ARMxy Embedded Computer

BLIIOT®
MAKE IIOT EASIER

BL440
User Manual

Version: V1.0

Date: 2025-9-29

Shenzhen Beilai Technology Co.,Ltd

Website: https://www.bliiot.com

Preface

Thanks for choosing BLIIOT ARM based Embedded Computer. These operating instructions contain all the information you need for operation of BL440.

Copyright

Disclaimer

This document is designed for assisting user to better understand the device. As the described device is under continuous improvement, this manual may be updated or revised from time to time without prior notice. Please follow the instructions in the manual. Any damages caused by wrong operation will be beyond warranty.

This product can only be used with the system version provided by our company. We shall not be held liable for any issues such as software installation failures, usage problems, incompatibility, property loss, or personal injury caused by the use of other systems.

Revision History

Revision Date	Version	Description	Owner
2025/9/24	V1.0	Initial Release	PH

Table of Contents

1 Introduction

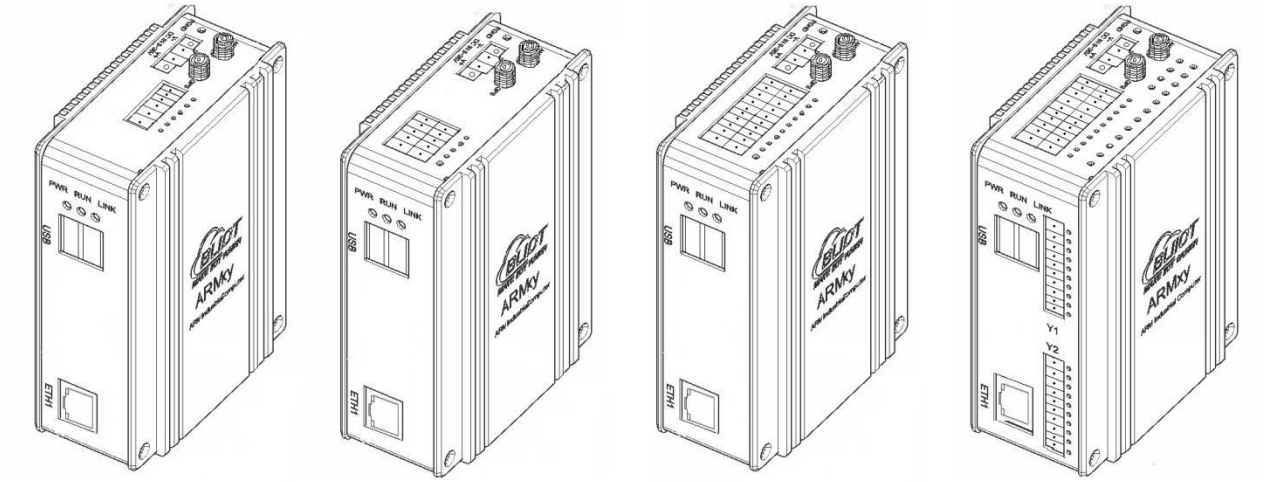
1.1 Overview

The BL440 series is built on an embedded Linux system for high stability and reliability. Powered by the Rockchip RK3576J/RK3576 processor (quad-core ARM Cortex-A72 + quad-core Cortex-A53 + Cortex-M0, up to 2.1/2.2GHz), it uses industrial-grade components and has passed high/low temperature tests to ensure dependable performance in industrial environments.

The BL440 offers rich interfaces, including 3 Ethernet ports, 2 USB ports, multiple RS485 ports, optional Wi-Fi and 4G modules, a power input, and an HDMI output. It supports Linux and Ubuntu systems, compatible with Node-RED, Qt, Python, and C++, and supports MySQL, InfluxDB, and SQLite databases, making it ideal for diverse industrial applications.

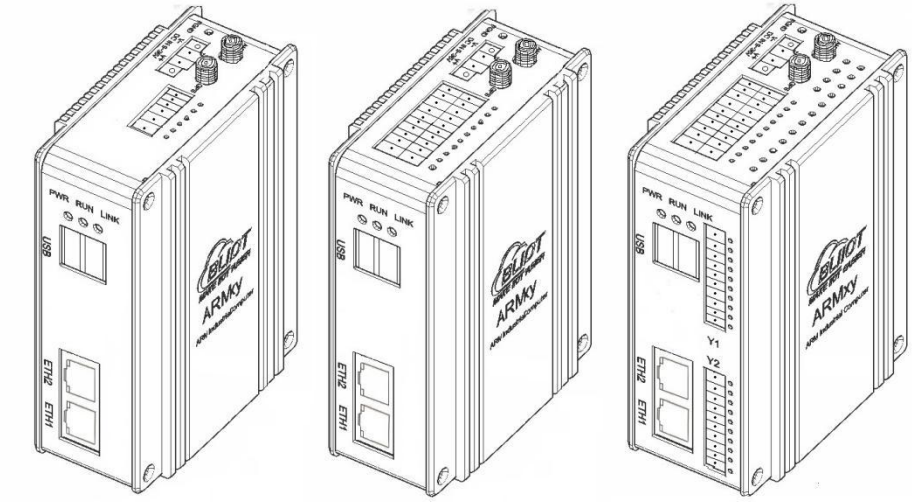
1.2 Appearance

Exterior Structure and Dimensions of Product with 1 Ethernet Port:

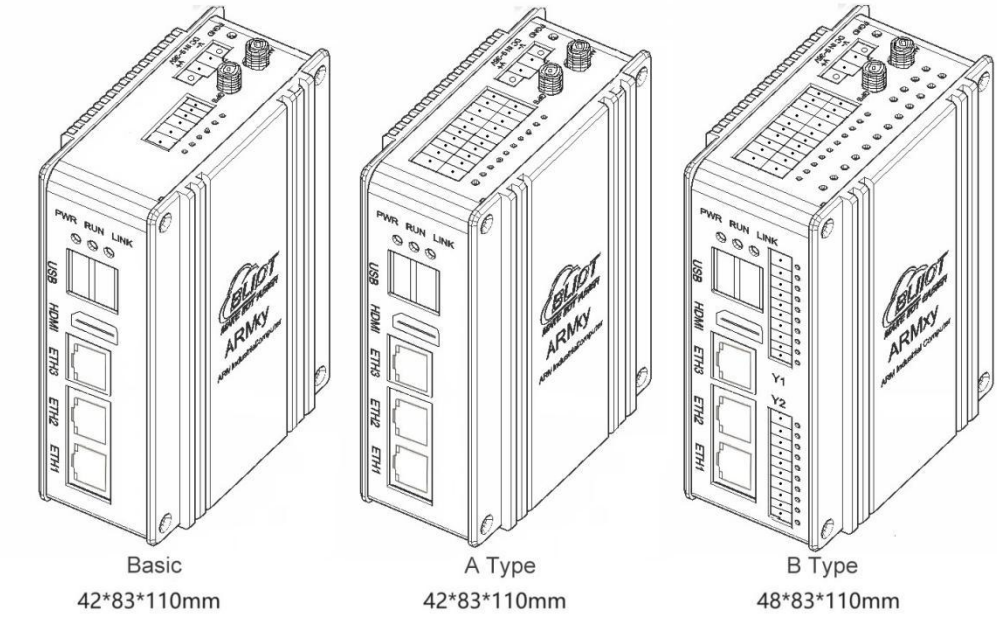


Basic 42*83*110mm | C Type 42*83*110mm | A Type 42*83*110mm | B Type 48*83*110mm

Exterior Structure and Dimensions of Product with 2 Ethernet Ports:



Exterior Structure and Dimensions of Product with 3 Ethernet Ports:



1.3 Technical Specifications

	Parameter	Description
System	CPU	Rockchip RK3576J/RK3576, 64-bit, 8nm
	Clock Speed	4× ARM Cortex-A72 RK3576J Clock: Normal mode 1.6 GHz, Overdrive mode 2.1 GHz RK3576 Clock: 2.2 GHz Note: To ensure processor longevity and meet various industrial application requirements, the Cortex-A72 cores

		of the RK3576J/RK3576 are by default configured with a maximum clock of 1.6 GHz.
		4× ARM Cortex-A53 RK3576J Clock: Normal mode 1.4 GHz, Overdrive mode 1.9 GHz RK3576 Clock: 2.0 GHz Note: To ensure processor longevity and support a wider range of industrial applications, the Cortex-A53 cores of the RK3576J/RK3576 are by default configured with a maximum clock of 1.4 GHz.
		1× ARM Cortex-M0, Clock: 400 MHz
	RAM	2/4/8GByte LPDDR4X
	eMMC	16/32/64GByte
	NPU	6 TOPS Supports INT4/INT8/INT16/BF16/TF32 Compatible with TensorFlow, PyTorch, Caffe, and MXNet deep learning frameworks
	GPU	GPU: Mali-G52 MC3, supporting OpenGL ES 1.1/2.0/3.2, OpenCL 2.0, and Vulkan 1.1
		ISP: 16 MP, supports HDR, 3A, CAC, 3DNR, 2DNR, and more
		Decoder: Supports 8K@30 fps and 4K@120 fps H.265, 4K@60 fps H.264 Encoder: Supports 4K@60 fps H.265/H.264
Power	Input Voltage	DC 12～24V
	Consumption	Normal: 312mA@12V(with 4G module), 252mA@12V (without 4G module) Maximum: 700mA@12V
	Reverse Polarity	Reverse Polarity Protection
Ethernet	Specification	RJ-45 ports, 1 to 3 available: 2 ports support 10/100/1000Mbps 1 port supports 10/100Mbps adaptive speed
	Protection	ESD ±6kV (contact), ±8kV (air);
SIM Card	Slot Quantity	1
	Type	Drawer interface
USB	Quantity	1*micro USB, 2*USB 3.2 HOST
SD Card	Quantity	1
	Type	Support SD, SDHC and SDXC(UHS-I) card
HDMI	Quantity	1

Antenna	Interface	1*WIFI/4G, 1*GPS antenna
	Type	SMA
Serial Port (optional)	Channels	2/4/8 channels x RS232/RS485
	Baud Rate	300bps–115200bps
	Data Bits	7, 8
	Parity	None, Even, Odd
	Stop Bits	1, 1.5, 2
X board digital input (optional)	Channels	2/4/8/16 channels
	Input Type	Supports dry contact or wet contact
	Dry Contact	Close = short circuit Open = open circuit
	Wet Contact	Logic 0 = 0–3V DC Logic 1 = 10–30V DC
	Isolation protection	2KVrms
X board digital output (optional)	Channels	2/4/8/16 channels
	Output Type	SINK
	Capacity	100mA per channel
4G Module(Optional)	L-E	GSM/EDGE:900,1800MHz WCDMA:B1,B5,B8 FDD-LTE:B1,B3,B5,B7,B8,B20 TDD-LTE:B38,B40,B41
	L-CE	GSM/EDGE:900,1800MHz WCDMA:B1,B8 TD-SCDMA:B34,B39 FDD-LTE:B1,B3,B8 TDD-LTE:B38,B39,B40,B41
	L-A	WCDMA:B2,B4,B5 FDD-LTE:B2,B4,B12
	L-AU	GSM/EDGE:850,900,1800MHz WCDMA:B1,B2,B5,B8 FDD-LTE:B1,B3,B4,B5,B7,B8,B28 TDD-LTE:B40
	L-AF	WCDMA:B2,B4,B5 FDD-LTE:B2,B4,B5,B12,B13,B14,B66,B71
	CAT-1	GSM:900,1800 FDD-LTE:B1,B3,B5,B8 TDD-LTE:B34,B38,B39,B40,B41
WiFi (Optional)	Interface	PCIE
	Protocol	IEEE 802.11b/g/n

	Mode	STA, AP
	Frequency	2.4GHz
	Channel QTY	Ch1 ~ Ch13
	Security	Open, WPA, WPA2
	Encryption	AES, TKIP, TKIPAES
	Number of connections	8 (Max)
	Speed	150Mbps (Max)
	SSID broadcast switch	Support
LED	Quantity	LED*3(with two programmable LEDs)
Environment	Working	-40～85°C/0～70°C, 5～95% RH
	Storage	-40 to 85°C, 5 to 95% RH
Others	Housing	Aluminium housing + stainless steel
	Dimensions	110*83*42mm or 110*83*48mm
	Protection Level	IP30
	Installation	DIN35 rail mounted, wall mounting
	System	Buildroot-2024.02(Linux-6.1.115, Linux-RT-6.1.115) Ubuntu 22.04

1.4 Model Selection

1.4.1 Host Model Selection

Model	ETH	USB	HDMI	X I/O Board	Y I/O Board	Dimension
BL440	1x10/100/1000M	2	×	1×6PIN	×	42×83×110mm
BL440A	1x10/100/1000M	2	×	1×20PIN	×	42×83×110mm
BL440B	1x10/100/1000M	2	×	1×20PIN	2	48×83×110mm
BL440C	1x10/100/1000M	2	×	1×10PIN	×	42×83×110mm
BL441	2x10/100/1000M	2	×	1×6PIN	×	42×83×110mm
BL441A	2x10/100/1000M	2	×	1×20PIN	×	42×83×110mm
BL441B	2x10/100/1000M	2	×	1×20PIN	2	48×83×110mm
BL442	2x10/100/1000M，1x10/100M	2	1	1×6PIN	×	42×83×110mm

BL442A	2x10/100/1000M，1x10/100M	2	1	1×20PIN	×	42×83×110mm
BL442B	2x10/100/1000M，1x10/100M	2	1	1×20PIN	2	48×83×110mm

1.4.2 SOM Selection

Model	MCU	Clock Speed	Kernel	NPU	eMMC	LPDDR4X	Temperature
SOM440	RK3576J	2.1GHz	4 x A72 + 4 x A53 + 1 x M0	6TPOPS	16GByte	2GByte	-40~85°C
SOM441	RK3576J	2.1GHz	4 x A72 + 4 x A53 + 1 x M0	6TPOPS	32GByte	4GByte	-40~85°C
SOM442	RK3576J	2.1GHz	4 x A72 + 4 x A53 + 1 x M0	6TPOPS	64GByte	8GByte	-40~85°C
SOM443	RK3576	2.2GHz	4 x A72 + 4 x A53 + 1 x M0	6TPOPS	32GByte	2GByte	0~80°C
SOM444	RK3576	2.2GHz	4 x A72 + 4 x A53 + 1 x M0	6TPOPS	32GByte	4GByte	0~80°C
SOM445	RK3576	2.2GHz	4 x A72 + 4 x A53 + 1 x M0	6TPOPS	64GByte	8GByte	0~80°C

1.4.3 X Series I/O Board Selection

You can choose the X-series I/O board based on your needs.

Note: The default port for this device is RS485. If you need RS232, please specify this to the sales team.

Model	RS232/RS485	CAN	DI	DO	GPIO	PIN
X10	2	x	x	x	x	6PIN
X11	x	2	x	x	x	6PIN
X12	1	1	x	x	x	6PIN
X13	x	x	2	2	x	6PIN
X14	x	x	4	x	x	6PIN
X15	x	x	x	4	x	6PIN
X16	x	x	x	x	4	6PIN
X20	4	x	x	x	x	10PIN
X21	3	1	x	x	x	10PIN
X22	2	2	x	x	x	10PIN
X23	4	x	4	4	x	20PIN
X24	3	1	4	4	x	20PIN
X25	2	2	4	4	x	20PIN
X26	2	x	8	4	x	20PIN
X27	1	1	8	4	x	20PIN
X28	2	x	12	x	x	20PIN
X29	1	1	12	x	x	20PIN
X30	x	x	x	x	16	20PIN

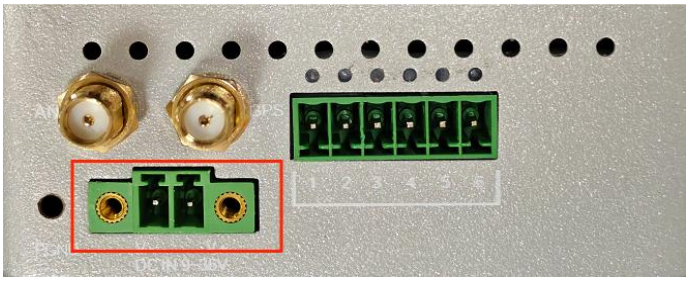
1.4.4 Y Series I/O Board Selection

You can select the Y-series I/O board based on your needs. Y-series I/O modules are compatible with all Y slots. When the Y63 is selected, you can not choose second Y-series IO board.

Model	Description		Model	Description
Y01	4DI+4DO, NPN		Y41	4AO, 0/4~20mA
Y02	4DI+4DO, PNP		Y43	4AO, 0~5/10V
Y11	8DI, NPN		Y46	4AO, ±5V/±10V
Y12	8DI, PNP		Y51	2RTD, 3-Wire PT100
Y13	8DI, Dry Contact		Y52	2RTD, 3-Wire PT1000
Y21	8DO, PNP		Y53	2RTD, 4-Wire PT100
Y22	8DO, NPN		Y54	2RTD, 4-Wire PT1000
Y24	4DO, Relay		Y56	Resistance measurement
Y31	4AI, single-ended, 0/4~20mA		Y57	Voltage measurement
Y33	4AI, single-ended, 0~5/10V		Y58	4TC
Y34	4AI, differential, 0~5/10V		Y63	4 RS485 or RS232
Y36	4AI, differential, ±5V/±10V		Y95	4 PWM Output + 4 Pulse Counter (1 High-Speed, 3 Low-Speed), NPN
Y37	4 IEPE Measurement		Y96	4 PWM Output + 4 Pulse Counter (1 High-Speed, 3 Low-Speed), PNP

2 Hardware

2.1 Power Interface



Supports 1CH DC12~24V input, with reverse polarity protection.

2.2 I/O Module Port Description

Different X/Y boards offer various serial port options. The currently available board types are as follows. Note: POWER serves as the common negative terminal for DO, COM is used for DI wet contact, and GND is used for DI dry contact.

2.2.1 X Series I/O Board Port Description

X10(2 RS485 or RS232 serial ports)						
Port Number	1	2	3	4	5	6
Name	ttyS1-A	ttyS1-B	GND	ttyS2-A	ttyS2-B	GND

X11(2 CAN ports)						
Port Number	1	2	3	4	5	6
Name	CAN0-H	CAN0-L	GND	CAN1-H	CAN1-L	GND

X12(1 RS485/RS232, 1 CAN)						
Port Number	1	2	3	4	5	6
Name	CAN0-H	CAN0-L	GND	ttyS1-A	ttyS1-B	GND

X13 (2 DO, 2 DI, COM used for DI wet contact and GND used for DI dry contact)						
Port Number	1	2	3	4	5	6
Name	DO1	DO2	GND	DI1	DI2	COM

X14 (4 DI, COM used for DI wet contact and the GND used for DI dry contact.)						
Port Number	1	2	3	4	5	6
Name	DI1	DI2	GND	DI3	DI4	COM

X15 (4 DO)						
Port Number	1	2	3	4	5	6
Name	DO1	DO2	GND	DO3	DO4	GND

X16 (4 GPIO)						
Port Number	1	2	3	4	5	6
Name	GPIO4	GPIO3	GND	GPIO2	GPIO1	GND

X20 (4 RS485 or RS232 serial ports)					
Port Number	1	3	5	7	9
Name	GND	ttyS8-A	ttyS4-A	ttyS2-A	ttyS1-A
Port Number	2	4	6	8	10
Name	GND	ttyS8-B	ttyS4-B	ttyS2-B	ttyS1-B

X21(3 RS485/RS232, 1 CAN)					
Port Number	1	3	5	7	9
Name	GND	ttyS8-A	ttyS4-A	ttyS2-A	CAN0-H
Port Number	2	4	6	8	10
Name	GND	ttyS8-B	ttyS4-B	ttyS2-B	CAN0-L

X22 (2 RS485 or RS232 serial ports, 2 CAN)					
Port Number	1	3	5	7	9
Name	GND	ttyS8-A	ttyS4-A	CAN1-H	CAN0-H
Port Number	2	4	6	8	10
Name	GND	ttyS8-B	ttyS4-B	CAN1-L	CAN0-L

X23 (4 RS485 or RS232 serial ports, 4 DO, and 4 DI)										
Port Number	1	3	5	7	9	11	13	15	17	19
Name	DI4	DI3	DI2	DI1	COM	GND	ttyS8-A	ttyS4-A	ttyS2-A	ttyS1-A
Port Number	2	4	6	8	10	12	14	16	18	20
Name	DO4	DO3	DO2	DO1	POWER	GND	ttyS8-B	ttyS4-B	ttyS2-B	ttyS1-B

X24(3 RS485/RS232, 4DO, 4DI, 1 CAN)										
Port Number	1	3	5	7	9	11	13	15	17	19
Name	DI4	DI3	DI2	DI1	GND	COM	ttyS8-A	ttyS4-A	ttyS2-A	CAN0-H
Port Number	2	4	6	8	10	12	14	16	18	20
Name	DO4	DO3	DO2	DO1	POWER	GND	ttyS8-B	ttyS4-B	ttyS2-B	CAN0-L

X25(2 RS485/RS232, 4DO, 4DI, 2CAN)										
Port Number	1	3	5	7	9	11	13	15	17	19
Name	DI4	DI3	DI2	DI1	GND	COM	ttyS8-A	ttyS4-A	CAN1-H	CAN0-H
Port Number	2	4	6	8	10	12	14	16	18	20
Name	DO4	DO3	DO2	DO1	POWER	GND	ttyS8-B	ttyS4-B	CAN1-H	CAN0-L

X26 (2 RS485 or RS232 serial ports, 4 DO, and 8 DI)										
Port Number	1	3	5	7	9	11	13	15	17	19
Name	DI6	DI5	DI4	DI3	COM	GND	DI2	DI1	ttyS2-A	ttyS1-A
Port Number	2	4	6	8	10	12	14	16	18	20
Name	DO4	DO3	DO2	DO1	POWER	GND	DI8	DI7	ttyS2-B	ttyS1-B

X27(1 RS485/RS232, 4 DO, 8 DI, 1 CAN)										
Port Number	1	3	5	7	9	11	13	15	17	19
Name	DI6	DI5	DI4	DI3	GND	COM	DI2	DI1	ttyS2-A	CAN0-H
Port Number	2	4	6	8	10	12	14	16	18	20
Name	DO4	DO3	DO2	DO1	POWER	GND	DI8	DI7	ttyS2-B	CAN0-L

X28 (2 RS485 or RS232 serial ports, 12 DI)										
Port Number	1	3	5	7	9	11	13	15	17	19
Name	DI6	DI5	DI4	DI3	COM	GND	DI2	DI1	ttyS2-A	ttyS1-A
Port Number	2	4	6	8	10	12	14	16	18	20
Name	DI12	DI11	DI10	DI9	POWER	GND	DI8	DI7	ttyS2-B	ttyS1-B

X29(1 RS485/RS232, 12 DI, 1 CAN)										
Port Number	1	3	5	7	9	11	13	15	17	19
Name	DI6	DI5	DI4	DI3	GND	COM	DI2	DI1	ttyS5-A	CAN0-H
Port Number	2	4	6	8	10	12	14	16	18	20
Name	DI12	DI11	DI10	DI9	POWER	GND	DI8	DI7	ttyS5-B	CAN0-L

X30 (16 GPIO)										
Port Number	1	3	5	7	9	11	13	15	17	19
Name	GPIO 8	GPIO 7	GPIO 6	GPIO 5	POWER	GND	GPIO 4	GPIO 3	GPIO 2	GPIO 1
Port Number	2	4	6	8	10	12	14	16	18	20
Name	GPIO 16	GPIO 15	GPIO 14	GPIO 13	POWER	GND	GPIO 12	GPIO 11	GPIO 10	GPIO 9

Note: The POWER port on the X30 module is 3.3V. All port inputs and outputs are user-defined. For details, please refer to Chapter 10: Pin Definition Appendix.

2.2.2 Y Series I/O Board Port Description

Y01 (4-channel DI(Dry contact or NPN type) and 4-channel NPN type DO module)										
Port Number	1	2	3	4	5	6	7	8	9	10
Name	DO1	DO2	DO3	DO4	GND_IOS	DI_COM	DI1	DI2	DI3	DI4

Note: GND_IOS is the common terminal for DO wet contact, and DI_COM is the common terminal for dry contact.

Y02 (4-channel DI(Dry contact or PNP type) and 4-channel PNP type DO module)										
Port Number	1	2	3	4	5	6	7	8	9	10
Name	DO1	DO2	DO3	DO4	GND_IOS	DI_COM	DI1	DI2	DI3	DI4

Note: GND_IOS is the common terminal for DO wet contact, and DI_COM is the common terminal for dry contact.

Y11 (8-channel NPN Type Digital Input Module)										
Port Number	1	2	3	4	5	6	7	8	9	10
Name	DI1	DI2	DI3	DI4	DI_COM	DI_COM	DI5	DI6	DI7	DI8

Note: DI_COM is the common terminal for dry contacts.

Y12 (8-channel PNP Type Digital Input Module)										
Port Number	1	2	3	4	5	6	7	8	9	10
Name	DI1	DI2	DI3	DI4	DI_COM	DI_COM	DI5	DI6	DI7	DI8

Note: DI_COM is the common terminal for dry contacts.

Y21 (8-channel PNP Type Digital Output Module)										
Port Number	1	2	3	4	5	6	7	8	9	10
Name	DO1	DO2	DO3	DO4	GND_IOS	GND_IOS	DO5	DO6	DO7	DO8

Note: GND_IOS is the common terminal for wet contacts of the DO ports.

Y22 (8-channel NPN Type Digital Output Module)										
Port Number	1	2	3	4	5	6	7	8	9	10
Name	DO1	DO2	DO3	DO4	GND_IOS	GND_IOS	DO5	DO6	DO7	DO8

Note: GND_IOS is the common terminal for wet contacts of the DO ports.

Y24 (4-channel Relay Module)										
Port Number	1	2	3	4	5	6	7	8	9	10
Name	AO1+	AO1-	AO2+	AO2-	/	/	AO3+	AO3-	AO4+	AO4-

Y31 (4-channel 4~20mA / 0~20mA Analog Single-ended Input Module)										
Port Number	1	2	3	4	5	6	7	8	9	10
Name	AI1+	AI1-	AI2+	AI2-	GND	GND	AI3+	AI3-	AI4+	AI4-

Y33 (4-channel 0~5V / 0~10V Analog Single-ended Input Module)										
Port Number	1	2	3	4	5	6	7	8	9	10
Name	AI1+	AI1-	AI2+	AI2-	/	/	AI3+	AI3-	AI4+	AI4-

Y34 (4-channel 0~5V / 0~10V Analog Differential Input Module)										
Port Number	1	2	3	4	5	6	7	8	9	10
Name	AI1+	AI1-	AI2+	AI2-	/	/	AI3+	AI3-	AI4+	AI4-

Y36 (4-channel -5~5V / -10~10V Analog Differential Input Module)										
Port Number	1	2	3	4	5	6	7	8	9	10
Name	AI1+	AI1-	AI2+	AI2-	/	/	AI3+	AI3-	AI4+	AI4-

Y41 (4-channel 4~20mA / 0~20mA Analog Single-ended Output Module)										
Port Number	1	2	3	4	5	6	7	8	9	10
Name	AO1+	AO1-	AO2+	AO2-	/	/	AO3+	AO3-	AO4+	AO4-

Y43 (4-channel 0~5V / 0~10V Analog Single-ended Output Module)										
Port Number	1	2	3	4	5	6	7	8	9	10
Name	AO1+	AO1-	AO2+	AO2-	/	/	AO3+	AO3-	AO4+	AO4-

Y46 (4-channel -5~5V / -10~10V Analog Single-ended Output Module)										
Port Number	1	2	3	4	5	6	7	8	9	10
Name	AO1+	AO1-	AO2+	AO2-	/	/	AO3+	AO3-	AO4+	AO4-

Y51 (2-channel RTD Module, Three-wire PT100)										
Port Number	1	2	3	4	5	6	7	8	9	10
Name	/	PT1+	PT1-	PT1-	/	/	/	PT2+	PT2-	PT2-

Y52 (2-channel RTD Module, Three-wire PT1000)										
Port Number	1	2	3	4	5	6	7	8	9	10
Name	/	PT1+	PT1-	PT1-	/	/	/	PT2+	PT2-	PT2-

Y53 (2-channel RTD Module, Four-wire PT100)										
Port Number	1	2	3	4	5	6	7	8	9	10
Name	PT1+	PT1+	PT1-	PT1-	/	/	PT2+	PT2+	PT2-	PT2-

Y54 (2-channel RTD Module, Four-wire PT1000)										
Port Number	1	2	3	4	5	6	7	8	9	10
Name	PT1+	PT1+	PT1-	PT1-	/	/	PT2+	PT2+	PT2-	PT2-

Y58 (4-channel Thermocouple Temperature Measurement Module)										
Port Number	1	2	3	4	5	6	7	8	9	10
Name	T1+	T1-	T2+	T2-	/	/	T3+	T3-	T4+	T4-

Y63(4-channels RS485 or RS232)										
Port Number	1	2	3	4	5	6	7	8	9	10
Name	ttyWCH0-A	ttyWCH0-B	ttyWCH1-A	ttyWCH1-B	GND	GND	ttyWCH2-A	ttyWCH2-B	ttyWCH3-A	ttyWCH3-B

2.2.3 RS485 Usage

In the BL440, “ttySX-A” and “ttySX-B” represent a pair of RS485 serial port lines. When using the RS485 serial port, connect the RS485 lines to these terminals. For example, in the X10 module, there are two terminals: ttyS2-A and ttyS2-B, corresponding to the device file /dev/ttyS2. Set the baud rate to 115200, data bits to 8, no parity, and 1 stop bit (8N1).

```
stty -F /dev/ttyS2 ispeed 115200 ospeed 115200 cs8
echo 12345 > /dev/ttyS2          //Send Data via RS485-1 Port
cat /dev/ttyS2                   //Wait to check the received data
```

Press "Ctrl+C" to stop.

2.2.4 RS232 Usage

In the BL440, “ttySX-RX” and “ttySX-TX” represent a pair of RS232 serial port lines. When using the RS232 serial port, connect the RS232 lines to these terminals. For example, in the X10 module, there are two terminals: ttyS2-RX and ttyS2-TX, corresponding to the device file /dev/ttyS2. Set the baud rate to 115200, data bits to 8, no parity, and 1 stop bit (8N1).

```
stty -F /dev/ttyS2 ispeed 115200 ospeed 115200 cs8
echo 12345 > /dev/ttyS2          //Send Data via RS232-1 Port
cat /dev/ttyS2                   //Wait to check the received data.
```

Press "Ctrl+C" to stop.

2.2.5 GPIO Usage

Enter the /sys/class/beilai/ directory and type ls to view the controllable GPIO ports:

```
root@bliiot:/sys/class/beilai# ls
GPIO1   GPIO2   GPIO3   GPIO4
root@bliiot:/sys/class/beilai/GPIO1# ls
cfg   data   device   drv   power   pull   subsystem   uevent
```

Among them, writing 1 to cfg sets the GPIO as output, and writing 0 sets it as input.

After setting it as output:

Writing 1 to data outputs a low level

Writing 0 to data outputs a high level

If set as input, reading from data will give the input value

For example, using GPIO1 (dry contact) on the X16 module, set GPIO1 as output and output a high level:

```
root@bliiot:/sys/class/beilai/GPIO1# echo 1 > cfg
root@bliiot:/sys/class/beilai/GPIO1# echo 0 > data
```

For example, using GPIO1 (dry contact) on the X16 module, set GPIO1 as input and read the current level:

```
root@bliiot:/sys/class/beilai/GPIO1# echo 0 > cfg
root@bliiot:/sys/class/beilai/GPIO1# cat data
```

2.2.6 Y board Serial Port Usage

Note: This usage method does not apply to the Y63 module. For the Y63 module, please refer to section 2.2.8.

(1) Software Installation

The corresponding files are located in the /usr/demo/ioy/ folder. Please refer to the actual file names. Execute the command chmod +x on BEILAI_IOy_BL440_*.bin. Then proceed with the software installation.

```
root@bliiot:/# cd /usr/demo/ioy/
root@bliiot:/# chmod +x BEILAI_IOy_BL440.bin
root@bliiot:/# ./BEILAI_IOy_BL440.bin
Md5 verify pass!
tar: ./iolib: time stamp 2024-05-29 09:16:25 is 1716973791.042311023 s in the future
tar: ./ioy: time stamp 2024-06-25 03:05:22 is 1719284328.036465231 s in the future
tar: ./S90iolib: time stamp 2024-05-27 07:47:16 is 1716795642.036139981 s in the future
Install complete!
Restarting iolib:
Stopping iolib: stopped iolib (pid 1568)
OK
Starting iolib: OK
```

(2) Usage of Y Board Ports

Use ioy show to view IO board information. Use ioy help to see command help.

```
root@bliiot:/# ioy help
Usage: ioy <command> [<arguments>]

Commands:
        show
        get             <address>|<slot>.<channel>
        set             <address>|<slot>.<channel> <value>
        config          <address>|<slot>.<channel> mode <mode>,
                        <address>|<slot>.<channel> min <min-value> max <max-value>

config mode:
        ai|ao           4t20(4~20mA),0t20(0~20mA),0t5(0~5V),0t10(0~10V),
                        -5t5(-5~5V),-10t10(-10~10V)
        rtd             pt100-3(pt100 3wire),pt100-4(pt100 4wire),
                        pt1000-3(pt1000 3wire),pt1000-4(pt1000 4wire)
        tc              k,j,e,t,s,r,b,n
```

For example, with the DI module, short-circuit DI2, then enter ioy show to view the information.

```
slot    name    channel  address  mode    value       min         max
2       Y12     1        2000     *       0           0.0000      0.0000
2       Y12     2        2001     *       1           0.0000      0.0000
2       Y12     3        2002     *       0           0.0000      0.0000
2       Y12     4        2003     *       0           0.0000      0.0000
2       Y12     5        2004     *       0           0.0000      0.0000
2       Y12     6        2005     *       0           0.0000      0.0000
2       Y12     7        2006     *       0           0.0000      0.0000
2       Y12     8        2007     *       0           0.0000      0.0000
```

You can also obtain the channel value using the get command:

```
root@bliiot:/# ioy get 2004      //View via address
address 2004 value 1
root@bliiot:/# ioy get 2.5       //View by <slot>.<channel>
slot 2 channel 5 value 1
```

For example, with the AO module, enter ioy show to view the information.

```
slot    name    channel  address  mode    value       min         max
2       Y41     1        4000     4t20    4.0000      4.0000      20.0000
2       Y41     2        4002     4t20    4.0000      4.0000      20.0000
2       Y41     3        4004     4t20    4.0000      4.0000      20.0000
2       Y41     4        4006     4t20    4.0000      4.0000      20.0000
2       Y41     5        4008     4t20    4.0000      4.0000      20.0000
2       Y41     6        4010     4t20    4.0000      4.0000      20.0000
2       Y41     7        4012     4t20    4.0000      4.0000      20.0000
2       Y41     8        4014     4t20    4.0000      4.0000      20.0000
```

In the "mode" column, if it shows "4t20," it corresponds to the 4~20mA current output as described in ioy help under config mode. Use the set command to set the channel value.

```
root@bliiot:/# ioy set 4000 10      //Set the output to 10mA via address
root@bliiot:/# ioy set 2.1 10       //Set the output via <slot>.<channel>
root@bliiot:~# ioy get 4000
address 4000 value 10.000000
```

(3) Port Configuration

By using the ioy help command, you can see the command format for config.

```
Usage: ioy <command> [<arguments>]

Commands:
        show
        get             <address>|<slot>.<channel>
        set             <address>|<slot>.<channel> <value>
        config          <address>|<slot>.<channel> mode <mode>,
                        <address>|<slot>.<channel> min <min-value> max <max-value>

config mode:
        ai|ao           4t20(4~20mA),0t20(0~20mA),0t5(0~5V),0t10(0~10V),
                        -5t5(-5~5V),-10t10(-10~10V)
        rtd             pt100-3(pt100 3wire),pt100-4(pt100 4wire),
                        pt1000-3(pt1000 3wire),pt1000-4(pt1000 4wire)
        tc              k,j,e,t,s,r,b,n
```

To change the range from 4-20mA to 0-20mA, either of the following two commands can be used:

```
root@bliiot:/# ioy config 4000 mode 0t20
root@bliiot:/# ioy config 2.1 mode 0t20        //Change the range to 0-20mA
```

Modify the range by setting the corresponding minimum and maximum values:

```
root@bliiot:/# ioy config 4000 min 0 max 20  //Set the minimum and maximum values to 0 and 20.
```

2.2.7 Y63 Board Usage

In the BL440,“ttyWCHX-A”and“ttyWCHX-B”represent a pair of RS485 serial port lines. When using the RS485 serial port, connect the RS485 lines to these terminals. For example, in the Y63 module, there are two terminals: ttyWCH0-A and ttyWCH0-B, corresponding to the device file /dev/ttyWCH0. Set the baud rate to 115200, data bits to 8, no parity, and 1 stop bit (8N1).

```
stty -F /dev/ttyWCH0 ispeed 115200 ospeed 115200 cs8
echo 12345 > /dev/ttyWCH0          //Send data via RS485-1 port.
cat /dev/ttyWCH0                   //Wait to check the received data.
```

Press "Ctrl+C" to stop.

2.3 LED

LED	Description
PWR	Power LED: It remains constantly on when the power is connected. This LED light cannot be programmed by the user.
RUN	Default Settings: The LED blinks when the CPU usage is below 90% and remains on continuously when the CPU usage exceeds 90% This LED light can be programmed by the user.
LINK	Default Settings: The LED remains on when there is an internet connection and turns off when there is no internet connection. This LED light can be programmed by the user.

The LED indicators are as follows:

LED2 (POWER): Stays on when the power is normal after startup.

LED1 (RUN): Blinks when the system is running normally.

LED0 (LINK): Remains on when connected to the internet via a wired network; blinks when using 4G or WiFi.

The configuration file for these settings is /etc/beilai_led.sh

To view the trigger conditions: cat /sys/class/leds/user-led0/trigger

```
root@bliiot:~# cat /sys/class/leds/user-led0/trigger
```

[none] rc-feedback mmc0 mmc1 mmc2 timer oneshot heartbeat backlight gpio cpu0 cpu1 cpu2 cpu3 default-on transient

Where [none] means the current trigger condition of led0 is none. Write the above string to trigger to modify the trigger condition.

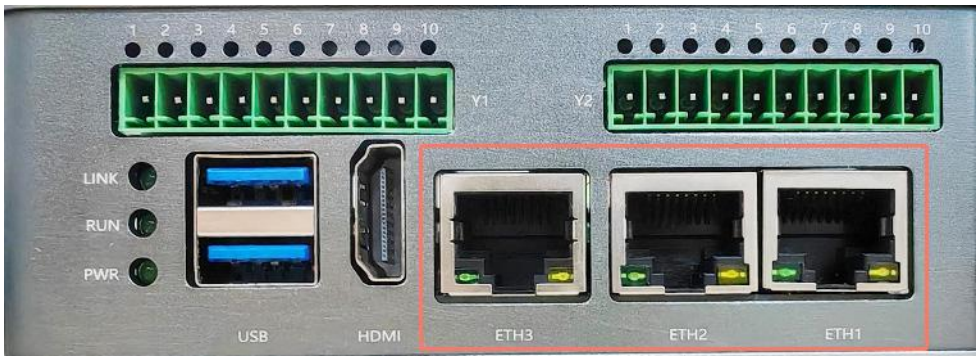
When the led trigger condition is set to none, the user can control the led light on or off by commands

To control LED0 to be on: echo 1 >/sys/class/leds/user-led0/brightness

```
root@bliiot:~# echo none >/sys/class/leds/user-led0/brightness
root@bliiot:~# echo 1 >/sys/class/leds/user-led0/brightness
```

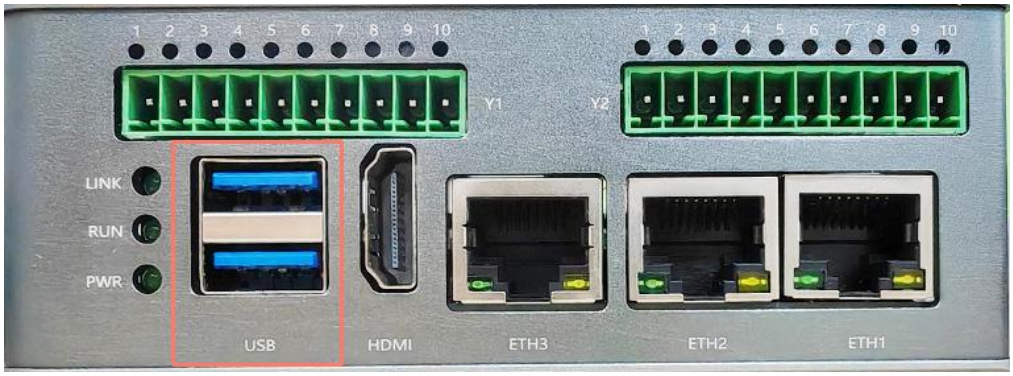
To control LED1 to be off: echo 0 >/sys/class/leds/user-led1/brightness

2.4 Ethernet Port



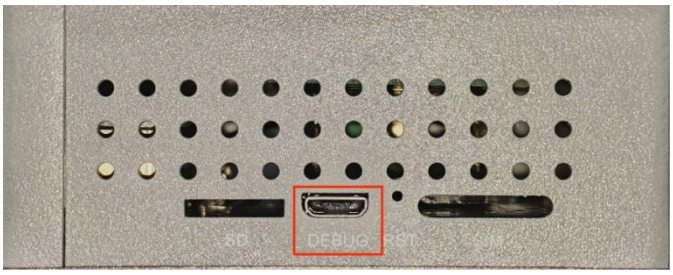
The device comes with a maximum of 3 network ports.

2.5 USB Port



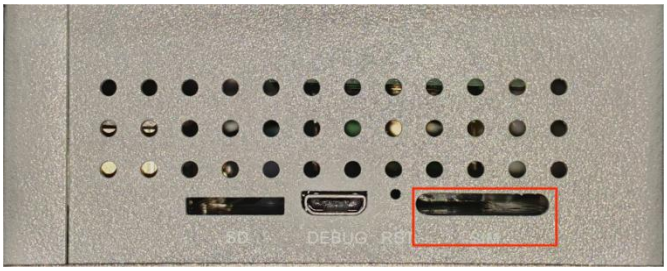
The device has 2 USB 3.2 HOST interfaces, supporting FAT32 formatted USB drives. When reading or writing data to the USB drive, use the sync command to ensure data is properly saved and prevent data loss.

2.6 Debugging Serial Port

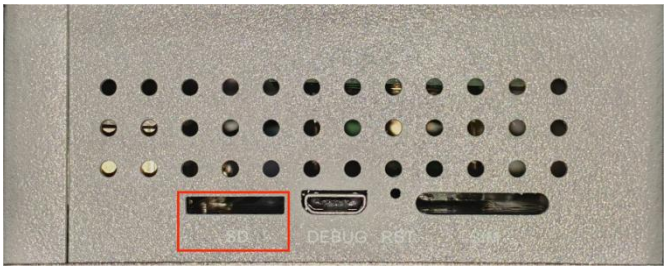


The debugging interface is as shown in the image. You can access the device's system through this port.

2.7 SIM Card Slot

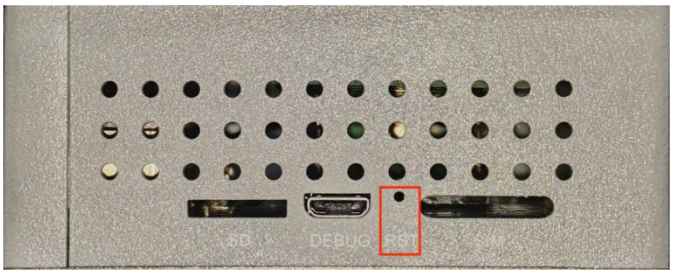


2.8 SD Card Slot



The SD card slot, as shown in the image, supports FAT32 formatted SD cards. After reading or writing data using this slot, use the sync command to ensure data is properly saved and prevent data loss.

2.9 Reset Button



Press the restart button and release it to reboot the device.

2.10 PCIE

The PCIe interface supports both 4G and WiFi.

2.10.1 4G Module

Using the Quectel EC20 module as an example, place the SIM card into the module and connect the antenna. The test program can be found in the /usr/demo/4G directory.

(1) Network Function

Disable other network connections and keep only the 4G module network active.

```
ifconfig eth1 down
ifconfig eth2 down
ifconfig eth3 down
udhcpc -i usb0
ifconfig
```

At this point, a network node usb0 should be generated. If this node is not present, the module may not have network functionality enabled by default. Try configuring the 4G module with the following commands:

```
microcom /dev/ttyUSB2
AT+QCFG="USBNET",1
```

If using the EC200 module, an additional command may be required to establish a network connection.

```
AT+QNETDEVCTL=3,1,1
```

After executing the command, if the device returns “OK”, it indicates that the configuration is

successful and this setup needs to be done only once. After rebooting the device, the usb0 node should be created. Then, you can re-run the network disable and enable commands.

Once the usb0 node is generated, use the following commands to test the network.

```
ping www.baidu.com -I usb0
```

(2) SMS Function

To test the SMS functionality, execute the test command in the program directory.

```
./send_sms <device> <phonenumber> <text>
```

Command Description:

<device>: The 4G module device node.

<phonenumber>: The target phone number for sending the SMS.

<text>: The content of the SMS. There should be no spaces between characters in the SMS content; otherwise, an error will be prompted.

For example: ./send_sms /dev/ttyUSB2 152******** test

At this time, the corresponding number should receive a text message with the content of "test".

(3) Call Function

To test the dialing function, execute the test command in the program directory:

```
./phone_call <device> <phonenumber>
```

Command Description: <device> is the 4G module device node. <phonenumber> is the dialling target mobile phone number.

For example: ./phone_call /dev/ttyUSB2 152********

At this point the corresponding number should receive an incoming call from the device.

(4) GPS Function

The GPS function can be tested by executing the test command in the test program directory:

```
./get_location <device> <timeout>
```

Command Description:

<device>: The device node, determined by the result of the command ls /dev/ttyUSB*. This may change after rebooting the device.

<timeout>: The time to wait for the return of latitude and longitude information (in seconds).

For example: ./get_location /dev/ttyUSB2 1

Obtaining latitude and longitude information may take a few minutes. If the retrieval fails or times out, check if the antenna is properly connected and ensure you are testing in an open area.

(5) 4G Module Usage

In some countries, the 4G module may fail to access the internet through standard commands. In such cases, the 4G module needs to be switched to USB interface mode, during which a network node named wwan0 should be generated.

If this node is not present, it may indicate that the module's network function is not enabled by default. You can try configuring the 4G module using the following commands.

(For EC200 series modules, the AT command port is /dev/ttyUSB1)

```
microcom -p /dev/ttyUSB2 -s 115200
```

After configuring the serial debugging tool, enter the "AT" command to check whether communication with the 4G module is working properly.
If the module replies with "OK", it means the communication is successful; otherwise, it indicates a communication failure.
Enter the following command to check the current signal strength of the 4G module:

```
AT+CSQ
```

If the returned value is greater than 20, it indicates that the communication signal strength is normal and network connection is possible.
If the value is less than 20, the signal is too weak to connect to the network.
If the returned value is 99.99, it means there is no signal.
Enter the following command to check whether the SIM card is communicating properly with the 4G module:

```
AT+CPIN?
```

If the returned message is "+CPIN: READY", it means the SIM card is communicating normally with the 4G module. Otherwise, it indicates a communication failure, please check whether the SIM card is functioning properly.
Enter the following command to check whether the SIM card can detect the operator's APN:

```
AT+COPS?
```

If the returned result shows the correct operator APN, it means this APN can be used for internet access during configuration.
Then, enter the following commands to configure the 4G module:

```
AT+QCFG="usbnet",0

AT+CFUN=1,1
```

Then exit the serial debugging interface, close all network interfaces, and enable the 4G network:

```
ifconfig eth1 down
```

```
ifconfig eth2 down
ifconfig eth3 down
udhcpc -i wwan0
```

When using the 4G module, the APN, username, and password may be required. You can use the quectel-CM application located in the /usr/demo/4G folder.
If APN configuration is not needed, simply run the program to connect to the internet.
If APN settings are required, execute the command in the following format:

```
quecteb-CM -s ”your_apn” -m ”your_apn_username” -v ”your_apn_password”
```

Note: your_apn is the operator’s APN, your_apn_username is the username provided by the operator, and your_apn_password is the password provided by the operator.
The quotation marks are part of the parameters and must be English quotation marks.

For more available parameters, you can enter the following command to view them:

```
quecteb-CM -h
```

Before use, ensure that the wwan0 network interface is already enabled. The command to enable it is:

```
ifconfig wwan0 up
```

When running the quectel-CM application, you must ensure that it runs in the background.
If the application exits, the network connection will not function properly.
To set the quectel-CM program to run in the background, use the following method:

```
quecteb-CM -s ”your_apn” -m ”your_apn_username” -v ”your_apn_password” &
```

Note: There is an “&” at the end of the command.

2.10.2 WiFi Module

The WiFi module used here is the BL-R8188EU2 (2.4G frequency band). The test program and drivers are located in the /usr/demo/wifi directory. Make sure to connect the antenna properly.
(1) STA Function

Enter the test program directory, disable other networks, keep only the WiFi network, and load the WiFi driver.

```
ifconfig eth1 down
ifconfig eth2 down
ifconfig eth3 down
insmod -f 8188eu.ko                 //Load WiFi driver
ifconfig wlan0 up                   //Based on the name of the network card shown in ifconfig
```

Execute the following command to connect the device to the specified WiFi network. Use -i followed by the WiFi name and -p followed by the WiFi password.

```
./wifi_setup.sh -i bliiot -p bebetter
```

You can check the obtained IP address using ifconfig. Then, execute the following command to test if the network functionality is working correctly.

```
ping www.baidu.com
```

(2) AP Function

After restarting the system, enter the directory where the test program is located, disable other networks, keep only the WiFi network, and load the WiFi driver.

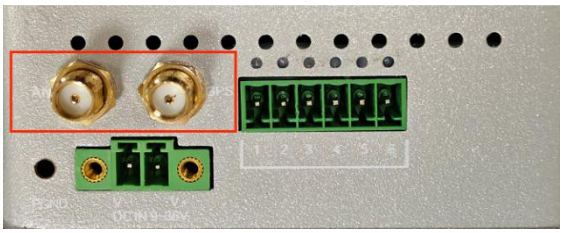
```
ifconfig eth1 down
ifconfig eth2 down
ifconfig eth3 down
insmod -f 8188eu.ko
Ifconfig wlan0 up
```

Execute the following command to set the WiFi module to AP mode:

```
./ap_setup.sh
```

The default WiFi name is rtl8188eu and the password is 88888888. You can modify these settings in the rtl_hostapd_2G.conf configuration file.

2.11 Antenna Interface



The antenna interfaces include one WiFi/cellular antenna interface and one GPS antenna interface.

Note: The GPS port is exclusively for connecting the GPS antenna; if there is no GPS, do not connect anything. The ANT interface is used to connect either the 4G signal antenna or the WiFi signal antenna.

2.12 Hardware Watchdog

The hardware watchdog timeout is 30ms. If you need to disable the hardware watchdog, you must unload the bl440_watchdog.ko module.

```
root@bliiot: rmmod -f bl440_watchdog.ko
```

If you need to re-enable the hardware watchdog, reload the bl440_watchdog.ko module from the /usr/demo/watchdog/ directory.

```
root@bliiot:cd /usr/demo/watchdog/

root@bliiot: insmod -f bl440_watchdog.ko
```

2.13 Encryption Chip

The encryption chip model RJGT102 is based on the SHA-256 encryption and authentication algorithm. It also provides a configurable watchdog timer and external reset functionality. The chip communicates with the MCU through an I²C-5 serial interface and supports a low-power mode.
The device uses the encryption chip's demo by writing /proc/sys/kernel/random/uuid to the encryption chip and saving the UUID to /usr/rjgt_unique.json. When used, the data from the encryption chip is compared with the external data. If the external data matches the internal data on the encryption chip, the encryption validation is successful.

Please modify the cross-compiler path in the Makefile and then run make to compile. Alternatively, refer to the "RJGT102 Data Manual" for more details.

Run the sample programme rigt102 and if the uuid is correct, the following reply will appear.

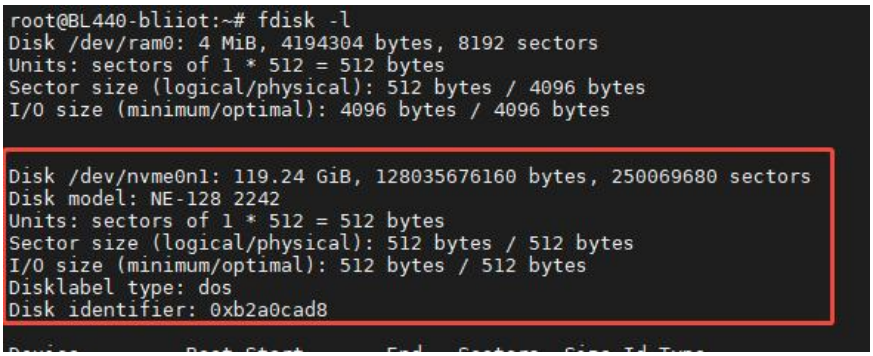
```
root@bliiot: ./rigt102

open unique file failed, create unique file!

random uuid would write rjgt102 : b6275e22-4928-4828-88fb-54a6fd8!

Contrast success

root@bliiot:./rigt102

Contrast success
```

2.14 SD Card, Solid-State Drive and USB Drive Usage

If the USB drive, Solid-State Drive or SD card is not formatted as FAT32, you need to format the USB drive, Solid-State Drive or SD card (formatting will erase all data, so please back up in advance).
To check the disk mounting status:

```
root@bliiot:~# fdisk -l
```

Locate the unmounted USB drives, SSDs, and SD cards. Here, we take the SSD as an example.



Partition the SSD as follows:

```
root@bliiot:~# fdisk /dev/nvme0n1
```

#command n: Create a new partition

#For subsequent prompts, press Enter to accept the default values. For example, select (default p): p — just enter p after the colon.

#command p: Select primary partition type

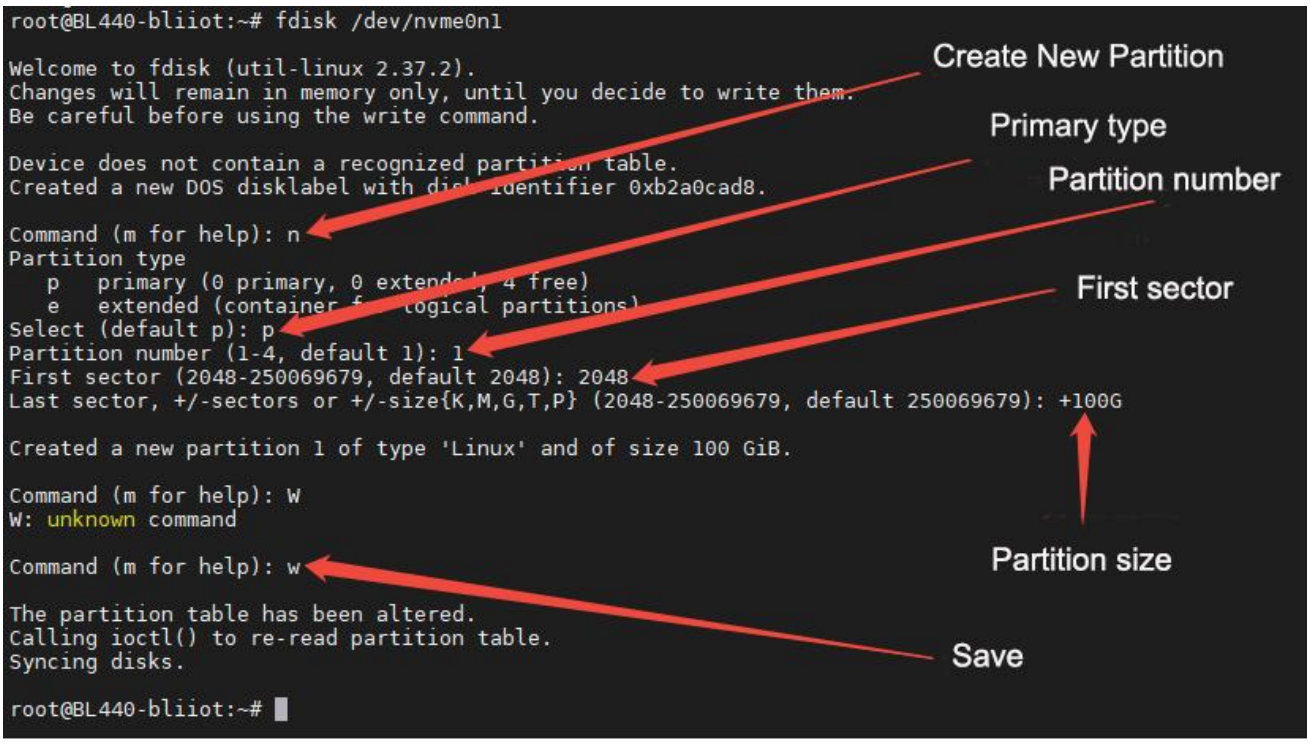
#Select partition number: 1–4

#Set the first partition size: 2048

#Set the sector capacity: 100G

#command w: Save the settings and exit

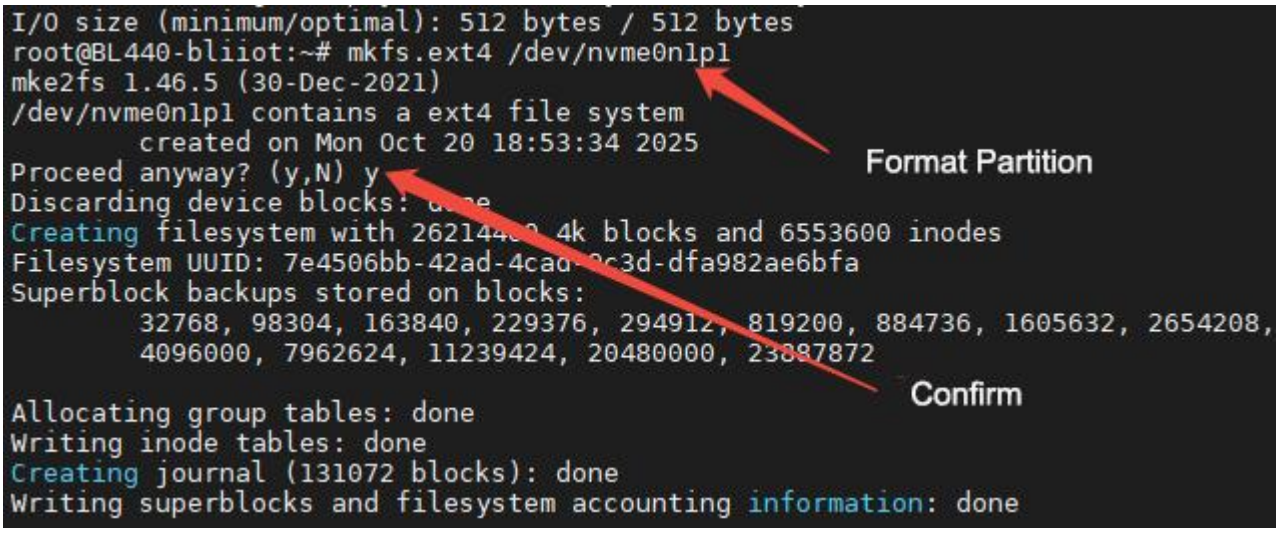
#command m: Display help information for all commands in fdisk



Format a USB drive, SSD, or SD card. Here, as an example, we will format the SSD partition nvme0n1p1:

```
root@bliiot:~# mkfs.ext4 /dev/nvme0n1p1
```

You will be prompted to confirm whether to format. Type y to start formatting:



After formatting is complete, you can mount the USB drive, SSD, or SD card normally. Use the following command to mount it:

```
root@bliiot:~# mkdir /mnt/data
root@bliiot:~# mount /dev/nvme0n1 /mnt/data
```

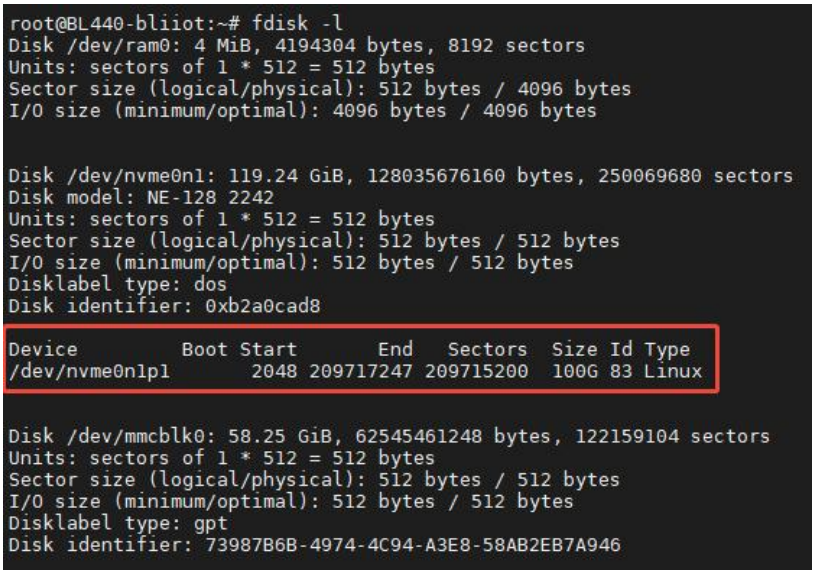
Once the mount is successful, you can use the USB drive, SSD, or SD card normally.

After use, you need to unmount the USB drive, SSD, or SD card. Use the following command to unmount it:

```
root@bliiot:~# umount /mnt/data
```

If you want to mount it permanently, follow these steps:

1, Identify the device: Insert the device and use the following command to check: fdisk -l or lsblk -f. Record the device's UUID and file system type (e.g., ext4, NTFS, vfat, etc.).



2, Create a mount point: For example, if we want to mount to /mnt/usb, then: sudo mkdir -p /mnt/usb

3, Get the UUID: Use the blkid command or check the output of lsblk -f to find the UUID of the corresponding device.

```
root@BL440-bliiot:~# blkid
/dev/mmcblk0p7: LABEL="oem" UUID="52c1d493-0c01-4925-83f5-8213837bfc63" BLOCK_SIZE="4096" TYPE="ext4" PARTLABEL="oe
UID="2bfee623-d83c-426a-ab80-21732c9bb7d3"
/dev/mmcblk0p8: LABEL="userdata" UUID="135f819f-5b8c-495d-8303-3fe801050789" BLOCK_SIZE="4096" TYPE="ext4" PARTLABE
ata" PARTUUID="b2af085d-a675-48c6-c437-f6d557ff4744"
/dev/mmcblk0p6: UUID="24493b91-b384-4f7f-b650-94c4956a2226" BLOCK_SIZE="4096" TYPE="ext4" PARTLABEL="rootfs" PARTUU
0000-0000-4b53-0000-1d28000054a9"
/dev/nvme0n1p1: UUID="7e4506bb-42ad-4cad-9c3d-dfa982ae6bfa" BLOCK_SIZE="4096" TYPE="ext4" PARTUUID="f499b177-01"
/dev/mmcblk0p5: PARTLABEL="backup" PARTUUID="24ceeb40-277f-4e11-ffeb-d0f20027a83b"
/dev/mmcblk0p3: PARTLABEL="boot" PARTUUID="7a3f0000-0000-446a-8000-702f00006273"
/dev/mmcblk0p1: PARTLABEL="uboot" PARTUUID="b750e44e-833f-4a30-c38c-b117241d84d4"
/dev/mmcblk0p4: PARTLABEL="recovery" PARTUUID="000b305f-484a-4582-9090-4ad0099d47bd"
/dev/mmcblk0p2: PARTLABEL="misc" PARTUUID="a1c81622-7741-47ad-b846-c6972488d396"
root@BL440-bliiot:~#
```

4, Edit /etc/fstab:

```
root@bliiot:~# nano /etc/fstab
```

5, Add a line at the end of the file in the following format:

UUID=<device UUID> <mount point> <file system type> <mount options> <dump backup setting> <fsck order>

For example, for an ext4 formatted drive, it can be written like this:

UUID=7e4506bb-42ad-4cad-9c3d-dfa982ae6bfa /mnt/usb ext4 defaults,uid=1000,gid=1000,umask=022 0 0

For Linux's common ext4 file system:

UUID=1234-5678 /mnt/ssd ext4 defaults 0 2

For FAT32 (vfat) format:

UUID=1234-5678 /mnt/sd vfat defaults,uid=1000,gid=1000,umask=000 0 0

Note: uid and gid set the user and group, while umask sets the permission mask (e.g., 000 means read/write access for all users).

```
/swapfile none swap sw 0 0
UUID=7e4506bb-42ad-4cad-9c3d-dfa982ae6bfa /mnt/usb ext4 defaults,uid=1000,gid=1000,umask=022 0 0
~
~
~
~
~
~
```

6, If you do not want to specify a user, you can omit options like uid, gid, and umask, and just use defaults.

7, For NTFS, you need to install ntfs-3g (usually already installed) and use ntfs-3g as the file system type, or simply write ntfs (on some systems it may be symlinked to ntfs-3g).

8, For exFAT, you need to install exfat-fuse and exfat-utils, and then use exfat as the file system type.

9, Test: After saving /etc/fstab, run the following command to check for errors:

sudo mount -a, If there is no error message, the mount is successful, and you can see the files at the mount point.

10, Permission settings: If the permissions are not as required after mounting, you can adjust them in the mount options or use chown and chmod commands after mounting. Important: If /etc/fstab is configured incorrectly, it may prevent the system from booting. Therefore, always test with sudo mount -a before rebooting. If the test fails, correct /etc/fstab according to the error messages.

Additionally, for removable devices (such as USB drives or SD cards), if you want them to mount only when inserted and allow users to safely unmount, you can consider using udisks2 and udev rules to enable automatic mounting (this is not permanent, but plug-and-play). The /etc/fstab method mounts the device at every system startup, which is suitable for permanently connected devices (such as

internal SSDs). Therefore, for USB drives and SD cards, if they are not always connected, using /etc/fstab for permanent mounting may not be appropriate, because if the device is absent at boot, the system may report an error and enter emergency mode. To avoid this situation, you can add the nofail option in the mount options. This way, even if the device is not present, the system will continue to boot.

For example:

UUID=7e4506bb-42ad-4cad-9c3d-dfa982ae6bfa /mnt/usb ext4 defaults,nofail,uid=1000,gid=1000,umask=022 0 0

This way, even if the device is not connected at boot, it will not affect the system startup.

2.15 External RTC

This device includes an external RTC clock.

To view the external RTC device node:

```
root@bliiot:~# ls /dev/rtc*
/dev/rtc      /dev/rtc0
root@bliiot:~# dmesg | grep rtc0
[       4.319167] rtc-isl1208 5-006f: rtc core: registered rtc-isl1208 as rtc0
```

To view the system clock:

```
root@bliiot:~# date
Tue Jul 05 01:22:15 UTC 2024
```

To set the system time:

```
root@bliiot:~# date -s "2024-7-05 09:24:00" && hwclock -w -f /dev/rtc0
root@bliiot:~# hwclock -f /dev/rtc0
```

To synchronize the system clock to the RTC:

```
root@bliiot:~# hwclock --systohc -u
root@bliiot:~# hwclock -u
```

To synchronize both the system clock and the RTC

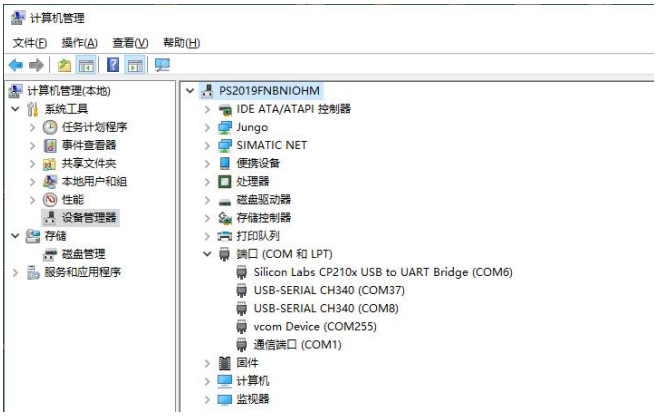
```
root@bliiot:~# hwclock --hctosys -u
```

After executing the command, the system will synchronize the RTC clock to be the system clock.

3 Device Login

3.1 USB Login

To access this on a computer, navigate to "This PC" → "Manage" → "Device Manager". Open the Ports section, then insert the USB cable. The refreshed port indicates the connected device port.



Here's an example using SecureCRT:

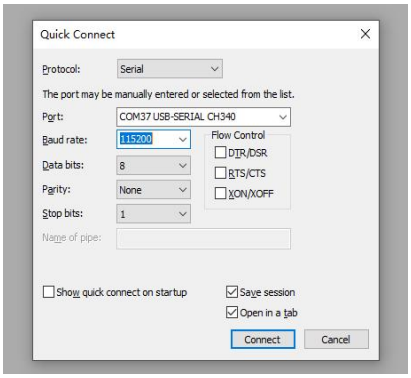
1. Open SecureCRT and create a new connection.
2. Choose "Serial" for the connection type.
3. Select the corresponding port.
4. Set the following parameters:
    1. Baud rate: 115200
    2. Data bits: 8
    3. Parity: None
    4. Stop bits: 1
5. Click "Connect" to access the device.

Linux systems do not have a default login password set.

For Ubuntu systems:

Default Login Account: root

Password: root

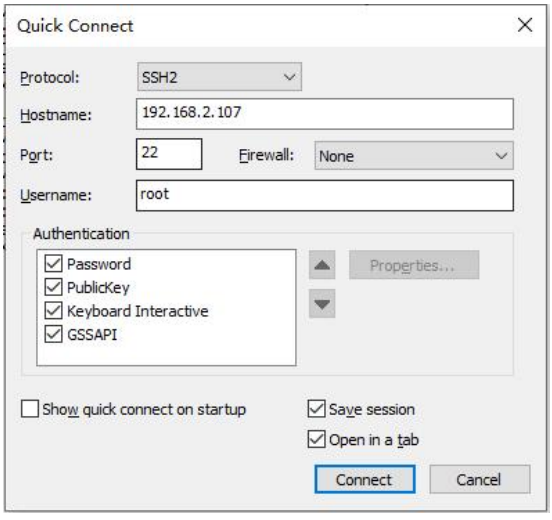


3.2 SSH2 Login

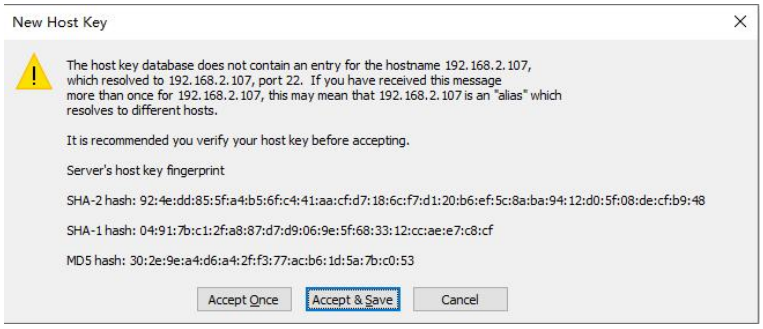
Before logging in via the network port, you need to set the IP address for the corresponding port. For example, ETH2 is connected to the router, and the obtained IP address is 192.168.2.107. The computer IP is on network segment 2.

```
docker0   Link encap:Ethernet  HWaddr 02:42:3D:E2:6F:88
          inet addr:172.17.0.1  Bcast:172.17.255.255  Mask:255.255.0.0
          UP BROADCAST MULTICAST  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

eth2      Link encap:Ethernet  HWaddr 00:E0:99:CD:55:B9
          inet addr:192.168.2.107  Bcast:192.168.2.255  Mask:255.255.255.0
          inet6 addr: fd5f:4184:3ad4:4:66ee:75b9:2b9:476d/64 Scope:Global
          inet6 addr: fe80::5d2c:48eb:826c:7f6/64 Scope:Link
          inet6 addr: fd5f:4184:3ad4:4::74e/128 Scope:Global
          inet6 addr: fd2f:fd7:7cda::74e/128 Scope:Global
          inet6 addr: fd2f:fd7:7cda:0:15d3:ffef:f05a:3ebf/64 Scope:Global
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:240 errors:0 dropped:18 overruns:0 frame:0
          TX packets:80 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:24541 (23.9 KiB)  TX bytes:8407 (8.2 KiB)

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1/128 Scope:Host
          UP LOOPBACK RUNNING  MTU:65536  Metric:1
          RX packets:146 errors:0 dropped:0 overruns:0 frame:0
          TX packets:146 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1
          RX bytes:10796 (10.5 KiB)  TX bytes:10796 (10.5 KiB)
```

Click Create Connection, select the protocol as SSH2, enter the hostname as the device IP: 192.168.2.107, set the port to 22, and use the username root. Then, click Connect to establish the connection.



Select Accept for a successful connection.



4 System Programming

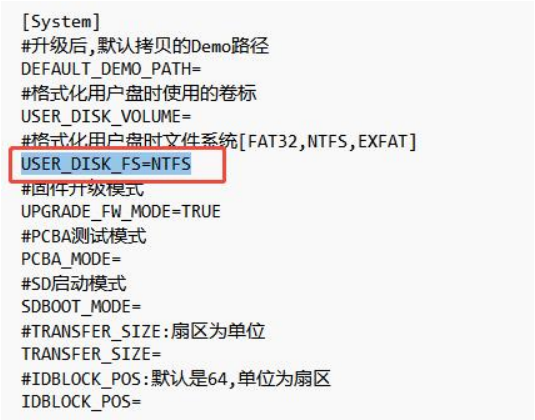
4.1 Micro SD Card Boot

4.1.1 Boot Card Creation

Since the BL440 image typically requires more than 4GB of memory, the memory card needs to be formatted as NTFS when creating the boot card, and the config.ini file must be edited.

You can first change the language to English via Select2.

Open the “config.ini” file, then locate the “System” section and add the line USER_DISK_FS=NTFS; otherwise, the flashing process may fail.



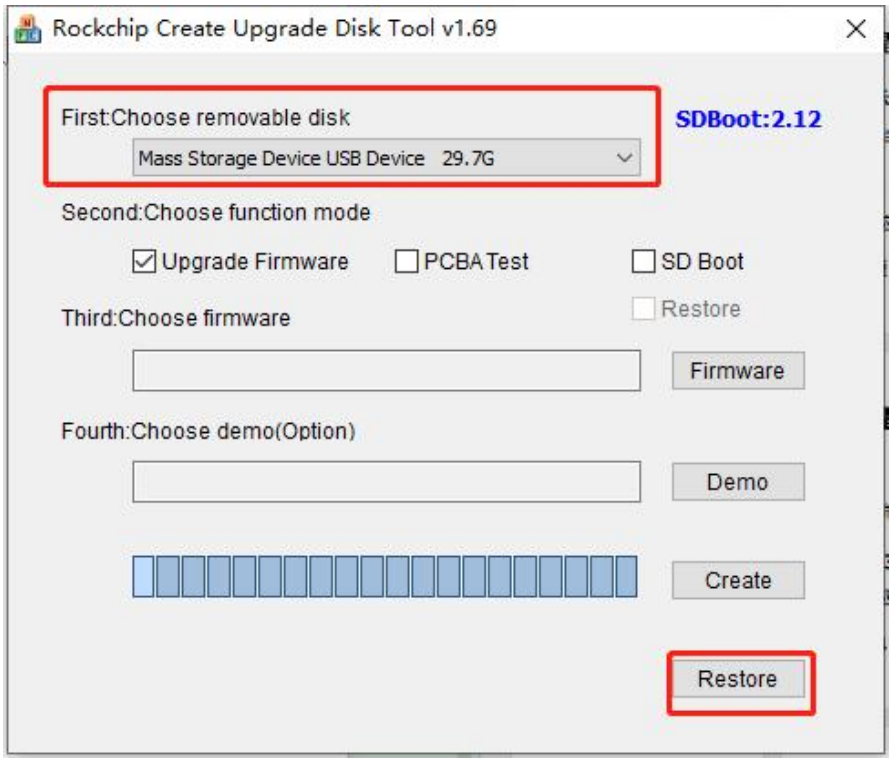
Connect the blank Micro SD card to your computer, right-click on "SD_Firmware_Tool.exe," and select "Run as administrator (A)."

After the tool runs, you will need to manually select the Micro SD card.

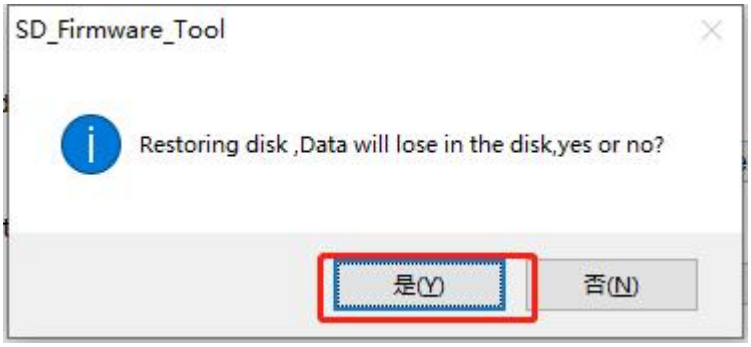
Note: The selected SD card will be formatted, so it is recommended to back up any files on the SD

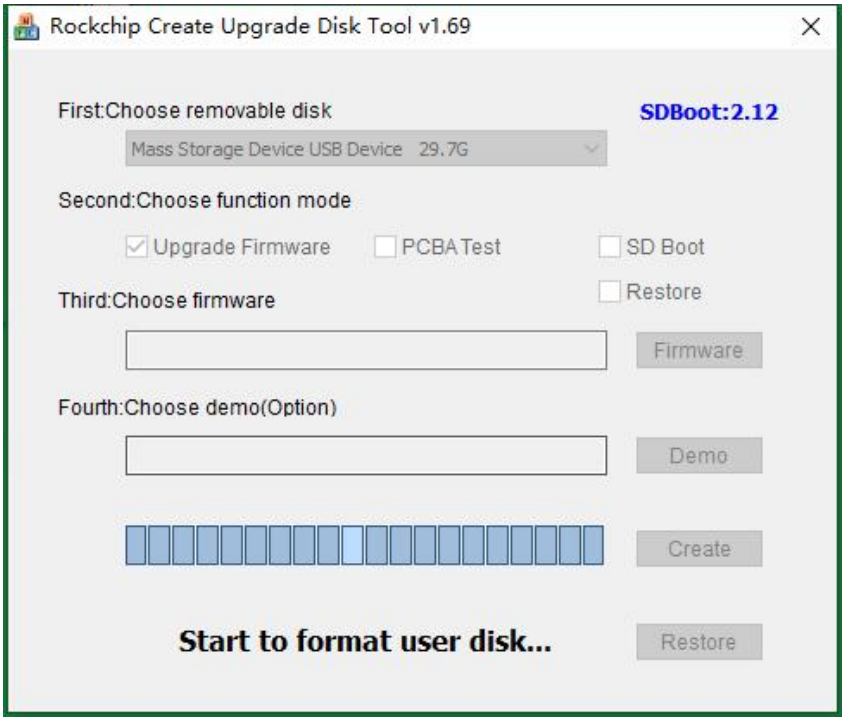
card beforehand. Frequent flashing of the system on an SD card can cause damage, so it is advised not to change the system on the SD card frequently after flashing.

After selecting the disk, first click “Restore” to ensure the system can be successfully written.

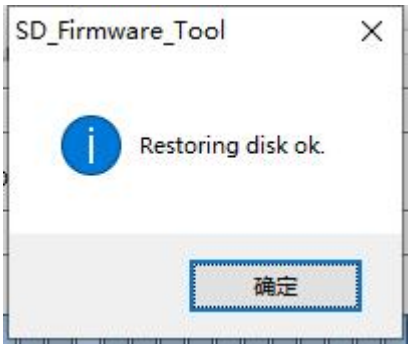


Please confirm that the selected removable disk device is correct, then click “Yes” in the pop-up window to proceed with formatting.

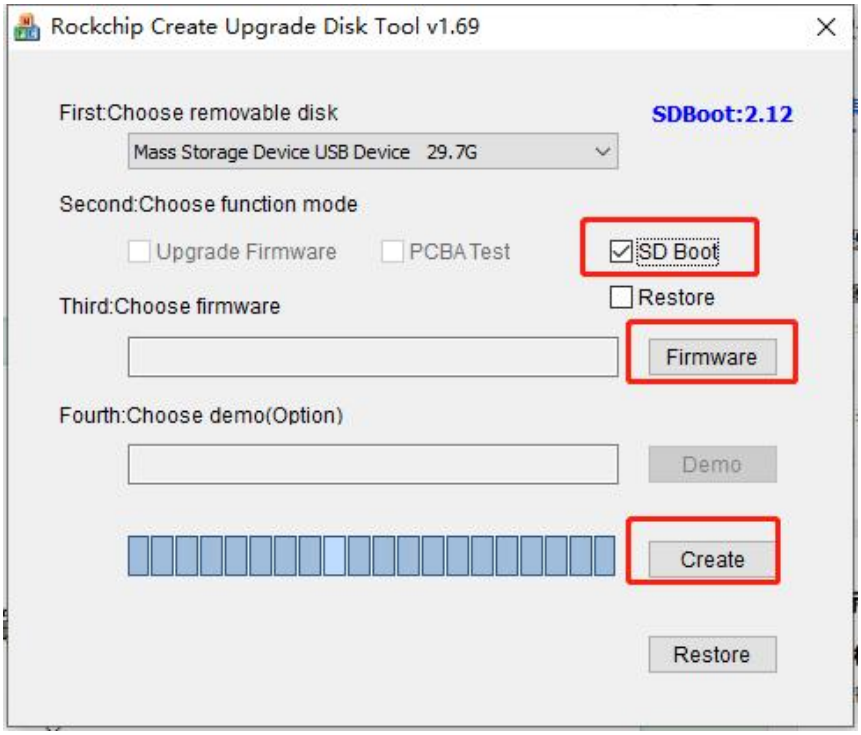


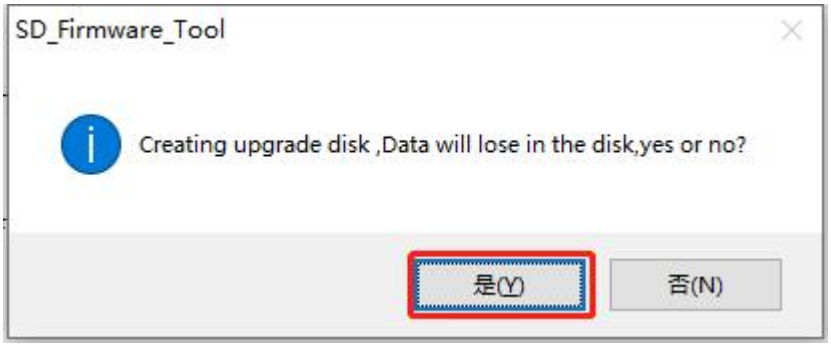


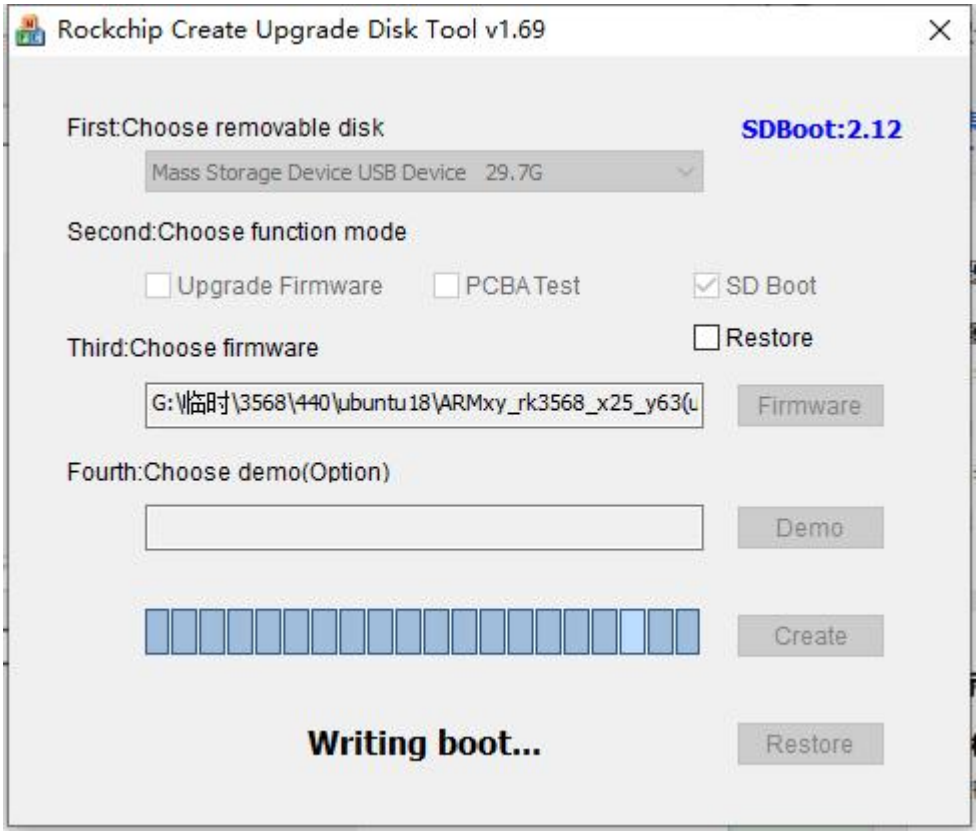
After the formatting is complete, click “OK” in the pop-up window.



Check the "SD Boot" option, click "Firmware" to choose the target system image file, then click "Create." In the pop-up window, click "Yes" to create the SD boot card.

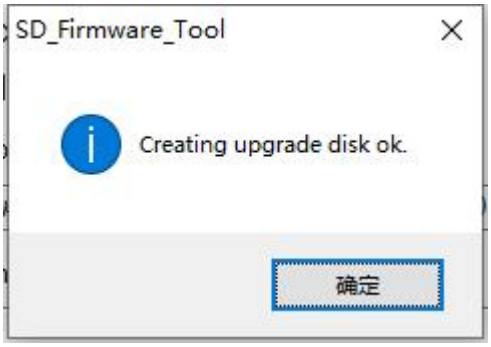

Rockchip Create Upgrade Disk Tool v1.69
First:Choose removable disk
SDBoot:2.12
Mass Storage Device USB Device 29.7G
Second:Choose function mode
Upgrade Firmware
PCBA Test
SD Boot
Restore
Third:Choose firmware
Firmware
Fourth:Choose demo(Option)
Demo
Create
Restore


SD_Firmware_Tool
Creating upgrade disk ,Data will lose in the disk,yes or no?
是(Y)
否(N)



When the message “Creating upgrade disk is ok” appears, it indicates that the system flashing is complete. If any other message appears, you need to restart the process from step 1.

In the pop-up window, click "OK." The SD boot card create is now complete.



4.1.2 Boot from the Boot Card

After inserting the boot card into the device's Micro SD card slot and powering on the device, the system will automatically boot from the boot card and log in as the root user. The serial debug terminal will print similar startup information.

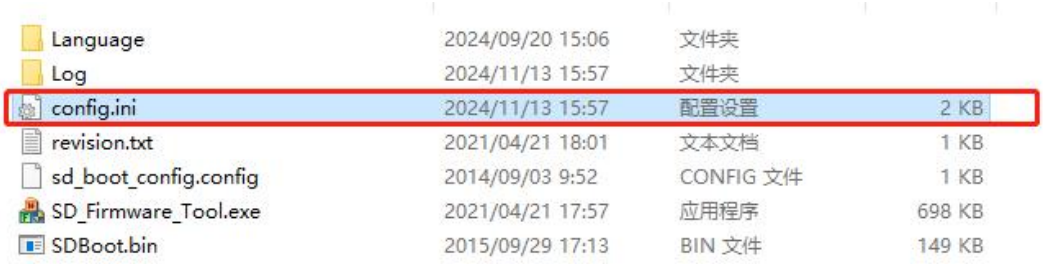
"Bootdev(atags): mmc 1" indicates booting in Micro SD mode, while "Bootdev(atags): mmc 0" indicates booting in eMMC mode.

```
U-Boot 2017.09 (Apr 09 2025 - 17:16:23 +0800)

Model: Rockchip RK3588 Evaluation Board
MPIDR: 0x0
PreSerial: 2, raw, 0xfeb50000
DRAM:  4 GiB
Sysmem: init
Relocation Offset: eda14000
Relocation fdt: eb7f9b60 - eb7fecd8
CR: M/C/I
optee api revision: 2.0
no mmc device at slot 1
mmc@fe2c0000: 1 (SD), mmc@fe2e0000: 0
Bootdev(atags): mmc 1
MMC1: Legacy, 52Mhz
PartType: EFI
TEEC: Waring: Could not find security partition
DM: v2
boot mode: None
```

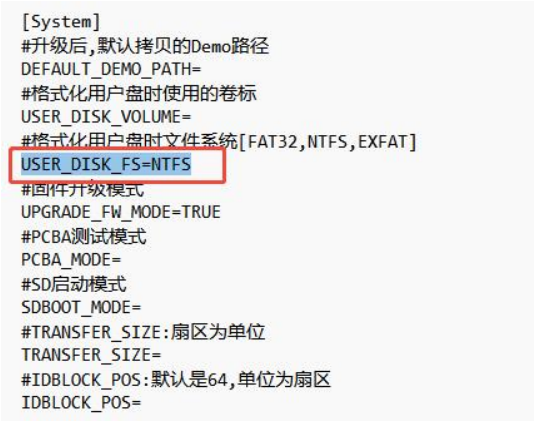
4.2 EMMC Boot

4.2.1 Programming Card Creation

Open the “SDDiskTool_v1.69” folder. Switch the language to English before running the software. Open the config.ini file. The setting Selected=2 means the language switched to English.



Open the “config.ini” file, then locate the “System” section and add the line USER_DISK_FS=NTFS; otherwise, the flashing process may fail.

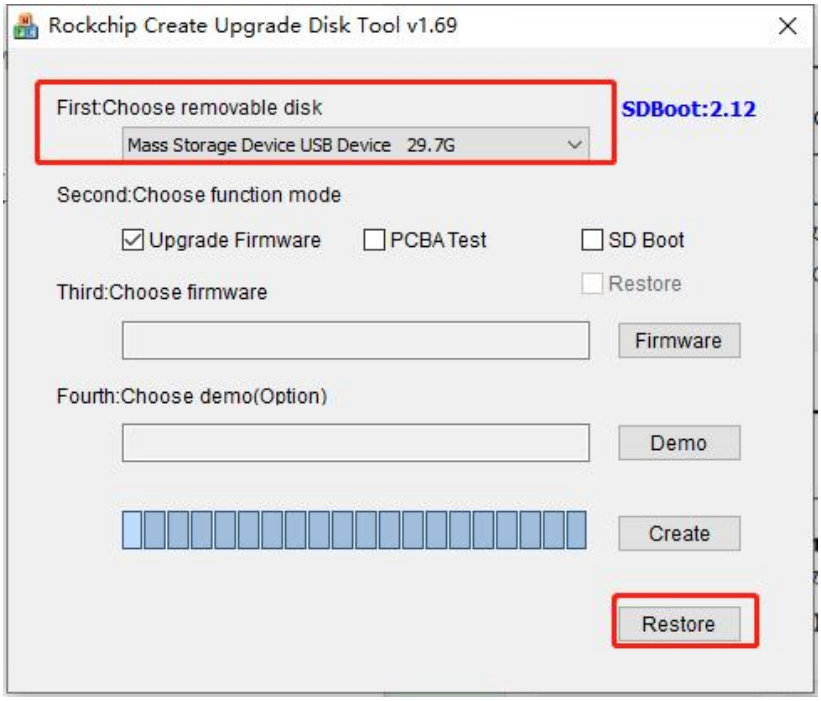


Connect the blank Micro SD card to your computer, right-click on "SD_Firmware_Tool.exe," and select "Run as Administrator (A)."

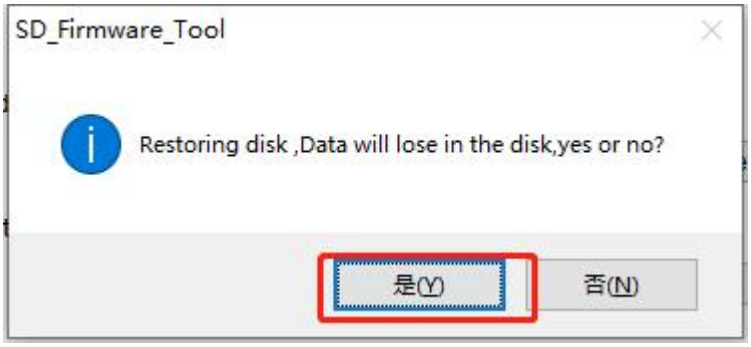
After the tool runs, you will need to manually select the Micro SD card.

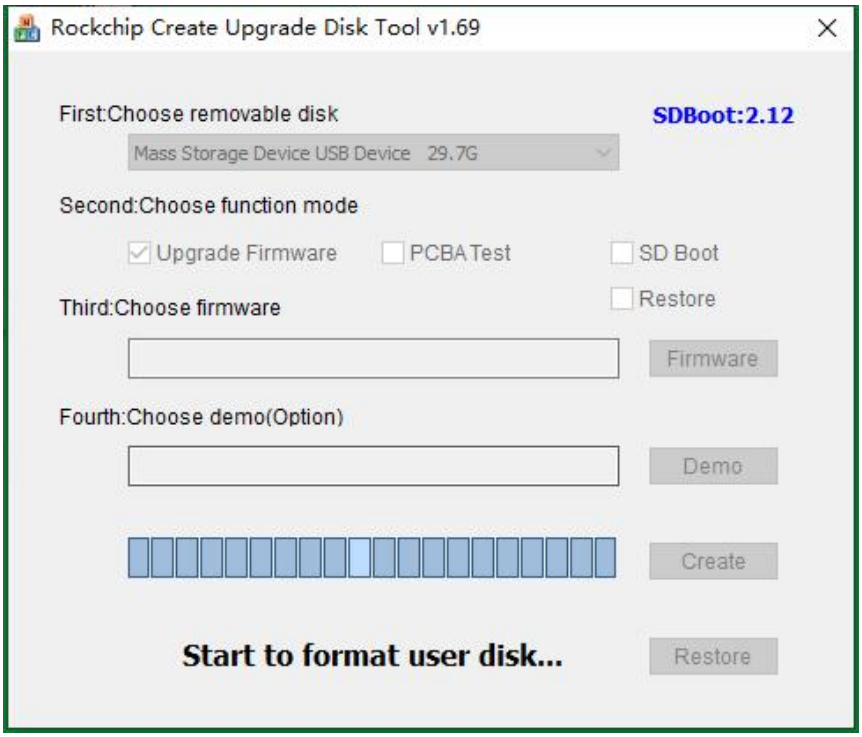
Note: The selected SD card will be formatted, so it is recommended to back up any files on the SD card beforehand. Frequent flashing of the system on an SD card can cause damage, so it is advised not to change the system on the SD card frequently after flashing.

In "First: Choose Removable Disk," choose the removable disk device, then click "Restore" to format it, as shown in the image below.

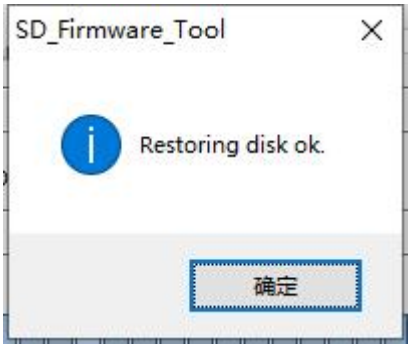


Please confirm that the selected removable disk device is correct, then click "Yes" in the pop-up window to proceed with formatting.

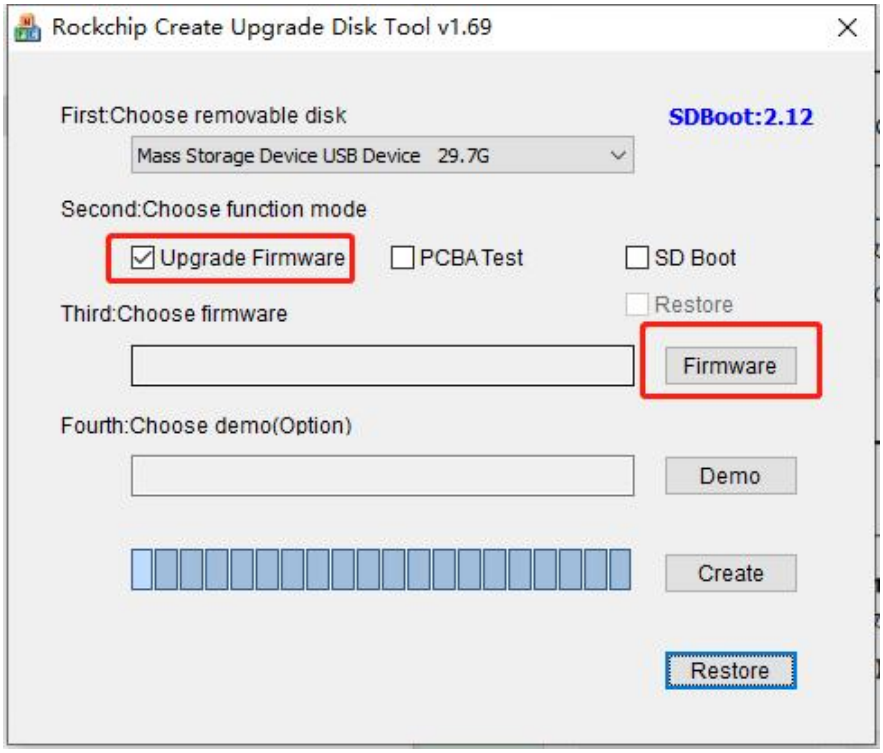


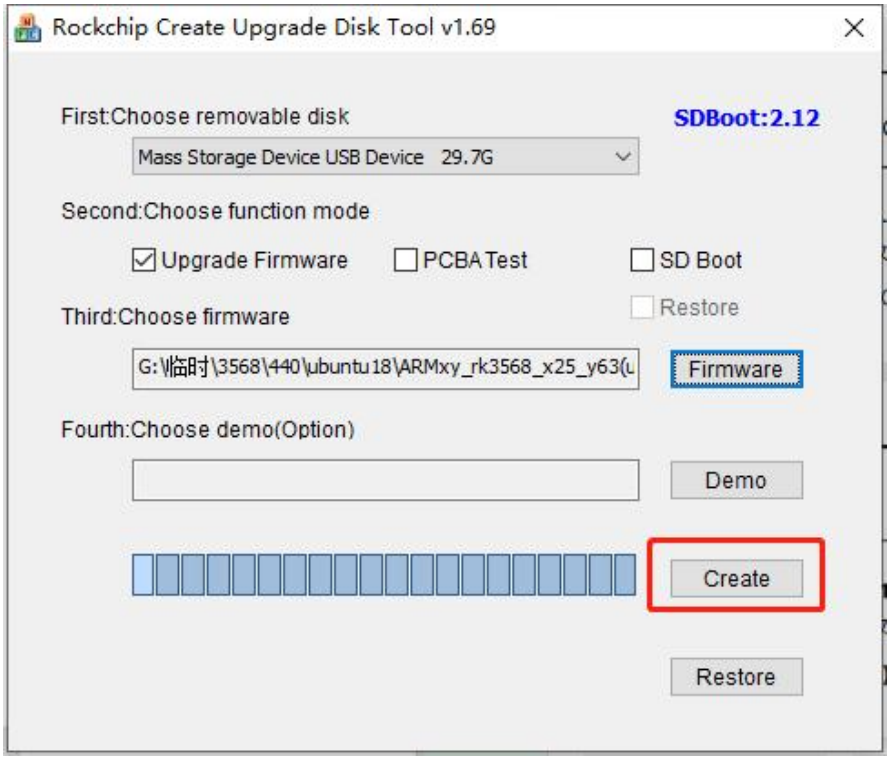


Wait for the formatting to complete, then click "OK" in the pop-up window.

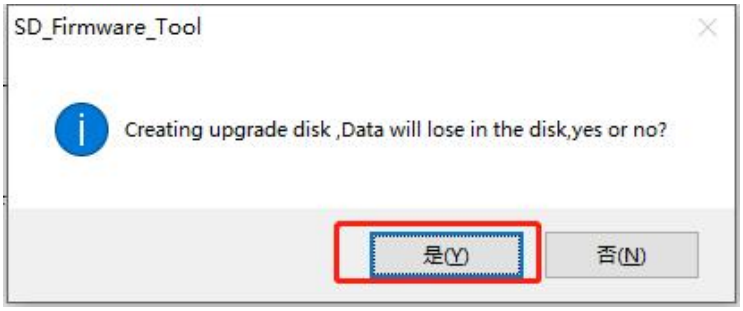


Check the "Upgrade Firmware" option, click "Choose Firmware" to choose the target system image file, then click "Create." In the pop-up window, click "Yes" to create the SD boot card.

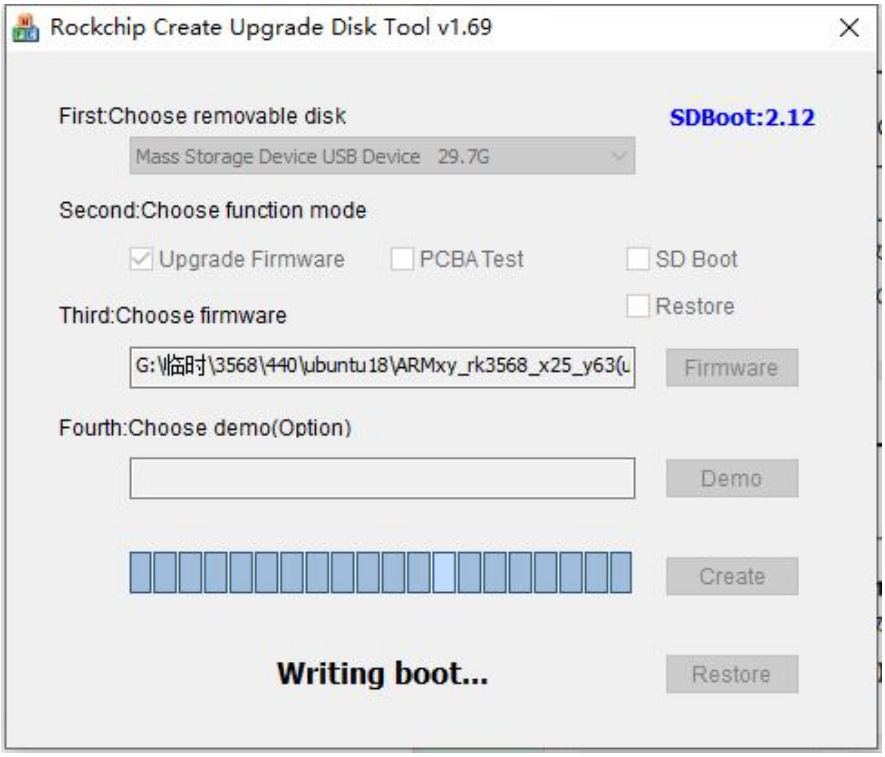

Rockchip Create Upgrade Disk Tool v1.69
First:Choose removable disk
SDBoot:2.12
Mass Storage Device USB Device 29.7G
Second:Choose function mode
Upgrade Firmware
PCBA Test
SD Boot
Restore
Third:Choose firmware
Firmware
Fourth:Choose demo(Option)
Demo
Create
Restore


Rockchip Create Upgrade Disk Tool v1.69
First:Choose removable disk
SDBoot:2.12
Mass Storage Device USB Device 29.7G
Second:Choose function mode
Upgrade Firmware
PCBA Test
SD Boot
Restore
Third:Choose firmware
G:\临时\3568\440\ubuntu18\ARMxy_rk3568_x25_y63(u
Firmware
Fourth:Choose demo(Option)
Demo
Create
Restore

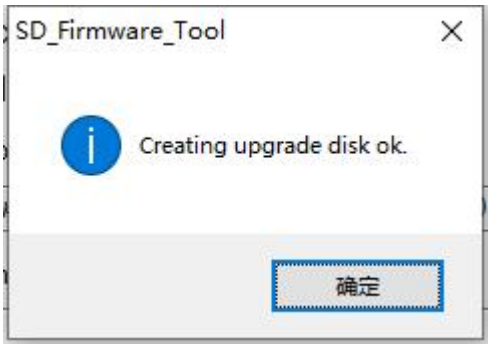
Click "OK"



Start flashing the system.

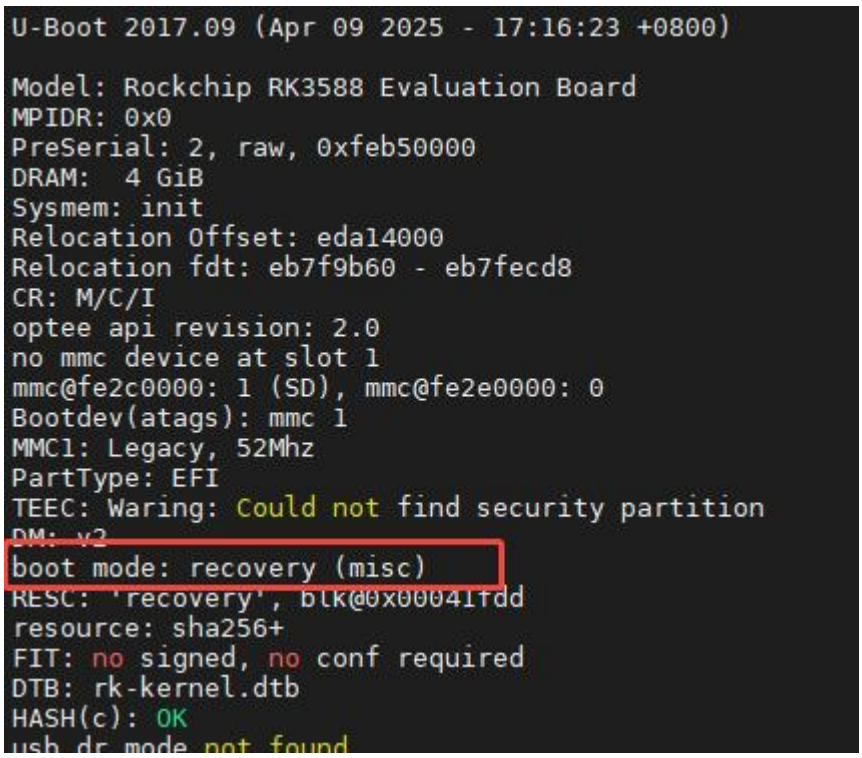


A prompt will appear indicating that the creation was successful. If any other prompts appear, you need to start over from Step 1.

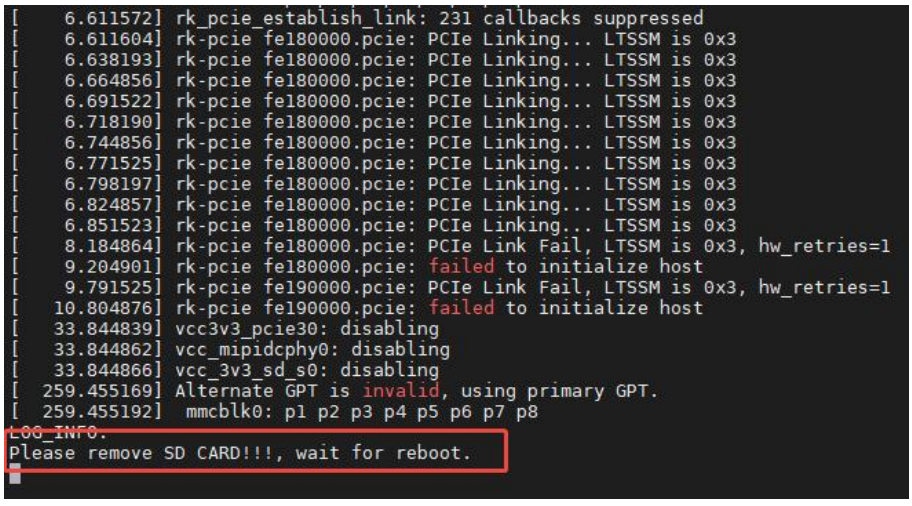


4.2.2 System Programming

Insert the prepared SD card into the device's Micro SD card slot. After powering on, the device will boot from the SD card. If you see “boot mode: recovery (misc)”, it indicates that the firmware is starting.



When the message “Please remove SD CARD!!!, wait for reboot.” appears, it means the firmware flashing is complete. Remove the SD card, and the device will automatically reboot.



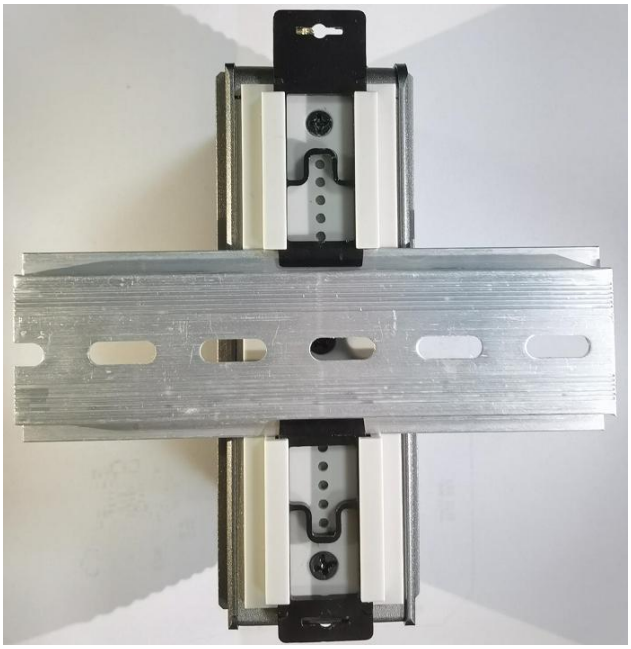
5 Software

- BLIoTLink
- Node-red
- Docker
- QT
- Codesys
- IgnitionSCADA
- Ubuntu 22.04

6 DIN Rail Mounting

The provided DIN rail clips are divided into two parts, upper and lower. The upper part, which is longer, is installed first, while the shorter lower part is mounted on the rail. This arrangement makes it easier to install screws.

Press the clip downward, and it can be mounted onto the DIN rail. The following is a rear view of the DIN rail installation:



7 Electromagnetic Compatibility Testing

Test	Item	Standard	Level	Condition	Result	Remarks
Electromagnetic Emission	Conducted Emission	GB/T 9254 Class A/ CISPR 32 Class A	Class A	150 kHz - 30 MHz	PASS	Complies with limits for general industrial environments
	Radiated Emission	GB/T 9254 Class A/ CISPR 32 Class A	Class A	30 MHz - 1 GHz	PASS	Complies with limits for general industrial environments
Immunity Testing	ESD	GB/T 17626.2/IEC 61000-4-2	Level III	Contact discharge: ±4 kV; Air discharge: ±8 kV	PASS	—
	Radiated RF Immunity	GB/T 17626.3/ IEC 61000-4-3	Level III	Field strength: 10 V/m, 80 MHz – 1 GHz	PASS	—
	EFT	GB/T 17626.4/ IEC 61000-4-4	Level III	Power lines: 2 kV; Signal lines: 1 kV	PASS	—
	Surge	GB/T 17626.5/ IEC 61000-4-5	Level III	Differential mode: 2 kV; Common mode: 4 kV	PASS	—
	Voltage Dips and Interruptions	GB/T 17626.11/ IEC 61000-4-11	Level III	Voltage dip: 70% for 500 ms; Complete interruption: 10 ms	PASS	—
	Power Frequency Magnetic Field Immunity	GB/T 17626.8/ IEC 61000-4-8	Level III	Test intensity: 30 A/m, 50 Hz	PASS	—

Note: If the Electrical Fast Transient (EFT) standard needs to reach Level 3, filter module must be purchased separately.

8 Appendix

X30 Port Numbering	Actual Pin Numbers
GPIO1	GPIO4_PA5
GPIO2	GPIO3_PC4
GPIO3	GPIO4_PB0
GPIO4	GPIO3_PD5
GPIO5	GPIO4_PB2
GPIO6	GPIO3_PC7
GPIO7	GPIO4_PA3
GPIO8	GPIO3_PC1
GPIO9	GPIO4_PA6
GPIO10	GPIO3_PC5
GPIO11	GPIO4_PB1
GPIO12	GPIO3_PD3
GPIO13	GPIO1_PA7
GPIO14	GPIO3_PD0
GPIO15	GPIO4_PA4
GPIO16	GPIO3_PC0

9 Warranty Terms

1) This equipment will be repaired free of charge for any material or quality problems within one year from the date of purchase.
2) This one-year warranty does not cover any product failure caused by man-made damage, improper operation, etc

10 Technical Support

Shenzhen Beilai Technology Co., Ltd
Website: https://www.bliiot.com