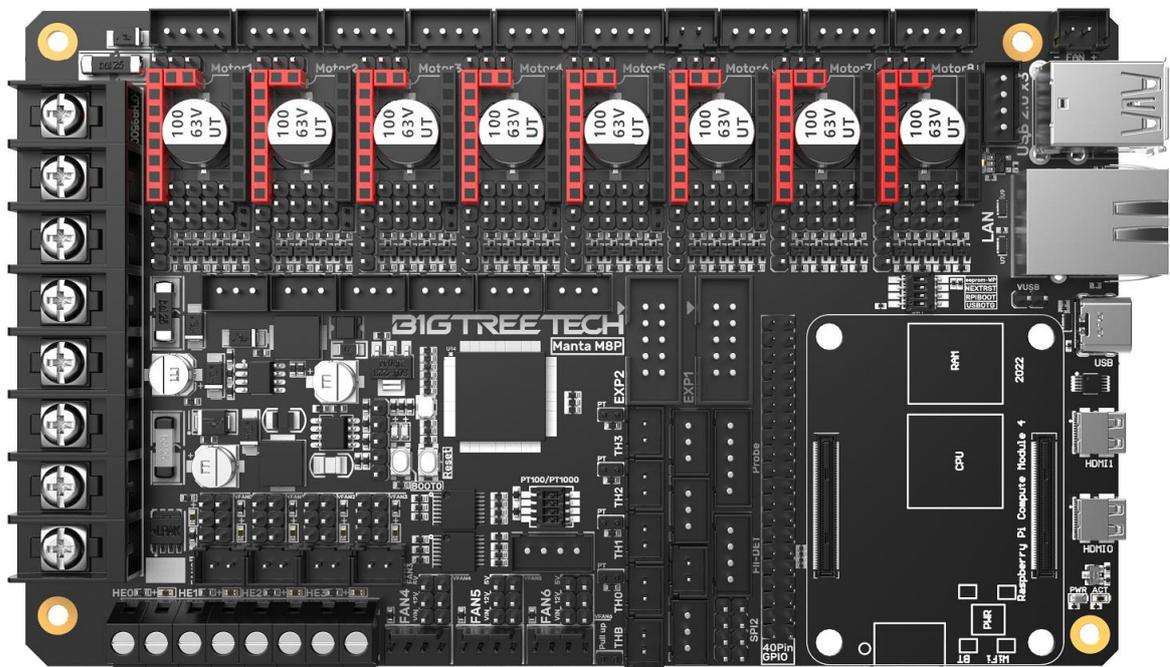


# BIGTREETECH

# MANTA M8P V1.0

## User Manual



## **Contents**

Contents.....	3
Revision History .....	3
1 Brief Introduction .....	4
1.1 Main Features .....	4
1.2 Basic Parameters .....	5
1.3 Product Dimension .....	6
2 Peripheral Interface .....	7
2.1 Interface Diagram .....	7
2.2 Pin Layout .....	8
3 Interface Instruction .....	8
3.1 USB Power Supply .....	8
3.2 Stepper Motor Drive .....	9
3.2.1 Normal STEP/DIR(STANDALONE) Mode .....	9
3.2.2 UART Mode of TMC Driver .....	10
3.2.3 SPI Mode of TMC Driver .....	11
3.2.4 DIAG(Sensorless Homing) of TMC Driver .....	11
3.3 Installing the Core Board .....	11
3.4 Voltage Selection of CNC Fans .....	12
3.5 100K NTC or PT1000 Setting .....	13
3.6 BLTouch Wiring .....	14
3.7 Auto Shutdown Module(Relay V1.2) Wiring .....	14
3.8 EXP1+EXP2 and LCD Screen Wiring .....	15
3.9 RGB Wiring .....	15
3.10 Filament Runout Detection Wiring .....	16
3.11 40 Pin GPIO .....	16
3.12 DSI/CSI Connection .....	17
3.13 Proximity Switch Wiring .....	17
3.14 Wiring of the 4-wire CNC Fan and the Water Cooling Device .....	18
4 Write OS Image .....	19
4.1 Preparations .....	19
4.1.1 Download OS Image(CM4) .....	19
4.1.2 Download OS Image(CB1 V2.0) .....	19
4.1.3 Download and Install Raspberry Pi Imager .....	19_Toc12626
4.2 CM4 LITE Version or CB1 V2.0(SD Card) .....	20
4.3 CM4 eMMC Version .....	22
5 System Settings .....	22
5.1 USB 2.0 Hub Ports .....	22
5.2 DSI1 Display Interface .....	22
5.3 CSI1 Camera .....	23
6 System Settings (CB1 V2.0) .....	23
6.1 Install Klipper with KIAUH Script .....	23
6.2 Checkout Klipper Branch .....	25
6.3 Fix KlipperScreen .....	27
7 Precautions .....	27

## Revision History

Revision	Description	Date
01.00	First Draft	2022/06/18

## **1 Brief Introduction**

BIGTREETECH MANTA M8P is a 32-bit printer motherboard developed by the 3D printing team of Shenzhen Big Tree Technology Co., Ltd. for Klipper firmware. You can simply plug in the core board to run the Klipper firmware, which greatly simplifies the connection between the motherboard and the Raspberry Pi, and saves a lot of space. Moreover, the BTB connector is designed to install CM4 or other solutions to solve the current expensive problem of CM4.

### **1.1 Main Features**

1. Adopt 32-bit 64MHz ARM Cortex-M0+ series STM32G0B1VET6 as the main control chip;
2. The power chip, TPS5450-5A, supports DC12/24V power input. The output current of the chip is up to 5A, and the peak value can reach 6A, which perfectly supports the power supply of Raspberry Pi;
3. There is a BOOT button reserved on the motherboard, users can update the bootloader through DFU;
4. The thermistor part includes a protection circuit that protects the main control chip from the possibility of burning caused by leakage of the heated bed or heater cartridge;
5. 24V, 12V, and 5V voltages are available for CNC fans, eliminating the need for an external transformer module, thereby reducing the chance of damage to the motherboard due to improper operation;
6. The thermistor can select the pull-up resistor value through the jumper, in this way, it supports PT1000 without an external module, which is convenient for customers to DIY;
7. The MCU firmware can be updated via an SD card, or through Klipper's make flash command using DFU;
8. The motherboard and the core board use the BTB connection to allow using other solutions other than CM4;
9. On-board TMC-driver SPI and UART working modes, on-board DIAG function pins, can be used by simply plugging and unplugging the jumper cap;
10. Support filament runout detection, auto shutdown, BLTouch, RGB lights...
11. High efficiency MOSFET for less heat generation;
12. Adopt replaceable fuse for easy replacement;
13. Three-way four-wire fan interface is reserved, and can be used to connect the water cooling device;

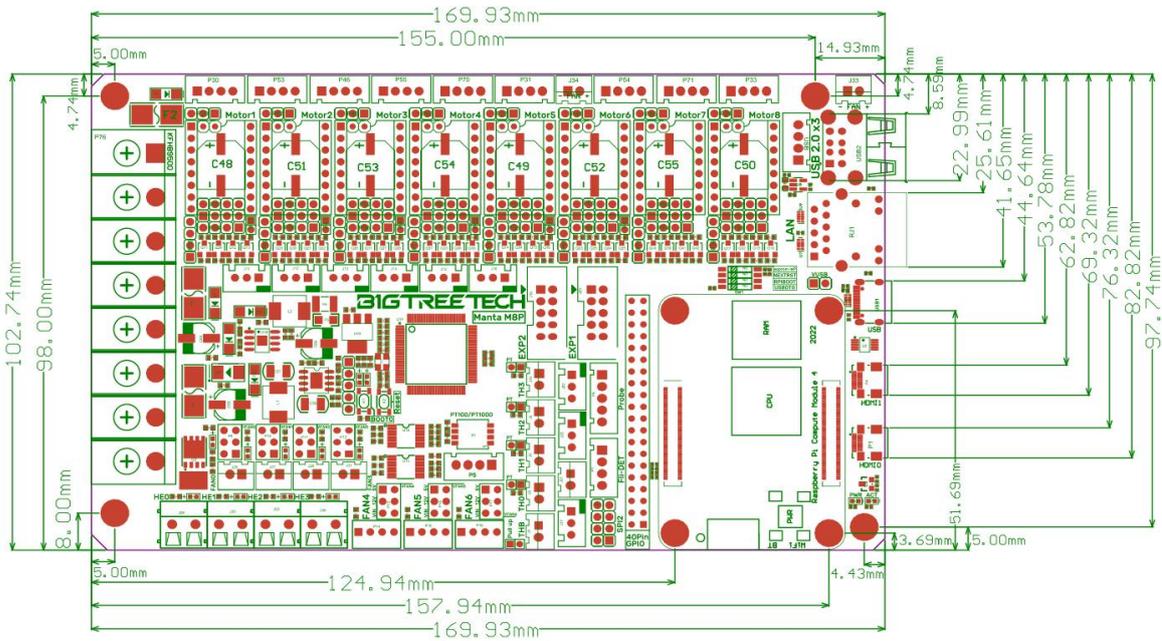
14. The proximity switch interface is reserved, supports NPN and PNP types, (24V, 12V, 5V) voltage selection is available, common voltage selection with VFAN6;
15. Provide the SPI expansion interface to allow Klipper firmware users to connect an external acceleration sensor for acceleration compensation.

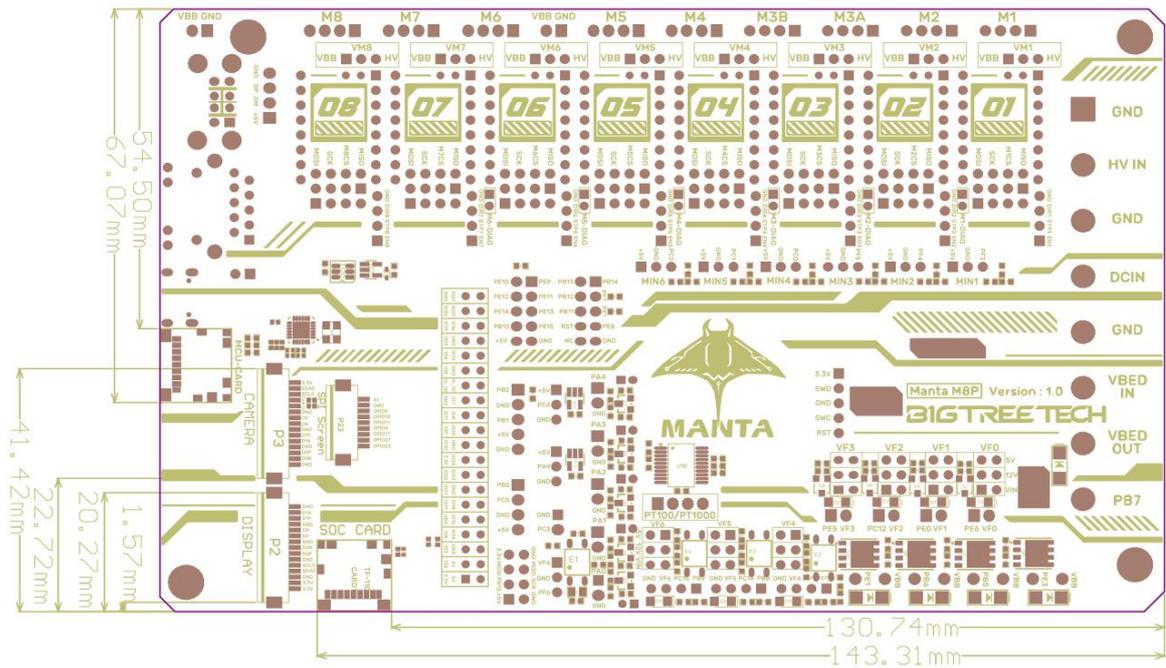
## 1.2 Basic Parameters

1. Product Size: 170 x 102.7mm, you can read more details here **BIGTREETECH MANTA M8P V1.0-SIZE-top.pdf**
2. Installation Size: Please read: **BIGTREETECH MANTA M8P V1.0-SIZE-top.pdf**
3. Microprocessor: ARM Cortex-M0+ STM32G0B1VET6 64MHz
4. Drive Input Voltage: 24V, HV(Optional)
5. Motherboard Input Voltage: VIN=DC12V or DC24V
6. Heated Bed Input Voltage: BED IN=DC12V or DC24V
7. Logic Voltage: DC3.3V
8. Heating Port: Heated Bed(HB), Heater Cartridge(HE0, HE1, HE2, HE3)
9. The maximum output current of the heated bed port: 10A, Peak Value: 12A
10. The maximum output current of the heater cartridge port: 5.5A, Peak Value: 6A
11. Fan Port: Two-wire CNC Fan (FAN0, FAN1, FAN2, FAN3), four-wire CNC Fan fan (FAN4, FAN5, FAN6), Always-on Fan (24V FAN x 2), among which the CNC Fan voltages are 5V, 12V, 24V optional
12. The maximum output current of the fan port: 1A, Peak Value: 1.5A
13. Total current for heater cartridge + driver + fan: <12A
14. Extended Interface: BLTouch(Servos, Probe), PS-ON, Fil-DET, RGBx2, SPI
15. Motor Driver: Support TMC5160, TMC2209, TMC2225, TMC2226, TMC2208, TMC2130, ST820, LV8729, DRV8825, A4988...
16. Driver Working Mode Support: SPI, UART, STEP/DIR
17. Motor Drive Interface: Motor1, Motor2(dual motor interface), Motor3, Motor4, Motor5, Motor6, Motor7, Motor8, a total of Eight

18. Temperature Sensor Interface: 5-way 100K NTC, of which 4-way 100K NTC and PT1000 are optional
19. Support Screen: SPI Touch Screen, LCD Screen
20. PC Communication Interface: Type-C
21. Functional Interface: USB 2.0 x 3, LAN, DSI, CSI, SPI, 40Pin-GPIO, HDMI0 and HDMI1, SOC-Card, MCU-Card
22. Support Machine Structure: Cartesian, Delta, Kossel, Ultimaker, CoreXY
23. Recommended Software: Cura, Simplify3D, Pronterface, Repetier-host, Makerware

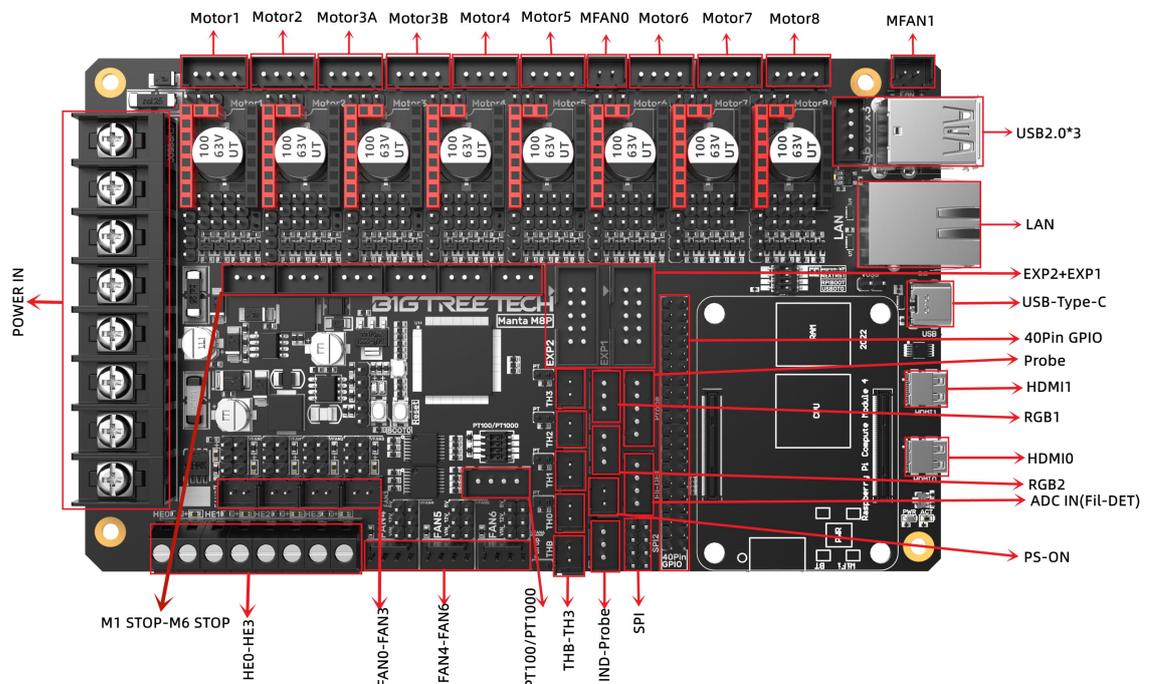
### 1.3 Product Dimension



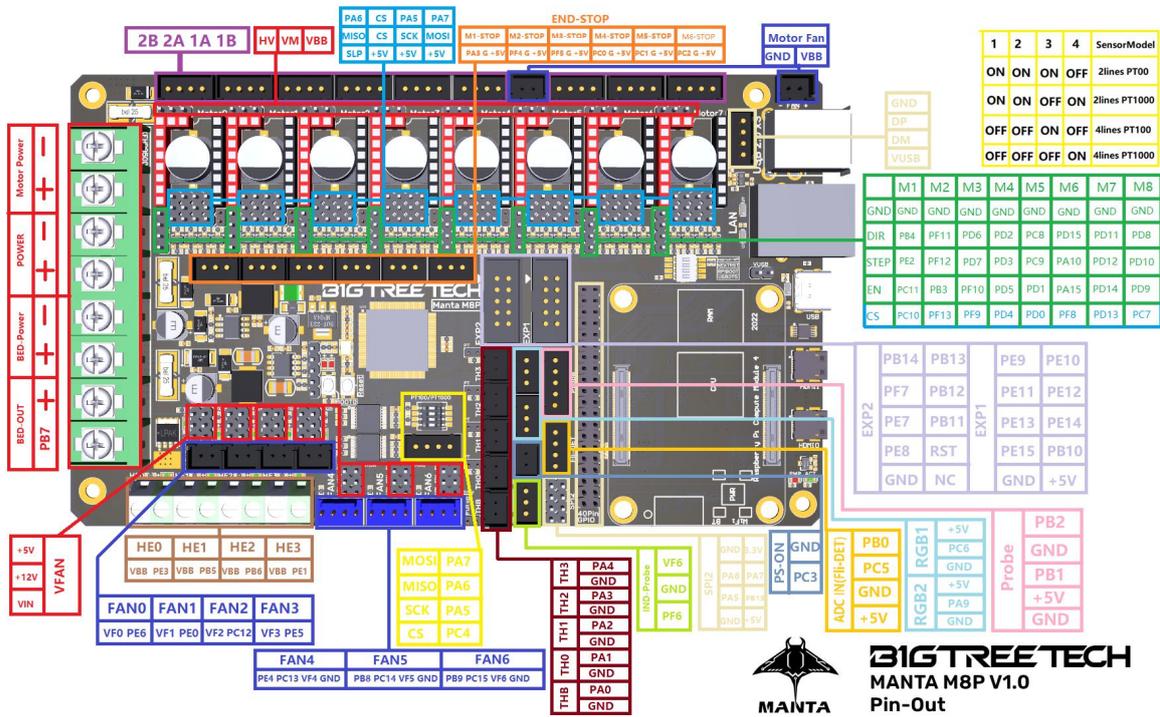


## 2 Peripheral Interface

### 2.1 Interface Diagram



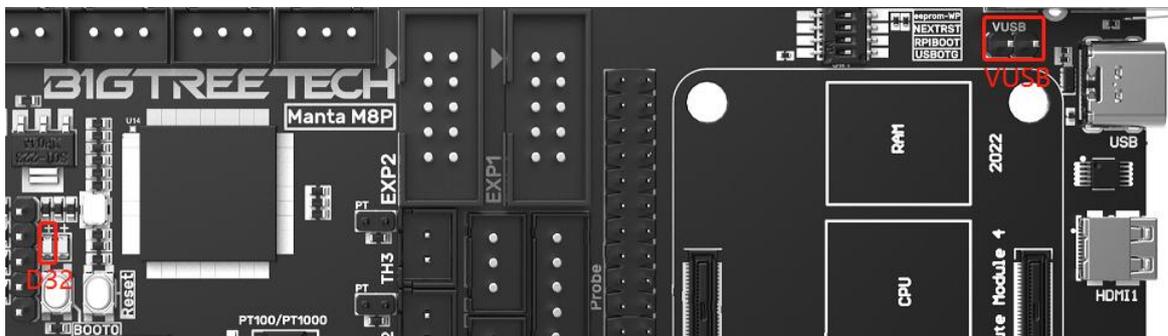
## 2.2 Pin Layout



## 3 Interface Instruction

### 3.1 USB Power Supply

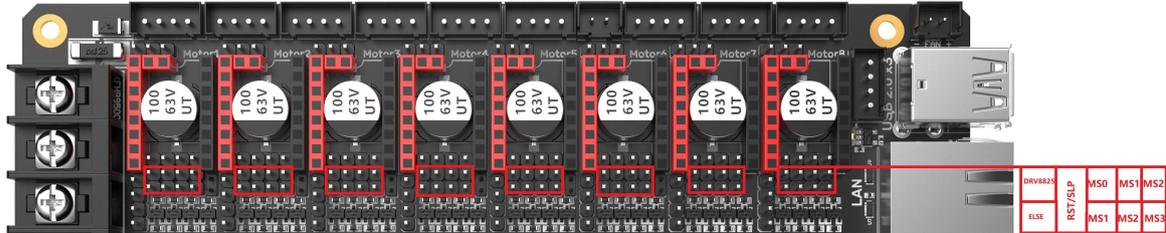
After the M8P motherboard is powered on, the D32 red light on the left side of the MCU will light up, indicating that the power supply is normal. The VUSB in the middle of the board is the power selection terminal. Only when using USB to supply power to the motherboard or need to supply power through USB, do you need to use the jumper to short it.



### 3.2 Stepper Motor Drive

#### 3.2.1 Normal STEP/DIR(STANDALONE) Mode

For example, A4988, DRV8825, LV8729, ST820...use the jumper cap to short MS0-MS2 according to the driver subdivision table.



**Note:** If using A4988 or DRV8825, RST and SLP must be shorted with jumper caps for normal operation.

Driver Chip	MS1	MS2	MS3	Subdivision	Excitation Mode
A4988 Max 16 Subdivisions 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
Driving Current Calculation Formula $R_S=0.1\Omega$	$I_{\text{TripMAX}} = \frac{V_{\text{REF}}}{8 * R_S}$				

Driver Chip	MODE 2	MODE 1	MODE 0	Subdivision	Excitation Mode
DRV8825 Max 32 Subdivisions 8.2V-45V 2.5A at 24V T=25°C	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	
Driving Current Calculation Formula $R_{\text{ISENSE}}=0.1\Omega$	$I_{\text{CHOP}} = \frac{V_{(\text{xREF})}}{5 * R_{\text{ISENSE}}}$				

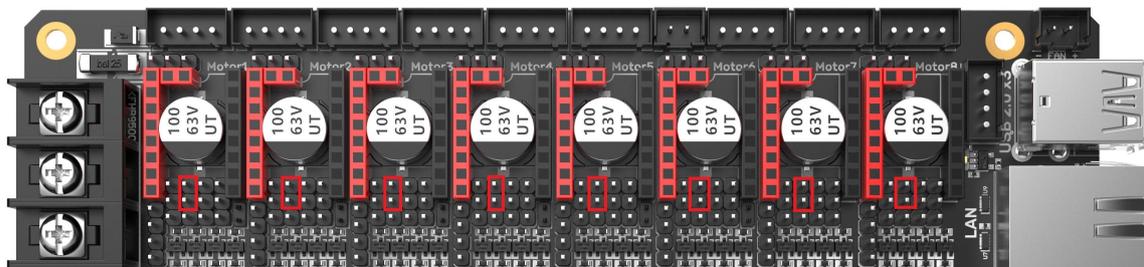
Driver Chip	MD3	MD2	MD1	Subdivis	Excitation Mode
-------------	-----	-----	-----	----------	-----------------

				ion	
LV8729 Max 128 Subdivisions 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
Driving Current Calculation Formula RF1=0.22Ω	$I_{OUT} = (V_{REF} / 5) / RF1$				

Driver Chip	MS3	MS2	MS1	Subdivision
ST820 Max 256 Subdivisions 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
Driving Current Calculation Formula Rs=0.15Ω	$I_{peak} = \frac{V_{REF} * V_{DD}}{5 * R_S}$			

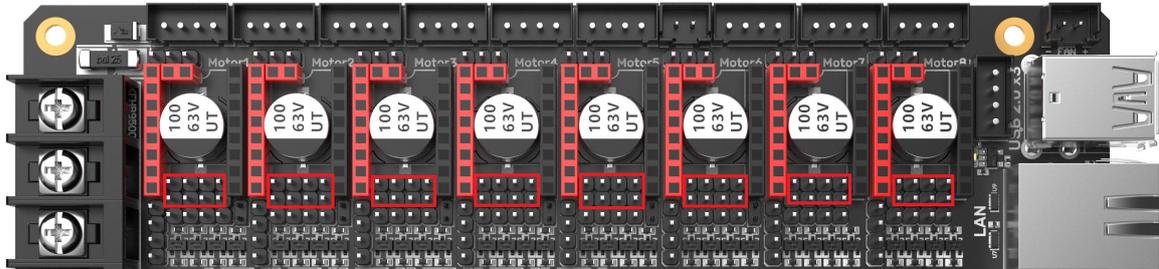
### 3.2.2 UART Mode of TMC Driver

For example, TMC2208, TMC2209, TMC2225... Use a jumper cap for each to connect the position of the red box in the figure, and the subdivision and driver current is set by firmware.



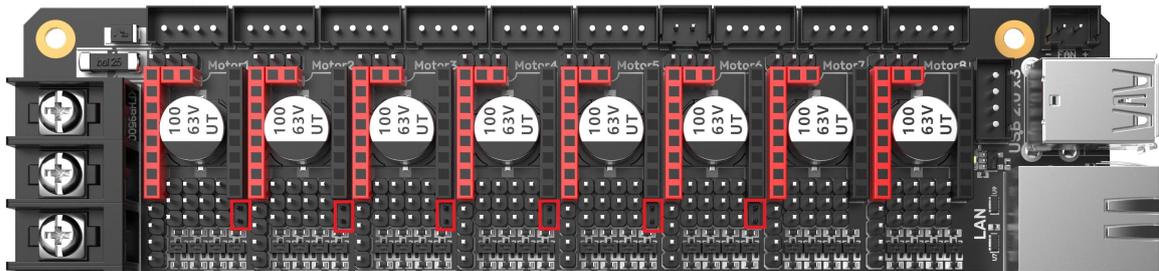
### 3.2.3 SPI Mode of TMC Driver

For example, TMC2130, TMC5160, TMC5161... Use 4 jumper caps for each to connect the position of the red box in the figure, and the subdivision and driver current is set by firmware.



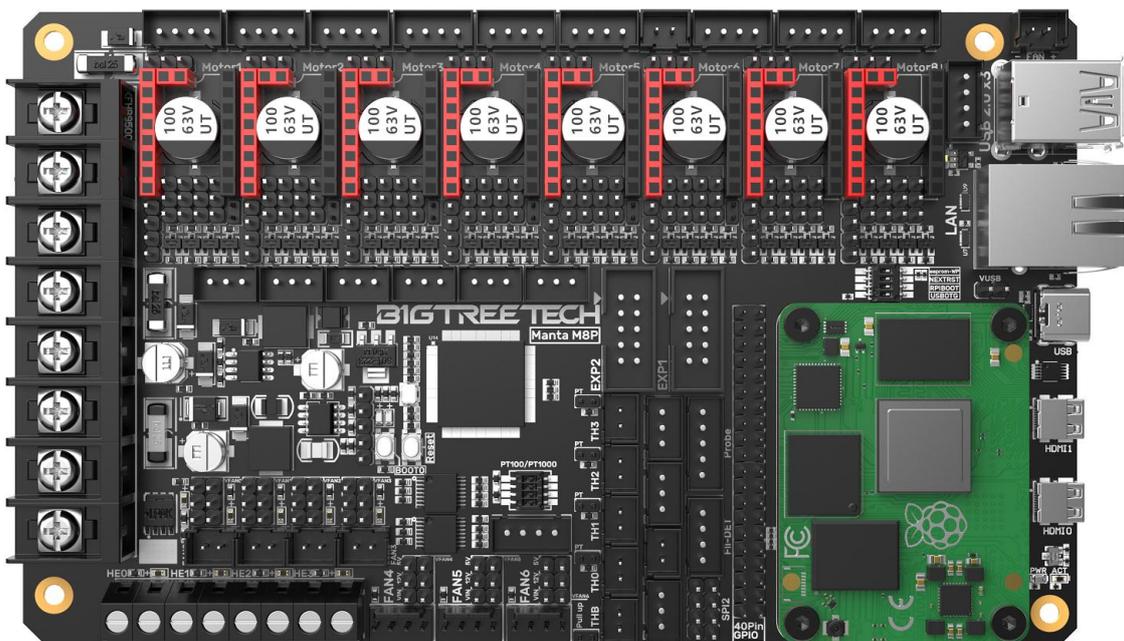
### 3.2.4 DIAG(Sensorless Homing) of TMC Driver

As shown in the figure, plug the jumper cap when using the Sensorless Homing function, and leave it unplugged when it is not used. There is no need to cut the DIAG pin of the driver.

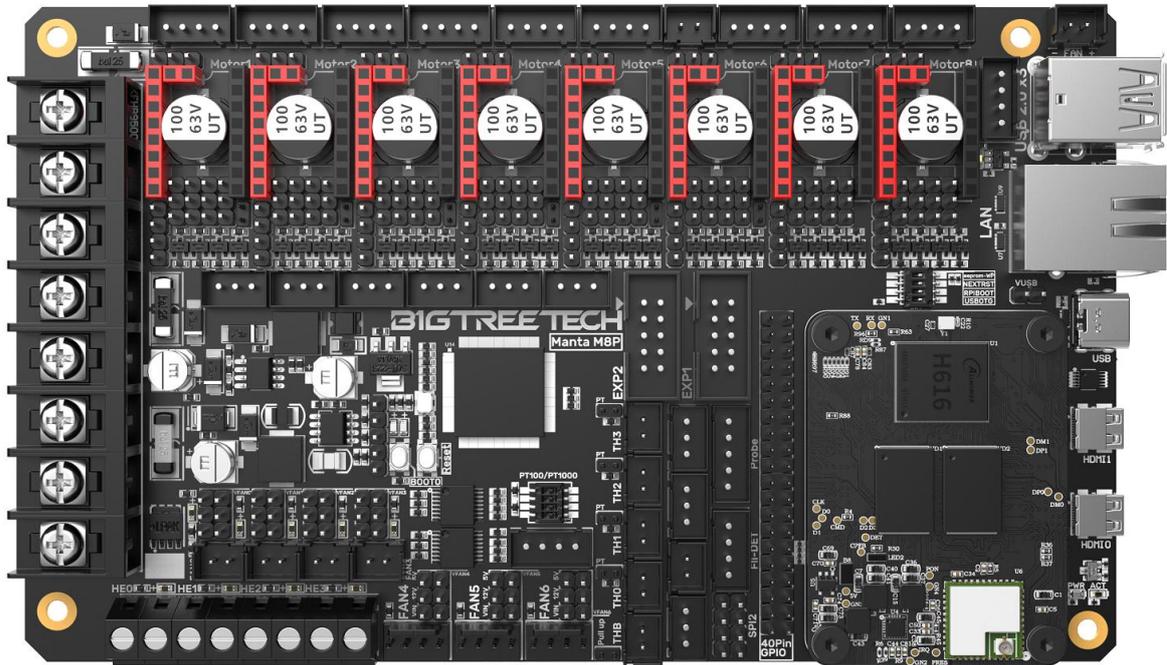


## 3.3 Installing the Core Board

M8P+CM4: Pay attention to the direction, as shown below.

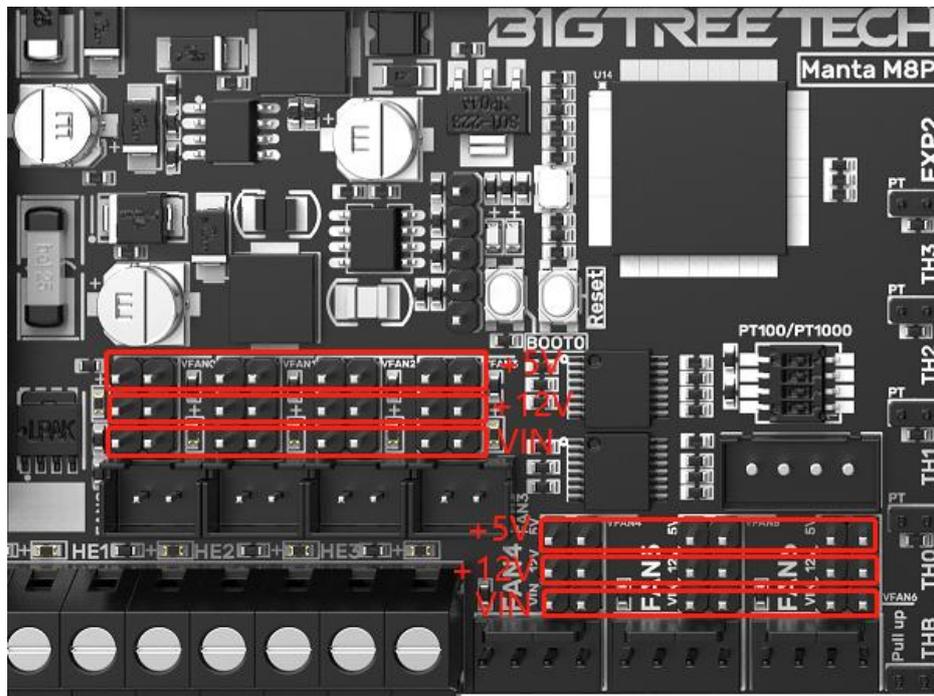


M8P+CB1: Pay attention to the direction, as shown below.



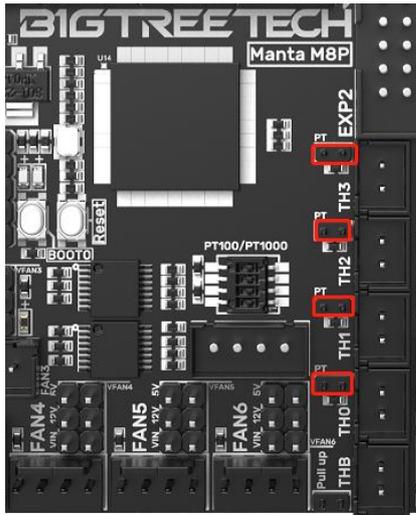
### 3.4 Voltage Selection of CNC Fans

Set the output voltage to 5V, 12V, or 24V with a jumper cap. **Note:** Please confirm the fan's operating voltage before choosing a voltage. Our company is not responsible for fan burnout caused by wrong selection.

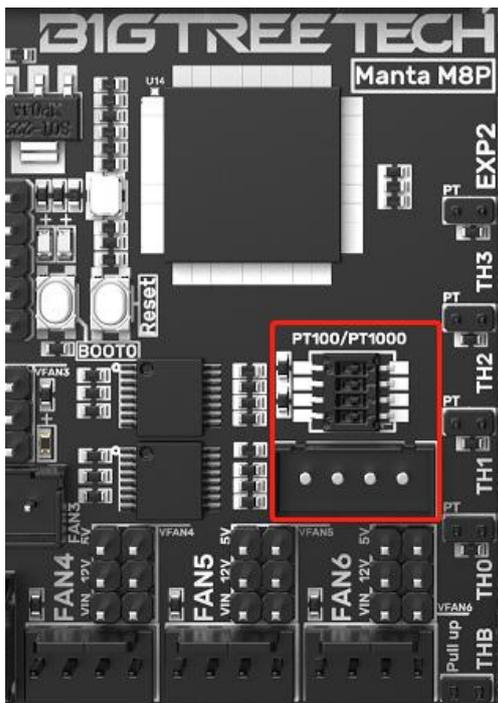


### 3.5 100K NTC or PT1000 Setting

When using a 100K NTC thermistor, there is no need to insert the jumper cap, and the pull-up resistance of TH0-TH3 is 4.7K 0.1%. When using PT1000, you need to use a jumper cap to connect the two pins in the red box in the figure below and connect a 4.12K 0.1% resistor in parallel. At this time, the pull-up resistor of TH0-TH1 is 2.2K (Note: The temperature accuracy read out in this way will be far less accurate than that read out by MAX31865).

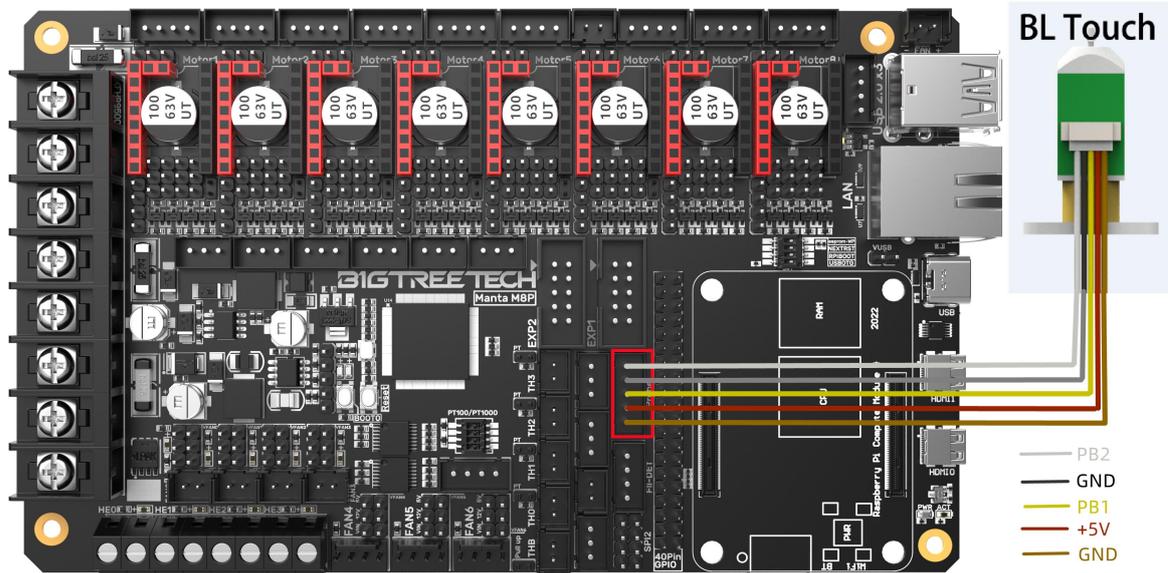


Use PT100/PT1000 by MAX31865 as shown below: (This function is not available on boards without the 31865 version.)

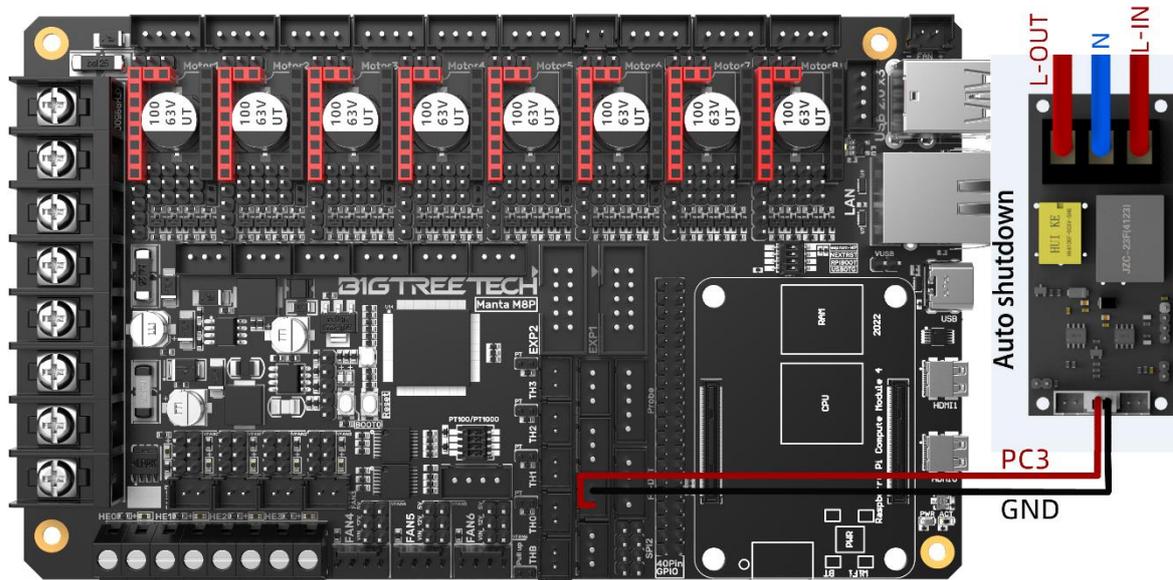


1	2	3	4	SensorModel
ON	ON	ON	OFF	2lines PT00
ON	ON	OFF	ON	2lines PT1000
OFF	OFF	ON	OFF	4lines PT100
OFF	OFF	OFF	ON	4lines PT1000

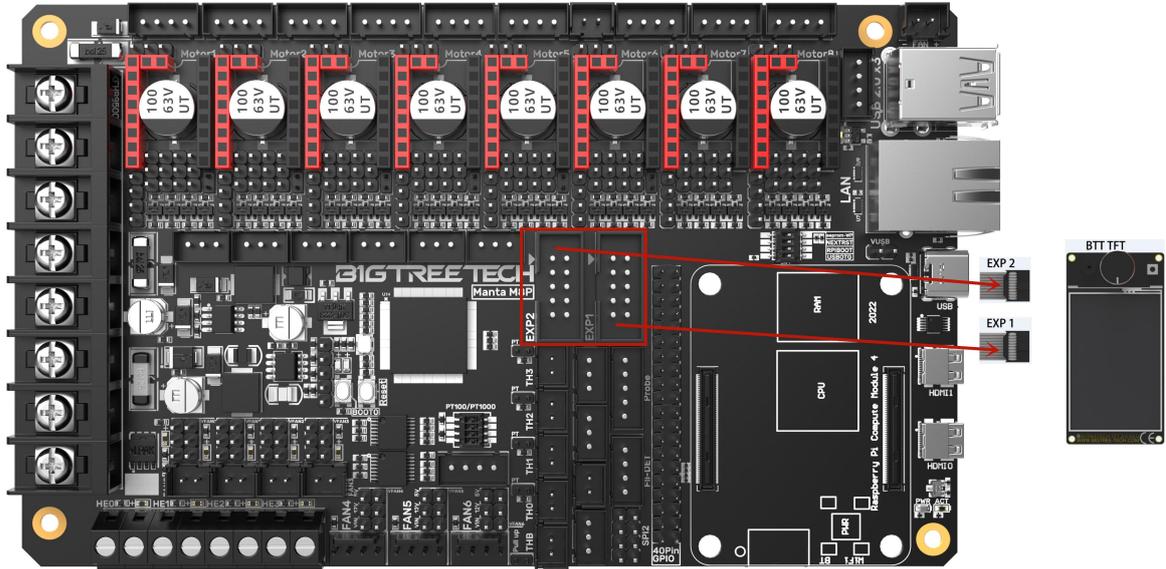
### 3.6 BLTouch Wiring



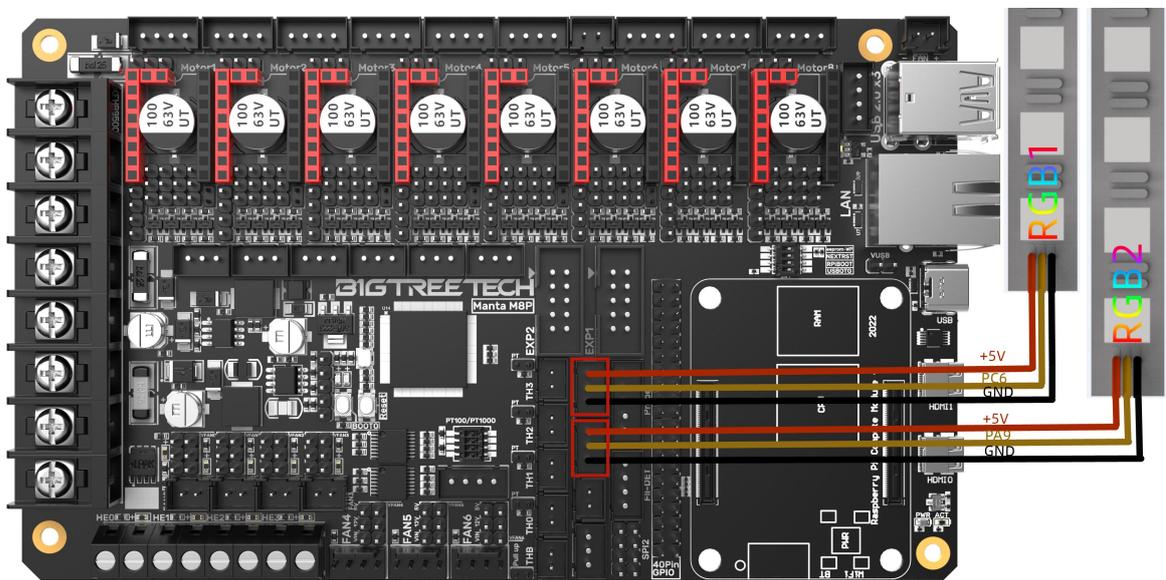
### 3.7 Auto Shutdown Module(Relay V1.2) Wiring



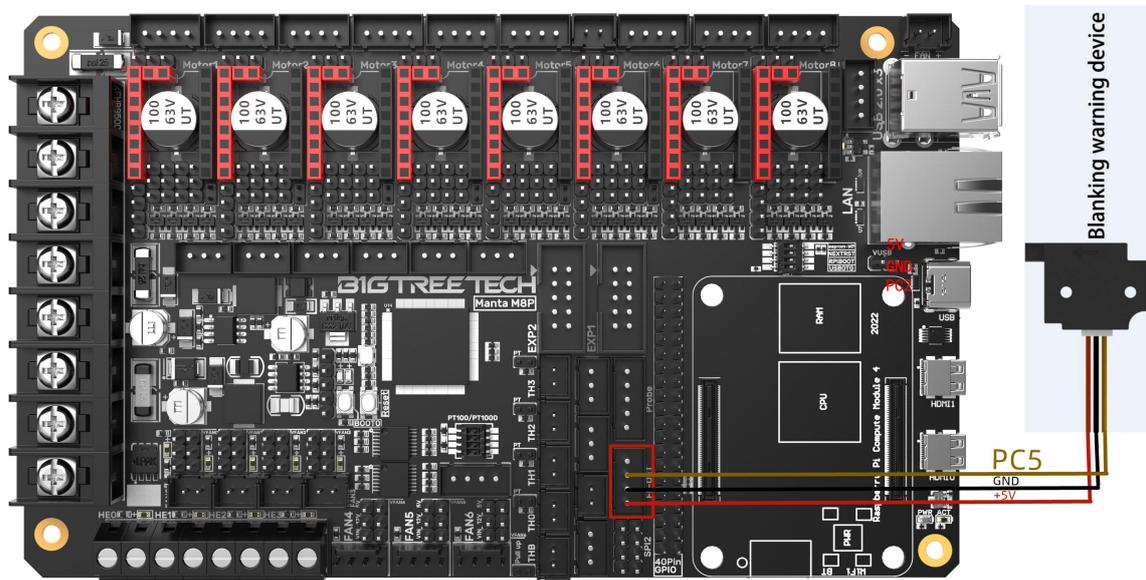
### 3.8 EXP1+EXP2 and LCD Screen Wiring



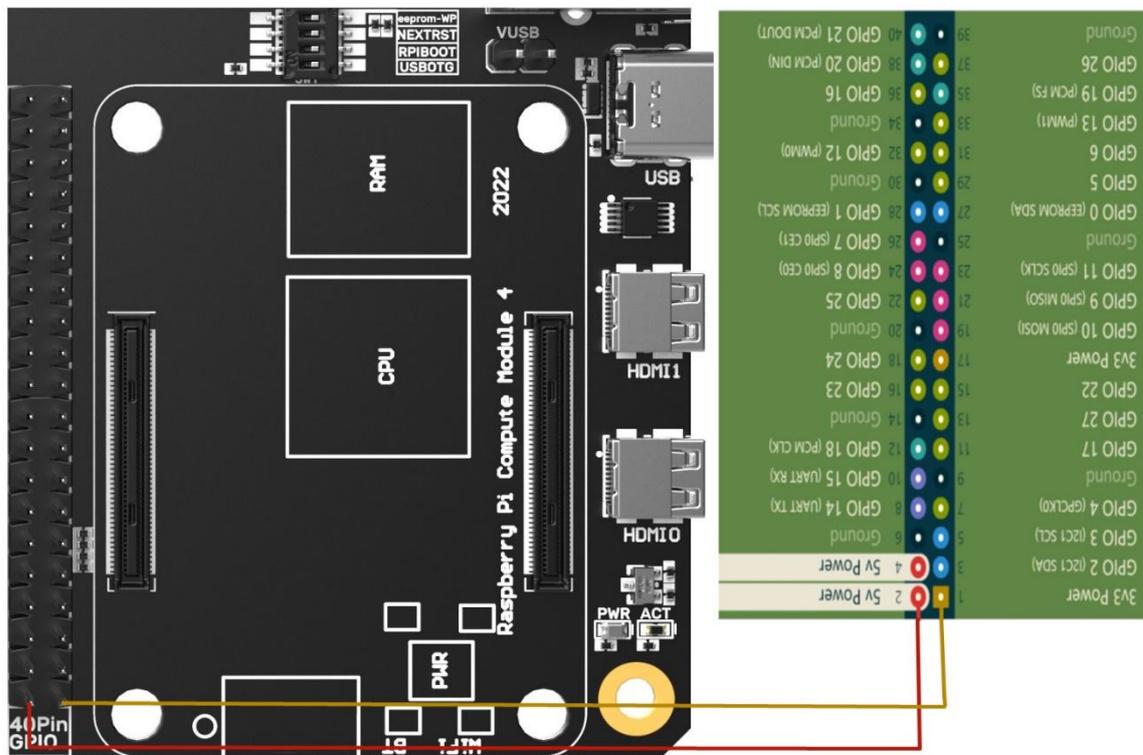
### 3.9 RGB Wiring



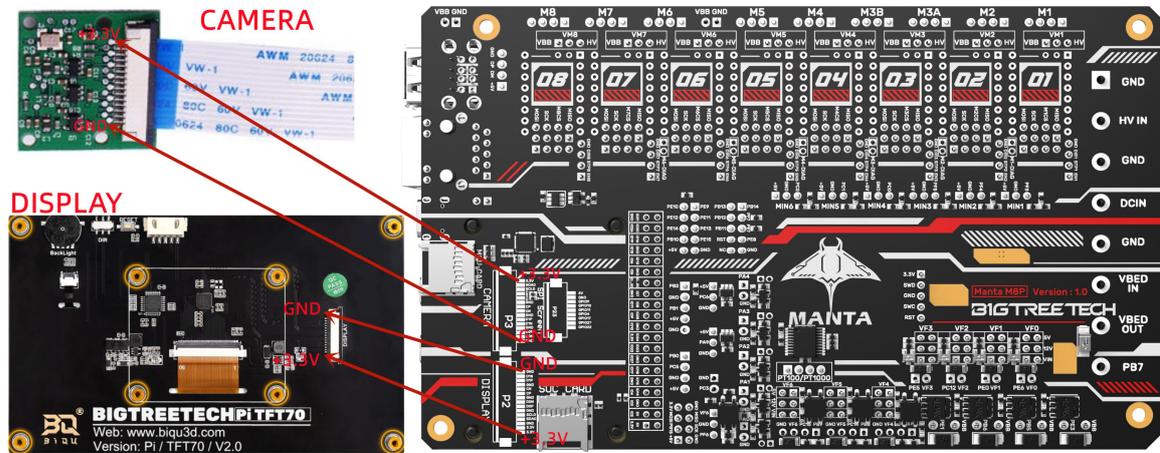
### 3.10 Filament Runout Detection Wiring



### 3.11 40 Pin GPIO

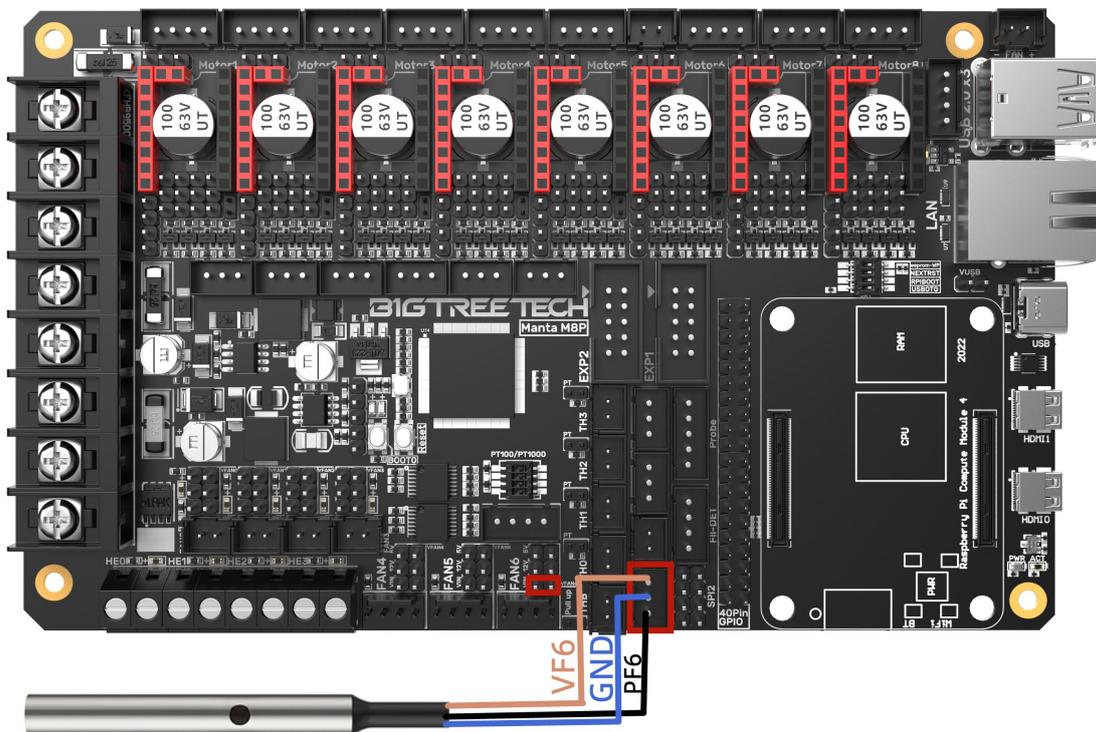


### 3.12 DSI/CSI Connection

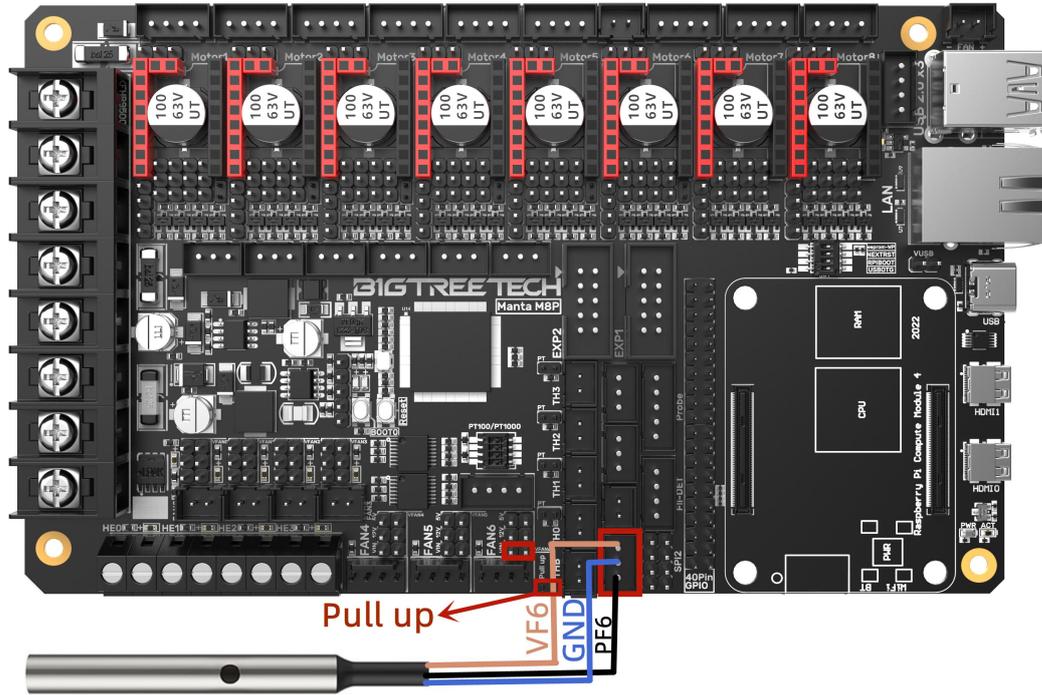


### 3.13 Proximity Switch Wiring

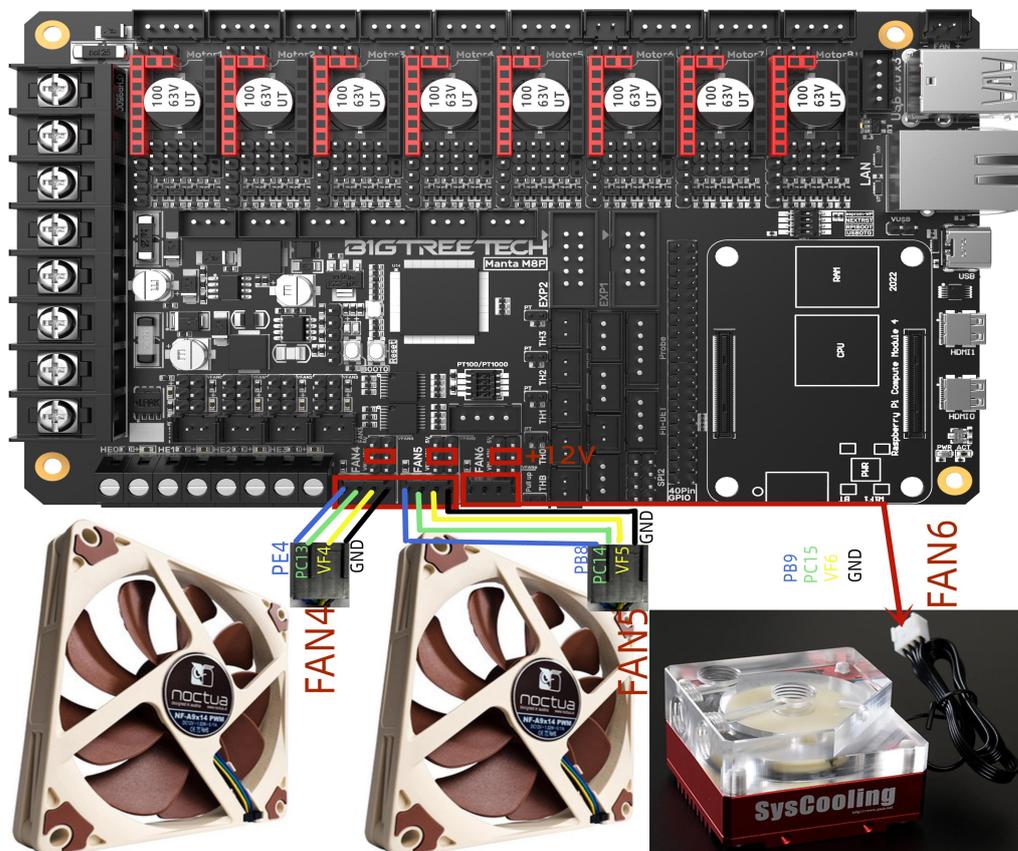
Always on (NPN type), no need to short-circuit via a jumper cap, 24V as an example, as shown in the following figure:



Always off (PNP type), need to short-circuit via a jumper cap, 24V as an example, as shown in the following figure:



### 3.14 Wiring of the 4-wire CNC Fan and the Water Cooling Device(12V as an example, as shown in the following figure:)



## 4 Write OS Image

### 4.1 Preparations

#### 4.1.1 Download OS Image(CM4)

Download the OS image from the official website of Raspberry Pi

Link: <https://www.raspberrypi.com/software/operating-systems>

(You can also directly download the images of Fluidd and Mainsail, whose operation is slightly different from the standard Raspberry Pi 3B, 4B, etc. CM4 needs to refer to the following system settings to enable the system's USB, DSI and other interfaces.)

#### Raspberry Pi OS

Our recommended operating system for most users.

Compatible with:

All Raspberry Pi models

##### Raspberry Pi OS with desktop

Release date: January 28th 2022  
System: 32-bit  
Kernel version: 5.10  
Debian version: 11 (bullseye)  
Size: 1,246MB  
[Show SHA256 file integrity hash:](#)  
[Release notes](#)

Download

[Download torrent](#)  
[Archive](#)

##### Raspberry Pi OS with desktop and recommended software

Release date: January 28th 2022  
System: 32-bit  
Kernel version: 5.10  
Debian version: 11 (bullseye)  
Size: 3,267MB  
[Show SHA256 file integrity hash:](#)  
[Release notes](#)

Download

[Download torrent](#)  
[Archive](#)

##### Raspberry Pi OS Lite

Release date: January 28th 2022  
System: 32-bit  
Kernel version: 5.10  
Debian version: 11 (bullseye)  
Size: 482MB  
[Show SHA256 file integrity hash:](#)  
[Release notes](#)

Download

[Download torrent](#)  
[Archive](#)

#### 4.1.2 Download OS Image(CB1 V2.0)

We provide OS image for you to download.

Link: <https://github.com/bigtreetech/CB1/releases>

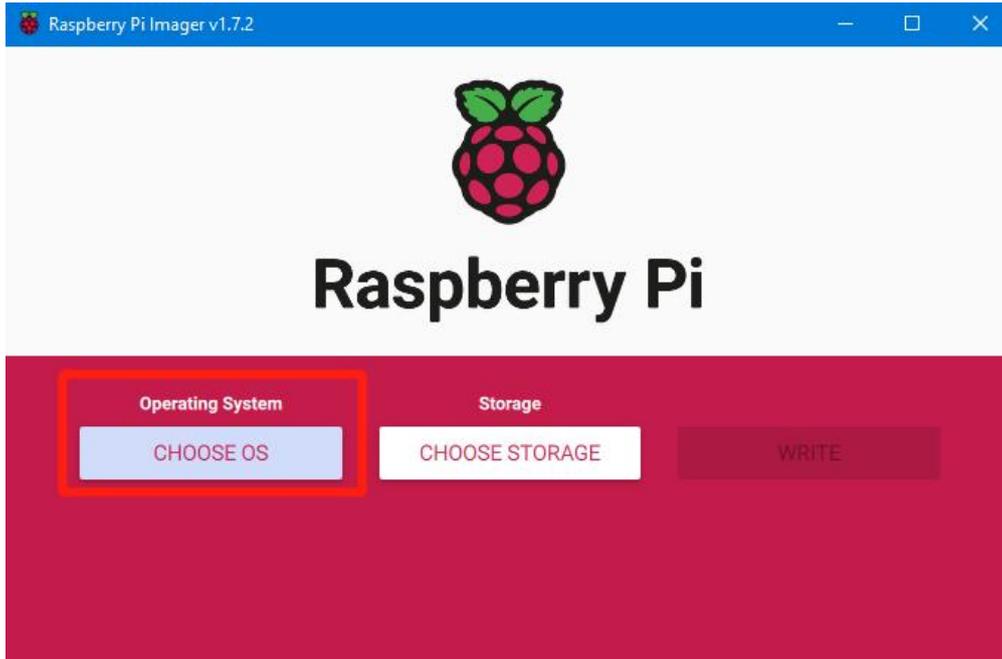
#### 4.1.3 Download and Install Raspberry Pi Imager

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

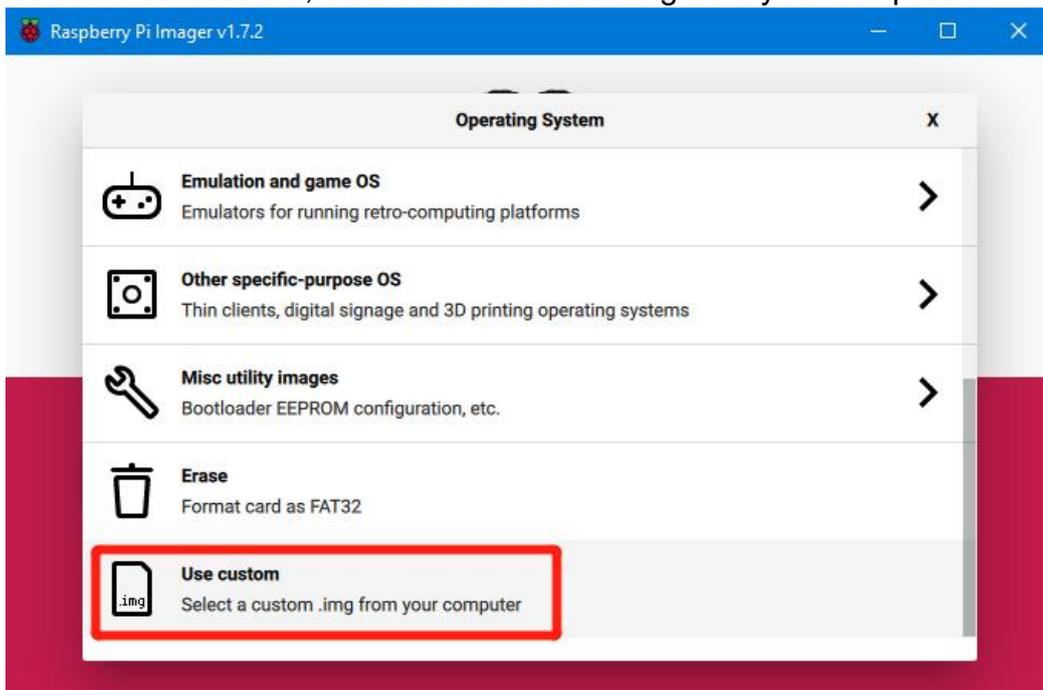
Both CM4 and CB1 V2.0 OS images can be written with this software.

#### 4.2 CM4 LITE Version or CB1 V2.0(SD Card)

1. Plug the Micro SD card into the computer via a card reader.
2. Select Operating System.



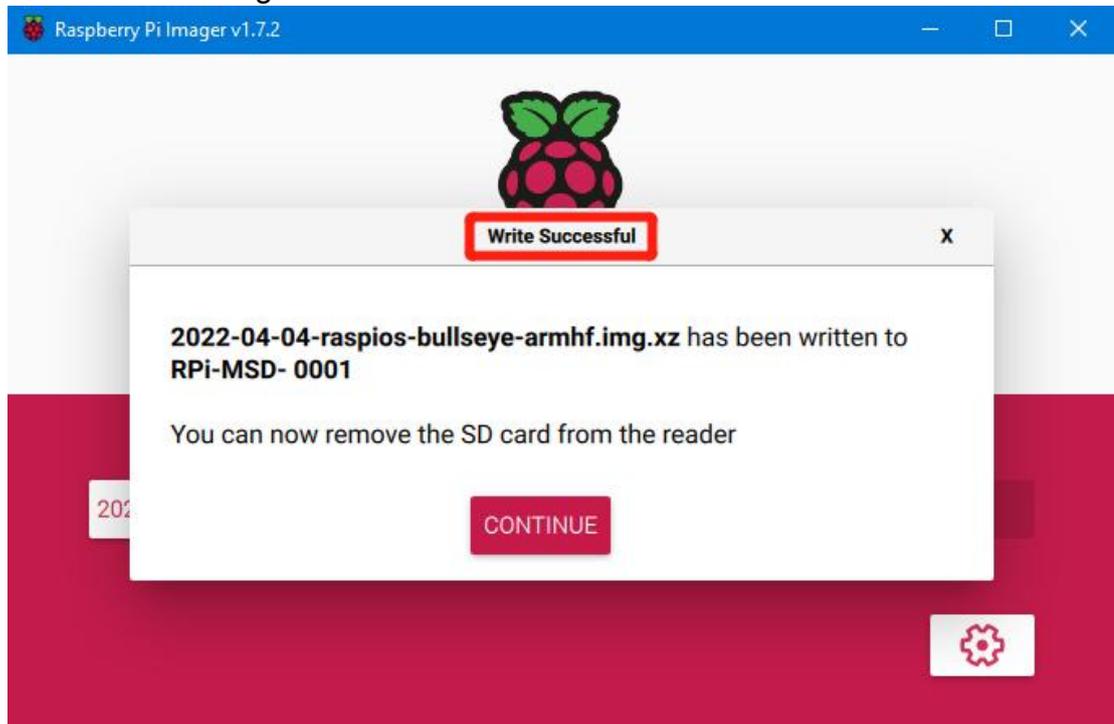
3. Select "Use Custom", then select a custom.img from your computer.



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



5. Wait for the writing to finish.



### **4.3 CM4 eMMC Version(Note: eMMC version will not run the system from the SD card.)**

1. Install rpiboot  
For Windows:  
[http://github.com/raspberrypi/usbboot/raw/master/win32/rpiboot\\_setup.exe](http://github.com/raspberrypi/usbboot/raw/master/win32/rpiboot_setup.exe)  
For Mac and Linux:  
<https://github.com/raspberrypi/usbboot#building>
2. Push the DIP switch 4 (USB OTG) and 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 best 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 as a mass storage device by the computer (if rpiboot reports an error at this time, you can try to re-plug the USB).
4. The step of using the Raspberry Pi Imager to write the OS image is exactly the same as the LITE version. Note: the SSH function should also be enabled.
5. When the writing is completed, push the DIP switch 4 (USB OTG) and 3 (RPIBOOT) back to OFF to enter the normal working mode.

## **5 System Settings**

### **5.1 USB 2.0 Hub Ports**

Pad5 is designed with a USB 2.0 Hub, in order to save power consumption, the USB port of CM4 is disabled by default. If you want to enable it, you need to add the following content to the config.txt file:

```
dtoverlay=dwc2,dr_mode=host
```

### **5.2 DSI1 Display Interface**

The default display interface is HDMI. The onboard screen of Pad5 uses the DSI1 interface. You need to download the DSI1 driver and enter the following sentence 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 of Pad5 will work normally. If you want to use the HDMI interface, you need to delete the downloaded `/boot/dt-blob.bin` driver and restart, then the HDMI can output normally.

## 5.3 CSI1 Camera

The DSI1 driver downloaded in **5.2 DSI1 Display Interface** 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, and then refer to the settings here.

<https://projects.raspberrypi.org/en/projects/getting-started-with-picamera/>

## 6 System Settings (CB1 V2.0)

### 6.1 Install Klipper with KIAUH Script

1. Download KIAUH:  
git clone -b CB1 --depth 1 <https://github.com/bigtreotech/kiauh.git>
2. Run KIAUH:  
./kiauh/kiauh.sh

```
##### [ KIAUH ] #####
Klipper Installation And Update Helper
#####

##### [ Main Menu ] #####

0) [Log-Upload] | Klipper: Not installed!
                 | Repo: -
                 | Branch: -

1) [Install]    | Moonraker: Not installed!
2) [Update]    |
3) [Remove]    | Mainsail: Not installed!
4) [Advanced]  | Fluid: Not installed!
5) [Backup]    | KlipperScreen: Not installed!
6) [Settings]  | Telegram Bot: Not installed!

v4.0.0-8       | Octoprint: Not installed!

lodge Custom   | F) Function
                | Q) Quit

##### Perform action: █
```

On the left side of the Main Menu: install, remove, upgrade, etc.

On the right side of the Main Menu: show the installation status.

3. Select 1 to enter the Installation Menu and install the software you need.

```
##### [ KIAUH ] #####
Klipper Installation And Update Helper
#####

##### [ Installation Menu ] #####

You need this menu usually only for installing
all necessary dependencies for the various
functions on a completely fresh system.

-----
Firmware & API:          | 3rd Party Webinterface:
 1) [Klipper]             | 6) [OctoPrint]
 2) [Moonraker]          |
-----
Klipper Webinterface:   | Other:
 3) [Mainsail]           | 7) [PrettyGCode]
 4) [Fluidd]             | 8) [Telegram Bot]
-----
Touchscreen GUI:       | Webcam Streamer:
 5) [KlipperScreen]     | 9) [MJPG-Streamer]
-----
                                B) < Back
##### Perform action: █
```

The 3D printer can work normally when having 'Klipper', 'Moonraker' and 'Fluidd', if you have a touch screen, you can also install 'KlipperScreen'.

4. During the installation process, when prompted for confirmation, you can select the configuration by default. After the installation is complete, back to the Main Menu to ensure that the installed software is in the 'Installed' status.

```
##### [ KIAUH ] #####
Klipper Installation And Update Helper
#####

##### [ Main Menu ] #####

0) [Log-Upload]          | Klipper: Installed: 1(py3)
                        | Repo: EchoHeim/klipper
                        | Branch: lodge
1) [Install]             | Moonraker: Installed: 1
2) [Update]              |
3) [Remove]              | Mainsail: Not installed!
4) [Advanced]            | Fluidd: Installed!
5) [Backup]              | KlipperScreen: Not installed!
6) [Settings]            | Telegram Bot: Not installed!
v4.0.0-8                 | Octoprint: Not installed!
lodge Custom             |
                        | F) Function
                        | Q) Quit
##### Perform action: █
```

## 6.2 Checkout Klipper Branch

If you want to customize the functions of Klipper, which the official does not support, you can fork the Klipper repository to your own repository, and use the KIAUH script to update after completing the function modification. The specific operations are as follows:

1. On the KIAUH Main Menu, select F to enter the Custom Function Menu.

```

##### [ KIAUH ] #####
Klipper Installation And Update Helper
#####

##### [ Custom Function Menu ] #####

0) Custom klipper with lodge
1) usb device auto mount
2) fix KlipperScreen

B) << Back

Perform action: █

```

2. Select 0, automatically add custom text, after the prompt of successful, select B to back to the Main Menu.
3. Select 6 to enter Settings, then select 2 to enter the checkout Klipper repository.

```

##### [ KIAUH ] #####
Klipper Installation And Update Helper
#####

##### [ Set custom Klipper repo ] #####

0) Klipper3d/klipper → master
1) EchoHeim/klipper → lodge

B) << Back | H) Help [?]

##### Perform action: █

```

0 is the official repository of Klipper, it is recommended not to modify it, it can be used to restore; 1 is the Klipper repository after we added our own modification function. The specific way to add is to modify the `~/KIAUH/Klipper_repos.txt` file.

```
# This file acts as an example file.
#
# 1) Make a copy of this file and rename it to 'klipper_repos.txt'
# 2) Add your custom Klipper repository to the bottom of that copy
# 3) Save the file
#
# Back in KIAUH you can now go into -> [Settings] and use action '2' to set a different Klipper repository
#
# Make sure to always separate the repository and the branch with a ','.
# <repository>,<branch> -> https://github.com/Klipper3d/klipper,master
# If you omit a branch, it will always default to 'master'
#
# You are allowed to omit the 'https://github.com/' part of the repository URL
# Down below are now a few examples of what is considered as valid:
https://github.com/Klipper3d/klipper,master
https://github.com/EchoHeim/klipper,lodge
```

Add your own repository name and branch name after the file, separated by an English comma (,). If you do not specify a branch name, the default is the master branch. When the addition is completed, you can view it in the KIAUH script.

4. Choose the Klipper branch you want, and a proceeding confirmation prompt will appear.

```

##### [ KIAUH ] #####
Klipper Installation And Update Helper
#####

##### [ Set custom Klipper repo ] #####

0) Klipper3d/klipper -> master
1) EchoHeim/klipper -> lodge

B) << Back | H) Help [?]

##### Perform action: 1
[>] Repo: EchoHeim/klipper Branch: lodge

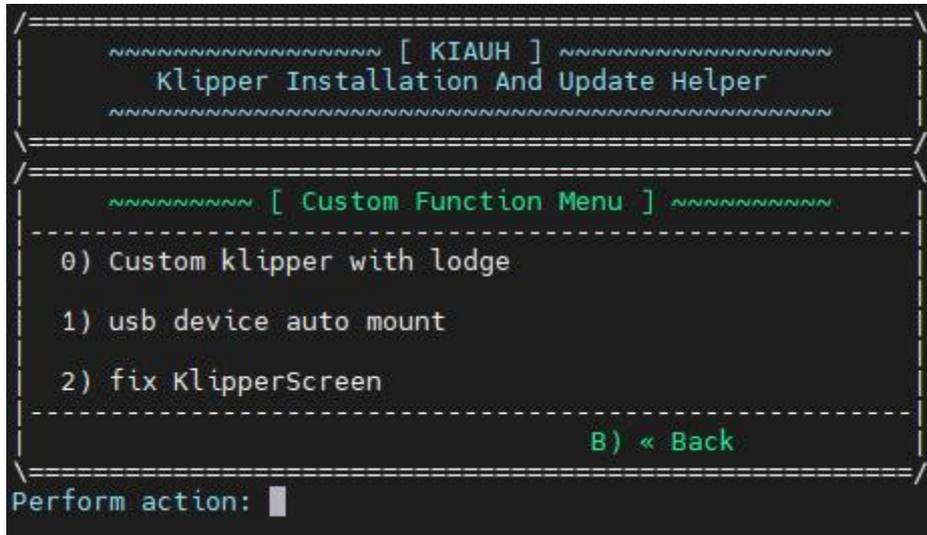
!!! ATTENTION !!!
Existing Klipper folder found! Proceeding will remove
the existing Klipper folder and replace it with a
clean copy of the previously selected source repo!

##### Proceed? (Y/n): █
```

Just confirm.

## 6.3 Fix KlipperScreen

On the KIAUH script Main Menu, select F to enter the Custom Function Menu, and then select 2 to fix.



```

      ~~~~~ [ KIAUH ] ~~~~~
      Klipper Installation And Update Helper
      ~~~~~

      ~~~~~ [ Custom Function Menu ] ~~~~~

      0) Custom klipper with lodge
      1) usb device auto mount
      2) fix KlipperScreen

      B) << Back

Perform action: █

```

## 7 Precautions

1. All unplugging and plugging operations should be performed under the condition of power off, including enabling the eMMC writing.
2. Pay attention to the heat dissipation of CM4 and CB1. The CM4/CB1 may become quite hot if the running application consumes too many system resources.

Other resources for this product can be found on <https://github.com/bigtreotech/>. If you cannot find the resources you need, you can contact our after-sales support.

We want to hear from you if you encounter any other problems while using our products, and we will answer them as quickly as possible; any good ideas or suggestions on our products will also be considered carefully. Thank you for choosing BIGTREETECH. Your support means a lot to us!