

Chipsee_BCM_Debian_User_Manual

Rev 2.1



About the Document

History

Revision	Date	Author	Description
2.1	2021-02-25	Chipsee	Modify 4G connection commands
2.0	2021-02-02	Chipsee	Add support for more products
1.0	2020-01-16	Chipsee	Initial

Supported Board

CS10600RA070

CS12800RA101-C111

CS10600RA4070

CS12800RA4101-C111

Supported Latest Images

2020-12-02-raspios-buster-armhf-full-chipsee.img.xz

2020-12-02-raspios-buster-armhf-chipsee.img.xz

2020-12-02-raspios-buster-armhf-lite-chipsee.img.xz

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System Features

Feature	Comment
Kernel	Kernel 5.4.79
System Version *	based on raspios 2020-12-02
Python	Python 2.7.16 / Python 3.7.3
Qt	Needs to be installed by the user
GCC	8.3.0
Debian Version	Debian 10 (Buster)
user/password	[pi/raspberry]

*The system we used is based on the Raspberry official system; we add Chipsee hardware drivers to the Raspberry official system. For more information, please refer to:

<https://github.com/Chipsee/industrial-pi>

1 Prepare

1.1. Hardware

- Chipsee Raspberry Pi
- 6V ~ 36V Power Adapter (CS10600RA070 /CS10600RA4070 /CS12800RA101)
- 12V 2A Power Adapter(CS12800RA4101)
- Mini-B USB OTG Cable (CS10600RA070 /CS12800RA101)
- Micro-B USB Cable (CS10600RA4070 /CS12800RA4101)
- USB to RS232 serial cable debug cable, the debug port use RS232 protocol
- SD Card (used for CM3 Lite , CM3+ Lite, CM4 Lite), 16GB at least

CS10600RA070 /CS10600RA4070 /CS12800RA101 need 6V ~ 36V power adapter that does not come by default. Please make sure you provide the power adapter by yourself. CS12800RA4101 needs a 12V 2A power adapter that comes with the product. Mini-B and Micro-B USB OTG Cable is used to download system images to the board with CM3/CM3+/CM4. USB to RS232 serial cable is used to debug the Chipsee Raspberry Pi product. SD card is used to make a bootable card. If you use CM3 Lite/CM3 Lite+/CM4 Lite, you also need one SD card, 16GB at least.

1.2. Software

- [7zip](#)
- Prebuilt Images
- [balenaEtcher](#)
- [rpiboot](#)
- [Xshell](#) or other terminal emulation software
- [VNC-Viewer](#)

If you need to change the system, you need 7zip/Prebuilt image/balenaEtcher/rpiboot. You can use Xshell or other terminal emulation software to debug Chipsee Raspberry Pi products in Windows. You can use VNC-Viewer to control Chipsee Raspberry Pi products over Ethernet.

2 Debug

In this document, we use Xshell to debug the Chipsee Raspberry Pi products. You can also use other tools such as Putty or another terminal emulation software.

2.1. Serial Debug

The RS232_0 is configured as debug console by default on all Chipsee Raspberry Pi products. You can use it to debug directly, and the default user and password is [pi/raspberry]. Use the session properties as shown in Figure 2-1.

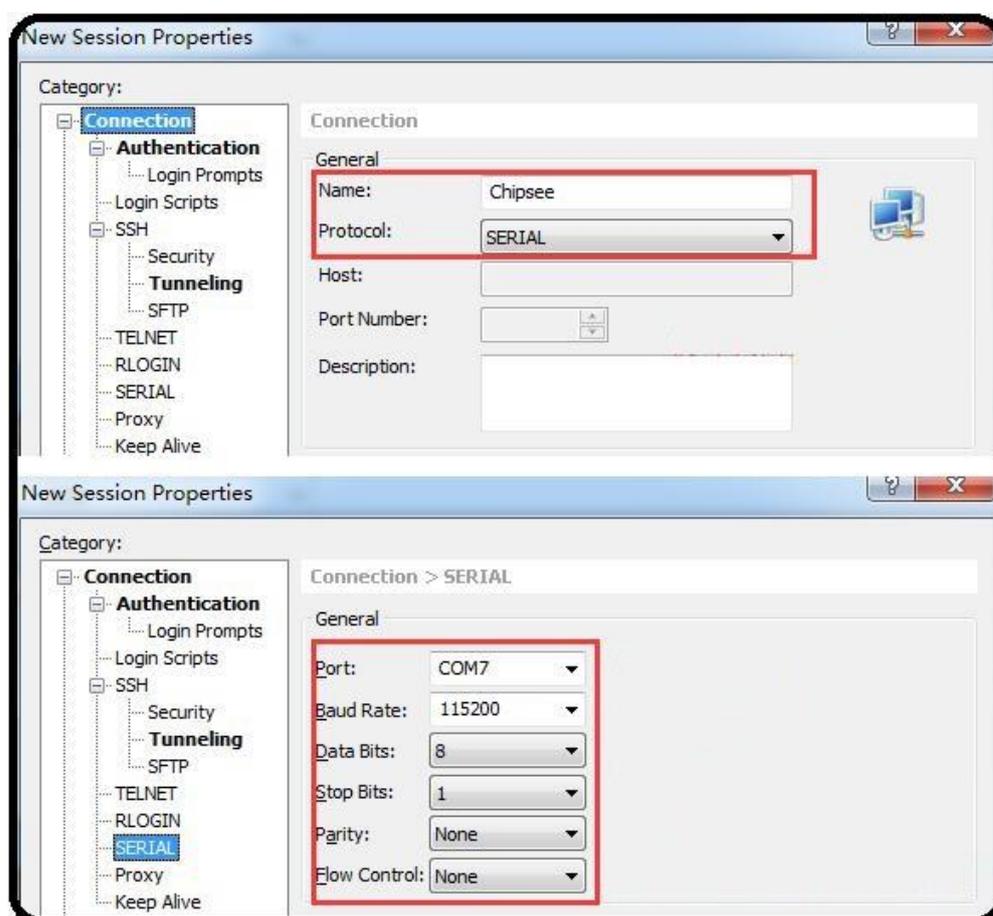


Figure 2-1: Session Properties

ATTENTION

If you need to change the debug serial to normal serial, you can remove `console=ttyAMA0, 115200` in `/boot/cmdline.txt` and reboot.

2.2. SSH Debug

Connect Chipsee Raspberry Pi product to the Internet, get the IP address. Then config Xshell or use ssh tool in the PC directly.

- You need to enable the SSH feature in Chipsee Raspberry Pi product first. Run the following command in debug console.

```
$ sudo raspi-config
```

```
Interfacing Options -> SSH -> Yes
```

- If you don't have debug console, you can also use GUI feature to enable SSH.

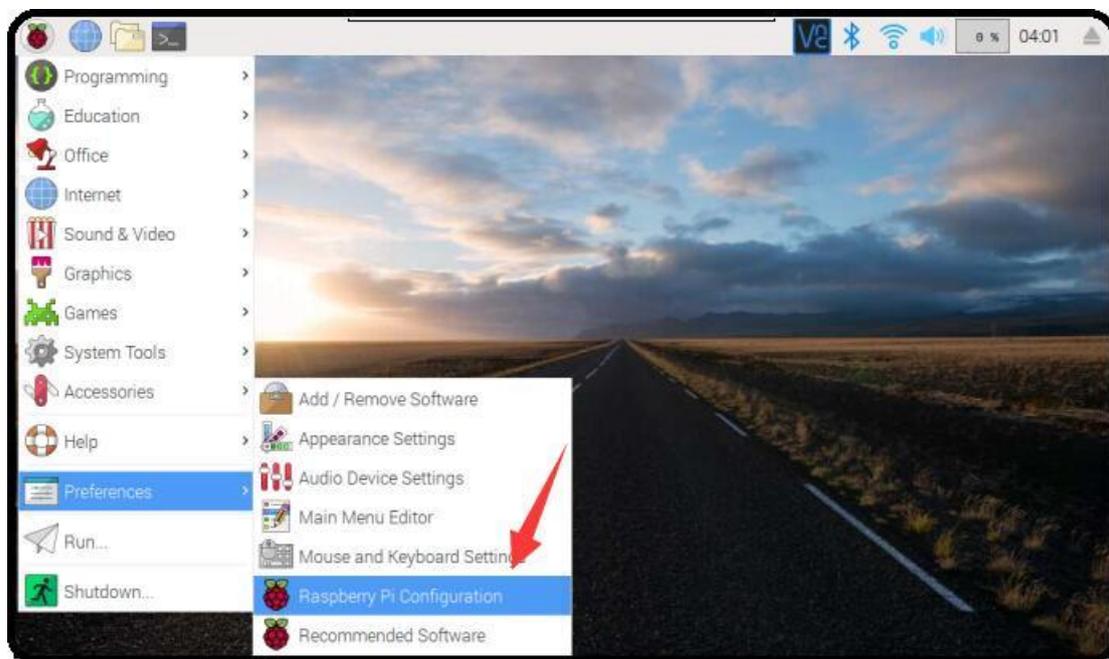


Figure 2-2: Configuration

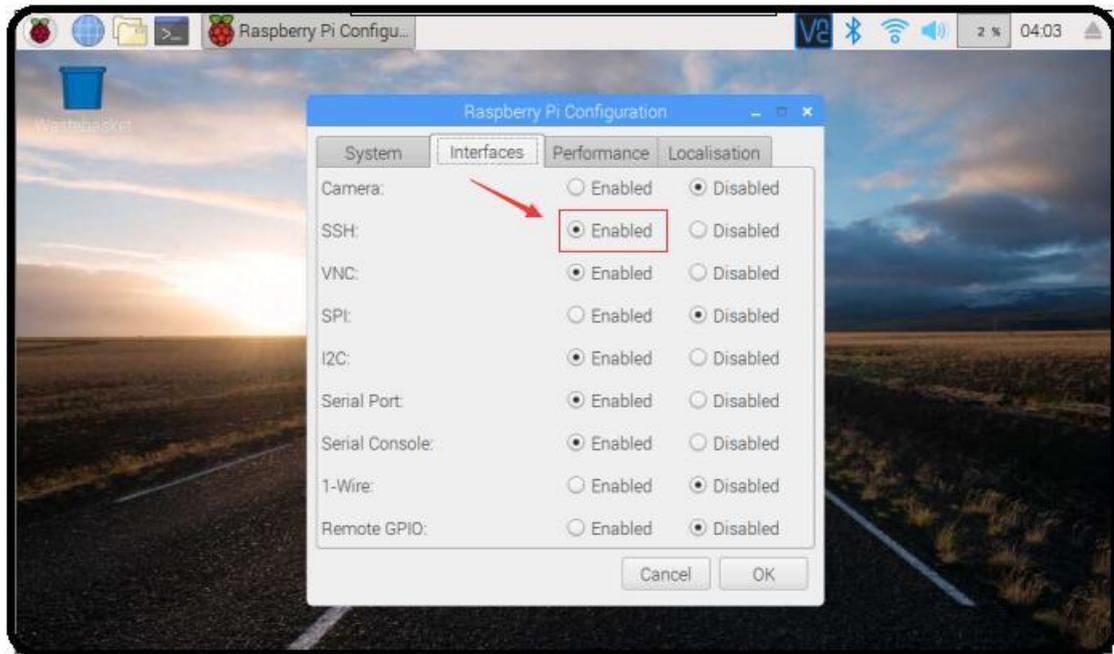


Figure 2-3: Configurations SSH

Now we will introduce Xshell ssh debug. First, we need to add a new session and set it like in Figure 2-4.

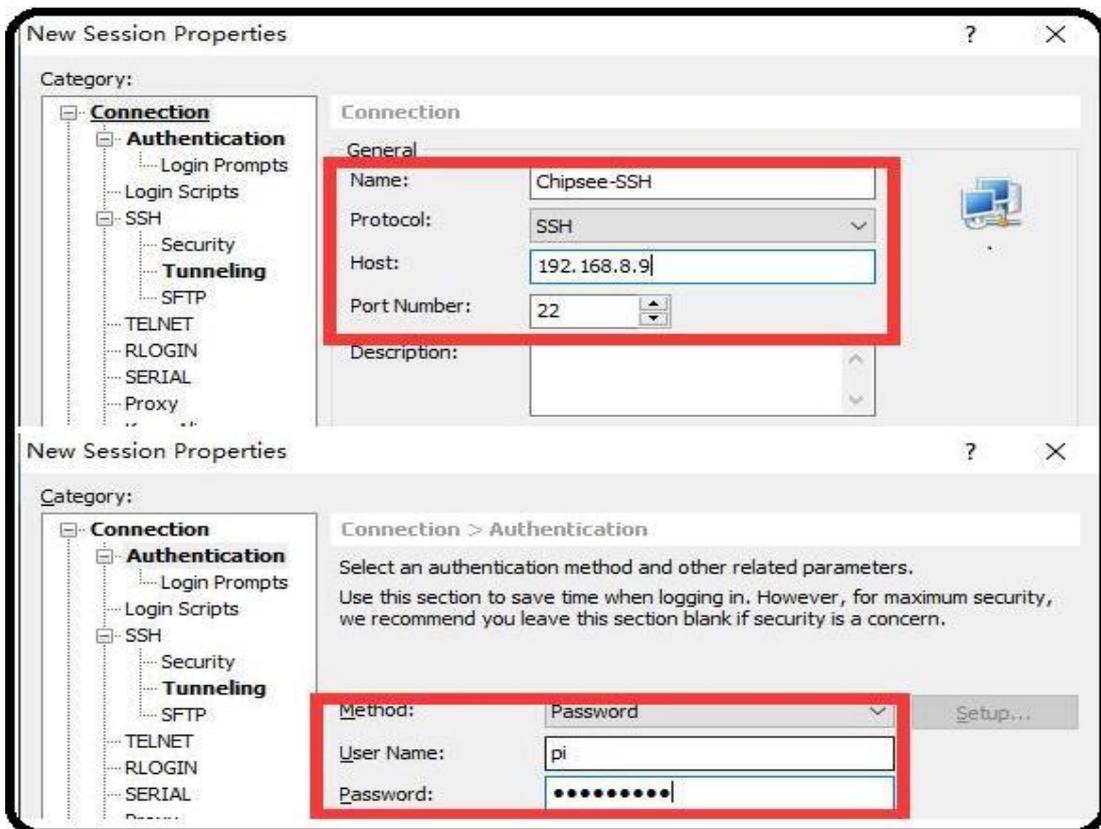


Figure 2-4: SSH Setting

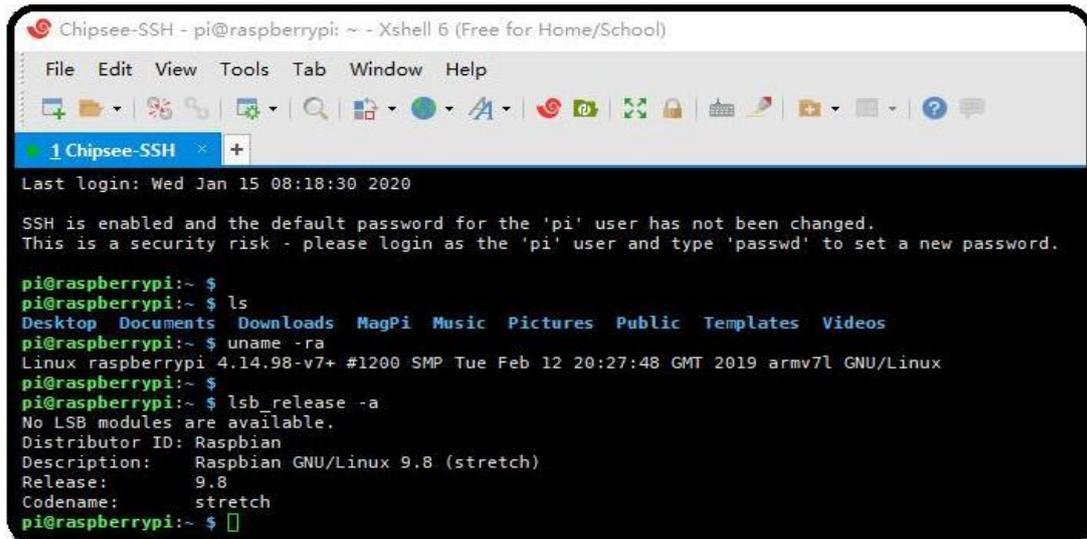


Figure 2-5 SSH Debug

2.3. VNC Debug

You can use VNC-Viewer in Windows to control Chipsee Raspberry Pi product over Ethernet.

- You need to enable the VNC feature in the Chipsee Raspberry Pi product. Run the following command in debug console:

```

$ sudo raspi-config

Interfacing Options -> VNC -> Yes
    
```

- If you don't have debug console, you can also use GUI feature to enable VNC.

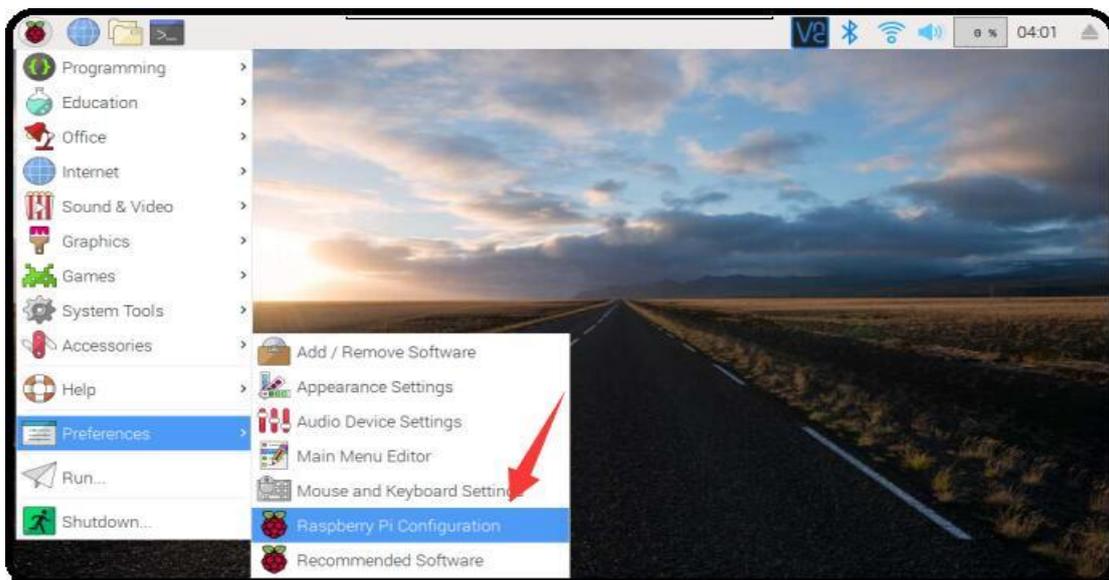
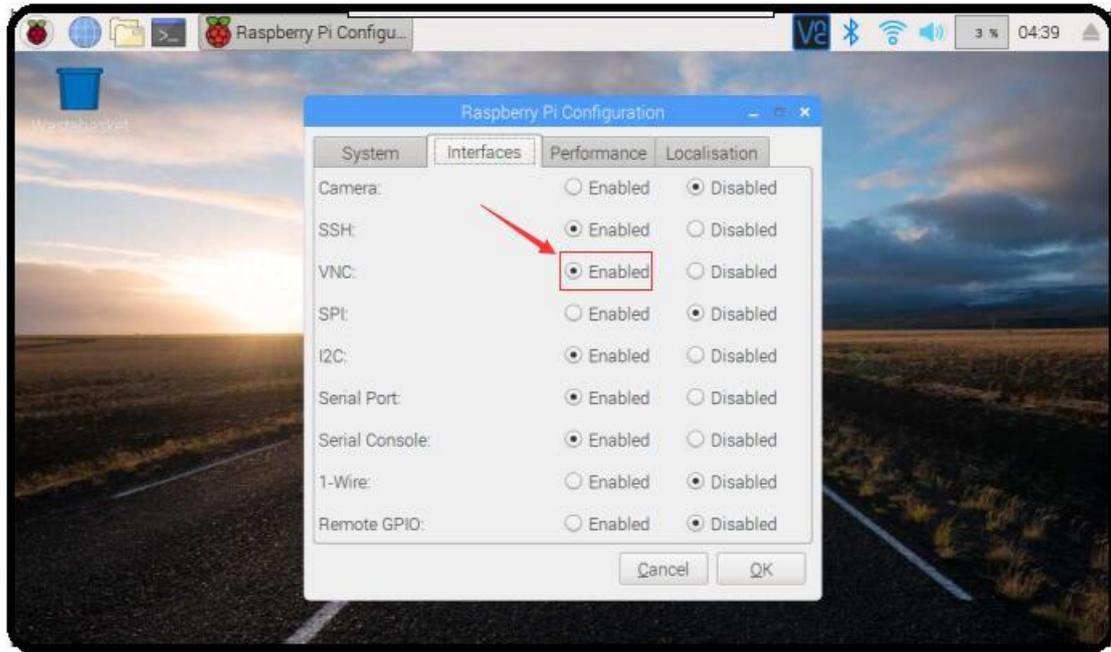


Figure 2-6: Configurations**Figure 2-7: VNC Configuration**

- Use VNC-Viewer in Windows to control it over Ethernet, as shown in Figures 2-8, 2-9, and 2-10.

**Figure 2-8: Connecting Vnc-Viewer**

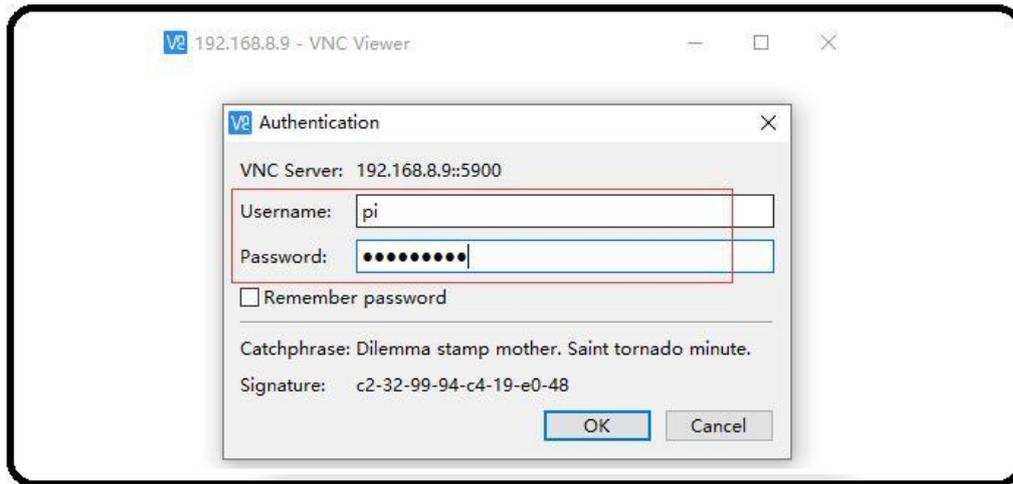


Figure 2-9: Authentication

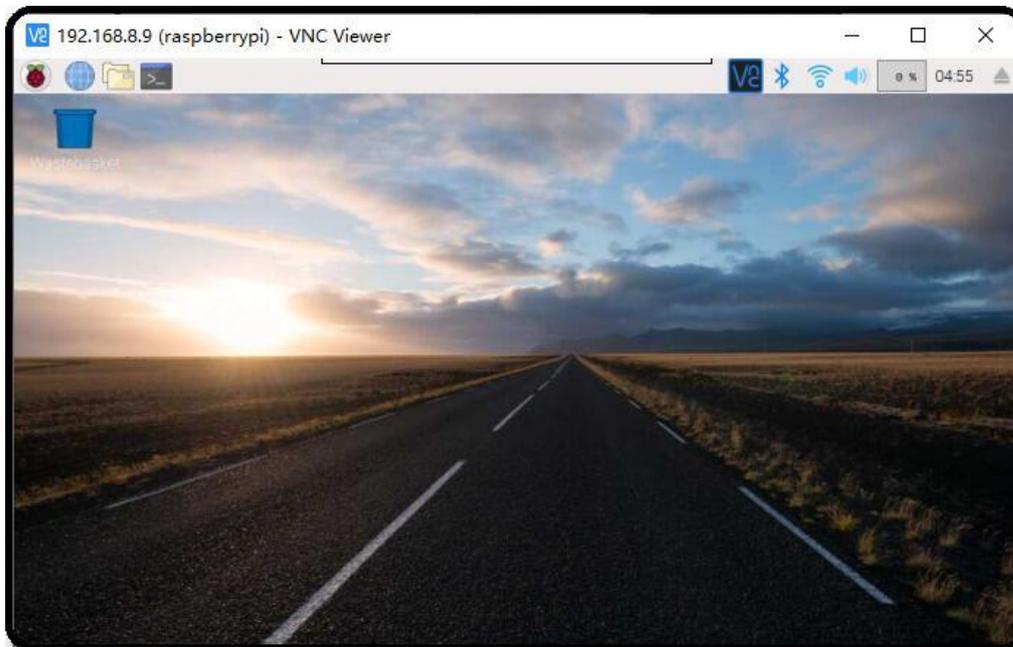


Figure 2-10: VNC Desktop

3 Downloading images

3.1. Booting switch configuration

Chipsee Raspberry Pi products support SD boot and eMMC boot (CS12800RA4101 only supports eMMC boot). It is based on your CM version. If you use CM with eMMC, you can only use eMMC boot. If you use CM Lite which has no eMMC, you can only use SD boot. The SD card should be placed in SD0 slot. The SD1 slot is used as external storage.

As to CS10600RA070 /CS12800RA101 /CS10600RA4070

When you need to download a new system to eMMC, you should configure the boot switch to **USB position** and insert Mini-B USB cable first, then power the board. This will enable eMMC to work as a USB storage. After the eMMC flash, you need to configure the boot switch to the **eMMC position** again.

When you need to use SD boot, you should configure the boot switch to the **eMMC position**.

As to CS12800RA4101

When you need to download a new system to eMMC, you should insert a Micro-B USB cable and press the power button first, then power the board to enable eMMC to work as a USB storage. Find detailed steps in the following text.

3.2. Prebuilt image

Chipsee Raspberry Pi products use the Raspberry Pi official system as a base and add some modules and drivers. You can get the driver and latest image from the following link:

<https://github.com/Chipsee/industrial-pi>

If you're not using balenaEtcher, you'll need to unzip .img.xz file and get the image file (.img) to write to your SD card.

3.3. Writing images to the SD card

Before you start, don't forget to check your SD card size (at least 16GB).

You will need to use an image writing tool to install the image you have downloaded on your SD card.

balenaEtcher is a graphical SD card writing tool that works on Mac OS, Linux and Windows, and is the easiest option for most users. balenaEtcher also supports writing images directly from the .img.xz file, without any unzipping required. To write your image with balenaEtcher:

Download the latest version of balenaEtcher and install it.

- Connect an SD card reader to the SD card inside.
- Open balenaEtcher and select from your hard drive the Raspberry Pi .img.xz file you want to write to the SD card.

- Select the SD card you want to write your image to.
- Review your selections and click 'Flash!' to begin writing data to the SD card.

Note: for Linux users, zenity might need to be installed on your machine for balenaEtcher to be able to write the image on your SD card.

3.4. Writing images to the eMMC

Before you start, don't forget to check your eMMC size, and select one image. You also need to install [rpitools](#) to enable eMMC to work as one USB storage in your PC.

Under Windows, an installer is available to install the required drivers and boot tool automatically. For those who just want to enable the Compute Module eMMC as a mass storage device under Windows, the stand-alone installer is the recommended option. The installer is [rpitools](#).

- Download and run the Windows installer [rpitools](#) to install the drivers and boot tool.
As to CS10600RA070 /CS12800RA101 /CS10600RA4070
- Plug your host PC Mini-B USB into the USB Downloader port, making sure the boot switch is set to the USB position.
As to CS12800RA4101
- Plug your host PC Micro-B USB into the USB Slave port (can be also called USB Download Port), press the power button and keep it pressed.
- Apply power to the board; Windows should now find the hardware and install the driver.
For CS12800RA4101, you can release the power button now.
- Once the driver installation is complete, run the RPiBoot.exe tool that was previously installed. You can run RPiBoot.exe in Windows PowerShell, like in Figure 3-1.

```
PS C:\Users\Administrator> rpiboot.exe
Waiting for BCM2835/6/7/2711...
Loading embedded: bootcode4.bin
Sending bootcode.bin
Successful read 4 bytes
Waiting for BCM2835/6/7/2711...
Loading embedded: bootcode4.bin
Loading embedded: bootcode4.bin
Failed to claim interface
Loading embedded: bootcode4.bin
Second stage boot server
Loading embedded: start4.elf
File read: start4.elf
Second stage boot server done
PS C:\Users\Administrator>
```

Figure 3-1: rpiboot tool

- After a few seconds, the Compute Module eMMC will pop up under Windows as a disk (USB mass storage device).
- Refer to [3.3 Writing images to the SD card](#) to flash system to eMMC (like the SD card in Windows)
- After done, power off and make sure the boot switch is set to eMMC position and power on to use the new system. **For CS12800RA4101, ignore the boot switch, reboot will be ok.** Check the following link to learn more:

<https://www.raspberrypi.org/documentation/hardware/computemodule/cm-emmc-flashing.md>

4 System Resource

4.1. SD Card/USB

SD Card is an external storage and needs to be placed in SD1 port. The SD0 port is used by boot. SD Card and USB Storage support hot plug. They will be automatically mounted on /media/pi/ as shown in Figure 4-1. **For CS12800RA4101, there is only one SD slot.**

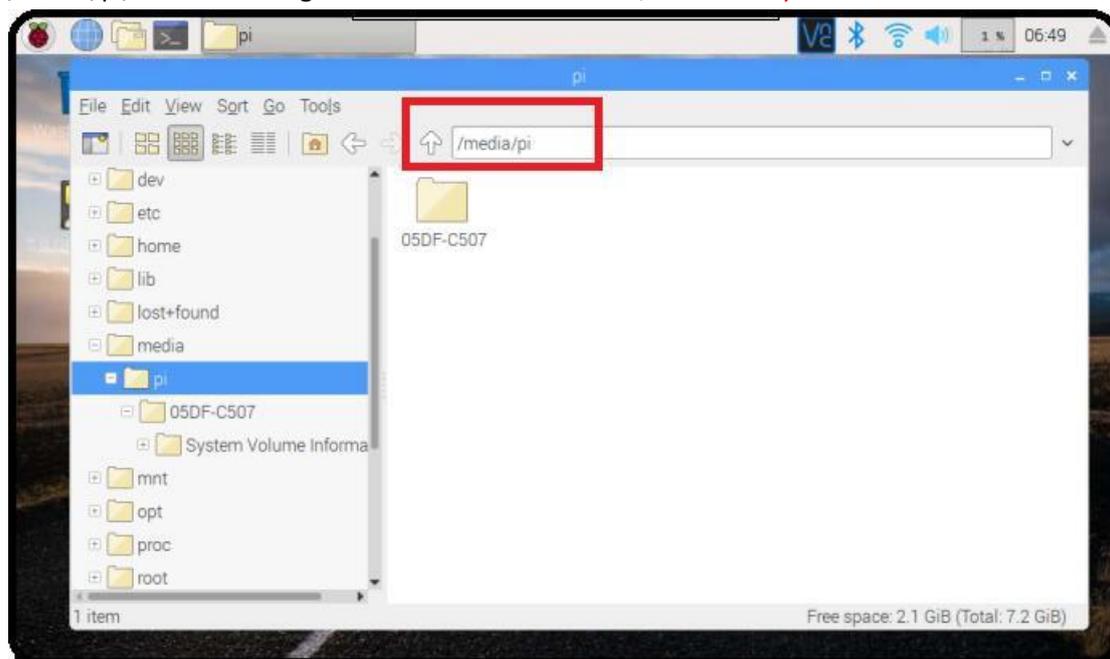


Figure 4-1: TF Card

4.2. Serial Port

Chipsee Raspberry Pi boards support RS232 and RS485. You can learn more about the serial port on different boards in the text below.

Table 4-1: CS10600RA070-C111

Ports	Name	Node	Protocol
1	RS232_0	/dev/ttyAMA0	RS232
2	RS232_1/RS485_1	/dev/S0	RS232/RS485

Note: RS232_1/RS485_1 use the same UART pins from CPU, so they use the same device node. You can only use one at a time. RS485 signal has been mounted on the 120Ohm Matched Resistor.

There is one GPIO which is used by RS485. You can control it to enable and disable RS485 send and receive. Check the tables below.

Table 4-2: RS485 control GPIO

GPIO	Initial	Control	Function
GPIO34	<pre>\$ echo 34 > /sys/class/gpio/export \$ echo out > /sys/class/gpio/gpio34/direction \$ ln -s /sys/class/gpio/gpio34/value /dev/rs485con</pre>	\$echo 1 > /dev/rs485con	Enable send Disable receive
		\$echo 0 > /dev/rs485con	Enable receive Disable send

Table 4-3: CS12800RA101

Ports	Name	Node	Protocol
1	CPU_RS232_0	/dev/ttyAMA0	RS232
2	CPU_RS232_1	/dev/S0	RS232
3	RS232_1	/dev/ttyUSB0	RS232
4	RS232_2	/dev/ttyUSB1	RS232
5	RS485_3	/dev/ttyUSB2	RS485
6	RS485_4	/dev/ttyUSB3	RS485

Table 4-4: CS10600RA4070-C111

Ports	Name	Node	Protocol
1	RS232_0	/dev/ttyAMA0	RS232
2	RS232_2	/dev/ttyAMA1	RS232
3	RS232_3	/dev/ttyAMA2	*
4	RS485_3	/dev/ttyAMA2	RS485
5	RS232_5	/dev/ttyAMA3	*
6	RS485_5	/dev/ttyAMA3	RS485

*These two channels are not used by default and can be configured to RS232. In this case port 4 and port 6 will be disabled. Feel free to contact us if you need different settings from the default one.

Table 4-5: CS12800RA4101

Ports	Name	Node	Protocol
1	RS232_0	/dev/ttyAMA0	RS232
2	RS232_1	/dev/ttyAMA1	RS232
3	RS485_2	/dev/ttyAMA2	RS485

You can install “cutecom” to test the serial port:

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

Only root user and use the serial port:

```
$ sudo cutecom
```

4.3. GPIO

There are 8 GPIOs, 4 Output and 4 Input, they are all isolated. You can control the output or input pin voltage by feeding the VDD_ISO suite voltage. You can select 5V~24V. Refer to the tables below for a detailed port definition:

Table 4-6: CS10600RA070 P19 Port

Pin Number	GPIO Number	Function	Device Node
1	GPIO11	IN4	/dev/chipsee-gpio8
2	GPIO10	IN3	/dev/chipsee-gpio7
3	GPIO9	IN2	/dev/chipsee-gpio6
4	GPIO8	IN1	/dev/chipsee-gpio5
5	GPIO7	OUT4	/dev/chipsee-gpio4
6	GPIO6	OUT3	/dev/chipsee-gpio3
7	GPIO5	OUT2	/dev/chipsee-gpio2
8	GPIO4	OUT1	/dev/chipsee-gpio1
9	GND_ISO	Isolated GND	NC
10	VDD_ISO	Isolated VDD(5V-24V)	NC

Table 4-7: CS12800RA101 P2 Port / CS10600RA4070 P19 Port

Pin Number	GPIO Number	Function	Device Node
1	GPIO499	IN4	/dev/chipsee-gpio8
2	GPIO498	IN3	/dev/chipsee-gpio7
3	GPIO497	IN2	/dev/chipsee-gpio6
4	GPIO496	IN1	/dev/chipsee-gpio5
5	GPIO500	OUT4	/dev/chipsee-gpio4
6	GPIO501	OUT3	/dev/chipsee-gpio3
7	GPIO502	OUT2	/dev/chipsee-gpio2
8	GPIO503	OUT1	/dev/chipsee-gpio1
9	GND_ISO	Isolated GND	NC
10	VDD_ISO	Isolated VDD(5V-24V)	NC

- Control OUT1, set it high or low

```
$ echo 1 > /dev/chipsee-gpio1 // set OUT1 high
$ echo 0 > /dev/chipsee-gpio1 // set OUT1 low
```

- Get INT1 value

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

4.4. Relay

There is one Relay on CS12800RA4101. For a detailed port definition, please refer to the table below:

Table 4-8: CS12800RA4101 Relay on P10

Ports	Name	GPIO Number	Function
8	Relay_NO	GPIO17	Nomal Open
9	Relay_COM		GND
10	Relay_NC		Nomal Close

Initialize this GPIO17 to output

```
$ echo 17 > /sys/class/gpio/export
$ echo out > /sys/class/gpio/gpio17/direction
```

Enable Relay NO short-circuit Relay COM

```
$ echo 1 > /sys/class/gpio/gpio17/value
```

Enable Relay NC short-circuit Relay COM

```
$ echo 0 > /sys/class/gpio/gpio17/value
```

4.5. Buzzer

The Chipsee Raspberry Pi boards have 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
```

4.6. Backlight

We use one GPIO to control the backlight for Chipsee Raspberry Pi boards, the GPIO is different for different boards. Find more details below.

Table 4-9: Backlight GPIO

Board	GPIO	GPIO Config in config.txt	PWM	PWM Func
CS10600RA070	41	gpio=41=op,dh	Pwm1	4
CS12800RA101	41	gpio=41=op,dh	Pwm1	4
CS10600RA4070	18	gpio=18=op,dh	Pwm0	2
CS12800RA4101	13	gpio=13=op,dh	Pwm1	4

We use `gpio=<GPIO>=op,dh` in `/boot/config.txt` to enable the backlight by default. You can open and close backlight as follows. GPIO41 is used as an example:

```
$ echo 41 > /sys/class/gpio/export
$ echo out > /sys/class/gpio/gpio41/direction
$ echo 1 > /sys/class/gpio/gpio41/value //enable backlight
$ echo 0 > /sys/class/gpio/gpio41/value //disable backlight
```

If you want to use PWM to control the backlight, you need to remove `gpio=<GPIO>=op,dh`, and add `dtoverlay=pwm, pin=<GPIO>, func=<PWM Func>` in `/boot/config.txt`. You can do it in the following way. GPIO13 is used as an example.

Remove this line in `/boot/config.txt`:

```
gpio=13=op,dh
```

And add the following line to `/boot/config.txt`:

```
dtoverlay=pwm,pin=13,func=4
```

Reboot, after that, Config and enable pwm

```
$ cd /sys/class/pwm/pwmchip0/
$ echo 1 > export //GPIO13 is pwm1, so we use 1
$ echo 1000000 > pwm1/period //set period to 10ms,100Hz
$ echo 800000 > pwm1/duty_cycle //set duty to 8ms
$ echo 1 > pwm1/enable //enable pwm1
```

4.7. 4G

You can use 4G on Chipsee Raspberry Pi products. If the 4G module is Quectel EC20, you can use the following tools to connect to internet.

```
$ sudo install udhcpc
$ sudo ifconfig wwan0 down
$ sudo quectel-CM -s 3gnet / cmnet / ctnet & // select different network base on your SIM
card, 3gnet is used by China-unicom and cmnet is used by China-mobile, ctnet is used by China
Telecom
```

If you use EC20 with GPS function, you can enable and get data in the following way.

Open one terminal to catch data:

```
cat /dev/ttyUSB1
```

Open another terminal to config and enable:

```
$ microcom -s 9600 /dev/ttyUSB2
AT+QGPSCFG="gpsnmeatype",1
AT+QGPS=1 // enable GPS, wait some minutes, you can get date from fist terminal.
AT+QGPSEND // disable GPS
```

Don't forget to use one GPS ANT.

4.8. CAN Bus

There is one channel CAN bus on CS12800RA101/CS10600RA4070. You can install can-utils and use them to test CAN. But you must add one 120ohm resistor between CAN_H and CAN_L on one of the two Boards, as shown in Figure 4-2.

NOTE: All CAN signals have mounted on the 120Ohm Matched Resistor by default on Chipsee Raspberry Pi boards.

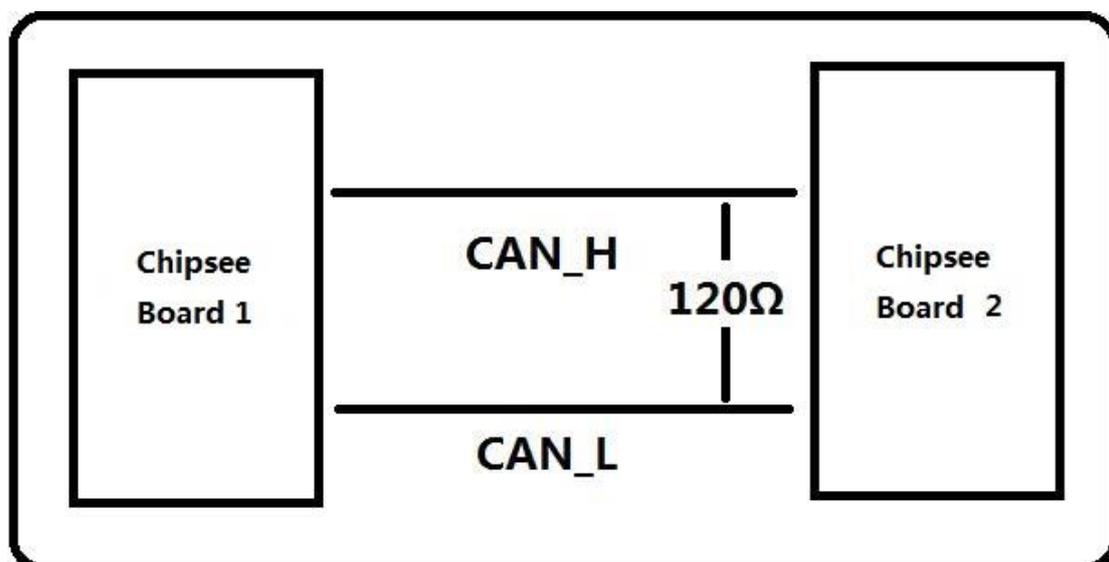


Figure 4-2: Connecting CAN

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

Install can-utils

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

- Set the bit-rate to 50Kbits/sec with triple sampling using the following command (**use ROOT user**):

```
$ sudo ip link set can0 type can bitrate 50000 triple-sampling on
```

- Bring up the device using the command:

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

- Transfer packets

- Transmit 8 bytes with standard packet id number as 0x10

```
$ sudo cansend can0 -i 0x10 0x11 0x22 0x33 0x44 0x55 0x66 0x77 0x88
```

- Transmit 8 bytes with extended packet id number as 0x800

```
$ sudo cansend can0 -i 0x800 0x11 0x22 0x33 0x44 0x55 0x66 0x77 0x88 -e
```

- Transmit 20 8 bytes with extended packet id number as 0xFFFF

```
$ sudo cansend can0 -i 0xFFFF 0x11 0x22 0x33 0x44 0x55 0x66 0x77 0x88 -e --loop=20
```

- Receive data from CAN bus

```
$ sudo candump can0
```

- Bring down the device

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

4.9. WIFI

The Chipsee Raspberry Pi boards support RTL8723BU/RTL8723DU chip Wi-Fi. The CS10600RA070/CS12800RA101 have an onboard RTL8723BU Wi-Fi chip. The CS10600RA4070/CS12800RA4101 have no onboard Wi-Fi by default so you can use the USB Wi-Fi dongle to enable the Wi-Fi.

4.10. Zigbee

The CS10600RA4070/CS12800RA4101 boards have an onboard ZigBee chip CC2531. Its device node in the system is **/dev/ttyACM0**. We use zigbee2mqtt project firmware by default. Check the following link to learn more about this project: <https://www.zigbee2mqtt.io>

4.11. Camera

The camera port CAM is compatible with Raspberry pi. Please refer to the following link to learn how to attach a camera.

<https://www.raspberrypi.org/documentation/hardware/computemodule/cmio-camera.md>

4.12. 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.

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