

## VORON Leviathan V1.2 Manual

We build space shuttles with gardening tools  
so anyone can have a space shuttle of their own.

VERSION 2023-05-29



Before you begin on your journey, a word of caution.

In the comfort of your own home you are about to assemble a robot. This machine can maim, burn, and electrocute you if you are not careful. Please do not become the first VORON fatality. There is no special Reddit flair for that.

Please, read the entire manual before you start assembly. As you begin wrenching, please check our Discord channels for any tips and questions that may halt your progress.

Most of all, good luck!

**THE VORON TEAM**

Foreword	04
Introduction	05
Controller board overview	06
Preparation	07
Wiring	08
Pin assignment	09
Extension port	10
Firmware	11
Klipper	12
Drawing	13
Credits	14

Why another board?

There was a time when the boards available on the market were either unreliable or just too feature rich. This gave Voron the idea to create their own board.

The target was to implement only the really essential functions that a Voron printer needs (maybe it turned out to be a bit more in the end). It quickly became clear that not everyone can build such a board themselves.

So they looked for a partner who could take on this task and also offer it on the market. This is how the cooperation with LDO came about.

At LDO it would also fit well into the portfolio with the existing kits. So the way was clear for both sides.

Thus the project Leviathan was born.

Sincerely!  
JNP

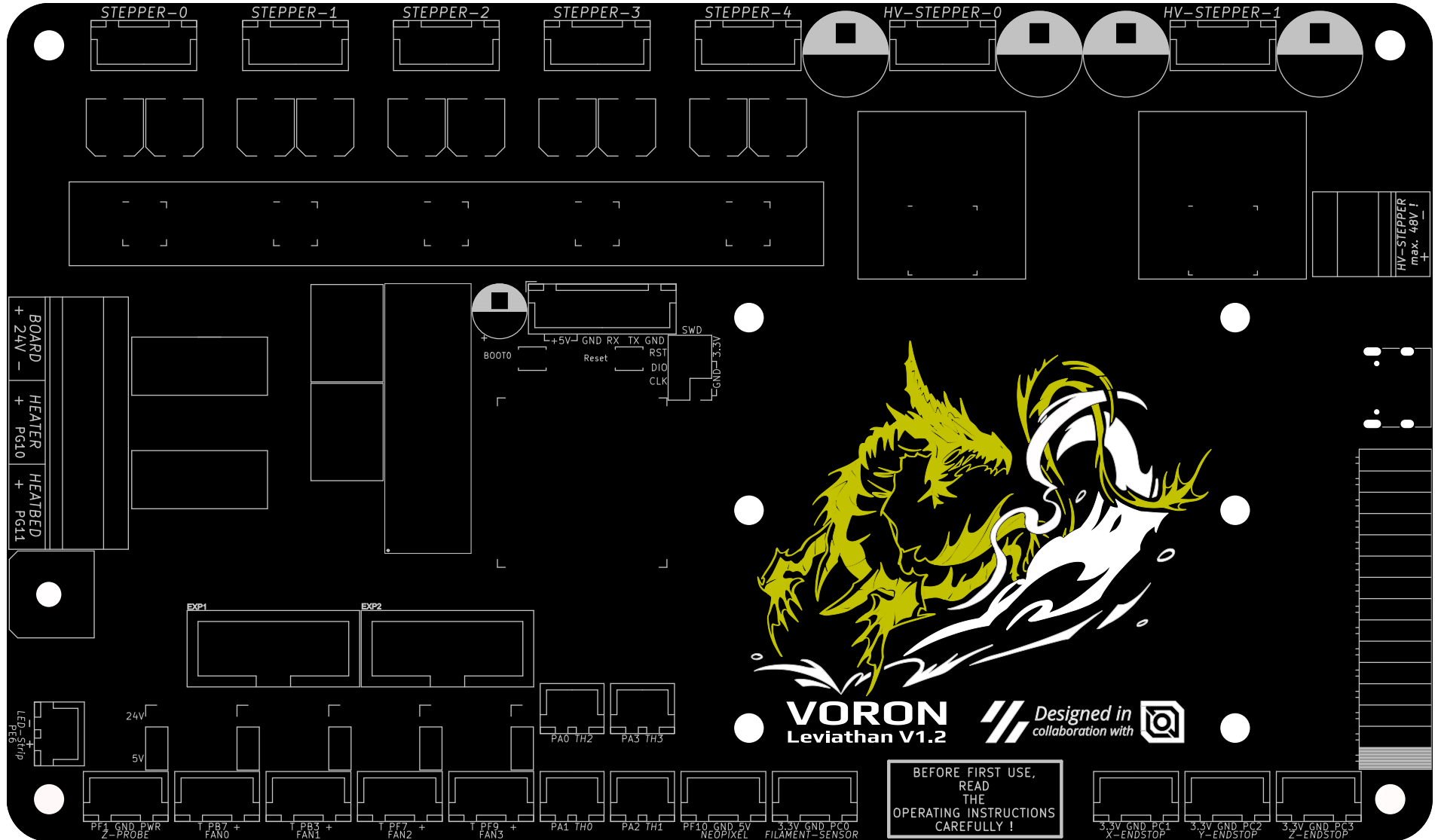
## LEVIATHAN BOARD

This Board is designed and developed for Voron printers. It provides all necessary functions.

These are the main features:

- Supports Klipper firmware
- STM32F446 MCU
- 1x Vin 24V Mainsupply (polarity and overvoltage protected)
- 1x Vin 24–48V TMC5160 supply (polarity and overvoltage protected)
- 5x TMC2209 onboard drivers (24V)
- 2x TMC5160 onboard drivers (24–48V), onboard 12V source for gate drive
- 4x Thermistor inputs
- 4x Fan outputs (with tacho signal support, 5/24V via jumpers)
- 1x Probe input (5/24V via jumper)
- 1x Filamentsensor input (5V tolerant)
- 1x Neopixel output
- 3x Endstop inputs (5V tolerant)
- 1x Hotend heater output (max. 180 W, 7.5 A)
- 1x Heatbed heater output (max. 240 W, 10 A)
- 1x dimmable LED-strip output (350mA constant current source)
- 1x EXP1 port
- 1x EXP2 port
- 1x Extension port (4x ADC, 1xUART, 1xSPI or 1xCAN, 10GPIO, 3.3V@0.5A, 5V0.5A, 24V@0.5A)
- 1x STM32 programmer interface (backup)
- 1x USB-C interface
- 1x CAN Bus interface (MicroFit 3.0 connector)
- 1x RPi Powersupply (5-pin JST-XH connector with UART support)
- Mounting holes for RPi Zero 2W and RPi3/4
- Better stepper driver cooling
- Dimensions: 170x100mm, Mounting holes: 160x90mm

# CONTROLLER BOARD OVERVIEW



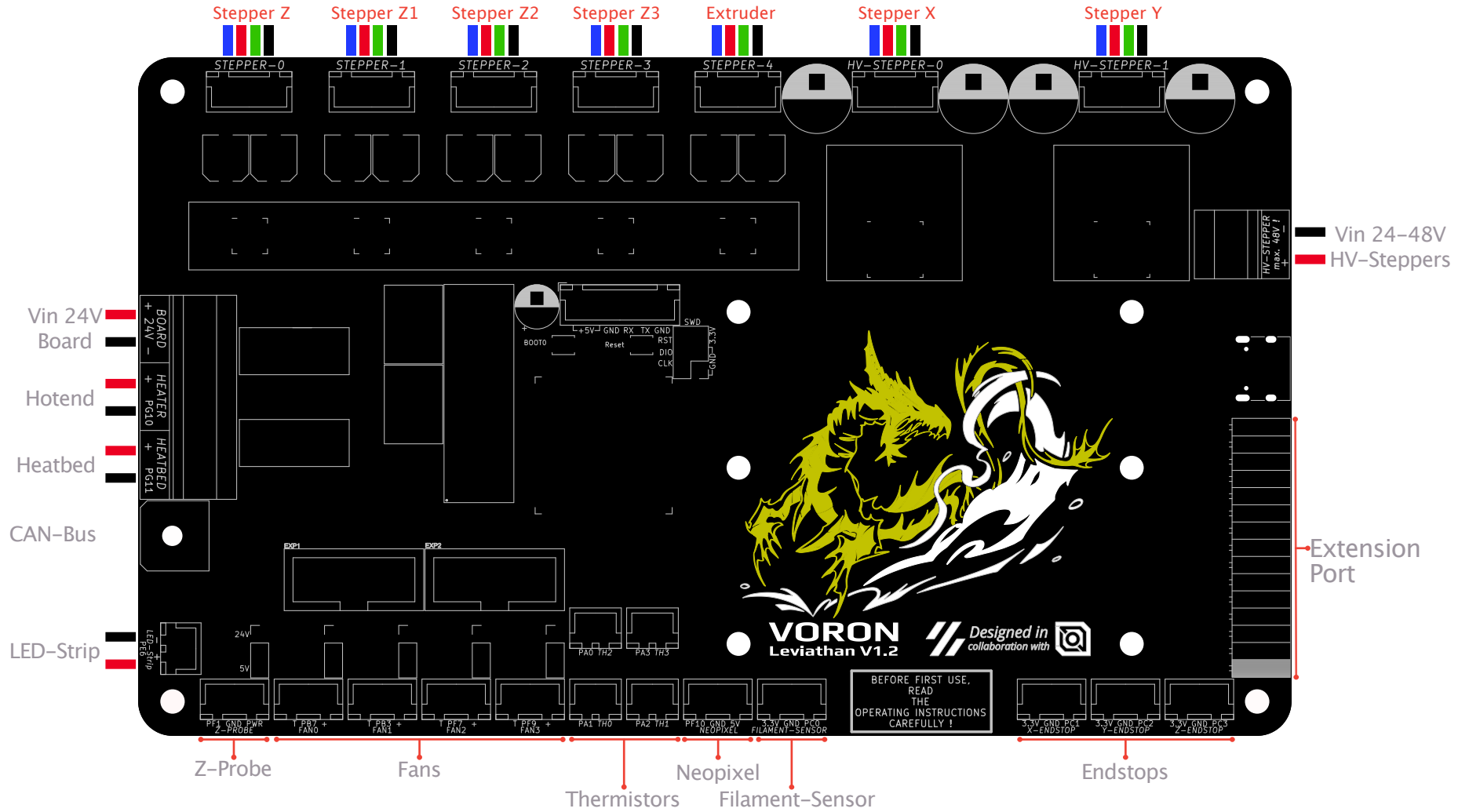
### CONTROLLER BOARD

The manual will outline the wiring for a Leviathan V1.2 board. You can find additional documentation and alternative configurations on [docs.vorondesign.com](https://docs.vorondesign.com)

### JUMPERS

Several jumpers need to be configured on the controller board. Begin by **removing all the JUMPERS** from the controller board (MCU).

- 1) Remove the jumper in the "Probe Voltage Selection"
- 2) Remove all the jumpers on the "Fan Voltage Selection"





# PIN ASSIGNMENT

Stepper	Signal	EN	STEP	DIR	DIAG	UART	CS	SCK	MOSI	MISO
Stepper0		PD7	PD4	PD3	PD6	PD5				
Stepper1		PD2	PC12	PC11	PD1	PD0				
Stepper2		PC10	PC9	PC8	PA15	PA8				
Stepper3		PC7	PG7	PG6	PC6	PG8				
Stepper4		PD13	PD10	PD9	PD12	PD11				
HV_Stepper0		PG0	PB10	PB11	PG1		PE15	PE12	PE14	PE13
HV_Stepper1		PE9	PF15	PF14	PE10		PE11	PE12	PE14	PE13

Fans	Signal	Fan0	Fan1	Fan2	Fan3
	PWM	PB7	PB3	PF7	PF9
	Tacho	PB0	PB4	PF6	PF8

Endstops	Signal	Endstop X	Endstop Y	Endstop Z	Z-Probe	Filament-Sensor
		PC1	PC2	PC3	PF1	PC0

EXP1	Signal	Beeper	BTN_ENC	LCD_EN	LCD_RS	LCD_D4	LCD_D5	LCD_D6	LCD_D7
		PG9	PG12	PG13	PG14	PC13	PC14	PC15	PF0

EXP2	Signal	SPI_MISO	SPI_SCK	BTN_EN2	SPI_CS	BTN_EN1	SPI_MOSI	SD_DET	Reset	Kill
		PA6	PA5	PE2	PE4	PE3	PA7	PE5	Reset	PE4

Thermistors	Signal	TH0	TH1	TH2	TH3
		PA1	PA2	PA0	PA3

Neopixel	Signal	Data
		PF10

LED-Strip	Signal	PWM
		PE6

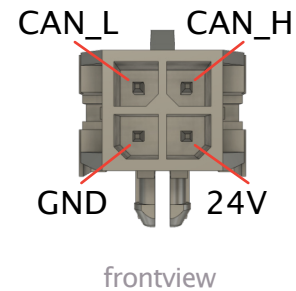
UART Pi	Signal	RX	TX
		PA10	PA9

Heatbed	Signal	PWM
		PG11

Hotend	Signal	PWM
		PG10

CAN Bus	Signal	RX	TX
		PB5	PB6

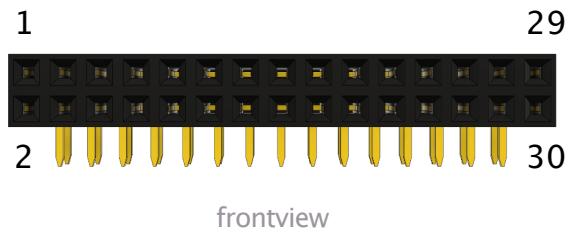
Status LED	PE1
------------	-----



## EXTENSION PORT

### ATTENTION !

All GPIO's directly connected to the MCU.  
Be carefull!



Pin	Signal	Function	IO structure	
1	5V			max. 0.5A
2	5V			
3	GND			
4	GND			
5	3.3V			max. 0.5A
6	3.3V			
7	PF5	I/O		FT
8	PF4	I/O		FT
9	PF3	I/O		FT
10	PF2	I/O		FT
11	PC4	I/O	ADC	FT
12	PC5	I/O	ADC	FT
13	PB0	I/O	ADC	FT
14	PB1	I/O	ADC	FT
15	PE8	I/O	UART5_TX	FT
16	PE7	I/O	UART5_RX	FT
17	PG5	I/O		FT
18	PG4	I/O		FT
19	PG3	I/O		FT
20	PG2	I/O		FT
21	PD15	I/O		FT
22	PD14	I/O		FT
23	PB15	SPI2_MOSI		FT
24	PB14	SPI2_MISO		FT
25	PB13	SPI2_CLK	CAN2_TX	FT
26	PB12	SPI2_CS	CAN2_RX	FT
27	GND			
28	GND			
29	24V			max. 0.5A
30	24V			

FT 5V tolerant I/O

\* For further information see data sheet STM32F446ZET6

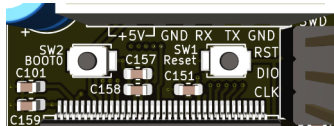
## FIRMWARE

### PREPARATION:

The board can be flashed via USB with the STM32CubeProgrammer.

(<https://www.st.com/en/development-tools/stm32cubeprog.html>)

The board can be put into the necessary DFU mode using two switches.



To do this, connect the board to the PC using a USB-C cable.

Then press the reset (SW1) and boot (SW2) switches at the same time.

First release the reset switch, then the boot switch. DFU mode is activated.

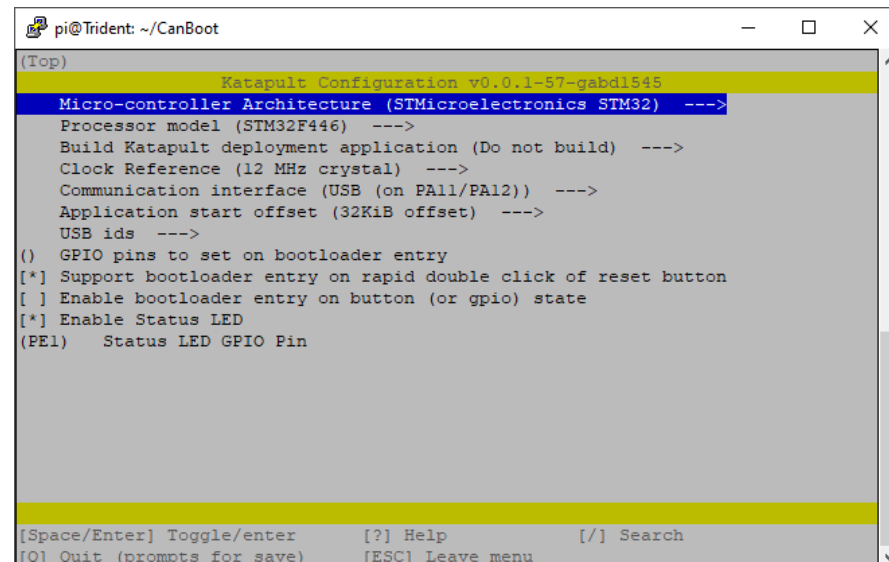
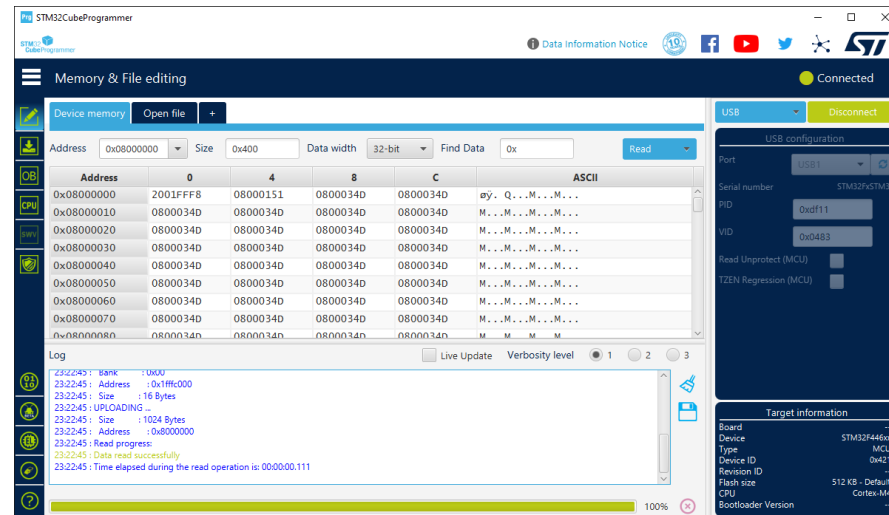
Firmware can now be flashed via STM32CubeProgrammer.

### BOOTLOADER:

Catapult (CanBoot) is recommended as a bootloader.

The necessary settings can be seen in the picture.

<https://github.com/Arksine/katapult>



## KLIPPER

Leviathan is supported by Klipper firmware.

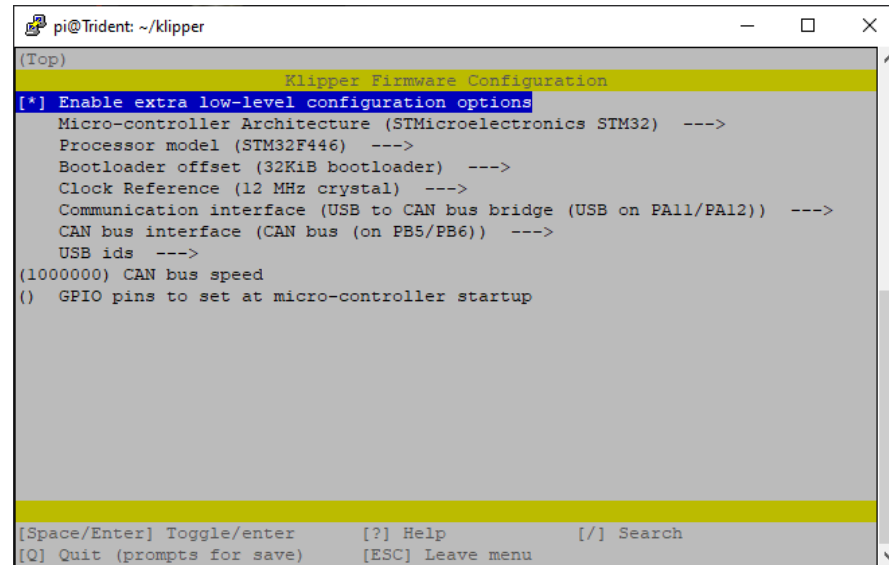
With the bootoader the Klipper firmware can be flashed directly via the RPi.

See also:

<https://www.klipper3d.org/Installation.html#building-and-flashing-the-micro-controller>

### CAN Interface:

If you want to use the CAN bus interface, Klipper must be configured as a USB to CAN bus bridge. Necessary settings can be seen in the picture.

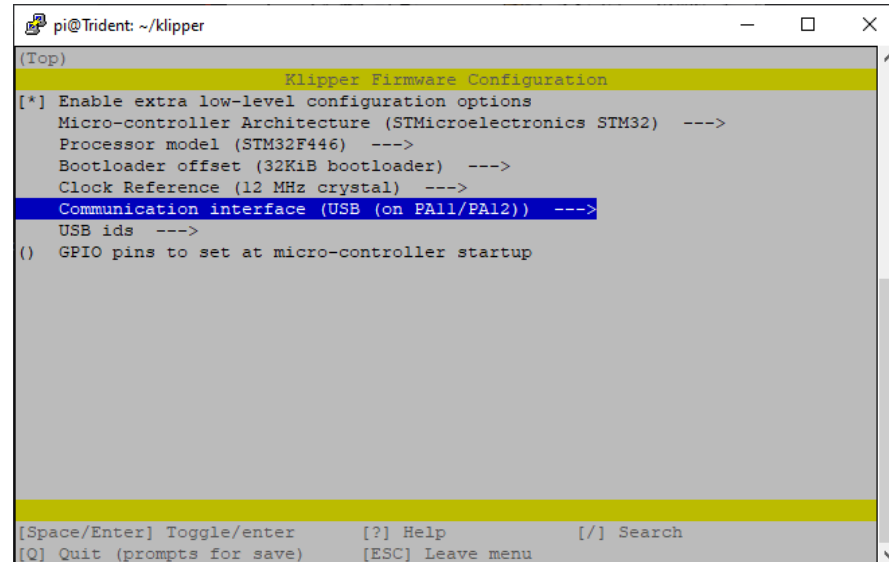


```
pi@Trident: ~/klipper
(Top)
Klipper Firmware Configuration
[*] Enable extra low-level configuration options
Micro-controller Architecture (STMicroelectronics STM32) --->
Processor model (STM32F446) --->
Bootloader offset (32KiB bootloader) --->
Clock Reference (12 MHz crystal) --->
Communication interface (USB to CAN bus bridge (USB on PA11/PA12)) --->
CAN bus interface (CAN bus (on PB5/PB6)) --->
USB ids --->
(1000000) CAN bus speed
() GPIO pins to set at micro-controller startup

[Space/Enter] Toggle/enter      [?] Help      [/] Search
[Q] Quit (prompts for save)    [ESC] Leave menu
```

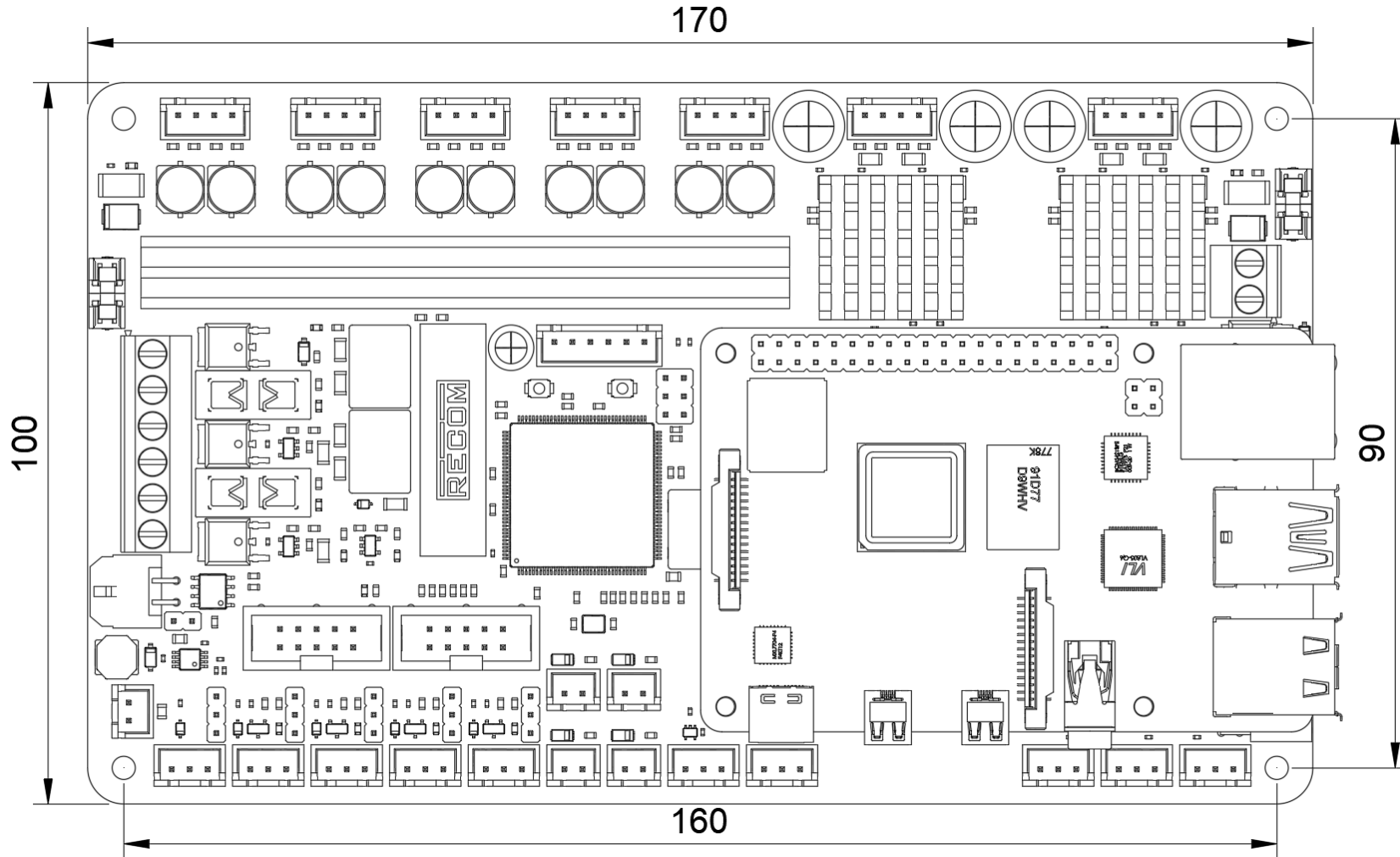
### USB Interface:

If you want to use the USB interface only, Klipper must be configured as a seen in the picture.



```
pi@Trident: ~/klipper
(Top)
Klipper Firmware Configuration
[*] Enable extra low-level configuration options
Micro-controller Architecture (STMicroelectronics STM32) --->
Processor model (STM32F446) --->
Bootloader offset (32KiB bootloader) --->
Clock Reference (12 MHz crystal) --->
Communication interface (USB (on PA11/PA12)) --->
USB ids --->
() GPIO pins to set at micro-controller startup

[Space/Enter] Toggle/enter      [?] Help      [/] Search
[Q] Quit (prompts for save)    [ESC] Leave menu
```



## CREDITS

VORONDESIGN.COM

I would like to thank everyone who supported and encouraged this project.

Thanks to Jason and Dave from LDO.

Thanks to the test team:

Alexz  
clee  
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meteyou  
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Stephan  
Steve  
Thebrakshow

Special thanks to Dunar for allowing me to use his design for this guide.

Thanks also to the Voron team. It was a pleasure for me!

I hope I did not forget anyone. If so, I apologize for this.



<https://docs.vorondesign.com>



<https://docs.ldomotors.com>