.tsinghua.edu.cn/ubuntu/ jammy-backports main restricted universe
deb https://mirrors.tuna.tsinghua.edu.cn/ubuntu/ jammy-backports main restricted universe
deb https://mirrors.tuna.tsinghua.edu.cn/ubuntu/ jammy-backports main restricted universe
deb https://mirrors.tuna.tsinghua.edu.cn/ubuntu/ jammy-backports main restricted universe
deb https://mirrors.tuna.tsinghua.edu.cn/ubuntu/ jammy-backports main restricted universe
deb https://mirrors.tuna.tsinghua.edu.cn/ubuntu/ jammy-backports main restricted universe
deb https://mirrors.tuna.tsinghua.edu.cn/ubuntu/ jammy-backports
deb https://mirrors.tuna.tsinghua.edu.cn/ubuntu/ jammy-backports
deb https://mirrors.tuna.tsinghua.edu.cn/ubuntu/ jammy-backports
deb https://mirrors.tuna.tsinghua.edu.cn/ubuntu/ jammy-backports
deb https://mirrors.tuna.tsinghua.edu.cn/ubuntu/ jammy-backports
deb https://mirrors.tuna.tsinghua.edu.cn/ubuntu/ jammy-backports
deb https://mirrors.tuna.tsinghua.edu.cn/ubuntu/ jammy-backports
deb https://mirrors.tuna.tsinghua.edu.cn/ubuntu/ jammy-backports
deb https://mirrors.tuna.tsinghua.edu.cn/ubuntu/ jammy-backports
deb https://mirrors.tuna.tsinghua.edu.

deb-src https://mirrors.tuna.tsinghua.edu.cn/ubuntu/ jammy-security main restricted universe multiverse

预发布软件源,不建议启用

deb https://mirrors.tuna.tsinghua.edu.cn/ubuntu/ jammy-proposed main restricted universe multiverse

deb-src https://mirrors.tuna.tsinghua.edu.cn/ubuntu/ jammy-proposed main restricted universe multiverse

c. The contents of the /etc/apt/sources.list file that need to be replaced are:

test@test:~\$ sudo mv /etc/apt/sources.list /etc/apt/sources.list.bak test@test:~\$ sudo vim /etc/apt/sources.list

The source code image is commented by default to improve apt update speed. You can uncomment it yourself if necessary.

deb https://mirrors.tuna.tsinghua.edu.cn/ubuntu/ jammy main restricted universe multiverse

deb-src https://mirrors.tuna.tsinghua.edu.cn/ubuntu/ jammy main restricted universe multiverse

deb https://mirrors.tuna.tsinghua.edu.cn/ubuntu/ jammy-updates main restricted universe multiverse

deb-src https://mirrors.tuna.tsinghua.edu.cn/ubuntu/ jammy-updates main restricted universe multiverse

deb https://mirrors.tuna.tsinghua.edu.cn/ubuntu/ jammy-backports main restricted universe multiverse

deb-src https://mirrors.tuna.tsinghua.edu.cn/ubuntu/ jammy-backports main restricted universe multiverse

deb https://mirrors.tuna.tsinghua.edu.cn/ubuntu/ jammy-security main restricted universe multiverse

deb-src https://mirrors.tuna.tsinghua.edu.cn/ubuntu/ jammy-security main restricted universe multiverse

Pre-release software source, not recommended to be enabled

deb https://mirrors.tuna.tsinghua.edu.cn/ubuntu/ jammy-proposed main restricted universe multiverse

deb-src https://mirrors.tuna.tsinghua.edu.cn/ubuntu/ jammy-proposed main restricted universe multiverse

d. After the replacement, you need to update the package information and ensure that no errors are reported.

test@test:~\$ sudo apt update

e. In addition, since the source code such as kernel and U-boot are stored on GitHub, it is very important to ensure that the computer can download the code from GitHub normally when compiling the image.

5. 2. **Obtain the source code of linux sdk**

5. 2. 1. Download orangepi-build from github

1) Linux sdk actually refers to the orangepi-build set of codes. Orangepi-build is modified based on the armbian build compilation system. Multiple versions of Linux images can be compiled using orangepi-build. First download the orangepi-build code, the command is as follows:

test@test:~\$ sudo apt-get update test@test:~\$ sudo apt-get install -y git test@test:~\$ git clone https://github.com/orangepi-xunlong/orangepi-build.git -b next

Note that the Orange Pi 5 Pro development board needs to download the source code of the next branch of orangepi-build. The above git clone command needs to specify the branch of the orangepi-build source code as next.

| Code | ⊙ Issues 6 1 Pull requests 1 | 🖓 Discussions 💿 Actions 🖽 Projects | 🛱 Wiki 🕕 Security 🗠 Insights 🕸 |
|------|-------------------------------|------------------------------------|---------------------------------|
| | 💡 next 🗸 💡 2 branches 🕥 0 tag | s | Go to file Add file - <> Code |
| | Switch branches/togs | × behind main. | 🕄 Contribute 🗸 |
| | Branches Tags Need to switch | n to next | 69dd359 4 days ago 🕚 222 commit |
| | main defau | t Update for Orange Pi 5 v1.0.2 | 4 days ago |
| | ✓ next View all branches | Update for Orange Pi 5 v1.0.2 | 4 days ago 4 days ago |
| | | Update for Orange Pi 5 v1.0.2 | 4 days ago |
| | LICENSE | First Commit | 2 <mark>yea</mark> rs ago |
| | README.md | Support orangepi3 next branch | 8 months ago |
| | ြာ build.sh | Bump to next branch | 9 months ago |

Downloading the orangepi-build code through the git clone command does not require entering the user name and password of the github account (the same is true for downloading other codes in this manual). If after entering the git clone command, Ubuntu PC prompts you to enter the user name of the github account. The name and password are usually entered incorrectly in the address of the orangepi-build warehouse behind git clone. Please carefully check whether there are any spelling errors in the command, rather than thinking that we have forgotten to provide the username and password of the github account.

2) The u-boot and linux kernel versions currently used by the development board are as follows

| branch | u-boot version | linux kernel version |
|--------|----------------|----------------------|
| legacy | u-boot 2017.09 | linux5.10 |

The branch mentioned here is not the same thing as the branch of orangepi-build source code, please don't get confused. This branch is mainly used to distinguish different kernel source code versions.

We currently define the linux5.10 bsp kernel provided by RK as the legacy branch. If the mainline kernel is supported in the future, a current branch will be added.

- 3) After orangepi-build is downloaded, it will contain the following files and folders
 - a. **build.sh**: Compile startup script
 - b. **external**: Contains configuration files, specific scripts, and source code of some programs needed to compile the image, etc.
 - c. LICENSE: GPL 2 license file
 - d. README. md: orangepi-build documentation
 - e. scripts: Common script for compiling linux images

test@test:~/orangepi-build\$ ls

build.sh external LICENSE README.md scripts

If you downloaded the orangepi-build code from github, after downloading, you may find that orangepi-build does not contain the source code of u-boot and linux kernel, and there is no cross-compilation tool required to compile u-boot and linux kernel. chain, this is normal, because these things are stored in other separate github repositories or some servers (their addresses will be detailed below). Orangepi-build will specify the addresses of u-boot, Linux kernel and cross-compilation tool chain in the script and configuration file. When running orangepi-build, when it finds that these things are not available locally, it will automatically download them from the corresponding places.

5. 2. 2. Download the cross-compilation tool chain

The cross-compilation tool chain will be downloaded only if you use orangepi-build to compile the image on an x64 computer. When compiling the Linux image of the development board in Ubuntu 22.04, the cross-compilation tool chain will not be downloaded. At this time, orangepi-build/toolchains will be an empty folder.

1) When orangepi-build is run for the first time, it will automatically download the cross-compilation toolchain and put it in the **toolchains** folder. Every time you run orangepi-build's build.sh script, it will check whether the cross-compilation toolchain in **toolchains** exists. , if it does not exist, the download will be restarted, if it exists, it will be used directly, and the download will not be repeated.

| |) Checking for external GCC compilers | ľ |
|----------|--|------|
| [] |] downloading using http(s) network [gcc-linaro-aarch64-none-elf-4.8-2013.11 linux.tar.xz] | ľ |
| [#8d7029 | 9 16MiB/24MiB(65%) CN:1 DL:7.9MiB ETA:1s] | |
| [o.k.] |] Verified [PGP] | l . |
| [] | decompressing | |
| í i |] gcc-linaro-aarch64-none-elf-4.8-2013.11 linux.tar.xz: 24.9MiB [14.4MiB/s] [==================================== | 100% |
| [] | downloading using http(s) network [gcc-linaro-arm-none-eabi-4.8-2014.04 linux.tar.xz] | |
| | 2 17MiB/33MiB(50%) CN:1 DL:10MiB ETA:15 | |
| [o.k.] | Verified [PGP] | |
| | decompressing | |
| |] gcc-linaro-arm-none-eabi-4.8-2014.04 linux.tar.xz: 33.9MiB [9.66MiB/s] [==================================== | 100% |
| | downloading using http(s) network [gcc-linaro-arm-linux-gnueabihf-4.8-2014.04 linux.tar.xz] | |
| | 4 48MiB/48MiB(99%) CN:1 DL:2.7MiB] | |
| | Verified [PGP] | ľ |
| | decompressing | |
| |] gcc-linaro-arm-linux-gnueabihf-4.8-2014.04 linux.tar.xz: 48.8MiB [13.0MiB/s] [==================================== | 100% |
| | downloading using http(s) network [gcc-linaro-4.9.4-2017.01-x86 64 arm-linux-gnueabi.tar.xz] | |
| | 272MiB/76MiB(93%) CN:1 DL:3.7MiB ETA:1s] | |
| | Verified (MD5) | |
| | decompressing | |
| | gcc-linaro-4.9.4-2017.01-x86 64 arm-linux-gnueabi.tar.xz: 77.0MiB [14.2MiB/s] [==================================== | 100% |
| | downloading using http(s) network [gcc-linaro-7.4.1-2019.02-x86 64 arm-linux-gnueabi.tar.xz] | |
| | 3 104MiB/104MiB(99%) CN:1 DL:2.8MiB | |
| [o.k.] | Verified [MD5] | ľ |
| [] | decompressing | |
| í i |] gcc-linaro-7,4.1-2019.02-x86 64 arm-linux-gnueabi.tar.xz: 104MiB [13.9MiB/s] [==================================== | 100% |
| [] | downloading using http(s) network [gcc-linaro-7.4.1-2019.02-x86 64 aarch64-linux-gnu.tar.xz] | 1 |
| #2c065e | e 108MiB/111MiB(97%) CN:1 DL:3.9MiB] | |
| [o.k.] | Verified [MD5] | ľ |
| [i | decompressing | |
| í i |] gcc-linaro-7.4.1-2019.02-x86 64 aarch64-linux-gnu.tar.xz: 111MiB [13.4MiB/s] [==================================== | 100% |
| | downloading using http(s) network [gcc-arm-9.2-2019.12-x86 64-arm-none-linux-gnueabihf.tar.xz] | 1 |
| #d232ee | 250MiB/251MiB(99%) CN:1 DL:2.0MiB] | |
| [o.k.] | Verified (MD5) | ľ |
| [] | decompressing | |
| [] |] gcc-arm-9.2-2019.12-x86 64-arm-none-linux-gnueabihf.tar.xz: 251MiB [13.7MiB/s] [==================================== | 100% |
| [] | downloading using http(5) network [gcc-arm-9.2-2019.12-x86 64-aarch64-none-linux-gnu.tar.xz] | |
| [#88b441 | 1 268MiB/269MiB(99%) CN:1 DL:0.9MiB] | |
| [o.k.] | Verified [MD5] | |
| r i | decompressing | |

2) The mirror URL of the cross-compilation tool chain in China is the open source software mirror site of Tsinghua University

https://mirrors.tuna.tsinghua.edu.cn/armbian-releases/_toolchain/

3) After **toolchains** is downloaded, it will contain multiple versions of cross-compilation toolchains, and the development board will only use two of them.

test@test:~/orangepi-build\$ ls toolchains/

gcc-arm-11.2-2022.02-x86_64-aarch64-none-linux-gnu

gcc-arm-11.2-2022.02-x86_64-arm-none-linux-gnueabihf

gcc-arm-9.2-2019.12-x86_64-aarch64-none-linux-gnu

| gcc-arm-9.2-2019.12-x86_64-arm-none-linux-gnueabihf |
|---|
| gcc-linaro-4.9.4-2017.01-x86_64_arm-linux-gnueabi |
| gcc-linaro-5.5.0-2017.10-x86_64_arm-linux-gnueabihf |
| gcc-linaro-7.4.1-2019.02-x86_64_aarch64-linux-gnu |
| gcc-linaro-7.4.1-2019.02-x86_64_arm-linux-gnueabi |
| gcc-linaro-aarch64-none-elf-4.8-2013.11_linux |
| gcc-linaro-arm-linux-gnueabihf-4.8-2014.04_linux |
| gcc-linaro-arm-none-eabi-4.8-2014.04 linux |

4) The cross-compilation tool chain used to compile the Linux kernel source code isa. linux5.10

gcc-arm-11.2-2022.02-x86_64-aarch64-none-linux-gnu

- 5) The cross-compilation tool chain used to compile u-boot source code is
 - a. v2017.09

gcc-linaro-7.4.1-2019.02-x86_64_aarch64-linux-gnu

5. 2. 3. orangepi-build complete directory structure description

1) After downloading, the orangepi-build warehouse does not contain the source code of the linux kernel, u-boot and cross-compilation tool chain. The source code of the linux kernel and u-boot is stored in an independent git warehouse.

a. The git warehouse where the Linux kernel source code is stored is as follows:

https://github.com/orangepi-xunlong/linux-orangepi/tree/orange-pi-5.10-rk35xx

b. The git warehouse where the b.u-boot source code is stored is as follows:

https://github.com/orangepi-xunlong/u-boot-orangepi/tree/v2017.09-rk3588

2) When orangepi-build is run for the first time, it will download the cross-compilation tool chain, u-boot and linux kernel source code. After successfully compiling the linux image, the files and folders that can be seen in orangepi-build are:

- a. **build.sh**: Compile startup script
- b. **external**: Contains the configuration files needed to compile the image, scripts for specific functions, and the source code of some programs. The rootfs compressed package cached during the image compilation process is also stored in external.
- c. **kernel**: Stores the source code of the Linux kernel. The folder named **orange-pi-5.10-rk35xx** stores the kernel source code of the legacy branch of the

RK3588/RK3588S series development board. Please do not modify the name of the kernel source code folder manually. If it is modified, When the compilation system is running, the kernel source code will be re-downloaded.

- d. LICENSE: GPL 2 license file
- e. **README.md**: orangepi-build documentation
- f. **output**: Store compiled u-boot, linux and other deb packages, compilation logs, and compiled images and other files
- g. scripts: Common script for compiling linux images
- h. toolchains: Store cross-compilation tool chain
- i. **u-boot**: Store the u-boot source code. The folder named **v2017.09-rk3588** stores the u-boot source code of the legacy branch of the RK3588/RK3588S series development board. Please do not modify the name of the u-boot source code folder manually. If Modified, the u-boot source code will be re-downloaded when the compilation system is running.
- j. userpatches: Store the configuration files needed to compile the script

test@test:~/orangepi-build\$ ls

build.sh external kernel LICENSE output README.md scripts toolchains u-boot userpatches

5.3. Compile u-boot

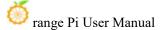
1) Run the build.sh script, remember to add sudo permissions

test@test:~/orangepi-build\$ sudo ./build.sh

2) Select U-boot package and press Enter

| Choose an option Compile image rootfs kernel u-boot |
|--|
| <mark>U-boot package</mark> Kernel package Rootfs and all deb packages |
| Full OS image for flashing |

3) Then select the model of the development board



| orangepi4 | Rockchip | RK3399 hexa core 4GB RAM GBE eMMC USB3 USB-C WiFi/BT | î |
|---------------|----------|---|---|
| orangepi4-lts | Rockchip | RK3399 hexa core 4GB RAM GBE eMMC USB3 USB-C WiFi/BT | |
| orangepi800 | Rockchip | RK3399 hexa core 4GB RAM GBE eMMC USB3 USB-C WiFi/BT VGA | |
| orangepi5 | Rockchip | RK3588S octa core 4-16GB RAM GBE USB3 USB-C NVMe | |
| orangepicm5 | Rockchip | RK3588S octa core 4-16GB RAM GBE USB3 USB-C | |
| orangepi5b | Rockchip | RK3588S octa core 4-16GB RAM GBE USB3 USB-C WiFi/BT eMMC | |
| orangepi5pro | Rockchip | RK3588S octa core 4-32GB RAM GBE USB3 WiFi/BT NVMe eMMC | |
| orangepi5plus | Rockchip | RK3588 octa core 4-32GB RAM 2.5GBE USB3 USB-C WiFi/BT NVMe eMMC | |
| orangepicm4 | Rockchip | RK3566 quad core 2-8GB RAM GBE eMMC USB3 NvMe WiFi/BT | |
| orangepi3b | Rockchip | RK3566 quad core 2-8GB RAM GBE eMMC USB3 NvMe WiFi/BT | Ļ |
| | | Select> <exit></exit> | |

4) Then it will start to compile u-boot. Some of the information prompted during compilation is as follows:

a. u-boot source code version

| [o.k.] Compiling u-boot [v2017.09] | | | | | |
|---|--|--|--|--|--|
| b. Version of the cross-compilation tool chain | | | | | |
| [o.k.] Compiler version [aarch64-linux-gnu-gcc 7.4.1] | | | | | |
| c. The path to the u-boot deb package generated by compilation | | | | | |
| [o.k.] Target directory [orangepi-build/output/debs/u-boot] | | | | | |
| d. The package name of the u-boot deb package generated by compilation | | | | | |
| [o.k.] File name [linux-u-boot-legacy-orangepi5pro_1.0.2_arm64.deb] | | | | | |
| e. Compilation time | | | | | |
| [o.k.] Runtime [1 min] | | | | | |
| f. Repeat the command to compile u-boot. Use the following command without | | | | | |
| selecting through the graphical interface. You can start compiling u-boot directly. | | | | | |
| [o.k.] Repeat Build Options [sudo ./build.sh BOARD=orangepi5pro | | | | | |
| BRANCH=legacy BUILD_OPT=u-boot KERNEL_CONFIGURE=no] | | | | | |
| | | | | | |

5) View the compiled u-boot deb package

test@test:~/orangepi-build\$ **ls output/debs/u-boot**/

linux-u-boot-legacy-orangepi5pro_1.0.2_arm64.deb

6) The files contained in the generated u-boot deb package are as follows:

a. Use the following command to decompress the deb package

test@test:~/orangepi-build\$ cd output/debs/u-boot

test@test:~/orangepi_build/output/debs/u-boot\$ \$ dpkg -x \

| linux-u-boot-legacy-orangepi5pro_1.0.2_arm64.deb . | (Note that there is a "." at |
|--|------------------------------|
| the end of the command.) | |
| test@test:~/orangepi_build/output/debs/u-boot\$ ls | |
| linux-u-boot-legacy-orangepi5pro_1.0.2_arm64.deb usr | |
| b. The decompressed file is as follows | |
| test@test:~/orangepi-build/output/debs/u-boot\$ tree usr | |
| usr | |
| L lib | |
| linux-u-boot-legacy-orangepi5pro_1.0.2_arm64 | |
| idbloader.img | |
| rkspi_loader.img | |
| u-boot.itb | |
| Lu-boot | |
| LICENSE | |
| orangepi_5_defconfig | |
| └── platform_install.sh | |
| | |
| 3 directories, 6 files | |

7) When the orangepi-bulid compilation system compiles the u-boot source code, it will first synchronize the u-boot source code with the u-boot source code of the github server. Therefore, if you want to modify the u-boot source code, you first need to turn off the download and update function of the source code. (You need to completely compile u-boot once before you can turn off this function, otherwise it will prompt that the source code of u-boot cannot be found. If the source code compressed package is downloaded from Baidu Cloud Disk, there is no such problem, because the source code of u-boot have been cached), otherwise the modifications will be restored. The method is as follows:

Set the IGNORE_UPDATES variable in userpatches/config-default.conf to "yes" test@test:~/orangepi-build\$ vim userpatches/config-default.conf IGNORE_UPDATES="yes"

8) When debugging u-boot code, you can use the following method to update u-boot in the linux image for testing

a. Upload the compiled deb package of u-boot to the Linux system of the

development board

test@test:~/orangepi-build\$ cd output/debs/u-boot

test@test:~/orangepi_build/output/debs/u-boot\$ scp \

linux-u-boot-legacy-orangepi5pro 1.0.2 arm64.deb root@192.168.1.xxx:/root

b. Then log in to the development board and uninstall the installed deb package of u-boot

root@orangepi:~# apt purge -y linux-u-boot-orangepi5pro-legacy

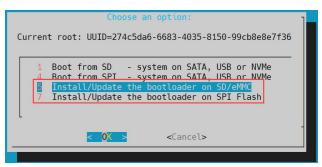
c. Install the new u-boot deb package just uploaded

root@orangepi:~# dpkg -i linux-u-boot-legacy-orangepi5pro_1.0.2_arm64.deb

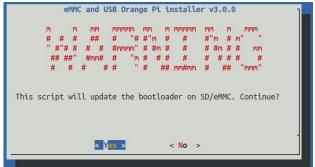
d. Then run the nand-sata-install script

root@orangepi:~# nand-sata-install

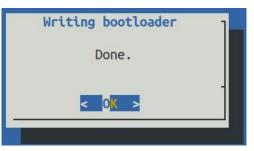
e. Then select **5 Install/Update the bootloader on SD/eMM** to update u-boot in the TF card or **7 Install/Update the bootloader on SPI Flash** to update u-boot in SPI Flash



f. After pressing the Enter key, a Warning will pop up first.



g. Press the Enter key again to start updating u-boot. After the update is completed, the following information will be displayed.



- h. Then you can restart the development board to test whether the u-boot modification has taken effect.
- 9) Other useful information
 - a. In u-boot 2017.09 source code, the defconfig configuration file used by the development board is

orangepi-build/u-boot/v2017.09-rk3588/configs/orangepi_5_pro_defconfig

b. In u-boot 2017.09 source code, the dts file used by the development board is orangepi-build/u-boot/v2017.09-rk3588/arch/arm/dts/rk3588s-orangepi-5-pro.dts

5.4. **Compile the linux kernel**

1) Run the build.sh script, remember to add sudo permissions test@test:~/orangepi-build\$ sudo ./build.sh

2) Select Kernel package and press Enter

Choose an option Compile image | rootfs | kernel | u-boot U-boot package Kernel package Rootfs and all deb packages Full OS image for flashing

3) Then select the model of the development board

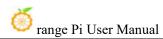
| X | |
|---|----------------------|
| Q | range Pi User Manual |

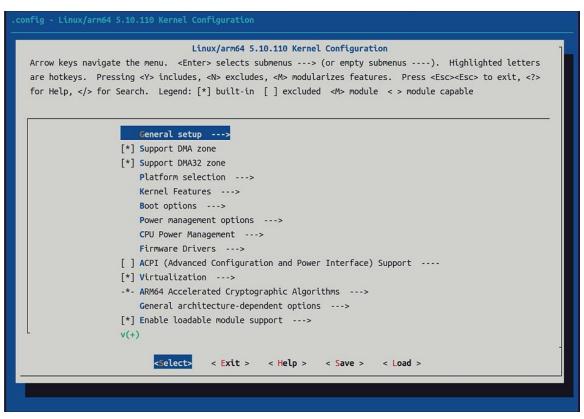
| orangepi4 | | RK3399 hexa core 4GB RAM GBE eMMC USB3 USB-C WiFi/BT |
|------------------------------|---------------------------|--|
| orangepi4-lts | 100 C 10 C 10 C 10 C 10 C | RK3399 hexa core 4GB RAM GBE eMMC USB3 USB-C WiFi/BT |
| orangepi800 orangepi5 | | RK3399 hexa core 4GB RAM GBE eMMC USB3 USB-C WiFi/BT VGA RK3588S octa core 4-16GB RAM GBE USB3 USB-C NVMe |
| orangepicm5 | | RK3588S octa core 4-16GB RAM GBE USB3 USB-C |
| orangepi5b | | RK3588S octa core 4-16GB RAM GBE USB3 USB-C WiFi/BT eMMC |
| orangepi5pro | Rockchip | RK3588S octa core 4-32GB RAM GBE USB3 WiFi/BT NVMe eMMC |
| orangepi5plus orangepicm4 | | RK3588 octa core 4-32GB RAM 2.5GBE USB3 USB-C WiFi/BT NVMe eMMC RK3566 quad core 2-8GB RAM GBE eMMC USB3 NvMe WiFi/BT |
| orangepi3b | | RK3566 quad core 2-8GB RAM GBE eMMC USB3 NvMe WiFi/BT |
| | | Select> <exit></exit> |

4) Then you will be prompted whether you need to display the kernel configuration interface. If you do not need to modify the kernel configuration, select the first one. If you need to modify the kernel configuration, select the second one.

| Select the kernel configuration. | | | | |
|---|--|--|--|--|
| Do not change the kernel configuration Show a kernel configuration menu before compilation | | | | |

5) If you choose to display the kernel configuration menu (the second option) in step 4), the kernel configuration interface opened through **make menuconfig** will pop up. At this time, you can directly modify the kernel configuration. After modification, save and exit. Yes, after exiting, the kernel source code will start to be compiled.





a. If you do not need to modify the kernel configuration options, when running the build.sh script, pass **KERNEL_CONFIGURE=no** to temporarily block the pop-up of the kernel configuration interface.

test@test:~/orangepi-build\$ sudo ./build.sh KERNEL_CONFIGURE=no

b. You can also set **KERNEL_CONFIGURE=no** in the

orangepi-build/userpatches/config-default.conf configuration file to permanently disable this function.

c. If the following error is prompted when compiling the kernel, this is because the Ubuntu PC terminal interface is too small, causing the **make menuconfig** interface to be unable to be displayed. Please adjust the Ubuntu PC terminal to the maximum size, and then rerun the build.sh script.



| HOSTCC sc | ripts/kconfig/mconf.o |
|--------------|--|
| HOSTCC sc | ripts/kconfig/lxdialog/checklist.o |
| HOSTCC sc | ripts/kconfig/lxdialog/util.o |
| HOSTCC sc | ripts/kconfig/lxdialog/inputbox.o |
| HOSTCC sc | ripts/kconfig/lxdialog/textbox.o |
| HOSTCC sc | ripts/kconfig/lxdialog/yesno.o |
| HOSTCC sc | ripts/kconfig/lxdialog/menubox.o |
| HOSTLD sc | ripts/kconfig/mconf |
| scripts/kcon | fia/mconf Kconfia |
| Your display | is too small to run Menuconfig! |
| It must be a | it least 19 lines by 80 columns. |
| scripts/kcon | fig/Makefile:28: recipe for target 'menuconfig' failed |
| make[1]: *** | [menuconfig] Error 1 |
| Makefile:560 | : recipe for target 'menuconfig' failed |
| make: *** [m | enuconfig] Error 2 |
| [error] ER | ROR in function compile_kernel [compilation.sh:376] |
| [error] Er | ror kernel menuconfig failed |
| [o.k.] Pro | cess terminated |

6) Part of the information prompted when compiling the kernel source code is explained as follows:

a. Linux kernel source code version

[o.k.] Compiling current kernel [5.10.160]

b. The version of the cross-compilation tool chain used

o.k.] Compiler version [aarch64-none-linux-gnu-gcc 11.2.1]

c. The configuration file used by the kernel by default and the path where it is stored

[o.k.] Using kernel config file [config/kernel/linux-rockchip-rk3588-legacy.config]

- d. The path of the kernel-related deb package generated by compilation
- [o.k.] Target directory [orangepi-build/output/debs/]

e. The package name of the kernel image deb package generated by compilation

- [o.k.] File name [linux-image-legacy-rockchip-rk3588_1.0.2_arm64.deb]
 - f. Compilation time

[o.k.] Runtime [**5 min**]

g. Finally, the compilation command to repeatedly compile the last selected kernel will be displayed. Use the following command without selecting through the graphical interface, and you can directly start compiling the kernel source code.

[o.k.] Repeat Build Options [sudo ./build.sh BOARD=orangepi5pro BRANCH=legacy BUILD_OPT=kernel KERNEL_CONFIGURE=no]

- 7) View the kernel-related deb package generated by compilation
 - a. linux-dtb-legacy-rockchip-rk3588_1.0.2_arm64.deb Contains dtb files used by the kernel
 - b. linux-headers-legacy-rockchip-rk3588_1.0.2_arm64.deb Contains kernel header files

c. **linux-image-legacy-rockchip-rk3588_1.0.2_arm64.deb** Contains kernel images and kernel modules

test@test:~/orangepi-build\$ **ls output/debs/linux-*** output/debs/linux-dtb-legacy-rockchip-rk3588_1.0.2_arm64.deb output/debs/linux-image-legacy-rockchip-rk3588_1.0.2_arm64.deb output/debs/linux-headers-legacy-rockchip-rk3588_1.0.2_arm64.deb

- 8) The files contained in the generated deb package of linux-image are as follows
 - a. Use the following command to decompress the deb package

test@test:~/orangepi-build\$ cd output/debs

test@test:~/orangepi build/output/debs\$ mkdir test

test@test:~/orangepi_build/output/debs\$ cp \

linux-image-legacy-rockchip-rk3588_1.0.2_arm64.deb test/

test@test:~/orangepi_build/output/debs\$ cd test

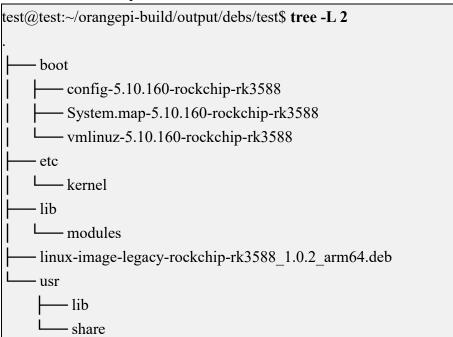
test@test:~/orangepi_build/output/debs/test\$ dpkg -x \

linux-image-legacy-rockchip-rk3588_1.0.2_arm64.deb .

test@test:~/orangepi_build/output/debs/test\$ ls

boot etc lib linux-image-legacy-rockchip-rk3588_1.0.2_arm64.deb usr

b. The decompressed file is as follows



9) When the orangepi-bulid compilation system compiles the linux kernel source code, it

will first synchronize the linux kernel source code with the linux kernel source code of the github server. Therefore, if you want to modify the linux kernel source code, you first need to turn off the update function of the source code (it needs to be completely compiled once This function can only be turned off after the linux kernel source code is obtained, otherwise it will prompt that the linux kernel source code cannot be found. If the source code compressed package is downloaded from Baidu Cloud Disk, there will be no such problem, because the linux source code has been cached), otherwise the All modifications will be restored, as follows:

Set the IGNORE_UPDATES variable in **userpatches/config-default.conf** to "yes" test@test:~/orangepi-build\$ **vim userpatches/config-default.conf** IGNORE_UPDATES="**yes**"

10) If the kernel is modified, you can use the following method to update the kernel and kernel module of the development board Linux system

a. Upload the compiled deb package of the Linux kernel to the Linux system of the development board

test@test:~/orangepi-build\$ cd output/debs

test@test:~/orangepi-build/output/debs\$ scp \

linux-image-legacy-rockchip-rk3588_1.0.2_arm64.deb root@192.168.1.xxx:/root

b. Then log in to the development board and uninstall the installed deb package of the Linux kernel.

root@orangepi:~# apt purge -y linux-image-legacy-rockchip-rk3588

c. Install the deb package of the new linux kernel just uploaded

root@orangepi:~# dpkg -i linux-image-legacy-rockchip-rk3588_1.0.2_arm64.deb

d. Then restart the development board and check whether the kernel-related modifications have taken effect.

root@orangepi:~# reboot

- 10) Other useful information
 - a. The storage location of the kernel configuration file is as follows. Please do not go to the kernel source code to find the kernel configuration file used by the development board.

orangepi-build/external/config/kernel/linux-rockchip-rk3588-legacy-opi5pro.config

b. The location of the dts file used by the development board is

orangepi-build/kernel/orange-pi-5.10-rk35xx/arch/arm64/boot/dts/rockchip/rk3588s

-orangepi-5-pro.dts

5.5. Compile rootfs

1) Run the build.sh script, remember to add sudo permissions

test@test:~/orangepi-build\$ sudo ./build.sh

2) Select Rootfs and all deb packages and press Enter

| Choose an option Compile image rootfs kernel u-boot | |
|--|--|
| U-boot package Kernel package <mark>Rootfs and all deb packages</mark> Full OS image for flashing | |

3) Then select the model of the development board

| orangepi4 | Rockchip | RK3399 hexa | core 4GB F | AM GBE | eMMC USB3 | USB-C WiFi/ | вт | Î |
|---------------|----------|-------------|-------------|---------|--|--------------|-------------|-----|
| orangepi4-lts | | | | | | USB-C WIFI | | |
| orangepi800 | Rockchip | RK3399 hexa | core 4GB F | AM GBE | eMMC USB3 | USB-C WIFI/ | BT VGA | |
| orangepi5 | Rockchip | RK3588S oct | a core 4-16 | GB RAM | GBE USB3 | USB-C NVMe | | |
| orangepicm5 | Rockchip | RK3588S oct | a core 4-16 | GB RAM | GBE USB3 | USB-C | | |
| orangepi5b | Rockchip | RK3588S oct | a core 4-16 | GB RAM | GBE USB3 | USB-C WiFi/B | T eMMC | |
| orangepi5pro | Rockchip | RK3588S oct | a core 4-32 | GB RAM | GBE USB3 | WiFi/BT NVMe | eMMC | |
| orangepi5plus | Rockchip | RK3588 octa | core 4-320 | B RAM 2 | 2.5GBE USB | 3 USB-C WiFi | /BT NVMe eM | MMC |
| orangepicm4 | | | | | | B3 NvMe WiFi | | |
| orangepi3b | Rockchip | RK3566 quad | core 2-8GE | RAM GE | BE eMMC US | B3 NvMe WiFi | /ВТ | Ţ |
| | | Select> | | | <exi< td=""><td>ts</td><td></td><td></td></exi<> | ts | | |

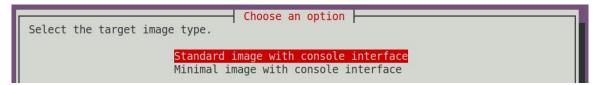
4) Then select the type of rootfs

| | bionic Ubuntu Bionic 18.04 LTS |
|---|--|
| t | bookworm Debian 12 Bookworm bullseye Debian 11 Bullseye focal Ubuntu Focal 20.04 LTS jammy Ubuntu jammy 22.04 LTS |
| | |
| <select< th=""><th>t> <exit></exit></th></select<> | t> <exit></exit> |

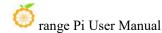
- 5) Then select the type of image
 - a. **Image with console interface (server)** Represents the image of the server version, which is relatively small in size.
 - b. **Image with desktop environment** Represents an image with a desktop, which is relatively large in size.

| | Choose an option |
|-------------------------------|-------------------------------|
| Select the target image type. | |
| Image wit | :h console interface (server) |
| | th desktop environment |
| image with | in desired environment |

6) If you are compiling the server version of the image, you can also choose to compile the Standard version or the Minimal version. The Minimal version will have much less pre-installed software than the Standard version (**please do not choose the Minimal version without special needs, because many things are not pre-installed by default. Some functions may not be available**)



7) If you are compiling a desktop version of the image, you need to select the type of desktop environment. Currently, Ubuntu Jammy mainly maintains XFCE and Gnome desktops, Ubuntu Focal only maintains XFCE desktops, Debian Bullseye mainly maintains XFCE and KDE desktops, and Debian Bookwork mainly maintains XFCE desktop



| Select the default desktop environment to bundle with this image |
|---|
| Gnome desktop environment <mark>Xfce desktop environment</mark> |
| |
| Choose the desktop environment config Select the configuration for this environment. |
| base configuration |

You can then select additional packages that need to be installed. Please press the Enter key here to skip directly.

| | | se desktop softwares to add | |
|--|--|-------------------------------------|--------|
| Select which kind of s | oftwares you'd | like to add to your build | |
| <pre>3dsupport [] 3dsupport [] browsers [] chat [] desktop_tools [] editors [] internet [] multimedia [] office [] programming [] remote_desktop</pre> | 3dsupport Browsers Chat Desktop_tools Editors Internet Multimedia Office Programming Remote_desktop | | |
| | <0k> | <ca< td=""><td>ancel></td></ca<> | ancel> |
| | | | |

8) Then the compilation of rootfs will begin. Some of the information prompted during compilation is as follows:

a. Type of rootfs

[o.k.] local not found [Creating new rootfs cache for **jammy**]

b. The storage path of the rootfs compressed package generated by compilation

[o.k.] Target directory [external/cache/rootfs]

c. The name of the rootfs compressed package generated by compilation

[o.k.] File name [jammy-xfce-arm64.f930ff6ebbac1a72108a2e100762b18f.tar.lz4]

d. Compilation time

[o.k.] Runtime [**13 min**]

- 9) View the compiled rootfs compressed package
 - a. jammy-xfce-arm64.f930ff6ebbac1a72108a2e100762b18f.tar.lz4 is a compressed package of rootfs. The meaning of each field in the name is:
 - a) **jammy** represents the type of Linux distribution of rootfs
 - b) **xfce** indicates that rootfs is the desktop version, and if it is **cli**, it indicates the server version type.
 - c) **arm64** represents the architecture type of rootfs
 - d) f930ff6ebbac1a72108a2e100762b18f is the MD5 hash value generated by the package names of all software packages installed by rootfs. As long as the list of software packages installed by rootfs is not modified, this value will not change. The compilation script will use this MD5 hash value. Determine whether rootfs needs to be recompiled
 - b. **jammy-xfce-arm64.f930ff6ebbac1a72108a2e100762b18f.tar.lz4.list** lists the package names of all packages installed by rootfs

test@test:~/orangepi-build\$ **ls external/cache/rootfs/ jammy-xfce-arm64.f930ff6ebbac1a72108a2e100762b18f.tar.lz4** jammy-xfce-arm64.f930ff6ebbac1a72108a2e100762b18f.tar.lz4.current jammy-xfce-arm64.f930ff6ebbac1a72108a2e100762b18f.tar.lz4.list

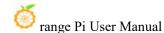
10) If the required rootfs already exists under **external/cache/rootfs**, then compiling the rootfs again will directly skip the compilation process and will not restart the compilation. When compiling the image, it will also go to **external/cache/rootfs** to check whether it already exists. There is a cached rootfs available. If it is available, use it directly. This can save a lot of download and compilation time.

5.6. Compile linux image

1) Run the build.sh script, remember to add sudo permissions

test@test:~/orangepi-build\$ sudo ./build.sh

2) Select Full OS image for flashing and press Enter



| Choose an option Compile image rootfs kernel u-boot | |
|--|--|
| U-boot package Kernel package Rootfs and all deb packages <mark>Full OS image for flashing</mark> | |

3) Then select the model of the development board

| orangepi4 | Rockchip | RK3399 hexa core 4GB RAM GBE eMMC USB3 USB-C WiFi/BT 1 |
|---------------|----------|---|
| orangepi4-lts | | RK3399 hexa core 4GB RAM GBE eMMC USB3 USB-C WiFi/BT |
| orangepi800 | | RK3399 hexa core 4GB RAM GBE eMMC USB3 USB-C WiFi/BT VGA |
| orangepi5 | | RK3588S octa core 4-16GB RAM GBE USB3 USB-C NVMe |
| orangepicm5 | Rockchip | RK3588S octa core 4-16GB RAM GBE USB3 USB-C |
| orangepi5b | Rockchip | RK3588S octa core 4-16GB RAM GBE USB3 USB-C WiFi/BT eMMC |
| orangepi5pro | | RK3588S octa core 4-32GB RAM GBE USB3 WiFi/BT NVMe eMMC |
| orangepi5plus | Rockchip | RK3588 octa core 4-32GB RAM 2.5GBE USB3 USB-C WiFi/BT NVMe eMMC |
| orangepicm4 | Rockchip | RK3566 guad core 2-8GB RAM GBE eMMC USB3 NvMe WiFi/BT |
| orangepi3b | Rockchip | RK3566 quad core 2-8GB RAM GBE eMMC USB3 NvMe WiFi/BT |
| | | |
| | | Select> <exit></exit> |

4) Then select the type of rootfs

| Select the target OS release package base | | | | |
|---|---|--|--|--|
| bookworm bullseye focal | Ubuntu Bionic 18.04 LTS Debian 12 Bookworm Debian 11 Bullseye Ubuntu Focal 20.04 LTS Ubuntu jammy 22.04 LTS | | | |
| <select></select> | <exit></exit> | | | |

- 5) Then select the type of image
 - a. **Image with console interface (server)** Represents the image of the server version, which is relatively small in size.
 - b. **Image with desktop environment** Represents an image with a desktop, which is relatively large in size.

| 2 | |
|------------|----------------------|
| \bigcirc | range Pi User Manual |

| Choose an option |
|---------------------------------------|
| Select the target image type. |
| Image with console interface (server) |
| Image with desktop environment |

6) If you are compiling the server version of the image, you can also choose to compile the Standard version or the Minimal version. The Minimal version will have much less pre-installed software than the Standard version (**please do not choose the Minimal version without special needs, because many things are not pre-installed by default. Some functions may not be available**)

| Select the target image type. |
|---------------------------------------|
| |
| Standard image with console interface |
| Minimal image with console interface |

7) If you are compiling a desktop version of the image, you need to select the type of desktop environment. Currently, Ubuntu Jammy mainly maintains XFCE and Gnome desktops, Ubuntu Focal only maintains XFCE desktops, Debian Bullseye mainly maintains XFCE and KDE desktops, and Debian Bookwork mainly maintains XFCE desktop

| Choose a desktop environment Select the default desktop environment to bundle with this image Gnome desktop environment Xfce desktop environment |
|---|
| Choose the desktop environment config Select the configuration for this environment. base configuration |

You can then select additional packages that need to be installed. Please press the Enter key here to skip directly.

| <pre>[] 3dsupport [] browsers [] chat [] desktop_tools [] editors [] internet [] multimedia [] office</pre> | ftwares you'd li 3dsupport Browsers Chat Desktop_tools Editors Internet Multimedia Office Programming | se desktop softwares to add Like to add to your build |
|---|--|--|
| | <0k> | <cancel></cancel> |

8) Then the compilation of the linux image will begin. The general process of compilation is as follows:

a. Initialize the compilation environment of Ubuntu PC and install the software packages required for the compilation process.

b. Download the source code of u-boot and linux kernel (if already cached, only update the code)

- c. Compile u-boot source code and generate u-boot deb package
- d. Compile linux source code and generate linux-related deb packages

e. Make the deb package of linux firmware

f. Make the deb package of orangepi-config tool

g. Create a deb package with board-level support

h. If you compile the desktop version image, you will also create a desktop-related deb package.

i. Check whether rootfs has been cached. If not, re-create rootfs. If it has been cached, decompress it directly and use it.

j. Install the deb package generated previously into rootfs

k. Make some specific settings for different development boards and different types of images, such as pre-installing additional software packages, modifying system configurations, etc.

1. Then create the image file and format the partition. The default type is ext4.

m. Then copy the configured rootfs to the mirror partition.

n. Then update initramfs

o. Finally, write the bin file of u-boot into the image through the dd command.

- 9) After compiling the image, the following message will be prompted
 - a. The storage path of the compiled image

[o.k.] Done building

[output/images/Orangepi5pro_1.0.2_debian_bullseye_desktop_xfce_linux5.10.160/ Orangepi5pro_1.0.2_debian_bullseye_desktop_xfce_linux5.10.160.img]

b. Compilation time

[o.k.] Runtime [19 min]

c. Repeat the command to compile the image. Use the following command to start compiling the image directly without selecting it through the graphical interface.

[o.k.] Repeat Build Options [sudo ./build.sh BOARD=orangepi5pro BRANCH=legacy BUILD_OPT=image RELEASE=bullseye BUILD_MINIMAL=no BUILD_DESKTOP=no KERNEL_CONFIGURE=yes]

6. Linux development manual

6.1. Method to compile the kernel source code separately in the Linux system of the development board

1) First download the Linux kernel source code of the development board

orangepi@orangepi:~\$ git clone --depth=1 -b orange-pi-5.10-rk35xx https://github.com/orangepi-xunlong/linux-orangepi

If there is a problem downloading the code from github, you can download the kernel source code compressed package from the official tool of the development board, then upload it to the Linux system of the development board, and then unzip it.



The command to decompress the kernel source code archive is: orangepi@orangepi:~\$ tar zxf orange-pi-5.10-rk35xx.tar.gz orangepi@orangepi:~\$ mv orange-pi-5.10-rk35xx linux-orangepi

After decompression, please execute the following command to synchronize the source code with github to ensure that the source code is in the latest state: orangepi@orangepi:~\$ cd linux-orangepi orangepi@orangepi:~/linux-orangepi\$ git pull

2) Then configure the default kernel configuration

orangepi@orangepi:~\$ cd linux-orangepi

orangepi@orangepi:~/linux-orangepi\$ make rockchip_linux_defconfig

The path of rockchip_linux_defconfig in the kernel source code is arch/arm64/configs/

3) Then compile the kernel source code

orangepi@orangepi:~/linux-orangepi\$ make -j10

4) Then install the kernel module

orangepi@orangepi:~/linux-orangepi\$ sudo make modules_install

The installation path of the kernel module is: /lib/modules

After executing the sudo make modules_install command, you can see that there is an additional kernel module folder under /lib/modules/:

orangepi@orangepi5pro:~\$ ls /lib/modules

5.10.160+ 5.10.160-rockchip-rk3588

5) Then install the kernel image and uInitrd

orangepi@orangepi:~/linux-orangepi\$ sudo make install

The installation path of the kernel image and uInitrd is: /boot/

After executing the sudo make install command, you can see that there is an additional kernel file under /boot/:

orangepi@orangepi5pro:~/orange-pi-5.10-rk3588\$ ls /boot/vmlinuz* /boot/vmlinuz-5.10.160+ /boot/vmlinuz-5.10.160-rockchip-rk3588

What is actually loaded when the system starts is the file /boot/Image. Image is a copy of the vmlinuz file.

6) Then install the dtb file into /boot/dtb

orangepi@orangepi:~/linux-orangepi\$ sudo make dtbs_install INSTALL_DTBS_PATH=/boot/dtb/

7) Then restart the Linux system and the newly compiled kernel will be loaded.
 orangepi@orangepi:~\$ uname -r
 5.10.160+

7. Instructions for use of Android 12 system

7.1. Supported Android versions

| Android version | Kernel version |
|-----------------|----------------|
| Android 12 | Linux5.10 |
| Android 12 Box | Linux5.10 |

7.2. Android function adaptation status

| Function | Android 12 | Android12 Box |
|----------|------------|---------------|
|----------|------------|---------------|

| HDMI 2.1 Video | OK | OK |
|---------------------------|----|----|
| HDMI 2.1 Audio | ОК | ОК |
| HDMI 2.0 Video | ОК | ОК |
| HDMI 2.0 Audio | ОК | ОК |
| USB2.0x3 | ОК | ОК |
| USB3.0x1 | ОК | ОК |
| Gigabit network port | ОК | ОК |
| Network port status light | ОК | ОК |
| WIFI | ОК | ОК |
| Bluetooth | ОК | ОК |
| Debug serial port | ОК | ОК |
| RTC chip | ОК | ОК |
| FAN fan interface | ОК | ОК |
| eMMC expansion interface | ОК | ОК |
| GPIO (40pin) | ОК | ОК |
| UART (40pin) | ОК | ОК |
| SPI (40pin) | ОК | ОК |
| I2C (40pin) | ОК | ОК |
| PWM (40pin) | OK | ОК |
| TF card boot | ОК | ОК |
| OV13850 camera | ОК | ОК |
| OV13855 camera | ОК | ОК |
| SPI+NVME boot | ОК | ОК |
| SPI+SATA boot | ОК | ОК |
| LCD | ОК | NO |
| MIC | ОК | ОК |
| Headphone playback | OK | ОК |
| Headphone recording | OK | ОК |
| Tri-color LED light | OK | ОК |
| GPU | ОК | ОК |
| NPU | ОК | ОК |
| VPU | ОК | ОК |
| On/off button | ОК | ОК |
| HDMI CEC function | NO | ОК |

7.3. WIFI connection test method

1) First click to enter Setting

| 2:04 🕤 🜵 | | | | | |
|----------------|----------|------------|---------|----------|-----------|
| | | Q Sear | ch apps | | |
| | | | ۲ | 8 | 6 |
| Calculator | Calendar | Camera | Clock | Contacts | Explorer |
| | | \bigcirc | ۲ | Q | \$ |
| Files | Gallery | Lightning | Music | Search | Settings |
| Sound Recorder | Video | WiringOP | | | |
| Sound Recorder | video | WINIGOP | | | |

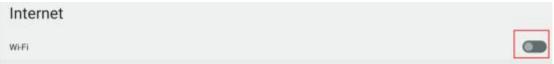
2) Then select Network & internet

| Settings | | | |
|--------------------------------------|-----|--|--|
| Q Search settings | | | |
| Network & internet Wi-Fi, hotspot | net | | |
| Connected devi Bluetooth, pairing | ces | | |

3) Then select Internet



4) Then turn on the Wi-Fi switch



5) If everything is normal after turning on Wi-Fi, you can scan for nearby Wi-Fi

hotspots.

| Internet | |
|---------------------------------------|---|
| Wi-Fi | |
| Version (set) | ۵ |
| armanii | ۵ |
| initia control to | ۵ |
| | ۵ |

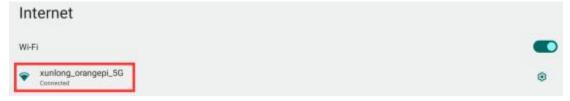
6) Then select the Wi-Fi you want to connect to, and the password input interface shown in the picture below will pop up.

| 0 |
|-----|
| p 🖾 |
| 0 |
| |
| ? . |
| |

7) Then use the keyboard to enter the password corresponding to Wi-Fi, and then use the mouse to click the Enter button on the virtual keyboard to start connecting to Wi-Fi.

| answord | ng_oran | | 3 | | | | | | | |
|---------------------|---------|---|---|---|---|---|---|---|---|-----|
|] Show pass | | | | | | | | | | |
| lidean-sail restine | na | | | | | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | Ø |
| @ |) # | ŝ | % | & | - | + | (|) | [| • |
| $\sim \ <$ | Υ. | = | * | | 2 | : | ; | 1 | ? | ~[< |
| ABC | | - | | | | | | / | | ٢ |

8) The display after successful Wi-Fi connection is as shown below:



7.4. How to use Wi-Fi hotspot

1) First, please make sure that the Ethernet port is connected to the network cable and can access the Internet normally.

2) Then select Settings

| 2:04 🕾 🜵 | | | | | |
|----------------|----------|-----------|---------|----------|-----------|
| | | Q Sear | ch apps | | |
| = | 100 | | ۲ | 8 | 6 |
| Calculator | Calendar | Camera | Clock | Contacts | Explorer |
| | | G | ۲ | Q | \$ |
| Files | Gallery | Lightning | Music | Search | Settings |
| ٩ | | 265 | | | |
| Sound Recorder | Video | WiringOP | | | |

3) Then select Network & internet

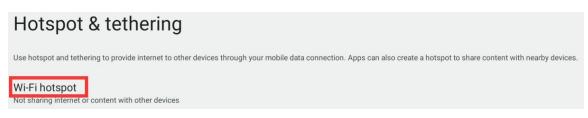


4) Then select Hotspot & tethering

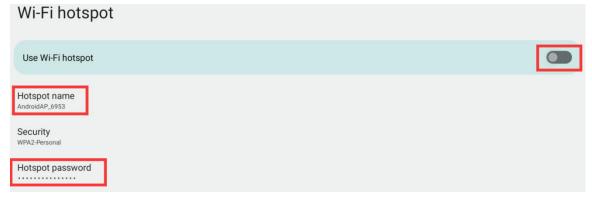
Network & internet

| €? | Internet Networks available | |
|-----------------|-----------------------------------|--|
| ų. | Calls & SMS No SIM | |
| ¥ | Airplane mode | |
| <i><</i> ··> | Ethernet | |
| 0 | Hotspot & tethering Hotspot on | |

5) Then select Wi-Fi hotspot



6) Then open the **Wi-Fi hotspot**. You can also see the name and password of the generated hotspot in the picture below. Remember them and use them when connecting to the hotspot (if you need to change the name and password of the hotspot, you need to turn off the Wi-Fi first. -Fi hotspot before you can modify it)



7) You can take out your mobile phone at this time. If everything is normal, you can find the WIFI hotspot with the same name (here AndroidAP_6953) shown under the Hotspot name in the picture above in the WI-FI list searched by the mobile phone. Then you can click AndroidAP_6953 to connect to the hotspot. The password can be seen under the Hotspot password in the picture above.

| 〈 设置 | 无线局域网 | |
|-------------|-------------------|----------------|
| 无约 | 线局域网 | |
| 🗸 xui | nlong_orangepi_5G | 🔒 🗢 i |
| 网络 | | |
| An | droidAP_6953 | a ≎ (j) |

8) After the connection is successful, it will be displayed as shown below (the interface will be different on different mobile phones, the specific interface is subject to the one displayed on your mobile phone). At this point, you can open a web page on your mobile phone to see if you can access the Internet. If the web page can be opened normally, it means that the **WI-FI Hotspot** of the development board can be used normally.



7.5. Bluetooth test method

1) First click to enter Setting

| 🍏 range Pi User | Manual | Copyright re | served by Shenz | hen Xunlong Sof | tware Co., Ltd |
|-----------------|----------|--------------|-----------------|-----------------|----------------|
| 2:04 🖯 🜵 | | | | | |
| | | Q Searc | ch apps | | |
| 82 | 200 | | • | 8 | 6 |
| Calculator | Calendar | Camera | Clock | Contacts | Explorer |
| | | G | ۲ | | \$ |
| Files | Gallery | Lightning | Music | Search | Settings |
| ٢ | | | | | |
| Sound Recorder | Video | WiringOP | | | |

2) Then select Connected devices

| Se | ttings | | | | |
|-----|---|---|--|--|--|
| ٩ | Search settings | | | | |
| (ŗ | Network & internet Wi-Fi, hotspot | | | | |
| C00 | Connected devices Bluetooth, pairing | ۲ | | | |

3) Then click **Pair new device** to turn on Bluetooth and start scanning for surrounding Bluetooth devices

| Сс | onnected devices |
|-------|---|
| Other | devices |
| ψ | USB Charging this device |
| + | Pair new device Bluetooth will turn on to pair |

4) The searched Bluetooth devices will be displayed under Available devices



5) Then click on the Bluetooth device you want to connect to start pairing. When the following interface pops up, please use the mouse to select the **Pair** option

| Pair new device | |
|-------------------|---|
| Device name | Pair with test? |
| Available devices | Bluetooth pairing code |
| 🗖 xuebutou | 972414 Allow access to your contacts and call history |
| Lest Raining. | CANCEL PAIR |

6) What is tested here is the Bluetooth configuration process between the development board and the Android phone. At this time, the following confirmation interface will pop up on the phone. Click the pairing button on the phone to start the pairing process.



7) After pairing is completed, you can see the paired Bluetooth device as shown in the picture below

| Сс | onnected devices | |
|-------|-----------------------------|---|
| Other | devices | |
| ψ | USB Charging this device | |
| + | Pair new device | |
| Previ | pusly connected devices | |
| L | test | ۲ |

8) At this time, you can use the Bluetooth of your mobile phone to send a picture to the development board. After sending, you can see the following confirmation interface in the Android system of the development board, and then click **Accept** to start receiving the pictures sent by the mobile phone.

| Accept incoming file? | | |
|---|----------------|---|
| From | | |
| test | | |
| Filename Screenshot_20220914_140609_com.android.settings.jpg | | |
| Size 170 kB | | |
| | DECLINE ACCEPT |] |

9) The pictures received by the Bluetooth system of the development board Android system can be viewed by opening the **Download** directory in the file manager.

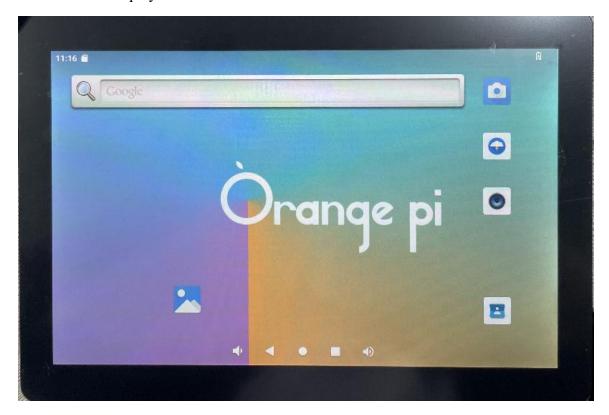
| Internal Memory/E | Download | | | | |
|-------------------|-------------------|------------------|------------------|-----------|---------------------------|
| 🛖 Home | LevelUp | 😑 Multi | 🗹 Editor | RewFolder | Rack |
| 💞 Screensho | t_20220914_140609 | _com.android.set | tings_102838.jpg | 165.97 K | 2022-09-07 10:28:44 -rw |

7.6. How to use the 10.1-inch MIPI screen

1) First, you need to assemble the screen. Please refer to the assembly method of the 10.1-inch MIPI screen.

2) The location of the interface of the mipi lcd screen on the development board is as shown in the figure below:

3) Connect the assembled screen to the LCD interface of the development board, connect the Type-C power supply to the board, and power it on. After the system starts, you can see the screen display as shown below.



7.7. Testing methods for OV13850 and OV13855 MIPI cameras

Currently, the development board supports two MIPI cameras, OV13850 and OV13855. The specific pictures are as follows:

a. OV13850 camera with 13 million MIPI interface



b. OV13855 camera with 13 million MIPI interface

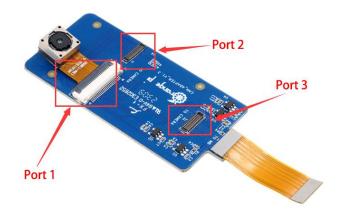


The adapter board and FPC cable used by the OV13850 and OV13855 cameras are the same, but the locations where the two cameras are connected to the adapter board are different. The FPC cable is shown in the figure below. Please note that the FPC cable has a direction. The end marked **TO MB** needs to be plugged into the camera interface of the development board, and the end marked **TO CAMERA** needs to be plugged into the camera adapter board.

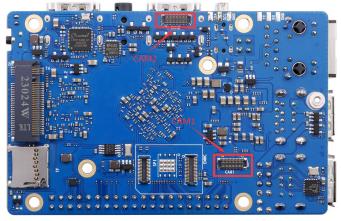


There are a total of 3 camera interfaces on the camera adapter board, and only one can be connected and used at the same time, as shown in the figure below, among which:

- a. Connect the OV13850 camera to interface 1
- b. Connect the OV13855 camera to interface 2
- c. Interface No. 3 is not used, just ignore it.



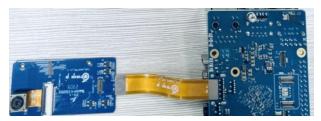
There are a total of 2 camera interfaces on the Orange Pi 5 Pro development board. We define the positions of Cam1 and Cam2 as shown below:



The method of plugging the camera into the Cam1 interface of the development board is as follows:

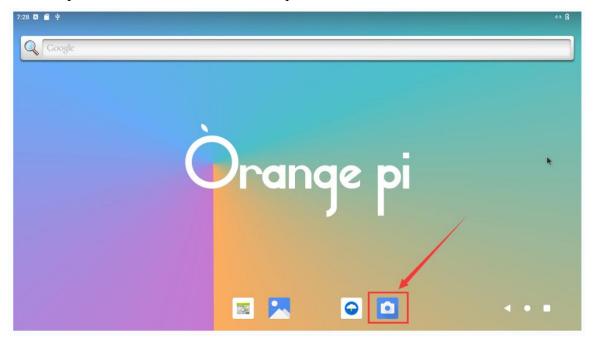


The method of plugging the camera into the Cam2 interface of the development board is as follows:

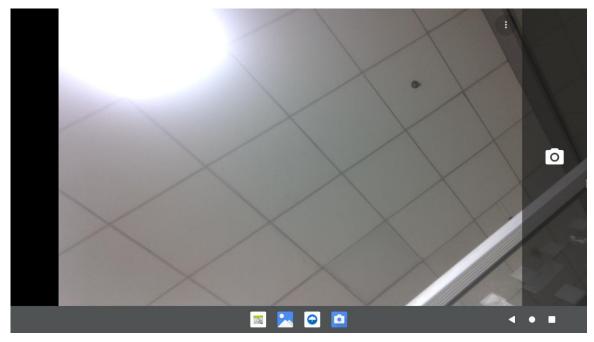


After connecting the camera to the development board, we can use the following method to test the camera:

a. Open the camera APP on the desktop



b. Then you can see the preview screen of the camera

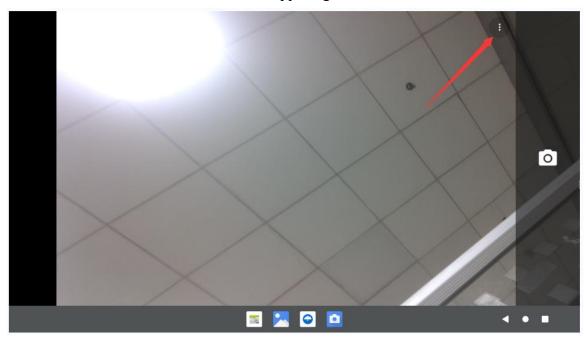


In addition to single camera, we can also connect two cameras at the same time.

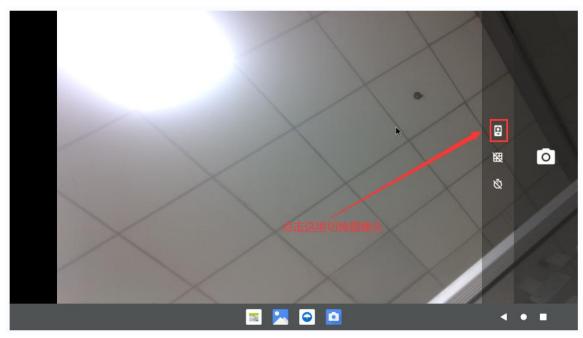
After connecting the dual cameras, follow the same steps as before and open the camera APP to see the picture of one of the cameras.

How to switch to another camera:

a. First click on the three dots in the upper right corner

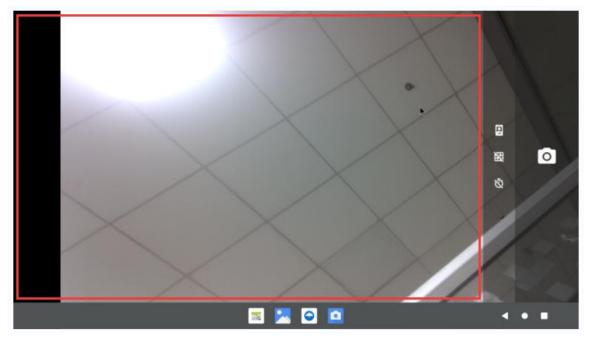


b. Then click the position shown in the picture below to switch the camera

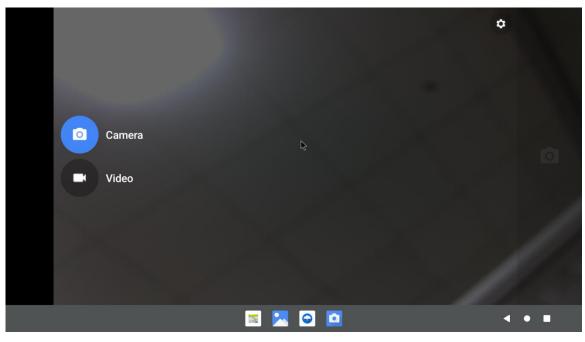


Press and hold the mouse in the area shown in the red box in the picture below on the

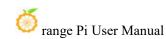
camera APP and drag it to the right to bring up the switching interface between taking pictures and recording videos.

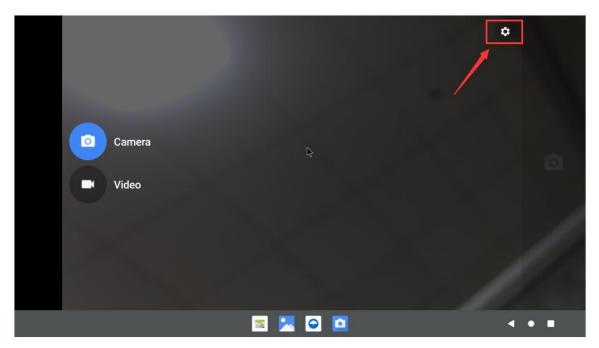


The switching interface between photo taking and video recording is as shown below. Click **Video** to switch to video recording mode.



Click the location shown in the picture below to enter the camera settings interface



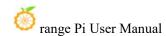


The camera setting interface is as follows:

| ← Settings | |
|--------------------------|-------|
| Resolution & quality | |
| Capture Sound | ۲ |
| Save location | ۲ |
| Restore Default Settings | |
| | |
| | |
| * | |
| | |
| | |
| | |
| | |
| 🔤 🚬 🖸 🧕 | ◀ ● ■ |

Currently tested OV13850 does not support 4K video recording (OV13855 supports it), and only supports up to 1080p. When recording video, please switch the video format to 1080p in the settings. The steps are as follows:

a. First enter the setting interface of the camera APP, then click **Resolution &** quality



| ← Settings | |
|--------------------------|--|
| Resolution & quality | |
| Capture Sound | |
| Save location | |
| Restore Default Settings | |

b. Then set the video format to 1080p in Video

| ← Settings | | | |
|--|--|--|--|
| Camera Back camera photo (4:3) 13.2 megapixels | | | |
| Front camera photo (4:3) 13.2 megapixels | | | |
| Video Back camera video HD 1080p | | | |
| Front camera video HD 1080p | | | |

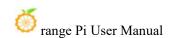
7.8. 40pin interface GPIO, UART, SPI and PWM testing

7. 8. 1. **40pin GPIO port test**

1) First click the wiringOP icon to open wiringOP APP

| | | Q Sea | arch apps | | |
|------------|----------------|---------|-----------------|------------|----------|
| - + | 128 | | 0 | ۲ | 2 |
| Calculator | Calendar | Camera | Chrome | Clock | Contacts |
| 6 | | | ۲ | | Q |
| Explorer | Files | Gallery | Music | Play Store | Search |
| Settings | Sound Recorder | Video | رقب wiringOP | | |

2) The main interface of wiringOP APP is displayed as shown below, then click the **GPIO_TEST** button to open the GPIO test interface



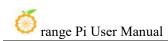
| wiringOP | |
|----------|-----------|
| | GPI0_TEST |
| | UART_TEST |
| | 12C_TEST |
| | SPLTEST |
| | PWM_TEST |

3) The GPIO test interface is as shown in the figure below. The two rows of **CheckBox** buttons on the left have a one-to-one correspondence with the 40pin pins. When the **CheckBox** button is checked, the corresponding GPIO pin will be set to **OUT** mode and the pin level is set to high level; when unchecked, the GPIO pin level is set to low level; when the right When pressing the **GPIO READALL** button, you can obtain information such as wPi number, GPIO mode, pin level, etc.;

When you click the **BLINK ALL GPIO** button, the program will control the 28 GPIO ports to continuously switch between high and low levels.

| wiringOP | |
|-----------------------|-----------------------------|
| 3.3V | GPIO READALL BLINK ALL GPIO |
| SDA.1 . 5V | |
| SCL.1 🔲 🔲 GND | |
| PWM13 | |
| GND 🗌 🔲 RXD.2 | |
| CAN1_RX 🗌 🗌 GPI01_A7 | |
| CAN1_TX | |
| GPIO1_B6 🗌 🗍 TXD.6 | |
| 3.3V 🗌 🔲 RXD.6 | |
| SPIO_TXD | |
| SPI0_RXD 🗌 🔲 GPI01_B0 | |
| SPIO_CLK 🗌 🔲 SPIO_CSO | |
| GND SPI0_CS1 | |
| SDA.4 🗌 🗌 SCL.4 | |
| GPI01_A4 🔲 📄 GND | |
| GPI01_A6 🗌 📄 PWM14 | |
| PWM15 🔲 🗍 GND | |
| GPI04_A7 🔲 🗍 TXD.0 | |

4) Then click the **GPIO READALL** button, and the output information is as shown below:



| wiringOP | | | | | | | | | | | | |
|----------------------|--------------|----------|--------------------------|----------------|-----------|----------|------------------|-----------|-------------|-------------------|------------|--------------|
| 3.3V 🔲 🔲 5V | | | | | | | | | | | | |
| SDA.1 🔲 📄 5V | | | GPIO READ | ALL | | | | | BLINK | ALL GPIO | | |
| SCL.1 🔲 🔲 GND | | | | | | | - | | | | | |
| PWM13 🗌 🗌 TXD.2 | + GPIO | wPi | ++ Name | Mode | ++ V | | 5 PRO sical | +· V | ⊦ Mode | + Name | + wPi | + GPIO |
| GND RXD.2 | ++ | | ++ 3.3V | | + + | ⊦ 1 | ++ 2 | + · | + | + 5V | + | |
| | 59 | 0 | SDA.1 | ALT9 | 1 | 3 | 4 | | | 5V | | |
| | 58 47 | 1 | SCL.1 PWM13 | ALT9 IN | 1 | 5 | 6 8 | | ALT10 | GND TXD.2 | 3 | 13 |
| AN1_TX 🔲 🗌 GND | i | | GND | | i | 9 | 10 | | ALT10 | RXD.2 | 4 | 14 |
| PI01_B6 | 138 139 | | CAN1_RX | ALT12 ALT12 | 1 | 11 | 12 | 1 | IN | GPI01_A7 GND | 6 | 39 |
| - 0 0 | 46 | 8 | GPI01_B6 | IN | 1 | 15 | 16 | | ALT10 | TXD.6 | 9 | 33 |
| 3.3V 🔲 🔲 RXD.6 | | | 3.3V | | | 17 | 18 | | ALT10 | RXD.6 | | 32 |
| | 42 41 | 11 12 | SPI0_TXD SPI0 RXD | ALT8 ALT8 | 1 1 | 19 21 | 20 | | IN | GND GPI01 B0 | 13 | 40 |
| | 43 | 14 | SPI0_CLK | ALT8 | ò | 23 | 24 | | ALT8 | SPI0_CS0 | 15 | 44 |
| PIO_RXD 🔲 🔲 GPIO1_B0 | | | GND | | | 25 | 26 | | IN | SPI0_CS1 | 16 | 45 |
| | 34 36 | 17 19 | SDA.4 GPI01_A4 | ALT9 IN | 0 | 27 29 | 28 | 0 | ALT9 | SCL.4 GND | 18 | 35 |
| | 38 | 20 | GPI01_A6 | IN | ŏ | 31 | 32 | | IN | PWM14 | 21 | 62 |
| GND SPI0_CS1 | 63 | 22 | PWM15 | IN | 1 | 33 | 34 | | | GND | | |
| SDA.4 🔲 🗌 SCL.4 | 135 134 | 23 25 | GPI04_A7 GPI04 A6 | IN IN | 0 0 | 35 37 | 36 38 | | ALT10 | TXD.0 RXD.0 | 24 | 131 132 |
| | 1 134 | 25 | GND | | ľ | 39 | 40 | i o | IN | GPI04_A5 | 27 | 133 |
| 101_A4 🔲 🔲 GND | + | | + | | ++ | | + | ÷ | | + | ÷ | ÷ |
| I01_A6 🗌 🗌 PWM14 | GPI0 | WPi | Name | Mode | V ++ | | sical 5 PRO - | V + | Mode | Name + | wPi + | GPI0 + |
| | | | | | | | | | | | | |
| PWM15 🔲 🔲 GND | | | | | | | | | | | | |
| 104_A7 🔲 🗌 TXD.0 | | | | | | | | | | | | |

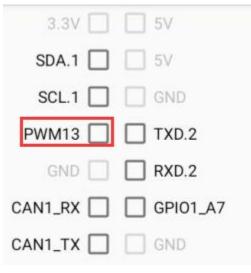
5) There are a total of 28 GPIO ports in the 40-pin development board that can be used. The following uses pin No. 7 - the corresponding GPIO is GPIO1_B7 - the corresponding wPi serial number is 2 - as an example to demonstrate how to set the high and low levels of the GPIO port. First click the **CheckBox** button corresponding to pin No. 7. When the button is selected, pin No. 7 will be set to high level. After setting, you can use a multimeter to measure the voltage value of the pin. If it is **3.3v**, it means the setting high level success



6) Then click the GPIO READALL button, you can see that the current pin 7 mode isOUT and the pin level is high level

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|--|---|--|---|---|---------------|---|--|---------------|---|--|---|--|--|--|--|
| wiringOP | | | | | | | | | | | | | | | |
| 3.3V . 5V SDA.1 . 5V | | | GPIO READ | DALL | | <u></u> | | | BLIN | KALL GPIO | | | | | |
| SCL.1 GND | | | | | | | PRO | | | | | | | | |
| PWM13 🗹 🔲 TXD.2 | GPIO | wPi | Name | Mode | V | Phys | | V | Mode | Name | wPi | GPIO | | | |
| GND RXD.2 CAN1_RX GPI01_A7 CAN1_TX GND SPI01_B6 TXD.6 3.3V RXD.6 SPI0_TXD GND SPI0_CXD GPI01_B0 SPI0_CLK SPI0_CS0 GND SPI0_CS1 SDA.4 SCL.4 | 59 58 47 138 139 46 42 41 43 34 36 38 63 3135 134 | 0 1 2 5 7 8 11 12 14 12 14 17 19 20 22 23 25 | 3.3V SDA.1 SCL.1 PHM13 GND CAN1_RX GP101_B6 3.3V SP10_RXD SP10_RXD SP10_RXD SP10_CKK GND1_A6 PF01_A6 PF01_A6 PF01_A6 GP104_A7 GP104_A6 | ALT9 ALT9 OUT ALT12 ALT12 IN ALT8 ALT8 ALT8 ALT8 ALT9 IN IN IN IN | | 1 3 5 7 9 11 13 15 17 17 19 21 23 25 27 27 27 27 31 33 35 37 37 39 | 2 4 6 8 10 12 14 16 18 20 22 24 26 30 32 34 36 38 40 | | ALT10 ALT10 IN ALT10 ALT10 ALT10 IN ALT8 IN ALT9 IN ALT10 ALT10 IN | 5V 5V 5V 5V 5V 5V 6ND 7XD.2 GPL01_A7 GPL01_B0 7XD.6 GPL01_B0 SPL0_CS0 S | | 13 14 39 32 32 40 44 45 35 62 131 132 | | | |
| PI01_A4 _ GND PI01_A6 _ PWM14 PWM15 _ GND PI04_A7 _ TXD.0 | ; GPI0 + | wPi | Name | Mode | + V + | ++ Phys + PI5 | ical PRO | + V + | Mode | + Name + | + wPi + | ++ GPIO ++ | | | |
| | | | x | | (| | | | | | | < ● ■ | | | |

7) Click the **CheckBox** button in the picture below again to uncheck it. Pin No. 7 will be set to low level. After setting, you can use a multimeter to measure the voltage value of the pin. If it is **0v**, it means the low level setting is successful.



8) Then click the **GPIO READALL** button, you can see that the current pin 7 mode is OUT and the pin level is low level

| of range Pi User Manual | | | Copyr | ight re | eser | ved | by | Sh | enzhei | n Xunlo | ng S | oftware | Co., Ltd |
|--|-------------|---|---|---|----------|--|--|---|--|--|--|---|----------|
| wiringOP | | | | | | | | | | | | | |
| 3.3V 5V SDA.1 5V SCL1 GND | | | GPIO REAL | DALL 🖑 | | | | | BLIN | (ALL GPIO | | | |
| PWM13 TXD.2 | + GPI0 | wPi | + Name | Mode | + V | ⊦ PI5 Phys | 1100 | v | Mode | + Name | + wPi | ++ GPIO | |
| GND RXD.2 CAN1_RX GPI01_A7 CAN1_TX GND GPI01_B6 TXD.6 3.3V RXD.6 SPI0_TXD GND SPI0_RXD GPI01_B0 SPI0_CLK SPI0_CS0 GND SPI0_CS1 SDA.4 SCL4 GPI01_A4 GND | | 0 1 2 7 8 11 12 14 17 19 20 22 23 25 | 3.3V SDA.1 SCL.1 PWM13 GND CAN1_TX GAT01_B6 3.3V SPI0_RXD SPI0_RXD SPI0_CLK SPI0_CLK GPI01_A6 GPI01_A4 GPI01_A6 GPI04_A7 GPI04_A6 GPI04_A6 | ALT9 ALT9 OUT ALT12 ALT12 IN ALT8 ALT8 ALT8 ALT8 ALT8 IN IN IN IN IN | + | 1 3 3 5 7 1 1 1 13 1 15 1 17 1 21 2 23 2 27 2 27 2 27 2 27 2 27 3 31 3 33 3 35 37 39 1 39 1 39 1 39 1 39 1 39 1 37 1 39 1 37 1 39 1 37 | 2 4 6 8 10 12 14 16 18 20 22 26 28 30 32 34 36 38 40 | 1 1 1 1 1 1 1 0 1 1 0 | ALT10 ALT10 IN ALT10 ALT10 IN ALT8 IN ALT9 IN ALT10 ALT10 IN | 5V 5V 5V 6ND TXD.2 RXD.2 RXD.2 GND TXD.6 RXD.6 GND SPI0_C50 SPI0_C51 SCL.4 GND PWM14 GND FXD.0 RXD.0 GPI04_A5 | 3 4 6 9 10 13 15 16 18 21 21 24 26 27 | 13 14 39 33 32 40 44 45 35 62 131 132 133 | |
| GPI01_A6 | GPI0 | wPi | Name | Mode | V + | | ical PRO + | V | Mode | Name + | wPi + | GPIO ++ | |
| PWM15 GND GPI04_A7 TXD.0 | | | x | | (| | 0 | | | | | • | |

7. 8. 2. **40pin UART test**

100

1) Two serial ports, UART0 and UART6, are opened by default in Android. The 40pin position is as shown in the figure below. The corresponding device nodes are /dev/ttyS0 and /dev/ttyS6



2) First click the wiringOP icon to open wiringOP APP

| | | Q Sea | rch apps | | |
|------------|----------------|---------|----------|------------|----------|
| Calculator | Calendar | | | Clock | |
| Calculator | Calendar | Camera | Chrome | | Contacts |
| Explorer | Files | Gallery | Music | Play Store | Search |
| \$ | ٩ | | ۵, | | |
| Settings | Sound Recorder | Video | wiringOP | | |

3) The main interface of wiringOP APP is displayed as shown below, then click the

UART_TEST button to open the UART test interface

| wiringOP | |
|----------|-----------|
| | GPI0_TEST |
| | UART_TEST |
| | 12C_TEST |
| | SPL_TEST |
| | PWM_TEST |

4) The serial port test interface of the APP is as shown in the figure below

| 12:30 | | | ⇔ () |
|------------------|-----------------|-------|-------|
| wiringOP | | | |
| /dev/ttyS0 = 11 | 5200 OPEN CLOSE | | |
| | | | |
| | | | |
| be the second at | | | |
| hello world! | | SEND | * |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | 🚬 🔁 🗖 | ◀ ● ■ |

5) Then enter the baud rate you want to set in the edit box, and then click the **OPEN** button to open the /dev/ttyS0 node. After the opening is successful, the **OPEN** button becomes unselectable, and the **CLOSE** button and **SEND** button become selectable.

| 12:31 | | | | | | | | ⇔ 0 |
|--------------|---|--------|------|-------|------|--|--|-----|
| wiringOP | | | | | | | | |
| /dev/ttyS0 | * | 115200 | OPEN | CLOSE | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| hello world! | | | | | | | | |
| | | | | | SEND | | | |

6) Then use Dupont wire to short the RXD and TXD pins of uart0

UART0



7) Then you can enter a character in the send edit box below and click the **SEND** button to start sending.

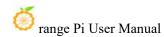
| 12:31 | | | | | | | | ⇔ 8 |
|--------------|---|--------|------|-------|------|--|--|-----|
| wiringOP | | | | | | | | |
| /dev/ttyS0 | * | 115200 | OPEN | CLOSE | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| hello world! | | | | | | | | |
| | | | | | SEND | | | |

8) If everything is normal, the received string will be displayed in the receiving box

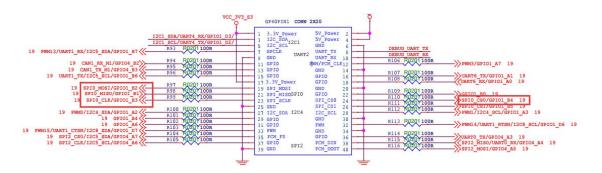
| 12:33 | | | | | | |
|--------------|---|----------|------|-------|--|------|
| wiringOP | | | | | | |
| /dev/ttyS0 | * | 115200 | OPEN | CLOSE | | |
| hello world! | | X | | | | |
| | | | | | | SEND |

7. 8. 3. **40pin SPI test**

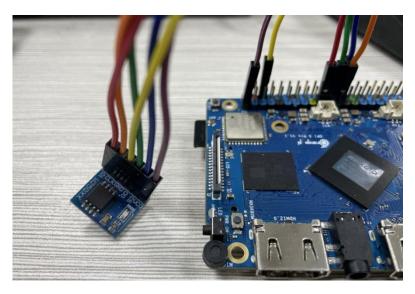
1) According to the schematic diagram of the 40pin interface, the available spi for Orange Pi 5 Pro is spi0



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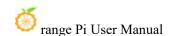
2) Here the SPI interface is tested through the w25q64 module. First, connect the w25q64 device to the SPI0 interface.



3) Then click the wiringOP icon to open wiringOP APP

| | | Q Sea | rch apps | | |
|------------|----------------|---------|----------|------------|----------|
| 82 | 22 | ۵ | 0 | ۲ | 2 |
| Calculator | Calendar | Camera | Chrome | Clock | Contacts |
| Explorer | Files | Gallery | Music | Play Store | Search |
| \$ | ٩ | | ۵, | | |
| Settings | Sound Recorder | Video | wiringOP | | |

4) The main interface of wiringOP APP is displayed as shown below. Click the SPI_TEST button to open the SPI test interface.



| wiringOP | |
|----------|-----------|
| | GPIO_TEST |
| | UART_TEST |
| | I2C_TEST |
| | SPLTEST |
| | PWM_TEST |

5) Then click the **OPEN** button to initialize the SPI

| 3:23 8 🚨 💼 | 2 |
|--|---|
| wiringOP | |
| /dev/spidev0.0 • SPI Channel: 0 SPI Port: 0 SPI Speed: 2000000 | |
| OPEN | |
| data[0]: 0x9f data[1]: 0x09 | |
| data[2]: 0x09 data[3]: 0x09 | |
| TRANSFER | |
| SPI Open Success, channel: 0, port: 0, speed:2000000 | |

6) Then fill in the bytes that need to be sent, such as reading the ID information of w25q64, filling in the address 0x9f in data[0], and then click the **TRANSFER** button

| wiringOP |
|---|
| /dev/spidev0.0 SPI Channel: 0 SPI Port: 0 SPI Speed: 2000000 |
| OPEN |
| data[0]: 0x9fdata[1]: 0x09 |
| data[2]: 0x09 data[3]: 0x09 |
| TRANSFER |
| SPI Open Success, channel: 0, port: 0, speed:2000000 |

7) Finally, the APP will display the read ID information.

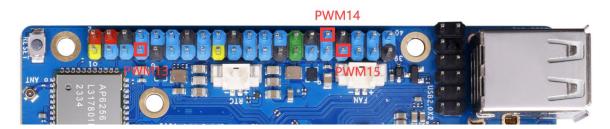
| wiringOP | |
|-----------------------------|---|
| /dev/spidev0.0 | Channel: 0 SPI Port: 0 SPI Speed: 2000000 |
| OPEN | |
| data[0]: 0x9f data[1]: 0x09 | |
| data[2]: 0x09 data[3]: 0x09 | |
| TRANSFER | |
| SPI Transfer success | |
| ret:4 | |
| data[0]:ff | |
| data[1]:ef | |
| data[2]:40 | |
| data[3]:17 | |

8) The MANUFACTURER ID of the w25q64 module is EFh, and the Device ID is 4017h, which corresponds to the value read above (h represents hexadecimal)

| MANUFACTURER ID | (MF7 - MF0) | | |
|----------------------|--------------------|--------------|--|
| Winbond Serial Flash | EFh | _ | |
| Device ID | (ID7 - ID0) | (ID15 - ID0) | |
| Instruction | ABh, 90h, 92h, 94h | 9Fh | |
| W25Q64FV (SPI) | 16h | 4017h | |
| W25Q64FV (QPI) | 16h | 6017h | |

7. 8. 4. **40pin PWM test**

1) Android has **PWM13**, **PWM14** and **PWM15** turned on by default. The corresponding pins are located at 40pin as shown in the figure below.



2) First click the wiringOP icon to open wiringOP APP

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|-----------------------|----------------|----------|--------------------|-------------------|-----------------|
| | | Q Sea | rch apps | | |
| Calculator | Calendar | Camera | Chrome | Clock | Contacts |
| Explorer | Files | Gallery | Music | Play Store | Search |
| Settings | Sound Recorder | Video | ک wiringOP | | |

3) Then click the **PWM_TEST** button on the main interface of wiringOP to enter the PWM test interface

| wiringOP |
|-----------|
| GPI0_TEST |
| UART_TEST |
| 12C_TEST |
| SPLTEST |
| PWM_TEST |

4) The base address of PWM13 is **febf0010**, the base address of PWM14 is **febf0020**, and the corresponding base address of PWM15 is **febf0030**. Here, **fd8b0020.pwm** is displayed on the right side of pwmchip0. At this time, you need to click the drop-down option to select other pwmchips. Take **PWM13** as an example. When When **febf0010.pwm** is displayed on the right, it means that **PWM13** is selected.

| wiringOP | |
|------------------------|--------------|
| Controller: pwmchip0 - | fd8b0020.pwm |
| Channel: 0 | |
| Period: 50000 ns | |
| EXPORT | |
| Enable pwmchip0 Duty | |

5) When the pull-down option selects **pwmchip2**, the corresponding base address of PWM13 on the right is **febf0010**

| wiringOP | |
|----------------------|----------------|
| Controller: pwmchip2 | ▼ febf0010.pwm |
| Channel: 0 | - |
| Period: 50000 ns | |
| EXPORT | |
| Enable pwmchip2 Duty | 0 |

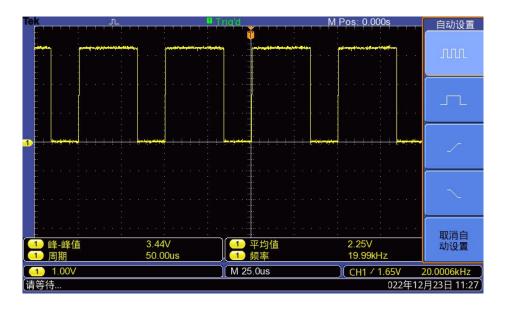
6) Then confirm the PWM channel, the default is channel 0, and confirm the PWM period. The default configuration is **50000ns**, which converts to a PWM frequency of **20KHz**. You can modify it yourself. Click the **EXPORT** button to export **PWM13**

| wiringOP | |
|----------------------|--------------|
| Controller: pwmchip2 | febf0010.pwm |
| Channel: 0 |] |
| Period: 50000 ns | |
| EXPORT | |
| Enable pwmchip2 Duty | 0 |

7) Then drag the drag bar below to change the PWM duty cycle, and then check Enable to output the PWM waveform.

| wiringOP | | | | | ↔ Q |
|--------------------------|----------|---|--------------|-----------------|-----|
| | pwmchip0 | * | febf0030.pwm | Period 50000 ns | |
| OFF Enable pwmchip0 Duty | | | • | | |

8) Then use an oscilloscope to measure pin No. 7 of the 40pin development board and you can see the following waveform.



7.9. How to use ADB

7. 9. 1. USB OTG mode switching method

The development board has 4 USB interfaces. The USB interface marked with the red box in the figure below can support both Host mode and Device mode. The other 3 USB interfaces only support Host mode.

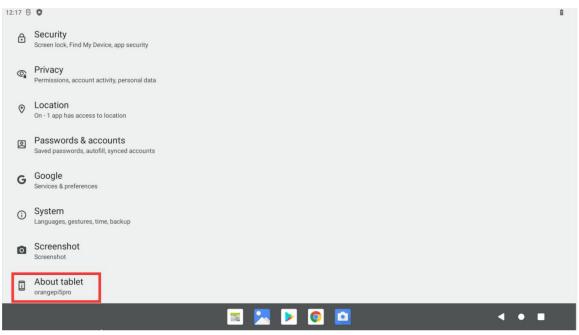


The USB OTG interface defaults to Host mode, which can be used to connect USB devices such as mouse and keyboard. If you want to use ADB, you need to manually switch to Device mode.

1) First open Settings

| of range Pi | User Manual | Copyrigh | t reserved by She | nzhen Xunlong S | oftware Co., Ltd |
|-------------|----------------|----------|-------------------|-----------------|------------------|
| 12:16 🖯 🗘 | | | | | ۵ |
| | | Q, Sea | arch apps | | |
| | 3 | | Q | ۲ | 8 |
| Calculator | Calendar | Camera | Chrome | Clock | Contacts |
| 6 | | | ۲ | > | Q |
| Explorer | Files | Gallery | Music | Play Store | Search |
| Settings | Sound Recorder | Video | ی wiringOP | | |

2) Then select About tablet

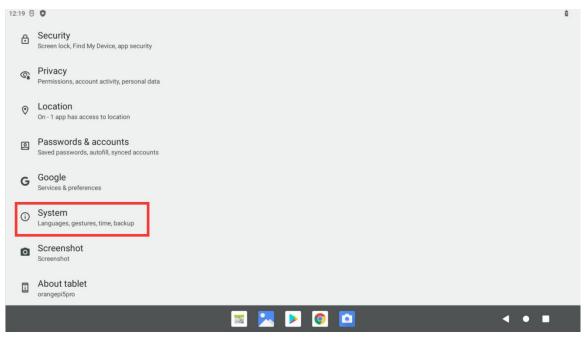


3) Then click the **Build number** menu bar multiple times with the mouse until the prompt **You are now a developer!** appears.

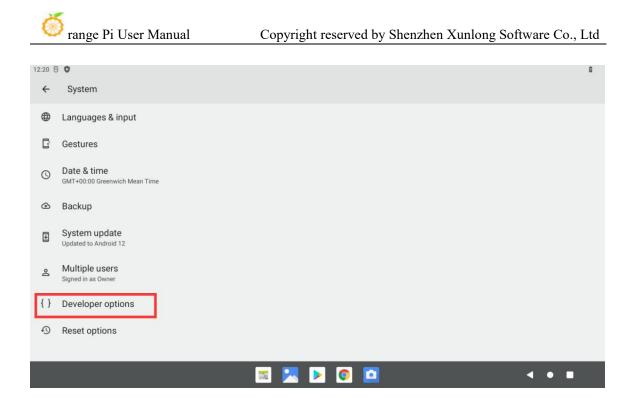
of range Pi User Manual

| 12:18 🖯 🖸 | 0 |
|---|---|
| ← About tablet | |
| Anuroia version 12 | |
| Device identifiers | |
| IP address Unavailable | |
| Wi-Fi MAC address To view, choose saved network | |
| Device Wi-Fi MAC address Unavailable | |
| Bluetooth address Unavailable | |
| Up time 41:33 | |
| Build number rk3588s_s-userdebug 12 SQ3A.220705.003.A1 eng.orangepi.20231221Yelease-ke | |
| 📼 🚬 💽 🚺 🔍 🕨 | |

4) Then click to return to the previous menu and select System



5) Then select **Developer options**



6) Finally find the **USB OTG Mode Switch**, turn on the switch to switch to Device mode, and turn off the switch to switch to Host mode

| 12:21 🖯 🗘 | Û |
|--|-------|
| ← Developer options | ۹ |
| Use developer options | |
| Quick settings developer tiles | |
| Debugging | |
| USB debugging Debug mode when USB is connected | |
| USB OTG Mode Switch Open: Device mode; Close: Host mode | |
| Wireless debugging Debug mode when Wi-Fi is connected | |
| Disable adb authorization timeout Disable automatic revocation of adb authorizations for systems that have not reconnected within the default (7 days) or user-configured (minimum 1 day) amount of time. | |
| Bug report shortcut | |
| 🔤 🊬 🕨 🧕 🗖 | ◀ ● ■ |

7. 9. 2. Use data cable to connect adb debugging

1) First prepare a good quality USB2.0 male-to-male data cable



2) Then refer to **the USB OTG mode switching method** to switch the USB OTG to device mode.

3) Then use a USB2.0 male-to-male data cable to connect the development board to the USB interface of the computer (please also use a TypeC power supply to power the development board)

4) Install adb tool on Ubuntu PC test@test:~\$ sudo apt update

test@test:~\$ sudo apt -y install adb

5) Use the following command to view the recognized ADB devices

test@test:~\$ **adb devices** List of devices attached S63QCF54CJ device test@test:~\$ **lsusb** Bus 003 Device 006: ID 2207:0006

6) Then you can log in to the android system through adb shell on Ubuntu PC test@test:~\$ adb shell console:/\$

7) Execute the command to remount the Android system

test@test:~\$ adb root

test@test:~\$ adb remount

8) Then you can transfer files to the Android system

test@test:~\$ adb push example.txt /system/

7. 9. 3. Use network connection adb debugging

Using network adb does not require a USB Type C interface data cable to connect the computer and development board, but communicates through the network, so first make sure that the wired or wireless network of the development board is connected, and then obtain the IP address of the development board. Later To be used.

1) Ensure that the **service.adb.tcp.port** of the Android system is set to the 5555 port number

console:/ # getprop | grep "adb.tcp" [service.adb.tcp.port]: [5555]

2) If **service.adb.tcp.port** is not set, you can use the following command to set the port number of network adb

console:/ # setprop service.adb.tcp.port 5555
console:/ # stop adbd
console:/ # start adbd

3) Install adb tool on Ubuntu PC

test@test:~\$ sudo apt update

test@test:~\$ sudo apt install -y adb

4) Then connect network adb on Ubuntu PC

test@test:~\$ adb connect 192.168.1.xxx (The IP address needs to be changed to the IP address of the development board)

* daemon not running; starting now at tcp:5037

* daemon started successfully

connected to 192.168.1.xxx:5555

test@test:~\$ adb devices

List of devices attached

192.168.1.xxx:5555 device

5) Then you can log in to the android system through adb shell on Ubuntu PC test@test:~\$ adb shell

console:/#

7. 10. 2.4G USB remote control tested by Android Box

- 7) A 2.4G USB remote control that has been tested so far is shown in the figure below
 - a. Contains a remote control



b. A USB wireless receiver



8) The Android Box system does not require any configuration, just plug it in and it's ready to use.

7.11. How to use the HDMI CEC function of Android Box system

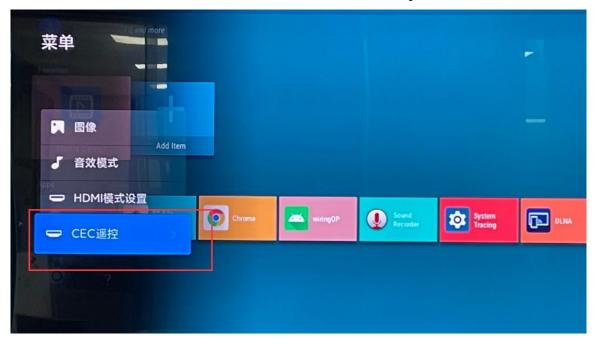
HDMI CEC allows users to control all connected devices through HDMI with only one remote control. Based on this function, we can control the development board with the TV's remote control.

Before testing this function, please make sure your TV supports HDMI CEC.

1) First connect the development board to the TV via HDMI cable, then power on and

start

2) Then turn on the HDMI CEC function in the TV settings. The turning on method of different TVs may be different. Here is Xiaomi TV as an example. Press the menu button of the remote control, then select the CEC remote control and press the confirm button.



3) Then select "On" to turn on the HDMI CEC remote control

| | CEC遥控 允许电视控制HDMi设备 | | | | | - |
|-------|-----------------------|--------|----------|-------------------|-------------------|------|
| | | | | | | |
| - · · | | Chrome | wiringOP | Sound Recorder | System Tracing | ANIO |

4) At this point, you can control the Android Box system of the development board through the TV's remote control.

8. Compilation method of Android 12 source code

8.1. Download the source code of Android 12

1) First download the compressed package of Android 12 source code from Baidu Cloud Disk or Google Cloud Disk

a. Baidu cloud disk

| 返回上一级 · 全部文件 。 RK3588S_Android 。 Android12 | | |
|--|------|------------------|
| 文件名 | 大小 | 修改日期 |
| Android_12.tar.gz07 | 440M | 2022-12-06 09:50 |
| Android_12.targ206 | 4G | 2022-12-06 09:50 |
| Android_12.tacg205 | 4G | 2022-12-06 09:50 |
| Android_12.tacg204 | 4G | 2022-12-06 09:50 |
| Android_12.tacg203 | 4G | 2022-12-06 09:50 |
| Android_12.targ202 | 4G | 2022-12-06 09:50 |
| Android_12.targ201 | 4G | 2022-12-06 09:50 |
| Android_12.tacg200 | 4G | 2022-12-06 09:50 |
| Android_12.tac.gz.md5sum | 432B | 2022-12-06 09:50 |

b. Google Cloud Drive

| 名称 个 | 所有者 | 上次修改日期 | 文件大小 | |
|-----------------------------|-----|------------|---------|--|
| Android_12.tar.gz.md5sum 41 | | 2022年12月6日 | 432 个学节 | |
| ₽ Android_12.tar.gz00 4% | | 2022年12月6日 | 4 GB | |
| Android_12.tar.gz01 41 | | 2022年12月6日 | 4 GB | |
| Android_12.tar.gz02 #1 | | 2022年12月6日 | 4 GB | |
| Android_12.tar.gz03 41 | | 2022年12月6日 | 4 08 | |
| Android_12.tar.gz04_41 | | 2022年12月6日 | 4 GB | |
| Android_12.tar.gz05 4% | | 2022年12月6日 | 4 GB | |
| Android_12.tar.g206 🚢 | | 2022年12月6日 | 4 G8 | |

2) After downloading the compressed package of Android 12 source code, please check whether the MD5 checksum is correct. If it is incorrect, please download the source code again.

| test@test:~\$ md5sum -c Android_12.tar.gz.md5sum |
|--|
| Android_12.tar.gz00: Confirm |
| Android_12.tar.gz01: Confirm |
| Android_12.tar.gz02: Confirm |
| Android_12.tar.gz03: Confirm |
| Android_12.tar.gz04: Confirm |
| Android_12.tar.gz05: Confirm |
| Android_12.tar.gz06: Confirm |
| Android_12.tar.gz07: Confirm |

3) Then execute the following command to decompress

```
test@test:~$ cat Android_12.tar.gz0* | tar -xvzf -
```

8.2. Compile the source code of Android 12

 First install the software packages needed to compile Android12 source code test@test:~\$ sudo apt-get update test@test:~\$ sudo apt-get install -y git gnupg flex bison gperf build-essential \ zip curl zlib1g-dev gcc-multilib g++-multilib libc6-dev-i386 \ lib32ncurses5-dev x11proto-core-dev libx11-dev lib32z1-dev ccache \ libg11-mesa-dev libxml2-utils xsltproc unzip test@test:~\$ sudo apt-get install -y u-boot-tools

2) There is a make.sh compilation script in the source code, and the compilation parameters are as follows

- a. -B: Compile uboot
- b. -K: Compile kernel
- c. -a: Compile android
- d. -F: Compile uboot, kernel and android
- e. -M: Generate partition image in rockdev directory
- f. -u: Package and generate a complete image that can finally be started
- g. --board: Specify development board model

3) Compile uboot, kernel, android and package them into a complete image that can finally be started

a. The command to compile support for HDMI 8K display image (LCD is turned off by default) is as follows:

test@test:~\$ cd Android_12

test@test:~/ Android_12\$./make.sh -FMu --board orangepi5pro --nvme --gapps

b. The command to compile support for LCD display image is as follows: test@test:~\$ cd Android_12 test@test:~/ Android_12\$./make.sh -FMu --board orangepi5pro --nvme --gapps --lcd

c. The command to compile the SATA boot image is as follows:

test@test:~\$ cd Android_12

test@test:~/ Android_12\$./make.sh -FMu --board orangepi5pro --sata --gapps

4) After compilation is completed, the following information will be printed

*******rkImageMaker ver 2.1******
Generating new image, please wait...
Writing head info...
Writing boot file...
Writing firmware...
Generating MD5 data...
MD5 data generated successfully!
New image generated successfully!
Making update.img OK.
Make update image ok!

5) The final generated image file will be placed in the **rockdev/Image-rk3588s_s** directory. Among them, **update.img** is the TF card boot image and **update spi nvme.img** is the NVME SSD boot image.

test@test:~/Android_12\$ cd rockdev/Image-rk3588s_s test@test:~/Android_12/rockdev/Image-rk3588s_s \$ ls update* update.img update_spi_nvme.img

6) If you compile an image that supports sata startup, the image name is **update_spi_sata.img**

test@test:~/Android_12\$ cd rockdev/Image-rk3588s_s

test@test:~/Android_12/rockdev/Image-rk3588s_s \$ **ls update*** update_spi_sata.img

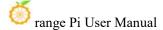
9. OpenWRT system usage instructions

9.1. **OpenWRT version**

| OpenWRT version | Kernel version | | |
|-----------------|----------------|--|--|
| snapshot | Linux6.1.43 | | |

9.2. **OpenWRT adaptation situation**

| Function | OpenWRT |
|------------------------------------|---------|
| USB2.0x3 | ОК |
| USB3.0x1 | ОК |
| eMMC interface | ОК |
| FAN fan interface | ОК |
| 3 pin debugging serial port | ОК |
| TF card startup | ОК |
| Gigabit network port | ОК |
| Network port status light | ОК |
| LED light | ОК |
| USB to wired network port | ОК |
| RTL8821CU USB network card | ОК |
| RTL8723BU USB network card | ОК |
| RTL8811 USB network card | ОК |
| M.2 NVMe SSD boot | ОК |



| M.2 SATA SSD boot | ОК |
|-------------------|----|
| AP6256 WIFI | ОК |

9.3. Expand the rootfs in the TF card before starting for the first time

1) When the TF card starts the OpenWRT system for the first time, it will execute the **resize-rootfs.sh** script to expand the rootfs. At this time, the system will restart several times.

2) After logging into the system, you can use the df -h command to check the size of rootfs. If it is consistent with the actual capacity of the TF card, it means that the automatic expansion is running correctly.

| root@OpenWrt:~# df -h | | | | |
|-----------------------|--------|--------------------------------|-----------------------|--|
| Filesystem | Size | Used Available Use% Mounted on | | |
| /dev/root | 14.8G | 14.7G | 91.6M 99% / | |
| tmpfs | 495.5M | 6.1M | 489.4M 1% /tmp | |
| tmpfs | 512.0K | 0 | 512.0K 0%/dev | |
| /dev/root | 14.8G | 14.7G | 91.6M 99% /opt/docker | |

9.4. How to log in to the system

9. 4. 1. Log in through serial port

1) First, for the use of the debugging serial port, please refer to the chapter on how to use the debugging serial port.

2) The OpenWrt system will automatically log in as the **root** user by default, and the display interface is as follows

| BusyBox v1.36.1 (2024-03-22 15:01:37 UTC) built-in shell (ash) |
|--|
| |
| OpenWrt SNAPSHOT, r24892+731-1b7e62b20b |
| === WARNING! ==================================== |
| root@OpenWrt:/# |

9. 4. 2. Log in to the system via SSH

Please note that in the OpenWrt system of Orange Pi 5 Pro, the network port is configured as a LAN port function by default, so the LAN port of the development board needs to be directly connected to the network port of the computer. There is no way to obtain the IP if connected to a router.

1) First use a network cable to connect the LAN port of the board to the network port of the computer so that the computer's network port can obtain the IP address through DHCP.

2) The default LAN port IP of the board is set to **192.168.2.1**, so at this time the computer can obtain an IP address starting with **192.168.2**

3) If the Ubuntu system is installed on the computer, you can execute the following command to log in to the system through SSH. By default, you can log in directly without a password.

test@ubuntu:~\$ ssh root@192.168.2.1

4) After successfully logging into the system, the display is as shown below



5) If the computer is installed with Windows system, you can refer to the method of SSH remote login to the development board under Windows in the Linux system instruction manual to log in.

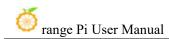
9. 4. 3. Log in to the LuCI management interface

Please note that in the OpenWrt system of Orange Pi 5 Pro, the network port is configured as a LAN port function by default, so the LAN port of the development board needs to be directly connected to the network port of the computer. There is no way to obtain the IP if connected to a router.

1) First use a network cable to connect the LAN port of the board to the network port of the computer so that the computer's network port can obtain the IP address through DHCP.

2) The default LAN port IP of the board is set to **192.168.2.1**, so at this time the computer can obtain an IP address starting with **192.168.2**

3) Enter the IP address **192.168.2.1** in the browser on your computer to log in to the LuCI interface



| $\leftarrow \ \rightarrow \ G$ | 🔘 🔀 192.168.2.1/cgi-bin/luci/ | | | | ☆ |
|------------------------------------|-------------------------------|------|------|---|---|
| | | | | | |
| | | 需要授权 | | | |
| | | | root |] | |
| | | 密码 | | | |
| | | | 登录 | | |
| | | | шт | | |
| | | | | | |
| | | | | | |

4) The OpenWrt system does not set a password by default, so just click the **login** button. After successful login, the interface will be displayed as shown below.

| 192.168.2.1/cgi-bin/luci/ | | | | |
|---------------------------|--------------------------|--------------|--|---------------------|
| | OpenWrt 状态 - | 系统 - 服务 - 网络 | 8 → 统计 → 退出 | 刷新 |
| | 未设置密码! 尚未设置密码。请为 root | 用户设置密码以保护主机; | 井 启用。 | 就转到宏码配置页 |
| | 状态 | | | |
| | 系统 | | | |
| | 主机名称 | | OpenWrt | |
| | 型号 | | RK3588S OPi 5 Pro | |
| | 架构 | | ARMv8 Processor rev 0 | |
| | 目标平台 | | rockchip/armv8 | |
| | 固件版本 | | OpenWrt SNAPSHOT r24892+718-1b7e62b20b / LuCl Master git-2 | 4.077.26240~f2a4910 |
| | 内核版本 | | 6.1.43 | |
| | 本地时间 | | 2024-03-27 01:21:39 | |
| | 运行时间 | | Oh 6m 51s | |
| | 平均负载 | | 0.39, 0.20, 0.11 | |
| | 内存 | | | |
| | 可用数 | | 15.36 GiB / 15.60 GiB (98%) | |
| | 已使用 | | 195.51 MiB / 15.60 GiB (1%) | |

9.4.4. Log in to the terminal through the LuCI management interface

Please note that in the OpenWrt system of Orange Pi 5 Pro, the network port is configured as a LAN port function by default, so the LAN port of the development board needs to be directly connected to the network port of the computer. There is no way to obtain the IP if connected to a router.

1) First use a network cable to connect the LAN port of the board to the network port of the computer so that the computer's network port can obtain the IP address through DHCP.

2) The default LAN port IP of the board is set to **192.168.2.1**, so at this time the computer can obtain an IP address starting with **192.168.2**

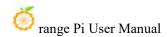
3) Enter the IP address **192.168.2.1** in the browser on your computer to log in to the LuCI interface

| $\leftarrow \ \rightarrow \ G$ | ○ 👌 192.168.2.1/cgi-bin/luci/ | | | | ☆ |
|------------------------------------|-------------------------------|------|------|---|---|
| | | | | | |
| | | 需要授权 | | | |
| | | 用户名 | root |] | |
| | | 密码 | | | |
| | | | 登录 | | |
| | | | 豆求 | | |
| | | | | | |
| | | | | | |

4) Select "Terminal" in the "Service" column of the navigation bar and click to enter

| OpenWrt a | 犬态 → 系统 → | Docker - | 服务 - | 网络 - | 统计 - | 退出 |
|----------------------------|--------------|----------|---------------------------|------------|------------|----|
| 未设置密码! 尚未设置密码。请注 | 为 root 用户设置著 | 密码以保护主机 | Aria2 动态 Dl 广告拦 | | | |
| 状态 ^{系统} | | | · 带宽监 Watchc 网络共 | 控 :at | | |
| 主机名 | | | Transm | iission | | |
| 型号 | | | <mark>终端</mark> 递归 Di | NS | | |
| 架构 | | | ARIV | ivo Proces | stor rev 0 | |

5) At this time, the terminal interface is as shown below



 OpenWrt
 状态 - 系统 - Docker - 服务 - 网络 - 统计 - 退出

 #我设置密码, 读为 root 用户设置密码以保护主机并启用。

 探索
 配置

 OpenWrt login:

6) Enter the username root to log in

| 终端 配置 | |
|--|---|
| OpenWrt login: root | * |
| BusyBox v1.36.1 (2024-03-23 09:38:14 UTC) built-in shell (ash) | |
| | |
| OpenWrt SNAPSHOT, r24892+718-1b7e62b20b | |
| === WARNING! ==================================== | |
| root@OpenWrt:~# | |
| | 1 |

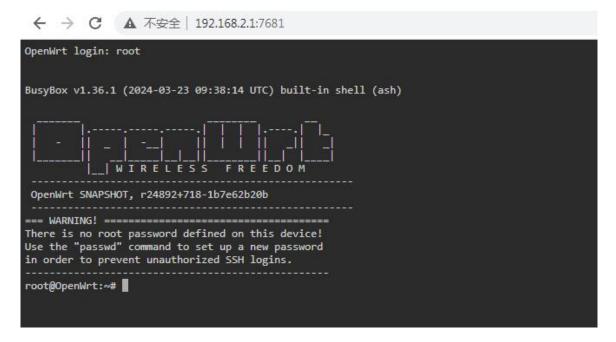
9. 4. 5. Log in to the terminal using IP address + port number.

Please note that in the OpenWrt system of Orange Pi 5 Pro, the network port is configured as LAN function by default, so the network port of the development board cannot be directly connected to the router through a network cable, but can only be directly connected to the computer's network port through a network cable. At this time, the system After startup, an IP address will be assigned to the computer's network port through the DHCP service.

1) First use a network cable to connect the LAN port of the board to the network port of the computer so that the computer's network port can obtain the IP address through DHCP.

2) The default LAN port IP of the board is set to **192.168.2.1**, so at this time the computer can obtain an IP address starting with **192.168.2**

3) Then enter **192.168.2.1:7681** in the browser to log in to the OpenWRT terminal



9.5. How to modify the LAN port IP address through the command line

1) In the OpenWrt system, a command line tool uci is provided, which can easily modify,

add, delete and read the contents of the configuration file. For detailed instructions, please refer to the official documentation

2) First use the following command to obtain the network configuration. The corresponding configuration file is /etc/config/network. You can see that the value of network.lan.ipaddr is 192.168.2.1

root@OpenWrt:~# uci show network ... network.lan=interface network.lan.device='br-lan' network.lan.proto='static' network.lan.ipaddr='192.168.2.1' network.lan.netmask='255.255.255.0' network.lan.ip6assign='60'

3) Then enter the following command to modify the network.lan.ipaddr item root@OpenWrt:~# uci set network.lan.ipaddr='192.168.100.1'

4) Then enter the following command to complete the submission, that is, write it to the configuration file

root@OpenWrt:~# **uci commit**

If the IP address in red font is consistent with the one to be set, the modification is successful.

```
root@OpenWrt:~# cat /etc/config/network
```

•••

config interface 'lan'

option device 'br-lan' option proto 'static' option netmask '255.255.255.0' option ip6assign '60' **option ipaddr '192.168.100.1'** 5) Restart the network through ubus. For instructions on using ubus, please refer to the official documentation.

root@OpenWrt:~# ubus call network restart

6) At this time, enter the command and you can see that the IP of the LAN port is already **192.168.100.1**

root@OpenWrt:, # ifconfig br lan

| root@Op | en wrt:~# ficoning br-ian |
|---------|--|
| br-lan | Link encap:Ethernet HWaddr FE:55:13:A3:EF:E7 |
| | inet addr:192.168.100.1 Bcast:192.168.100.255 Mask:255.255.255.0 |
| | inet6 addr: fd60:c4cd:1033::1/60 Scope:Global |
| | UP BROADCAST MULTICAST MTU:1500 Metric:1 |
| | RX packets:0 errors:0 dropped:0 overruns:0 frame:0 |
| | TX packets:3 errors:0 dropped:0 overruns:0 carrier:0 |
| | collisions:0 txqueuelen:1000 |
| | RX bytes:0 (0.0 B) TX bytes:370 (370.0 B) |
| | |

9.6. How to change the root password

9. 6. 1. Modification through command line

1) First enter passwd root on the system command line. The following prompt message will appear. At this time, you can enter the password you want to set and press the Enter key to confirm.

root@OpenWrt:/# **passwd root**

Enter new UNIX password:

2) You will then be prompted to re-enter your password. At this time, enter your password again to confirm and press Enter.

Retype password:

3) The successful modification is displayed as follows

passwd: password for root changed by root

9. 6. 2. Modify through LuCI management interface

1) First refer to logging in to the LuCI management interface to enter the OpenWRT management interface.

- 2) Then follow the steps below to change the password
 - a. Find the "System" option in the navigation bar and click
 - b. In the vertical column options below the system, select "Management Rights" and click

| OpenWrt सक≁ | 系统 - 服务 - 网络 - 统计 - 退 出 系统 | |
|----------------------------|--------------------------------------|----------|
| 未设置密码! 尚未设置密码。请为 root P | | |
| 0 | 软件包 启动项 | 跳转到密码配置页 |
| 路由器密码 SSH 访问 | 计划任务 | |
| 路由器密码 | | |
| 更改访问设备的管理员密码 | 备份与升级 | |
| 2 | | |
| 确认密 | 호码 * | |
| | | 保存 |

c. Select the "Router Password" option on the Tab page

| 未设置密码。请为 roc | 用户设置密码以保护主机并 | 启用。 | | |
|--------------|-------------------|-----|--|--|
| 由器密码 SSH 访问 | SSH 密钥 HTTP(S) 访问 | 9 | | |
| 由器密码 | z. | | | |
| (如何反由的自注风中) | | | | |
| | 密码 | * | | |

- 3) Modify and save the router password
 - a. Enter the password you set in the "**Password**" and "**Confirm Password**" dialog boxes (if you are not sure whether the password is entered correctly, you can click the "*" icon behind the dialog box to display the input characters)
 - b. Click "Save" to save the newly modified password.

orange Pi User Manual

| OpenWrt 状态 - 系約 | 充 ▼ Docker ▼ 服务 ▼ 网络 | 各→ 统计→ 退出 | |
|-------------------------------------|--|-----------|----|
| 未设置密码! 尚未设置密码。请为 root 用户该 | 2置密码以保护主机并启用。 | | |
| 路由器密码 SSH 访问 SSH | H密钥 HTTP(S)访问 | | |
| 路由器密码 更改访问设备的管理员密码 密码 确认密码 | ···································· | | 2 |
| | | | 保存 |
| | | | |

| Note: | In | the | "Password" | and | "Confirm | Password" | dialog | boxes, | the |
|-----------|-----|------|------------|------|-------------|-----------|--------|--------|-----|
| passwords | ent | ered | twice must | be c | consistent. | | | | |

4) After the password is successfully changed, a pop-up box showing "System password has been changed successfully" will pop up. At this time, you will need a password to log in to OpenWRT.

| 系统密码已更改成功。 | | 关闭 |
|------------------------------------|--------|----|
| 未设置密码! 尚未设置密码。请为 root 用户设置密码以保护 | 主机并启用。 | |
| 路由器密码 SSH 访问 SSH 密钥 HTT | 9(S)访问 | |
| 路由器密码 更改访问设备的管理员密码 | | |
| 密码 | * | |
| 确认密码 | * | |
| | | 保存 |

9.7. USB interface test

9.7.1. Mount USB storage device from command line

1) First insert the USB disk into the USB interface of the Orange Pi development board

2) Execute the following command. If you can see the output of sdX, it means the USB disk is successfully recognized.

| root@OpenW | ′rt:~# cat | /proc/partitions grep "sd*" |
|-------------|------------|-------------------------------|
| major minor | #blocks | name |
| 8 | 0 15 | 126528 <mark>sda</mark> |

3) Use the mount command to mount the U disk to /mnt, and then you can view the files in the U disk

```
root@OpenWrt:~# mount /dev/sda /mnt/
root@OpenWrt:~# ls /mnt/
test.txt
```

4) After mounting, you can check the capacity usage and mount point of the U disk through the df -h command.

| root@Open | Wrt:~# df -h gr | ep "sd" | | | |
|-----------|--------------------------|---------|-------|---------|--|
| /dev/sda | 14.4G | 187.2M | 14.2G | 1% /mnt | |

9. 7. 2. Mount USB storage device in LuCI management interface

1) First connect the U disk (or other storage device) to the development board through USB2.0

2) Then log in to the LuCI management interface to enter the LuCI management interface.

3) Then in the LuCI management interface, click "System->Mount Point" to enter the mount point configuration interface



- 4) Then follow the steps below to add a mount point
 - a. Find "Mount Point" at the bottom of the mount point global settings interface.
 - b. Below the mount point, select the "Add" button and click to enter

| 日 | 设备 | 挂载点 | 文件系统 | 挂载选 项 | 文件系统 检查 | | |
|---|--|----------------|----------------|----------|------------|----|----|
| | UUID: 84173db5-fa99-e35a-95c6-28613cc79ea9 (/dev/mmcblk1p1, 64.00 MiB) | /mnt/mmcblk1p1 | auto (ext4) | defaults | 否 | 编辑 | 删除 |
| | UUID: ff313567-e9f1-5a5d-9895-3ba130b4a864 (/dev/mmcblk1p2, 29.61 (200) | 1 | auto (ext4) | defaults | 否 | 编辑 | 删除 |

c. The following pop-up window interface will pop up

| 已启用 | |
|------|---------------------------------|
| UUID | 根据 UUID 匹配 ・ |
| | ⑦ 如果指定,则通过 UUID 而不是固定的设备文件来挂载设备 |
| 卷标 | 根据标签匹配 |
| | ❷ 如果指定,则通过分区卷标而不是固定的设备文件来挂载设备 |
| 设备 | 未指定・ |
| | ❷存储器或分区的设备文件(例如://dev/sda1) |
| 挂载点 | - 请选择 • |
| | ❷ 指定设备的挂载目录 |

- d. Then you can start mounting the storage device
 - a) Check "Enabled"
 - b) Select the actual connected device /dev/sda in the General Settings UUID column (select according to your own device)
 - c) Select "Custom" in the mount point column and fill in the target directory to be mounted. Here, the /mnt directory is used as an example. After filling in, press Enter to confirm.
 - d) Then click the "Save" button in the lower right corner



5) Then you will return to the mount point global settings page. Click "Save and Apply" in the lower left corner of the page to make the mount point effective.

| 已启 用 | 设备 | 挂截点 | 文件系统 | 挂载选 项 | 文件系统 检查 | | | |
|-----------|---|-----------------------------------|----------------|----------|------------|-----------------|--------------|-------------|
| | UUID: 84173db5-fa99-e35a-95c6-28613cc79ea9 (/dev/mmcblk1p1, 64.00 MiB) | /mnt/mmcblk1p1 | auto (ext4) | defaults | 否 | = | 编辑 | |
| | UUID: ff313567-e9f1-5a5d-9895-3ba130b4a864 (/dev/mmcblk1p2, 29.61 GiB) | I | auto (ext4) | defaults | 否 | | 编辑 | |
| | UUID: ce4b-c491 (/dev/sda, 59.48 GiB) | /mnt | auto (vfat) | defaults | 否 | = | 编辑 | |
| 添加 交换分 | <u></u> | | | | - | +/06 D A 1 4 2 | Rienstria | E into 1 at |
| 交换分 | ▶ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ | 的 <u>RAM</u> 。请注意:数据女 | 换的过程会 | 非常慢,因为 | 9交换设备无法 | 去像 <u>RAM</u> 刑 | 『样的高速 | 题地访 |
| 交换分 | ▶ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ | 160 <u>RAM</u> ,请注意:数据交 尚无任何配置 | 换的过程会 | 非常慢,因为 | 9交换设备无法 | 去像 <u>RAM</u> 刑 | 降样的高速 | 图地访 |

6) After saving, you can see that the storage device has been mounted successfully in "Mounted File Systems"

| 25 | |
|------------|----------------------|
| \bigcirc | range Pi User Manual |

| 文件系统 | 挂载点 | 可用 | 已使用 | 卸载分区 |
|-----------|-------------|-------------------------|--------------------|---------------|
| /dev/root | 1 | 28.93 GiB / 29.25 GiB | 1.04% (310.21 MiB) | 2 |
| tmpfs | /tmp | 7.67 GiB / 7.68 GiB | 0.06% (4.69 MiB) | - |
| tmpfs | /dev | 512.00 KiB / 512.00 KiB | 0.00% (0 B) | . |
| /dev/root | /opt/docker | 28.93 GiB / 29.25 GiB | 1.04% (310.21 MiB) | 卸载分区 |
| /dev/sda | /mnt | 59.46 GiB / 59.46 GiB | 0.00% (640.00 KiB) | 卸载分区 |

挂载点 配置存储设备挂载到文件系统中的位置和参数

9.8. USB to network port test

1) The usable USB network ports that have been tested so far are as follows:

| Chip model | VID&PID |
|-------------------|-----------|
| RTL8153 (Gigabit) | 0bda:8153 |
| RTL8152 (100M) | 0bda:8152 |

2) First insert the USB to network port module into the USB interface of the development board, then power on and start the development board

3) Then enter the LuCI management interface according to the method of logging in to the LuCI management interface, and then click "Network->Interface" to enter the wired network configuration interface

| OpenWrt 状态 → 系统 → Docker → 服务 → | 网络- 统计- 退出 | 刷新 |
|---|-------------------------|----|
| 未设置密码 ! 尚未设置密码。请为 root 用户设置密码以保护主机并启用。 | 接口 无线 路由 | |
| 状态系统 | DHCP/DNS 网络诊断 防火墙 | |
| 主机名 Open | | |
| 型룩 Orar | 服务质量(QoS) | |
| 架构 ARM | fv8 Processor rev 0 | |

4) If you can see the "eth1" device as shown in the figure below in the configuration interface, it means that the USB transfer port has been identified. As can be seen from the figure below, "eth1" is configured as a WAN port function by default.

| X | |
|----|----------------------|
| C) | range Pi User Manual |

| OpenWrt 状态 - 系统 | ;- Docker - 服务 - 网络 - 统计 - 退出 | Rin |
|---|---|------------------------|
| 未设置密码! 尚未设置密码。请为 root 用户设 接口 设备 全局网络选项 接口 | 置密码以保护主机并启用。 | |
| docker ig5 ^g docker0 | 协议: 不配置协议 MAC: 02:42:0B:F4:43:A6 接收: 0 B (0 Pkts.) 发送: 0 B (0 Pkts.) 信息: 开机时不启动 | 重启停止编辑 |
| lan g≆ (ﷺ) br-lan | 协议: 静态地址 运行时间: 0h 4m 5s MAC: 5A:5A:59:B7:EB:2E 接收: 1.61 MB (9426 Pkts.) 发送: 4.43 MB (8834 Pkts.) IPv4: 192.168.2.1/24 IPv6: fd8a:b994:72fb::1/60 | 重启停止编辑》 |
| wan P eth1 | 协议: DHCP 客户端 运行时间: 0h 4m 1s MAC: 00:E0:4C:68:69:5B 接收: 5.03 MB (15593 Pkts.) 发送: 1.18 MB (7236 Pkts.) IPv4: 192.168.1.121/24 | 重启 停止 筹辑 删除 |
| wan6 | 协议: DHCPv6 客户端 运行时间: 0h 3m 57s MAC: 00.E0.4C:68:69:5B 接收: 5.03 MB (15593 Pkts.) 发送: 1.18 MB (7236 Pkts.) | 重启停止编辑别除 |

5) At this time, after the USB to network port is connected to the main router through a network cable, the IP address can be automatically obtained through DHCP, and then the development board and the computer connected to the development board LAN port can access the Internet through the main router.

9.9. AP6256 WIFI test

9.9.1. Method of creating WIFI hotspot

1) After the system starts, log in to the LUCI interface and click **Network -> Wireless** to enter the wireless WiFi configuration interface.

| 192.168.2.1/cgi-bin/luci/ | | | |
|---------------------------|--|--------------------------------|-------|
| | OpenWrt 状态 - 系统 - Docker - 服 | 傍→ 网络→ 统计→ 退出 | 19937 |
| | 未设置密码 ! 尚未设置密码。请为 root 用户设置密码以保护主机并 | □ 注用。 资用 | |
| | 状态 ^{系统} | DHCP/DNS 网络诊断 防火増 | |
| | 主机名 | Opet MultiWAN 管理器 最终质量(QoS) | |
| | 型号 | Oran ARMv8 Processor rev 0 | |
| | 目标平台 | rockchip/armv8 | |

2) The default wireless configuration of the OpenWRT system is **Master** mode. To facilitate the next operation, we will remove the default wireless connection.

| 无线概况 | | | | | | | |
|------|----------|------------------------------------|-------------|-----|-----------|----|-------|
| 9 | radio0 | Generic MAC80211 802 设备未激活 | .11ac/b/g/n | | | 重启 | 扫描添加 |
| | ,已禁用 | SSID: OpenWrt 模式: Maste 无线末开启 | r | | | 启用 | 编辑 移除 |
| 已连接站 | <u>ل</u> | | | | | | / |
| 网络 | MAC 地址 | 主机 | 信号// | 噪声 | 接收速率/发送速率 | | |
| | | | 无可用 | 时信息 | | / | |

3) Then click **Save** in the lower right corner of the page to make the configuration take effect.

| 网络 | MAC 地址 | 主机 | 信号/噪声 | 接收速率/发送速率 |
|----|--------|----|-------|------------|
| | | | 无可用信息 | |
| | | | | 保存并应用 • 保存 |

4) Then click the **Add** button on the right.

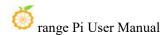
 Sciencic MAC80211 802.11ac/b/g/n

 愛 radio0
 Generic MAC80211 802.11ac/b/g/n
 重启 扫描 添加

 已连接站点
 工具
 目目

 网络
 MAC 地址
 主机
 信号/噪声
 接收速率/发送速率

5) In the pop-up tab **"Device Configuration"**, we set the parameters as shown in the figure below.



设备配置

| 常规设置 | 高级设置 | | | | | | | | |
|------|---------|-----------------------|-------------------------------------|----------|--------|---------|---------|-----|--|
| | 状态 | <u>。</u> 模式 dBm 无线 | : Master SSID: Oper 标关联 | nWrt | | | | | |
| | 无线网络已启用 | 禁用 | | | _ | | | | |
| | | 模式 | 信道 | 通道宽度 | | | | | |
| | 工作频率 | AC 🗸 | 36 (5180 Mhz) 🗸 | 80 MHz 🗸 | | | | | |
| | 最大传输功率 | 驱动默认 | ✔ - 当前功率 | : 未知 | | | | | |
| | | ?指定最大次 | 发射功率。依据监管要: | 求和使用情况, | 驱动程序可能 | 将实际发射功率 | 率限定在此值以 | 以下。 | |

6) Then in Interface Configuration -> General Settings, set the mode to Access Point AP, ESSID (wireless network name) to OpenWrt, and the network to lan

| 接口配置 | | |
|-----------------|-----------------|---------------------|
| 常规设置 无线安全 MAC 过 | t滤 高级设置 WLAN 漫游 | |
| 模式 | 接入点 AP 🗸 | |
| ESSID | OpenWrt | |
| 网络 | lan: 🔊 | 7 |
| | ✓ Ian: 50 | 客 创建栏来新建网络。 |
| 隐藏 <u>ESSID</u> | wan: 🖉 | |
| | wan6: 🗾 | 能无法漫游且信道占用效率可能显著降低。 |
| WMM 模式 | 自定义 | |

7) Then in **Interface Configuration -> Wireless Security**, select **WPA2-PSK** as the encryption algorithm; set the key (wireless password) to **password**

| 接口配置 | 1 | | | | |
|------|------|--------|----------|---------|---|
| 常规设置 | 无线安全 | MAC 过滤 | 高级设置 | WLAN 漫游 | |
| | | 加密 | WPA2-PSK | (强安全性) | ~ |
| | | 算法 | 自动 | | ~ |
| | | 密钥 | password | | * |

8) After the above settings are completed, click **Save** in the lower right corner of the page, and then exit the tab page

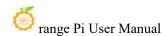
| 接口配置 | | | | | | | | | | | | |
|-------|----------------------|--------|------------|---|--------|---------|-------|--------|----------|--------|--------|----|
| 常规设置 | 无线安全 | MAC 过滤 | 高级设置 | WLAN 漫游 | | | | | | | | |
| | | 加密 | WPA2-PSK (| 强安全性) | ~ | | | | | | | |
| | | 算法 | 自动 | | ~ | | | | | | | |
| | | 密钥 | password | | | • | | | | | | |
| | 802.11w 管理 | 里帧保护 | 已禁用 | | ~ | | | | | | | |
| 启用密钥重 | 重新安装(KF | RACK) | 2 通过禁用用 | 无线驱动程序不 于 安装 密钥的 E 性问题,并降低 | APOL-K | ley 帧的重 | 新传输,来 | 增加客户端密 | Si 明重安装攻 | 古的复杂度。 | 此解决方法可 | 能会 |
| | 一键加密按锁 (2)-PSK/WP | | | | | | | | | | | |
| | | | | | | | | | | | 关闭 | 将 |

9) Then click **Save and Apply** in the lower right corner of the page and wait for the configuration to be applied.

| T / 13 | LOT STOL |
|--------|----------|
| - 21 | 704 . 4 |
| 无线 | 196776 |

| | | Generic MAC80211 80 设备未激活 | 02.11ac/b/g/n | | 重启 | 扫描 | 添加 |
|-------|-------------|--|---------------|------------|------|----|----|
| 0 | | SSID: OpenWrt 模式: Mas 接口有 7 个未应用的更改 | ter | | 禁用 | 编辑 | 移除 |
| 已连接站, | 点 MAC 地址 | 主机 | 信号/噪声 | 接收速率/发送速率 | | | |
| 13,44 | | 7.00 | 无可用信息 | Strepticet | | | |
| | | | | | 保存并的 | 立用 | 保存 |

10) The display interface for successfully creating a hotspot is as shown below



| OpenWr | t 状态 - 系统 - 服务 | - 网络- 统计- | 退出 | | 刷新 |
|-----------------|---------------------------------------|--|---------------|-----------|------------|
| 未设置密任 尚未设置密任 | <mark>码!</mark> 码。请为 root 用户设置密码以例 | 护主机并启用。 | | | 跳转到密码配置页 |
| 无线概况 | | | | | |
| | | AC80211 802.11ac/b 0 GHz) 比 特率: ? Mbit/ | | | 重启 扫描 添加 |
| - []]. | | /rt 模式: Master 5:35:41:4D:69 加密: WP | A2 PSK (CCMP) | | 禁用编辑移除 |
| 已连接站 | <u>ل</u> | | | | |
| 网络 | MAC 地址 | 主机 | 信号/噪声 | 接收速率/发送速率 | |
| | | | 无可用信息 | | |
| | | | | | 保存并应用 • 保存 |

9. 9. 2. Method of connecting to WIFI hotspot

1) After the system starts, click **Network -> Wireless** to enter the wireless WiFi configuration interface.

| 192.168.2.1/cgi-bin/luci/ | | | |
|---------------------------|-------------------------------------|--------------------------------|------|
| | OpenWrt 状态 - 系统 - Docker - | 服务 ▼ 网络 ▼ 统计 ▼ 退出 | Rist |
| | 未设置密码! 尚未设置密码。请为 root 用户设置密码以保护目 | 按□ 无线 前并自用。 前日 | |
| | 状态 ^{系统} | DHCP/DNS 网络诊断 防火場 | |
| | 主机名 | Oper MultiWAN 管理器 | |
| | 型号 | Oran 服务质量(QoS) | |
| | 架构 | ARMv8 Processor rev 0 | |
| | 目标平台 | rockchip/armv8 | |

2) The default wireless configuration of the OpenWRT system is **Master** mode. To facilitate the next operation, we will remove the default wireless connection.

| 无线概况 | | | | | | | |
|-------|----------|--------------------------|--------------|---------|-----------|----|-------|
| | radio0 | Generic MAC8 设备未激活 | 0211 802.11a | c/b/g/n | | 重启 | 扫描 添加 |
| | ,已禁用 | SSID: OpenWrt 无线未开启 | 莫式: Master | | | 启用 | 编辑 移除 |
| 已连接站; | <u>ل</u> | | | | | | / |
| 网络 | MAC 地址 | | 主机 | 信号/噪声 | 接收速率/发送速率 | | |
| | | | | 无可用信息 | | / | |

3) Then click **Save** in the lower right corner of the page to make the configuration take effect.

| 网络 | MAC 地址 | 主机 | 信号/噪声 | 接收速率/发送速率 |
|----|--------|----|-------|-----------|
| | | | 无可用信息 | |
| | | | | 保存并应用一•保存 |

4) Then click the Scan button to scan the surrounding WiFi hotspots.

| 无线概况 | | | | | |
|------|--------|--|--------|-----------|------------|
| | | MAC80211 802.11ac GHz) 比特率: ? Mbit/s | /b/g/n | | 重启 扫描 添加 |
| 已连接站 | 点 | | | | 1 |
| 网络 | MAC 地址 | 主机 | 信号/噪声 | 接收速率/发送速率 | |
| | | | 无可用信息 | | / |
| | | | | | 保存并应用 • 保存 |

5) Then the following window will pop up to display the available WiFi hotspots. At this time, click the **Join Network** button to the right of the WiFi hotspot you want to connect to connect to the WiFi hotspot.

| 加入网络:搜索无线 | | | | | | |
|-----------|--------------------|-----|--------|-------------------|-----------------|------|
| 信号 | SSID | 信道 | 模式 | BSSID | 加密 | |
| 🔳 -58 dBm | | 48 | Master | E8:9F:80:DF:4F:3F | WPA2 PSK (CCMP) | 加入网络 |
| 🔳 -59 dBm | | 153 | Master | E8:9F:80:DF:4F:40 | WPA2 PSK (CCMP) | 加入网络 |
| 🔳 -60 dBm | | 149 | Master | A0:40:A0:A1:72:31 | WPA2 PSK (CCMP) | 加入网络 |
| 🚽 -67 dBm | The concrete COUNC | 60 | Master | 50:6A:03:AB:90:1A | WPA2 PSK (CCMP) | 加入网络 |

6) Then an interface for connecting to the WiFi hotspot will pop up. We enter the password of the hotspot as shown in the figure below, and then click the **Submit** button.

| 正在加入网络:"xunlong_ | orangepi_5G" | |
|------------------|---|-------|
| 重置无线配置 | | |
| | 途中此选项以从无线中删除现有网络。 ① | |
| 新网络的名称 | wwan ● 合法学符:A-2、A-2、D-3 和 _ | |
| WPA 密明 | ···································· | 0 |
| 锁定到 BSSID | | |
| | ⑦(連接到 BSSID 为 EsigF:80:DF:4F:40 的网络,而不是其它 SSID 相同的网络。 | |
| 创建/分配防火墙区域 | wan wan. 🖉 wan6: 🧝 | |
| | ♥为此披口分配所属的防火墙区域,选择未搅定可将该接口移出已关联的区域,或者填写创建栏束创建一个新的区域,并将当前接口与之建立关联。 | |
| | | 取消 提交 |

7) Then the following interface will pop up, click the **Save** button in the lower right corner.

| 記置 | | |
|--|--|--|
| 置 高级设置 | | |
| 状态 | 個式: Client SSID: xunlong_orangepi_5G GBm 元紀未央駅 | |
| 无线网络已启用 | · ———————————————————————————————————— | |
| | 概式 信道 帝宽 | |
| | | |
| 工作频率 | a AC → 36 (5180 Mhz) → 80 MHz → | |
| 最大传输功率 | | |
| | | |
| | · | |
| | · | |
| 最大传输功率 | 1 観动教は、 ✓ 当期切楽、未知 ● 指記載大支射切場、依護血管要求和後期構成, 認必程序可能将实际交射切場現在在此個以下。 | |
| | ・当前功率、未知 ・当前功率、未知 ・間定意大致封功率、依張宣誓要求和使物常常2、並び程序可能将实际改封功率限度在式通い下、 | |
| 最大傳輸功率 記置 元成安全 高级 | : 顧沈厳以、 | |
| 最大传输功率 記置 置 无线安全 商级设 模式 | | |
| 電大体能力率 電 2 2 3 2 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 | ・当前10束、未知 ・当前10束、未知 ・当前10束、未知 ・回加設本(大規10本) ・回加設本(大利10本) ・回加設本(大利10本) ・ ・ ・ | |

8) Finally, you will return to the main interface of wireless configuration, click Save andApply and wait for the configuration to be applied.

| 无线概况 | | | | | | | |
|------|---|-------------------------------|----|---------|---------------|-----|-------|
| 9 | vadio0 | Generic MAC80 信道:?(?GHz) 比 | | c/b/g/n | | 重启 | 扫描添加 |
| | SSID: xunlong_orangepi_5G 模式: C 邊 已禁用 接口有 7 个未应用的更改 | | | Client | | 禁用 | 編組務除 |
| 已连接站 | 点 MAC 地址 | | 主机 | 信号/峄声 | 接收速率/发送速率 | | |
| 73.4 | MAC 754 | | TM | 无可用信息 | ISTUE + ADE + | | |
| | | | | | | 保存并 | 应用・保存 |

9) After successfully connecting to the WiFi hotspot, the interface is displayed as shown below.

| 线概况 | | | | | |
|--|--|---|-------------|-------|-----------------------|
| 👳 radio0 | | c MAC80211 80 (5.180 GHz) 比特率 | - | | 重启 扫描 添加 |
| SSID: xunlong_orangepi_5G 模式: Client BSSID: C2:F5:35:41:4D:69 加密: - | | | 日模式: Client | | |
| dBm | | | | | 禁用 编辑 移除 |
| 네 dBm | | | | | 禁用 编辑 移除 |
| (| | | | 信号/噪声 | 禁用 编辑 移除 接收速率/发送速率 |

9.10. Installing packages via the command line

9. 10. 1. Install through opkg in the terminal

1) Update the list of available software packages

root@OpenWrt:/# opkg update

2) Get the software list

root@OpenWrt:/# opkg list

3) Install the specified software package

root@OpenWrt:/# opkg install <package name>

4) View installed software

root@OpenWrt:/# opkg list-installed

5) Uninstall the software

root@OpenWrt:/# **opkg remove <package name>**

9.11. OpenWRT management interface installation package

If you need to add a new software package, you can install it through the OpenWRT management interface.

9. 11. 1. View the list of available software packages on the system

- 1) First enter the software package management page
 - a. Find the "System" option in the navigation bar and click to enter
 - b. In the vertical column options below the system, select "Software Package" and click to enter

| OpenWrt | 系统 - 服务 - 网络 | - 统计- 退出 | | 未保存的配置: 13 |
|---|--------------------------------|-----------------------|----------------------|------------|
| 未设置密码! 尚未设置密码 请为 root 所 | 系统 管理权 软件包 启动项 | 8用. | | 跳转到密码配置页 |
| 软件包 用 opkg 安装额外软件并用于 警告!包操作可能 损坏你的 | 计划任务 挂载点 LED 配置 | 2 | | |
| 磁盘空间: 0% 已使用 (106.90 MiB 已) | 备份与升级 自定义命令 | ≈ 29.14 GiB) | | |
| 过滤器: 输入以筛选 | 重启 清除 软件 | 安装软件包: 包名称或 URL 确认 | 操作: 更新列表 上传软件包 配置 | anka |
| 湘山八山川市辺 | /月防 | 也占你现 URL 拥以 | 里初列表 上位软件包 配直 | t opkg |

2) Then the main page of the software package will appear, as shown in the figure below, to obtain the list of available software

- a. In the "Action" option of the software package, click "Update List" to obtain the list of available software packages.
- b. In the Tab page, click "Available" to view the currently available software packages.
- c. View the number of currently available software packages

| 次件包 | | | • | | | |
|--------------------------|----|--------------|-------------------------------|------|-------|---------|
| 2闲空间: 18% (28.94 GiB) | | | 0 | | | |
| 帝选器: | | 下载并安装软件包 | | 操作: | 2 | |
| 輸入以筛选 | 清除 | 软件包名称或 UR | 确认 | 更新列表 | 上传软件包 | 配置 opkg |
| | | | | | | |
| 可用 已安装 ! | 更新 | | 正在显示 1-100 , 共 717 | 4 | | * |
| 可用 已安装 !! 软件包名称 | | 大小 (.ipk) | 正在显示 1-100,共 717 描述 | 4 | | 30 |

9. 11. 2. Installation package example

- 1) Take the installation of the software package "luci-app-acl" as an example
 - a. In the OpenWRT package management interface, click the filter dialog box and

enter "luci-app-acl"

In the list of software packages, you can see the version, package size and description information of the "luci-app-acl" software package, and then click the "Install" button

| 空闲空间: 98% (28.94 GiB) | | | | | | |
|--|---------|----------------------------|-------------------|---------------|---------------------------------------|---------|
| 席洗器· | | 下载并安装软件包: | | 操作: | · · · · · · · · · · · · · · · · · · · | |
| luci-app-ac | 清除 | 软件包名称或 URL | 确认 | 更新列表 | 上传软件包 | 配置 opkg |
| 已过滤 全部 可用 已安装 更 | | | | | | |
| | | | 元左月元 1 3 廿 3 | | | (m) |
| | ĸ | | 正在显示 1-3 , 共 3 | | | 3 |
| 软件包名称 | « 版本 | 大小 (.ipk) | 正在显示 1-3,共3 描述 | | | > |
| 软件包名称 luci-app-acl | | 大小(.ipk) | | gement module | | 3 安装 |
| | 版本 | 大小 (.ipk) b06c 4.14 KiB | 描述 | | | |

c. Then the following pop-up window will appear, click "Install"



d. Then wait for the installation to complete

| OpenWrt 状态▼ 系统▼ 服务▼ Docker▼ 网络▼ 统计→ | - 退出 | | | |
|-------------------------------------|-----------------------------|--|--|--|
| | 未设置密码! 尚未设置密码, 请为 root 月 | 正在执行软件包管理器 禁 等待命令 opkg install 执行完成 | | |
| | 软件包 | | | |
| | | | | |
| | SCHERE. | 下部25-0-3450/0-40- | | |

e. The installation completion display is as follows

正在执行软件包管理器

```
Installing luci-i18n-acl-en (git-23.090.61754-f7f34d4) to root...
Downloading
https://downloads.openwrt.org/releases/22.03.4/packages/aarch64_generic/luci/
luci-i18n-acl-en_git-23.090.61754-f7f34d4_all.ipk
Installing luci-app-acl (git-21.194.67617-f74b06c) to root ...
Downloading
https://downloads.openwrt.org/releases/22.03.4/packages/aarch64_generic/luci/
luci-app-acl git-21.194.67617-f74b06c all.ipk
Installing luci-i18n-acl-zh-cn (git-23.090.61754-f7f34d4) to root...
Downloading
https://downloads.openwrt.org/releases/22.03.4/packages/aarch64 generic/luci/
luci-i18n-acl-zh-cn_git-23.090.61754-f7f34d4_all.ipk
Package luci-app-acl (git-21.194.67617-f74b06c) installed in root is up to
date.
Configuring luci-app-acl.
Configuring luci-il8n-acl-zh-cn.
Configuring luci-il8n-acl-en.
                                                                         关闭
```

- 2) Check whether the software package is installed successfully
 - a. In the OpenWRT package management interface, click the filter dialog box and enter "luci-app-acl"
 - b. Select and click "Available" on the Tab page
 - c. The "**luci-app-acl**" software package will be displayed in the software package list, and the status will be updated to "**Installed**"

软件包

| | | | 95% (7.4 GB) | | | |
|--------------|---------|------------|---------------------|------|-------|---------|
| 筛选器: | | 下载并安装软件包: | | 操作: | | |
| luci-app-acl | 清除 | 软件包名称或 URL | 确认 | 更新列表 | 上传软件包 | 配置 opkg |
| - | | | | | | |
| × 0 | «د | IE | 在显示 1-36,共 36 | | | 2 |
| 2 软件包名称 | « 版本 | | 在显示 1-36,共 36 描述 | | | 3 |

9. 11. 3. Remove package example

- 1) Take removing the software package "luci-app-acl" as an example
 - a. In the OpenWRT package management interface, click the filter dialog box and enter "luci-app-acl"
 - b. Select "Installed" on the Tab page to display the list of **installed** software packages.
 - c. Click "Remove" on the right to remove the corresponding software package

| 次件包 | | | | | | | | |
|--------------|------------|------------|------------|--------------|----------------|-------------|---------|--|
| 空闲空间: | | | | | | | | |
| | | | | % (7.4 GB) | | | | |
| 筛选器: | | | 下载并安装软件包: | | 操作: | | | |
| luci-app-acl | | 清除 | 软件包名称或 URL | 确认 | 更新列表 | 上传软件包 | 配置 opkg | |
| 可用已安装 | 更新 2 « | | 1 | 显示 1-1 , 共 1 | | | ÿ | |
| 软件包名称 | 版本 | | 大小 (.i | ok) 描述 | | 3 | | |
| luci-app-acl | ait-21 194 | 67638-1d60 | 53e ~4.2 k | B LuCI | account manage | mont modulo | 移除 | |

d.Then the pop-up window below will be displayed, click "Remove"

移除软件包 luci-app-acl

```
版本: git-21.194.67638-1d6053e
大小: ~3.4 KB 已安装
```

描述

LuCI account management module

✓ 自动移除未使用的依赖

| म्रा | 12RA |
|-------|--------|
| 41.1月 | 132107 |

e.After successful removal, the display interface is as follows

| 关闭 |
|----|
| |

- 2) Check whether the software package was successfully removed
 - a. In the OpenWRT package management interface, click the filter dialog box and enter "luci-app-acl"
 - b. Select and click "Installed" on the Tab page
 - c. The "luci-app-acl" software package will not be displayed in the software package list. At this time, the "luci-app-acl" software package has been successfully removed.

软件包

| 陈诜器: | | 下载并安装软件包: | | 操作: | | |
|--------------|----|------------|-------|----------|-------|---------|
| luci-app-acl | 清除 | 软件包名称或 URL | 确认 | 更新列表 | 上传软件包 | 配置 opkg |
| 可用已安装更新 | | | | | | |
| « | | В | 这有软件包 | | | 20 |
| 软件包名称 | | 版本 | 7 | 大小(.ipk) | 描述 | |

9.12. Using Samba network sharing

There are two main software options for OpenWRT LAN file sharing implementation, Samba and NFS. The Samba system has good compatibility, and NFS has superior performance. For users who need to use Windows devices, it is recommended to choose Samba.

- 1) Enter the management page of Samba network share
 - a. Find the "Service" option in the navigation bar and click to enter

b. In the vertical bar options below the service, select "Network Sharing" and click to enter



- 2) Select the interface that the Samba service needs to monitor
 - a. Select "General Settings" in the navigation bar of network sharing and click to enter
 - b. The interface is specified according to actual needs. If you want to access through the "wan port", set it to "wan"

| 网络共享 | | |
|-------------|---------------|---|
| Samba Versi | ion 4.14.7 | |
| 常规设置 编辑 | 莫板 | |
| | 接口 | 末間定 |
| | 工作组 | docker: 35 |
| | 描述 | wan6: 🛃 |
| J | 宫用扩展调整 | □ - 自定义 |
| | 强制同步 I/O | □ ② 在低端设备上,可以通过强制使用同步I/O而不是默认的异步来提高速度。 |

- 3) Set up a shared directory for network sharing
 - a. Click "Add" shared directory address in "Shared Directory" of "General Settings" of network sharing.
 - b. Enter the name of the shared folder as "**mmt**" under the name.
 - c. Under the path of the shared directory, select "/**mnt**" to set the shared directory location.
 - d. Check "Browsable" and "Run anonymous user"

e. Click "Save and Apply" to save the configuration

| 名称 Enter 1 | 路径→ the nan | 览 | | | 允许用 I folder shared c | 允许 匿名 用户 | 仅 来 宾 用) | 继承所有者 | 创建权 限掩码 | 目录权 限掩码 | VFS 对象 | Apple Time- machine 共享 | Time- machine 大 小(GB) | |
|---------------|----------------|---|---|---|-----------------------------|----------------|-----------------------|-------|------------|------------|---------|---------------------------------|-----------------------------|--------|
| mmt | /mnt | | 0 | 0 | | | | 0 | 0777 | 0777 | | 0 | | 删除 |
| 新增 | | | | | | | | | 4. Click | "Save a | and App | ly" to sav | e the config | uratio |

4) Windows 10 starts network discovery and sharing

Note: When accessing Samba and sharing under Windows 10 system, you need to first confirm whether Windows 10 has enabled network discovery and sharing. If not, perform the following settings first.

a. Enable Samba v1/v2 access

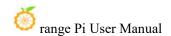
a) Enter the "Control Panel" of Windows 10

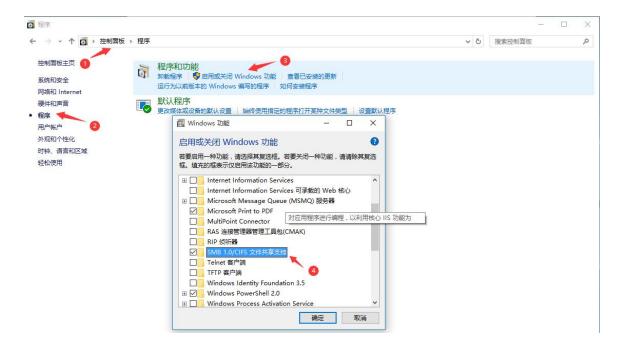
b) Click "Programs" on the left navigation bar of the control panel

c) Select "Turn Windows features on or off" in Programs and Features

d) Check "SMB 1.0/CIFS file sharing support" in the pop-up box to enable or disable Windows features.

e) Click "OK" to configure the application





b. Turn on network discovery in Windows 10

a) Enter the "Control Panel" of Windows 10

b) Select "Network and Internet" in the Control Panel

c) Then open "Network and Sharing Center"

d) Click | "Advanced Sharing Settings"

e) Turn on "Enable network discovery" and "Enable file and printer sharing"

f) Click "Save Changes" to save the network discovery configuration of Windows 10

| •4 高级共享设置 | | | 2 | - 0 | × |
|--|---|---|--------|-----|-----|
| ← → → ↑ 🔩 > 控制面板 > 网络和 Internet > 网络和共享中心 > 高级共享设置 | ~ | G | 搜索控制面板 | | ٩ |
| 针对不同的网络配置文件更改共享选项 Windows 为你所使用的每个网络创建单独的网络配置文件。你可以针对每个配置文件选择特定的选项。 | | | | | ^ |
| 专用 (当前配置文件) 〇 | | | | | |
| 网络发现 | | | | | |
| 如果已扁用网络发现,则这估计算机可以发现网络上的其他计算机和设备,而且其他网络计算机也可以发现这估计算机。 ● 启用网络发现 | | | | | |
| ● 启用文件和打印机共享 ○ 关闭文件和打印机共享 | | | | | |
| 家庭组连接 | | | | | |
| 通常,Windows 管理与其他家庭组计算机的连接。但是,如果你在所有计算机上拥有相同的用户帐 户和密码,则可以让家庭组改用你的帐户。 | | | | | |
| ● 允许 Windows 管理家庭组连接(推荐) | | | | | - 1 |
| ○使用用户帐户和密码连接到其他计算机 | | | | | |
| 来真或公用 () | | | | | ~ |
| 保存更改 取消 | | | | | |

5) After the setting is completed, enter \\OpenWrt in the address bar of the resource manager to access the shared directory. The user name is root, and the password is the password set by the development board host.

| OneDrive System Volume Information 2020/9/7 18:26 文件夹 WPS网盘 audio.wav 2020/8/17 18:10 WAV 文件 1,936 KB 此电脑 openwrt-sunxi-cortexa7-sun8i-h2-plu 2019/1/9 9:14 MD5SUM 文件 1 KB orangepi.txt 2020/9/25 17:29 文本文档 1 KB 文档 usbcamera.apk 2020/11/13 21:55 APK 文件 20,451 KB 文档 下载 五年 五年 五年 20,451 KB 東面 本地磁盘 (C:) temp (\\vboxsrv)) 1 1 | • → • ↑ 🚽 > 网 | 络 > OpenWrt > mmt | | | |
|--|------------------|-------------------------------------|------------------|-----------|-----------|
| OneUnve wiringOP 2020/11/28 5:12 文件夹 WPS网盘 audio.wav 2020/8/17 18:10 WAV 文件 1,936 KB 此电脑 openwrt-sunxi-cortexa7-sun8i-h2-plu 2019/1/9 9:14 MD5SUM 文件 1 KB 砚版 orangepi.txt 2020/9/25 17:29 文本文档 1 KB 図片 usbcamera.apk 2020/11/13 21:55 APK 文件 20,451 KB 文档 下载 ● 方 桌面 本地磁盘 (C:) temp (\\vboxsrv)) | 📌 快速访问 | 名称 | 修改日期 | 类型 | 大小 |
| WPS网盘 WuringOP 2020/11/28 5:12 文件夹 2020/8/17 18:10 WAV 文件 1,936 KB openwrt-sunxi-cortexa7-sun8i-h2-plu 2019/1/9 9:14 MD5SUM 文件 1 KB orangepi.txt 2020/9/25 17:29 文本文档 1 KB orangepi.txt 2020/11/13 21:55 APK 文件 20,451 KB 文档 素 桌面 本地磁盘 (C:) temp (\\vboxsrv) | | System Volume Information | 2020/9/7 18:26 | 文件夹 | |
| 此电脑 openwrt-sunxi-cortexa7-sun8i-h2-plu 2019/1/9 9:14 MD5SUM 文件 1 KB orangepi.txt 2020/9/25 17:29 文本文档 1 KB usbcamera.apk 2020/11/13 21:55 APK 文件 20,451 KB 文档 下载 音乐 桌面 本地磁盘 (C:) temp (\\vboxsrv) | Onebrive | wiringOP | 2020/11/28 5:12 | 文件夹 | |
| ■ 砚颇 ① orangepi.txt 2020/9/25 17:29 文本文档 1 KB ① usbcamera.apk 2020/11/13 21:55 APK 文件 20,451 KB ① 立路 amera.apk 2020/11/13 21:55 APK 文件 20,451 KB ① 立路 amera.apk 2020/11/13 21:55 APK 文件 20,451 KB ① 章乐 ① 桌面 ① 章乐 ① 桌面 ① 章乐 ① 章乐 ① 章乐 ① 章乐 ① 章乐 ① 章乐 ① 章乐 ① 章 | SWPS网盘 | audio.wav | 2020/8/17 18:10 | WAV 文件 | 1,936 KB |
| □ orangepi.txt 2020/9/25 17:29 又本又指 1 KB □ usbcamera.apk 2020/11/13 21:55 APK 文件 20,451 KB □ 文档 ↓ 下载 ↓ 音乐 □ 桌面 ▲ 本地磁盘 (C:) ■ temp (\\vboxsrv) | 一些电脑 | openwrt-sunxi-cortexa7-sun8i-h2-plu | 2019/1/9 9:14 | MD5SUM 文件 | 1 KB |
| □ usbcamera.apk 2020/11/13 21:55 APK 文件 20,451 KB ② 文档 ↓ 下载 ↓ 音乐 ■ 桌面 ▲ 本地磁盘 (C:) ■ temp (\\vboxsrv) | | orangepi.txt | 2020/9/25 17:29 | 文本文档 | 1 KB |
| ☆ 大档 ◆ 下式 ◆ 音乐 ● 桌面 ▲ 本地磁盘 (C:) temp (\\vboxsrv); | | 📄 usbcamera.apk | 2020/11/13 21:55 | APK 文件 | 20,451 KB |
| ↓ 下载 ▲ 音乐 ■ 桌面 ▲ 本地磁盘 (C:) 量 temp (\\vboxsrv) | 1.5.1.75.1 | | | | |
| 音乐 貞面 本地磁盘 (C:) temp (\\vboxsrv)) | 📑 文档 | | | | |
| 桌面 ▲ 本地磁盘 (C:) ★ temp (\\vboxsrv) (| ↓ 下载 | | | | |
| ▲ 本地磁盘 (C;) temp (\\vboxsrv) ι | ▶ 音乐 | | | | |
| temp (\\vboxsrv) | 真面 | | | | |
| temp (\\vboxsrv) | 느 本地磁盘 (C:) | | | | |
| ▶ 网络 | temp (\\vboxsrv) | | | | |
| | 🕨 网络 | | | | |

9. 13. zerotier instructions for use

The OpenWRT system has been pre-installed with the zerotier client. After creating a virtual LAN on the zerotier official website, the client can directly join it through the Network ID. The specific operations are as follows.

1) Log in to zerotier official website https://my.zerotier.com/network, register and click Network->Create A Network to create a virtual LAN

| $\overline{\Phi}$ ZEROTIER | | Download | d Knowledge Ba | ise Accoun | t Networks | System | API | Community | Logout |
|----------------------------|---|----------------------|----------------|------------|------------|----------|-------|-----------|--------|
| | | Crea | ite A Network | | | | | | |
| | | Create a Net | work to Get | Started | | | | | |
| $\overline{\Phi}$ ZEROTIER | | Download Kr | nowledge Base | Account | Networks | System | API | Community | Logout |
| | | Crea | te A Network | | | | | | |
| | Your Networks | SEARCH 1 networks | | | | | | | |
| | Networks: 1 Authorized Members: 0 / 50 | NETWORK ID | NAME † | DESCRIP | TION SUB | NET M | NODES | | |
| | Online Members: 0 | 8286ac0e47d53bb5 | happy_metcal | fe | 172.2 | 7.0.0/16 | 0/0 | | |

2) Click to enter the network console page and set the privacy option to public, so that the added network nodes do not need to be verified.

| Basics | Network ID 8286ac0e47d53 | 3bb5 |
|--------|---|---|
| | Name happy_metcalfe | |
| | Description | |
| | | |
| | Access Control | |
| | PRIVATE | <u>PUBLIC</u> © |
| | Nodes must be authorized to become <i>members</i> | Any node can become a <i>member.</i> Members cannot be de- authorized or deleted. |

3) Next, you can choose the network segment for automatically assigning the address. The selected network segment here is 172.27.*.*

| ito-Assign from | Range | | | | |
|-----------------|---------------|---------------|---------------|--|--|
| Eas | sy | Advanced | | | |
| 10.147.17.* | 10.147.18.* | 10.147.19.* | 10.147.20.* | | |
| 10.144.*.* | 10.241.*.* | 10.242.*.* | 10.243.*.* | | |
| 10.244.*.* | 172.22.*.* | 172.23.*.* | 172.24.*.* | | |
| 172.25.*.* | 172.26.*.* | 172.27.*.* | 172.28.*.* | | |
| 172.29.*.* | 172.30.*.* | 192.168.191.* | 192.168.192.* | | |
| 192.168.193.* | 192.168.194.* | 192.168.195.* | 192.168.196.* | | |

4) Enter the following command in the OpenWRT terminal to join the virtual LAN created above, where 8286ac0e47d53bb5 is the Network ID of the virtual LAN created above.

| root@OpenWrt:/# zerotier-one -d | #Start zerotier client |
|--|------------------------|
| root@OpenWrt:/# zerotier-cli join 8286ac0e47d53bb5 | #Join the network |

5) Enter if config in the terminal and you can see that there is a new **ztks54inm2** device with an IP address of **172.27.214.213**

| root@OpenWrt:/# ifconfig |
|--|
| ztks54inm2 Link encap:Ethernet HWaddr F6:4E:DE:BF:D8:52 |
| inet addr:172.27.214.213 Bcast:172.27.255.255 Mask:255.255.0.0 |
| inet6 addr: fe80::e82f:d0ff:fe5a:867e/64 Scope:Link |
| UP BROADCAST RUNNING MULTICAST MTU:2800 Metric:1 |
| RX packets:18 errors:0 dropped:0 overruns:0 frame:0 |
| TX packets:48 errors:0 dropped:0 overruns:0 carrier:0 |
| collisions:0 txqueuelen:1000 |
| RX bytes:1720 (1.6 KiB) TX byte81 (8.2 KiB) |

6) Install the zerotier client on another device (Ubuntu 18.04 is used as an example here), execute the following command to install. After the installation is completed, you need to restart the computer.

test@ubuntu:~\$ curl -s https://install.zerotier.com | sudo bash

7) After restarting, join the virtual LAN according to the Network ID. You can also see that the IP address assigned by zerotier has been obtained. At this time, the Ubuntu PC and OrangePi R1 Plus LTS are in the same LAN, and the two can communicate freely.

| est@ubuntu:~\$ sudo zerotier-cli join 8286ac0e47d53bb5 | | |
|---|--|--|
| test@ubuntu:~\$ ifconfig | | |
| ztks54inm2: flags=4163 <up,broadcast,running,multicast> mtu 2800</up,broadcast,running,multicast> | | |
| inet 172.27.47.214 netmask 255.255.0.0 broadcast 172.27.255.255 | | |
| inet6 fe80::5ce1:85ff:fe2b:6918 prefixlen 64 scopeid 0x20 <link/> | | |
| ether f6:fd:87:68:12:cf txqueuelen 1000 (以太网) | | |
| RX packets 0 bytes 0 (0.0 B) | | |
| RX errors 0 dropped 0 overruns 0 frame 0 | | |
| TX packets 46 bytes 10006 (10.0 KB) | | |
| TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0 | | |

8) Test whether the two terminals can communicate

root@OpenWrt:/# ping 172.27.47.214 -I ztks54inm2 PING 172.27.47.214 (172.27.47.214): 56 data bytes 64 bytes from 172.27.47.214: seq=0 ttl=64 time=1.209 ms 64 bytes from 172.27.47.214: seq=1 ttl=64 time=1.136 ms 64 bytes from 172.27.47.214: seq=2 ttl=64 time=1.203 ms 64 bytes from 172.27.47.214: seq=3 ttl=64 time=1.235 ms ^C --- 172.27.47.214 ping statistics ---4 packets transmitted, 4 packets received, 0% packet loss round-trip min/avg/max = 1.136/1.195/1.235 ms

| <i>y</i>) Zerotter und other common communes | | | | |
|---|---------------------------------|--|--|--|
| root@OpenWrt:/# zerotier-one -d | #Start zerotier client | | | |
| root@OpenWrt:/# zerotier-cli status | #Get address and service status | | | |
| root@OpenWrt:/# zerotier-cli join # Network ID | #Join the network | | | |
| root@OpenWrt:/# zerotier-cli leave # Network ID | #Off the grid | | | |
| root@OpenWrt:/# zerotier-cli listnetworks | #list networks | | | |
| OPENWRT_DEVICE_REVISION="v0" | | | | |
| OPENWRT_RELEASE="OpenWrt 22.03.4 r20123-38ccc47687" | | | | |
| | | | | |

9) Zerotier and other common commands

10. Compilation method of OpenWRT source code

10.1. Download OpenWRT source code

1) First execute the following command to download the source code

test@test:~\$ sudo apt update test@test:~\$ sudo apt install -y git test@test:~\$ git clone https://github.com/orangepi-xunlong/openwrt.git -b orangepi5pro

2) After the OpenWRT code is downloaded, it will contain the following files and folders test@test:~/openwrt\$ ls
 BSDmakefile Config.in include Makefile README.md scripts toolchain Config feeds.conf.default LICENSE package rules.mk target tools

10.2. Compile OpenWRT source code

1) First install the following dependent software (currently only tested on Ubuntu22.04, you need to install the following software. If you compile on other versions of the system, please install the dependent software yourself according to the error message)

test@test:~/openwrt\$ sudo apt update test@test:~/openwrt\$ sudo apt install -y ack antlr3 asciidoc autoconf \ automake autopoint binutils bison build-essential \ bzip2 ccache cmake cpio curl device-tree-compiler fastjar \ flex gawk gettext gcc-multilib g++-multilib git gperf haveged \ help2man intltool libc6-dev-i386 libelf-dev libglib2.0-dev \ libgmp3-dev libltdl-dev libmpc-dev libmpfr-dev \ libncurses5-dev \libncursesw5-dev libreadline-dev libssl-dev \ libtool lrzsz mkisofs msmtp nano ninja-build p7zip p7zip-full \ patch pkgconf python2.7 python3 python3-pyelftools \ libpython3-dev qemu-utils rsync scons squashfs-tools \ subversion swig texinfo uglifyjs upx-ucl unzip \ vim wget xmlto xxd zlib1g-dev

2) Then execute ./scripts/feeds update -a and ./scripts/feeds install -a to download dependency packages

test@test:~/openwrt\$./scripts/feeds update -a test@test:~/openwrt\$./scripts/feeds install -a

- 3) Then select the profile using OrangePi 5 Pro
 - a. Compile an image that supports TF card, eMMC, and NVMe boot, and select the following configuration

test@test:~/openwrt\$ cp configs/orangepi-5-pro-rk3588_defconfig .config

b. Compile and support SPI Flash boot image, select the following configuration

test@test:~/openwrt\$ cp configs/orangepi-5-pro-rk3588-spi_defconfig .config

 4) Then execute the following command to make the configuration take effect test@test:~/openwrt\$ make defconfig

5) Execute the following command to start compiling the openwrt source code test@test:~/openwrt\$ make V=s

6) After compilation is completed, the path where the image is generated is:

test@test:~/openwrt\$ tree -L 1 bin/targets/rockchip/armv8/

bin/targets/rockchip/armv8/

- └── config.buildinfo
- ├─── feeds.buildinfo
- openwrt-rockchip-armv8-xunlong_orangepi-5-pro-ext4-sysupgrade.img.gz
- ----- openwrt-rockchip-armv8-xunlong_orangepi-5-pro.manifest
- openwrt-rockchip-armv8-xunlong_orangepi-5-pro-squashfs-sysupgrade.img.gz
- packages
- profiles.json
- ├─── sha256sums
- └── version.buildinfo

1 directory, 9 files

11. Appendix

11. 1. User manual update history

| Version | Date | Release Notes |
|---------|------------|---|
| v1.0 | 2024-04-07 | initial version |
| v1.1 | 2024-05-16 | Method of burning Linux image to TF card+NVMe SSD |

11.2. Image update history

| Date | Release Notes |
|------------|--|
| 2024-04-07 | Orangepi5pro_1.0.0_ubuntu_focal_server_linux5.10.160.7z |
| | Orangepi5pro_1.0.0_ubuntu_jammy_server_linux5.10.160.7z |
| | Orangepi5pro_1.0.0_debian_bullseye_server_linux5.10.160.7z |
| | Orangepi5pro_1.0.0_debian_bookworm_server_linux5.10.160.7z |
| | Orangepi5pro_1.0.0_ubuntu_focal_desktop_xfce_linux5.10.160.7z |
| | Orangepi5pro_1.0.0_ubuntu_jammy_desktop_xfce_linux5.10.160.7z |
| | Orangepi5pro_1.0.0_debian_bullseye_desktop_xfce_linux5.10.160.7z |
| | Orangepi5pro_1.0.0_debian_bookworm_desktop_xfce_linux5.10.160.7z |
| | |
| | OrangePi5Pro_RK3588S_Android12_v1.0.0.tar.gz |
| | OrangePi5Pro_RK3588S_Android12_lcd_v1.0.0.tar.gz |
| | OrangePi5Pro_RK3588S_Android12_spi-sata_v1.0.0.tar.gz |
| | OrangePi5Pro_RK3588S_Android12_spi-nvme_v1.0.0.tar.gz |
| | OrangePi5Pro_RK3588S_Android12_lcd_spi-sata_v1.0.0.tar.gz |
| | OrangePi5Pro_RK3588S_Android12_lcd_spi-nvme_v1.0.0.tar.gz |
| | OrangePi5Pro_RK3588S_Android12_box_v1.0.0.tar.gz |
| | OrangePi5Pro_RK3588S_Android12_box_spi-nvme_v1.0.0.tar.gz |
| | OrangePi5Pro_RK3588S_Android12_box_spi-sata_v1.0.0.tar.gz |

| | Opios-droid-aarch64-opi5pro-24.02-linux5.10.160.tar.gz |
|------------|---|
| | Opios-droid-aarch64-opi5pro-24.02-linux5.10.160-spi-nvme.tar.gz |
| | Opios-droid-aarch64-opi5pro-24.02-linux5.10.160-spi-sata.tar.gz |
| | |
| | Opios-arch-aarch64-gnome-opi5pro-24.03-linux5.10.160.img.xz |
| | openwrt-aarch64-opi5pro-24.03-linux-6.1.43-ext4.img.gz |
| | openwrt-aarch64-opi5pro-24.03-linux-6.1.43-spi-squashfs.bin |
| | * initial version |
| 2024-05-09 | OrangePi5Pro RK3588S Android12 v1.0.1.tar.gz |
| | OrangePi5Pro RK3588S Android12 box v1.0.1.tar.gz |
| | OrangePi5Pro RK3588S Android12 spi-sata v1.0.1.tar.gz |
| | OrangePi5Pro RK3588S Android12 spi-nvme v1.0.1.tar.gz |
| | OrangePi5Pro RK3588S Android12 box spi-nvme v1.0.1.tar.gz |
| | OrangePi5Pro_RK3588S_Android12_box_spi-sata_v1.0.1.tar.gz |
| | * Update bl31, optimize 4GB/8GB memory stability |
| | * Add the function of uboot to detect LCD connection. When the LCD is |
| | connected, turn on the LCD display |
| | Opios-droid-aarch64-opi5pro-24.05-linux5.10.160.tar.gz |
| | Opios-droid-aarch64-opi5pro-24.05-linux5.10.160-spi-nvme.tar.gz |
| | Opios-droid-aarch64-opi5pro-24.05-linux5.10.160-spi-sata.tar.gz |
| | Opios-arch-aarch64-gnome-opi5pro-24.05-linux5.10.160.img.xz |
| | |
| | * Update bl31, optimize 4GB/8GB memory stability |
| | Orangepi5pro_1.0.2_ubuntu_focal_server_linux5.10.160.7z |
| | Orangepi5pro_1.0.2_ubuntu_jammy_server_linux5.10.160.7z |
| | Orangepi5pro_1.0.2_debian_bullseye_server_linux5.10.160.7z |
| | Orangepi5pro_1.0.2_debian_bookworm_server_linux5.10.160.7z |



| Orangepi5pro_1.0.2_ubuntu_focal_desktop_xfce_linux5.10.160.7z |
|--|
| Orangepi5pro_1.0.2_ubuntu_jammy_desktop_xfce_linux5.10.160.7z |
| Orangepi5pro_1.0.2_debian_bullseye_desktop_xfce_linux5.10.160.7z |
| Orangepi5pro_1.0.2_debian_bookworm_desktop_xfce_linux5.10.160.7z |
| |
| * Update bl31, optimize 4GB/8GB memory stability |
| * Update the yt6801 network port chip driver |