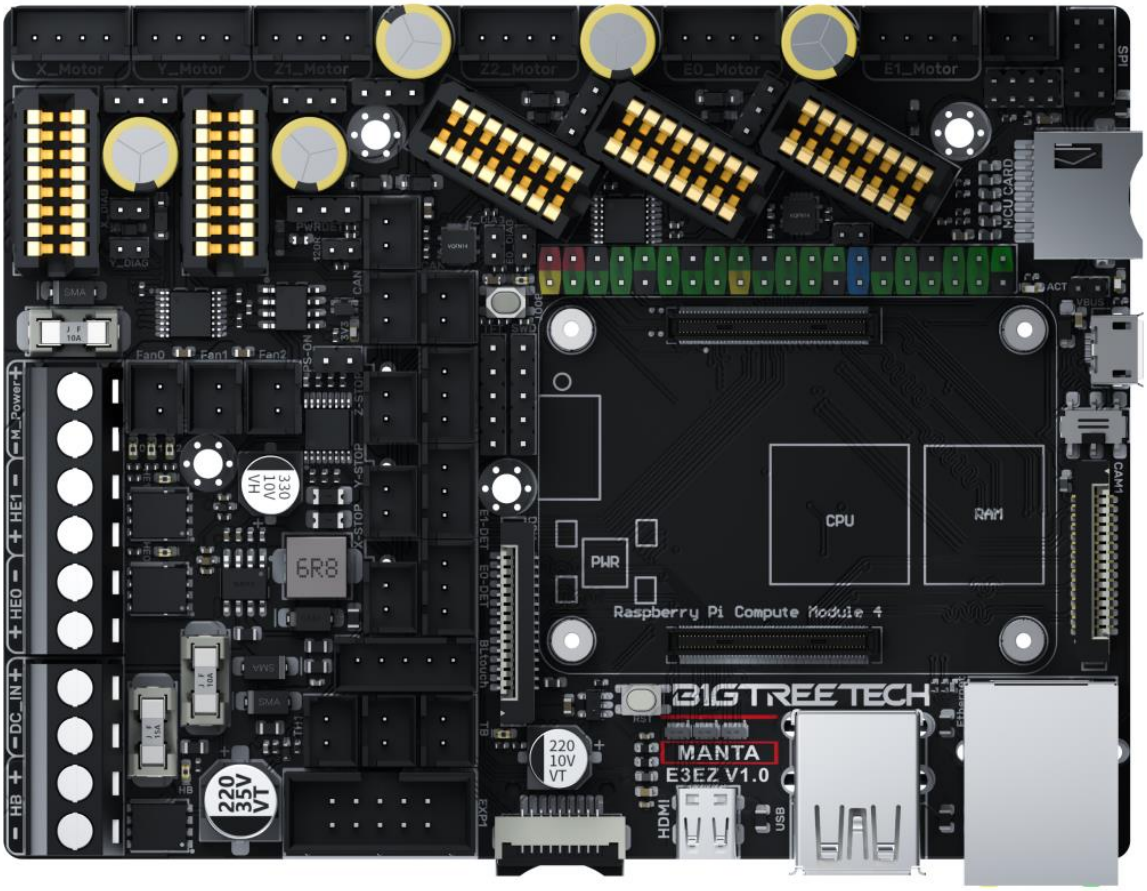
BIGTREETECH MANTA E3EZ V1.0

User Manual



Contents

Revision History

Version	Revisions	Date
01.00	Original	2022/11/07

Product Profile

BIGTREETECH MANTA E3EZ V1.0 is a 32-bit motherboard developed by the 3D printing team of Shenzhen Big Tree Technology Co., Ltd. for Ender-3, Klipper running, and EZ series drivers. It is compatible with Ender-3 motherboard mounting holes. Simply plug in the core board, and your Ender-3 will be able to run Klipper, greatly eliminating the mass wiring between the motherboard and Raspberry Pi, and also greatly saving space in the chassis. The BTB headers are designed on MANTA E3EZ V1.0, 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 STM32G0B1RE MCU.

2. TPS5450-5A power supply chip supports DC12/24V power input, current output rated at 5A max continuous and 6A max instantaneous, sufficient power supply for Raspberry Pi.

3. The thermistor circuit is protected to prevent MCU damage from shorted heated bed and heater cartridge connections.

4. MCU firmware can be upgraded via SD card, or use DFU via Klipper's make flash command.

5. BTB connectors are adopted between the motherboard and core board, allowing the choice of other core board solutions in addition to CM4.

6. Onboard SPI and UART mode of EZ driver, which can be used directly without a jumper.

7. Onboard DIAG pin, easily configurable with jumpers.

8. Support power loss recovery, filament runout sensor, auto power-off, BLTouch, RGB, etc.

9. High-efficiency MOSFET for less heat generation.

10. Replaceable fuse for easy maintenance.

11. Onboard SPI interface for connecting acceleration sensor to enable Klipper's input shaping.

12. The temperature sensor interface adopts a high-precision pull-up resistor.

13. Each motor driver module can select the corresponding motor voltage by jumper caps.

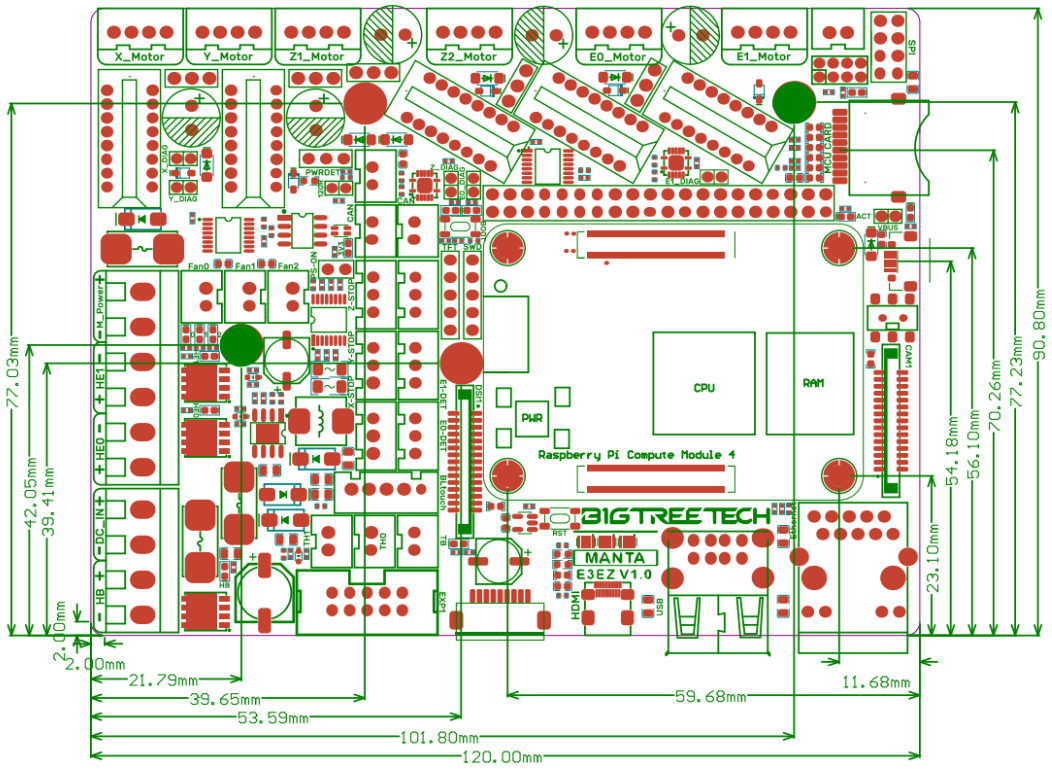
14. The motor power supply supports up to 56V, and for the larger voltage when using EZ5160, an isolation chip is used to protect the main control from burning IO.

Specifications

Dimensions	90.8x120mm, for details please refer to **BIGTREETECH Manta E3EZ V1.0-SIZE.pdf**
Mounting Size	Please refer to **BIGTREETECH Manta E3EZ V1.0-SIZE.pdf**
MCU	ARM Cortex-M0+ STM32G0B1RE 64MHz
Motherboard Power Supply Voltage	DC12V-DC24V
Motor Power Supply Voltage	DC12V-DC56V
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	5A Continuous, 6A Instantaneous
Fan Port	3 x CNC, 2 x Always On
Fan Port Max Current	1A Continuous, 1.5A Instantaneous
Overall Max Current(Heater Cartridge+Driver+All Fans)	＜10A
Expansion Port	BLTouch, PS-ON, PWR-DET, Fil-DET, RGB, CAN FD, SPI
Motor Driver	Support EZ5160, EZ2209, EZ2208, EZ2225, EZ2226, EZ2130, EZ6609...

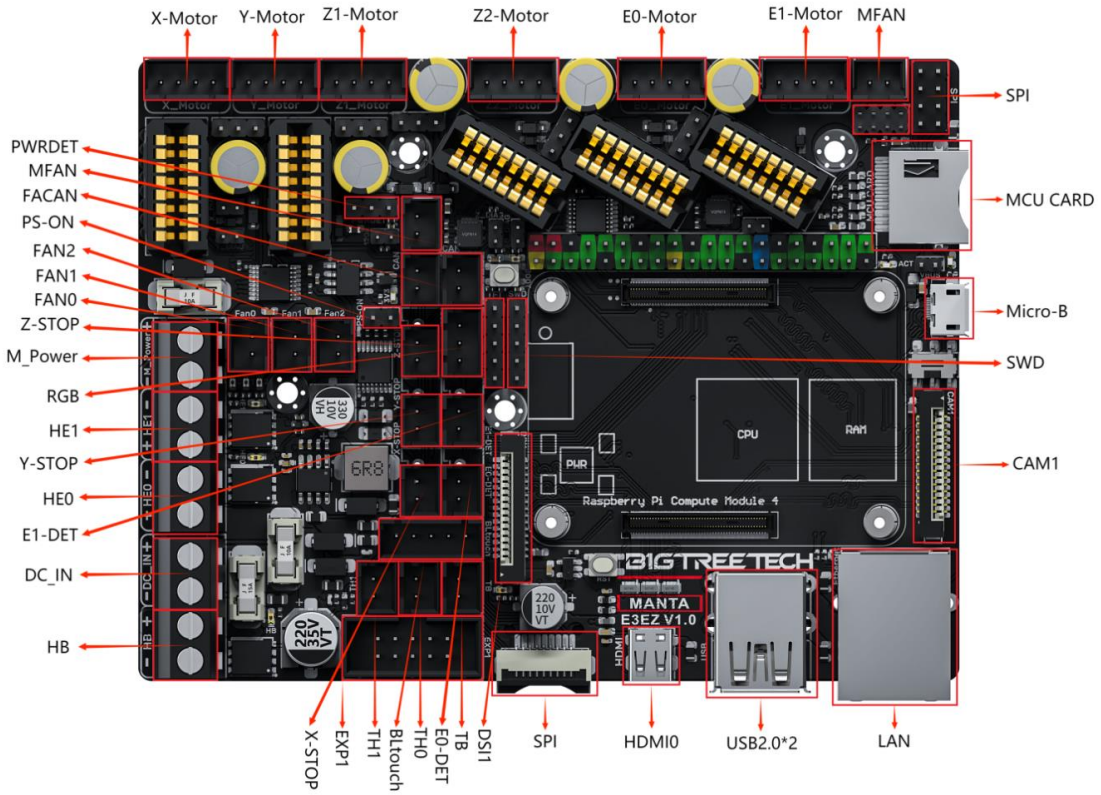
Driver Mode	SPI, UART
Motor Socket	X, Y, Z (Dual Z Axes), E0, E1, 5 Channels in Total
Thermistor	3 x 100K NTC
Display	SPI Touchscreen, LCD Display
PC Connection	Micro-USB
Functional Ports	USB 2.0x2, LAN, DSI, CSI, SPI, 40 Pins GPIO, HDMI0, SOC-Card, MCU-Card
Supported File Format	G-code
Supported Kinematics	Cartesian, Delta, Kossel, Ultimaker, CoreXY
Recommended Slicer/Console	Cura, Simplify3D, Pronterface, Repetier-host, Makerware

Dimensions

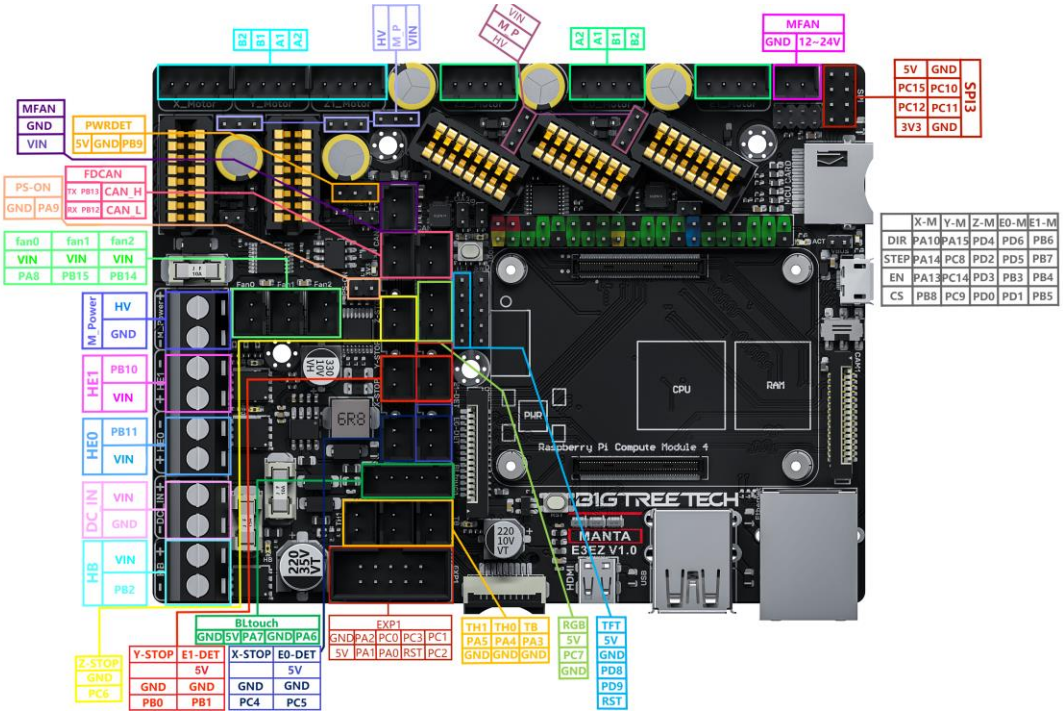


Peripheral Port

Connector Diagram



Pinout Diagram



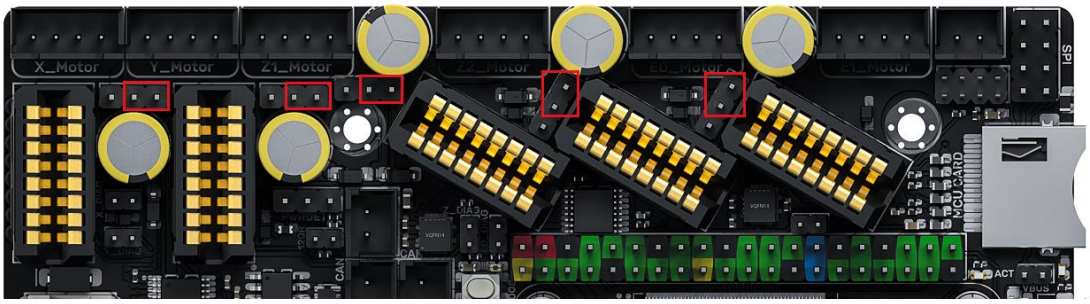
Connection Description

USB Power Supply

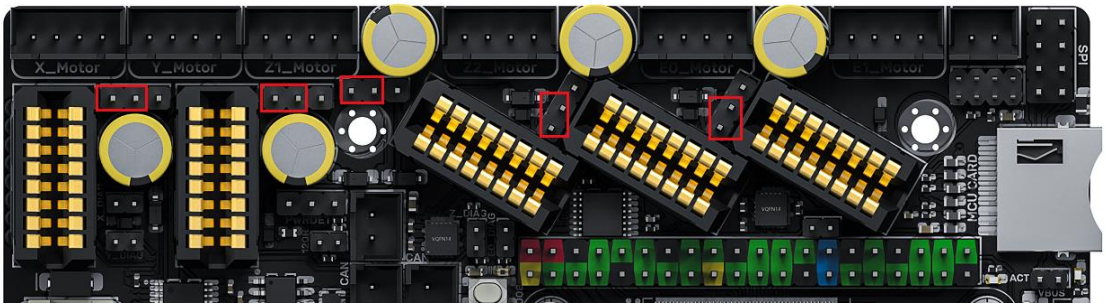
After the BIGTREETECH MANTA E3EZ V1.0 has been powered, the Red light 3V3 will light up, indicating power on. When using only USB to power the board, please insert the jumper cap onto the VBUS.

Motor Voltage Selection

Select Motherboard Supply Voltage



Select Motor Supply Voltage



Stepper Motor Driver

UART/SPI Mode of EZ Driver

Onboard SPI and UART mode of EZ driver, which can be used directly without the need for a jumper.

EZ series drivers support the use of both UART and SPI drivers at the same time.

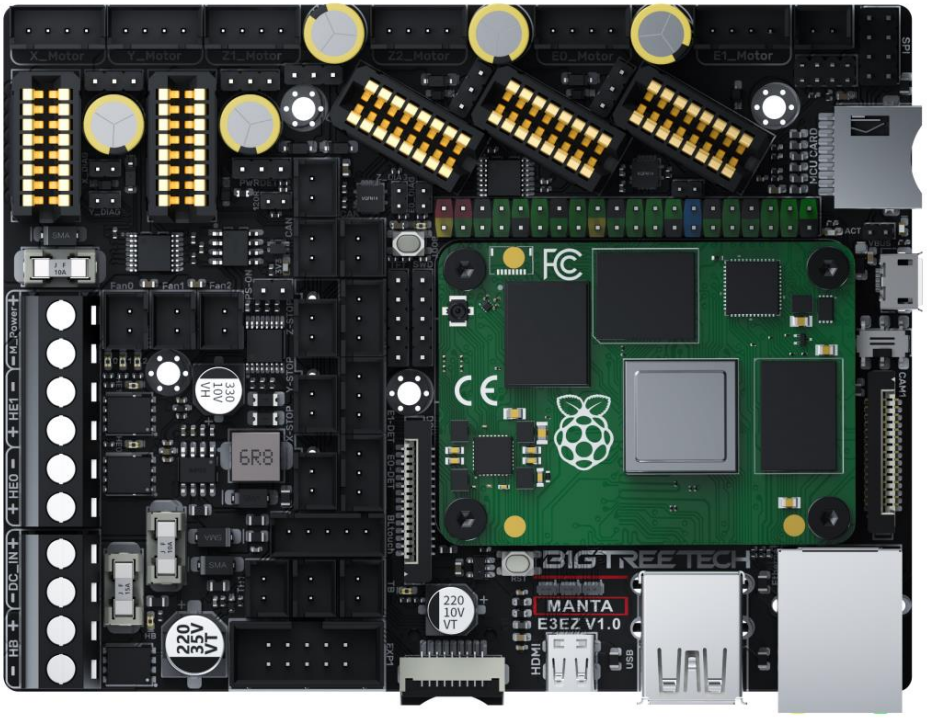
EZ Driver DIAG (Sensorless Homing)

When using sensorless homing, place jumpers according to the diagram below.

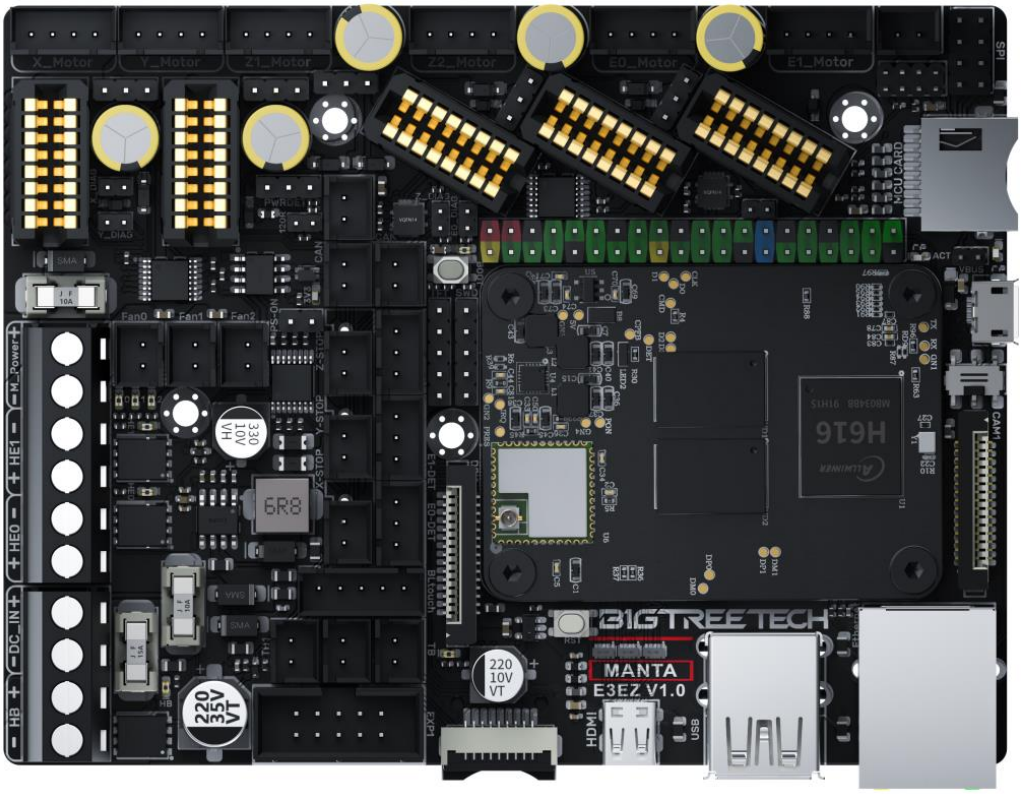
DIAG and limit switches cannot be used at the same time because there will be a level conflict.

Install the Core Board via BTB Connection

E3EZ+CM4: Pay attention to the direction, as shown in the figure below:

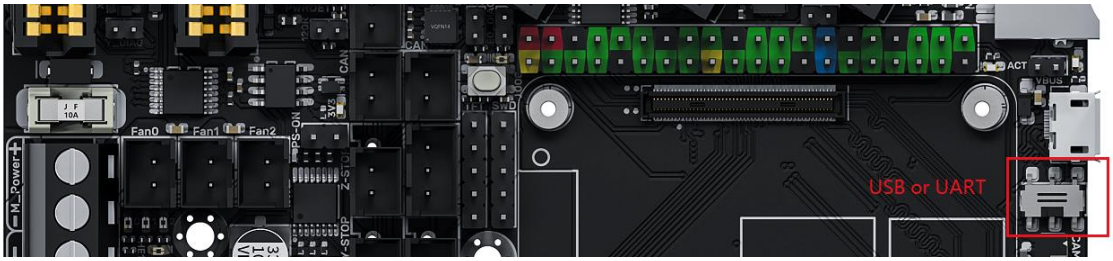


E3EZ+CB1: Pay attention to the direction, as shown in the figure below:

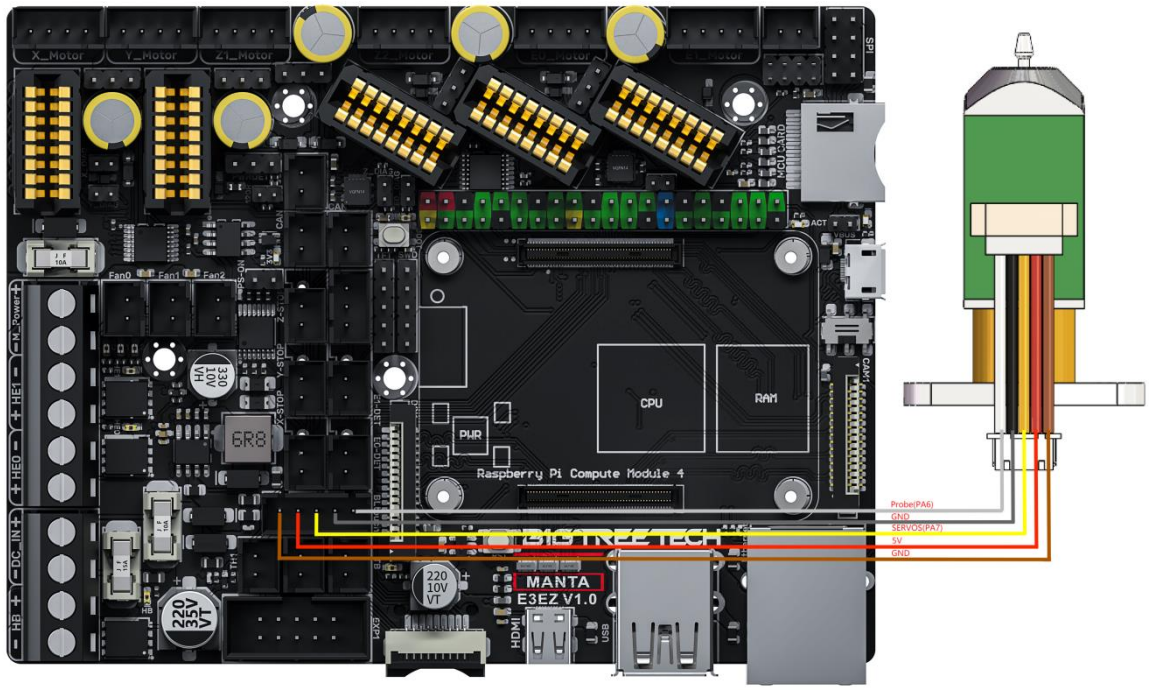


USB or UART Mode

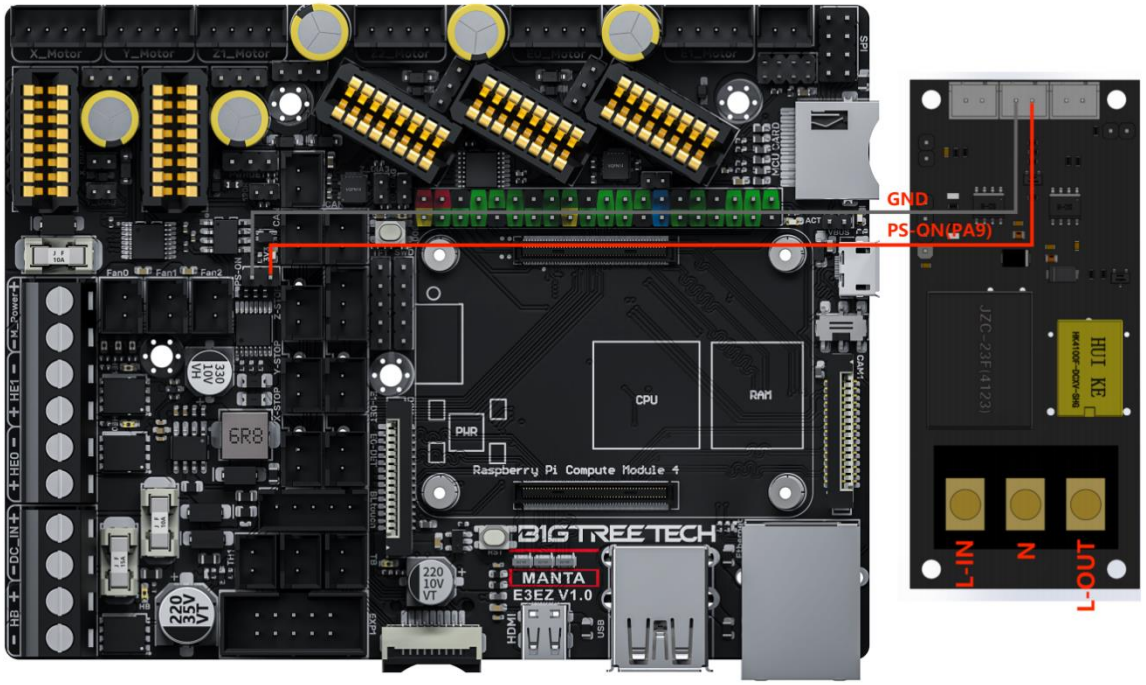
As shown in the figure below, the DPDT switch slides to the right to connect to the UART pin of the core board and slides to the left to connect to the USB-OTG function of the core board. When sliding to the right, you can use the Micro-USB cable to connect with the computer, then a CH340 port will be identified.



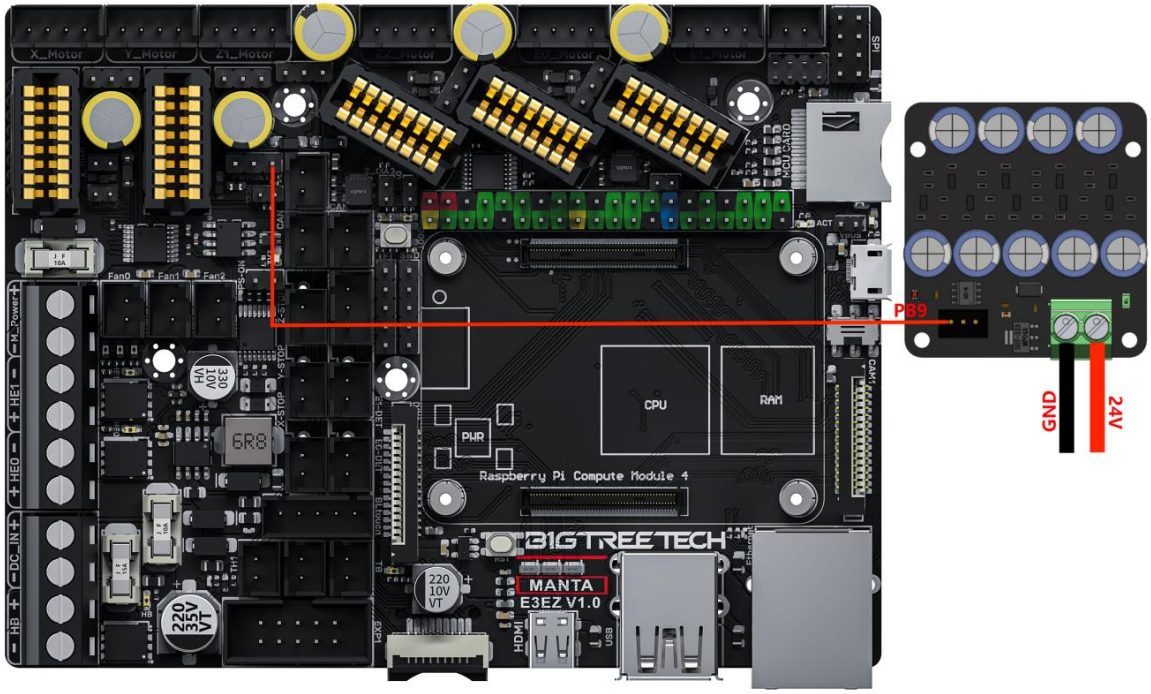
BLTouch Wiring



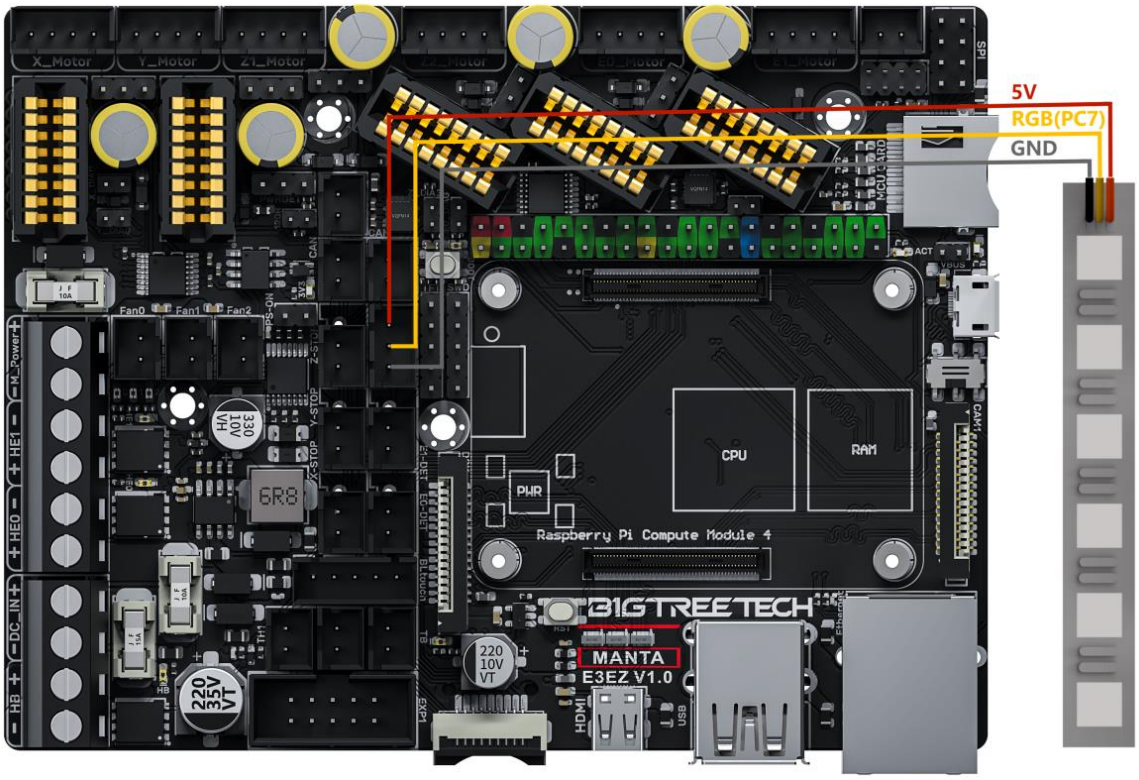
Auto Power Off (Relay V1.2) Wiring



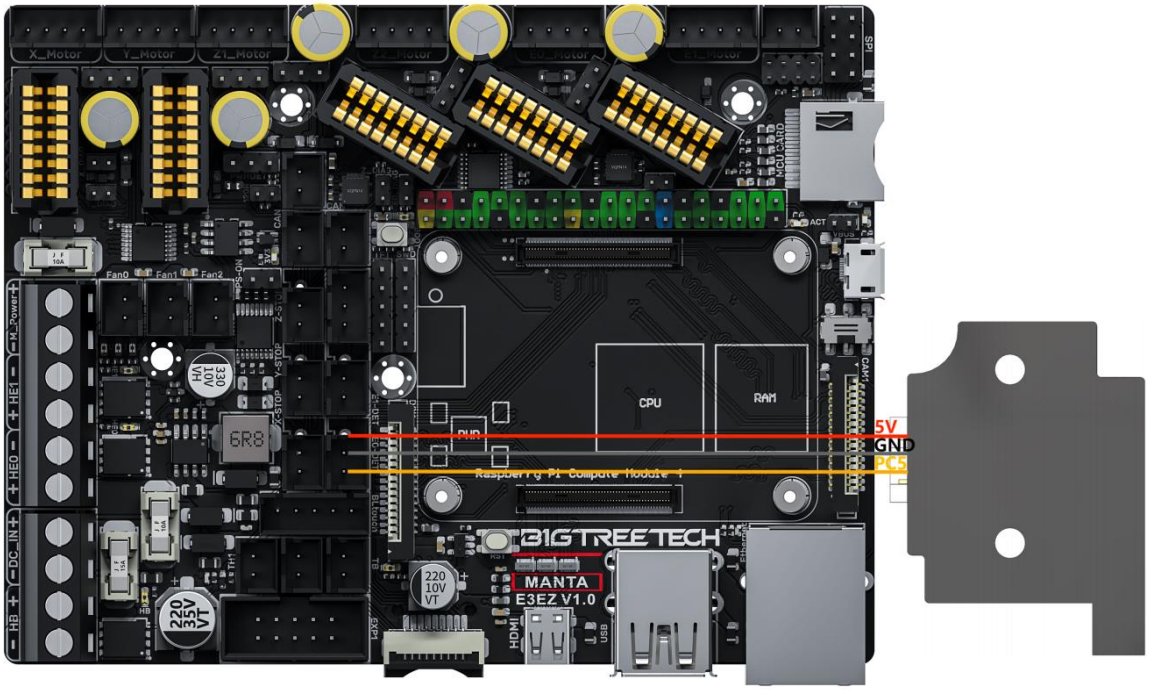
Power Loss Recovery (UPS 24V V1.0) Wiring



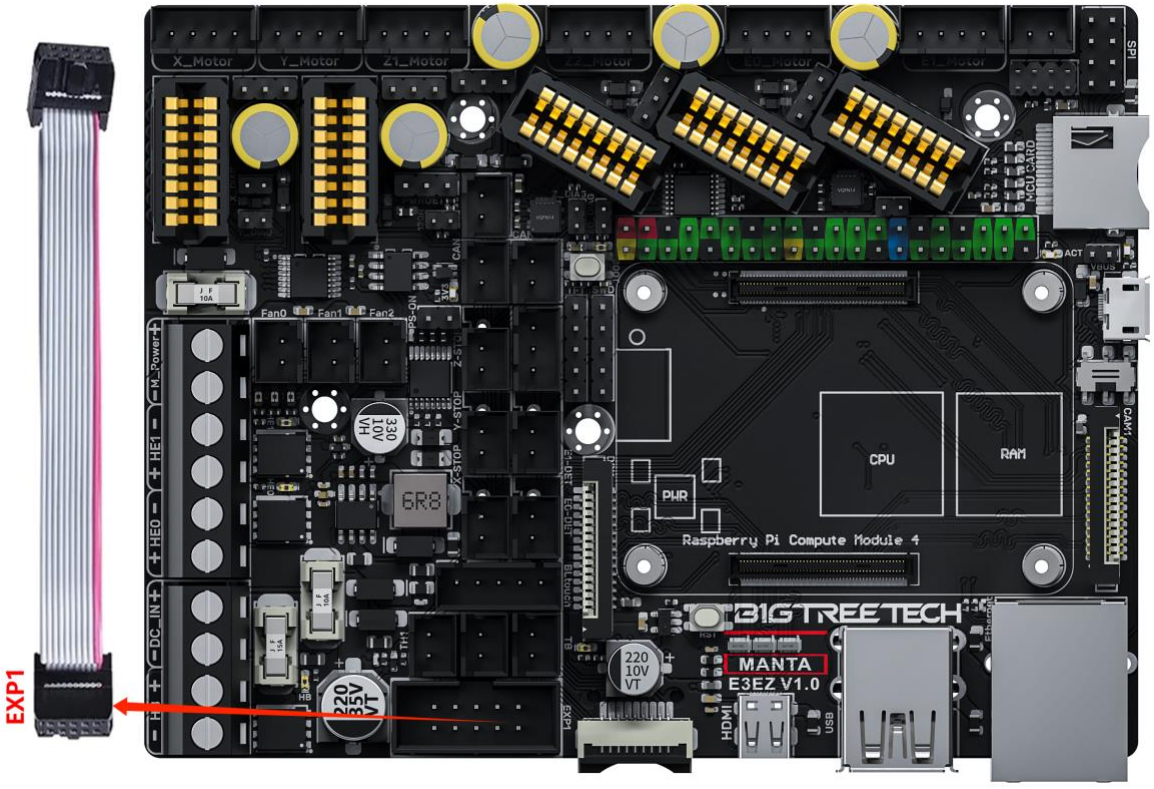
RGB Wiring



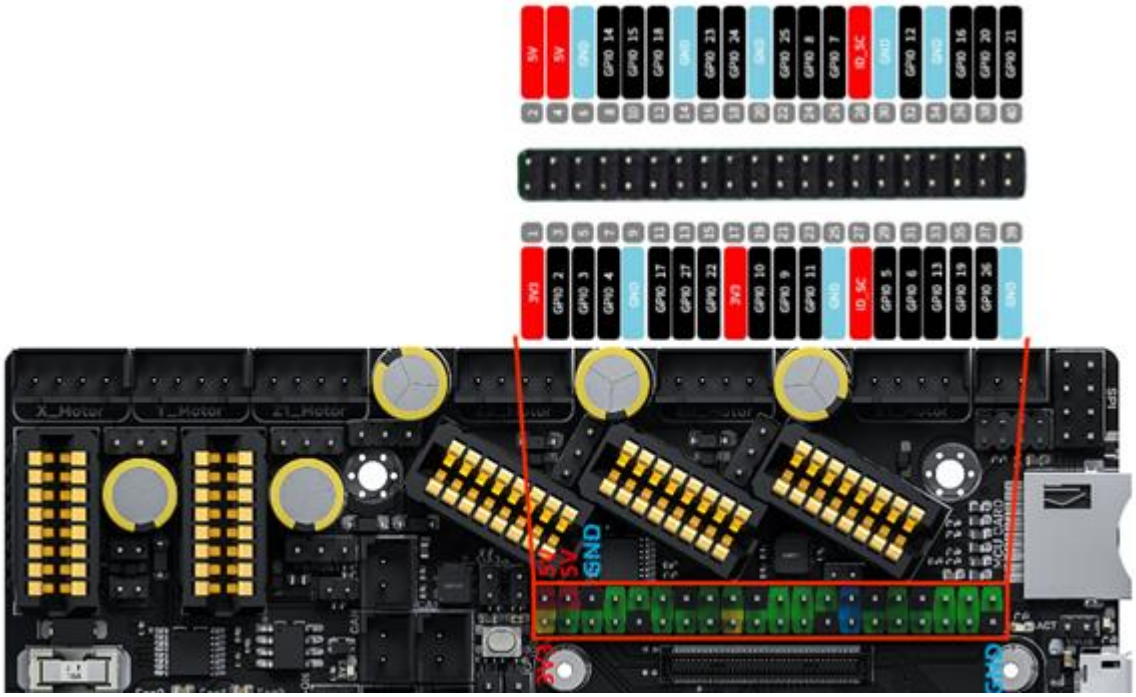
Filament Sensor Wiring



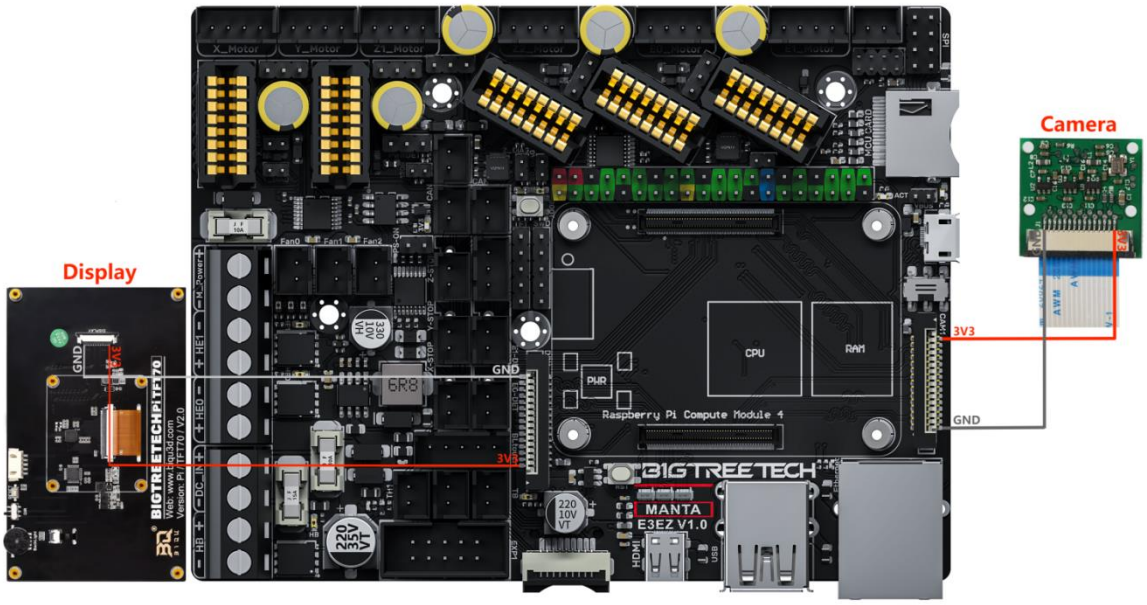
LCD Screen Wiring



40 Pins GPIO



DSI, CSI Wiring



Raspberry Pi CM4 Usage Instructions

Download OS Image

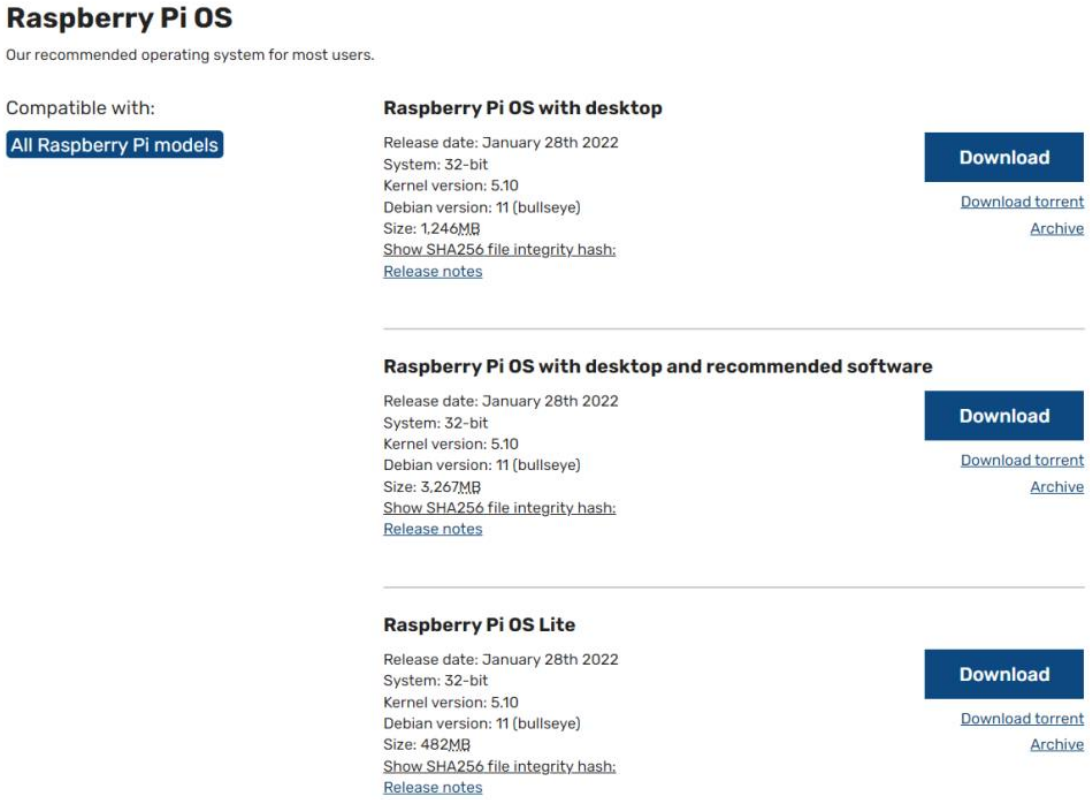
When using CM4, download the image of Fluidd, Mainsail directly, also, you can download a pure OS image from the Raspberry Pi official website and install it yourself.

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 Raspberry Pi 3B, 4B, etc., CM4 needs to refer to the system settings section to enable the system's USB, DSI, and other interfaces).



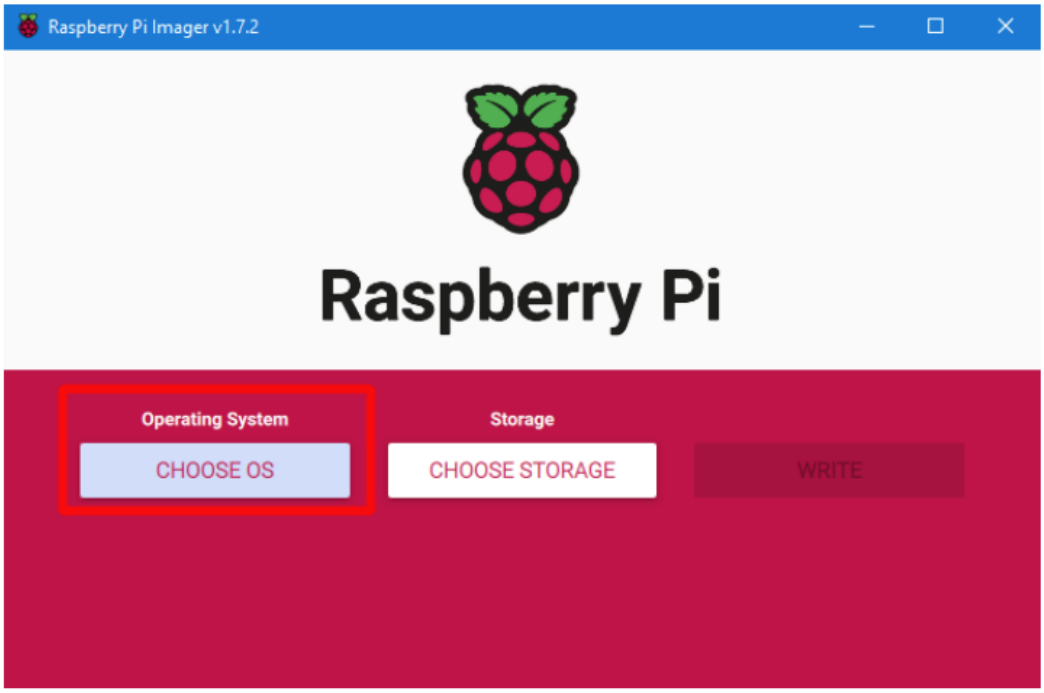
Download and Install Raspberry Pi Imager

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

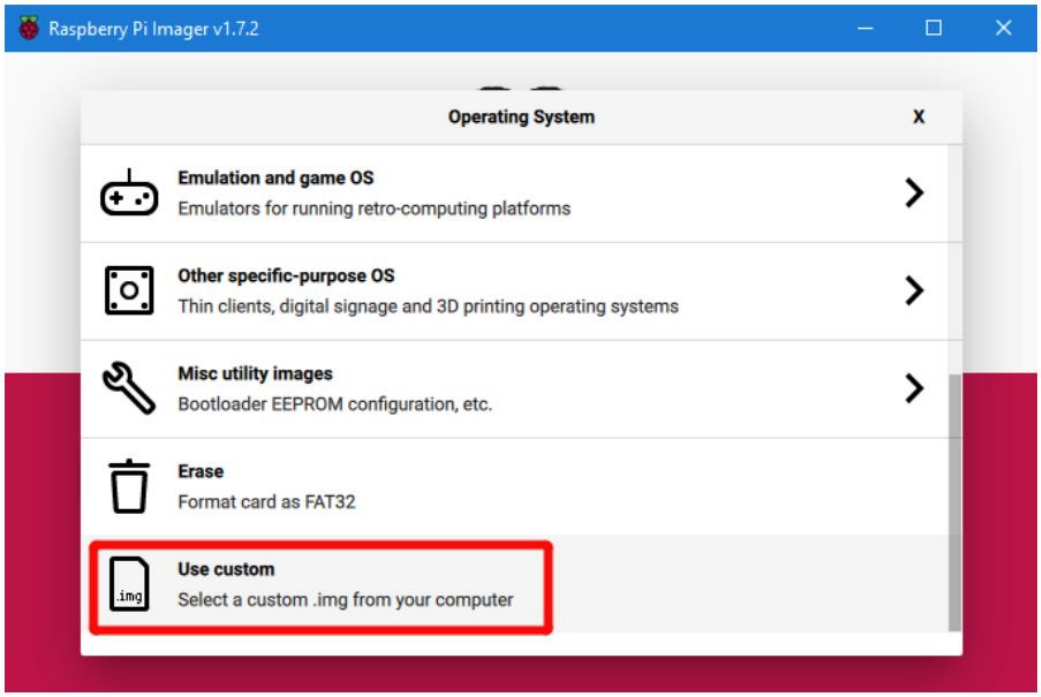
Write OS

CM4 LITE Version (MicroSD Card)

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

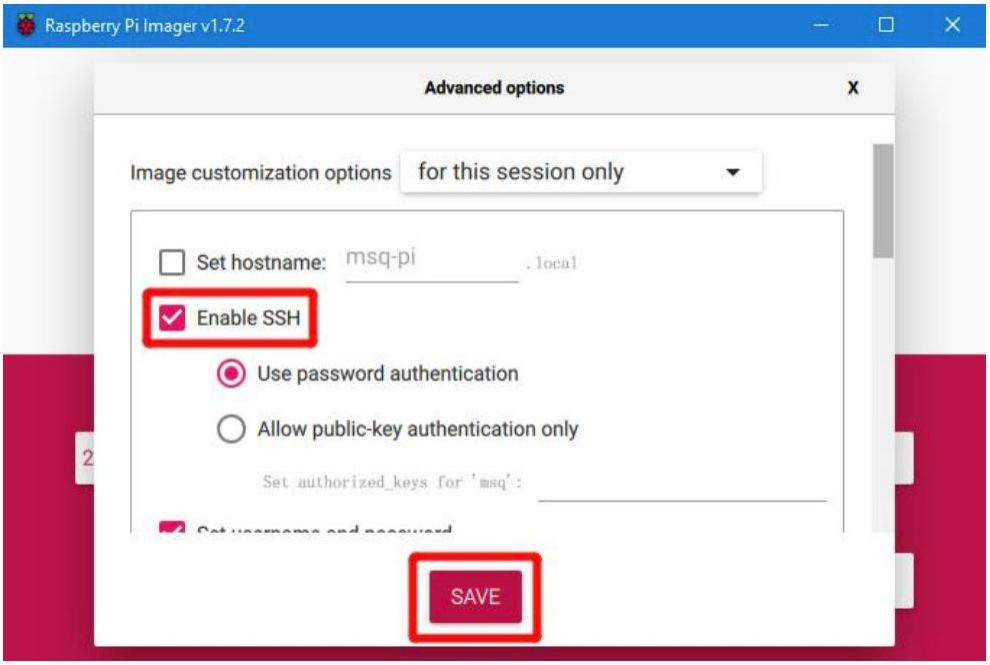


3. Select "Use custom", then select the image that you downloaded.



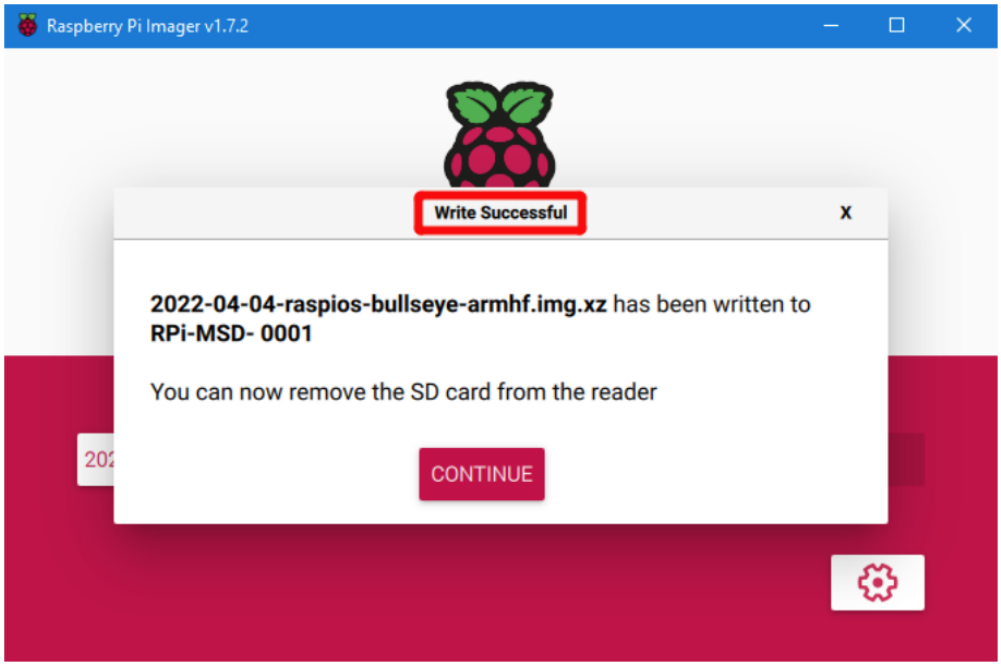
4. Click the settings icon in the lower right corner.

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

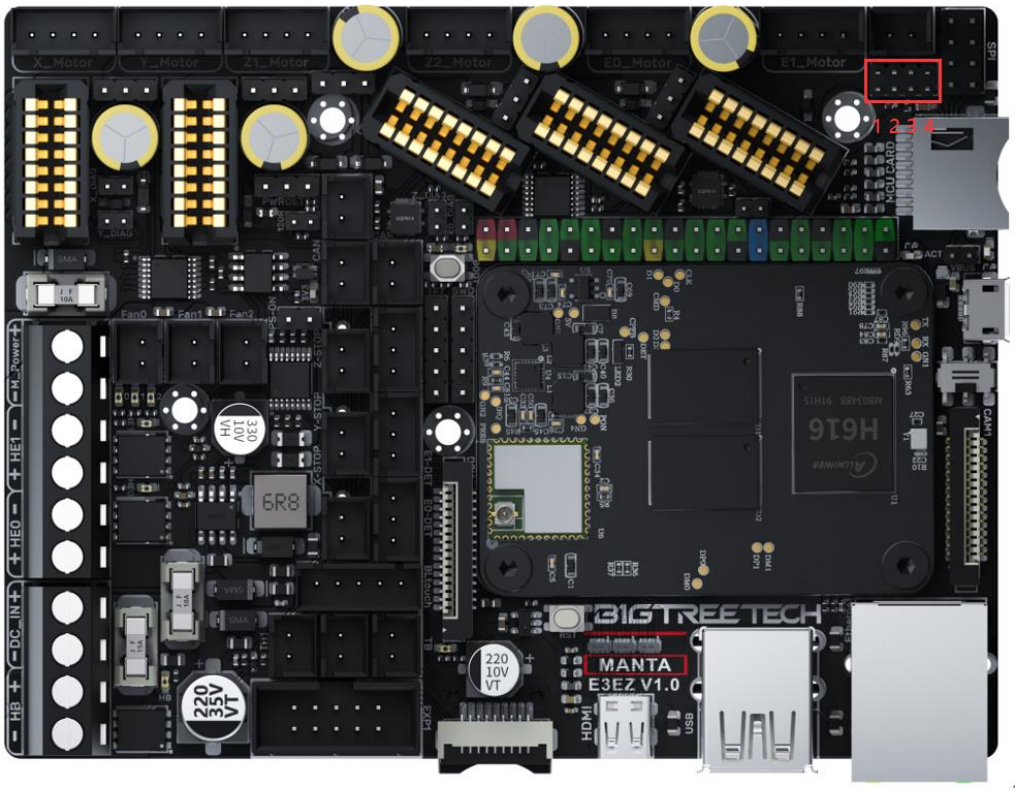
   For Windows::

   http://github.com/raspberrypi/usbboot/raw/master/win32/rpiboot_setup.exe

   For Mac and Linux:

   https://github.com/raspberrypi/usbboot#building

2. Plug jumpers on 4 (USBOTG), 3 (RPIBOOT) to enter BOOT mode.



3. Plug the Micro USB 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 the same as the LITE version.

5. When the writing is complete, remove the jumpers from 4 (USBOTG) and 3 (RPIBOOT), and then enter the normal working mode after powering on again.

System Setting (CM4)

USB 2.0 Hub

E3EZ 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 E3EZ 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.

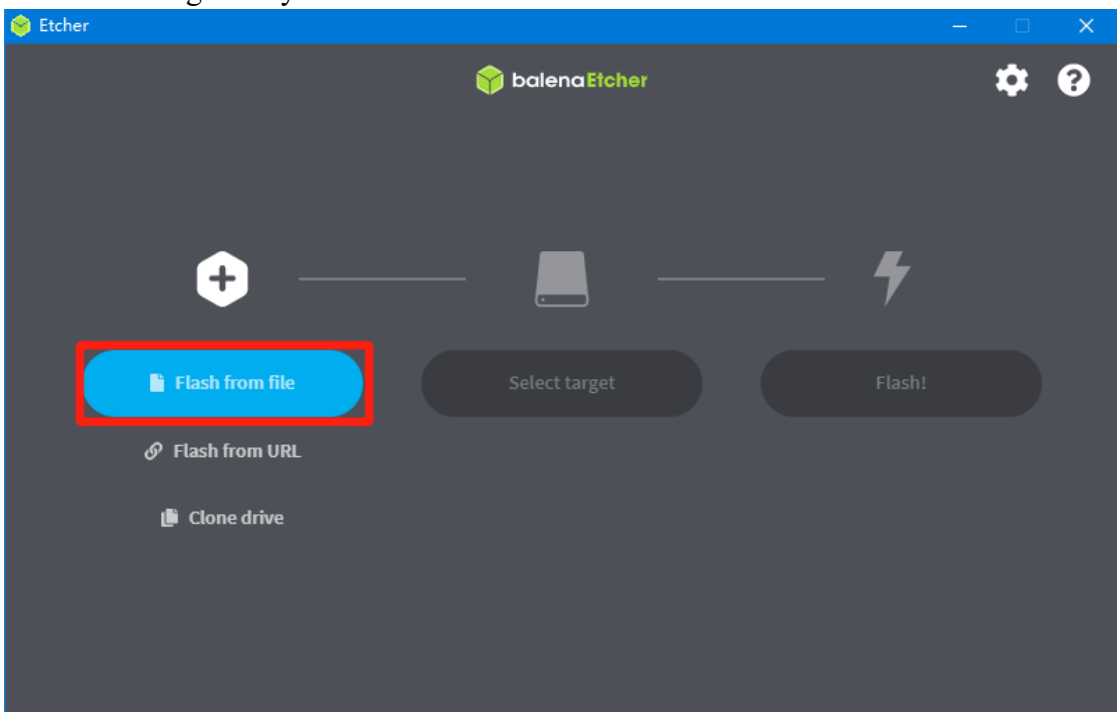
https://github.com/bigtreetech/CB1/releases

Download and Install balenaEtcher

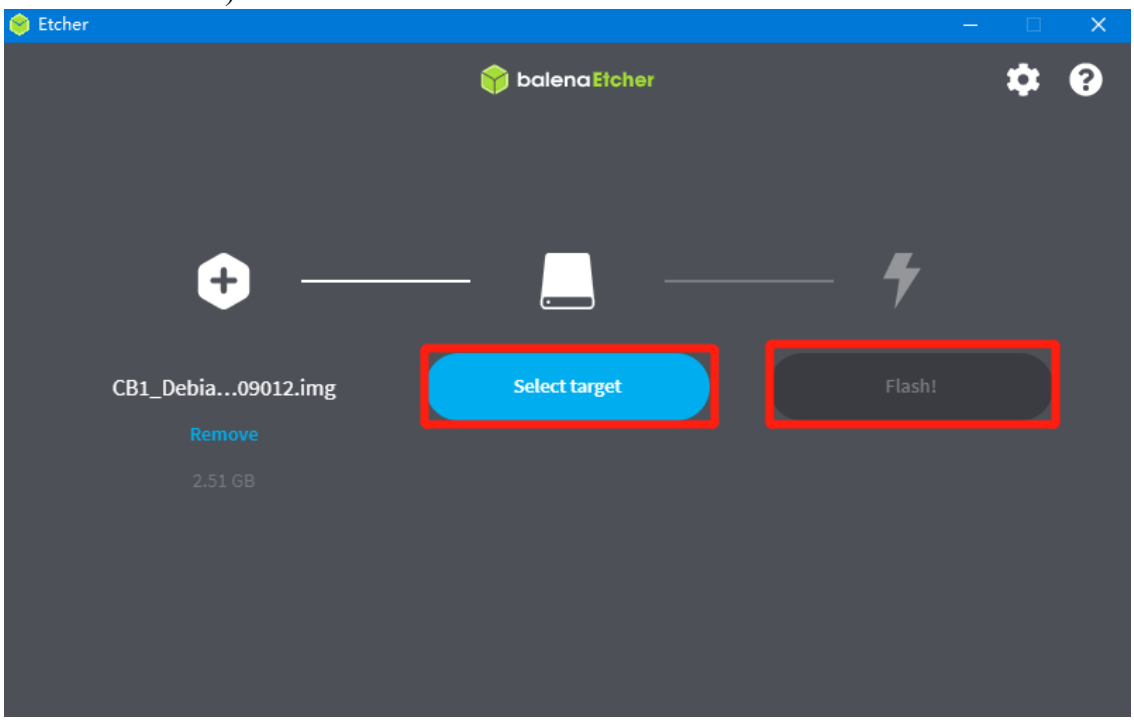
BalenaEtcher: https://www.balena.io/etcher/

Write OS

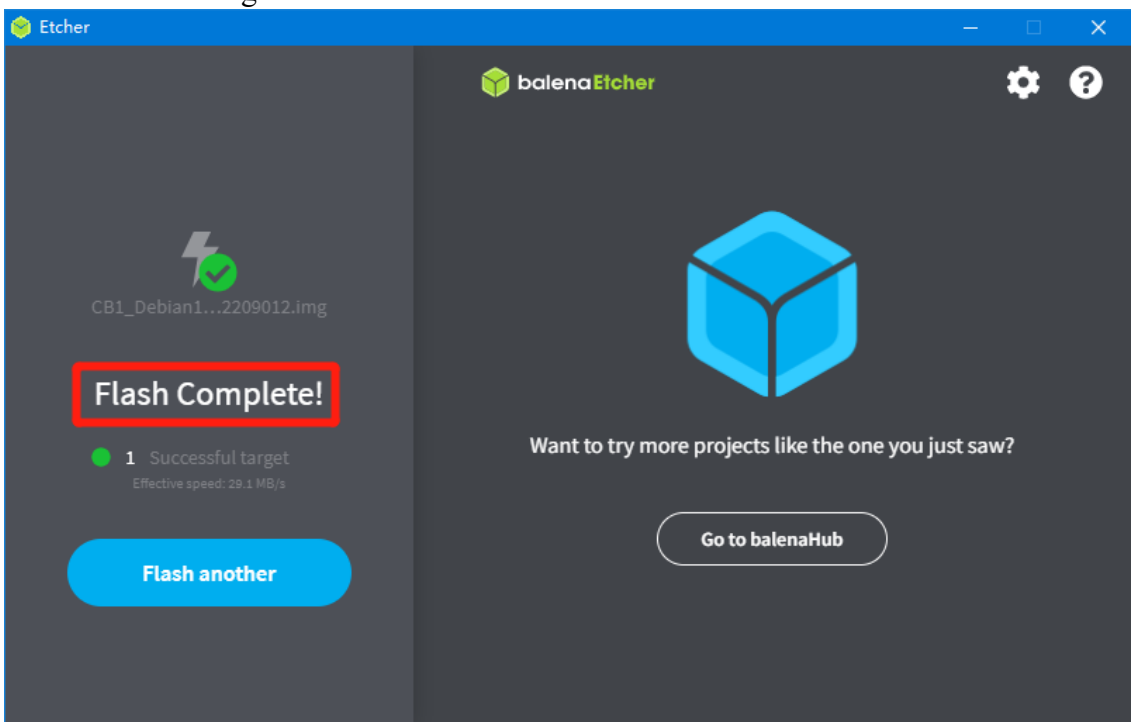
1. Insert a MicroSD card into your computer via a card reader.
2. Select the image that you downloaded.



3. 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).



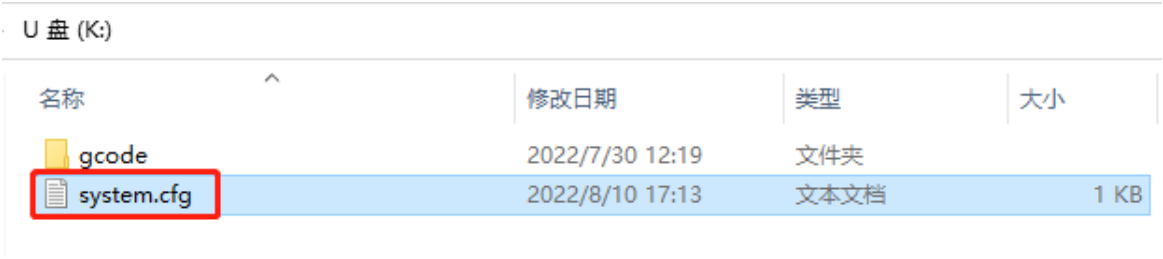
4. Wait for the writing to finish.



WiFi Setting

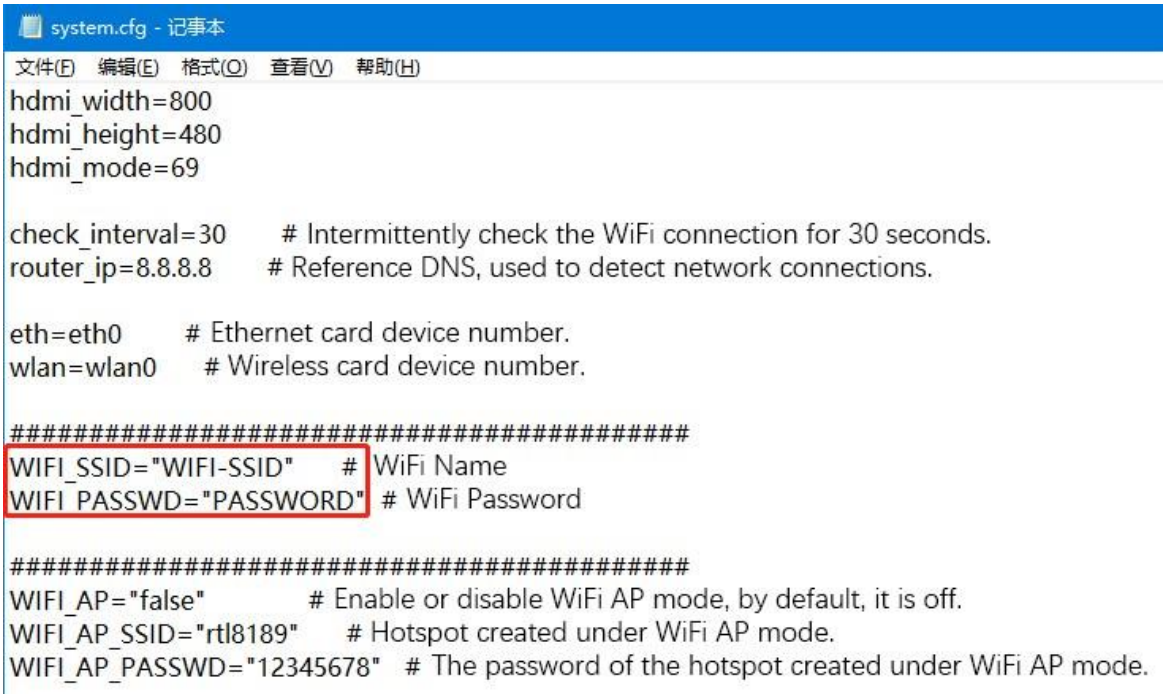
Note: This step can be skipped if you are using a network cable connection.

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



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

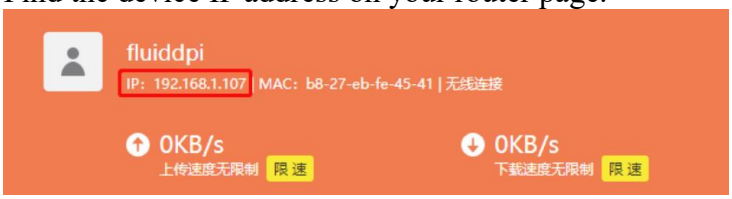
PASSWORD with your password.



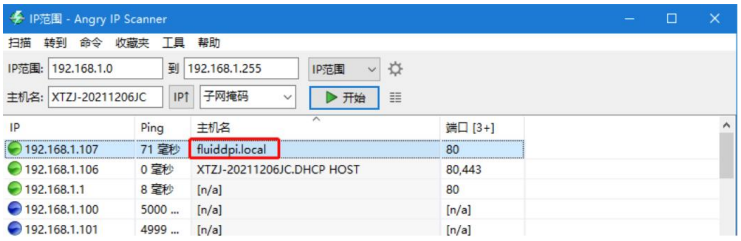
Configure the Motherboard

SSH Connect to Device

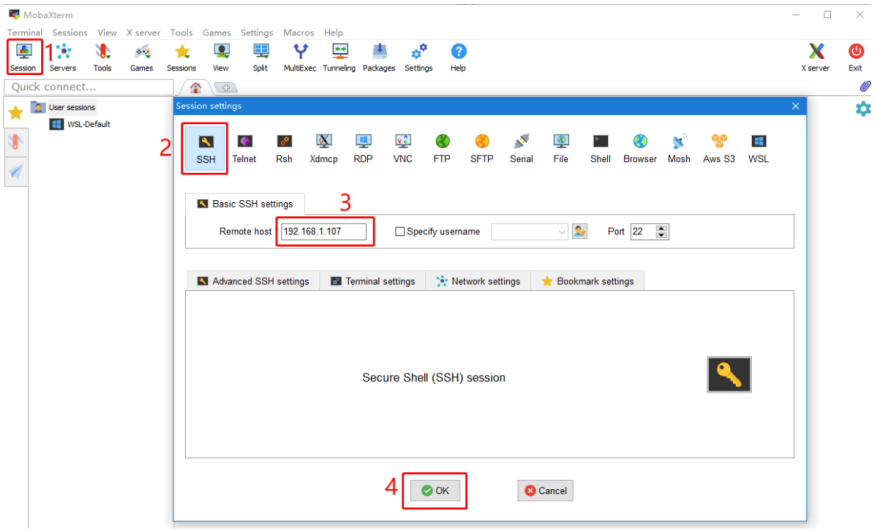
1. Install the SSH application Mobaxterm: https://mobaxterm.mobatek.net/download-home-edition.html
2. Insert MicroSD card to E3EZ, and wait for the system to load after power on, approx. 1-2min.
3. The device will automatically be assigned an IP address after successfully connecting to the network.
4. 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, Hurakan (CB1), as 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 under the same network).



7. Login:

CM4:

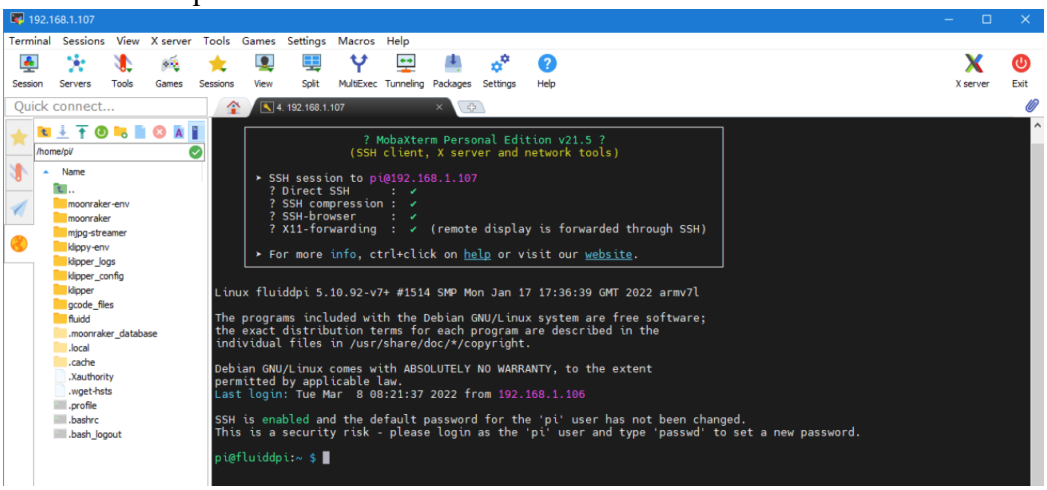
Login as: pi

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**

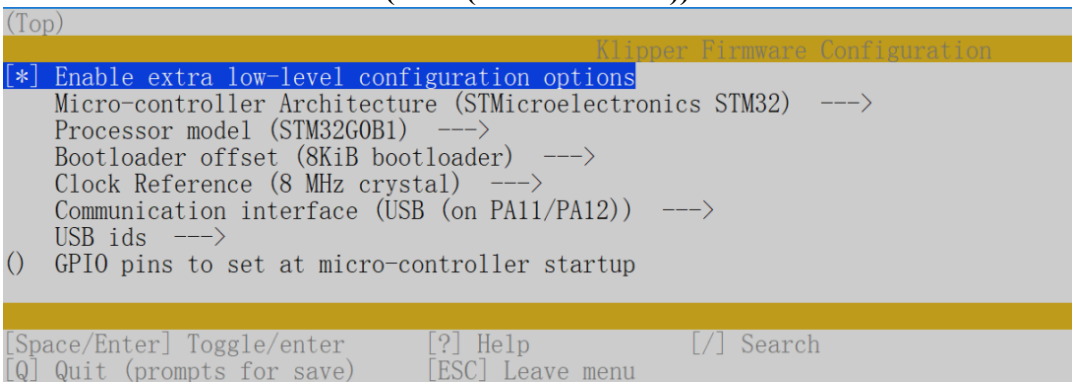
*** Micro-controller Architecture (STMicroelectronics STM32) --->**

*** Processor model (STM32G0B1) --->**

*** Bootloader offset (8KiB bootloader) --->**

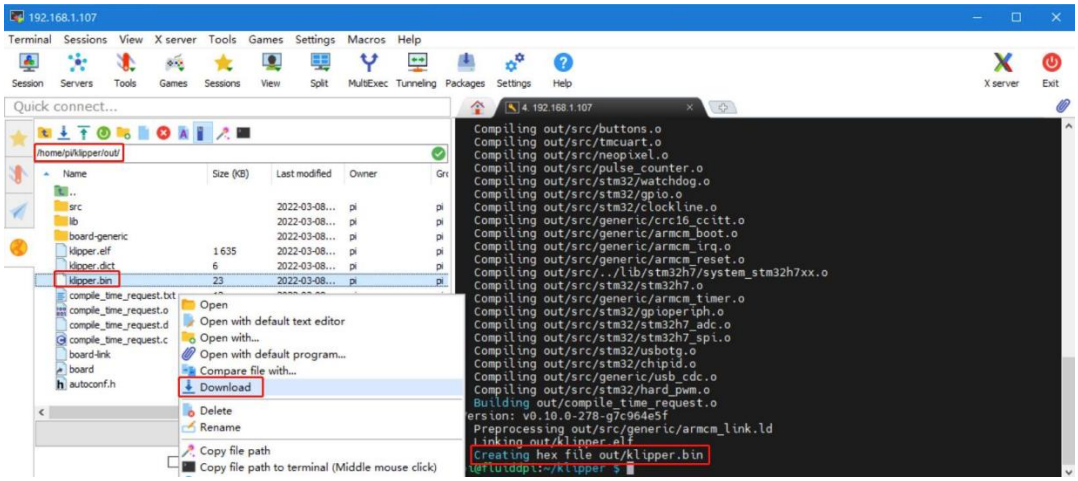
*** Clock Reference (8 MHz crystal) --->**

*** 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 the **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 E3EZ, 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

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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
```
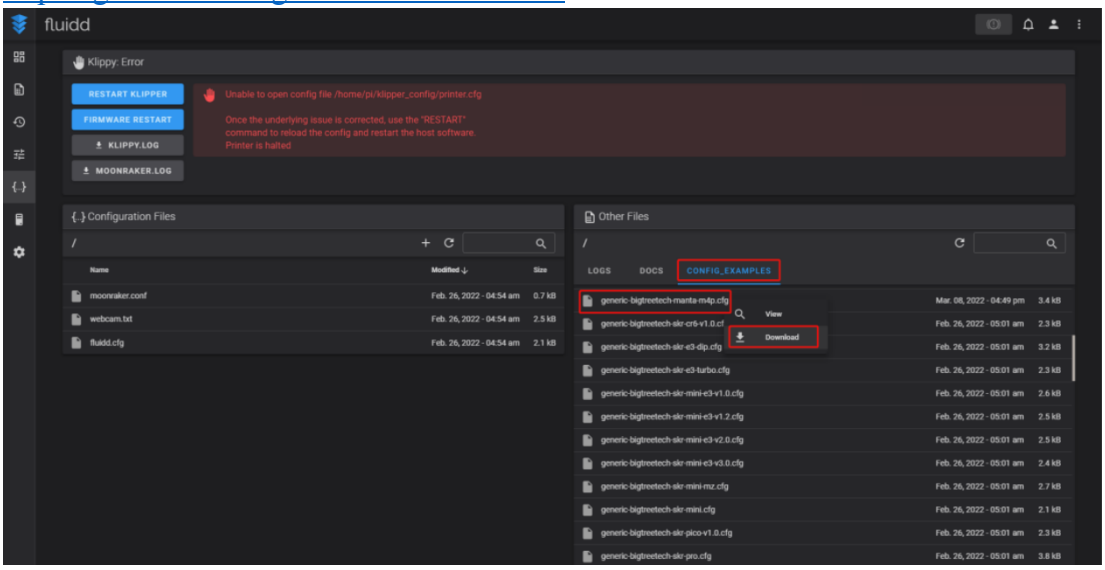
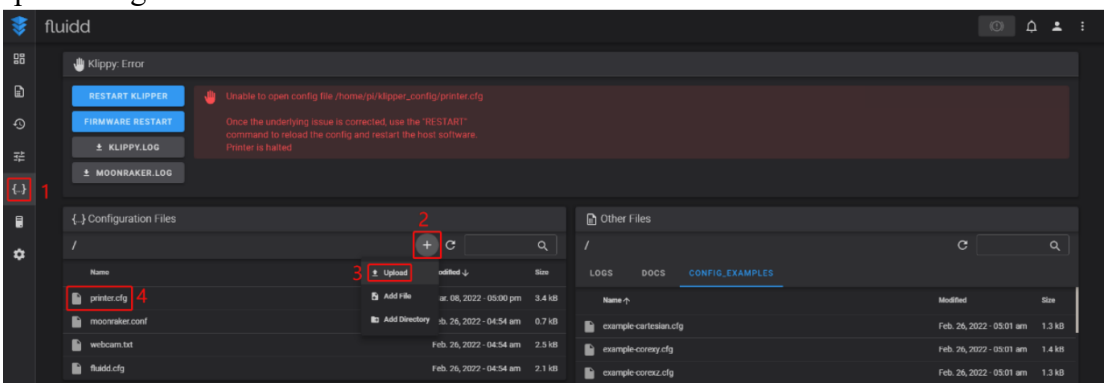

After the writing is completed, there will be an error message: dfu-util: Error during download get_status, just ignore it.

Configure Klipper

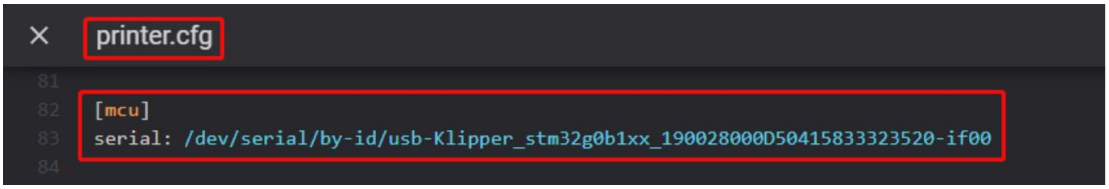
1. Enter your device IP address into your browser, and find the reference config for the motherboard in the directory shown below, if there is no such config available, update your Klipper source code to the newest version or download it from GitHub: https://github.com/bigtreetech/Manta-E3EZ



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

1. Maximum heated bed current is 10A, if high power heated bed is preferred, please use 24V to power the system and use a 24V heated bed.
2. Except for HDMI, USB, and RJ45, unplugging and plugging operations should be performed under the condition of power off, including the eMMC writing function.
3. Pay attention to the heat dissipation of CB1/CM4. If the running application consumes too many system resources, CB1/CM4 will get hot quite seriously.
4. The MicroSD card slot is not spring loaded, please be careful when inserting the MicroSD card to prevent damage to the card slot. BTT is not responsible for any damage caused by forcefully inserting the MicroSD card.

FAQ

Q: Max current of heated bed, heater cartridge, fan port?
A: Heated Bed: 10A Continuous, 11A Instantaneous
Heater Cartridge: 5.5A Continuous, 6A Instantaneous

Fan Port: 1A Continuous, 1.5A Instantaneous

The combined current of heater cartridge, driver and fan port should not exceed 10A.

Q: Cannot update firmware with SD card
A: Make sure your SD card is formatted to FAT32, firmware file name is "firmware.bin", make sure your system is showing file suffix, if suffix is hidden, "firmware.bin" will be shown as "firmware".