

# ZeroPointModule von pkelectronics

## Youtube Video #47



## Nutzerkreis

Grundsätzlich kann das ZPM überall da eingesetzt werden, wo CAN mit einem Raspberry zusammen benötigt wird. Bei den Druckern passt es besonders gut in die kleinen High-End DIY Drucker wie den Voron V0, aber natürlich auch in den Micro oder den Salad Fork. Generell kann man sagen eignet sich das ZPM überall da, wo der Platz eher knapp ist und ein Fullsize Raspberry + CAN Adapter + 5V Netzteil nur schwer unter zubekommen ist.

## Shop

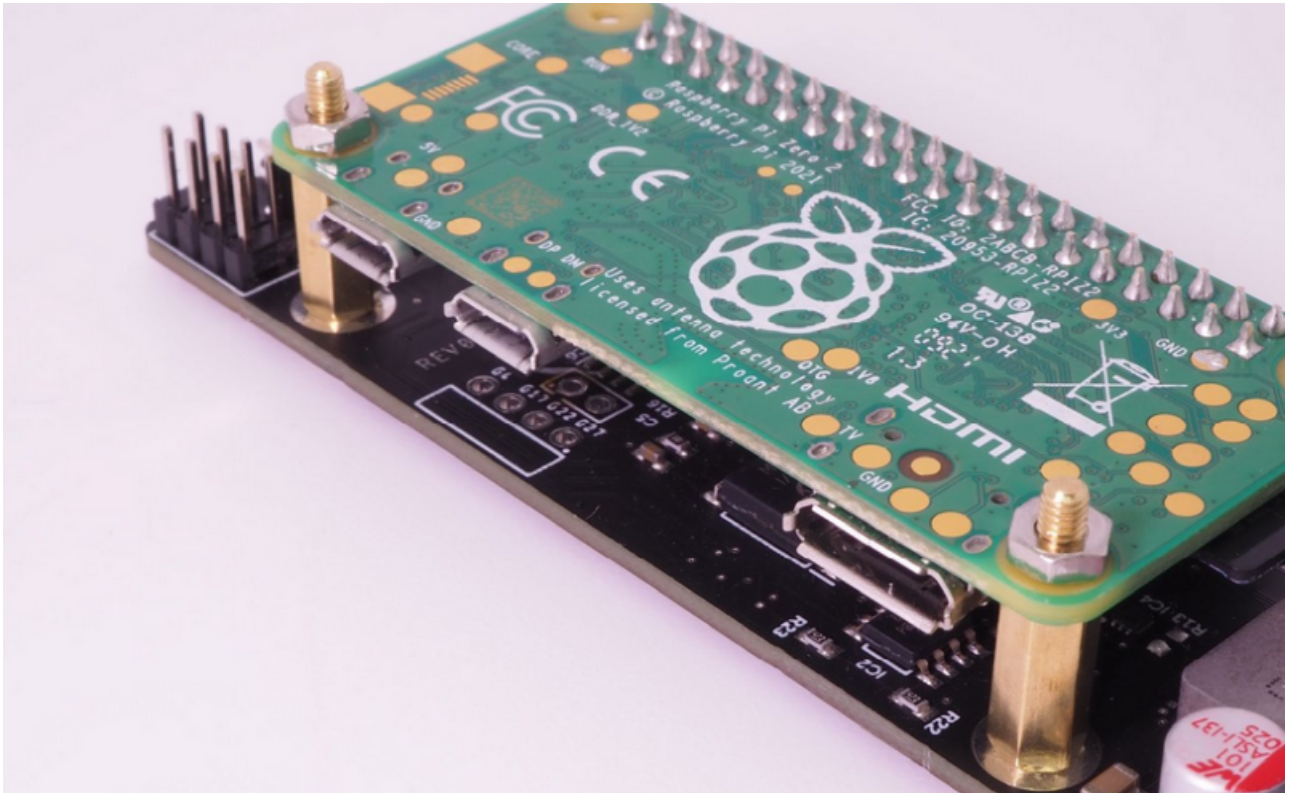
<https://ib-wistinghausen.de/produkt/zeropointmodule/>

## Eigenschaften

- 5V 5A/3A DCDC converter powering the Pi and added peripherals
- MCP2515 CAN-Bus Controller and corresponding transceiver
- Two hardware PWM channels with low-side mosfet switches
- SPI, Uart and I2C connections broken out to dedicated connectors
- Two connectors for 4-pin PWM Fans (5V/24V selectable)
- low profile form-factor possible
- eeprom based autoconfiguration of IOs and kernel modules

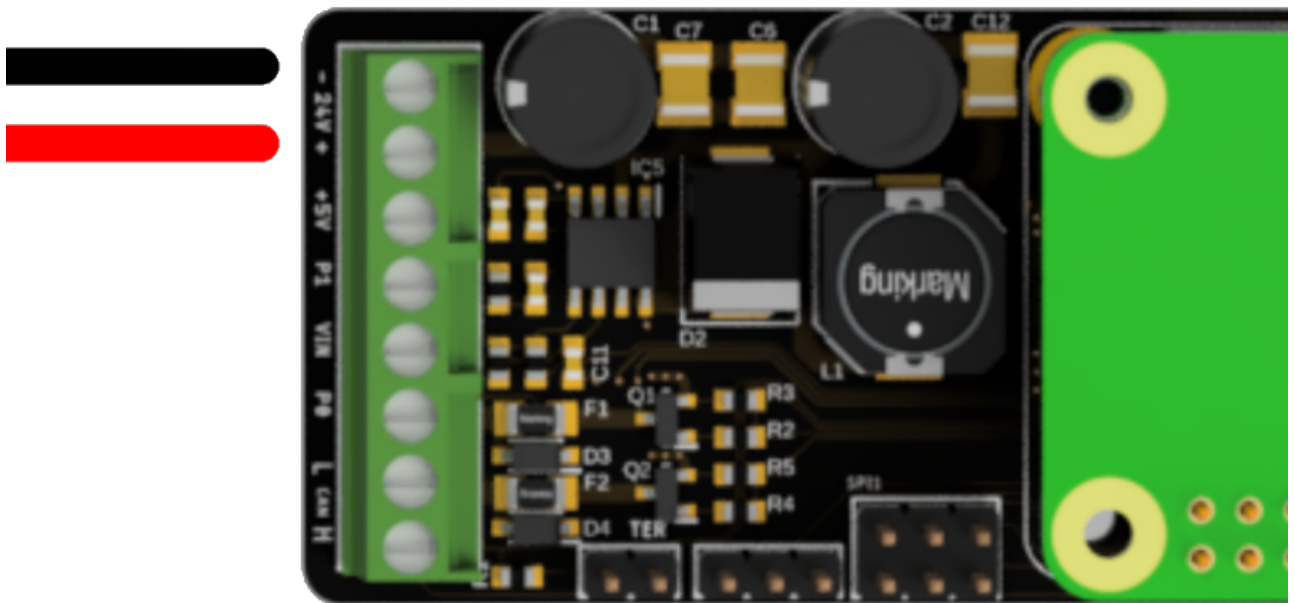
## Grundinstallation

- Den Raspberry Pi Zero auf dem ZeroPointModul aufstecken (auf korrekte Einbaulage achten !)



Die Ports (HDMI, USB) zeigen Richtung ZeroPointModul.

- 24V Spannungsversorgung am Board anschließen



### Hinweis

Die Platine kann auch mit weniger als 24V betrieben werden. 12V lief im Test auch stabil.

- SD-Karte vorbereiten
  - Installation über [MainsailOS](#)
  - Installation über [kiauh](#)
- SD-Karte in den Raspberry Pi einstecken und Spannungsversorgung einschalten
- per SSH einloggen und Updates / Tools installieren

```
sudo apt update && sudo apt upgrade -y && sudo apt install -y git silversearcher-ag wavemon hexedit sudoku tcpdump iptraf mc htop dcfldd nano usbutils ranger tldr ncd u can-utils multitail fd-find && mkdir -p
```

```
~/.local/share && tldr -u
```

- ungenutzte Dienste entfernen
 

```
sudo apt autoremove -y modem* cups* pulse* avahi* triggerhappy*
```

## Betrieb mit UART

- Serielle Schnittstelle aktivieren
 

```
sudo raspi-config
```

  - → 3 Interface Options
  - → I6 Serial Port
  - Would you like a login shell to be accessible over serial? → No
  - Would you like the serial port hardware to be enabled? → Yes
- Bluetooth abschalten
 

```
sudo nano /boot/config.txt
```

  - unter [all] folgenbden Eintrag hinzufügen dtoverlay=disable-bt
- ```
sudo reboot
```
- Firmware mit Serial als Communication interface
 

```
Communication interface (Serial (on USART1 PAXX/PAXX)) --->
```

```
(Top) - Communication interface
( ) USB (on PA11/PA12)
(X) Serial (on USART1 PA10/PA9)
( ) Serial (on USART1 PB7/PB6)
( ) Serial (on USART2 PA3/PA2)
( ) Serial (on USART2 PD6/PD5)
( ) Serial (on USART3 PB11/PB10)
( ) Serial (on USART3 PD9/PD8)
( ) CAN bus (on PA11/PA12)
( ) CAN bus (on PA11/PB9)
( ) CAN bus (on PB8/PB9)
( ) CAN bus (on PI9/PH13)
( ) CAN bus (on PB5/PB6)
( ) CAN bus (on PB12/PB13)
( ) CAN bus (on PD0/PD1)
( ) USB to CAN bus bridge (USB on PA11/PA12)
```

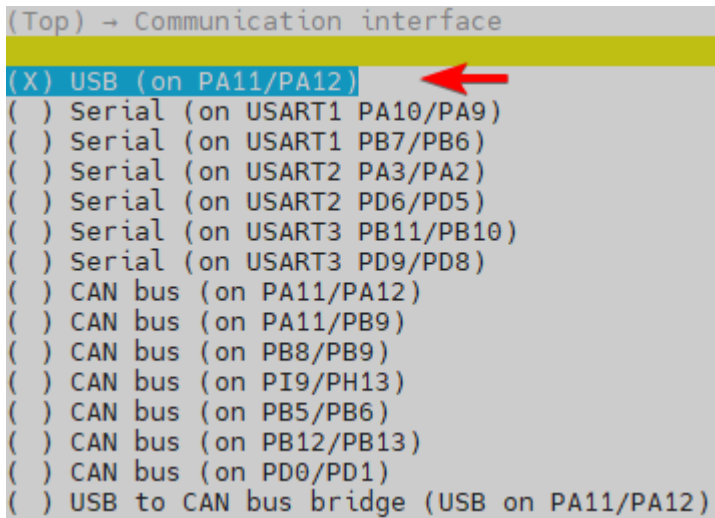
- Seriellen Port in Linux finden
 

```
ls -lR /dev/ | grep -v '\->\s../tty' | grep -e 'tty[[:alpha:]]' -e serial
```
- Kommunikation Testen
 

```
sudo systemctl stop klipper
~/klippy-env/bin/python ~/klipper/klippy/console.py /dev/ttyAMA0
sudo systemctl stop klipper
```
- Seriellen Port in printer.cfg eintragen

## Betrieb mit USB

- die Firmware mit USB Support kompilieren



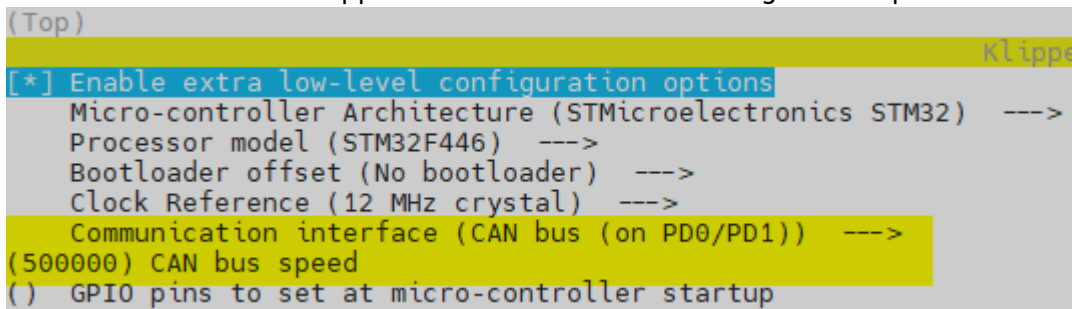
- USB Port verbinden
  - USB-Micro auf USB-A Adapter
  - USB-Hub für Raspberry Pi Zero
- Seriellen Port in Linux finden

```
ls -lR /dev/ | grep -v '\->\s../tty' | grep -e 'tty[[:alpha:]]' -e serial
```
- Kommunikation Testen

```
sudo systemctl stop klipper
~/klippy-env/bin/python ~/klipper/klippy/console.py /dev/ttyAMA0
sudo systemctl stop klipper
```
- Seriellen Port in printer.cfg eintragen

## Betrieb mit CAN

- Die Firmware mit CAN Support und korrekter Geschwindigkeit compilieren und flashen



- Buskoppler prüfen

```
dmesg |grep '251\|can\|spi'
```
- CAN erstmal down

```
pi@TestPi:~ $ ip a
2: can0: <NOARP,ECHO> mtu 16 qdisc noop state DOWN group default qlen
10
    link/can
```

- Interface UP

```
sudo ip link set can0 up type can bitrate 500000
```
- `sudo nano /etc/network/interfaces.d/can0`

```
auto can0
iface can0 can static
    bitrate 500000
    up ifconfig $IFACE txqueuelen 128
```

- pi@TestPi:~ \$ ~/klippy-env/bin/python ~/klipper/scripts/canbus\_query.py can0  
Found **canbus\_uuid=5b5a812a7283**, Application: Klipper  
Total **1** uuids found

- CAN UUID in der printer.cfg eintragen

```
[mcu]
restart_method          : command
canbus_uuid             : 5b5a812a7283
```

- Kommunikation Testen  
sudo systemctl stop klipper  
~/klippy-env/bin/python ~/klipper/klippy/console.py -c can0 5b5a812a7283  
sudo systemctl stop klipper

## Extra Hardware über RPi nutzen

- Hardware PWM einrichten  
[https://www.klipper3d.org/RPi\\_microcontroller.html](https://www.klipper3d.org/RPi_microcontroller.html)
- Problem Neopixel → Timinig Problem  
<https://github.com/Klipper3d/klipper/issues/3366>
- Problem ADXL345  
<https://forums.raspberrypi.com//viewtopic.php?t=149981>

## Raspberry PI MCU

- cd ~/klipper/
- sudo cp ./scripts/klipper-mcu.service /etc/systemd/system/
- sudo systemctl enable klipper-mcu.service
- make menuconfig

```
[*] Enable extra low-level configuration options
    Micro-controller Architecture (Linux process)  --->
    () GPIO pins to set at micro-controller startup
```

- sudo usermod -a -G tty pi
- sudo service klipper stop
- make flash -j4
- sudo service klipper start

## Pin / GPIO Übersicht

| PIN                | Funktion         | Position |
|--------------------|------------------|----------|
| GPIO2 / SDA        | General IO / I2C | J1       |
| GPIO3 / SCL        | General IO / I2C | J1       |
| GPIO4              | General IO       | J8       |
| GPIO5              | General IO       | J5       |
| GPIO6              | General IO       | J6       |
| GPIO7              | NC               | -        |
| GPIO12 / PWM0      | General IO / PWM | J3 / J6  |
| GPIO13 / PWM1      | General IO / PWM | J3 / J5  |
| GPIO14 / TXD0      | UART             | J1       |
| GPIO15 / RXD0      | UART             | J1       |
| GPIO16             | LED              | D6       |
| GPIO17             | General IO       | J8       |
| GPIO18 / SPI1_CS0  | General IO / SPI | J4       |
| GPIO19 / SPI1_MISO | General IO / SPI | J4       |
| GPIO20 / SPI1_MOSI | General IO / SPI | J4       |
| GPIO21 / SPI1_SCLK | General IO / SPI | J4       |
| GPIO22             | General IO       | J8       |
| GPIO23             | General IO       | J2       |
| GPIO26             | LED              | D1       |
| GPIO27             | General IO       | J8       |

## Beispiel Konfig

[ZeroPoint.cfg](#)

```
[mcu RPi]
serial : /tmp/klipper_host_mcu

[fan_generic RPiFan_0]
pin      : RPi:gpio12
max_power : 1.0
cycle_time : 0.0010
hardware_pwm : false #true
kick_start_time : 0.100

[fan_generic RPiFan_1]
pin      : RPi:gpio13
max_power : 1.0
cycle_time : 0.0010
hardware_pwm : false #true
kick_start_time : 0.100

[output_pin RPi_GPIO_4]
pin      : RPi:gpio4
```

```
[output_pin RPi_GPIO_5]
pin          : RPi:gpio5

[output_pin RPi_GPIO_6]
pin          : RPi:gpio6

[output_pin RPi_GPIO_16_LED]
pin          : RPi:gpio16

[output_pin RPi_GPIO_17]
pin          : RPi:gpio17

[output_pin RPi_GPIO_22]
pin          : RPi:gpio22

[output_pin RPi_GPIO_23]
pin          : RPi:gpio23

[output_pin RPi_GPIO_26_LED]
pin          : RPi:gpio26

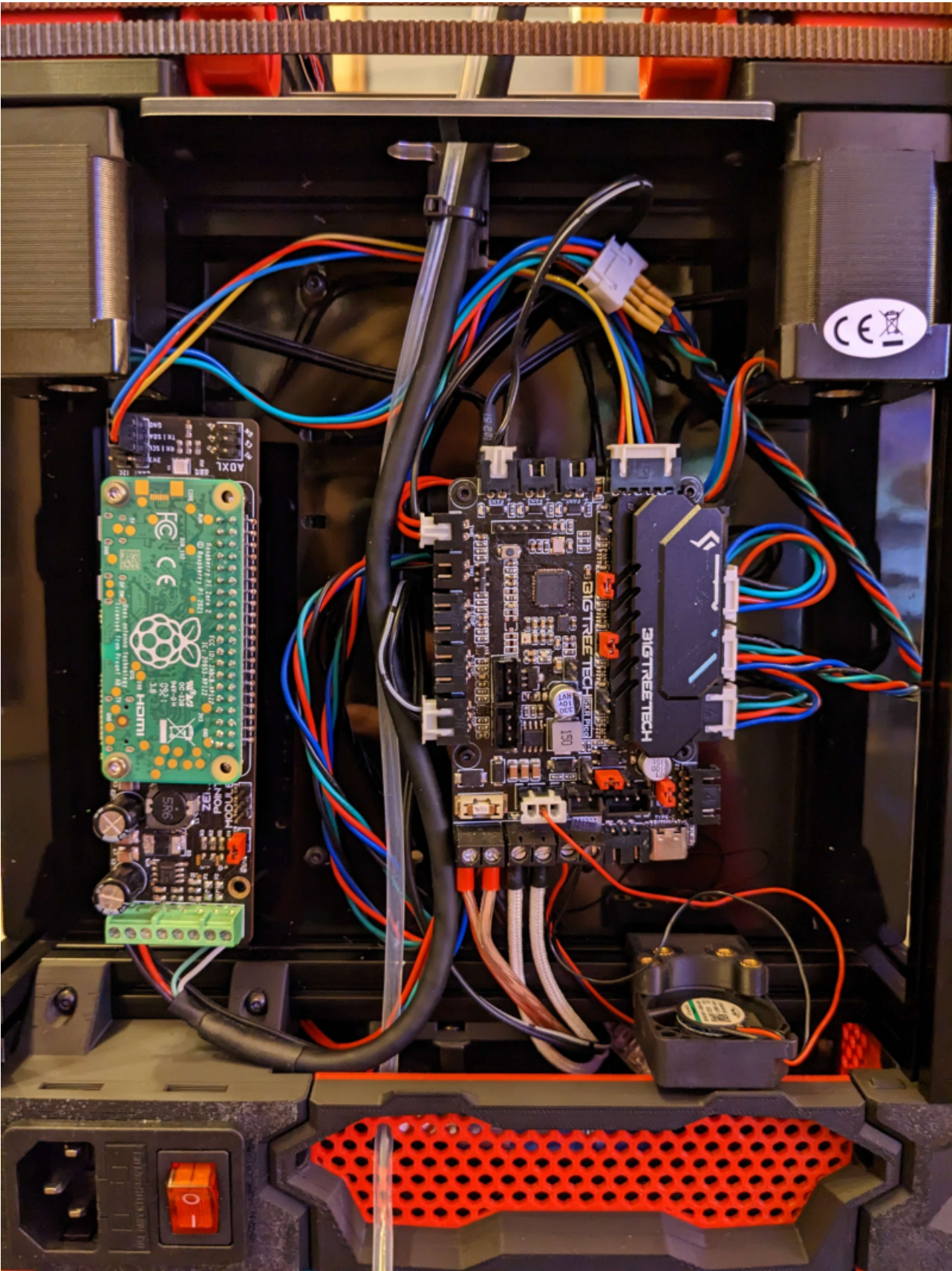
[output_pin RPi_GPIO_27]
pin          : RPi:gpio27

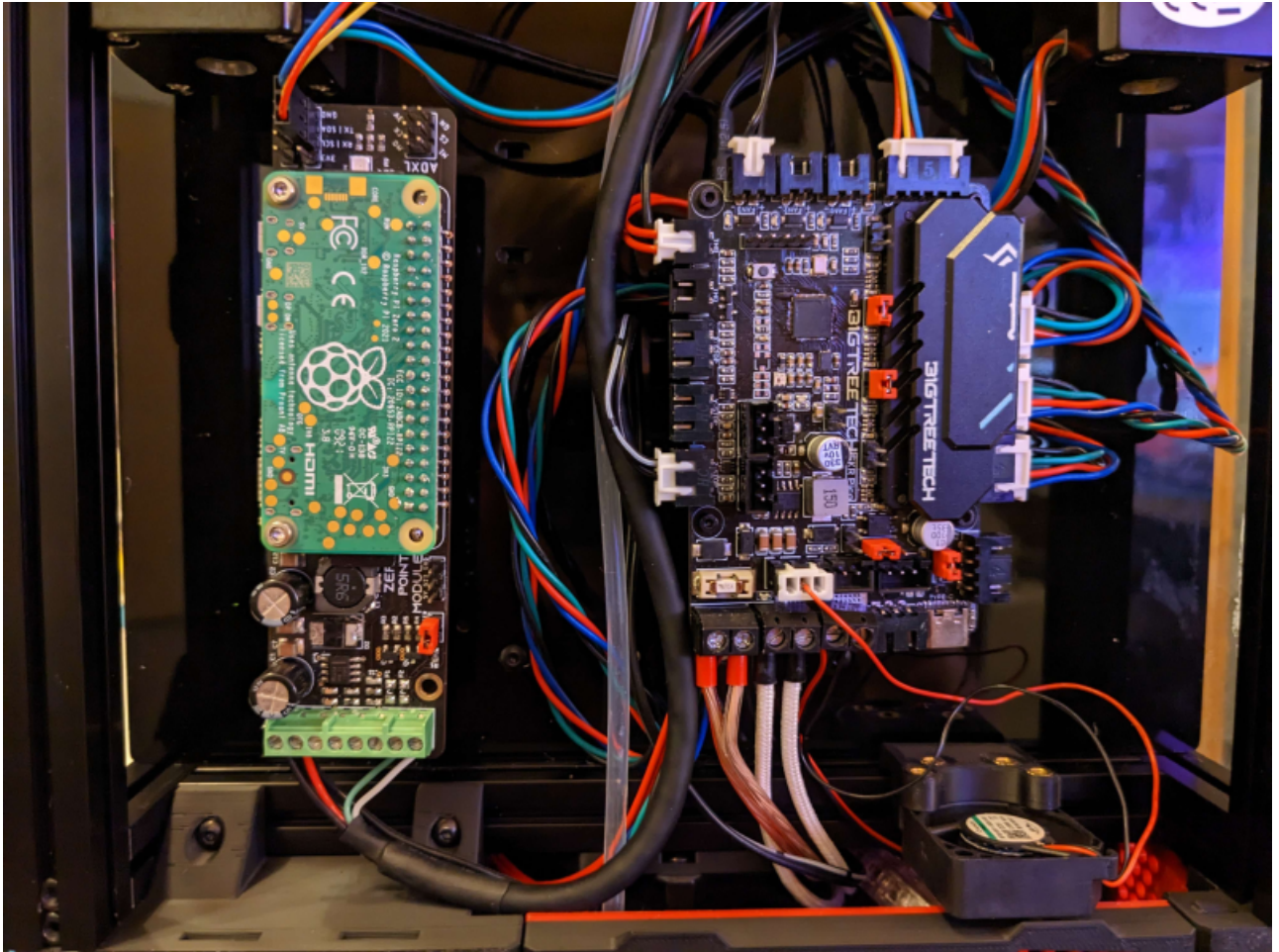
[temperature_sensor BME_280]
sensor_type  : BME280
i2c_address  : 118
i2c_mcu     : RPi
i2c_bus     : i2c.1

[gcode_macro QUERY_BME280]
gcode:
    {% set sensor = printer["bme280 BME_280"] %}
    {action_respond_info(
        "Temperature: %.2f C\n"
        "Pressure: %.2f hPa\n"
        "Humidity: %.2f%%" % (
            sensor.temperature,
            sensor.pressure,
            sensor.humidity))}
```

## Einbauvarianten

- Stefan Dej (meteyou) - Voron V0





## Probleme

- sehr kleine Beschriftung auf dem Board
- SPI Port vom Zero nicht nutzbar (TBD)
- Schrauben übereinander → Fuckelig 😊

## Links

- ZeroPointModule auf Github  
<https://github.com/pkElectronics/ZeroPointModule>
- Schaltplan  
<https://raw.githubusercontent.com/pkElectronics/ZeroPointModule/main/SRC/Schematic%20v20.pdf>
- Pascal Wistinghausen - IB-Wistinghausen  
<https://ib-wistinghausen.de/>

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