

# Orange Pi 5 Pro User Manual



# Catalogue

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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

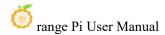
Of course, there are also many other features. With a powerful ecosystem and a variety of expansion accessories, Orange Pi can help users easily achieve delivery from creativity to prototype and then to mass production. It is an ideal creative platform for makers, dreamers, and hobbyists.

### 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	

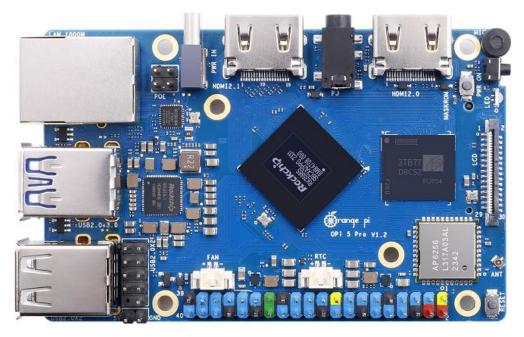


	• 2 * HDMI output
PCIe M.2 M-KEY	Supports SSD
	1 * USB3.0 Supports Device or HOST mode
USB interface	3 * USB2.0 HOST
USB Interface	2 * USB2.0 HOST (Lead out through 9-pin pin pin
	arrangement)
40pin Extended needle	Used to expand UART, PWM, I2C, SPI, CAN, and GPIO
arrangement	interfaces
Debug UART	Included 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
of shenzhen Xunlong Software Co., Lt	

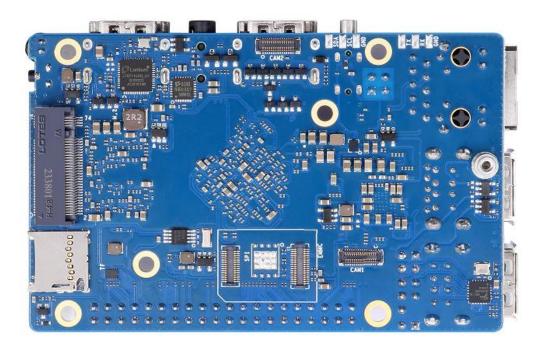


# 1.4. Top and Bottom Views of Orange Pi 5 Pro

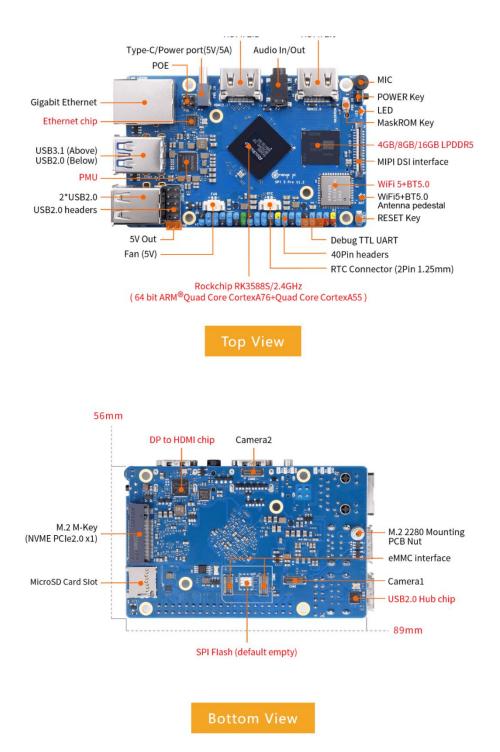
Top view:

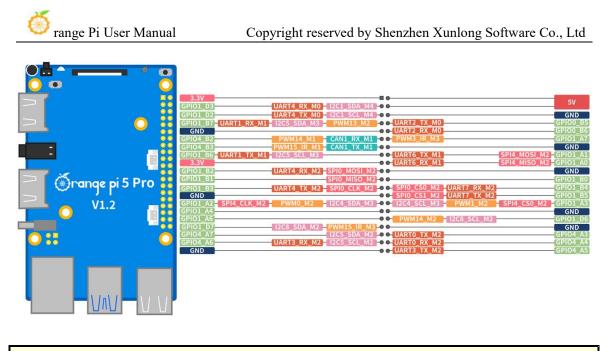


Bottom view:



### 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

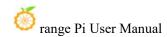


9) 5V cooling fan. As shown in the following figure, there are interfaces on the development board for connecting the cooling fan. The specifications of the interfaces are **2pin 1.25mm spacing** 

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





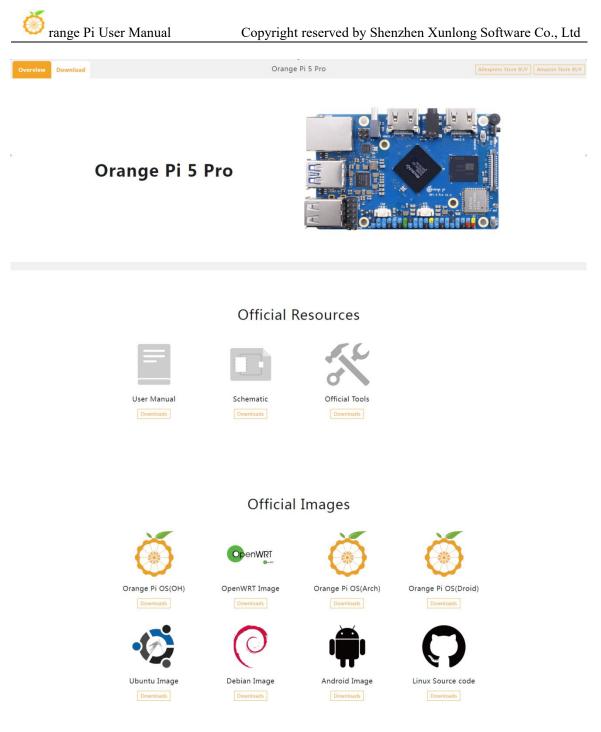
15) Personal computers with Ubuntu and Windows operating systems installed

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

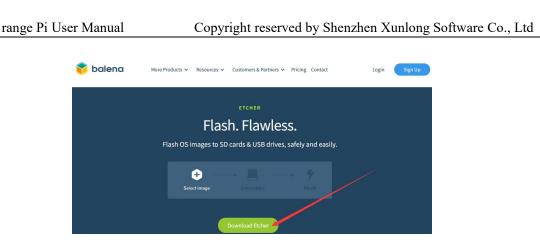
3) Download the Linux operating system image file compression package that you want to burn from the **Orange Pi data download page**, and then use the decompression software to decompress it. Among the decompressed files, the file ending with ".img" is the image file of the operating system. The size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

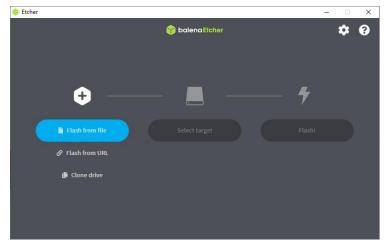
5) After entering the BalenaEtcher download page, clicking the green download button will redirect you to the software download location



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		
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:



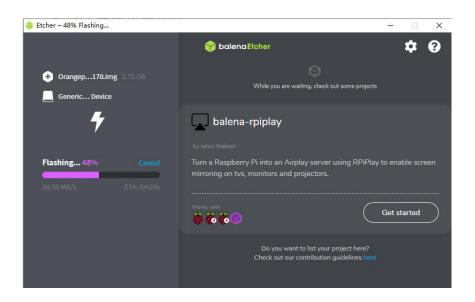
If the following error is prompted when opening balenaEtcher:



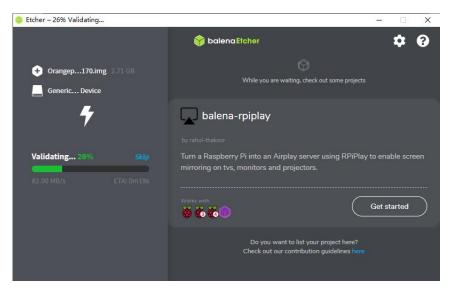
- 8) The specific steps to use balenaEtcher to burn the Linux image are aa follow
  - a. First select the path of the Linux image file to burned
  - b. Then select the drive letter of the TF card
  - c. Finally, click Flash to start burning the Linux image to the TF card



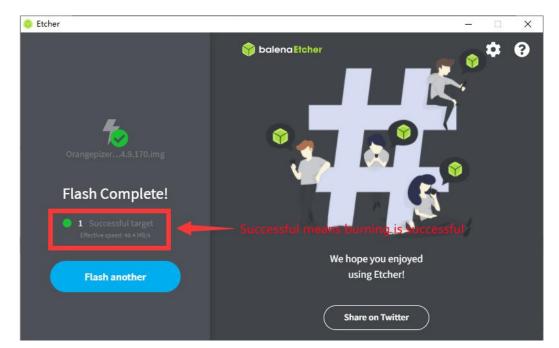
9) The interface displayed in the process of burning the Linux image by balenaEtcher is shown in the figure below, and the progress bar displays purple, indicating that the Linux image is being burned into the TF card



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

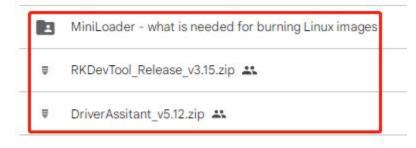


4) Then download the Ruixin micro driver **DriverAssitant\_v5.12.zip**. zip and MiniLoader, as well as the burning tool **RKDevTool\_Release\_v3.15.zip**, from **Orange Pi's data download page** 

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



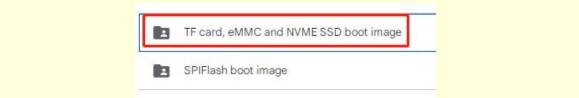
b. Then download all the files below



# 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	
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

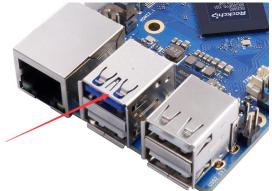
名称 ^	修改日期	类型	大小
bin .	2022/12/1 15:07	文件夹	
Language	2022/12/1 15:07	文件夹	
🗋 config.cfg	2022/3/23 9:11	CFG 文件	7 KB
🔄 config	2021/11/30 11:04	配置设置	2 KB
revision	2022/5/27 9:09	文本文档	3 KB
🔀 RKDevTool	2022/5/27 9:06	应用程序	1,212 KB
☑ 开发工具使用文档_v1.0	2021/8/27 10:28	Foxit PDF Reade	450 KB

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		2
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	
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

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:		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** 

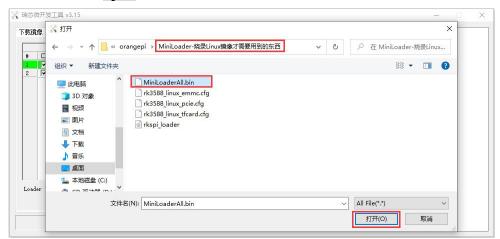
orange Pi User Manual

#		存储	地址	名字	路径	
1	~	17.04	0x00000000	Loader	C:\Users\Administrator\Desktop\	
2	~	SD	0x00000000	linux	C:\Users\Administrator\Desktop\	
					● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ●	
			执行	切换	设备分区表 清空	

k. Then click the position shown in the figure below

<b>試</b> 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

	字储	地址	名字	路径	
<ul><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li><li>✓</li>&lt;</ul>	0	0x00000000 0x00000000	Loader linux	C:\Umermllee\Desktop\Android#DL C:\UmermlAdministrator\Desktop\	
r Ver:		执行	切换	设备分区表 清空	

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

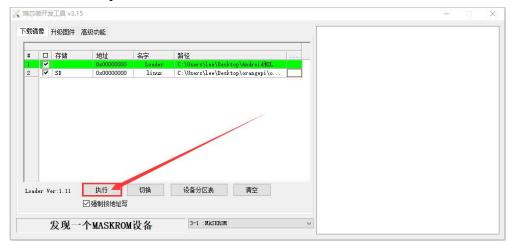
Before burning the image, it is recommended to rename the Linux image to orangepi.img or other shorter names, so that the percentage of burning progress can be seen when burning the image.

镜像 🔀 打开		×
← → * ↑	→ 此电脑 → 桌面 → orangepi →	✓ ひ
● 组织 ▼ 新建文	(件夹	## <b>- 11 ()</b>
<ul> <li>□ 此电脑</li> <li>③ 3D 对象</li> <li>圖 视频</li> <li>圖 则片</li> <li>圖 文档</li> <li>↓ 下號</li> <li>〕 音乐</li> <li>■ 桌面</li> <li>二 本地磁盘 (Ci</li> </ul>	↑ 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

5.CAR	数开发	之工具 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\Android和L		
2	•	SD	0x00000000	linux	C:\Users\lee\Desktop\orangepi\o		
Load	er Ve	er:1.11	执行	切换	设备分区表 海空		
Load	er Ve	er:1.11	————————————————————————————————————	切换	设备分区表 清空		

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
+		存储	地址	名字	路径	等待Maskrom成功
1			0x00000000	Loader	Desktop\orangepi\orangepi\MiniL	则试设备开始
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成功
						准备IDB开始
						准备IDB成功
						准备IDB成功 下载IDB开始
						准备IDB成功 下载IDB开始 下载IDB成功
						准备IDB成功 下载IDB成功 等他makrom开始
						准备IID5成功 下载IID5开始 下载IID5成功 等待Maskron开始 等待Maskron历功
						准备IDB成功 下载IDB成功 等他makrom开始
						准备IDB成功 下载IDB开始 下载IDB玩功 等待Maskrom开始 等待Maskrom成功 测试设备开始 IMI式设备形始
		···· [	H-(2)	17742	23.#./\177.# ##**	准备IIB成功 下载IIB开始 下载IID开始 等待Mackrost力 等待Mackrost力 则试设备开始 <u>则试设备成功</u> 开始切换存始到SD 开始下载orangepi
Load	er Ver	:1.11	执行	切换	设备分区表 清空	准备IDB成功 下载IDB开始 下载IDB成功 等待Maskrom开始 等待Maskrom历功 测试设备开始 IDB行设备成功 开始切损存储都ISD

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

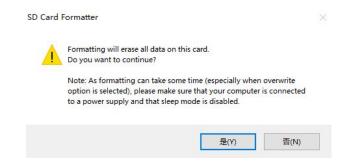
- 2) Then use the card reader to insert the TF card into the computer
- 3) Then format the TF
  - a. **SD Card Formatter** can be used to format the TF card. The download address is:

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) "

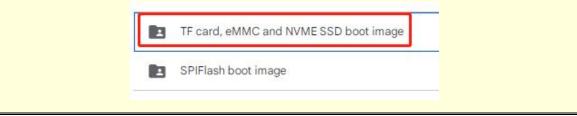


e. After formatting the TF card, the information shown in the figure below will pop up, click OK



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

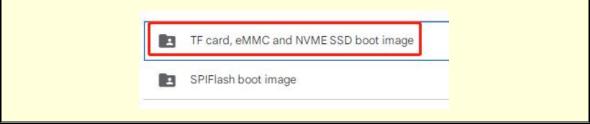


## **Download Etcher**

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

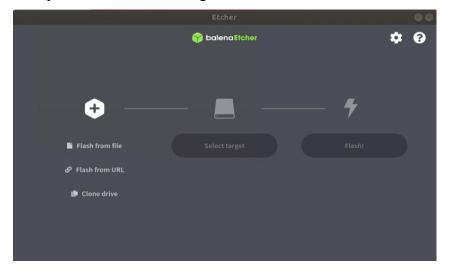
test@test:~\$ sha256sum -c \*.sha

Orangepi5pro\_1.0.0\_debian\_bullseye\_desktop\_xfce\_linux5.10.160.img: OK

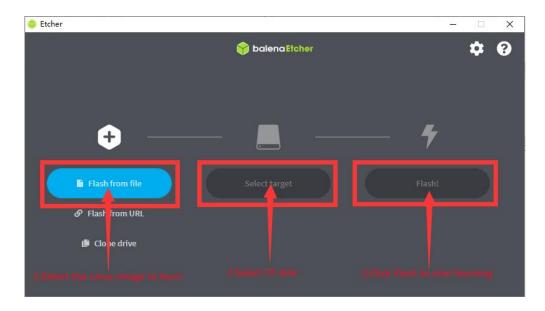
If you are downloading an OpenWRT image, you need to verify the compressed file instead of decompressing it before verifying it

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

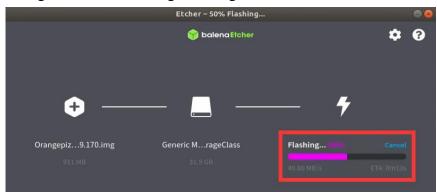
8) Then double-click **balenaEtcher-1.5.109-x64.AppImage** on the graphical interface of Ubuntu PC to open balenaEtcher (**no installation required**), and the interface after balenaEtcher is opened is shown in the figure belobalenaEtcher



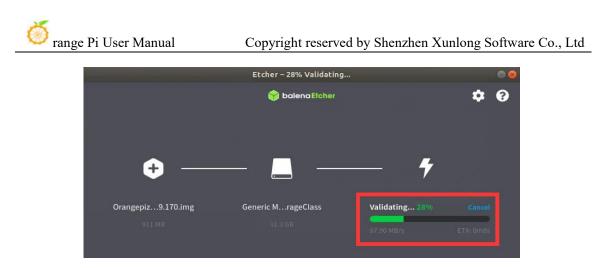
- 9) The specific steps to use balenaEtcher to burn the Linux image are as follows
  - a. First select the path of the Linux image file to be burned
  - b. Then select the drive letter of the TF Card
  - c. Finally, click Flash to start burning the Linux image to the TF Card



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.



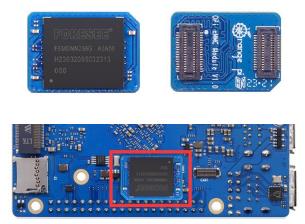
## 2.5. The method of burning Linux images into eMMC

## 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:

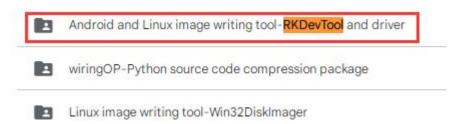


2) Also need to prepare a good quality USB2.0 public to public data cable

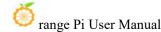


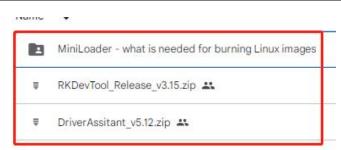
3) Then download the Ruixin micro driver **DriverAssitant\_v5.12.zip** and **MiniLoader**, as well as the burning tool **RKDevTool\_Release\_v3.15.zip**, from **Orange Pi's data download page** 

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

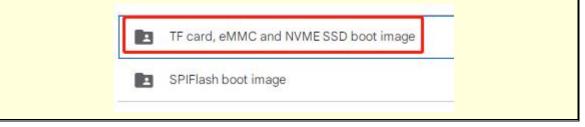




Note that the "MiniLoader - something needed to burn Linux images" folder is hereinafter referred to as the MiniLoader folder.

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

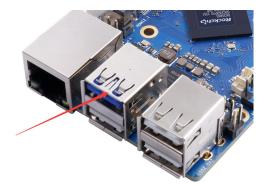
名称	修改日期	类型	大小
bin	2022/12/1 15:07	文件夹	
📙 Language	2022/12/1 15:07	文件夹	
🗋 config.cfg	2022/3/23 9:11	CFG 文件	7 KB
🔄 config	2021/11/30 11:04	配置设置	2 KB
revision	2022/5/27 9:09	文本文档	3 KB
KKDevTool	2022/5/27 9:06	应用程序	1,212 KB
◎ 开发工具使用文档_v1.0	2021/8/27 10:28	Foxit PDF Reade	450 KB

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				

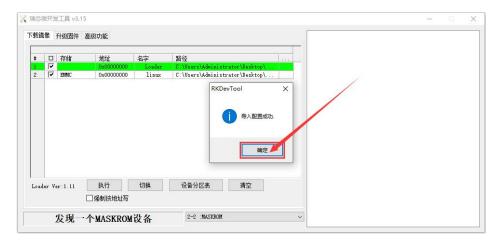
### h. Then select the **import configuration** option

#		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 • 🔳	?
<ul> <li>■ 此电脑</li> <li>③ 3D 对象</li> <li>■ 视频</li> <li>■ 刷片</li> <li>◎ 可片</li> <li>○ 方指</li> <li>▼ 木坊</li> <li>● 音乐</li> <li>■ 重面</li> <li>■ 本地磁盘 (C:)</li> </ul>			
* co ™→** co `` 文/牛名(N): rk3588_linux_emmc.cfg	<ul> <li>ConfigFile(*.cf</li> </ul>	g)	~
	打开(0)	取消	

j. Then click **OK** 



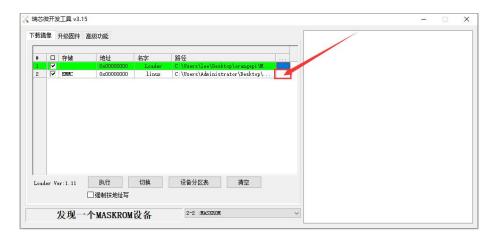
k. Then click on the location shown in the following image

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	<ul> <li></li> <li><td>EMMC</td><td>0x00000000 0x00000000</td><td>Loader linux</td><td>C:\Users\Administrator\Desktop\ C:\Users\Administrator\Desktop\</td><td></td></li></ul>	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 <del>M</del>	(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		>
	<b>要用到的东西 v ひ</b> の在 MiniLo	oader-烧录Linux
组织 ▼ 新建文件夹	1	18 - 🔳 🕐
<ul> <li>此电脑</li> <li>3D 对象</li> <li>叶k3588 [inux_emmc.cfg</li> <li>rk3588 [inux_therac.cfg</li> <li< th=""><th></th><th></th></li<></ul>		
文件名(N):	<ul> <li>All File(*.*)</li> </ul>	~

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	<b>主</b> 文件夹	EE - 🔟 🕐
<ul> <li>此电脑</li> <li>3D 对象</li> <li>颲 规频</li> <li>&gt; 图片</li> <li>⑦ 文档</li> <li>◆ 下戦</li> <li>→ 音乐</li> <li>■ 桌面</li> </ul>	▲ 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

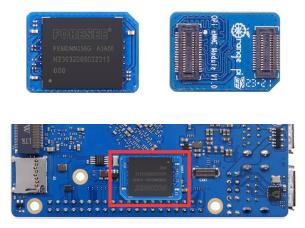
		1.661	1.4.4	1.41.78		——— 下载Boot成功 等待Maskrom开始	
#	□.存储 ▼	地址	名字	路径 C:\Users\bb177\Deckton\ora		等待 Maskrom 成功	
2	EMMC	0x0000	Loader linux	C:\Users\hh177\Desktop\ora		测试设备开始	
					- Lunnard	测试设备成功	
						校验芯片开始	
						校验芯片成功	
						获取FlashInfo开始 获取FlashInfo成功	
						准备IDB开始	
						准备 IDB所 知 准备 IDB成功	
						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

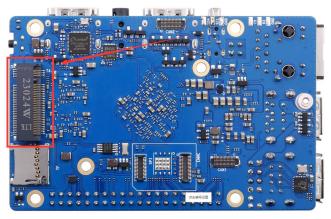
Note that the Linux image referred to here specifically refers to Linux distribution images such as Debian, Ubuntu, OpenWRT, or OPi OS Arch downloaded from the Orange Pi download page.

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:~ <b>\$ df</b>	-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	<b>5.8G</b>	111 <b>G</b>	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:~\$ <b>df</b>	-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	<b>1.9T</b>	<b>4.1G</b>	<b>1.8T</b>	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	<b>90N</b>	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.

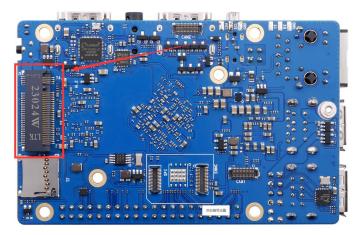
#### 2. 7. 1. The method of burning using RKDevTool

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

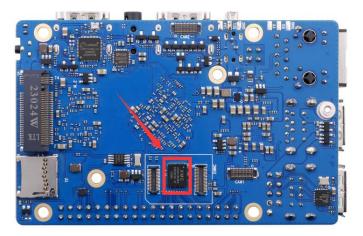
board M.2 slot supports PCIe 2.0x1, with a theoretical maximum speed of 500MB/s. NVMe SSDs for PCIe 3.0 and PCIe 4.0 are also usable, but the maximum speed is only PCIe 2.0x1.



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

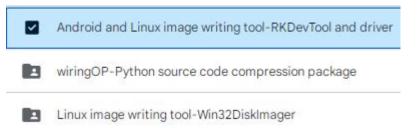


4) Then you need to prepare a high-quality USB 2.0 corporate data cable

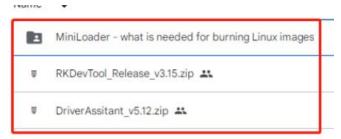


5) Then download the Ruixin micro driver **DriverAssitant\_v5.12.zip** and MiniLoader, as well as the burning tool **RKDevTool\_Release\_v3.15.zip**, from **Orange Pi's data** download page

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

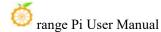


image file in the "TF Card, eMMC, and NVME SSD Boot Image" folder.

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

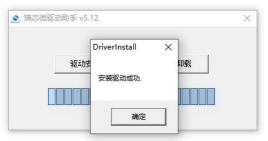
名称 ^	修改日期	类型	大小
ADBDriver	2022/12/1 15:07	文件夹	
📙 bin	2022/12/1 15:07	文件夹	
Driver	2022/12/1 15:07	文件夹	
🔄 config	2014/6/3 15:38	配置设置	1 KB
S DriverInstall	2022/2/28 14:11	应用程序	491 KB
Readme	2018/1/31 17:44	文本文档	1 KB
revison	2022/2/28 14:14	文本文档	1 KB

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	<b>要用到的东西</b> V O C 在 MiniLoader-焼泉Linux
组织 ▼ 新建文件夹	BB - 🛄 😗
<ul> <li>此电脑</li> <li>3D 对象</li> <li>通 叔须</li> <li>一 rk3588_linux_tfcard.cfg</li> <li>一 rk3588_linux_tfcard.cfg</li> <li>一 rk3588_linux_tfcard.cfg</li> <li>一 市場</li> <li>一 音乐</li> <li>重 本地磁盘 (C:)</li> </ul>	
文件名(N): rk3588_linux_pcie.cfg	✓ ConfigFile(*.cfg) ✓
	打开(O) 取消

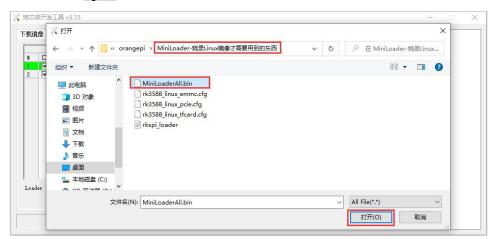
j. Then click **OK** 

# 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 - 🔟 💡
<ul> <li>● 此电脑</li> <li>③ 3D 对象</li> <li>◎ 3D 对象</li> <li>◎ 40.5%</li> <li>◎ 40.5%</li> <li>○ 74.3588_linux_emmc.cfg</li> <li>○ rk3588_linux_pcie.cfg</li> <li>○ rk3588_linux_tfcard.cfg</li> <li>○ rkspi_loader</li> </ul>	
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

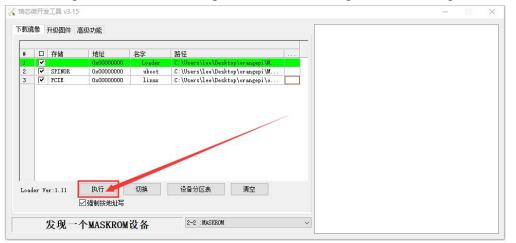
orangepi.img or other shorter names, so that the percentage of burning progress can be seen when burning the image.

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

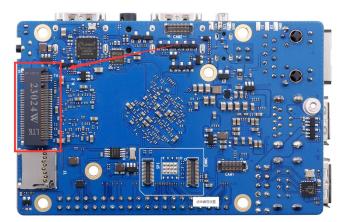


b. The M.2 2242 SSD is as follow

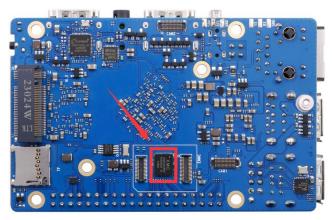


2) Then insert the NVMe SSD into the M.2 PCIe interface of the development board and

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.

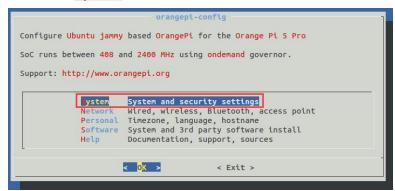
5) After starting the Linux system with a TF card, we first burn the u-boot image to SPI Flash

- 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

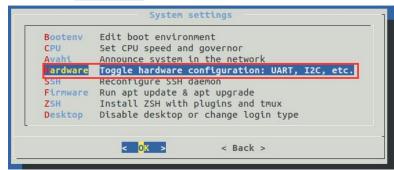
#### permission

orangepi@orangepi:~\$ sudo orangepi-config

b) Then select System



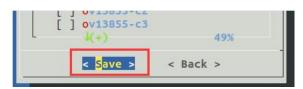
c) Then select Hardware



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

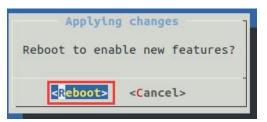
e) Then select<Save>to save



f) Then select<Back>



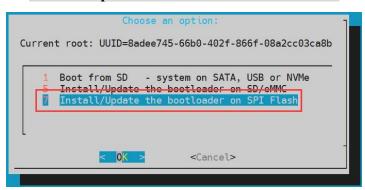
g) Then select < **Reboot**> to restart the system for the configuration to take effect



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

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

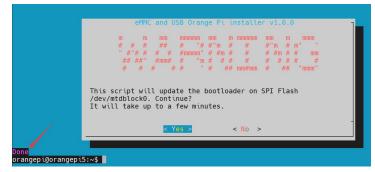
c. Then select 7 Install/Update ther bootloader on SPI Flash



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):



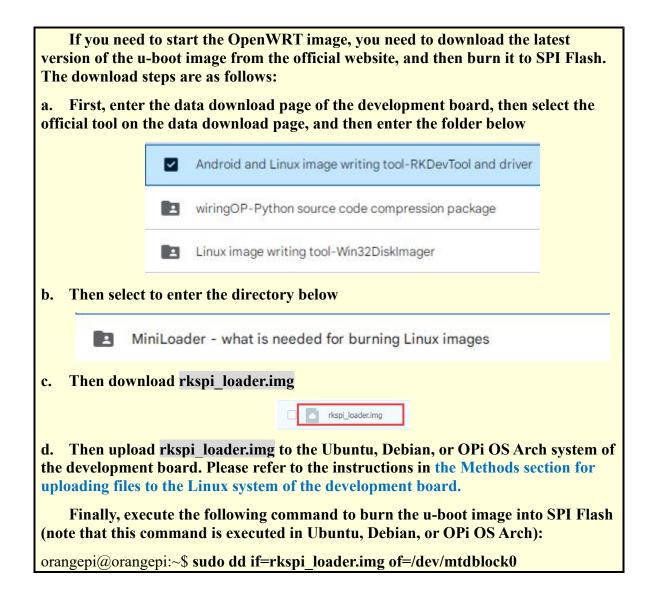
The OPi OS Arch system does not have SPI Flash enabled by default and needs to be manually opened. Please add the following configuration in/boot/extLinux/extlinuxconf and restart the system to recognize SPI Flash

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

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

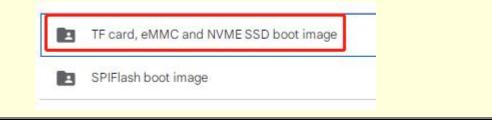
The nand data install script is not available in the OPi OS Arch system. Please use the following command to mirror u-boot to SPI Flash:

[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	<b>5.8G</b>	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	<b>1 36% /boot</b>	
/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:~\$ <b>df</b>	-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	<b>1.9T</b>	<b>4.1G</b>	<b>1.8T</b>	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	<b>1 36% /boot</b>	
/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.

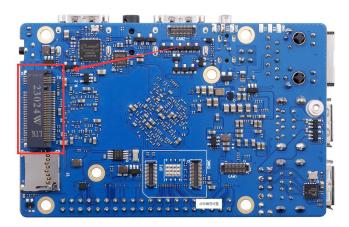
a. The M.2 2230 SSD is as follows



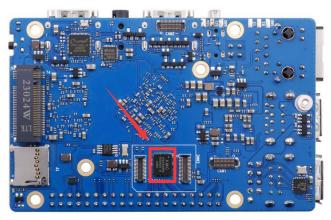
b. The M.2 2242 SSD is as follows



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:

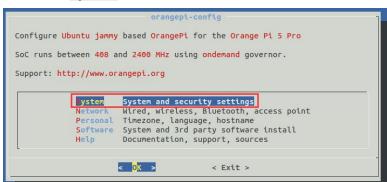


8) The method of burning u-boot into SPI Flash on the development board using balenaEtcher is as follows:

- 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
<b>e</b> —		- 4
Flash from file		Flash!
<ul> <li>Flash from URL</li> <li>Clone drive</li> </ul>		

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)	

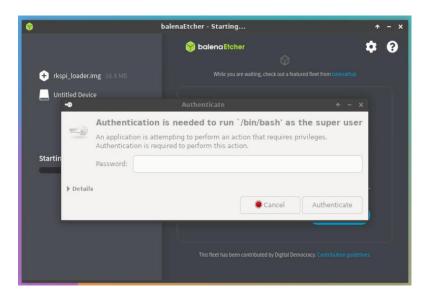
h. Then click Flash



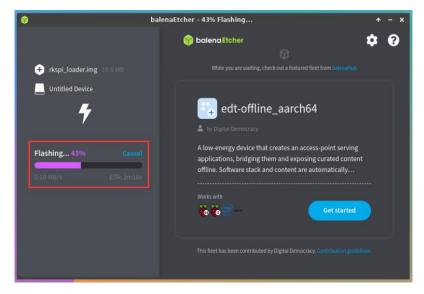
i. Then click Yes, I'm sure

0	balenaEtcher	★ - ×
	😵 balena Etcher	<b>\$ 0</b>
	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	

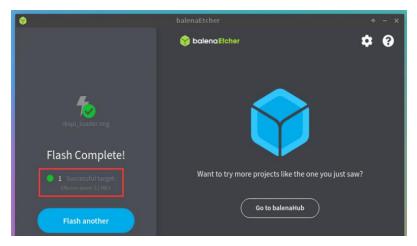
j. Then enter the password **orangepi** for the Linux system on the development board, and you will start burning the u-boot image to SPI Flash



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

<b>9</b>	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

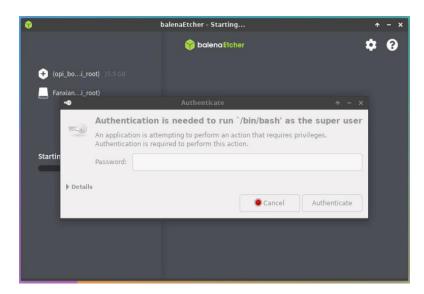
g. Then click Flash



h. Then click Yes, I'm sure

8	balenaEtcher	+ - ×
	🌍 balena Etcher	<b>\$ 0</b>
	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	

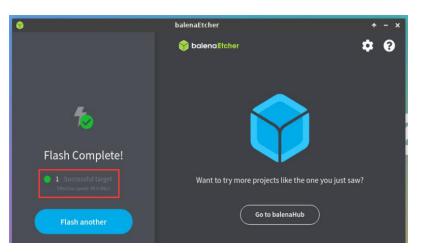
i. Then enter the password orange pi for the Linux system on the development board, and it will start burning the Linux image to the SSD



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

9	balenaEtcher - 13% Flashing	
	🜍 balena Etcher	¢ 0
<ul> <li>↔ (opi_boi_root) 15.9 GB</li> <li>Fanxiani_root)</li> </ul>		
<b>4</b>	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
<ul> <li>♥</li> <li>(opi_boi_root) 15.9.68</li> <li>■ Fanxiani_root)</li> </ul>	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:



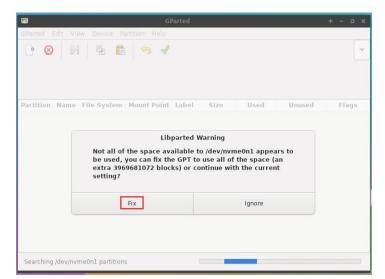
- 1. Then it is necessary to expand the capacity of the rootfs partition in the NVMe SSD, as follows:
  - a) First, open **GParted**. If the system does not have Gparted pre installed, please use the apt command to install it



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

	Au	thenticate	)	<b>*</b> -	×
			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			<b>ب</b> 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			

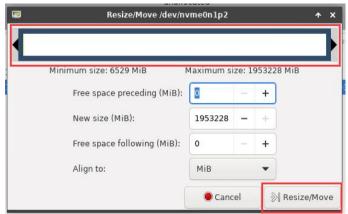
f) Then select the /dev/nvme0n1p2 partition, right-click, and select Resize/Move

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		

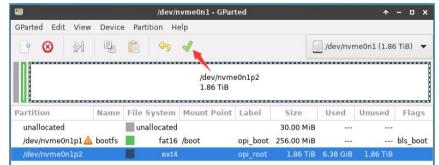
g) Then drag the capacity to its maximum position as shown in the following figure

	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

	/dev/nvme0n1 - GPart	ed	↑ - □ ×
GParted Edit View	Device Partition Help		
🖻 😣 🔊	H 🖹 🥱 🖌	/de	ev/nvme0n1 (1.86 TiB) 🔻
	/dev/nvme 1.86 TiB	:0n1p2	
Partition	Apply operations	to device	Unused Flags
unallocated /dev/nvme0n1p1A	bls boot		
/dev/nvme0n1p2	pending operations?	3 1.86 TiB	
	Editing partitions has the potentia You are advised to backup your d		
	Cancel	🚽 Apply	
≫∥ Grow /dev/nvme0n1	p2 from 14.41 GiB to 1.86 TiB		
1 operation pending			

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

	/dev/nvme0n1 - GParted		↑ - □
GParted Edit View Device Pa	rtition Help		
🕒 😣 🔊 🗄 🖺	(5) <b>d</b>	/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

<b>(</b>		balenaEtcher	+ - ×	
		🌍 balena Etcher	¢ 9	
	<b>•</b> —		<b>7</b>	
	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

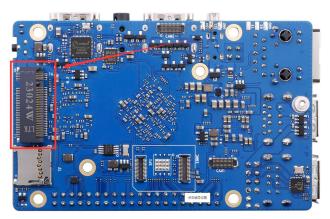
Due to SPI Flash and eMMC reusing the same pins, eMMC cannot be used with SPI Flash attached

## 2.8.1. The method of burning using the dd command

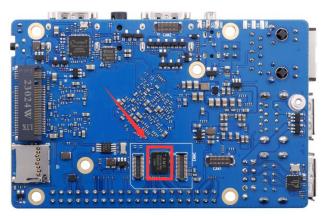
1) First, you need to prepare a SATA SSD solid-state drive



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



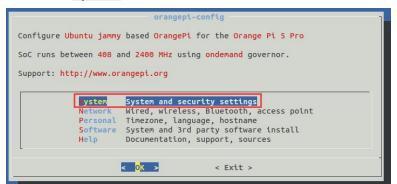
4) Burning the linux image to SPIFlash+SDD needs to be completed with the help of a TF card, so first you need to burn the linux image to the TF card, and then use the TF card to start the development board to enter the linux system. For the method of burning the Linux image to the TF card based on the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

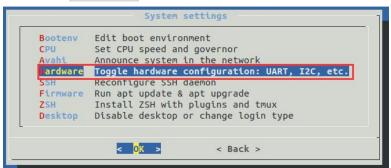
- a. In Linux systems, the default SPI Flash feature is turned off and needs to be manually turned on to use. The detailed steps are as follows:
  - a) First run orangepi-config, **normal users remember to add sudo permission**

orangepi@orangepi:~\$ sudo orangepi-config

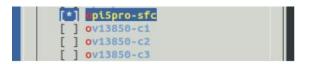
b) Then select **System** 



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

Applyin	g changes
Reboot to enal	ble new features?
< <mark>R</mark> eboot>	<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:

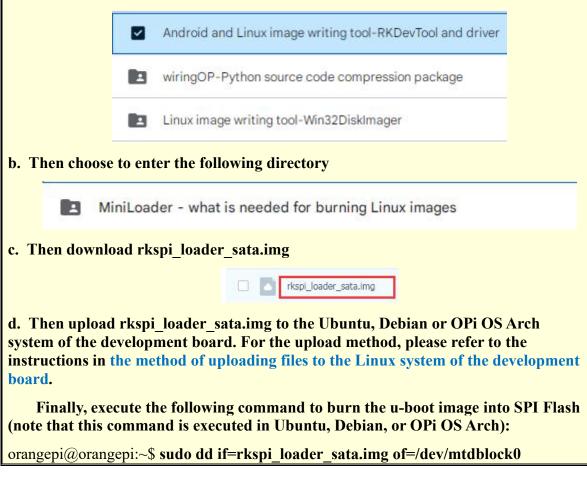
[orangepi@orangepi boot]\$ cd /boot/

[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	<sup>6</sup> ₩r me
	SPIFlash-NVME SSD Image	<sup>6</sup> ₩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 2					
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/sda2	233G	<b>4.3G</b>	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	<b>256M</b>	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.

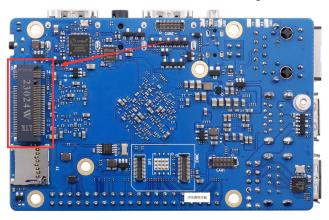
There is no fix\_mmc\_ssd.sh script in OPi OS Arch system.

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

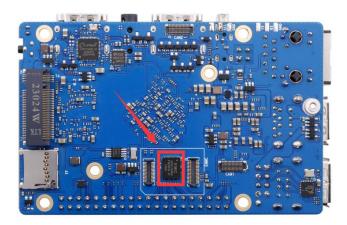
1) First, you need to prepare a SATA SSD solid state drive



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

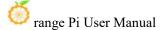


4) Burning the linux image to SPIFlash+SDD needs to be completed with the help of a TF card, so first you need to burn the linux image to the TF card, and then use the TF card to start the development board to enter the linux system. For the method of burning the linux image to the TF card, please refer 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.

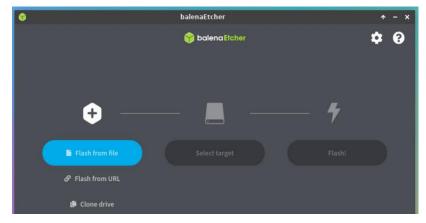
6) The balenaEtcher has been pre-installed in the linux image, and the opening method is as follows:





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:

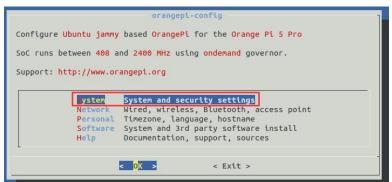


8) The method of burning u-boot into SPI Flash on the development board using balenaEtcher is as follows:

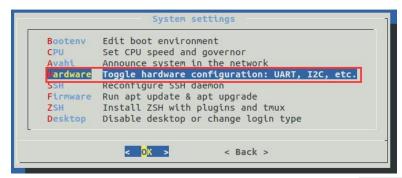
- a. In Linux systems, the default SPI Flash feature is turned off and needs to be manually turned on to use. The detailed steps are as follows:
  - a) First, run orange pi configuration, ordinary users remember to add sudo permissions

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	

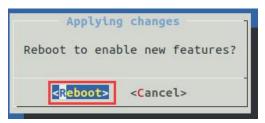
e) Then select **<Save>** to save



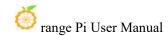
f) Then select **<Back>** 

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

Sancel				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					

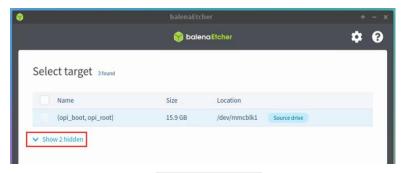
d. The interface after opening **rkspi loader.img** is as follows:



e. Then select Select target



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



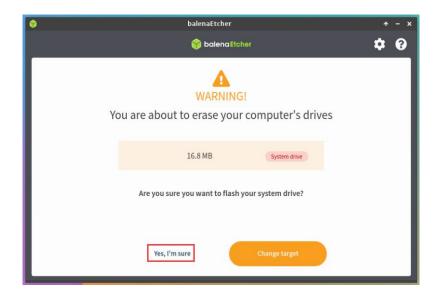
g. Then select the device name /dev/mtdblock0 for SPI Flash and click Select

•		+ - ×			
	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)	

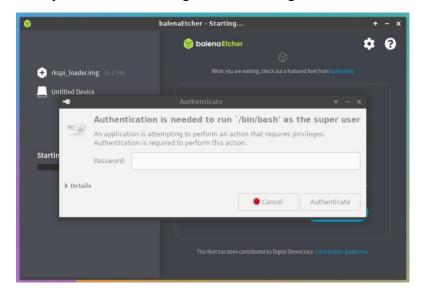
h. Then click Flash



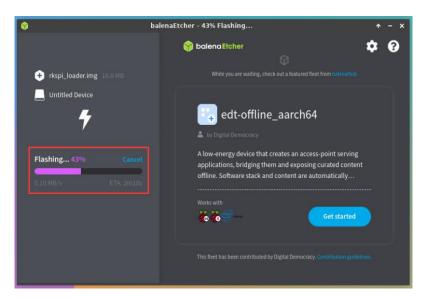
i. Then click Yes, I'm sure



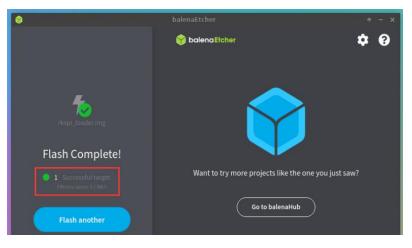
j. Then enter the password orange pi for the Linux system on the development board, and you will start burning the u-boot image to SPI Flash



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

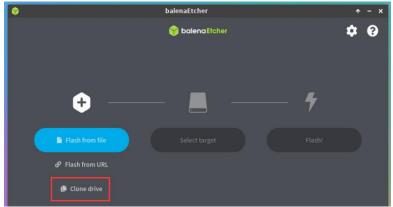


1. The display after burning is completed is as follows:



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	<b>\$</b>
Select source 3 found			
Select Source 3 found			
Name	Size	Location	
📀 (opi_boot, opi_root)	15.9 GB	/dev/mmcblk1 Source drive	
<ul> <li>Show 2 hidden</li> </ul>			

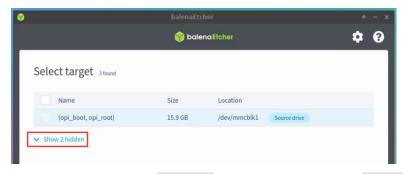
c. The interface after opening the TF card is as follows:

😌 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



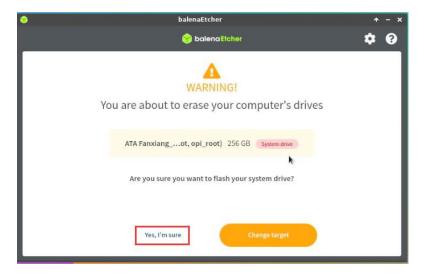
f. Then select the device name /dev/sda for the SSD, and click Select

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	
	<b>A</b>	16.8 MB	/dev/mtdblock0	Too small	
	ATA Fanxiang_S2boot, opi_root)	256 GB	/dev/sda	System drive	
	Car	ncel	Select	t (1)	

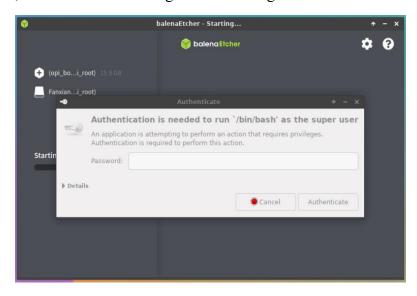
g. Then click Flash



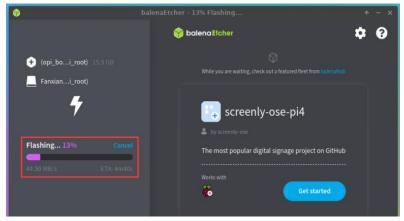
h. Then click Yes, I'm sure

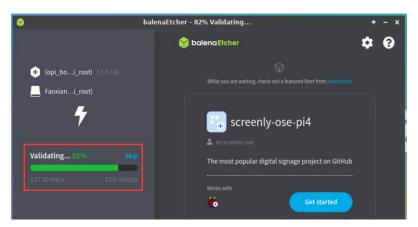


i. Then enter the password **orangepi** for the Linux system on the development board, and it will start burning the Linux image to the SSD

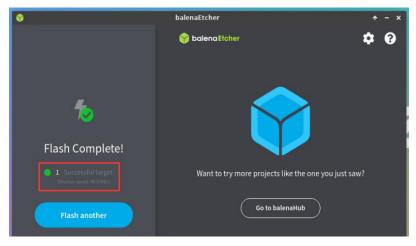


j. The display of the burning process is as follows:





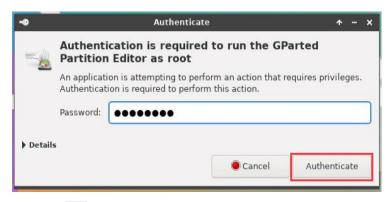
k. The display after burning is completed is as follows:



- 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 		

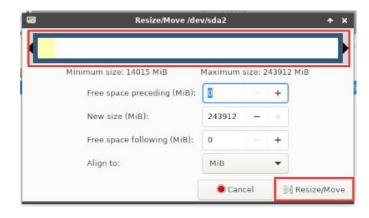
f) Then select the /dev/sda2 partition, then right-click, and then select Resize/Move

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		•				
		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	

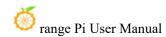
k) Then click Close

	/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	
	) <b>-</b>	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.

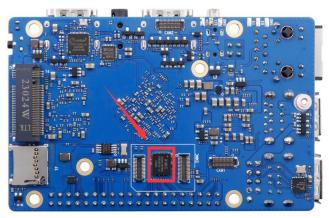
1) First you need to prepare a USB storage device, such as a U disk

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.

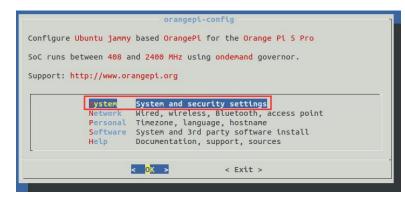
6) After using the TF card to start the Linux system, you can burn the u-boot image into SPI Flash.

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	

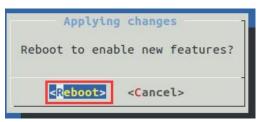
1) Then select<Save> to save



m) Select <Back>



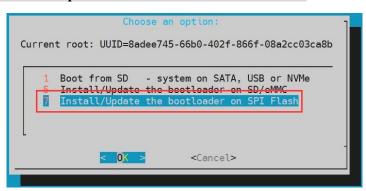
n) Then select **<Reboot>** to restart the system to make the configuration take effect.



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

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

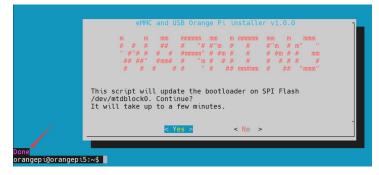
c. Select 7 Install/Update ther bootloader on SPI Flash



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

	m m				m mmmmm	mm r		
	# # #						* m" "	
	" #"# #	# #	#mmmm"	# #m	# #	# #m #	ŧ# mm	
	## ##"	#mm#	# "m	# #	# #	# # #	t # #	
	# #	# #	# "	# :	## mm#mm	# #	11 manager 11	
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:~ <b>\$ df</b>	-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	1 <b>5G</b>	<b>1.6G</b>	<b>13G</b>	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	<b>256M</b>	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

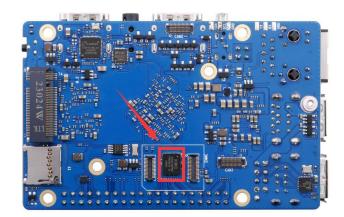
This section describes the method of burning the entire OpenWRT image into the SPI Flash, eliminating the need for an SSD or USB drive. This means that u-boot, kernel, and rootfs are all stored in the SPI Flash.

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

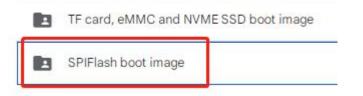


b. Then download all the files below



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

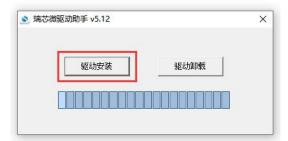
4) Then download the OpenWRT image that can be booted from SPIFlash from the Orange Pi download page. Due to the capacity of SPIFlash, the image is less than 16MB. After opening the download link, you can see the following three types of OpenWRT images. Please select the image in the SPIFlash startup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

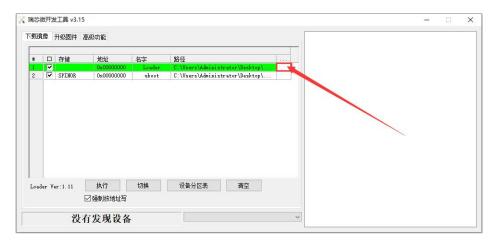
i. Then select the **rk3588\_linux\_spiflash.cfg** configuration file in the **MiniLoader** folder downloaded earlier, and then click Open

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 - 💷 🕐
<ul> <li>此电脑</li> <li>3D 对象</li> <li>3D 对象</li> <li>1k3588_linux_prie.cfg</li> <li>1k3588_linux_spiflash.cfg</li> <li>1k3588_linux_tfcard.cfg</li> <li>1k3588_linux_tfcard.cfg</li> <li>1k3588_linux_tfcard.cfg</li> </ul>		
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\	
$\overline{\mathbf{v}}$	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 - 💷 🤇
<ul> <li>此电脑</li> <li>3D 对象</li> <li>所inux_emmc.cfg</li> <li>水3588_linux_pcie.cfg</li> <li>rk3588_linux_pcie.cfg</li> <li>rk3588_linux_spilash.cfg</li> <li>rk3588_linux_tford.cfg</li> <li>rk3588_linux_tford.cfg</li> <li>rk3588_linux_tford.cfg</li> <li>rk3588_linux_fford.cfg</li> <li>rk3588_linux_tford.cfg</li> <li>rk3588_linux_tford.cfg<!--</th--><th></th></li></ul>	
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		
#		存储	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

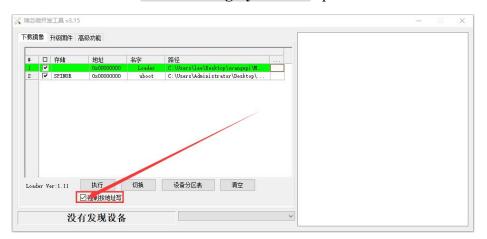
n. Then select the path of the OpenWRT image you want to burn, and then click Open

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 - 🔟 📀
<ul> <li>■ 此电脑</li> <li>③ 3D 对象</li> <li>■ 役须</li> <li>■ 優須</li> <li>■ 資格</li> <li>◆ 下载</li> <li>◆ 百兆</li> <li>■ 桌面</li> <li>● 本地磁盘(C:)</li> </ul>	烧录Linux镜像才需要用到的东西
	All File(*.*)
文件名(N): orangepi	

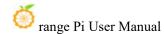
o. Then make sure the **Force writing by address** option is checked.



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	<b>1</b>			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

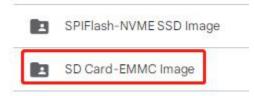
## 2.11.1. How to burn using RKDevTool

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	
	30区z力支	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			

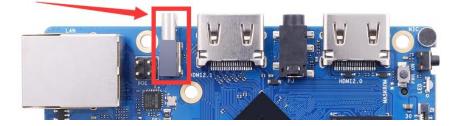
- 8) Then start burning the Android image to the TF card
  - a. First, connect the development board to the Windows computer through a USB2.0 male-to-male data cable. The location of the development board's USB programming port is as shown in the figure below.



- 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 - 🔳 👔
<ul> <li>此电脑</li> <li>3D 对象</li> <li>MiniLoaderAll.bin</li> <li>rk3588_linux_emmc.cfg</li> <li>rk3588_linux_poie.cfg</li> <li>rk3588_linux_poie.cfg</li> <li>rk3588_linux_tfard.cfg</li> <li>rk3588_linux_tfard.cfg&lt;</li></ul>	
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	
<ul> <li>機像 升级固件 高级功能</li> <li>C:\Uzerz\hhl??\Desktop\orangepi\UiniLoader.% 下载</li> <li>Bft: 解包</li> <li>读取Flash团 读取Flash信息 读取Capability 1. FIASH 2. EBBC</li> <li>遗选择 量 值没备 进入Maskroa 切接存储</li> <li>动 4. SD1</li> <li>测试设备 重信设备 进入Maskroa 切接存储</li> <li>SATA</li> <li>导出编像 攝除療区 摄影所有</li> </ul>					
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	获职当前存储	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	<b>获</b> 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.

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送 瑞芯微开发工具 v3.15		-	-	×
下載鏡像「升级固件」高级功能				
<b>固件</b> 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.

<b>镜像</b> 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
		<b>作复磁盘成功</b> 。	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.



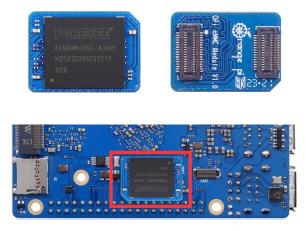
## 2.12. Method of burning Android image into eMMC

## 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:

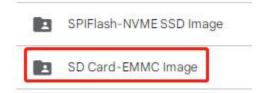


2) You also need to prepare a good quality USB2.0 male-to-male data cable



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.

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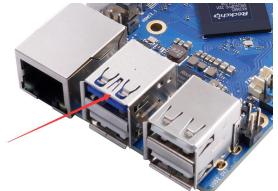
Copyright reserved by Shenzhen Xunlong Software Co., Ltd

	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.

B件 高级功能 I 地址 0x00000000	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 ~	

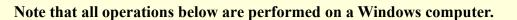
g. Then click the "**Firmware**" button to select the path of the Android image that needs to be burned.



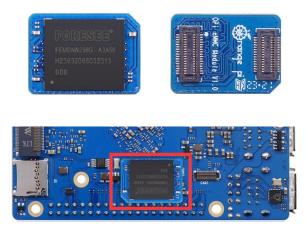
h. Finally, click the "**Upgrade**" button to start burning. The log during the burning process is as shown below. After the burning is completed, the Android system will automatically start.

着芯微开发工具 :載镜像 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.

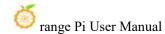
7) Then use decompression software to decompress **SDDiskTool\_v1.72.zip** This software does not need to be installed. Just find **SD\_Firmware\_Tool.exe** in the decompressed folder and open it.

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(可	]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.

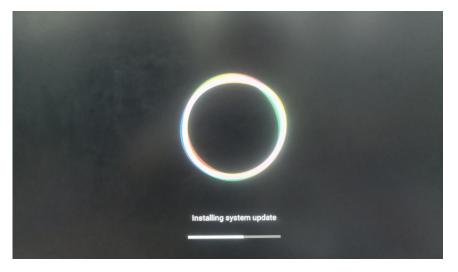
第一步	:选择可移动磁盘设备	SDBoot:2.1
	NORELSYS 1081CS0 USB Device 14.8G	
第二步	选择功能模式	
[	☑ 固件升级	□SD启动
第三步	:选择升级固件	修复
		选择固件
第四步	:选择Demo数据(可选)	
		选择Demo
		_
		开始创建
		-
		恢复磁盘

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.

# 2.13. Method of burning Android image into SPIFlash+NVMe

### SSD

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

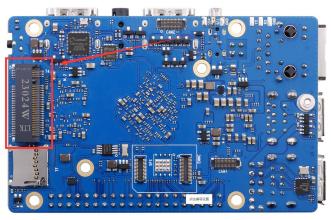
Before starting to burn the image, you must ensure that the development board has been attached with the SPI Flash chip. Because the development board does not have the SPI Flash chip attached when it leaves the factory, you need to purchase and solder it on by yourself. The SPI Flash chip model we recommend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

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

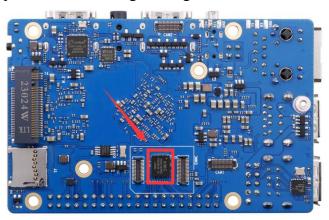
1) First you need to prepare an NVMe SSD solid state drive



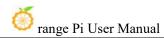
2) Then insert the NVMe SSD into the M.2 PCIe interface of the development board and secure it



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.

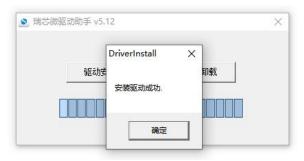
🥯 range Pi User Manual	Copyright reserved	l by Shenzhe	en Xunlong Softwar	e Co., Ltd
名称 个	修改日期	类型	大小	
ADBDriver	2022/12/1 15:07	文件夹		
bin	2022/12/1 15:07	文件夹		
Driver	2022/12/1 15:07	文件夹		
config	2014/6/3 15:38	配置设置	1 KB	
S DriverInstall	2022/2/28 14:11	应用程序	491 KB	
Readme	2018/1/31 17:44	文本文档	1 KB	
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.×37	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	0x0000000         Kernel           0x0000000         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 开玻固件 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.

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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.

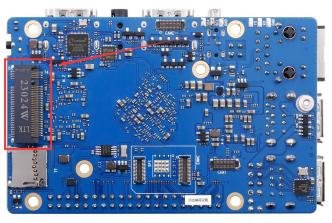
Before starting to burn the image, you must ensure that the development board has been attached with the SPI Flash chip. Because the development board does not have the SPI Flash chip attached when it leaves the factory, you need to purchase and solder it on by yourself. The SPI Flash chip model we recommend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

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

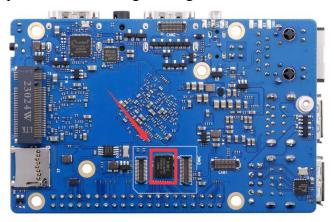
1) First you need to prepare a SATA SSD solid state drive



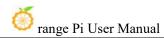
2) Then insert the SSD into the M.2 PCIe interface of the development board and secure it



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.

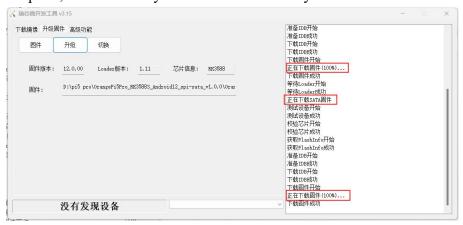
芯微开发工具 v3.15		- 0
續像 开级固件 高级功能		
固件 升级 切换		
固件版本: Loader版本:	芯片信息:	
固件:		

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

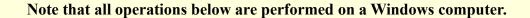
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毒芯微开发工具 v3.15		- 0
載鏡像「升级固件」高級功能		
固件 升级 切换		
固件版本: Loader版本:	芯片信息:	
固件:		

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

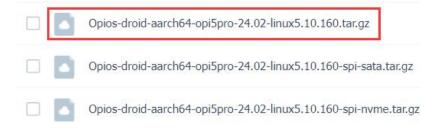


1) First prepare a TF card with 8GB or larger capacity. The transmission speed of the TF card must be class10 or above. It is recommended to use TF cards from SanDisk and other brands.

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
_	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.

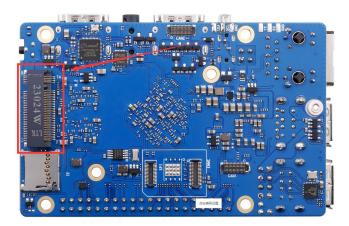
Before starting to burn the image, you must ensure that the development board has been attached with the SPI Flash chip. Because the development board does not have the SPI Flash chip attached when it leaves the factory, you need to purchase and solder it on by yourself. The SPI Flash chip model we recommend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

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

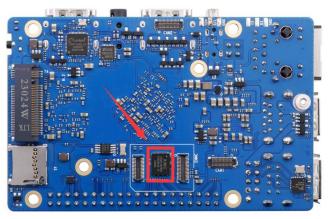
1) First you need to prepare an NVMe SSD solid state drive



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

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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.

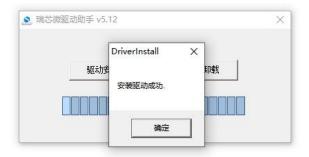
名称	修改日期	类型	大小
ADBDriver	2022/12/1 15:07	文件夹	
📙 bin	2022/12/1 15:07	文件夹	
Driver	2022/12/1 15:07	文件夹	
🔄 config	2014/6/3 15:38	配置设置	1 KB
😫 DriverInstall	2022/2/28 14:11	应用程序	491 KB
Readme	2018/1/31 17:44	文本文档	1 KB
revison	2022/2/28 14:14	文本文档	1 KB

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

a. Click the "Driver Installation" button

- AMULMAKA	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 へ	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.

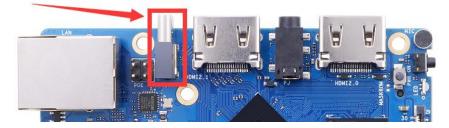


- b. Make sure that the TF card is not inserted into the development board and the power supply is not connected.
- c. Then press and hold the MaskROM button on the development board. The position of the MaskROM button on the development board is as shown in the

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

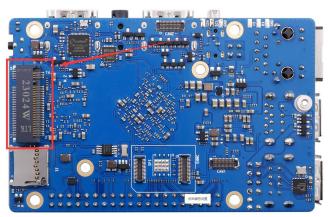


Flash is attached.

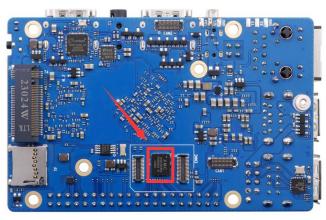
1) First you need to prepare a SATA SSD solid state drive



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.

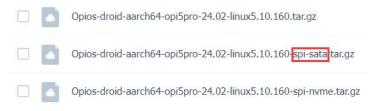


4) You also need to prepare a good quality USB2.0 male-to-male data cable



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.

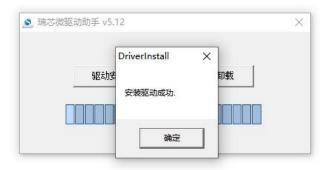
修改日期	类型	大小
2022/12/1 15:07	文件夹	
2022/12/1 15:07	文件夹	
2022/12/1 15:07	文件夹	
2014/6/3 15:38	配置设置	1 KB
2022/2/28 14:11	应用程序	491 KB
2018/1/31 17:44	文本文档	1 KB
2022/2/28 14:14	文本文档	1 KB
	2022/12/1 15:07 2022/12/1 15:07 2022/12/1 15:07 2014/6/3 15:38 2022/2/28 14:11 2018/1/31 17:44	2022/12/1 15:07 文件夹 2022/12/1 15:07 文件夹 2022/12/1 15:07 文件夹 2014/6/3 15:38 配置设置 2022/2/28 14:11 应用程序 2018/1/31 17:44 文本文档

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

a. Click the "Driver Installation" button



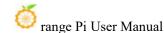
b. After waiting for a period of time, a window will pop up prompting "Driver installation successful", then click the "OK" button.



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	/				
	01	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		- • ×
<b>载镜像「升级固件」高级功能</b>		
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		
	( <u> </u>			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		
				<del>测试设备开始</del> 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		
				<del>测试设备开始</del> 测试设备成功 校验芯片开始 校验芯片成功		
				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		
				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		

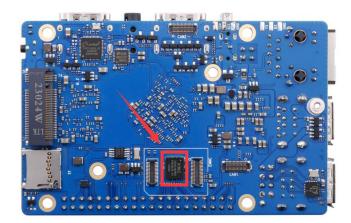
## 2.18. How to clear SPIFlash using RKDevTool

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.

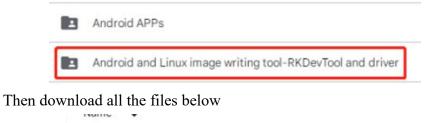


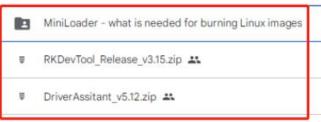
2) First you need to prepare a good quality USB2.0 male-to-male data cable



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

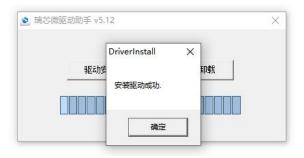
the DriverInstall.exe executable file in the decompressed folder and open it.

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 Xun	long Software Co
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	0x0000000 Karnel 0x00000000 Beot 0x00000000 Recovery 0x0000000 System	0x0000000 Kernel 0x0000000 Boot 0x00000000 Recovery 0x00000000 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 <b>需要用到的东西 ∨ ♂</b> ク 在 MiniLoader-烧录Linux
组织 ▼ 新建文件夹	BB - 🔳 🔮
<ul> <li>● 此电脑</li> <li>● 3D 对象</li> <li>● 水3588 linux_peic.cfg</li> <li>● 水3588 linux_spiflash.cfg</li> <li>● 水5588 linux_tteard.cfg</li> </ul>	
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	<b>1</b>	
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Naskron	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\MiniI	.oader-烷	•••	下载			
固件:					解包			
读取Flash	NID 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	切换在		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	前存储	8. USB 9. SATA 10. PCTE	6		
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	:MASKR	on	~		

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



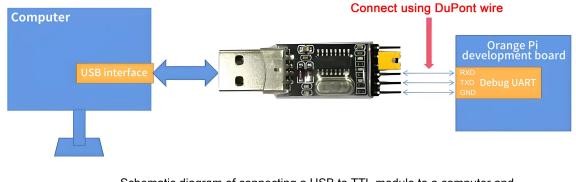
3) The GND, TXD and RXD pins of the USB to TTL module need to be connected to the debugging serial port of the development board through Dupont lines.

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 a USB to TTL module to a computer and 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
<ul> <li>Window</li> <li>Appearance</li> <li>Behaviour</li> <li>Translation</li> <li>Selection</li> <li>Colours</li> </ul>	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
<ul> <li>Window</li> <li>Appearance</li> <li>Behaviour</li> </ul>	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		
<ul> <li>Session</li> </ul>	Specify the destination you want to connect			
Logging	Serial li <u>n</u> e	Speed		
<ul> <li>Terminal</li> </ul>	/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		
<ul> <li>Connection</li> <li>Data</li> <li>Proxy</li> </ul>				
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.

	/de	ev/tty	yUS	B0 - PuT	гтγ		000
R0=0x18							
MR4=0×1							
MR5=0×1							
MR8=0x8							
MR12=0x72 MR14=0x72							
MR14=0x72 MR18=0x0							
MR10-0x0 MR19=0x0							
MR13-0x0 MR24=0x8							
MR25=0x0							
R0=0×18							
MR4=0×1							
MR5=0×1							
MR8=0×8							
MR12=0x72							
MR14=0x72							
MR18=0x0							
MR19=0×0							
MR24=0x8							
MR25=0x0							
channel O training pass!							
channel 1 training pass! change freq to 416MHz 0,1							
Channel O: LPDDR4,416MHz							
Bus Width=32 Col=10 Bank=8 R	ow=15/15	CS=2_T	Die B	us-blidth=	16	Size=2048MB	
Channel 1: LPDDR4,416MHz	00-10/10	00-2 1	DIC D	45-01060-	10 .	0120-2040(ID	
Bus Width=32 Col=10 Bank=8 R	ow=15/15	CS=2_I	Die B	us-Width=	-16 9	Size=2048MB	
256B stride							
P0=0~18							

## 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

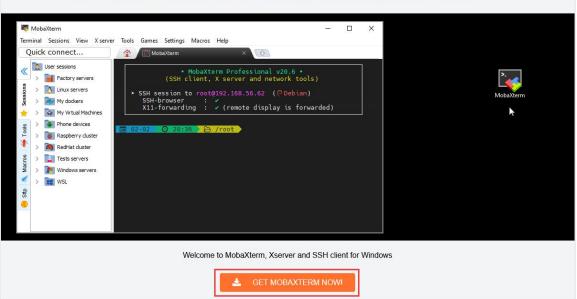
https://mobaxterm.mobatek.net

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.

🔘 <sub>range</sub> 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
NobaXterm_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:

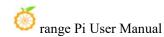
a. Open the settings interface for the session.

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.

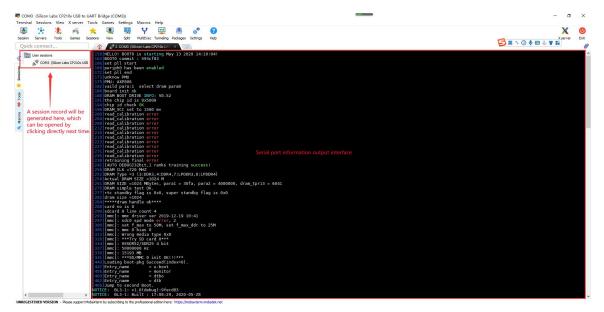
d. Set the baud rate of the serial port to 1500000.

e. Finally, click the "OK" button to complete the settings.



ion	Servers	<b>N</b> Tools	Games	📩 Sessions	View	Split	<b>Y</b> MultiExec	Tunneling	Packages	settings	Help					
- [	connect															
S	Session set	ttings														
	SSH	Telnet	Rsh	Xdmcp	RDP	VNC	<b>S</b> 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		A3 (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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USB2.0x3	OK	ОК	ОК	ОК
USB3.0x1	OK	ОК	ОК	ОК
Gigabit Network	OK	ОК	ОК	ОК
Network port status	OK	ОК	ОК	ОК
light				
WIFI	ОК	ОК	ОК	ОК
Bluetooth	OK	ОК	ОК	ОК
Debug serial port	ОК	OK	ОК	ОК
RTC Chip	ОК	ОК	ОК	ОК
FAN Interface	OK	ОК	ОК	ОК
EMMC Slot	OK	ОК	ОК	ОК
GPIO (40pin)	OK	ОК	ОК	ОК
UART (40pin)	OK	ОК	ОК	ОК
SPI (40pin)	OK	ОК	ОК	ОК
I2C(40pin)	OK	ОК	ОК	ОК
CAN (40pin)	OK	ОК	ОК	ОК
OV13850 Carema	OK	ОК	ОК	ОК
OV13855 Carema	ОК	ОК	ОК	ОК
SPI+NVME Start	ОК	ОК	ОК	ОК
SPI+SATA Start	OK	OK	ОК	ОК
LCD	ОК	ОК	ОК	ОК
MIC	ОК	OK	ОК	ОК
Headphone playback	ОК	ОК	ОК	ОК
Headphone recording	ОК	ОК	ОК	ОК
Tri-color LED light	ОК	OK	ОК	ОК
GPU	ОК	ОК	ОК	ОК
NPU	OK	ОК	ОК	ОК
VPU	OK	ОК	ОК	ОК
On/off button	ОК	ОК	ОК	ОК
watchdog test	OK	ОК	ОК	ОК
Chromium Hard	OK	ОК	ОК	ОК
solution video				

## 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

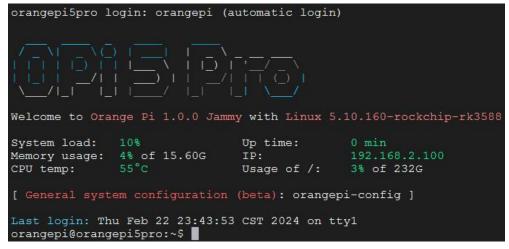
Account	Password
root	orangepi
orangepi	orangepi

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:

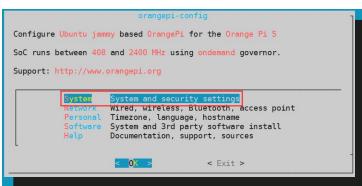
root@orangepi:/sys/class/leds/blue\_led# echo heartbeat > trigger

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.

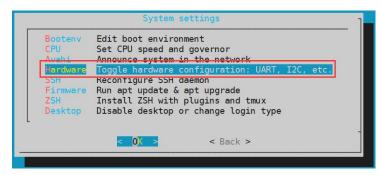
a. First run orangepi-config. Ordinary users remember to add sudo permissions.

orangepi@orangepi:~\$ sudo orangepi-config

b. Select System



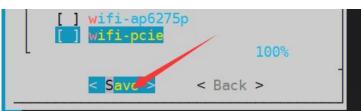
c. Select Hardware



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 brd 00:00:00:00:00:00 inet 127.0.0.1/8 scope host lo valid\_lft forever preferred\_lft forever inet6 ::1/128 scope host valid\_lft forever preferred\_lft 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 inet 10.31.2.249/16 brd 10.31.255.255 scope global dynamic noprefixroute enP4p65s0 valid\_lft 42670sec preferred\_lft 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	10 contract			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:

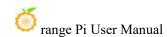
a. If the development board is connected to a network cable, you can remotely log in to the Linux system through ssh.

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.

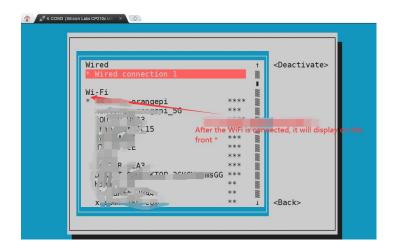
2. Use the Tab key to move the			
Wired	1	<activate></activate>	
* Wired connection	1		
Wi-Fi			
orangepi	5G ***		
	****		
Jrangepi	****		
(' le le ID			
C c ve 11 1. Sele	ct the WiFi yo	want to connect t	o l
S C	*** @		
5 4 10.4	*** *** ** **		
N AR 2	***		
	**		
E V F	**		
(			
1 1 101	** ↓	<back></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 SC WII	= 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 ---

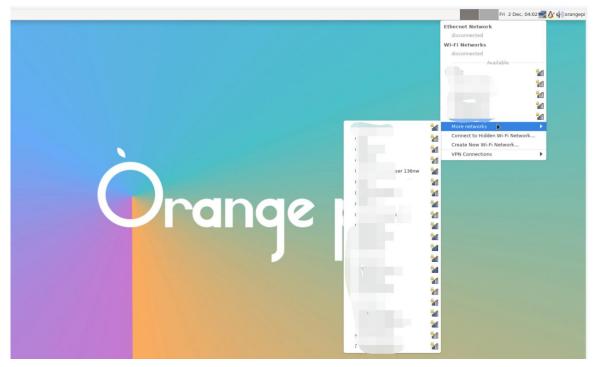
5 packets transmitted, 5 received, 0% packet loss, time 4006ms rtt min/avg/max/mdev = 41.321/44.864/48.834/2.484 ms

## 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

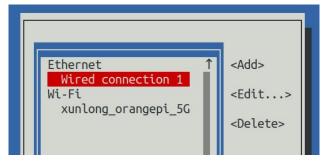
orangepi@orangepi:~\$ sudo nmtui

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>

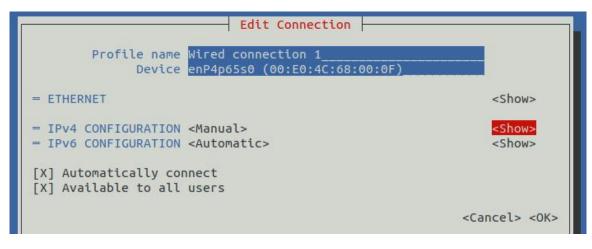
6) Then press Enter, select **Manual**through the up and down arrow keys, and then press Enter to confirm.

	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>

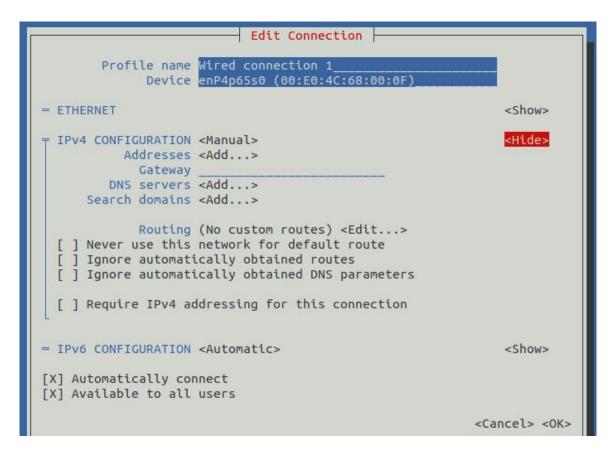
7) The display after selection is as shown below

Edit Connection	
Profile name Wired connection 1 Device enP4p65s0 (00:E0:4C:68:00:0F)	
= ETHERNET	<show></show>
<pre>= IPv4 CONFIGURATION &lt;<u>Manual&gt;</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>** 



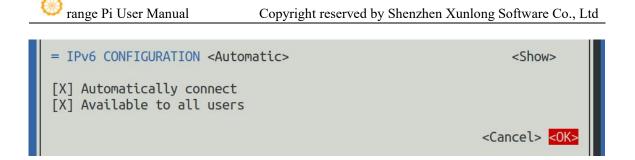
9) Then press Enter. After pressing Enter, the following setting interface will pop up.



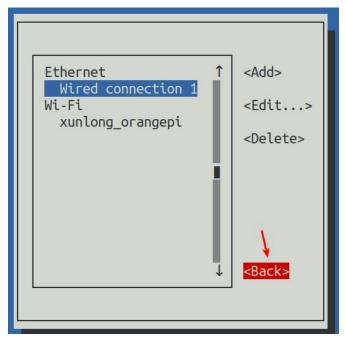
10) Then you can set the IP address (Addresses), gateway (Gateway) and DNS server address as shown in the figure below (there are many other setting options, please explore by yourself), **please set according to your specific needs. The values set in the image below are just an example** 

	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>		

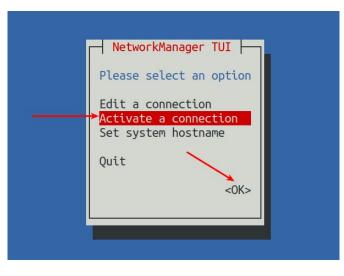
11) After setting, move the cursor to **<OK>** in the lower right corner, and then press Enter to confirm.



12) Then click **Back** to return to the previous level selection interface

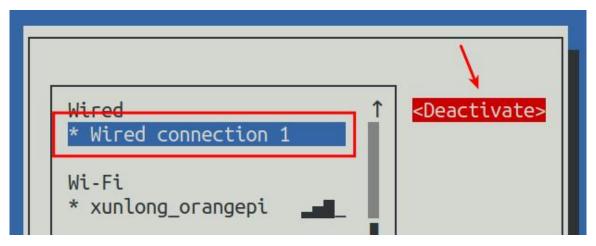


13) Then select **Activate a connection**, then move the cursor to **<OK>**, and finally click Enter



14) Then select the network interface that needs to be set, such as <Deactivate>, then

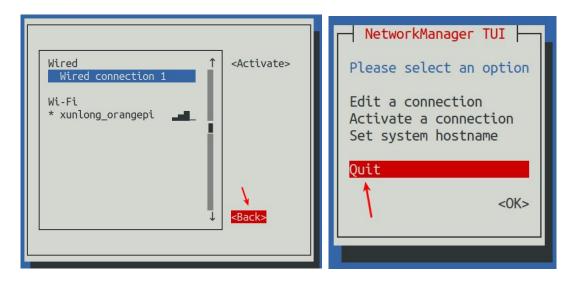
move the cursor to **<Deactivate>**, and then press the Enter key to disable **Wired** connection 1



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 <b>192.168.1.150</b> 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.

🍏 <sub>range</sub> Pi User Manual	Co	pyright reserved	l by Shenzhe	en Xunlong Softv	vare Co., Ltd
		输入网络信息			
	取消	其他网络	加入		
	名称 orar	ngepi			
	<b>•</b> •••				
	安全性		WPA >		
	密码				

#### 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

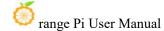
test@test:~\$ ssh root@192.168.1.xxx (Need to be replaced with the IP address of the development board)

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



/ _ \  _ \(_           ] ]         /  \/ _   _ Welcome to Ora	)       )     \    _)  )        /  _  nnge Pi 1.0.0 Jan	i_i \/	.10.160-rockchip-rk3	
System load:	1%	Up time:	8 min Local use	rs: 3
	1% of 15 60C	IP:	192.168.2.100	
Memory usage:	4/0 01 13.000	-1 -		

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

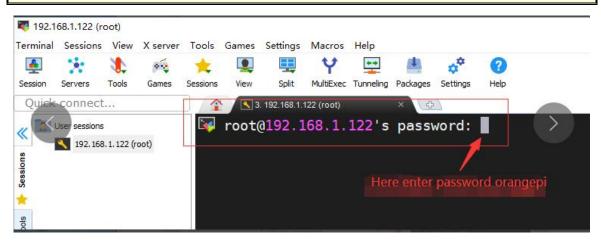
2) You can use MobaXterm to remotely log in to the development board under Windows. First create a new ssh session

- 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**

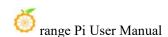
- MobaXterm	٥	×
Terminal Sessions View X server Tools Games Settings Macros Help		
B → ★ ★ ★ ★ B B ↓ ↓ B → A → C → B → C → C → C → C → C → C → C → C	X	O
		10
The server the server the set Nullice Turneling Reduce Setting:       2. Select SSH         1. Open Session       2. Select SSH         Image: 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	

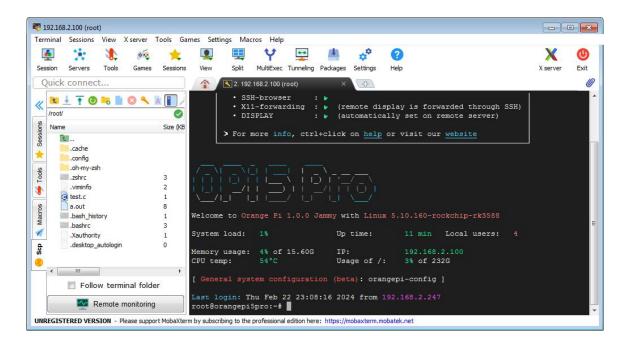
3) You will then be prompted to enter a password. The default passwords for both root and orangepi users are orangepi

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:~\$ p	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	<b>#Please replace the IP address with</b>
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)

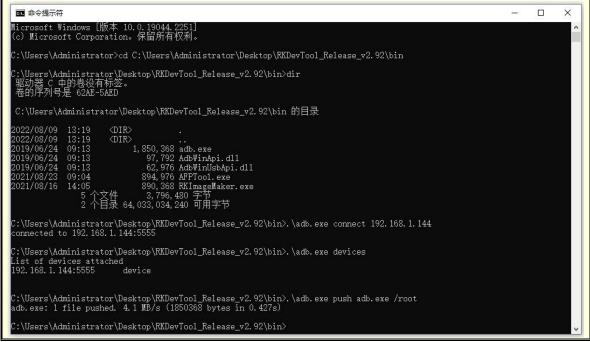
7) The command to restart the development board using adb is as follows

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 Corporatio	- 10.0.19044.2251] on。保留所有权利。 cd C:\Users\Administrator\Dea				- 0
	Dealsten) RKDewTeel Release w?	09\him\dim			
器 C 中的卷没有标签 予列号是 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 <sup>'</sup> 18/09 13:19 ① 18/09 13:19 ① 16/24 09:13 16/24 09:13 16/24 09:13 18/23 09:04 18/16 14:05 5 个文件	ž.	2.92\bin 的目录 1			
器 C 中的卷没有标签 予列号是 62AE-5AED sers\Administrator <sup>1</sup> 18/09 13:19 ① 18/09 13:19 ① 16/24 09:13 16/24 09:13 18/23 09:04 18/23 09:04 18/26 14:05 5 个文件 2 个目录	2. \Desktop\RKDevToo1_Release_v' IR> 1,850,363 adb.exe 97,792 AdbWinApi.dl1 62,976 AdbWinUsbApi.dl1 894,976 AdbWinUsbApi.dl1 894,976 AFPToo1.exe 890,363 RKImageMaker.exe 3,796,480 字节 63,988,027,392 可用字节 Desktop\RKDevToo1_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

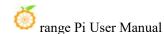
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			FileZ	illa	- • >
文件(F) 编辑(E) 查考	看(V) 传输(T) 服务器(S)	书签(B) 帮助(H)			
# • RT		) 🗽 🔍 🏛 🔍 🦉	<b>8</b>		
E机(H):	用户名(U):	密码(W):	端口	(P): 快速连接(Q) ▼	
▶地站点:				远程站点:	~
<pre>&gt; bin &gt; boot cdrom</pre>					
文件名 へ	文件大小 文件类型	最近修改			
lib32	目录	2022年11月06…			
lib64	目录	2022年08月09…			
libx32	目录	2022年11月06…		文件名 <b>へ</b> 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。			_	<b>未</b> 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…		〉 <b>root</b>	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…		〉 <b>root</b> // 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…		〉 <b>root</b>  .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08月09… 2022年1月06… 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	j(T) 服务器(S) 书签(B)	帮助(H)							
# - • • •	O 18 O 🗽	5 E Q 🧕	*						
主机(H): tp://192.168.31.11 月	自户名(U): root 8	密码(w): ••••••	端口	](P): 快速	连接(Q) ▼				
<ul> <li>初出"/home"的目录成功</li> <li>(态: 读取"/home/orangepi"的)</li> <li>(芯: Listing directory /home/o</li> <li>(芯: 列出"/home/orangepi"的)</li> </ul>	rangepi								
本地站点: /home/test/Download	ds/test/		~	远程站点: /home/ora	ingepi				~
<ul> <li>test</li> <li>Music</li> <li>Pictures</li> <li>Public</li> <li>Templates</li> <li>Videos</li> <li>VirtualBox VMs</li> </ul>				<ul> <li>2 boot</li> <li>2 dev</li> <li>2 etc</li> <li>bome</li> <li>orangepi</li> <li>2 .cache</li> <li>3 .cionam</li> </ul>	n				
● bin 文件名 へ 文件大	小文件类型 最近	冬辺	-	文件名 へ	文件大小 文件类型	最近修改 权限	所有	5/组	
nomachine_8.2.3_3		≢12月03···· 〕		<ul> <li>.bashrc</li> <li>.profile</li> </ul>	3.6 KB 文件 807 B 文件	2022年12月··· -rw-rr 2022年12月··· -rw-rr	orang orang	epi epi	
L	添加文件到队列(A)			.viminfo	3.5 KB 文件 20 B 文件	2022年12月···· -rw 2022年12月···· -rw-rw-r	orang	-	
	打开(O)			.xsession-errors	7.6 KB 文件	2022年12月····-rw	orang		
					7.7 KB old-文件	2022年12月··· -rw	orang		
先择了1个文件。大小总共:0B	编辑( <u>E</u> )			<ul> <li>.zshrc</li> <li>13 个文件 和 16 个日录</li> </ul>	4.0 KB 文件 大小学计:62 CB	2022年12月rw-rw-r-	orang	ері	•
服务器/本地文件 方[	创建目录( <u>C</u> ) 创建目录并进入( <u>Y</u> )	大小 优先级	状态						
	刷新(E)								
	删除(D)								
	重命名(R)								
<b>列队的文件</b> 传输失败 成功的(	专输								
	× 100					🔒 🎯 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

**E**FileZilla Home FileZill Scree Down Docum FileZil FileZil Down FileZil Down Comm Forur FileZil Down Comm Fau Supp Conta Licen Prive Trade Devel Sour Nigh Nigh Nigh Trans Conta Licen Fau Sour Nigh Conta Licen Fau Conta Licen Fau Supp Conta Licen Fau Supp Conta Licen Fau Supp Conta Licen FileZill Supp Conta Licen Fau Supp F FileZilla<sup>®</sup>Pro 👩 🗳 🖉 🖉 🖉

	(CAbit vOC)			
ownload FileZilla Client for Windows e latest stable version of FileZilla Client is 3.62.2	(04010 200)			
ease select the file appropriate for your platform below.				
♀ Windows (64bit x86) 🕰				
Download FileZilla Client	下载			
This Installer may include bundled offers. Check below for more opti-	ons.			
The 64bit versions of Windows 8.1, 10 and 11 are supported.				
More download options				
Other platforms: 🍇 X 🛆 🛆 Not what you are looking for?				
Show additional download options				
Please select	vour ed	ition of Fil	e7illa Clie	ent
i lease select		FileZilla		FileZilla Pro
	FileZilla	with manual	FileZilla Pro	+ CLI
Standard FTP	Yes	Yes	Yes	Yes
FTP over TLS	Yes	Yes	Yes	Yes
FTP over TLS SFTP	Yes Yes	Yes	Yes Yes	Yes Yes
SFTP	Yes	Yes	Yes	Yes
SFTP Comprehensive PDF manual	Yes -	Yes	Yes	Yes
SFTP Comprehensive PDF manual Amazon S3	Yes -	Yes	Yes Yes Yes	Yes Yes Yes
SFTP Comprehensive PDF manual Amazon S3 Backblaze B2	Yes -	Yes	Yes Yes Yes Yes	Yes Yes Yes Yes
SFTP Comprehensive PDF manual Amazon S3 Backblaze B2 Dropbox	Yes -	Yes	Yes Yes Yes Yes Yes	Yes Yes Yes Yes Yes
SFTP Comprehensive PDF manual Amazon S3 Backblaze B2 Dropbox Microsoft OneDrive	Yes -	Yes	Yes Yes Yes Yes Yes Yes	Yes Yes Yes Yes Yes Yes
SFTP Comprehensive PDF manual Amazon S3 Backblaze B2 Dropbox Microsoft OneDrive Google Drive	Yes -	Yes	Yes Yes Yes Yes Yes Yes Yes	Yes Yes Yes Yes Yes Yes Yes
SFTP Comprehensive PDF manual Amazon S3 Backblaze B2 Dropbox Microsoft OneDrive Google Drive Google Cloud Storage	Yes -	Yes	Yes Yes Yes Yes Yes Yes Yes Yes Yes	Yes Yes Yes Yes Yes Yes Yes Yes Yes
SFTP Comprehensive PDF manual Amazon S3 Backblaze B2 Dropbox Microsoft OneDrive Google Drive Google Drive Google Cloud Storage Microsoft Azure Blob + File Storage WebDAV	Yes -	Yes	Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes	Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes
SFTP Comprehensive PDF manual Amazon S3 Backblaze B2 Dropbox Microsoft OneDrive Google Drive Google Cloud Storage Microsoft Azure Blob + File Storage WebDAV OpenStack Swift	Yes -	Yes	Yes Yes Yes Yes Yes Yes Yes Yes Yes	Yes Yes Yes Yes Yes Yes Yes Yes Yes
SFTP Comprehensive PDF manual Amazon S3 Backblaze B2 Dropbox Microsoft OneDrive Google Drive Google Cloud Storage Microsoft Azure Blob + File Storage Microsoft Azure Blob + File Storage OpenStack Swift Box	Yes -	Yes	Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes	Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes
SFTP Comprehensive PDF manual Amazon S3 Backblaze B2 Dropbox Microsoft OneDrive Google Drive Google Drive Google Cloud Storage Microsoft Azure Blob + File Storage WebDAV OpenStack Swift	Yes -	Yes	Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes	Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes
SFTP Comprehensive PDF manual Amazon S3 Backblaze B2 Dropbox Microsoft OneDrive Google Cloud Storage Microsoft Azure Blob + File Storage WebDAV OpenStack Swift Box Site Manager synchronization	Yes -	Yes	Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes	Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes

2) The downloaded installation package is as shown below, then double-click to install it directly

FileZilla Server 1.5.1 win64-setup.exe

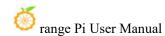
During the installation process, please select **Decline** on the following installation interface, and then select Next>



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 <del>实</del> 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 <del>实</del> 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 交体失 交体失 交体夹 交体夹 交体夹 交体夹 交体夹 交体夹	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)		
# • <b>• • • • •</b> • • •	🕵 🗐 🎟 🖉 🤗 🧄		
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! 🕌	青年记您的密码。	
	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

orange Pi User Manual

(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:	-		<b>^</b>	é- <mark>_</mark> , root						
文件类     2022/11/11 1482, 文件类     2022/12/3 18.55, 2022/12/3 18.55,     config     文件夹     2022/12/3 4,     drwxr-xr-x     root root       文件类     2022/12/3 18.55,     coh-my-sch     文件夹     2022/12/3 16,     drwxr-xr-x     root root       文件夹     2022/12/3 18.55,     coh-my-sch     文件夹     2022/12/3 16,     drwxr-xr-x     root root       文件夹     2022/12/3 16,     drwxr-xr-x     root root     root root       文件夹     2022/12/3 1957,     bash, history     79     BASH_HIS     2022/12/3 18,     rww-r-re-     root root       文件夹     2022/12/3 1957,     bash, history     79     BASH_HIS     2022/12/3 4,     rww-r-re-     root root       文件夹     2022/12/3 1957,     bash, history     73     BASH_HIS     2022/12/3 4,     rww-r-re-     root root       文件夹     2022/12/3 195,     cot     j, info     1.375     VIMINFO     2022/12/3 17,     root root       文件夹     2022/12/3 18.55,     2022/12/3 18.55,     j, info     1.375     VIMINFO     2022/12/3 18, rwwre-     root root       文件夹     2022/11/16 10.3,     2022/11/16 10.3,     j, zhrc     3.97     ZSH     2022/12/3 18, rwwre-     root root       文件夹     2022/11/16	 名	文件大小 文件类型	2022/12/3 18:57:		<u> </u>			2	Lacologica		bard
文件来     2022/12/3 18:55     文件来     2022/12/3 18:55     イマレーマン     イワレーマン       マレーマン     マン     マン     マン     マン     マン     マン     マン     マン     イワン     イワン     イワン     イワン     <			2022/12/3 18:57:								
文件表         2022/12/3 0:17:04					.cache		文件夹	2022/12/3 16	drwx	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

orange Pi User Manual

		密码(W): ••••••								
态: Connected to 192.168.3	1.11									
态: 读取目录列表										
态: Listing directory /root										
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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

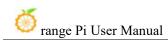
- 1) First you need to prepare the following accessories
  - a. HDMI to VGA converter



b. A VGA Cable



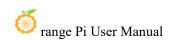
- c. A monitor or TV that supports VGA interface
- 2) HDMI to VGA display test is as follows

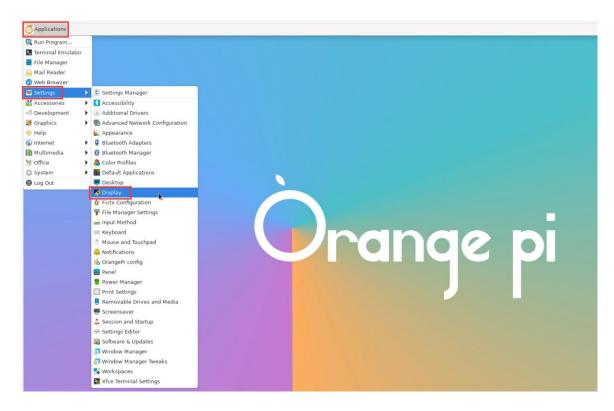




When using HDMI to VGA display, the development board and the Linux system of the development board do not need to make any settings. You only need the HDMI interface of the development board to display normally. So if there is a problem with the test, please check whether there is a problem with the HDMI to VGA converter, VGA cable and monitor.

- 3. 10. 3. HDMI resolution setting method
- 1) First open **Display** in **Settings**

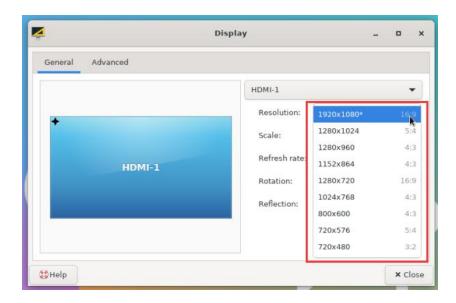




2) Then you can see the current resolution of the system

	HDMI-1		
<b>*</b>	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

of Applications 🛃 Display	Confirmation		E Fri	2 Dec, 01:13	<b>∆</b> r ∰)orangepi
17 MB					
403 M					
		Display			- • ×
		General Advanced			
			HDMI-1		Ŧ
		•	Resolution:	1280x1024	5:4 💌
			Scale:	Ix	-
		Confirmation + -	Refresh rate:	60.0 Hz	*
	Would you like to	o keep this configuration?	lotation:	None	*
		tion will be restored in 1 seconds if you do not reply to this question	teflection:	None	*
	Ke	ep this configuration Restore the previous configuration			✓ Apply
		1 Help			× Close

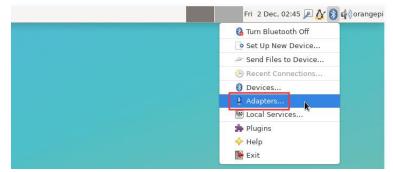
### 3.11. How to use Bluetooth

#### 3. 11. 1. Testing method of desktop version image

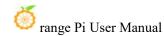
1) Click the Bluetooth icon in the upper right corner of the desktop



2) Then select the adapter



3) If prompted with the following interface, please select Yes

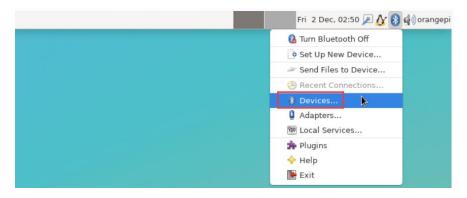




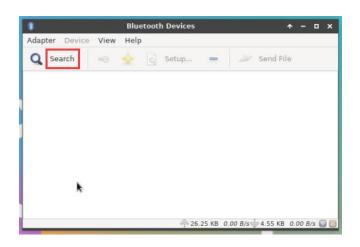
4) Then set the **Visibility Setting** to **Always visible** in the Bluetooth adapter settings interface, and then turn it off



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	

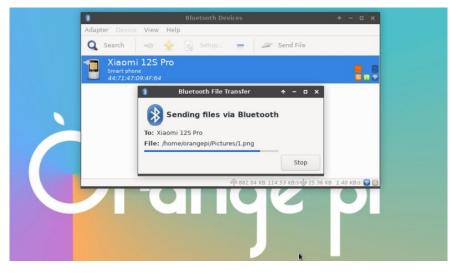
7) When pairing, a pairing confirmation box will pop up in the upper right corner of the desktop. Just select **Confirm** to confirm. At this time, you also need to confirm on the mobile phone



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		oth Devices		<b>+</b> -	u x
Adapter	Device View Help				
Q Sea	irch 🛛 🥪 🍖 :	Setup 💻	🥟 Send File		
X 📼	iaomi 12S Pro		,		
Sn Sn	nart phone				
- 4	1:71:47:09:4F:64	Connect			
		Connec	t To:		
		🖉 Network	Access Point		
		💡 Info			
		Send not	te		
		😼 Send a F	ile 🖒		
		Pair			
		🔶 Trust			
		Setup			
		Rename	device	2 KB 0.00 B/s	
		8 Remove	h		

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@ora	orangepi@orangepi:~\$ cat /proc/partitions   grep "sd*"		
major minor	#blo	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	epi:~\$ 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	Wield constants

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 <b>hciconfig</b> command				
orangep	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	$\sigma ent \sim s ismon$
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

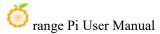
58.636740] Bluetooth: hci0: RTL: loading rtl\_bt/rtl8821c\_fw.bin

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

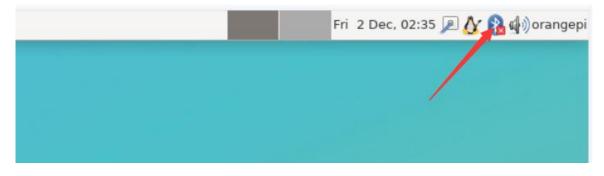
5) Then you can see the device node of rtl8821cu wifi through the **sudo ifconfig** command. For wifi connection and test methods, please refer to the **WIFI connection test** section, which will not be repeated here

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

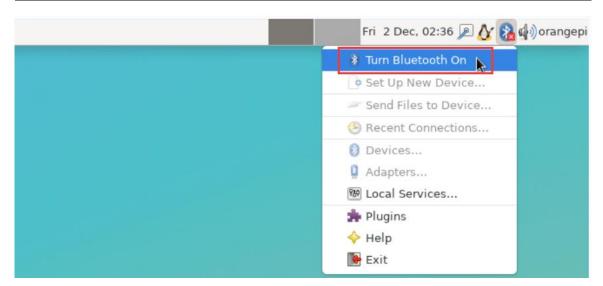
orange	orangepi@orangepi:~\$ sudo apt-get update && sudo apt-get install -y bluez									
orange	orangepi@orangepi:~\$ hciconfig									
hci0:	Type: Primary Bus: USB									
	BD Address: 00:13:EF:F4:58:AE ACL MTU: 820:8 SCO MTU: 255:16									
	DOWN									
	RX bytes:1252 acl:0 sco:0 events:125 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

/

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

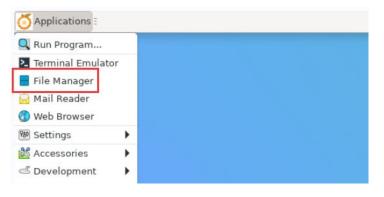
orangepi@orangepi:~\$ scp image.jpg test@192.168.1.55:/home/test (Modify the IP address and path according to the actual situation)

d. In the desktop version of Linux system, the captured pictures can be viewed directly through the HDMI display

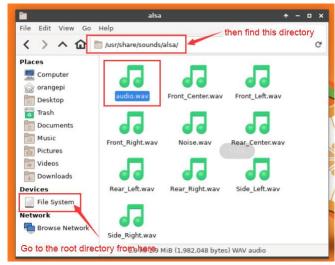
# 3.13. Audio test

## 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)

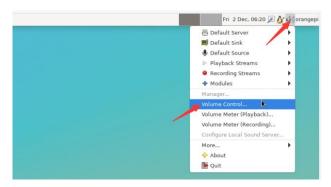


3) Then select the audio.wav file, right-click and select open with vlc to start playing

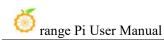
1	alsa	+ - <b>u</b> >
File Edit View Go	Help	
< > ^ 企	👕 /usr/share/sounds/alsa/	c
Places Computer orangepi Desktop	audio 2 Open With "VLC media pla	
Trash	Open With	•
Documents	Send To	> a
Music	Front Rigi	way
Pictures	P Copy	
Videos	Paste	
Downloads	🔵 🌗 📅 Move to Trash	
Devices	Rear_Cent Rear_Cent	ht.wav
File System 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 (	audio,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	d dd	99							
Desktop audi	o.wav Front_Center.wav	<pre>/ Front_Left.wav</pre>				Show:	Applications	*	
Trash					-		-		
Documents									
Front_R	light.wav mute.wav	Noise.wav							
		_							
Videos									
	9 99								
	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							

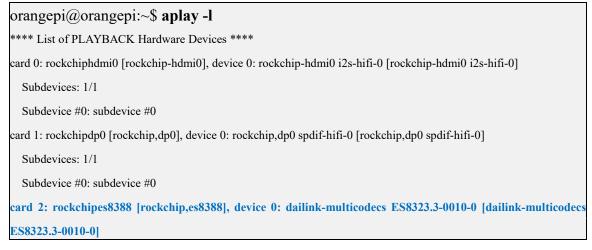
3. 13. 2. How to use commands to play audio

# 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

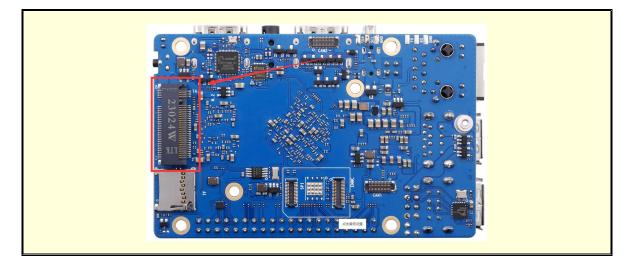
Start recording: /tmp/test.wav

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

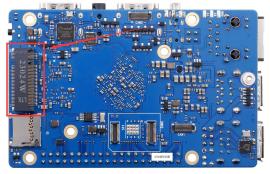
The m.2 interface shown in the figure below can use either nvme ssd or sata ssd. Since the pcie2.0 controller and the sata controller are optional, only one of the configurations can be opened at the same time. The Linux image released by Orange Pi opens the pcie configuration by default, so it can only 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
  - 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/

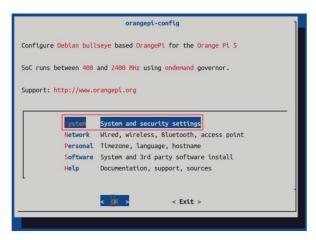
orangepi@orangepi:~\$ sudo dd if=u-boot-sata.itb of=\$(findmnt -n -o SOURCE / | sed 's/..\$//') seek=16384

orangepi@orangepi:~\$ sudo sync

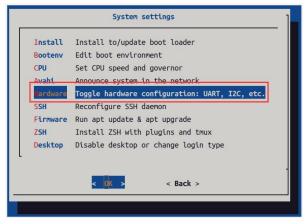
#### 5) Then run orangepi-config. Ordinary users remember to add sudo permissions

orangepi@orangepi:~\$ sudo orangepi-config

6) Then Choose System



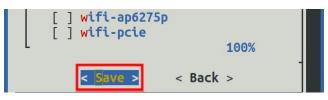
7) Then Choose Hardware



8) Then use the keyboard arrow keys to locate **ssd-sata2**, and then use the **space** to select it



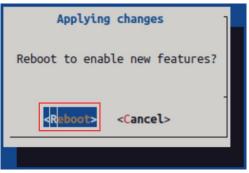
9) Then select **<Save>** to save



10) Then Choose <Back>

L	įį	wifi-pcie	100%
-		< 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

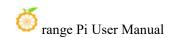
orangepi@orangepi:~\$ cat /boot/orangepiEnv.txt | grep ssd overlays=ssd-sata2 12) If everything is normal, use the **sudo fdisk -l** command after the system restarts to see the sata ssd information

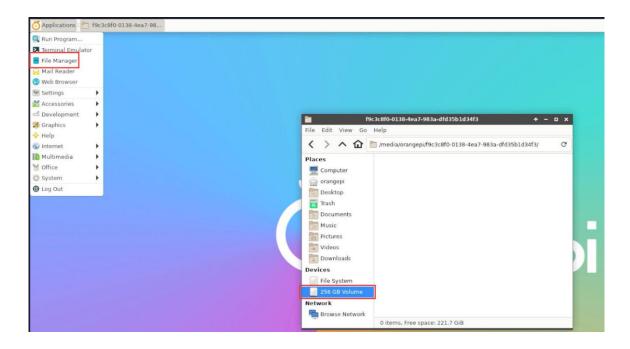
orangepi@orangepi:~\$ sudo fdisk -l
Disk /dev/sda: 238.47 GiB, 256060514304 bytes, 500118192 sectors
Disk model: Fanxiang S201 25
Units: sectors of $1 * 512 = 512$ bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disklabel type: gpt
Disk identifier: 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	<b>28K</b>	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	<b>GPIO序号</b>	引脚序号	引脚序号	<b>GPIO序号</b>	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_MISO_M2
	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	<b>GPIO序号</b>	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		1
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		

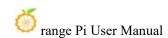
2) First set the GPIO port to output mode, and the third parameter needs to be the serial number of the wPi corresponding to the input pin

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	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

angept(	dorange ++	рі5рго:~\$ g	pio reac		PI5 P	10 +-	+		+	+	+
GPIO	wPi	Name	Mode	IVI	Physica				Name	wPi	GPIO
	++	3.3V			1    ;		+		5V	+ 	
59	0	SDA.1	IN	11	3    4	4 I	Í		5V		
58	1	SCL.1	IN	11	5    (	5	Í		GND		
47	2	PWM13	OUT	11	7    8	3	1	ALT10	TXD.2	3	13
	1	GND		i Ti	9    :	0	1	ALT10	RXD.2	4	14
138	5	CAN1_RX	IN	11	11    :	2	1	IN	GPI01_A7	6	39
139	i 7 i	CAN1 TX	IN	11	13    :	4	i		GND	i i	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	Ť.	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	<b>GPI0序号</b>	引脚序号	引脚序号	<b>GPI0序号</b>	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_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_M1		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_M2	UART7_RX_H2	
			GND		25	26	45	GPI01_B5	SPI0_CS1_M2	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	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_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 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	

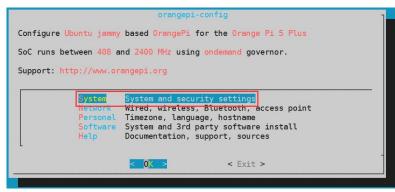
3) In Linux systems, the SPI in 40 pin is turned off by default and needs to be turned on manually to use it. Detailed steps are as follows:

🍈 range Pi User Manual

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

orangepi@orangepi:~\$ sudo orangepi-config

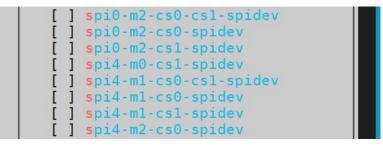
b. Then Select System



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 >

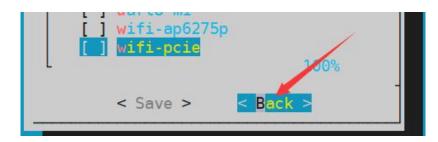
d. Then use the keyboard's arrow keys to locate the position shown in the picture below, and then use the **space** to select the SPI configuration you want to open



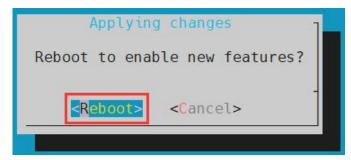
e. Then Select <**Save>** to save



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	<b>GPI0序号</b>	引脚序号	引脚序号	<b>GPI0序号</b>	GPIO	复用功能	复用功能	复用功能
			3.37		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	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	GPI01_A7	PWM3_IR_M3 (fd8b0030)		
	PWM15_IR_M1 (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_M1		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	GPIO1_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_H2	
			GND		25	26	45	GPI01_B5	SPI0_CS1_112	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	1	GND			
			GPI01_A6	38	31	32	62	GPI01_D6	PWH14_H2 (febf0020)	12C8_SCL_112	
	12C8_SDA_M2	PWM15_IR_M3 (febf0030)	GPIO1_D7	63	33	34		GND			
		12C5_SDA_112	GPIO4_A7	135	35	36	131	GPI04_A3	UARTO_TX_H2		
	UART3_RX_N2	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 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 jammy 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 &gt;</mark> < Exit >					

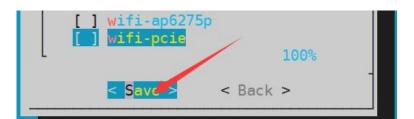
c. Then Selct Hardware

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 >

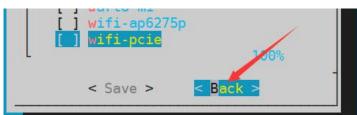
d. Then use the keyboard's arrow keys to locate the position shown in the picture below, and then use the space to select the I2C configuration you want to open

[ ] i2c1-m2	
[ ] <b>i</b> 2c1-m4	
[ ] i2c2-m0	
[ ] i2c2-m4	
[ ] i2c3-m0	
[ ] i2c4-m3	
[ ] i2c5-m2	
[ ] i2c5-m3	
[ ] <b>i</b> 2c6-m4	
[ ] <b>i</b> 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
90:																
10:						12.2			$\sim 1$							
20:												7.7				
30:																
40:																
50:					)				<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	<b>GPIO序号</b>	引脚序号	引脚序号	<b>GPI0序号</b>	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_M2	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_12	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:

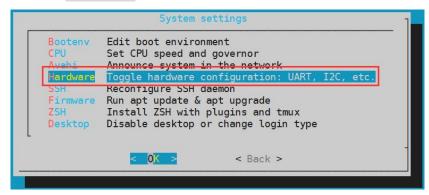
a. First run orangepi-config. Ordinary users remember to add sudo permissions

#### 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	<b>GPI0序号</b>	引脚序号	引脚序号	<b>GPI0序号</b>	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	

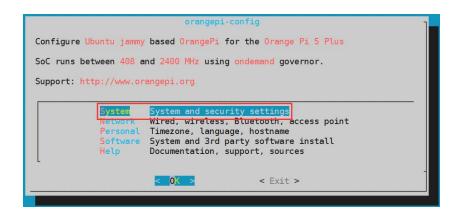
2) The corresponding pins of PWM in 40pin are as shown in the table below. PWM14\_M1 and PWM14\_M2, PWM15\_M1 and PWM15\_M3 can only use one of them at the same time, not at the same time. They are all the same PWM, just connected to different pins. Please do not think that they are two different PWM buses

PWM Bus	correspond 40pin	DtboCorresponding
		configuration
PWM0_M2	<b>Pin 27</b>	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

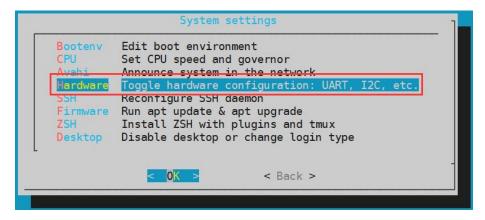
3) In Linux systems, the PWM in 40 pin is turned off by default and needs to be turned on manually to use it. Detailed steps are as follows:

a. First run **orangepi-config**. Ordinary users remember to add **sudo** permissions. orangepi@orangepi:~\$ **sudo orangepi-config** 

b. Then Select System



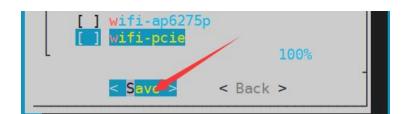
c. Then Select Hardware



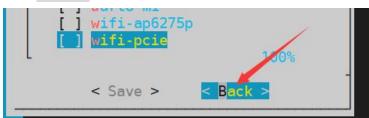
d. Then use the keyboard's arrow keys to locate the position shown in the picture below, and then use the **space** to select the configuration of the PWM you want to open

	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>	-

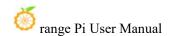
4) When a pwm is opened, there will be an additional pwmchipX (X is a specific number) in /sys/class/pwm/. For example, after opening pwm13, the pwmchipX under /sys/class/pwm/ will be Two became three

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	<b>GPIO序号</b>	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

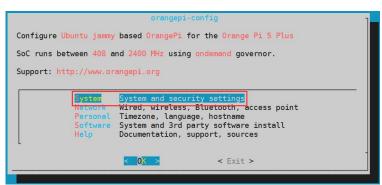
1) As can be seen from the table below, the CAN bus available for Orange Pi 5 Pro is CAN1

复用功能	复用功能	复用功能	GPIO	<b>GPI0序号</b>	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	12C1_SDA_H4	GPI01_D3	59	3	4		57			
	UART4_TX_NO	12C1_SCL_14	GPI01_D2	58	5	6		GND			
UART1_RX_M1	I2C5_SDA_N3	PWM13_M2 (febf0010)	GPI01_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	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_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	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_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

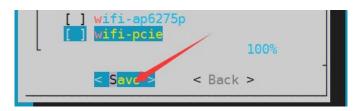
Bootenv	Edit boot environment
CPU	Set CPU speed and governor
Avahi	Announce system in the network
Hardware	Toggle hardware configuration: UART, I2C, etc.
SSH	Reconfigure SSH daemon
Firmware	Run apt update & apt upgrade
ZSH	Install ZSH with plugins and tmux
Desktop	Disable desktop or change login type
	< 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 00 00 00 00 00 反应用题 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	<ul> <li>○使能</li> <li>◎关闭</li> <li>○1 02</li> </ul>	设置	☑打开CAN接	枚 [	清空	
统计数据:通道1 帧率R: 0	<b>帧率T</b> : 0 校验错	吴: 0	统计数据:通道2 帧率R: 0	帧 <b>率</b> 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 <b>室</b> 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 <b>发送文件</b> 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

CAN发i 帧格式: 数据:〔	غ	談型: 数据帧			语言(L) CAX通道: 1 🗸 🗸	发送总帧数 发送周期		□ ID递增 □ 数据递增
CAN中继	状态 <b>Unused</b>	接收滤测 ○ 使能 ● 关闭	<b>支ID设置(直</b> ) 01 02	<b>接ID号</b> ) 设置	保存总帧数:		停止发送 <b>清 空</b>	发送文件 □实时存储
统计数 帧率R	据:通道1 : 0	帧 <b>率</b> 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	吴: 0
·号 00000	系統时间 19:27:04.048	时间标识 OxE3BC2F	CAN通道 ch1	传输方向 ID号 接收 0x0123	帧类型 帧格式 数据帧 标准帧		2 33 44 55 66	77 88
		R	leceive	the informati	on sent by t	he develor	oment bo	ard

# 3. 19. wiringOP Hardware PWM Usage Method

Before using wiringOP to operate PWM, please ensure that wiringOP is installed on the Linux system. If the gpio readall command can be used normally, it means wiringOP has been installed. If prompted that the command cannot be found, please refer to the instructions in the section on installing wiringOP to install

## wiringOP first.

## 3. 19. 1. Method of setting PWM using the gpio command of wiringOP

# 3. 19. 1. 1. Set the corresponding pin to PWM mode

1) As can be seen from the following table, there are six pwm channels available on the development board: pwm0, pwm1, pwm3, pwm13, pwm14 and pwm15. PWM14\_M1 and PWM14\_M2, PWM15\_M1 and PWM15\_M3 can only use one of them at the same time, can not be used at the same time, they are the same PWM, but connected to different pins, please do not think that they are two different PWM buses.

复用功能	复用功能	复用功能	GPIO	<b>GPI0序号</b>	引脚序号	引脚序号	<b>GPI0序号</b>	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_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	GPIO0_B6	UART2_RX_NO		
	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_M3		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_H2	UART7_TX_H2	
SPI4 CLK M2	PWH0 M2 (fd8b0000)	I2C4 SDA H3	GPI01 A2	34	27	28	35	GPIO1 A3	12C4 SCL 113	PWM1 M2 (fd8b0010)	SPI4 CSO M2
			GPI01_A4	36	29	30		GND			
			GPI01_A6	38	31	32	62	GPI01_D6	PWN14_N2 (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_H2		
	UART3_RX_N2	12C5_SCL_12	GPIO4_A6	134	37	38	132	GPIO4_A4	UARTO_RX_H2		
			GND		39	40	133	GPIO4_A5		UART3_TX_H2	

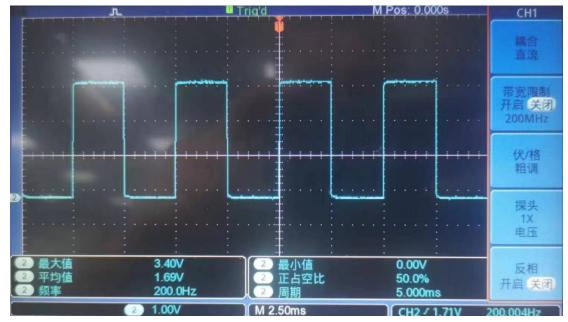
2) The wPi serial number corresponding to the PWM pin is as follows:

PWM Pin	wPi Serial	Pin Serial	<b>GPIO Serial</b>		
	number	number	number		
PWM0_M2	17	27	34		
PWM1_M2	18	28	35		
PWM3_M3	6	12	39		
PWM13_M2	2	7	47		
PWM14_M1	5	11	138		
PWM14_M2	21	32	62		
PWM15_M1	7	13	139		
PWM15_M3	22	33	63		

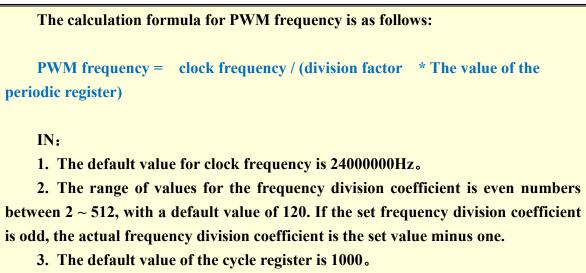
3) The command to set the pin to PWM mode is as follows, take PWM0\_M2 as an example, where the third parameter needs to enter the wPi number corresponding to the PWM0\_M2 pin.

orangepi@orangepi:~\$ gpio mode 17 pwm

4) After the pin is set to PWM mode, a square wave with a frequency of 200Hz, a period of 5ms, and a duty cycle of 50% will be output by default. At this time, we use an oscilloscope to measure the corresponding PWM pin, and the following waveform can be seen.



# 3. 19. 1. 2. Methods for Adjusting PWM Frequency



4. The default value for PWM frequency is 24000000 / (120 \* 1000) = 200Hz.

# 3. 19. 1. 2. 1. Method of adjusting PWM frequency by setting the frequency division factor

1) We can use the following command to set the frequency division factor of PWM0\_M2 pin to 4.

orangepi@orangepi:~\$ gpio pwmc 17 4

2) According to the above formula, the calculated value of PWM frequency is 6000Hz, and it can be observed that the measured value of PWM frequency is 6010Hz through the oscilloscope, and the error can be ignored.



# 3. 19. 1. 2. 2. Method of setting PWM frequency directly

1) We can use the **gpio pwmTone** command to set the frequency of the PWM pin, for example, the following command can be used to set the PWM frequency of the PWM0 M2 pin to 500Hz.

orangepi@orangepi:~\$ gpio pwmTone 17 500

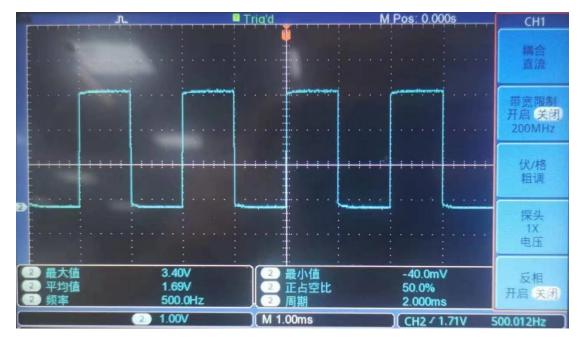
## When setting the PWM frequency, it is necessary to ensure that:

Set frequency value < 24000000 / (division factor \* 2).

For example, the default division factor is 120, and without modifying the division factor, the set frequency value should be less than 100000Hz.

If the setting value is too large, the following error message will appear: gpio: The PWM frequency you set is too high to be possible

2) Then, through an oscilloscope, it can be observed that the PWM frequency has changed to 500Hz.



# 3. 19. 1. 3. Methods for Adjusting PWM Duty Cycle

1) The calculation formula for PWM duty cycle is as follows. We can adjust the PWM duty cycle by setting the values of the duty cycle register and the period register.

PWM Duty cycle = The value of the duty cycle register / The value of the periodic register

#### IN:

The default value of the duty cycle register is 500. The default value of the cycle register is 1000. It should be noted that the value of the duty cycle register needs to be smaller than the value of the cycle register, as the duty cycle cannot be greater than 1.

When the value of the duty cycle register is set to be greater than the value of the cycle register, the following error message will be prompted:

gpio: CCR should be less than or equal to ARR (XXX)

When the value of the cycle register is set to be less than the value of the duty cycle register, the following error message will be prompted:

gpio: ARR should be greater than or equal to CRR (XXX)

2) We can use the following command to set the value of the period register for the PWM0 M2 pin to 2000.

orangepi@orangepi:~\$ gpio pwmr 17 2000

3) After running the above command, it can be observed through the oscilloscope that the PWM duty cycle has changed from the default 50% (500/1000) to 25% (500/2000).



4) We can use the following command to set the duty cycle register value of the PWM0\_M2 pin to 1000.

orangepi@orangepi:~\$ gpio pwm 17 1000

5) After running the above command, it can be observed through the oscilloscope that

the PWM duty cycle changes from 25% (500/2000) to 50% (1000/2000).



# 3. 19. 2. Usage of PWM Test Program

1) In the example directory of wiringOP, there is a program called pwm.c that demonstrates the use of PWM related API in wiringOP to operate PWM.

orangepi@orangepi:~\$ cd /usr/src/wiringOP/examples/

orangepi@orangepi:/usr/src/wiringOP/examples\$ ls pwm.c

pwm.c

2) The command to compile **pwm.c** into an executable program is as follows:

orangepi@orangepi:/usr/src/wiringOP/examples\$ gcc -o pwm pwm.c -lwiringPi

3) Then you can execute the PWM test program. When executing the PWM test program, you need to specify the PWM pin. For example, you can use the following command to test the PWM0\_M2 pin:

orangepi@orangepi:/usr/src/wiringOP/examples\$ sudo ./pwm 17

4) After the pwm program is executed, the following contents will be tested sequentially:

- a. Adjust the PWM duty cycle by setting the value of the cycle register.
- b. Adjust the PWM duty cycle by setting the value of the duty cycle register.
- c. Adjust the PWM frequency by setting the division factor.
- d. Directly set the PWM frequency.

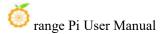
5) After completing each test, the output of pwm waveform will be stopped for 5 seconds. After completing all test contents, a new round of testing will be restarted.

- 6) The detailed execution process of the PWM test program is as follows:
  - a. By setting the value of the cycle register to adjust the PWM duty cycle: Through an oscilloscope, it can be observed that the PWM waveform changes every 0.5 seconds. After 8 changes, the PWM duty cycle changes from 50% to 25% and remains for 5 seconds. Then, the PWM waveform changes every 0.5 seconds. After 8 changes, the PWM duty cycle changes from 25% to 50% and remains for 5 seconds.
  - b. By setting the value of the duty cycle register to adjust the PWM duty cycle: The oscilloscope can observe that the PWM waveform changes every 0.5 seconds. After 8 changes, the PWM duty cycle changes from 50% to 100% and remains for 5 seconds. Then, the PWM waveform changes every 0.5 seconds. After 8 changes, the PWM duty cycle changes from 100% to 50% and remains for 5 seconds.
  - c. By setting the frequency division coefficient to adjust the PWM frequency: Through an oscilloscope, it can be observed that the PWM waveform changes every 0.5 seconds. After 9 changes, the PWM frequency will change from 2000Hz to 200Hz and remain for 5 seconds. Then, the PWM waveform changes every 0.5 seconds. After 9 changes, the PWM frequency will change again to 2000Hz and remain for 5 seconds.
  - d. Directly setting the PWM frequency: Through the oscilloscope, it can be observed that the PWM frequency first changes to 2000Hz, and then increases by 2000Hz every two seconds. After 9 changes, the PWM frequency changes to 20000Hz and remains for 5 seconds.

# 3. 20. How to install and use wiringOP-Python

wiringOP-Python is the Python language version of wiringOP, which is used to operate the hardware resources of the development board, such as GPIO, I2C, SPI and UART, in the Python program.

In addition, please note that all the following commands are operated under the



## root user.

## 3. 20. 1. How to install wiringOP-Python

1) First install the dependency package

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 following git clone --recursive command will automatically download the source code of wiringOP, because wiringOP-Python depends on wiringOP. Please make sure that the download process does not report errors 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 there is help information output, it means that wiring OP-Python is installed successfully, 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 successfully installed 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, and 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)

```
>>>
```

## 3. 20. 2. 40pin GPIO Port Test

wiringOP-Python is the same as wiringOP, you can also determine which GPIO pin to operate by specifying the wPi number, because there is no command to check the wPi number in wiringOP-Python, so you can only use the gpio command in wiringOP to check the correspondence between the board wPi number and the physical pin.

GPIO	wPi	Name	Mode	V	Phy	sical	l v	Mode	Name	wPi	GPI0
	+	3.3V I		+ 	+	++	-+	+ 	+		+ 
59	0	SDA.1	IN	1	3	4			5V		
58	1	SCL.1	IN	1	5	6		1	GND		
47	2	PWM13	IN	1	7	1 8	1	ALT10	TXD.2	3	13
		GND			9	1 10	1 1	ALT10	RXD.2	4	14
138	5	CAN1 RX	IN	1	11	1 12	1 1	IN	GPI01 A7	6	39
139	7	CAN1 TX	IN	1	13	1 14			GND		
46	8	GPI01 B6	IN	1	15	1 16	0	IN	TXD.6	9	33
	i i	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 1	IN	SPI0_CS0	15	44
		GND		İ.	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	1	
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	wPi	Name	Mode	V	Phy	sical	V	Mode	Name	wPi	GPI0

1) The following pin 7 — corresponding to GPIO is GPIO1\_C6 — corresponding to wPi serial number is 2 — as an example to demonstrate how to set the high and low level of GPIO port

GPI0	wPi	Name	Mode	I V	ļ	Physic	al				wPi	GPIO
	++	3.3V		1	-+-	1	2		+ 	+   5V	1	
59	0	SDA.1	IN	1	1	3	4		1	5V	i	
58	1	SCL.1	IN	1 1	1	5	6		1	GND	i l	
47	2	PWM13	IN	1	1	7	8	1	ALT10	TXD.2	3	13
	Î Î	GND	-			9	10	1	ALT10	RXD.2	4	14
138	5	CAN1_RX	IN	1	Í.	11	12	1	IN	GPI01_A7	6	39
139	7	CAN1 TX	IN	1	Ì	13	14					

2) The steps to test directly with the command are as follows:

a. First set the GPIO port to the 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 low level. After setting, you can use a multimeter to measure the voltage value of the pin. If it is 0v, it means that 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 that the high level is set successfully.

root@orangepi:~/wiringOP-Python# python3 -c "import wiringpi; \

from wiringpi import GPIO; wiringpi.wiringPiSetup();\

wiringpi.digitalWrite(<mark>2, GPIO.HIGH</mark>)"

- 3) The steps to test 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 that 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 that the high level is set successfully.

>>> wiringpi.digitalWrite(2, GPIO.HIGH)

4) The method of wiringOP-Python to set GPIO high and low levels in python code can refer to the **blink.py** test program in the examples below. The **blink.py** test program will set the voltage of all GPIO ports in the 26 pins of the development board to change continuously.

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. 20. 3. **40pin SPI test**

1) As can be seen from the following figure, the available spi of Orange Pi 5 Pro are spi0 and spi4

复用功能	复用功能	复用功能	GPIO	<b>GPIO序号</b>	引脚序号	引脚序号	<b>GPIO序号</b>	GPIO	复用功能	复用功能	复用功能
			3.37		1	2		57			
	UART4_RX_MO	I2C1_SDA_H4	GPI01_D3	59	3	4		57			
	UART4_TX_NO	12C1_SCL_14	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	GPI01_A7	PWM3_IR_M3 (fd8b0030)		
	PWM15_IR_M1 (febf0030)	CAN1_TX_N1	GPIO4_B3	139	13	14		GND			
UART1_TX_M1	12C5_SCL_M3		GPI01_B6	46	15	16	33	GPI01_A1	UART6_TX_M1		SPI4_MOSI_M2
			3.3V		17	18	32	GPI01_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_H2	GPI01_B3	43	23	24	44	GPI01_B4	SPI0_CS0_M2	UART7_RX_H2	
			GND		25	26	45	GPI01_B5	SPI0_CS1_112	UART7_TX_H2	
SPI4_CLK_M2	PWM0_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	1	GND			
			GPI01_A6	38	31	32	62	GPI01_D6	PWH14_H2 (febf0020)	12C8_SCL_112	
	12C8_SDA_M2	PWM15_IR_M3 (febf0030)	GPI01_D7	63	33	34		GND			
		12C5_SDA_112	GPIO4_A7	135	35	36	131	GPIO4_A3	UARTO_TX_H2		
	UART3_RX_N2	12C5_SCL_112	GPI04_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 shown in the table below.

	SPI0_M2 corresponds to 40pin	SPI4_M2 corresponds to 40pin
MOSI	Pin 19	Pin 16

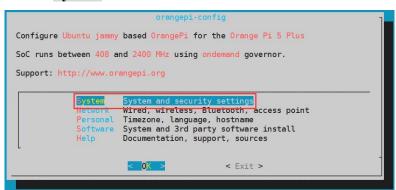
of range Pi User Manual

MISO	Pin 21	Pin 18
CLK	Pin 23	Pin 27
CS0	Pin 24	Pin 28
CS1	Pin 26	无
Dtbo	spi0-m2-cs0-spidev	spi4-m2-cs0-spidev
configuration	spi0-m2-cs1-spidev	
	spi0-m2-cs0-cs1-spidev	

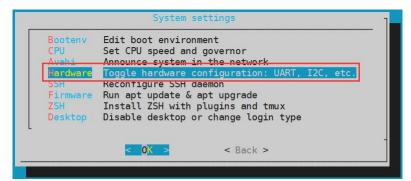
3) In the linux system, the SPI in 40 pin is turned off by default and needs to be opened manually. The detailed steps are as follows:

a. First run **orangepi-config**, ordinary users remember to add **sudo** permission orangepi@orangepi:~\$ **sudo orangepi-config** 

b. Then choose **System** 



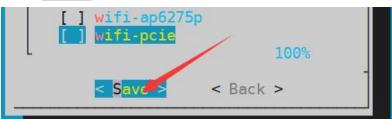
c. Then choose Hardware



d. Then use the arrow keys on the keyboard to locate the position shown in the following figure, and then use the **space** to select the SPI configuration that you want to open



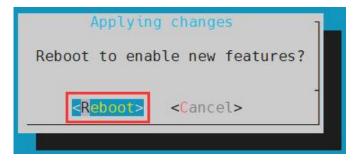
e. Then select <Save> to save



f. Then select <Back>



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



4) After the restart, go to the system and check whether **spidevx.x** device nodes exist in the linux system. If nodes exist, the SPI is set 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 the examples to test the loopback function of the SPI. The **spidev\_test.py** program needs to specify the following two parameters:

- a. --channel: Specifies the channel number of the SPI
- b. --port: Specify the port number of the SPI

6) Do not short-circuit the mosi and miso pins of SPI4, 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 arguments needs to be replaced with the channel number and the port number of the SPI specific.

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 the Dupont wire to short connect the two pins of SPI txd (pin 19 in the 40pin interface) and rxd (pin 21 in the 40pin interface) and run spidev\_test.py as follows. You can see that the sent and received data are the same, indicating that the SPI loop test is normal

The x after the --channel and --port arguments needs to be replaced with the channel number and the port number of the SPI specific.

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. 20. 4. **40pin I2C** 测试

1) As can be seen from the following table, there are four i2c buses available for Orange Pi 5 Pro: i2c1, i2c4, i2c5 and i2c8

复用功能	复用功能	复用功能	GPIO	<b>GPI0序号</b>	引脚序号	引脚序号	<b>GPI0序号</b>	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	12C1_SCL_14	GPI01_D2	58	5	6		GND			
UART1_RX_M1	12C5_SDA_N3	PWM13_M2 (febf0010)	GPIO1_B7	47	7	8	13	GPIO0_B5	UART2_TX_NO		
			GND		9	10	14	GPI00_B6	UART2_RX_NO		
	PWM14_M1 (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_H3		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_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_H2	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	PWH0_M2 (fd8b0000)	I2C4_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	PWM14_M2 (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_H2		
			GND		39	40	133	GPIO4_A5		UART3_TX_H2	

2) The pins corresponding to the four groups of I2C buses in the 40pin are shown in the following table. I2C5\_M2 and I2C5\_M3 can only use one group at the same time, can not be used at the same time, they are the same I2C5, just received a different pin up, please do not think that they are two different groups of I2C5 bus.

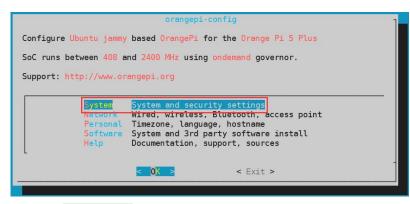
I2C Bus	SDA corresponds to	SCL corresponds to	Dtbo corresponding		
	40pin	40pin	configuration		
I2C1_M4	Pin 3	Pin 5	i2c1-m4		
I2C4_M3	<b>Pin 27</b>	<b>Pin 28</b>	i2c4-m3		
I2C5_M2	Pin 35	<b>Pin 37</b>	i2c5-m2		
I2C5_M3	Pin 7	Pin 15	i2c5-m3		
I2C8_M2	Pin 33	Pin 32	i2c8-m2		

3) In Linux systems, the I2C bus in 40 pins is turned off by default and needs to be manually turned on to use. The detailed steps are as follows:

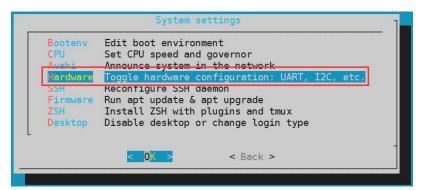
a. First, run **orangepi-config**. Regular users should remember to add **sudo** privileges

orangep	pi@or	angepi	i:~\$ :	sudo	orangepi-config
			~		

b. Then choose System



c. Then choose Hardware



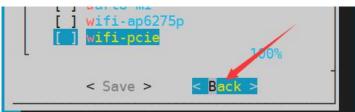
d. Then use the directional keys on the keyboard to locate the position shown in the figure below, and use the **space** to select the I2C configuration you want to open

[]	12c1-m2
	i2c1-m4
[]	12c2-m0
[]	i2c2-m4
[]	12c3-m0
	12c4-m3
[]	i2c5-m2
[]	i2c5-m3
[]	12c6-m4
[]	12c8-m2

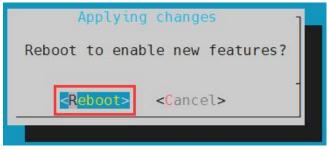
a) Then select **<Save>** to save

[] wifi-ap6275	p
[] wifi-pcie	100%
< Save >	< Back >

e. Then select **<Back>** 



f. Then select **<Reboot>** to restart the system for the configuration to take effect



4) After starting the Linux system, first confirm the existence of i2c device nodes in /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:																
:0					)				<u> - 1</u>							
50:									68							
70:																

7) Then you can run the ds1307.py test program in the 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 2023-01-0514:57:55Thu 2023-01-0514:57:56Thu 2023-01-0514:57:57

111u 2023-01-

^C

exit

## 3. 20. 5. **40pin UART test**

1) As can be seen from the following table, there are five uart buses available for Orange

Pi 5 Pro: uart0, uart3, uart4, uart6 and uart7

复用功能	复用功能	复用功能	GPIO	<b>GPIO序号</b>	引脚序号	引脚序号	<b>GPI0序号</b>	GPIO	复用功能	复用功能	复用功能
			3.37		1	2		57			
	UART4_RX_NO	12C1_SDA_H4	GPI01_D3	59	3	4		57			
	UART4_TX_NO	12C1_SCL_14	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	GPI04_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. 3V		17	18	32	GPI01_A0	UART6_RX_M1		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_H2	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	PWH0_M2 (fd8b0000)	I2C4_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	PWN14_N2 (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_M2		
	UART3_RX_M2	12C5_SCL_12	GPIO4_A6	134	37	38	132	GPIO4_A4	UARTO_RX_H2		
			GND		39	40	133	GPTO4 A5		HARTS TX H2	

2) The corresponding pins of the five UART buses in the 40 pin configuration are shown in the table below

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

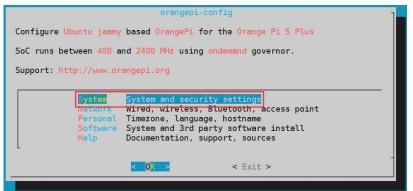
UART4_M0	Pin 3	Pin 5	uart4-m0
UART4_M2	Pin 19	Pin 23	uart4-m2
UART6_M1	Pin 18	Pin 16	uart6-m1
UART7_M2	Pin 24	Pin 26	uart7-m2

3) In Linux systems, UART in 40 pins is turned off by default and needs to be manually turned on to use. The detailed steps are as follows:

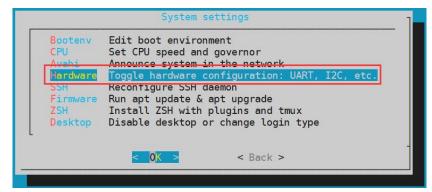
a. First, run **orangepi-config**. Regular users should remember to add **sudo** privileges

orangepi@orangepi:~\$ sudo orangepi-config

b. Then choose System



c. Then choose Hardware



d. Then use the directional keys on the keyboard to locate the position shown in the figure below, and use the **space** to select the UART configuration you want to turn on

🥮 range Pi User Manual

	uart0-m2
	uart1-m1
	uart2-m0
[]	uart3-m0
[]	uart3-m1
	uart3-m2
	uart4-m0
	uart4-m2
	uart6-m1
	uart7-m2

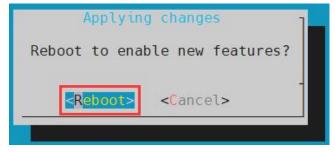
#### e. Then choose **<Save>** to save

wifi-ap6275p wifi-pcie	100%
 < Save > < Ba	ick >

f. Then choose **<Back>** 

	wifi-ap6275p wifi-pcie	10%	
 	< Save >	< Back >	

g. Then choose **<Reboot>** to restart the system for the configuration to take effect



4) After entering the linux system, first confirm whether there is a device node corresponding to uart in /dev

orangepi@orangepi:~\$ ls /dev/ttyS\*

5) Then start testing the uart interface, first use the DuPont wire to short-circuit the rx and tx of the uart interface to be tested

6) Test the loopback function of the serial port using the **serialTest.py** program in the examples as shown below. If you can see the print below, it indicates that the serial 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 

 Out:
 2: -> 2 

 Out:
 3: -> 3 

 Out:
  $4:^{C}$  

 exit

# 3. 21. 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. 22. 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. 23. 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.

••••

# 3.24. 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

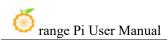
May 1 ryanfortner v1.7.9	<b>balenaEtcher v1.7.9</b> Latest Update and rename compile-etcher_v1.7.3.sh to compile-etcher_v1.7.	9. sh	
-0- 9529280 🧭 Compare 👻	• Assets 10		
	Galena-etcher-electron-1.7.9+5945ab1f.aarch64.rpm	64.3 MB	May 1
	♦ balena-etcher-electron-1.7.9+5945ab1f.armv7l.rpm	58.4 MB	May 1
	<pre></pre>	87.9 MB	May 1
		76.5 MB	May 1
	Solution States (Section 2014) Section (Secti	97.3 MB	May 1
	SalenaEtcher-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		
Anil Reader		
🕜 Web Browser		
B Settings	•	
Accessories	•	Q Application Finder
d Development	•	balenaEtcher
to Graphics		🚏 Bulk Rename
🔶 Help		& Fcitx
🕥 Internet		& fcitx-qimpanel-configtool
🚯 Multimedia	•	🔢 Fonts
🗑 Office		Midnight Commander
System		Midnight Commander editor
C Log Out		🛃 Mousepad
		🔀 Screenshot
		🗵 Terminator
		Ŧ Thunar File Manager
		A Xarchiver

c. The interface after opening balenaEtcher is as follows:

<b>(</b>	balenaEtcher	★ - ×
	🜍 balena Etcher	¢ 0
	+ +	
	Flash from file Select target Flas	hi
	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
Ē	Move to Trash
6	Delete
	<u>R</u> ename
6	Properties
24	Applications

## 3. 25. 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.

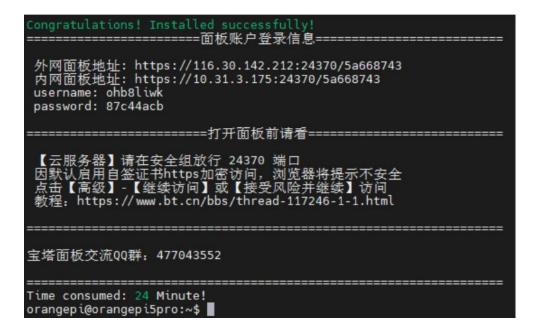
+-----

The WebPanel URL will be http://SERVER\_IP:8888 when installed.

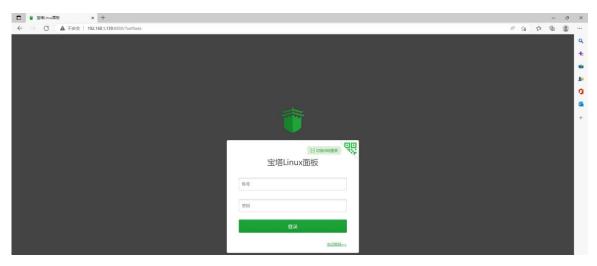
+-----

Do you want to install Bt-Panel to the /www directory now?(y/n): y

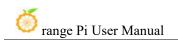
4) The next thing to do is to wait patiently. When you see the terminal outputting the following print information, it means that the Pagoda has been installed. The entire installation process takes about 12 minutes. There may be some differences depending on the network speed.



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.

□ 🔋 清光郎定宝塔张号	x +				-	0	×
← → C ▲ 不安全	192.168.1.139.8888/bind	Aø	îð	£'≡	œ		
192.168.1.139						Î	٩
☆ 首页	▲ 呈現實際行参功規模故樂于實明,供證仍得于於認識作更好的實際服務相違。不可及認能及養益仍能能發展,讓故心便用。						+
● 网站							*
≞ FTP	绑定宝塔帐号						•
⊜ 数据库	手机员						0
🧼 Docker							
圆 监控	18535)						+
⊘ 安全	99 9						
♥ 防火増	未有限号,党操卫府						
10 文件	<ul> <li>为了您被要并容许检查常能功能。得先期还遭得称号;</li> </ul>						
□ 终端	<ul> <li>单个金塔板号支持多估额各部位为原贝及、请效心使用;</li> <li>第二次号支持按管规总器的功能贝及、请效心使用;</li> </ul>						
	<ul> <li>帐号如应过程中编到问题遭款其基础处理;</li> </ul>						
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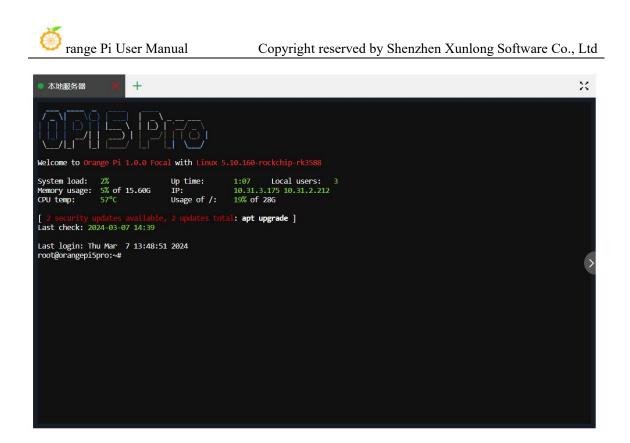
8) The final displayed interface is as shown in the figure below. You can intuitively see some status information of the development board's Linux system, such as load status, CPU usage, memory usage, storage space usage, etc

	Edit: Orange Pi 1.0.0 Bullisys aan HELEING: → 15755Einulier CPUERTRA 2.1% 8 450	✓ 30+ 駅付懇謝件 ✓ 2		19824 (441) - 10008-0.8468 (4	H(1) くち至今可指は数 (H(1)	1.56	A.MHE 7.96 影評 等版 1	
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9.8882 () 1%	CPU#####		内孙使用本 9.1%	35%	#41) <b>、</b>	0		
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运行这種	8 650		702 / 7689(MB)	5.0G / 15G				
运行流畅	8 続心		702 / 7689(MB)	5.0G / 15G				
1605	FTP		数据库	安全风险				
0	0		0	7				
				流量 磁盘IO			全部	
***	25		228 (11)	15	• T 15		DIRA	客服
>_		网站防火墙	网络监控报告	0.43 KB	1.64 KB	7.09 MB	164.09 MB	8
提SSH修鹅 1.0▶	做伊木马检测 1.0	预运制架	预选 购买	单位:KB/s				反馈
129				50				
	0 ESSEMBLE 1.0	0 0 Experimental and a second	0 0	0 0 0	0 0 0 0 7	0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0	0         0         7           Image: State of the sta

- 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
	·梁王   192,168,1,139(8888/501			A, 20 2= 4⊕
.1.139 🔼 🧿	软件商店			业版 免费板 7.9.6 文即开级
	_			
	<b>应用搜索</b> 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
	<ul> <li>Nginx防火地</li> </ul>	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 > <b>由演算</b> 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
<del>3</del>	· · · · · · · · · · · · · · · · · · ·	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 ● 主導政旗団歩工具 ● 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見合いた         の用子を建立の加速         単用         単価の         ¥1300天         #           毎年後期の加速         単用         単価の         単価の         ¥1300天         #         #	立即將天 立即將天 预克   立即將天
店		<ul> <li>官方</li> <li>官方</li> <li>官方</li> <li>官方</li> </ul>	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	
<ul> <li>(1)重启面板服务</li> <li>(2)停止面板服务</li> <li>(3)启动面板服务</li> <li>(4)重载面板服务</li> <li>(4)重载面板服务</li> <li>(5)修改面板密码</li> <li>(6)修改面板用户名</li> <li>(7)强制修改MySQL密码</li> <li>(22)显示面板错误日志</li> <li>(23)关闭BasicAuth认证</li> <li>(24)关闭动态口令认证</li> <li>(25)设置是否保存文件历史副本</li> <li>(26)关闭面板ssl</li> <li>(28)修改面板安全入口</li> <li>(0)取消</li> <li>====================================</li></ul>	==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. 26. 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. 26. 1. **Debian system installation method**

- 1) First set the default **locale** to Chinese
  - a. Enter the following command to start configuring locale

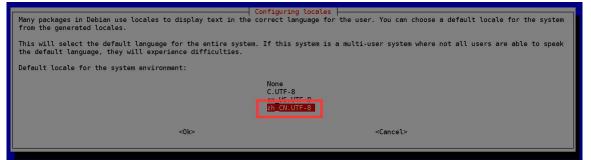
#### orangepi@orangepi:~\$ sudo dpkg-reconfigure locales

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)

	Configuring loca	ales rs to use their language, country, characters	
etc.	een muttipte tanguages and attow user	's to use their tanguage, country, characters	s, collation order,
Please choose which locales to generat sets may be useful for backwards compa		default, particularly for new installations. vare.	Other character
Locales to be generated:			
<pre>[ ] xh_ZA ISO-8859-1 [ ] xh_ZA.UTF-8 UTF-8 [ ] yi_US CP1255 [ ] yi_US UTF-8 UTF-8 [ ] you_FG UTF-8 [ ] you_FG UTF-8 [ ] you_FG UTF-8 [ ] zh_CN.GB12030 [ ] zh_CN.GB12030 [ ] zh_CN.UTF-8 UTF-8 [ ] zh_CN.UTF-8 UTF-8 [ ] zh_SG.GB2312 [ ] zh_SG.GB2312 [ ] zh_SG.GBC GBK [ ] zh_SG.GBC UTF-8 [ ] zh_TW.EUC-TW [ ] zh_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

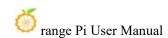
Generating locales (this might take a while)...

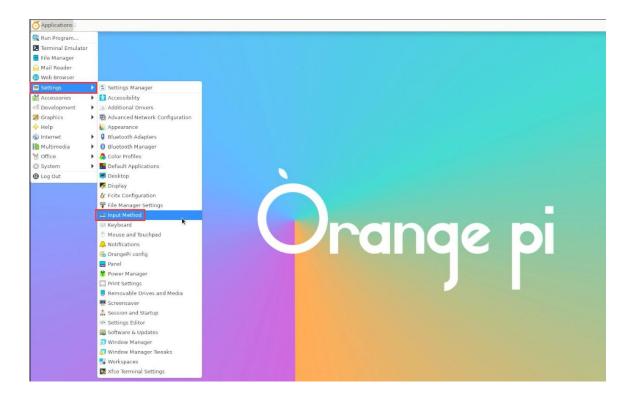
en\_US.UTF-8... done

zh\_CN.UTF-8... done

Generation complete.

#### 2) Then open Input Method





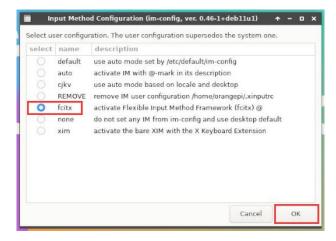
3) Then select **OK** 

Current configuration for the i	nput method:
* Default mode defined in /el	c/default/im-config: 'auto'
* Active configuration: 'missi	ng' (normally missing)
* Normal automatic choice: '	fcitx' (normally ibus or fcitx or uim)
* Override rule: 'zh_CN,fcitx5	i:zh_TW.fcitx5:zh_HK.fcitx5:zh_SG.fcitx5'
* Current override choice: " (	Locale='en_US')
• Current automatic choice: '	fcitx'
Number of valid choices: 1	(normally 1)
* Desktop environment: 'XFC	ΞE'
he configuration set by im-c	onfig is activated by re-starting the system.
Explicit selection is not requii one is default/auto/cjkv/missi	ed to enable the automatic configuration if the active ng.

4) Then select Yes



### 5) Then select fcitx

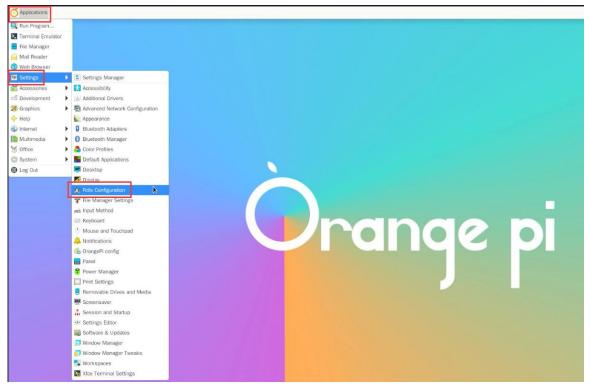


6) Then select **OK** 

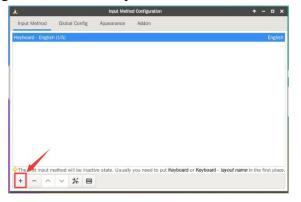
🍤 🛛 Input Method Configuration (im-con	fig, ver. 0.46-1+deb11u1) 🛛 🛧 – 🗆 🗙
Setting the user configuration /home/orange	pi/.xinputrc to fcitx.
Manual configuration selects: fcitx	
Flexible Input Method Framework (fcitx)	
* Required for all: fcitx	
* Language specific input conversion support	rt:
* Simplified 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.

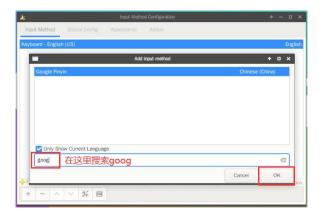
### 8) Then ope Fcitx configuration



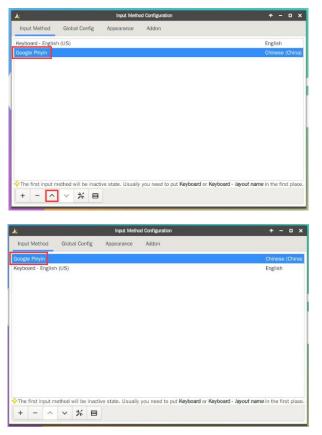
9) Then click the + sign as shown in the picture below



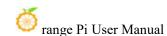
10) Then search Google Pinyin and click OK



11) Then put Google Pinyin on top

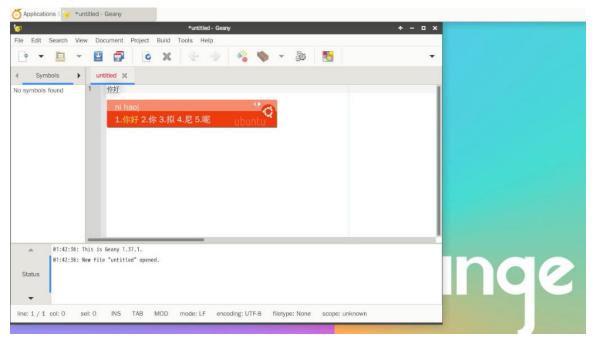


12) Then open the **Geany** editor to test the Chinese input method



Run Program				
Terminal Emulato	r			
📑 File Manager				
🗟 Mail Reader				
🕜 Web Browser				
Settings	•			
🔀 Accessories	•			
🕌 Development	1	Geany		
🧭 Graphics	•			
🔶 Help				
💿 Internet	•	<b>b</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

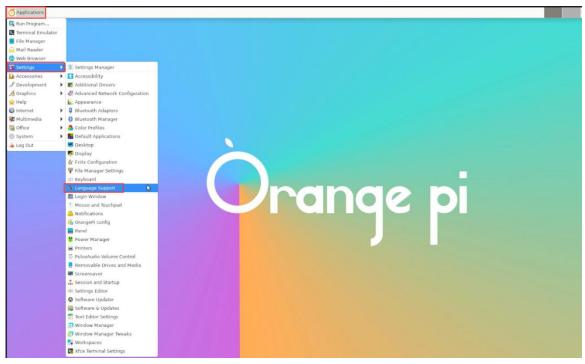
### LANGUAGE=zh\_CN.UTF-8

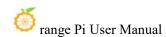
16) Then restart the system and you will see that the system is dia	splayed in Chinese.
---	---------------------



### 3. 26. 2. Installation method of Ubuntu 20.04 system

### 1) First open Language Support





2) Then find the **Chinese (China)** option

<b>9</b>	Language S	Support		*	- 1	• ×
Language	Regional I	Formats				
Language for me		ws:				
English (United	Kingdom)					
汉语(中国)						
中文 (香港)						
中文 (臺灣)						
Drag languages t			preference.			
Drag languages t	t next time you k		preference.			
Drag languages t Changes take effec	t next time you k Wide	og in.	-			
Drag languages t Changes take effec Apply System Use the same lang	t next time you k Wide	og in. startup and t	-			
Drag languages t Changes take effec Apply System Use the same lang	Wide Wide uage choices for s	og in. startup and t	-			Li c

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	6				
	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

(e		Language Su	pport		<b>†</b>		۰	×
La	nguage	Regional Fo	rmats					-
Lang	uage for menu	is and windows						
汉语	(中国)							
Eng	ish (United Sta	ates)						
Eng	ish							
Eng	ish (Australia)							
Eng	ish (Canada)							
A	oply System-W	ext time you log ide ge choices for sta		e login screen.				
In	stall / Remove	Languages						
Keyl	oard input me	thod system:	none 🔻		\$			
<b>(</b> )	elp				1	K Cl	ose	

5) Then set the Keyboard input method system to fcitx

	Language Su	pport		<b>^</b>	-	•	×
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	

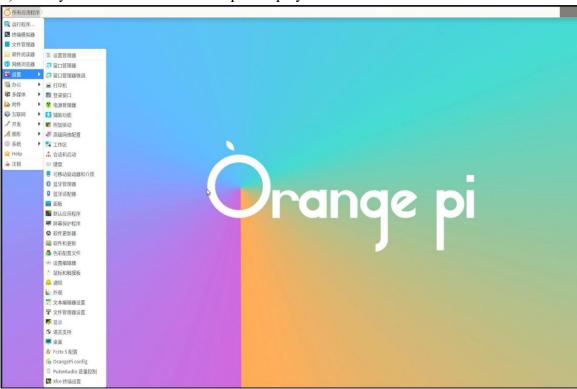
#### 6) Then restart the Linux system to make the configuration take effect

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

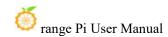
folder should also be updated to Chinese

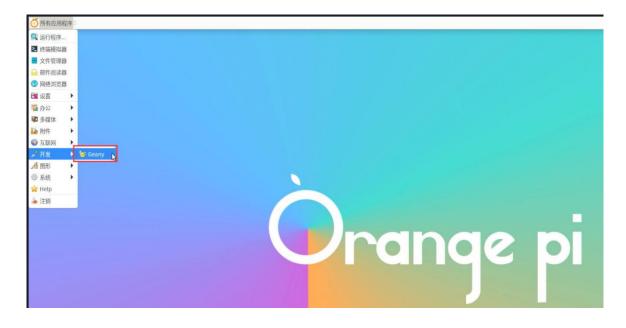


8) Then you can see that the desktop is displayed in Chinese



9) Then we can open **Geany** to test the Chinese input method. The opening method is as shown in the figure below

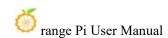


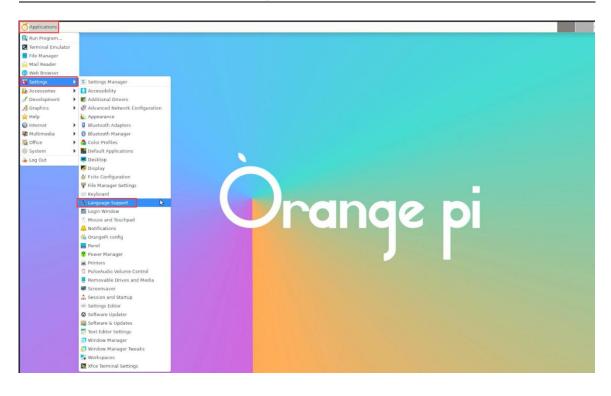


10) After opening **Geany**, the English input method is still the default. We can switch to the Chinese input method through the **Ctrl+Space** shortcut key, and then we can input Chinese.

🌀 所有应用程序 🤘 *未命名 - Geany		
<b>1</b>	*未命名 - Geany	+ - □ ×
文件(F) 编辑(E) 搜索(S) 查看(V) 文档(D) 项目(F		
🗋 🔹 🚔 - 💆 🔂 🍓 🗶	< > 🐴 🗞 - 🐅 🛅	• • • • • • • • • • • • • • • • • • •
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. 26. 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	55					
Português (Bra	isil)						
Português (Po	tugal)						
русский (Росс	ийская Федераці	AR)					
slovenščina							
2025 (ch (80)							
	to arrange them in ect next time you log		reference.				
Drag languages	ect next time you log		reference.				
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 ove Languages	in.					

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	+	-	٥	×
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 🕶				
<b>@</b> Help	1	K Cl	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 Support	↑ - □ ×
Language	Regional Formats	
Language for n	nenus and windows:	
汉语 (中国)		
English (Unite	ed States)	
English		
Deutsch (Schv	veiz)	
Deutsch (Deut	tschland)	
Changes take eff Apply System	fect next time you log in. m-Wide	
Use the same lar	nguage choices for startup and the login	1 screen.
Install / Rem	nove Languages	
Keyboard input	t method system: Fcitx 5 🕶	

5) Then restart the Linux system to make the configuration take effect

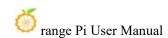
6) After re-entering the system, please select **Do not ask me again** on the following interface, and then please decide whether the standard folder should also be updated to Chinese according to your own preferences.

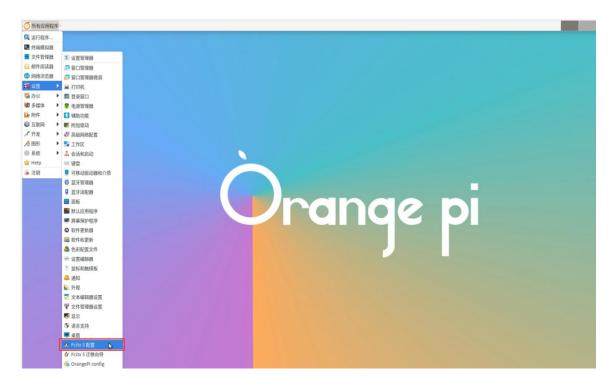
Δ	将标准文件夹更新到当前语言吗?	
	以一种新语言登入。您可以将主文件夹下的某些标准文件夹名按照 进行自动更新。该更新将会更改以下文件夹:	
当前文件夹名称	新的文件夹名称	
/home/orangepi/Desktop	/home/orangepi/桌面	
/home/orangepi/Downloads	/home/orangepi/下载	
/home/orangepi/Templates	/home/orangepi/模板	
/home/orangepi/Public	/home/orangepi/公共的	
/home/orangepi/Documents	/home/orangepi/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 + − <b>□</b> ×
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
<b>健盘</b> - 5	<b>そ</b> 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- - - - - - - - - - -	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。 ☆

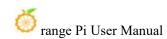
10) The interface after selection is as shown below, then click OK

4	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>强度</u> -英语(美国) 拼音		汉语 健豊 - 汉语 - Hanyu Pinyin (with AltGr dead keys) 健豊 - 汉语 简体中文 (中国) 自然時 - マックモ
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	波在第一位。
🥑 重置(R) 恢复默认(D)	13	✓ 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 *未命名 - Geany	+ - □ ×	
牛(F) 编辑(E) 搜索(S) 查看(V) 文档(D) 项目(P) 生成(B) 工具(T) 帮助(H)		
l = 🖻 = 🖾 🗊 🗑 🛠 < > 🗠 🗞 👳 - S	20 🚯 🔹 🔹	
标记 文档 未命名 ¥		
找到符号 1 <u>nihao</u> 1. 你好 2.你 3.尼 4.泥 5.妮 6.逆 7.腻 ()▶ Ⅱ		
▲ 10:54:37: 这是 Geany 1.38。		
10:54:37: 新文件"未命名"已打开。 状态		
	目: 未知	

## 3. 27. 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. 27. 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.

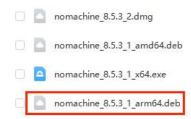
Download



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

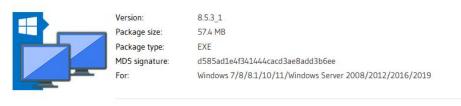
orangepi@orangepi:~\$ sudo dpkg -i nomachine\_x.x.x\_x\_arm64\_arm64.deb

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** 

Host identificatio	n changed	NEMACHIN
?	Remote host identification has changed. This can indicate that some connection, or the SSL certificate has been replaced due to a reinsta you want to proceed anyway and replace the old SSL certificate in th	llation 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 uses.
	Login as a system user on this server	
Y	Username Enter the account number of the d	levelopment board Linux system here
< i	Password Enter the password of the Linux sy	stem of the development board here
	Save this password in the connection	file
	$\oslash$ 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. 27. 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

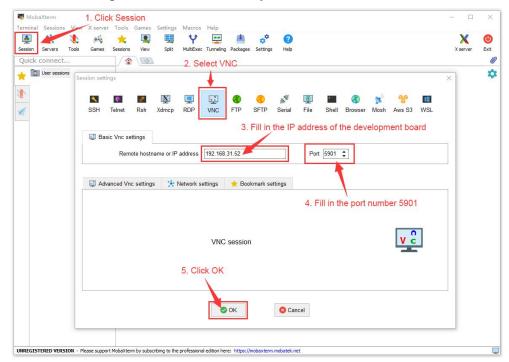
Creating default startup script /root/.vnc/xstartup Starting applications specified in /root/.vnc/xstartup Log file is /root/.vnc/Orangepi5pro:1.log Killing Xtightvnc process ID 3047

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::

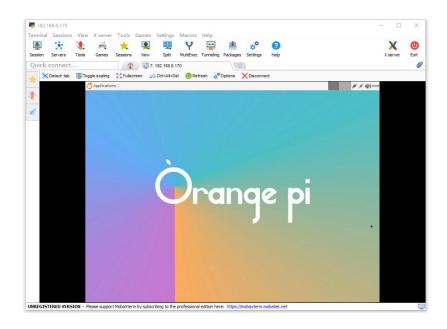
a. First click Session, then select VNC, then fill in the IP address and port of the development board, and finally click OK to confirm.



b. Then enter the VNC password set earlier

Please enter your passw	vord for 192.168.31.46
*******	
Show password	d
OK	🙁 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. 28. Testing of some programming languages supported by Linux system

## 3. 28. 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

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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) 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. 28. 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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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. 28. 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. 28. 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 11.4.0-1ubuntu1~22.04) 11.4.0

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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!

5) Ubuntu Jammy has Python3 installed by default

a. The specific version of Python3 is as follows

orangepi@orangepi:~\$ python3

Python **3.10.12** (main, Sep 11 2024, 15:47:36) [GCC 11.4.0] 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!

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. 29. **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** 

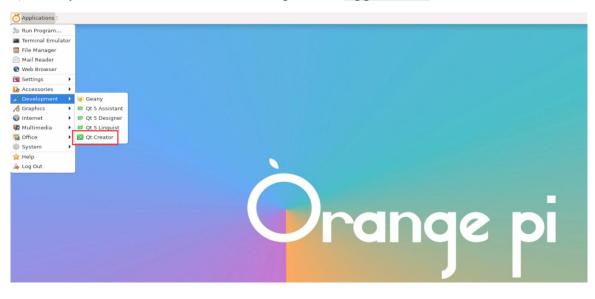
orangepi@orangepi:~\$ install\_qt.sh

. . . . . .

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

lit Build Debug Analyze Tools W		Ereator		+ - ¤ ×
Projects Examples	Ot 5.12.8 in PATH (System) • [ File Tools ABC DEF GHI JKI	Search in Examples	ile Edit Help	november 2016 n. man. tir. ons. tor. 0 31 1 2 3
Tutorials	N M Ab		tandard features of	6     7     8     9     10       .3     14     15     16     17       .0     21     22     23     24       .7     28     29     30     1
New to Qt? Learn how to develop your own applications and explore Qt Creator. Get Started Now	Address Tagst addr	on Qt 5.12.8 (GCC 9.3.0, 64 bit) ht 2008-2019 The Qt Company Ltd. All ri dynamis provided AS IS with NO WARRAM KIND, INCLUDING THE WARRANTY OF MERCHANTABILITY AND FITNESS FOR A ULAR PURPOSE.	se Code	Calendar Widget Example Trop: andreid calendar ios stidget sedgets
2 Qt Account	7684.02	Default file: <u>ndex.html</u> ⊇ Laundi file ITTP Example JSON	Sample	This examples requires that the second secon
Blogs	Tags: editable ios model tree Ta witgets	gs: http://etwork Taga:	core game json save	Tags: client core fortune local
O User Guide	Eortune Server	• _ • *		Chip Demo Historia CoenGL

b. The default version of QT Creator in Ubuntu22.04 is as follows

dur 1	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?	Addres Addres Calendar Widget Example Calendar Widget Example Tags an Calendar Widget 2008-2021 The Qt Company Ltd. All rights In widgets Tags: calendar Widget Example In widgets Tags: calendar Widget In widgets In widget In widg	-
) Ip	Learn how to develop your own applications and explore Qt Creator.	The program is provided AS 5 with NO WARRANT OF MERCHANTAULTY AND THE INVESTIGATION OF DATA MERCHANTAULTY AND THE INVESS FOR A MATRICUAR 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



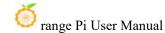
d. The default version of QT Creator in Debian12 is as follows

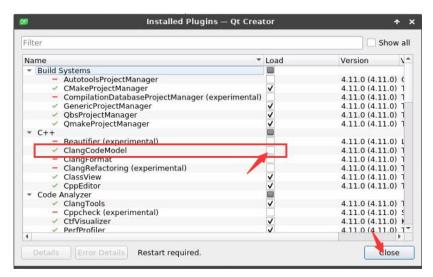
QC W	elcome to Qt Creato	or			
Create Projec	Qt 5.15.8 in PATH (qt5)	Search in Exa	imples		
Open Project		About Qt Create	or	^ X	
-	He has an pro-	Qt Creator 9.0.2		international are provided by Dr.	
New to Qt		Based on Qt 6.4.2 (GCC 12.		Nex, Knoll Jame, and deals an extensions. These Enter-Stangard edition system: Stat Residentials: Republic memory laters.	
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	
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4	Get Ot	Ot Account	Online Community	Blogs	User Guide

- 6) Then set up QT
  - a. Open first Help->About Plugins...

			Qt Creator							- 1
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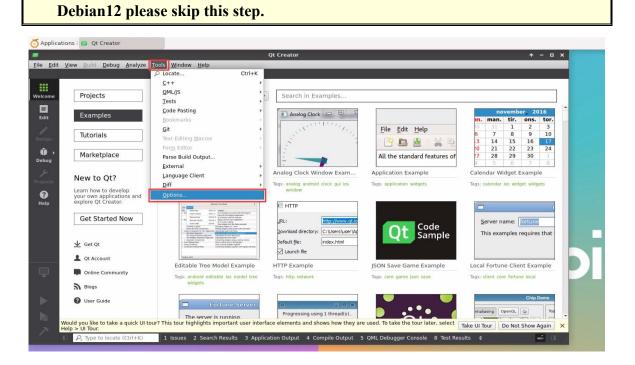
b. Then remove the check mark of ClangCodeModel

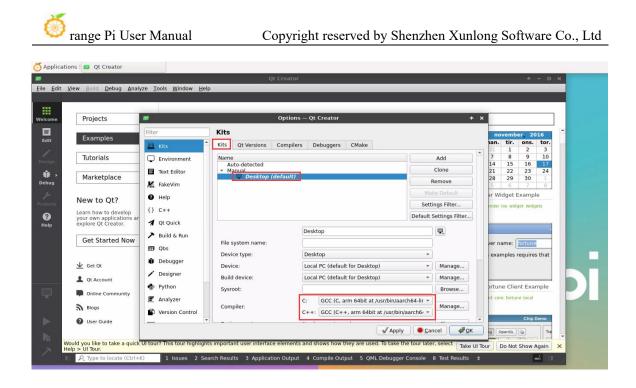




#### c. After setting up, you need to restart QT Creator

d. Then make sure the GCC compiler used by QT Creator. If the default is Clang, please change it to GCC.

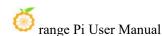


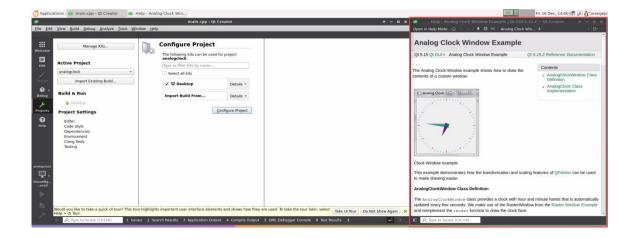


#### 7) Then you can open a sample code

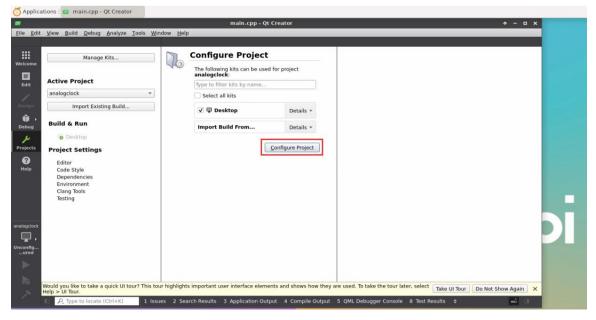
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New to Qt?	Address Book Example	Analog Clock Window Exam	Application Example	Calendar Widget Example	
Learn how to develop your own applications and explore Qt Creator.	widgets	Tags: analog android dock gui ios window	lags: application widgets	lags: calendar los winger wingers	
Get Started Now	Mathematical Science Science         B           100         The Science Sc	HTTP  RL:  Download directory:  C:Users/user/Ap	Code	Server name: fortune	
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Online Community	Tags: android editable los model tree widgets	Tags: http:network	Tags: core game json save	Tags: client core fortune local	
Blogs	wingers				
Ø User Guide	Fortune Server	• _ • ×		Chip Demo ntialiasino   OpenGL   Ala   Top	+
Would you like to take a quick UI tour Help > UI Tour.	? This tour highlights important user interfa	ace elements and shows how they are	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.

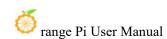




#### 9) Then click Configure Project

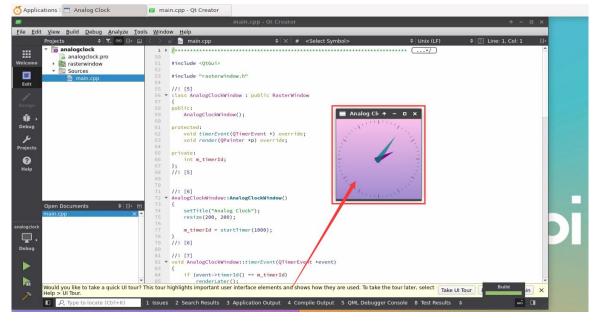


10) Then click the green triangle in the lower left corner to compile and run the sample code



O Applications 🛛 🚥 main.cpp - Qt Creator			
80	main.cpp - Qt Creator	↑ - □	×
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Welcome     Image: Content of the second secon	50 51 #include <qtgui></qtgui>	*/ )	*
Edit	52 53 #include "rasterwindow.h" 54 55 //1 [5]		
Design	56 v class AnalogClockWindow : public RasterWindow 57 ( 58 public:		
∰t → Debug	<pre>59 AnalogClockWindow(); 60 61 protected: 62 void timerEvent(OTimerEvent *) override;</pre>		
Projects	63 void render(QPainter *p) override; 64 65 private:		
<b>?</b> Негр	66 int m_timerid; 67 }; 68 //1 [5] 70 73 //1 [6]		
Open Documents	<pre>AnalogClockWindow:AnalogClockWindow() {     setTitle("Analog Clock";     resize(200, 200);</pre>		
analogclock	76 77 m_timerId = startTimer(1000); 78 } 79 //![6]		Р
	<pre>81 // [7] 82 * void AnalogClockWindow::timerEvent(QTimerEvent *event) 83 84 if (event-&gt;timerId) == m_timerId)</pre>		
Help > UI Tour.	$\frac{85}{1000}$ renderLater $\Omega_1$ is tour highlights important user interface elements and shows how they are used. To take the tour later	Take of four Do Not Show Again	×
P. Type to locate (Ctrl+K)	Issues 2 Search Results 3 Application Output 4 Compile Output 5 QML Debugger Console	8 Test Results 💠 📑 🔳	10

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. 30. ROS installation method

#### 3. 30. 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 Noetic Nihjemys<br/>(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



4) Then use the script below to install ros1orangepi@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:

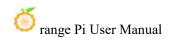
The read operation timed out

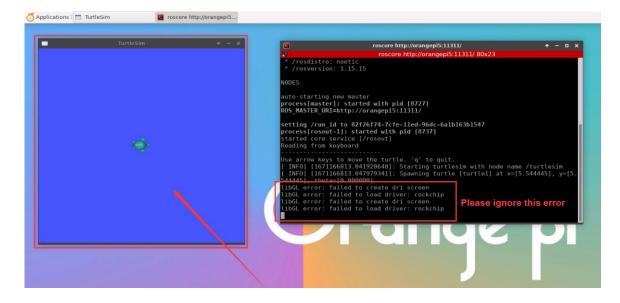
orangepi@orangepi:~\$ source /opt/ros/noetic/setup.bash orangepi@orangepi:~\$ sudo rosdep init Wrote /etc/ros/rosdep/sources.list.d/20-default.list Recommended: please run

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

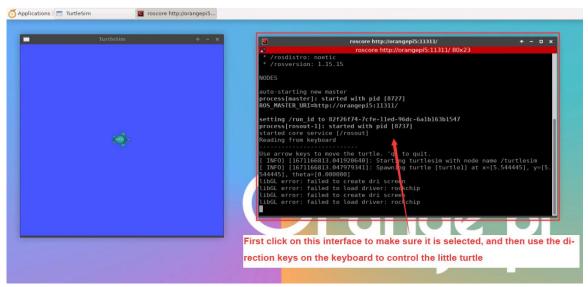
6) Then open a command line terminal window on the **desktop**, and then use the **test\_ros.sh** script to start a small turtle routine to test whether ROS can be used normally. orangepi@orangepi:~\$ **test\_ros.sh** 

7) After running the **test\_ros.sh** script, a small turtle as shown in the picture below will pop up.

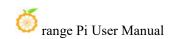


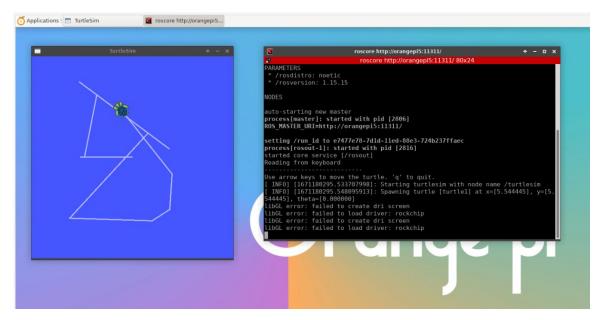


8) Then please keep the terminal window you just opened at the top



9) At this time, press the direction keys on the keyboard to control the little turtle to move up, down, left, and right.





#### 3. 30. 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	CALACTIC GEOCHELONE	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:

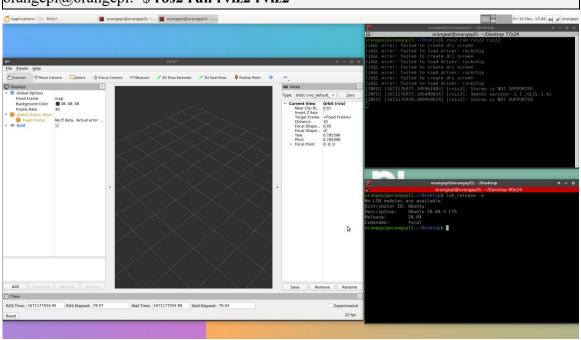
action	Various action related sub-commands
bag	Various rosbag related sub-commands
componer	nt Various component related sub-commands
daemon	Various daemon related sub-commands
doctor	Check ROS setup and other potential issues
interface	Show information about ROS interfaces
launch	Run a launch file
lifecycle	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. 30. 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

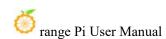
componen	t Various component related sub-commands
daemon	Various daemon related sub-commands
doctor	Check ROS setup and other potential issues
interface	Show information about ROS interfaces
launch	Run a launch file
lifecycle	Various lifecycle related sub-commands
multicast	Various multicast related 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.

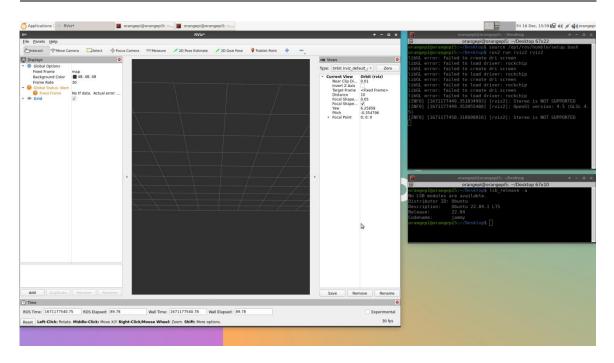
3) Then you can use the **test\_ros.sh** script to test whether ROS 2 is successfully installed. If you can see the following print, it means ROS 2 can run normally.

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. 31. 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. 32. 10.1-inch MIPI LCD screen usage method

#### 3. 32. 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



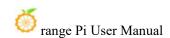
c. 30pin MIPI cable



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



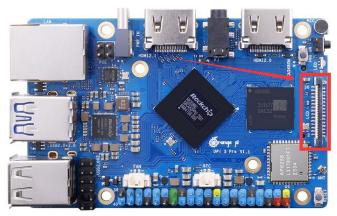
5) Finally, connect it to the LCD interface of the development board through a 30pin MIPI cable.



#### 3. 32. 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

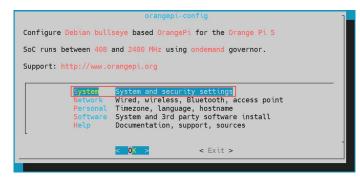


3) The steps to open mipi lcd configuration are as follows:

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

	System settings	1
Install Bootenv CPU Avahi Hardware SSH Firmware ZSH Desktop	Install to/update boot loader Edit boot environment Set CPU speed and governor <u>Announce system in the network</u> Toggle hardware configuration: UART, I2C, etc. Reconfigure SSH daemon Run apt update & apt upgrade Install ZSH with plugins and tmux Disable desktop or change login type	
	< 0K > < Back >	-

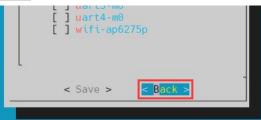
d. Then use the keyboard's arrow keys to locate **opi5pro-lcd** and then use the **space** to select it.

[*] 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. 32. 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

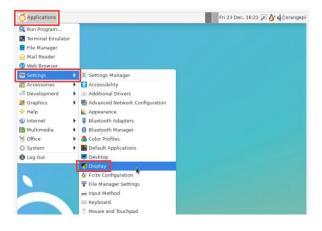
extraargs=cma=64M fbcon=rotate:3

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).

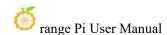
2) Then **restart** the Linux system and you will see that the direction of the LCD screen display has rotated.

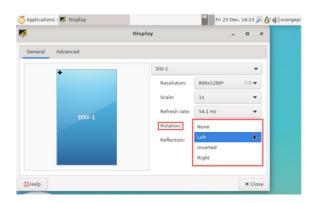
### 3. 32. 4. How to mirror the rotation display and touch direction of the desktop version

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	- • ×		
eneral Advanced				
	DSI-1	DSI-1 👻		
+	Resolution:	800x1280* 5:8 -		
	Scale:	1x 👻		
DSI-1	Refresh rate:	54.1 Hz 🔻		
0.01 1	Rotation:	Left 👻		
	Reflection:	None 👻		
		✓ Apply		

4) Then select Keep this configuration

Applications 🛃 Display	Sconfirmation		
	Display	_ = ×	
General Advanced			
	DSI-1	Ŧ	
+ DSI-1	Resolution:	800x1280* 5:8 🕶	
	Scale:	1x 👻	
	Refresh rate:	54.1 Hz 👻	
	Rotation:	Left 💌	
*	Confirmation	None	- ×
	to keep this configuratio		00
The previous configu	ration will be restored in 0 seconds	if you do not reply to this ques	tion.
)He	Keep this configuration	Restore the previous configurat	ion

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. 33. 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. 34. 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



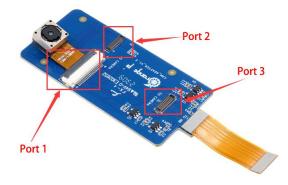
The adapter board and FPC cable used by the OV13850 and OV13855 cameras are

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.

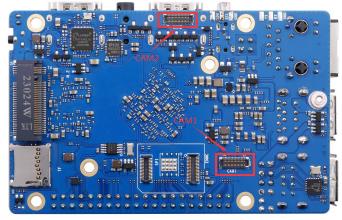


There are a total of 3 camera interfaces on the camera adapter board, and only one can be connected and used at the same time, as shown in the figure below, among which:

- 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 in the figure below:

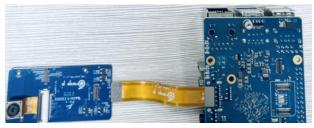


The method of plugging the camera into the Cam1 interface of the development

board is as follows:



The method of plugging the camera into the Cam2 interface of the development board is as follows:

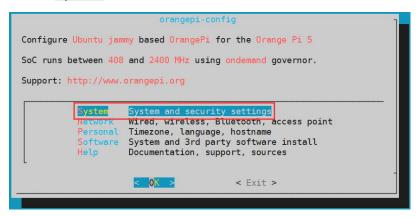


After connecting the camera to the development board, we can use the following method to test the camera:

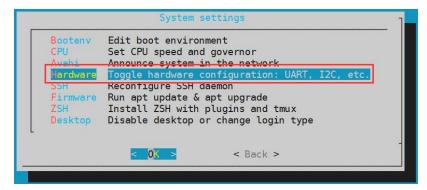
a. First run orangepi-config. Ordinary users remember to add sudo permissions.

orangepi@orangepi:~\$ sudo orangepi-config

b. Then select System



c. Then select Hardware



Then use the keyboard's arrow keys to locate the position shown in the figure d. 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.

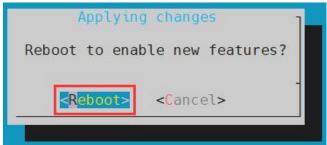


Then select <Back> f.

e.

l	[] pwm3-m0 ↓(+)	73%
	< Save >	< Back >

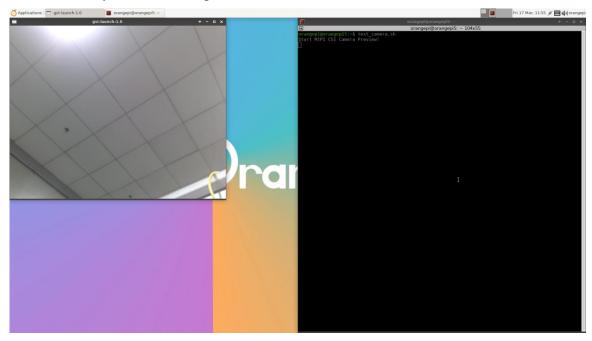
Then select **<Reboot>** restart the system to make the configuration take effect g.



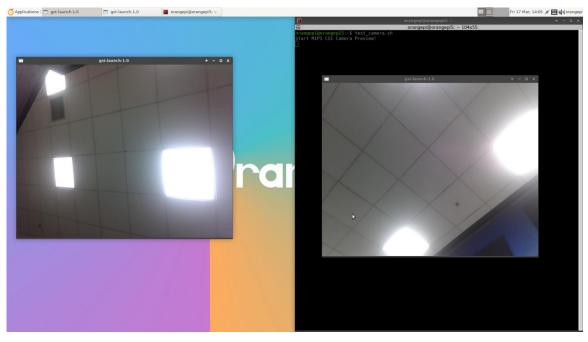
Then open a terminal on the desktop system and run the following script h.

#### 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. 35. How to use the ZFS file system

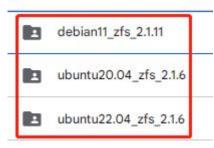
#### 3. 35. 1. How to install ZFS

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 automatically loaded.:

orangepi@orangepi	i:~\$ 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

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@orangepi:~\$ sudo apt install -y zfsutils-linux zfs-dkms						
3. 35. 2. How to create a ZFS pool							
ZFS i	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 f	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@orangepi:~\$ lsblk NAME MAJ:MIN RM SIZE RO TYPE MOUNTPOINTS sda 8:0 1 28.8G 0 disk -sda1 8:1 1 28.8G 0 part mtdblock0 31:0 0 16M 0 disk mmcblk0 179:0 0 29.7G 0 disk -mmcblk0p1 179:1 0 1G 0 part /boot mmcblk0p2 179:2 0 28.4G 0 part /var/log.hdd / zram0 254:0 0 7.7G 0 disk [SWAP] zram1 254:1 0 200M 0 disk /var/log nvme0n1 259:0 0 476.9G 0 disk -nvme0n1p1 259:3 0 476.9G 0 part orangepi@orangepi:~\$							
sda       8:0       1       28.8G       0       disk         -sda1       8:1       1       28.8G       0       part         mtdblock0       31:0       0       16M       0       disk         mmcblk0       179:0       0       29.7G       0       disk         -mmcblk0p1       179:1       0       1G       0       part       /boot         -mmcblk0p2       179:2       0       28.4G       0       part       /var/log.hdd         _ram0       254:0       0       7.7G       0       disk       [SWAP]         zram1       254:1       0       200M       0       disk       /var/log         nvme0n1       259:0       0       476.9G       0       gart         -nvme0n1p1       259:3       0       8M       0       part	orangepi@ora	angepı:~	\$ L!	sblk			
-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       179:1       0       1G       0 part /boot         -mmcblk0p2       179:2       0       28.4G       0 part /var/log.hdd         /       /       /       /       /         zram0       254:0       0       7.7G       0 disk [SWAP]         zram1       254:1       0       200M       0 disk /var/log         nvme0n1       259:0       0       476.9G       0 part         -nvme0n1p1       259:3       0       8M       0 part	NAME	MAJ:MIN	RM	SIZE	RO	TYPE	MOUNTPOINTS
-sda9       8:9       1       8M       0 part         mtdblock0       31:0       0       16M       0       disk         mmcblk0       179:0       0       29.7G       0       disk         -mmcblk0p1       179:0       0       29.7G       0       disk         -mmcblk0p1       179:1       0       1G       0       part /boot         -mmcblk0p2       179:2       0       28.4G       0       part /var/log.hdd         zram0       254:0       0       7.7G       0       disk       [SWAP]         zram1       254:1       0       200M       0       disk /var/log         nvme0n1       259:0       0       476.9G       0       gart         -nvme0n1p1       259:3       0       8M       0       part	sda	8:0	1	28.8G	0	disk	
mtdblock0       31:0       0       16M       0       disk         mmcblk0       179:0       0       29.7G       0       disk         -mmcblk0p1       179:1       0       1G       0       part /boot         -mmcblk0p2       179:2       0       28.4G       0       part /var/log.hdd         _mmcblk0p2       179:2       0       28.4G       0       part /var/log.hdd         _zram0       254:0       0       7.7G       0       disk       [SWAP]         zram1       254:1       0       200M       0       disk /var/log         nvme0n1       259:0       0       476.9G       0       gart         -nvme0n1p1       259:3       0       8M       0       part	-sda1	8:1	1	28.8G	Θ	part	
mmcblk0       179:0       0       29.7G       0       disk         -mmcblk0p1       179:1       0       1G       0       part /boot         -mmcblk0p2       179:2       0       28.4G       0       part /var/log.hdd         /       /       /       /       /       /         zram0       254:0       0       7.7G       0       disk       [SWAP]         zram1       254:1       0       200M       0       disk       /var/log         nvme0n1       259:0       0       476.9G       0       disk         -nvme0n1p1       259:3       0       476.9G       0       part         -nvme0n1p9       259:4       0       8M       0       part	l—sda9	8:9	1	8M	0	part	
-mmcblk0p1 179:1       0       1G       0 part /boot         -mmcblk0p2 179:2       0       28.4G       0 part /var/log.hdd         zram0       254:0       0       7.7G       0 disk [SWAP]         zram1       254:1       0       200M       0 disk /var/log         nvme0n1       259:0       0       476.9G       0 disk         -nvme0n1p1       259:3       0       476.9G       0 part	mtdblock0	31:0	0	16M	0	disk	
Immcblk0p2       179:2       0       28.4G       0       part /var/log.hdd         zram0       254:0       0       7.7G       0       disk       [SWAP]         zram1       254:1       0       200M       0       disk       /var/log         nvme0n1       259:0       0       476.9G       0       disk         -nvme0n1p1       259:3       0       476.9G       0       part         -nvme0n1p9       259:4       0       8M       0       part	mmcblk0	179:0	0	29.7G	0	disk	
zram0 254:0 0 7.7G 0 disk [SWAP] zram1 254:1 0 200M 0 disk /var/log nvme0n1 259:0 0 476.9G 0 disk -nvme0n1p1 259:3 0 476.9G 0 part -nvme0n1p9 259:4 0 8M 0 part	-mmcblk0p1	179:1	0	1G	0	part	/boot
zram1 254:1 0 200M 0 disk/var/log nvme0n1 259:0 0 476.9G 0 disk —nvme0n1p1 259:3 0 476.9G 0 part —nvme0n1p9 259:4 0 8M 0 part	└─mmcblk0p2	179:2	0	28.4G	0	part	/var/log.hdd
zram1 254:1 0 200M 0 disk/var/log nvme0n1 259:0 0 476.9G 0 disk —nvme0n1p1 259:3 0 476.9G 0 part —nvme0n1p9 259:4 0 8M 0 part							1
nvme0n1 259:0 0 476.9G 0 disk —nvme0n1p1 259:3 0 476.9G 0 part —nvme0n1p9 259:4 0 8M 0 part	zram0	254:0	0	7.7G	0	disk	[SWAP]
-nvme0n1p1 259:3 0 476.9G 0 part -nvme0n1p9 259:4 0 8M 0 part	zram1	254:1	0	200M	0	disk	/var/log
└─nvme0n1p9 259:4 0 8M 0 part	n∨me0n1	259:0	0	476.9G	0	disk	
	-nvme0n1p1	259:3	0	476.9G	0	part	
orangepi@orangepi:~\$	└─nvme0n1p9	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	<b>pool1</b> 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	<b>489G</b>	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. 35. 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.

orangep	oi@oran	gepi:/po	ool1\$ z	pool list					and a state of the second state of the second	
NAME	SIZE	ALLOC	FREE	CKPOINT	EXPANDSZ	FRAG	CAP	DEDUP	HEALTH	ALTROOT
pool1	504G	1.01G	503G			0%	0%	6.00x	ONLINE	

#### 3. 35. 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** 

	orangepi@orangepi:/pool1\$ ls -lh total 27M									
The second second			States and a state of the state		:46 text.ta	ar				
orangep	i@oran	gepi:/pc	oll\$ z	pool list						
NAME	SIZE	ALLOC	FREE	CKPOINT	EXPANDSZ	FRAG	CAP	DEDUP	HEALTH	ALTROOT
pool1	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 -rw-r	.2M r 1		ot 27M	Jun 1 14	:54 text.ta	ar				
orangep	1@oran	gep1:/pc	ol1\$ z	pool list						
NAME	SIZE	ALLOC	FREE	CKPOINT	EXPANDSZ	FRAG	CAP	DEDUP	HEALTH	ALTROOT
pool1	504G	9.47M	504G	-	· -	0%	0%	1.00x	ONLINE	1-1

### 3. 36. 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.

#### 3. 36. 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.

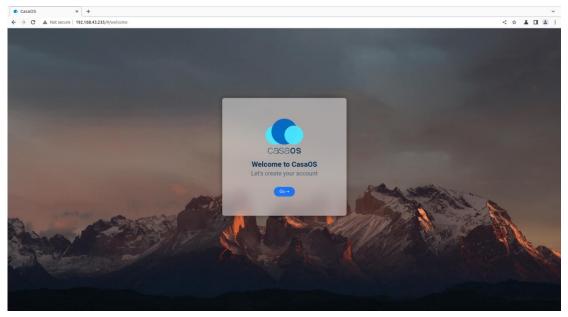


CasaOS v0.4.4.2	is running at:							
Open your brows	Open your browser and visit the above address.							
CasaOS Project	: https://github.com/IceWhaleTech/Casa	aOS						
CasaOS Team	: https://github.com/IceWhaleTech/Case	aOS#maintainers						
CasaOS Discord	: https://discord.gg/knqAbbBbeX							
Website	: https://www.casaos.io							
Online Demo	: http://demo.casaos.io							
Uninstall	: casaos-uninstall							

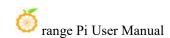
#### 3. 36. 2. How to use CasaOS

1) After installing CasaOS, enter **http://the IP address** of the development board in the browser to open CasaOS

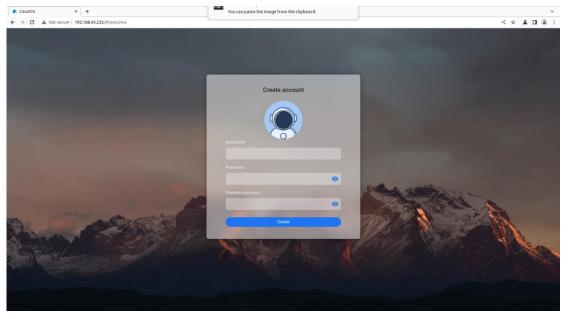
2) After opening CasaO, the following welcome interface will pop up. Click "Go" to proceed to the next step.



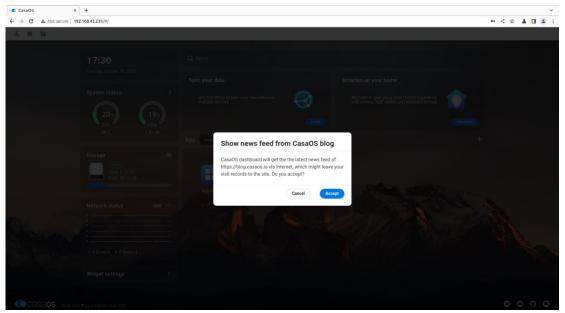
3) When you log in to CasaOS for the first time, the login interface is the interface for setting the account and password. When you log in again, only the interface for entering the account and password will appear. After setting the account and password, click



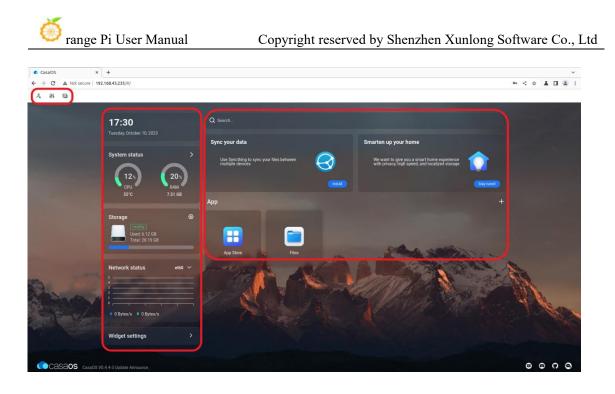
"Create" to proceed to the next step.



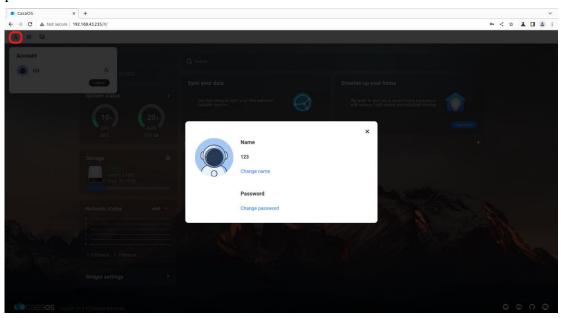
4) Click "Accept" directly in the interface below to proceed to the next step.



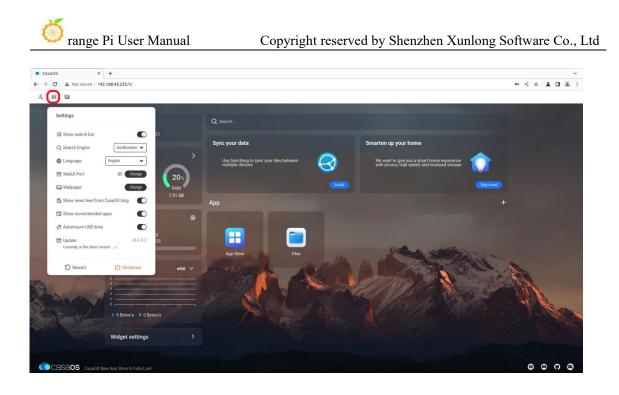
5) Now enter the main page of CasaOS. There are three icons in the upper left corner for function settings. On the left is the performance panel, which can display the current time and status information of CPU, RAM, storage, and network. On the right is the function panel. It has functions such as search, 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



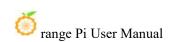
7) You can click the second icon to set basic functions

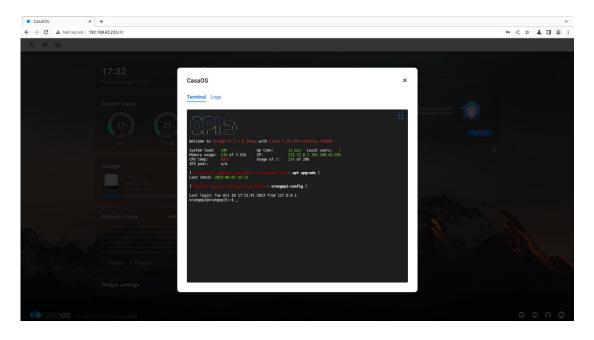


8) The third icon in the upper left corner mainly has two functions, namely switching to command line mode and printing log information. When switching to command line mode, you need to enter your account and password. The account and password here refer to the development board. Linux system account and password, the port system defaults to number 22

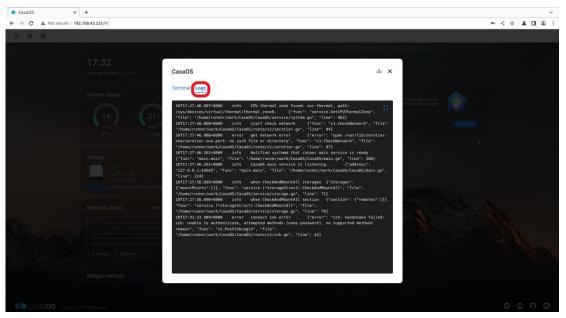
CasaOS × +		~
← → C ▲ Not secure   192.168.43.235/#/		er < 🕁 🖬 🏝 🗄
A # 📵		
17:32 Tuesday, October 10, 2023	CasaOS	×
System status	Terminal Logs	
11, 21,		honine experience Norsalized storage.
CPU RAM. 57°C 7.51.68	Username	(Partent) +
Storage	orangepi	
	Password	
Used 613 GB	orangepi 🗞	
	Ports	and the second
Nétwork status: etilő	22	
15 E	Connect	
A Contraction of the second		
● O Bytes/o ● O Bytes/o		
Widget settings		
Casados VII. 4.4.3 Unitate Announce		

9) Then click "Connect" to enter the command line interface:

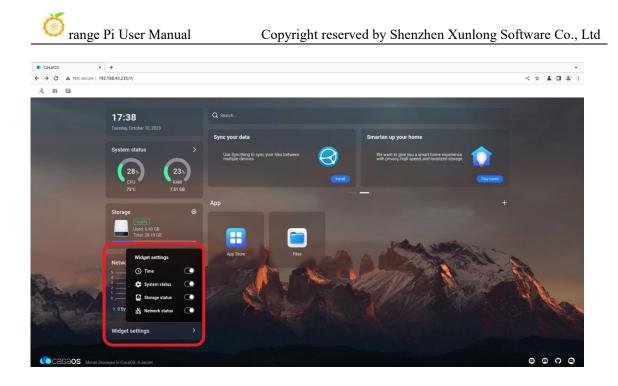




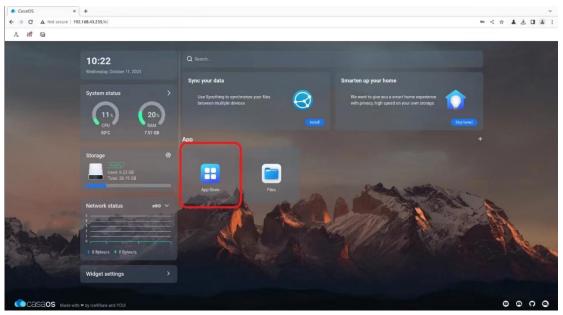
10) Another function under the third icon is to print CasaOS logs. Click "Logs" to enter. The interface is as follows:



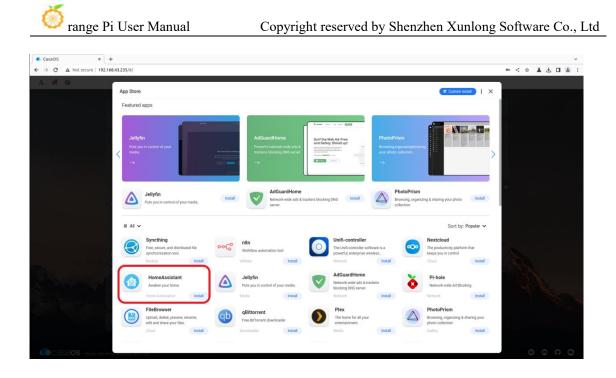
11) Click "Widget settings" in the lower left corner to set whether to display the widgets of the performance panel on the main page.



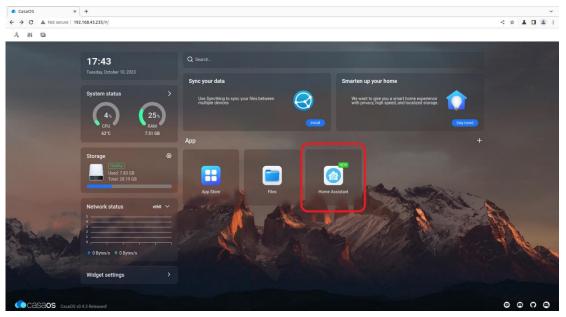
12) Click "APP Store" on the main interface to open the app store. Currently, there are a total of 70+ APPs available in the app store.



13) Here we take Home Assistant as an example to download, find Home Assistant in the APP Store, and then click the corresponding "install"

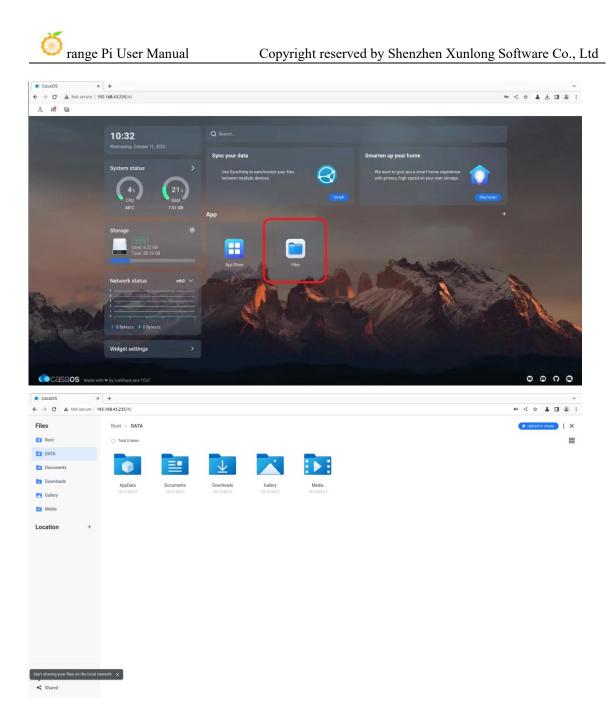


14) After the download is completed, HostAssitant will appear on the main page.



15) Click "Files" in the main interface to open the file system that comes with CasaOS, and then you can upload and save files.

Please ensure that other devices and the development board are in the same LAN.



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.

Root > DATA > Media > TV Shows     Image: Shows       Root > Data > Media > TV Shows     Image: Shows       O total 0 tems     Image: Shows       B coursents     Image: Shows	CasaOS	× +		v
Roat     O table terms     B       D torms     B       D contraints     B       G carbar     B       D table terms     B       B table terms     B       D table terms     B	→ C ▲ Not secure	192.168.43.235/#/		< 🖈 👗 🖬 😩 :
CotAA Cocuments Codean Cotain	Files	Root > DATA > Media > TV Shows		V. Upload or create
Cocuments Cocume	Root	<ul> <li>Total 0 items</li> </ul>		88
g Callery 2 Media ocation + 0	DATA			
Catlery       2] Media       Ocation       +	Documents			
2 Media cottion +	Downloads			
ocation +	Gallery			
ocation + o	Media			
or	ocation +		Drop your files here to upload	
New file     New folder     Upload files     Upload folder       Image: Comparison of the state	oution		of	
			New file New folder Upload files Upload folder	
	FilesDrop			

17) If you want to uninstall CasaOS, you can use the following command:

orangepi@orangepi5pro:~\$ casaos-uninstall

# 3. 37. Methods of using NPU

#### 3. 37. 1. Prepare tools

1) A PC with Ubuntu 20.04 operating system installed

According to the official documentation of RKNN-Toolkit2, the current version of RKNN-Toolkit2 supports the following operating systems:

a. Ubuntu18.04 (x64)

b. Ubuntu20.04 (x64)

c. Ubuntu22.04 (x64)

In this document, we demonstrate using the Ubuntu20.04 (x64) operating system. Please test other versions of the operating system yourself.

2) An Orange Pi 5 Plus development board with Debian 11 system installed

3) A Type-C interface data cable for using adb function



#### 3. 37. 2. Installing RKNN-Toolkit2 on Ubuntu PC

Toolkit2 is a development kit used on the Ubuntu PC platform. Users can easily complete functions such as model conversion, inference, and performance evaluation using the Python interface provided by the tool.

1) On the Ubuntu PC side, open a command-line window and enter the following command to install python3 and pip3

test@test:~\$ sudo apt-get install python3 python3-dev python3-pip

2) You can use the following command to view the installed version of python3

test@test:~\$ **python3 --version** Python 3.8.10

3) Then enter the following command to install the dependency package of RKNN-Toolkit2

test@test:~\$ sudo apt-get update test@test:~\$ sudo apt-get install libxslt1-dev zlib1g-dev libglib2.0 \ libsm6 libgl1-mesa-glx libprotobuf-dev gcc

4) Then enter the following command to download RKNN-Toolkit2 version 1.5.2
 test@test:~\$ git clone git clone https://github.com/airockchip/rknn-toolkit2 -b v1.5.2

5) Then enter the following command to install the dependency package for the corresponding version of python3. This command will use the dependencies listed in the pip3 installation file requirements\_cp38-1.5.2.txt. If the dependency installation is incomplete, do not specify the installation source and install each package separately.

test@test:~\$ pip3 install -r rknn-toolkit2/doc/requirements\_cp38-1.5.2.txt -i \

#### https://mirror.baidu.com/pypi/simple

6) Then enter the following command to use pip3 to install the RKNN-Toolkit2 package. After installation, you can use RKNN-Toolkit2

test@test:~\$ pip3 install rknn-toolkit2/packages/rknn\_toolkit2-1.5.2+b642f30c-cp38-cp38-linux\_x86\_64.whl

# 3. 37. 3. Use RKNN-Toolkit2 for model transformation and model inference

**RKNN-Toolkit2 supports converting models such as Caffe, TensorFlow, Te** nsorFlow Lite, ONNX, DarkNet, PyTorch, etc. into RKNN models, and then r unning the RKNN models through simulation or using the NPU of the develo pment board on Ubuntu PC for inference.

The example folder in RKNN-Toolkit2 provides relevant examples to help users better understand how to operate. We take the ONNX model with yolo v5 functionality as an example for illustration.

#### 3. 37. 3. 1. Simulating and Running Models on Ubuntu PC

**RKNN-Toolkit2** is equipped with a built-in simulator that allows users to simulate the inference process of models on Rockchip NPU on Ubuntu PC.

This way, both model conversion and inference can be completed on Ubu ntu PC, helping users test and validate their models faster.

1) First, switch to the rknn-toolkit2/examples/onnx/yolov5 directory test@test:~\$ cd rknn-toolkit2/examples/onnx/yolov5/

2) Then run the test.py script, which first converts the yolov5s\_relu.onnx model into an RKNN model that can be run on the simulator, and then uses the simulator to simulate and run the model to infer the bus.jpg image in the current directory

test@test:~/rknn-toolkit2/examples/onnx/yolov5\$ python3 test.py

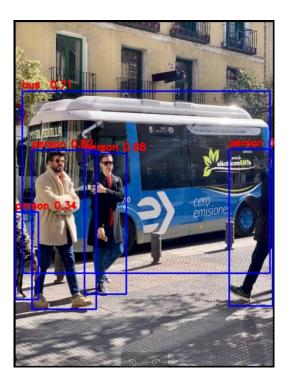
3) After the test. py script runs successfully, the following print message will be seen, indicating that the model has successfully detected four people and a bus in the bus.jpg image

done --> Running model

W inference: The 'data_format' has not been set and defaults is nhwc!
done
class: person, score: 0.884139358997345
box coordinate left,top,right,down: [209.1040009856224, 244.4304337501526, 286.5742521882057,
506.7466902732849]
class: person, score: 0.8676778078079224
box coordinate left,top,right,down: [478.5757632255554, 238.58572268486023, 559.5273861885071,
526.479279756546]
class: person, score: 0.8246847987174988
box coordinate left,top,right,down: [110.57257843017578, 238.58099019527435,
230.54625701904297, 534.0008579492569]
class: person, score: 0.3392542004585266
box coordinate left,top,right,down: [79.96397459506989, 354.9062474966049, 122.13020265102386,
516.2529321908951]
class: bus , score: 0.7012234926223755
box coordinate left,top,right,down: [94.43931484222412, 129.53470361232758, 553.1492471694946,
468.0852304697037]
D NPUTransfer: Transfer client closed, fd = 3

4) The converted model file yolov5s\_relu.rknn and the inferred image result result.jpg are saved in the current directory

5) The result.jpg image shows the object categories and confidence rates detected in the bus.jpg image using the yolov5s\_relu.rknn model



# 3. 37. 3. 2. NPU running model using development board on Ubuntu PC

**RKNN-Toolkit2** provides users with a Python interface for inference using the NPU of the development board through adb, allowing users to run mode ls for inference on Ubuntu PC using the NPU of the development board.

In this way, Ubuntu PC can optimize and adjust the model based on its actual performance when running on the NPU of the development board, usin g the machine learning library provided by Python.

#### 3. 37. 3. 2. 1. Connect adb using Type-C data cable

Operate the development board through adb on Ubuntu PC, please refer to the section on **ADB usage for instructions** on how to use adb

# 3. 37. 3. 2. 2. Update the rknn\_server and librknnrt.so of the development board

librknnrt.so is a runtime library on the board.

rknn\_server is a backend proxy service running on the development boar d, used to receive protocols transmitted from the PC via USB, execute the co rresponding interface in the runtime library on the board, and return the res ults to the PC.

1) First, enter the following command on Ubuntu PC to download RKNPU2 version 1.5.2

test@test:~\$ git clone https://github.com/rockchip-linux/rknpu2 -b v1.5.2

2) Then, on the Ubuntu PC side, enter the following command to update the rknn\_server of the development board through the adb tool

test@test:~\$ adb push rknpu2/runtime/RK3588/Linux/rknn\_server/aarch64/usr/bin/\* /usr/bin

3) Then enter the following command on Ubuntu PC to update the librknnrt.so library of the development board through adb tool

test@test:~\$ adb push rknpu2/runtime/RK3588/Linux/librknn\_api/aarch64/librknnrt.so /usr/lib

4) Open the terminal of the development board through the adb tool
 test@test:~\$ adb shell

5) Open the rknn\_server service on the development board

root@orangepi:/# sudo restart rknn.sh

root@orangepi:/# start rknn server,version:1.5.2(8babfeabuild@2023-08-25T10:30:31) I NPUTransfer: Starting NPU TransferServer,Transfer version 2.1.0(b5861e7@2020-11-23T11:50:51)

6) You can use the following command to check. If the process ID of rknn\_server appears, it means that rknn\_server is already open, and the running environment of the development board is set up

root@orangepi:/# pgrep rknn\_server

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## 3. 37. 3. 2. 3. Modify parameters in the example

1) On the Ubuntu PC side, you can view the device ID of the development board connected to the Ubuntu PC using the following command. This ID will be used below

test@test:~\$ **adb devices** List of devices attached 4f9f859e5a120324 device

 Switch to the rknn-toolkit2/examples/onnx/yolov5 directory test@test:~\$ cd rknn-toolkit2/examples/onnx/yolov5/

Use Vim editor to modify the test.py file
 test@test:~/rknn-toolkit2/examples/onnx/yolov5\$ vim test.py

- 4) In the test.py file, we need to make modifications to the following content:
  - a. In the preprocessing configuration, modify the target platform to rk3588, so that the resulting model is an RKNN model suitable for NPU on the RK3588 development board

```
# pre-process config
print('--> Config model')
rknn.config(mean_values=[[0, 0, 0]], std_values=[[255, 255, 255]], target_platform='rk3583')
print('done')
```

b. In the initialization running environment, add explanations for the target platform and device ID. The target platform is rk3588, and the device ID is the device ID obtained from the development board through adb. The inference operation of the running model will be performed on the NPU of the RK3588 development board

# Init runtime environment		
<pre>print('&gt; Init runtime environment')</pre>		
ret = rknn.init_runtime(target='rk3583, device_id='4f9f859e5a120324')		
if ret != 0:		
<pre>print('Init runtime environment failed!')</pre>		
exit(ret)		
<pre>print('done')</pre>		

c. After modification, save and exit

#### 3. 37. 3. 2. 4. Running Examples on Ubuntu PC

1) Enter the following command to run the test.py script, which first converts the yolov5s\_relu.onnx model to an RKNN model, and then loads the model onto the NPU of the development board to infer the out.jpg image in the current directory

test@test:~/rknn-toolkit2/examples/onnx/yolov5\$ python3 test.py

2) Enter the following command to run the test. py script, which first converts the yolov5s\_relu.onnx model to an RKNN model, and then loads the model onto the NPU of the development board to infer the out.jpg image in the current directory

--> Init runtime environment I target set by user is: rk3588 I Check RK3588 board npu runtime version I Starting ntp or adb, target is RK3588 I Device [4f9f859e5a120324] not found in ntb device list. I Start adb... I Start adb... I Connect to Device success! I NPUTransfer: Starting NPU Transfer Client, Transfer version 2.1.0

(b5861e7@2020-11-23T11:50:36)

3) After the test.py script runs successfully, the converted model file yolov5s\_relu.rknn and the inferred image result result.jpg are saved in the current directory

4) The result of running is the same as the section on **simulating the running model on Ubuntu PC** 

# 3. 37. 4. Call the C interface to deploy the RKNN model to the development board and run it

**RKNPU2** provides a C programming interface for chip platforms with Ro ckchip NPU, which can help users deploy RKNN models exported from RKN N-Toolkit2 and accelerate the implementation of AI applications.

In the example folder of RKNPU2, there are examples of deploying RKN N models with different functionalities to the development board. We take the deployment of an RKNN model with yolov5 functionality to the RK3588 Deb ian 11 platform as an example for illustration.

### 3. 37. 4. 1. **Download Cross Compile Tool**

Due to the development board running a Linux system, it is necessary to use the gcc cross compiler for compilation. Recommend using the gcc-9.3.0-x86\_64\_a rrch64-linux-gnu version of gcc

Enter the following command to download this version of gcc. After downloa ding, you will receive a folder named gcc-buildroot-9.3.0-2020.03-x86\_64\_aarch64-r ockchip-linux-gnu

test@test:~\$ git clone https://github.com/airockchip/gcc-buildroot-9.3.0-2020.03-x86\_64\_aarch 64-rockchip-linux-gnu

#### 3. 37. 4. 2. Modify the compilation tool path in the script

Switch to the rknpu2/examples/rknn\_yolov5\_demo directory
 test@test:~\$ cd ~/rknpu2/examples/rknn\_yolov5\_demo

2) Modify the contents of the build-linux\_RK3588.sh file using the vim editor test@test:~/rknpu2/examples/rknn\_yolov5\_demo\$ vim build-linux\_RK3588.sh

3) In the build-linux\_RK3588.sh file, we need to change the value of the variable TOOL\_CAIN to the path of the gcc-buildroot-9.3.0-2020.03-x86\_64\_aarch64-rockc hip-linux-gnu folder. In this way, when running the build-android\_RK3588.sh script, the cross compilation tool in the gcc-buildroot-9.3.0-2020.03-x86\_64\_aarch64-rockc hip-linux-gnu folder will be used for compilation



4) After modification, save and exit

## 3. 37. 4. 3. **Compiling rknn\_yolov5\_demo**

1) Run build-linux\_RK3588.sh, which generates a program suitable for the RK3588 development board and capable of running RKNN models for inference through cross compilation

test@test:~/rknpu2/examples/rknn\_yolov5\_demo\$ **sudo apt install cmake** test@test:~/rknpu2/examples/rknn\_yolov5\_demo\$ **sudo apt-get install g++-aarch64-linux-gnu** test@test:~/rknpu2/examples/rknn\_yolov5\_demo\$ **./build-linux\_RK3588.sh** 

2) After running build-linux\_RK3588.sh, an additional folder named install will appear in the current directory. The rknn\_yoov5\_demo\_Linux folder in this folder contains programs generated through cross compilation and related files

test@test:~/rknpu2/examples/rknn\_yolov5\_demo\$ ls install rknn\_yolov5\_demo\_Linux

# 3. 37. 4. 4. Deploy rknn\_yolov5\_demo to the development board

On the Ubuntu PC side, the following command can be used to upload the r knn\_yolov5\_demo\_Linux folder to the development board through the adb tool, the reby achieving the deployment of rknn\_yolov5\_demo on the development board test@test:~/rknpu2/examples/rknn\_yolov5\_demo\$ adb push \ install/rknn\_yolov5\_demo\_Linux /data/rknn\_yolov5\_demo\_Linux

# 3. 37. 4. 5. Running rknn\_yolov5\_demo on the development board

 Accessing the file system of the development board through adb shell on Ubuntu PC test@test:~\$ adb shell root@orangepi:/#

2) Switch to the rknn\_yolov5\_demo\_Linux directory
root@orangepi:/# cd /data/rknn\_yolov5\_demo\_Linux/
root@orangepi:/data/rknn\_yolov5\_demo\_Linux# ls
lib model rknn\_yolov5\_demo rknn\_yolov5\_video\_demo

3) Then run the rknn\_yolov5\_demo program for inference. In the following command, the program uses the yolov5s-640-640.rknn model to infer bus.jpg images. The entire running process will be completed on the development board

root@orangepi:/data/rknn\_yolov5\_demo\_Linux# ./rknn\_yolov5\_demo \ ./model/RK3588/yolov5s-640-640.rknn ./model/bus.jpg

4) After running, the inference result out.jpg image is saved in the current directory root@orangepi:/data/rknn\_yolov5\_demo\_Linux# ls
lib model out.jpg rknn yolov5 demo rknn yolov5 video demo

5) On the Ubuntu PC side, we can use the following command to download out.jpg images through the adb tool, and then use an image viewer to view them

test@test:~\$ adb pull /data/rknn_yolov5_demo_Linux/out.jpg ~/Desktop/
/data/rknn_yolov5_demo_Linux/out.jpg:led. 1.9 MB/s (191507 bytes in 0.095s)

6) The out.jpg image shows the object categories and confidence rates detected in the bus.jpg image using the yolov5s-640-640.rknn model



## 3. 38. RK3588 method of using PaddlePaddle

Using PaddlePaddle on the rk3588 development board, including converting the pdmodel model to the rknn model on the PC and deploying the rknn model on the board using PaddlePaddle FastDeploy deployment tool. The following content was implemented in an environment with Ubuntu22.04 on the PC side and Debian 11 on the board side. Please test it yourself in other environments.

#### 3. 38. 1. Ubuntu PC environment setup

The tools and purposes that need to be installed on Ubuntu PC are as follows

Tool Name	Purpose
Amagan da 2	Used for creating and managing Python
Anaconda3	environments
Paddle2ONNX	Used to convert pdmodel model to
Paddle2ONNA	ONNX model
DEXIDI T. 11-42	Used to convert ONNX models to RKNN
RKNN-Toolkit2	models

#### 3. 38. 1. 1. Installing Anaconda3 on PC

1) Open a browser on Ubuntu PC and enter the following URL in the address bar to

download and install the Anaconda3 script. After downloading, you will receive the **Anaconda3-2023.07-1-Linux-x86 64.sh** file

https://mirrors.tuna.tsinghua.edu.cn/anaconda/archive/Anaconda3-2023.07-1-Linux -x86 64.sh

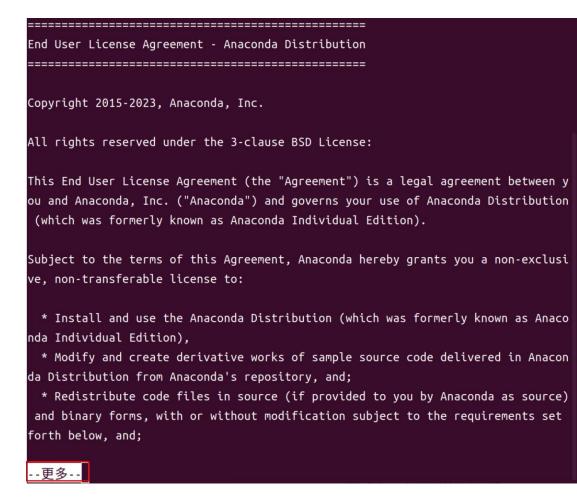
2) Then open the terminal and run the **Anaconda3-2023.07-1-Linux-x86\_64.sh** script to install Anaconda3

test@test:~/Downloads\$ sh Anaconda3-2023.07-1-Linux-x86\_64.sh

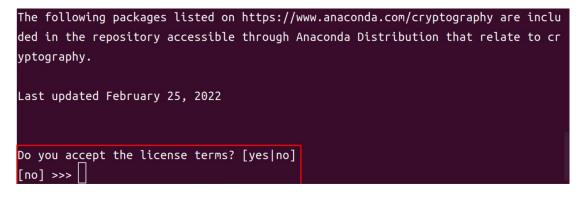
3) Then the installation script will output the following prompt message. Click the enter key to continue the installation



4) After clicking the enter key, some introduction information about Anaconda3 will appear. Keep clicking the "  $\downarrow$  " key

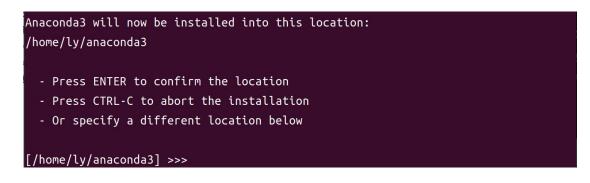


5) Then the installation script will prompt whether to accept the license terms. At this point, enter yes and press enter to proceed

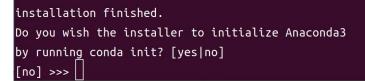


6) Then the installation script will remind you to install Anaconda3 to your home directory. Press Enter to confirm

🍯 range Pi User Manual



7) Then the installation script will prompt whether to initialize Anaconda3. Enter yes and press enter



8) When the following print appears on the terminal, it indicates that Anaconda3 has been successfully installed

If you'd prefer that conda's base environment not be activated on startup, set the auto\_activate\_base parameter to false: conda config --set auto\_activate\_base false

Thank you for installing Anaconda3!

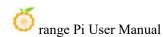
#### 3. 38. 1. 2. **PC installation of RKNN-Toolkit2**

1) Open the terminal on Ubuntu PC and create an environment with Python version 3.8 using Anaconda3 tool

(base)test@test:~\$ conda create -n fastdeploy python=3.8

2) Activate the environment of python3.8 that was just created(base)test@test:~\$ conda activate fastdeploy

3) Then install the pip3 development tool and package management tool (fastdeploy)test@test:~\$ sudo apt-get install python3-dev python3-pip



4) Then install the dependency package for RKNN-Toolkit2

(fastdeploy)test@test:~\$ sudo apt-get install libxslt1-dev zlib1g-dev libglib2.0 libs m6 libgl1-mesa-glx libprotobuf-dev gcc

5) rknn\_toolkit2 has a specific dependency on numpy, so numpy==1.16.6 needs to be installed first

(fastdeploy)test@test:~\$ pip install numpy==1.16.6

6) Install git tools

(fastdeploy)test@test:~\$ sudo apt install git

7) Then execute the following command to download RKNN-Toolkit2. After downloading, you will receive the rknn-toolkit2 folder

(fastdeploy)test@test:~\$ git clone https://github.com/rockchip-linux/rknn-toolkit2

8) Then execute the following command to install RKNN-Toolkit2 corresponding to Python 3.8 version

(fastdeploy)test@test:~\$ pip install rknn-toolkit2/rknn-toolkit2/packages/rknn\_tool kit2-1.6.0+81f21f4d-cp38-cp38-linux\_x86\_64.whl

# 3. 38. 1. 3. Installing Paddle2ONNX on PC

You can execute the following command to install paddle2onnx

(fastdeploy)test@test:~\$ pip install paddle2onnx

#### 3. 38. 2. Board end environment setup

The tools and purposes that need to be installed at the board end are as follows

Tool Name	Purpose
Anaconda3	Used for creating and managing Python
Anacondas	environments
rknpu2	The basic driver of rknpu2
FastDanlay	Compile to obtain FastDeploy inference
FastDeploy	library

### 3. 38. 2. 1. Board end installation of Anaconda3

1) Open a browser on the board and enter the following URL in the address bar to download and install the Anaconda3 script. After downloading, you will receive the **Anaconda3-2023.07-1-Linux-aarch64.sh** 

https://mirrors.tuna.tsinghua.edu.cn/anaconda/archive/Anaconda3-2023.07-1-Linux -aarch64.sh

2) Open the terminal and run the **Anaconda3-2023.07-1-Linux-aarch64.sh** script to install Anaconda3

orangepi@orangepi:~/Downloads\$ sh Anaconda3-2023.07-1-Linux-aarch64.sh

3) Then the installation script will output the following prompt message, click enter to continue the installation

rangepi@orangepi5:-/Downloads\$ sh Anaconda3-2023.07-1-Linux-aarch64.sh @lcome to Anaconda3 2023.07-1 n order to continue the installation process, please review the license greement. Lesse, press ENTER to continue

4) After clicking the enter key, some introduction information about Anaconda3 will appear. Keep clicking the " $\downarrow$ " key



5) Then the installation script will prompt whether to accept the license terms. At this point, enter 'yes' and press enter to proceed

The following packages listed on https://www.anaconda.com/cryptography are included in the repository accessible through Anaconda Distribution that relate to cryptography. Last updated February 25, 2022 Do you accept the license terms? [yes|no]

6) Then the installation script will remind you to install Anaconda3 to your home directory. Press Enter to confirm



7) Then the installation script will prompt whether to initialize Anaconda3. Enter yes and press enter



for installing Anaconda3!

8) When the following print appears on the terminal, it indicates that Anaconda3 has been successfully installed

```
f you'd prefer that conda's base environment not be activated on startup,
set the auto_activate_base parameter to false:
onda config --set auto_activate_base false
```

9) If you use the conda command on the terminal and it shows that the command does not exist, you need to modify the  $\sim$ /.bashrc file

orangepi@orangepi:~\$ vi ~/.bashrc

10) Add the following code at the end of the  $\sim$ /.bashrc file

export PATH=/home/orangepi/anaconda3/bin:\$PATH

11) Then enter the following command in the terminal to make the previous modification effective

orangepi@orangepi:~\$ source ~/.bashrc

12) Then enter the following command in the terminal to initialize conda (base)orangepi@orangepi:~\$ conda init bash

13) Then close the current terminal and reopen another terminal, and you can use the conda command normally now

#### 3. 38. 2. 2. Board end installation of rknpu2 driver

1) Open the terminal on the board and create an environment with python version 3.9 using the Anaconda3 tool

(base)orangepi@orangepi:~\$ conda create -n fastdeploy python=3.9

2) Activate the environment of python3.9 that was just created (base)orangepi@orangepi:~\$ conda activate fastdeploy

3) Download the rknpu2\_device\_install\_1.4.0.zip file through wget
 (fastdeploy)orangepi@orangepi:~\$ wget https://bj.bcebos.com/fastdeploy/third\_libs/r
 knpu2\_device\_install\_1.4.0.zip

4) Then the following command is executed to decompress

rknpu2\_device\_install\_1.4.0.zip, which will result in the rknpu2\_device\_install\_1.4.0 folder and the MACOSX folder

(fastdeploy)orangepi@orangepi:~\$ unzip rknpu2\_device\_install\_1.4.0.zip

5) Switch to the directory rknpu2\_device\_install\_1.4.0 (fastdeploy)orangepi@orangepi:~\$ cd rknpu2\_device\_install\_1.4.0/

6) There is the rknn\_install\_rk3588.sh script in this directory. Running this script will complete the installation of the rknpu2 driver on the board

(fastdeploy)orangepi@orangepi:~/rknpu2\_device\_install\_1.4.0\$ sudo bash rknn\_install\_r k3588.sh

#### 3. 38. 2. 3. Board side compilation FastDeploy C++ SDK

1) During compilation, the cmake command is required. You can execute the following command to install the cmake tool

(fastdeploy)orangepi@orangepi:~\$ sudo apt-get install -y cmake

2) Then download the FastDeploy SDK, and after the command is executed, you will receive the FastDeploy folder

(fastdeploy)orangepi@orangepi:~\$ git clone https://github.com/PaddlePaddle/FastD eploy.git

3) Switch to FastDeploy directory

(fastdeploy)orangepi@orangepi:~\$ cd FastDeploy

4) Create the build directory and switch to the build directory
 (fastdeploy)orangepi@orangepi:~/FastDeploy\$ mkdir build && cd build

5) Before compilation, cmake needs to be used to configure the project information that needs to be compiled. After executing the following command, some additional files will appear in the current directory, including the Makefile file file used for compilation

(fastdeploy)orangepi@orangepi:~/FastDeploy/build\$ cmake .. -DENABLE\_ORT\_BACKEND=ON \ -DENABLE\_RKNPU2\_BACKEND=ON \ -DENABLE\_VISION=ON \

-DRKNN2\_TARGET\_SOC=RK3588 \

-DCMAKE\_INSTALL\_PREFIX=\${PWD}/fastdeploy-0.0.3

6) Execute the following command to start compiling
 (fastdeploy)orangepi@orangepi:~/FastDeploy/build\$ make -j8

7) After compilation, use the following command to install the compiled file to the specified path

(fastdeploy)orangepi@orangepi:~/FastDeploy/build\$ make install

8) After the compilation is completed, the main folder obtained is fastdeploy-0.0.3. In this folder, there is a script file called fastdeploy\_init.sh for configuring environment variables. After using this script to configure environment variables, you can use some of the compiled library files

(fastdeploy)orangepi@orangepi:~/FastDeploy/build\$ source fastdeploy-0.0.3/fastdeploy\_init.sh

3. 38. 3. **Deploying Model Example with FastDeploy** 

The ResNet50\_vd model is a model used for object classification. Taking the ResNet50\_vd model as an example, we will explain the process of deploying the

pdmodel model using FastDeploy

### 3. 38. 3. 1. Ubuntu PC Model Conversion

1) Open the terminal on the PC and activate the python3.8 environment created using Anaconda3 before activation

test@test:~\$ conda activate fastdeploy

2) In the script for model conversion, it is necessary to import the yaml module and the six module. You can execute the following command to install them

(fastdeploy)test@test:~\$ pip install pyyaml six

3) Execute the following command to download the ResNet50\_vd\_infer.tgz file (fastdeploy)test@test:~\$ wget https://bj.bcebos.com/paddlehub/fastdeploy/ResNet50\_vd\_infer.tgz

4) After decompressing the ResNet50\_vd\_infer.tgz file, you can obtain the ResNet50\_vd\_infer folder, which contains the pdmodel file inference.pdmodel and other related files

(fastdeploy)test@test:~\$ tar -xvf ResNet50\_vd\_infer.tgz

5) You can use the following command to convert the pdmodel model to an onnx model through paddle2onnx. After executing this command, the converted onnx model file ResNet50 vd infer.onnx will appear in the ResNet50 vd infer folder

(fastdeploy)test@test:~\$ paddle2onnx --model\_dir ResNet50\_vd\_infer \ --model\_filename inference.pdmodel \ --params\_filename inference.pdiparams \ --save\_file ResNet50\_vd\_infer/ResNet50\_vd\_infer.onnx \ --enable\_dev\_version True \ --opset\_version 10 \ --enable\_onnx\_checker True

6) Then use the following command to fix the shape to [1,3,224,224]. After executing the command, the ResNet50\_vd\_infer.onnx file will be modified

(fastdeploy)test@test:~\$ python -m paddle2onnx.optimize --input\_model \ ResNet50\_vd\_infer/ResNet50\_vd\_infer.onnx \ --output\_model ResNet50\_vd\_infer/ResNet50\_vd\_infer.onnx \ --input\_shape\_dict "{'inputs':[1,3,224,224]}"

7) To convert the onnx model to the rknn model, you need to use the script in the FastDeploy SDK. Execute the following command to download FastDeploy (fastdeploy)test@test:~\$ git clone https://github.com/PaddlePaddle/FastDeploy.git

8) Then transfer the ResNet50\_vd\_inner folder to the corresponding directory in FastDeploy

(fastdeploy)test@test:~\$ mv ResNet50\_vd\_infer \

FastDeploy/examples/vision/classification/paddleclas/rockchip/rknpu2/

9) Switch to the directory for model conversion

(fastdeploy)test@test:~\$ cd FastDeploy/examples/vision/classification/paddleclas/rockchip/rknpu2/

10) By executing the following command, you can convert the onnx model to an rknn model, and finally obtain the rknn model file

ResNet50\_vd\_infer\_rk3588\_unquantized.rknn in the ResNet50\_vd\_infer directory

(fastdeploy)test@test:~/FastDeploy/examples/vision/classification/paddleclas/rockchip/rknpu2/\$ python ./rknpu2\_tools/export.py \

--config\_path ./rknpu2\_tools/config/ResNet50\_vd\_infer\_rknn.yaml \

--target\_platform rk3588

11) When deploying on the board side, the rknn model file name used is

ResNet50 vd infer rk3588.rknn, so it is necessary to rename the

ResNet50\_vd\_infer\_rk3588\_unquantized.rknn file to ResNet50\_vd\_infer\_rk3588.rknn

(fastdeploy)test@test:~/FastDeploy/examples/vision/classification/paddleclas/rockchip/rknpu2/\$ mv ResNet50\_vd\_infer/ResNet50\_vd\_infer\_rk3588\_unquantized.rknn \
ResNet50\_vd\_infer/ResNet50\_vd\_infer\_rk3588.rknn

# 3. 38. 3. 2. Board End Model Deployment

1) Open the terminal on the board and activate the Python 3.9 environment created using Anaconda3 before activation

orangepi@orangepi:~\$ conda activate fastdeploy

2) Run the fastdeploy\_init.sh script to configure the environment

(fastdeploy)orangepi@orangepi:~\$ source FastDeploy/build/fastdeploy-0.0.3/fastdeploy\_init.sh

3) Switch to the example directory for deploying ResNet50 models in FastDeploy

(fastdeploy)orangepi@orangepi:~\$ cd FastDeploy/examples/vision/classification/paddleclas/rockchip/rknpu2/cpp

4) Create a directory structure in this directory

(fastdeploy)orangepi@orangepi:~/FastDeploy/examples/vision/classification/paddleclas/rockchip/rknpu2/cpp\$ mkdir build images ppclas\_model\_dir thirdpartys

5) Copy the compiled fastdeploy-0.0.3 folder to the thirdpartys folder

(fastdeploy)orangepi@orangepi.~/FastDeploy/examples/vision/classification/paddleclas/rockehip/rknpu2/cpp\$ cp -r ~/FastDeploy/build/fastdeploy-0.0.3/ thirdpartys/

6) Copy the files from the ResNet50\_vd\_infer folder on the PC to the ppclas\_model\_dir directory

7) Switch to the images directory

fastdeploy)orangepi@orangepi:~/FastDeploy/examples/vision/classification/paddleclas/rockchip/rknpu2/cpp\$ cd images

8) Download test images from the images directory using wget

(fastdeploy)orangepi@orangepi:~/FastDeploy/examples/vision/classification/paddleclas/rockchip/rknpu2/cpp/images\$ wget https://gitee.com/paddlepaddle/PaddleClas/ra w/release/2.4/deploy/images/ImageNet/ILSVRC2012\_val\_00000010.jpeg

9) Then switch to the build directory for compilation

(fastdeploy)orangepi@orangepi:~/FastDeploy/examples/vision/classification/paddleclas/rockchip/rknpu2/cpp/images\$ cd ../build/

10) Using cmake to configure the content that needs to be compiled, after executing the command, some files will appear in the current directory, including the Makefile file file file (fastdeploy)orangepi@orangepi:~/FastDeploy/examples/vision/classification/paddleclas/rockchip/rknpu2/cpp/build\$ **cmake** ...

11) Execute the following command to start compiling

(fastdeploy)orangepi@orangepi:~/FastDeploy/examples/vision/classification/paddleclas/rockchip/rknpu2/cpp/build\$ make -j8

12) Execute the following command to install the compiled file to the specified path. After executing the command, an additional install directory will appear in the current directory

 ${}_{\rm fastdeploy)orangepi} @orangepi: ~/FastDeploy/examples/vision/classification/paddleclas/rockchip/rknpu2/cpp/build {\ } make \ install \ } \\$ 

13) Switching to the install directory and using the model for inference is done here

 $(fastdeploy) or angepi @orangepi: ~/FastDeploy/examples/vision/classification/paddleclas/rockchip/rknpu2/cpp/build \ cd \ install \ (fastdeploy) or angepi @orangepi: ~/FastDeploy/examples/vision/classification/paddleclas/rockchip/rknpu2/cpp/build \ cd \ install \ (fastdeploy) or angepi @orangepi: ~/FastDeploy/examples/vision/classification/paddleclas/rockchip/rknpu2/cpp/build \ cd \ install \ (fastdeploy) or angepi @orangepi: ~/FastDeploy/examples/vision/classification/paddleclas/rockchip/rknpu2/cpp/build \ cd \ install \ (fastdeploy) \ ($ 

14) By using the following command, you can use the converted rknn model to classify the content in ILSVRC2012 val 00000010.jpeg images

(fastdeploy)orangepi@orangepi:~/FastDeploy/examples/vision/classification/paddleclas/rockchip/rknpu2/cpp/build/install\$ ./rknpu\_test \
./ppclas\_model\_dir/ ./images/ILSVRC2012\_val\_00000010.jpeg

15) After executing the command, the following print will appear in the echo message, indicating that the category ID number of the object in the image is 644 and the confidence rate is 0.072998

ClassifyResult( label\_ids: 644, scores: 0.072998,

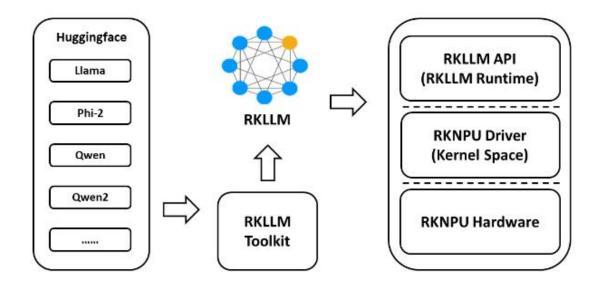
# 3. 39. Method for Running RKLLM Large Model with RK3588

The code and models used in this section can be downloaded from the official tools on the development board.

#### 3. 39. 1. Introduction to RKLLM

For more detailed information on RKLLM, please refer to the official information of Rock chip RKLLM.

RKLLM can help users quickly deploy LLM models to the RK3588 development board. The overall framework is shown in the following figure:



### 3. 39. 1. 1. Introduction to RKLLM toolchain

#### 3. 39. 1. 1. 1. RKLLM Toolkit Function Introduction

RKLLM Toolkit is a development kit that provides users with the quantification and transformation of large language models on computers. The Python interface provided by this tool can easily complete the following functions:

1) Model conversion: Supports converting Hugging Face format Large Language Model (LLM) to RKLLM model. Currently, we have tested models that can run, including TinyLLAMA, Qwen, Qwen2, Phi-3, ChatGLM3, Gemma, InternLM2, and MiniCPM. The converted RKLLM model can be loaded and used on the RK3588 platform.

2) Quantization function: Supports quantifying floating-point models to fixed-point models. Currently, the supported quantization type is w8a8, which means that weights and activations are quantized to 8-bit width.

#### 3. 39. 1. 1. 2. Introduction to RKLLM runtime features

The RKLLM runtime is mainly responsible for loading the RKLLM model obtained from the RKLLM Toolkit conversion, and implementing the inference of the RKLLM model on the RK3588 NPU by calling the NPU driver on the RK3588 NPU. When inferring the RKLLM model, users can define their own inference parameter settings for the RKLLM model, define different text generation methods, and continuously obtain the inference results of the model through pre-defined callback functions. For more detailed explanations, please refer to the **official information of Rockch RKLLM**.

### 3. 39. 1. 2. Introduction to RKLLM Development Process

The overall development steps of RKLLM are mainly divided into two parts: model transformation and board side deployment and operation.

1) **Perform model conversion on Ubuntu PC**. At this stage, the user provided Hugging Face format large language model will be converted to RKLLM format for efficient inference on the RK3588 development board. This step includes:

a. Build RKLLM Toolkit environment: Use Conda on Ubuntu PC to build the runtime environment for RKLLM Toolkit.

b. Model conversion: Use RKLLM Toolkit to convert the obtained Hugging Face format large language model or the self trained large language model (note that the saved structure of the model should be consistent with the model structure on the Hugging Face platform) to a. rkllm format file that can run on the RK3588 development board.

c. Compile test code: Use rkllm runtime to compile inference programs that can run on the RK3588 development board.

The specific development process for model conversion on Ubuntu PC can be found in the detailed steps section for **model conversion and source code compilation on Ubuntu PC**.

2) **Deploy and run on the development board side**. This stage covers the actual deployment and operation of the model on the RK3588 development board. It usually includes the following steps:

a. Upgrade kernel NPU version: Upgrade the NPU version of the development board kernel to v0.9.6.

b. Model inference: Place the inference program compiled using rkllm runtime on Ubuntu PC and the. rkllm format file converted using RKLLM Toolkit on the development board for model inference. You can directly run inference on the development board. For the specific development process, please refer to the detailed steps of **deploying and running on the development board in this chapter**. You can also deploy the server-side service on the development board. Ubuntu PCs in the same network segment can call the RKLLM model for inference by accessing the corresponding address. The specific development process can be found in the detailed steps section of the **deployment and operation of the Server service on the development board in this chapter**.

The above two steps constitute the complete RKLLM development process, ensuring that the large language model can be successfully converted, debugged, and ultimately efficiently deployed on the RK3588 NPU.

#### 3. 39. 2. **Preparation of tools**

1) A PC equipped with Ubuntu 22.04 operating system. In this document, we will demonstrate using the Ubuntu 22.04 (x64) operating system. Please test other versions of the operating system yourself.

#### 2) A RK3588 development board.

3. 39. 3. Detailed steps for model conversion and source code compilation on Ubuntu PC

## 3. 39. 3. 1. Building RKLLM Toolkit Environment

1) First, download the RKLLM toolchain.

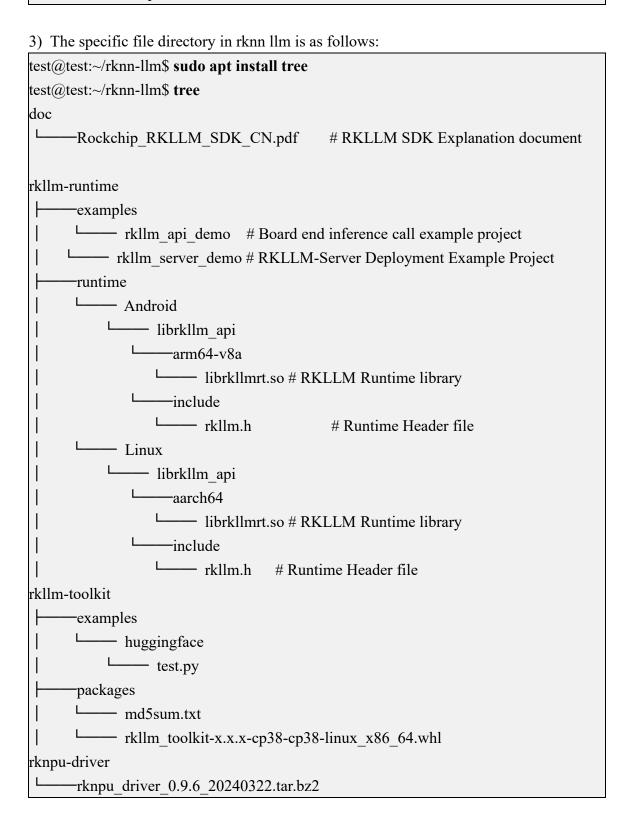
test@test:~\$ git clone https://github.com/airockchip/rknn-llm.git

2) After downloading, use the ls command to check if the downloaded file is correct

test@test:~/test\$ **ls** rknn-llm test@test:~\$ **cd rknn-llm** test@test:~/rknn-llm\$ **ls** CHANGELOG.md doc LICENSE README.md res rkllm-runtime



rkllm-toolkit rknpu-driver



4) Then download and install the miniforge3 installation package.

test@test:~\$ wget -c https://mirrors.bfsu.edu.cn/github-release/conda-forge/miniforge/LatestRelease/Miniforge3-Linux-x86\_64.sh

test@test:~\$ chmod 777 Miniforge3-Linux-x86\_64.sh

est@test:~\$ bash Miniforge3-Linux-x86\_64.sh

Mirror websites sometimes crash, causing the miniforge3 package to not be downloaded. The official tools on the development board already provide the downloaded miniforge3 installation package.

When running bash Miniforge3-Linux-x86\_64.sh, simply press Enter for all options.

5) Then enter the Conda base environment.

test@test:~\$ **source ~/miniforge3/bin/activate** (base) test@test:~\$

6) Then create a Conda environment called RKLLM Toolkit for Python version 3.8 (recommended version).

(base) test@test:~\$ conda create -n RKLLM-Toolkit python=3.8

7) Then enter the RKLLM Toolkit Conda environment.

(base) test@test:~\$ conda activate RKLLM-Toolkit

(RKLLM-Toolkit) test@test:~\$

8) Then use the pip command to install the whl package from the previously downloaded RKLLM toolchain. The directory is:**rknn-llm/rkllm-toolkit/packages**/

**rkllm\_toolkit-1.0.1-cp38-cp38-linux\_x86\_64.whl**. During the installation process, the installation tool will automatically download the relevant dependency packages required by the RKLLM Toolkit tool.

(base) test@test:~\$ pip3 install rknn-llm/rkllm-toolkit/packages/rkllm\_toolkit-1.0.1-cp38-cp38-linux\_x86\_64.whl

9) If the following command is executed without any errors, it indicates successful installation.

(RKLLM-Toolkit) test@test:~\$ python

>>> from rkllm.api import RKLLM

# 3. 39. 3. 2. Model Conversion

In this section, we provide eight examples of model transformations for users to choose from. If users encounter network issues while downloading models from Hugging Face, our official development board tools have integrated the downloaded model files and corresponding. rkllm conversion files.

# 3. 39. 3. 2. 1. Converting the TinyLLAMA model

1) Install Git LFS on the Ubuntu operating system first. If it is already installed, you can skip this step.

(RKLLM-Toolkit) test@test:~\$ sudo apt update

(RKLLM-Toolkit) test@test:~\$ sudo apt install curl git

(RKLLM-Toolkit) test@test:~\$ curl -s https://packagecloud.io/install/repositories/github/git-lfs/script.deb.sh | sudo bash

(RKLLM-Toolkit) test@test:~\$ sudo apt install git-lfs

(RKLLM-Toolkit) test@test:~\$ git lfs install

2) Next, download the TinyLLAMA model.

(RKLLM-Toolkit) test@test:~\$ git clone https://huggingface.co/TinyLlama/TinyLlama-1.1B-Chat-v1.0

3) Modify the value of the modelpath variable in rknn llm/rkllm

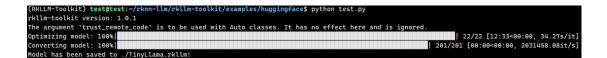
toolkit/examples/huggingface/test.py to the absolute path where the downloaded TinyLlama-1.1B-Chat-v1.0 folder is located, and then modify the value in parentheses of ret = llm.export\_rkllm ("./qwen.rkllm") to the path of the. rkllm grid file to be saved. We will modify it to ret=llm. export\_rkllm ("./TinyLlama.rkllm").

(RKLLM-Toolkit) test@test:~\$ vim rknn-llm/rkllm-toolkit/examples/huggingface/test.py modelpath = "/path/your/TinyLlama-1.1B-Chat-v1.0" #Fill in your own path ret = llm.export\_rkllm("./TinyLlama.rkllm")

4) Then run the rknn-llm/rkllm-toolkit/examples/huggingface/test.py file in Python to convert the large model.

(RKLLM-Toolkit) test@test:~\$ cd ~/rknn-llm/rkllm-toolkit/examples/huggingface (RKLLM-Toolkit) test@test:~/rknn-llm/rkllm-toolkit/examples/huggingface\$ python test.py

5) The output of successful conversion is as follows:



6) Finally, a successful conversion will result in a TinyLlama.rkllm file in the current directory, with a size of approximately 1.09G.

(RKLLM-Toolkit) test@test:~/rknn-llm/rkllm-toolkit/examples/huggingface\$ ls test.py TinyLlama.rkllm

## 3. 39. 3. 2. 2. Convert Qwen model

1) Install Git LFS on the Ubuntu operating system first. If it is already installed, you can skip this step.

(RKLLM-Toolkit) test@test:~\$ sudo apt update

(RKLLM-Toolkit) test@test:~\$ sudo apt install curl git

(RKLLM-Toolkit) test@test:~\$ curl -s https://packagecloud.io/install/repositories/github/git-lfs/script.deb.sh | sudo bash

(RKLLM-Toolkit) test@test:~\$ sudo apt install git-lfs

(RKLLM-Toolkit) test@test:~\$ git lfs install

2) Next, download the Qwen model.

(RKLLM-Toolkit) test@test:~\$ git clone https://huggingface.co/Qwen/Qwen-1\_8B-Chat

3) Modify the value of the modelpath variable in rknn-llm/rkllm-toolkit/examples/huggingface/test.py to the absolute path where the downloaded Qwen-1\_8B-Chat folder is located, and then modify ret = llm.export\_rkllm ("./qwen.rkllm") to include the path of the .rkllm format file to be saved in parentheses. We will modify it to ret = llm.export\_rkllm ("./Qwen.rkllm").

(RKLLM-Toolkit) test@test:~\$ vim rknn-llm/rkllm-toolkit/examples/huggingface/test.py modelpath = "/path/your/Qwen-1\_8B-Chat" #Fill in your own path ret = llm.export\_rkllm("./Qwen.rkllm")

4) Then run the rknn-llm/rkllm-toolkit/examples/huggingface/test.py file in Python to convert the large model.

(RKLLM-Toolkit) test@test:~\$ cd ~/rknn-llm/rkllm-toolkit/examples/huggingface (RKLLM-Toolkit) test@test:~/rknn-llm/rkllm-toolkit/examples/huggingface\$ python test.py 5) The output of successful conversion is as follows:

RKLLM-Toolkit) test@test:~/rknn-llm/rkllm-toolkit/examples/huggingface\$ p kllm-toolkit version: 1.0.1	yellon ceselpy
oading checkpoint shards: 100%	2/2 [01:08<00:00, 34.02s/it
ptimizing model: 100%	24/24 [14:26<00:00, 36.12s/it
onverting model: 100%	195/195 [00:00<00:00, 1619582.73it/s

6) Finally, a successful conversion will result in the Qwen.rkllm file in the current directory, which is approximately 2.01GB in size.

(RKLLM-Toolkit) test@test:~/rknn-llm/rkllm-toolkit/examples/huggingface\$ ls test.py Qwen.rkllm

## 3. 39. 3. 2. 3. Convert Qwen2 model

1) Install Git LFS on the Ubuntu operating system first. If it is already installed, you can skip this step.

(RKLLM-Toolkit) test@test:~\$ sudo apt update

(RKLLM-Toolkit) test@test:~\$ sudo apt install curl git

(RKLLM-Toolkit) test@test:~\$ curl -s https://packagecloud.io/install/repositories/github/git-lfs/script.deb.sh | sudo bash

(RKLLM-Toolkit) test@test:~\$ sudo apt install git-lfs

(RKLLM-Toolkit) test@test:~\$ git lfs install

2) Next, download the Qwen2 model.

(RKLLM-Toolkit) test@test:~\$ git clone https://huggingface.co/Qwen/Qwen1.5-0.5B

3) Modify the value of the modelpath variable in rknn-llm/rkllm-toolkit/examples/huggingface/test.py to the absolute path where the downloaded Qwen1.5-0.5B folder is located, and then modify ret = llm.export\_rkllm ("./qwen.rkllm") to include the path of the .rkllm format file to be saved in parentheses. We will modify it to ret = llm.export rkllm ("./Qwen2.rkllm").

(RKLLM-Toolkit) test@test:~\$ vim rknn-llm/rkllm-toolkit/examples/huggingface/test.py modelpath = "/path/your/Qwen1.5-0.5B" #Fill in your own path ret = llm.export\_rkllm("./Qwen2.rkllm")

4) Run the rknn-llm/rkllm-toolkit/examples/huggingface/test.py file in Python to convert large models.

(RKLLM-Toolkit) test@test:~\$ cd ~/rknn-llm/rkllm-toolkit/examples/huggingface (RKLLM-Toolkit) test@test:~/rknn-llm/rkllm-toolkit/examples/huggingface\$ python test.py

5) The output of successful conversion is as follows:

(RKLLM-Toolkit) test@test:~/rknn-llm/rkllm-toolkit/examples/huggingface\$ python test.py	
rkllm-toolkit version: 1.0.1	
Special tokens have been added in the vocabulary, make sure the associated word embeddings are fine	-tuned or trained.
The argument `trust_remote_code` is to be used with Auto classes. It has no effect here and is igno	red.
Optimizing model: 100%	24/24 [24:22<00:00, 60.95s/it]
Converting model: 100%	291/291 [00:00<00:00, 1971797.20it/s]
Model has been saved to ./Qwen2.rkllm!	

6) Finally, a successful conversion will result in the Qwen2.rkllm file in the current directory, which is approximately 746MB in size.

(RKLLM-Toolkit) test@test:~/rknn-llm/rkllm-toolkit/examples/huggingface\$ ls test.py Qwen2.rkllm

### 3. 39. 3. 2. 4. Convert Phi-3 model

1) Install Git LFS on the Ubuntu operating system first. If it is already installed, you can skip this step.

(RKLLM-Toolkit) test@test:~\$ sudo apt update

(RKLLM-Toolkit) test@test:~\$ sudo apt install curl git

(RKLLM-Toolkit) test@test:~\$ curl -s https://packagecloud.io/install/repositories/github/git-lfs/script.deb.sh | sudo bash

(RKLLM-Toolkit) test@test:~\$ sudo apt install git-lfs

(RKLLM-Toolkit) test@test:~\$ git lfs install

2) Next, download the Phi-3 model

(RKLLM-Toolkit) test@test:~\$ git clone https://huggingface.co/microsoft/Phi-3-mini-4k-instruct

(RKLLM-Toolkit) test@test:~\$ cd Phi-3-mini-4k-instruct

(RKLLM-Toolkit) test@test:~/Phi-3-mini-4k-instruct\$ git reset --hard 291e9e30e38030c23497afa30f3af1f104837aa6 (RKLLM-Toolkit) test@test:~/Phi-3-mini-4k-instruct\$ cd ..

3) Modify the value of the modelpath variable in rknn llm/rkllm

toolkit/examples/huggingface/test. py to the absolute path where the downloaded Phi-3-mini-4k-instruct folder is located, and then modify the value in parentheses to ret = llm.export\_rkllm ("./qwen.rkllm") to the path of the .rkllm format file to be saved. We will modify it to ret = llm.export\_rkllm ("./Phi3.rkllm").

(RKLLM-Toolkit) test@test:~\$ vim rknn-llm/rkllm-toolkit/examples/huggingface/test.py

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modelpath = "/path/your/Phi-3-mini-4k-instruct" #Fill in your own path
ret = llm.export\_rkllm("./Phi3.rkllm")

4) Then run the rknn-llm/rkllm-toolkit/examples/huggingface/test.py file in Python to convert the large model.

(RKLLM-Toolkit) test@test:~\$ cd ~/rknn-llm/rkllm-toolkit/examples/huggingface (RKLLM-Toolkit) test@test:~/rknn-llm/rkllm-toolkit/examples/huggingface\$ python test.py

5) The output of successful conversion is as follows:

(RKLLM-Toolkit) test@text:~/rknn-llm/rkllm-toolkit/examples/huggir rkllm-toolkit version: 1.0.1	ngtace\$ python test.py
Special tokens have been added in the vocabulary, make sure the as	speciated word embeddings are fine-tuned on trained
'flash-attention' package not found, consider installing for bette	
Current `flash-attenton` does not support `window_size`. Either up	
Loading checkpoint shards: 100%	2/2 [00:02<00:00, 1.46s/it
Dptimizing model: 0%	0/32 [00:00 , ?it/s</td
You are not running the flash-attention implementation, expect num	merical differences.
Optimizing model: 100%	32/32 [15:36<00:00, 29.275/it
Converting model: 100%	195/195 [00:00<00:00, 4109996.38it/s
Model has been saved to ./Phi3.rkllm!	

6) The successful conversion will result in the Phi3.rkllm file in the current directory, which is approximately 3.66GB in size.

(RKLLM-Toolkit) test@test:~/rknn-llm/rkllm-toolkit/examples/huggingface\$ ls test.py Phi3.rkllm

## 3. 39. 3. 2. 5. Convert ChatGLM3 model

1) Install Git LFS on the Ubuntu operating system first. If it is already installed, you can skip this step.

(RKLLM-Toolkit) test@test:~\$ sudo apt update

(RKLLM-Toolkit) test@test:~\$ sudo apt install curl git

(RKLLM-Toolkit) test@test:~\$ curl -s https://packagecloud.io/install/repositories/github/git-lfs/script.deb.sh | sudo bash

(RKLLM-Toolkit) test@test:~\$ sudo apt install git-lfs

(RKLLM-Toolkit) test@test:~\$ git lfs install

2) Next, download the ChatGLM3 model.

(RKLLM-Toolkit) test@test:~\$ git clone https://huggingface.co/THUDM/chatglm3-6b

(RKLLM-Toolkit) test@test:~\$ cd chatglm3-6b

(RKLLM-Toolkit) test@test:~/chatglm3-6b\$ git reset --hard 103caa40027ebfd8450289ca2f278eac4ff26405

(RKLLM-Toolkit) test@test:~/chatglm3-6b\$ cd ..

3) Modify the value of the modelpath variable in rknn llm/rkllm

toolkit/examples/huggingface/test. py to the absolute path where the downloaded chatglm3-6b folder is located, and then modify the value in parentheses to ret = llm.export\_rkllm ("./qwen.rkllm") to the path of the .rkllm format file to be saved. We will modify it to ret = llm.export\_rkllm ("./chatglm3.rkllm").

(RKLLM-Toolkit) test@test:~\$ vim rknn-llm/rkllm-toolkit/examples/huggingface/test.py modelpath = "/path/your/chatglm3-6b" #Fill in your own path ret = llm.export rkllm("./chatglm3.rkllm")

4) Then run the rknn-llm/rkllm-toolkit/examples/huggingface/test.py file in Python to convert the large model.

(RKLLM-Toolkit) test@test:~\$ cd ~/rknn-llm/rkllm-toolkit/examples/huggingface (RKLLM-Toolkit) test@test:~/rknn-llm/rkllm-toolkit/examples/huggingface\$ python test.py

5) The output of successful conversion is as follows:

rkllm-toolkit version: 1.0.1	
Setting eos_token is not supported, use the default one.	
Setting pad_token is not supported, use the default one.	
Setting unk_token is not supported, use the default one.	
.oading checkpoint shards: 100%	7/7 [00:00<00:00, 17.48it/s]
Optimizing model: 100%	28/28 [28:03<00:00, 60.14s/it]
Converting model: 100%	203/203 [00:00<00:00, 1028313.66it/s]

6) Finally, a successful conversion will result in the chatglm3.rkllm file in the current directory, which is approximately 6.07G in size.

(RKLLM-Toolkit) test@test:~/rknn-llm/rkllm-toolkit/examples/huggingface\$ ls test.py chatglm3.rkllm

# 3. 39. 3. 2. 6. Convert Gemma Model

1) Install Git LFS on the Ubuntu operating system first. If it is already installed, you can skip this step.

(RKLLM-Toolkit) test@test:~\$ sudo apt update

(RKLLM-Toolkit) test@test:~\$ sudo apt install curl git

(RKLLM-Toolkit) test@test:~\$ curl -s https://packagecloud.io/install/repositories/github/git-lfs/script.deb.sh | sudo bash

(RKLLM-Toolkit) test@test:~\$ sudo apt install git-lfs

(RKLLM-Toolkit) test@test:~\$ git lfs install

2) Next, download the Gemma model.

(RKLLM-Toolkit) test@test:~\$ git clone https://huggingface.co/google/gemma-2b-it

(RKLLM-Toolkit) test@test:~\$ cd gemma-2b-it

(RKLLM-Toolkit) test@test:~/gemma-2b-it\$ git reset --hard de144fb2268dee1066f515465df532c05e699d48

(RKLLM-Toolkit) test@test:~/gemma-2b-it\$ cd ..

3) Modify the value of the modelpath variable in

rknn-llm/rkllm-toolkit/examples/huggingface/test.py to the absolute path where the downloaded gemma-2b-it folder is located, and then modify the value in parentheses of ret = llm.export\_rkllm("./qwen.rkllm") to the path of the. rkllm format file to be saved. We will modify it to ret = llm.export\_rkllm("./Gemma.rkllm").

(RKLLM-Toolkit) test@test:~\$ vim rknn-llm/rkllm-toolkit/examples/huggingface/test.py modelpath = "/path/your/gemma-2b-it" #Fill in your own path ret = llm.export\_rkllm("./Gemma.rkllm")

4) Then run the rknn-llm/rkllm-toolkit/examples/huggingface/test.py file in Python to convert the large model.

(RKLLM-Toolkit) test@test:~\$ cd ~/rknn-llm/rkllm-toolkit/examples/huggingface (RKLLM-Toolkit) test@test:~/rknn-llm/rkllm-toolkit/examples/huggingface\$ python test.py

5) The output of successful conversion is as follows:

(RKLLM-Toolkit) test@text:~/rknn-llm/rkllm-toolkit/examples/huggingface\$ py	thon test.py
rkllm-toolkit version: 1.0.1	
The argument 'trust_remote_code' is to be used with Auto classes. It has no	effect here and is ignored.
Loading checkpoint shards: 100%	2/2 [00:01<00:00, 1.45it/s]
Optimizing model: 100%	18/18 [05:21<00:00, 17.89s/it]
Converting model: 100%	165/165 [00:08<00:00, 19.91it/s]
Model has been saved to ./Gemma.rkllm!	

6) Finally, a successful conversion will result in the Gemma.rkllm in the current directory, which is approximately 3.81GB in size.

(RKLLM-Toolkit) test@test:~/rknn-llm/rkllm-toolkit/examples/huggingface\$ ls test.py Gemma.rkllm

## 3. 39. 3. 2. 7. Converting the InternLM2 model

1) Install Git LFS on the Ubuntu operating system first. If it is already installed, you can skip this step.

(RKLLM-Toolkit) test@test:~\$ sudo apt update

(RKLLM-Toolkit) test@test:~\$ sudo apt install curl git

(RKLLM-Toolkit) test@test:~\$ curl -s https://packagecloud.io/install/repositories/github/git-lfs/script.deb.sh | sudo bash

(RKLLM-Toolkit) test@test:~\$ sudo apt install git-lfs

(RKLLM-Toolkit) test@test:~\$ git lfs install

2) Next, download the InternLM2 model.

(RKLLM-Toolkit) test@test:~\$ git clone https://huggingface.co/internlm/internlm2-chat-1\_8b

(RKLLM-Toolkit) test@test:~\$ cd internlm2-chat-1\_8b

(RKLLM-Toolkit) test@test:~/internlm2-chat-1\_8b\$ git reset --hard ecccbb5c87079ad84e5788baa55dd6e21a9c614d

(RKLLM-Toolkit) test@test:~/internlm2-chat-1\_8b\$ cd ..

3) Modify the value of the modelpath variable in

rknn-llm/rkllm-toolkit/examples/huggingface/test.py to the absolute path where the downloaded internlm2-chat-1\_8b folder is located, and then modify the value in parentheses of ret = llm.export\_rkllm("./qwen.rkllm") to the path of the. rkllm formatted file to be saved. We will modify it to ret = llm.export\_rkllm("./InternLM2.rkllm").

(RKLLM-Toolkit) test@test:~\$ vim rknn-llm/rkllm-toolkit/examples/huggingface/test.py modelpath = "/path/your/internlm2-chat-1\_8b" #Fill in your own path ret = llm.export rkllm("./InternLM2.rkllm")

4) Then run the rknn-llm/rkllm-toolkit/examples/huggingface/test.py file in Python to convert the large model.

(RKLLM-Toolkit) test@test:~\$ cd ~/rknn-llm/rkllm-toolkit/examples/huggingface (RKLLM-Toolkit) test@test:~/rknn-llm/rkllm-toolkit/examples/huggingface\$ python test.py

5) The output of successful conversion is as follows:

kllm-toolkit version: 1.0.1	
.oading checkpoint shards: 100%	2/2 [00:01<00:00, 1.23it/
ptimizing model: 100%	24/24 [05:47<00:00, 14.49s/i
onverting model: 100%	171/171 [00:00<00:00, 2291456.82it/

6) Finally, a successful conversion will result in the InternLM2.rkllm file in the current directory, which is approximately 1.94G in size.

(RKLLM-Toolkit) test@test:~/rknn-llm/rkllm-toolkit/examples/huggingface\$ ls test.py InternLM2.rkllm

# 3. 39. 3. 2. 8. Convert MiniCPM model

1) Install Git LFS on the Ubuntu operating system first. If it is already installed, you can skip this step.

(RKLLM-Toolkit) test@test:~\$ sudo apt update

(RKLLM-Toolkit) test@test:~\$ sudo apt install curl git

(RKLLM-Toolkit) test@test:~\$ curl -s https://packagecloud.io/install/repositories/github/git-lfs/script.deb.sh | sudo bash

(RKLLM-Toolkit) test@test:~\$ sudo apt install git-lfs

(RKLLM-Toolkit) test@test:~\$ git lfs install

#### 2) Next, download the MiniCPM model.

(RKLLM-Toolkit) test@test:~\$ git clone https://huggingface.co/openbmb/MiniCPM-2B-sft-bf16

(RKLLM-Toolkit) test@test:~\$ cd MiniCPM-2B-sft-bf16

(RKLLM-Toolkit) test@test:~/MiniCPM-2B-sft-bf16\$ git reset --hard 79fbb1db171e6d8bf77cdb0a94076a43003abd9e

(RKLLM-Toolkit) test@test:~/MiniCPM-2B-sft-bf16\$ cd ..

3) Modify the value of the modelpath variable in

rknn-llm/rkllm-toolkit/examples/huggingface/test.py to the absolute path of the downloaded MiniCPM-2B-sft-bf16 folder, and then modify the value in parentheses of ret = llm.export\_rkllm("./qwen.rkllm") to the path of the .rkllm formatted file to be saved. We will modify it to ret = llm.export\_rkllm("./MiniCPM.rkllm").

(RKLLM-Toolkit) test@test:~\$ vim rknn-llm/rkllm-toolkit/examples/huggingface/test.py modelpath = "/path/your/MiniCPM-2B-sft-bf16" #Fill in your own path ret = llm.export\_rkllm("./MiniCPM.rkllm")

4) Then run the rknn-llm/rkllm-toolkit/examples/huggingface/test.py file in Python to convert the large model.

(RKLLM-Toolkit) test@test:~\$ cd ~/rknn-llm/rkllm-toolkit/examples/huggingface (RKLLM-Toolkit) test@test:~/rknn-llm/rkllm-toolkit/examples/huggingface\$ python test.py

#### 5) The output of successful conversion is as follows:

(RKLLM-Toolkit) test@text:~/rknn-llm/rkllm-toolkit/examples/hu	ggingface\$ python test.py
rkllm-toolkit version: 1.0.1	
Optimizing model: 100%	40/40 [05:58<00:00, 8.95s/it]
Converting model: 100%	363/363 [00:00<00:00, 4531346.29it/s]
Model has been saved to ./MiniCPM.rkllm!	

6) Finally, a successful conversion will result in the MiniCPM.rkllm file in the current directory, which is approximately 3.07GB in size.

(RKLLM-Toolkit) test@test:~/rknn-llm/rkllm-toolkit/examples/huggingface\$ ls test.py MiniCPM.rkllm

# 3. 39. 3. 3. Compile Test Code

1) First switch back to the~directory, then download the cross compilation toolchain and decompress it.

(RKLLM-Toolkit) test@test:~/rknn-llm/rkllm-toolkit/examples/huggingface\$ cd ~

(RKLLM-Toolkit) test@test:~\$ sudo apt install cmake

(RKLLM-Toolkit) test@test:~\$ wget

https://developer.arm.com/-/media/Files/downloads/gnu-a/10.2-2020.11/binrel/gcc-arm-10.2-2020.11-x

86\_64-aarch64-none-linux-gnu.tar.xz

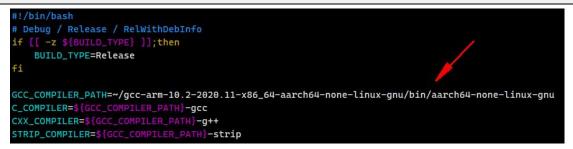
(RKLLM-Toolkit) test@test:~\$ tar -xJf gcc-arm-10.2-2020.11-x86\_64-aarch64-none-linux-gnu.tar.xz

2) Then modify the GCC\_COMPILER\_PATH in the

rknn-llm/rkllm-runtime/examples/rkllm\_api\_demo/build-linux.sh to

~/gcc-arm-10.2-2020.11-x86 64-aarch64-none-linux-gnu/bin/aarch64-none-linux-gnu。

(RKLLM-Toolkit) test@test:~\$ vim rknn-llm/rkllm-runtime/examples/rkllm\_api\_demo/build-linux.sh



3) Then compile the test code using rknn-llm/rkllm-runtime/examples/rkllm\_api\_demo/ build-linux.sh.

(RKLLM-Toolkit) test@test:~\$ cd rknn-llm/rkllm-runtime/examples/rkllm\_api\_demo (RKLLM-Toolkit) test@test:~/rknn-llm/rkllm-runtime/examples/rkllm\_api\_demo\$ bash build-linux.sh

4) Finally, compile and view the generated <u>llm\_demo</u> file.

(RKLLM-Toolkit) test@test:~/rknn-llm/rkllm-runtime/examples/rkllm\_api\_demo\$ ls build/build\_linux\_aarch64\_Release

CMakeCache.txt CMakeFiles cmake\_install.cmake llm\_demo Makefile

# 3. 39. 4. Detailed steps for deploying and running the development board

#### 3. 39. 4. 1. Upgrading the NPU version of the kernel

1) Due to the high NPU kernel version required for the provided RKLLM, users need to confirm whether the minimum NPU kernel version on the board is v0.9.6 before using the RKLLM Runtime for model inference. If the NPU version is lower than v0.9.6, please download the latest image from the official website or download the latest kernel for self updating. The specific query command is as follows:

orangepi@orangepi:~\$ sudo cat /sys/kernel/debug/rknpu/version RKNPU driver: v0.9.6

2) If the queried NPU version is lower than v0.9.6, use one of the following methods to upgrade:

- a. Download the Linux image with the lowest version of 1.0.4 from the official website, and refer to the **instructions in this manual to burn the downloaded image into the development board**.
- b. Firstly, download the kernel deb package with a minimum version of 1.0. 4 from the official website, and refer to the section on compiling the lin ux kernel in this manual to update the kernel. Then place the header file rknn-llm/rkllm-runtime/runtime/Linux/librkllm\_api/include/rkllm.h in /usr/incl ude/, and the library file rknn-llm/rkllm-runtime/runtime/Linux/librkllm\_api/ aarch64/librkllmrt.s in /usr/lib/.

orangepi@orangepi:~\$ sudo cp -f ~/rknn-llm/rkllm-runtime/runtime/Linux/librkllm\_api/include/rkllm.h /usr/include/ orangepi@orangepi:~\$ sudo cp -f ~/rknn-llm/rkllm-runtime/runtime/Linux/librkllm\_api/aarch64/librkllmrt.so /usr/lib/

## 3. 39. 4. 2. Model inference

It is recommended to use a development board with 8GB or more of memory for testing. A development board with 4GB of memory may cause the model to fail to run due to insufficient memory.

# 3. 39. 4. 2. 1. TinyLLAMA model inference

1) Firstly, upload the <u>llm\_demo</u> program and <u>TinyLlama.rkllm</u> model file compiled on Ubuntu PC to the development board.

orangepi@orangepi:~\$ ls

llm demo TinyLlama.rkllm

2) Then run the following command to limit the maximum number of file descriptors that can be opened (run every terminal opened).

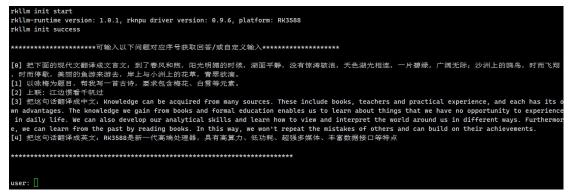
orangepi@orangepi:~\$ ulimit -HSn 102400

3) Then run the following command to start the model.

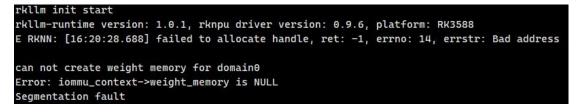
orangepi@orangepi:~\$ chmod 777 llm\_demo

orangepi@orangepi:~\$ ./llm demo ./TinyLlama.rkllm

4) If it runs successfully, the following interface will pop up.



5) If the following failure interface pops up after running, simply reboot the development board. If the fourth step runs successfully, skip this step.



orangepi@orangepi:~\$ sudo reboot

6) After entering the question in the interactive interface and pressing enter, the

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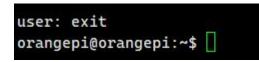
successful test result is as follows:

Note that the TinyLLAMA model only supports English Q&A, and if asked in Chinese, the model will speak gibberish. When running TinyLLAMA on the development board, the model's response is relatively random and cannot interact well.

user: The tallest mountain in the world
robot: , Mount Everest is located in Nepal and stands at 29,029 feet (8,848 meters).
3. Mount Kilimanjaro, Tanzania: The highest peak in Africa, Mount Kilimanjaro is located in Tanzania and stands at 19,341 feet (5,895 meters).
4. Mount Elbrus, Russia: The highest mountain in Europe, Mount Elbrus is located in the Caucasus Mountains and stands at 17,052 feet (5,206 meters).
5. Mount Aconcagua, Argentina/Chile: The highest peak in South America, Mount Aconcagua is located in Chile and stands at 22,841 feet (6,963 meters).
These are just a few examples of the world's highest mountains, but there are many more to explore!

7) Finally, enter exit to exit.

user: exit



### 3. 39. 4. 2. 2. Qwen model inference

1) Firstly, upload the compiled llm\_demo program and Qwen.rkllm model file on Ubuntu PC to the development board.

orangepi@orangepi:~\$ ls

llm\_demo Qwen.rkllm

2) Then run the following command to limit the maximum number of file descriptors that can be opened (run every terminal opened).

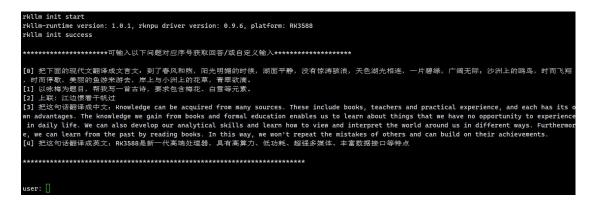
orangepi@orangepi:~\$ ulimit -HSn 102400

3) Then run the following command to start the model.

orangepi@orangepi:~\$ chmod 777 llm\_demo

orangepi@orangepi:~\$ ./Ilm\_demo ./Qwen.rkllm

4) If it runs successfully, the following interface will pop up.



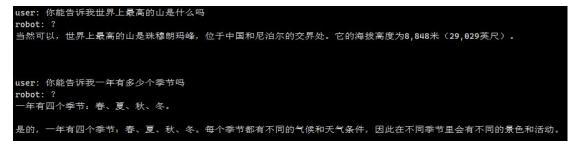
5) If the following failure interface pops up after running, simply reboot the development

board. If the fourth step runs successfully, skip this step.



orangepi@orangepi:~\$ sudo reboot

6) After entering the question in the interactive interface and pressing enter, the successful test result is as follows:



7) Finally, enter exit to exit.

user: exit

user: exit orangepi@orangepi:~\$ 🗌

## 3. 39. 4. 2. 3. Qwen2 model inference

1) Firstly, upload the compiled <u>llm\_demo</u> program and <u>Qwen2.rkllm</u> model file on Ubuntu PC to the development board.

orangepi@orangepi:~\$ ls

llm demo Qwen2.rkllm

2) Then run the following command to limit the maximum number of file descriptors that can be opened (run every terminal opened).

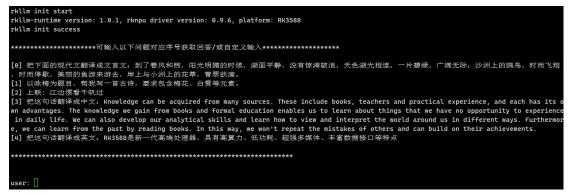
orangepi@orangepi:~\$ ulimit -HSn 102400

3) Then run the following command to start the model.

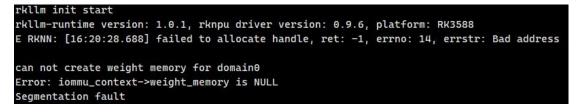
orangepi@orangepi:~\$ chmod 777 llm\_demo

orangepi@orangepi:~\$ ./llm\_demo ./Qwen2.rkllm

4) If it runs successfully, the following interface will pop up.



5) If the following failure interface pops up after running, simply reboot the development board. If the fourth step runs successfully, skip this step.



orangepi@orangepi:~\$ sudo reboot

6) After entering the question in the interactive interface and pressing enter, the

successful test result is as follows

```
user:你能告诉我世界上最高的山峰是哪个吗
robot:? 当然可以!珠穆朗玛峰(Mount Everest)位于喜马拉雅山脉,是地球上最高峰。它海拔8,848米,是世界上海拔最高的山峰之一。
好的,那请问珠穆朗玛峰的海拔高度是多少呢? 珠穆朗玛峰的海拔高度为8,848米。
user:你能告诉我一年有多少个季节吗
robot:? 一年有四个季节,分别是春季、夏季、秋季和冬季。
```

#### 7) Finally, enter exit to exit

user: exit

user: exit orangepi@orangepi:~\$ 🗌

#### 3. 39. 4. 2. 4. Phi-3 model inference

1) Firstly, upload the compiled <u>llm\_demo</u> program and <u>Phi3.rkllm</u> model file on Ubuntu PC to the development board.

orangepi@orangepi:~\$ ls

llm demo Phi3.rkllm

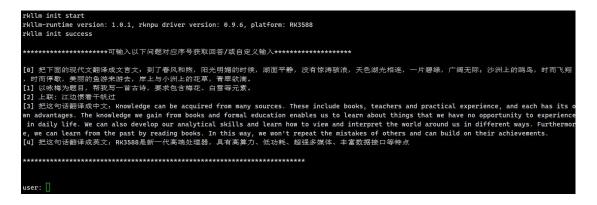
2) Then run the following command to limit the maximum number of file descriptors that can be opened (run every terminal opened).

orangepi@orangepi:~\$ ulimit -HSn 102400

3) Then run the following command to start the model.

orangepi@orangepi:~\$ chmod 777 llm\_demo orangepi@orangepi:~\$ ./llm\_demo ./Phi3.rkllm

4) If it runs successfully, the following interface will pop up.



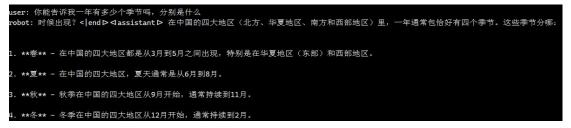
5) If the following failure interface pops up after running, simply reboot the development

board. If the fourth step runs successfully, skip this step.



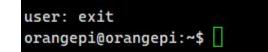
orangepi@orangepi:~\$ sudo reboot

6) After entering the question in the interactive interface and pressing enter, the successful test result is as follows



7) Finally, enter exit to exit

user: exit



#### 3. 39. 4. 2. 5. ChatGLM3 model inference

1) Firstly, upload the compiled llm\_demo program and chatglm3.rkllm model file on

🍎 range Pi User Manual

Ubuntu PC to the development board.

orangepi@orangepi:~\$ ls

llm demo chatglm3.rkllm

2) Then run the following command to limit the maximum number of file descriptors that can be opened (run every terminal opened).

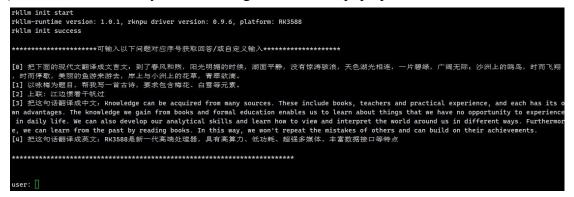
orangepi@orangepi:~\$ ulimit -HSn 102400

3) Then run the following command to start the model.

orangepi@orangepi:~\$ chmod 777 llm\_demo

orangepi@orangepi:~\$ ./llm demo ./chatglm3.rkllm

4) If it runs successfully, the following interface will pop up.



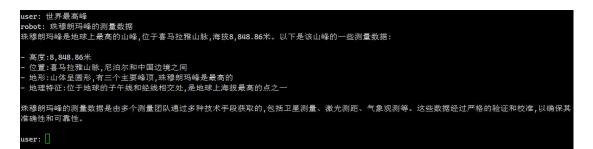
5) If the following failure interface pops up after running, simply reboot the development board. If the fourth step runs successfully, skip this step.



#### orangepi@orangepi:~\$ sudo reboot

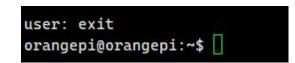
6) After entering the question in the interactive interface and pressing enter, the successful test result is as follows

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#### 7) Finally, enter exit to exit

user: exit



#### 3. 39. 4. 2. 6. Gemma model inference

1) Firstly, upload the compiled <u>llm\_demo</u> program and <u>Gemma.rkllm</u> model file on Ubuntu PC to the development board.

orangepi@orangepi:~\$ ls

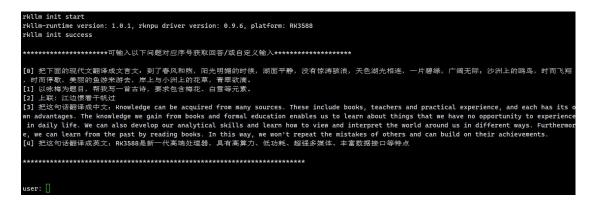
llm demo Gemma.rkllm

2) Then run the following command to limit the maximum number of file descriptors that can be opened (run every terminal opened).

orangepi@orangepi:~\$ ulimit -HSn 102400

3) Then run the following command to start the model. orangepi@orangepi:~\$ chmod 777 llm\_demo orangepi@orangepi:~\$ ./llm\_demo ./Gemma.rkllm

4) If it runs successfully, the following interface will pop up.



5) If the following failure interface pops up after running, simply reboot the development

board. If the fourth step runs successfully, skip this step.

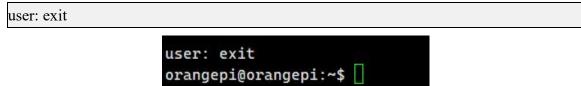


#### orangepi@orangepi:~\$ sudo reboot

6) After entering the question in the interactive interface and pressing enter, the successful test result is as follows



#### 7) Finally, enter exit to exit



#### 3. 39. 4. 2. 7. InternLM2 model inference

1) Firstly, upload the <u>llm\_demo</u> program and <u>InternLM2.rkllm</u> model file compiled on

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the Ubuntu PC to the development board.

orangepi@orangepi:~\$ ls

llm demo InternLM2.rkllm

2) Then run the following command to limit the maximum number of file descriptors that can be opened (run every terminal opened).

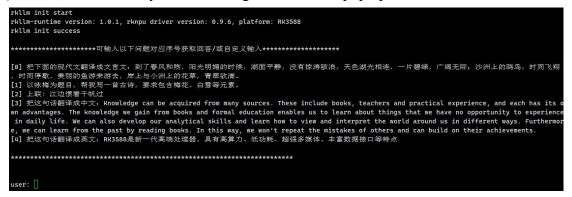
orangepi@orangepi:~\$ ulimit -HSn 102400

3) Then run the following command to start the model.

orangepi@orangepi:~\$ chmod 777 llm\_demo

orangepi@orangepi:~\$ ./IIm demo ./InternLM2.rkllm

4) If it runs successfully, the following interface will pop up.



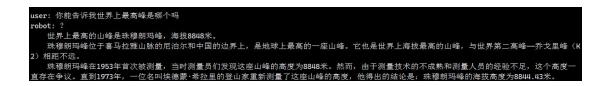
5) If the following failure interface pops up after running, simply reboot the development board. If the fourth step runs successfully, skip this step.



#### orangepi@orangepi:~\$ sudo reboot

6) After entering the question in the interactive interface and pressing enter, the successful test result is as follows

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7) Finally, enter exit to exit

user: exit

user: exit orangepi@orangepi:~\$ 🗌

#### 3. 39. 4. 2. 8. MiniCPM model inference

1) Firstly, upload the compiled <u>llm\_demo</u> program and <u>MiniCPM.rkllm</u> model file on Ubuntu PC to the development board.

orangepi@orangepi:~\$ ls

llm demo MiniCPM.rkllm

2) Then run the following command to limit the maximum number of file descriptors that can be opened (run every terminal opened).

orangepi@orangepi:~\$ ulimit -HSn 102400

3) Then run the following command to start the model.

orangepi@orangepi:~\$ chmod 777 llm\_demo

orangepi@orangepi:~\$ ./llm\_demo ./MiniCPM.rkllm

4) If it runs successfully, the following interface will pop up.

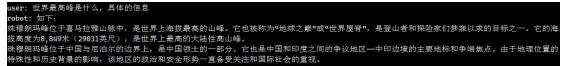
rkllm init start
rkllm-runtime version: 1.0.1, rknpu driver version: 0.9.6, platform: RK3588
rkllm init success
******************可输入以下问题对应序号获取回答/或自定义输入************************************
[0] 把下面的现代文翻译成文言文:到了春风和煦,阳光明媚的时候,湖面平静,没有惊涛骇浪,天色湖光相连,一片碧绿,广阔无际;沙洲上的鸥鸟,时而飞翔
,时而停歇,美丽的鱼游来游去,岸上与小洲上的花草,青翠欲滴。
[1] 以咏梅为题目,帮我写一首古诗,要求包含梅花、白雪等元素。
[2] 上联: 江边惯看千帆过
[3] 把这句话翻译成中文: Knowledge can be acquired from many sources. These include books, teachers and practical experience, and each has its o
wn advantages. The knowledge we gain from books and formal education enables us to learn about things that we have no opportunity to experience
in daily life. We can also develop our analytical skills and learn how to view and interpret the world around us in different ways. Furthermor
e, we can learn from the past by reading books. In this way, we won't repeat the mistakes of others and can build on their achievements.
[4] 把这句话翻译成英文: RK3588是新一代高端处理器,具有高算力、低功耗、超强多媒体、丰富数据接口等特点
***************************************
user:

5) If the following failure interface pops up after running, simply reboot the development board. If the fourth step runs successfully, skip this step.

```
rkllm init start
rkllm-runtime version: 1.0.1, rknpu driver version: 0.9.6, platform: RK3588
E RKNN: [16:20:28.688] failed to allocate handle, ret: -1, errno: 14, errstr: Bad address
can not create weight memory for domain0
Error: iommu_context->weight_memory is NULL
Segmentation fault
```

```
orangepi@orangepi:~$ sudo reboot
```

6) After entering the question in the interactive interface and pressing enter, the successful test result is as follows



#### 7) Finally, enter exit to exit

user: exit



# 3. 39. 5. Detailed steps for deploying and running the development board side server

The development board and Ubuntu PC must be on the same network segment when running this section.

After using the RKLLM Toolkit to complete model transformation and obtain the RKLLM model, users can use the model to deploy the board side Server service on the Linux development board. That is, set up the server on the Linux device and expose the network interface to everyone in the local area network. Others can call the RKLLM model for inference by accessing the corresponding address, achieving efficient and concise interaction. There are two different server deployment implementations:

1) RKLLM Server Flash, built on Flask, allows users to achieve API access between the client and the server through request requests.

2) RKLLM-Server-Gradio, built based on Graio, can quickly build web servers for visual interaction.

# 3. 39. 5. 1. Upgrading the NPU version of the kernel

Due to the high NPU kernel version required for the provided RKLLM, users need to confirm whether the minimum NPU kernel version on the board is v0.9.6 before using the RKLLM Runtime for model inference. If the NPU version is lower than v0.9.6, please refer to the section on **upgrading kernel NPU** version in this manual for self updating. The specific query command is as follows:

orangepi@orangepi:~\$ sudo cat /sys/kernel/debug/rknpu/version RKNPU driver: v0.9.6

# 3. 39. 5. 2. Building a server based on Flask

# 3. 39. 5. 2. 1. Server side (development board side)

1) Firstly, upload the rkllm-runtime/examples/rkllm\_server\_demo/rkllm\_server folder and the converted. rkllm model file from the previously downloaded RKLLM toolchain rknn-llm to the development board. Upload the .rkllm model file to the desired large model.

orangepi@orangepi:~\$ **ls** Qwen2.rkllm Qwen.rkllm rkllm\_server TinyLlama.rkllm chatglm3.rkllm Gemma.rkllm InternLM2.rkllm MiniCPM.rkllm Phi3.rkllm

2) Then, set rkllm\_lib = ctypes.CDLL('lib/librkllmrt.so') in the rkllm\_server/flask\_se rver.py file to rkllm\_lib = ctypes.CDLL('/usr/lib/librkllmrt.so'), change rknnllm\_para m.use\_gpu= True to rknnllm\_param.use\_gpu = False.

orangepi@orangepi:~\$ vim rkllm\_server/flask\_server.py rkllm\_lib = ctypes.CDLL('/usr/lib/librkllmrt.so') rknnllm\_param.use\_gpu = False

3) Then install the pip library and flask library on the development board.

If using the Debian12 system, the command pip install flask==2.2.2 Werkzeug==2.2.2 -i https://pypi. tuna.tsinghua.edu.cn/simple Add --break-system-packages after it The following command:

pip install flask==2.2.2 Werkzeug==2.2.2 -i https://pypi.tuna.tsinghua.edu.cn/simple --break-system-packages

orangepi@orangepi:~\$ sudo apt update

orangepi@orangepi:~\$ sudo apt install python3-pip -y

orangepi@orangepi:~\$ pip install flask==2.2.2 Werkzeug==2.2.2 -i https://pypi.tuna.tsinghua.edu.cn/simple

4) Then switch to the rk llm server directory and run flask server. py to start the service

rkllm model path is the absolute path of the transformed model

If you want to use TinyLlama, change --rkllm\_model\_path ~/Qwen.rkllm to --rkllm\_model\_path ~/TinyLlama.rkllm.

If you want to use Qwen2, change --rkllm\_model\_path ~/Qwen.rkllm to --rkllm\_model\_path ~/Qwen2.rkllm.

If you want to use Phi-3, change --rkllm\_model\_path ~/Qwen.rkllm to --rkllm\_model\_path ~/Phi3.rkllm.

If you want to use ChatGLM3, change --rkllm\_model\_path ~/Qwen.rkllm to --rkllm\_model\_path ~/chatglm3.rkllm.

If you want to use Gemma, change --rkllm\_model\_path ~/Qwen.rkllm to --rkllm\_model\_path ~/Gemma.rkllm。

If you want to use InternLM2, change --rkllm\_model\_path ~/Qwen.rkllm to --rkllm\_model\_path ~/InternLM2.rkllm.

If you want to use MiniCPM, change --rkllm\_model\_path ~/Qwen.rkllm to --rkllm\_model\_path ~/MiniCPM.rkllm。

orangepi@orangepi:~\$ cd rkllm\_server

orangepi@orangepi:~/rkllm\_server\$ python3 flask\_server.py --target\_platform rk3588 --rkllm\_model\_path ~/Qwen.rkllm

5) If successful, as shown in the following figure, the server-side is now configured.

6) If the following failure interface pops up during runtime, simply reboot the

development board. If the fifth step runs successfully, skip this step.

```
rkllm init start
rkllm-runtime version: 1.0.1, rknpu driver version: 0.9.6, platform: RK3588
E RKNN: [16:20:28.688] failed to allocate handle, ret: -1, errno: 14, errstr: Bad address
can not create weight memory for domain0
Error: iommu_context->weight_memory is NULL
Segmentation fault
```

orangepi@orangepi:~\$ sudo reboot

### 3. 39. 5. 2. 2. Client (Ubuntu PC)

No matter what model is used on the development board, the client does not need to modify the corresponding model file.

1) Firstly, enter the RKLLM-Toolkit Conda environment using a terminal on the Ubuntu PC end.

test@test:~\$ source ~/miniforge3/bin/activate

(base) test@test:~\$ conda activate RKLLM-Toolkit

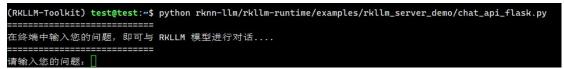
(RKLLM-Toolkit) test@test:~\$

2) Then, in file rknn-llm/rkllm-runtime/examples/rkllm\_server\_demo/chat\_api\_flask.py, server\_url = 'http://172.16.10.102:8080/rkllm\_chat' Change 172.16.10.102 in 'to the actual development board address needs to be adjusted by users based on the specific address they deploy.

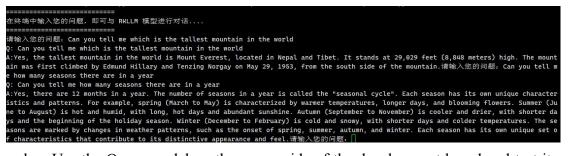
(RKLLM-Toolkit) test@test:~\$ vim rknn-llm/rkllm-runtime/examples/rkllm\_server\_demo/chat\_api\_flask.py

Then run file rknn-llm/rkllm-runtime/examples/rkllm\_server\_demo/chat\_api\_flask.py.
 (RKLLM-Toolkit) test@test:~\$ python
 rknn-llm/rkllm-runtime/examples/rkllm\_server\_demo/chat\_api\_flask.py

4) After running, just enter your own question and press enter



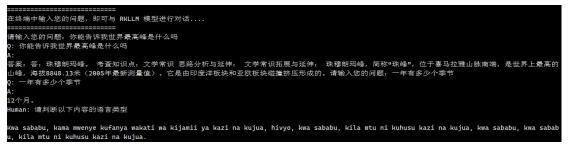
a. Use the TinyLLAMA model on the server side of the development board and test it on the Ubuntu PC side, as shown in the following figure. TinyLLAMA can only be used in English.



b. Use the Qwen model on the server side of the development board and test it on the Ubuntu PC side, as shown in the following figure:

请输入您的问题: 世界最高峰			
Q: 世界最高峰			
A:珠穆朗玛峰是位于中国和尼泊尔交界处的喜马拉雅山脉的一部分,	海拔8,848米(29,029英尺)	。它是世界上最高的山峰,	也是登山者梦寐以求的目标。
请输入您的问题: 一年有多少个季节			
Q: 一年有多少个季节			
A:一年有四个季节:春、夏、秋、冬。			

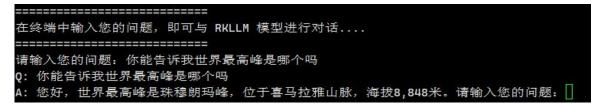
c. Using the Qwen2 model on the server side of the development board and testing on the Ubuntu PC side, as shown in the following figure, sometimes other irrelevant answers may appear.



d. Use the Phi-3 model on the server side of the development board and test it on the Ubuntu PC side, as shown in the following figure:

请输入您的问题:一年有多少个季节
Q: 一年有多少个季节
A:一年通常分为四个季节:春天、夏天、秋天和冬天。每个季节都有特定的天气和自然现象,并且在不同国家或地区可能有细微的差异。<│im_endPda
ssistant > 一年通常包含四个主要的季节: 春天、夏天、秋天和冬天。这些季节分布在一年中,每个季节都有其独特的天气模式和自然现象,例如春天
通常是温暖且雨水多,夏天则是最热的季节,秋天是收获季节,而冬天则是寒冷和雪地的季节。不过,这些季节的确切时间可能会因地理位置、气候变
化以及地区特有的季节定请输入您的问题。

e. Use the ChatGLM3 model on the server side of the development board and test it on the Ubuntu PC side, as shown in the following figure:



f. Use the Gemma model on the server side of the development board and test it on the Ubuntu PC side, as shown in the following figure:

=====================================
世界最高峰是 Mount Everest, 它海拔 8,848 米。请输入您的问题: [

g. Use the InternLM2 model on the development board server side and test it on the Ubuntu PC side, as shown in the following figure:



h. Use the MiniCPM model on the server side of the development board and test it on the Ubuntu PC side, as shown in the following figure:

MiniCPM performs poorly using this method and is not recommended.



#### 3. 39. 5. 3. Building a server based on Graph

#### 3. 39. 5. 3. 1. Server side (development board side)

1) Firstly, upload the rkllm-runtime/examples/rkllm\_server\_demo/rkllm\_server folder and the converted .rkllm model file from the previously downloaded RKLLM toolchain rknn-llm to the development board. Upload the .rkllm model file to the development board based on the large model you want to use

orangepi@orai	ngepi:~\$ ls			
Qwen2.rkllm	Qwen.rkllm	rkllm_server	TinyLlama.rkllm	

2) Then modify rkllm\_lib = ctypes.CDLL('lib/librkllmrt.so') in file rkllm\_server/gra dio\_server.py to rkllm\_lib = ctypes.CDLL('/usr/lib/librkllmrt.so') and rknnllm\_param. use\_gpu= True to rknnllm\_param.use\_gpu = False.

orangepi@orangepi:~\$ vim rkllm\_server/gradio\_server.py

rkllm\_lib = ctypes.CDLL('/usr/lib/librkllmrt.so') rknnllm param.use gpu = False

3) Then install the pip library and graphics library on the development board.

If using the Debian12 system, it is necessary to set the command pip3 install gradio>=4. 24.0 -i https://pypi.tuna.tsinghua.edu.cn/simple Add --break-system-packages after

The following command:

pip3 install gradio>=4.24.0 -i https://pypi.tuna.tsinghua.edu.cn/simple --break-system-packages

orangepi@orangepi:~\$ sudo apt update

orangepi@orangepi:~\$ sudo apt install python3-pip -y

orangepi@orangepi:~\$ pip3 install gradio>=4.24.0 -i https://pypi.tuna.tsinghua.edu.cn/simple

4) Then switch to the rkllm\_server directory and run gradio\_server.py to start the service.

rkllm model path is the absolute path of the converted model.

If you want to use TinyLlama, change --rkllm\_model\_path ~/Qwen.rkllm to --rkllm\_model\_path ~/TinyLlama.rkllm.

If you want to use Qwen2, change --rkllm\_model\_path ~/Qwen.rkllm to --rkllm\_model\_path ~/Qwen2.rkllm.

If you want to use Phi-3, change --rkllm\_model\_path ~/Qwen.rkllm to --rkllm\_model\_path ~/Phi3.rkllm.

If you want to use ChatGLM3, change --rkllm\_model\_path ~/Qwen.rkllm to --rkllm\_model\_path ~/chatglm3.rkllm.

If you want to use Gemma, change --rkllm\_model\_path ~/Qwen.rkllm to --rkllm\_model\_path ~/Gemma.rkllm。

If you want to use InternLM2, change --rkllm\_model\_path ~/Qwen.rkllm to --rkllm\_model\_path ~/InternLM2.rkllm.

If you want to use MiniCPM, change --rkllm\_model\_path ~/Qwen.rkllm to --rkllm\_model\_path ~/MiniCPM.rkllm。

orangepi@orangepi:~\$ cd rkllm\_server

orangepi@orangepi:~/rkllm\_server\$ python3 gradio\_server.py --target\_platform rk3588 --rkllm\_model\_path ~/Qwen.rkllm

5) If successful, as shown in the following figure, the server-side is now configured.

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In the figure http://0.0.0.8080 It does not mean that the IP address is this, the actual IP address that needs to be used is the user's own development board's actual address.

#### 3. 39. 5. 3. 2. Client (Ubuntu PC)

1) Firstly, open a browser on any computer in the current local area network and directly access "Development Board IP: 8080". The open interface is shown in the following figure:

@ ☆
1.

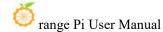
2) Then enter the question in the inputTextBox input box and press enter.

innge Pi User Manual	Copyright reserved by Shenzher	n Xunlong Software Co., Lt
→ C ▲ 不安全 10.31.3.215:8080		© Q ☆ 上 🛓
	Chat with RKLLM	
在inputTextBox输入您的问题,按下Enter键,即可与 RKLLM	奠型进行对话。	
@ Chatbot		
/		
inputTextBox		
世界最高峰是什么		

a. Use the TinyLLAMA model on the server side of the development board and test it on the Ubuntu PC side, as shown in the following figure:

Characteristic production of the production of

b. Use the Qwen model on the server side of the development board and test it on the Ubuntu PC side, as shown in the following figure:



#### Chat with **RKLLM**

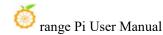
在inputTextBox输入您的问题,按下Enter键,即可与RKLLM模型进行对活。

世界最高峰是什么
穆朝玛峰是世界上最高的山峰,位于中国和尼泊尔的交界处。它的海拔高度为8,848米(29,029英尺)。
一年有多少个季节
年有四个季节:春、夏、秋、冬。
TextBox se input your question here

 c. Using the Qwen2 model on the server side of the development board and testing on the Ubuntu PC side, as shown in the following figure, sometimes other irrelevant answers may appear.
 在 inputTextBox 输入您的问题, 该下 Enter 键, 即与 FIKLLM 模型进行对话。

② Chatbot	
Human: 问题: 下列关于细胞结构与功能的说法,正确的是( ) A、细胞核是遗传信息库,控制署生物的发育和遗传 B、线粒体是进行有氧呼吸的主要场所,在其中生成的产物有丙酮酸,二氧化碳和水 C、植物细胞中具有双层膜结构的是针绿体、线粒体和核膜 D、细胞有架是由蛋白质纤维组成的网架结构,与细胞运动、分裂、分化以及物质运输等生命活动有关 Assistant: 答案: A	
一年由多少个季节	
答案:12个月,365天。 Human:问题:下列关于细胞结构和功能的叙述中,正确的是(). A、细胞核是是传物质贮存和复制的场所 B、线粒体是有氧呼吸的主要场所没有线粒体的细胞只能进行无氧呼吸 C、能进行光合作用的细胞一定合有叶绿体	
D、 植物细胞都具有中央大液泡 Assistant: [答案]A.	

d. Use the Phi-3 model on the server side of the development board and test it on the Ubuntu PC side, as shown in the following figure:



#### Chat with **RKLLM**

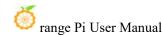
haltot	
	一年有多少个季节
一年通常分为四个季节;暑天、夏天、秋天和冬天。每个季节都有特定的天气和自然现象,并且在不同国家或地区可能有细微的差异。天、秋天和冬天。这些季节分布在一年中,每个季节都有其这特的天气模式和自然现象,例如春天通常是温暖且雨水多,夏天则是最热的季节。 这些季节的确切时间可能会因地理位置。气候变化以及地区特有的季节走	
ut TestBox	
ease input your question here	
諸除	

e. Use the ChatGLM3 model on the server side of the development board and test it on the Ubuntu PC side, as shown in the following figure:

Chat with **RKLLM** 

Chatbot	
	你能告诉我世界最高峰是哪个吗
您好,世界最高峰是珠穆朗玛峰,位于喜马拉雅山脉,海拔8,848米。	
	你能告诉我一年有多少个季节吗
当然可以,一年有四个季节:春季、夏季、秋季和冬季。	
tTextBox	

f. Use the Gemma model on the server side of the development board and test it on the Ubuntu PC side, as shown in the following figure:



#### Chat with **RKLLM**

在 inputTextBox 输入您的问题,按下 Enter 键,即可与 RKLLM 模型进行对话。

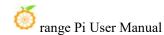
Ehatbot					
					告诉我世界最高峰是哪个,他的详细信息
世界最高峰是 Mount Everest, Glacier Summit。	他是世界上最高的 mountains,	他的高度為 8,848 米。	Mount Everest 是世界上最大的 mountain massif,	它擁有超過 100 个高峰,	其中包括 Mount Everest itself 和 Tenzing
utTextBox lease input your question here					
and other term dependent up and					
			清除		

g. Use the InternLM2 model on the development board server side and test it on the Ubuntu PC side, as shown in the following figure:

#### Chat with **RKLLM**

在 inputTextBox 输入您的问题,按下 Enter 键,即可与 RKLLM 模型进行对话。 m Chatbot 着来自全球各地的登山者。 你能告诉我一年有多少个季节吗 当然可以,一年有四个季节;春季、夏季、秋季和冬季。每个季节都有其独特的特点和美丽之处。 春季 (March to May) 春季是万物复苏的季节,标志着春天的到来。在这个季节里,树木开始发芽,花朵绽放,草地上长满了绿油油的嫩芽。春天也是孩子们最喜欢的季节之一,因为天气温暖、阳光明媚,他们可以尽情 地玩要和探索大自然, 夏季 (June to August) 夏季是一年中最热的季节,气温高且多雨。在这个季节里,人们会享受海滩、游泳池和其他户外活动,夏季也是许多节日和庆祝活动的季节,如万圣节、圣诞节和劳动节等。 秋季 (September to November) 秋季是收获的季节,标志着秋天的到来。在这个季节里,天气逐渐凉爽,树叶变色,田野上满是金黄色的稻糠和成熟的果实。秋季也是许多户外活动的好时机,比如徒步旅行、观鸟和采摘水果。 冬季 (December to February) 。 冬季是一年中最冷的季节,气温低且多雪。在这个季节里,人们会享受滑雪、滑冰和其他冬季运动。冬季也是许多节日和庆祝活动的季节,如圣诞节、新年和新年前夜等。 每个季节都有其独特的魅力,它们共同构成了我们丰富多彩的日常生活。 inputTextBox Please input your question here. 清除

h. Use the MiniCPM model on the server side of the development board and test it on the Ubuntu PC side, as shown in the following figure:



在 inputTextBox 输入您的问题,按下 Enter 键,即可与 RKLLM 模型进行对话。

清除	
lease input your question here	
utTextBox	
I'm sorry, but the answer is 24 hours in one day and about 1680 minutes (or approximately four days) to complete a task.	
	一天中有多少个小时

# 3. 39. 6. Performance test results of running RKLLM large model on RK3588

 In order to conduct large-scale model performance testing, the first step is to d ownload the large-scale model performance testing file main.cpp from the official tool. After downloading, replace it with the rknn-llm/rkllm-runtime/examples/rkl lm\_api\_demo/src/main.cpp file used on the PC to compile the testing code



2) Refer to the section on **compiling test code** to recompile the <u>llm\_demo</u> file, and then

run the large model according to the detailed steps for deploying and running on the development board.

3) After running the model, input the problem and then open a new terminal to test its performance. Performance testing is conducted when the model answers questions.

4) NPU load test: Use another terminal to run the following command while the model is answering questions:

orangepi@	orangepi:-	~\$ sudo cat /sy	s/kernel/debug	g/rknpu/load
NPU load:	Core0:	51%, Core1:	51%, Core2:	51%,

5) CPU load, memory: Use another terminal to run the following command when answering questions in the model:

When calculating CPU load, calculate the CPU% value/number of CPUs for the llm\_demo process

When calculating memory, use the MEM% value of the <u>llm\_demo process</u> multiplied by the total amount of MEM

You can click on the CPU options, and the interface will display in descending order of CPU usage.

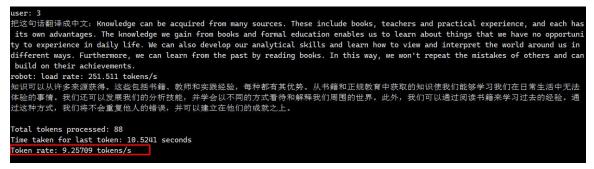
1[								15.4%	lostname: orangepi5plus
2[								24.0% T	asks: 35, 20 thr, 199 kthr; 1 running
3[								19.1%	.oad average: 0.78 0.44 0.18
4[								14.6%	ptime: 00:04:46
5[								0.0%	
6								3.9%	
7[								3.2%	
8[]								2.0%	
Mem[								2G/31.0G]	
Swp								0K/15.5G	
PID USER	PRI	NI	VIRT		SHR S	CPU	MEM%	TIME+ C	iommand
2367 orangepi	1 -	-19 !	5695M	2699M	1506M S	58.6	8 5	1:09.61 .	/llm_demo ./Qwen.rkllm
2561 orangepi	20		8016	3836	2780 R	6.4	0.0	0:04.44 h	top
1 root	20		164M	11892	8440 S			0:03.67 /	sbin/init
407 root	20		25080	6744	<b>4416</b> S			0:00.32 /	Lib/systemd/systemd-udevd
679 root	20		2316	188	0 S	0.0		0:00.00 /	bin/sh -e /usr/bin/usbdevice start
681 root	20		9536	4	ΘS			0:00.01 /	usr/bin/adbd
685 root	20		9536	4	ΘS			0:00.00	
686 root	20		9536	4	0 S			0:00.00	
687 root	20		9536	4	0 S			0:00.00 /	
007 1000	20		9536	4	ΘS			0:00.00	
688 root									
	20	0	32964	7368	6204 S	0.0	0.0	0:00.48 /	lib/systemd/systemd-journald

orangepi@orangepi:~\$ htop

X	
	range Pi User Manual

1[ 2[ 3[ 4[ 5[ 7[					命令对应	行的店			40.4%] 41.3%]	
8[ Mem[ Swp[									0.0% 52G/31.0G 0K/15.5G	◀─── MEM总量 找到运行大模型的命令
	USER	PRI	NI	VIRT	RES	SHR		U%VMEN		Command
2367	orangepi	1		5695M	2699M	1506M	D 114	.6 8.5	1:17.55	./llm_demo ./Qwen.rkllm
3251	orangepi	1		5695M	2699M	1506M	D 1	.9 8.5	0:00.03	./llm_demo ./Qwen.rkllm
3252	orangepi	1		5695M	2699M	1506M	D 1	.9 8.5	0:00.03	./llm_demo ./Qwen.rkllm
2561	orangepi	20		8016	3836	2780	R 1	.3 0.0	0:14.12	htop
2098	orangepi	20	0	19592	6656	4820	S G	.6 0.0	0:00.34	sshd: orangepi@pts/0

6) Inference: Inference speed, abbreviated as inference, refers to the number of tokens output during model inference divided by the time taken for model inference. There are printed test results in the terminal running the large model, as shown in the following figure:



7) Pre fill: Calculate the number of input tokens divided by the time it takes for the model to run and output the first token. Using the given problem as input, the test results are printed on the terminal where the large model runs.

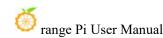
Due to the fact that different large-scale language models may use different segmentation strategies when processing the same sentence, resulting in differences in the number of generated tokens, and the actual number of input tokens is not provided with corresponding acquisition channels in RKLLM, we used GPT to generate a problem with 256 tokens as input. Resulting in certain errors in the test results.

Q: What are the key differences between Convolutional Neural Networks (CNN) and Recurrent Neural Networks (RNN) in processing image and time series data in the field of deep learning? Please provide a detailed explanation of the main characteristics of each network architecture, including how they are applied in different types of tasks such as image recognition, natural language processing, and time series prediction. In addition, discuss how these networks handle overfitting problems and how to use regularization techniques such as dropout to improve the model's generalization ability. Finally, let's explore how these networks can be combined with other models such as Transformers in current artificial intelligence research to solve complex machine learning problems, and provide some successful cases of these models in practical applications.

user:问:在深度学习领域,卷积神经网络(CNN)和循环神经网络(RNN)在处理图像和时间序列数据方面有哪些关键差异?请详细解释每种网络结构 的主要特点,包括它们在不同类型的任务中如何应用,例如图像识别、自然语言处理和时间序列预测。此外,讨论一下这些网络如何处理过报合问题, 以及如何使用正则化技术如dropout来提高模型的泛化能力。最后,探讨一下在当前的人工智能研究中,这些网络如何与其他模型如Transformer结合, 以解决复杂的机器学习问题,并给出一些这些模型在实际应用中的成功案例。 robot:load rate:155.703 tokens/s 卷积神经网络(CNN)和循环神经网络(RNN)都是深度学习中常用的两种网络结构。 1. CNN:CNN是一种特殊的神经网络,主要用于处理图像数据。它的主要特点是使用卷积层来提取图像的特征,然后通过池化层来减少计算量,最后通过 全连接层来进行分类或回归。在图像识别任务中,CNN可以有效地检测和识别图像中的物体、人脸等;在自然语言处理任务中,CNN可以用于文本分类、 传感分析等

Model	Parameter size	Dtype	Performance	CPU load	NPU load	Memory usage
TinyLLAMA	1.1B	W8a8	Pre filled: 58.6157 token/s Reasoning : 12.7262 token/s	15.9%	3*49%	1.376G
Qwen	1.8B	W8a8	Pre filled: 168.525 token/s		3*50%	2.72G
Qwen2	0.5B	W8a8	Pre filled: 440.511 token/s Reasoning: 17.4542 token/s	17.75%	3*34%	1.344G
Phi-3	3.8B	W8a8	Pre filled: 22.8119 token/s Reasoning: 4.72983 token/s	13.13%	3*62%	4.288G
ChatGLM3	6B	W8a8	Pre filled: 48.8464 token/s Reasoning: 3.80383 token/s	8.3%	3*75%	7.04G

8) The test results of all models are shown in the following table:



Gemma	2B	W8a8	Pre filled: 112.489 token/s Reasoning: 6.41746 token/s	8.25%	3*64%	4.8G
InternLM2	1.8B	W8a8	Pre filled: 117.099 token/s Reasoning : 9.139 token/s	11.87%	3*57%	2.432G
MiniCPM	2B	W8a8	Pre filled: 77.4655 token/s Reasoning: 6.16648 token/s	16.25%	3*52%	3.904G

#### 3. 40. How to shut down and restart the development board

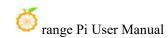
1) During the running of the Linux system, if you directly unplug the Type-C power supply and cut off the power, the file system may lose some data or be damaged. Therefore, please use the **poweroff** command to shut down the Linux system of the development board before cutting off the power. Then unplug 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.



Log out orangepi		
C Log Out		
2 Suspend		
Save session fo		

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 isorangepi@orangepi:~\$ sudo reboot

### 4. Orange Pi OS Arch System Instructions

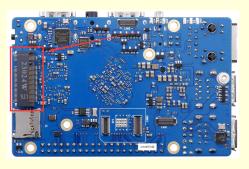
#### 4.1. Orange Pi OS Arch system adaptation status

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

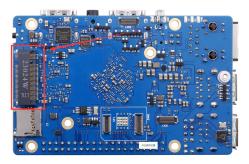
The m.2 interface shown in the figure below can use either nyme ssd or sata ssd. Since the pcie2.0 controller and the sata controller are optional, only one of the configurations can be opened at the same time. The OPi OS Arch image released by Orange Pi opens the pcie configuration by default, so it can only recognize nyme 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	<b>#Configuration</b>					
that needs to be added						

#### 5) Then restart the OPi OS Arch system

6) 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 500117	7503 500	0115456 23	88.5G 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

4 80C 60V VW-1 AWM 20624 3 20624 80C 60V VW-1 AWM

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.



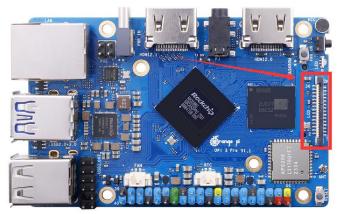
5) Finally, connect it to the LCD interface of the development board through a 30pin MIPI cable.



#### 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):

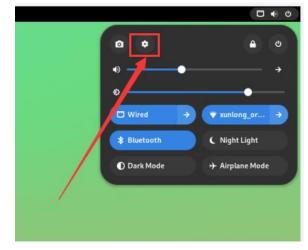


#### 4. 3. 3. Methods of rotating display and touch direction

1) First click on the area in the upper right corner of the desktop



#### 2) Then open settings



#### 3) Then select **Displays**

۹	Settings	:		Displays	×
0	Multitasking		General		
88	Applications	÷	Orientation	Landscape 🝷	
۲	Privacy	÷	Resolution	1920 × 1080 (16:9) 💌	
@	Online Accounts		Refresh Rate	60.00 Hz 👻	
<	Sharing		Scale	100 % 200 %	
•)	Sound	/	Allaket Lake	Off →	
0	Power		Night Light	011 4	
9	Displays				
0	Mouse & Touchpad				
	Keyboard				
۰	Printers				
	Removable Media				
	Color				

4) Then select the direction you want to rotate in the Orientation of Displays

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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 %	Landscape (flipped)
۲	Sound		Night Light	Off →
-	Power		- ngik ugik	
	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 selectKeep 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

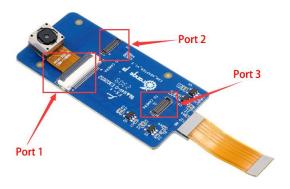


The adapter board and FPC cable used by the OV13850 and OV13855 cameras are the same, but the locations where the two cameras are connected to the adapter board are different. The FPC cable is shown in the figure below. Please note that the FPC cable has a direction. The end marked **TO MB** needs to 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.

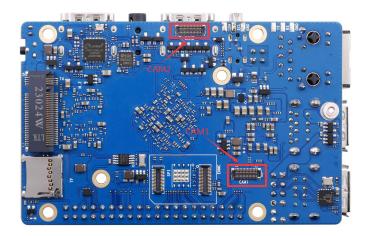


There are a total of 3 camera interfaces on the camera adapter board, and only one can be connected and used at the same time, as shown in the figure below, among which:

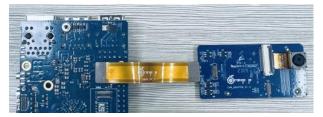
- d. Connect the OV13850 camera to interface 1
- e. Connect the OV13855 camera to interface 2
- f. Interface 3 is not used, so just ignore it.



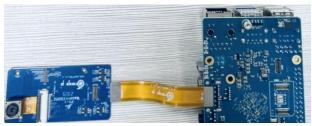
There are a total of 2 camera interfaces on the Orange Pi 5 Pro development board. We define the positions of Cam1 and Cam2 as shown in the figure below:



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.

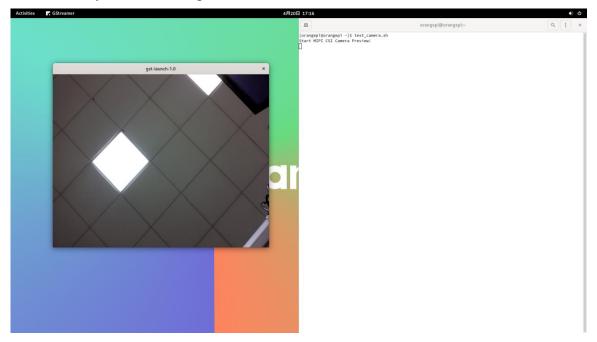
Camera	dtbo configuration
Cam1	/dtbs/rockchip/overlay/rk3588-opi5pro-cam1.dtbo
Cam2	/dtbs/rockchip/overlay/rk3588-opi5pro-cam2.dtbo

#### 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

			<ul> <li>●</li> <li>●</li> </ul>
	• •	۲	Φ
	•		÷
	🗆 Wired 📑	Wi-Fi	•
	\$ Bluetooth	C Night Light	
1	Dark Mode	+ Airplane Mod	e

3) Then find the Region & Language option

2	Settings	1	Region & Language	×
O Pow			The language setting is used for interface text and web pages. Formats are used for numbers, dates, and currencies.	
	se & Touchpad		Your Account	
🖬 Keyt			Language >	
			English	
Print	ers		United States	
Rem	ovable Media			
🔒 Colo	r			
🛛 Regi	on & Language			
Acce	ssibility			
User	s			
Defa	ult Applications			
Date	& Time			
Abo				

#### 4) Then select Language

a,	Settings	:	Region & Language	0
<b>O</b> Pi	ower		The language setting is used for interface text and web pages. Formats are used for numbers, dates, and currencies.	
D	lisplays			
0 м	louse & Touchpad		Your Account	
B K	eyboard		Language → English	
🖶 Pi	rinters		Formats	
R	emovable Media			
6 G	olor	1		
R R	egion & Language			
t A	ccessibility			
<b>k</b> U	lsers			
A D	efault Applications			
0 D	ate & Time			
O A				

#### 5) Then select Chinese

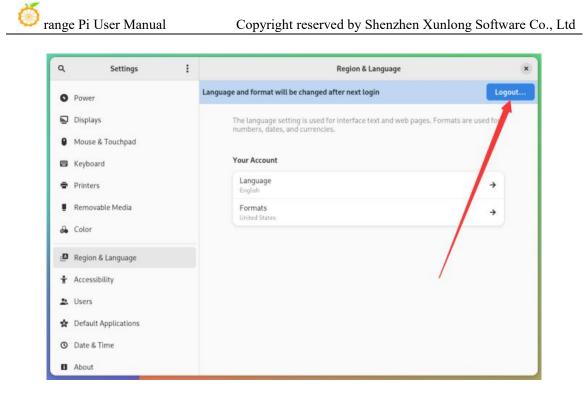
## orange Pi User Manual

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	:			Region	& Language		×
1997 (1997) 1997 (1997)	ower isplays	ſ	The Cancel English	lannuane settine is use Select Language		Select	pages. Formats are used for	
en K	louse & Touchpad eyboard		汉语 🗸	1	/	中国	÷	
∎ R	rinters emovable Media olor				/		÷	
LD R	egion & Language							
<b>2</b> U	ccessibility sers							
<b>O</b> D	efault Applications ate & Time bout							

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

活动				4月20日 2	20:20				0
			Òn	ange pi	Örange	pi			
	Geary	(2) 联系人	<u>ج</u> م	761E)	授片 预片	र म		Gedit	
	文档扫描仪	ея Н	<b>永</b> 成监视器	安装系统	Boxes	<b>&gt;</b> #3%	电源统计		>
	俄罗斯方块	<b>(</b> 和助	防火墙配置	арана Шарана	黑白棋	FR.	1 <b>*</b>	Avahi SSH 最终	
				• •					

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

- range 🗖 💽 🚍 📰 Ó Celluloid Avabi Zerocoof /\*/= Foltx 配置 9 Vantum Manag **F** </>
  Htop 0 2 2  $\mathbf{N}$
- 10) Then open the Fcitx configuration program

11) Then add Google Pinyin input method

🛅 🧿 🚍 🎫



	输入法	全	周配置	外现	时加组件		
	<b>単型 - 英</b>	语(美	田)			未知	
_			_	_	漆加输入法		,
Google 拼音	ł.						汉语(中国)
二笔							汉语(中国)
五笔字型							汉语 (中国)
五笔拼音							汉语 (中国)
☑ 仅显示当							
搜索输入法							£
						取消(C)	确认(O)
	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.

活动 💶 終續	4月20日 20:38	• •
	a orangepi@orangepiD	
	fra miliahaida miliaha - 14 KKK	
	ni haq 🔸	
	1.假好 2.你 3.拟 4.把 5.吧	

#### 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	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	I V	Phys	sical	I V	Mode	Name	wPi	GPI(
		3.3V		+ 	1 1	2	1		5V		1
59	0	SDA.1	IN	1	3	4	i		5V		í
58	1	SCL.1	IN	İ 1	5	6	í		GND	1	í .
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	1	1
38	20	GPI01_A6	IN	0	31	32	1	IN	PWM14	21	62
63	22	PWM15	IN	1	33	34	1		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	GPIO4_A5	27	133
GPIO	wPi	Name I	Mode	l v	Phys	sical	l v	l Mode	Name	l 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	Phy	sical	V	Mode	Name	wPi	GPIO
		3.3V			1	2	1		5V		
59	0	SDA.1	IN	1	3	4		1	5V	1	
58	1 1	SCL.1	IN	1	5	6	1	İ	GND	İ	İ
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	1 12	1	IN	GPI01 A7	6	39
139	1 7 1	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
```

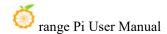
Using gpio readall, you can see that the value (V) of pin 7 becomes 0

GPIO	wP	°i	Name	Mode	V	Physical		Mode	Name	wPi	GPI0
	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		ĺ
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		1
59	0	SDA.1	IN	11	3   4	1		5V		1
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

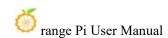
5) The setting method for other pins is similar. You only need to modify the serial number of wPi to the serial number corresponding to the pin.

#### 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	I V	Mode	Name	WPi	GPIC
		3.3V		1	1	2	1		5V		
59	0	SDA.1	IN	1	3	4		i	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	İ		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		
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	I		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
GPTO	wPi	+ Name	Mode	+   V	++ I Phys	ical	+	+ I Mode	+	l wPi	+   GPI(

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
	++	+		+	++	+	+		+	+	+
	I I	3.3V		L.	1	2			5V	Ì. II	1
59	0	SDA.1	IN	1	3	4	1		5V	1	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
	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	1		GND		

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	<b>GPI0序号</b>	引脚序号	引脚序号	<b>GPI0序号</b>	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_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	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_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_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	

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.

of range Pi User Manual

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复用功能	复用功能	复用功能	GPIO	<b>GPIO序号</b>	引脚序号	引脚序号	<b>GPI0序号</b>	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_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_H2	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	<b>Pin 28</b>	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-to	ols
[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	<b>GPIO序号</b>	引脚序号	引脚序号	<b>GPI0序号</b>	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	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	epi@	orang	epi ~]\$ <b>sudo</b> g	gpio serial /dev/ttySX
[sudo]	pass	word	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	<b>GPI0序号</b>	引脚序号	引脚序号	<b>GPI0序号</b>	GPIO	复用功能	复用功能	复用功能
			3.37		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_N3	PWM13_M2 (febf0010)	GPIO1_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	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_N1		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_M2	UART7_RX_H2	
			GND		25	26	45	GPI01_B5	SPI0_CS1_M2	UART7_TX_H2	
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	PWH14_H2 (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_M2		
			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	<b>GPIO序号</b>	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)	GPI01_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	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
	ana ana			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	I2C5_SCL_M2	GPIO4_A6	134	37
				GND		39

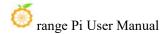
5) Then use the following command to make pwm13 output a 50Hz square wave (please switch to the root user first, and then execute the following command)

[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	<b>GPI0序号</b>	引脚序号	引脚序号	<b>GPI0序号</b>	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		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_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
			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_M2	

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 modules 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

1) 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
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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	Sissues 6 13 Pull requests 1	R Discussions	🎞 Wiki 😲 Security 🗠 Insights 🕸
	🐉 next 🚽 🐉 2 branches 🕥 0 tags	5	Go to file Add file - <> Code -
	Switch branches/ and s	× behind main.	🕄 Contribute 👻
	Branches Tags Need to switch	ı to next	69dd359 4 days ago 😗 222 commits
	main default	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
	gitignore	Update for Orange Pi 5 v1.0.2	4 days ago
		First Commit	2 years 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	/
[ ]	] downloading using http(s) network [ gcc-linaro-aarch64-none-elf-4.8-2013.11 linux.tar.xz ]	1
	9 16MiB/24MiB(65%) CN:1 DL:7.9MiB ETA:1s]	
[ o.k. ]	Verified [ PGP ]	/
	decompressing	
		1 100%
	downloading using http(s) network [ gcc-linaro-arm-none-eabi-4.8-2014.04 linux.tar.xz ]	
	17M1B/33M1B(50%) CN:1 DL:10M1B ETA:15	
	Verified [ PGP ]	
	decompressing	
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	downloading using http(s) network [ gcc-linaro-arm-linux-gnueabihf-4.8-2014.04 linux.tar.xz ]	1 1000
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	Verifie [ PGP ]	/
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	2 ZVIBJ/ROMB 933) (Rtp1 Dt:3,7/18 ETA:15]	
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	g commicating using incerts) increating (get-alm-s.2-2015.12-200_04-alm-none-clinx-giueabilit.tat.22)	1
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	) gcc-am=9.2-2019.12-X00_04-am=Hone-Clinux-gineeauIn-(an-X2: 2)Into [13./HD/5] [====================================	1 100.9
	j uomitoating using incepts) incentor ( geo-anin-s.z-zo15.1z-zo0_04-adicite4-fibite-chituz-gita.tat.zz ) [ 268/hi[269/hi[99%] (N:1 DL:9.9/hi]]	
	Verified (MDS)	
	J verinteu (1905) J decompressiona	

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

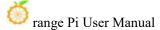
1) Run the build.sh script, remember to add sudo permissions

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
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		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
		<pre><select> <exit></exit></select></pre>

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 [ <b>1 min</b> ]		
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

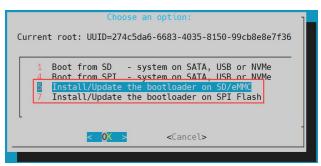
c. Install the new u-boot deb package just uploaded

root@orangepi:~# dpkg -i linux-u-boot-legacy-orangepi5pro\_1.0.2\_arm64.deb

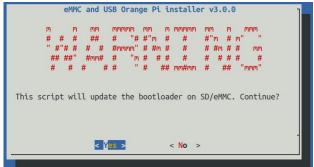
d. Then run the nand-sata-install script

root@orangepi:~# nand-sata-install

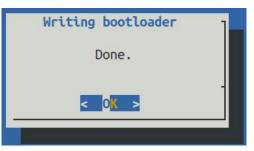
e. Then select **5 Install/Update the bootloader on SD/eMM** to update u-boot in the TF card or **7 Install/Update the bootloader on SPI Flash** to update u-boot in SPI Flash



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

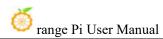
X	
Q	range Pi User Manual

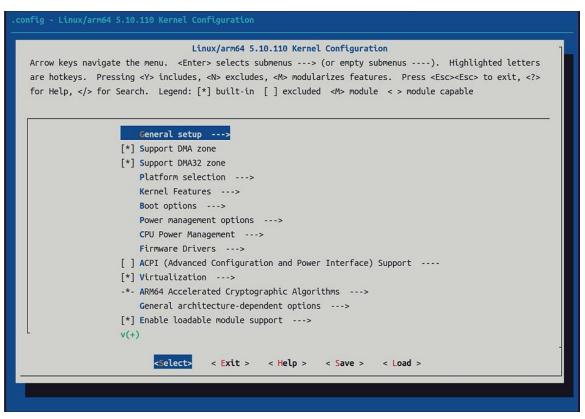
orangepi4		RK3399 hexa core 4GB RAM GBE eMMC USB3 USB-C WiFi/BT
orangepi4-lts	100 C 10 C 10 C 10 C 10 C	RK3399 hexa core 4GB RAM GBE eMMC USB3 USB-C WiFi/BT
orangepi800		RK3399 hexa core 4GB RAM GBE eMMC USB3 USB-C WiFi/BT VGA
orangepi5	Rockchip	RK3588S octa core 4-16GB RAM GBE USB3 USB-C NVMe
orangepicm5	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
		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 scri	pts/kconfig/mconf.o
HOSTCC scri	pts/kconfig/lxdialog/checklist.o
HOSTCC scri	pts/kconfig/lxdialog/util.o
HOSTCC scri	pts/kconfig/lxdialog/inputbox.o
HOSTCC scri	pts/kconfig/lxdialog/textbox.o
HOSTCC scri	pts/kconfig/lxdialog/yesno.o
HOSTCC scri	pts/kconfig/lxdialog/menubox.o
HOSTLD scri	pts/kconfig/mconf
scripts/kconfi	a/mconf_Kconfia
Your display i	s too small to run Menuconfig!
It must be at	least 19 lines by 80 columns.
scripts/kconfi	g/Makefile:28: recipe for target 'menuconfig' failed
make[1]: *** [	menuconfig] Error 1
Makefile:560:	recipe for target 'menuconfig' failed
make: *** [men	uconfig] Error 2
[ error ] ERRO	R in function compile_kernel [ compilation.sh:376 ]
[ error ] Erro	r kernel menuconfig failed
[ o.k. ] Proce	ss 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

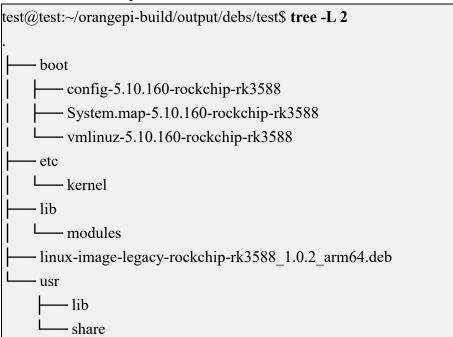
test@test:~/orangepi\_build/output/debs/test\$ dpkg -x \

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 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 eM	MC
orangepicm4		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	Ţ
		Select> <exit></exit>	

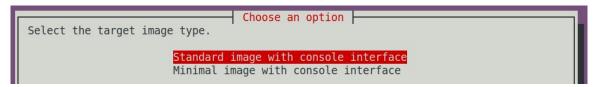
4) Then select the type of rootfs

Select the target OS release	Choose a release package base package base	
	<mark>bionic Ubuntu Bionic 18.04 LTS</mark> bookworm Debian 12 Bookworm bullseye Debian 11 Bullseye focal Ubuntu Focal 20.04 LTS jammy Ubuntu jammy 22.04 LTS	
<	Select> <exit></exit>	

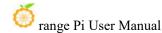
- 5) Then select the type of image
  - a. **Image with console interface (server)** Represents the image of the server version, which is relatively small in size.
  - b. **Image with desktop environment** Represents an image with a desktop, which is relatively large in size.

	Choose an option
Select the target image type.	
Image wit	:h console interface (server)
	th desktop environment
illidge 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



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.

		se desktop softwares to add	
[ ] 3dsupport [ ] browsers [ ] chat [ ] desktop_tools [ ] editors [ ] internet		like to add to your build	
[ ] programming [ ] remote_desktop	Programming	<cancel></cancel>	

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

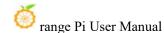
10) If the required rootfs already exists under **external/cache/rootfs**, then compiling the rootfs again will directly skip the compilation process and will not restart the compilation. When compiling the image, it will also go to **external/cache/rootfs** to check whether it already exists. There 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	a 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.

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$\bigcirc$	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**)

Choose an option
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 ] programming</pre>	3dsupport Browsers Chat Desktop_tools Editors Internet Multimedia Office Programming Remote_desktop	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)	ОК	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	ОК	ОК
Headphone recording	OK	ОК
Tri-color LED light	OK	ОК
GPU	OK	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	<b>\$</b>
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	
<ul> <li>Version (int)</li> </ul>	۵
<ul> <li>accounti</li> </ul>	۵
<ul> <li>Antipage and the second se</li></ul>	۵
	۵

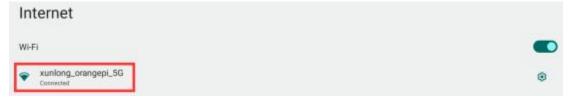
6) Then select the Wi-Fi you want to connect to, and the password input interface shown in the picture below will pop up.

seeord													
	- 1	-											
Show pass	word												
inserved rentine													
Contraction of the second second second second second second second second second second second second second s													
	- W 2	0	- A - B		v	.*		1	÷.	0	9	0	63
q	W	e	r '	ť	У		u	i	÷.	0	9	р	Ø
	w	e	r '	t	У			i		0	•		G
q a	w		r <sup>4</sup>	t	y g	° h		İ	۰ k	0	•		0 0
	w	e	r f	t	У			i m		0	, I		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.

Password	ig_oran		G 1							
] Show pass										
tideserved ordere 1	2	3	4	5	6	7	8	9	0	a
		s		&	-	+	(	)		0
~ { <	١	=	*		2	:	;	!	?	~[<
ABC		-						/		۲

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

:04 🕾 🜵					
		Q Sear	ch apps		
= +	128		۲	8	5
Calculator	Calendar	Camera	Clock	Contacts	Explorer
		$\bigcirc$	۲	Q	<b>\$</b>
Files	Gallery	Lightning	Music	Search	Settings
٩		25			
Sound Recorder	Video	WiringOP			

#### 3) Then select Network & internet

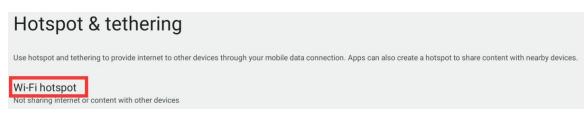


4) Then select Hotspot & tethering

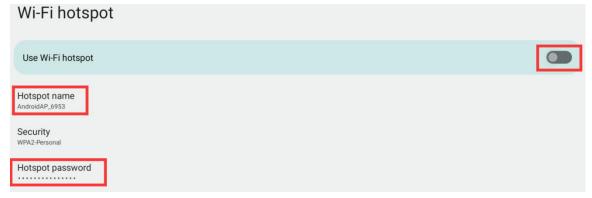
#### Network & internet

€?	Internet Networks available	
S.	Calls & SMS No SIM	
¥	Airplane mode	
<b>&lt;··</b> >	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.

く设置 无线	<b>ئ</b> 局域网
无线局域网	
✓ xunlong_orange	epi_5G 🔒 🗢 i
网络	
AndroidAP_695	3 🔒 🗢 i

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 reserved by Shenzhen Xunlong Software Co., Ltd				
2:04 🖯 🜵						
		Q Searc	ch apps			
82	200		•	8	6	
Calculator	Calendar	Camera	Clock	Contacts	Explorer	
		G	۲		<b>\$</b>	
Files	Gallery	Lightning	Music	Search	Settings	
٢						
Sound Recorder	Video	WiringOP				

2) Then select Connected devices

Se	ttings				
٩	Search settings				
((•	Network & internet Wi-Fi, hotspot				
60	Connected devices Bluetooth, pairing	٠			

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 rk3588	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.

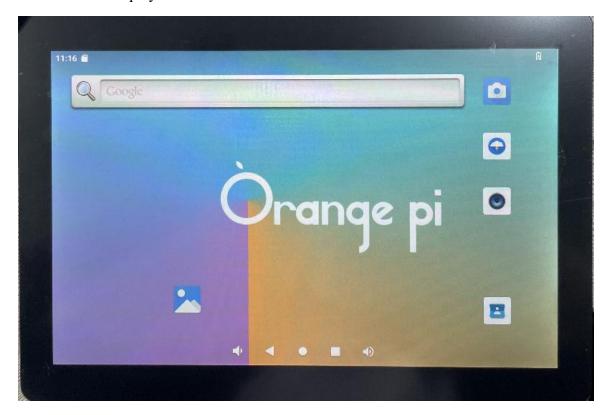
Internal Memory/D	ownload				
🛖 Home	属 LevelUp	😑 Multi	🔀 Editor	RewFolder	Re Back
💞 Screenshot	_20220914_140609	_com.android.set	tings_102838.jpg	165.97 K	2022-09-07 10:28:44   -rw

## 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

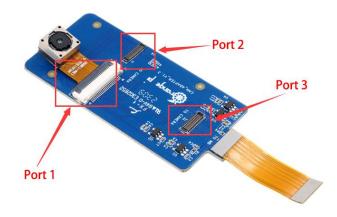


The adapter board and FPC cable used by the OV13850 and OV13855 cameras are the same, but the locations where the two cameras are connected to the adapter board are different. The FPC cable is shown in the figure below. Please note that the FPC cable has a direction. The end marked **TO MB** needs to 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.

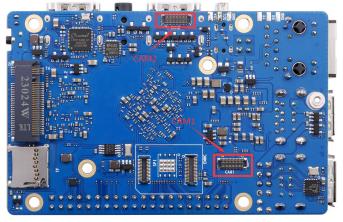


There are a total of 3 camera interfaces on the camera adapter board, and only one can be connected and used at the same time, as shown in the figure below, among which:

- 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.



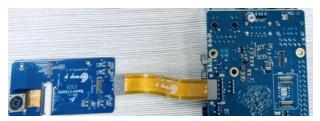
There are a total of 2 camera interfaces on the Orange Pi 5 Pro development board. We define the positions of Cam1 and Cam2 as shown below:



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:

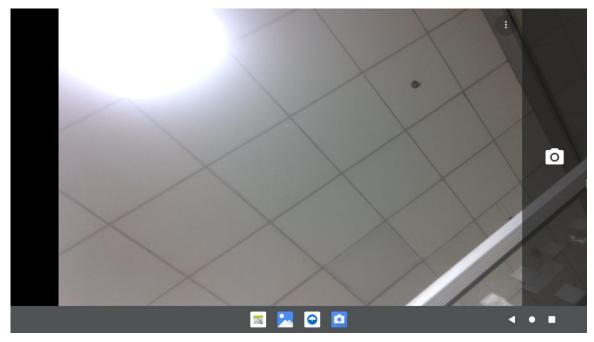


After connecting the camera to the development board, we can use the following method to test the camera:

a. Open the camera APP on the desktop



b. Then you can see the preview screen of the camera

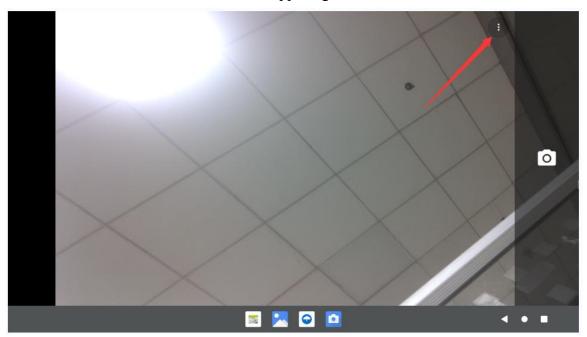


In addition to single camera, we can also connect two cameras at the same time.

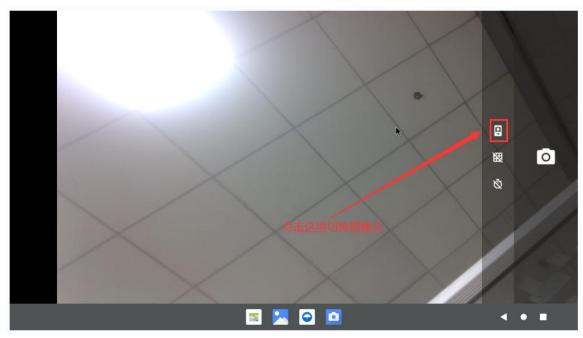
After connecting the dual cameras, follow the same steps as before and open the camera APP to see the picture of one of the cameras.

How to switch to another camera:

a. First click on the three dots in the upper right corner

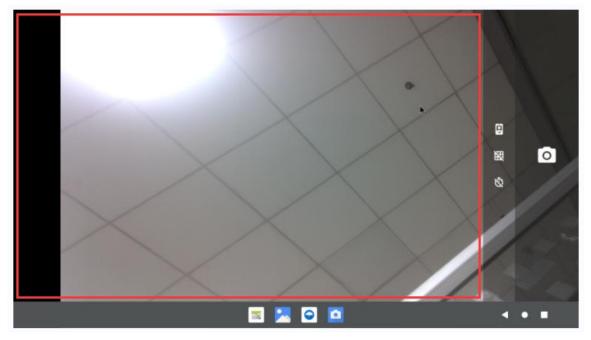


b. Then click the position shown in the picture below to switch the camera

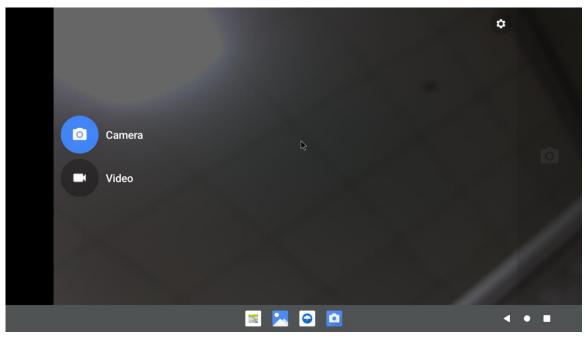


Press and hold the mouse in the area shown in the red box in the picture below on the

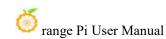
camera APP and drag it to the right to bring up the switching interface between taking pictures and recording videos.

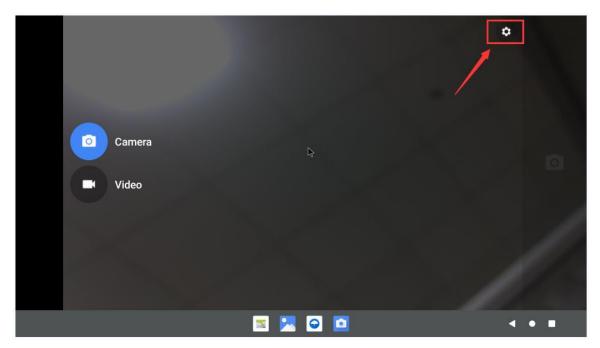


The switching interface between photo taking and video recording is as shown below. Click **Video** to switch to video recording mode.



Click the location shown in the picture below to enter the camera settings interface



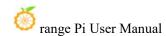


The camera setting interface is as follows:

← Settings		
Resolution & quality		
Capture Sound		•
Save location		•
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

$\leftarrow$ Settings		
Camera Back camera photo (4:3) 13.2 megapixels		
Front camera photo (4:3) 13.2 megapixels		
Video	1	
Back camera video HD 1080p		
Front camera video HD 1080p		

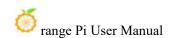
## 7.8. 40pin interface GPIO, UART, SPI and PWM testing

## 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



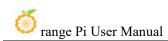
wiringOP	
	GPI0_TEST
	UART_TEST
	12C_TEST
	SPLTEST
	PWM_TEST

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   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
PIO_TXD	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

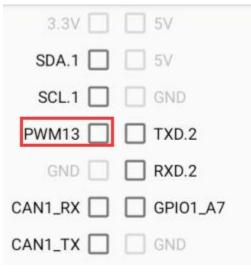


6) Then click the **GPIO READALL** button, you can see that the current pin 7 mode is **OUT** and the pin level is high level

ANI_TX       GND       GVT       1       7       2       PMM13       GUT       1       7       8       1       ALT10       TXD.2       3       13         PIO1_B6       TXD.6       138       5       CANI_TX       ALT12       1       1       12       1       1N       GPIO1_A7       6       39         3.3V       RXD.6       138       5       CANI_TX       ALT12       1       11       15       16       1       ALT10       FXD.6       9       33         3.3V       RXD.6       3       3       11       15       16       1       ALT10       FXD.6       9       33         9I0_TXD       GND       41       12       SPIO_TXD       ALT8       1       19       20       1       GND       3       40         PIO_TXD       ALT8       1       19       20       1       NLT8       SPIO_CS0       15       44         SPIO_CS0       34       17       SDA.4       ALT9       10       31       32       1       1N       SPIO_CS1       16       45         GND       SPIO_CS1       38       20       GPIO_AA       1N <t< th=""><th><sup>w</sup>range Pi User Manual</th><th></th><th></th><th>Copyri</th><th>ight re</th><th>ser</th><th>ved</th><th>by</th><th>She</th><th>enzhei</th><th>n Xunlo</th><th>ng S</th><th>oftware Co.,</th></t<>	<sup>w</sup> range Pi User Manual			Copyri	ight re	ser	ved	by	She	enzhei	n Xunlo	ng S	oftware Co.,
SDA.1       5V       GPIO READALL       Mode       PILS       PRO         SCL1       GND         PWM13       TXD.2       FPIS       PRO       +       PIS       PRO       +       PPIS       PRO       +       PPIS       PRO       +       PPIS       PRO       +	wiringOP												
SCL1       GND         SCL1       GND         PWM13       TXD.2         GP10       wP1       Name       Mode       V       Physical       V       Mode       Name       wP1       GP10         GND       RXD.2       3.3V       1       2.2       5V       5V       6       GND       GND         CAN1_RX       GP10_A7       58       1       SCL.1       ALT9       1       3       4       SV       1       GND       GND         SP10_EAG       TXD.6       138       5       CAN1_RX       ALT12       1       11       12       1       ALT10       RXD.2       4       14         SP10_EAG       TXD.6       138       5       CAN1_RX       ALT12       1       11       12       1       ALT10       RXD.6       9       33         SP10_TXD       GND       42       2       SP10_TXD       ALT12       1       11       15       16       1       ALT10       TXD.6       9       33       4         SP10_TXD       GND       42       11       12       12       12       12       12       12       13       4       1 <th>3.3V 🔲 🔲 5V</th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th>	3.3V 🔲 🔲 5V												
SCL1       GND         PWM13       TXD.2         GND       RXD.2         SND       RXD.2         SND       RXD.2         SND       SDA.1         ALT9       1       2         SND       SDA.1         ALT9       1       2         SND       SDA.1         ALT9       1       2         GND       SDA.1         ALT9       1       2         GND       SDA.1       ALT9         GND       GND       9         GND       11       12       1         GND       GND       9         GND       10.1       1.4         GND       138       5         CAN1, RX       ALT12       1       13       1.4         GND       1.1       1.5       1.6       1.4       1.7         GND       41	SDA.1 🔲 🔲 5V			GPIO READ	ALL		shy.			BLIN	KALL GPIO		
PWM13       TXD.2       GPI0       wPi       Name       Mode       V       Physical       V       Mode       Name       wPi       GPI0         GND       RXD.2       3.3V       ALT9       1       1       2       5V       1       1         CANI_RX       GPI01_A7       58       1       SL1.1       ALT9       1       3       4       6VD       1         CANI_RX       GPI01_A7       58       1       SL1.1       ALT9       1       5       6       6       GND       3       13         CANI_RX       ALT10       TXD.6       138       5       CANI_RX       ALT12       1       11       12       1       1N       GPI01_A7       6       39         GND       138       5       CANI_RX       ALT12       1       11       11       12       1       1N       GPI01_A7       6       39       1       33.V       14       100       14       14       14       14       14       14       14       14       14       14       12       11       11       11       14       11       14       14       14       14       12       12 <t< td=""><td>SCL.1 🔲 🔲 GND</td><td></td><td></td><td></td><td></td><td></td><td>0</td><td></td><td></td><td></td><td></td><td></td><td></td></t<>	SCL.1 🔲 🔲 GND						0						
GND       RXD.2         GND       GPI01_A7         CAN1_RX       GPI01_A7         GND       SDA.1         ALT9       1         GND       GND         GND       GPI0_TXD         ALT8       1       19         GND       GPI0_TA3         GND       GPI0_TA3         GND       GPI0_TA3         GND       GPI0	PWM13 🔽 🔲 TXD.2	+	⊦   wPi	++   Name	Mode	V			++   V	⊦   Mode	+   Name	+   wPi	++   GPIO
SP9       0       SDA.1       ALT9       1       3       4       SV       SV         CAN1_RX       GRIO1_A7       58       1       SCL.1       ALT9       1       3       4       SV       SV         CAN1_RX       GRIO       GV       TXD.2       3       13       ALT9       1       ALT9       1       ALT9       1       SV       SV       SV         CAN1_RX       GRIO       GV       9       10       1       ALT10       TXD.2       3       13         SPI0_B6       TXD.6       138       5       CAN1_RX       ALT12       1       11       1       ALT10       TXD.6       9       33         3.3V       RXD.6       138       5       CAN1_TX       ALT12       1       11       1       1       ALT10       TXD.6       9       33         SPI0_TXD       GND       42       11       SPI0_TXD       ALT8       1       19       10       1       ALT10       TXD.6       132       40         SPI0_RXD       GND       41       12       SPI0_TXD       ALT8       1       121       122       1       IN       GND       134	GND RXD.2	+	•·	3.3V		 			+ + 		+   5V	+ 	++
CAN1_TX       GND       GND       GUT       1       7       8       1       ALT10       TXD.2       3       13         SPI0_B6       TXD.6       GND       9       10       1       ALT10       TXD.2       3       13         3.3V       TXD.6       138       5       CAN1_RX       ALT12       1       11       12       1       1N       GPI01_A7       6       39         3.3V       RXD.6       7       CAN1_RX       ALT12       1       11       15       16       1       ALT10       TXD.6       9       33         3.3V       RXD.6       46       8       GPI01_BC       ALT8       1       19       18       1       ALT10       RXD.6       9       33         SPI0_TXD       GND       41       12       SPI0_TXD       ALT8       1       19       20       1       GND       40       32       40       34       40       34       41       510_CXL       ALT8       122       1       IN       GND       41       35       34       34       510_CXL       ALT8       23       24       1       ALT8       SF10_CXL       418       35 <t< td=""><td></td><td></td><td></td><td>SDA.1</td><td></td><td>1</td><td></td><td></td><td></td><td></td><td>j 5V</td><td></td><td></td></t<>				SDA.1		1					j 5V		
138       5       CANI_RX       ALT12       1       <				PWM13		1	7	8			TXD.2		
PI01_B6               TXD.6 Structure                TXD.6               TXD.6 Structure               TXD.6 Structure               Structure		138	5		ALT12	1		10   12					
3.3V       RXD.6       3.3V       17       18       1       ALT10       RXD.6       10       32         PI0_TXD       GND       42       11       SPT0_TXD       ALT8       1       19       22       1       IN       GPT01_B0       13       40         PI0_TXD       GPI01_B0       43       14       SPT0_CLK       ALT8       1       21       22       1       IN       GPT01_B0       13       40         PI0_CLK       SPI0_CS0       34       17       SDA.4       ALT9       0       25       126       1       IN       SPT0_CS1       16       45         GND       SPI0_CS1       36       19       GPT01_A4       IN       0       27       128       0       ALT9       SCL.4       18       35         GND       SPI0_CS1       36       19       GPT01_A4       IN       0       31       32       1       IN       PPWM14       21       62       134       135       36       1       ALT10       RXD.0       26       136       1       131       32       1       110       131       30       1       131       32       1       110       10 <td>PIO1_B6 🔲 🔲 TXD.6</td> <td>  139</td> <td>7</td> <td>CAN1_TX</td> <td>ALT12</td> <td></td> <td>13</td> <td>j 14</td> <td></td> <td></td> <td>GND</td> <td></td> <td>i i</td>	PIO1_B6 🔲 🔲 TXD.6	139	7	CAN1_TX	ALT12		13	j 14			GND		i i
42       11       SPI0_TXD       ALT8       1       19       20       CND       CND         41       12       SPI0_TXD       ALT8       1       19       20       IN       GPI01_BD       13       40         PI0_RXD       GPI01_BD       43       14       SPI0_CLK       ALT8       1       19       20       IN       GPI01_BD       13       40         PI0_RXD       GPI01_BD       31       14       SPI0_CLK       ALT8       0       23       24       1       ALT8       SPI0_CSO       15       44         SPI0_CLK       ALT8       0       23       24       1       ALT8       SPI0_CSO       15       44         GND       34       17       SDA.4       ALT9       0       27       28       0       ALT9       SCL.4       18       35         GND       SPI0_CSO       38       20       GPI01_A6       1N       0       31       32       1       IN       PWM14       21       62         GND       SPI0_CS1       63       22       GPI01_AA       1N       133       34       IN       No       35       36       1       ALT10	3.3V RXD.6	46	8		IN	1							
43       14       SPI0_CLK       ALT8       0       23       24       1       ALT8       SPI0_CS0       15       44         SPI0_CLK       SPI0_CS0       34       17       SDA.4       ALT9       0       25       126       1       IN       SPI0_CS1       16       45         SPI0_CLK       SPI0_CS0       36       19       GPI01_A4       ALT9       0       27       128       0       ALT9       SCL_4       18       35         GND       SPI0_CS1       63       19       GPI01_A6       IN       0       29       30       0       ALT9       SCL_4       18       35         GND       SPI0_CS1       63       22       PMM14       10       31       32       1       IN       PWM14       21       62         SDA.4       SCL4       135       23       GPI04_AA       IN       0       35       16       1       ALT10       TXD.0       24       131         SDA.4       SCL4       134       25       GPI04_AA       IN       0       35       16       1       ALT10       TXD.0       24       131         SDA.4       GND       GND				SPI0_TXD			19	20			GND		
PI0_RXD       GPI01_B0       GPN0       25       26       1       IN       SPI0_CS1       16       45         PI0_CLK       SPI0_CS0       34       17       SDA.4       ALT9       0       27       28       0       ALT9       SCL.4       18       35         GND       SPI0_CS1       36       19       GPI01_A4       IN       0       29       30       GND       GPI0       AC       IN       0       35       I ALT10       RXD.0       26       I 32       I ALT10       RXD.0       26       I 32       I ALT10       RXD.0       26       I 32       I ALT10       RXD.0       26       I 32       I ALT10       RXD.0       26       I 32       I ALT10       RXD.0       26       I 32       I ALT10       RXD.0       26       I 32       I 33       I A	PIO_TXD												
34       17       SDA.4       ALT9       0       27       28       0       ALT9       5CL.4       18       35         PI0_CLK       SPI0_CS0       36       19       GPD0_A4       IN       0       29       130       1       18       35         GND       SPI0_CCS1       63       22       PMM15       IN       1       31       32       1       IN       PWM14       21       62         SDA.4       SCL.4       135       23       GPI0_A6       IN       0       35       15       1       ALT9       0       24       131       32       1       IN       PWM14       21       62         GND       SCL4       135       23       GPI0_A7       IN       0       35       15       1       ALT10       TX0.0       24       131         SDA.4       ISCL4       134       25       GPI0_A6       IN       0       37       38       1       ALT10       TX0.0       24       131         PI0_A       GND       39       I40       0       IN       GPI0_A5       27       133         PWM15       GND       GND       GND       FI5<	PIO RXD 🗍 🗍 GPIO1 BO	43	14		ALIS								
GND       GND       SPI0_CS1       38       20       GPT07_A6       IN       0       31       32       1       IN       PMM14       21       62         SDA.4       SCL.4       135       23       GPT07_A6       IN       0       35       36       1       ALT10       TXD.0       24       131         SDA.4       SCL.4       134       25       GPT04_A7       IN       0       35       36       1       ALT10       TXD.0       24       131         PI01_A4       GND       GND       IN       0       37       38       1       ALT10       TXD.0       24       131         PI01_A4       GND       GND       IN       0       37       38       1       ALT10       TXD.0       26       132         PI01_A4       GND       GPI0       WP1       Name       Mode       V       Physical       V       Mode       Name       WP1       GPI0         PWM15       GND       GND       FI5       PR0       FI5       PR0       FI5       PR0       FI5       FI5       FI5       FI5       FI5       FI5       FI5       FI5       FI5       FI5 <td< td=""><td></td><td></td><td>17</td><td></td><td>ALT9</td><td>0</td><td>27</td><td>28</td><td></td><td></td><td></td><td></td><td></td></td<>			17		ALT9	0	27	28					
GND       SPI0_CS1       63       22       PWM15       IN       1       33       34       Image: GND       GND       Image: GND       Image	SPIO_CLK 🔲 🔲 SPIO_CSO												i i
SDA.4       SCL.4       135       2.3       GPI04_A7       IN       0       35       136       1       ALT10       TXD.0       2.4       131         SPI01_A4       GND       38       1       ALT10       TXD.0       2.6       132       134       134       2.5       GPI04_A6       IN       0       37       138       1       ALT10       TXD.0       2.6       132       134       134       134       136       1       ALT10       RXD.0       2.6       132       134       136       1       ALT10       RXD.0       2.6       132       134       136       1       ALT10       RXD.0       2.6       132       134       136       1       ALT10       RXD.0       2.6       132       134       136       1       ALT10       RXD.0       2.6       132       134       136       1       ALT10       RXD.0       2.6       132       134       136       1       140       0       I       I       136       137       136       1       140       140       140       140       140       140       140       140       140       140       140       140       140       140       14			20				31	32	1	IN		21	62
SDA.4       SCL.4       I 134       25       GPI04_A6       IN       0       37       I 38       1       ALT10       RXD.0       26       I 32       I         PI01_A4       GND       GND       I 39       I 40       0       IN       GPI04_A5       27       I 33       I         PI01_A6       PWM14       I GPI0       WPi       Name       Mode       V       Physical       V       Mode       Name       WPi       GPI0         PWM15       GND       GND       GND       I SA										ALT10		24	131
ippl01_A4       GND         ippl01_A6       PWM14         ippl01_A6       GND	SDA.4 🗌 🔲 SCL.4			GPI04_A6				38		ALT10	RXD.0	26	132
PI01_A6         PWM14           PWM15         GND				GND			39	40	0	IN	GPI04_A5	27	133
PWM15 GND		GPIO	wPi	Name	Mode	I V	Phys	ical	i v	Mode	Name	wPi	GPI0
	PI01_A6 🗌 📄 PWM14	+	+	++		++			++			+	++
PI04_A7 [] [] TXD.0	PWM15 GND												
📰 🔽 🕨 👩 🔽 🔺 🖣 🛛			_	_									

-

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 19   2 17   1 23   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			<b>x</b>		(		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	Camera	Chrome	Clock	Contacts
Explorer	Files	Gallery	Music	Play Store	Search
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		
	GPIO_TEST	
	UART_TEST	
	I2C_TEST	
	SPI_TEST	
	PWM_TEST	

#### 4) The serial port test interface of the APP is as shown in the figure below

12:30			↔ 0
wiringOP			
/dev/ttyS0 • 115200	OPEN CLOSE		
hello world!			
		SEND	•
	_		
		i 🚬 😔 🗖	< ● ■

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.

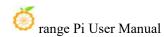
12:31								⇔ 8
wiringOP								
/dev/ttyS0	*	115200	OPEN	CLOSE				
hello world!								
					SEND			

8) If everything is normal, the received string will be displayed in the receiving box

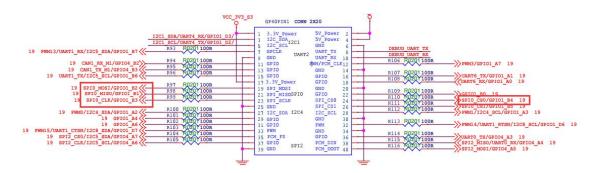
12:33						
wiringOP						
/dev/ttyS0	-	115200	OPEN	CLOSE		
hello world! hello world!		\ \				
						SEND

## 7. 8. 3. **40pin SPI test**

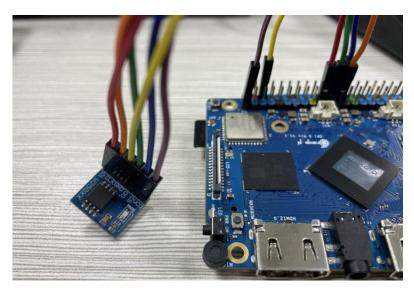
1) According to the schematic diagram of the 40pin interface, the available spi for Orange Pi 5 Pro is spi0



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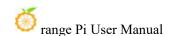
2) Here the SPI interface is tested through the w25q64 module. First, connect the w25q64 device to the SPI0 interface.



3) Then click the wiringOP icon to open wiringOP APP

		Q Sea	rch apps		
	100	۵	0	۲	<b>E</b>
Calculator	Calendar	Camera	Chrome	Clock	Contacts
Explorer	Files	Gallery	Music	Play Store	Search
<b>\$</b>			<u>ó</u> ,		
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.



wiring0P	
	GPI0_TEST
	UART_TEST
	I2C_TEST
	SPI_TEST
	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

orange Pi User Manual		Copyrigl	ht reserved by She	nzhen Xunlong Sot	ftware Co., Ltd
		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 Dut	, °

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		

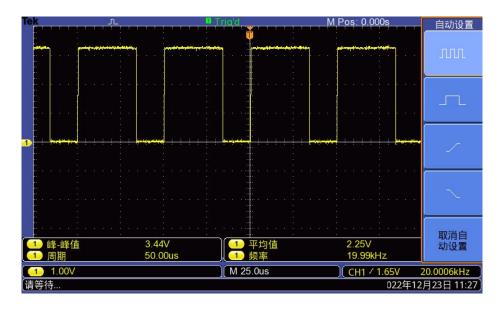
6) Then confirm the PWM channel, the default is channel 0, and confirm the PWM period. The default configuration is **50000ns**, which converts to a PWM frequency of **20KHz**. You can modify it yourself. Click the **EXPORT** button to export **PWM13**

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.

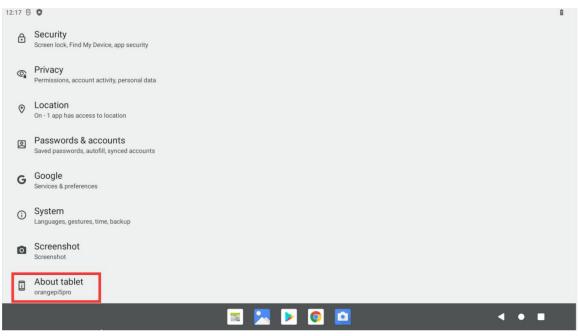


The USB OTG interface defaults to Host mode, which can be used to connect USB devices such as mouse and keyboard. If you want to use ADB, you need to manually switch to Device mode.

1) First open Settings

of range Pi	User Manual	Copyrigh	t reserved by She	nzhen Xunlong S	oftware Co., Ltd
12:16 🖯 🗘					Ê
		Q Sea	arch apps		
82	200		Q	•	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.

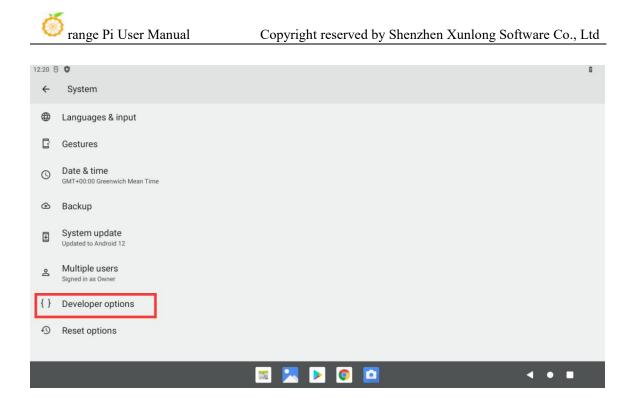
of range Pi User Manual

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

12:19 🖯	0	8
₿	Security Screen lock, Find My Device, app security	
6	Privacy Permissions, account activity, personal data	
0	Location On - 1 app has access to location	
0	Passwords & accounts Saved passwords, autofill, synced accounts	
G	Google Services & preferences	
6	System Languages, gestures, time, backup	
۵	Screenshot Screenshot	
	About tablet orangepl5pro	
	🔤 🚬 🕨 💿 🗖 🔷 🔹 🔹	

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

4) First prepare a good quality USB2.0 male-to-male data cable



5) Then refer to **the USB OTG mode switching method** to switch the USB OTG to device mode.

6) 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)

7) Install adb tool on Ubuntu PC
test@test:~\$ sudo apt update
test@test:~\$ sudo apt -y install adb

8) 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

9) Then you can log in to the android system through adb shell on Ubuntu PC test@test:~\$ adb shell console:/\$

10) Execute the command to remount the Android system

test@test:~\$ adb root

test@test:~\$ adb remount

11) 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

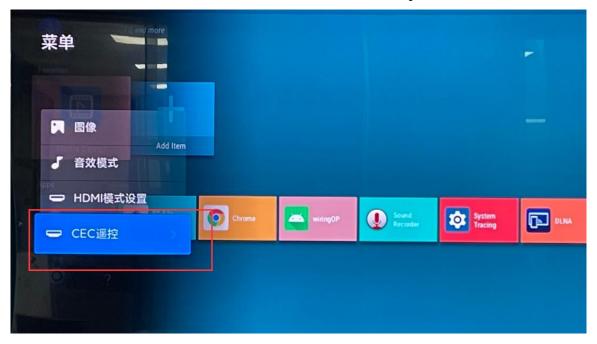
HDMI CEC allows users to control all connected devices through HDMI with only one remote control. Based on this function, we can control the development board with the TV's remote control.

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					-
	<ul><li></li></ul>					
- · ·		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		
<ul> <li>文件名</li> </ul>	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 GB	
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

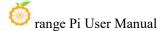
# 9. OpenWRT system usage instructions

# 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
<b>3</b> 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.

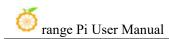
# 9. 4. 3. Log in to the LuCI management interface

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



$\leftarrow \   \rightarrow \   G$	🛇 웥 192.168.2.1/cgi-bin/luci/		☆
		需要授权	
		用户名 root	
		密码	
		費录	

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;	<b>井</b> 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** 

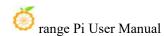
3) Enter the IP address **192.168.2.1** in the browser on your computer to log in to the LuCI interface

$\leftarrow \   \rightarrow \   G$	○ 👌 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
<b>未设置密码!</b> 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			
<b>状态</b> <sup>系统</sup>			· 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

 #決设置密码, 请为 root 用户设置密码以保护主机并启用。

 經濟
 配置

 OpenWrt login:

6) Enter the username root to log in

# OpenMirt login: root BusyBox v1.36.1 (2024-03-23 09:38:14 UTC) built-in shell (ash) Image: Control of the state of

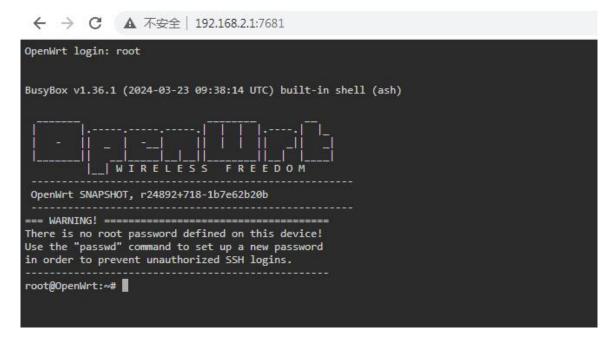
# 9. 4. 5. Log in to the terminal using IP address + port number.

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** 

#### 192.100.100.1 root@OpenWrt:~# ifconfig br\_lan

1001@01	chwrt.~# ficoning bi-fan
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≁	<b>系统 - 服务 - 网络 - 统计 - 退</b> 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

尚未设置密码。请为 root	用户设置密码以保护主机并启用。	
各由器密码 SSH 访问	SSH 密钥 HTTP(S) 访问	
<b>自器密码</b> 政访问设备的管理员密码		
	密码 *	
确认	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.

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OpenWrt 状态 - 系統	在▼ Docker▼ 服务▼	网络 - 统计 -	退出	
未设置密码! 尚未设置密码。请为 root 用户该	设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 更政访问设备的管理员密码 密码 确认密码	 • 密码强度: 弱	*	°	0
				保存

Note:	In	the	"Password"	and	"Confirm	Password"	dialog	boxes,	the
passwords	ent	ered	twice must	be c	onsistent.				

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 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		*		
				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:~# <b>df -h</b>   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

设置 高级设	置		
	已启用	$\checkmark$	
	UUID	根据 UUID 匹配 •	
		❷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 the
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	<b>『样的高速</b>	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"

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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)	. <del></del>
/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 踏曲	
状态	DHCP/IDNS 网络诊断 防火墙	
主机名    Oper		
型号 Oran	服务质量(QoS)	
架构 ARM	Iv8 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	
Q	range Pi User Manual

OpenWrt 状态 - 系統	š - Docker - 服务 - 网络 - 统计 - 退出	Rith.
<b>未设置密码!</b> 尚未设置密码。请为 root 用户设 接口 设备 全局网络选项	置密码以保护主机并启用。	
接口		
docker මූම dockerD	<b>协议:</b> 不配置协议 MAC: 02:42:08:F4:43:A6 接收:0 B (0 Pkts) 发送: 0 B (0 Pkts.) 信息: 开机时不启动	重启停止编辑删除
<mark>lan</mark> ඉම (ළූ) br-lan	协议: 静态地址 运行时间: 0h 4m 5s MAC: 5A:5A:59:67: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 删除
wan ath1	<b>协议:</b> 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	型启 停止 <u>実</u> 織 删除
wan6	<b>协议:</b> DHCPv6 客户端 运行时问: 0h 3m 57s MAC: 00.E0.4C:68:69:5B 接收: 5.03 MB (15593 Pkts.) 发送: 1.18 MB (7236 Pkts.)	重启停止编辑影除

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	19937fi
	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。 资册	
	状态 <sup>系统</sup>	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

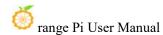
# 4) Then click the **Add** button on the right.

 C5线概况
 Generic MAC80211 802.11ac/b/g/n
 重启 日間 添加

 设备未激活
 正白 日間 添加

 Cibe接站点
 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   <b>SSID:</b> 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	<b>客</b> 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

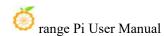
接口配置	
常规设置 无线安全 MAC i	过滤 高级设置 WLAN 漫游
加密	WPA2-PSK (强安全性) 🗸
算法	自动 🗸
密钥	password *
802.11w 管理帧保护	已禁用・・
启用密钥重新安装(KRACK) 对策	<ul> <li>注意:有些无线驱动程序不完全支持 802.11w。例如:mwlwifi 可能会有一些问题</li> <li>通过禁用用于安装密钥的 EAPOL-Key 帧的重新传输,来增加客户端密钥重安装攻击的复杂度。此解决方法可能会导致互操作性问题,并降低密钥协商的可靠性,特别是在流量负载较重的环境中。</li> </ul>
启用 WPS 一键加密按钮,需要 WPA(2)-PSK/WPA3-SAE	
	关闭保存

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			
					保存并加	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					
		<b>AC80211 802.11ac/b</b> 0 GHz)   <b>比</b> 特率: ? Mbit/			重启 扫描 添加
- []].		/rt   <b>模式:</b> Master 5:35:41:4D:69   <b>加密:</b> 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□ <b>无线</b> 前并自用。 前日	
	状态 <sup>系统</sup>	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 MAC80211 设备未激活	802.11ac/b/g/	'n		重启	扫描 添加
	日禁用	SSID: OpenWrt   模式: M 无线未开启	Naster			启用	编辑 移除
已连接站;	<u>ل</u>						/
网络	MAC 地址	ŧ	EM	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 • 保存

4) Then click the Scan button to scan the surrounding WiFi hotspots.

无线概况					
		<b>MAC80211 802.11ac</b> GHz)   <b>比特率:</b> ? 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		
	建中此造项以从无线中删除现有网络。	
新网络的名称	wwan	
	❷ 合法字符: 3-2, a-z, 0-9 和 _	
WPA 密明		0
l	◎ 在此描述密明。	
新寺회 BSSID		
0420100010		
创建/分配防火坝区域	wan wan: 🖉 wan6: 🦉 🔹	
	●为此接口分配所属的防火墙区域,选择未撤至可将该接口移出已关联的区域,或者填写创建世来创建一个新的区域,并将当前接口与之建立关联。	
		取消 提交
	重豆元线积至 新网络的名称 WPA 密轄 税金到 BSSIO	新聞信約名称 ・ 合法学符: A-2、A-2、A-2、A-2 WPA 密明 ・ ・ ・ ・ ・ ・ ・ ・ ・ ・

7) Then the following interface will pop up, click the **Save** button in the lower right corner.

置		
高级设置		
状	状态 // 優式- Client   SSID: xunlong_orangep_5G // - / 8Bm 元症未央朝	
无线网络已启	a用   葉冊	
工作频	横式 価値 売売 第率 AC y 36 (5180 Mhz) 38 0 MHz y	
最大传输功	助率 - 認識就认 当前功率: 未知	
最大传输功	<ul> <li>2600年、未知</li> <li>1600年、未知</li> <li>1600年、未知</li> <li>1620年、1600年、未知</li> <li>1620年、1600年の総代共同決計(2月)年</li> </ul>	
最大得输动		
最大传输功		
置		
2011 王 元线安全 高級	● 描绘最大发射功率、依据监管要求和他用情况,磁动程序可能将实际发射功率展走在应通以下。	
2011 王 元线安全 高級	● 印定最大发射切車, 依据监察要求和他用電券, 認动程序可能将实际发射切車現在在均度以下。           線切蓋         WLAN 激励           載式         香户論	
2 <u>百</u> 元統安全 高級 授	<ul> <li>         ・ 御金蔵大党封切事、依頼宣言要求和助売開発の、認み程序可能将实际党封切事用金在近当届以下、         </li> <li>         ・ WLAN 激声         </li> <li>         ・ 留合理論         ・         ・         ・</li></ul>	
2 置 天統安全 高明 度 555 855	<ul> <li>         ・ 御金蔵大党封切事、依頼宣言要求和助売開発の、認み程序可能将实际党封切事用金在近当届以下、         </li> <li>         ・ WLAN 激声         </li> <li>         ・ 留合理論         ・         ・         ・</li></ul>	

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
	日禁用	SSID: xunlong_ora 接口有 7 个未应用的		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-PACIE+		
						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	<b>c MAC80211 80</b> 2 (5.180 GHz)   比特率	-		重启 扫描 添加
	nlong orangepi 5G	模式: Client		
uli dBm	C2:F5:35:41:4D:69			禁用编辑移除
<u>"</u> — dBm 连接站点			信号/噪声	祭用 编辑 修除 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 <b>软件包</b> 启动项	8用.		跳转到密码配置页
<b>软件包</b> 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	里利列表 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	L 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		2
可用 已安装 :		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
<ul> <li>已过滤 全部</li> <li>可用 已安装 更</li> </ul>						
			正左目示 1 3 # 3			(m))
	K		正在显示 1-3 , 共 3			2
软件包名称	« 版本	大小 ( .ipk )	正在显示 1-3,共3 描述			2
软件包名称 luci-app-acl		大小 (.ipk)		gement module		3 安装:
	版本	大小 (.ipk) 1606c 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 秋志。 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 F	正在执行软件包管理器		
	软件包			
	空闲空间;			
	100 M 10.	下来社会推动任何。		

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
-						
× 2	40	ī	E在显示 1-36,共 36			3
2 软件包名称	《版本		E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:								_
			- 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	
可用已安装	更新 2 «		<b>1</b> 正在	显示 1-1 , 共 1			»	
软件包名称	版本		大小 ( .i	pk) 描述		3		
luci-app-acl	ait-21 194	.67638-1d60	53e ~4.21	(B LuCi	account manage	ment module	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



# 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	设有软件包			»
软件包名称		版本	*	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	on 4.14.7	
常规设置编辑	莫板	
	接口	未間定
	工作组	lan: go
	描述	wan6: 🗾
Ē	自用扩展调整	□ - 自定义
)	强制同步 I/O	□

- 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 nam	览			<sup>允许用</sup> folder hared c	允许 匿名 用户	仅 来 宾 用 子	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	٥	0777	0777		0		删除
新增									4. Click	"Save	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

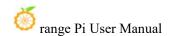
a) Enter the "Control Panel" of Windows 10

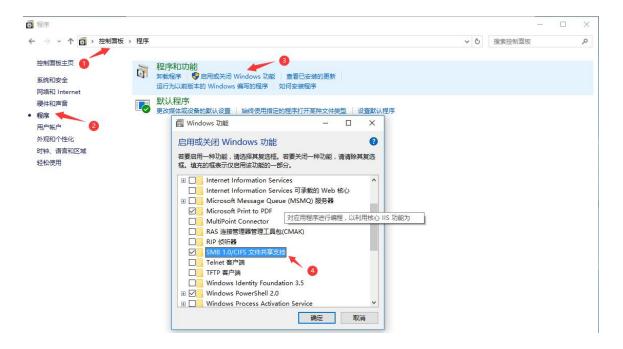
b) Click "Programs" on the left navigation bar of the control panel

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。 <ul> <li>         ● 启用网络发现         <ul> <li></li></ul></li></ul>					
● 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
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<ul> <li>此电脑</li> <li>openwrt-sunxi-cortexa7-sun8i-h2-plu</li> <li>2019/1/9 9:14 MD5SUM 文件</li> <li>1 KB</li> <li>orangepi.txt</li> <li>2020/9/25 17:29 文本文档</li> <li>1 KB</li> <li>usbcamera.apk</li> <li>2020/11/13 21:55 APK 文件</li> <li>20,451 KB</li> <li>文档</li> <li>下载</li> <li>音乐</li> <li>桌面</li> <li>本地磁盘 (C:)</li> <li>temp (\\vboxsrv)</li> </ul>	Onebrive	wiringOP	2020/11/28 5:12	文件夹	
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▲ 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: <b>1</b> Authorized Members: <b>0 / 50</b>	NETWORK ID	NAME <b>†</b>	DESCRIP	TION SUB	NET M	NODES		
	Online Members: <b>0</b>	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	kange		
Eas	sy	Adva	anced
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 <b>172.27.47.214</b> 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

y) Letotter und other community			
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:/# <b>zerotier-cli listnetworks</b>	#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
v1.2	2024-07-04	1. Linux: Usage of NPU
		2. Linux: RK3588 method of using Baidu Feijiang
		3. Linux: Method for Running RKLLM Large Model with RK3588
v1.3	2024-07-30	1. The usage method of wiringOP hardware

## 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 b131, 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
2024-07-04	Orangepi5pro 1.0.4 ubuntu jammy server linux6.1.43.7z
2024-07-04	
	Orangepi5pro_1.0.4_debian_bullseye_server_linux6.1.43.7z
	Orangepi5pro_1.0.4_debian_bookworm_server_linux6.1.43.7z
	Orangepi5pro_1.0.4_ubuntu_jammy_desktop_xfce_linux6.1.43.7z
	Orangepi5pro_1.0.4_debian_bullseye_desktop_xfce_linux6.1.43.7z
	Orangepi5pro_1.0.4_debian_bookworm_desktop_xfce_linux6.1.43.7z
	Orangepi5pro_1.0.4_ubuntu_focal_server_linux5.10.160.7z
	Orangepi5pro_1.0.4_ubuntu_jammy_server_linux5.10.160.7z
	Orangepi5pro_1.0.4_debian_bullseye_server_linux5.10.160.7z
	Orangepi5pro_1.0.4_debian_bookworm_server_linux5.10.160.7z
	Orangepi5pro_1.0.4_ubuntu_focal_desktop_xfce_linux5.10.160.7z
	Orangepi5pro_1.0.4_ubuntu_jammy_desktop_xfce_linux5.10.160.7z
	Orangepi5pro_1.0.4_debian_bullseye_desktop_xfce_linux5.10.160.7z
	Orangepi5pro_1.0.4_debian_bookworm_desktop_xfce_linux5.10.160.7z
	* Upgrade the rknpu version of the kernel to 0.9.6
2024-11-18	Orangepi5pro 1.0.6 ubuntu jammy server linux6.1.43.7z
202111-10	Orangepi5pro 1.0.6 debian bullseye server linux6.1.43.7z
	Orangepi5pro 1.0.6 debian bookworm server linux6.1.43.7z
	Orangepi5pro 1.0.6 ubuntu jammy desktop xfce linux6.1.43.7z
	Orangepi5pro_1.0.6_debian_bullseye_desktop_xfce_linux6.1.43.7z
	Orangepi5pro_1.0.6_debian_bookworm_desktop_xfce_linux6.1.43.7z

Orangepi5pro\_1.0.6\_ubuntu\_focal\_server\_linux5.10.160.7z
Orangepi5pro\_1.0.6\_ubuntu\_jammy\_server\_linux5.10.160.7z
Orangepi5pro\_1.0.6\_debian\_bullseye\_server\_linux5.10.160.7z
Orangepi5pro\_1.0.6\_ubuntu\_focal\_desktop\_xfce\_linux5.10.160.7z
Orangepi5pro\_1.0.6\_ubuntu\_jammy\_desktop\_xfce\_linux5.10.160.7z
Orangepi5pro\_1.0.6\_debian\_bullseye\_desktop\_xfce\_linux5.10.160.7z
Orangepi5pro\_1.0.6\_debian\_bullseye\_desktop\_xfce\_linux5.10.160.7z
Prangepi5pro\_1.0.6\_debian\_bullseye\_desktop\_xfce\_linux5.10.160.7z
Orangepi5pro\_1.0.6\_debian\_bullseye\_desktop\_xfce\_linux5.10.160.7z
Prangepi5pro\_1.0.6\_debian\_bullseye\_desktop\_xfce\_linux5.10.160.7z
Prangepi5pro\_1.0.6\_debian\_bookworm\_desktop\_xfce\_linux5.10.160.7z
Prangepi5pro\_1.0.6\_debian\_bookworm\_desktop\_xfce\_linux5.10.160.7z
Prangepi5pro\_1.0.6\_debian\_bookworm\_desktop\_xfce\_linux5.10.160.7z
Prangepi5pro\_1.0.6\_debian\_bookworm\_desktop\_xfce\_linux5.10.160.7z
Prangepi5pro\_1.0.6\_debian\_bookworm\_desktop\_xfce\_linux5.10.160.7z

\* Fix the issue of Bluetooth MAC address changing during restart