# CM4 INDUSTRIAL

## AN INDUSTRIAL EMBEDDED COMPUTER BASED ON RASPBERRY PI CM4

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EDA Technology Co.,LTD– Electronics Development Accelerator

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# Contents

# 1 Product Overview

CM4 Industrial is an industrial embedded computer based on Raspberry Pi Compute Module 4. The system can be configured into 1GB/2GB/4GB/8GB RAM and 0GB/8GB/16GB/32GB eMMC according to different applications, which supports boot up from SD card.

It provides a variety of industrial communication interfaces and functions, such as multi-channel RS232, RS485, multi-channel high-precision ADC, isolated IO input, relay control, battery backup real-time clock and alarm buzzer. It also provides powerful communication capabilities, one Gigabit Ethernet interface with PoE function, one 10/100M network port, 4G/LTE module, certified 2.4/5.8G dual-band WiFi and Bluetooth, and supports external antennas.

CM4 Industrial can support 2 CSI interfaces, 1 DSI display interface and 1 HDMI cable interface. Other features include on-board 32Mb serial Flash for storing system data, wide power supply range, V1.4 version is 9~36V, V1.1~V1.3 version is 9~18V, and ESD protection for important interfaces.

## 1.1 Target Application

- IOT gateway
- Industrial control
- Displays equipment
- Intelligent manufacture

## 1.2 Specifications and Parameters

| Function | Parameters |
|---|---|
| CPU | BCM2711 4 core, ARM Cortex-A72(ARM v8), 1.5GHz, 64bit CPU |
| Memory | 1GB / 2GB / 4GB / 8GB option |
| eMMC | 0GB / 8GB / 16GB / 32GB option |
| SD card | micro SD card, support CM4 Lite without eMMC |
| Extended storage | 1x 32Mb Serial Flash |
| Ethernet | Dual net port, 1x Gigabit Ethernet, 1x 100 Mbps Ethernet |
| WiFi / Bluetooth | 2.4G / 5.8G Dual band WiFi, bluetooth5.0 |
| 4G | 1x 4G/LTE module(option), Full Netcom, supporting mobile, Unicom and telecom network standards. |
| HDMI | 1x standard HDMI |
| HDMI FPC touch screen | 1x FPC HDMI, support USB touch, PWM Dimming |
| DSI | 1x DSI, support Raspberry Pi 7-inch official touch screen |

| Function | Parameters |
|---|---|
| Camera | 2x CSI, Support official 5M/8M/12M cameras |
| USB Host | 2x USB 2.0 Type A, 1x USB 2.0 integrated in Mini PCIe interface, 2x USB 2.0 Host Pin Header extend, 1x USB micro-B used for eMMC flash |
| RS485 | 2x RS485 |
| RS232 | 1x RS232 |
| Serial(TTL) | 1x Serial(TTL), can be used in the default console of the system, and supports configuration as a standard serial port. |
| ADC channel | 3x ADC IN Channel, 12bit ADC |
| Isolated IO | 2x DI |
| No-isolated IO | 1x DIO |
| Relay | 1x double-pole double-throw relay |
| Mini PCIe | 1-lane PCIe 2.0, Highest support 5Gbps, 1x USB 2.0 Host |
| 40-Pin GPIO | Raspberry Pi 40-Pin GPIO HAT extend |
| Real time clock | 1x RTC |
| Buzzer | 1x buzzer |
| User button | 1x user button |
| Fan | 1x adjustable speed fan control interface |
| DC power supply output | 5V@1A, can be used to support Raspberry Pi 7 inch official touch screen power supply. |
| LED indicator | red(power indicator), green(system state indicator) |
| Operation system | compatible with official Raspberry Pi OS, provides BSP software support package, and supports online installation and update of APT. |
| Power input | V1.4 version is 9V~36V DC, V1.1~V1.3 version is 9V~18V DC |
| Dimensions | 170(length) x 120(wide) x 30(wide) mm |
| Case | Full Metal Shell, Support DIN guide rail installation |
| Antenna accessory | Support optional WiFi/BT external antenna, which has passed wireless authentication together with Raspberry Pi CM4, and optional 4G external antenna. |
| Working environment temperature | -25 ~ 50°C |

## 1.3 System Diagram
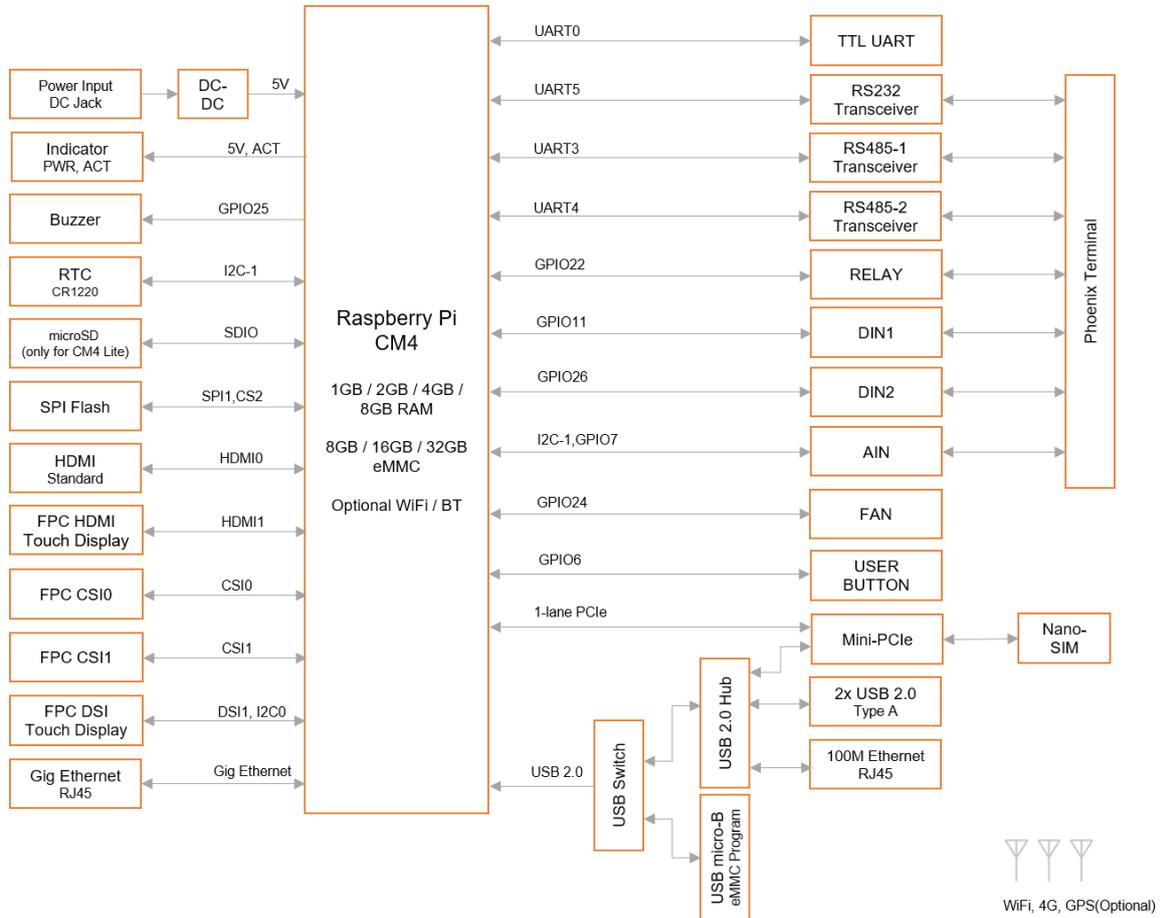


**ED-CM4IND: EDATEC CM4 Industrial**

**Note: V1.4 version power input range is 9V~36V, V1.1~V1.3 version power input range is 9V~18V.**

## 1.4 Functional Layout
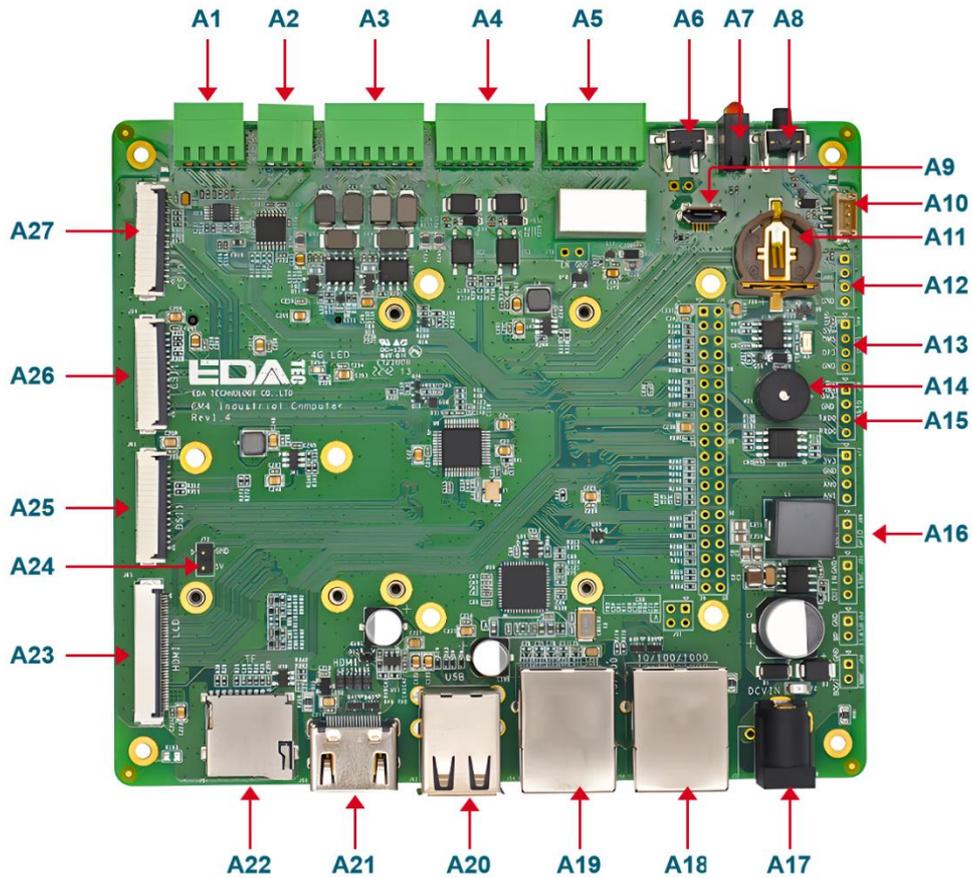
| No. | Function | No. | Function |
|-----|----------|-----|----------|
| A1 | 2×ADC | A15 | Debug serial port |
| A2 | RS232 | A16 | Customize GPIO Pin Header |
| A3 | 2×RS485 | A17 | DC power socket |
| A4 | 2×DIN | A18 | Gigabit Ethernet RJ45 port |
| A5 | 2×relay | A19 | 100 Gigabit Ethernet RJ45 port |
| A6 | Reset button | A20 | 2×USB 2.0 |
| A7 | Signal indicating LED | A21 | HDMI Type A |
| A8 | User key | A22 | Micro SD slot |
| A9 | Micro USB interface | A23 | HDMI FPC interface |
| A10 | Fan interface | A24 | 5V power output |
| A11 | RTC battery socket | A25 | DSI interface |
| A12 | USB6 Pin Header | A26 | CSI1 interface |
| A13 | USB5 Pin Header | A27 | CSI0 interface |
| A14 | buzzer | | |

| No. | Function | No. | Function |
|-----|----------|-----|----------|
| B1 | mini PCIe interface | B3 | CM4 socket |
| B2 | Standard SIM slot | | |
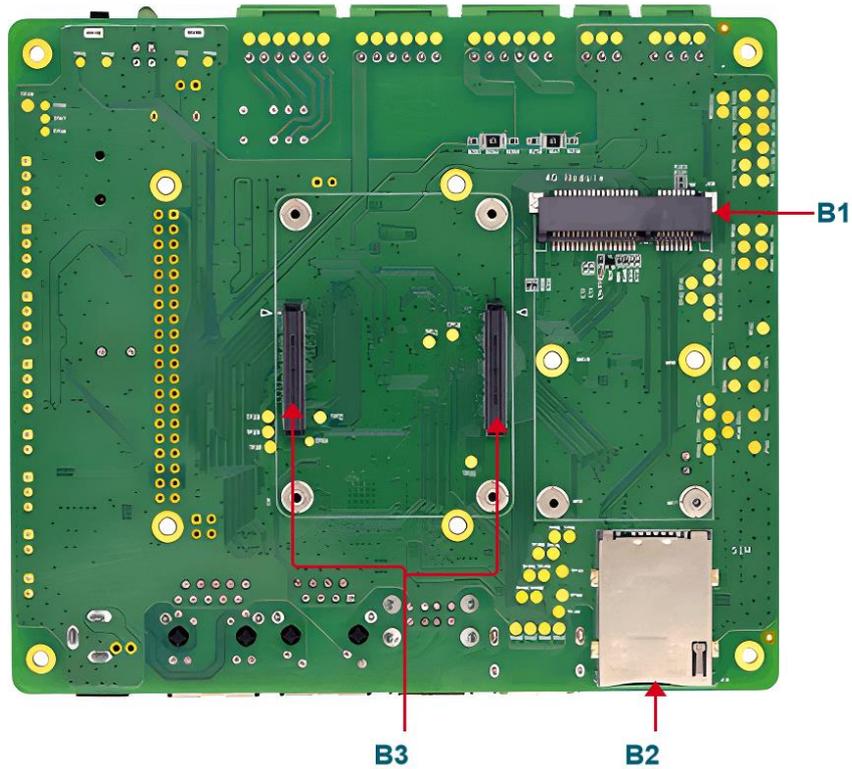
## 1.5 Packing List

- 1x CM4 Industrial host computer
- [option WiFi/BT version] 1x 2.4GHz/5GHz WiFi/BT antenna
- [option 4G version] 1x 4G/LTE antenna

## 1.6 Order Code

| ED | - | CM4IND | - | 1 | 2 | 32 | - | 4CN | I | - | 10 |

EDATEC

CM4 Industrial

0 = Without WiFi & BT
1 = With WiFi & BT

10 = V1.0 revision

Blank = Operating Temperature 0~+50°C
I = Operating Temperature -25°C~+50°C

1 = 1GB DDR
2 = 2GB DDR
4 = 4GB DDR
8 = 8GB DDR

Blank = Without 4G module
4CN = EC20CN CN 4G data transfer
4CE = EC20CE CN 4G+GPS data transfer
4AF = EC25AF US 4G data transfer
4EU = EC25EU EU 4G data transfer
4EF = EC25EF Southeast Asia/ India/ Korea
4G+GPS data transfer
4AU = EC25AU AU 4G data transfer

SD = 32GB SD Card
00 = No eMMC
08 = 8GB eMMC
16 = 16GB eMMC
32 = 32GB eMMC

**Example**

**Part# : ED-CM4IND-1232-4CNI-10**

**Configration :** CM4 Industrial Computer V1.0 version
CM4102032 Compute Module with Wireless, 2GB DDR & 32GB eMMC
CN 4G Module with 1pcs 4G antenna
1pcs Raspberry Pi certified WiFi/Bluetooth Antenna
Metal Case
Operating Temparature: -25°C~+50°C

# 2 Quick Start

Quick start is mainly to guide you how to connect devices, start configuration for the first time.

## 2.1 Equipment List

- 1x CM4 Industrial host computer
- 1x 2.4GHz/5GHz WiFi/BT antenna
- 1x 4G External antenna
- 1x 12V@2A adapter
- 1x CR1220 button battery (RTC power supply)

## 2.2 Hardware Connection

Use the device with case, eMMC, WiFi and 4G module as an example to demonstrate how to install it.

In addition to the CM4 Industrial host computer, you also need:
- 1x Network cable

- [可选] 1x micro SIM card, It can be a mobile, Unicom or telecom 4G card.
- 1x HDMI display
- 1x standard HDMI to HDMI cable
- 1x keyboard
- 1x mouse

1.Install the WiFi external antenna.

2.[Optional] Insert the micro SIM card.

3.Insert the network cable into the Gigabit network port, and the network cable is connected with network devices such as routers and switches that can access the Internet.

4.Mouse and keyboard plugged into USB interface.

5.Plug in the HDMI cable and connect the monitor.

6.Power the 12V@2A power adapter and plug it into the DC power input port of CM4 Industrial (marked with +12V DC).

## 2.3 First Start

CM4 Industrial has no power switch. Plug in the power cord and the system will start.

1.The red LED lights up, which means the power supply is normal.

2.The green light starts flashing, indicating that the system starts normally, and then the logo of Raspberry will appear in the upper left corner of the screen.

### 2.3.1 Raspberry Pi OS (Desktop)

After the Desktop version of the system is started, directly enter the desktop.
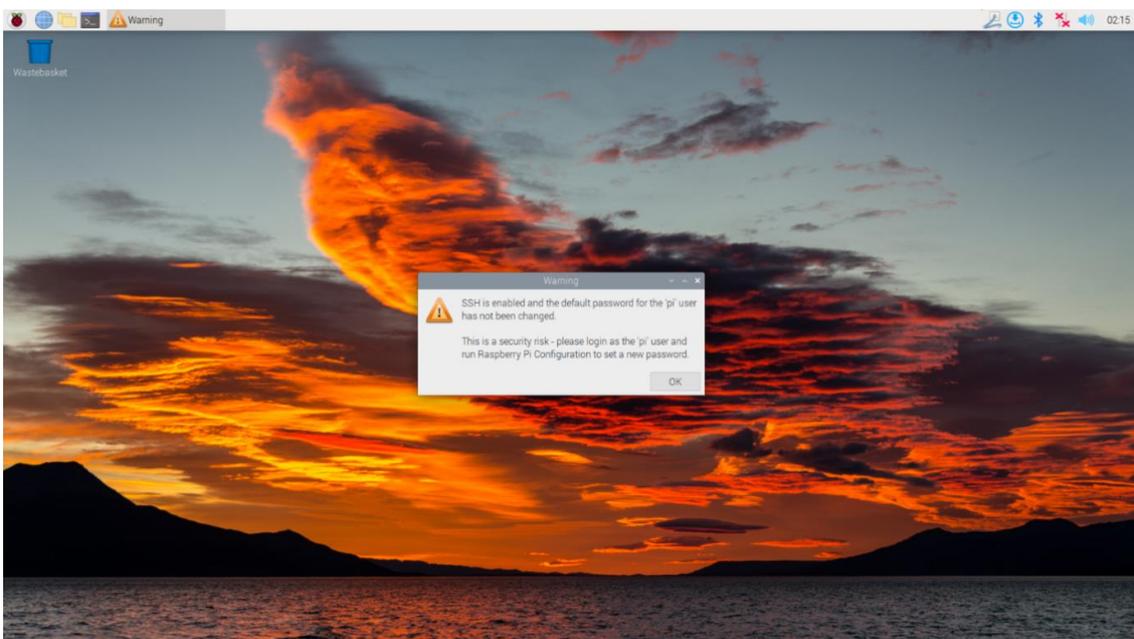
If you use the official system image, and the image is not configured before burning, the Welcome to Raspberry Pi application will pop up and guide you to complete the initialization setting when you start it for the first time.



- Click Next to start the setup.
- Setting　Country, Language and Timezone, click Next。

**NOTE: You need to select a country region, otherwise the default keyboard layout of the system is the English keyboard layout (our domestic keyboards are generally the American keyboard layout), and some special symbols may not be typed.**



- Input a new password for the default account pi, and click Next.

**NOTE: default password is raspberry**

**Change Password**

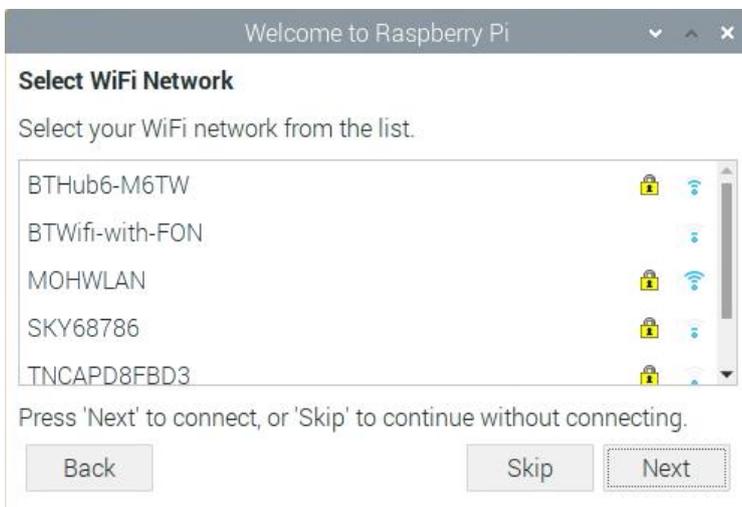The default 'pi' user account currently has the password 'raspberry'. It is strongly recommended that you change this to a different password that only you know.

Enter new password:

Confirm new password:

☑ Hide characters

Press 'Next' to activate your new password.

Back    Next

- Select the wireless network you need to connect to, enter the password, and then click Next.

**Select WiFi Network**

Select your WiFi network from the list.

BTHub6-M6TW

BTWifi-with-FON

MOHWLAN

SKY68786

TNCAPD8FBD3

Press 'Next' to connect, or 'Skip' to continue without connecting.

Back    Skip    Next

**NOTE: If your CM4 module does not have a WIFI module, there will be no such step.**

**NOTE: Before upgrading the system, you need to wait for the wifi connection to be normal (the wifi icon appears in the upper right corner).**

- Click Next, and the wizard will automatically check and update Raspberry Pi OS.

**Update Software**

The operating system and applications will now be checked and updated if necessary. This may involve a large download.

Press 'Nex                Reading update list - please wait...                inue
without ch

Back    Skip    Next
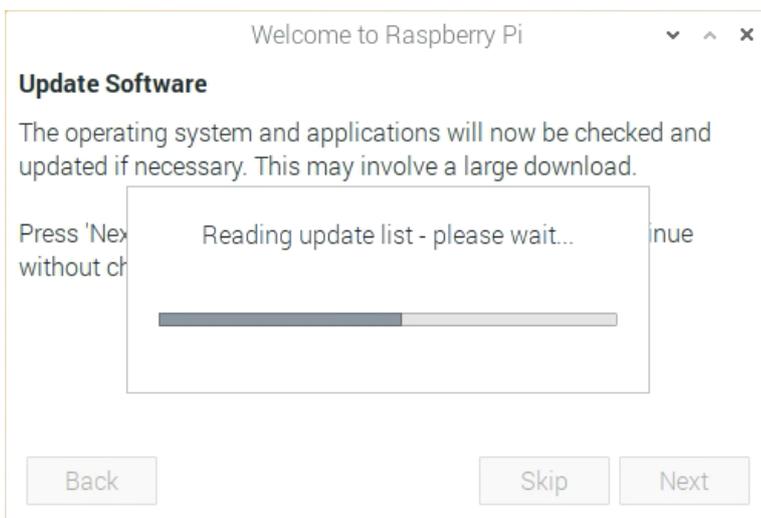
● Click Restart to complete the system update.



## 2.3.2 Raspberry Pi OS (Lite)

If you use the system image provided by us, after the system starts, you will automatically log in with the user name pi, and the default password is raspberry.



If you use the official system image, and the image is not configured before burning, the configuration window will appear when you start it for the first time. You need to configure the keyboard layout, set the user name and the corresponding password.

● Set the configuration keyboard layout
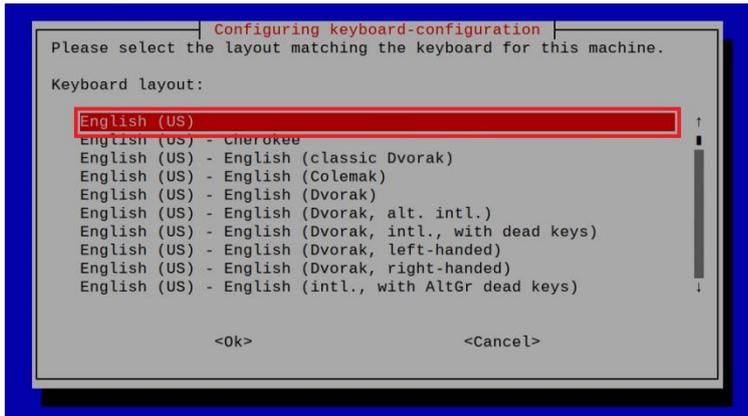
● Creat new user name
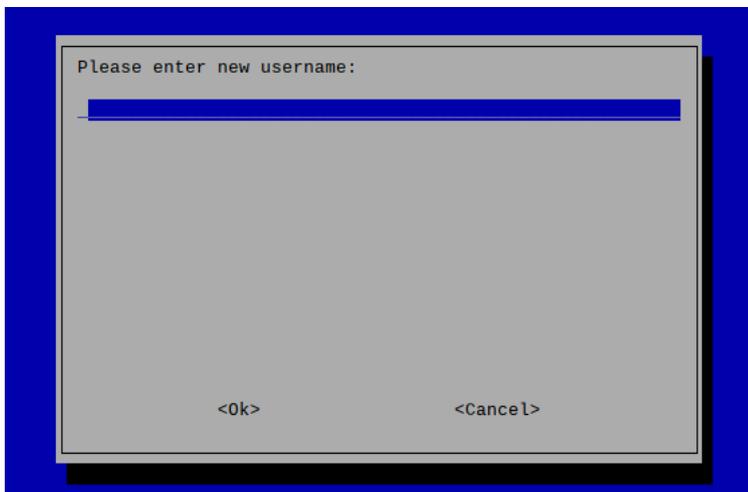


Then set the password corresponding to the user according to the prompt, and enter the password again for confirmation. At this point, you can log in with the user name and password you just set.

## 2.3.3 Use SSH

All the images we provide have turned on the SSH function. If you use the official image, you need to turn on the SSH function.

### 2.3.3.1 Use raspi-config Enable SSH

```
sudo raspi-config
```

1. Choose 3 Interface Options
2. Choose I2 SSH
3. Would you like the SSH server to be enabled? Select Yes
4. Choose Finish

### 2.3.3.2 Add Empty File To Enable SSH

Put an empty file named ssh in the boot partition, and the SSH function will be automatically enabled after the device is powered on.

## 2.3.4 Get The Device IP

- If the display screen is connected, you can use the ifconfig command to find the current device IP.
- If there is no display screen, you can view the assigned IP through the router.
- If there is no display screen, you can download the nmap tool to scan the IP under the current network.

  Nmap supports Linux, macOS, Windows and other platforms. If you want to use nmap to scan the network segments from 192.168.3.0 to 255, you can use the following command：

  ```
  nmap -sn 192.168.3.0/24
  ```

  After waiting for a period of time, the result will be output.

  ```
  Starting Nmap 7.92 ( https://nmap.org ) at 2022-12-30 21:19 中国标准时间
  Nmap scan report for 192.168.3.1 (192.168.3.1)
  Host is up (0.0010s latency).
  MAC Address: XX:XX:XX:XX:XX:XX (Phicomm (Shanghai))
  Nmap scan report for DESKTOP-FGEOUUK.lan (192.168.3.33)
  Host is up (0.0029s latency).
  MAC Address: XX:XX:XX:XX:XX:XX (Dell)
  Nmap scan report for 192.168.3.66 (192.168.3.66)
  Host is up.
  Nmap done: 256 IP addresses (3 hosts up) scanned in 11.36 seconds
  ```

# 3 Wiring Guide

## 3.1 Panel I/O

### 3.1.1 ADC

Taking ADC1 as an example, the wiring diagram of analog signal input is as follows:
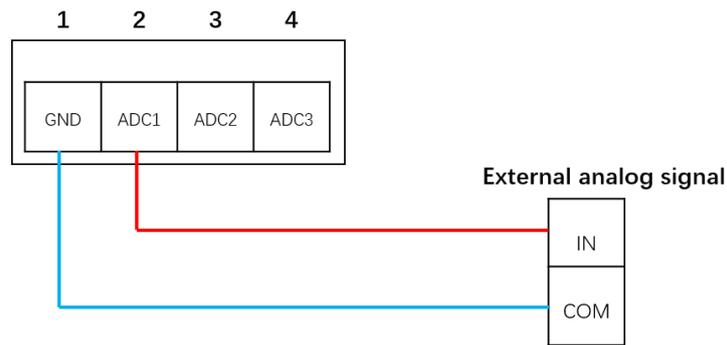
## 3.1.2 DI

CM4 Industrial has two channels of digital input detection with isolation. There are only two states of digital input: high level and low level. There are two connection methods for digital input signals, namely dry contact (passive) connection and wet contact (active) connection.

The digital signal input equivalent circuit is shown in the following figure:
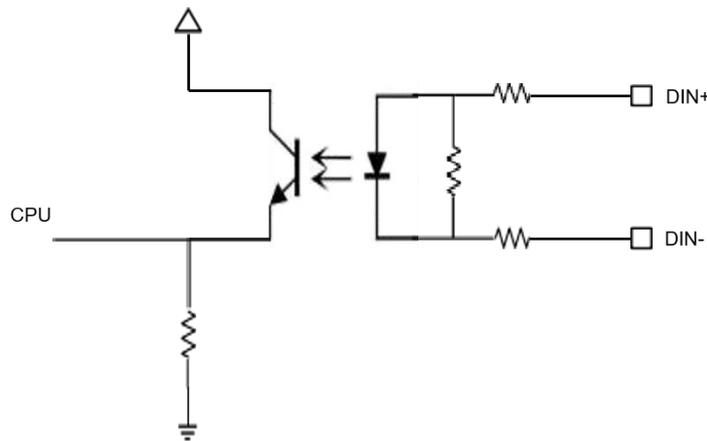


### 3.1.2.1   Wet Contact

The connection mode of wet contact needs external power supply, the input is active signal, the positive electrode is connected to the DIN+ port of equipment, and the negative electrode is connected to the DIN- port of equipment. When DIN+ and DIN- are connected and the level signal is greater than 3V, the internal optical coupler of DI port is connected, that is, the module considers the input signal as low level; when DIN+ and DIN- are disconnected, the internal optical coupler of DI port is connected, that is, the module considers the input signal as high level.
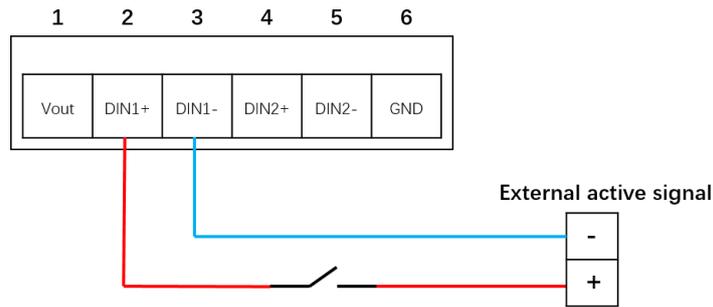
In the field of industrial control, three wire PNP type and NPN type sensors are the most common. Among the three wires, usually brown represents the positive electrode (VCC), blue represents the negative electrode (GND), and black represents the signal output terminal (OUT).

PNP type sensors are also known as source input mode sensors. When a signal is triggered, the OUT signal terminal outputs a high level.

The connection diagram of PNP type sensor is as follows.
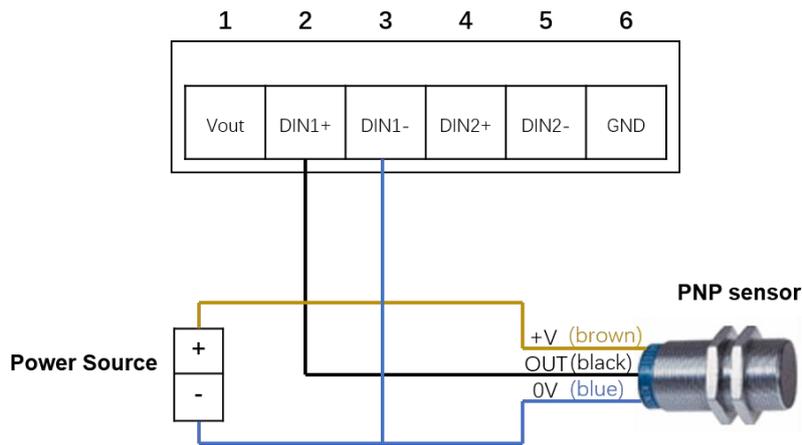


If you do not use an external power supply to power the sensor, you can use the Vout provided by CM4 Industrial for power supply. The connection diagram for PNP type sensors using Vout power supply is as follows:



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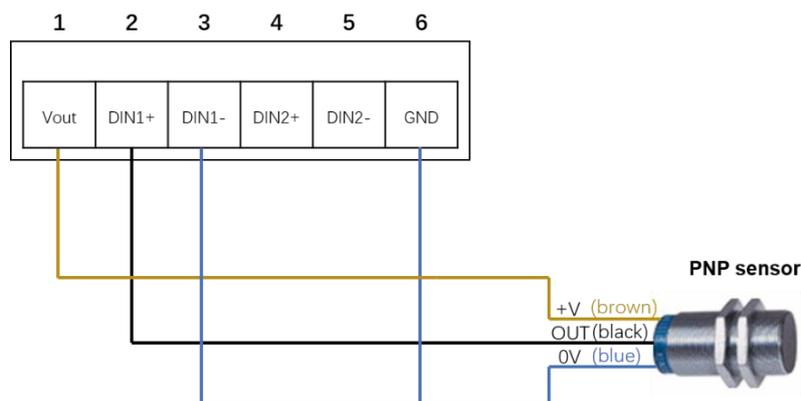
**WARN: Vout can only provide 12V power output.**

NPN type sensors are also known as sinking input mode sensors. When a signal is triggered, the OUT signal terminal outputs a low level.

The connection diagram of NPN type sensor is as follows.
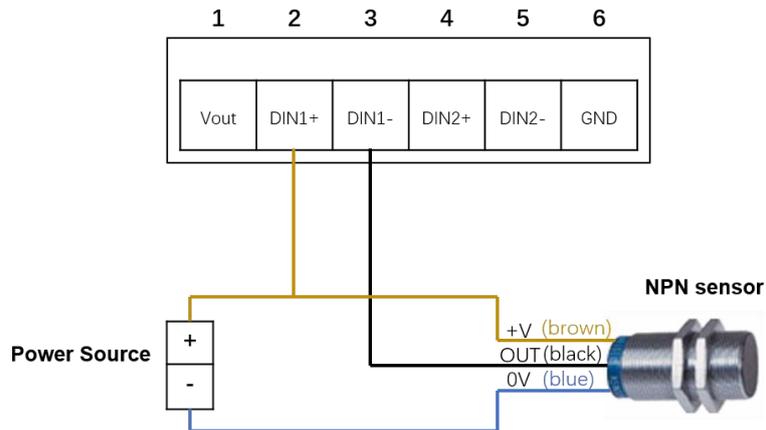


If you do not use an external power supply to power the sensor, you can use the Vout provided by CM4 Industrial for power supply. The connection diagram for NPN type sensors using Vout power supply is as follows:
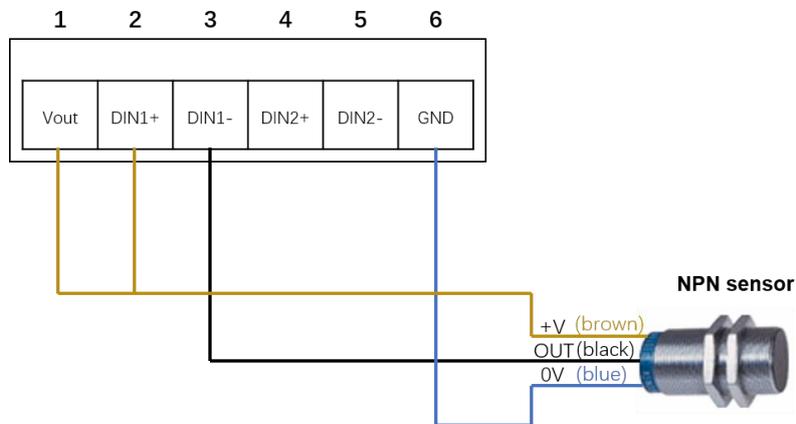


**WARN: Vout can only provide 12V power output.**

### 3.1.2.2 Dry Contact

The input signal of dry contact connection mode is passive switching signal. The change of input state can be detected by disconnecting or shorting the DI and COM port.

| 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
| Vout | DIN1+ | DIN1- | DIN2+ | DIN2- | GND |
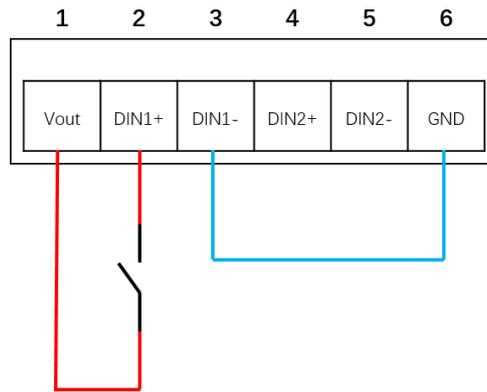
### 3.1.3 Relay

Relay output interfaces NC, COM and NO correspond to normally closed, common interface and normally open relay respectively. The relay on board CM4 Industrial is a double-pole, double-throw relay. When the control relay is closed, NO1 and NO2 are closed relative to COM1 and COM2, and when the control relay is bounced off, NO1 and NO2 are open relative to COM1 and COM2.
Taking external DC load as an example, the wiring diagram of relay is as follows:

| 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
| NC2 | COM2 | NO2 | NC1 | COM1 | NO1 |

**Power source**

+

-

+ **External load** -
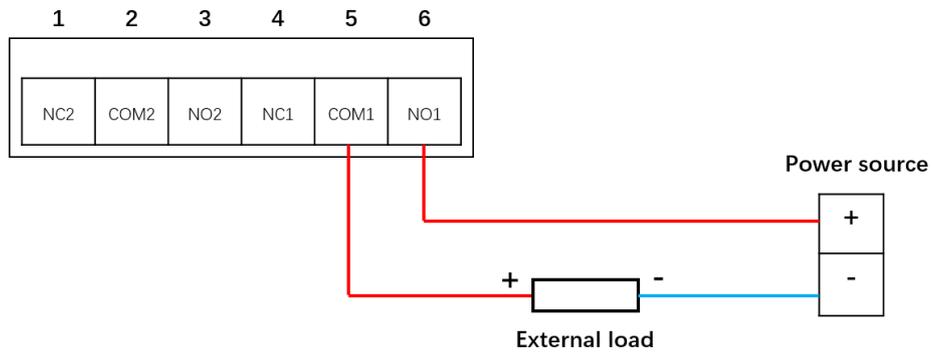
### 3.1.4 RS232

CM4 Industrial has a serial port with standard RS232.

The wiring diagram of RS232 serial port is as follows:

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External RS232

| Pin# | Signal |
|------|--------|
| 2 | RX |
| 3 | TX |
| 5 | GND |
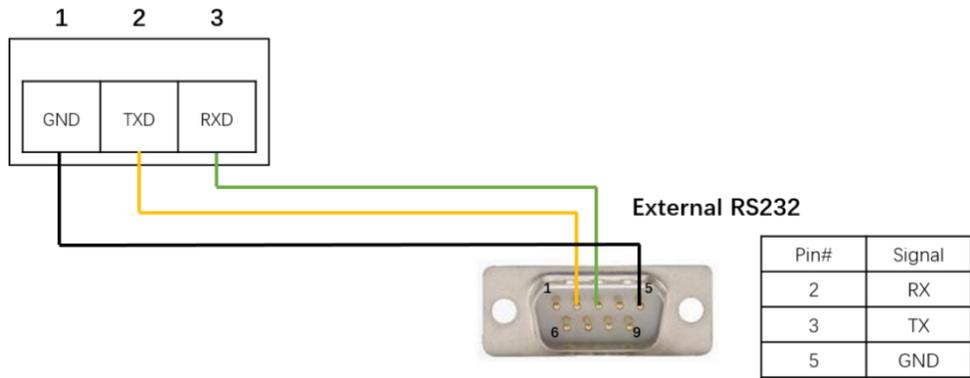
## 3.1.5 RS485

CM4 Industrial has two RS485 channels.

Taking RS485-1 interface as an example, the wiring diagram is as follows:
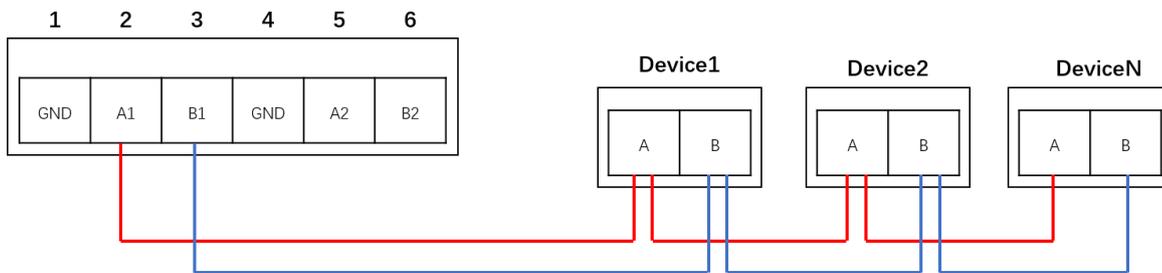


## 3.1.6 micro-SD Card

There is a micro SD card slot on CM4 Industrial. Please insert the micro SD card face up into the micro SD card slot.
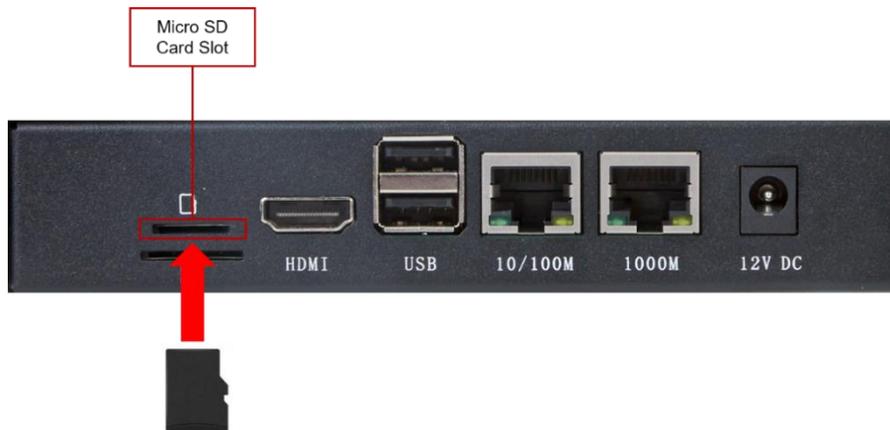


## 3.1.7 SIM Card

CM4 Industrial uses standard SIM card, please insert the chip end of the SIM card into the SIM card slot.
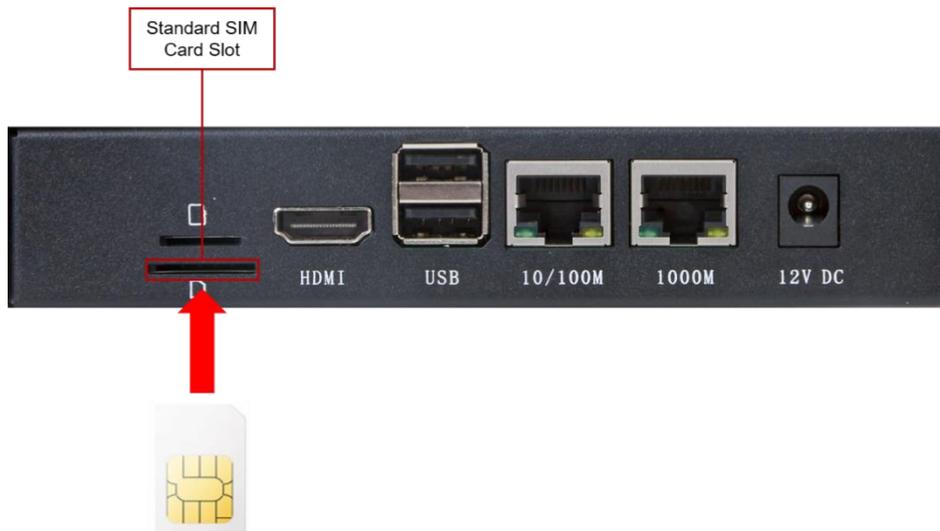


## 3.2 Internal I/O

### 3.2.1 DSI

The DSI interface should be connected with a single-sided FPC cable with a spacing of 15pin 1mm, with the metal contact face up and inserted in the direction perpendicular to the FPC connector, as shown in the following figure.
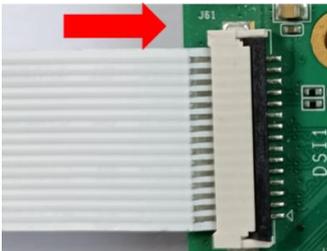


### 3.2.2 CSI

Please connect the CSI interface with a single-sided FPC cable with a spacing of 15pin 1mm, and insert the metal contact face up in the direction perpendicular to the FPC connector, as shown in the following figure.
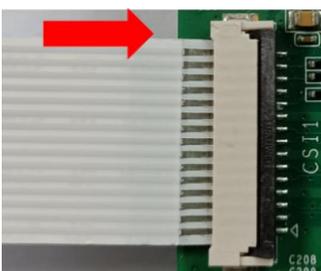
# 4 Software Operation Guide

## 4.1 USB 2.0

### 4.1.1 Check USB Device Information

List USB device

```
lsusb
```

The information displayed is as follows:

```
Bus 002 Device 001: ID 1d6b:0003 Linux Foundation 3.0 root hub
Bus 001 Device 005: ID 1a2c:2d23 China Resource Semico Co., Ltd Keyboard
Bus 001 Device 004: ID 30fa:0300    USB OPTICAL MOUSE
Bus 001 Device 003: ID 0424:9e00 Microchip Technology, Inc. (formerly SMSC)
LAN9500A/LAN9500Ai
Bus 001 Device 002: ID 1a40:0201 Terminus Technology Inc. FE 2.1 7-port Hub
Bus 001 Device 001: ID 1d6b:0002 Linux Foundation 2.0 root hub
```

### 4.1.2 USB Storage Device Mounting

You can connect an external hard disk, SSD or USB stick to any USB port on Raspberry Pi and mount the file system to access the data stored on it.

By default, your Raspberry Pi will automatically mount some popular file systems, such as FAT, NTFS and HFS+, in the location of /media/pi/HARD-DRIVE-LABEL.

In general, you can directly use the following commands to mount or unmount external storage devices.

```
lsblk

NAME            MAJ:MIN RM   SIZE RO TYPE MOUNTPOINT
sda             8:0      1 29.1G   0 disk
 └─sda1          8:1      1 29.1G   0 part
mmcblk0        179:0      0 59.5G   0 disk
 ├──mmcblk0p1 179:1      0   256M   0 part /boot
 └──mmcblk0p2 179:2      0 59.2G   0 part /
```

Use the mount command to mount sda1 to the /mnt directory. After the mount is completed, users can directly operate storage devices in the /mnt directory.

```
sudo mount /dev/sda1 /mnt
```

After using, use the command umount to uninstall the storage device.

```
sudo umount /mnt
```

### 4.1.2.1 Mount

You can install the storage device in a specific folder location. It is usually done in the /mnt folder, such as /mnt/mydisk. Please note that the folder must be empty.

1. Insert the storage device into the USB port on the device.

2. Use the following command to list all disk partitions on Raspberry Pi:
   ```
   sudo lsblk -o UUID,NAME,FSTYPE,SIZE,MOUNTPOINT,LABEL,MODEL
   ```
   Raspberry Pi uses mount points/and /boot. Your storage device will appear in this list, along with any other connected storage devices.

3. Use the Size, Label and Model columns to identify the name of the disk partition that points to your storage device. For example, sda1.

4. The FSTYPE column contains file system types. If your storage device uses the exFAT file system, please install the exFAT driver:
   ```
   sudo apt update
   sudo apt install exfat-fuse
   ```

5. If your storage device uses NTFS file system, you will have read-only access to it. If you want to write to the device, you can install the ntfs-3g driver:
   ```
   sudo apt update
   sudo apt install ntfs-3g
   ```

6. Run the following command to get the location of the disk partition:
   ```
   sudo blkid
   ```
   like, /dev/sda1

7. Create a target folder as the mount point of the storage device. The mount point name used in this example is mydisk. You can specify a name of your choice:
   ```
   sudo mkdir /mnt/mydisk
   ```

8. Mount the storage device at the mount point you created:
   ```
   sudo mount /dev/sda1 /mnt/mydisk
   ```

9. Verify that the storage device has been successfully mounted by listing the following:
   ```
   ls /mnt/mydisk
   ```

**WARN：If there is no desktop system, external storage devices will not be automatically mounted.**

### 4.1.2.2 Unmount

When the device is turned off, the system will unmount the storage device so that it can be pulled out safely. If you want to uninstall the device manually, you can use the following command:

```
sudo umount /mnt/mydisk
```

If you receive a "destination busy" error, it means that the storage device has not been unmounted. If no

error is displayed, you can safely unplug the device now.

### 4.1.2.3 Set Up Automatic Mount In The Command Line

You can modify the fstab setting to mount automatically.

1. First, you need to get the disk UUID.

   ```
   sudo blkid
   ```

2. Find the UUID of the mounted device, such as 5C24-1453.

3. Open the fstab file

   ```
   sudo nano /etc/fstab
   UUID=5C24-1453 /mnt/mydisk fstype defaults,auto,users,rw,nofail 0 0
   ```

   Replace fstype with the type of your file system, which you can find in step 2 of "Mounting storage devices" above, for example, ntfs.

4. If the file system type is FAT or NTFS, adding umask = 000 immediately after nofail will allow all users full read/write access to every file on the storage device.

Can use man fstab to learn more information about fstab.

## 4.2 Ethernet Configuration

### 4.2.1 Gigabit Ethernet

There is an adaptive 10/100/1000Mbsp Ethernet interface on CM4 Industrial, which is adjacent to the DC power socket. It is recommended to use Cat6 (Category 6) network cable to cooperate with it. By default, the system uses DHCP to automatically obtain IP.

### 4.2.2 100 Gigabit Ethernet

CM4 Industrial also has an adaptive 10/100Mbsp Ethernet interface, with screen printing logo: 10/100, which is adjacent to the USB Type-A double-layer socket and is extended by USB 2.0.

**WARN：If we use our factory image, this hardware function is available. If we use the official image, we need to install BSP according to our BSP package. Please refer to the chapter "Install BSP Online Based On The Original Raspberry Pi OS".**

When the product leaves the factory, the MAC address has been burned for 100 Mbps Ethernet. If the customer wants to burn his own MAC address, we provide a burning script, which can be operated by yourself.

```
git clone https://gist.github.com/8c5c05e1bf22eff4e6ea76ae429f377a.git lan-utils
cd lan-utils
./lan9500-mac-addr-set.sh
```

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```
Usage:   { prog addr | read | erase }
```

- read MAC address

```
sudo ./lan9500-mac-addr-set.sh read
```

- erase

```
sudo ./lan9500-mac-addr-set.sh read
```

- burn MAC address and restart takes effect

```
sudo ./lan9500-mac-addr-set.sh prog aa:bb:cc:dd:ee:ff

Program MAC address: aa:bb:cc:dd:ee:ff...... OK

sudo reboot
```

### 4.2.3  Using The Network Manager To Configure

If you use the desktop image, it is recommended to install the NetworkManager plug-in network-manager-gnome. After installation, you can directly configure the network through the desktop icon.

```
sudo apt update
sudo apt install network-manager-gnome
sudo reboot
```

**NOTE: If use our factory image, the network-manager tool and the network-manager-gnome plug-in are installed by default.**
**NOTE: If use our factory image, the NetworkManager service is automatically started and the dhcpcd service is disabled by default.**

After the installation is completed, you will see the NetworkManager icon in the status bar of the system desktop. 。

Right-click the NetworkManager icon and select Edit Connections。
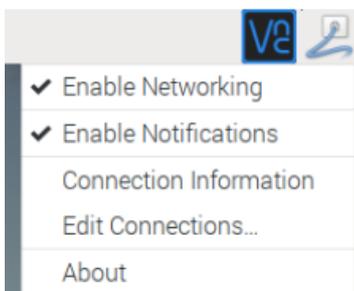


Select the connection name to modify, and then click the gear below.
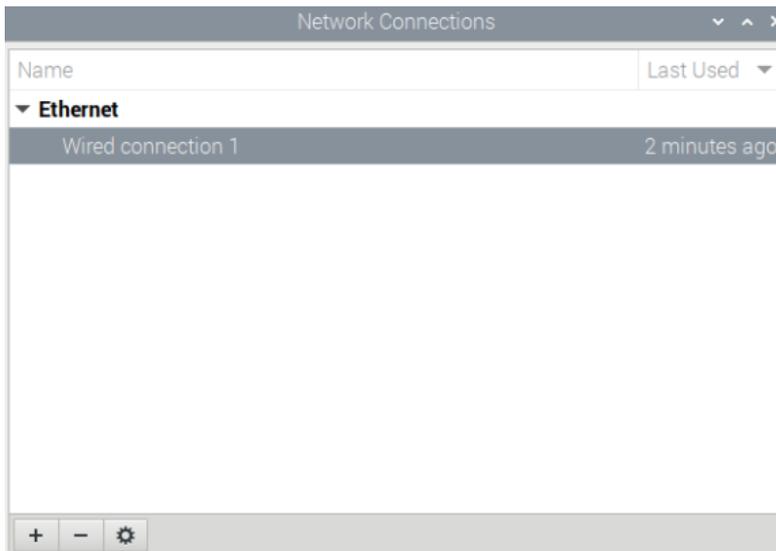
Switch to the configuration page of IPv4 Settings. If you want to set static IP, the Method selects Manual, and Addresses the IP you want to configure. If you want to set it as dynamic IP acquisition, just configure the Method as Automatic(DHCP) and restart the device.
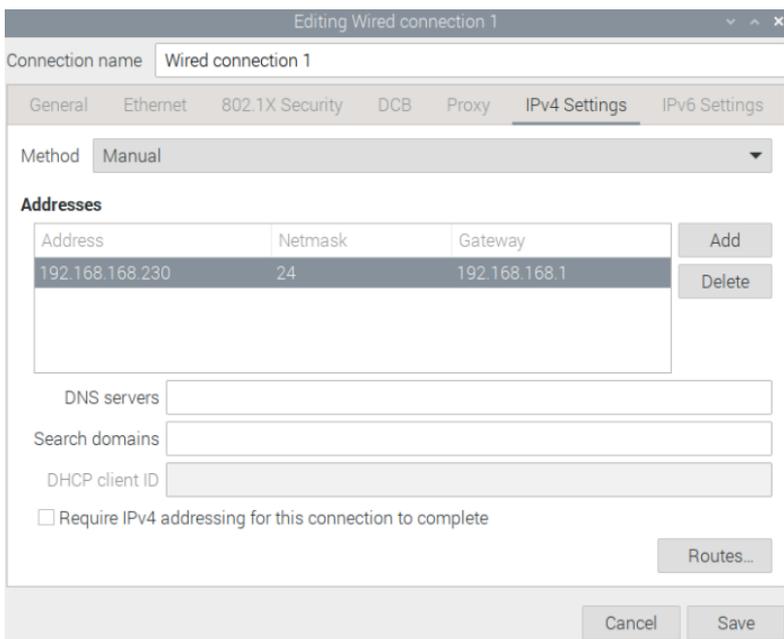


If you use the Lite version of the system, you can configure it through the command line.

If you want to use the command to set the static IP for the device, you can refer to the following methods.
 set the static IP

```
sudo nmcli connection modify <name> ipv4.addresses 192.168.1.101/24 ipv4.method manual
```

set the gateway

```
sudo nmcli connection modify <name> ipv4.gateway 192.168.1.1
```

Set dynamic IP acquisition

```
sudo nmcli connection modify <name> ipv4.method auto
```

## 4.2.4 Configuration With dhcpcd Tool

The official system of Raspberry Pi uses dhcpcd as the network management tool by default.

If you use the factory image provided by us and want to switch from NetworkManager to dhcpcd network management tool, you need to stop and disable NetworkManager service and enable dhcpcd service first.

```
sudo systemctl stop NetworkManager
sudo systemctl disable NetworkManager
sudo systemctl enable dhcpcd
sudo reboot
```

The dhcpcd tool can be used after the system is restarted.

Static IP can be set by modifying/etc/dhcpcd.conf. For example, eth0 can be set, and users can set wlan0 and other network interfaces according to their different needs.

```
interface eth0
static ip_address=192.168.0.10/24
static routers=192.168.0.1
static domain_name_servers=192.168.0.1 8.8.8.8 fd51:42f8:caae:d92e::1
```

## 4.3 WiFi

Customers can purchase CM4 Industrial with WiFi version, which supports 2.4 GHz and 5.0 GHz IEEE 802.11 b/g/n/ac dual-band WiFi. We provide dual-band external antenna, which has passed wireless authentication together with Raspberry Pi CM4.

## 4.3.1 Enable WiFi

The WiFi function is blocked by default, so you need to set the country region before you can use it. If you use the desktop version of the system, please refer to the chapter: Initialization Settings Configure WiFi. If you use the Lite version of the system, please use raspi-config to set the WiFi country area. Please refer to the documentation.："Raspberry Pi official documents - Using the Command Line"

#### 4.3.1.1　Configure Using The Network Manager Tool.

After installing the desktop plug-in, you can directly connect to the WIFI network through the desktop icon.

You can also use the command line to execute the following commands:

Scan WIFI

```
sudo nmcli device wifi
```

Connect WIFI with password.

```
sudo nmcli device wifi connect <SSID> password <password>
```

Set up WIFI automatic connection

```
sudo nmcli connection modify <name> connection.autoconnect yes
```

#### 4.3.1.2　Configure Using The dhcpcd Tool

The official system of Raspberry Pi uses dhcpcd as the network management tool by default.

```
sudo raspi-config
```

1. Choose 1 System Options
2. Choose S1 Wireless LAN
3. Choose your country in Select the country in which the Pi is to be used ，than choose OK，This prompt only appears when setting up WIFI for the first time.
4. Please enter SSID，input WIFI SSID
5. Please enter passphrase. Leave it empty if none，input password than restart the device

## 4.3.2 External Antenna and Internal PCB Antenna

You can switch whether to use an external antenna or a built-in PCB antenna through software configuration. Considering compatibility and widest support, the factory default system is the built-in PCB antenna. If the customer chooses a complete machine with a case and equipped with an external antenna, you can switch by the following operations:

Edit /boot/config.txt

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

Choose external add

```
dtparam=ant2
```

Than reboot the device to take effect.

### 4.3.3 AP and Bridge Mode

WiFi on CM4 Industrial also supports configuration in AP router mode, bridge mode or mixed mode.

Please refer to the open source project github: garywill/linux-router to learn how to configure it.

## 4.4 Bluetooth

CM4 Industrial can choose whether the Bluetooth function is integrated. If it is, this function is turned on by default.

Bluetoothctl can be used to scan, pair and connect Bluetooth devices. Please refer to the ArchLinux-Wiki-Bluetooth guide to configure and use Bluetooth.

### 4.4.1 Usage

Scan：
```
bluetoothctl scan on/off
```

Find：
```
bluetoothctl discoverable on/off
```

Trust device：
```
bluetoothctl trust [MAC]
```

Connect device：
```
bluetoothctl connect [MAC]
```

Disconnect device：
```
bluetoothctl disconnect [MAC]
```

### 4.4.2 Example

Into bluetootch shell
```
sudo bluetoothctl
```

Enable Bluetooth
```
power on
```

Scan device
```
scan on
```

```
Discovery started
[CHG] Controller B8:27:EB:85:04:8B Discovering: yes
[NEW] Device 4A:39:CF:30:B3:11 4A-39-CF-30-B3-11
```

Find the name of the turned-on Bluetooth device, where the name of the turned-on Bluetooth device is test.

```
devices

Device 6A:7F:60:69:8B:79 6A-7F-60-69-8B-79
Device 67:64:5A:A3:2C:A2 67-64-5A-A3-2C-A2
Device 56:6A:59:B0:1C:D1 Lefun
Device 34:12:F9:91:FF:68 test
```

Pair device
```
pair 34:12:F9:91:FF:68
Attempting to pair with 34:12:F9:91:FF:68
[CHG] Device 34:12:F9:91:FF:68 ServicesResolved: yes
[CHG] Device 34:12:F9:91:FF:68 Paired: yes
Pairing successful
```

Add as trusted device
```
trust 34:12:F9:91:FF:68
[CHG] Device 34:12:F9:91:FF:68 Trusted: yes
Changing 34:12:F9:91:FF:68 trust succeeded
```

# 4.5  4G LTE

CM4 Industrial supports 4G networks. If you choose products with 4G modules, we have configured the mobile EC20 full netcom 4G module in China, which supports mobile, Unicom and telecom network standards. The 4G module is extended by USB 2.0, and supports one Standard-SIM card.

### 4.5.1.1  Configure Using The Network Manager Tool.

To connect to the 4G network, you need to create a gsm network connection first. The following connections are created according to different configuration requirements.

● There is no need to configure APN and other configurations.
```
sudo nmcli connection add type gsm con-name <connection_name>
```
For example, create a gsm network called mobilegsm.
```
sudo nmcli connection add type gsm con-name mobilegsm
```

● APN needs to be configured.
```
sudo nmcli connection add type gsm con-name <connection_name> ifname cdc-wdm0 gsm.apn
"cmnet"
```

- configure username and password

```
sudo nmcli connection add type gsm con-name <connection_name> ifname cdc-wdm0 gsm.number
"#777" gsm.username "ctnet@mycdma.cn" gsm.password "vnet.mobi"
```

- Generally, China Mobile Unicom can dial successfully by using the first method. If problems are found, you can also try the following command.

```
# China Mobile
sudo nmcli connection add type gsm con-name "mobile" ifname cdc-wdm0 gsm.number "*98*1#"
gsm.apn "cmnet"
```

```
# China Unicom
sudo nmcli connection add type gsm con-name "Unicom" ifname cdc-wdm0 gsm.number "*99#"
gsm.apn "3gnet"
```

```
# China Telecom
sudo nmcli connection add type gsm con-name "Telecom" ifname cdc-wdm0 gsm.number "#777"
gsm.username "ctnet@mycdma.cn" gsm.password "vnet.mobi"
```

### 4.5.1.2    Configure Using dhcpcd

Before using 4G, we need to add our APT library first. All the images given by our company have been added with this library, so users don't need to add it manually.

```
sudo apt update
sudo apt install ed-ec20-qmi
```

Automatic dialing is not started by default. If users want to start automatic dialing, they need to enable LTE lte-reconnect.service service.

```
sudo systemctl enable lte-reconnect.service
sudo systemctl start lte-reconnect.service
```

After successful dialing, you can use the ifconfig command to see the wwan0 network port.

If you need to set APN additionally, you need to modify the dialing command in/usr/share/ed-ec20-qmi/LTE-reconnect.sh.$BSP_HOME_PATH/quectel-CM -4 -f $LOGFILE &
The quectel-CM dialing configuration information is as follows:

```
$BSP_HOME_PATH/quectel-CM -4 -f $LOGFILE -s <APN> &
```

Restart lte-reconnect.service after setting.

```
sudo systemctl restart lte-reconnect.service
```

# 4.6  RTC

CM4 Industrial is integrated with RTC. For the version sold in China, we will install CR1220 button cell (RTC backup power supply) by default when shipping. In this way, the system can be guaranteed to have an uninterrupted and reliable clock, which is not affected by factors such as equipment power

down.

The default shipping system image will integrate the RTC automatic synchronization service we wrote, so guests can automatically synchronize the clock without setting it, and can use RTC without feeling. The general principle is:

- When the system is turned on, the service automatically reads the saved time from RTC and synchronizes it to the system time.
- If there is an Internet connection, the system will automatically synchronize the time from the NTP server and update the local system time with Internet time.
- When the system is shut down, the service automatically writes the system time into RTC and updates the RTC time.
- Because of the installation of button cell, although CM4 Industrial is powered off, RTC is still working and timing.

In this way, we can ensure that our time is accurate and reliable.

**WARN：If it is the first time to boot, because there is no effective time in RTC, synchronization may fail, so just restart it directly. When rebooting, the system time will be written into RTC for normal use.**

**If you don't want to use this service, you can turn it off manually:**
```
sudo systemctl disable rtc
sudo reboot
```

**Re-enable this service:**
```
sudo systemctl enable rtc
sudo reboot
```

**Read RTC manually:**
```
sudo hwclock -r
2022-11-09 07:07:30.478488+00:00
```

**Manually synchronize RTC time to the system:**
```
sudo hwclock -s
```

**Write the system time into RTC**
```
sudo hwclock -w
```

**Trouble Shooting**
Please first check whether there is an rtc device (/dev/rtc0) mount:
```
ls /dev/rtc0
```

If not, maybe you used the official standard system, but didn't install our BSP package. Please refer to

the chapter [Install BSP Online Based On The Original Raspberry Pi OS](#) to install BSP. In addition, you also need to install ed-rtc package to enable RTC automatic synchronization.

Other possible checkpoints:
- Is CR1220 button cell installed?
- NTP network time protocol, you need to connect to the Internet to synchronize the time automatically, and you need to open the port (UDP, 123), otherwise the synchronization will fail.

# 4.7 Button

## 4.7.1 Reset Button

The reset button is connected to the RUN_PG pin of the CM4 chip. When the pin is pulled low, the CM4 module will be reset. When the reset button is pressed, the RUN_PG pin will be pulled low, thus resetting the CM4 Industrial equipment.

## 4.7.2 User Button

User-defined buttons are screen-printed on the shell as user, which is connected to the GPIO6 pin of CM4 chip. By default, it is at high level, and when the button is pressed, the pin is at low level.

We use the raspi-gpio command to test, and query the GPIO6 pin when the key is not pressed.
```
raspi-gpio get 6
GPIO 6: level=1 fsel=0 func=INPUT pull=UP
```
A level of 1 indicates that the GPIO6 pin is high.

When the key is pressed, query the GPIO6 pin.
```
raspi-gpio get 6
GPIO 6: level=0 fsel=0 func=INPUT pull=UP
```
A level of 0 indicates that the GPIO6 pin is low.

# 4.8 LED Indication

CM4 Industrial has two indicator lights, the red LED is connected with the LED_PI_nPWR pin of CM4, which is the power indicator light, and the green LED is connected with the LED_PI_nACTIVITY pin of CM4, which is the running status indicator light.

# 4.9 Buzzer

CM4 Industrial buzzer control pin is GPIO25.

open buzzer
```
sudo raspi-gpio set 25 op dh
```
Op means set to output, dh means pin is high.

close buzzer
```
sudo raspi-gpio set 25 op dl
```
Op means set to output, and dl means pin is low.

## 4.10  SPI Flash

CM4 Industrial has extended a piece of SPI Flash, 32Mbits, that is, 4MByte, for guests to store data, etc. On Linux, serial Flash is recognized as MTD(Memory Technology Device) device, and on CM4 Industrial, the device file of this Flash is /dev/mtd0.

**NOTE：MTD devices are different from our common Block devices such as hard disk, SD card, U-disk and EMMC. The typical difference is that MTD devices need to perform Erase operation, and the Sector of Erase is usually larger than the Page of the writing unit. Block devices usually have device hardware processing, and there is no difference between writing and erasing on the Host side. We usually use JFFS2 file system to manage MTD devices, not ext4.**

**WARN：If the guest uses the image provided by us, this function is turned on by default. If the official image is used, the BSP should be installed according to our BSP package. Please refer to the chapter Install BSP Online Based On The Original Raspberry Pi OS.**

Install mtd-utils tool to manage Flash devices
```
sudo apt update
sudo apt install mtd-utils
```

First time to use, or you need to' format', please Erase the whole Flash device.
```
sudo flash_erase /dev/mtd0 0 0
```

Mount as JFFS2 type, read and write.
```
sudo mount -t jffs2 /dev/mtd0 /mnt
```

After mounting, you can read and write the /mnt directory to read and write Flash devices.

## 4.11  Serial Communication

## 4.11.1 Install picocom Tool

Picocom serial terminal can be debugged conveniently in Linux environment.

First install picocom

```
sudo apt-get install picocom
```

After opening the corresponding serial port with picocom, you can type Ctrl+a and then Ctrl+h to see the available commands.

```
*** Picocom commands (all prefixed by [C-a])

*** [C-x] : Exit picocom
*** [C-q] : Exit without reseting serial port
*** [C-b] : Set baudrate
*** [C-u] : Increase baudrate (baud-up)
*** [C-d] : Decrease baudrate (baud-down)
*** [C-i] : Change number of databits
*** [C-j] : Change number of stopbits
*** [C-f] : Change flow-control mode
*** [C-y] : Change parity mode
*** [C-p] : Pulse DTR
*** [C-t] : Toggle DTR
*** [C-g] : Toggle RTS
*** [C-|] : Send break
*** [C-c] : Toggle local echo
*** [C-w] : Write hex
*** [C-s] : Send file
*** [C-r] : Receive file
*** [C-v] : Show port settings
*** [C-h] : Show this message
```

Type Ctrl+a first, then Ctrl+c to switch the local echo mode.
Type Ctrl+a first, then Ctrl+q to exit picocom.

## 4.11.2 RS232

Connect the RS232 serial port of CM4 Industrial with the RS232 serial port of external equipment.

The RS232 serial port of CM4 Industrial corresponds to the device file /dev/ttyAMA3.
Execute the following instructions to open the serial port and configure the baud rate to 115200.

```
picocom -b 115200 /dev/ttyAMA3
```

Then, you can enter some data, which will be received by RS232 at the other end.

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### 4.11.3 RS485

Connect the RS485 serial port of CM4 Industrial with the RS485 serial port of external device.

The device file corresponding to CM4 Industrial RS485-1 is /dev/ttyAMA2
Execute the following instructions to open the serial port and configure the baud rate to 115200.

```
picocom -b 115200 /dev/ttyAMA2
```

CM4 Industrial RS485-2 corresponding devicefile is /dev/ttyAMA1
Execute the following instructions to open the serial port and configure the baud rate to 115200.

```
picocom -b 115200 /dev/ttyAMA1
```

Then, you can enter some data, which will be received by RS485 at the other end.

### 4.11.4 Debug UART

Debugging serial interface J58, screen printing name UART0, TTL level serial port.

To enable debugging serial port, you need to modify the config.txt configuration file.

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

Add at the end

```
[all]
enable_uart=1
```

The default baud rate of debugging serial port is 115200. You can check the current baud rate of debugging serial port through cmdline.txt file.

```
sudo nano /boot/cmdline.txt
```

## 4.12  ADC

ADC driver is supported by using CM4 Industrial factory image. If you use the official image of Raspberry Pi, please refer to Install BSP Online Based On The Original Raspberry Pi OS.

There are 3 ADC channels on CM4 Industrial. Take AIN1 as an example to demonstrate how to read them:

```
cd /sys/bus/iio/devices
cd iio\:device0

cat in_voltage1_raw
```

## 4.13 DI

CM4 Industrial's 2-way DIN is connected with GPIO11 and GPIO26 of cm4 after optical coupler isolation. The default wiring method of the equipment is wet contact (active) wiring, DIN+ is connected to the positive pole of external power supply, and DIN- is connected to the negative pole of external power supply.

DIN1 corresponds to GPIO11, and use raspi-gpio command to check the pin status of GPIO11.

```
raspi-gpio get 11
```

When DIN1+ and DIN1- are disconnected:

```
GPIO 11: level=1 fsel=0 func=INPUT pull=DOWN
```

When DIN1+ and DIN1- are connected:

```
GPIO 11: level=0 fsel=0 func=INPUT pull=DOWN
```

DIN2 corresponds to GPIO26, and use raspi-gpio command to check the pin status of GPIO26.

```
raspi-gpio get 26
```

When DIN2+ and DIN2- are disconnected:

```
GPIO 26: level=1 fsel=0 func=INPUT pull=DOWN
```

When DIN1+ and DIN1- are connected:

```
GPIO 26: level=0 fsel=0 func=INPUT pull=DOWN
```

## 4.14 Relay

CM4 Industrial has a double-pole double-throw relay on board, and its switch is controlled by the high and low level of GPIO22 pin. By default, it is normally closed, COM1 and NC1 are on, and COM2 and NC2 are on. When GPIO22 is high, the relay is turned on, COM1 and NO1 are turned on, and COM2 and NO2 are turned on.

open relay

```
sudo raspi-gpio set 22 op dh
```

Op means set to output, dh means pin is high.

close

```
sudo raspi-gpio set 22 op dl
```

Op means set to output, and dl means pin is low.

# 5 Operating System Installation

## 5.1 Image Download

Based on the latest official desktop and Lite of Raspberry OS, we installed the BSP support package in an integrated way, enabling the SSH service, and customers can burn it directly without installing the BSP package.

**NOTE：After 2022, the CM4 Industrial sold version is V1.3 and V1.4.**

**Release 2022-07-08**
Raspberry Pi OS, Debian bullseye(11), version: 2022-07-08

| Image | Download Link |
|---|---|
| Raspberry Pi OS with desktop, 32-bit | 2022-07-08-cm4ind11-armhf.zip |
| Raspberry Pi OS with desktop, 64-bit | 2022-07-08-cm4ind11-arm64.zip |
| Raspberry Pi OS Lite, 32-bit | 2022-07-08-cm4ind11-armhf-lite.zip |
| Raspberry Pi OS Lite, 64-bit | 2022-07-08-cm4ind11-arm64-lite.zip |

Image Download Link: https://1drv.ms/u/s!Au060HUAtEYBcfxSFUKWnOEZC6w?e=3bKmhu

## 5.2 eMMC Flash

EMMC burning is required only when CM4 is a non-Lite version.

- Download and install rpiboot_setup.exe
- Download and install Raspberry Pi Imager or   balenaEtcher

If the installed CM4 is a non-Lite version, the system will burn to eMMC:
- Open the upper cover of CM4 Industrial equipment.
- Connect the MicroUSB data cable with J73 interface (screen printed as USB PROGRAM).
- Start the rpiboot tool just installed on the Windows PC side, and the default path is C:\Program Files (x86)\Raspberry Pi\rpiboot.exe。
- When the CM4 Industrial is powered on, the CM4 eMMC will be recognized as a mass storage device.
- Use the image burning tool to burn your image to the identified mass storage device.

## 5.3 Install BSP Online Based On The Original Raspberry Pi OS

BSP package provides support for some hardware functions, such as SPI Flash, RTC, RS232, RS485, CSI, DSI, etc. Customers can use the image of our pre-installed BSP package or install the BSP package themselves.

We support installing and updating BSP through apt-get, which is as simple as installing some other software or tools.

1. First, download the GPG key and add our source list.

```
curl -sS https://apt.edatec.cn/pubkey.gpg | sudo apt-key add -
echo "deb https://apt.edatec.cn/raspbian stable main" | sudo tee /etc/apt/sources.list.d/edatec.list
```

2. Then, install the BSP package
CM4 Industrial hardware version V1.1 or V1.2 execution.

```
sudo apt update
sudo apt install raspberrypi-kernel raspberrypi-kernel-headers
sudo apt install ed-cm4ind-rev1p1-bsp ed-rtc
```

CM4 Industrial hardware version V1.3 or V1.4 execution.

```
sudo apt update
sudo apt install ed-cm4ind-rev1p3-bsp ed-rtc
```

3.Install the NetworkManager network management tool [optional]
NetworkManager tools can more easily configure routing rules and set priorities.

```
# If you use the Raspberry Pi OS Lite version system.
sudo apt install ed-networkmanager

# If you use a system with a desktop, we recommend that you install the plug-in ed-networkmanager-gnome.
sudo apt install ed-networkmanager-gnome
```

4.reboot

```
sudo reboot
```

# 6 FAQ

## 6.1 Default username and password

The default user name of our factory image is pi, and the default password is raspberry.

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# 7 About us

## 7.1 About EDATEC

EDATEC, located in Shanghai, is one of Raspberry Pi's global design partners. Our vision is to provide hardware solutions for Internet of Things, industrial control, automation, green energy and artificial intelligence based on Raspberry Pi technology platform.

We provide standard hardware solutions, customized design and manufacturing services to speed up the development and time to market of electronic products.

## 7.2 Contact us

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