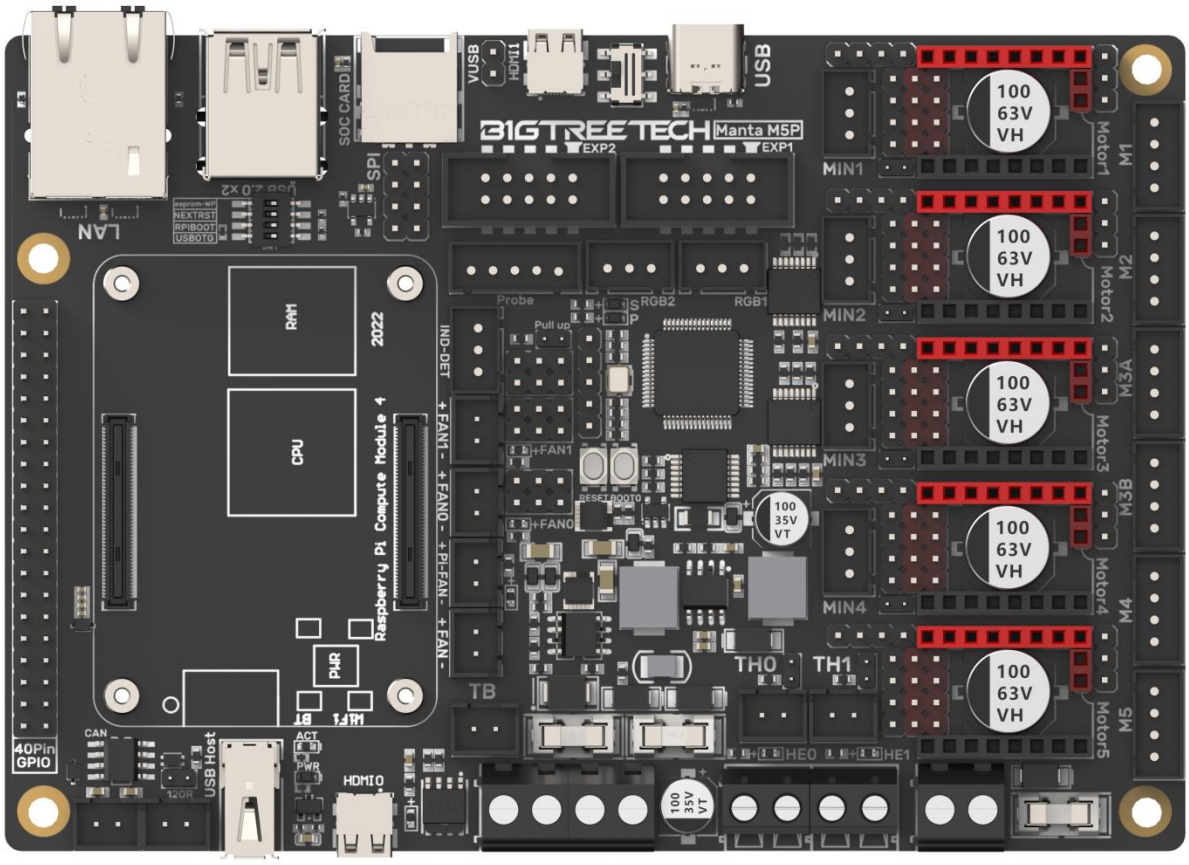
Shenzhen Big Tree Technology Co., Ltd.
BIGTREETECH

BIGTREETECH MANTA M5P V1.0

User Manual



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Revision History

Version	Revisions	Date
01.00	Original	2022/10/20

Product Profile

BIGTREETECH MANTA M5P is a 32-bit motherboard developed by the 3D printing team of Shenzhen Big Tree Technology Co., Ltd. for Klipper running. It can run Klipper with a core board, which greatly eliminates the mass wiring between the motherboard and Raspberry Pi, and also greatly saves space in the chassis. The BTB headers are designed on MANTA M5P, so that customers can choose to use CM4 or other solutions, thus solving the insane shortage of Raspberry Pi CM4.

Feature Highlights

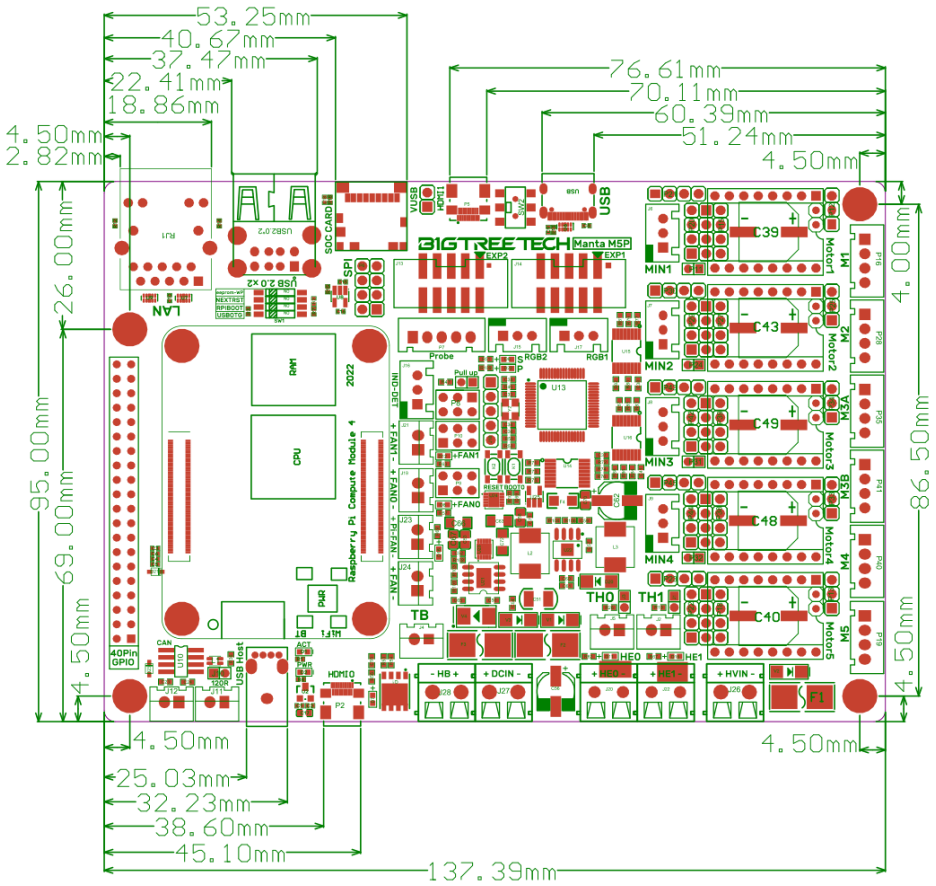
1. 32bit 64MHz ARM Cortex-M0+ series STM32G0B1RET6 MCU.
2. The thermistor circuit is protected to prevent MCU damage from shorted heated bed and heater cartridge connections.
3. The CNC fan's voltage is selectable in 24V, 12V, and 5V, no more need for external stepdown thus preventing board damage from user error.
4. Thermistor connection supports pull-up resistance value setting using jumpers, no more extra module needed for PT1000.
5. MCU firmware can be upgraded via an SD card, or use DFU via Klipper's make flash command.
6. BTB connectors are adopted between the motherboard and core board, allowing the choice of other core board solutions in addition to CM4.
7. Integrated SPI and UART mode of TMC driver and DIAG pin, easily configurable with jumpers.
8. Support filament runout sensor, BLTouch, RGB, etc.
9. Replaceable fuse for easy maintenance.
10. Onboard proximity switch port, support NPN and PNP type selection, (24V, 12V, 5V) voltage selection.
11. Onboard SPI interface for connecting acceleration sensor to enable Klipper's input shaping.
12. The new E-FUSE fuse is equipped, which can respond quickly, enhance self-protection ability, and greatly reduce the motherboard burnout caused by short circuits or ignition.

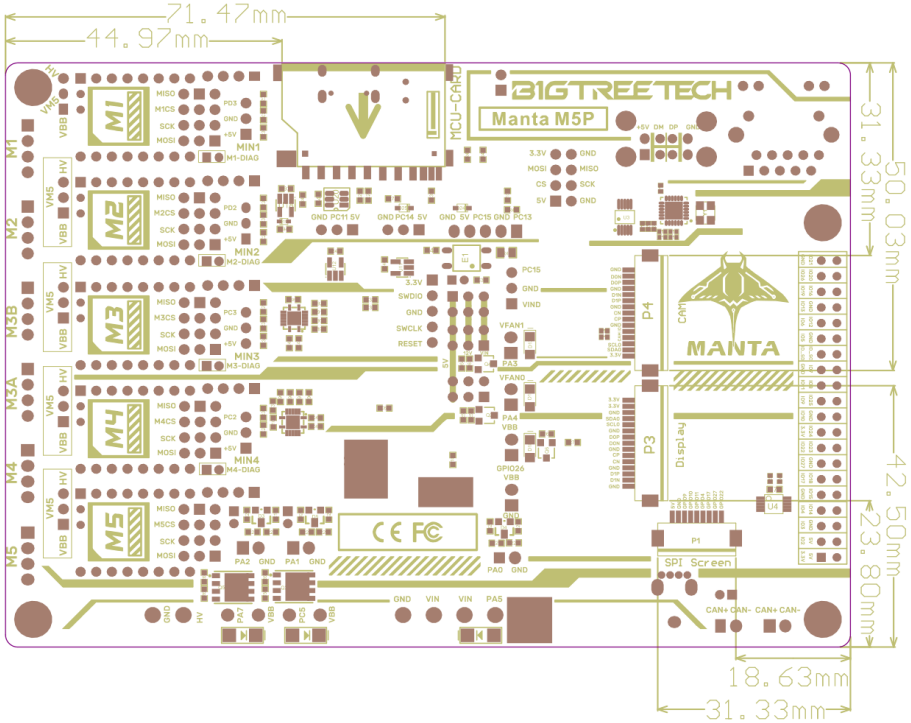
Specifications

Dimensions	137.5mm x 95mm, for details please refer to **BIGTREETECH MANTA M5P V1.0-SIZE-top.pdf**
Mounting Size	Please refer to **BIGTREETECH MANTA M5P V1.0-SIZE-top.pdf**
MCU	ARM Cortex-M0+ STM32G0B1RET6 64MHz
Driver Input Voltage	VIN (DC12V-24V), HV (DC24V-56V) Selectable
Motherboard Input Voltage	VIN=DC12V or DC24V
Logic Voltage	DC 3.3V
Heater Connection	Heated Bed (HB), Heater Cartridge (HE0, HE1)
HB Port Max Current	10A Continuous, 11A Instantaneous
Heater Cartridge Max Current	5.5A Continuous, 6A Instantaneous
Fan Port	3 x 2 pins CNC (FAN0, FAN1, Pi-FAN) (5/12/24V Selectable Voltage), 1 x Always On (FAN)
Fan Port Max Current	1A Continuous, 1.1A Instantaneous
Overall Current of Fan Ports)	＜2.5A
Expansion Port	CAN, Probe, RGBx2, SPI, EXP1+EXP2, MIN1-MIN4, 40Pin-GPIO
Motor Driver	Support TMC5160, TMC2209, TMC2225, TMC2226, TMC2208, TMC2130, ST820, LV8729, DRV8825, A4988...
Driver Mode	SPI, UART, STEP/DIR

Motor Driver Port	Motor1, Motor2, Motor3 (Dual Motors Port), Motor4, Motor5 5 Channels in Total
Thermistor	3 x 100K NTC, two of which are selectable for NTC and PT1000
Display	SPI Touchscreen, LCD Display, HDMI Touchscreen, DSI Touchscreen
PC Connection	Type-C
Interface	USB 2.0x2, LAN, DSI, CSI, SPI, HDMI0, HDMI1, SOC-Card, MCU-Card
Supported Kinematics	Cartesian, Delta, Kossel, Ultimaker, CoreXY
Recommended Slicer/Console	Cura, Simplify3D, Pronterface, Repetier-host, Makerware

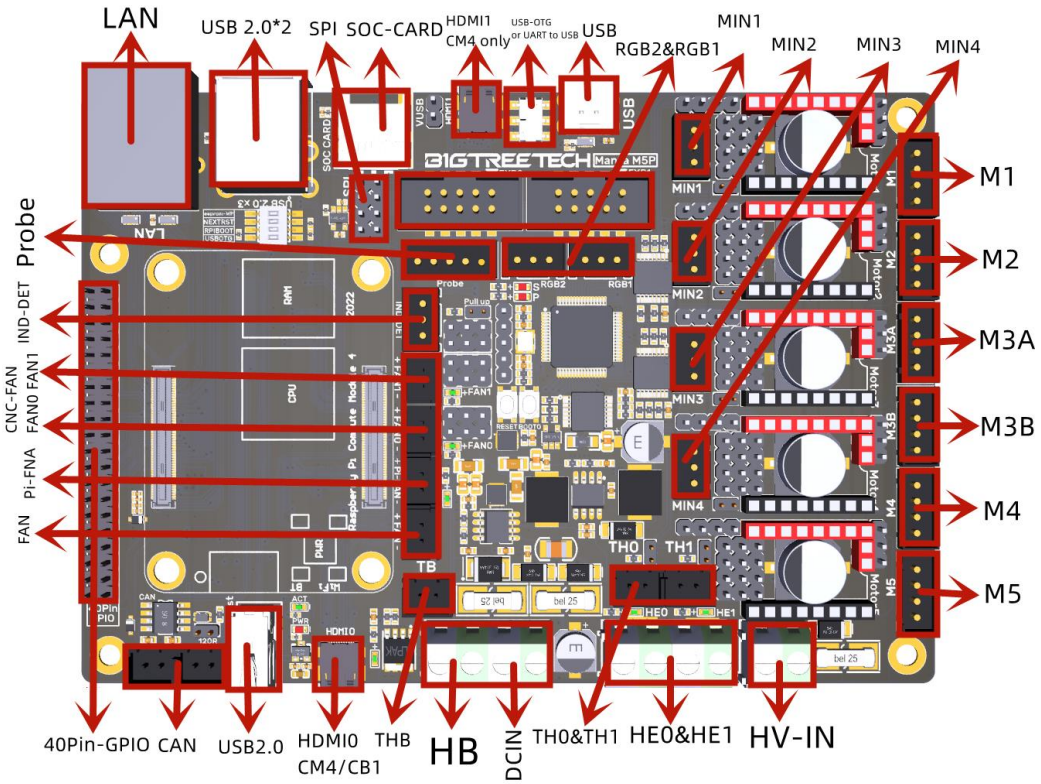
Dimensions


53.25mm
40.67mm
37.47mm
22.41mm
18.86mm
4.50mm
2.82mm
76.61mm
70.11mm
60.39mm
51.24mm
4.50mm
26.00mm
95.00mm
69.00mm
4.50mm
4.00mm
86.50mm
4.50mm
4.50mm
4.50mm
25.03mm
32.23mm
38.60mm
45.10mm
137.39mm
BIGTREETECH
Manta M5P
Raspberry Pi Compute Module 4
MANTA

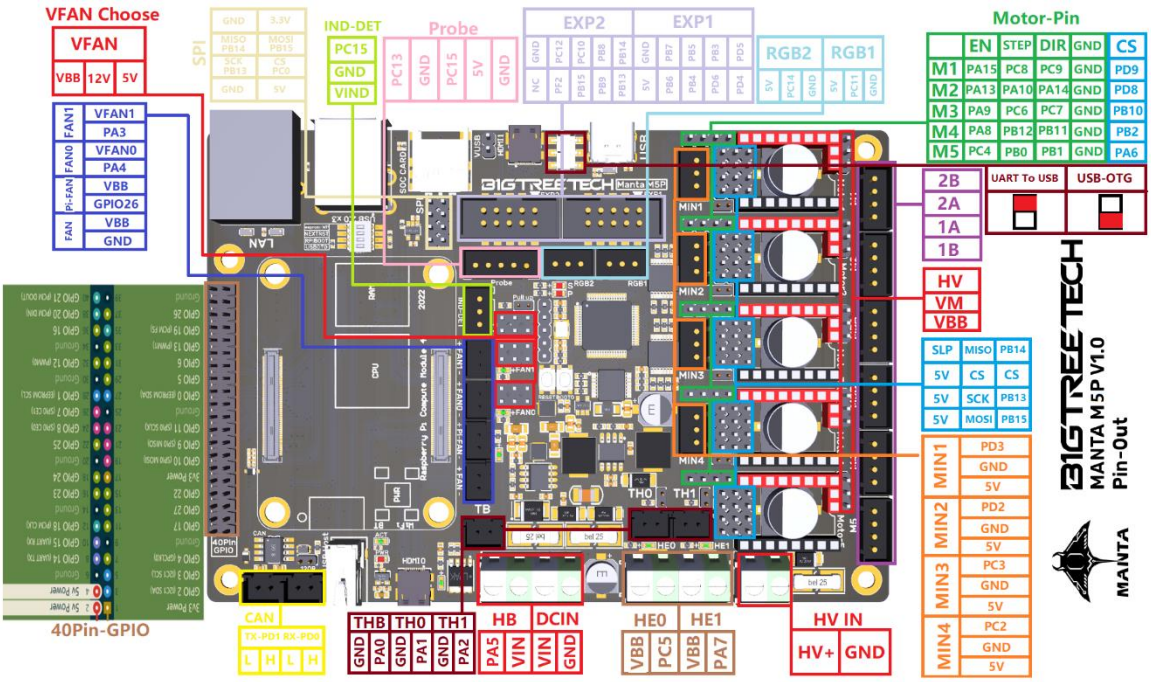

71.47mm
44.97mm
31.33mm
50.03mm
42.50mm
23.80mm
18.63mm
31.33mm
BIGTREETECH
Manta M5P
MCU-CARD
MANTA
SPI Screen

Peripheral Port

Connector Diagram



Pinout Diagram



Connection Description

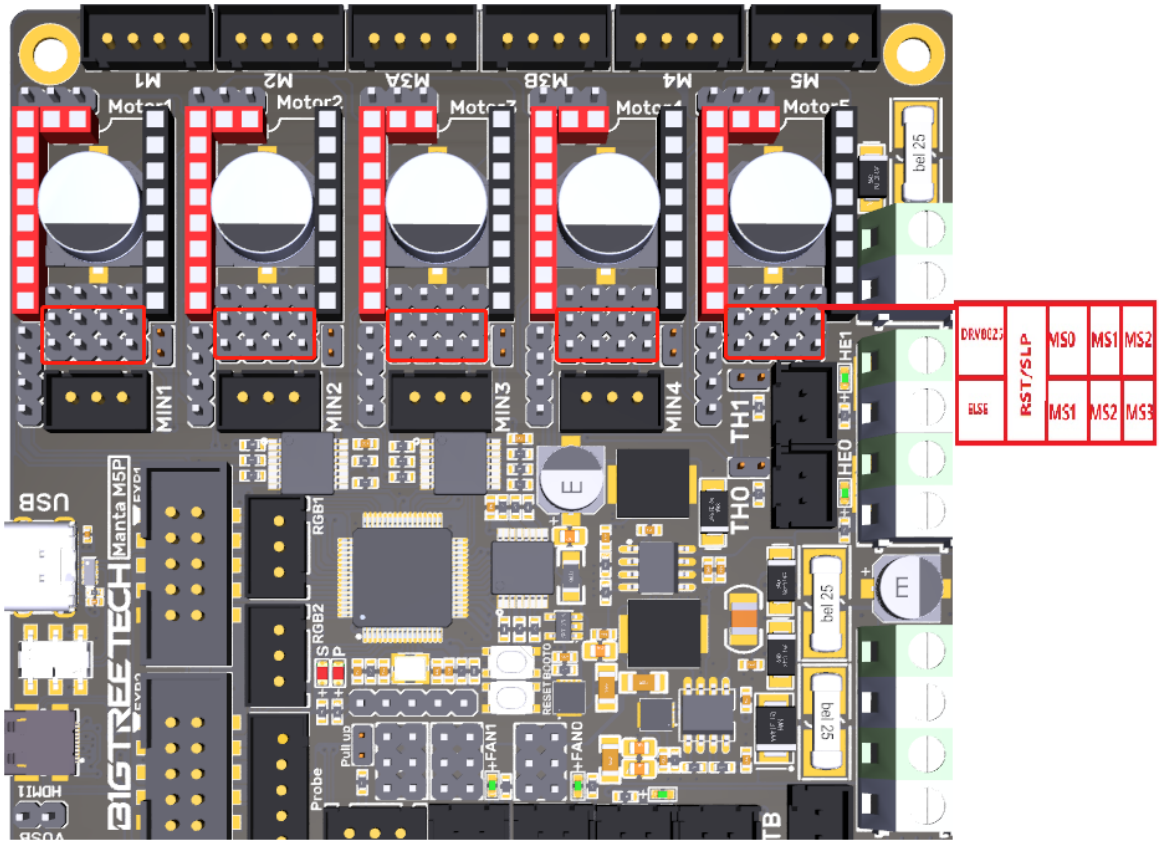
USB Power Supply

After the BIGTREETECH MANTA M5P has been powered, the red light D22 on the left side of the MCU will light up, indicating power on. When using only the USB to power the board or provide power through the USB, please insert the jumper cap onto the VUSB.

Stepper Driver

STEP/DIR (STANDALONE) Mode

e.g.: A4988, DRV8825, LV8729, ST820, etc., connect jumpers(MS0-MS2) according to the microstep chart.



Note: RST and SLP must be shorted by jumpers for A4988 or DRV8825.

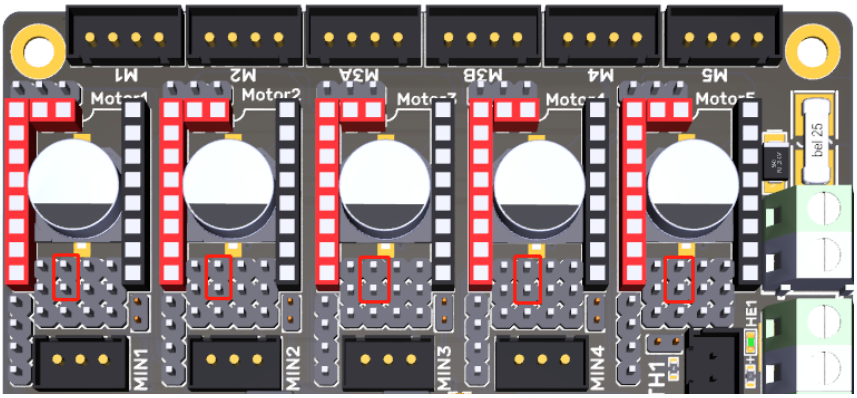
Driver Chips	MODE2	MODE1	MODE0	Microsteps	Excitation Mode
DRV8825 Maximum 32 microsteps 8.2V-45V 2.5A at 24V T=25℃	L	L	L	Full Step	2 Phase
	L	L	H	1/2	1-2 Phase
	L	H	L	1/4	W1-2 Phase
	L	H	H	1/8	
	H	L	L	1/16	
	H	L	H	1/32	
	H	H	L	1/32	
	H	H	H	1/32	
Current $\mathbf{R}_{ISENSE}$=0.1Ω	$\mathbf{I_{CHOP}} = \frac{\mathbf{V_{(xREF)}}}{\mathbf{5} * \mathbf{R}_{ISENSE}}$				

Driver Chips	MS1	MS2	MS3	Microsteps	Excitation Mode
A4988 16 microstep max 35V 2A	L	L	L	Full Step	2 Phase
	H	L	L	1/2	1-2 Phase
	L	H	L	1/4	W1-2 Phase
	H	H	L	1/8	2W1-2 Phase
	H	H	H	1/16	4W1-2 Phase
Current $\mathbf{R}_S$=0.1Ω	$\mathbf{I_{TripMAX}} = \frac{\mathbf{V_{REF}}}{\mathbf{8} * \mathbf{R}_S}$				

Driver Chips	MD3	MD2	MD1	Microsteps	Excitation Mode
LV8729 Maximum 128 microsteps 36V 1.8A	L	L	L	Full Step	2 Phase
	L	L	H	1/2	1-2 Phase
	L	H	L	1/4	W1-2 Phase
	L	H	H	1/8	2W1-2 Phase
	H	L	L	1/16	4W1-2 Phase
	H	L	H	1/32	8W1-2 Phase
	H	H	L	1/64	16W1-2 Phase
	H	H	H	1/128	32W1-2 Phase
Current RF1=0.22Ω	$\mathbf{I}_{\mathrm{OUT}} = (\mathbf{V_{REF}} / 5) / \mathrm{RF1}$				

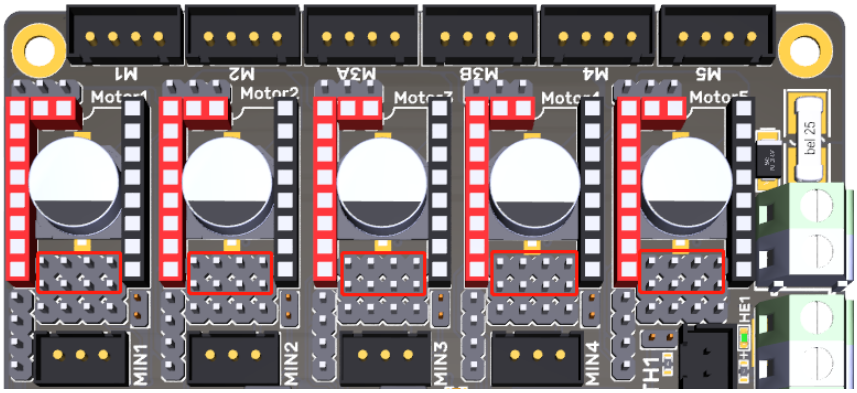
UART Mode of TMC Driver

e.g.: TMC2208, TMC2209, TMC2225, etc., place jumpers according to the diagram below, microstep and current can be configured in firmware.



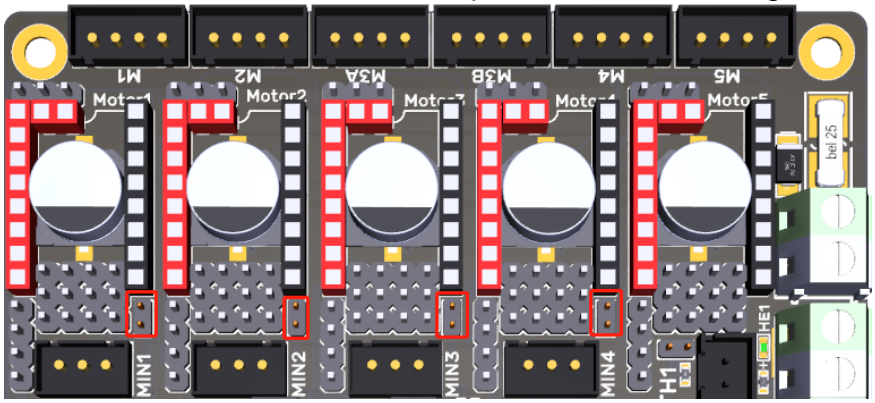
TMC Driver SPI Mode

e.g.: TMC2130, TMC5160, TMC5161, etc., place jumpers according to the diagram below, microstep and current can be configured in firmware.

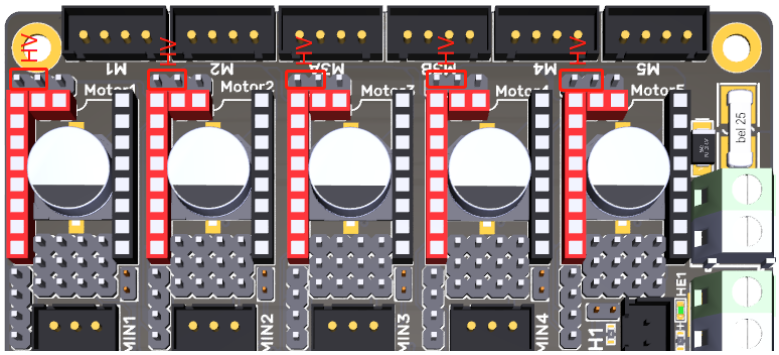


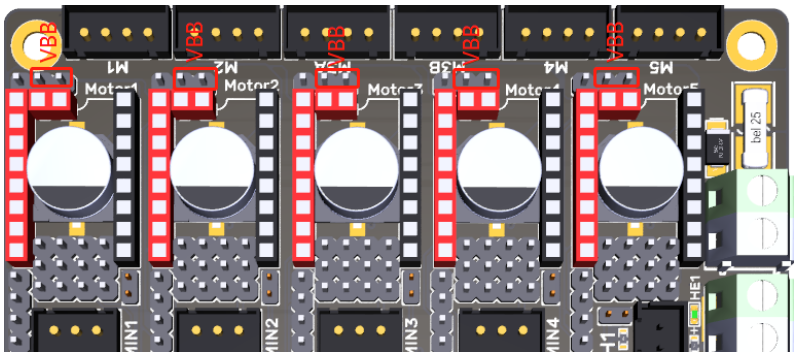
TMC Driver DIAG (Sensorless Homing)

When using sensorless homing, place jumpers according to the diagram below, there is no need to cut the DIAG pin off when not being used.



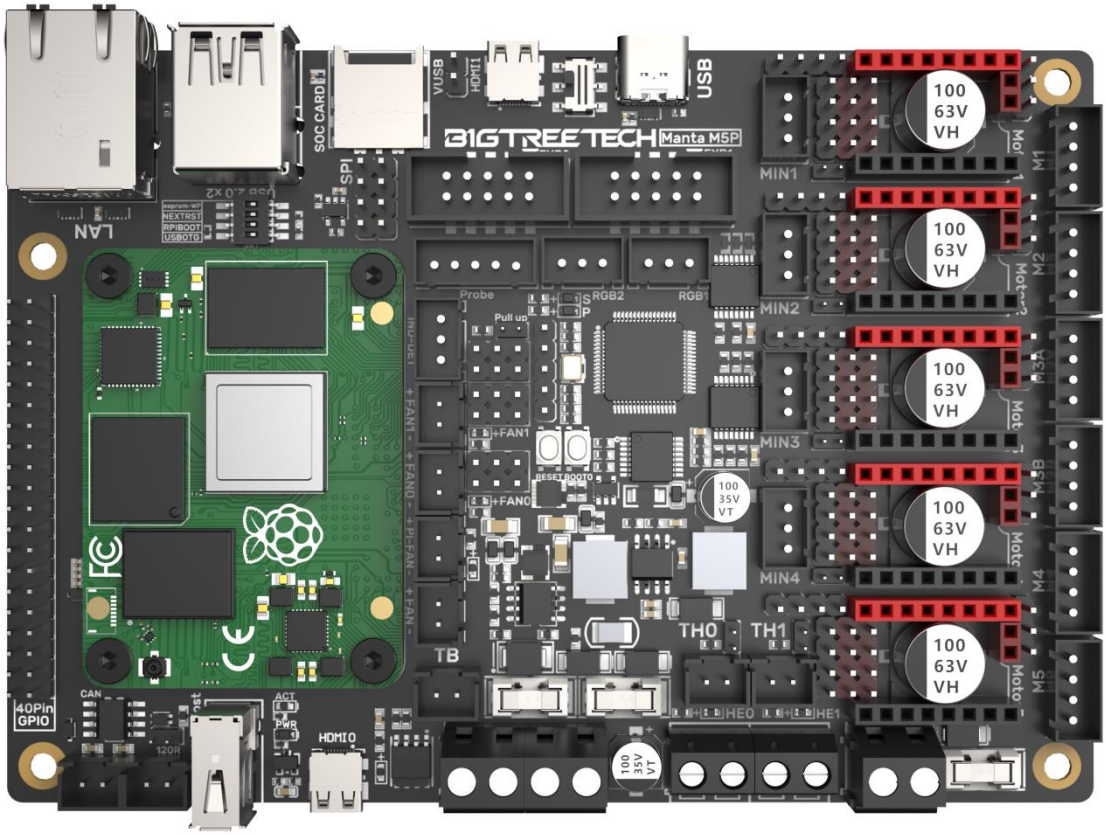
Driver Voltage Selection



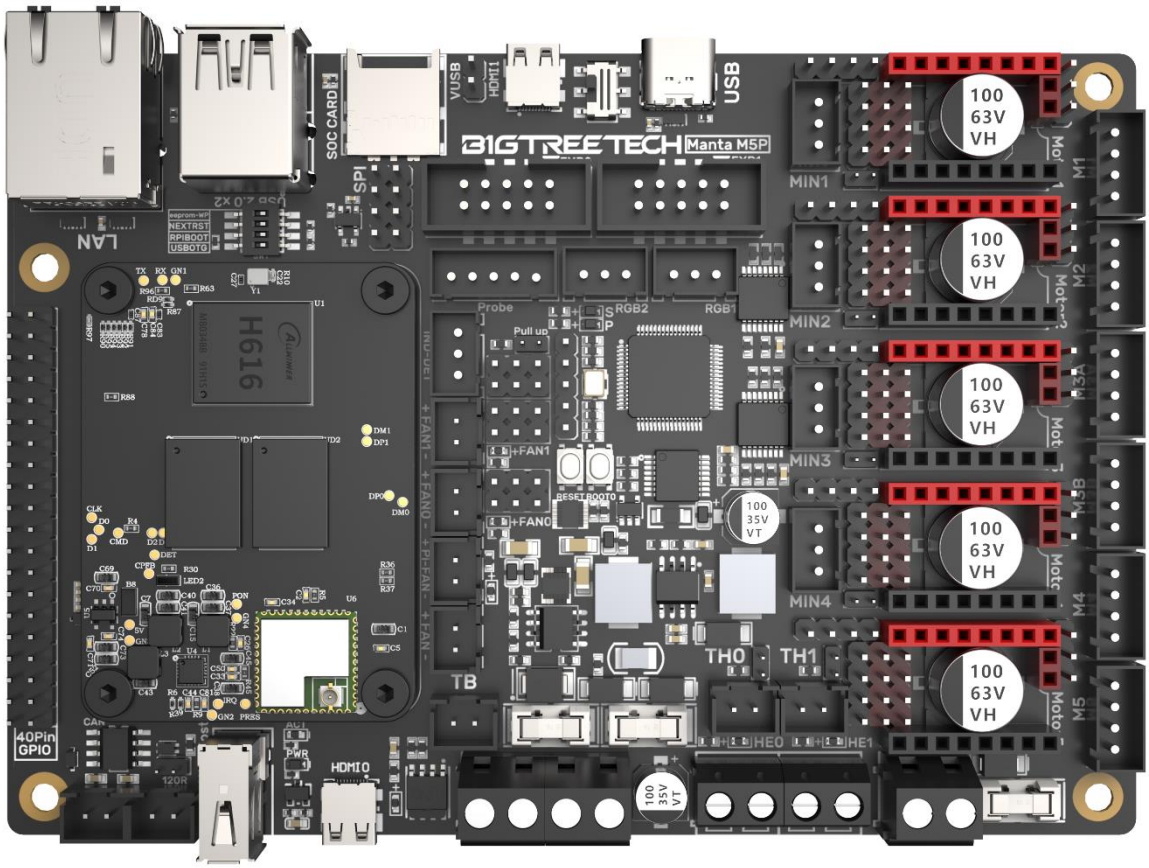


Install the Core Board via BTB Connection

M5P+CM4: Note the direction, as shown in the figure below:

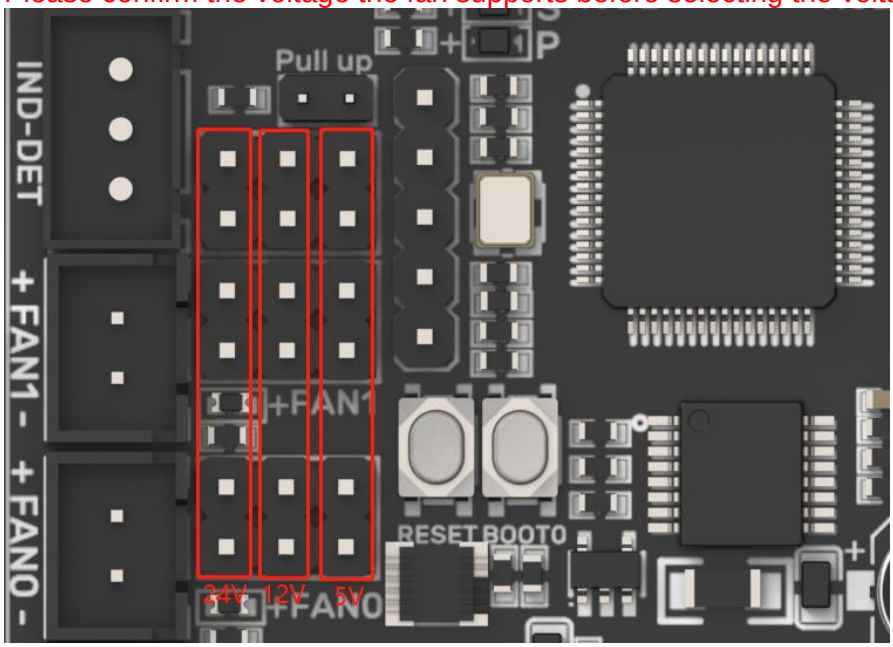


M5P+CB1: Note the direction, as shown in the figure below:



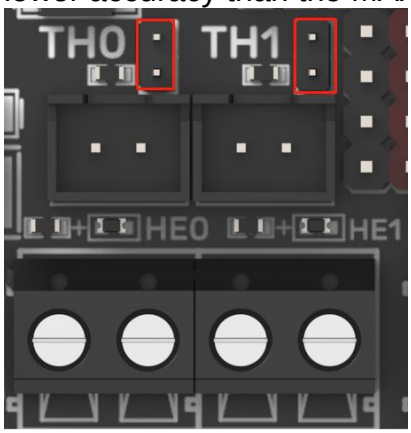
Voltage Selection for CNC Fan

Through the jumper cap, you can set the output voltage to 5V, 12V, or 24V.
Note: We are not responsible for fan burnout caused by incorrect voltage selection. Please confirm the voltage the fan supports before selecting the voltage.

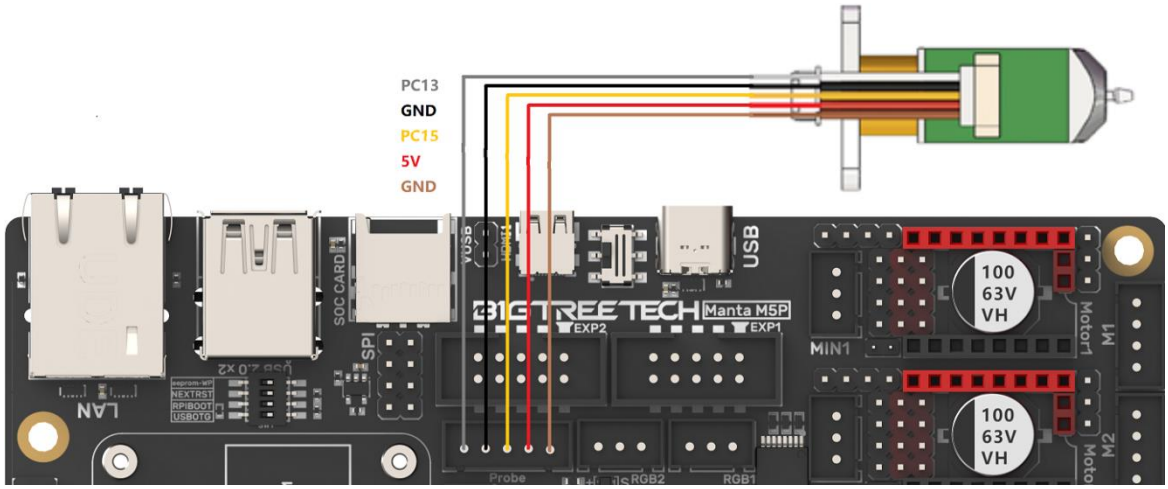


100K NTC or PT1000 Setting

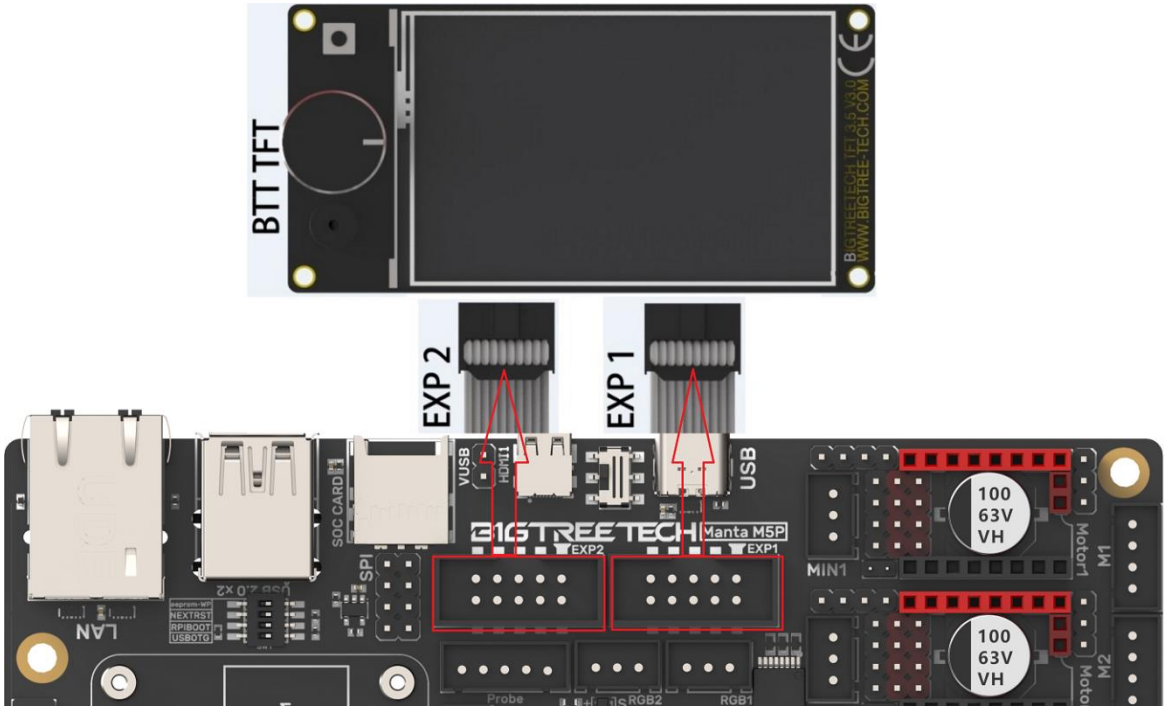
When using 100K NTC, no jumpers need to be connected, the pull up resistance of TH0-TH3 is 4.7K 0.1%. When using PT1000, the pins indicated in the picture below need to be connected via jumpers, parallel connection of 4.12K 0.1% resistors, the pull-up resistance of TH0-TH1 is 2.2K. (This method has a much lower accuracy than the MAX31865 in reading temperature.)



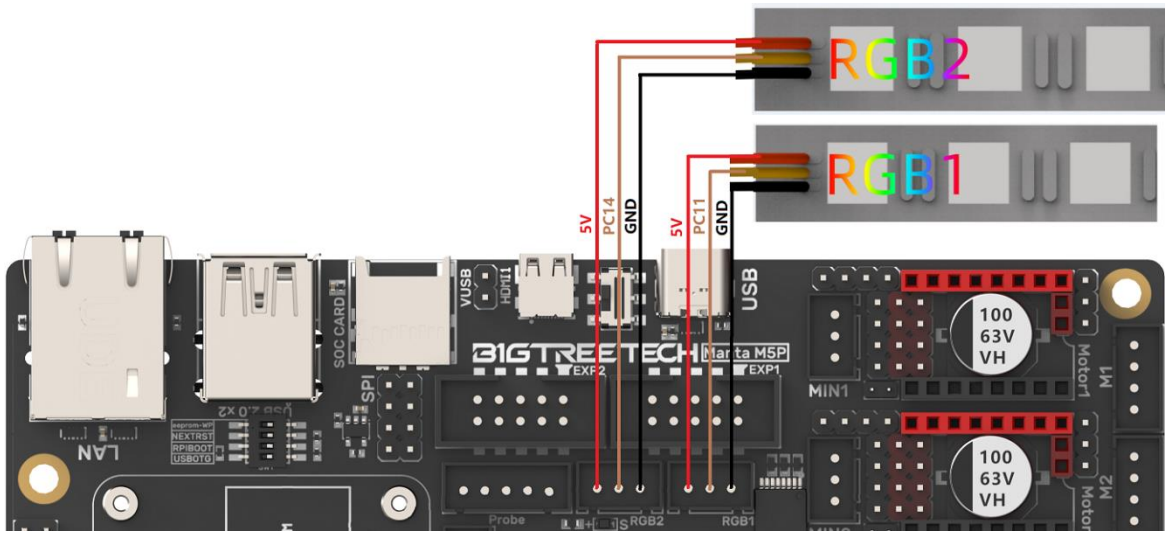
BLTouch Wiring



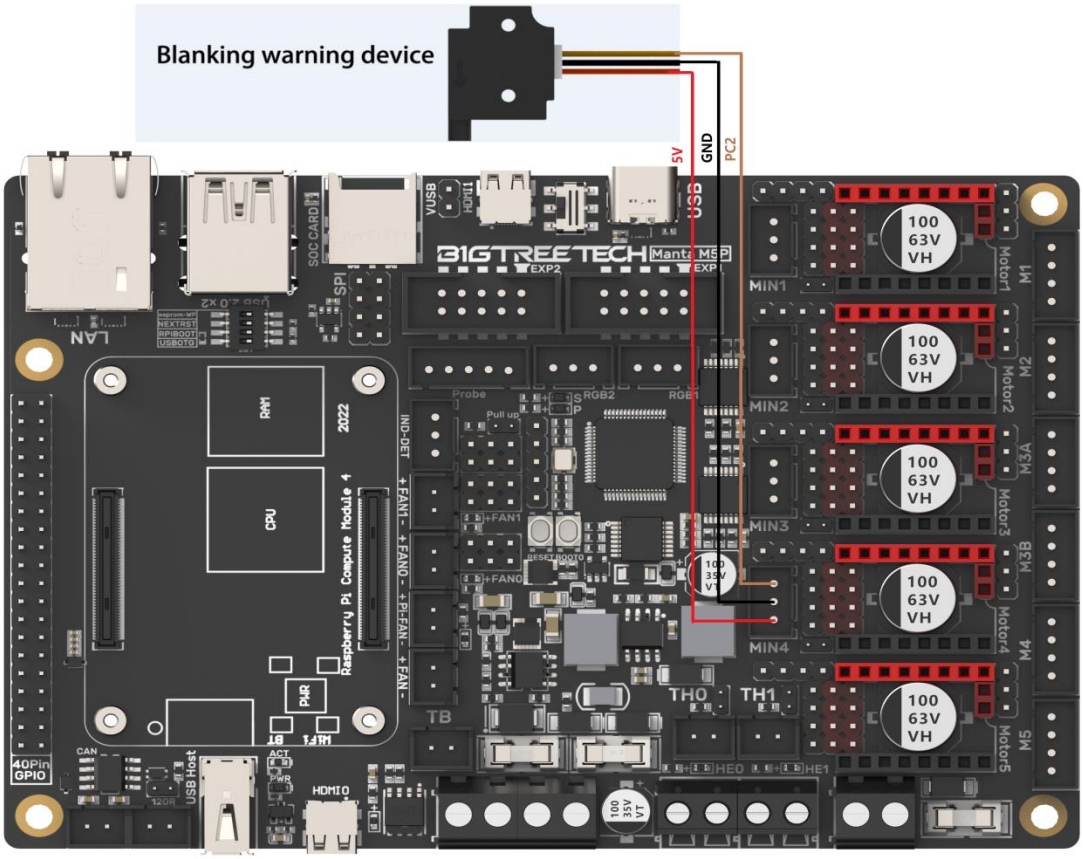
Wiring between LCD Screen and EXP1+EXP2



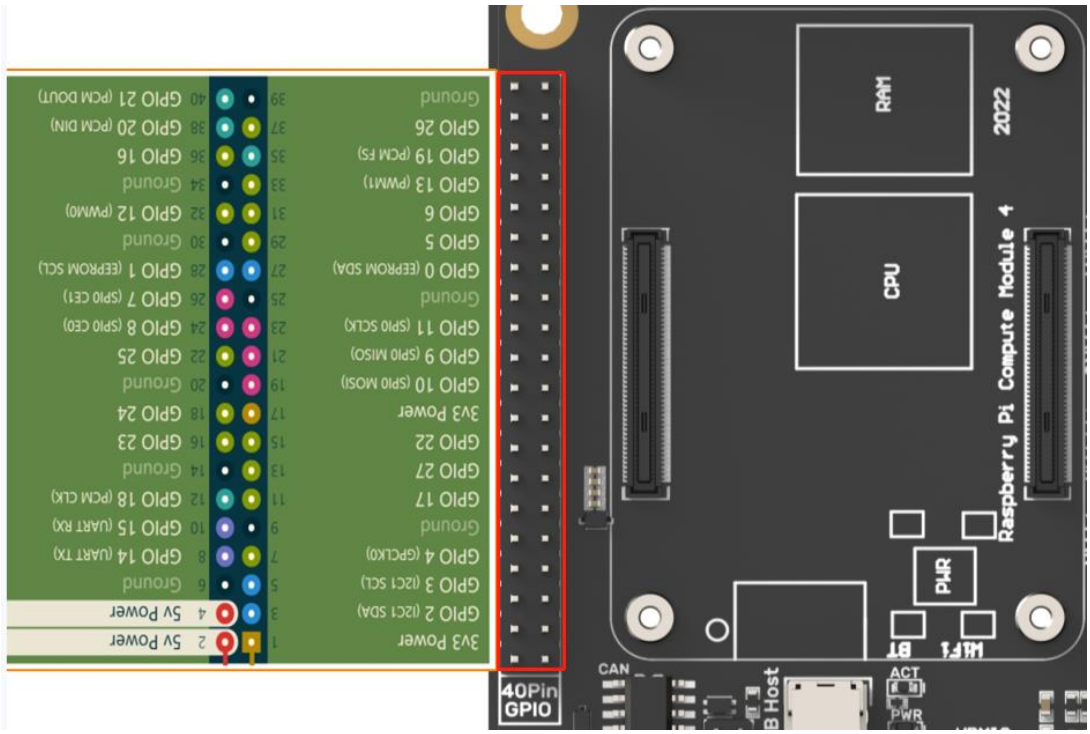
RGB Wiring



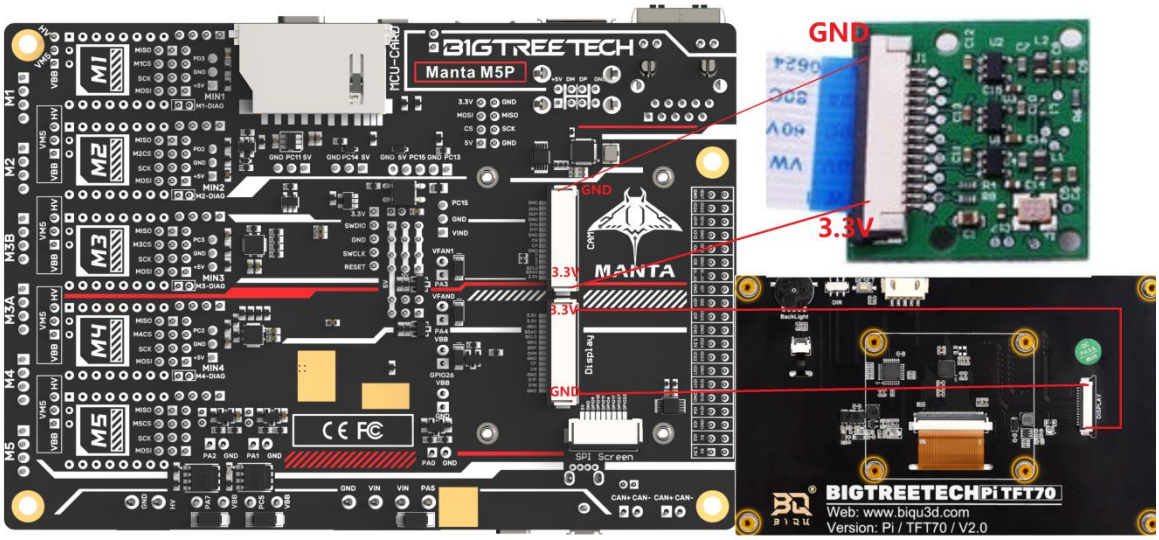
Filament Sensor Wiring



40 Pins GPIO

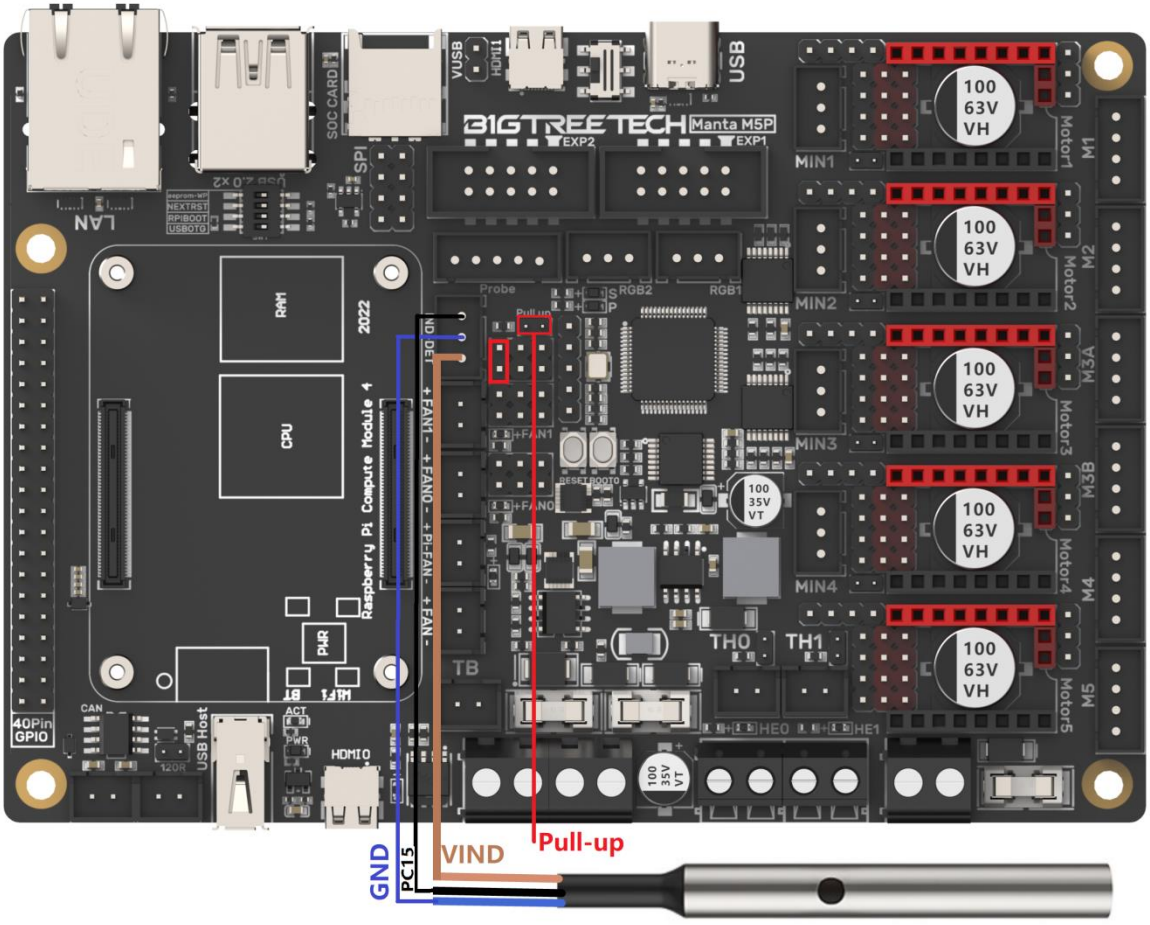


DSI/CSI Wiring

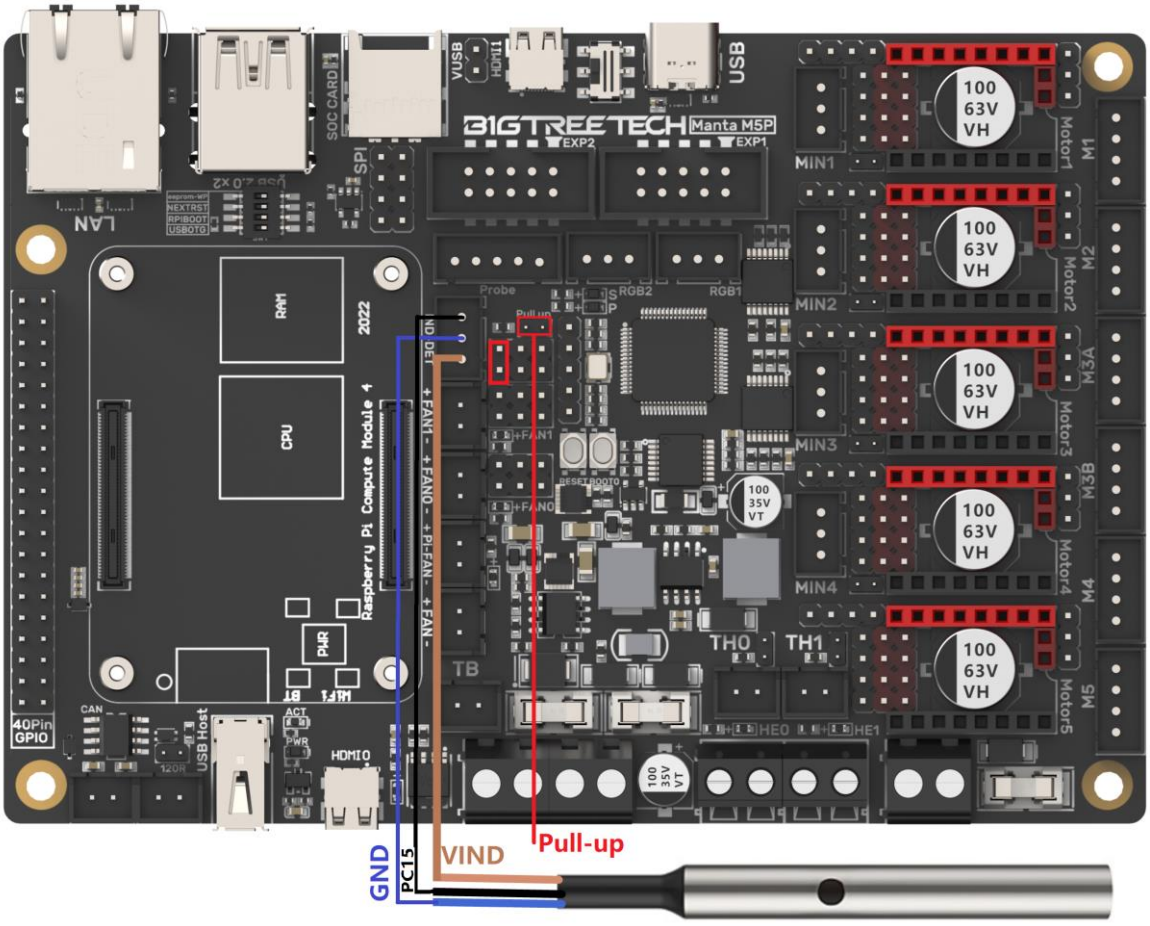


Proximity Switch Wiring

As shown in the figure below, 24V as an example, normally open (NPN type), no need for shorting through a jumper cap:



As shown in the figure below, 24V as an example, normally closed (PNP type), need for shorting through a jumper cap.

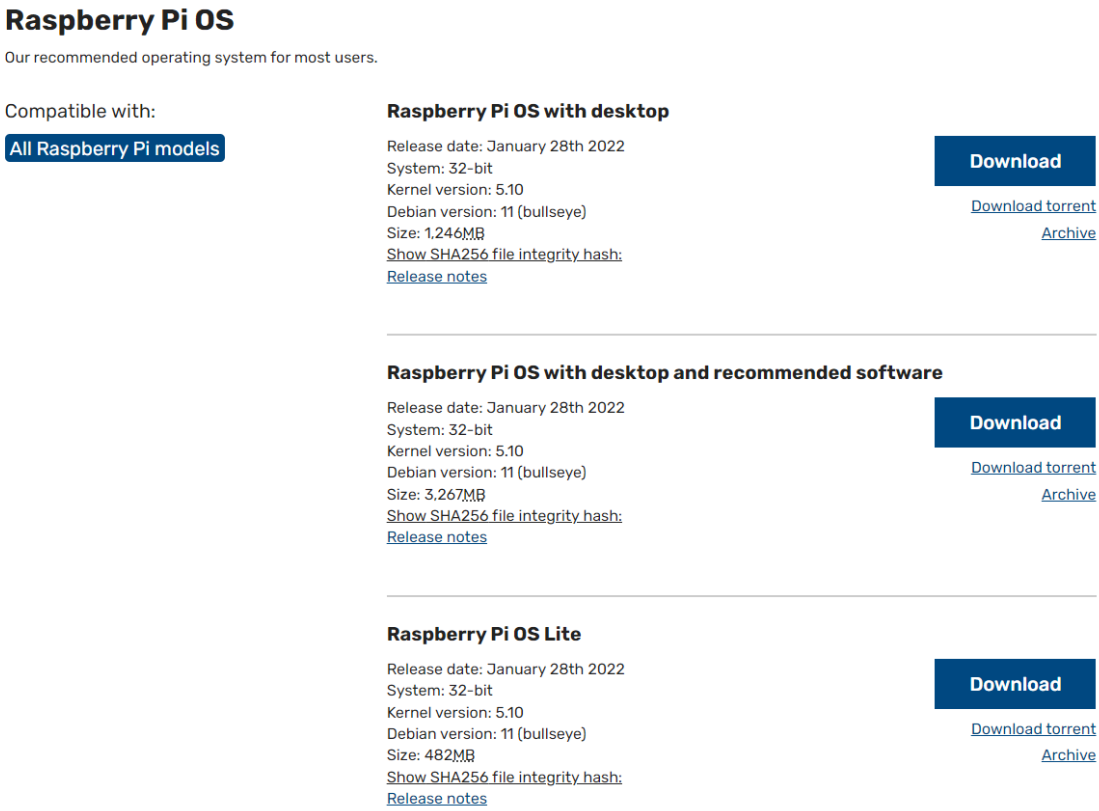


Raspberry Pi CM4 Usage Instructions

Download OS Image

When using CM4, download the image of Fluidd, Mainsail directly, also, you can download a pure OS image from the Raspberry Pi official website and install it yourself.

Fluidd: https://github.com/fluidd-core/FluiddPI/releases
Mainsail: https://github.com/mainsail-crew/MainsailOS/releases
Official Raspberry Pi OS Image: https://www.raspberrypi.com/software/operating-systems
(The usage of CM4 is slightly different from the standard Raspberry Pi 3B, 4B, etc., CM4 needs to refer to the system settings section to enable the system's USB, DSI, and other interfaces).



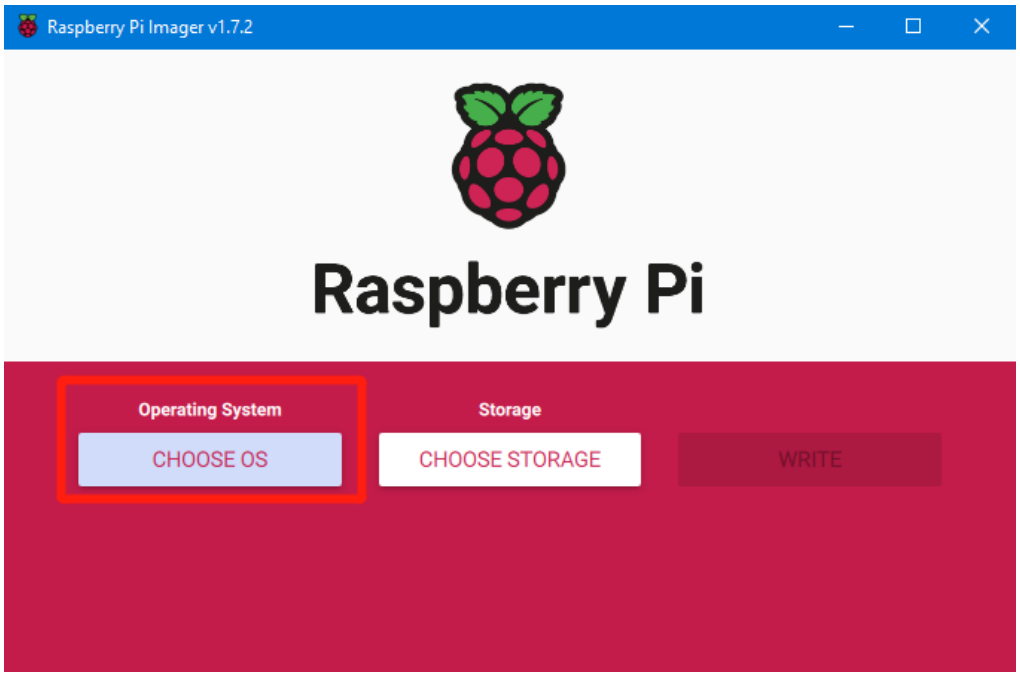
Download and Install Raspberry Pi Imager

Install the official Raspberry Pi Imager: https://www.raspberrypi.com/software/

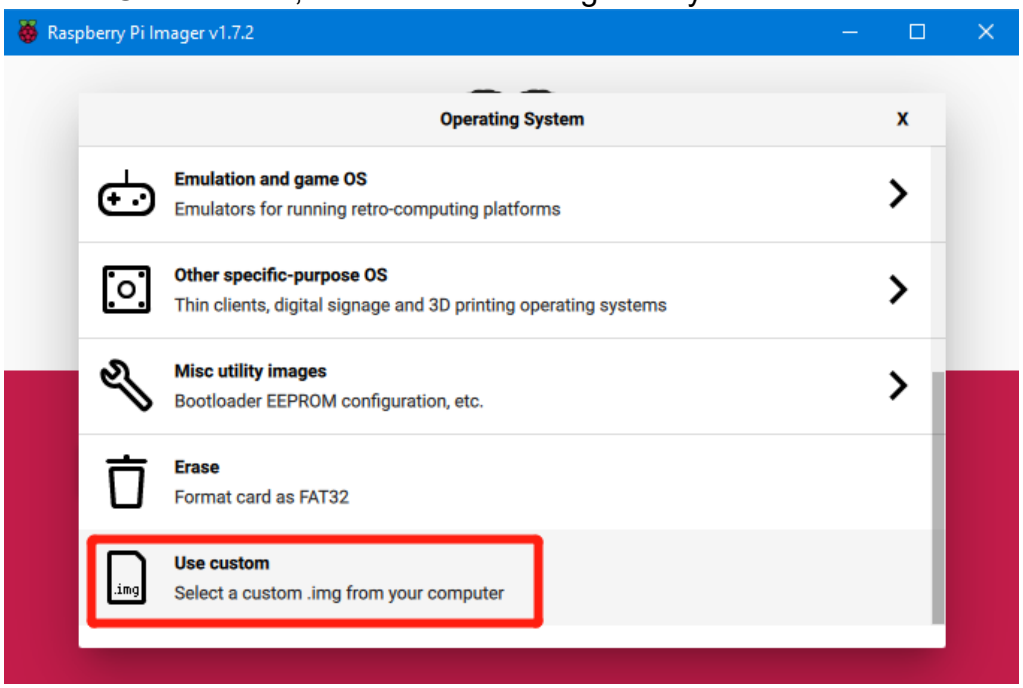
Write OS

CM4 LITE Version(MicroSD Card)

1. Insert MicroSD into your computer via a card reader.
2. Choose OS.

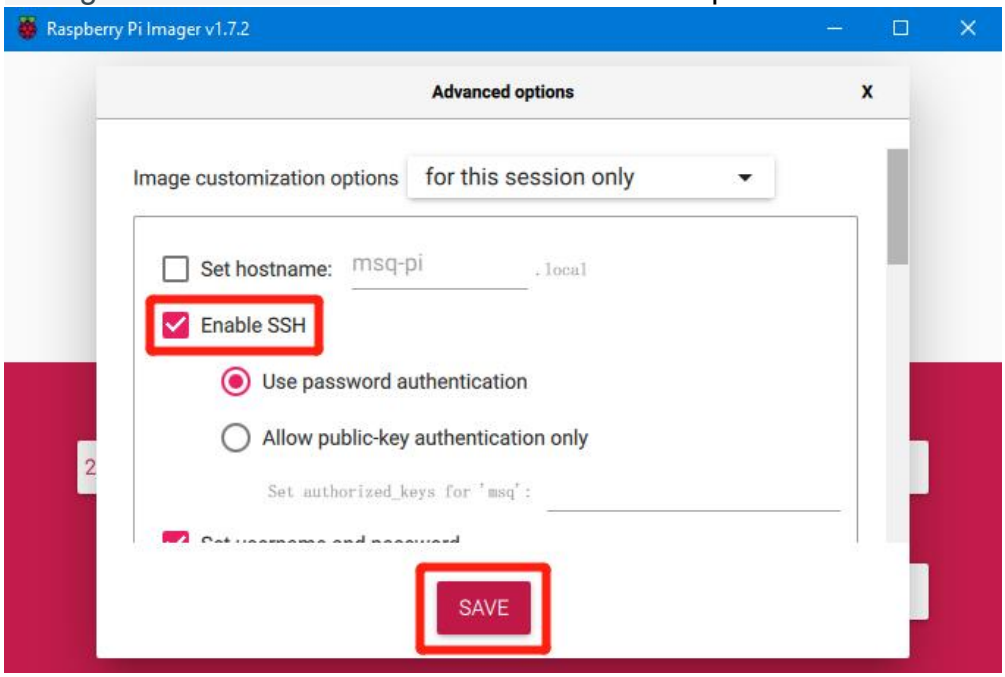


3. Select "Use custom", then select the image that you downloaded.



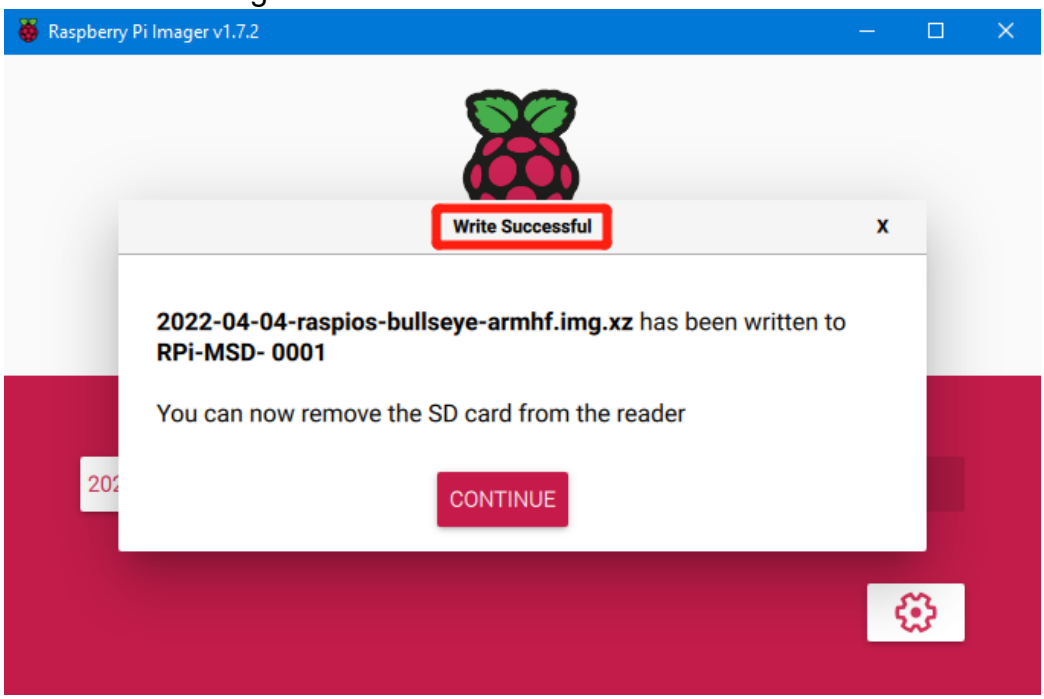
4. Click the settings icon in the lower right corner.

5. "Enable SSH" and then click "Save", there are other functions that can be set in this interface, please modify them according to your needs. Details are as follows:
Set hostname: raspberrypi.local // custom hostname, default is raspberrypi.local
Enable SSH
Set username and password // custom username and password, default username: pi, password: raspberry
Configure wireless LAN // custom WiFi name and password.



6. Select the MicroSD card and click "WRITE" (WRITE the image will format the MicroSD card. Be careful not to select the wrong storage device, otherwise the data will be formatted).

7. Wait for the writing to finish.



CM4 eMMC Version

(Note: the eMMC version will not run the system from the MicroSD card.)

1. Install rpiboot
   For Windows:
   http://github.com/raspberrypi/usbboot/raw/master/win32/rpiboot_setup.exe
   For Mac and Linux
   https://github.com/raspberrypi/usbboot#building
2. Turn DIP switch 4 (USBOTG), 3 (RPIBOOT) to ON to enter BOOT mode.
3. Plug the Type-C into the USB port of the computer (in order to avoid problems caused by the insufficient USB power supply of the computer, it is recommended to use an external 24V power supply to power the motherboard), run `sudo ./rpiboot` (Mac/Linux) or rpiboot.exe on Windows, then the eMMC of CM4 will be recognized by the computer as a mass storage device (if rpiboot reports an error at this time, you can try to re-plug the USB).
4. The steps of using the Raspberry Pi Imager to write the OS image are exactly the same as the LITE version.
5. When the writing is complete, turn the DIP switch 4 (USBOTG) and 3 (RPIBOOT) back to OFF after powering off, and then enter the normal working mode after powering on again.

System Setting (CM4)

USB 2.0 Hub

MANTA M5P is equipped with a USB 2.0 Hub. In order to save power consumption, the USB port of CM4 is disabled by default. If you need to enable it, you need to add the following content in the config.txt file:
`dtoverlay=dwc2,dr_mode=host`

DSI1 Display

The default display interface is HDMI, and the DSI interface of MANTA M5P is DSI1, you need to download the DSI1 driver, and enter the following in the command line:
`sudo wget` https://datasheets.raspberrypi.com/cmio/dt-blob-disp1-cam1.bin -O /boot/dt-blob.bin
After downloading this driver and restarting, the screen connected to the DSI interface can be displayed normally. If you want to use the HDMI interface, you need to delete the downloaded `/boot/dt-blob.bin` driver and restart, and then the HDMI can output normally.

CSI1 Camera

The DSI1 driver downloaded in **DSI1 Display** also includes the

CSI1 driver. If you just want to install the CSI1 driver, not DSI1, please find the driver you want to use at https://datasheets.raspberrypi.com/licence.html and

download it in the boot folder of CM4 and rename it to `dt-blob.bin`, then refer

to the settings here: https://projects.raspberrypi.org/en/projects/getting-started-with-picamera/

BIGTREETECH CB1 Usage

Download OS Image

When using CB1, you can only download and install the OS image provided by BIGTREETECH.

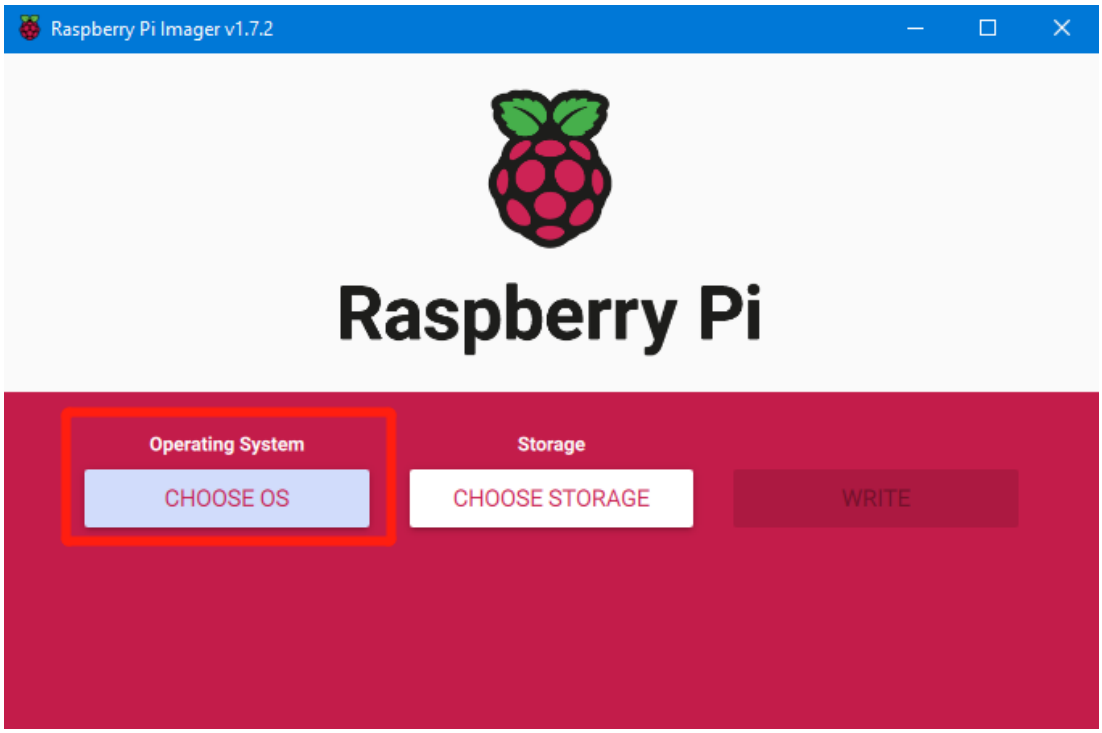
https://github.com/bigtreetech/CB1/releases

Download and Install Raspberry Pi Imager

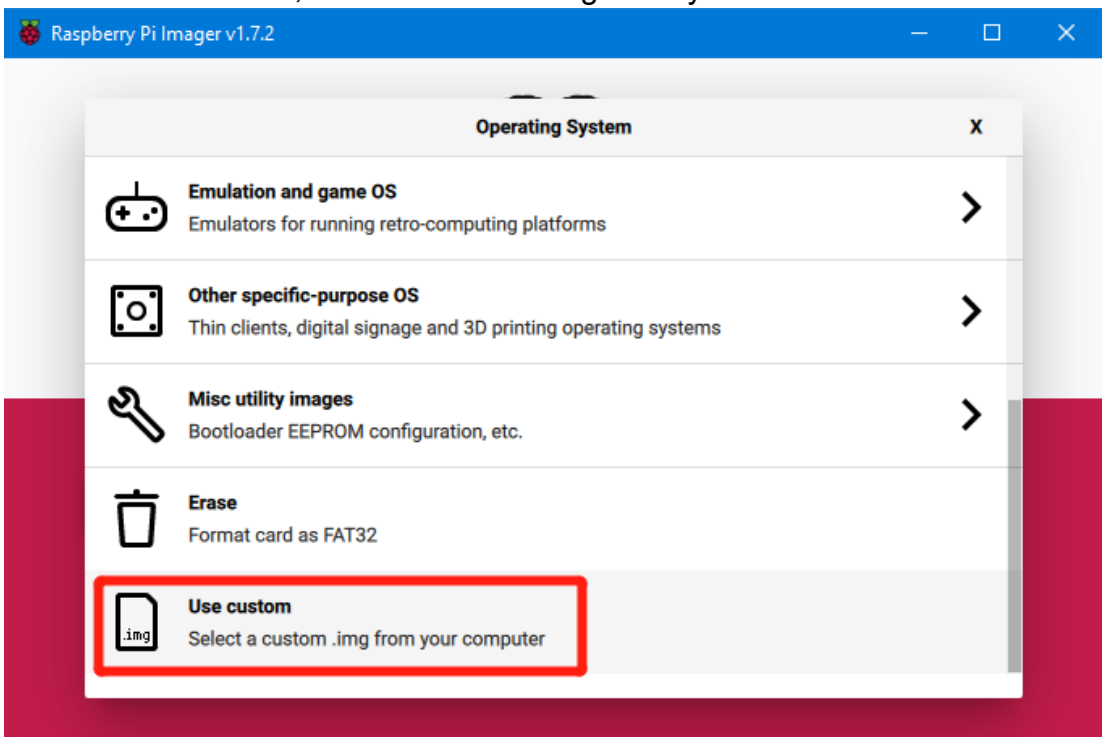
Install the official Raspberry Pi Imager: https://www.raspberrypi.com/software/, This software can also write the OS image of CB1.

Write OS

1. Insert a MicroSD card into your computer via a card reader.
2. Choose OS.

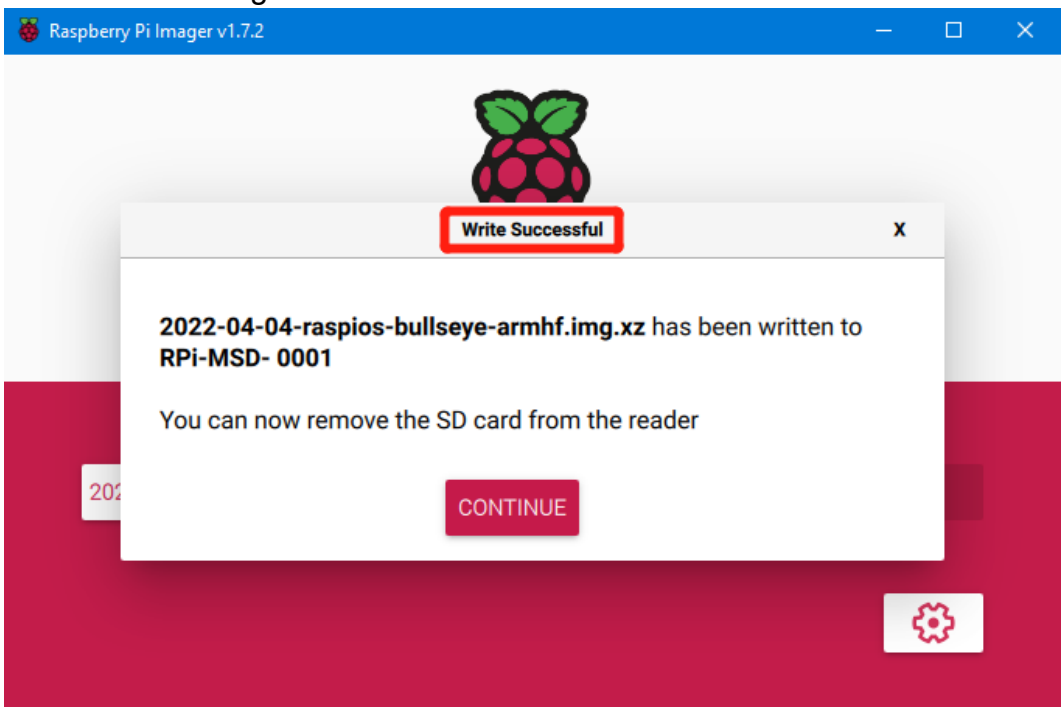


3. Select "Use custom", then select the image that you downloaded.



4. Select the MicroSD card and click "WRITE" (WRITE the image will format the MicroSD card. Be careful not to select the wrong storage device, otherwise the data will be formatted).

5. Wait for the writing to finish.

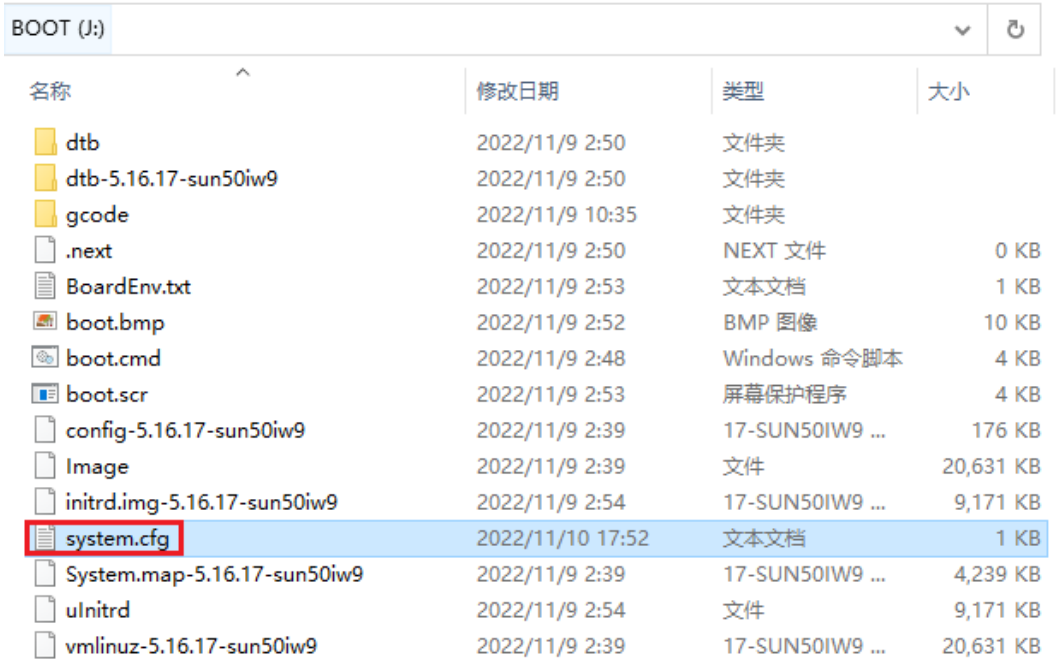


WiFi Setting

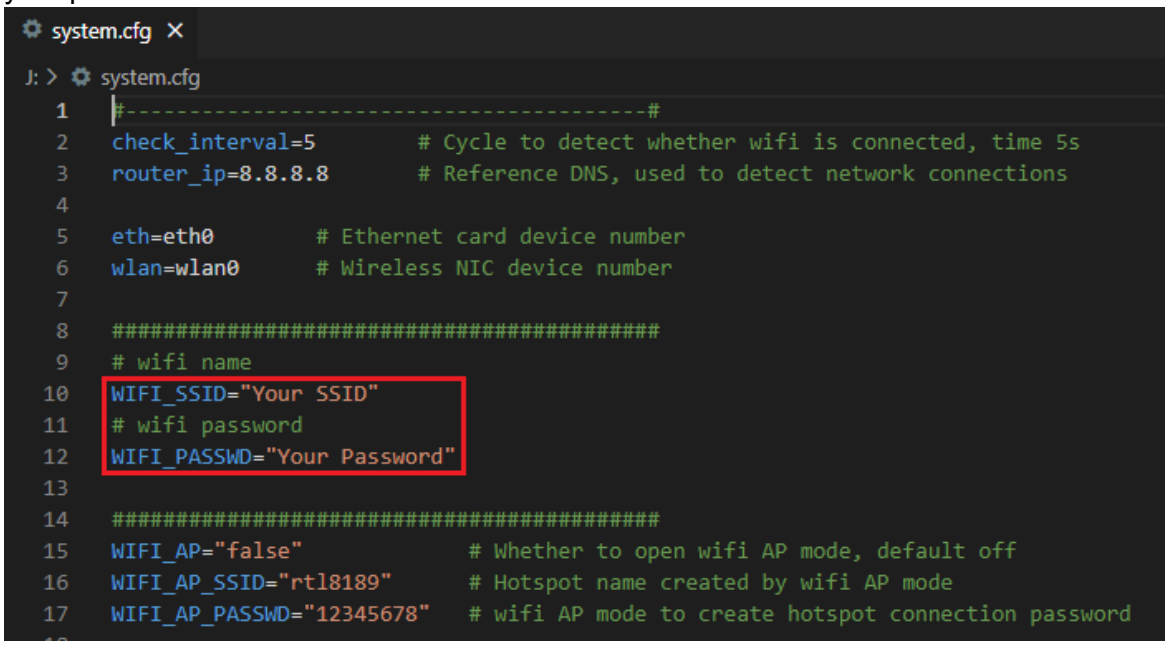
Note: This step can be skipped if you are using a network cable connection.

CB1 cannot directly use the Raspberry Pi Imager to set the WiFi name

and password like CM4. After the OS image writing is completed, the MicroSD card will have a FAT32 partition recognized by the computer, find "system.cfg"



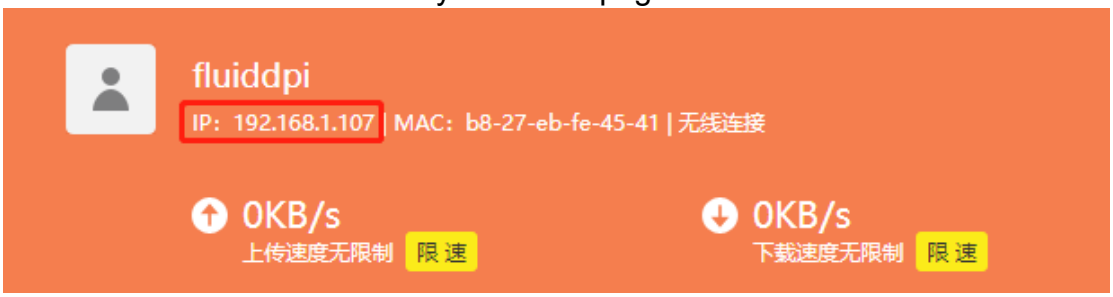
Open it with Notepad, replace WIFI-SSID with your WiFi name, and PASSWORD with your password.



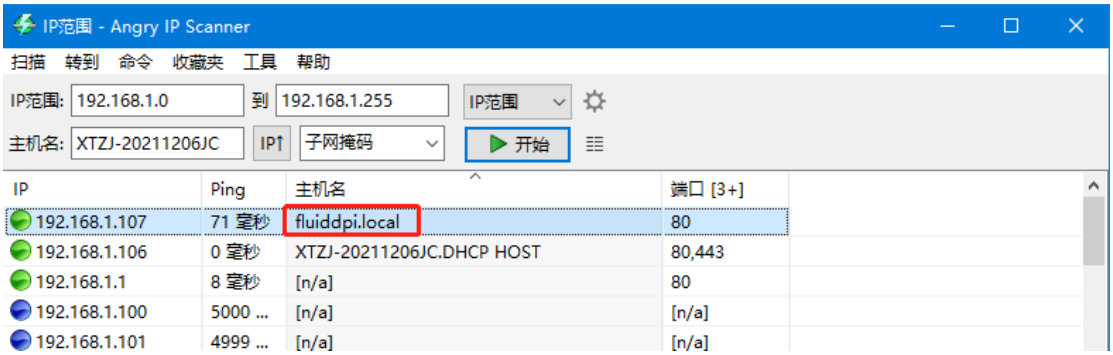
Configure the Motherboard

SSH Connect to Device

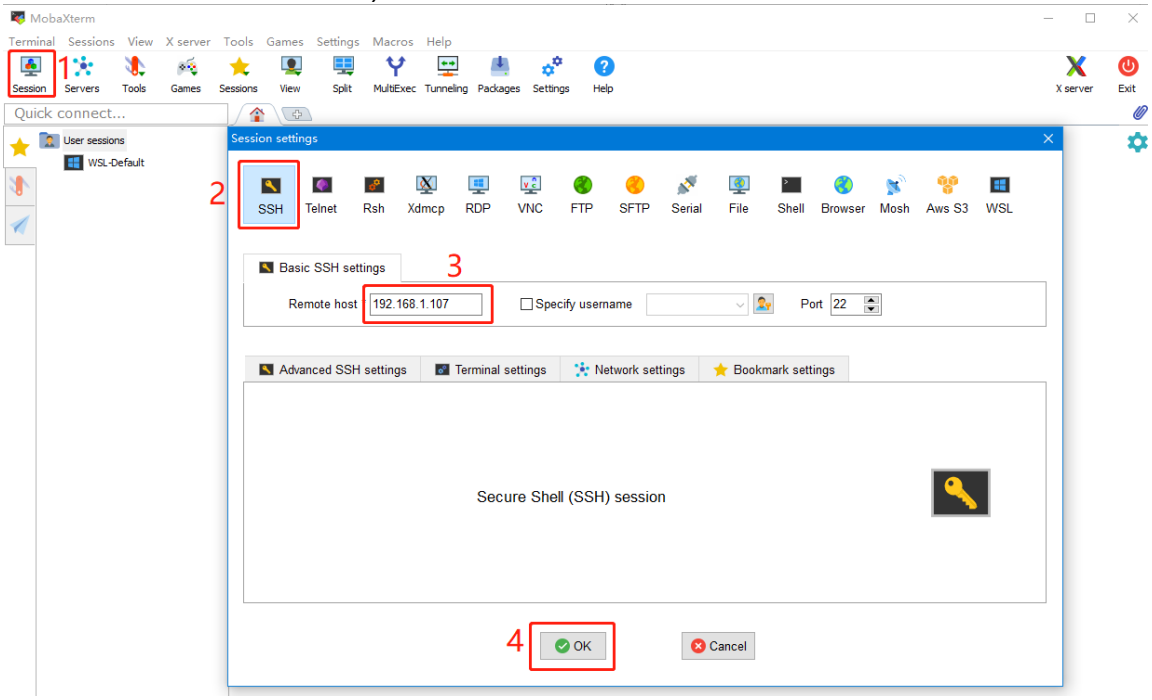
1. Install the ssh application Mobaxterm: https://mobaxterm.mobatek.net/download-home-edition.html
2. Insert MicroSD card to MANTA M5P, and wait for the system to load after power on, approx. 1-2min.
3. The device will automatically be assigned an IP address after successfully connecting to the network.
4. Find the device IP address on your router page.



5. Or use the https://angryip.org/ tool, scan all IP addresses in the current network organize by names, and find the IP named Fluidd, Mainsail (CM4), or BTT-CB1 (CB1), like shown below.



6. Open Mobaxterm and click "Session", and click "SSH", inset the device IP into Remote host, and click "OK" (Note: your computer and the device needs to be in the same network).



7. Login:

CM4:

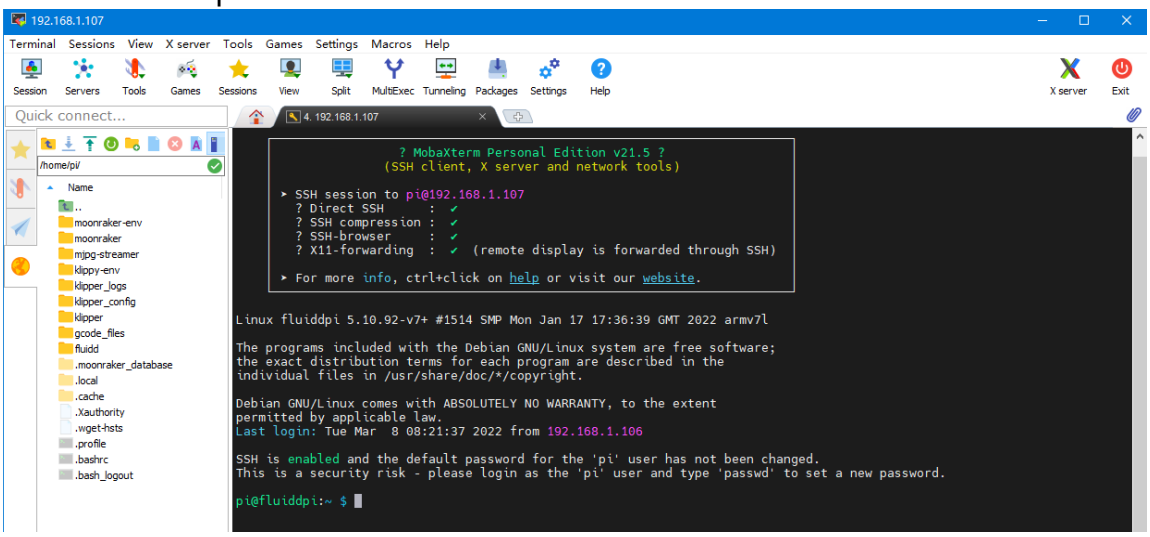
Login as: pi

Password: raspberry

CB1:

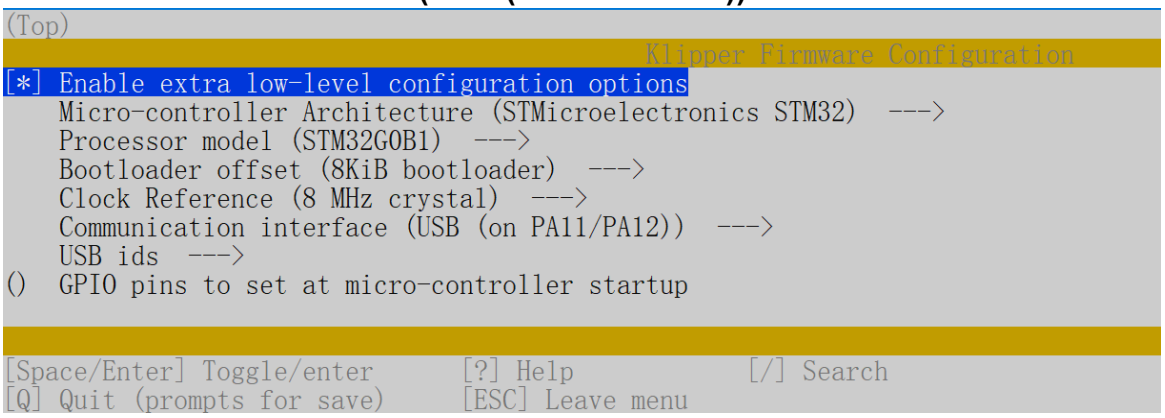
Login as: biqu

Password: biqu



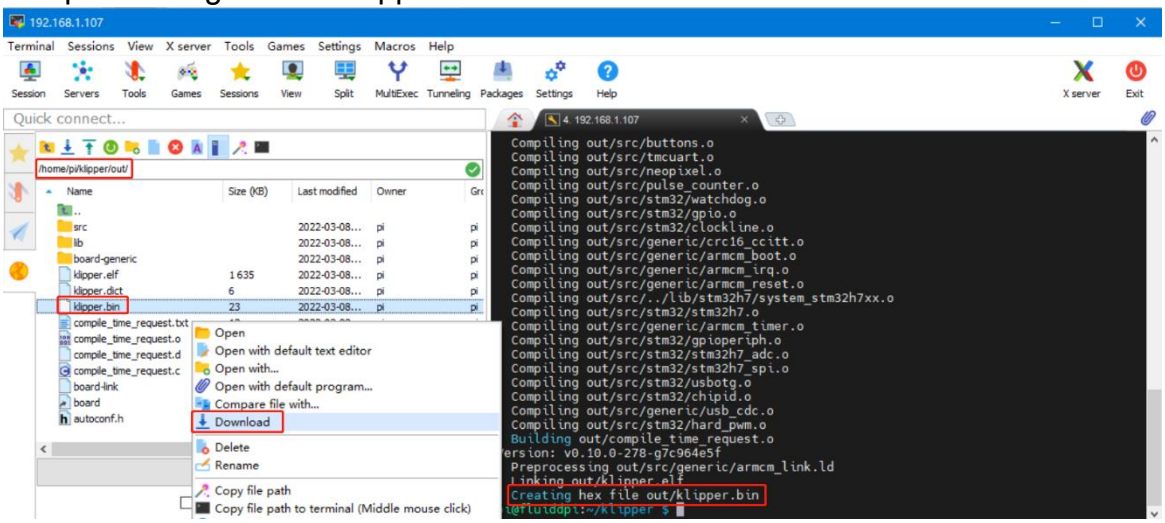
Compile MCU Firmware

1. After SSH is successfully connected to the device, enter in the terminal:
   cd ~/klipper/
   make menuconfig
   Compile the firmware with the following configuration(if the options below are not available, please update your Klipper source code to the newest version).
   *** [*] Enable extra low-level configuration options**
   *** Micro-controller Architecture (STMicroelectronics STM32) --->**
   *** Processor model (STM32G0B1) --->**
   *** Bootloader offset (8KiB bootloader) --->**
   *** Clock Reference (8 MHz crystal) --->**
   *** Communication interface (USB (on PA11/PA12)) --->**



2. Press 'q' to exit, and "Yes" when asked to save the configuration.

3. Run **make** to compile firmware, 'klipper.bin' file will be generated in **home/pi/klipper/out** folder when **make** is finished, download it onto your computer using the SSH application.



Firmware Update

Update Using SD Card

1. Rename klipper.bin to "firmware.bin", copy it to the root directory of the SD card, insert the SD card into the SD card slot of the MANTA M5P, click the reset button, or power on again, the firmware will be updated automatically, after the update is complete, "firmware.bin" in the SD card will be renamed to "FIRMWARE.CUR".

2. Enter **ls /dev/serial/by-id/** in the command line to check the motherboard ID to confirm whether the firmware is updated successfully as shown below.

```
pi@fluiddpi:~/klipper $ ls /dev/serial/by-id/
usb-Klipper_stm32g0b1xx_190028000D50415833323520-if00
pi@fluiddpi:~/klipper $
```

   copy and save this ID, it is needed when configuring the file.

Update via DFU

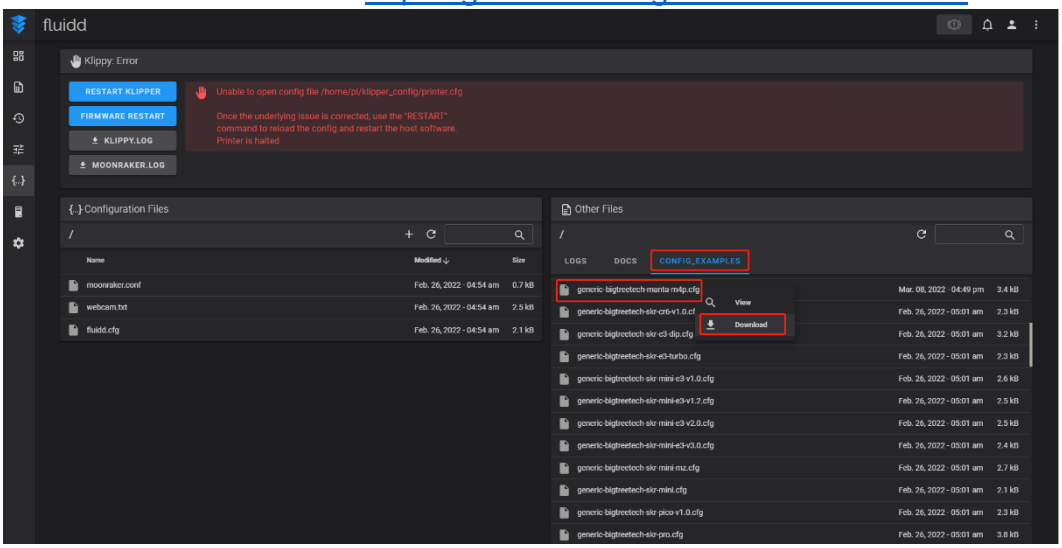
If **ls /dev/serial/by-id/** can find the klipper device ID of the MCU, you can enter make flash FLASH_DEVICE= /dev/serial/by-id/usb-Klipper_stm32g0b1xx_190028000D50415833323520-if00
directly to write the firmware. (note: replace /dev/serial/by-id/xxx with the actual ID queried in the previous step.)

```
biqu@Hurakan:~/klipper$ make flash FLASH_DEVICE=/dev/serial/by-id/usb-Klipper_stm32g0b1xx_190028000D50415833323520-if00
  Building hid-flash
/bin/sh: 1: pkg-config: not found
    hid-flash requires libusb-1.0, please install with:
    sudo apt-get install libusb-1.0
  Flashing out/klipper.bin to /dev/serial/by-id/usb-Klipper_stm32g0b1xx_190028000D50415833323520-if00
Entering bootloader on /dev/serial/by-id/usb-Klipper_stm32g0b1xx_190028000D50415833323520-if00
Device reconnect on /sys/devices/platform/soc/5200000.usb/usb1/1-1/1-1.1/1-1.1:1.0
sudo dfu-util -p 1-1.1 -R -a 0 -s 0x8002000:leave -D out/klipper.bin

dfu-util 0.9

Copyright 2005-2009 Weston Schmidt, Harald Welte and OpenMoko Inc.
Copyright 2010-2016 Tormod Volden and Stefan Schmidt
This program is Free Software and has ABSOLUTELY NO WARRANTY
Please report bugs to http://sourceforge.net/p/dfu-util/tickets/

dfu-util: Invalid DFU suffix signature
dfu-util: A valid DFU suffix will be required in a future dfu-util release!!!
Opening DFU capable USB device...
ID 0483:df11
Run-time device DFU version 011a
Claiming USB DFU Interface...
Setting Alternate Setting #0 ...
Determining device status: state = dfuIDLE, status = 0
dfuIDLE, continuing
DFU mode device DFU version 011a
Device returned transfer size 1024
DfuSe interface name: "Internal Flash  "
Downloading to address = 0x08002000, size = 25264
Download        [=========================] 100%        25264 bytes
Download done.
File downloaded successfully
dfu-util: Error during download get_status

Failed to flash to /dev/serial/by-id/usb-Klipper_stm32g0b1xx_190028000D50415833323520-if00: Error running dfu-util

If the device is already in bootloader mode it can be flashed with the
following command:
  make flash FLASH_DEVICE=0483:df11
  OR
  make flash FLASH_DEVICE=1209:beba

If attempting to flash via 3.3V serial, then use:
  make serialflash FLASH_DEVICE=/dev/serial/by-id/usb-Klipper_stm32g0b1xx_190028000D50415833323520-if00
```

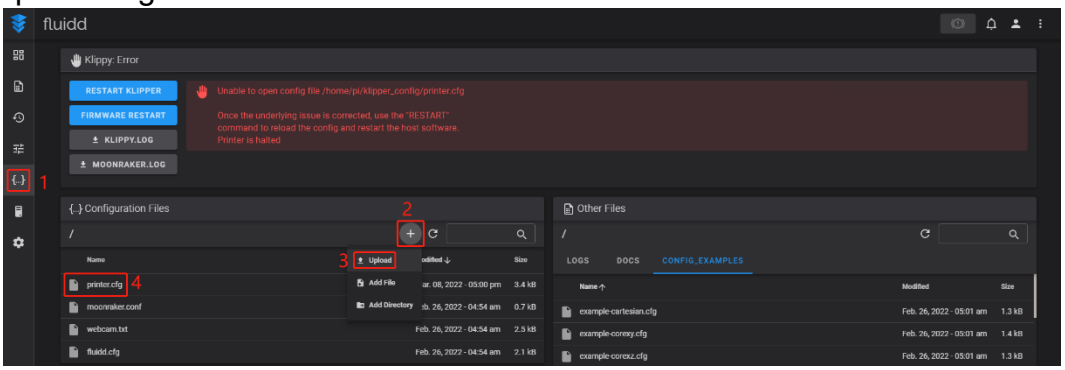
After the writing is completed, there will be an error message: dfu-util: Error during download get_status, just ignore it.

Configure Klipper

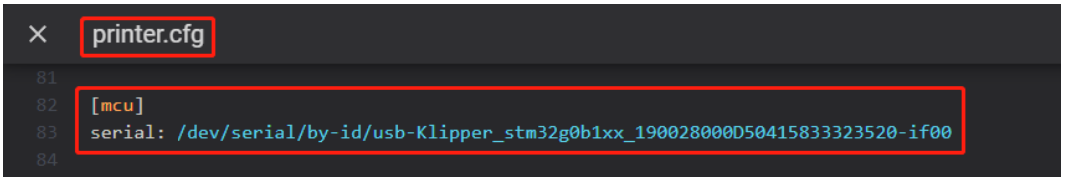
1. Enter your device IP address into your browser, and find the reference config for the motherboard in the directory shown below, if there is no such config available, update your Klipper source code to the newest version or download it from GitHub: https://github.com/bigtreetech/Manta-M8P.



2. Upload your finished config file into Configuration Files, and rename it to "printer.cfg".



3. Enter the correct ID.



Follow the instructions https://www.klipper3d.org/Overview.html to configure the specific functions of the machine.

Cautions

- Except for HDMI, USB, and RJ45, all unplugging and plugging operations should be performed under the condition of power off, including the eMMC writing function.
- Pay attention to the heat dissipation of CB1/CM4. If the running application consumes too many system resources, the CB1/CM4 will get hot quite seriously.

If you need other resources for this product, please visit https://github.com/bigtreetech/ and find them yourself. If you cannot find the resources you need, you can contact our after-sales support.

If you encounter other problems during use, feel free to contact us, and we are answering them carefully; any good opinions or suggestions on our products are welcome, too and we will consider them carefully. Thank you for choosing BIGTREETECH. Your support means a lot to us!