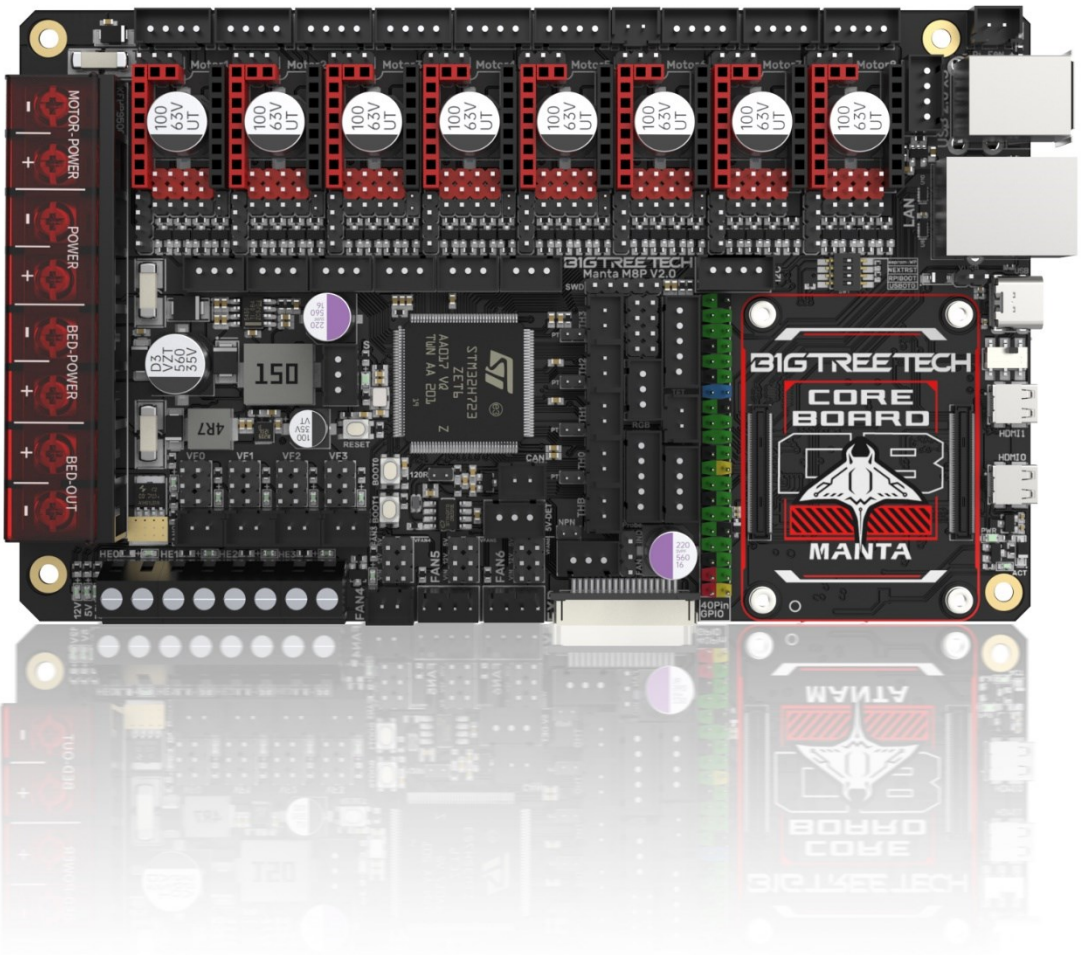
BIGTREETECH

MANTA M8P V2.0

User Manual



Revision Log

Version	Date	Revisions
v1.00	20th August 2023	Initial Version
v1.01	1th April 2024	Update Pin for FAN5 and FAN6

CONTENTS

Product Profile

BIGTREETECH Manta M8P V2.0 is a 32-bit 3D printer control board designed for use with Klipper firmware. It allows direct installation of a core board to run Klipper, greatly simplifying connections to a Raspberry Pi and saving space in the electronics enclosure. The board has a BTB socket for use with a CM4, CB1, or other solutions, providing flexibility beyond the expensive CM4.

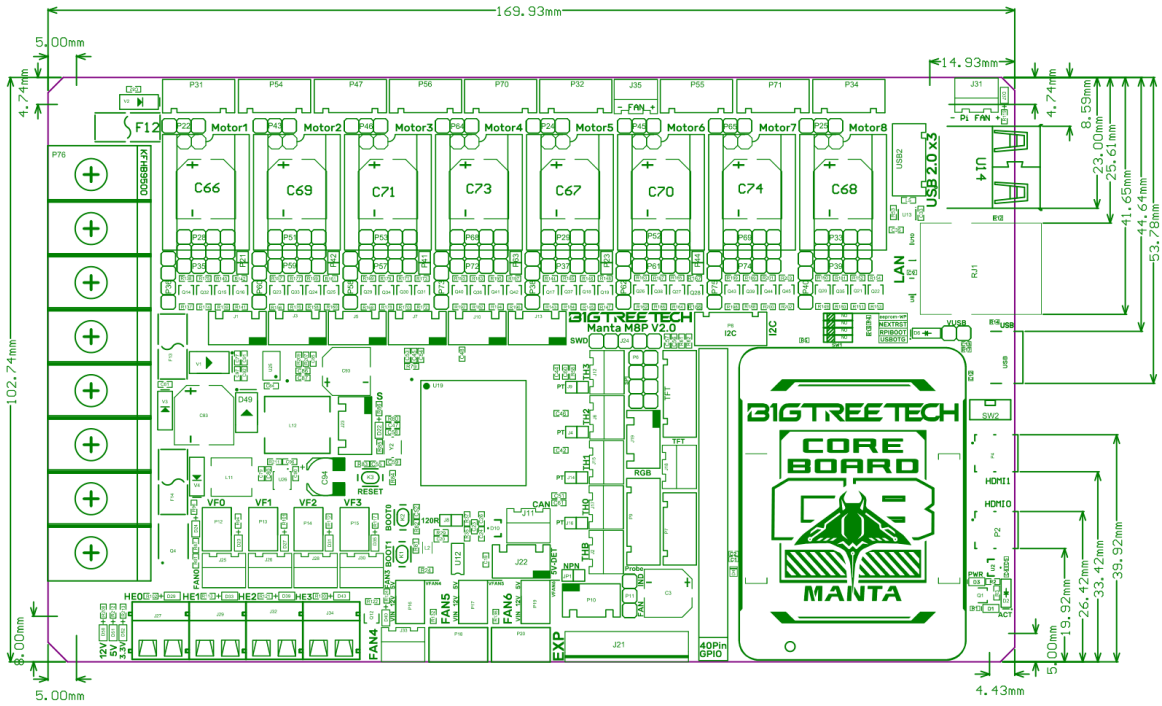
Feature Highlights

- Uses a 32-bit STM32H723ZET6 ARM Cortex-M7 MCU running at 550MHz.
- The TPS5450-5A power chip supports 12/24V DC input and delivers up to 5A/6A peak for powering a Raspberry Pi.
- A BOOT button is provided for DFU firmware updates.
- The thermistor circuit is protected to prevent MCU damage from shorted heated bed and heater cartridge connections.
- PWM fans support 24/12/5V voltage selection without external transformer module, reducing failure points.
- The thermistor resistor can select the pull-up resistor value through a jumper to support PT1000 without an external module, which is convenient for customers to use for DIY purposes.
- The MCU firmware can be upgraded through an SD card or through the "make flash" command in Klipper to update the MCU firmware via DFU.
- The BTB connector allows use of CM4, CB1, or other core boards.
- The onboard TMC driver works in SPI and UART modes, and the onboard DIAG function pin can be used by simply plugging in a jumper.
- Connectors for filament sensor, auto power-off, BLTouch, RGB, I2C, servo, 5V power detection, etc.
- High performance MOSFETs reduce heating.
- Replaceable fuses for easy service.
- 3x 4-pin fan headers usable for water cooling.
- Proximity switch header supports NPN and PNP (24/12/5V).
- SPI expansion for accelerometer-based resonance compensation.

Specifications

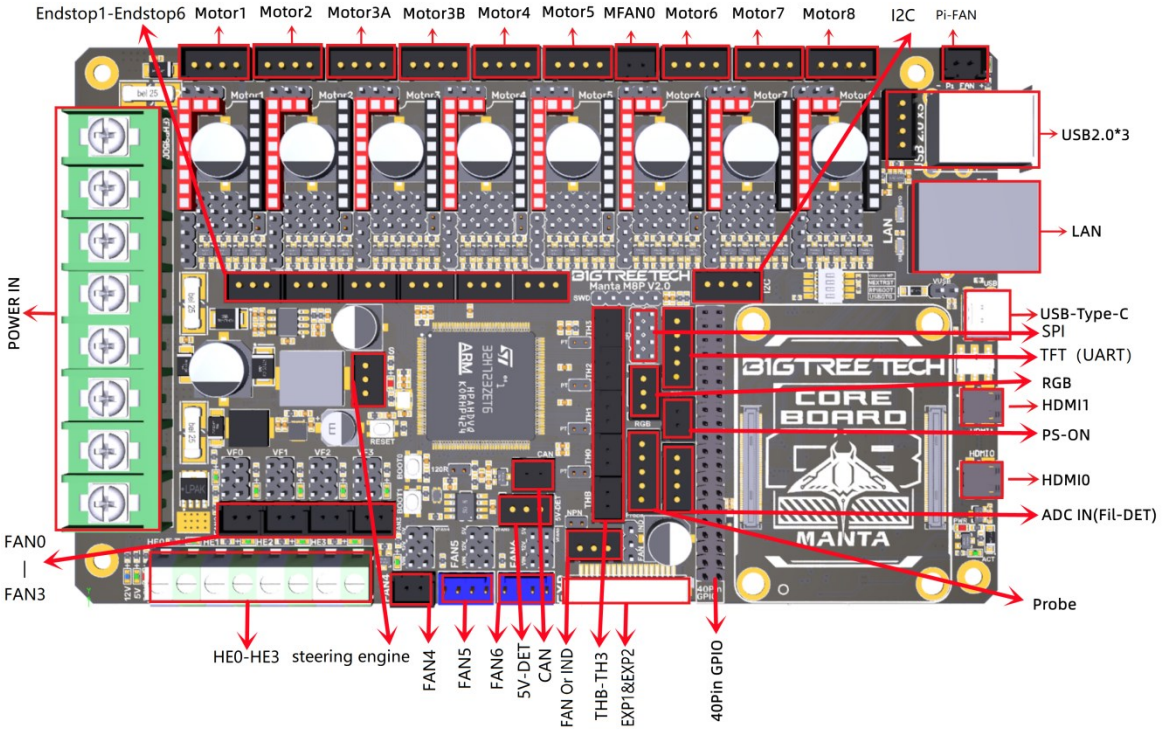
Overall Dimensions	170 x 102.7mm
Installation Dimensions	Please refer to **BIGTREETECH MANTA M8P V2.0-SIZE-top.pdf**
Microprocessor	ARM Cortex-M7 STM32H723ZET6 550MHz
Driver Input Voltage	24V, HV (24-60V) Selectable
Board Input Voltage	VIN=DC12V or DC24V
Heated Bed Input Voltage	BED IN=DC12V or DC24V
Logic Voltage	DC3.3V
Heating Interfaces	Heated Bed (HB), Heater Cartridge (HE0, HE1, HE2, HE3)
Max Heated Bed Output Current	10A, peak 10.5A
Max Heater Cartridge Output Current	5.5A, peak 6A
Fan Interfaces	5x 2-pin PWM fans (FAN0, FAN1, FAN2, FAN3, FAN4),1x 2-pin Pi FAN, 2x 4-pin PWM fans (FAN5, FAN6), 1x always on fan, FAN0, FAN1, FAN2, FAN3, FAN4, FAN5, FAN6 are available with 5/12/24V selections.
Max Fan Output Current	1A, peak 1.1A
Total Current for Heater Cartridge + Driver + Fans	Less than 12A
Expansion Interfaces	BLTouch (Servos, Probe), Servo, Filament Sensor, 5V Power Loss Detection, PS-ON, I2C, RGB, SPI, TFT, EXP, CAN etc.
Motor Drivers	Supports TMC5160, TMC2209, TMC2225, TMC2226, TMC2208, TMC2130, ST820, LV8729, DRV8825, A4988 etc.
Driver Modes	SPI, UART, STEP/DIR
Motor Interfaces	Motor1, Motor2, Motor3 (dual), Motor4, Motor5, Motor6, Motor7, Motor8 (8 total)
Temperature Sensor Interfaces	5x 100K NTC, 4x support NTC and PT1000
Display Interfaces	SPI touchscreen, LCD display
PC Communication	Type-C for easy plug/unplug
Function Interfaces	USB 2.0*3, LAN, DSI, CSI, SPI, 40-pin GPIO, HDMI0/HDMI1, SOC-Card, MCU-Card
Supported Machine Types	Cartesian, Delta, Kossel, Ultimaker, CoreXY
Recommended Software	Cura, Simplify3D, Pronterface, Repetier-host, Makerware

Dimensions

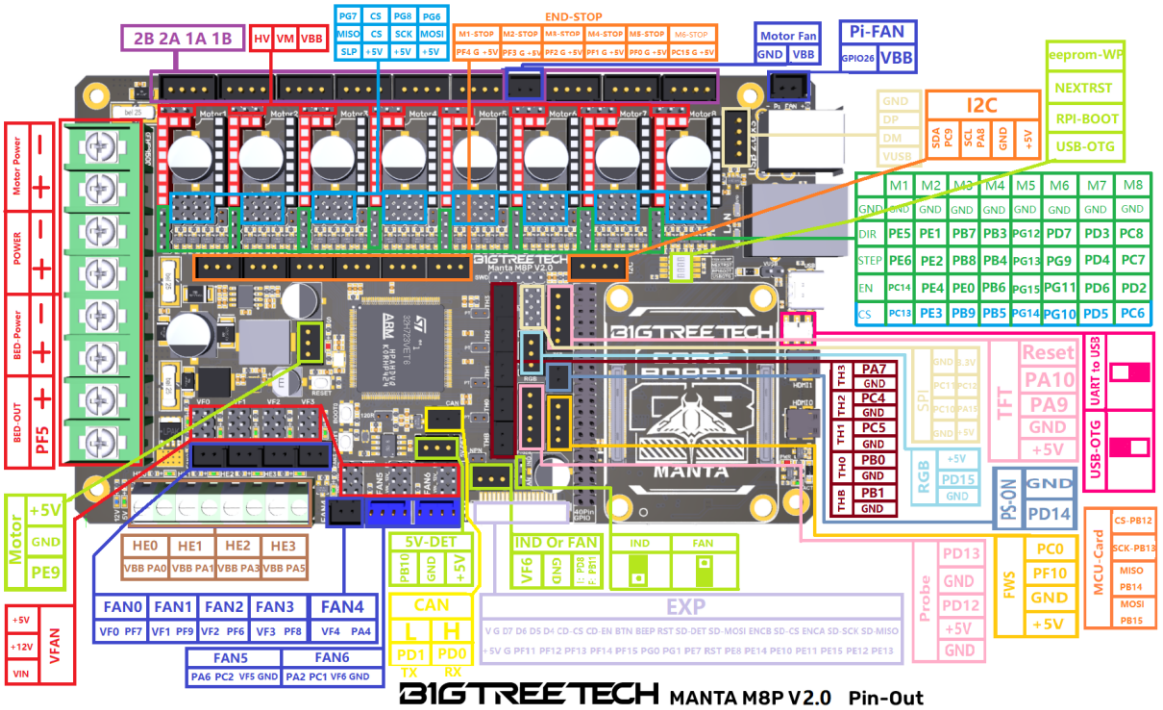

169.93mm
5.00mm
14.93mm
4.74mm
102.74mm
8.00mm
5.00mm
4.43mm
Motor1
Motor2
Motor3
Motor4
Motor5
Motor6
Motor7
Motor8
USB 2.0 x3
LAN
BIGTREETECH
Manta M8P V2.0
CORE BOARD
MANTA
40Pin GPIO
EXP
FAN4
FAN5
FAN6
HE0
HE1
HE2
HE3
RESET
CAN
RGB
HDMI1
HDMI0

Peripheral Interfaces

Interface Diagram



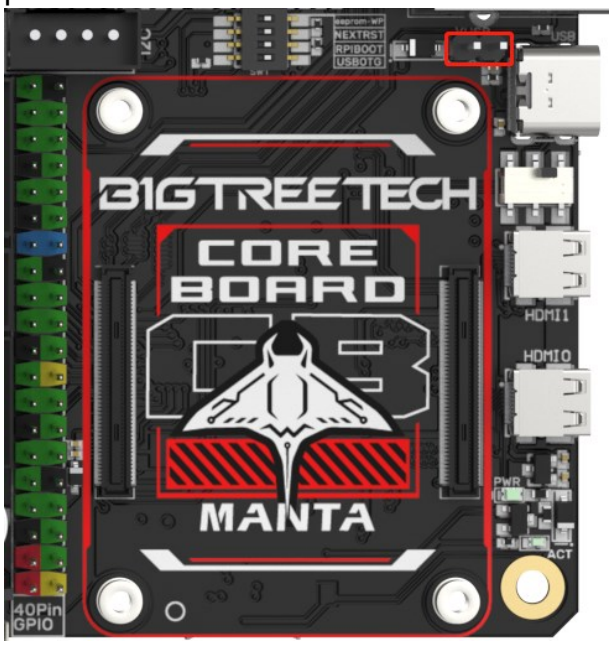
Pin Description



Interface Introduction

USB Power Supply

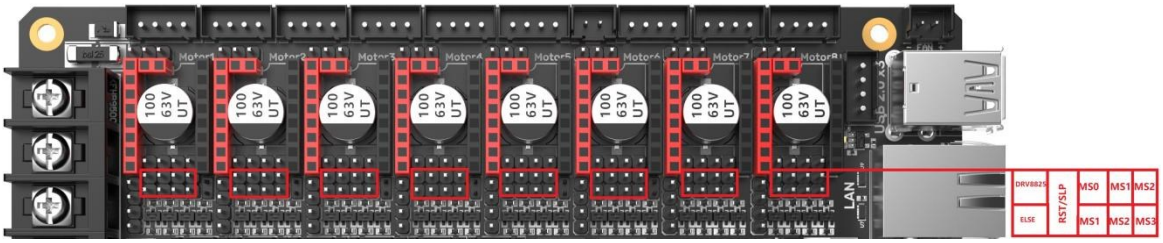
After powering on the M8P, the LED on the bottom left corner will light up to indicate normal power supply. The VUSB jumper in the center is for selecting power - it should only be shorted when powering the board via USB or supplying power out via USB.



Stepper Motor Drivers

Standard STEP/DIR (STANDALONE) Mode

For drivers like A4988, DRV8825, LV8729, ST820, etc, use a jumper to short MS0-MS2 based on the microstepping table.



Note: A4988 and DRV8825 require RST and SLP jumpered for proper operation.

Driver Chip	MODE 2	MODE 1	MODE 0	Microsteps	Excitation Mode
DRV8825 Max 32 microsteps,8.2V -45V 2.5A at	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	

24V T=25℃	H	L	L	1/16	
	H	L	H	1/32	
	H	H	L	1/32	
	H	H	H	1/32	
Drive Current Formula $\mathbf{R}_{ISENSE}$=0.1Ω	$\mathbf{I_{CHOP}} = \frac{\mathbf{V_{(xREF)}}}{\mathbf{5} * \mathbf{R}_{ISENSE}}$				

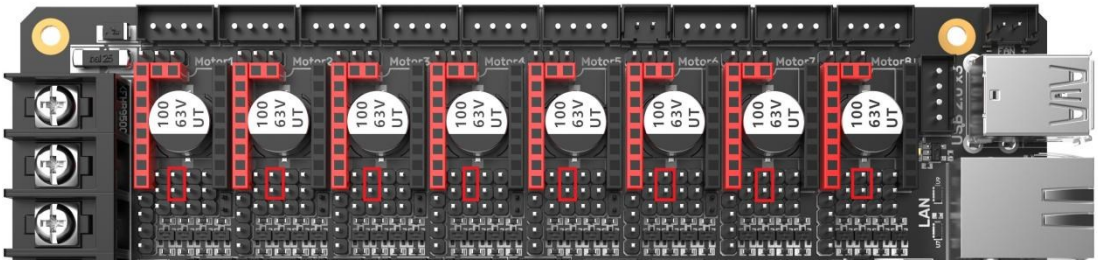
Driver Chip	MS1	MS2	MS3	Microsteps	Excitation Mode
A4988 Max 16 microsteps, 35V 2A	L	L	L	Full Step	2 Phase
	H	L	L	1/2	1-2 Phase
	L	H	L	1/4	W1-2 Phase
	H	H	L	1/8	2W1-2 Phase
	H	H	H	1/16	4W1-2 Phase
Drive Current Formula $\mathbf{R}_S$=0.1Ω	$\mathbf{I_{TripMAX}} = \frac{\mathbf{V_{REF}}}{\mathbf{8} * \mathbf{R}_S}$				

Driver Chip	MD3	MD2	MD1	Microsteps	Excitation Mode
LV8729 Max 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
Drive Current Formula RF1=0.22Ω	$\mathbf{I}_{\mathrm{OUT}}$ = ($\mathbf{V_{REF}}$ / 5) / RF1				

Driver Chip	MS3	MS2	MS1	Microsteps
ST820 Max 256 microsteps, 45V 1.5A	L	L	L	Full Step
	L	L	H	1/2
	L	H	L	1/4
	L	H	H	1/8
	H	L	L	1/16
	H	L	H	1/32
	H	H	L	1/128
	H	H	H	1/256
Drive Current Formula Rs=0.15Ω	$\mathbf{I_{peak}} = \frac{\mathbf{V_{REF*}}\,\mathbf{V_{DD}}}{\mathbf{5} * \mathbf{R_S}}$			

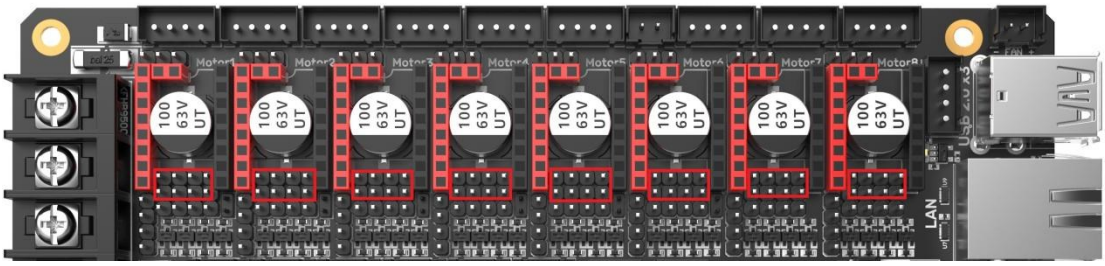
TMC Drivers - UART Mode

For TMC2208, TMC2209, TMC2225, etc, short the jumper for each as shown in the red box. Microsteps and current are configured in firmware.



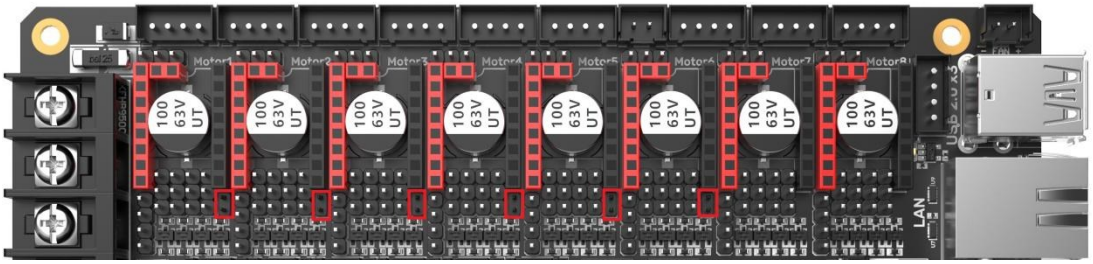
TMC Drivers - SPI Mode

For example, TMC2130, TMC5160, TMC5161, etc. Each uses four jumpers to short the red box positions in the diagram. Micro-stepping and drive current are set through the firmware.

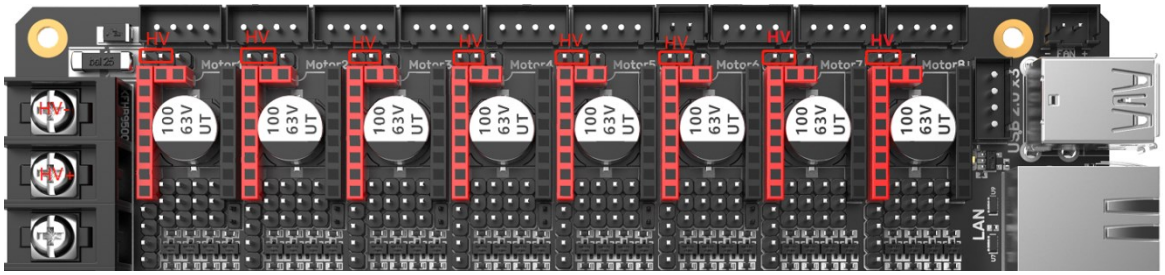


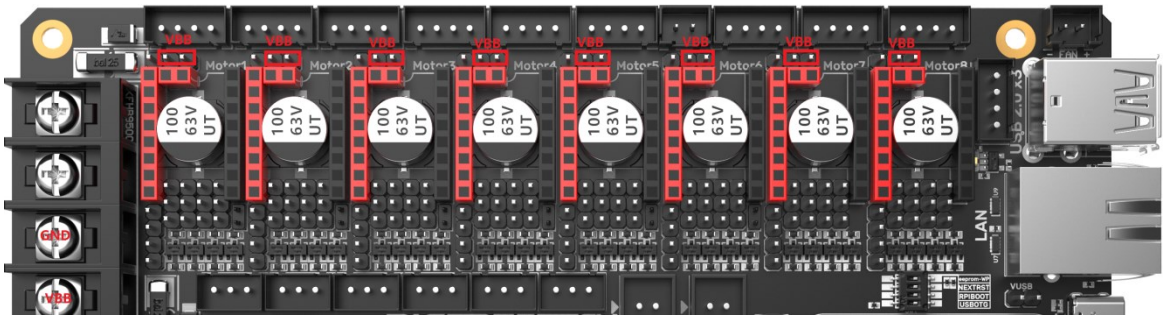
TMC Drivers - DIAG (Sensorless Homing)

For sensorless homing, insert the jumper as shown. Remove when not in use - no need to cut the DIAG pin of the driver.



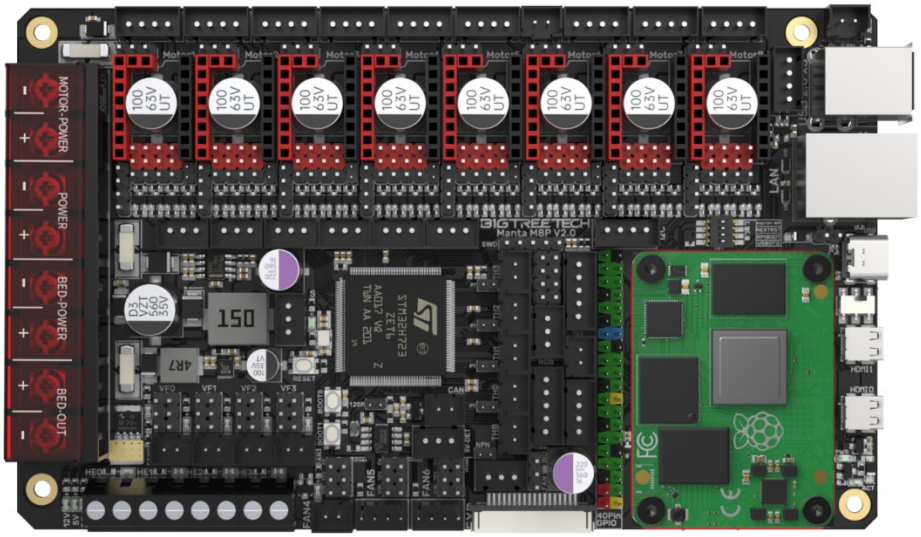
Driver Voltage Selection



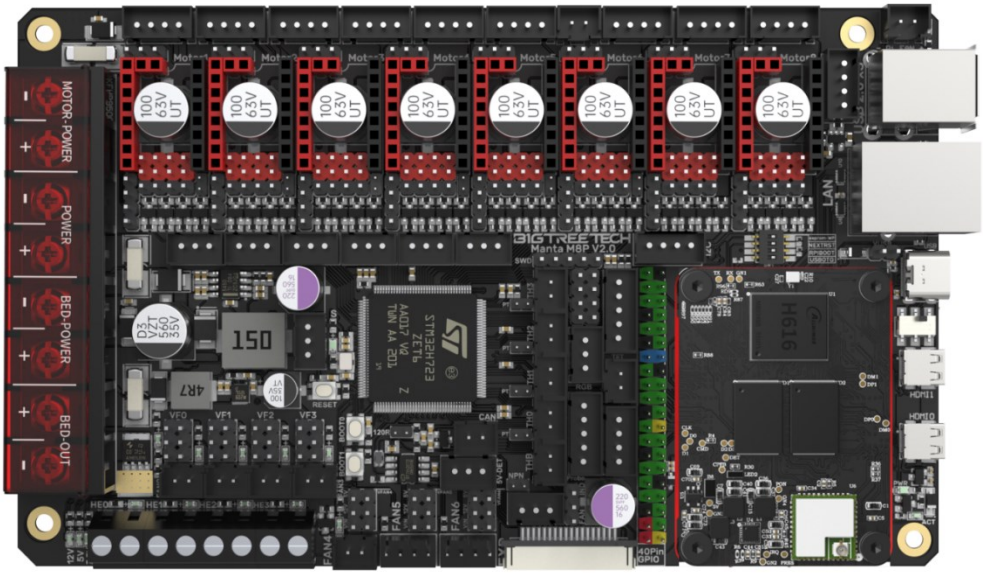


Installing a Core Board on the BTB Connector

M8P+CM4: Note orientation as shown below.

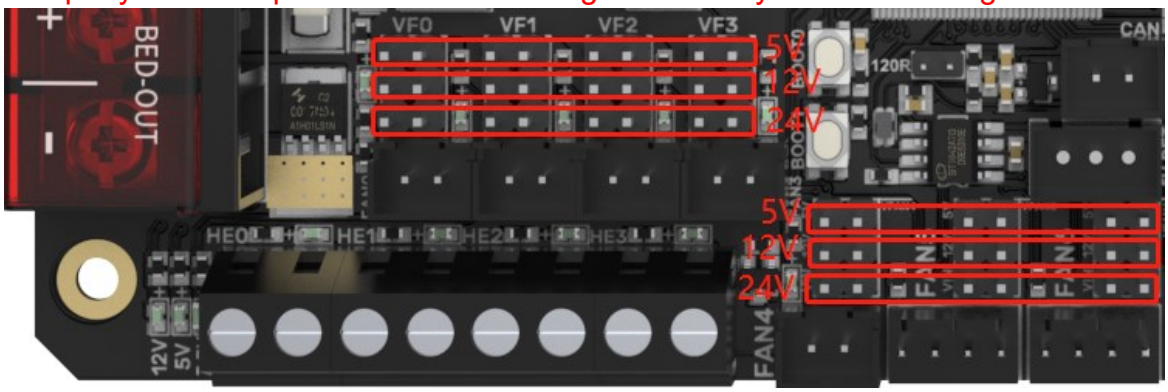


M8P+CB1: Note orientation as shown below.



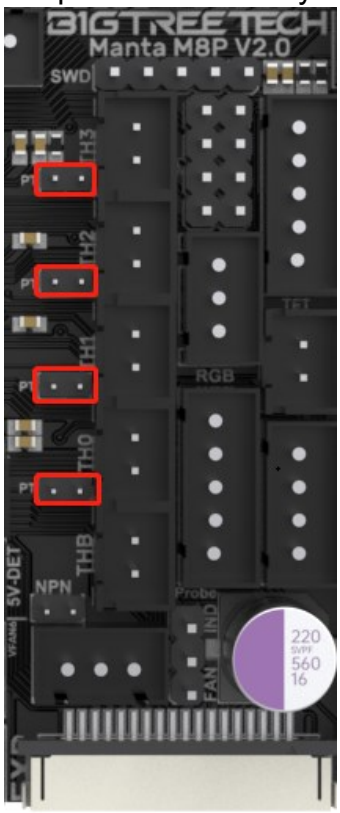
CNC Fan Voltage Selection

Set the output voltage to 5V, 12V, or 24V using jumpers. Note: Before selecting the voltage, please make sure to confirm the supported voltage of the fan. Our company is not responsible for fan damage caused by incorrect voltage selection.

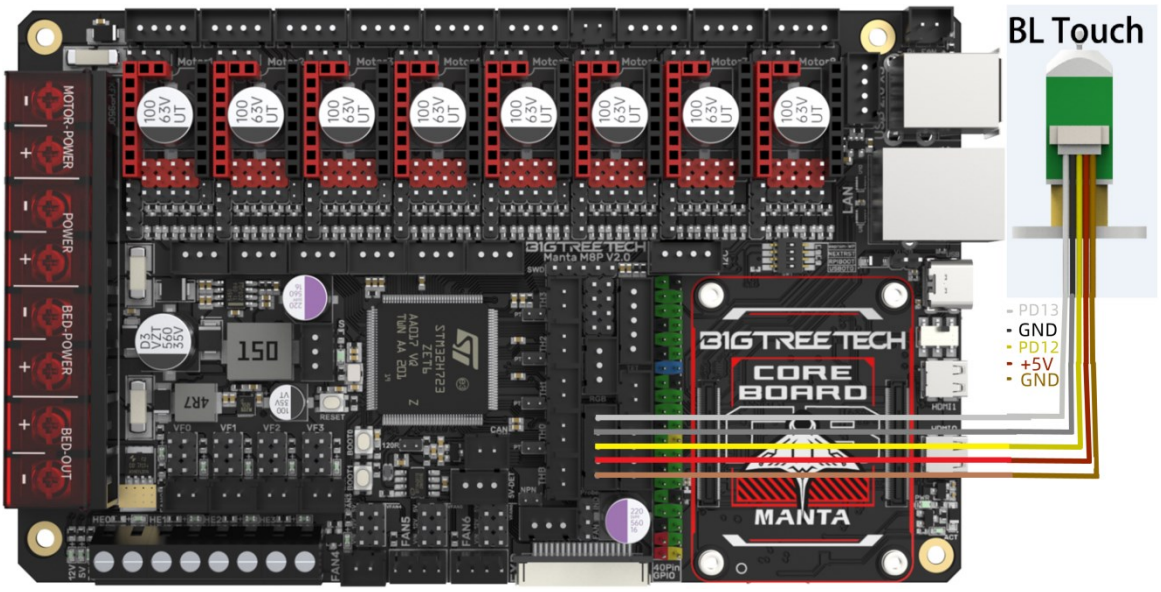


100K NTC or PT1000 Settings

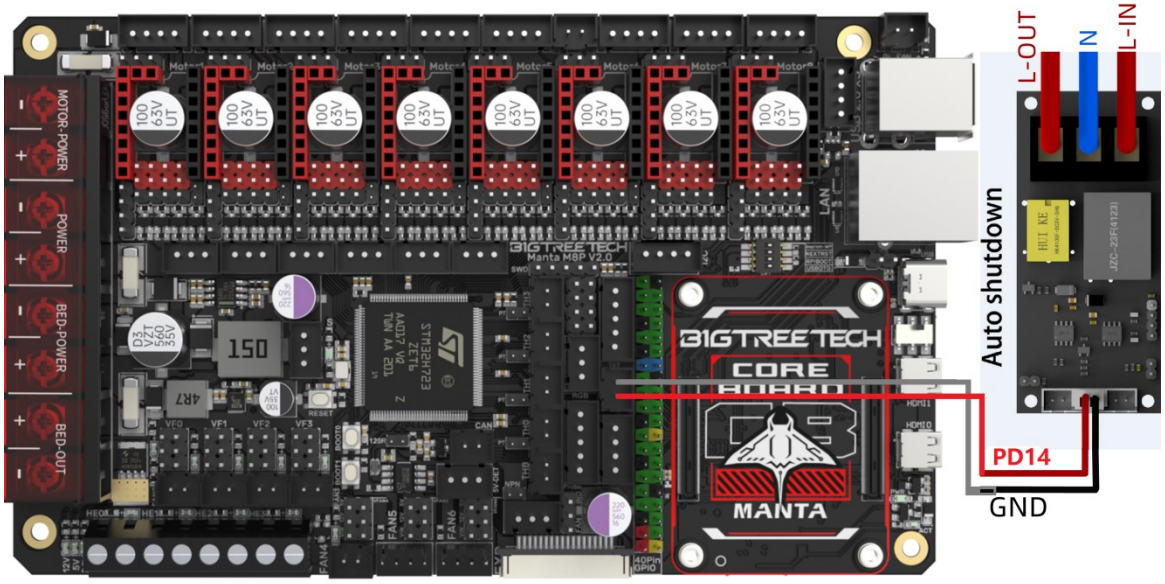
For 100K NTC thermistors, no jumper is needed. At this time, the pull-up resistor of TH0-TH3 is 4.7K 0.1%. For PT1000, short the pins in the red box to add 4.12K 0.1% in parallel, at this time, the pull-up resistor of TH0-TH1 is 2.2K (Note: The temperature accuracy read using this method will be lower than MAX31865.)



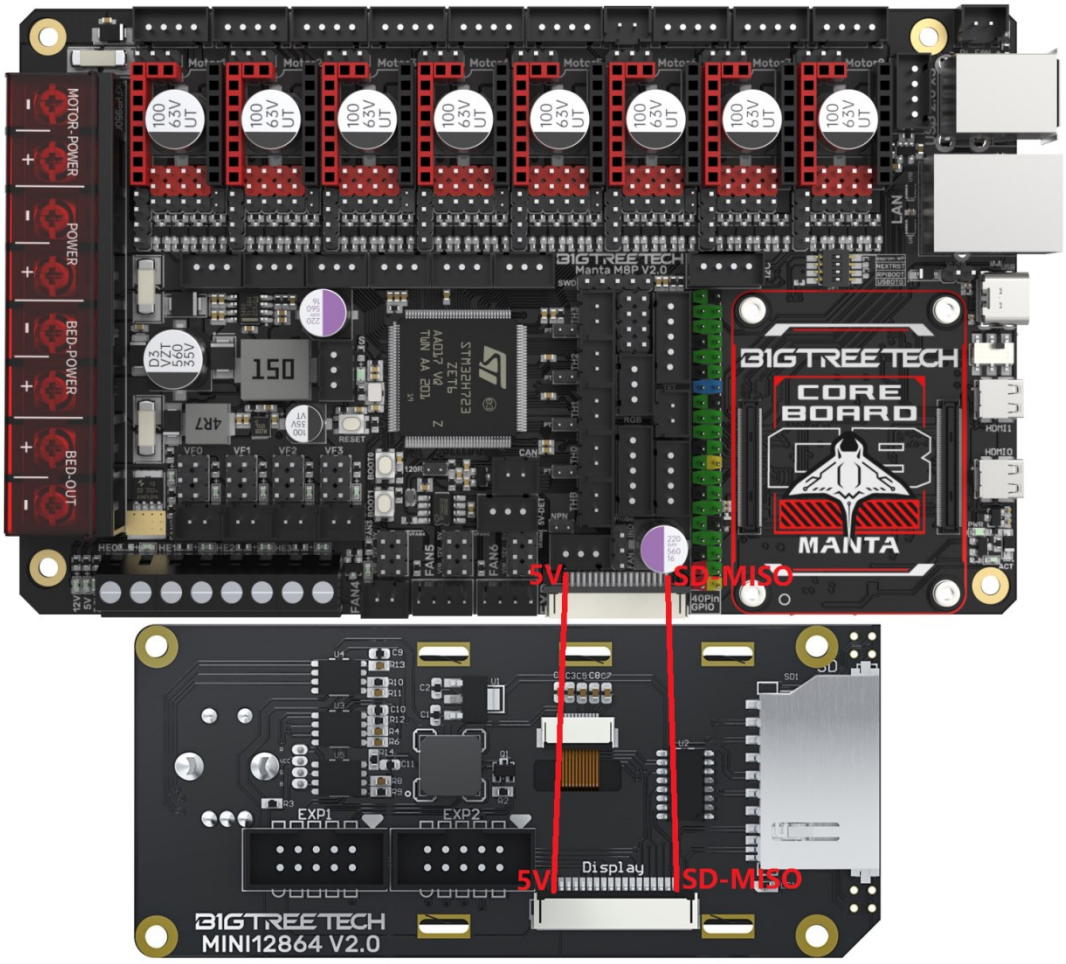
BLTouch Wiring



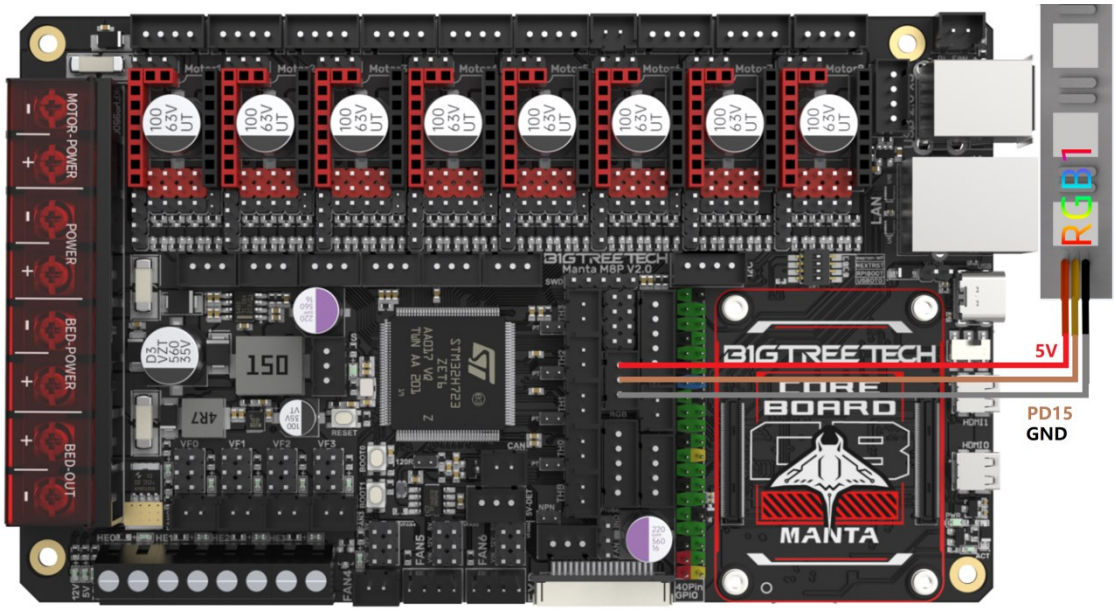
Auto Power Off (Relay V1.2) Wiring



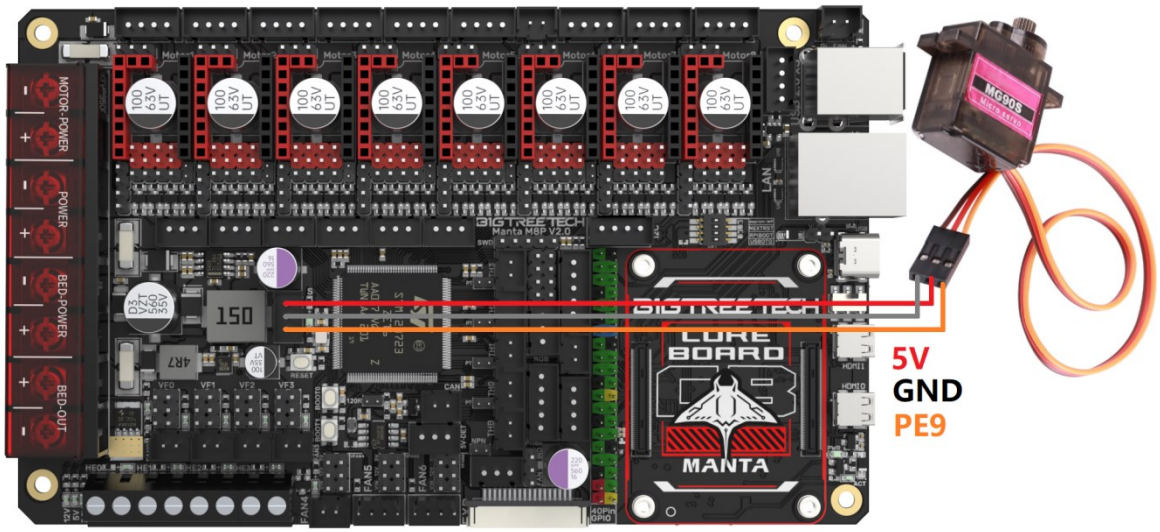
MINI12864 V2.0 Wiring



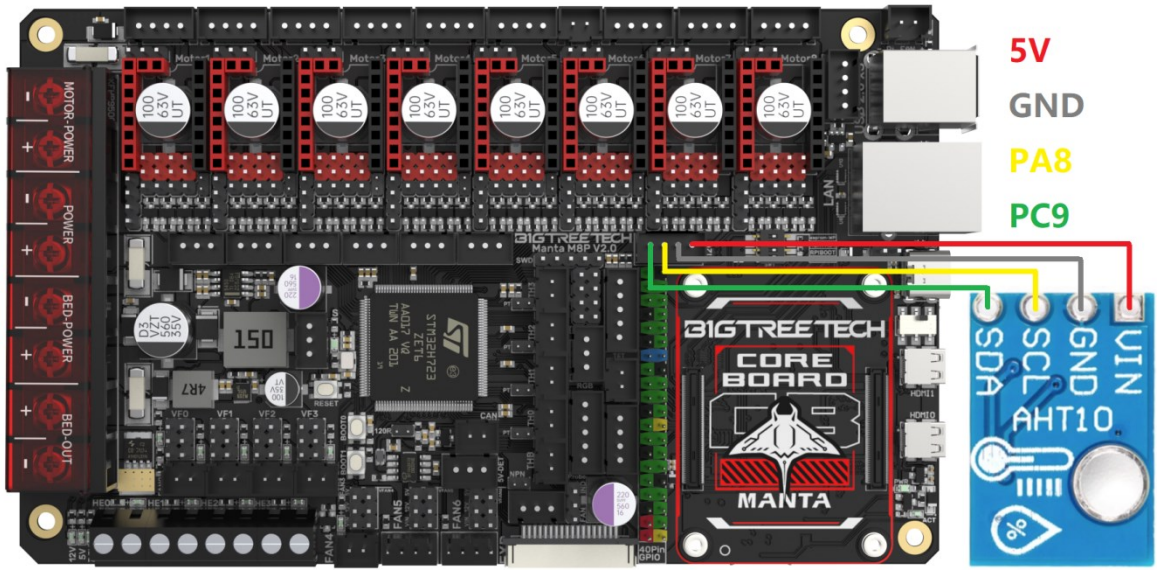
RGB Wiring



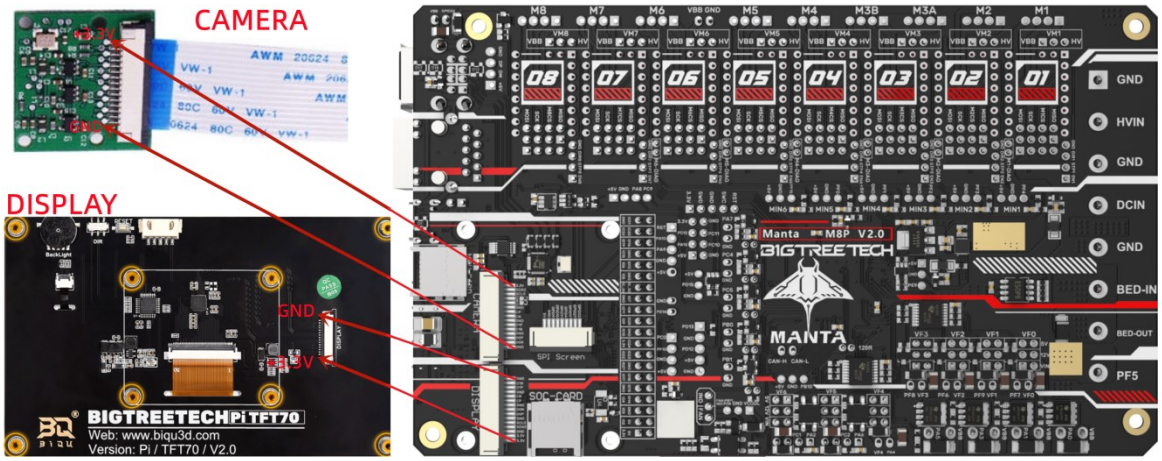
Servo Wiring



I2C Wiring (Temperature and Humidity Sensor)

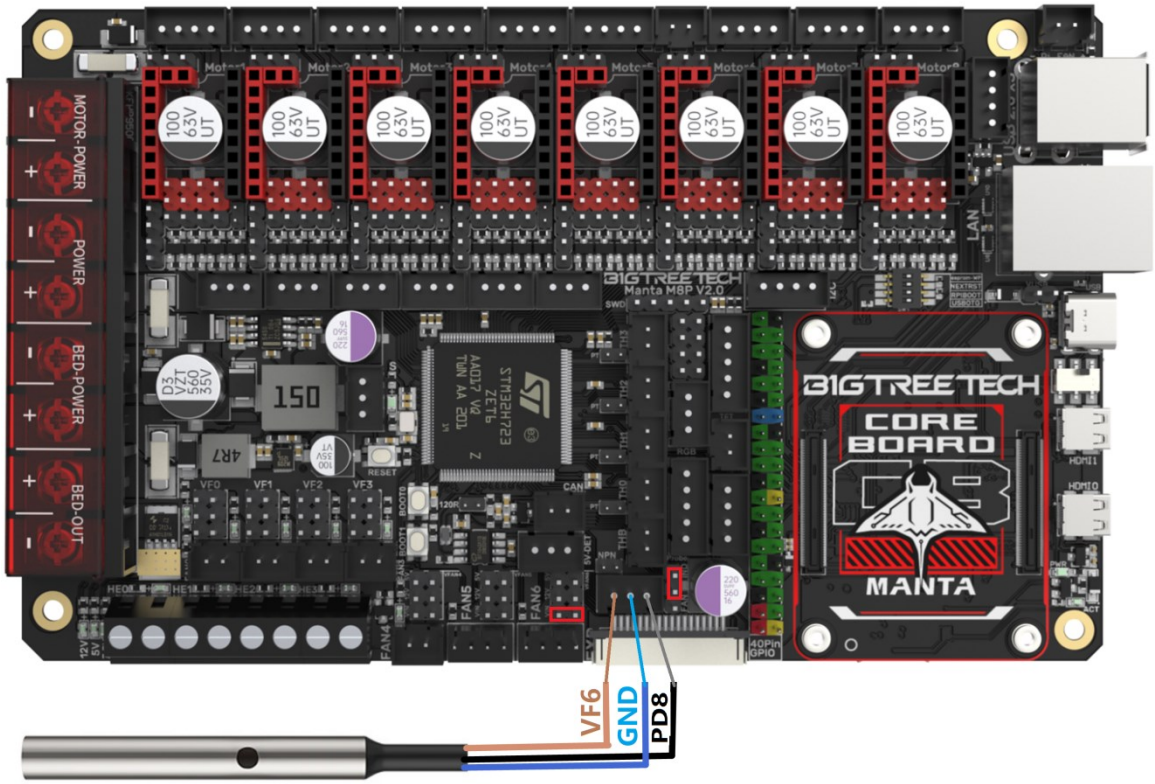


DSI and CSI Connections

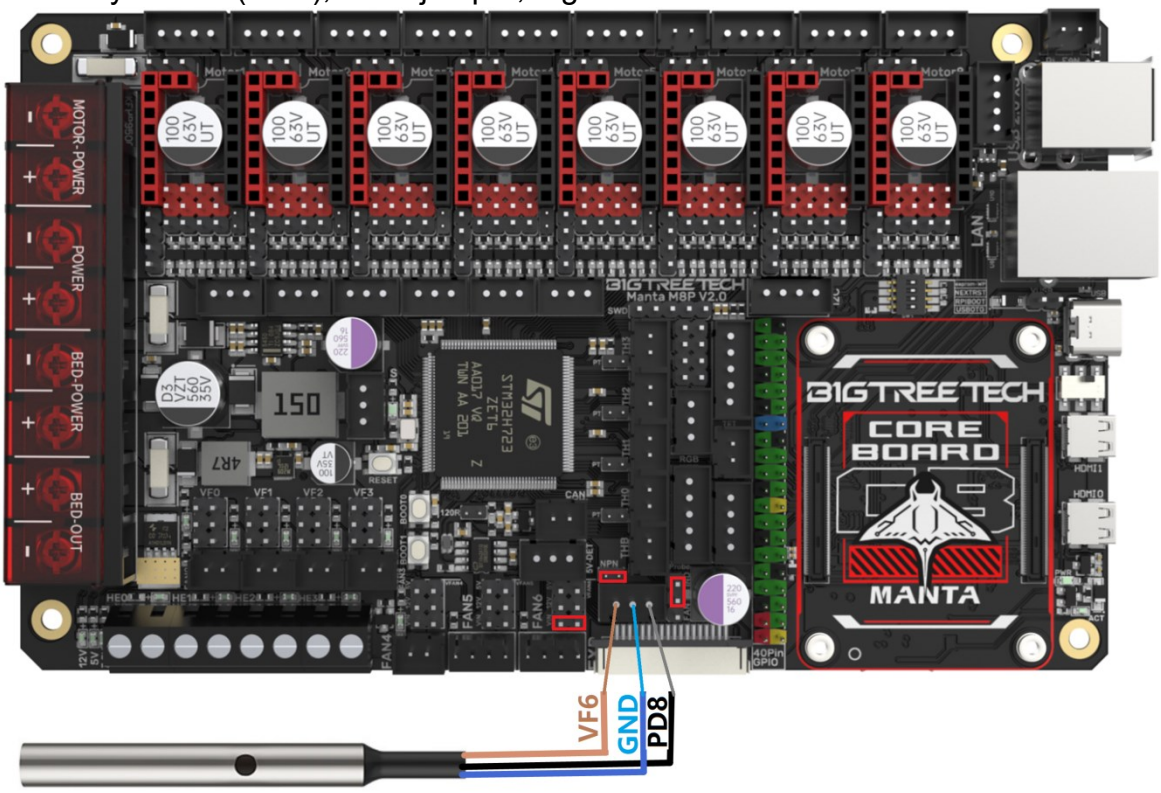


Proximity Switch Wiring

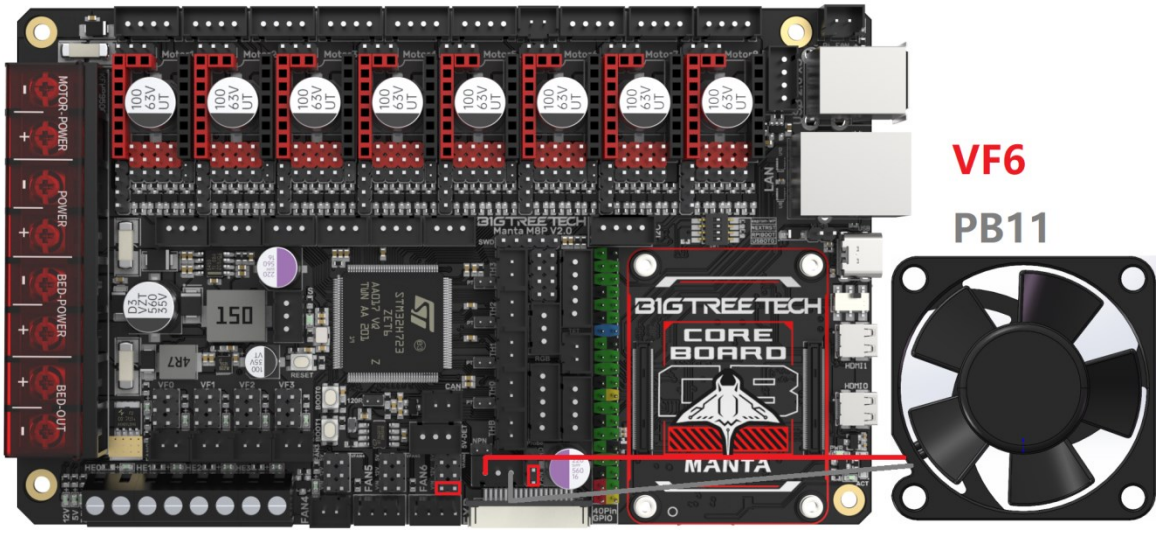
Normally open (NPN), no jumper needed, e.g. 24V:



Normally closed (PNP), short jumper, e.g. 24V:

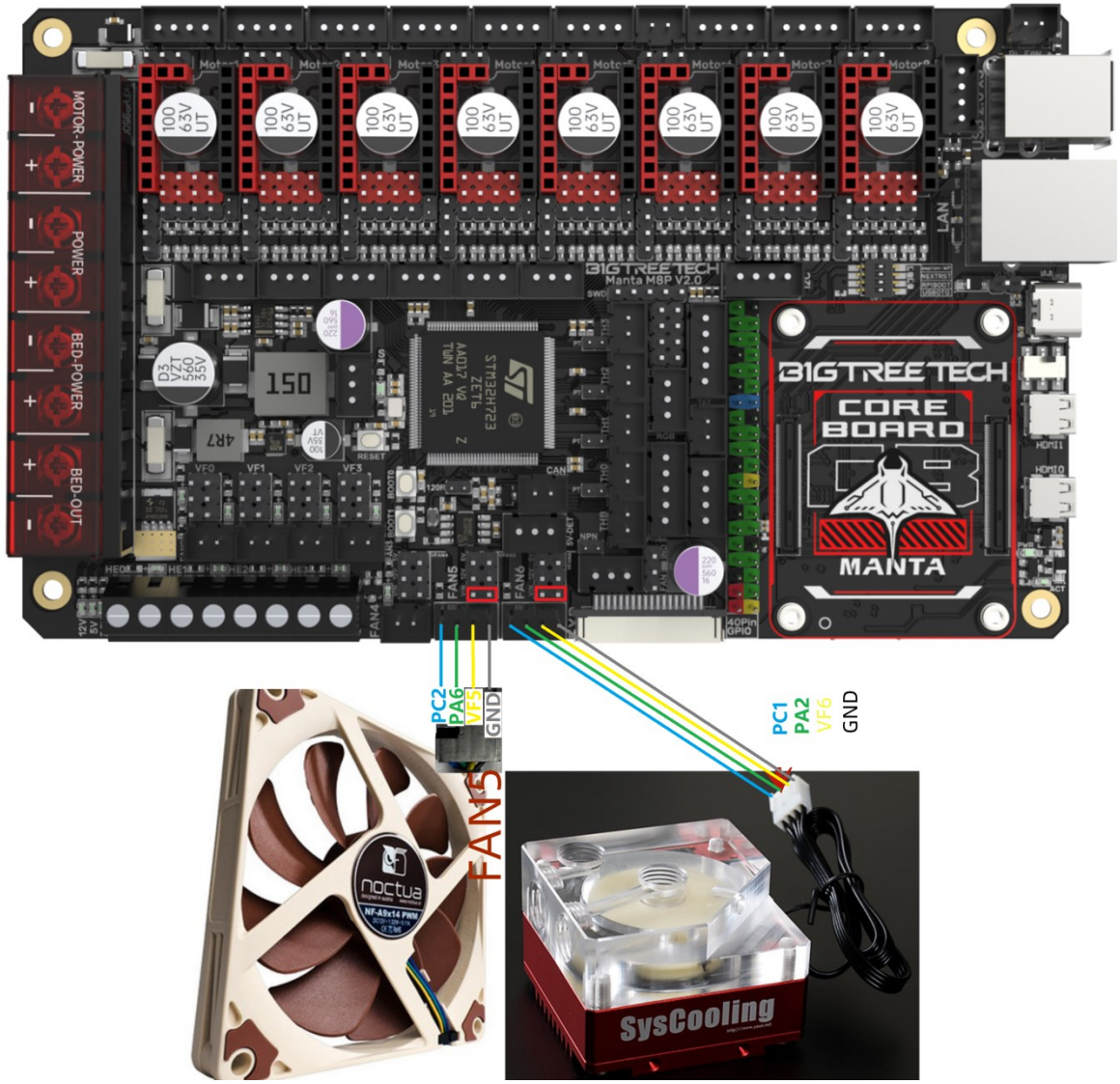


CNC fan function, short jumper, e.g. 24V:



4-Pin Fan / Water Cooling Connection

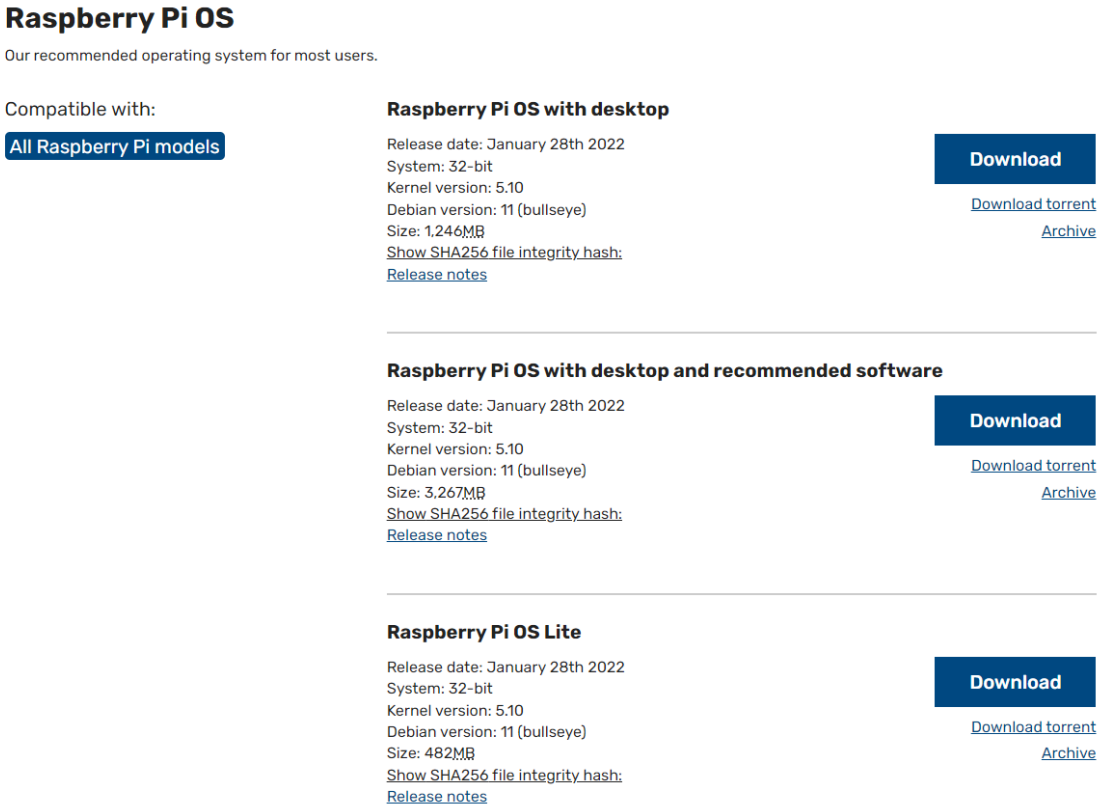
(24V example below)



Using the Raspberry Pi CM4

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 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
(Note: CM4 has some differences from Pi 3B/4B, refer to the system configuration section to enable USB, DSI etc.)



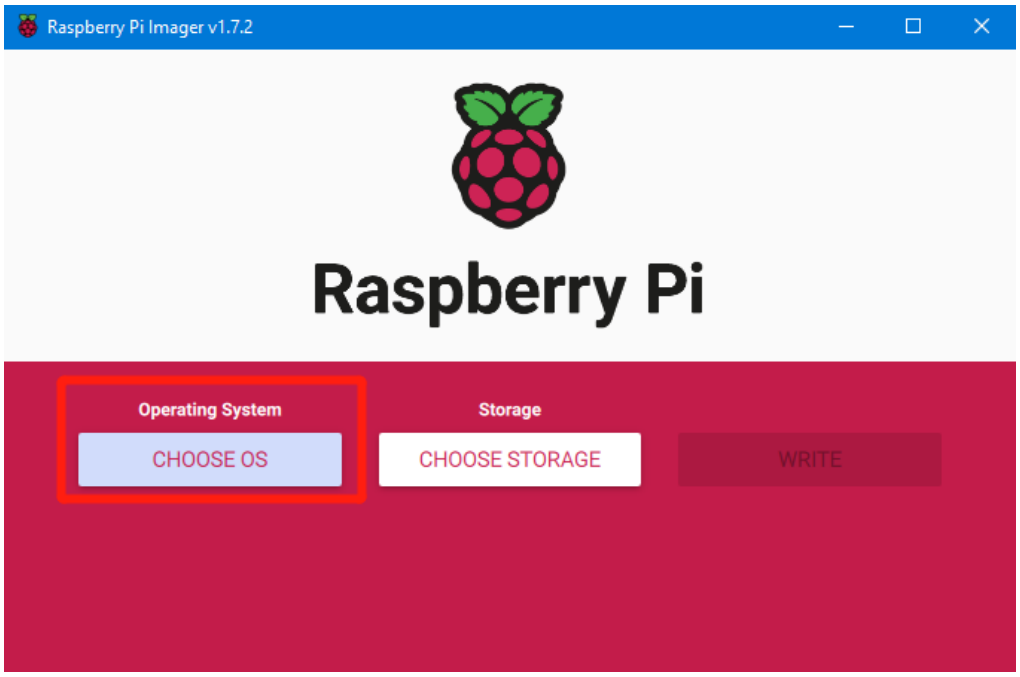
Download and install Raspberry Pi Imager

Download and install the official Raspberry Pi burning software:
https://www.raspberrypi.com/software/

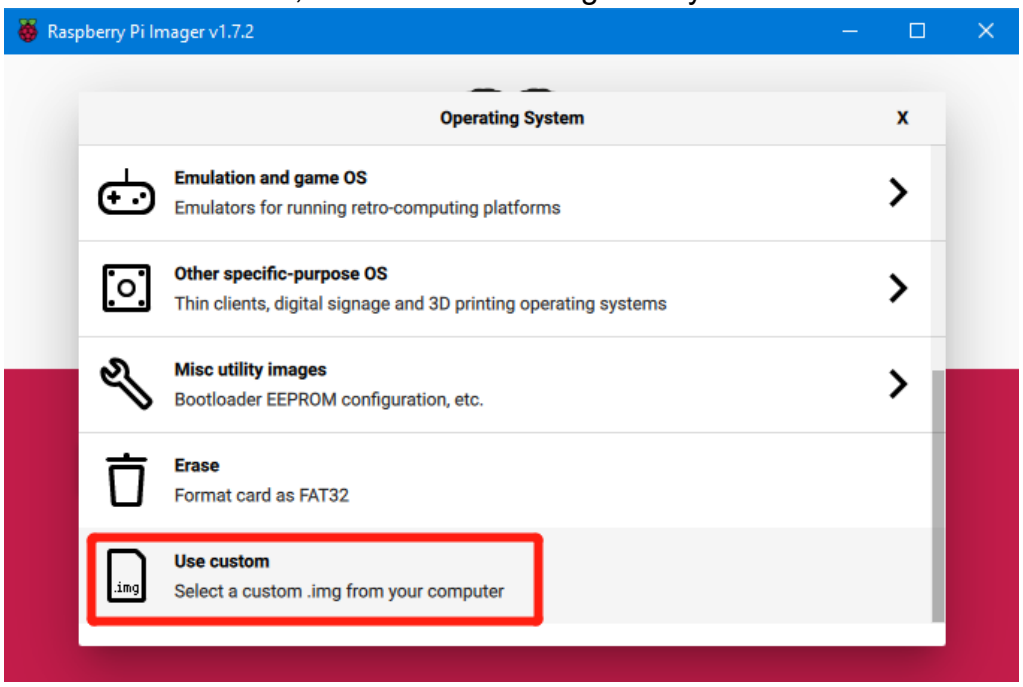
Write OS

CM4 LITE Version (MicroSD Card)

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

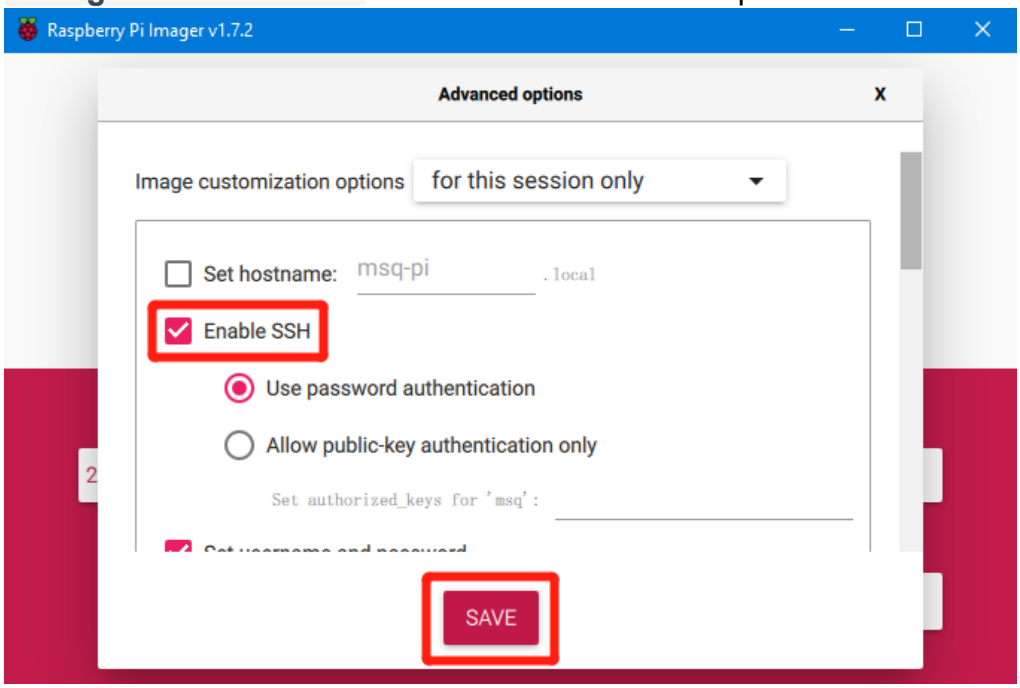


3. Select "Use custom", then select the image that you downloaded.



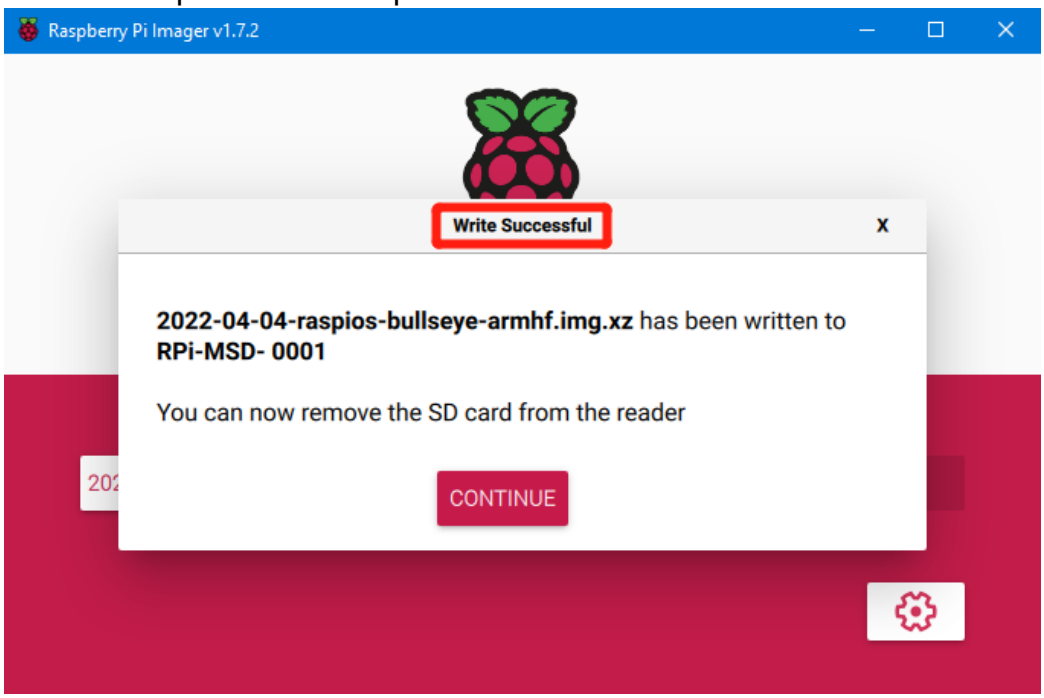
4. Click the settings icon in the lower right corner.

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 process to complete.



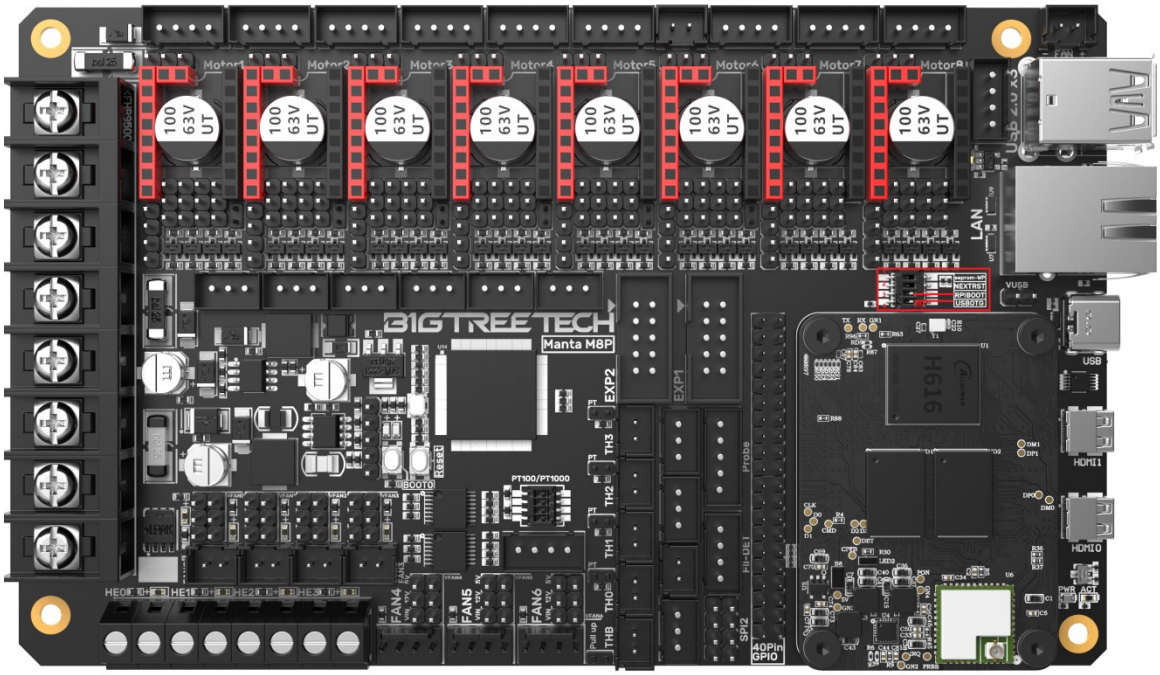
CM4 eMMC Version

Note: eMMC version will not run the system in the Micro SD 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. Toggle switches 4 (USBOTG) and 3 (RPIBOOT) to ON to enter BOOT mode.



3. Connect the Type-C to the computer's USB port (to avoid problems caused by insufficient computer USB power supply, it is recommended to use an external 24V power supply for the motherboard), run **sudo ./rpiboot**(Mac/Linux) or rpiboot.exe on Windows, and then the CM4 eMMC will be recognized as a large-capacity storage device by the computer (if rpiboot reports an error at this time, you can try unplugging and re-plugging the USB).
4. Use the Raspberry Pi Imager software to write the OS image. The steps are exactly the same as the LITE version.
5. After the writing is completed, power off and toggle switches 4 (USBOTG) and 3 (RPIBOOT) back to OFF. After powering on again, it will enter the normal working mode.

System Settings (CM4)

USB 2.0 Hub Port

MANTA M8P has a USB 2.0 Hub. To save power, the USB port of the CM4 is disabled by default. To enable it, add the following content to the config.txt file:
dtoverlay=dwc2,dr_mode=host

DSI1 Display

The default display interface is HDMI. The DSI interface of the MANTA M8P is DSI1. To use it, download the DSI1 driver by entering the following command:
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 on the DSI interface can be displayed normally. If you want to use the HDMI interface, delete the downloaded **/boot/dt-blob.bin** driver and restart, then HDMI can output normally.

CSI1 Camera

The DSI1 driver downloaded in **DSI1 Display** also includes the CSI1 driver. If you don't want to install the DSI1 driver and only want to install the CSI1 driver, find the driver you want to use at https://datasheets.raspberrypi.com/licence.html download it to the CM4's boot folder, and rename it to **dt-blob.bin**, then refer to the settings here for use:
https://projects.raspberrypi.org/en/projects/getting-started-with-picamera/

Using the BIGTREETECH CB1

Download OS Image

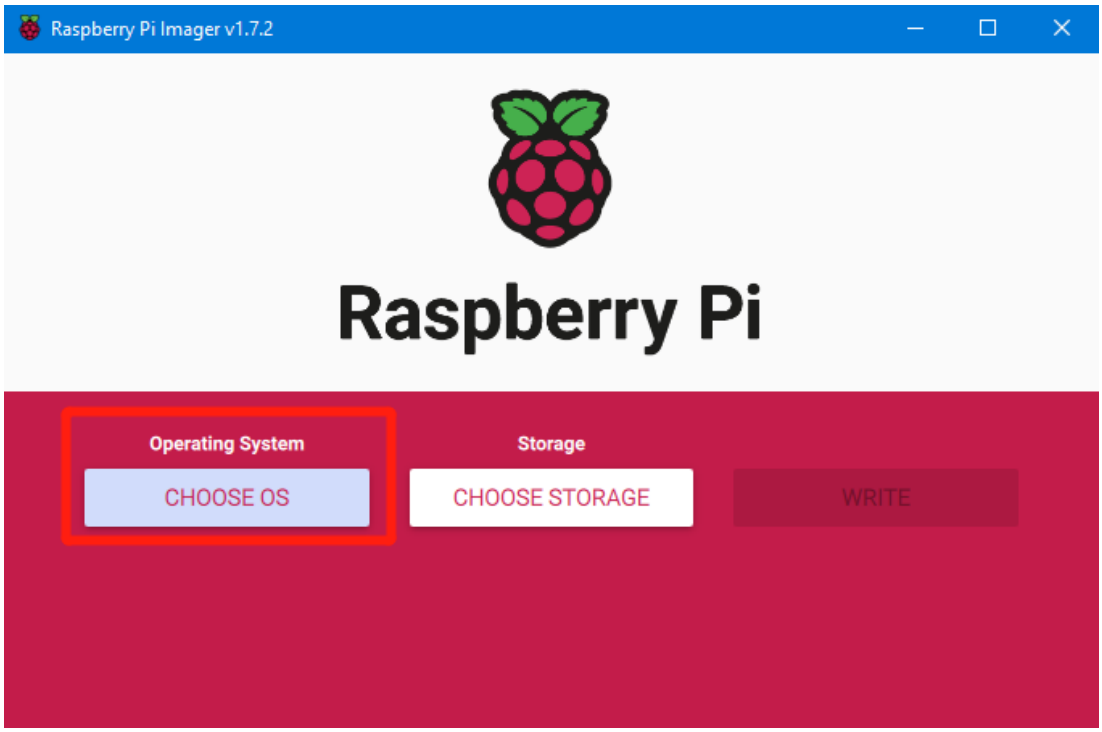
When using CB1, use the provided image:
https://github.com/bigtreetech/CB1/releases

Download and install Raspberry Pi Imager

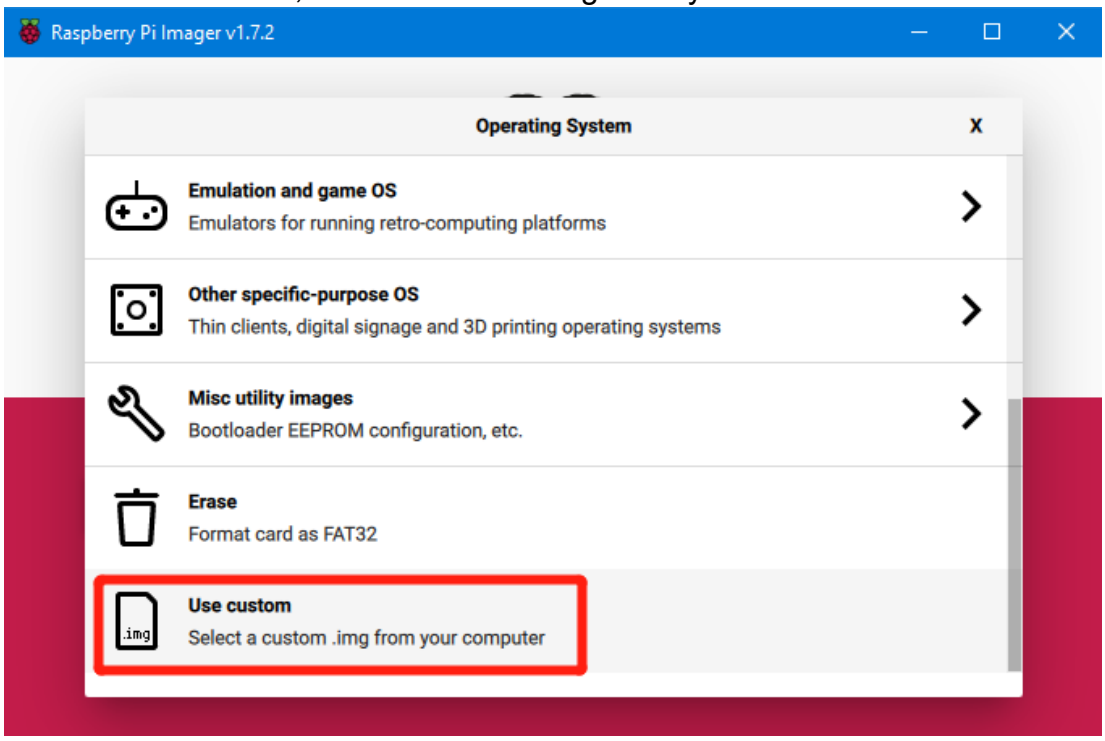
Download and install the official Raspberry Pi writing software:
https://www.raspberrypi.com/software/ The CB1 OS image can also be written using this software.

Write OS

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

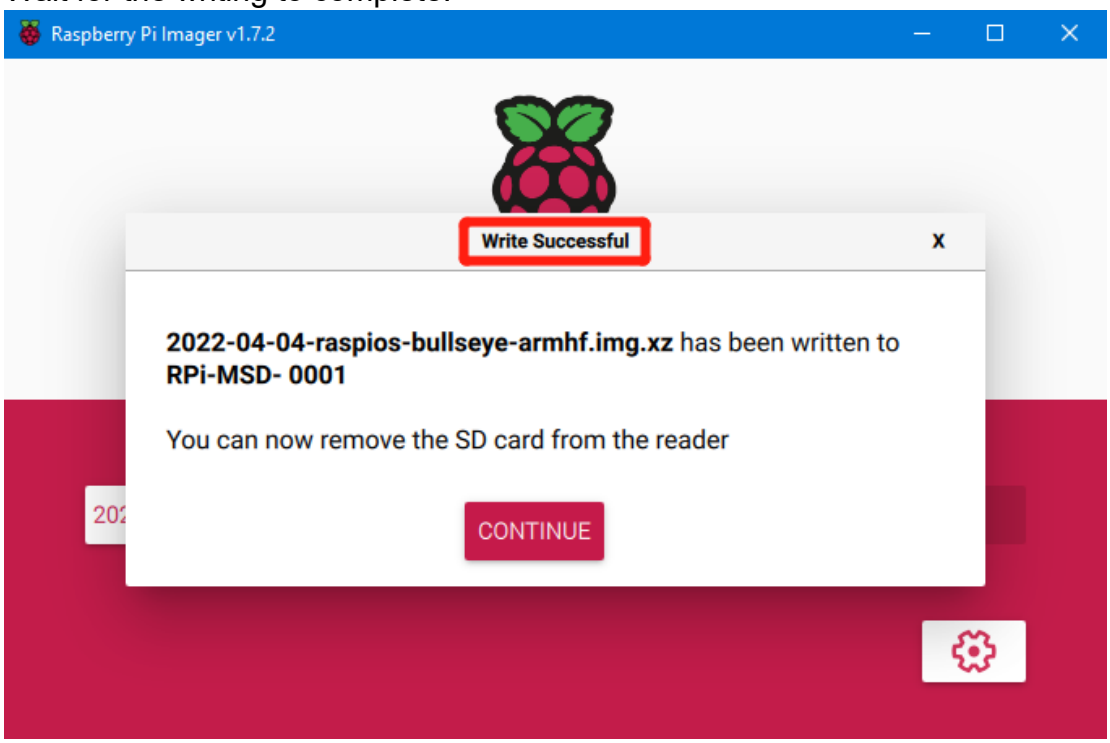


3. Select "Use custom", then select the image that you downloaded.



4. 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).

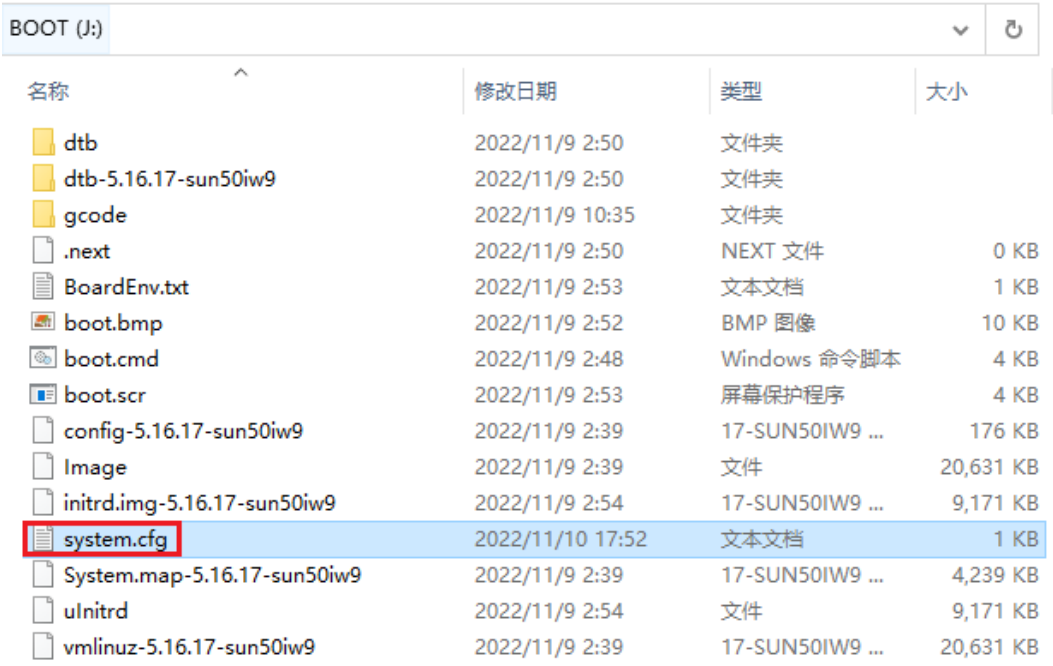
5. Wait for the writing to complete.



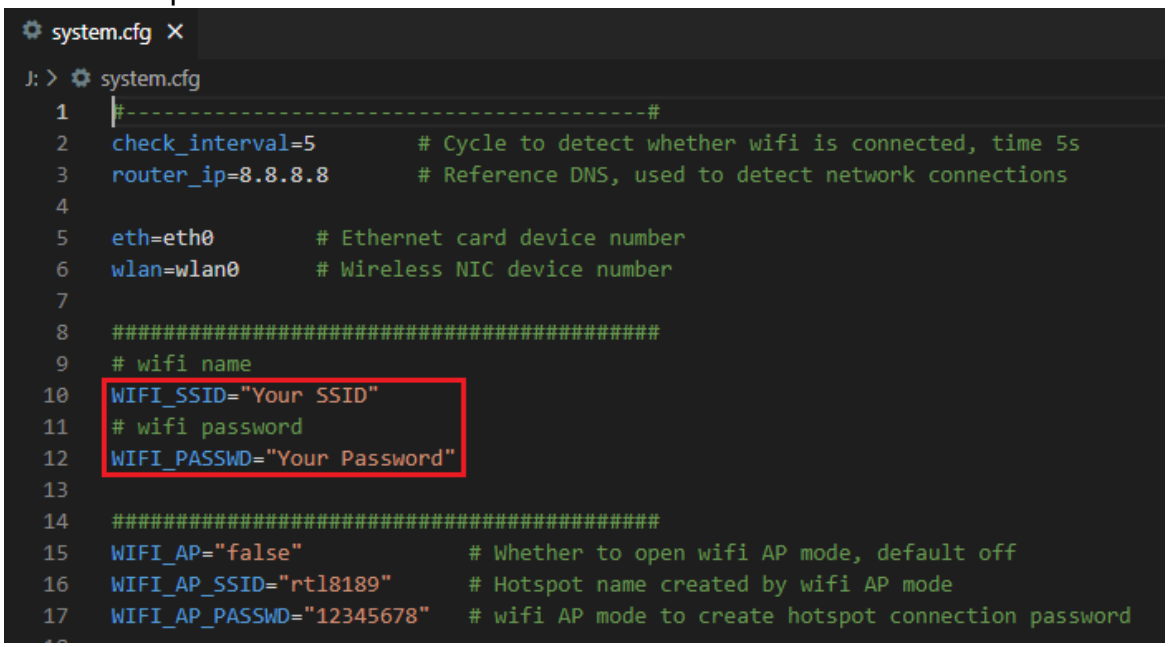
Set up WiFi

Note: If you are using an Ethernet connection, please skip this step.

CB1 cannot directly use the Raspberry Pi Imager software to set up Wi-Fi name and password like CM4. After the OS image is burned, there will be a FAT32 partition recognized by the computer on the MicroSD card. In this partition, there is a configuration file named "system.cfg".



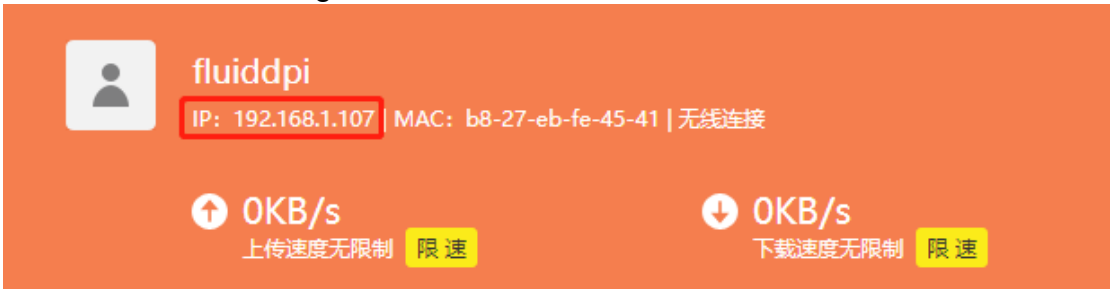
Edit in Notepad and set WIFI-SSID and PASSWORD.



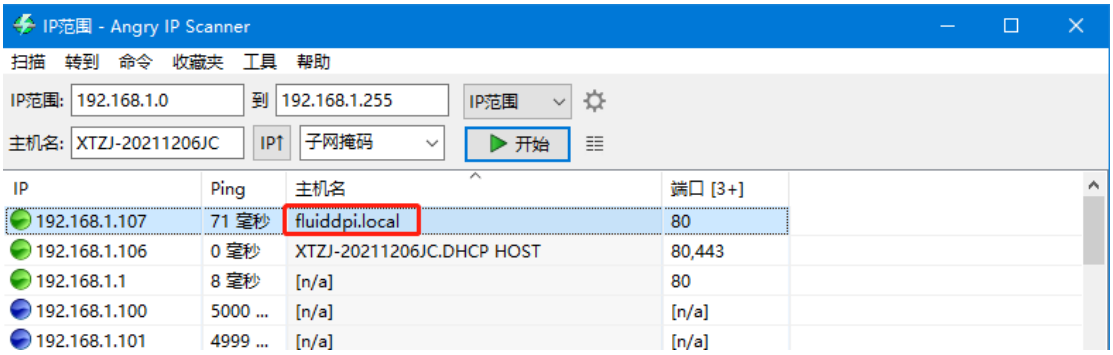
Configure the Motherboard

Connect to the Device Using SSH Software

1. Install the SSH software Mobaxterm: https://mobaxterm.mobatek.net/download-home-edition.html
2. Insert the MicroSD card into the MANTA M8P and power it on. Wait for the system to start, which takes about 1-2 minutes.
3. After the device is connected to Wi-Fi or an Ethernet cable, it will be automatically assigned an IP address.
4. Enter the router management interface to find the device's IP address.

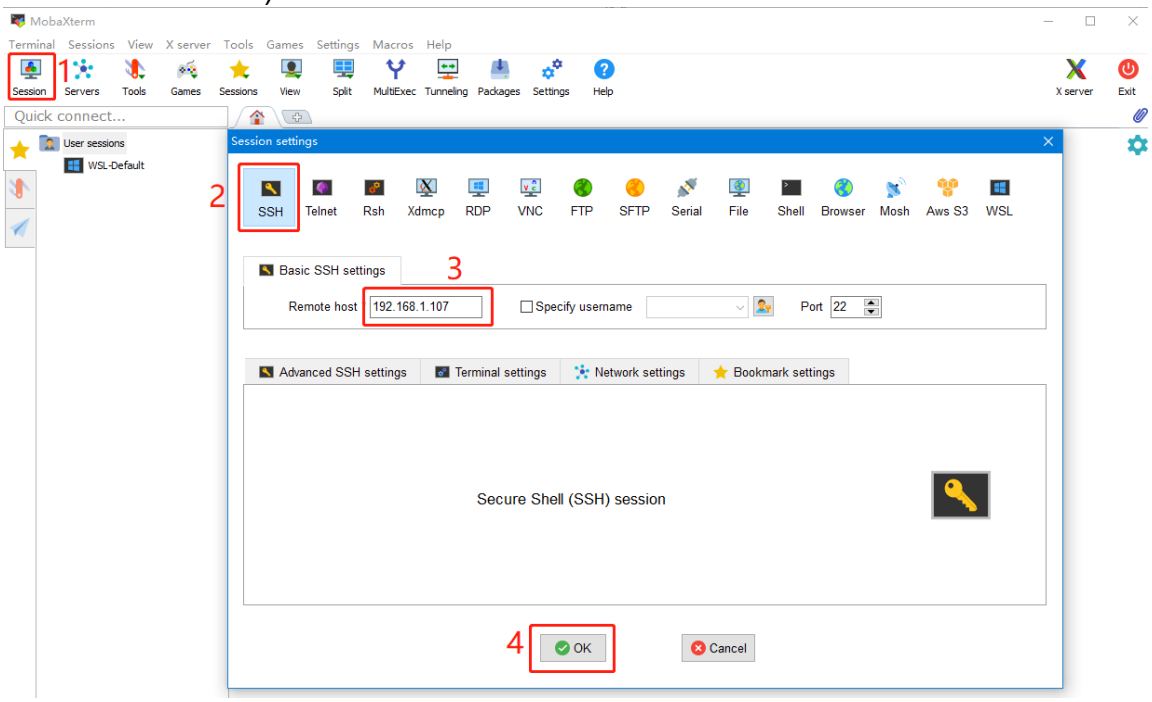


5. Alternatively, use the tool https://angryip.org/ to scan all IP addresses in the current local area network and reorder them by hostname. Find the device with the hostname Fluidd, Mainsail, or BTT-CB1, as shown in the image below.



6. Open the installed Mobaxterm software, click "Session", click "SSH" in the pop-up window, enter the device's IP address in the "Remote host" input box, and click "OK" (Note: The computer and the device must be on the same

local area network).



7. Enter the login name and password to access the SSH terminal interface.

CM4:

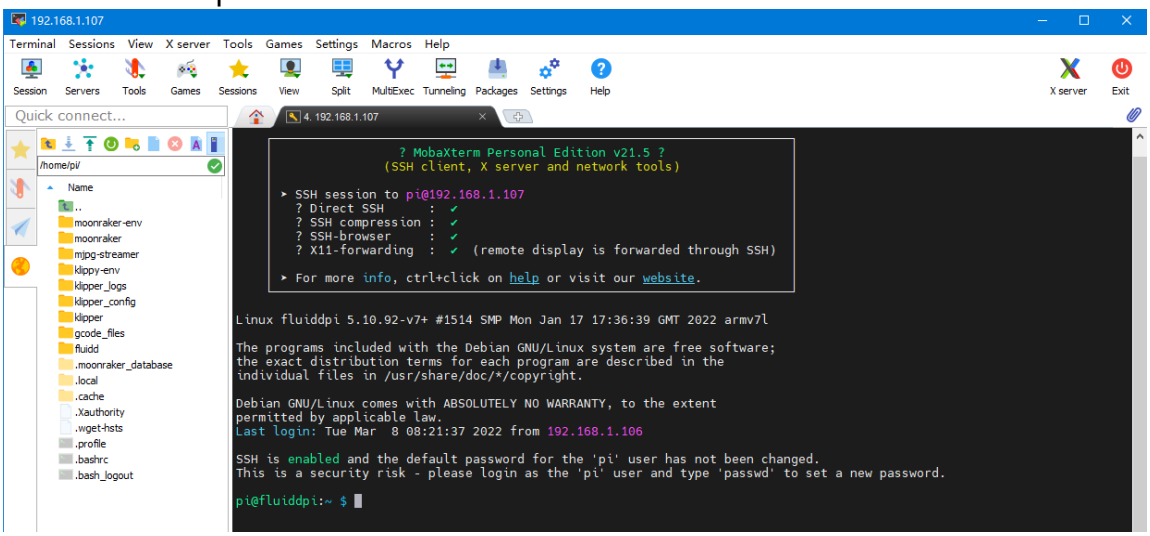
Login name: pi

Password: raspberry

CB1:

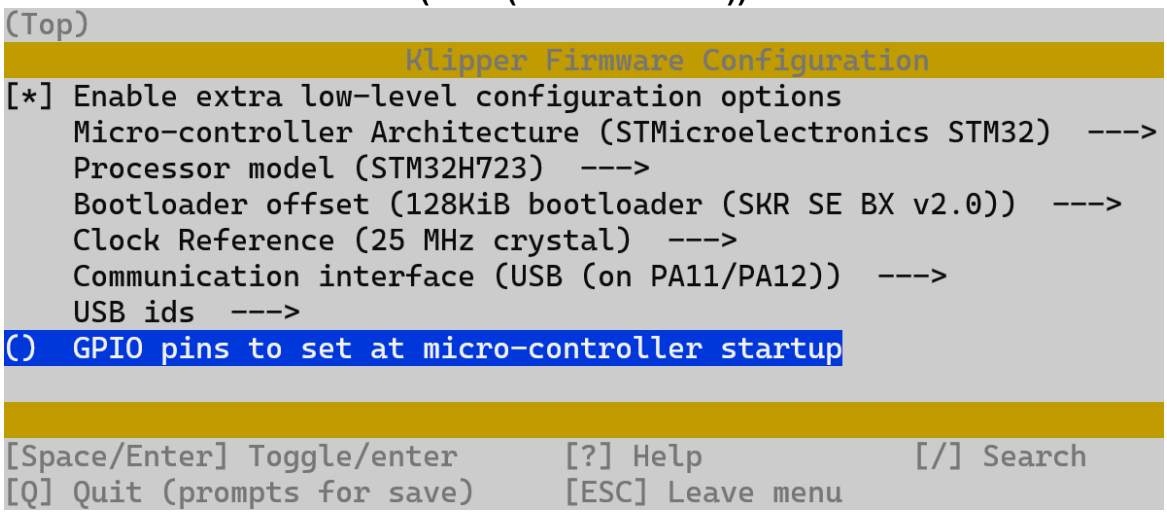
Login name: biqu

Password: biqu



Compile MCU Firmware

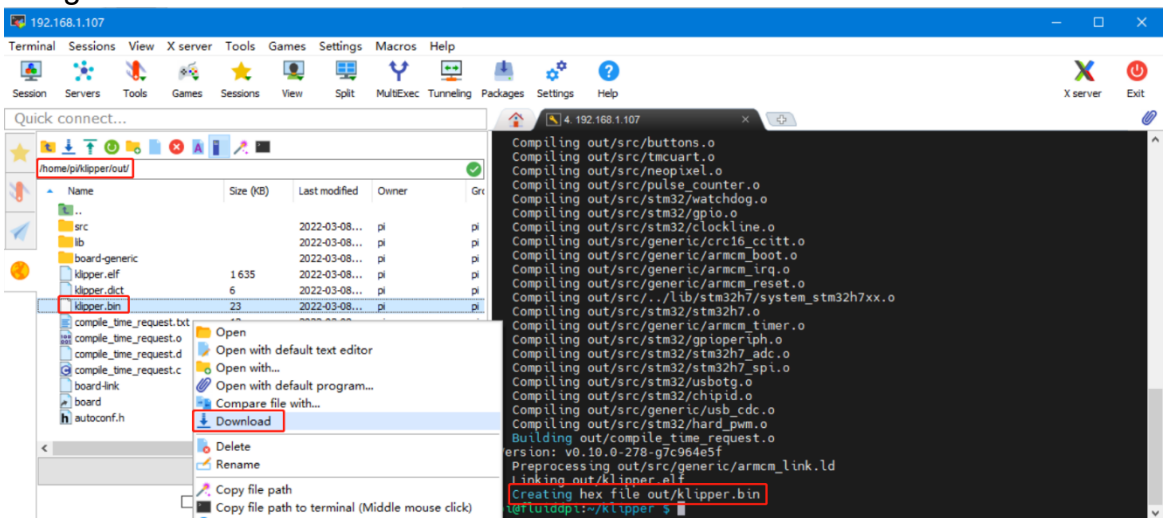
1. After connecting to the device via SSH, enter the following command in the command line:
   `cd ~/klipper/`
   `make menuconfig`
   Use the following configuration to compile the firmware (if the options below are not available, please update the Klipper firmware source code to the latest version):
   *** [*] Enable extra low-level configuration options**
   *** Micro-controller Architecture (STMicroelectronics STM32) --->**
   *** Processor model (STM32H723) --->**
   *** Bootloader offset (128KiB bootloader (SKR SE BX v2.0)) --->**
   *** Clock Reference (25 MHz crystal) --->**
   *** Communication interface (USB (on PA11/PA12)) --->**



2. After completing the configuration selection, enter `q` to exit the configuration interface. When asked if you want to save the configuration, select "Yes".

3. Enter `make` to compile the firmware. After the `make` command is executed, the **klipper.bin** firmware we need will be generated in the device's `home/pi/klipper/out` folder. You can download it directly to your computer

using the SSH software.



Update Firmware

SD Card Update

1. Rename `klipper.bin` to "firmware.bin", copy it to the root directory of the SD card, insert the SD card into the MANTA M8P SD card slot, press the reset button or power on again, and the firmware will be automatically updated. After the update is complete, the "firmware.bin" in the SD card will be renamed to "FIRMWARE.CUR".

2. Enter **ls /dev/serial/by-id/** in the command line to query the mainboard's ID and confirm whether the firmware has been successfully burned. If the burning is successful, a Klipper device ID will be returned, as shown in the image below.

```
pi@fluiddpi:~/klipper $ ls /dev/serial/by-id/
usb-Klipper_stm32h723xx_41003D001751303232383230-if00
pi@fluiddpi:~/klipper $
```

Copy and save this ID, as it needs to be set in the configuration file.

DFU Update

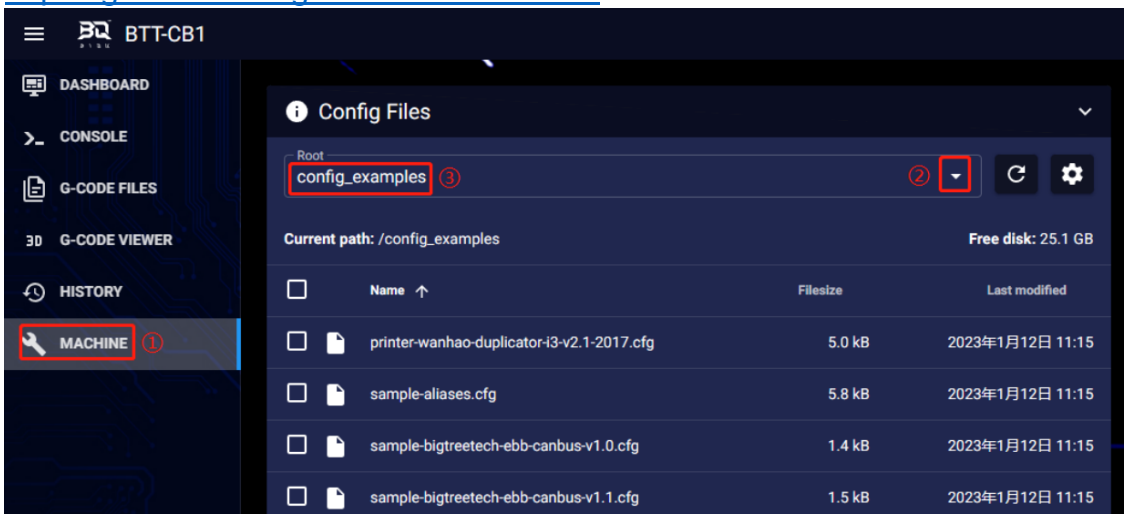
If you can find the MCU's Klipper device ID using **ls /dev/serial/by-id/,** you can directly enter
make flash FLASH_DEVICE= /dev/serial/by-id/usb-Klipper_stm32h712xx_41003D001751303232383230-if00
to burn the firmware (Note: Replace **/dev/serial/by-id/xxx** with the actual ID found in the previous step).

```
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
```

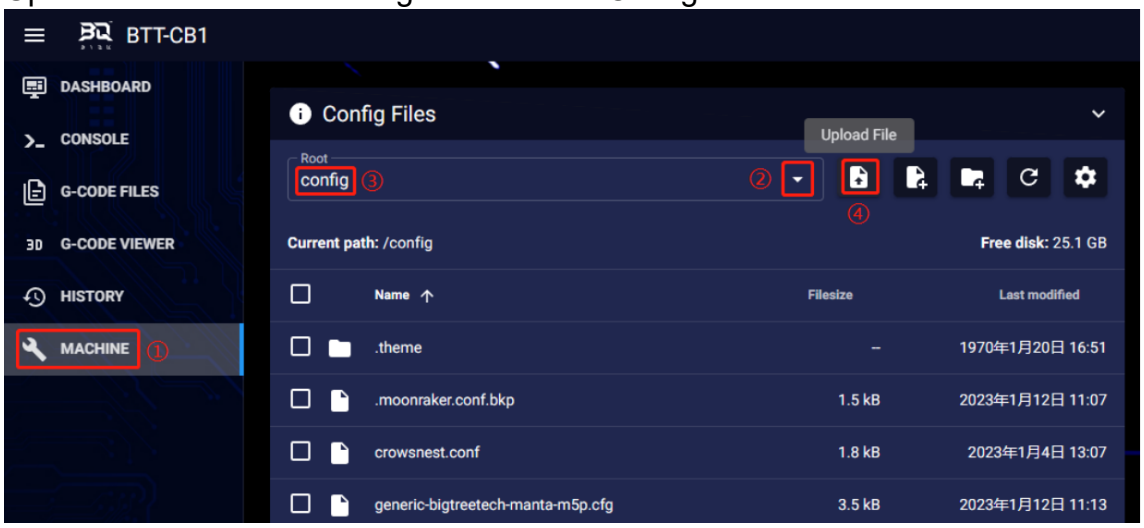
After the burning is completed, there will be a dfu-util: **Error during download get_status** error message, which can be ignored.

Configure Klipper

1. Enter the Raspberry Pi's IP address in the computer's browser to access it. Download the reference configuration named **generic-bigtreetech-manta-m8p-V2_0.cfg** in the path shown in the image below. If you cannot find this file, please update the Klipper firmware source code to the latest version or download it from GitHub:
   https://github.com/bigtreetech/Manta-M8P



2. Upload the mainboard configuration file to Configuration Files.



3. Add the mainboard configuration in the "printer.cfg" file:

   [include generic-bigtreetech-manta-m8p-V2_0.cfg]

4. Modify the ID number in the configuration file to the actual ID of the mainboard.

5. Follow the instructions in the link below to configure the specific functions of the mainboard:
   https://www.klipper3d.org/Overview.html

V2.0 Upgrade Notes

- Upgraded MCU to ARM Cortex-M7 STM32H723ZET6 550MHz.
- Added interfaces: servo, I2C, 5V detection, TFT expansion ports.
- Changed EXP1+EXP2 to FPC connectors.
- Increased USB output current.
- Added large-capacity energy storage capacitors to the 5V circuit, especially at the core board 5V input port, to prevent the 5V supply from breaking due to excessive current during CM4 startup.
- Upgraded 12V power supply for increased capacity and resistance.

Precautions

- Power off before connecting/disconnecting anything except USB, HDMI and Ethernet. Includes enabling eMMC flashing.
- Pay attention to the heat dissipation issues of CM4 and CB1. If the running application consumes excessive system resources, it can lead to significant heating.

If you need further resources for this product, you can find them at [GitHub](https://github.com/bigtreetech/). If you cannot find what you need, you may contact our after-sales support(service005@biqu3d.com).

If you encounter any other problems during use or have suggestions or feedback, please contact us. Thank you for choosing BIGTREETECH products.