BIGTREETECH

SFS V2.0

User Manual

Revision Log

Version	Date	Revisions
v1.00	10th February 2023	Initial Version
v1.10	16th November 2023	1. Wiring diagrams and Klipper configuration instructions have been added for the following boards: Octopus V1.1/Pro V1.0.1/Pro V1.1/MAX EZ SKR MINI E3 V3.0 MANTA E3EZ/M5P/M8P V1.0, V2.0 2. The Calibration guide has been added.

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Product Profile

SFS V2.0 is a smart filament sensor that enhances 3D printing reliability by leveraging a highly accurate photoelectric sensor to detect problematic filament issues like runout, tying, and clogging.

Feature Highlights

1. The SFS V2.0 is bi-directional, there is no restriction on filament direction, giving the users more flexibility during installation.
2. It detects extrusion errors caused by filament runout, nozzle clogging, filament tying, and extruder trouble. It has two signal outputs and indicator lights to distinguish between clogging or filament runout.
3. Works with Marlin, Klipper, and RRF firmware.
4. Compact, lightweight, and easy to install.
5. Works with Bowden extruders and direct-drive extruders.
6. Support motherboards with available endstop ports or dedicated filament runout ports.

Instruction

The filament can be threaded through either side of the SFS V2.0, as directionality does not affect functionality.

The red light will illuminate when there is no filament in the module.

The blue light will flash when the extrusion is normal.

The blue light will stay on or off when there is no extrusion.

Specifications

Dimensions: 53.1 x 30.3 x 27.3 mm

Weight: 36 g

Rated Voltage: 3.3V-5V

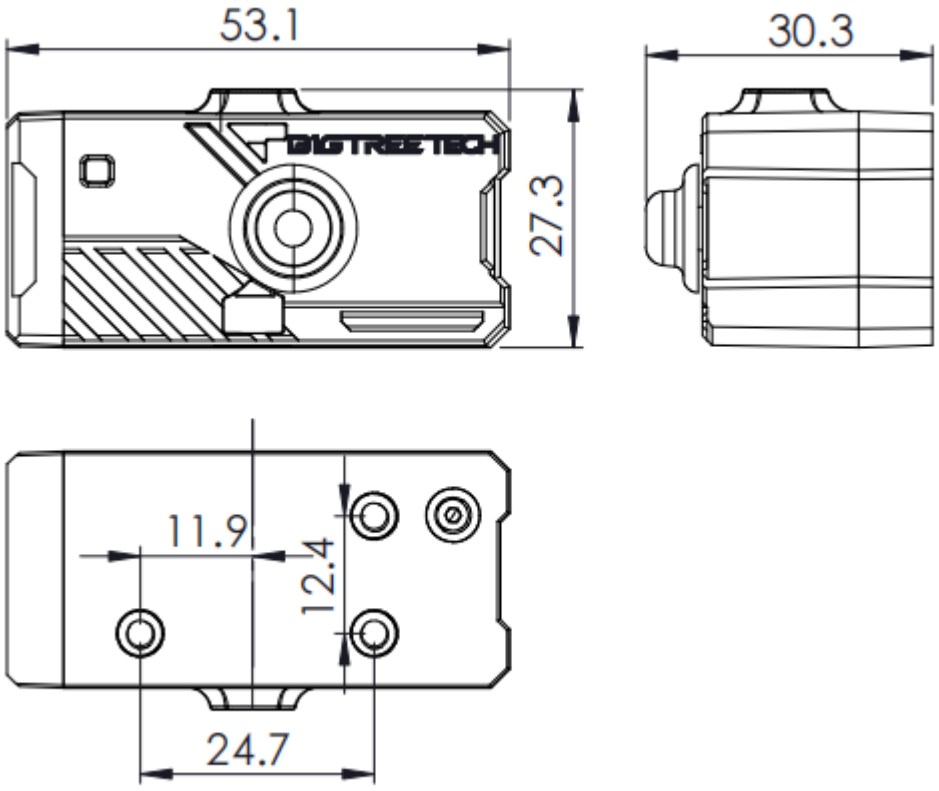
Working Temperature: -10 to 50 ℃

Working Humidity: 10% to 90%

Filament Diameter: 1.75mm

Mounting Hole Spacing: 12.4 x 24.7 mm

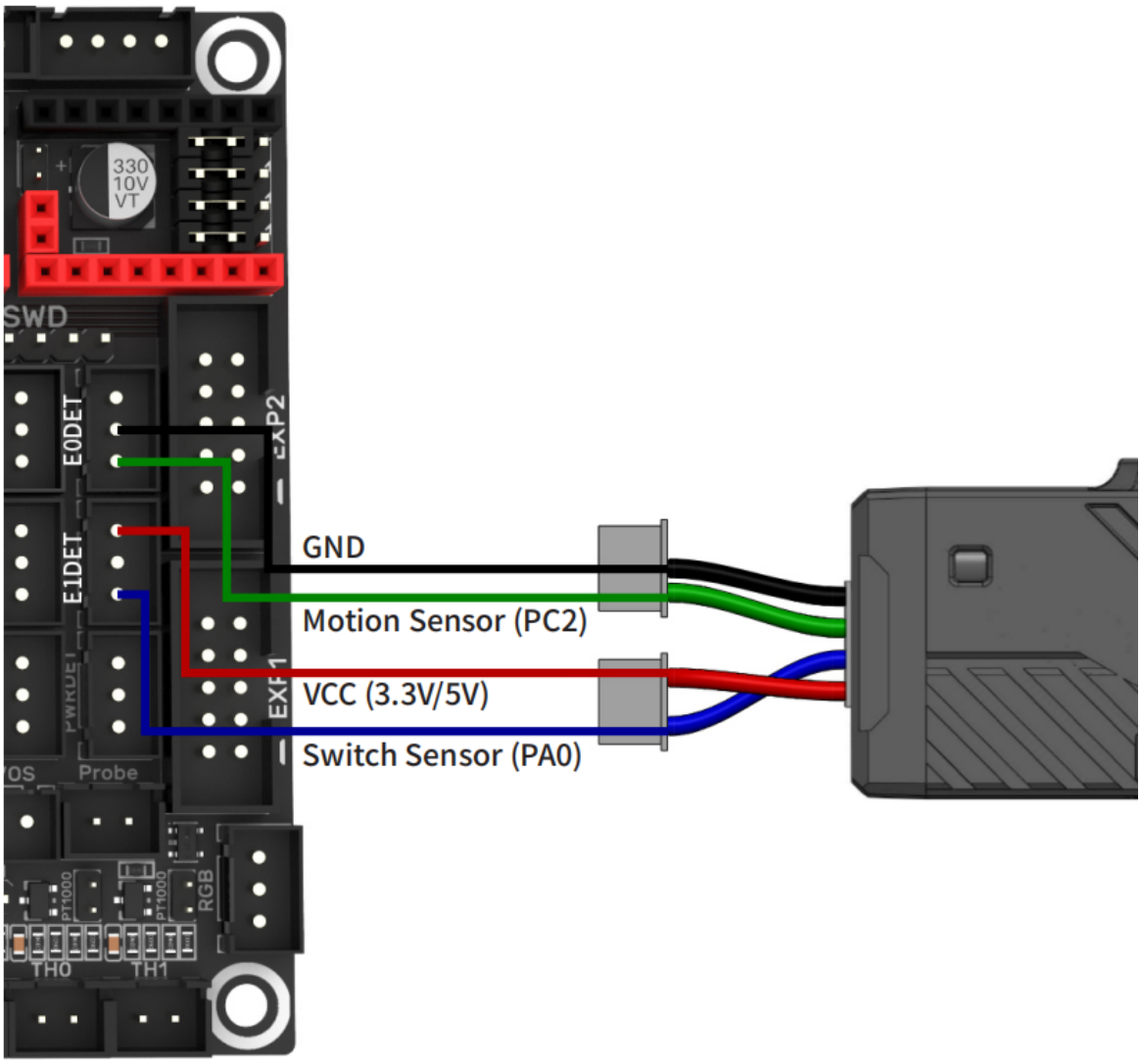
Detection Length: 2.88 mm (theoretical detection length, may need adjustment)



Wiring

The SFS V2.0 uses a splitting cable, the 3-pin connectors plug into the motherboard, and the 4-pin connector plugs into the SFS V2.0.

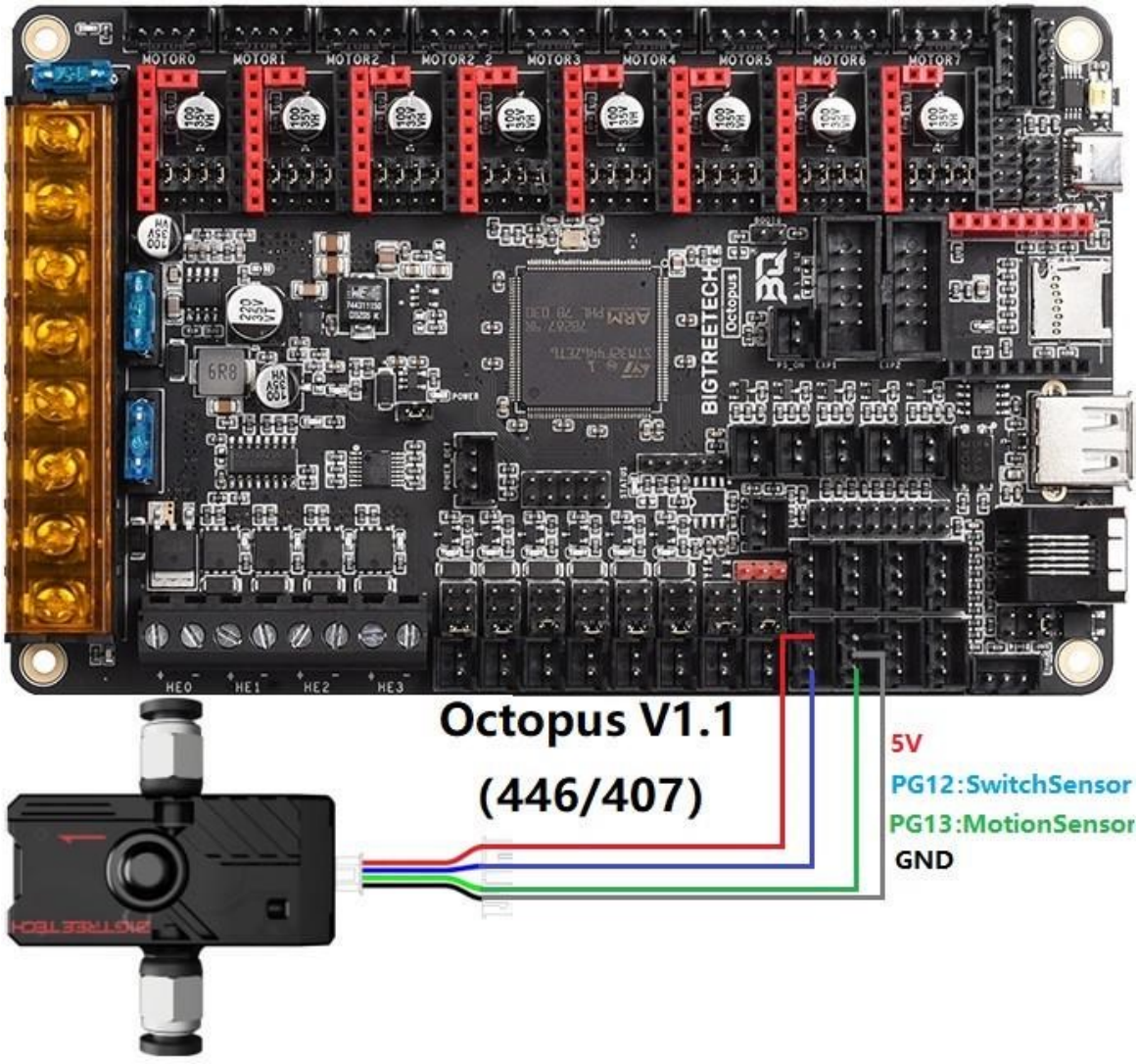
SFS V2.0+SKR3




```
[filament_switch_sensor switch_sensor]
switch_pin: ^PA0
pause_on_runout: False
runout_gcode:
    PAUSE  #  [pause_resume] is required in printer.cfg
    M117 Filament switch runout
insert_gcode:
    M117 Filament switch inserted
```

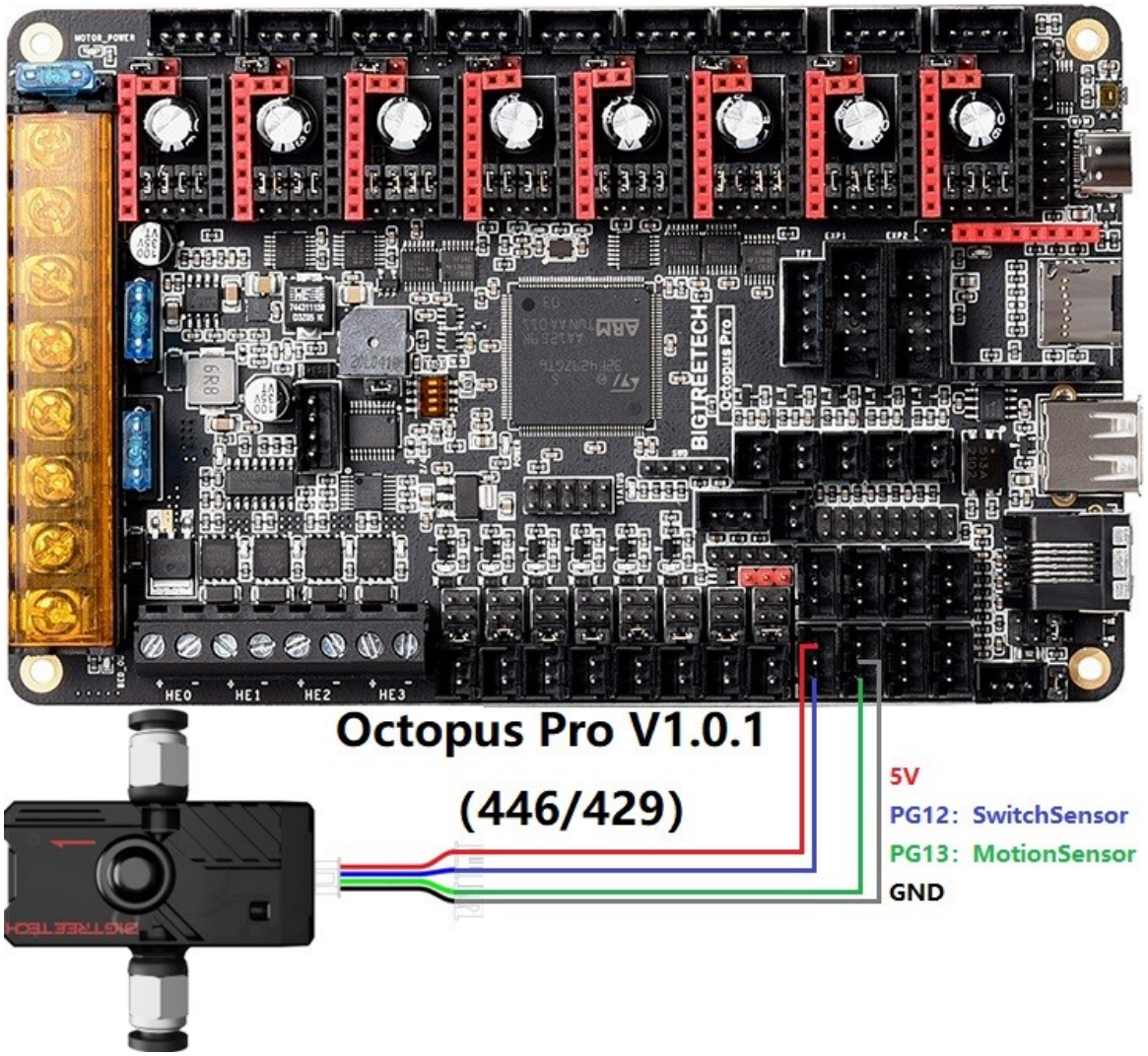
```
[filament_motion_sensor encoder_sensor]
switch_pin: ^PC2
detection_length: 2.88 # accuracy of motion sensor 2.88mm
extruder: extruder
pause_on_runout: False
runout_gcode:
    PAUSE  #  [pause_resume] is required in printer.cfg
    M117 Filament encoder runout
insert_gcode:
    M117 Filament encoder inserted
```

SFS V2.0+Octopus V1.1



```
[filament_switch_sensor switch_sensor]
switch_pin: ^PG12
pause_on_runout: False
runout_gcode:
   PAUSE  #  [pause_resume] is required in printer.cfg
   M117 Filament switch runout
insert_gcode:
   M117 Filament switch inserted

[filament_motion_sensor encoder_sensor]
switch_pin: ^PG13
detection_length: 2.88 # accuracy of motion sensor 2.88mm
extruder: extruder
pause_on_runout: False
runout_gcode:
   PAUSE  #  [pause_resume] is required in printer.cfg
   M117 Filament encoder runout
insert_gcode:
   M117 Filament encoder inserted
```

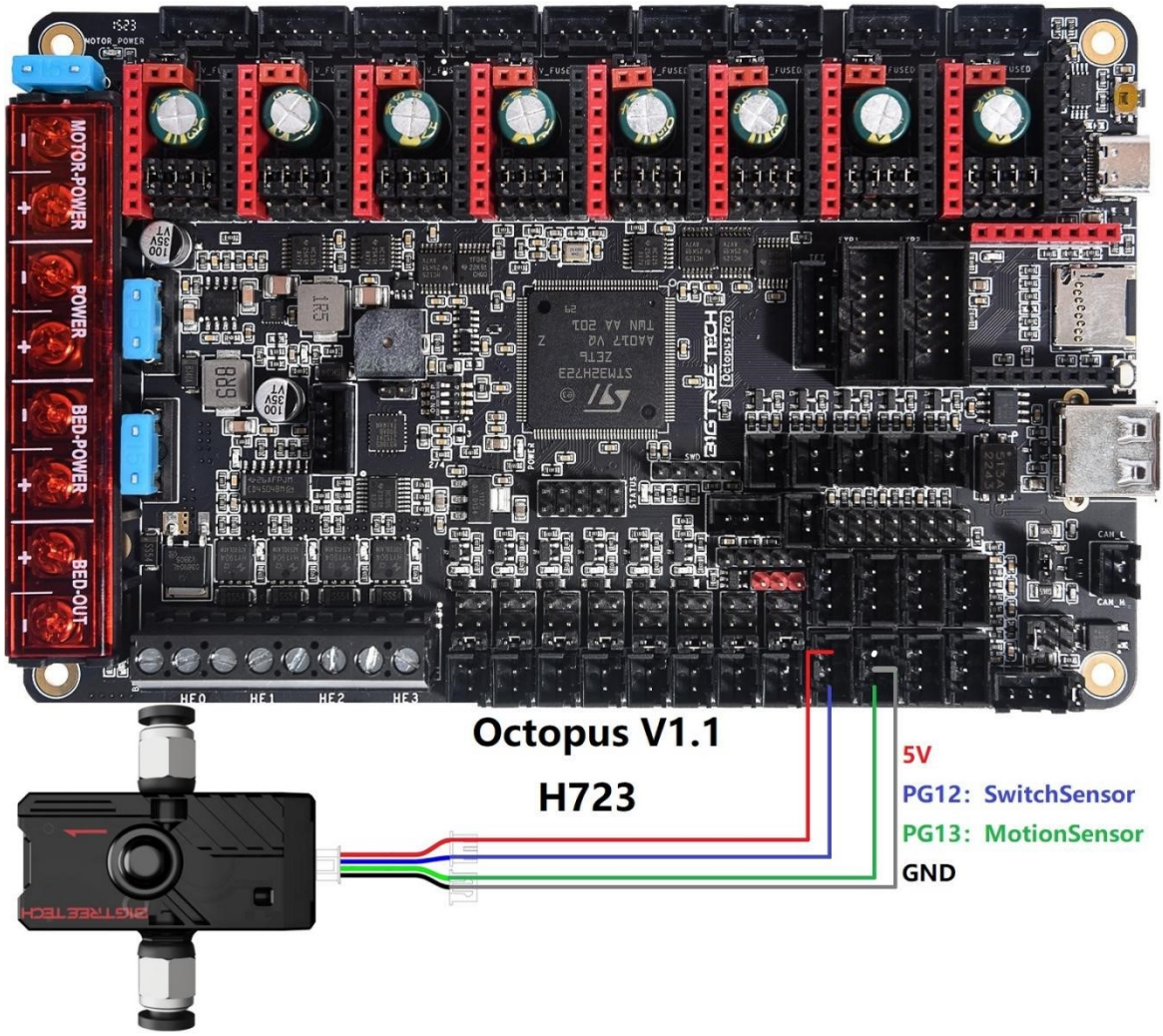
SFS V2.0+Octopus Pro V1.0.1




```
[filament_switch_sensor switch_sensor]
switch_pin: ^PG12
pause_on_runout: False
runout_gcode:
   PAUSE  #  [pause_resume] is required in printer.cfg
   M117 Filament switch runout
insert_gcode:
   M117 Filament switch inserted

[filament_motion_sensor encoder_sensor]
switch_pin: ^PG13
detection_length: 2.88 # accuracy of motion sensor 2.88mm
extruder: extruder
pause_on_runout: False
runout_gcode:
```

```
    PAUSE  #  [pause_resume] is required in printer.cfg
    M117 Filament encoder runout
insert_gcode:
    M117 Filament encoder inserted
```

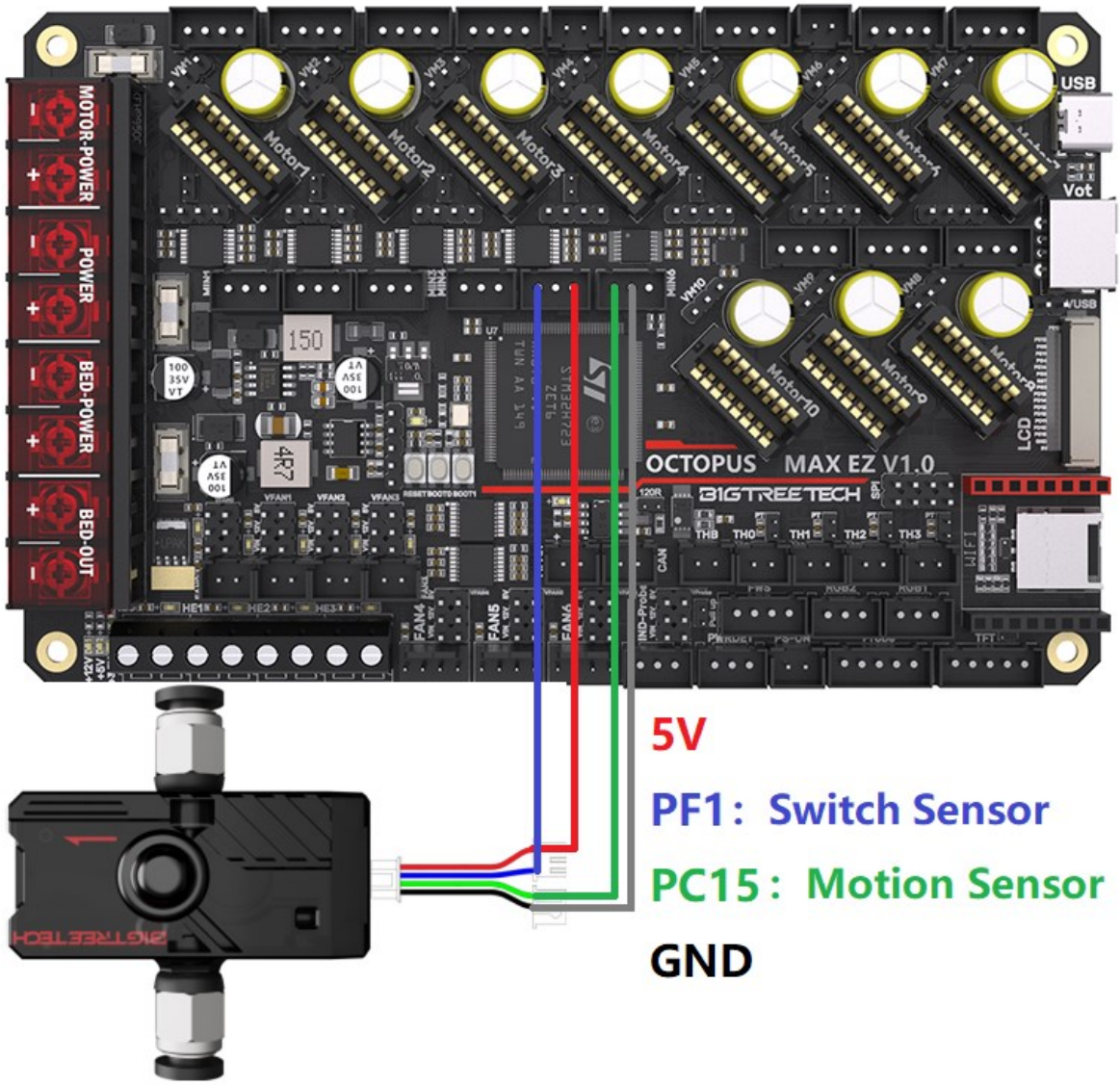
SFS V2.0+Octopus Pro V1.1




```
[filament_switch_sensor switch_sensor]
switch_pin: ^PG12
pause_on_runout: False
runout_gcode:
    PAUSE  #  [pause_resume] is required in printer.cfg
    M117 Filament switch runout
insert_gcode:
    M117 Filament switch inserted
```

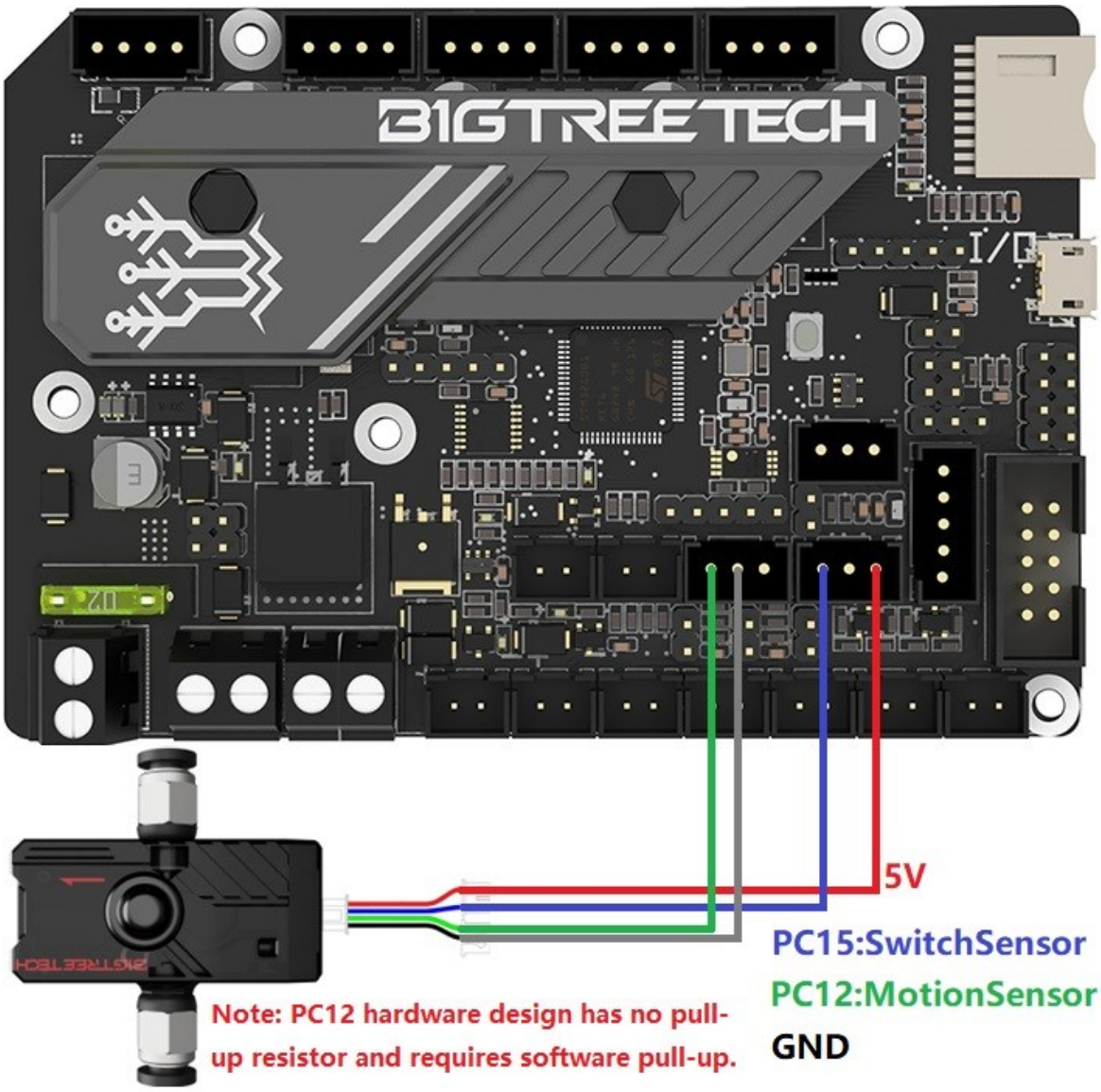
```
[filament_motion_sensor encoder_sensor]
switch_pin: ^PG13
detection_length: 2.88 # accuracy of motion sensor 2.88mm
extruder: extruder
pause_on_runout: False
runout_gcode:
    PAUSE  #  [pause_resume] is required in printer.cfg
    M117 Filament encoder runout
insert_gcode:
    M117 Filament encoder inserted
```

SFS V2.0+Octopus MAX EZ



```
[filament_switch_sensor switch_sensor]
switch_pin: ^PF1
pause_on_runout: False
runout_gcode:
   PAUSE  #  [pause_resume] is required in printer.cfg
   M117 Filament switch runout
insert_gcode:
   M117 Filament switch inserted

[filament_motion_sensor encoder_sensor]
switch_pin: ^PC15

detection_length: 2.88 # accuracy of motion sensor 2.88mm
extruder: extruder
pause_on_runout: False
runout_gcode:
   PAUSE  #  [pause_resume] is required in printer.cfg
   M117 Filament encoder runout
insert_gcode:
   M117 Filament encoder inserted
```

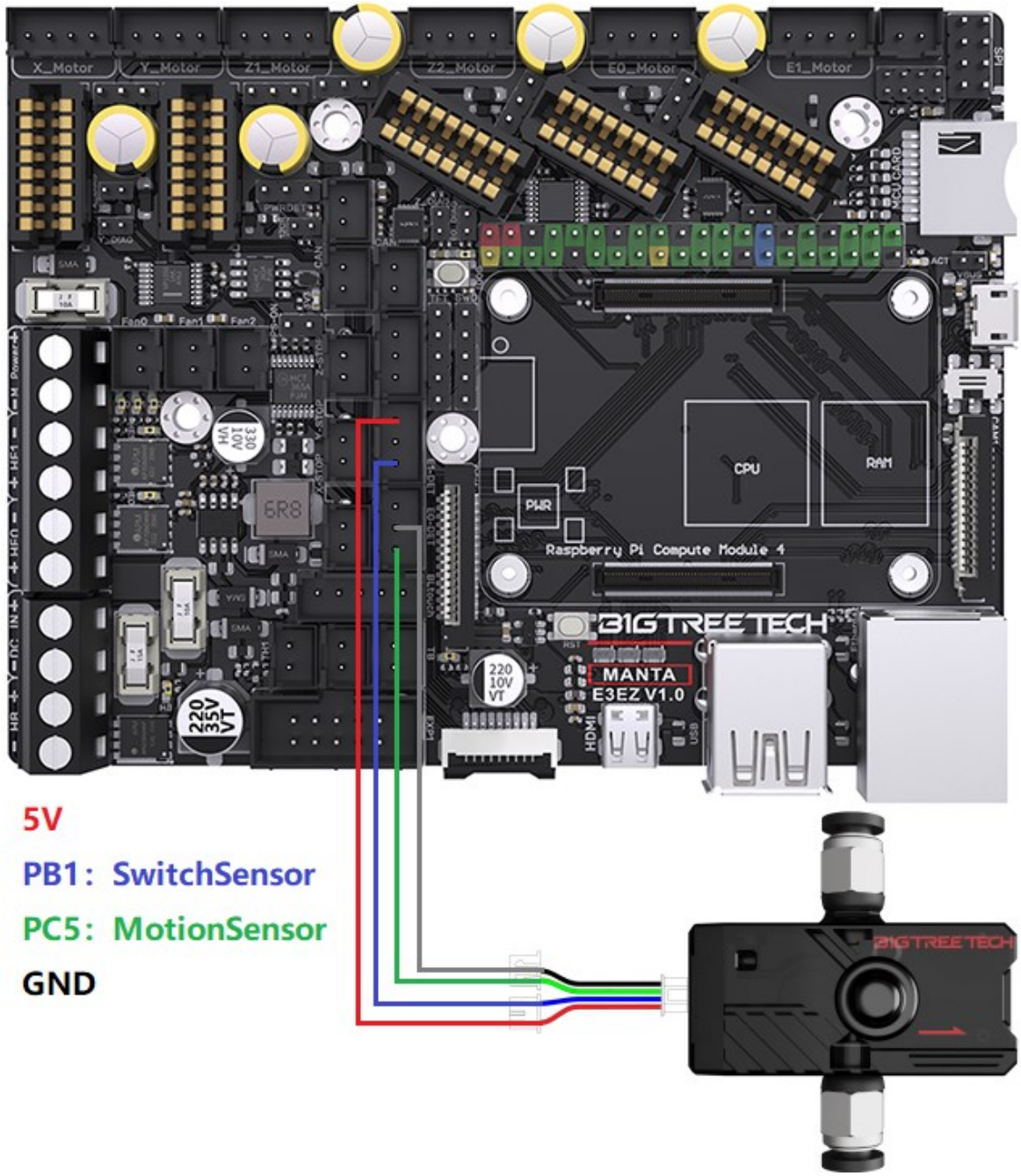
SFS V2.0+SKR MINI E3 V3.0




```
[filament_switch_sensor switch_sensor]
switch_pin: ^PC15
pause_on_runout: False
runout_gcode:
    PAUSE  #  [pause_resume] is required in printer.cfg
    M117 Filament switch runout
insert_gcode:
    M117 Filament switch inserted

[filament_motion_sensor encoder_sensor]
switch_pin: ^PC12
detection_length: 2.88 # accuracy of motion sensor 2.88mm
extruder: extruder
```

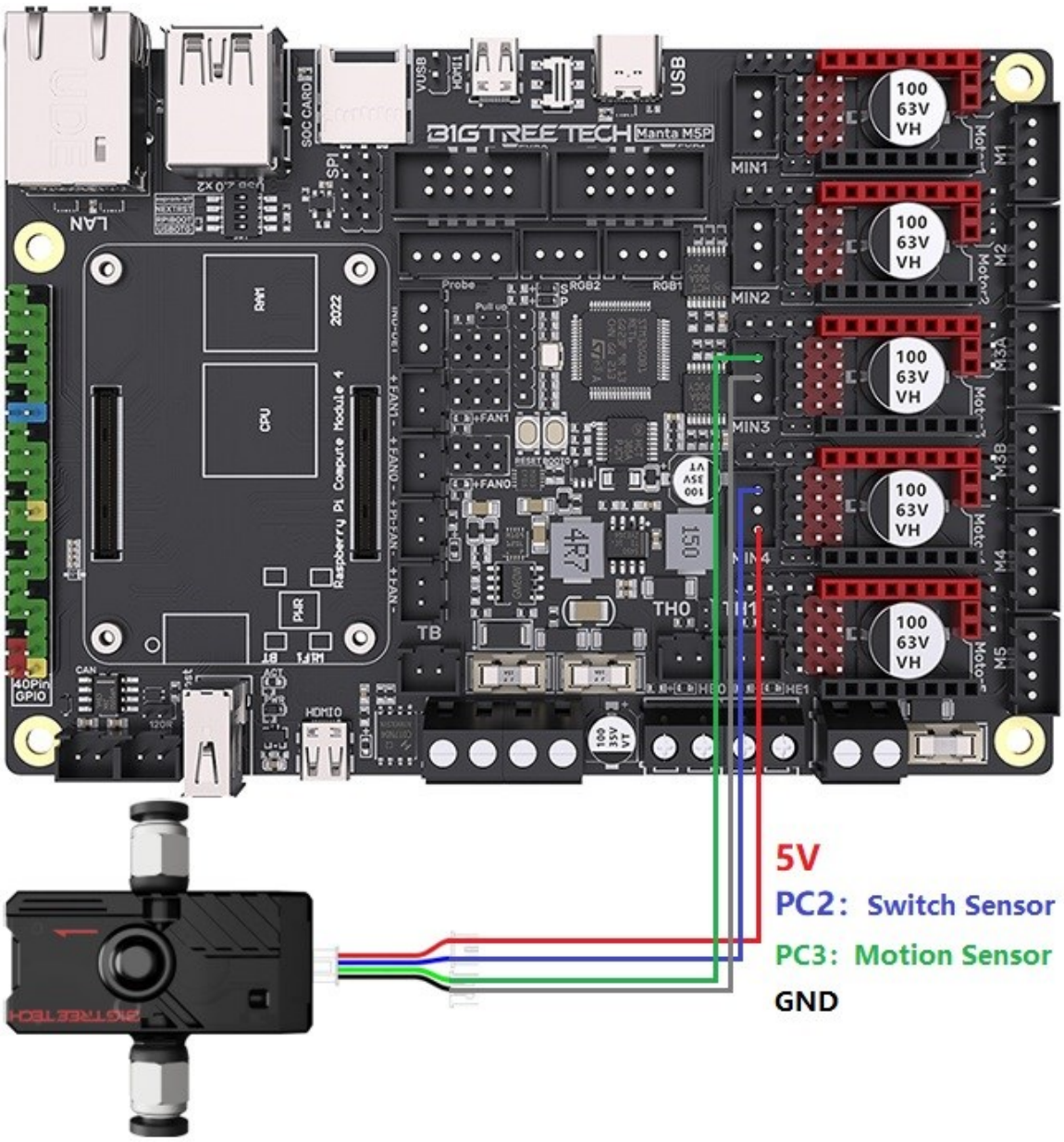
```
pause_on_runout: False
runout_gcode:
    PAUSE  #  [pause_resume] is required in printer.cfg
    M117 Filament encoder runout
insert_gcode:
    M117 Filament encoder inserted
```

SFS V2.0+E3EZ



```
[filament_switch_sensor switch_sensor]
switch_pin: ^PB1
pause_on_runout: False
runout_gcode:
   PAUSE  #  [pause_resume] is required in printer.cfg
   M117 Filament switch runout
insert_gcode:
   M117 Filament switch inserted

[filament_motion_sensor encoder_sensor]
switch_pin: ^PC5
detection_length: 2.88 # accuracy of motion sensor 2.88mm
extruder: extruder
pause_on_runout: False
runout_gcode:
   PAUSE  #  [pause_resume] is required in printer.cfg
   M117 Filament encoder runout
insert_gcode:
   M117 Filament encoder inserted
```

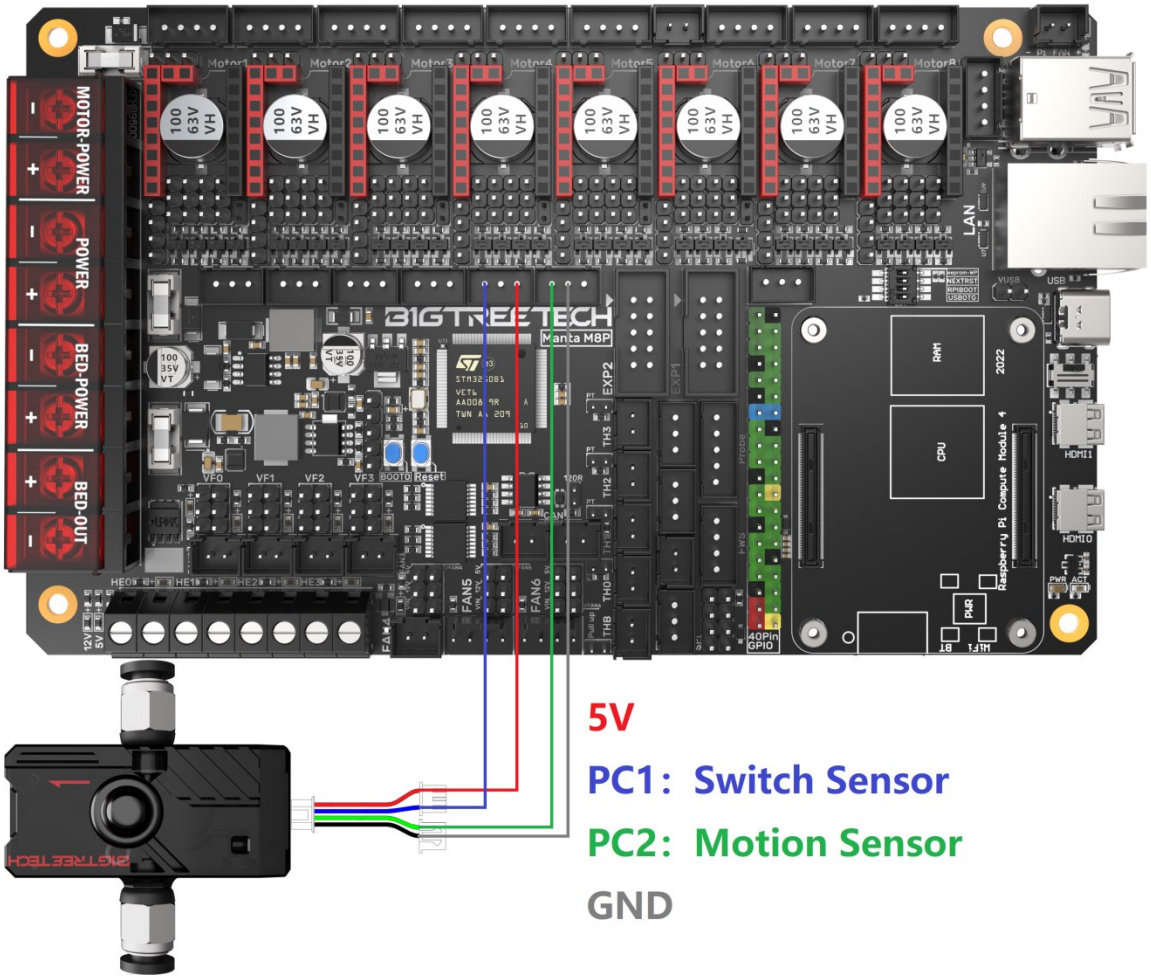
SFS V2.0+MANTA M5P




```
[filament_switch_sensor switch_sensor]
switch_pin: ^PC2
pause_on_runout: False
runout_gcode:
    PAUSE  #  [pause_resume] is required in printer.cfg
    M117 Filament switch runout
insert_gcode:
    M117 Filament switch inserted

[filament_motion_sensor encoder_sensor]
switch_pin: ^PC3
```

```
detection_length: 2.88 # accuracy of motion sensor 2.88mm
extruder: extruder
pause_on_runout: False
runout_gcode:
    PAUSE  #  [pause_resume] is required in printer.cfg
    M117 Filament encoder runout
insert_gcode:
    M117 Filament encoder inserted
```

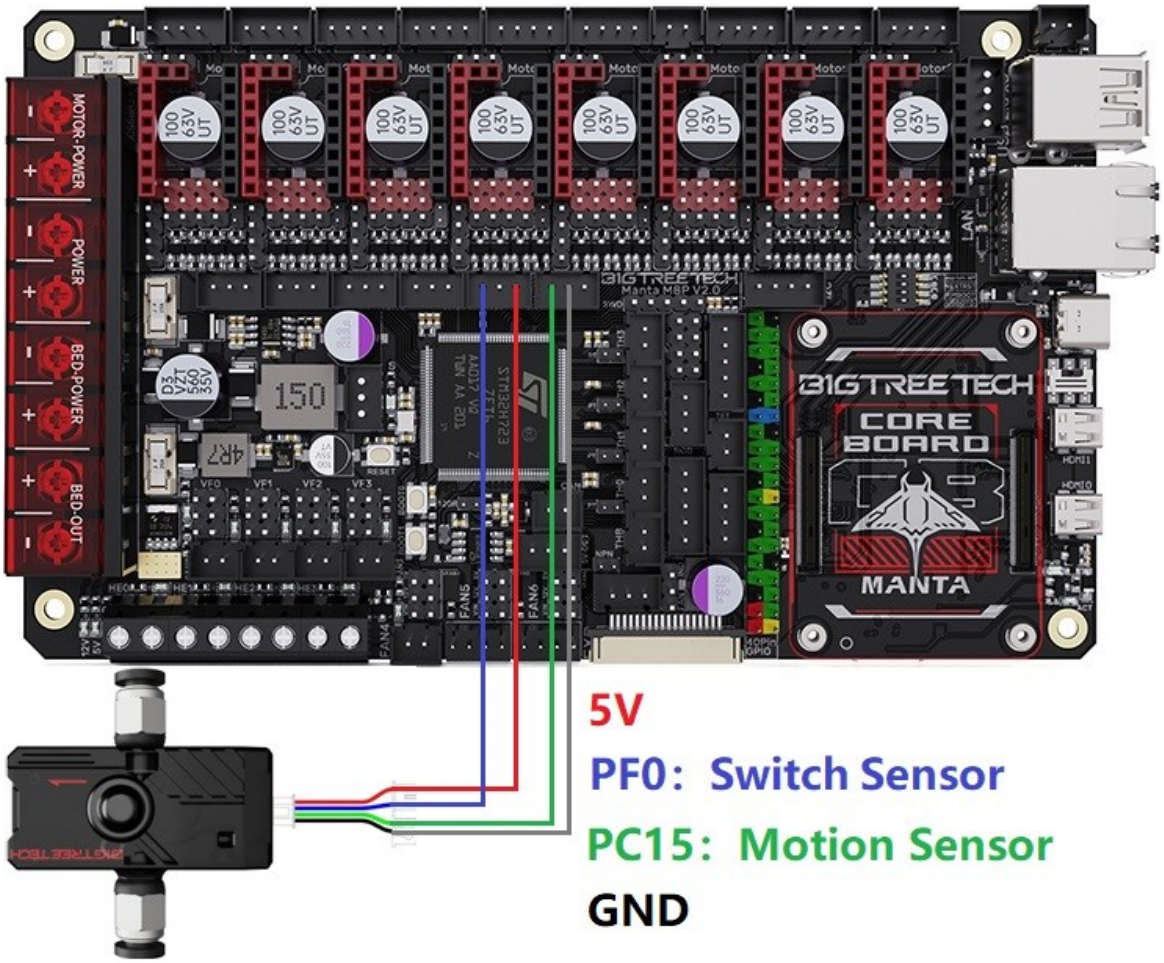
SFS V2.0+MANTA M8P V1.0/V1.1




```
[filament_switch_sensor switch_sensor]
switch_pin: ^PC1
pause_on_runout: False
runout_gcode:
    PAUSE  #  [pause_resume] is required in printer.cfg
```

```
    M117 Filament switch runout
insert_gcode:
    M117 Filament switch inserted

[filament_motion_sensor encoder_sensor]
switch_pin: ^PC2
detection_length: 2.88 # accuracy of motion sensor 2.88mm
extruder: extruder
pause_on_runout: False
runout_gcode:
    PAUSE  #  [pause_resume] is required in printer.cfg
    M117 Filament encoder runout
insert_gcode:
    M117 Filament encoder inserted
```

SFS V2.0+MANTA M8P V2.0



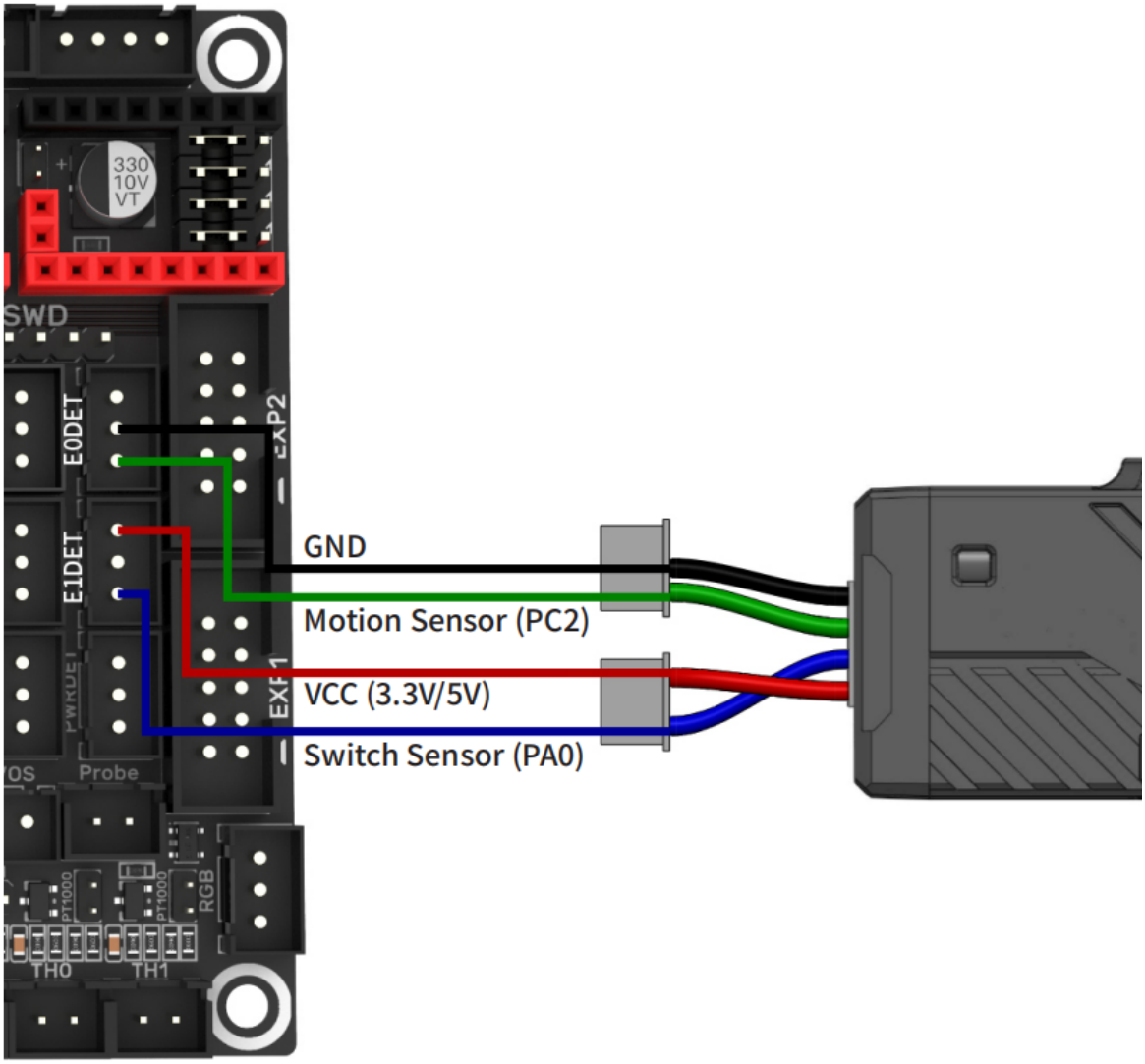
```
[filament_switch_sensor switch_sensor]
switch_pin: ^PF0
pause_on_runout: False
runout_gcode:
   PAUSE  #  [pause_resume] is required in printer.cfg
   M117 Filament switch runout
insert_gcode:
   M117 Filament switch inserted

[filament_motion_sensor encoder_sensor]
switch_pin: ^PC15
detection_length: 2.88 # accuracy of motion sensor 2.88mm
extruder: extruder
pause_on_runout: False
runout_gcode:
   PAUSE  #  [pause_resume] is required in printer.cfg
   M117 Filament encoder runout
insert_gcode:
   M117 Filament encoder inserted
```

Firmware Modification

1. The signal output of the switch sensor is at low level when no filament is detected, IO pin should be set to pull_up input.
2. The signal output of motion sensor changes level at every 2.88mm of filament movement, the IO pin should also be set to pull_up input.

For details: https://github.com/bigtreetech/smart-filament-detection-module

Taking the SKR3 motherboard as an example:



1. Klipper

```
[filament_switch_sensor switch_sensor]
switch_pin: ^PA0  # switch sensor IO is PA0 pause_on_runout: False
runout_gcode:
   PAUSE  #  [pause_resume] is required in printer.cfg
   M117 Filament switch runout
```

```
insert_gcode:
   M117 Filament switch inserted
```

References:

https://www.klipper3d.org/Config_Reference.html#filament_switch_sensor

```
[filament_motion_sensor encoder_sensor]
switch_pin: ^PC2  # motion sensor IO is PC2

detection_length: 2.88 # accuracy of motion sensor 2.88mm
extruder: extruder
pause_on_runout: False
runout_gcode:
   PAUSE  #  [pause_resume] is required in printer.cfg
   M117 Filament encoder runout
insert_gcode:
   M117 Filament encoder inserted
```

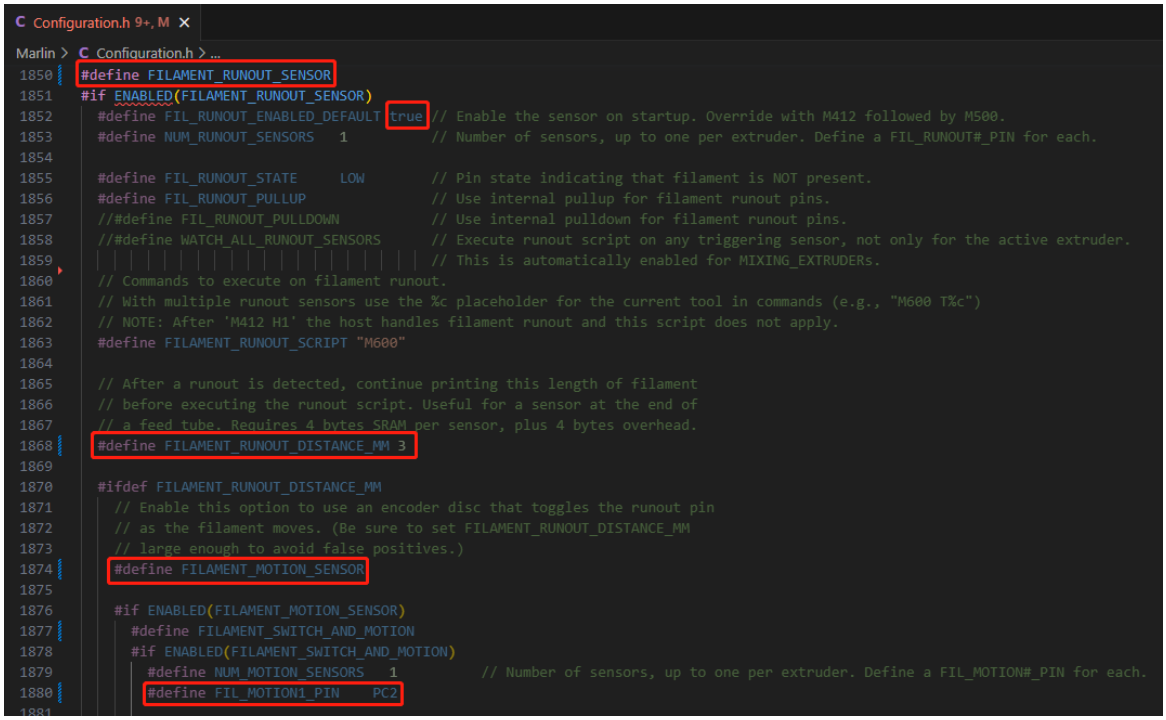
References:

https://www.klipper3d.org/Config_Reference.html#filament_motion_sensor

Note: 2.88 mm is the minimum detection length required for the sensor to function properly. If you encounter problem of false triggers, try increasing the detection length by 1mm increments until the problem is resolved.

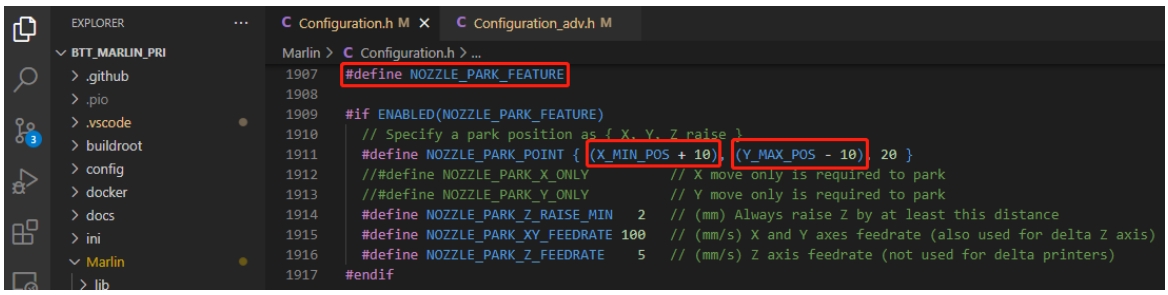
2. Marlin

On Marlin, an extruder can only correspond to one filament detection, so we choose "motion sensor", follow the steps below to enable the motion sensor (Note: It is necessary to check whether the FIL_RUNOUT_PIN in the pin file of the motherboard is the same as the actual motion sensor connecting pin).

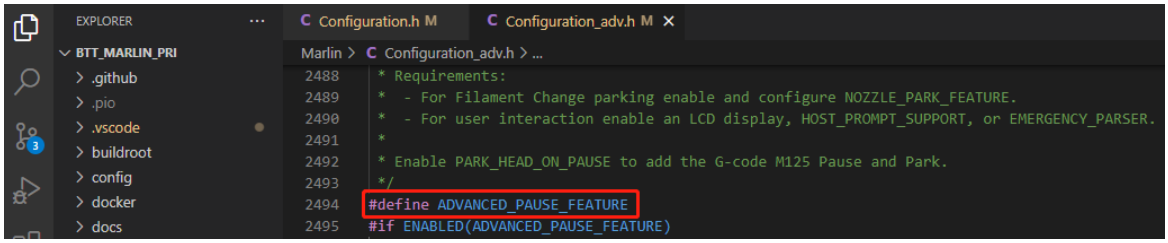


#define FILAMENT_RUNOUT_SENSOR
#define FILAMENT_RUNOUT_ENABLED_DEFAULT true
#define FILAMENT_RUNOUT_DISTANCE_MM 3 // set sensitivity, the recommended setting for SFS V2.0 is 3mm, which means if no signal of filament movement is detected after 3mm of filament travel command, filament error will be triggered.
#define FILAMENT_MOTION_SENSOR // set encoder type
#define FILAMENT_SWITCH_AND_MOTION // Enable both SWITCH and MOTION
#define FIL_MOTION1_PIN PC2 // set motion pin to actual GPIO of motherboard

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 coordinates of the nozzle



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

3. RRF

M591 D0 P7 C"e0stop" L2.88 R75:125 E9 S1; accuracy of motion sensor is 2.88mm, motion sensor pin: e0stop

Calibration

The theoretical detection length of 2.88mm is the amount of filament that will be extruded between each pulse of the signal. This means that if no filament movement signal is detected after 2.88mm of filament travel command, a filament error will be triggered.

Setting the detection distance to exactly 2.88mm may likely cause false triggers or errors. You can treat this parameter as the sensitivity of the sensor, the higher the number, the less sensitive the sensor will be.

The detection length needs to be adjusted depending on the mounting location of your SFS V2.0. The further away from the extruder, the higher the number will need to be. We recommend a starting point of 3mm. If you keep getting false triggers, increase the detection length by 1mm increments until the problem is resolved.

Caution

1) Power supply: 3.3V or 5V, please note that any higher voltage will cause damage.

2) The housing can be damaged if quick connectors are tightened frequently or incorrectly.

3) To connect to a motherboard without dedicated filament runout port, please consult our technical support.

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.