# VORON

## Assembly/Setup Guide

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# Introduction

Thank you for downloading the unofficial VORON CoreXY 3D printer assembly and setup guide! This guide was developed with the 3D printing newcomer in mind to ensure better understanding of the concepts of the printer, regardless of your level of experience.

This guide will walk you through every stage of the VORON setup process, explaining concepts as they become necessary to understand. It is important that you read each page in its entirety to ensure that you configure everything exactly as described, especially once you get to the electronics layout. **Failure to follow instructions with electronic components can lead to catastrophic failure of your equipment, with shorted equipment at best, and electrical shock/fires at worst.**

Take note that the VORON CoreXY 3D printer is an open source platform, under the lead of Maksim Zolin, and this guide may be outdated by the time you read it. To ensure that you have the most up to date set of instructions, please visit one of the official VORON sites:

**VORON Website**
http://mzbot.us/

**VORON Reddit Community**
https://www.reddit.com/r/voroncorexy/

**VORON GitHub Repository**
https://github.com/mzbotreprap/VORON

In addition to these pages, a VORON Facebook group has been started to ensure better coverage across the community.

# List of Changes

Because this is a living document, changes will continue to be made as the VORON evolves and the community submits improvements/advice.

| Date | Change Description | Author |
|------|-------------------|--------|
| 11/26/16 | Guide created | Terrance S. |

# Bill of Materials

The parts shown here within the bill of materials (BOM) have been copied from those on the official VORON CoreXY GitHub page. The primary difference here is that these components have links provided to vendors that will reduce shipping costs and overall wait for the VORON components. That being said, Amazon is extensively used due to the fact that they have the vast majority of parts required for the built at relatively competitive prices.

Where possible, links have been provided to the vendor pages for easier ordering. **Please ensure you read the notes, as this BOM has been modified from the official VORON BOM due to Amazon components being substituted, among other changes/notes.**

For the quantities of each of these components, bear in mind that these *exact* quantities are required to complete the build. As such, you may want to procure spares of certain items—screws, DuPont, and MicroFit3 connectors, for example—to ensure that you have more on hand in the event you make a mistake and damage them.

To reiterate one final time: This BOM encompasses all the parts listed from the official BOM, but with a heavier lean on Amazon for the procurement of the parts. Bear in mind that some of these parts may be inferior to those specified in the official BOM; where applicable, user ratings have been taken into consideration when selecting these components.

## Frame

| Description | MZBot Part # | Supplier | Supplier Part # | Qty |
|---|---|---|---|---|
| 2020 Extrusion – Black – 370mm | VB-FR-01-EXT1 | Misumi | HFSB5-2020-370 | 12 |
| Cube Corner Bracket | VB-FR-01-CB1 | OpenBuilds | Link | 8 |

As of November 25, 2016, Misumi is offering 30% off all orders within 30 days of creating your account.

## Linear Motion

| Description | MZBot Part # | Supplier | Supplier Part # | Qty |
|---|---|---|---|---|
| Linear Shaft – 8mm – Hardened – 320mm | VB-LM-01-LS1 | Misumi | PSFJ8-320 | 8 |
| Linear Bearing (Single) | VB-LM-01-LB1 | Misumi | LM8UU | 2 |
| Linear Bearing (Double) | VB-LM-01-LB2 | Misumi | LMUW8 | 6 |
| GT2 belt – 6mm x 2mm pitch 1.5M | VB-LM-01-GTB1 | Amazon | Link | 2 |

| | | | | |
|---|---|---|---|---|
| GT2 pulley – 20 tooth – 2mm pitch | VB-LM-01-GTP1 | Amazon | Link | 2 |
| NEMA 17 Linear Stepper TR8x8 300mm (with nut) | GB-EL-01-LSM1 | Amazon | Link | 2 |
| F695ZZ – Flanged Ball Bearing | VB-LM-01-BBF1 | Amazon | Link | 16 |

## Electronics

| Description | MZBot Part # | Supplier | Supplier Part # | Qty |
|---|---|---|---|---|
| NEMA 17 Stepper | VB-EL-01-SM1 | Amazon | Link | 2 |
| Arduino MEGA2560 R3 | VB-EL-01-AM3 | Amazon | Link (RAMPS Kit) | 1 |
| RAMPS 1.4 SP | VB-EL-01-RSP | Amazon | | 1 |
| LCD Controller Full Graphics | VB-EL-01-LCD | Amazon | | 1 |
| DRV8825 Drivers (set of 5) | VB-EL-01-DRV | Amazon | Link | 1 |
| Endstop Microswitch (KW10 series, hole distance 6.5mm) | VB-EL-01-ESS1 | Amazon | Link | 2 |
| 12V PSU 16.7A | VB-EL-01-PSU1 | OMC StepperOnline | S-201-12 | 1 |
| 250V 10A 3pin IEC320 C14 Inlet w/ fuse and switch | VB-EL-01-ISW1 | Amazon | C14 | 1 |
| Bed Thermistor – M3 Hex Stud – EPOCS | VB-EL-01-TB1 | eBay | Link | 1 |
| Bed Harness Connector – Molex | VB-EL-01-BHC1 | Mouser | 538-76650-0065 (2-pack) | 1 |
| Silicone Heater 110V 250W | VB-EL-01-BH1 | Omega | SRFG-505/10-P | 1 |
| 110V SSR – Omron | VB-EL-01-SSR1 | Mouser | 653-G3A-210B-DC5 | 1 |
| 2-pin DuPont jumper wire (12V supply for Fan Expansion Board) | VB-EL-01-FXW1 | eBay | Link | 1 |
| RAMPS Fan Expansion Board | VB-EL-01-RFX1 | eBay | Link | 1 |
| DuPont Connector Kit | N/A | Amazon | Link | 1 |
| Molex MicroFit3 3-pin plug housing | VB-EL-01-MLX-H3 | Mouser | 538-43640-0301 | 1 |
| Molex MicroFit3 3-pin receptacle | VB-EL-01-MLX-R3 | Mouser | 538-43645-0300 | 1 |
| Molex MicroFit3 2-pin plug housing | VB-EL-01-MLX-H2 | Mouser | 538-43640-0201 | 7 |
| Molex MicroFit3 2-pin receptacle | VB-EL-01-MLX-R2 | Mouser | 538-43645-0200 | 7 |

| Description | MZBot Part # | Supplier | Supplier Part # | Qty |
|---|---|---|---|---|
| Molex MicroFit3 female pin (20-24AWG) | VB-EL-01-MLX-FP1 | Mouser | 538-43030-0007 | 4 |
| Molex MicroFit3 female pin (26-30AWG) | VB-EL-01-MLX-FP2 | Mouser | 538-43030-0010 | 13 |
| Molex MicroFit3 male pin (20-24AWG) | VB-EL-01-MLX-MP1 | Mouser | 538-43031-0007 | 4 |
| Molex MicroFit3 male pin (26-30AWG) | VB-EL-01-MLX-MP2 | Mouser | 538-43031-0010 | 13 |
| Spade connector (female) | VB-EL-01-SPC-F | Amazon | Link | 8 |
| Spade connector (male) | VB-EL-01-SPC-M | Amazon | Link | 1 |
| 20AWG wire (black) 9' | VB-EL-01-W20-B | Amazon | Link | 1 |
| 20AWG wire (red) 9' | VB-EL-01-W20-R | Amazon | Link | 1 |
| 20AWG wire (white) 9' | N/A | Amazon | Link | 1 |
| 20AWG wire (green) 3' | VB-EL-01-W20-G | Amazon | Link | 1 |
| CAT5e stranded patch cable wire (6') | VB-EL-01-CAT5 | Amazon | Link | 1 |
| 80x80x10 case fan 12V | VB-EL-01-F802 | Amazon | Link | 1 |
| 40x40x20 blower fan 12V | VB-EL-01-F302 | Amazon | Link | 1 |
| Inductive Proximity Sensor | VB-EL-01-IPS1 | Amazon | LJ12A3-4-Z/BX | 1 |
| 2M Ohm resistor (for inductive sensor) | VB-EL-01-R2M | Amazon | Link | 1 |
| USB Cable | VB-EL-01-USB | Amazon | Link | 1 |
| C14 Power Cable (US) | VB-EL-01-PC-US | Amazon | Link | 1 |

## Electronics (Optional)

| Description | MZBot Part # | Supplier | Supplier Part # | Qty |
|---|---|---|---|---|
| LED strip | VB-EL-01-LED1 | Amazon | Link | 1 |
| Thermal protection fuse (120°C) | VB-EL-01-TPF1 | Amazon | Link | 1 |

## Extrusion

| Description | MZBot Part # | Supplier | Supplier Part # | Qty |
|---|---|---|---|---|

| E3D Chimera and/or E3Dv6 Kit | VB-EX-01-DHK1 | Filastruder | Link | 1 |
|---|---|---|---|---|
| NEMA 17 Stepper | VB-EL-01-LSM1 | Amazon | Link | 2 |
| VORON Belted Extruder – Bowden | VB-BX-HW-KIT2 | MZBot | (see separate BOM for parts) | 2 |

## Build Plate

| Description | MZBot Part # | Supplier | Supplier Part # | Qty |
|---|---|---|---|---|
| Aluminum tooling plate MIC-6 9"x9"x0.25" | VE-B-AL-9 | Midwest Metal Warehouse | Link | 1 |
| PEI sheet 9"x9"x0.04" | VE-B-PEI-9 | Amazon | Link | 1 |
| 3M 468MP 12"x12" | VE-B-3-M468-12 | Amazon | Link | 1 |

## Hardware (KIT4)

| Description | MZBot Part # | Supplier | Supplier Part # | Qty |
|---|---|---|---|---|
| 10mm M5 cap socket screw | VB-HW-CSS-M5-10 | McMaster Carr | 91239A224 | 36 |
| 30mm M5 cap socket screw | VB-HW-CSS-M5-30 | McMaster Carr | 91239A236 | 6 |
| 20mm M3 hex socket screw | VB-HW-HSS-M3-20 | McMaster Carr | 91290A123 | 9 |
| 30mm M3 hex socket screw | VB-HW-HSS-M3-30 | McMaster Carr | 91290A130 | 5 |
| 40mm M3 hex socket screw | VB-HW-HSS-M3-40 | McMaster Carr | 91290A136 | 2 |
| 16mm M3 hex socket screw | VB-HW-HSS-M3-16 | McMaster Carr | 91290A120 | 19 |
| 8mm hex socket screw | VB-HW-HSS-M3-8 | McMaster Carr | 91290A113 | 25 |
| 12mm hex socket screw | VB-HW-HSS-M3-12 | McMaster Carr | 91290A117 | 2 |
| 6mm M4 cap socket screw | VB-HW-HSS-M4-6 | McMaster Carr | 91239A138 | 4 |
| M3 hex nut | VB-HW-HN-M3 | McMaster Carr | 90591A250 | 14 |
| M3 hex lock nut | VB-HW-HLN-M3 | McMaster Carr | 90576A102 | 4 |
| M5 hex nut | VB-HW-HN-M5 | McMaster Carr | 98676A300 | 2 |

| | | | | |
|---|---|---|---|---|
| M5 steel washer | VB-HW-WST-M5 | McMaster Carr | 98269A440 | 2 |
| No. 6 neoprene washer | VB-HW-WNP-M3 | McMaster Carr | 90133A005 | 16 |
| M3 steel washer | VB-HW-WST-M3 | McMaster Carr | 98269A420 | 4 |
| Plastics screw No. 1 7/16" | VB-HW-PS-1 | McMaster Carr | 92470A056 | 4 |
| 1" L spring 0.408" OD | VB-HW-SPB-1 | McMaster Carr | 9657K311 | 4 |
| M3 pressfit threaded insert | VB-HW-PFTI-M3 | McMaster Carr | 94510A030 | 3 |
| M5 drop-in T-slot nuts | VB-FR-01-TSN2 | Amazon | Link | 36 |
| Phillips #10-24 5/8" thread-rolling screws | VB-FR-01-PTS1 | Fastenal | 145017 | 24 |

ⓘ   For the thread-rolling screws (VB-FR-01-PTS1): These are for actually connecting your extrusions together. **Note: This is an incredibly time-intensive process and will require patience and care to avoid damaging the aluminum extrusions.**

## Tools

| Description | MZBot Part # | Supplier | Supplier Part # | Qty |
|---|---|---|---|---|
| Ball-end Allen wrenches | | Brondhus | | 1 |
| SuperLube 21030 synthetic lube with PTFE | | Amazon | Link | 1 |

## Tools (Optional)

| Description | MZBot Part # | Supplier | Supplier Part # | Qty |
|---|---|---|---|---|
| DuPont crimper | | Amazon | Link | 1 |

# Electronics Preparation

Before beginning assembly, it may be a good idea to test your electronic components to ensure that the RAMPS assembly and the stepper motors are in good working order. To that end, you will begin with some initial preparation to ensure that your computer system is in working order to move forward as you progress through the guide.

## Download the Arduino IDE

Arduino is an open-source system that allows you to control physical components through a computer interface. Before you can do this with your own Arduino MEGA2560 board (a component of the overall RAMPS assembly), you will need to download and install the Arduino IDE (Integrated Development Environment).

1. Go to the Arduino IDE download page at https://www.arduino.cc/en/Main/Software.

2. Download the Arduino software for your platform (Windows/Mac/Linux).

3. Once downloaded, install the software; install drivers if prompted to do so.

## Download Pronterface

Pronterface is one of many programs that can be used to interface with the control boards in 3D printers. Though it is not as full-featured as many of the higher end programs, its strengths are in its expandability, as well as that it is free for use.

1. Go to the Printrun GitHub repository at https://github.com/kliment/Printrun.

2. Scroll down the page until you see "GETTING PRINTRUN". You will see links to a page that has the Windows and Mac binaries (executables and their dependencies), as well as steps for Linux users. Download the binaries and extract them if necessary. You are done here for now, but remember the location of your Pronterface executable.

## Download and Configure Cura

Cura is software developed by the Ultimaker company, creators of a high-end desktop 3D printer. Cura's function in the 3D printing space is that of the *slicer*: a program that takes a 3D model and "slices" it into the many, many layers that a 3D printer can understand. The output from a slicer is either sent directly to the printer via wifi or USB connection, or saved as GCode.

1. Go to the Cura download website at https://ultimaker.com/en/products/cura-software/list.

2. Scroll down if necessary and select the most recent version 15 release. As of the time of this writing, that is version 15.04.6 (released on 06/07/16). Version 2 of Cura brings with it a lot of extra bells and whistles, but may not work correctly with the provided VORON Cura profile.

3. A window will pop up asking for your usage of the software. You can choose to answer the question (and its follow-on questions) or you can select "I don't want to share any information". Either way, download the software.

4. Once downloaded, install Cura. During the setup of Cura, one of the options provided is to install Arduino drivers. Unless you skipped installation of those drivers when you installed the Arduino IDE, you can skip it (uncheck the option) now.

5. Once installation is completed, go ahead and run Cura to get the basic VORON profile set up.

   a. One of the first things you should see when you run Cura for the first time is the **Configuration Wizard**. If you don't, cancel out of any window you're in to access the main Cura Interface, and select **Machine > Add new machine...**. You should see a window that looks similar to the following.
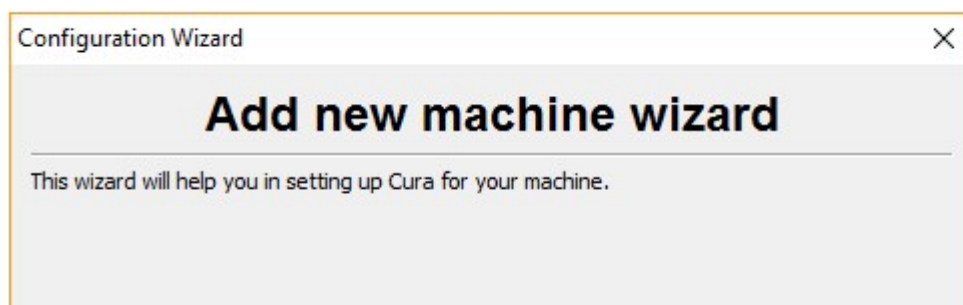


The Cura Configuration Wizard.

   b. Click **Next**.

   c. On the **Select your machine** screen, select **Other (Ex: RepRap/Makerbot/Witbox)**, and then click **Next**.

   d. On the **Other machine information** screen, leave **Custom...** selected and click **Next**.

   e. Use the following settings in the **Custom RepRap Information** screen:

   **Machine Name:** VORON

   **Machine Width X (mm):** 230

   **Machine Depth Y (mm):** 230

   **Machine Height Z (mm):** 230

   **Nozzle size (mm):** 0.4

Check **Heated Bed**

Leave **Bed center is 0, 0, 0 (RoStock)** unchecked (this is used for delta-style 3D printers; on the VORON printer, the bed center is at **115, 115, 10**)

f.   Click **Finish**.

g.   This will return you to the main Cura interface. All that remains now is to load the VORON Cura profile.

     i.   Download the VORON Cura profile here, or using the following link: https://syrinathos.com/files/cura_profile.ini.

     ii.   Back in Cura, click **File > Open Profile...**.

     iii.   Select the profile you downloaded in step i, and click **Open**. The VORON configuration settings are now loaded into Cura for use later.

h.   Cura configuration is now complete. You can quit Cura until later.

# RAMPS Board Setup

Getting your RAMPS (RepRap Arduino MEGA Polulu Shield) board set up is straightforward, but can seem daunting to first-time 3D printer users. Depending on the route you chose for sourcing the parts, you may end up needing to perform soldering to get your board up and running; this is why a RAMPS kit has been recommended for the modified BOM within this guide.

# Arduino Setup and Marlin Configuration

This section of the guide will walk you through the setup and configuration of Arduino and Marlin. If you are new to 3D printing, it is recommended that you read through this section in its entirety.

⚠️ **Failure to follow the steps outlined here can lead to a catastrophic failure of your electronic components, including shorted equipment at best, and shock/electrical fires at worst.**

For those that are new to 3D printing: Arduino is an open-source framework that allows for the control of physical devices. When paired with your RAMPS board, it is the primary driving force behind everything that your 3D printer actually does.

To go along with your Arduino and RAMPS board is the software: Marlin is the firmware being used for the VORON due to its robust feature set and ease of use. Currently, the version that is supported by the VORON community is Marlin v1.1.0 RC6, which you can download on its GitHub page.

# VORON Build Preparation

Before commencing with the build, take the time to go through and verify that all of your components have been sorted out. As mentioned in the BOM section, the BOM itself as it stands with regards to quantity is very exact, and as such, is very unforgiving.

# Executing the Build

## Glossary

| Term | Definition |
|------|------------|
|      |            |

# References

**Arduino Mega Polulu Shield**
http://reprap.org/wiki/Arduino_Mega_Pololu_Shield

**A4988 vs DRV8825 Chinese Stepper Driver Boards**
http://reprap.org/wiki/A4988_vs_DRV8825_Chinese_Stepper_Driver_Boards

# Resources

# Acknowledgements

Primary thanks, of course, goes to Maksim Zolin for his incredible work on the VORON CoreXY printer system. As well, all the contributors of the RepRap community as a whole are to thank for their dedication and hard work.