

# VORON Leviathan V1.2 Manual

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

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VERSION 2023-11-25



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

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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

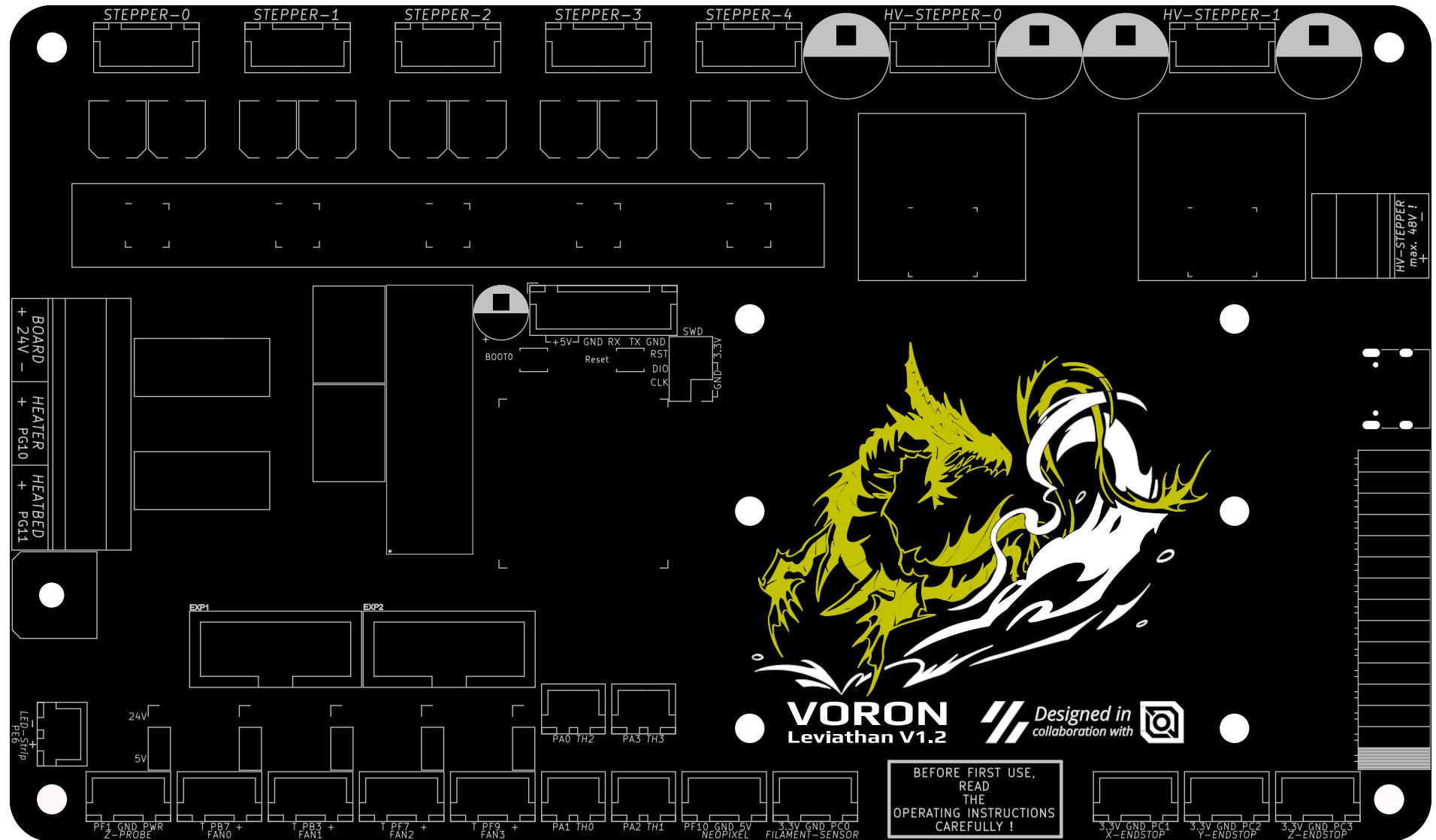
This Board is designed and developed for Voron printers. It provides all necessary functions.

These are the main features:

- Supports Klipper, Marlin and RRF
- STM32F446 MCU
- 1x Vin 24V Mainsupply (polarity and overvoltage protected)
- 1x Vin 24–48V TMC5160 supply (polarity and overvoltage protected)
- Superior stepper drive cooling
- 5x TMC2209 onboard drivers (24V)
- 2x TMC5160 onboard drivers (24–48V), onboard 12V source for gate drive
- 4x Thermistor inputs (pullup 2200)
- 4x Fan outputs (with tacho signal support, 5/24V via jumpers)
- 1x Probe input (5/24V via jumper)
- 1x Filament sensor 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 (SWD, backup)
- 1x USB port (type-C connector)
- 1x CAN Bus interface (MicroFit 3.0 connector)
- 1x RPi Power supply (5-pin JST-XH connector with UART support)
- Mounting holes for RPi Zero 2W and RPi3/4
- Dimensions: 170x100mm, Mounting holes: 160x90mm

## CONTROLLER BOARD OVERVIEW

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### 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"

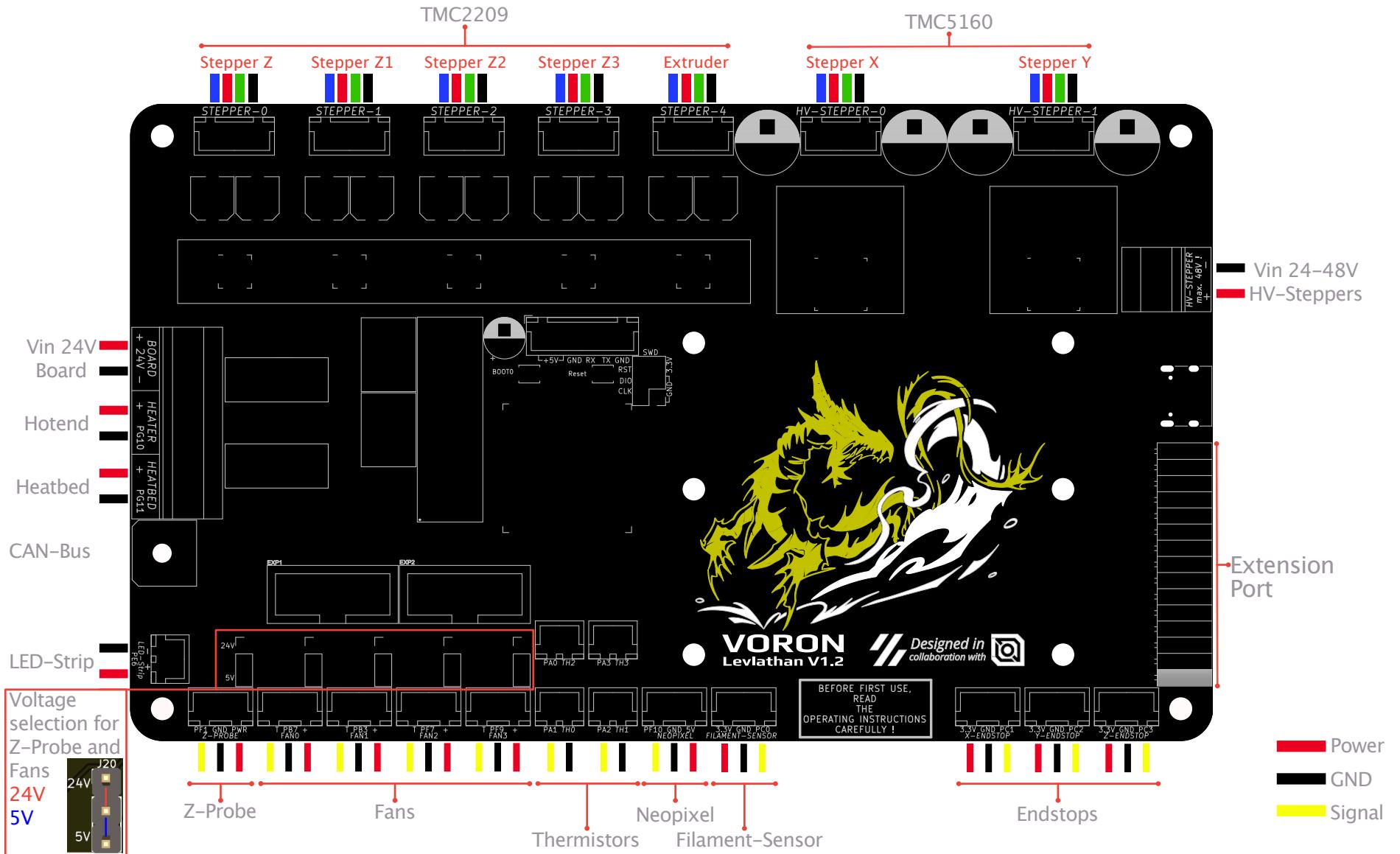
### WARNING !

When using passive toolhead boards, check if the 24V supply is shared between the fan, hotend and probe.

If so, set jumpers to 24V – as a 5V selection may cause the 5V and 24V line to be shorted.

## WIRING

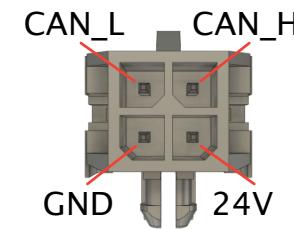
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## PIN ASSIGNMENT

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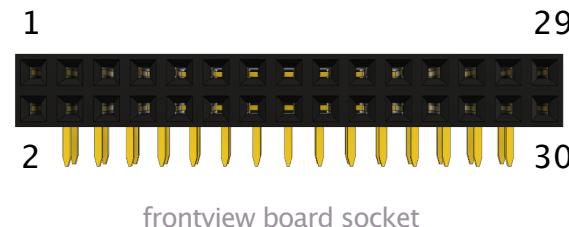
	Signal	EN	STEP	DIR	DIAG	UART	CS	SCK	MOSI	MISO
Stepper										
	Stepper0	PD7	PD4	PD3	PD6	PD5				
	Stepper1	PD2	PC12	PC11	PD1	PD0				
	Stepper2	PC10	PC9	PC8	PA15	PA8				
	Stepper3	PC7	PG7	PG6	PC6	PG8				
	Stepper4	PD13	PD10	PD9	PD12	PD11				
	HV_Stepper0	PG0	PB10	PB11	PG1		PE15	PE12	PE14	PE13
	HV_Stepper1	PE9	PF15	PF14	PE10		PE11	PE12	PE14	PE13
Fans	Signal	Fan0	Fan1	Fan2	Fan3					
	PWM	PB7	PB3	PF7	PF9					
	Tacho	PB8	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	PA4	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	Signal	PE1								



frontview board socket

## ATTENTION !

All GPIOs directly connected to the MCU.  
Be carefull!



Pin	Signal	Function	IO structure	
1	5V		max. 0.5A	
2	5V			
3	GND		max. 0.5A	
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			

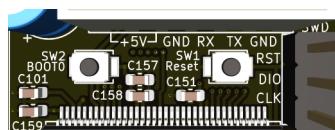
FT 5V tolerant I/O

\* For further information see data sheet STM32F446ZET6

## 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.

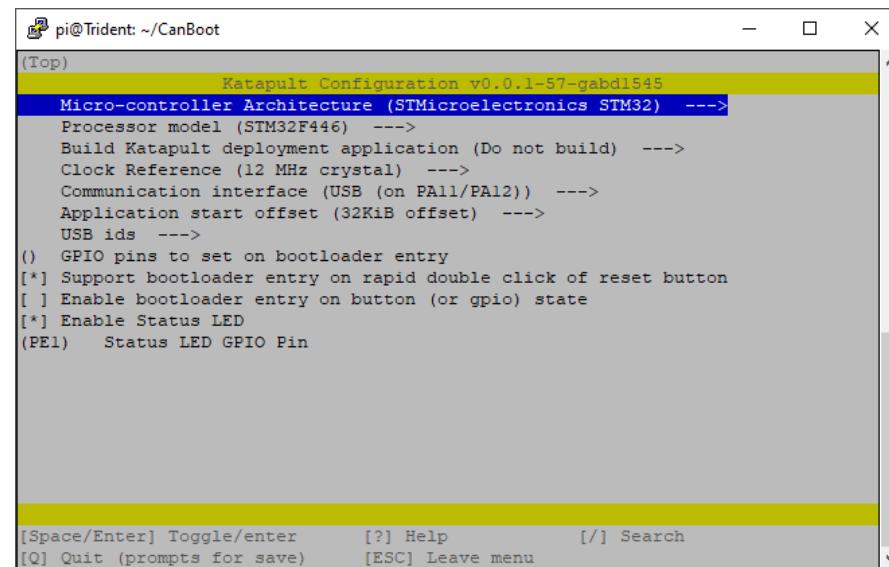
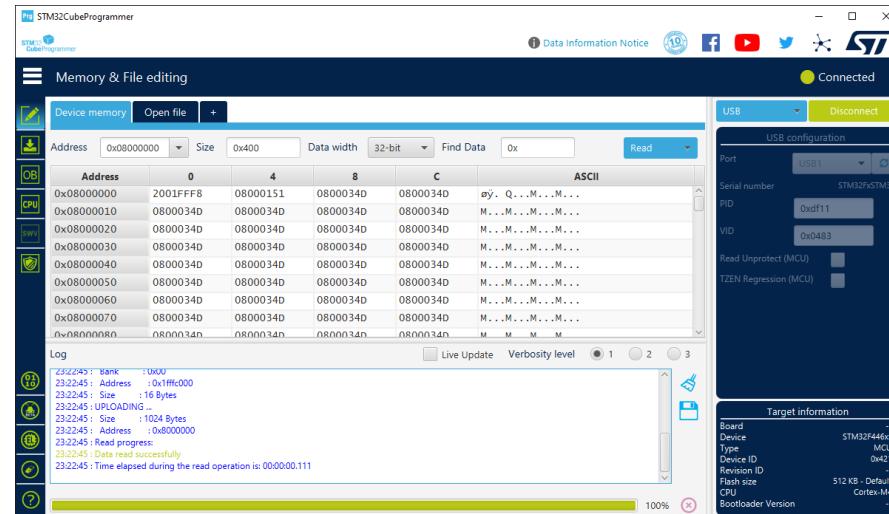
Firmware can now be flashed via STM32CubeProgrammer.

## BOOTLOADER:

Katapult (CanBoot) is recommended as a bootloader.

The necessary settings can be seen in the picture.

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



Leviathan is supported by Klipper firmware.

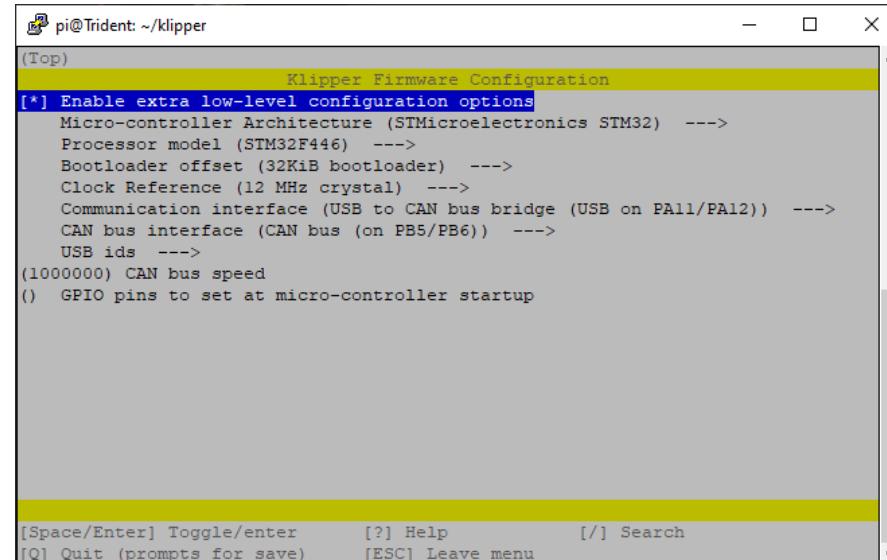
With the bootloader the Klipper firmware can be flashed directly via the RPi.

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
(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:

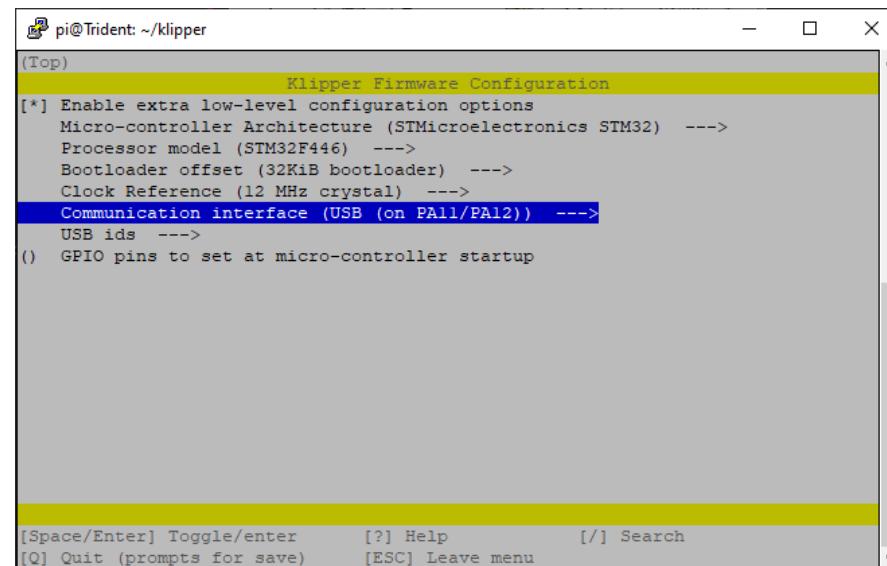
If you want to use the USB interface only, Klipper must be configured as seen in the picture.

#### UART Interface for Pi:

PA9/PA10 are the UART Pins for RPi

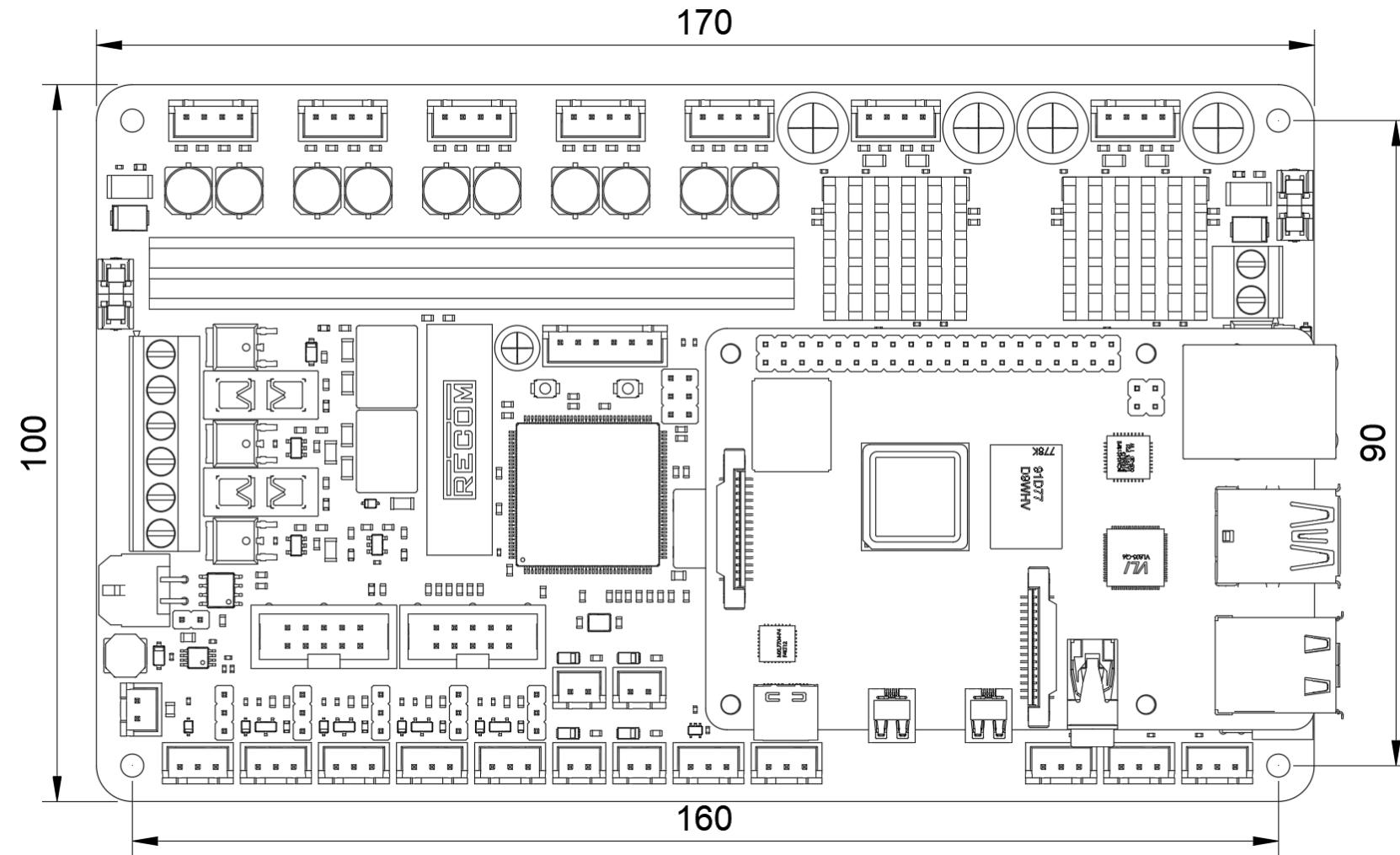
#### Note!

If communication between board and Pi via UART is used, CAN bus bridge mode is not available. This is not supported by the firmware.



```
pi@Trident: ~/klipper
(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

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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  
Doc  
Dunar  
Dustin  
Eddie  
FrySennberg  
Haribro  
HartK  
Jared  
meteyou  
Sanity  
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>