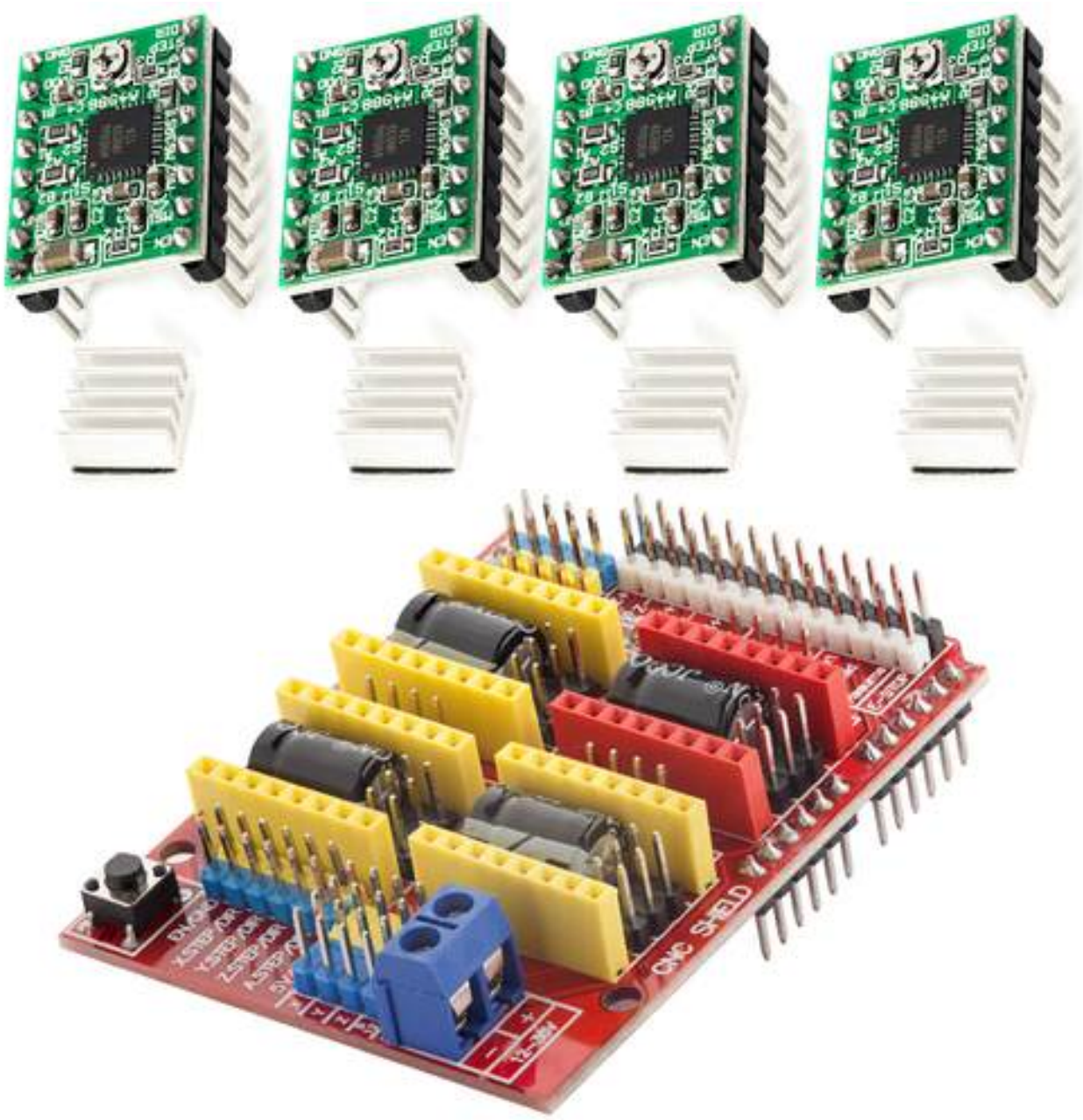
Welcome!

Thank you for purchasing our *AZ-Delivery CNC Shield V3 Bundle*. On the following pages, you will be introduced to how to use and set up this handy device.

Have fun!



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Introduction

The CNC Shield V3.0 Bundle consists of CNC Shield for Uno R3 and 4 A4988 stepper motor driver modules. The CNC Shield V3.0 can be used as drive expansion board for stepper motor drivers.

There are 4 slots on the board for stepper motor driver modules, and each stepper motor needs only two I/O ports. Shield supports A4988 and DRV8825 driver types.

The CNC Shield V3.0 Bundle suitable for a variety of small and medium sized automation equipment and instruments, such as engraving machine, marking machine, cutting machine, laser typesetting, plotters, drawbots, CNC machine tools, handling the devices.

Specifications

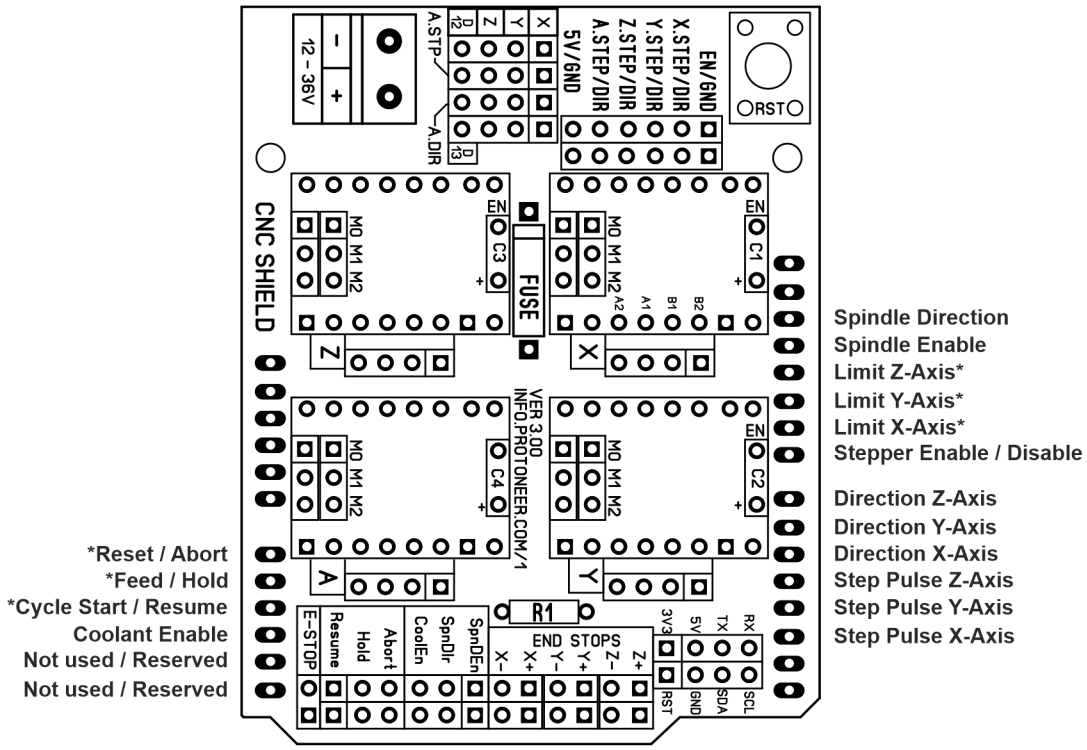
Minimum operating voltage	12V
Maximum operating voltage	36V
Continuous Current per phase	1A
Maximum current per phase	2A
Current limit adjustment	Analog trim pot
Micro-step resolutions	Full, 1/2, 1/4, 1/8, 1/16, and 1/32 steps
Connectors	Screw terminal and molex connectors
Logic operating voltage range	3.3V, 5V
Operating temperature	0 to 40°C
Storage temperature	-40 to 70°C
Dimensions	68x54x30mm [2.6x2.1x1.2in]

Features

- Arduino CNC Shield Version 3
- GRBL compatible. (Open source firmware that runs on an Uno that turns G-Code commands into stepper signals (link)
- 4-Axis support (X, Y, Z , A - Can duplicate X, Y, Z or do a full 4th axis with custom firmware using pins D12 and D13)
- 2 x End stops for each axis (6 in total)
- Coolant enable
- Uses removable A4988 compatible stepper drivers. (A4988, DRV8825 and others)
- Jumpers to set the Micro-Stepping for the stepper drivers.
- Stepper Motors can be connected with 4 pin molex connectors or soldered in place
- Runs on 12-36V. (only the DRV88825 driver can handle up to 36V so if using A4988 power supply voltage should not exceed 24V)
- Compact design

The pinout

CNC Shield V3.0 has Uno compatible pins. The pinout is shown on the following image:



WARNING: Beware the orientation of driver boards. Wrong orientation will destroy the driver module.

Extra pins

- Limit switch pins have been doubled up so that each axis has a “Top/+” and “Bottom/-”. This makes it easier to install two limit switches for each axis. (For use with a normally open switch)
- E-Stop – These pins can be connected to an emergency stop switch. This does the same as the RESET button on the Uno board. (It is advisable that an extra *EMERGENCY BUTTON* is also installed that cuts power to all machinery.
- Spindle and coolant control has their own pins.
- External GRBL Command Pins have been broken out allowing you to add buttons for Pause/Hold , Resume and Abort.
- Serial Pins (D0-D1) and I2C Pins (A4-A5) have their own break-out pins for future extensions. I2C can later be implemented later by software to control things like spindle speed or heat control.
- Version 3.00 of the board added jumper to configure the 4th axis (Clone the other axes or run from Pins D12-D13), Comm Header (RX+TX, I2C) and a Stepper Control Header (All Pins needed to run 4 steppers).

CNC Shield V3

The CNC Shield is designed to take advantage of the demand for a low cost controller solution for DIY CNC machines. It was designed to be 100% compatible with GRBL, Open-source, G-code interpreter, and fit onto the popular Uno. The CNC Shield can be used to control a number of different types of CNC machines, including CNC milling machines, laser engraving/cutting machines, drawing machines, 3D printers or any project that needs precision control of stepper motors. Compatible stepper drivers can be used, either A4988 or the higher current DRV8825.

There are three main components needed to get the CNC Shield up and` running:

1. CNC Shield
2. Stepper Drivers
3. Uno

Stepper driver modules

Stepper driver modules in this bundle are based on A4988 driver chips. The A4988 is a complete micro-stepping motor driver with built-in translator for easy operation. It is designed to operate bipolar stepper motors in full-step, half-step, quarter-step, eighth-step, and sixteenth-step modes, with an output drive capacity of up to 35V and ±2A.

NOTE: Output drive capacity is the maximum (recommended) value. It is advisable that drivers are not supplied with more than a 24VDC through the CNC Shield, otherwise it may burn out the stepper driver, even damage the shield and Uno.

Excessive power dissipation of the driver chip results in a rise of temperature that can go beyond the capacity of chip, probably damaging it. Even if the driver IC has a maximum current rating of 2A per coil, the chip can only supply currents around 1A per coil without getting overheated. For achieving more than 1A per coil, a heatsink or other cooling method is required. Our A4988 driver module comes with an aluminum heatsink. It is advisable to install the heatsinks before using the modules.

For more information on A4988 Stepper drivers there is an eBook that can be downloaded on the following link.

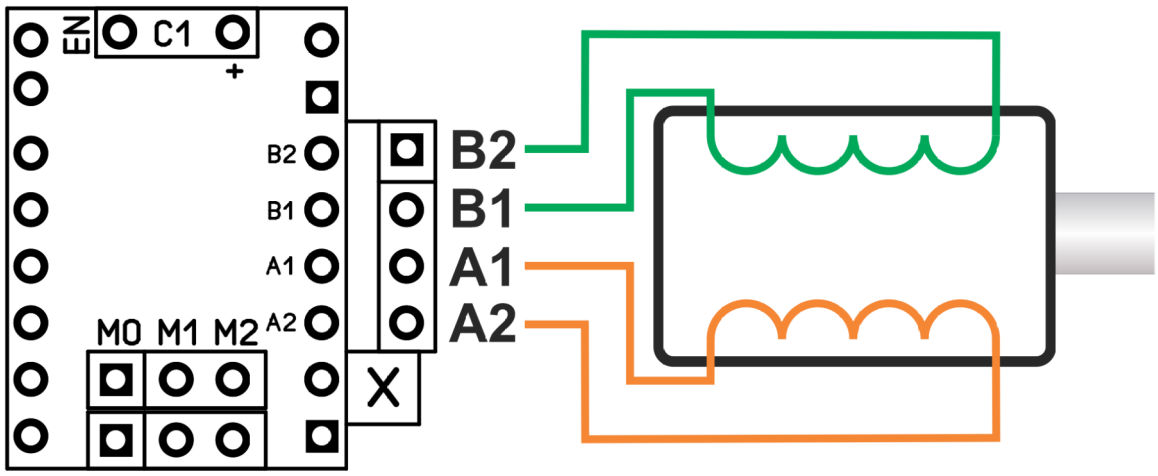
Component assembly

1. Insert the CNC Shield into the Uno making sure the correct pins of the CNC Shield are inserted into correct Uno headers.

2. Micro stepper settings may be setup for wanted application and place the jumpers as required.

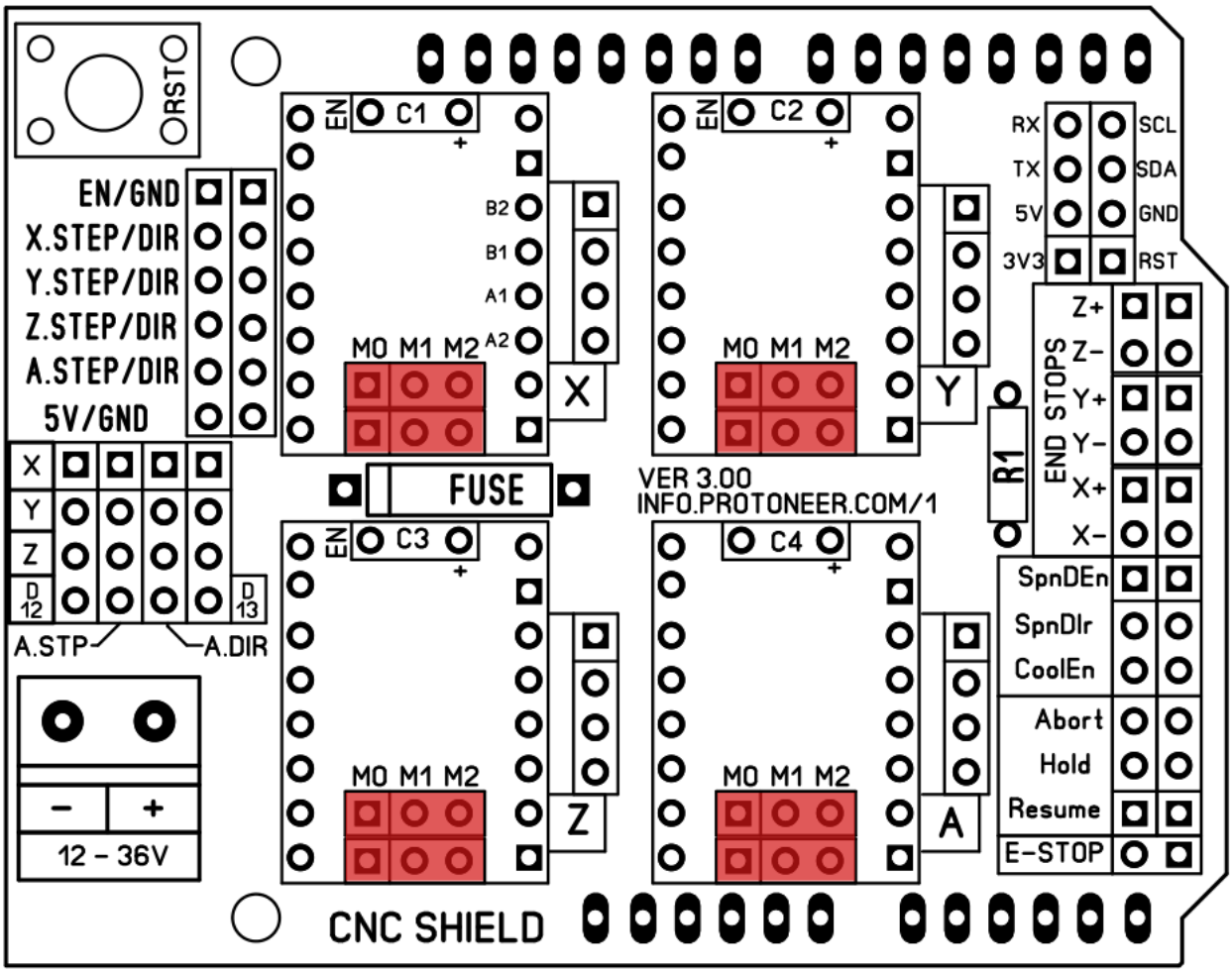
3. Insert stepper drivers into the CNC Shield paying special attention to match the enable (EN) pin to the enable socket.

4. Connect the stepper motor to the header pins. Check stepper motor to make sure the correct wiring sequence. Different stepper motors have different wire colors. Check the stepper motor technical documentation to determine the right sequence.



Jumper Settings

Jumpers are used to configure the 4th Axis, micro stepping configuration.



The micro stepping can be configured for each axis. In the table below *High* indicates that a jumper is inserted and *Low* indicates that no jumper is inserted.

The following table are jumper settings configuration for A4988 stepper driver:

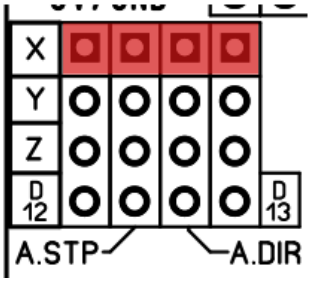
MS0	MS1	MS2	Microstep resolution
Low	Low	Low	Full step
High	Low	Low	Half step
Low	High	Low	Quarter step
High	High	Low	Eight step
High	High	High	Sixteenth step

The following table are jumper settings configuration for DRV8825 stepper driver:

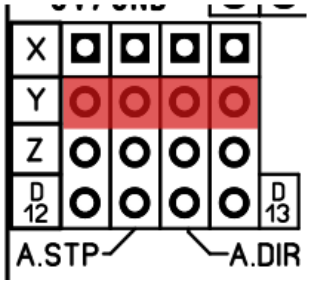
MODE0	MODE1	MODE2	Microstep Resolution
Low	Low	Low	Full step
High	Low	Low	Half step
Low	High	Low	1/4 step
High	High	Low	1/8 step
Low	Low	High	1/16 step
High	Low	High	1/32 step
Low	High	High	1/32 step
High	High	High	1/32 step

Using two jumpers the 4th axis can be configured to clone the X or Y or Z axis. It can also run as an individual axis by using Digital Pin 12 for stepping signal and Digital Pin 13 as direction signal.

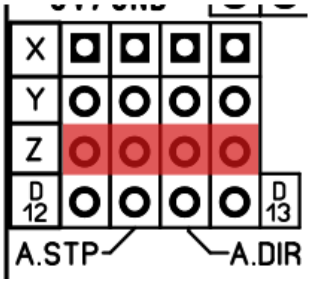
Clone X-Axis to the 4th stepper driver (Marked as A)



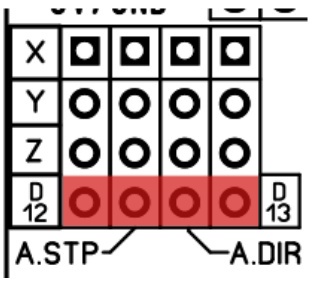
Clone Y-Axis to the 4th stepper driver (Marked as A)



Clone Z-Axis to the 4th stepper driver (Marked as A)

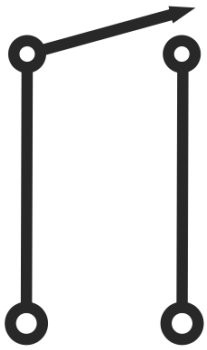


Use D12 and D13 to drive the 4th stepper driver (Marked as A)



End - Stop configuration

By default, GRBL is configured to trigger an alert, if an end-stop goes low (Gets grounded). End-stop switch is standard *always open* switch. These pins are used for *EMERGENCY BUTTON* connection.



Current Limit adjustment for Stepper driver (Reference voltage)

The way to set the current limit by measuring the voltage on the “ref” pin and to calculate the resulting current limit (the current sense resistors are 0.100Ω). The current limit relates to the reference voltage as follows:

Current Limit = VREF × 2

For example, if a stepper motor is rated for 1 A, the current limit can be set to 1 A by setting the reference voltage to 0.5V.

NOTE: The coil current can be very different from the power supply current, so you should not use the current measured at the power supply to set the current limit. The appropriate place to put your current meter is in series with one of your stepper motor coils.

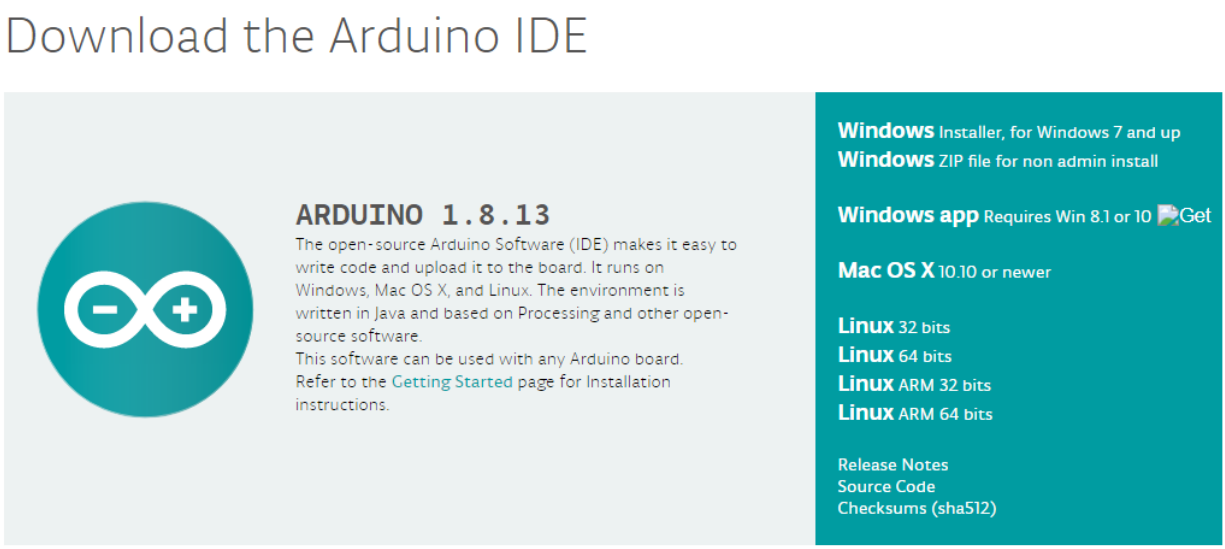
Reference voltage is adjusted via small trimpots on the stepper driver board. Adjusting the reference voltage in small increments is suggested - not more than a quarter turn at a time. For a starting point, set the max current to 1A. If the motor overheats, reduce the VREF. If the motor does not move or misses steps, increase the VREF.

Stepper motors

When the stepper drivers are enabled they will make funny vibrating noises. This is normal. For more details have a look at this *wiki page*. The stepper drivers will get warm and need cooling if they are going to be used for long periods. Small heat sinks and extractor fans are advised. Having extra stepper drivers is always handy. Some of the stepper drivers have thermal protection and will cut out if the temperature gets too high. This is a good sign that they need cooling or that they are overpowered.

How to set-up Arduino IDE

If the Arduino IDE is not installed, follow the *link* and download the installation file for the operating system of choice. The Arduino IDE version used for this eBook is **1.8.13.**



For *Windows* users, double click on the downloaded *.exe* file and follow the instructions in the installation window.

For *Linux* users, download a file with the extension *.tar.xz*, which has to be extracted. When it is extracted, go to the extracted directory and open the terminal in that directory. Two *.sh* scripts have to be executed, the first called *arduino-linux-setup.sh* and the second called *install.sh*.

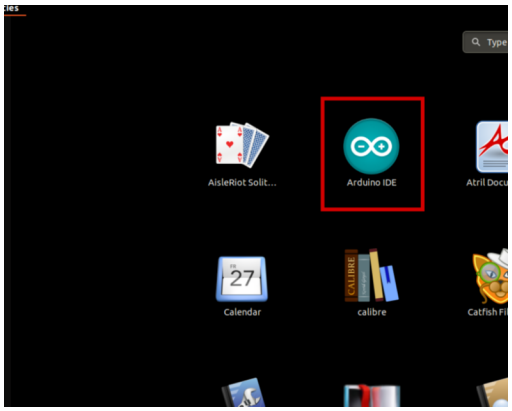
To run the first script in the terminal, open the terminal in the extracted directory and run the following command:

sh arduino-linux-setup.sh user_name

user_name - is the name of a superuser in the Linux operating system. A password for the superuser has to be entered when the command is started. Wait for a few minutes for the script to complete everything.

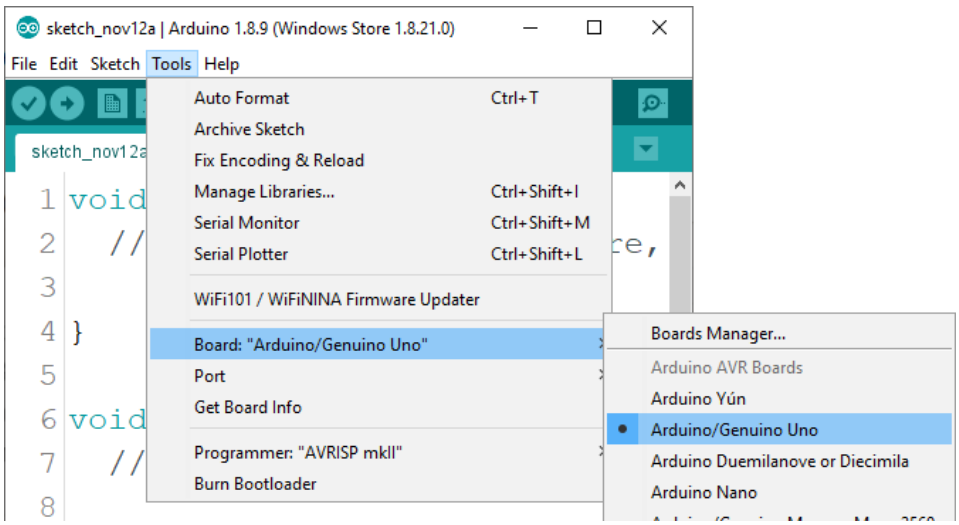
The second script, called *install.sh*, has to be used after the installation of the first script. Run the following command in the terminal (extracted directory): **sh install.sh**

After the installation of these scripts, go to the *All Apps*, where the *Arduino IDE* is installed.



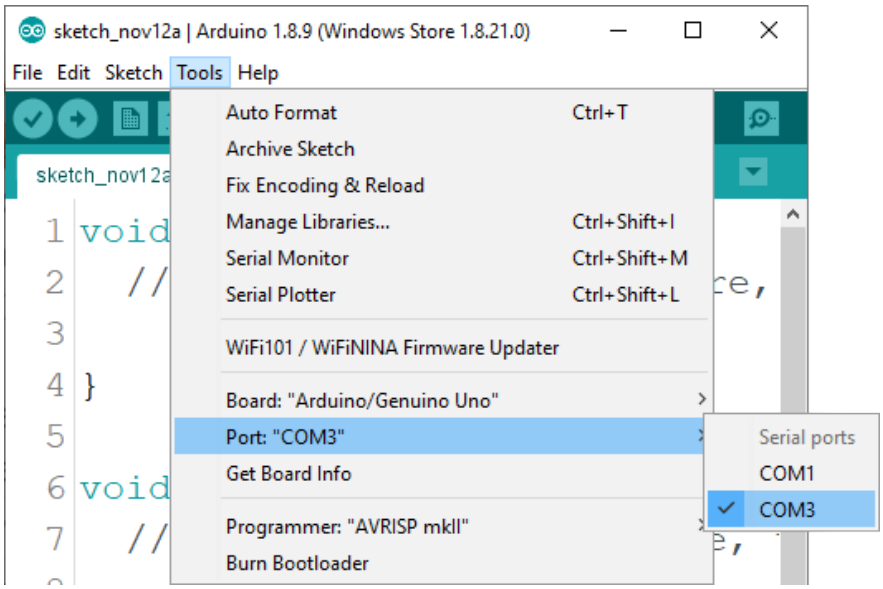
Almost all operating systems come with a text editor preinstalled (for example, *Windows* comes with *Notepad*, *Linux Ubuntu* comes with *Gedit*, *Linux Raspbian* comes with *Leafpad*, etc.). All of these text editors are perfectly fine for the purpose of the eBook.

Next thing is to check, if your PC can detect an Arduino board. Open freshly installed Arduino IDE, and go to:
Tools > Board > {your board name here}
{your board name here} should be the *Arduino/Genuino Uno*, as it can be seen on the following image:



The port to which the Arduino board is connected has to be selected. Go to:
Tools > Port > {port name goes here}
and when the Arduino board is connected to the USB port, the port name can be seen in the drop-down menu on the previous image.

If the Arduino IDE is used on Windows, port names are as follows:



For *Linux* users, for example port name is */dev/ttyUSBx*, where *x* represents integer number between *0* and *9*.

Library for Arduino IDE

To use the CNC Shield Bundle with Uno it is recommended to download an external library. The library that is used in this eBook is called the *GRBL*, that can be downloaded on the following *link*.

When the *.zip* file is downloaded, open Arduino IDE and go to:
Sketch > Include Library > Add .ZIP Library
and add the downloaded zip file.

After installation of the *GRBL* library, the code has to be uploaded to the Uno. To prepare the Uno for receiving the G-Code an example can be found at following: *Files > Examples > grblmain*

The G-Code can be sent from a specific software such as *Universal G-code sender* which can be found on Internet. There are many tutorials and guides on Internet how to operate and calibrate the Uno with a CNC shield for different purposes. Further explanations are not in the scope of this eBook.

Now it is the time to learn and make your own projects. You can do that with the help of many example scripts and other tutorials, which can be found on the Internet.

If you are looking for the high quality products for Arduino and Raspberry Pi, AZ-Delivery Vertriebs GmbH is the right company to get them from. You will be provided with numerous application examples, full installation guides, eBooks, libraries and assistance from our technical experts.

https://az-delivery.de

Have Fun!

Impressum

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