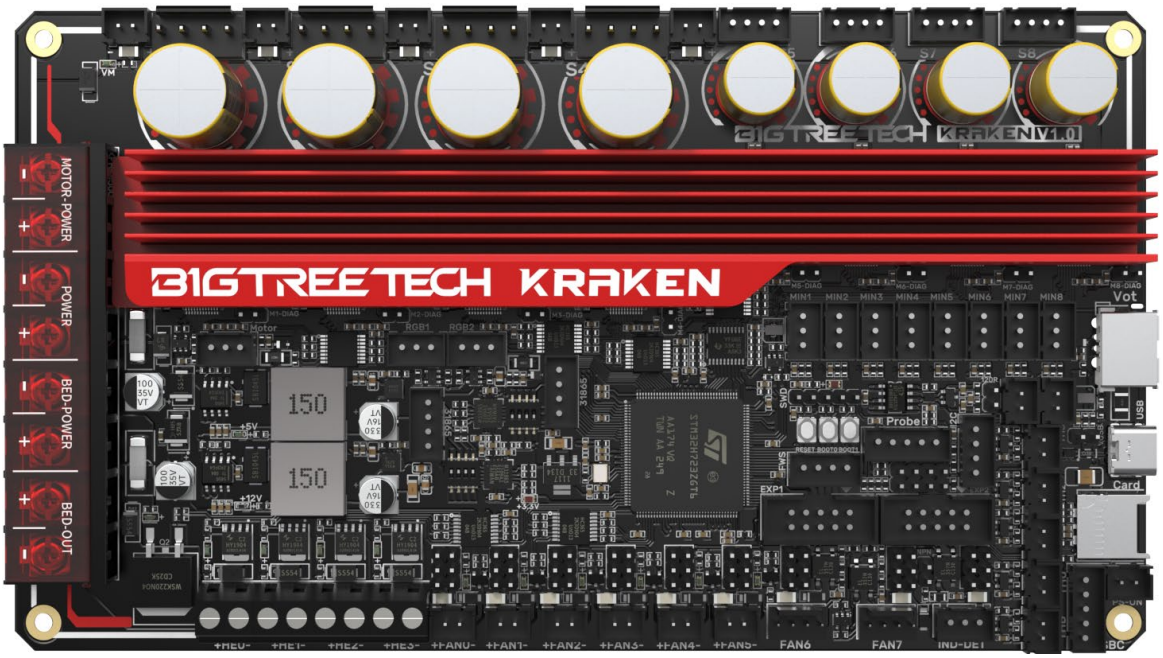
BIGTREETECH

KRAKEN V1.0

User Manual



Revision Log

Version	Date	Revisions
v1.00	22nd December 2023	Initial Version

CONTENT

Product Profile

BIGTREETECH Kraken V1.0 is a 32-bit motherboard for large printers. It comes with onboard high-voltage, high-current stepper motor drivers, significantly simplifying the connection between the motherboard and high-voltage drivers and saving space in the chassis. The board uses silkscreened ID design with an ID-design heat sink for aesthetics and practical cooling.

Features Highlights

- Utilizes a 32-bit ARM Cortex-M7 series STM32H723ZGT6 MCU with a main frequency of 550 MHz.
- TPS5450-5A power chip, supporting DC12/24V power input. This chip provides an output current of up to 5A, peaking at 6A, perfectly supporting Raspberry Pi power supply.
- The motherboard has a reserved BOOT button, allowing users to update the bootloader via DFU mode.
- The thermistor circuit is protected to prevent MCU damage from shorted heated bed and heater cartridge connections;
- Selectable voltage (24V, 12V, 5V) for PWM fan, eliminating the need for external voltage conversion modules, thereby reducing the likelihood of motherboard damage.
- Onboard two MAX31865 modules, supporting dual PT thermocouples and compatible with two or four-wire PT100/PT1000, facilitating DIY usage for customers.
- Firmware can be upgraded via MicroSD card or through the Klipper's `make flash` command via DFU.
- Onboard 8 TMC2160 drivers in SPI mode with DIAG function pins; simply plug and unplug jumpers for easy use.
- Reserved interfaces for Filament Detection, Auto Power-Off, Probe, RGB, I^2C, Servo, EXP1+EXP2, CAN, UART (SBC), and USB A power output.
- High-performance MOSFETs to reduce heat generation.
- Replaceable fuses for easy replacement.
- 2x 4-pin fan interfaces with selectable voltages of 24V, 12V, and 5V, also suitable for water cooling setups.
- Onboard proximity switch port, supports NPN and PNP types, 24V, 12V, 5V voltage selectable;

- Reserved SPI interface for connecting an accelerometer for Klipper resonance compensation.
- External DC12V powers the MOSFET control power for TMC2160, reducing driver output impedance and chip heat generation.

Specifications

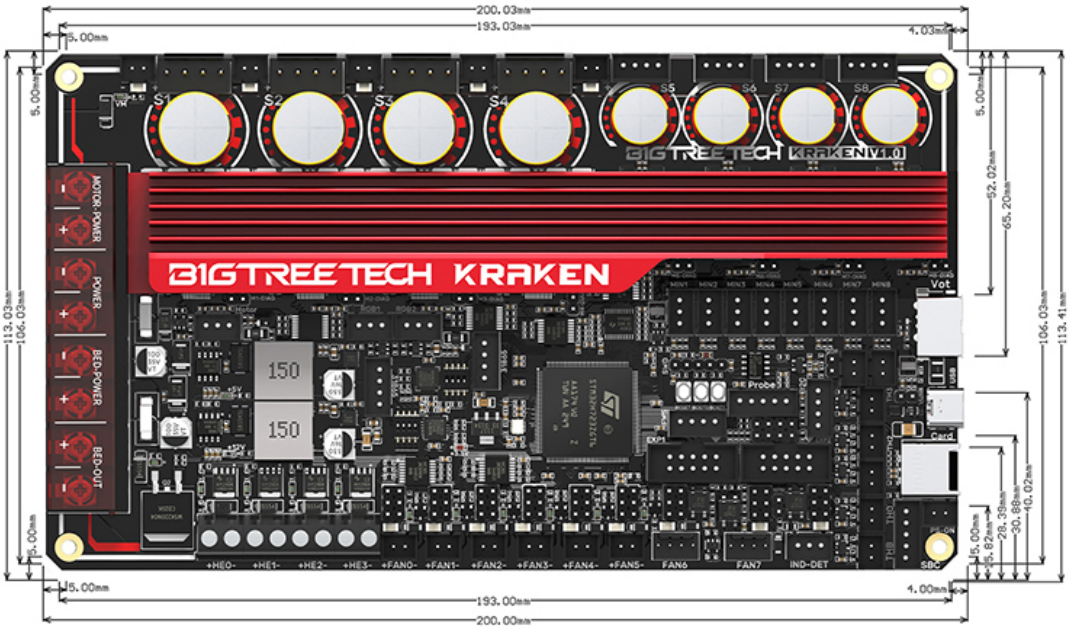
MCU	ARM Cortex-M7 STM32H723ZGT6 550MHz
Driver Input Voltage	HV (24-60V)
Motherboard Input Voltage	DCIN = DC12V or DC24V
Heated Bed Input Voltage	BED IN = DC12V or DC24V
Logic Voltage	DC3.3V
Heating Interface	Heating Interface: Heated Bed (HB), Heater Cartridge (HE0, HE1, HE2, HE3)
Max Heated Bed Output Current	10A, peak 11A
Max Heater Cartridge Output Current	6A, peak 6.5A
Fan Interfaces	6x 2-pin PWM Fans (FAN0, FAN1, FAN2, FAN3, FAN4, FAN5), 2x 4-pin PWM Fans (FAN6, FAN7), 5x Always-On Fan, PWM Fans Voltage (5V, 12V, 24V) Selectable
Max Fan Output Current	1A, peak 1.5A
Total Current for Heater Cartridge + Fans	Less than 14A
Motherboard Max 5V Output Current	5A (peak 6A)
Motherboard Max 12V Output Current	5A (peak 6A)
Expansion Interfaces	Probe (Servos, Probe), Servo, Filament Sensor, PS-ON, I²C, RGBx2, SPI, SBC (UART), EXP1+EXP2,

	CANx2, PT100/PT1000x2, USB-A 5V Power, Endstop Portx8, etc.
Motor Drivers	Onboard TMC2160, support 24-60V, Max 8A driving current for S1-S4(Rsense=22mR), Max 3A for S5-S8(Rsense=75mR)
Driver Modes	SPI
Motor Interfaces	S1, S2, S3, S4, S5, S6, S7, S8
Temp Sensor Interfaces	5x 100K NTC, 2x MAX31865
Display	LCD
PC Communication	Type-C
Supported Kinematics	Cartesian, Delta, Kossel, Ultimaker, CoreXY
Recommended Slicer/Console	Cura, Simplify3D, Pronterface, Repetier-host, Makerware
Dimensions	200 x 113mm
Mounting Dimensions	for details please refer to **BIGTREETECH Kraken V1.0-SIZE.png**

Firmware Support

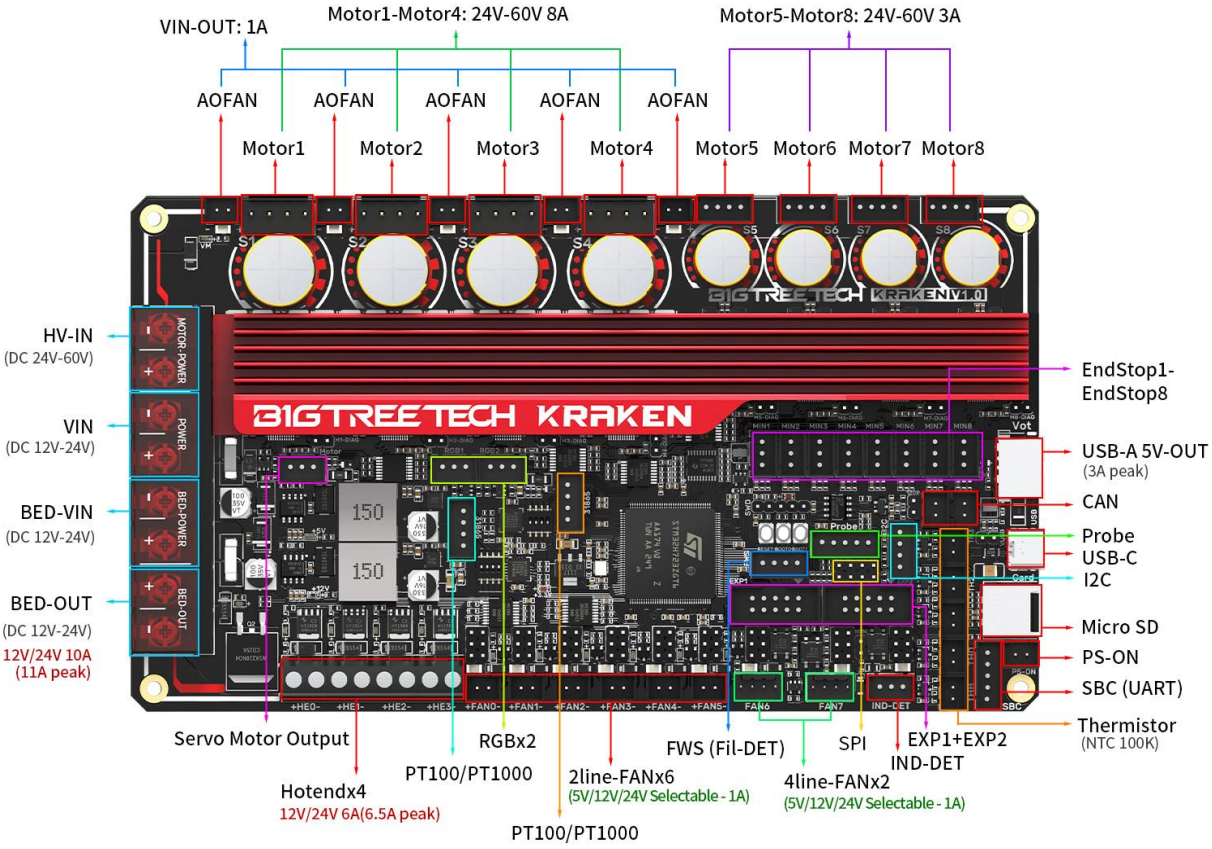
Compatible with Klipper, Marlin, RRF(RepRapFirmware)

Dimensions

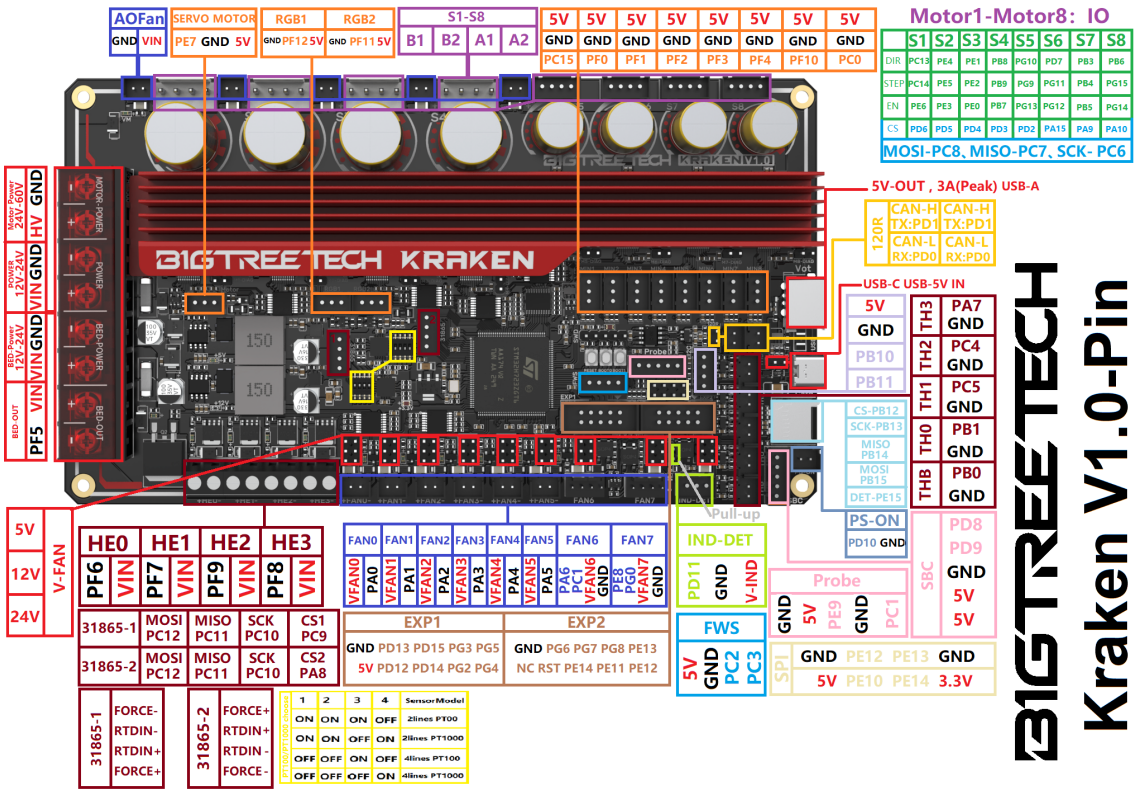


Peripheral Interface

Interface Diagram



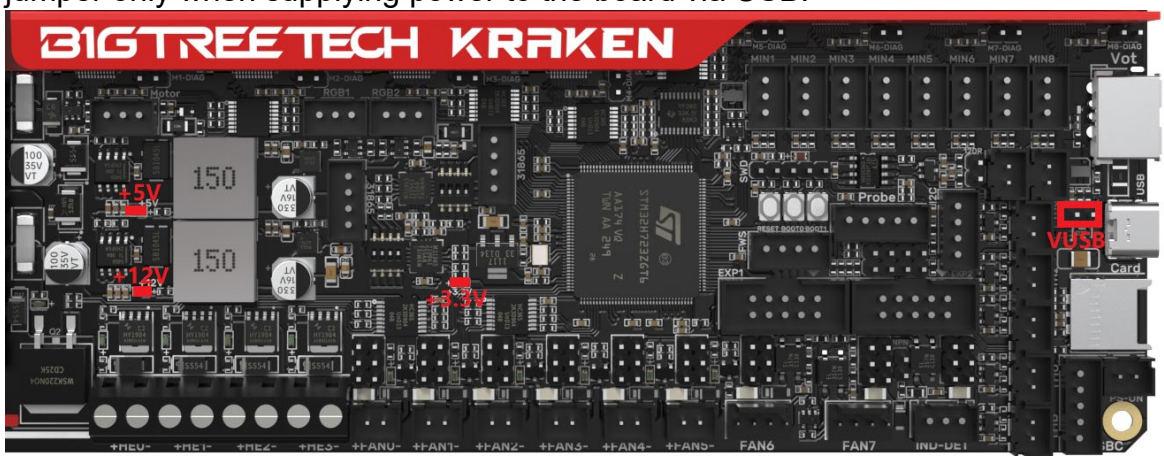
Pin Description



Interface Introduction

USB Power Supply

When Kraken is powered on, the power indicator light turns red, indicating normal power supply. VUSB is the power select pin which needs to be shorted with a jumper only when supplying power to the board via USB.



Stepper Motor Drivers

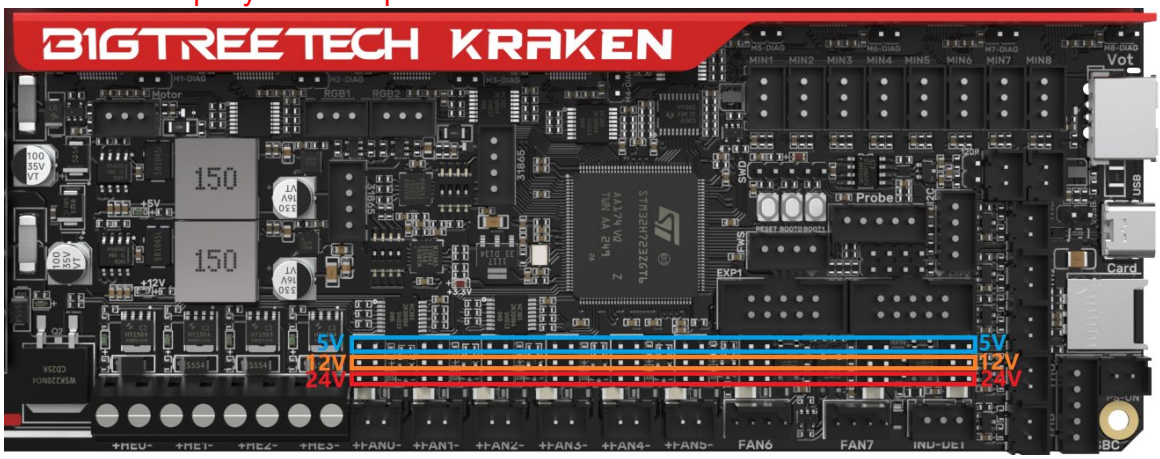
Onboard TMC2160 in SPI mode

No jumper is needed to select the mode; directly use the SPI mode. When using Sensorless Homing, plug in the jumper; if not, leave it unplugged. DIAG connection as follows:

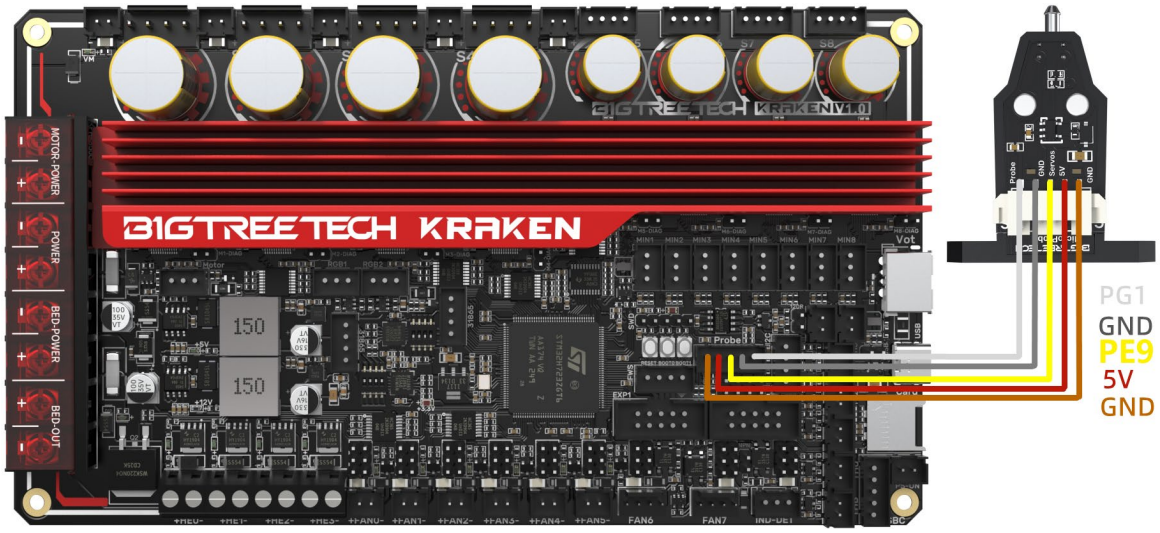
PWM Fan Voltage Selection

Set the output voltage to 5V, 12V, or 24V via a jumper. The fan interface output current is 1A.

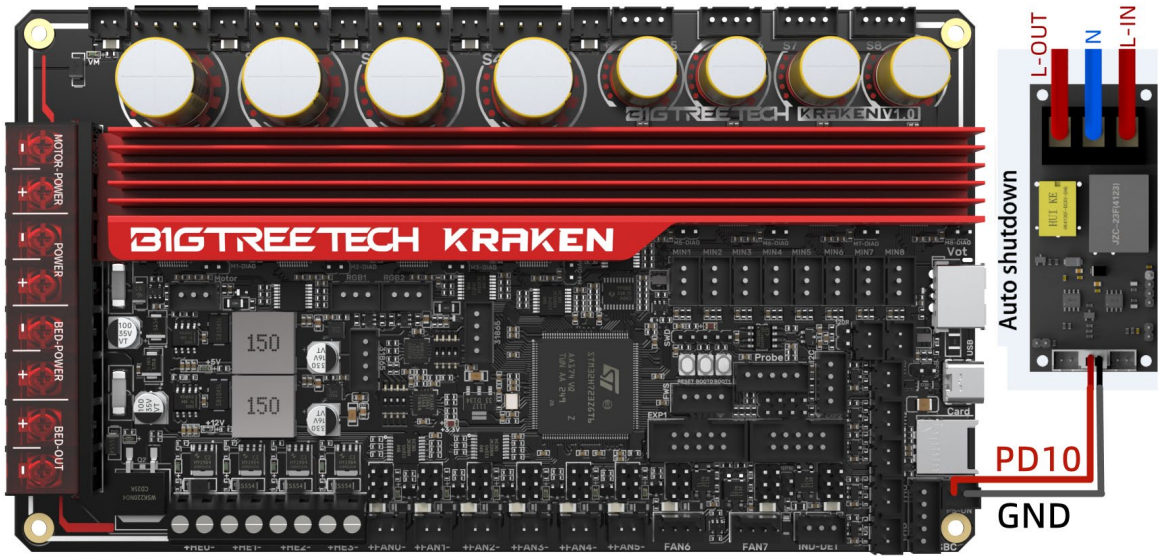
Be sure to confirm the supported voltage of the fan before selection to avoid damage for which our company is not responsible.



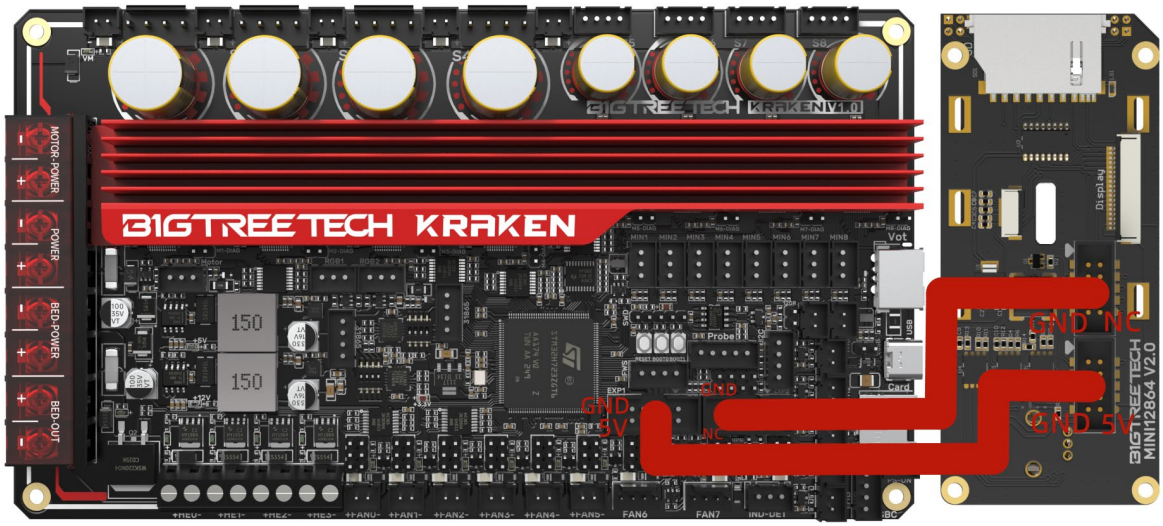
MicroProbe V2.0 Wiring



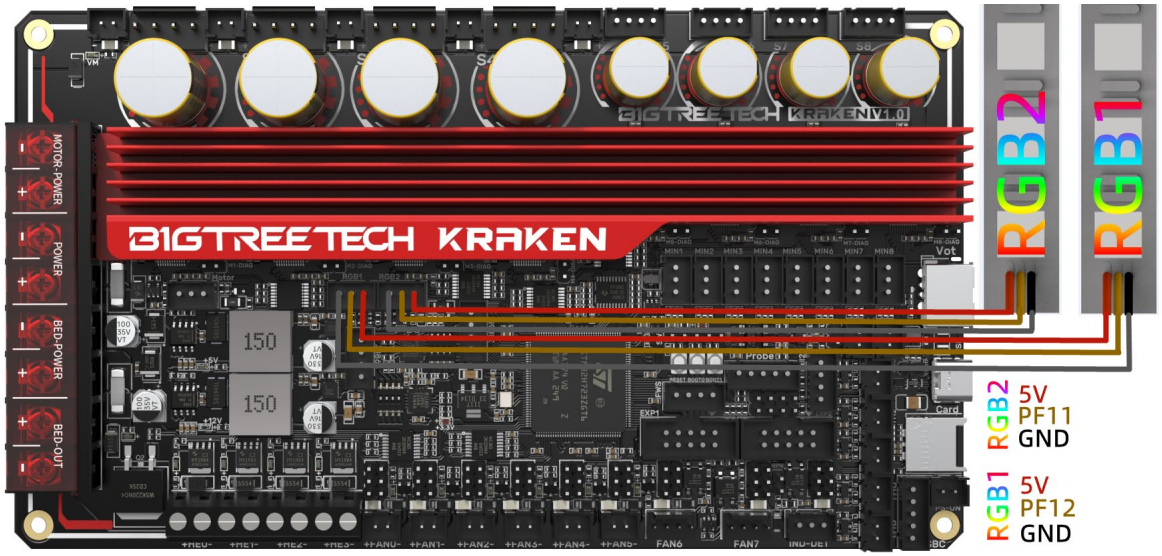
Auto Power Off (Relay V1.2) Wiring



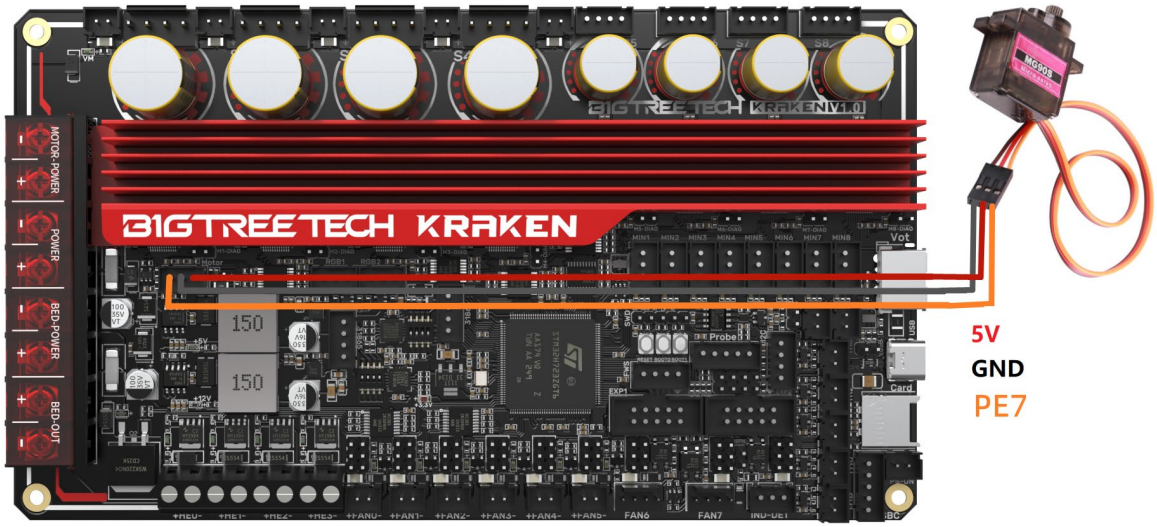
EXP1+EXP2 and MINI12864 V2.0 Display Wiring



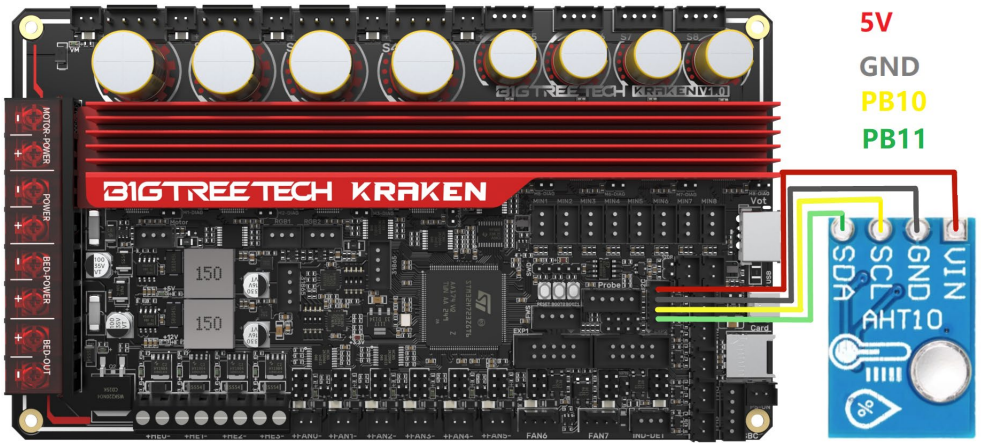
RGB Wiring



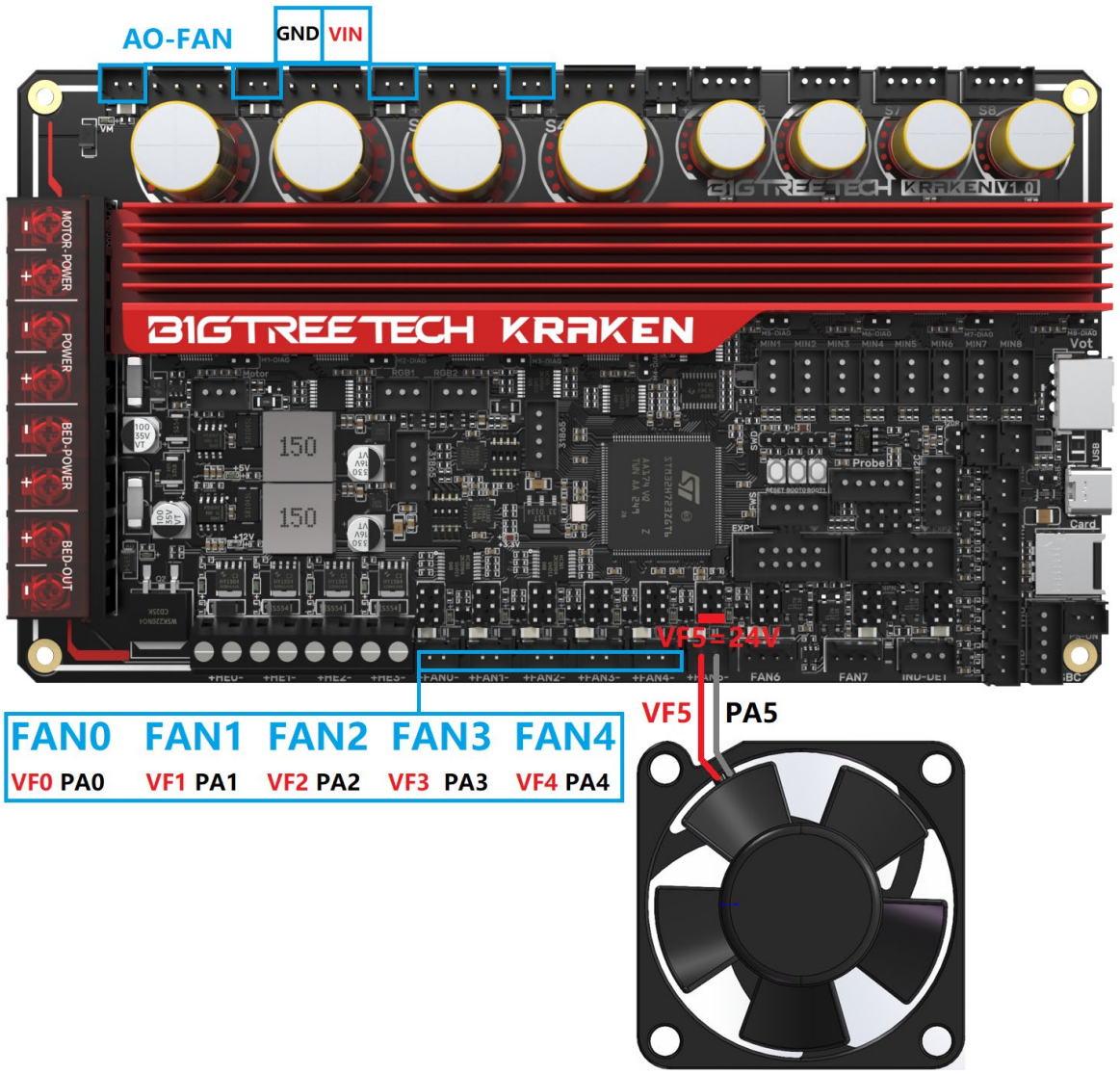
Servo Wiring



I²C Wiring (Temperature and Humidity Sensor)

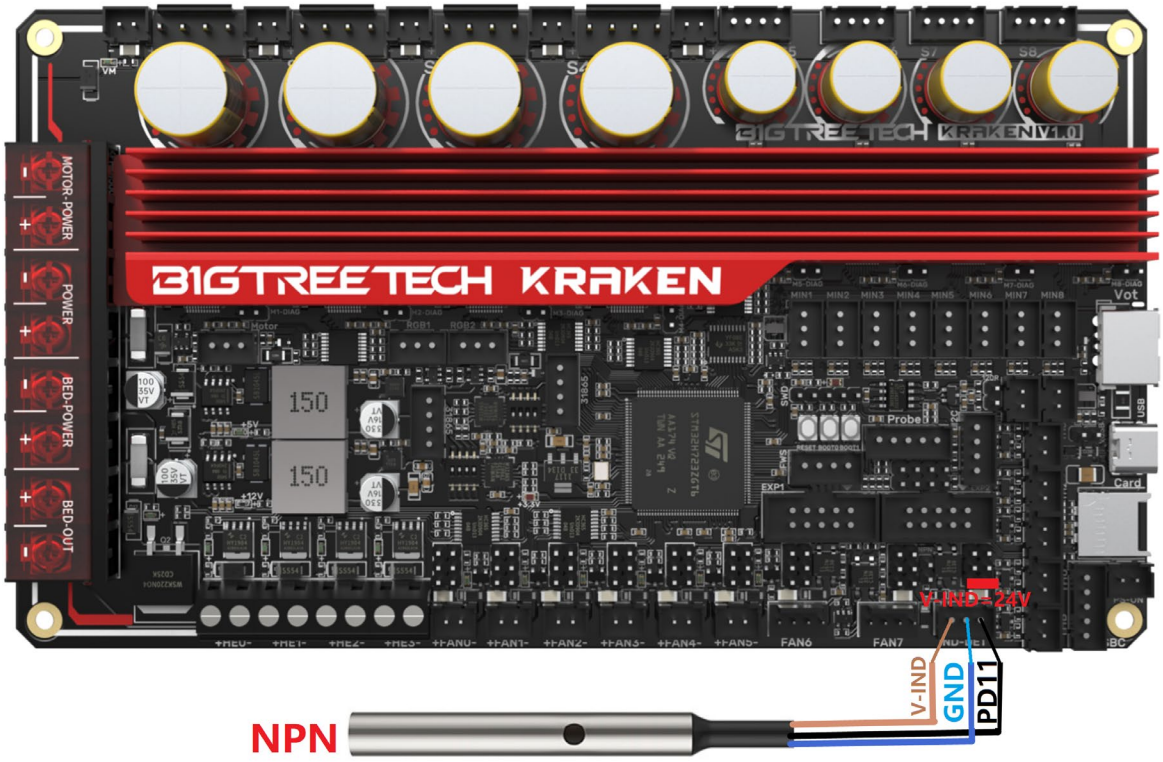


2-pin Fan Connection

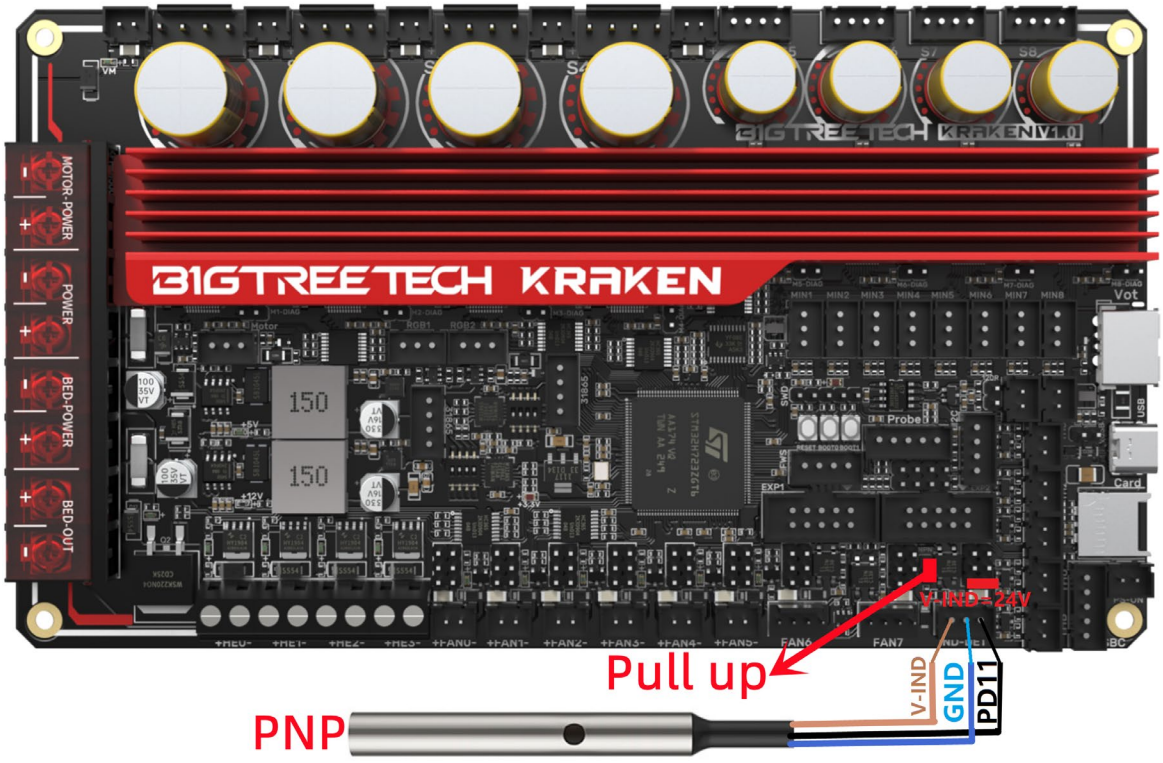


Proximity Switch Connection

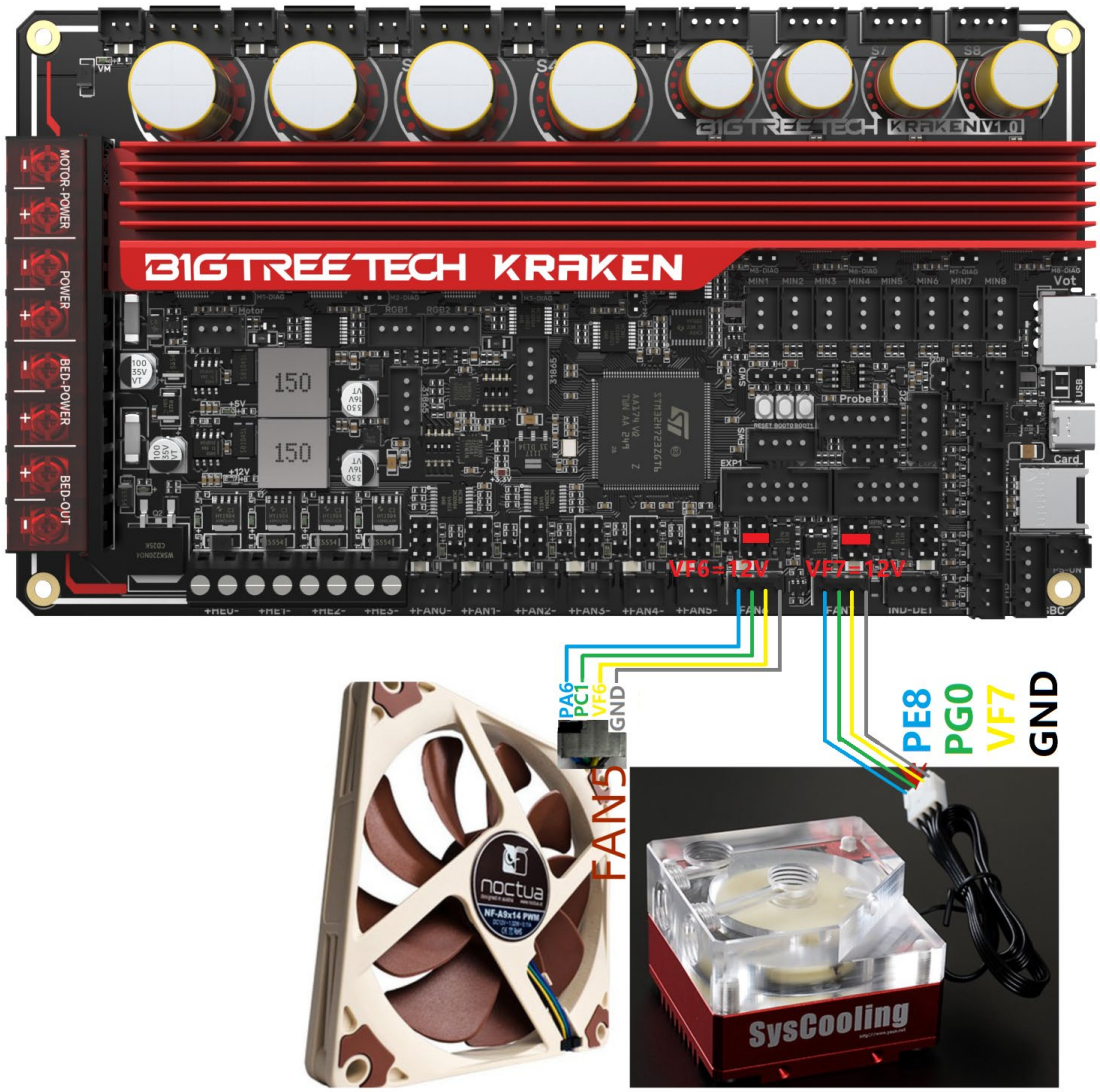
Normally open (NPN type), no jumper is required, as shown in the 24V example.



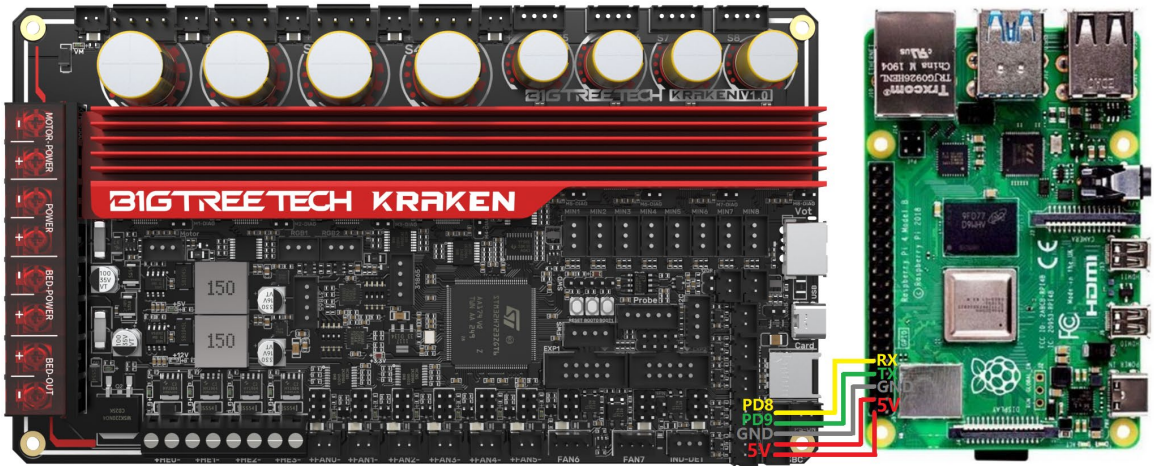
Normally closed (PNP type), a jumper is needed, as shown in the 24V example.



4-pin PWM Fan and Water Cooling Connection (12V example)



Raspberry Pi Connection



Marlin

Install Compiling Environment

https://github.com/bigtreetech/Document/blob/master/How%20to%20install%20VScode%2BPlatformio.md
https://marlinfw.org/docs/basics/install_platformio_vscode.html

Download Marlin Firmware

Get pre-configured firmware source code from our GitHub:
https://github.com/bigtreetech/BIGTREETECH-Kraken

Configure Firmware

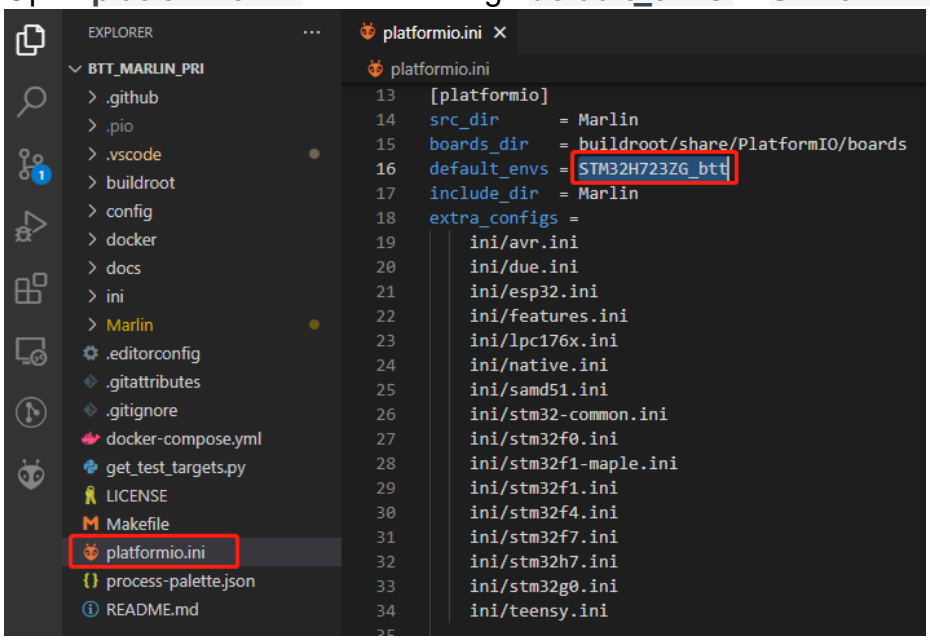
Open Marlin Project

You can open Marlin in VS Code in one of several ways:

- Drag the downloaded Marlin Firmware folder onto the VScode application icon;
- Use the **Open...** command in the VSCode **File** menu;
- Open the PIO Home tab and click the **Open Project** button.

Compiling Environment

Open **platformio.ini** file and change **default_envs** to **STM32H723ZG_btt**.

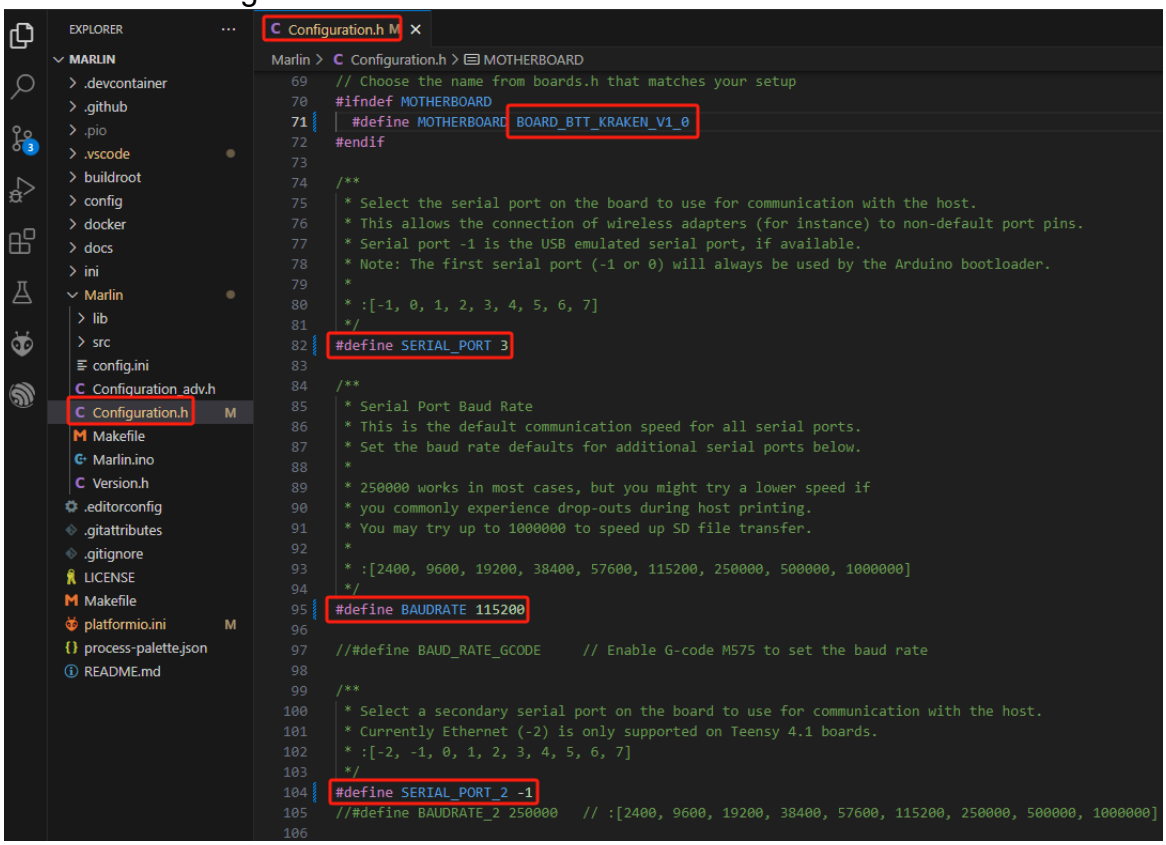


Configure Motherboard and Serial Port

Set **MOTHERBOARD** as **BOARD_BTT_KRAKEN_V1_0**

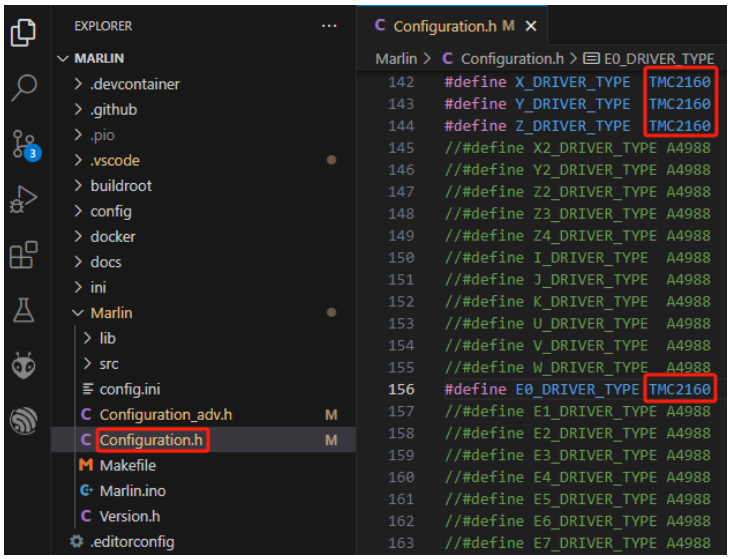
```
#define MOTHERBOARD BOARD_BTT_KRAKEN_V1_0
```

#define SERIAL_PORT 3 (Enable SBC serial port)
#define BAUDRATE 115200 (Set baudrate to the same as the communication device)
#define SERIAL_PORT_2 -1 (Enable USB serial port)
The above settings can be enabled as needed.



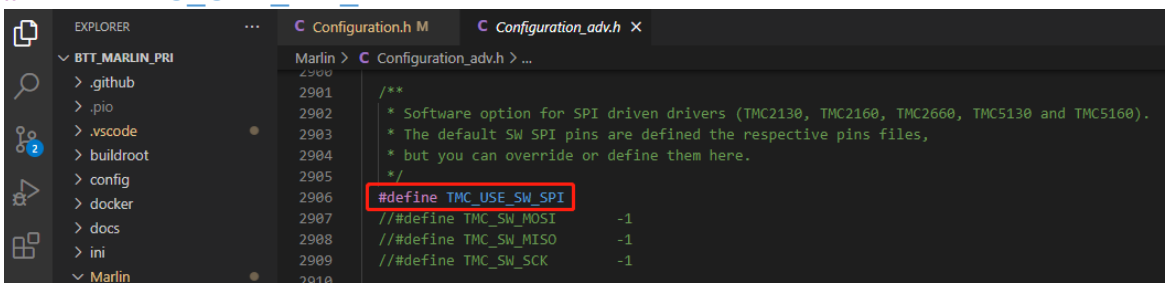
Configure Stepper Driver

Kraken has 8 TMC2160 drivers onboard

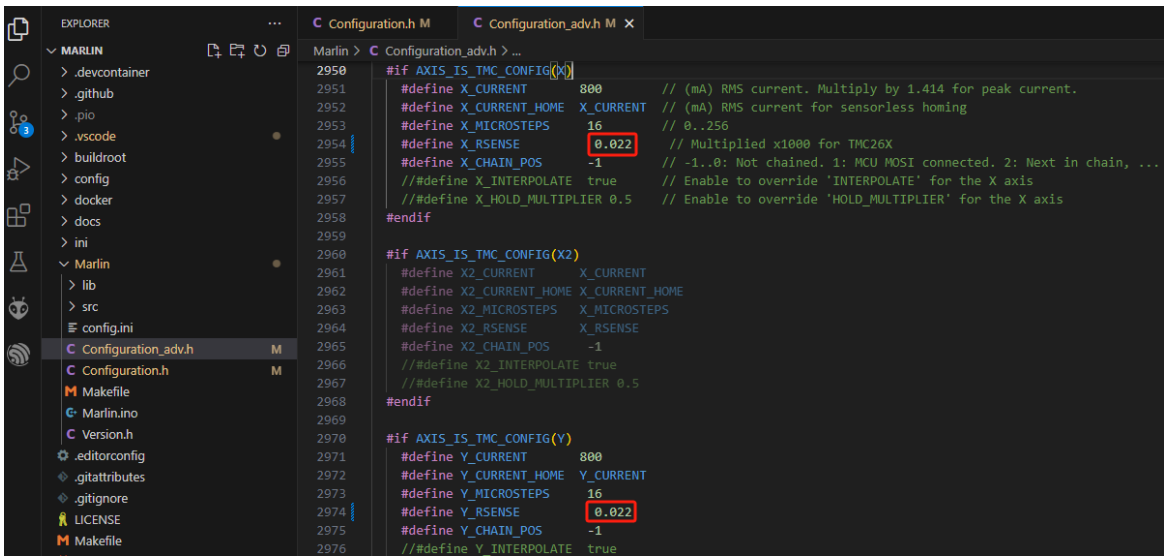


We need to enable TMC_USE_SW_SPI in Configuration_adv.h

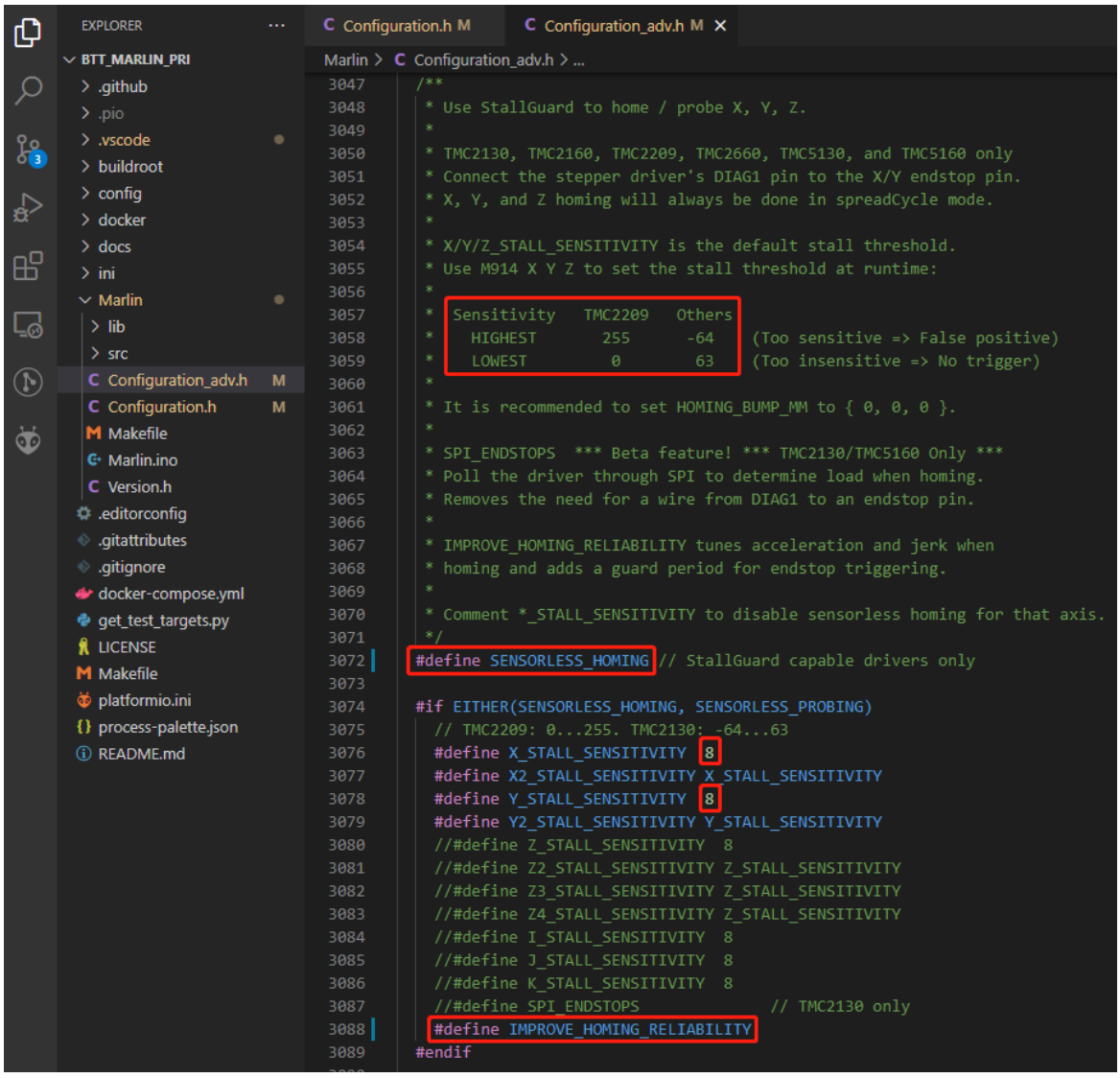
#define TMC_USE_SW_SPI



The Rsense of S1-S4 is 22mΩ, so the firmware needs to be set to 0.022. The Rsense of S5-S8 is 75mΩ, so the firmware needs to be set to 0.075.



Sensorless Homing

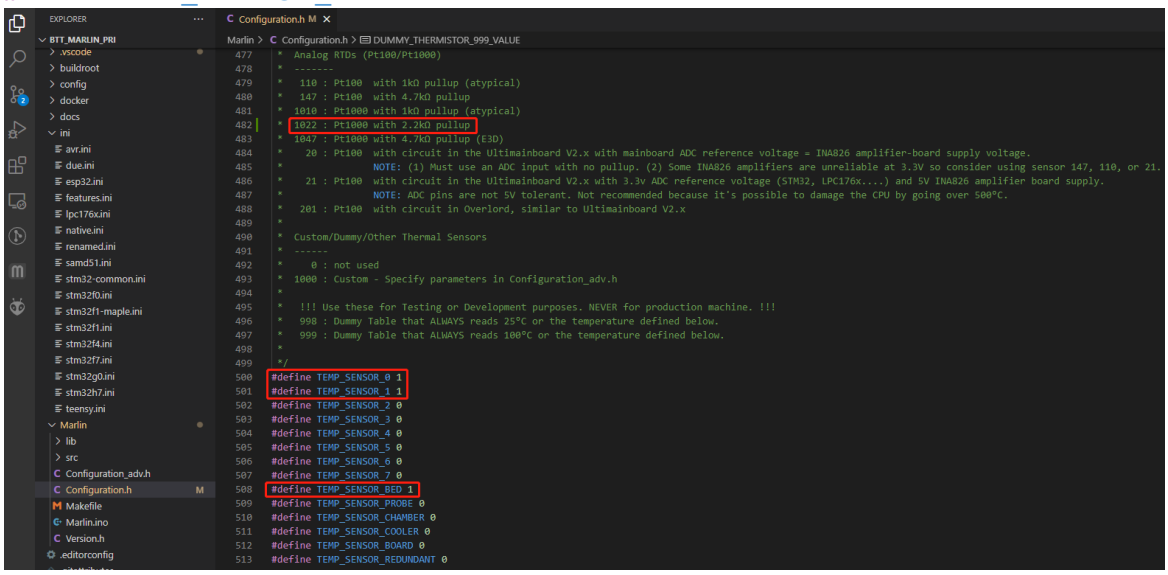


#define SENSORLESS_HOMING // enable sensorless homing
#define xx_STALL_SENSITIVITY 8 // sensitivity setting, TMC2209 range from 0 to 255, higher number results in more sensitive trigger threshold, sensitivity too high will cause endpoint to trigger before gantry actually moves to the end, lower number results in less sensitive trigger threshold, too low of sensitivity will cause endpoint to not trigger and gantrying continue. Other drivers range from 63 to -64, lower numbers result in a more sensitive trigger threshold.
#define IMPROVE_HOMING_RELIABILITY // can be used to set independent motor current for homing moves(xx_CURRENT_HOME) to improve homing reliability.

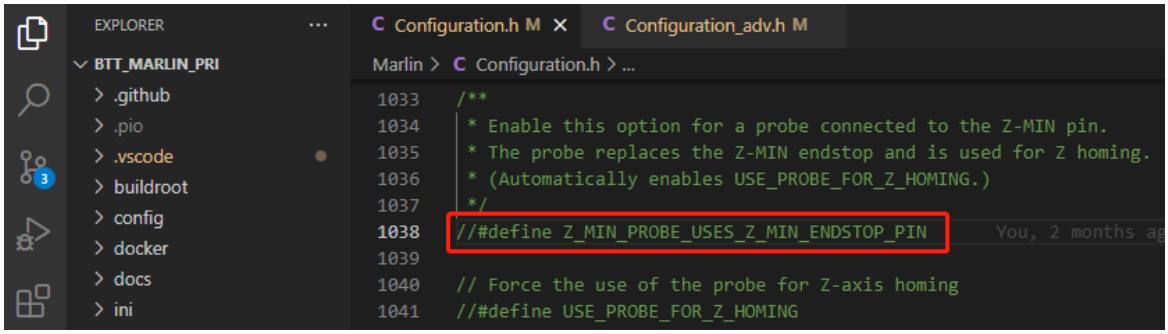
100K NTC or PT1000

In Marlin firmware, "1" represents a 100K NTC with a 4.7K pull-up resistor.

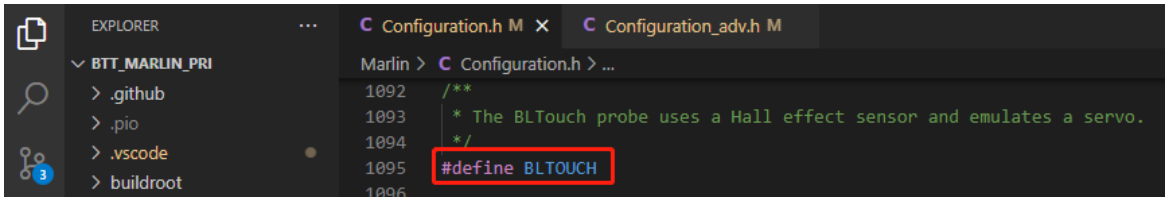
```
#define TEMP_SENSOR_0 1
#define TEMP_SENSOR_1 1
#define TEMP_SENSOR_BED 1
```



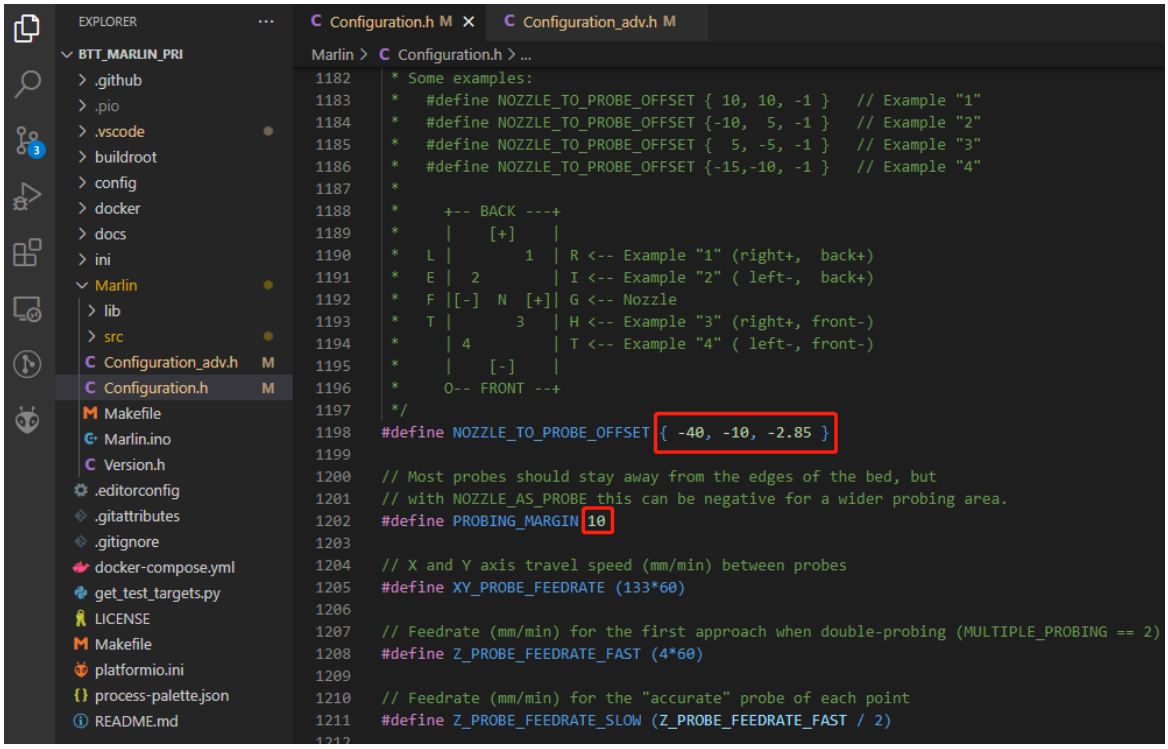
BLTouch




```
//#define Z_MIN_PROBE_USES_Z_MIN_ENDSTOP_PIN // Do not remap the Z_PROBE_PIN to the Z_MIN port.
```

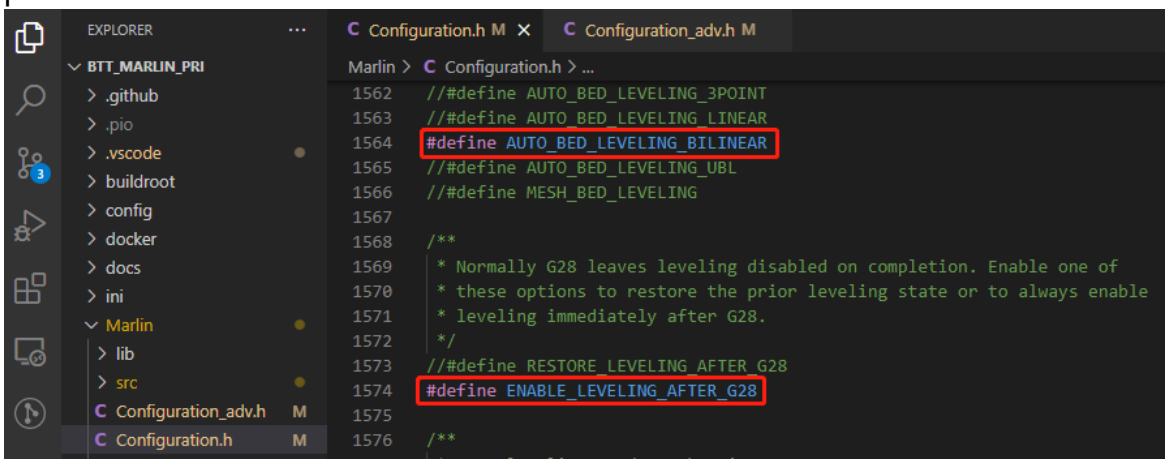



```
#define BLTOUCH  // Enable BLTouch
```



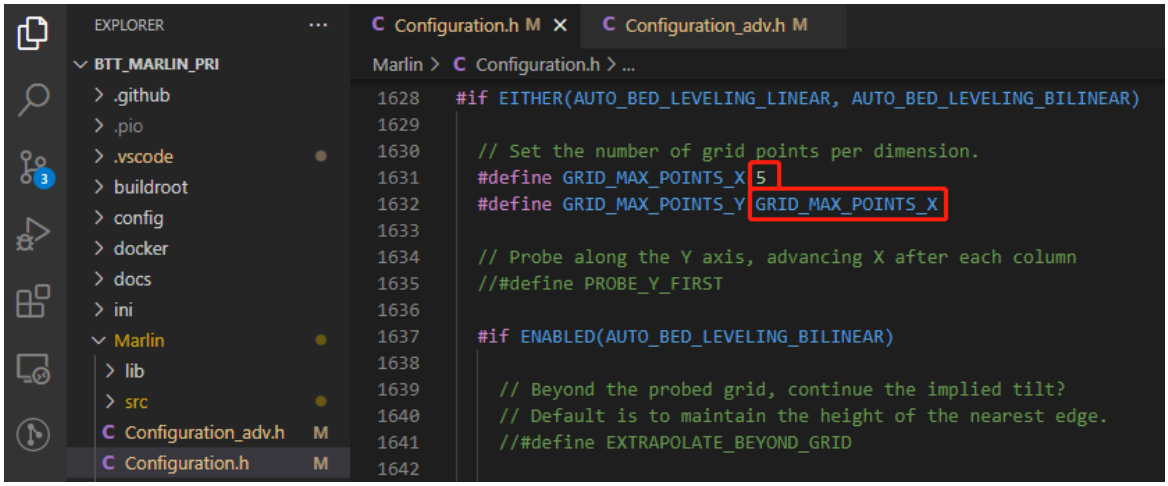
#define NOZZLE_TO_PROBE_OFFSET { -40, -10, -2.85 } // set BLTouch probe offset

#define PROBING_MARGIN 10 // set distance between probe area and print area perimeter



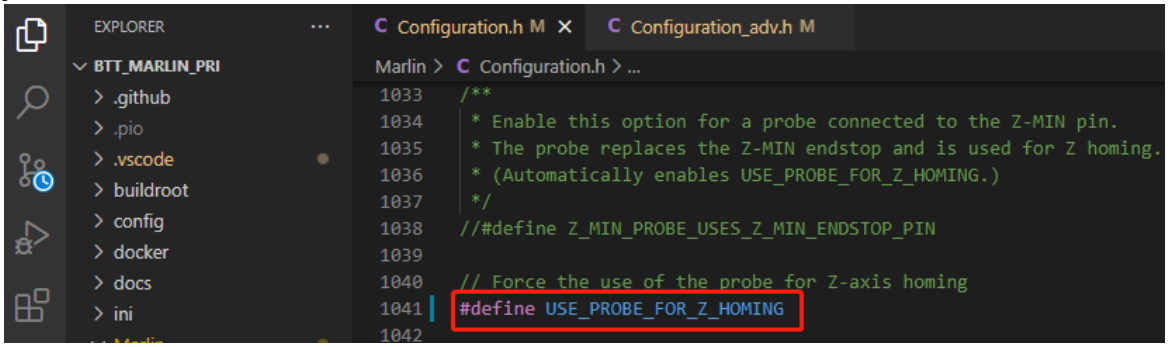
#define AUTO_BED_LEVELING_BILINEAR // set probe pattern

#define RESTORE_LEVELING_AFTER_G28 // apply leveling after G28 homing command

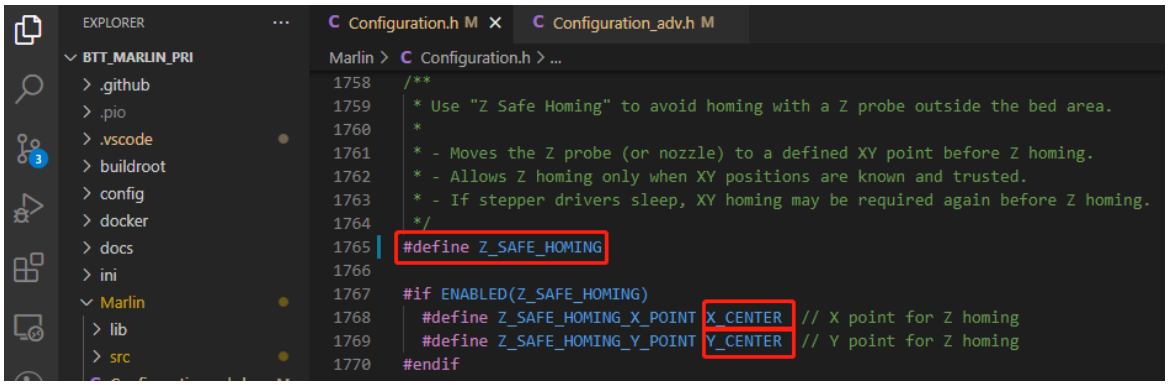


#define GRID_MAX_POINTS_X 5 // set number of probe points for X axis, usually 5 point is sufficient
#define GRID_MAX_POINTS_Y GRID_MAX_POINTS_X // set the number of probe points for Y axis to the same as X axis.

If BLTouch also functions as your Z homing sensor, no wiring change is needed, just set it in the firmware.

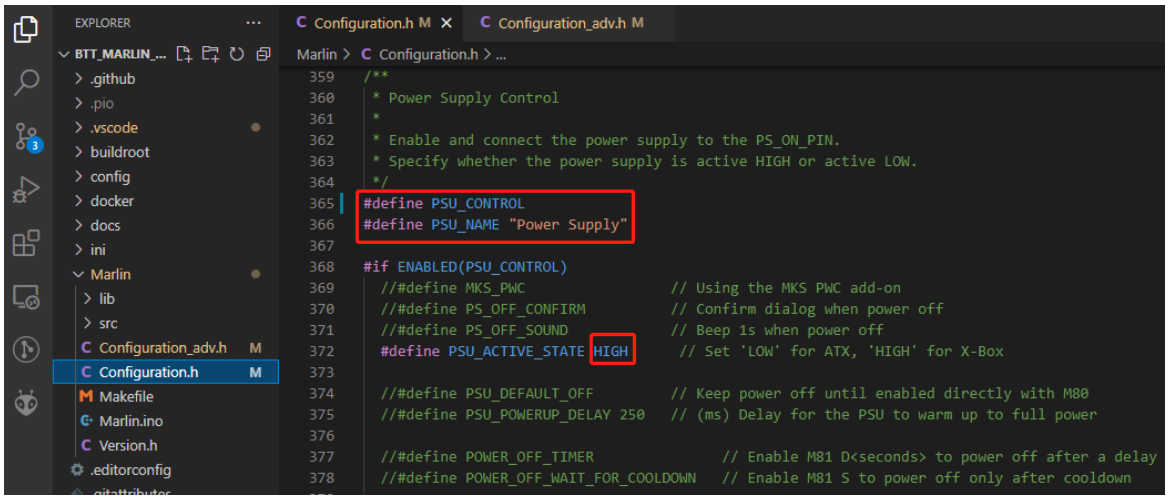


#define USE_PROBE_FOR_Z_HOMING // use Z Probe(BLTouch) for Z homing



#define Z_SAFE_HOMING // home Z at the center of print bed to prevent probing outside of the print bed.

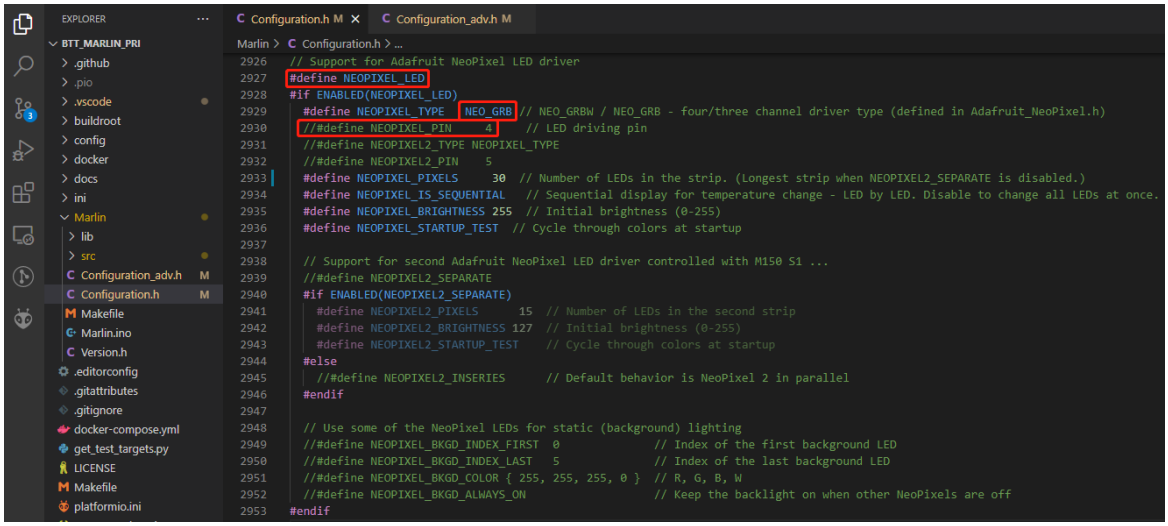
Auto Power Off (Relay V1.2)



#define PSU_CONTROL // enable PSU control to turn on and off using M80 and M81

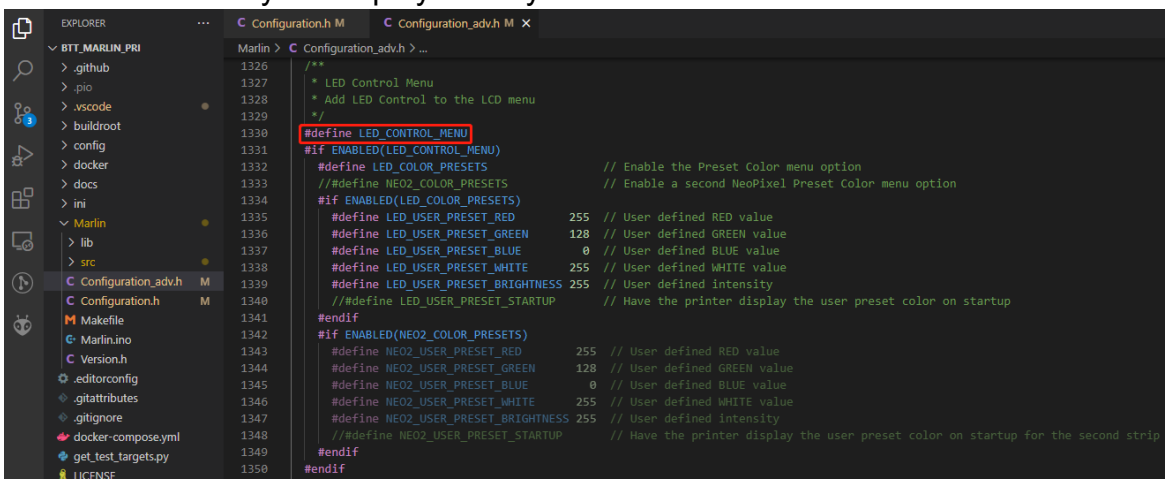
#define PSU_ACTIVE_STATE HIGH // set turn on level, Relay V1.2 is turned on with high level and turned off with low level, so this setting needs to be HIGH.

RGB



#define NEOPIXEL_LED // enable Neopixel
#define NEOPIXEL_TYPE NEO_GRB // set Neopixel type
//#define NEOPIXEL_PIN 4 // disable PIN setting, use the correct signal pin in the pin file of the motherboard
#define NEOPIXEL_PIXELS 30 // number of LEDs
#define NEOPIXEL_STARTUP_TEST // the light will show red green and blue sequentially to self-test

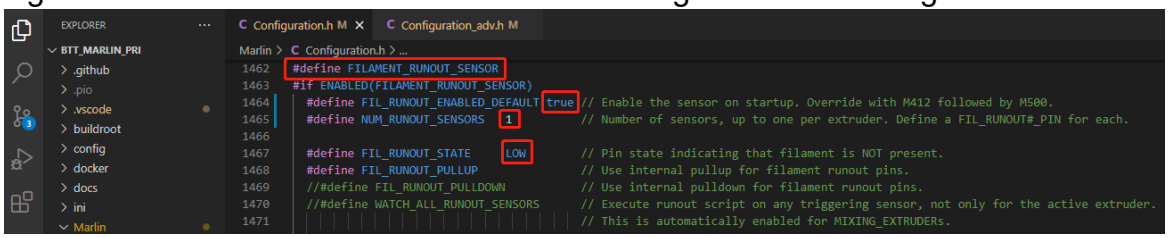
If you are using displays like LCD2004, 12864, mini12864, etc., you can also control RGB from your display directly.



#define LED_CONTROL_MENU // add LED control to your menu.

Filament Sensor

Standard filament run out sensors are usually comprised of a microswitch which signals the mainboard of filament status with High or Low level signal.

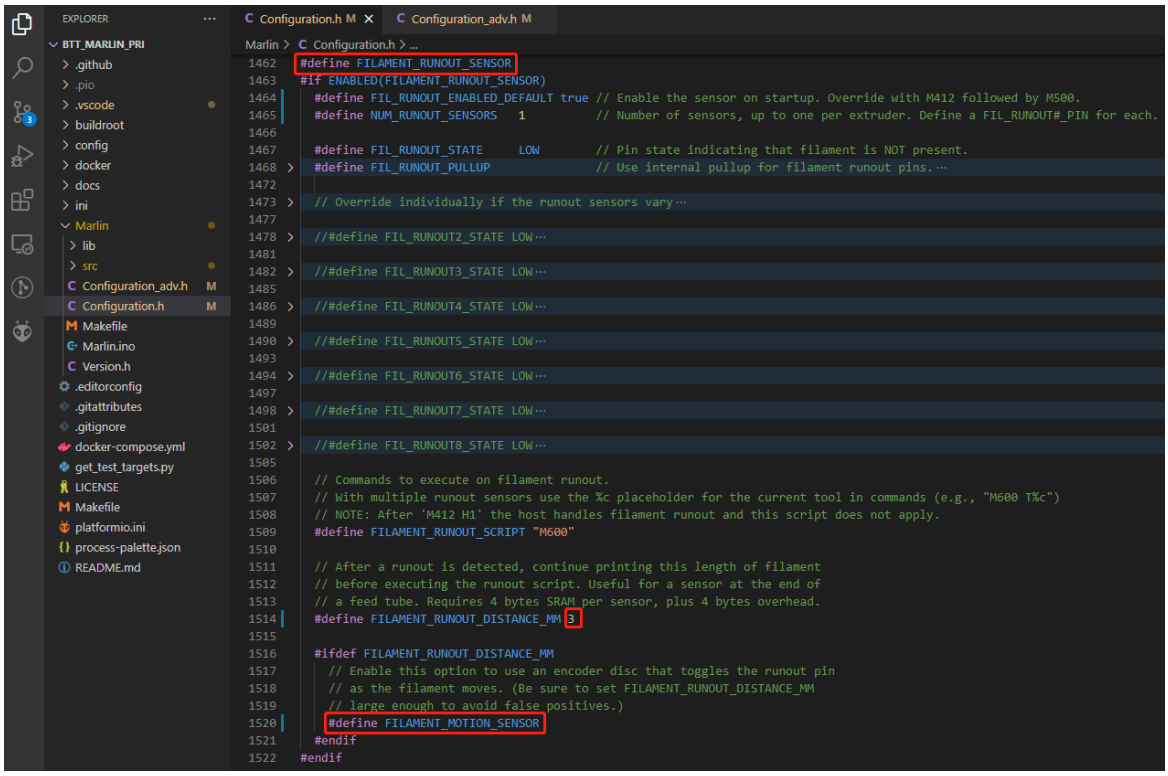


#define FILAMENT_RUNOUT_SENSOR // enable filament run out sensor
#define FIL_RUNOUT_ENABLED_DEFAULT true // true default to filament run out sensor enabled

#define NUM_RUNOUT_SENSORS 1 // number of filament run out sensor
#define FIL_RUNOUT_STATE LOW // voltage level of the filament runout sensor trigger signal. Set according to the actual situation of the module. If the module sends a low level when the filament is abnormal, set it to LOW.

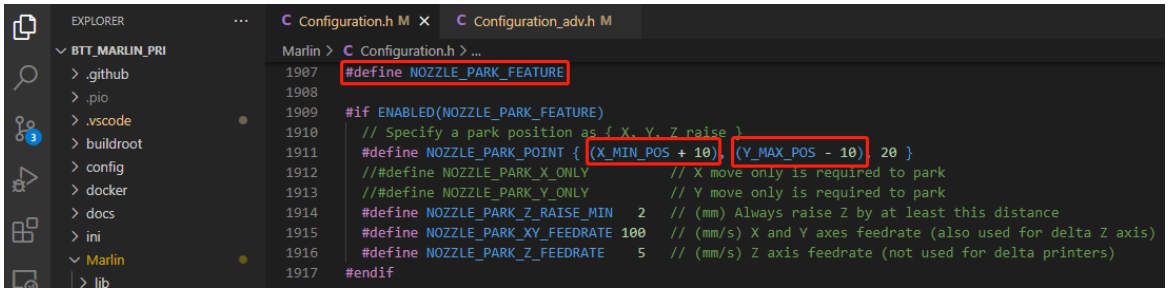
Smart Filament Sensor (SFS V1.0)

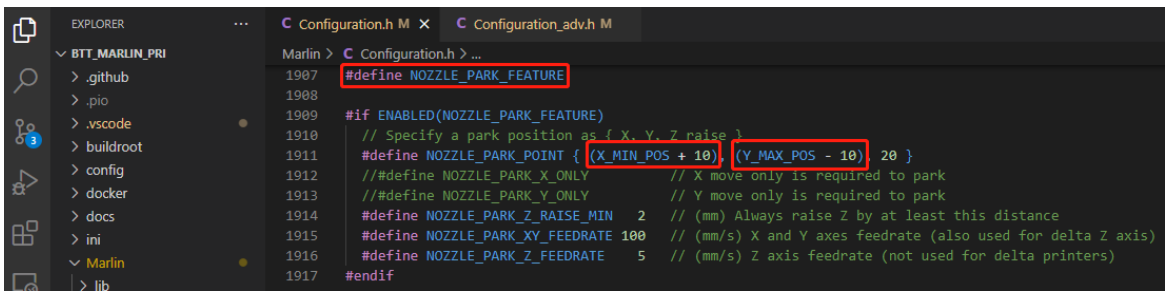
The smart filament sensor works by continuously sending signal to the mainboard to communicate filament status.



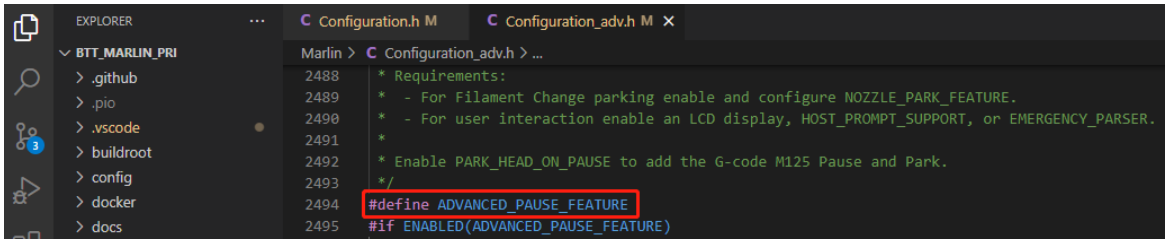
#define FILAMENT_MOTION_SENSOR // set encoder type
#define FILAMENT_RUNOUT_DISTANCE_MM 7 // set sensitivity, SFS V1.0 nominal setting should be 7mm, which means if no signal of filament movement is detected after 7mm of filament travel command, filament error will be triggered.

The settings below also need to be set to instruct the printer to park the nozzle after filament error is detected.





#define NOZZLE_PARK_FEATURE // park nozzle
#define NOZZLE_PARK_POINT { (X_MIN_POS + 10), (Y_MAX_POS - 10), 20 }
// set the X, Y and Z offset coordinate of the nozzle

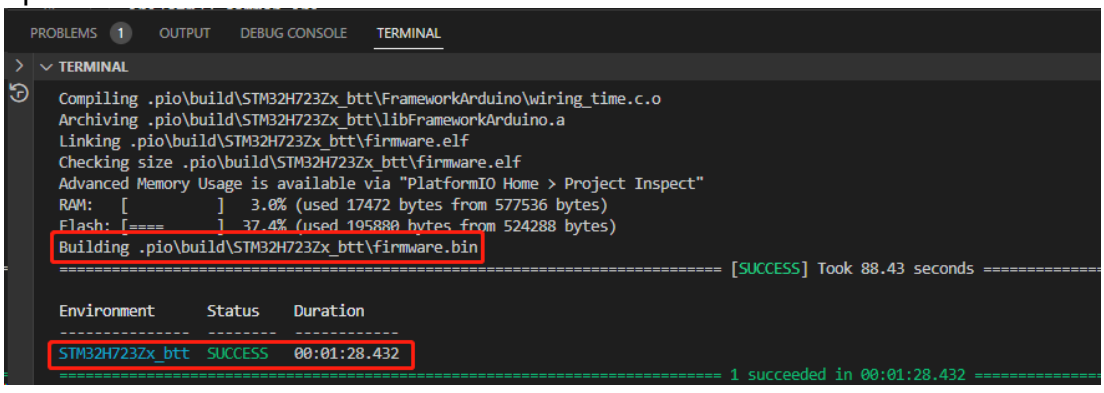


#define ADVANCED_PAUSE_FEATURE // retraction setting of nozzle park movement and filament purge distance after the print is resumed.

Compile Firmware

1. Click "√" to compile firmware.

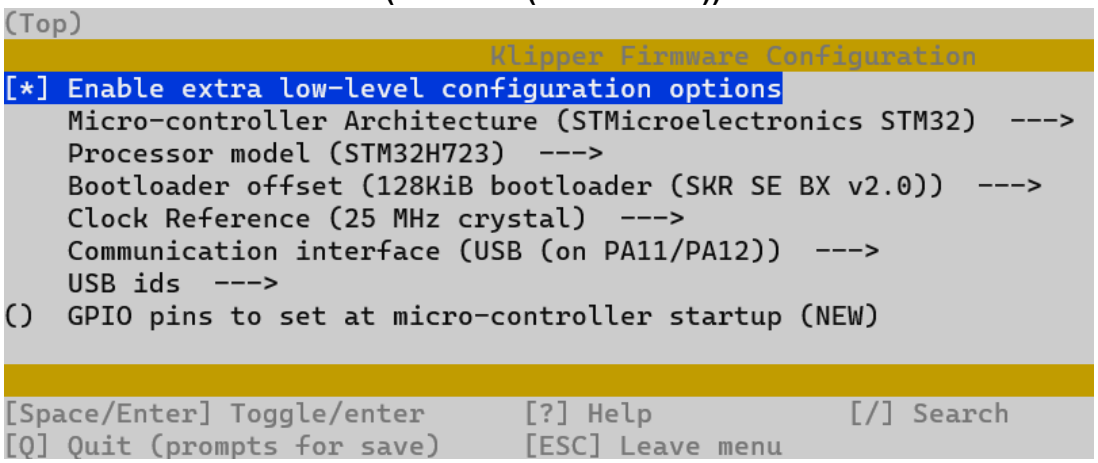
2. Copy the compiled "firmware.bin" to SD card and insert to motherboard to update firmware.



Klipper

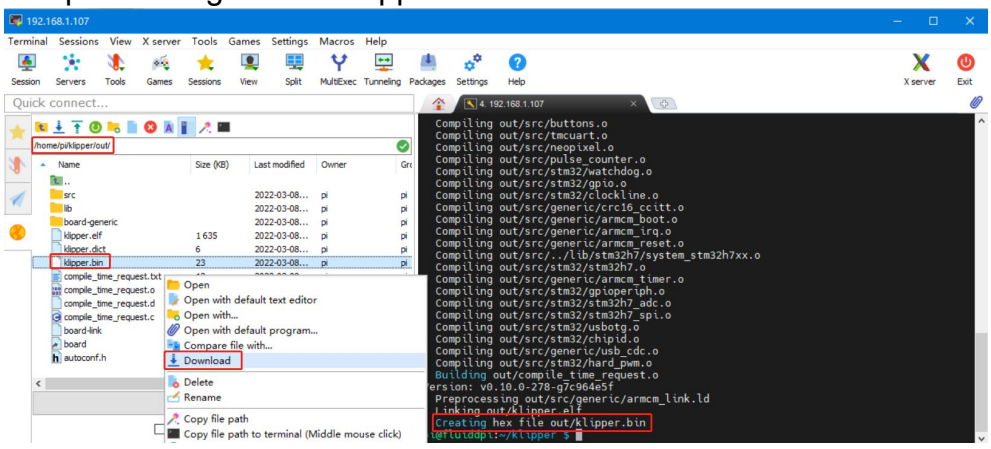
Compiling the Firmware

1. Use the following configuration to compile the firmware (if these options 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) --->**
   USB Interface
   *** Communication interface (USB (on PA11/PA12)) --->**
   CANBUS Interface
   *** Communication interface (CAN bus (on PD0/PD1)) --->**



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.



4. Rename klipper.bin to "firmware.bin", copy to SD card to update firmware.

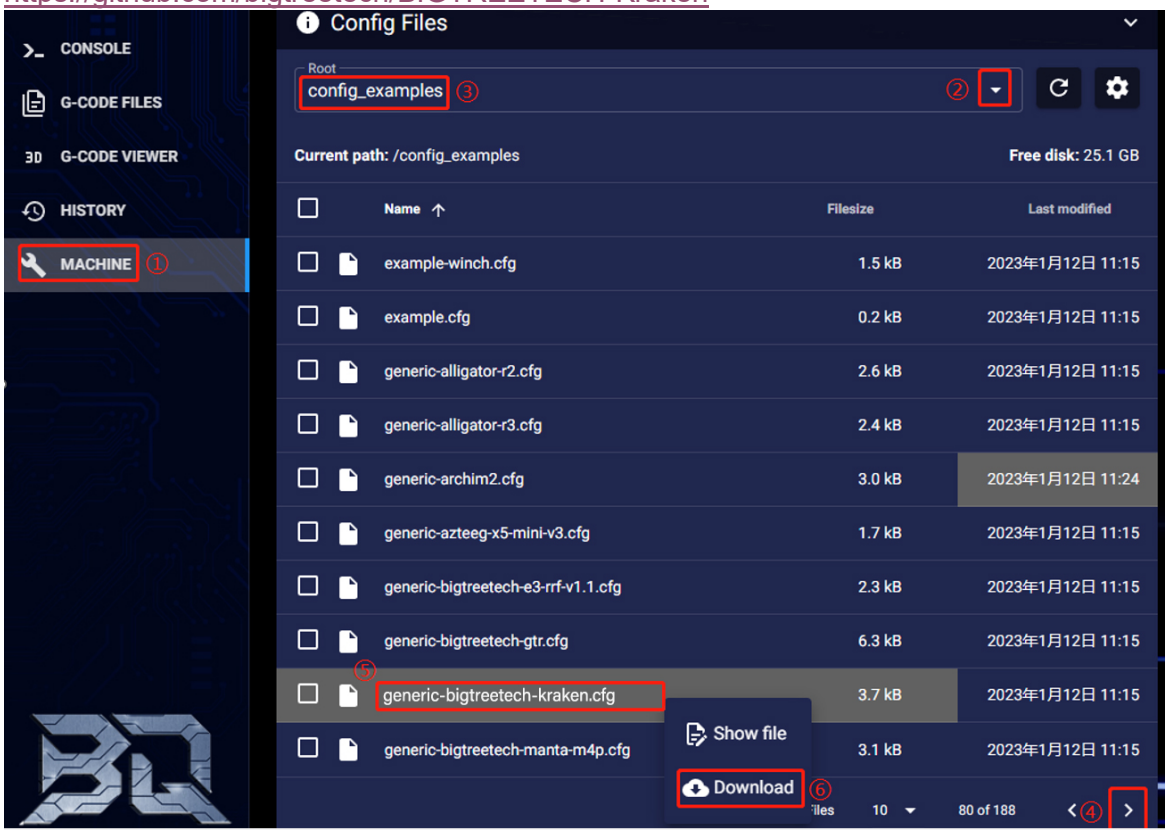
5. Enter: **ls /dev/serial/by-id/** in command line to check motherboard ID to confirm whether firmware is updated successfully, as shown below.

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

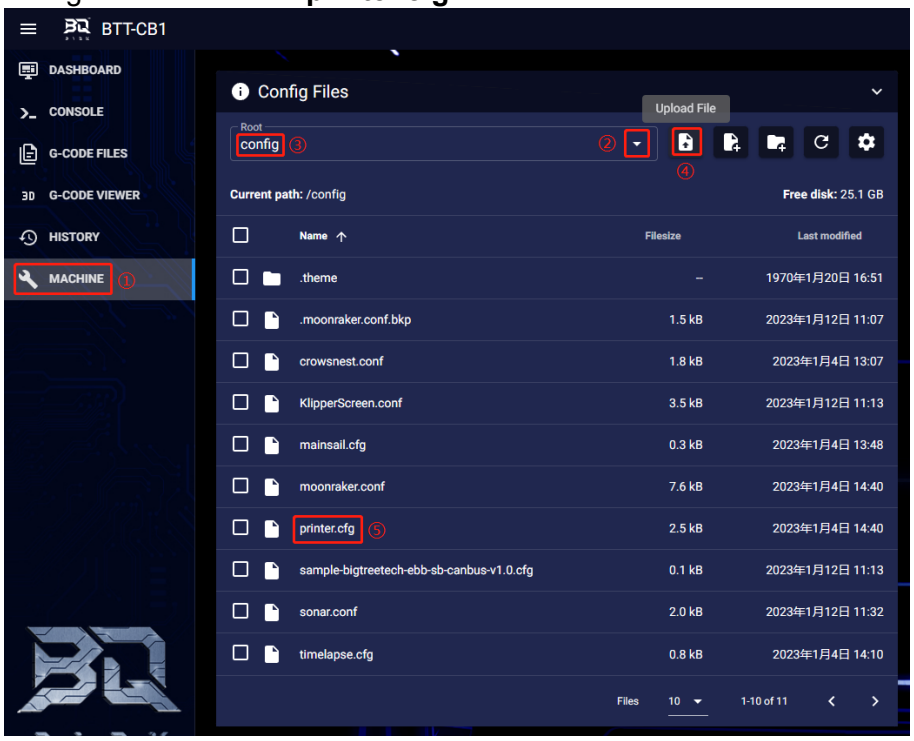
copy and save this ID, it is needed when modifying klipper config.

Configuring Klipper

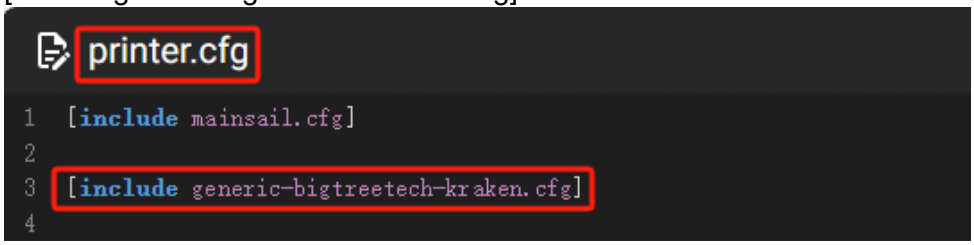
1. Enter the Raspberry Pi's IP in a browser to access it. Download the motherboard's reference configuration in the path shown in the image below. If you cannot find this file, update the Klipper firmware source code to the latest version or download from GitHub: https://github.com/bigtreetech/BIGTREETECH-Kraken



2. Upload the motherboard's configuration file to **Configuration Files** and include this configuration file in the **printer.cfg** file.



[include generic-bigtreetech-kraken.cfg]



3. Insert the correct motherboard ID.

4. Refer to https://www.klipper3d.org/Overview.html for detailed configuration guide according to your machine type.

Firmware Updates

Updating via microSD

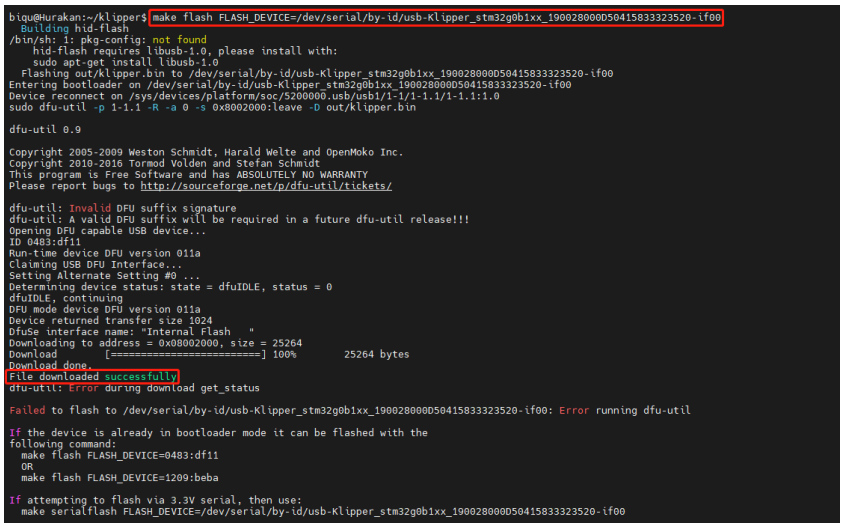
1. Ensure the microSD card is formatted as FAT32.
2. Rename the compiled firmware or the firmware downloaded from GitHub to "firmware.bin" (note: make sure the computer system's extension settings are clear, as some users hide the extension, and "firmware.bin" actually displays as "firmware").
3. Copy "firmware.bin" to the root directory of the microSD card.
4. Insert the microSD card into the motherboard's slot, power on the motherboard, and the bootloader will automatically update the firmware.
5. The status LED will blink during update.
6. When it stops and the file is renamed "FIRMWARE.CUR", the update is complete.

Updating Klipper via DFU

1. Run **ls /dev/serial/by-id/** to get the board ID. If Klipper is running, it will return a klipper ID.

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

2. If **ls /dev/serial/by-id/** is able to find the MCU's klipper device ID, you can directly input: **cd ~klipper**
make flash FLASH_DEVICE=/dev/serial/by-id/usb-Klipper_stm32h723xx_41003D001751303232383230-if00
to write firmware (Note: Replace/dev/serial/by-id/xxx with the actual ID queried in the previous step)



After writing completes, there may be an error message **dfu-util: Error during download get_status**, just ignore it.

Precautions

1. Forbidden to switch driver voltage when stepper motors are in motion;

2. When switching stepper motor driver voltage, ensure no control signals are being output from the MCU to the driver chips;

3. When driver current exceeds 7A, it is recommended to add a cooling fan for the driver for heat dissipation.

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.