Chipsee

Industrial PC

Raspberry Pi OS on Raspberry Pi CM5 User Manual

For Raspberry Pi CM5 Products

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Raspberry Pi OS

Chipsee CM5 Industrial PC

User Manual for Raspberry Pi OS

This is the software manual for Chipsee Raspberry Pi CM5 industrial PC. If you've never developed on this hardware with a Raspberry Pi OS, this manual can get you started quickly.

Supported Chipsee PCs: all Chipsee Raspberry Pi CM5 based industrial PCs, including but not limited to:

- PPC-CM5-050 (CS12720RA5050P)
- EPC-CM5-070 (CS10600RA5070E)
- PPC-CM5-070 (CS10600RA5070P)
- PPC-CM5-070-D (CS10600RA5070P-D)
- PPC-CM5-101 (CS12800RA5101P)
- PPC-CM5-133 (CS19108RA5133)
- PPC-CM5-150 (CS10768RA5150)
- PPC-CM5-156 (CS19108RA5156)
- PPC-CM5-170 (CS12102RA5170)
- PPC-CM5-190 (CS12102RA5190)
- PPC-CM5-215 (CS19108RA5215)
- PPC-CM5-236 (CS19108RA5236)
- CS-CM5-BOX (CSRA5BOX)

Not supported:

- AIO-CM5-101 (CS12800RA5101A)

- AIO-CM5-156 (CS19108RA5156A)

Prepare for Developing

To power on the Chipsee industrial PC, you need a power adapter; then you may want to connect to this PC from your laptop or computer. Let’s prepare some hardware and software.

Prepare the Hardware

Power Adapter:

- For products with a screen of 5” or 7” and BOX product, a power adapter between 9V ~ 30V DC output is required.
- For products with a screen of 10.1” or larger, you need a DC adapter with output between 15V ~ 30V.

For example, you can use a switching power DC adapter; or use a laptop adapter with proper voltage such as 18.5V, 19V etc when developing; or use a 12V power adapter from a used router for small screen products when developing.

To connect to the Chipsee industrial PC from your workstation, you can use:

1. A USB to serial cable (if you need serial debug, i.e. connect to RS232 serial debug port).
2. An Ethernet cable (if you want to SSH into the Chipsee industrial PC). You may also use WiFi if your Chipsee industrial PC supports WiFi, in this case you don’t need the Ethernet cable.
3. A USB type-C cable (if you want to flash a new OS).

If you use the CM5 Lite module which doesn’t have built-in eMMC storage, you also need one TF(Micro SD) card, 16GB at least, to boot your system.

Prepare the Software

Thanks to the Raspberry Pi OS, developing on a Chipsee industrial PC isn’t really different from developing on a normal Raspberry Pi (except for optical isolated GPIO, RS232/485 serial ports and other hardware resources which a Pi doesn’t have), you can use any developer software you’re comfortable with.

The software listed below are not mandatory, they’re recommendations because we find them easy to use:

1. To SSH into a Chipsee industrial PC, you may find **PuTTY** or **XShell** on Windows handy; for Linux and macOS users, a terminal app should come with your OS out of box, like **Terminal/iTerm2** on macOS and **xterm** on Linux.

2. To use a remote desktop, you can download **VNC Viewer** on your laptop or PC.
3. 7zip for firmware image decompression, you could use your workstation's stock unzip program as well.
4. You can use **BalenaEtcher** or the official **Raspberry Pi Imager** to flash OS to the machine.
5. `Rpiboot for Windows`, or Rpiboot for other platforms to let your host machine detect the Chipsee industrial Pi eMMC as a USB device.

> **Note**
>
> - In this documentation, all the commands are executed with `root` user privileges.

Connect to the Device

There are 3 ways to connect to the device from your workstation:

1. From **Serial** RS232 port
2. From **Ethernet** or **Wi-Fi** (SSH)
3. From **Ethernet** or **Wi-Fi** (Remote Desktop/VNC)

Let's take a look at these connecting methods one by one.

Connect From Serial Port

[Cheatsheet for experienced developers: username is **pi**, password is **raspberry**, pin is **RS232_0**]

Enable/Disable Serial Debug Port

By default serial debug is enabled, you don't have to do anything to use the RS232_0 as a serial debug port. If you need to disable the debug function for this port to use a normal serial function instead, you could edit the *`/boot/firmware/cmdline.txt`* file in the Raspberry Pi OS.

By default the file looks like this:

```
pi@raspberrypi:~ $ cat /boot/firmware/cmdline.txt
console=ttyAMA0,115200 console=tty1 root=PARTUUID=70b1faa5-02 rootfstype=ext4 fsck.repair=yes rootwait quiet splash plymouth.ignore-serial-consoles vt.global_cursor_default=0 loglevel=0 cfg80211.ieee80211_regdom=CN
```

To disable debug: remove *`console=ttyAMA0,115200`*, reboot.

To enable debug: add *`console=ttyAMA0,115200`* back, reboot.

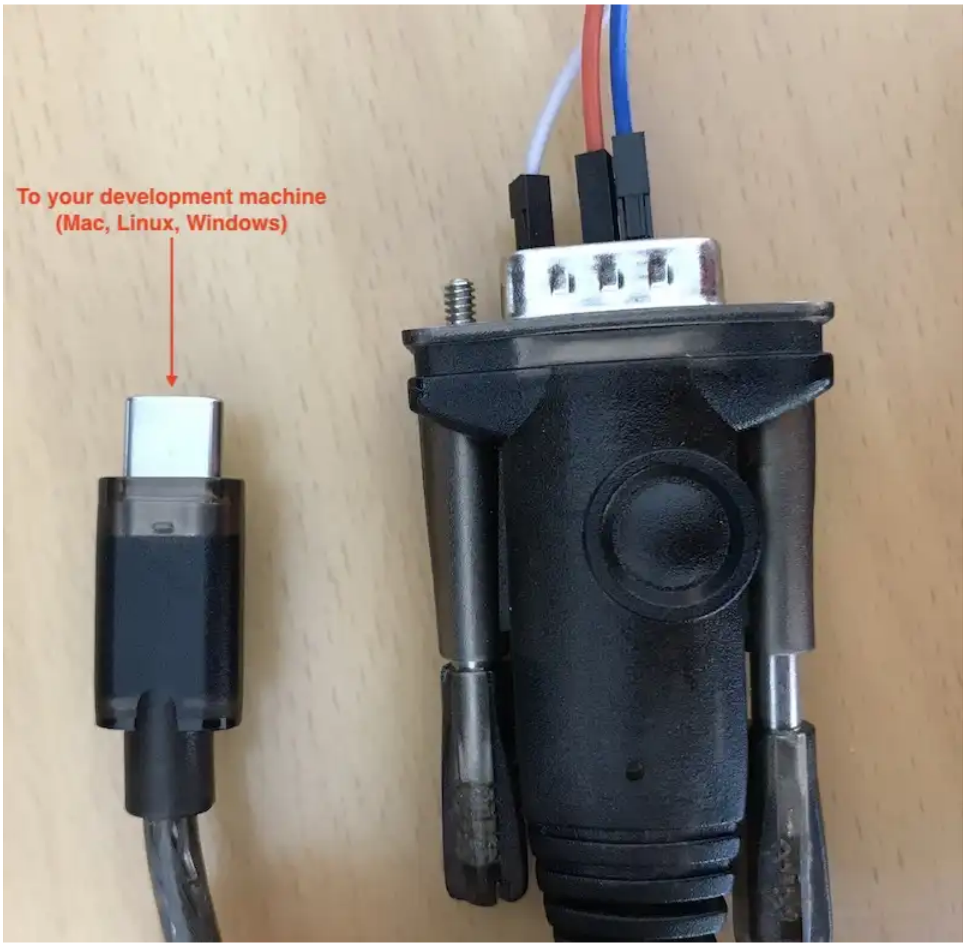
> **Warning**
>
> Please don't use the *raspi-config* to toggle the serial debug function switch. Because the official Pi OS uses "serial0" TTL debug port instead of "ttyAMA0" (the one we use here), which will not work for the "RS232_0" serial debug port. If you happen to have disabled the serial debug in *raspi-config*, you can manually enable it with the method above.

Connect the Wire

In our pre-built Raspberry Pi OS, the RS232_0 serves as a serial debug port. We can connect a RS232 cable between the Chipsee industrial PC and our workstation, allowing us to control the Chipsee industrial PC from our workstation.

To get started, you need a USB to serial cable, we will use a USB Type-C to DB-9 cable as an example, you can use a USB-A cable as well, you need to plug the USB end to your workstation, and the serial end to the Chipsee device.

I will plug the USB Type-C port to a Mac (Windows and Linux work fine too), and then I would use three female to female dupont wires, to connect 3 of the DB-9 pins to GND and RS232_0 (RX and TX) pins of my Chipsee industrial PC.

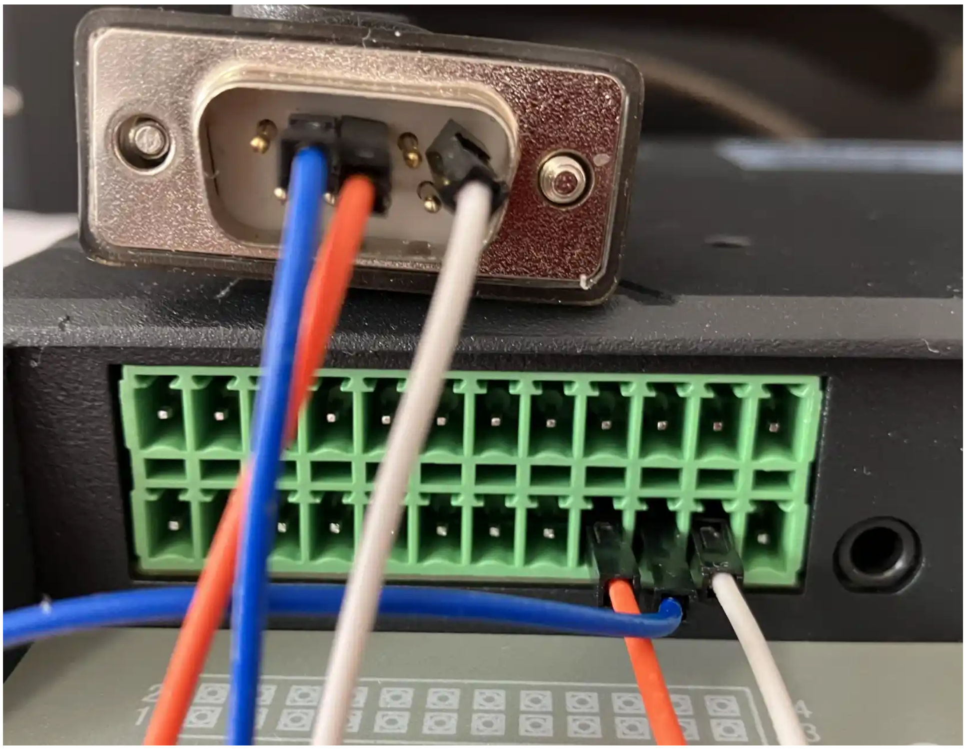


Use a USB to Serial Cable to Connect the Chipsee Industrial PC with Your Workstation

Take a look at the image below, this is the 10.1" product, if your product has a different screen size, check out the hardware document to find out which pins are RS232_0 TX and RX.

> **Note**
>
> Each hardware doc has a "RS232/RS485/CAN" section, it lists which is the RS232_0 TX and RX in the image and the table of their respective docs. Find your model here (Industrial PCs Powered by Raspberry Pi) and scroll to the "RS232/RS485/CAN" section to check out.

You should connect the DB-9's RX to the device's TX, and DB-9's TX to the device's RX, you should also connect their GNDs (the white wire).



Connect 3 Pins with Dupont Wires (or with a phoenix connector)

Linux and MacOS

1. For **MacOS and Linux** users, you will need a program called **screen**. It should be already installed on most MacOS and Linux distributions(if the screen program is not installed on your computer, you can search how to install it, for example, “apt install screen” on Debian). Open your terminal and type *screen -v* . If the *screen* program is already installed in your computer, you should see a version number, like that in the image below:

Confirm You Have the Screen Program (MacOS & Linux)

2. Because the USB end of the cable is plugged into our workstation, we need to know which USB device it is in Linux/MacOS. We can find it out by testing:

```
ls /dev/tty*
```

You might see many *tty* devices listed in your terminal, and cannot decide which is your USB to RS232 cable. Here is a tip: you can unplug the cable first, type the command to see what is listed in the OS. Then you plug it back in, and test again, to see what has recently appeared. The difference between the two should be your cable. In the image below, we found the */dev/tty.usbserial-10* is our USB to RS232 cable.

Find Out Which Device is Your USB to Serial Cable

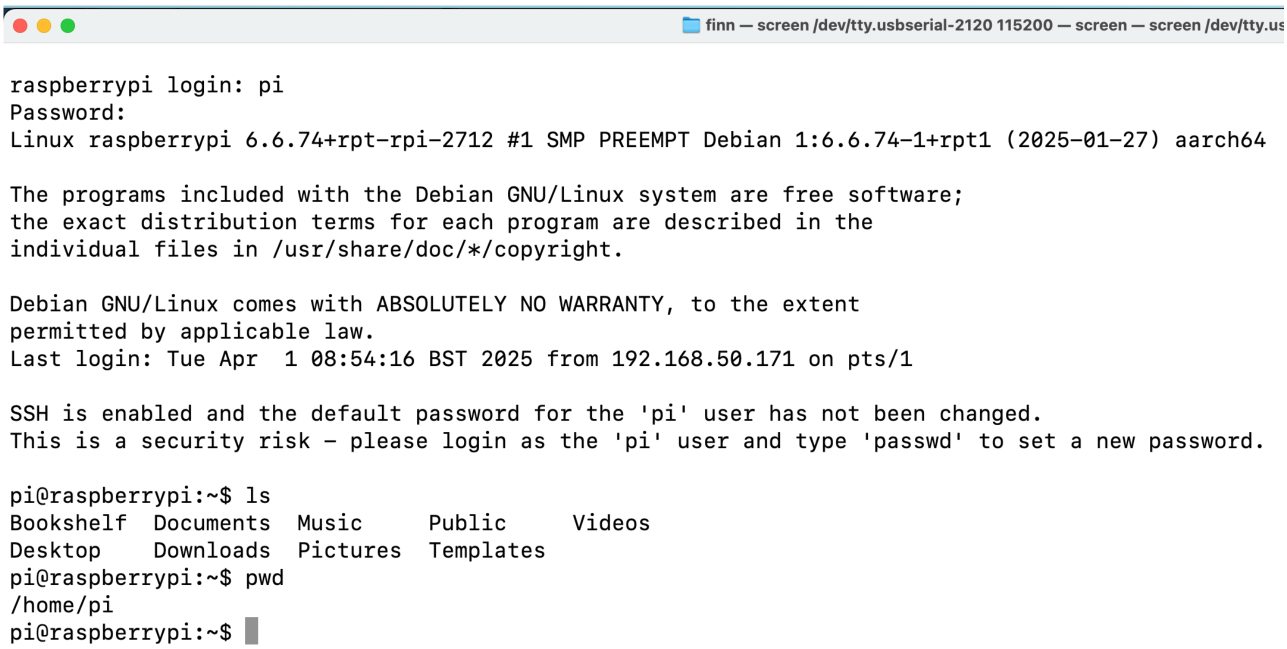
1. You can put the device name you found to the screen program as an argument. To connect to the device (115200 is the default baud rate of the device):

```
screen /dev/tty.usbserial-10 115200
```

2. When the prompt asks you to login, type the user name **pi**, its password is **raspberry**:

```
1 raspberrypi login: pi
2 pi@raspberrypi:~$ ls /
3 bin   dev  home  lost+found  mnt  proc  run   srv  tmp  var
4 boot  etc  lib   media       opt  root  sbin  sys  usr
5 pi@raspberrypi:~$
```

3. If there is a blank/white screen, you can hit Enter or type some commands to see if you can interact with the device. In the image below, the device responds to my *ls* command.



The Screen Program Connects Your Workstation to the Industrial PC's Android Console

4. If you want to **exit** the screen program, you can press *Ctrl+A* then press *K* .

   The program will ask you if you want to kill this window, then press *y* to exit the program.

Press “Ctrl + A” Follow by a “K” to Exit the Program

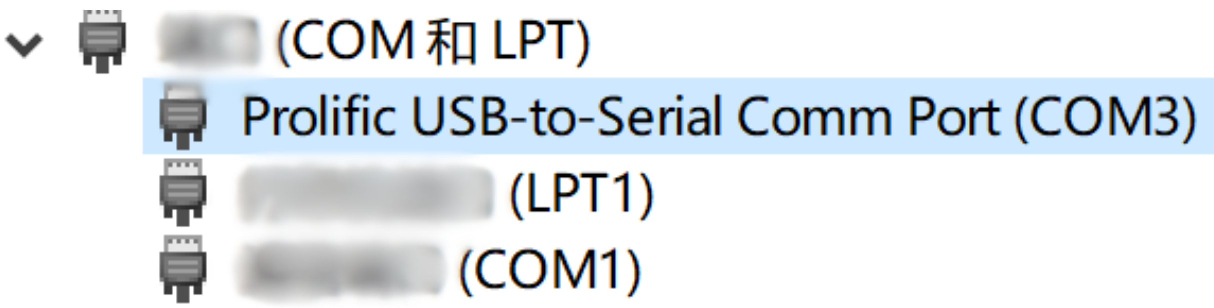
Windows

1. For **Windows** users, you don’t need to install a specific “driver” kind of thing for Windows to recognize a Chipsee PC, but before proceeding, you should see a COM port appear/disappear when plug/unplug your USB to serial cable in Windows.

   Most USB to serial cables don’t require driver installation on Windows10/11. But if you find your cable isn’t recognizable by Windows, try checking the cable’s manufacturer’s website to learn more about it. Most of the time, simply doing a Windows update should do the trick, Windows can detect the cable’s USB driver and install it for you.

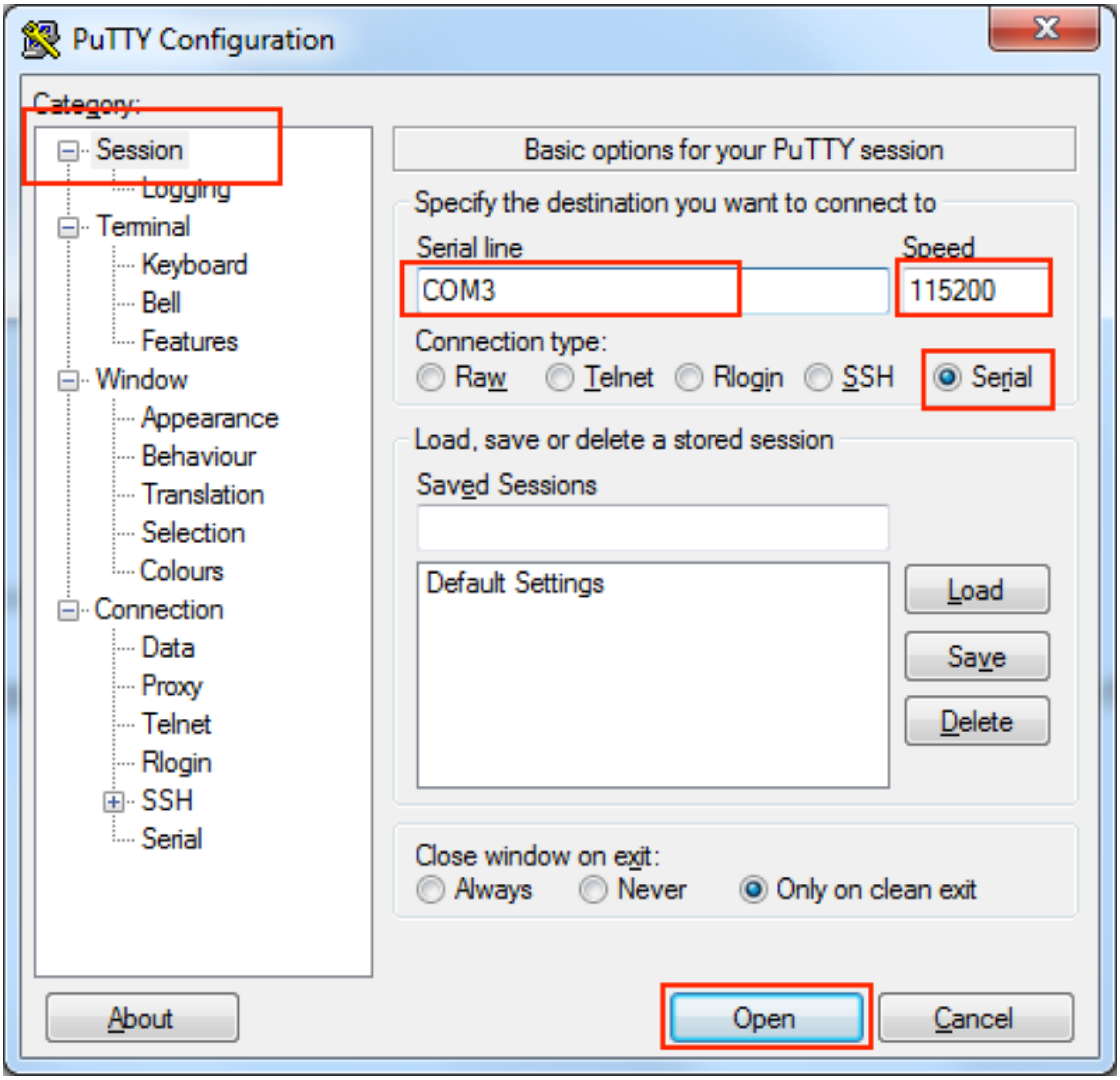
2. You could install a program called **PuTTY** (or XShell etc), here is a link to download the software: https://www.putty.org/. If you’re comfortable with other clients other than PuTTY, you can use those as well.

3. With PuTTY in your belt, let’s find out which COM port your USB to RS232 cable is using. One tip is to check the *Microsoft Windows Device Manager* (right click Windows icon, select Device Manager). Check which COM port appears/disappears when you plug/unplug the USB to serial cable. And that COM port device should be your USB to RS232 cable. Keep a note of the COM port your serial cable is using, let’s say it’s “your-com”, or “COM3” in this example.



COM3 is the USB to Serial Cable

4. Open the PuTTY program, select **Session**, choose **Serial** in the radio buttons, and fill the COM port(your-com, or **COM3** in this example) you found in the Microsoft Windows Device Manager, and choose **115200** as baud rate, then click **Open**.



Input your-com in the Serial Line field, in our case COM3

5. Now you should be able to connect from your workstation to the device through the serial port. You can try to hit Enter, or type some commands, like *ls* , to see if the device replies to your commands. If the prompt asks you to login, type the user name **pi**, password is **raspberry**:

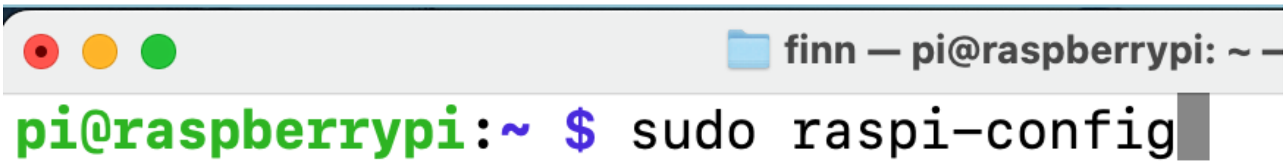
```
raspberrypi login: pi
pi@raspberrypi:~$ ls /
bin   dev   home  lost+found  mnt  proc  run   srv  tmp  var
boot  etc   lib   media       opt  root  sbin  sys  usr
pi@raspberrypi:~$
```

Connect From Network (SSH)

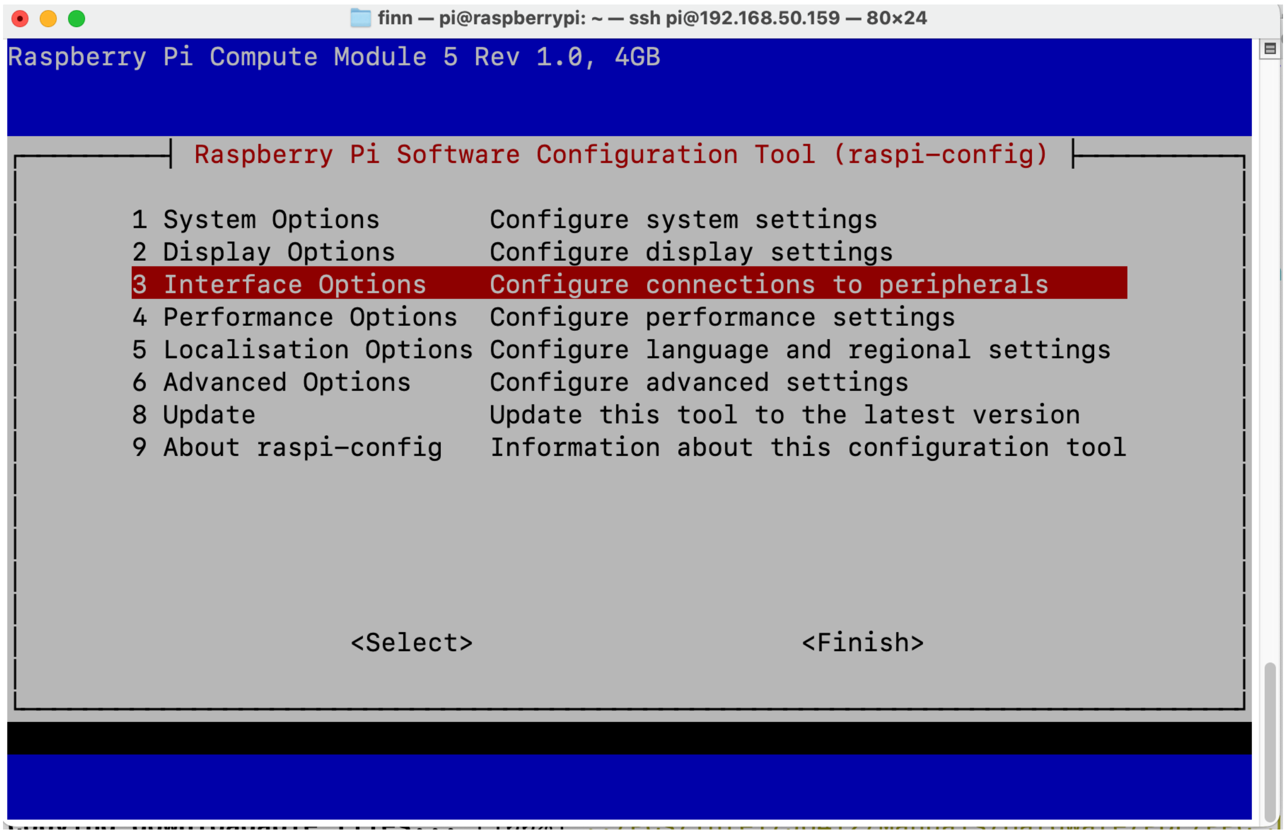
[Cheatsheet for experienced developers: username: pi, password: raspberry]

By default SSH and VNC are disabled for security reasons, you could enable them through:

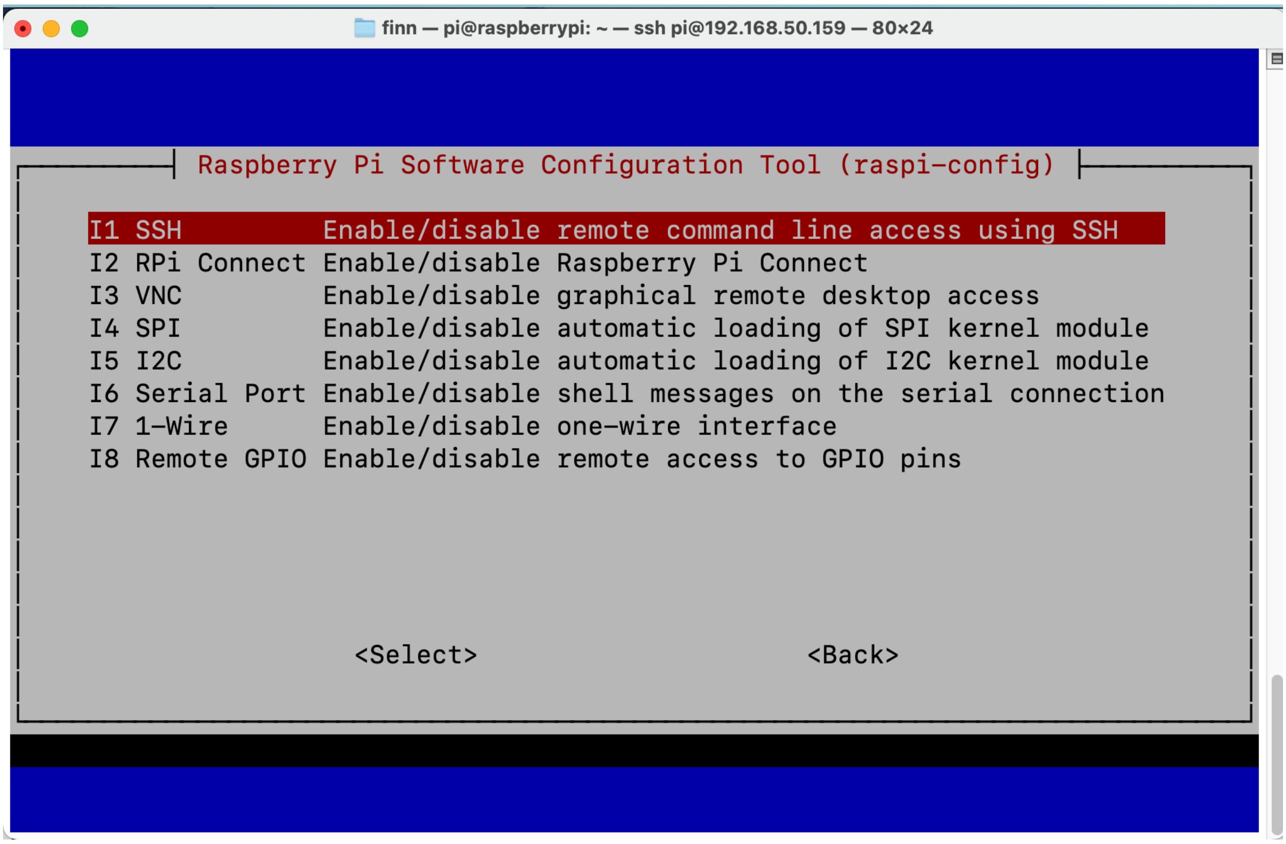
- raspi-config
- A GUI of raspi-config



Go to TUI of raspi-config



Move to Interfaces

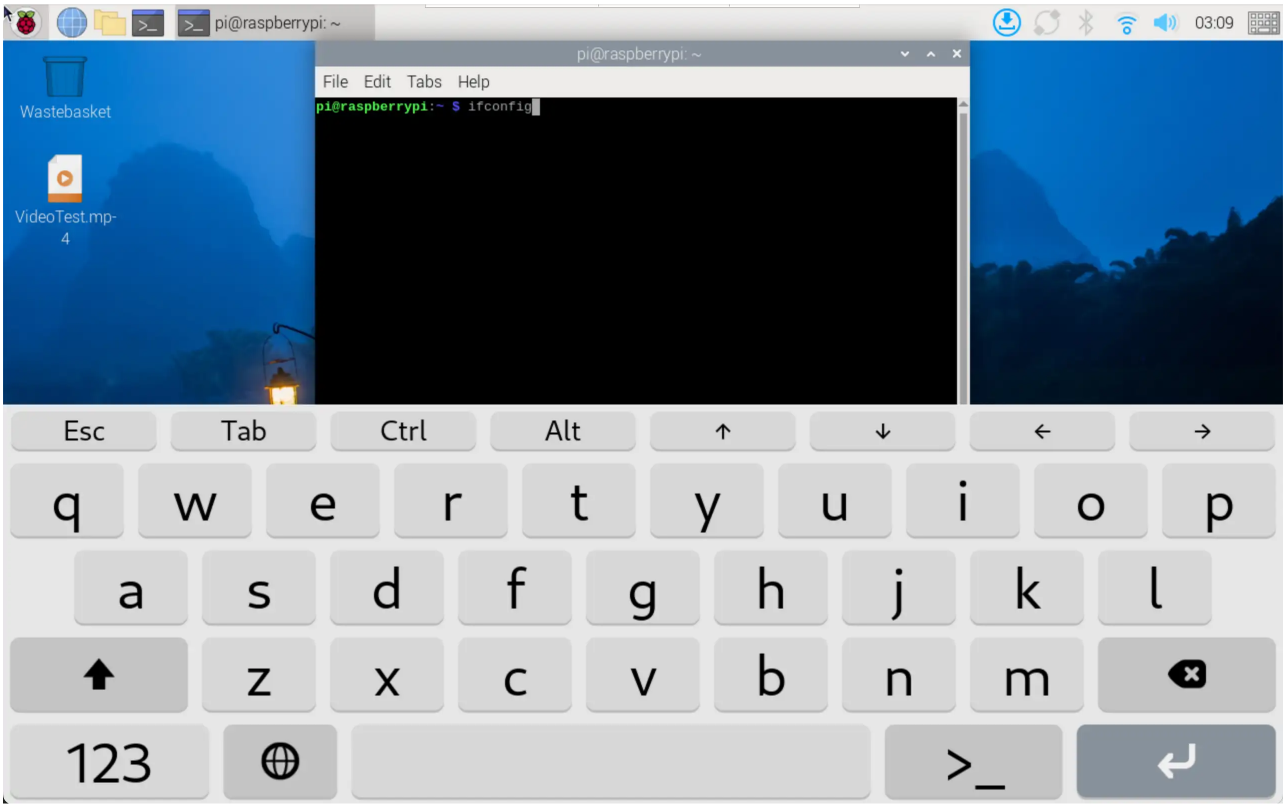


Hit Enter and Confirm to Enable SSH

You can SSH to the device when it's connected to the network, either through Wi-Fi or Ethernet.

First make sure you're connected through WiFi or Ethernet (to learn how, jump to the Network section below. Ethernet can be automatically detected, WiFi needs some configuration).

Then you can check the IP address with **ifconfig**:



Hit Enter and Confirm to Enable SSH

```
pi@raspberrypi:~ $ ifconfig
eth0: flags=4099<UP,BROADCAST,MULTICAST>  mtu 1500
     ether 2c:cf:67:b8:84:5c  txqueuelen 1000  (Ethernet)
     RX packets 0  bytes 0 (0.0 B)
     RX errors 0  dropped 0  overruns 0  frame 0
     TX packets 0  bytes 0 (0.0 B)
     TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
     device interrupt 107

eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.0.100  netmask 255.255.255.0  broadcast 192.168.0.255
        inet6 fe80::6523:8977:2a7a:d657  prefixlen 64  scopeid 0x20<link>
        inet6 240e:413:910:55:592d:e9eb:bf59:e0d4  prefixlen 64  scopeid 0x0<global>
        ether 22:89:84:6a:96:ab  txqueuelen 1000  (Ethernet)
        RX packets 1108  bytes 1385789 (1.3 MiB)
        RX errors 202  dropped 0  overruns 0  frame 197
        TX packets 922  bytes 129320 (126.2 KiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
        inet 127.0.0.1  netmask 255.0.0.0
        inet6 ::1  prefixlen 128  scopeid 0x10<host>
        loop  txqueuelen 1000  (Local Loopback)
        RX packets 101  bytes 9544 (9.3 KiB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 101  bytes 9544 (9.3 KiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

```

```
29 wlan0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
30         inet 192.168.50.159  netmask 255.255.255.0  broadcast 192.168.50.255
31         inet6 fe80::99ba:18c8:40a8:8fc3  prefixlen 64  scopeid 0x20<link>
32         ether 2c:cf:67:b8:84:5d  txqueuelen 1000  (Ethernet)
33         RX packets 189  bytes 53162 (51.9 KiB)
34         RX errors 0  dropped 3  overruns 0  frame 0
35         TX packets 80  bytes 13850 (13.5 KiB)
36         TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

The **inet** line contains **your-ip** of eth0(wired) and wlan0(wireless). In the case above the IP address is 192.168.50.159 through **wlan0**.

If you're using Ethernet, it should be one of eth0(line 2) and eth1(line 9), depending on your device model. For example, on the dual-lan 7 inch product, LAN0 port is eth0, LAN1 port is eth1.

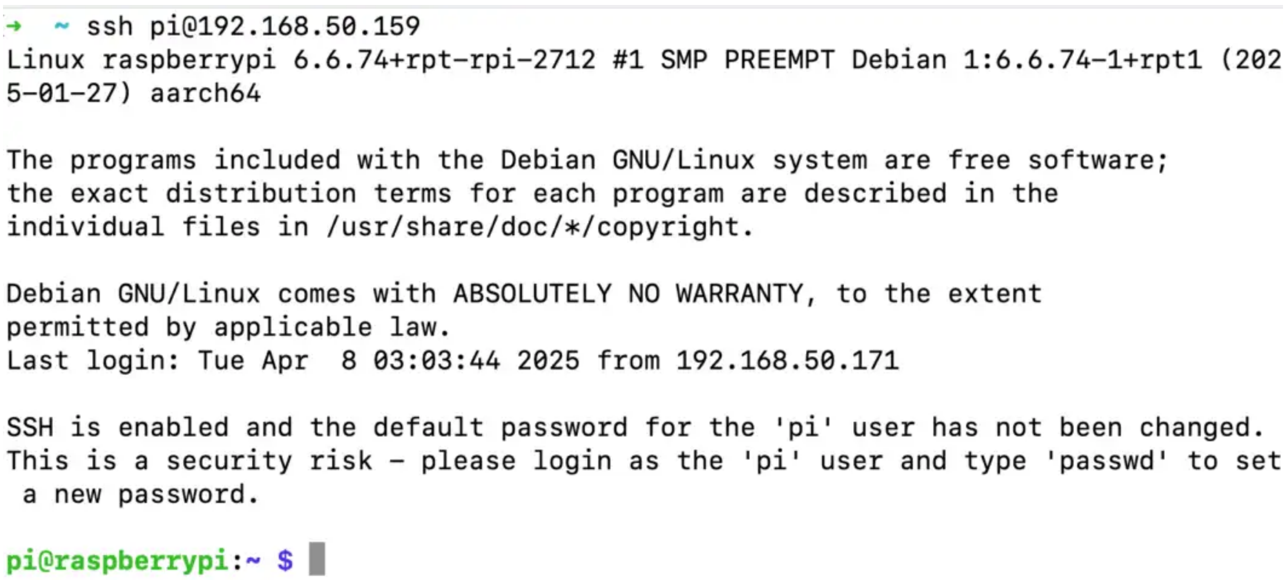
Then we can ssh from our workstation with this IP address.

Linux / MacOS

For Linux and MacOS users, you can use your terminal and type:

```
ssh pi@your-ip
# In our case, your-ip is 192.168.50.159
ssh pi@192.168.50.159
```

The username is pi, and the password is raspberry.

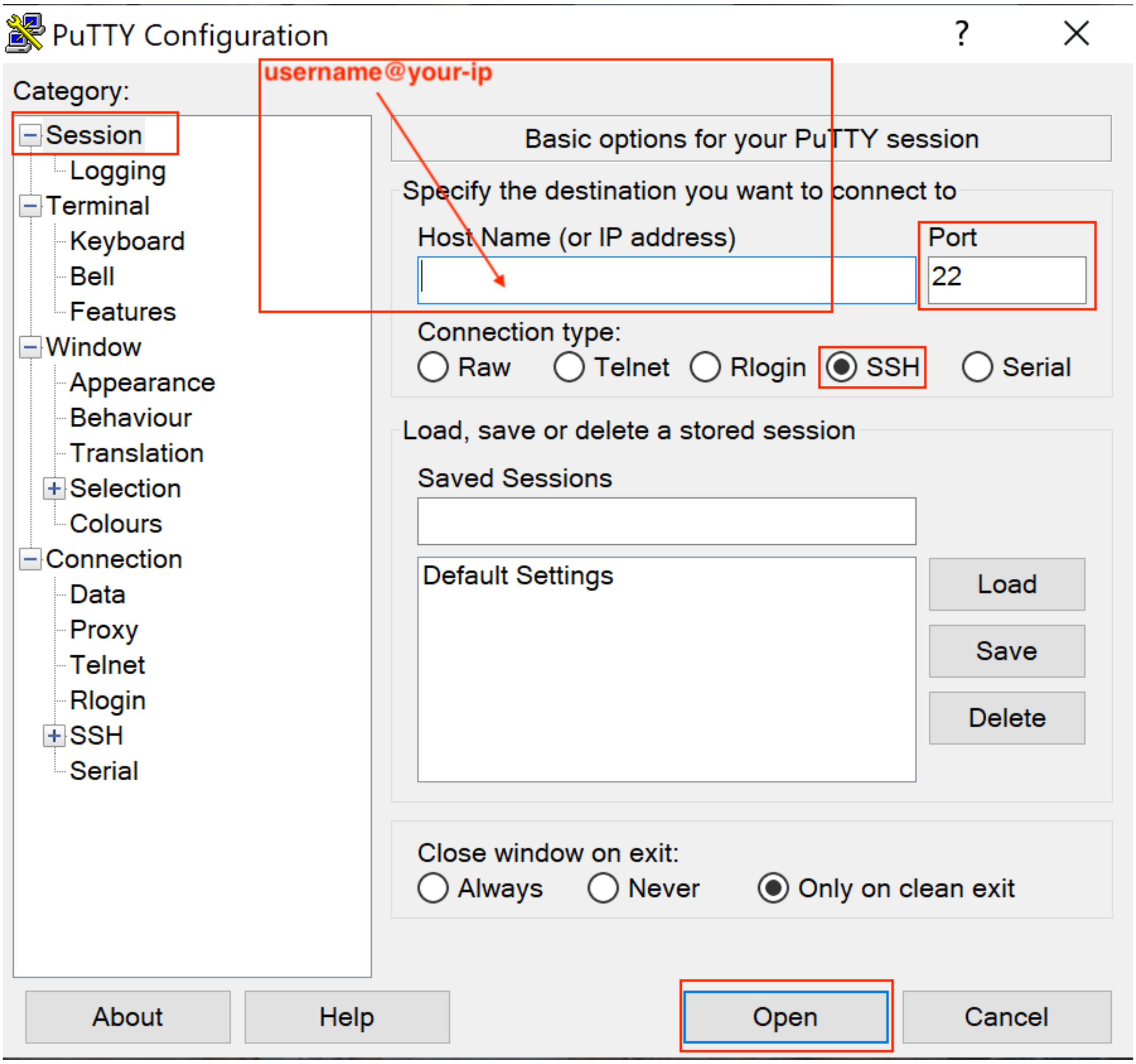


```
→  ~ ssh pi@192.168.50.159
Linux raspberrypi 6.6.74+rpt-rpi-2712 #1 SMP PREEMPT Debian 1:6.6.74-1+rpt1 (202
5-01-27) aarch64

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

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Tue Apr  8 03:03:44 2025 from 192.168.50.171

SSH is enabled and the default password for the 'pi' user has not been changed.
This is a security risk - please login as the 'pi' user and type 'passwd' to set
 a new password.

pi@raspberrypi:~ $
```

SSH with your-ip

Windows

For Windows users using PuTTY, you can choose Session, input **username@your-ip** (in our case *pi@192.168.50.159*, yours should be different) in the Host Name field. Port Number should remain 22, choose SSH as the connection type in the radio buttons, click “Open”. The password is raspberry.



Input username@your-ip in the Host Name field, in our case pi@192.168.50.159

Now you have connected to the device through the network.

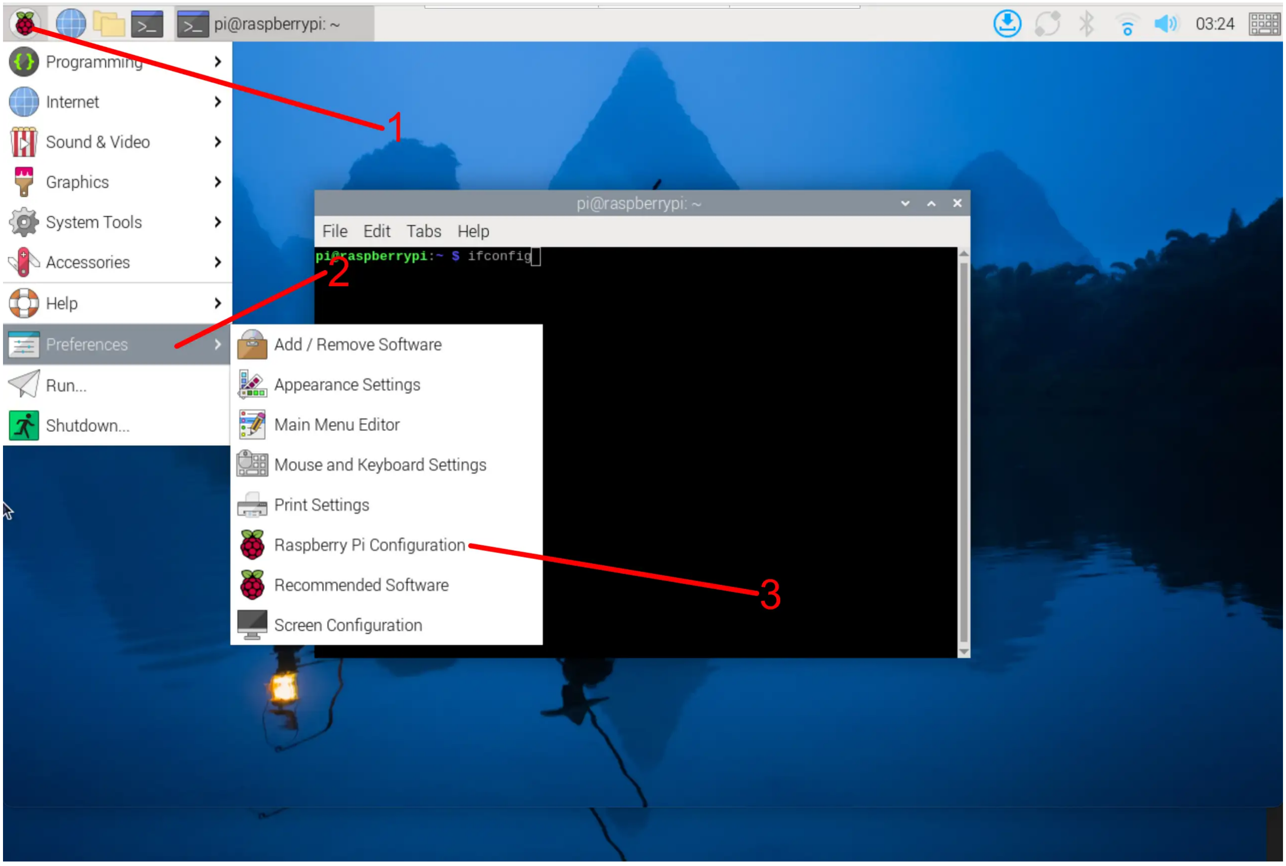
Connect with VNC Remote Desktop

[*Cheatsheet for experienced developer*: username: **pi**, password: **raspberry**, IP check: **ifconfig**, VNC port: **5900** (default port).]

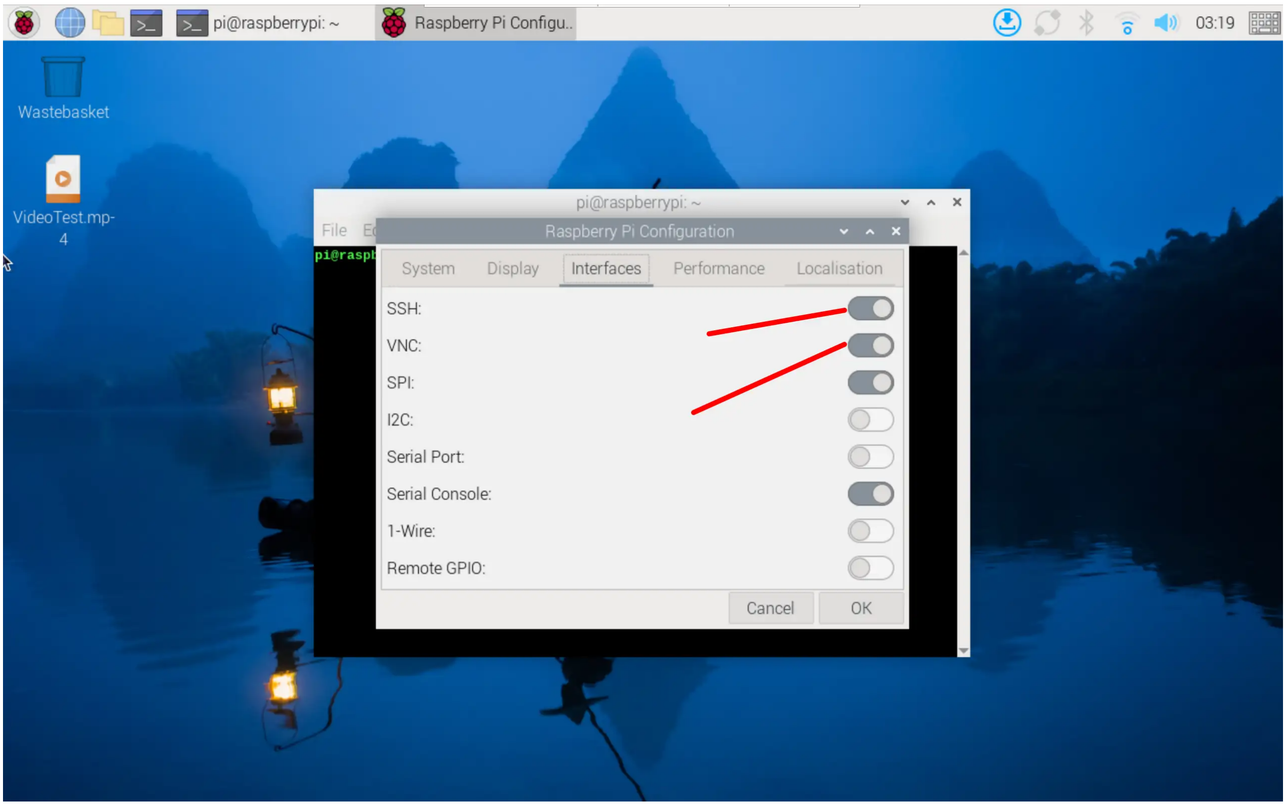
We can have a graphical user interface if we use VNC to connect to our Chipsee industrial PC. This is handy if you're developing an HMI and want to test from your own laptop or computer. Here is how:

By default VNC is disabled, you can enable VNC from **sudo raspi-config** or in the GUI.

In the previous SSH section there are images of how to enable them through TUI, but you can also use the GUI program:



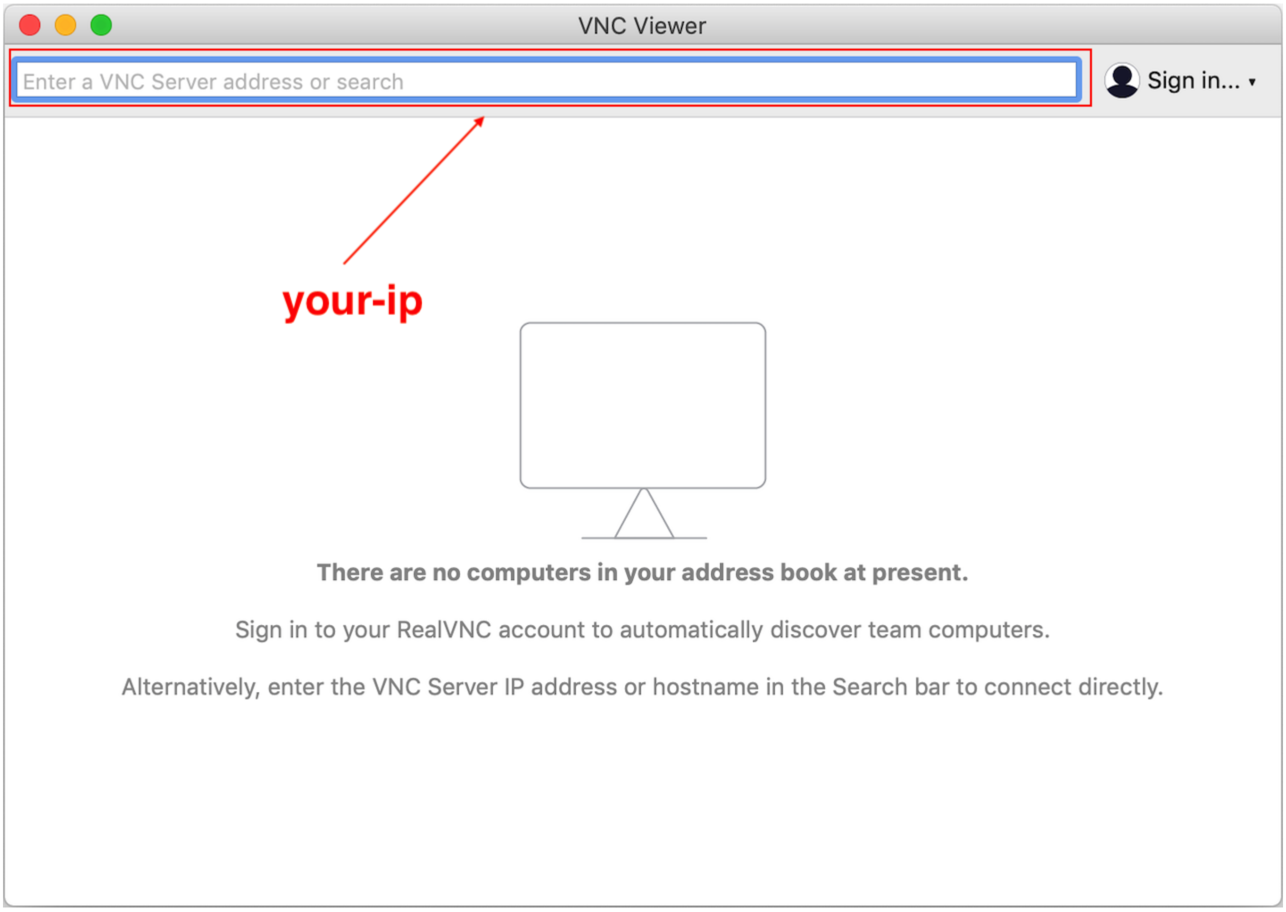
Go to GUI of raspi-config



Enable VNC (or SSH if need so)

After enabling the VNC service, refer to the previous section to learn how to use **ifconfig** to find out your Chipsee industrial PC's IP address. In our case we get 192.168.50.159.

Then, for either Windows, macOS or Linux users, please open the VNC Viewer software on your laptop or PC. In the input area, which has a placeholder "Enter a VNC server address or search", you should input the IP address we obtained earlier: **your-ip**, in our case: 192.168.50.159 (**yours should be different**), and hit enter.



Change the input to your-ip, in our case 192.168.50.159

VNC Viewer might ask for your credentials, you should input our username and password, in our case: username: **pi**, password: **raspberry**. And then continue, VNC Viewer might tell you the connection is not encrypted, it's OK if you're in your local network.

Now we should see our Chipsee industrial PC's desktop GUI in the VNC Viewer software.

Hardware Resources

When you develop software for the Chipsee industrial PC, you can open the hardware document beside this software document, to aid you in wiring your devices.

Network

> **Note**
>
> If your product has a CAT-1 (Simcom 7670G) 4G/LTE modem, but SIM card is not inserted, WiFi/Ethernet traffic to the Internet will not be routed through Ethernet/WiFi by default. You can disable routing through 4G and use Ethernet/WiFi instead with:
>
> ```
> # If your product only has 1 Ethernet port, eth1 is 4G device
> $ sudo ip route del default via 192.168.0.1 dev eth1
> # If your product has 2 Ethernet ports, eth2 is 4G device
> $ sudo ip route del default via 192.168.0.1 dev eth2
> ```
>
> This is useful when you're developing in house and don't want to use the 4G traffic.
>
> More background:
>
> Operating system will route traffic from **smaller metric** device first. To check the routing info:
>
> ```
> $ ip route
> ```
>
> This will delete the route to eth1(4G/LTE) with metric 100, and then add a new one with metric of 700:
>
> ```
> $ sudo ip route del default via 192.168.0.1 dev eth1
> $ sudo ip route add default via 192.168.0.1 dev eth1 proto dhcp src 192.168.0.100 metric 700
> ```

General

To check the network interface information:

```
$ ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.50.158  netmask 255.255.255.0  broadcast 192.168.50.255
        inet6 fe80::16d:68d8:c0f5:1bd6  prefixlen 64  scopeid 0x20<link>
        ether 2c:cf:67:b8:84:5c  txqueuelen 1000  (Ethernet)

eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.0.100  netmask 255.255.255.0  broadcast 192.168.0.255
        inet6 fe80::6523:8977:2a7a:d657  prefixlen 64  scopeid 0x20<link>
        ether 22:89:84:6a:96:ab  txqueuelen 1000  (Ethernet)

lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
        inet 127.0.0.1  netmask 255.0.0.0
        inet6 ::1  prefixlen 128  scopeid 0x10<host>
        loop  txqueuelen 1000  (Local Loopback)
```

```

wlan0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.50.159  netmask 255.255.255.0  broadcast 192.168.50.255
        inet6 fe80::99ba:18c8:40a8:8fc3  prefixlen 64  scopeid 0x20<link>
        ether 2c:cf:67:b8:84:5d  txqueuelen 1000  (Ethernet)
```

You can find your ipv4 address of each interface after the **inet** line.

> **Warning**
>
> When inserting a SIM card, **power off** the device first. SIM card **does not** support hot plug.

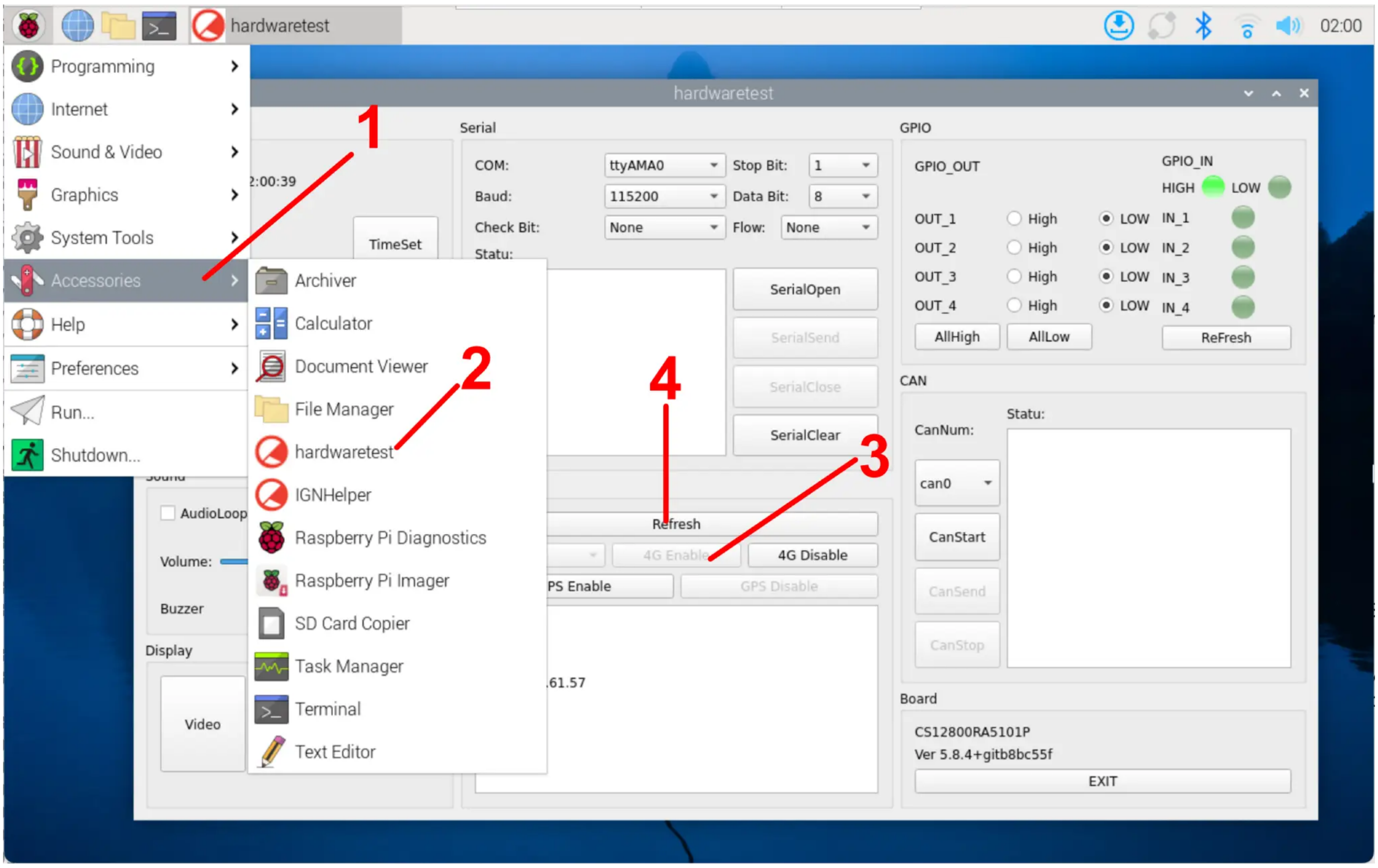
4G/LTE (CAT4 Module)

For the CAT4 module (Quectel EC25).

```
pi@raspberrypi:~ $ mmcli -m 0
  ----------------------------------
  General  |                   path: /org/freedesktop/ModemManager1/Modem/0
           |              device id: 1ac7091779b95aa44ea3b27752d8fd3bd2ef247f
  ----------------------------------
  Hardware |           manufacturer: QUALCOMM INCORPORATED
           |                  model: QUECTEL Mobile Broadband Module
           |      firmware revision: EC25EUXGAR08A13M1G
           |         carrier config: default
           |           h/w revision: 10000
           |              supported: gsm-umts, lte
           |                current: gsm-umts, lte
           |           equipment id: 8687110630
  ----------------------------------
  System   |                 device: /sys/devices/platform/axi/1000480000.usb/usb5/5-1
           |                drivers: qmi_wwan, option
           |                 plugin: quectel
           |           primary port: cdc-wdm0
           |                  ports: cdc-wdm0 (qmi), ttyUSB0 (qcdm), ttyUSB1 (gps),
           |                         ttyUSB2 (at), ttyUSB3 (at), wwan0 (net)
  ----------------------------------
  Numbers  |                    own:
  ----------------------------------
  Status   |                   lock: sim-pin2
           |         unlock retries: sim-pin (3), sim-puk (10), sim-pin2 (3), sim-puk2 (10)
           |                  state: enabled
           |            power state: on
           |         signal quality: 0% (recent)
  ----------------------------------
  Modes    |              supported: allowed: 2g; preferred: none
           |                         allowed: 3g; preferred: none
           |                         allowed: 4g; preferred: none
           |                         allowed: 2g, 3g; preferred: 3g
           |                         allowed: 2g, 3g; preferred: 2g
           |                         allowed: 2g, 4g; preferred: 4g
           |                         allowed: 2g, 4g; preferred: 2g
           |                         allowed: 3g, 4g; preferred: 4g
           |                         allowed: 3g, 4g; preferred: 3g
           |                         allowed: 2g, 3g, 4g; preferred: 4g
           |                         allowed: 2g, 3g, 4g; preferred: 3g
           |                         allowed: 2g, 3g, 4g; preferred: 2g
           |                current: allowed: 2g, 3g, 4g; preferred: 4g
  ----------------------------------
  Bands    |              supported: egsm, dcs, utran-1, utran-8, eutran-1, eutran-3, eutran-7,
           |                         eutran-8, eutran-20, eutran-28, eutran-38, eutran-40, eutran-41
           |                current: egsm, dcs, utran-1, utran-8, eutran-1, eutran-3, eutran-7,
           |                         eutran-8, eutran-20, eutran-28, eutran-38, eutran-40, eutran-41
  ----------------------------------
  IP       |              supported: ipv4, ipv6, ipv4v6
  ----------------------------------
  3GPP     |                   imei: 8687110630
           |          enabled locks: fixed-dialing
           |   packet service state: detached
  ----------------------------------
  3GPP EPS |   ue mode of operation: csps-2
           |    initial bearer apn: ctlte
           | initial bearer ip type: ipv4v6
  ----------------------------------
  SIM      |       primary sim path: /org/freedesktop/ModemManager1/SIM/0
           |         sim slot paths: slot 1: /org/freedesktop/ModemManager1/SIM/0 (active)
```

Checking Modem with mmcli

If your product has a 4G modem, after inserting a SIM card, you can test the 4G/LTE with the *Chipsee Hardware Test* program first:



In the Hardware Test program, click *4G Enable* , then *Refresh* to check your connection information, you can also open the browser to test you're connected to the Internet.

To programmatically enable 4G:

In QMI mode you can use *quectel-CM* to enable 4G/LTE to connect to Internet:

```
sudo quectel-CM &
```

To test you're connected to the Internet:

```
ping 1.1.1.1
```

The program will set your DNS automatically.

```
root@raspberrypi:/home/pi# quectel-CM &
[2] 5247
root@raspberrypi:/home/pi# [04-24_10:02:20:877] Quectel_Linux_ConnectManager_SR01A01V21
[04-24_10:02:20:877] quectel-CM profile[1] = (null)/(null)/(null)/0, pincode = (null)
[04-24_10:02:20:877] Find qmichannel = /dev/cdc-wdm0
[04-24_10:02:20:877] Find usbnet_adapter = wwan0
[04-24_10:02:20:884] /proc/2890/fd/7 -> /dev/cdc-wdm0
[04-24_10:02:20:884] /proc/2890/exe -> /usr/libexec/qmi-proxy
[04-24_10:02:22:884] cdc_wdm_fd = 7
[04-24_10:02:22:983] Get clientWDS = 5
[04-24_10:02:23:015] Get clientDMS = 1
[04-24_10:02:23:047] Get clientNAS = 2
[04-24_10:02:23:079] Get clientUIM = 1
[04-24_10:02:23:111] Get clientWDA = 1
[04-24_10:02:23:143] requestBaseBandVersion EC25EUXGAR08A13M1G
[04-24_10:02:23:239] requestGetSIMStatus SIMStatus: SIM_READY
[04-24_10:02:23:303] requestGetProfile[1] ctlte///0
[04-24_10:02:23:337] requestRegistrationState2 MCC: 460, MNC: 11, PS: Attached, DataCap: LTE
[04-24_10:02:23:367] requestQueryDataCall ConnectionStatus: DISCONNECTED
[04-24_10:02:23:431] requestRegistrationState2 MCC: 460, MNC: 11, PS: Attached, DataCap: LTE
[04-24_10:02:23:463] requestSetupDataCall WdsConnectionIPv4Handle: 0x84751de0
[04-24_10:02:23:527] requestQueryDataCall ConnectionStatus: CONNECTED
udhcpc: started, v1.35.0
udhcpc: broadcasting discover
udhcpc: broadcasting select for 10.148.63.226, server 10.148.63.225
udhcpc: lease of 10.148.63.226 obtained from 10.148.63.225, lease time 7200

root@raspberrypi:/home/pi# ip route
default via 10.148.63.225 dev wwan0
default via 192.168.50.1 dev wlan0 proto dhcp src 192.168.50.159 metric 600
10.148.63.224/30 dev wwan0 proto kernel scope link src 10.148.63.226
192.168.50.0/24 dev wlan0 proto kernel scope link src 192.168.50.159 metric 600
```

Run quectel-CM to Enable 4G and Connect to the Internet

The *quectel-CM* program doesn't persist across reboot, you may consider creating a systemd service to auto start the *quectel-CM* program on boot, or run the *sudo quectel-CM &* command in your own application. There is a simple starting point:

```
# create a file /etc/systemd/system/quectel-cm.service

[Unit]
Description=Quectel Connection Manager

[Service]
Type=simple
ExecStartPre=/bin/sh -c 'until [ -e /dev/cdc-wdm0 ]; do sleep 1; done'
# give the modem some time to initialize
ExecStart=/usr/bin/quectel-CM
SyslogIdentifier=quectel-cm
KillMode=control-group
Restart=always
RestartSec=30
TimeoutStartSec=30
StandardOutput=journal
StandardError=journal
```

```
[Install]
WantedBy=multi-user.target
```

Reload the systemd after creating or modifying *quectel-cm.service* :

```
sudo systemctl daemon-reload
```

Manually start/stop the service (enable/disable 4G):

```
sudo systemctl start quectel-cm.service
sudo systemctl stop quectel-cm.service
```

Check status and logs:

```
sudo systemctl status quectel-cm.service
```

Enable/disable autostart on boot:

```
sudo systemctl enable quectel-cm.service
sudo systemctl disable quectel-cm.service
```

Then you could have 4G enabled that persists across reboot, you can edit the */etc/systemd/system/quectel-cm.service* file to meet your needs.

```
pi@raspberrypi:~ $ sudo systemctl status quectel-cm.service
● quectel-cm.service - Quectel Connection Manager
     Loaded: loaded (/etc/systemd/system/quectel-cm.service; enabled; preset: enabled)
     Active: active (running) since Fri 2025-04-25 02:42:57 BST; 8min ago
    Process: 1736 ExecStartPre=/bin/sh -c until [ -e /dev/cdc-wdm0 ]; do sleep 1; done (code=exited, status=0/SUCCESS)
   Main PID: 1737 (quectel-CM)
      Tasks: 2 (limit: 4745)
        CPU: 33ms
     CGroup: /system.slice/quectel-cm.service
             └─1737 /usr/bin/quectel-CM

Apr 25 02:42:57 raspberrypi systemd[1]: Starting quectel-cm.service - Quectel Connection Manager...
Apr 25 02:42:57 raspberrypi systemd[1]: Started quectel-cm.service - Quectel Connection Manager.
Apr 25 02:42:59 raspberrypi quectel-cm[1745]: udhcpc: started, v1.35.0
Apr 25 02:42:59 raspberrypi quectel-cm[1745]: udhcpc: broadcasting discover
Apr 25 02:42:59 raspberrypi quectel-cm[1745]: udhcpc: broadcasting select for 10.72.109.196, server 10.72.109.197
Apr 25 02:43:00 raspberrypi quectel-cm[1745]: udhcpc: lease of 10.72.109.196 obtained from 10.72.109.197, lease time 7200
pi@raspberrypi:~ $ ps -ef | grep quectel-CM
root        1737       1  0 02:42 ?        00:00:00 /usr/bin/quectel-CM
pi          2294    2225  0 02:51 pts/0    00:00:00 grep --color=auto quectel-CM
```

Use Systemd to Auto Start quectel-cm Program on System Boot to Auto Connect 4G/LTE

You can also use normal AT commands to check network information:

First listen the response from */dev/ttyUSB2* :

```
1 $ cat /dev/ttyUSB2 &
```

To acquire IMEI:

```
$ echo -e "AT+GSN\r" > /dev/ttyUSB2

# Response:
868414063045508

OK
```

To check signal strength:

```
$ echo -e "AT+CSQ\r" > /dev/ttyUSB2

# Response:
+CSQ: 18,99 # strength: 18; ber: 99(99 means not known or not detectable)

OK
```

To switch to QMI device mode (default mode) if you switched to other mode accidentally:

```
echo -e 'AT+QCFG="usbnet",0\r' > /dev/ttyUSB2
echo -e 'AT+CFUN=1,1\r' > /dev/ttyUSB2
```

4G/LTE (CAT1 Module)

For the CAT1 module (Simcom 7670G).

If your product has a 4G modem, after inserting a SIM card, the 4G function should work out of box. The product uses RNDIS (Remote Network Driver Interface Specification) for 4G modem.

If you still have problems connecting with 4G, you can take a look at *`/opt/chipsee/test`* folder, unzip the *`/opt/chipsee/test/simcom-linux-4g`* with *`sudo tar -xzf simcom-linux-4g.tar.gz`* , there is a **README** file along with some scripts used to connect 4G.

```
pi@raspberrypi:/opt/chipsee/test $ ls
cantest  gpiotest.sh  quectel-linux-4g.tar.gz  simcom-linux-4g  simcom-linux-4g.tar.gz  uarttest.txt
pi@raspberrypi:/opt/chipsee/test $ cd simcom-linux-4g/
pi@raspberrypi:/opt/chipsee/test/simcom-linux-4g $ ls
other-scripts  ppp-peers  ppp-scripts  README
pi@raspberrypi:/opt/chipsee/test/simcom-linux-4g $
```

You can check the status of your modem with **mmcli** (ModemManager):

```
$ mmcli -L
  /org/freedesktop/ModemManager1/Modem/0 [SIMCOM INCORPORATED] SIM7670G-LNGV
$ mmcli -m 0
  ----------------------------
  General  |              path: /org/freedesktop/ModemManager1/Modem/0
  ----------------------------
  Hardware |      manufacturer: SIMCOM INCORPORATED
  ----------------------------
```

```
  System    |                device: /sys/devices/platform/axi/1000480000.usb/usb5/5-1
            |                 ports: eth1 (net), ttyACM0 (at), ttyACM1 (ignored), ttyACM2 (at)
  -----------------------------
  Status    |                 state: failed
            |         failed reason: sim-missing
            |           power state: on
  -----------------------------
  Modes     |             supported: allowed: any; preferred: none
  -----------------------------
  IP        |             supported: ipv4, ipv6, ipv4v6, non-ip
```

In the highlighted lines, you can see that the 4G/LTE device is **eth1** on PPC-CM5-101 or larger screen models; in dual-lan PPC-CM5-070D the 4G will be **eth2**. The status shows the failed reason is "sim-missing" when a SIM card is not inserted.

When a sim card is inserted, 4G should work automatically.

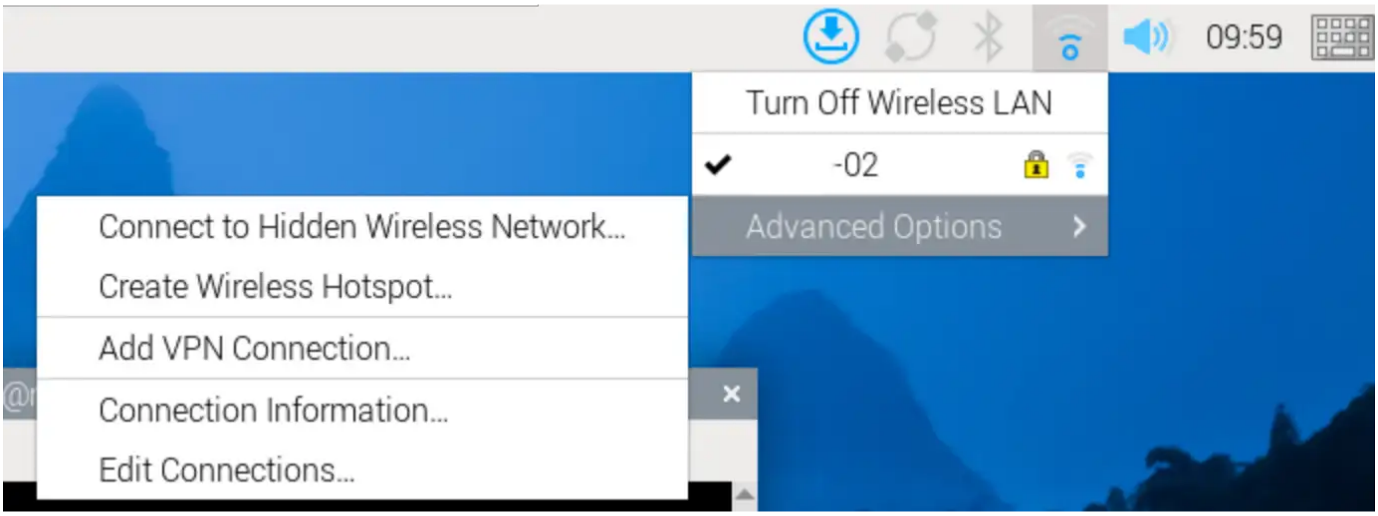
```
finn — pi@raspberrypi: ~ — ssh pi@192.
pi@raspberrypi:~ $ mmcli -m 0
  --------------------------------
  General  |                  path: /org/freedesktop/ModemManager1/Modem/0
           |             device id: 18548870ac0b24e1ac6fb45d9e62a86b85443dfc
  --------------------------------
  Hardware |          manufacturer: SIMCOM INCORPORATED
           |                 model: SIM7670G-LNGV
           |     firmware revision: 2374B03SIM767XM5A
           |             supported: gsm-umts
           |               current: gsm-umts
           |          equipment id: 864643060179290
  --------------------------------
  System   |                device: /sys/devices/platform/axi/1000480000.usb/usb5/5-1
           |               drivers: cdc_acm, rndis_host
           |                plugin: generic
           |          primary port: ttyACM0
           |                 ports: eth1 (net), ttyACM0 (at), ttyACM1 (ignored), ttyACM2 (at)
  --------------------------------
  Numbers  |                   own: +861
  --------------------------------
  Status   |                 state: disabled
           |           power state: on
  --------------------------------
  Modes    |             supported: allowed: any; preferred: none
           |               current: allowed: any; preferred: none
  --------------------------------
  IP       |             supported: ipv4, ipv6, ipv4v6, non-ip
  --------------------------------
  3GPP     |                  imei: 864643060179290
  --------------------------------
  3GPP EPS | ue mode of operation: csps-2
  --------------------------------
  SIM      |      primary sim path: /org/freedesktop/ModemManager1/SIM/0
pi@raspberrypi:~ $ curl ifconfig.io
240e:412:900:         :3159:9f82:e7d8
pi@raspberrypi:~ $
```

When 4G is connected, check Public IP with curl

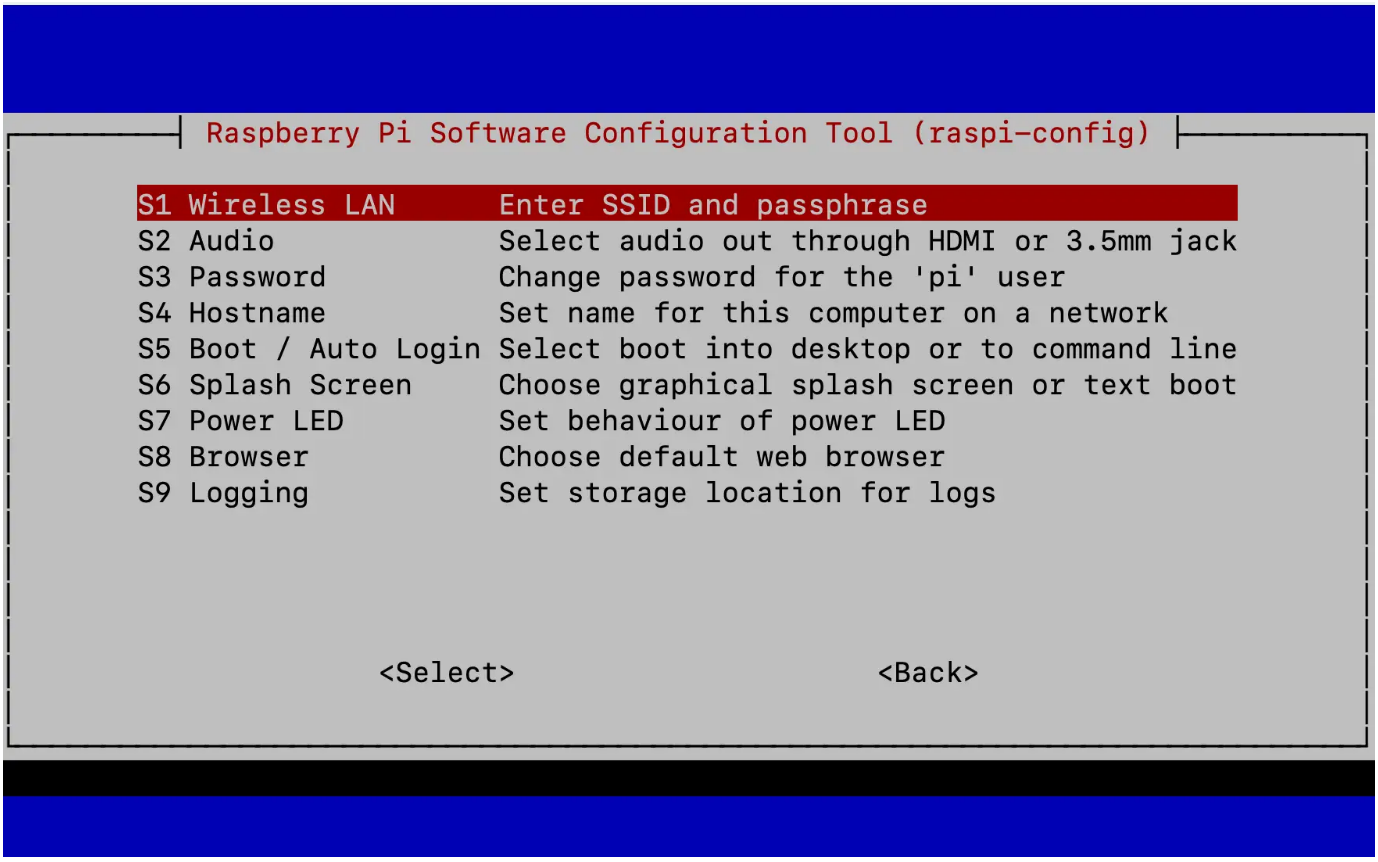
Ethernet and WiFi

When you plug your Ethernet cable to the device, Ethernet should be connected automatically.

For connecting to WiFi, it's the same as normal Raspberry Pi's, you can refer to the Raspberry Pi's official documentation to learn how to use WiFi and Ethernet in the networking section: https://www.raspberrypi.com/documentation/computers/configuration.html#networking.



Method 1: Connecting WiFi from Desktop GUI



Method 2: Connecting WiFi from raspi-config TUI's System Options -> S1 Wireless LAN

From the terminal, you can use **nmcli** to configure the network, **nmcli** is the new default of Raspberry Pi OS. If the examples in the official Pi's documentation is not enough, you can also refer to the documents of the **nmcli** program.

```
pi@raspberrypi:~ $ nmcli radio wifi
enabled
pi@raspberrypi:~ $ sudo nmcli radio wifi on
pi@raspberrypi:~ $ nmcli dev wifi list
IN-USE  BSSID              SSID      MODE   CHAN  RATE        SIGNAL  BARS
SECURITY
*       04:42:1A:65:B3:10  chipsee   Infra  8     270 Mbit/s  50      ▂▄__   WPA2
pi@raspberrypi:~ $ sudo nmcli --ask dev wifi connect <your-ssid>
Password: ••••••••
Device 'wlan0' successfully activated with
'c6052b81-03d4-44fc-97f9-28d5bb121750'.
```

Method 3: Connecting WiFi with nmcli

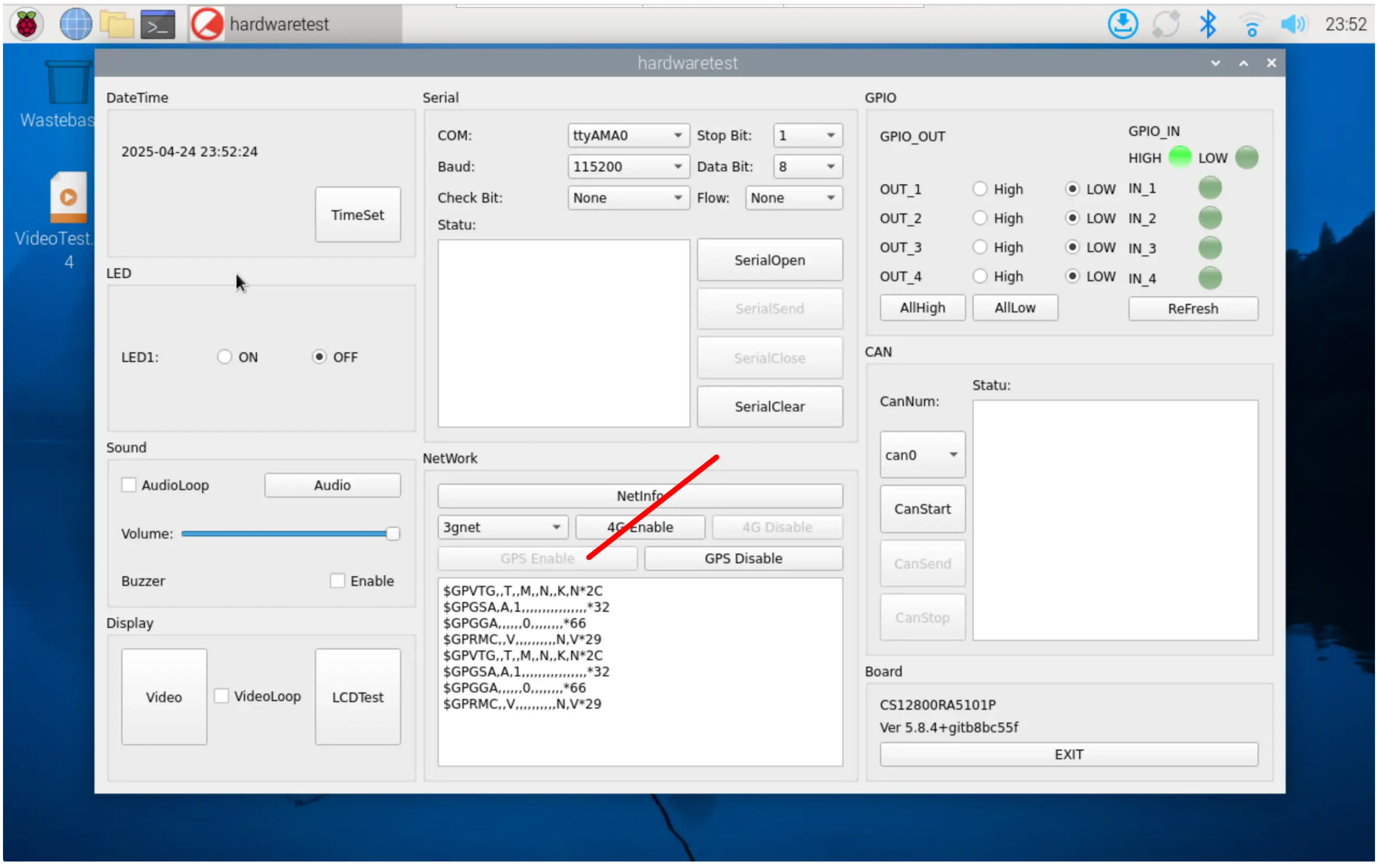
Note that **nmcli cannot manage 4G connections**.

GNSS/GPS

GPS is integrated in the CAT-1 SIM7670G-MNSV module and CAT-4 Quectel EC25 4G/LTE module, if your product comes with one of these module, and a GPS antenna, you can enable the GPS feature.

GPS (CAT-4 Module)

You can test with the *Chipsee hardware test* program, click **GPS Enable** button, you should see some random code(GPS information) in the text box. Wait a few minutes for GPS to become stable.



Click GPS Enable

You can also use GPS programmatically with serial port.

GPS Port: **/dev/ttyUSB1**

AT port: **/dev/ttyUSB2**

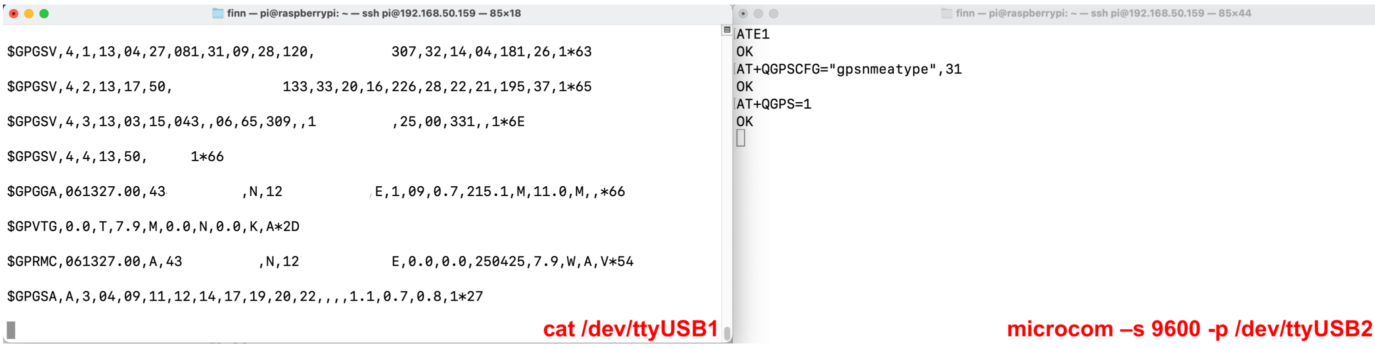
In the first terminal, we use cat to listen for GPS info:

```
cat /dev/ttyUSB1
# hit Enter, the port will keep listening
# until any information comes to the port(after you send AT command to AT port)
```

In the second terminal, send AT instructions:

```
$ microcom –s 9600 -p /dev/ttyUSB2
ATE1 # Enable displaying. Hit Enter after you type ATE1
AT+QGPSCFG="gpsnmeatype",31 # Turn on all output type, GGA/RMC/GSV/GSA/VTG, this setting will be saved to NVRAM, persists after reboot
AT+QGPS=1 # enable GPS, wait some minutes, you can get data from terminal.
```

> **Note**
>
> Ensure the antenna has clear view of the sky — GPS needs time to acquire satellites (can take 30s–2min cold start).



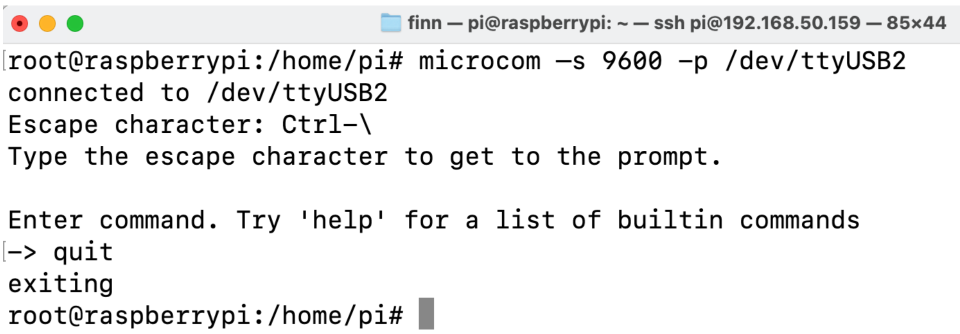
Read GPS from AT Command and NMEA Stream

To disable GPS:

```
AT+QGPSEND # disable GPS
```

To exit microcom:

```
# Press:
# Ctrl + \
# Followed by:
quit
```



Quit from microcom

GPS (CAT-1 Module)

You can use GPS programmatically with serial port on the SIM7670G-MNSV module.

GPS port: **/dev/ttyACM0**

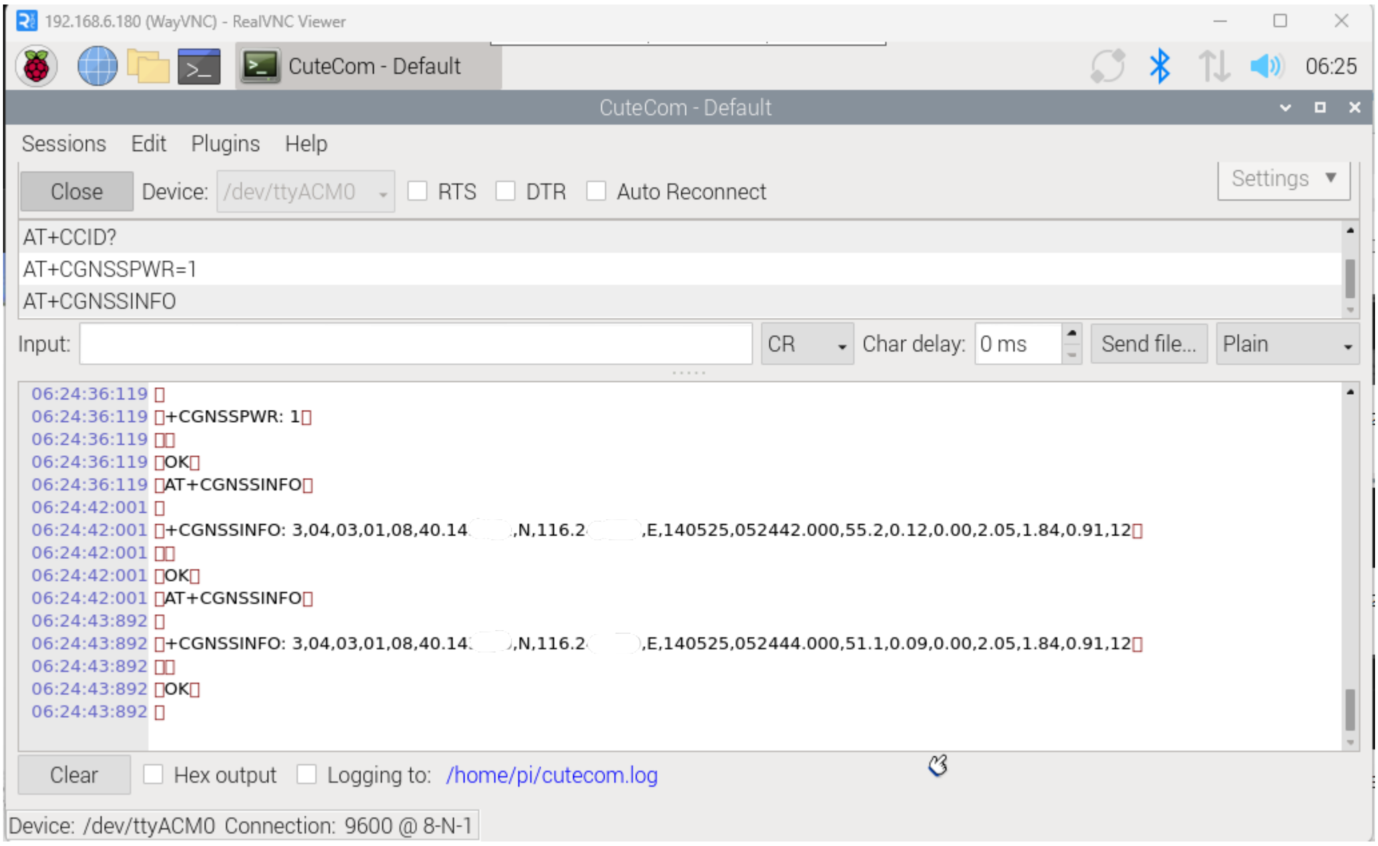
AT port: **/dev/ttyACM0**

Serial port connection: Baudrate 9600 @ 8-N-1.

You can use the CuteCom program to test AT commands:

```
AT+SIMCOMATI # Check CAT-1 module info.

AT+CGNSSPWR=1 # Enable GPS. Command is not persisted across reboot.

AT+CGNSSINFO # Query GPS infomation
```

After each AT command to query GPS, one response is returned.



GPS/GNSS on CAT-1 Module

> **Note**
>
> Ensure the antenna has clear view of the sky — GPS needs time to acquire satellites (can take 30s–2min cold start).

BUZZER

The Chipsee industrial PC has one buzzer. We have created one symbol link to */dev/buzzer* . You can control it as follows:

```
$ echo 1 > /dev/buzzer    # enable buzzer

$ echo 0 > /dev/buzzer    # disable buzzer
```

Backlight

You can turn on or off backlight:

```
$ pinctrl get 18         # get current backlight status
# 18: op dh pd | hi // GPIO18 = output

$ pinctrl set 18 op dh   # set backlight on

$ pinctrl set 18 op dl   # set backlight off
```

Serial Port RS232 and RS485

Check the table below of the RS232/RS485 pin definition to wire your ports:

5 inch product

- PPC-CM5-050(CS12720RA5050P):

Pin Number	Definition	Description	OS Node
Pin 12	CAN1_H	CPU SPI0, CAN H signal	
Pin 11	CAN1_L	CPU SPI0, CAN L signal	CAN0
Pin 10	RS485_5-	CPU UART5, RS485 –(B) signal	
Pin 9	RS485_5+	CPU UART5, RS485 +(A) signal	/dev/ttyAMA4
Pin 8	RS485_3-	CPU UART3, RS485 –(B) signal	
Pin 7	RS485_3+	CPU UART3, RS485 +(A) signal	/dev/ttyAMA2
Pin 6	RS232_2_RXD	CPU UART2, RS232 RXD signal	
Pin 5	RS232_2_TXD	CPU UART2, RS232 TXD signal	/dev/ttyAMA1
Pin 4	RS232_0_RXD	CPU UART0, RS232 RXD signal, Debug Port	
Pin 3	RS232_0_TXD	CPU UART0, RS232 TXD signal Debug Port	/dev/ttyAMA0
Pin 2	GND	System Ground	
Pin 1	+5V	System +5V Power Output, No more than 1A Current output	

Table 483 RS232 / RS485 / CAN Pin Definition for 5 inch product

7 inch / Box products

- EPC-CM5-070 (CS10600RA5070E)
- PPC-CM5-070 (CS10600RA5070P)
- PPC-CM5-070-D (CS10600RA5070P-D)
- CS-CM5-BOX (CSRA5BOX):

RS232 / RS485 / CAN Pin Definition:			
Pin Number	**Definition**	**Description**	**OS Node**
Pin 16	CAN_H	CPU SPI0, CAN BUS “H” signal	CAN0
Pin 15	CAN_L	CPU SPI0, CAN BUS “L” signal	
Pin 14	RS485_5-	CPU UART5, RS485 –(B) signal	/dev/ttyAMA4
Pin 13	RS485_5+	CPU UART5, RS485 +(A) signal	
Pin 12	RS232_5_RXD	CPU UART5, RS232 RXD signal	/dev/ttyAMA4
Pin 11	RS232_5_TXD	CPU UART5, RS232 TXD signal	
Pin 10	RS485_3-	CPU UART3, RS485 –(B) signal	/dev/ttyAMA2
Pin 9	RS485_3+	CPU UART3, RS485 +(A) signal	
Pin 8	RS232_3_RXD	CPU UART3, RS232 RXD signal	/dev/ttyAMA2
Pin 7	RS232_3_TXD	CPU UART3, RS232 TXD signal	
Pin 6	RS232_2_RXD	CPU UART2, RS232 RXD signal	/dev/ttyAMA1
Pin 5	RS232_2_TXD	CPU UART2, RS232 TXD signal	
Pin 4	RS232_0_RXD	CPU UART0, RS232 RXD signal, Debug Port	/dev/ttyAMA0
Pin 3	RS232_0_TXD	CPU UART0, RS232 TXD signal, Debug Port	
Pin 2	GND	System Ground	
Pin 1	+5V	System +5V Power Output, No more than 1A Current output	

Table 484 RS232 / RS485 / CAN Pin Definition for 7 inch/Box products

10.1 inch and above products

- PPC-CM5-101 (CS12800RA5101P)
- PPC-CM5-133 (CS19108RA5133)
- PPC-CM5-150 (CS10768RA5150)
- PPC-CM5-156 (CS19108RA5156)
- PPC-CM5-170 (CS12102RA5170)
- PPC-CM5-190 (CS12102RA5190)
- PPC-CM5-215 (CS19108RA5215)
- PPC-CM5-236 (CS19108RA5236)

PIN1	PIN2	PIN3	PIN4	PIN5	PIN6	PIN7	PIN8	PIN9	PIN10	PIN11	PIN12
CAN_H	CAN_L	RS485_5B	RS485_5A	RS485_3B	RS485_3A	RS232_2RX	RS232_2TX	RS232_0RX	RS232_0TX	GND	VDD_5V

Pin Number	Definition	Description	OS Node
Pin 1	CAN_H	CPU SPI0, CAN H signal	
Pin 2	CAN_L	CPU SPI0, CAN L signal	CAN0
Pin 3	RS485_5-	CPU UART5, RS485 –(B) signal	
Pin 4	RS485_5+	CPU UART5, RS485 +(A) signal	/dev/ttyAMA4
Pin 5	RS485_3-	CPU UART3, RS485 –(B) signal	
Pin 6	RS485_3+	CPU UART3, RS485 +(A) signal	/dev/ttyAMA2
Pin 7	RS232_2_RXD	CPU UART2, RS232 RXD signal	
Pin 8	RS232_2_TXD	CPU UART2, RS232 TXD signal	/dev/ttyAMA1
Pin 9	RS232_0_RXD	CPU UART0, RS232 RXD signal, Debug Port	
Pin 10	RS232_0_TXD	CPU UART0, RS232 TXD signal Debug Port	/dev/ttyAMA0
Pin 11	GND	System Ground	

Pin Number	Definition	Description	OS Node
Pin 12	+5V	System +5V Power Output, No more than 1A Current output	

Table 485 RS232 / RS485 / CAN Pin Definition for 10.1 inch and above products

The 120 Ohm match resistor is **NOT** mounted on the RS485 port.

RS485 ports are half-duplex, the hardware can switch the Tx/Rx direction automatically. RS232 ports are full-duplex.

You can use **cutecom** to test the serial port, they're already installed. If not, you could install with:

```
$ sudo apt-get install cutecom
```

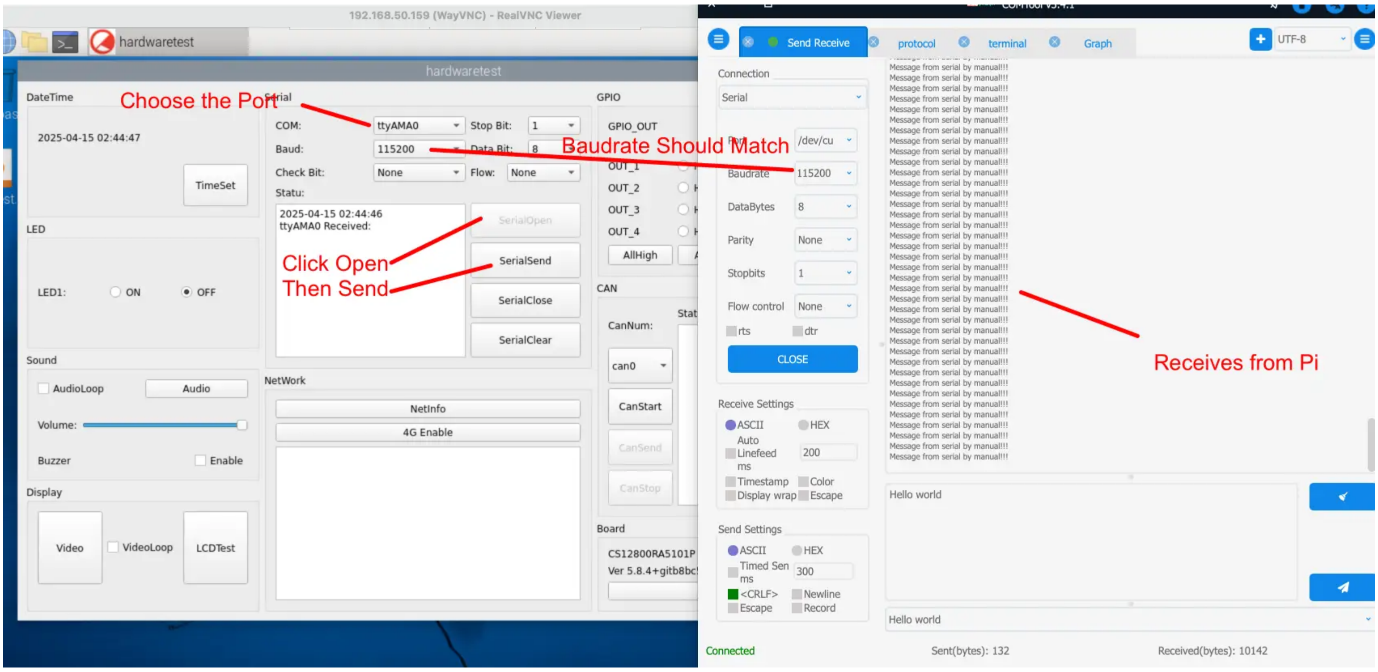
Only root user can use the serial port:

```
$ sudo cutecom
```

Apart from **cutecom**, you can also use the pre-installed HardwareTest program developed by Chipsee to test serial ports, for example, you've wired the serial cable on the RS232_0_RX, RS232_0_TX on the 10.1 inch product, then you can select "ttyAMA0" in "COM", click "SerialOpen".

Then you can use your workstation or another Chipsee PC to communicate with this product.

You may also wish to install a UART/COM Assistant software (such as COMTool) which has a GUI for testing.



Testing Serial Port with Your Workstation

If you’re an experienced engineer, you can also use a programming language to test the serial ports, like C, C++, Python, Javascript. They have their libraries for controlling serial port devices.

By the way, serial debugging is enabled (login from serial) by default, you can refer to the Enable/Disable Serial Debug Port section to change the RS232 port to a normal serial port.

CAN Bus

There is one CAN bus on the Raspberry Pi CM5 based Chipsee industrial PC. You can install *can-utils* and use them to test CAN. But you must add one 120Ω resistor between CAN_H and CAN_L on one of the two Boards, as shown on the figure below.

> **Note**
>
> The Chipsee IPC does not mount the 120Ω matched resistor on all CAN signals by default.

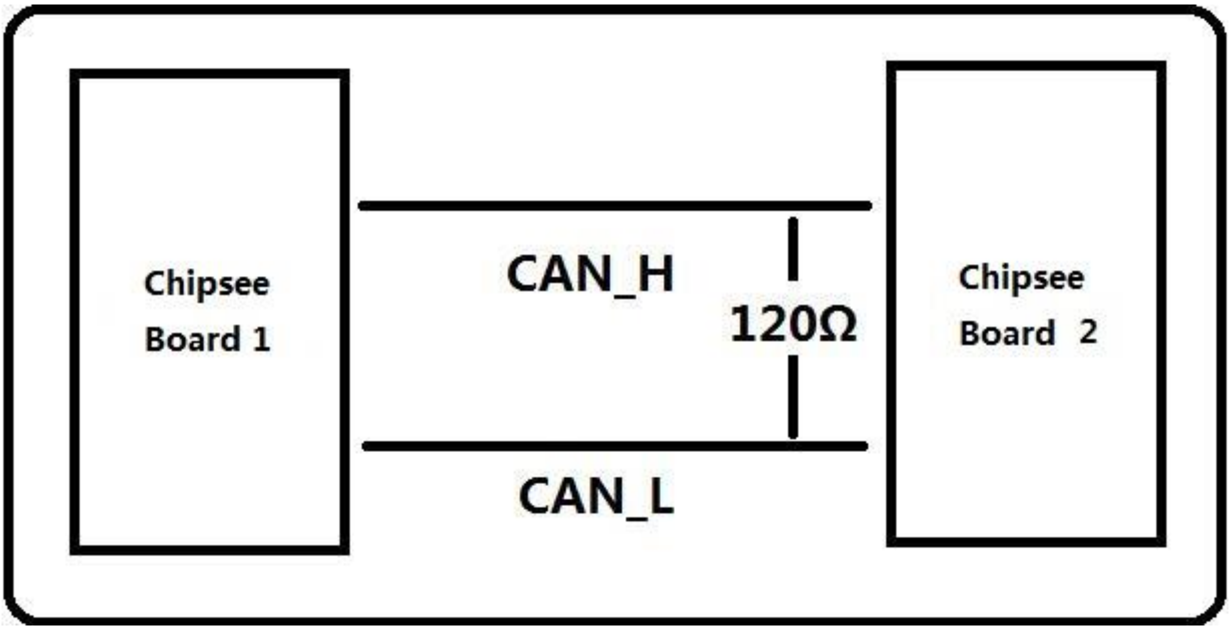


Figure 1065: Connecting CAN

Here are a few examples to test CAN by using CAN units.

- Install *can-utils* if you haven't.

```
$ sudo apt install can-utils
```

- Set the bit-rate to **1Mbits/sec** and data rate to **8Mbits/sec** using the following command (use ROOT user):

```
$ sudo ip link set can0 down
$ sudo ip link set can0 up type can bitrate 1000000 dbitrate 8000000 restart-ms 1000 berr-reporting on fd on
```

> **Note**
>
> If you see:
>
> *RTNETLINK answers: Connection timed out*

> Make sure to mount the 120Ω matched resistor.

- Bring up the device using the command:

```
$ sudo ip link set can0 up
```

- Transfer packets

```
$ sudo cansend can0 5A1#11.2233.44556677.88
```

- Receive data from CAN bus

```
$ sudo candump can0
```

- Bring down the device

```
$ sudo ip link set can0 down
```

GPIO

There are 8 GPIOs, 4 output and 4 input. They are all optical isolated. You can control the output or input pin voltage by feeding the VDD_ISO suite voltage. The pin voltage should be from 5V to 24V, while testing we usually use an external power supply to apply to GND_ISO and VDD_SIO.

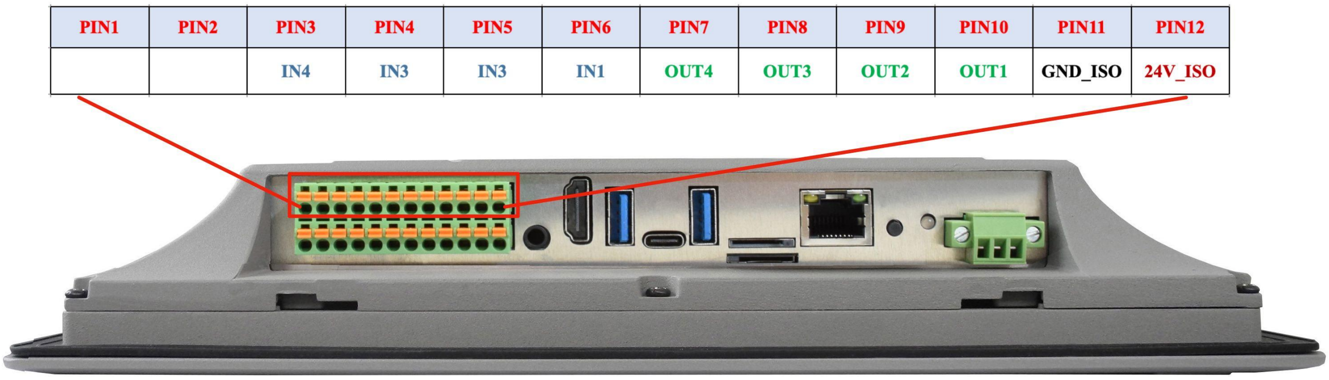
Refer to the tables below for a detailed port definition for:

- EPC-CM5-070 (CS10600RA5070E)
- PPC-CM5-070 (CS10600RA5070P)
- PPC-CM5-070-D (CS10600RA5070P-D)
- CS-CM5-BOX (CSRA5BOX):
- PPC-CM5-101 (CS12800RA5101P)
- PPC-CM5-133 (CS19108RA5133)
- PPC-CM5-150 (CS10768RA5150)
- PPC-CM5-156 (CS19108RA5156)
- PPC-CM5-170 (CS12102RA5170)
- PPC-CM5-190 (CS12102RA5190)
- PPC-CM5-215 (CS19108RA5215)
- PPC-CM5-236 (CS19108RA5236)

Function	Device Node	GPIOD Chip	GPIOD line
IN4	/dev/chipsee-gpio8	0	27
IN3	/dev/chipsee-gpio7	0	26
IN2	/dev/chipsee-gpio6	0	25
IN1	/dev/chipsee-gpio5	0	24
OUT4	/dev/chipsee-gpio4	0	23
OUT3	/dev/chipsee-gpio3	0	22
OUT2	/dev/chipsee-gpio2	0	19
OUT1	/dev/chipsee-gpio1	0	17
Isolated GND	NC		
Isolated VDD(5V-24V)	NC		

Table 486 GPIO Device Node

For 10.1 inch and above products:



GPIO of PPC-CM5-101 (and above screen size) products

For other 7 inch products and box products, there are silk screen indicating the ports (IN 4,3,2,1 / OUT 4,3,2,1 / GND / VDD) on the product body. You can also check the images of GPIO in the hardware documents of your product.

To control GPIO, you can choose between *Chipsee GPIO* (default) or *gpiod* .

Chipsee GPIO

Control *OUT1* by setting it high or low:

```
$ echo 1 > /dev/chipsee-gpio1    # set OUT1 to high

$ echo 0 > /dev/chipsee-gpio1    # set OUT1 to low
```

Get *IN1* value:

```
$ cat /dev/chipsee-gpio5    # value 1 indicates high, value 0 indicates low
```

GPIOD

By default the product is set to use Chipsee GPIO, to use libgpiod to control the GPIO, first open */opt/chipsee/chipsee-init.sh* and comment the following lines to disable Chipsee-GPIO:

```
# comment out the following lines in /opt/chipsee/chipsee-init.sh first
# GPIO
# Comment the below code
num=1
nnum=1
if [ "x$OUT" != "x" ]; then
  for i in $OUT; do
  [ ! -d /sys/class/gpio/gpio$i ] && echo $i > /sys/class/gpio/export
  echo out > /sys/class/gpio/gpio$i/direction
  chmod a+w /sys/class/gpio/gpio$i/value
```

```
  ln -sf /sys/class/gpio/gpio$i/value /dev/chipsee-gpio$num
  ln -sf /sys/class/gpio/gpio$i/value /dev/gpio-out$nnum
  num=`expr $num + 1`
  nnum=`expr $nnum + 1`
  done
fi

sleep 1

nnum=1
if [ "x$IN" != "x" ]; then
  for i in $IN; do
  [ ! -d /sys/class/gpio/gpio$i ] && echo $i > /sys/class/gpio/export
  echo in > /sys/class/gpio/gpio$i/direction
  chmod a+r /sys/class/gpio/gpio$i/value
  ln -sf /sys/class/gpio/gpio$i/value /dev/chipsee-gpio$num
  ln -sf /sys/class/gpio/gpio$i/value /dev/gpio-in$nnum
  num=`expr $num + 1`
  nnum=`expr $nnum + 1`
  done
fi
# Comment the above code
```

Then reboot the machine to take effect:

```
# reboot to use libgpiod
$ sudo reboot
```

The product uses Raspberry Pi CM5 GPIO, you can use *gpioset* and *gpioget* to control them, the GPIOD chip is 0, the GPIOD line is listed in the table above.

Set OUTPUT with GPIOD

For example, to set OUT1 to high, we need to run *gpioset chip line=1* which is *gpioset 0 17=1* , the “17” is the GPIOD line number for OUT1 pin.

```
$ gpioset 0 17=1 # Set OUT1 to high
$ gpioset 0 17=0 # Set OUT1 to low
```

Check INPUT with GPIOD

To check the INPUT level, use *gpioget* . For example, to check the input level for IN4, it is *gpioget chip line* which is *gpioget 0 27* , the “27” is the GPIOD line number for IN4 pin:

```
$ gpioget 0 27 # Gets the input level for IN4
0 # input is low
1 # input is high
```

Other Tools of GPIOD

libgpiod includes several tools that are available in Raspberry Pi OS, such as:

```
gpiodetect # list gpiochips

gpioinfo # list GPIO lines

gpiomon # wait for edge events on GPIO lines

gpiofind # determine the location of the specific named GPIO
```

You can search their usage on the Internet if you wish to learn more.

Camera

The camera connector(if your product has one) is compatible with the official Raspberry Pi. Please refer to the following link to learn how to attach a camera: https://www.raspberrypi.com/documentation/computers/compute-module.html#attach-a-camera-module

The camera connector uses a 22-pin socket, you can check your product's hardware document to find out the pin definition.

Chipsee-init shell

We use one **chipsee-init.sh** as an initial shell which is placed in *`/opt/chipsee/chipsee-init.sh`*.

We initialize the GPIO/Buzzer and other configs in it. If you want to change it, please be careful.

Do a backup first before you modify anything. This script will generaged one log file which is located on /var/log/chipsee-init.sh.log.

If your device has booting issues, you can send Chipsee® the file to help you find out what happened.

Flashing an image to the Compute Module

This part is mostly the same as the official Raspberry Pi Compute Module documentation, except that you need to press the "PROG_Button" before supplying power to the device, see details below.

The Chipsee industrial Pi runs on the Raspberry Pi Compute Module, the module has an on-board eMMC. This guide explains how to flash (write) an operating system image to the eMMC storage of the device.

CM5 Lite does not have on-board eMMC. Instead, flash the OS just like a regular Raspberry Pi's TF card (https://www.raspberrypi.com/documentation/computers/getting-started.html#installing-the-operating-system).

Prerequisites

To flash an image, you need the following:

- Download the `Latest system image for Chipsee Industrial Pi products`
- Another computer, referred to as a host device. You can use Linux (like Raspberry Pi 64bit OS on a regular Pi 4/5, Ubuntu or Debian), Windows 10/11, or macOS.
- A USB-C to USB-C cable; or a USB-C to USB-A cable.

> **Note**
>
> In some cases, USB hubs can prevent the host device from recognising the Compute Module. If your host device does not recognise the Compute Module, try connecting the Compute Module directly to the host device. For more diagnostic tips, see the usbboot troubleshooting guide.

Usbboot

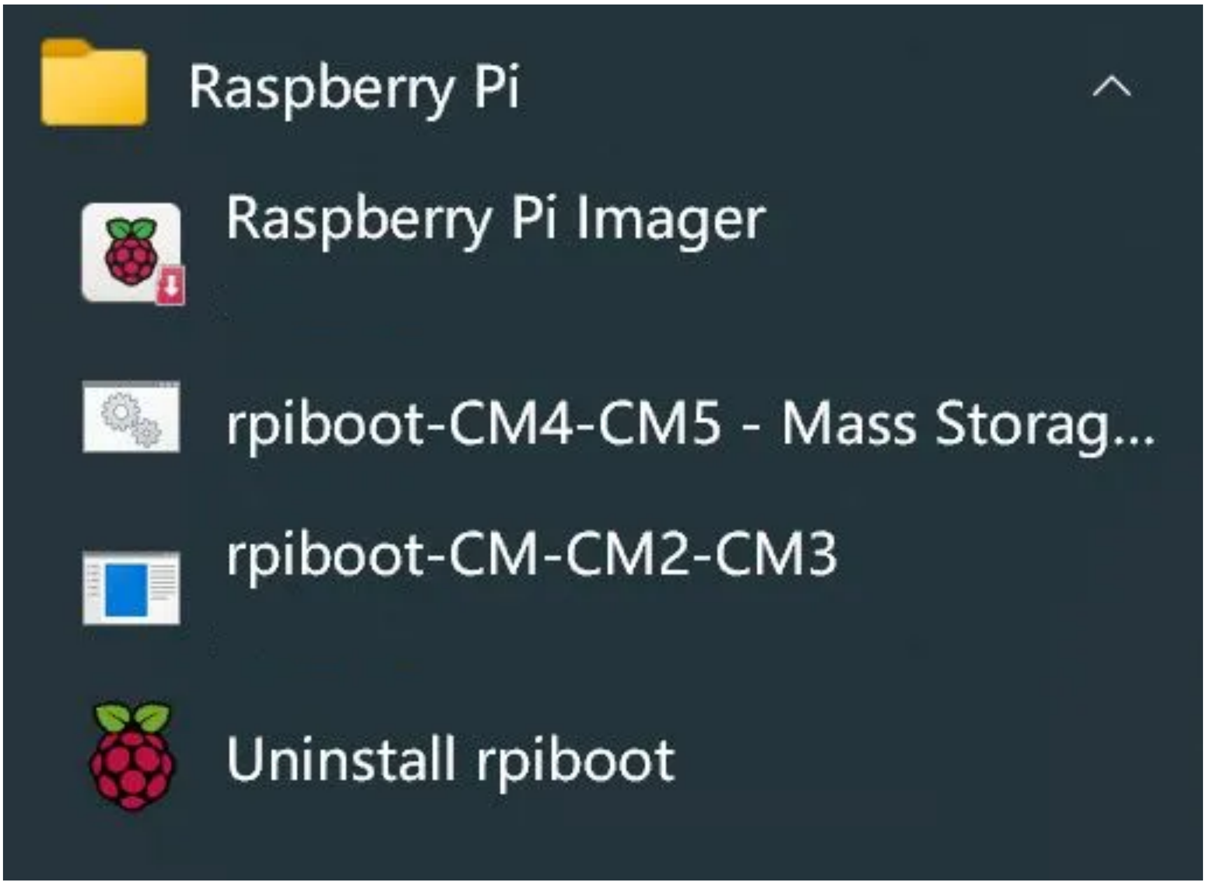
In short, we will run a Raspberry Pi *usbboot* program on the host, it will recognize the Chipsee industrial Pi as a storage. After that we press the PROG button on the device before supplying power, while pressing we plug the power cable, the device will boot as a storage, such that our host's *usbboot* program can recognize it. Let see how to do it in different OS:

For Window

To set up software on a Windows 10/11 host device:

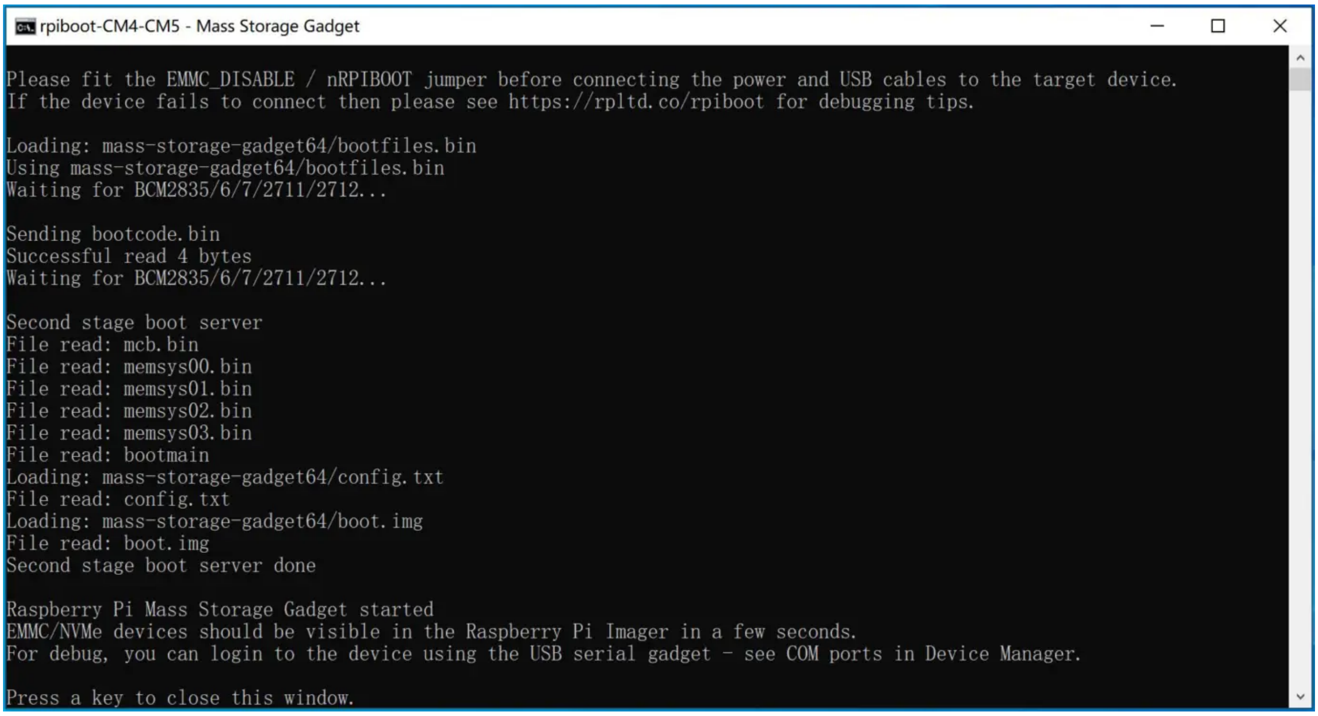
1. Download the Windows installer (or, alternatively, build Windows rpiboot from source).
2. Double-click on the installer to run it. This installs the drivers and boot tool. Do not close any driver installation windows which appear during the installation process.

3. Reboot Windows.
4. Connect the USB-C on the device to your host device.
5. Run the *rpiboot* program installed by the Windows installer in the Windows Start menu.



Run the rpiboot-CM4-CM5 program

6. Press and hold the PROG button, then supply power to the device, keep holding the PROG button for 5 seconds, until you see the host machine's command line has new text appearing, then release the button.



Successfully Configured eMMC as USB mass storage

7. Then you can enter the Flash the eMMC section below.

For Linux

To set up software on a Linux host device:

1. Run the following command to install rpiboot (or, alternatively, build Linux rpiboot from source):

```
sudo apt install rpiboot
```

Note

Whether or not to build rpiboot from source depends on your OS version, for example, on Ubuntu 24, the Ubuntu apt source's rpiboot program is outdated, in this case you need to build from source to recognize CM5.

After running **rpiboot**, if you see: *Waiting for BCM2835/6/7/2711...* It doesn't have support for *BCM2712* , then it can't recognize CM5.

```
finn@ubuntu24:~$ sudo apt install rpiboot
[sudo] password for finn:
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following NEW packages will be installed:
  rpiboot
0 upgraded, 1 newly installed, 0 to remove and 107 not upgraded.
Need to get 65.9 MB of archives.
After this operation, 77.7 MB of additional disk space will be used.
Get:1 http://archive.ubuntu.com/ubuntu noble/multiverse amd64 rpiboot amd64 0~20
220315+git6fa2ec0+nowin-0ubuntu1 [65.9 MB]
Fetched 65.9 MB in 12s (5,454 kB/s)
Selecting previously unselected package rpiboot.
(Reading database ... 192144 files and directories currently installed.)
Preparing to unpack .../rpiboot_0~20220315+git6fa2ec0+nowin-0ubuntu1_amd64.deb .
..
Unpacking rpiboot (0~20220315+git6fa2ec0+nowin-0ubuntu1) ...
Setting up rpiboot (0~20220315+git6fa2ec0+nowin-0ubuntu1) ...
Processing triggers for man-db (2.12.0-4build2) ...
finn@ubuntu24:~$ sudo rpiboot
RPIBOOT: build-date Jan 31 2022 version 0~20220315+git6fa2ec0+nowin-0ubuntu1
Waiting for BCM2835/6/7/2711...
```

Just BCM2835/6/7/2711, doesn't support CM5

If you see: *Waiting for BCM2835/6/7/2711/2712...* , then it supports BCM2712 (CM5).

```
finn@ubuntu24:~/Downloads$ cd usbboot/
finn@ubuntu24:~/Downloads/usbboot$ make
xxd -i msd/bootcode.bin > msd/bootcode.h
xxd -i msd/start.elf > msd/start.h
xxd -i msd/bootcode4.bin > msd/bootcode4.h
cc -Wall -Wextra -g   -o rpiboot main.c bootfiles.c decode_duid.c `pkg-config --cfla
gs --libs libusb-1.0` -DGIT_VER="\"ecfb7222\"" -DPKG_VER="\"local\"" -DBUILD_DATE="\
"2025/04/22\"" -DINSTALL_PREFIX=\"/usr\"
finn@ubuntu24:~/Downloads/usbboot$ sudo ./rpiboot -d mass-storage-gadget64
RPIBOOT: build-date 2025/04/22 pkg-version local ecfb7222

Please fit the EMMC_DISABLE / nRPIBOOT jumper before connecting the power and USB ca
bles to the target device.
If the device fails to connect then please see https://rpltd.co/rpiboot for debuggin
g tips.

Loading: mass-storage-gadget64/bootfiles.bin
Using mass-storage-gadget64/bootfiles.bin
Waiting for BCM2835/6/7/2711/2712...

Sending bootcode.bin
Successful read 4 bytes
Waiting for BCM2835/6/7/2711/2712...

Second stage boot server
File read: mcb.bin
File read: memsys00.bin
File read: memsys01.bin
File read: memsys02.bin
File read: memsys03.bin
File read: bootmain
Loading: mass-storage-gadget64/config.txt
File read: config.txt
Loading: mass-storage-gadget64/boot.img
File read: boot.img
Second stage boot server done
```

> *Has 2712, supports CM5*

2. Connect the USB-C on the device to your host device.
3. Then, run rpiboot:

```
sudo rpiboot # if using OS apt source

sudo ./rpiboot -d mass-storage-gadget64 # if you built from source
```

   You should see:

```
Loading: mass-storage-gadget64/bootfiles.bin
Using mass-storage-gadget64/bootfiles.bin
Waiting for BCM2835/6/7/2711/2712...
```

4. Press and hold the PROG button, then supply power to the device, keep holding the PROG button for 5 seconds, until you see the host machine's command line has new text appearing, then release the button.
5. After a few seconds, the Compute Module should appear as a mass storage device. You can see a *bootfs, rootfs* appear in Ubuntu Files sidebar like a external storage. Alternatively, run **lsblk** and search for a device with a storage capacity that matches the capacity of your Compute Module.

```
finn@ubuntu24:~$ lsblk
NAME        MAJ:MIN RM   SIZE RO TYPE MOUNTPOINTS
loop0         7:0    0     4K  1 loop /snap/bare/
loop1         7:1    0  73.9M  1 loop /snap/core2
loop2         7:2    0  73.9M  1 loop /snap/core2
loop3         7:3    0   258M  1 loop /snap/firef
loop4         7:4    0   242M  1 loop /snap/firef
loop5         7:5    0  11.1M  1 loop /snap/firmw
loop6         7:6    0   516M  1 loop /snap/gnome-
loop7         7:7    0  91.7M  1 loop /snap/gtk-c
loop8         7:8    0  10.8M  1 loop /snap/snap-
loop9         7:9    0  10.8M  1 loop /snap/snap-
loop10        7:10   0  44.4M  1 loop /snap/snapd
loop11        7:11   0  44.4M  1 loop /snap/snapd
loop12        7:12   0   568K  1 loop /snap/snapd-
sda           8:0    0 238.5G  0 disk
├─sda1        8:1    0     1G  0 part /boot/efi
└─sda2        8:2    0 237.4G  0 part /
sdb           8:16   1  29.1G  0 disk
├─sdb1        8:17   1   512M  0 part
└─sdb2        8:18   1  28.6G  0 part
```

A 32GB eMMC appears as /dev/sdb

6. Then you can enter the Flash the eMMC section below.

For MacOS

To set up software on a macOS host device:

1. First, build macOS rpiboot from source.
2. Connect the USB-C on the device to your host device.
3. Then, run the *rpiboot* executable with the following command:

```
$ sudo ./rpiboot -d mass-storage-gadget64
# this command might change in the future, check the Github repo's macOS
section for the latest information
```

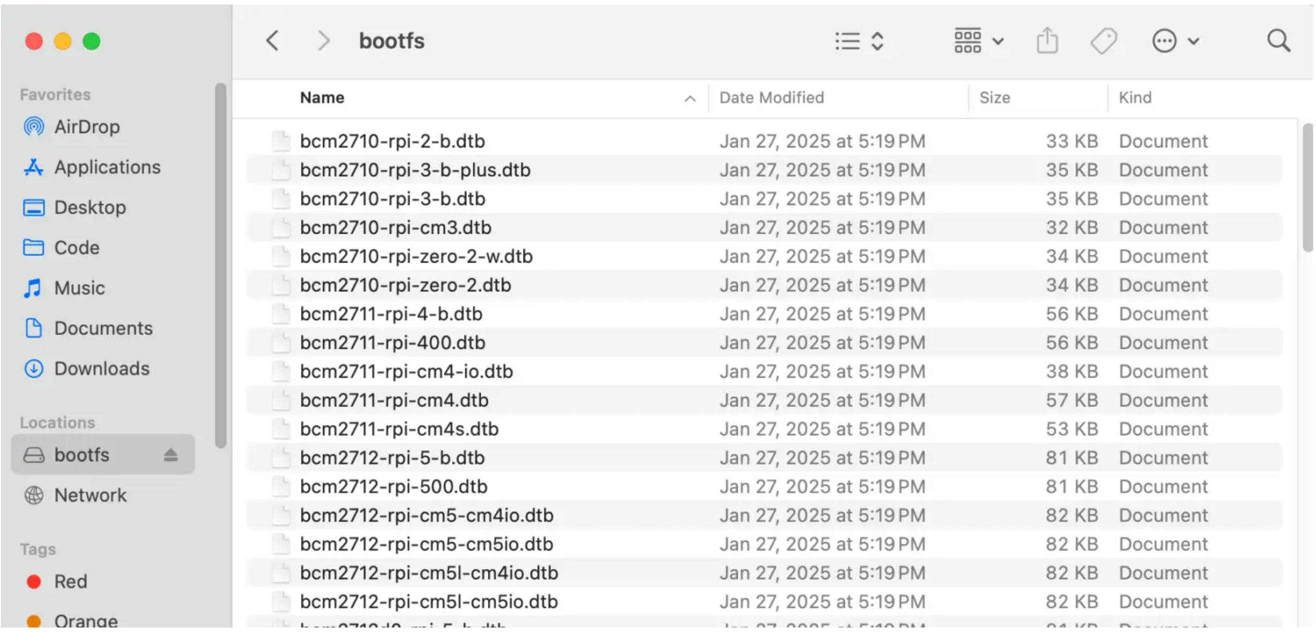
   You should see:

```
Loading: mass-storage-gadget64/bootfiles.bin
Using mass-storage-gadget64/bootfiles.bin
Waiting for BCM2835/6/7/2711/2712...
```

4. Press and hold the PROG button, then supply power to the device, keep holding the PROG button for 5 seconds, until you see the host machine's command line has new text appearing, then release the button.
5. You should see:

```
Waiting for BCM2835/6/7/2711/2712...

Sending bootcode.bin
Successful read 4 bytes
Waiting for BCM2835/6/7/2711/2712...

Second stage boot server
File read: mcb.bin
File read: memsys00.bin
File read: memsys01.bin
File read: memsys02.bin
File read: memsys03.bin
File read: bootmain
Loading: mass-storage-gadget64/config.txt
File read: config.txt
Loading: mass-storage-gadget64/boot.img
File read: boot.img
Second stage boot server done
```

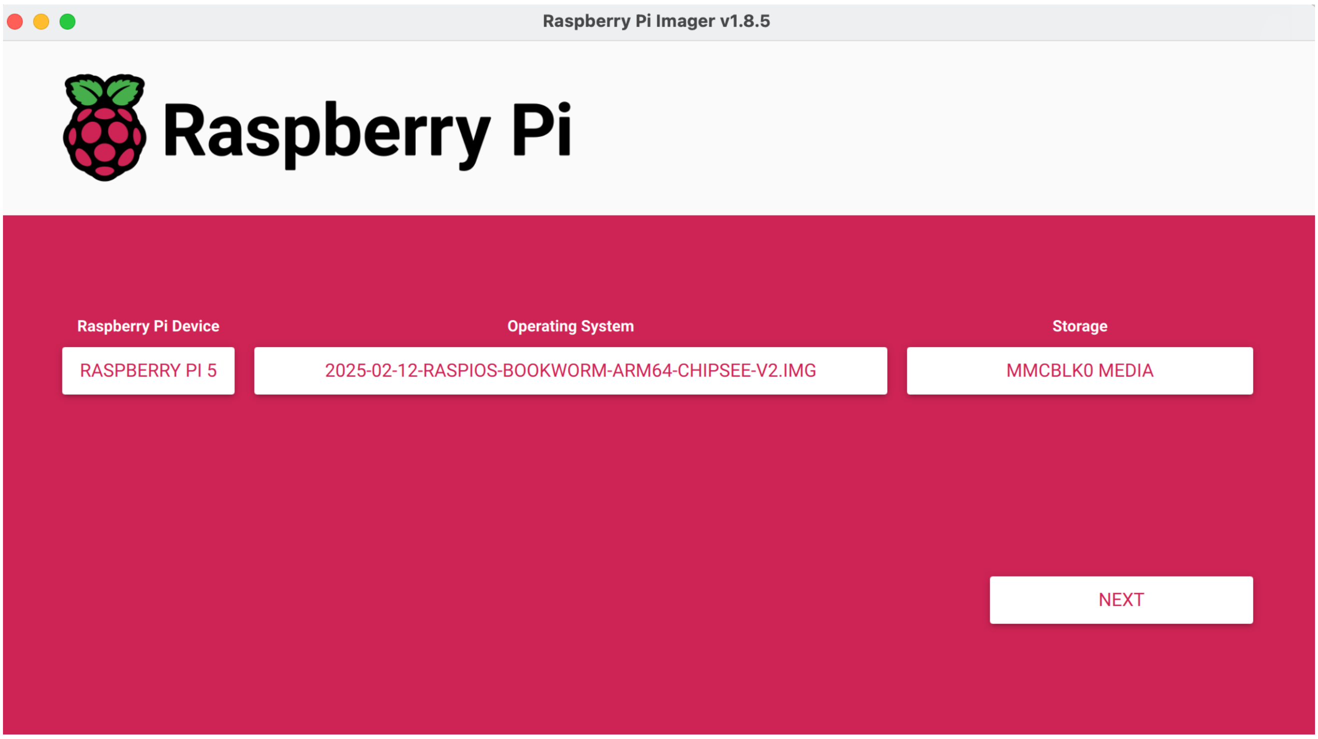
6. When the command finishes running, you should see a *bootfs* disk in Finder. Your Compute Module should now appear as a mass storage device.



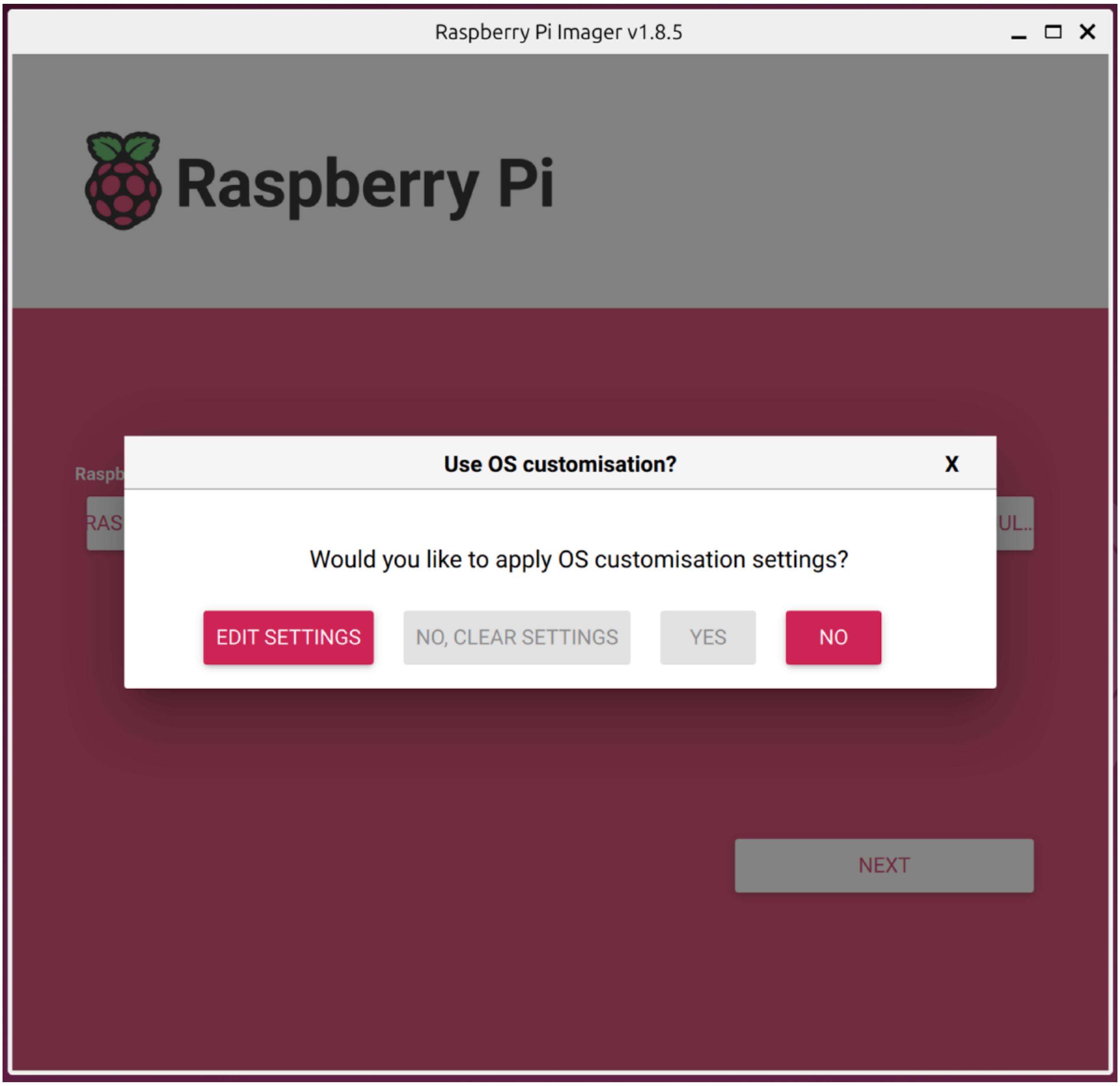
Flash the eMMC

After the device's eMMC has been detected as a USB mass storage, you can use Raspberry Pi Imager or Balena Etcher to flash an operating system image to a Compute Module.

1. First **decompress** the xxx-raspios-chipsee-xxx **.img.xz** file (around 1GB) you `downloaded before`, the decompressed xxx-raspios-chipsee-xxx **.img** file should be around 6GB (with desktop) in file size.
2. Use either Raspberry Pi Imager *or* Balena Etcher:
   - If using Raspberry Pi Imager, select *Raspberry 5 / Compute Module 5* in Device; select *Use custom -> choose the decompressed .img file* in Operating System; select the appeared *mmcblk0 (bootfs)* in Storage.



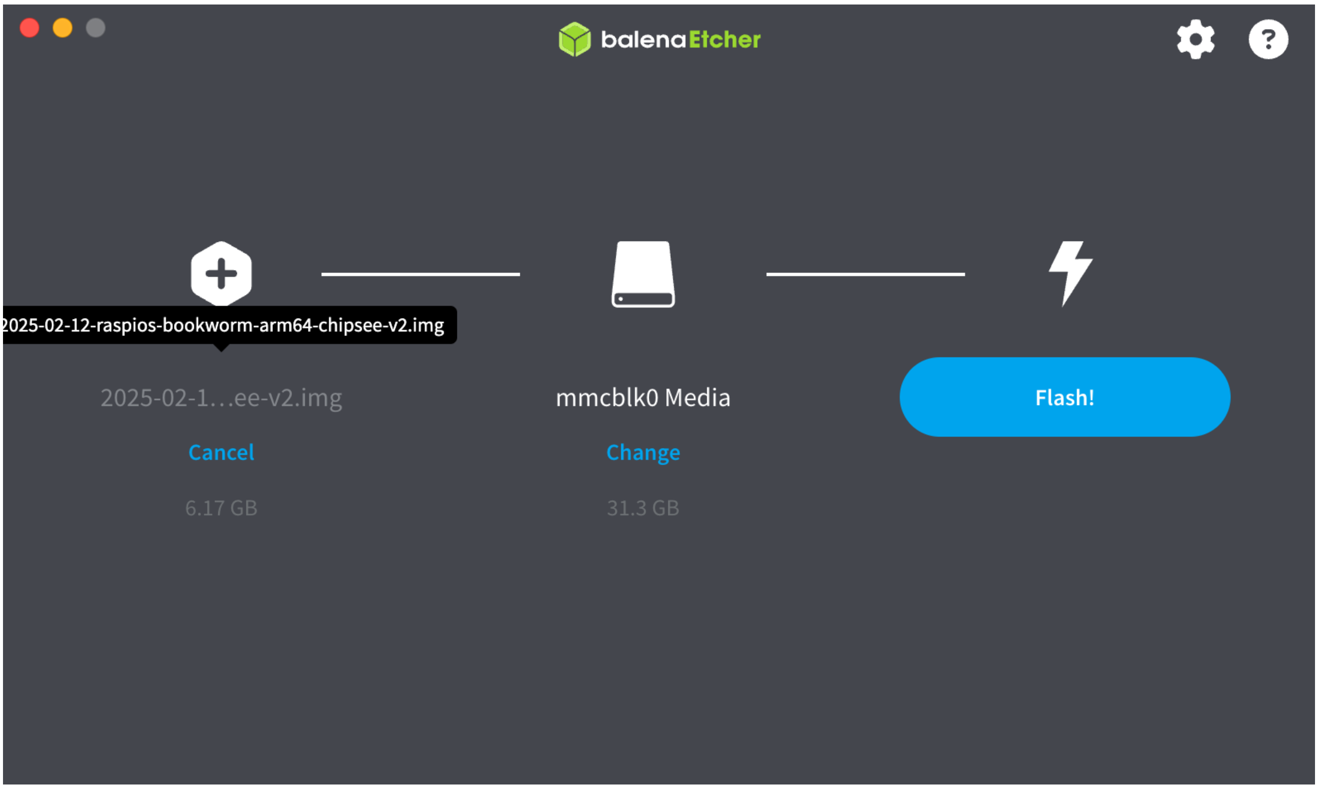
Flash OS with Raspberry Pi Imager



Clear Settings and Select No Customization Unless You Need Customization

Successfully Flash OS with Raspberry Pi Imager

- If using Balena Etcher, choose *Flash from File* and select the decompress **.img** file; select the appeared *mmcblk0* (or similar capacity of your Compute Module) in *Select Target*, click *Flash!*.



3. At last, reboot the device. It could take a few minutes in the first boot, now you have a brand new Raspberry Pi OS.

Hailo AI

The Chipsee CM5 products have a M.2 slot that supports Hailo AI module, you can buy the module from Chipsee or bring your own and install it by yourself.

To use the Hailo AI module with Raspberry Pi of on CM5 product, you can follow the official Raspberry Pi Hailo documentation, or follow the guide below.

As of the time writing (Apr 30, 2025), the Hailo 8L module has been tested on the Chipsee CM5 products, it works pretty much out of the box with only a few commands to install the driver and software kit.

The main references for using Hailo AI module on CM5 is Hailo's official Github repo and Raspberry Pi's official documentation

Install the dependencies required to use the NPU:

```
$ sudo apt install hailo-all
```

Reboot your Raspberry Pi with *sudo reboot* .

To ensure everything is running correctly:

```
pi@raspberrypi:~ $ hailortcli fw-control identify

Executing on device: 0000:01:00.0
Identifying board
Control Protocol Version: 2
Firmware Version: 4.20.0 (release,app,extended context switch buffer)
Logger Version: 0
Board Name: Hailo-8
Device Architecture: HAILO8L
Serial Number: HLDDLBB
Part Number: HM21LB1C2LAE
Product Name: HAILO-8L AI ACC M.2 B+M KEY MODULE EXT TMP
```

Test TAPPAS Core installation by running the following commands:

Hailotools: (TAPPAS Gstreamer elements)

```
pi@raspberrypi:~ $ gst-inspect-1.0 hailotools

  Plugin Details:
  Name                     hailotools
  Description              hailo tools plugin
  Filename                 /lib/aarch64-linux-gnu/gstreamer-1.0/
libgsthailotools.so
```

```
Version                   3.31.0
License                   unknown
Source module             gst-hailo-tools
Binary package            gst-hailo-tools
Origin URL                https://hailo.ai/

hailoaggregator: hailoaggregator - Cascading
hailocounter: hailocounter - postprocessing element
hailocropper: hailocropper
hailoexportfile: hailoexportfile - export element
hailoexportzmq: hailoexportzmq - export element
hailofilter: hailofilter - postprocessing element
hailogallery: Hailo gallery element
hailograytonv12: hailograytonv12 - postprocessing element
hailoimportzmq: hailoimportzmq - import element
hailomuxer: Muxer pipeline merging
hailonv12togray: hailonv12togray - postprocessing element
hailonvalve: HailoNValve element
hailooverlay: hailooverlay - overlay element
hailoroundrobin: Input Round Robin element
hailostreamrouter: Hailo Stream Router
hailotileaggregator: hailotileaggregator
hailotilecropper: hailotilecropper - Tiling
hailotracker: Hailo object tracking element

18 features:
+-- 18 elements
```

Hailonet: (HailoRT inference Gstreamer element)

```
pi@raspberrypi:~ $ gst-inspect-1.0 hailotools

Plugin Details:
Name                      hailo
Description               hailo gstreamer plugin
Filename                  /lib/aarch64-linux-gnu/gstreamer-1.0/libgsthailo.so
Version                   1.0
License                   unknown
Source module             hailo
Binary package            GStreamer
Origin URL                http://gstreamer.net/

hailodevicestats: hailodevicestats element
hailonet: hailonet element
synchailonet: sync hailonet element

3 features:
+-- 3 elements
```

Install hailo-rpi5-examples:

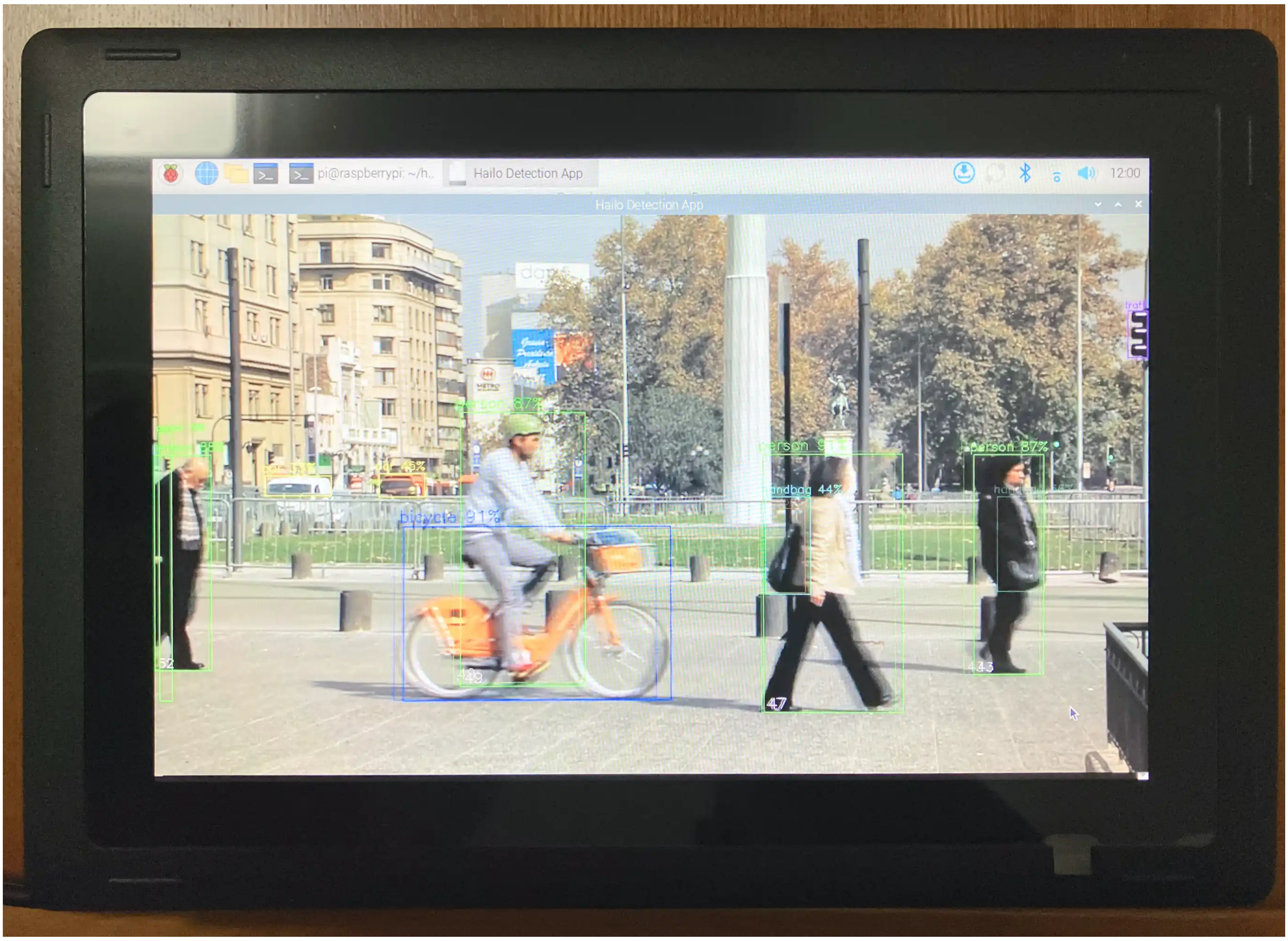
```
git clone https://github.com/hailo-ai/hailo-rpi5-examples.git

cd hailo-rpi5-examples

./install.sh
```

Running the examples:

```
$ source setup_env.sh

Setting up the environment...
Setting up the environment for hailo-tappas-core...
TAPPAS_VERSION is 3.31.0. Proceeding...
You are not in the venv_hailo_rpi5_examples virtual environment.
Virtual environment exists. Activating...
TAPPAS_POST_PROC_DIR set to /usr/lib/aarch64-linux-gnu/hailo/tappas/
post_processes
DEVICE_ARCHITECTURE is set to: HAILO8L
```

To run the video detection example:

```
python basic_pipelines/detection.py
```



Hailo 8L on Chipsee PPC-CM5-101 Object Detection

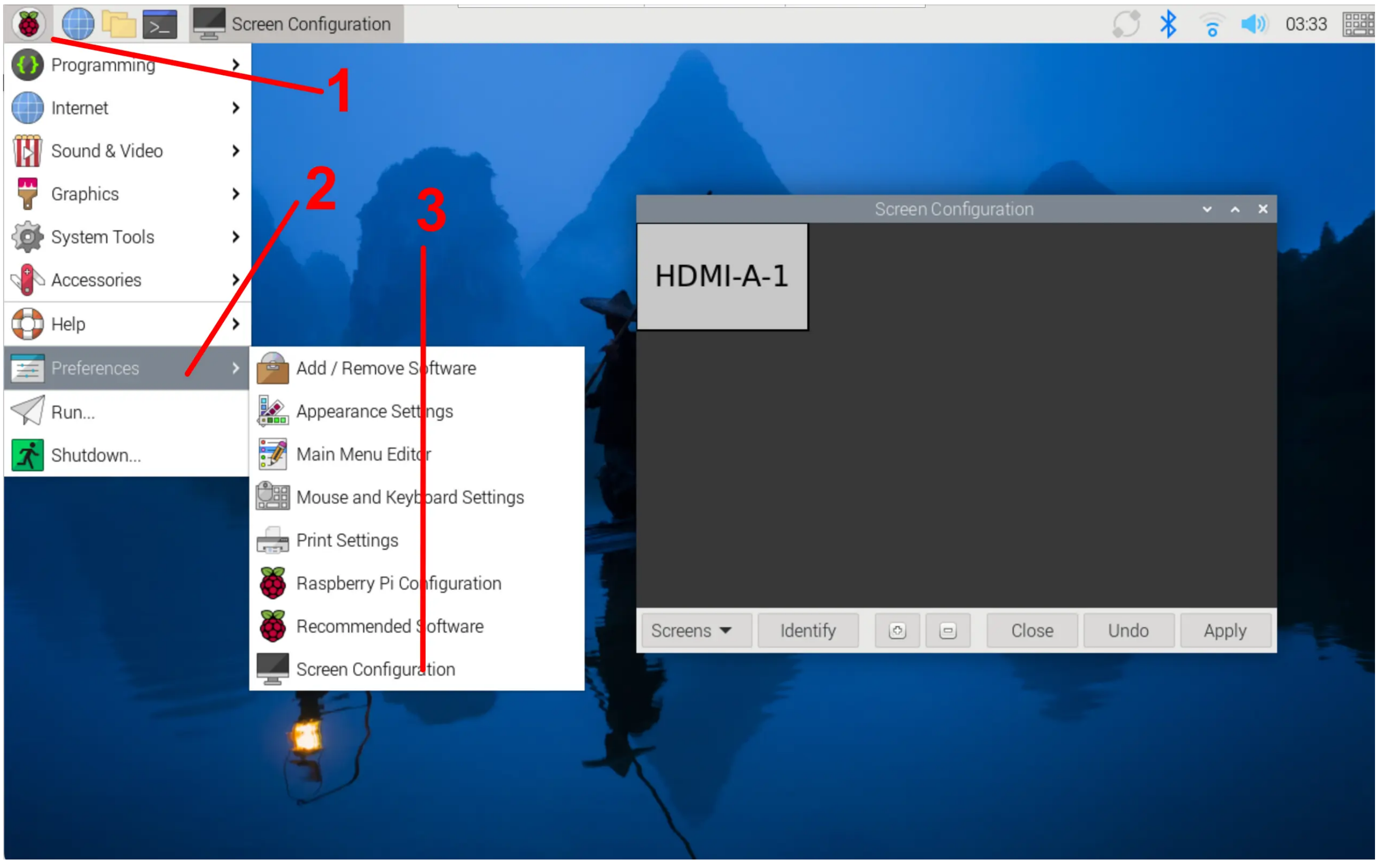
Running with USB camera input (webcam):

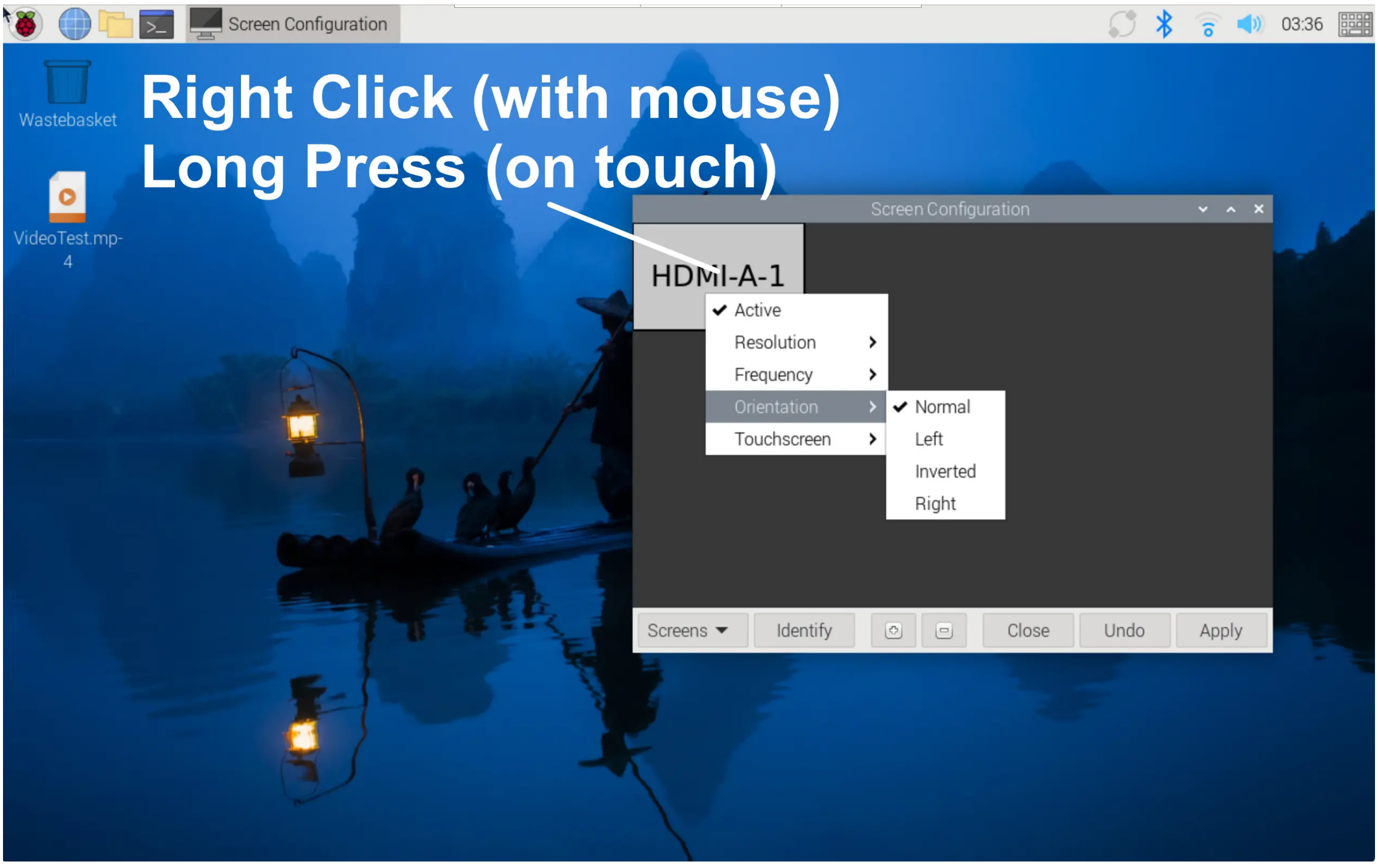
```
python basic_pipelines/detection.py --input usb
```

FAQ

How to rotate the screen?

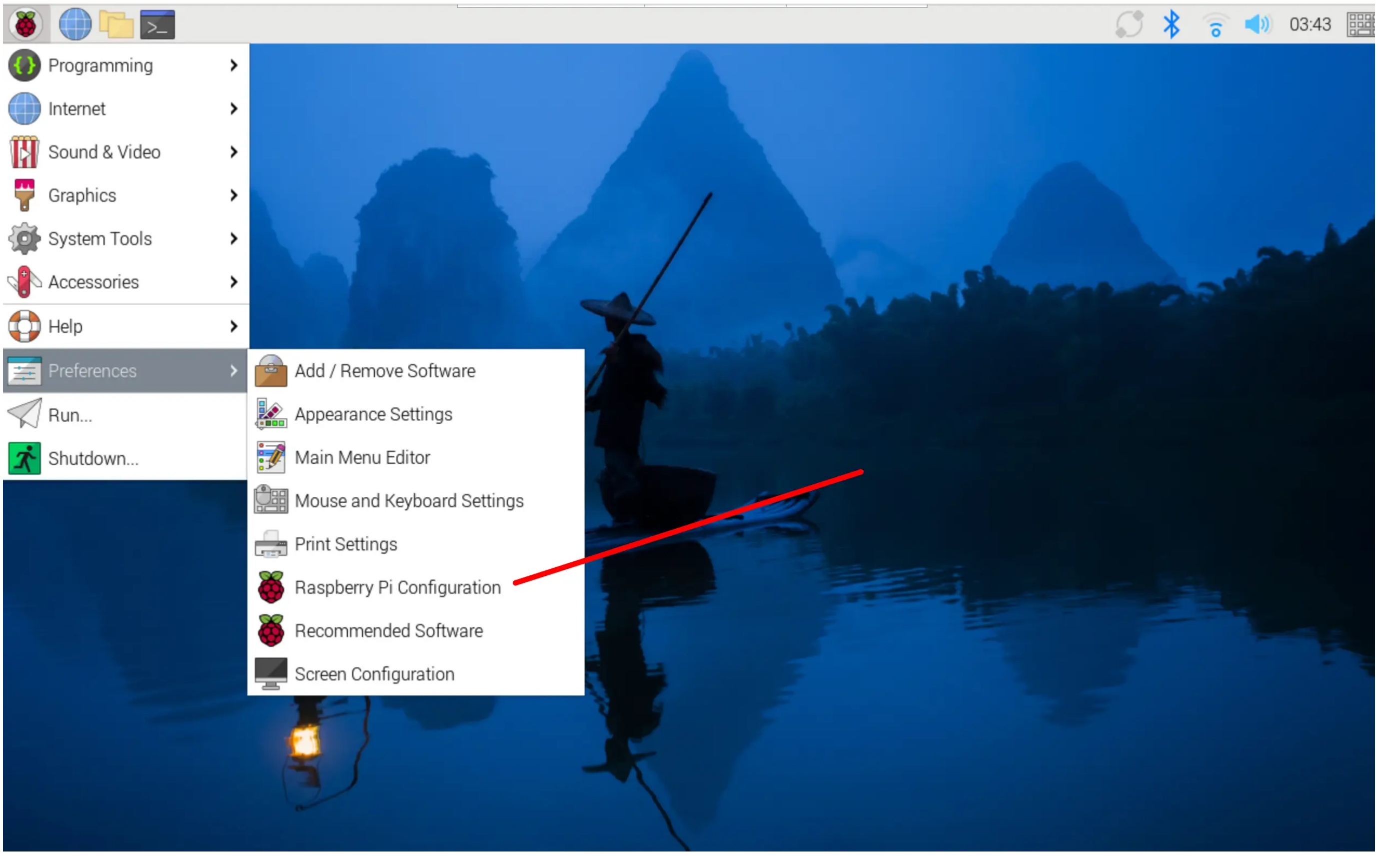
Click top left menu, Preferences -> Screen Configuration. Then right click (or long press if using touch screen) HDMI-A-1 grey area, Choose orientation, then select the rotate option. The touchscreen will be rotated along with the display.

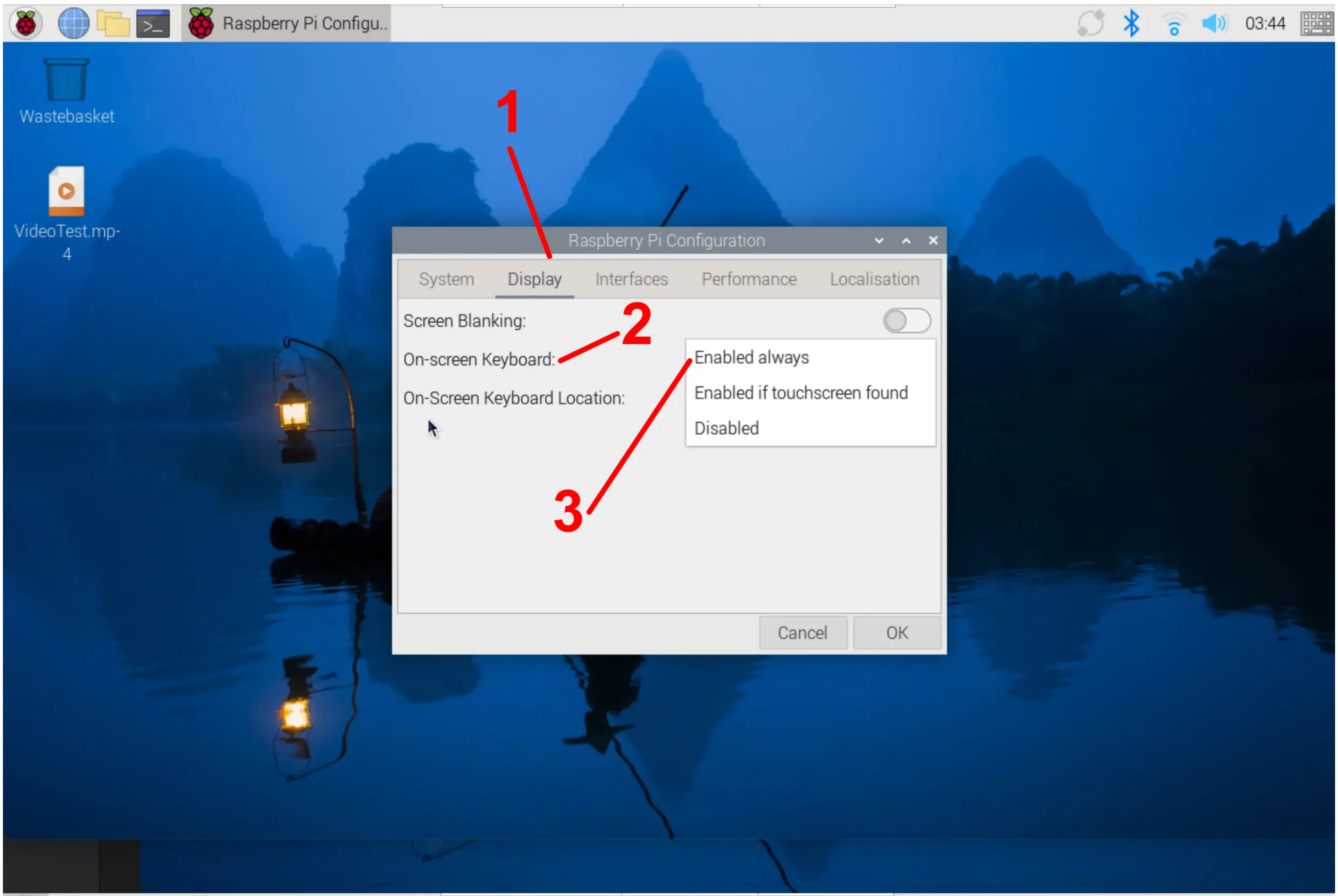


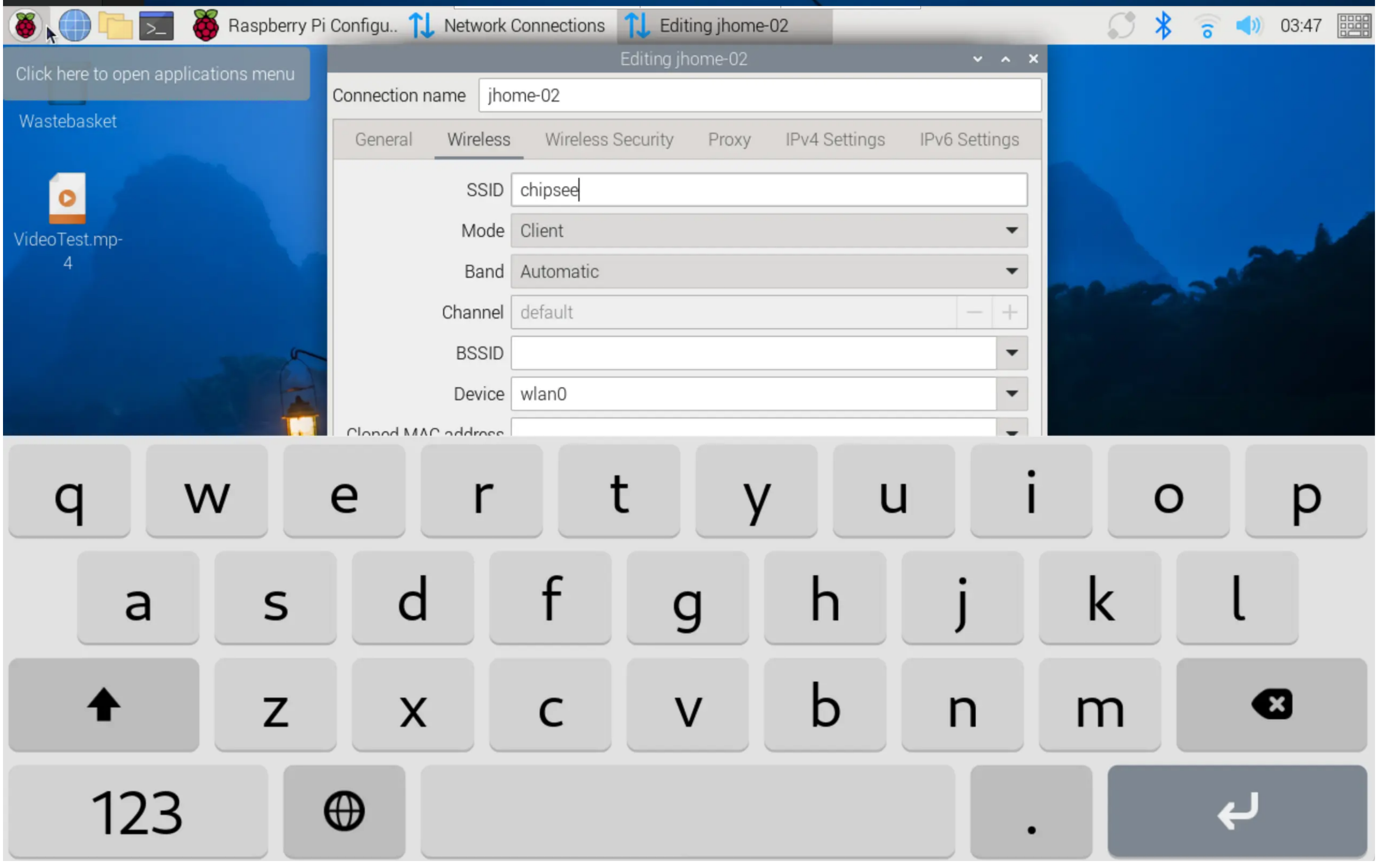


How to enable the on screen virtual keyboard?

Select Raspberry Pi Configuration, choose “Display”, in On-screen keyboard, select “Enabled Always”, then click OK to save.







The keyboard will automatically pop up when entering text.

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