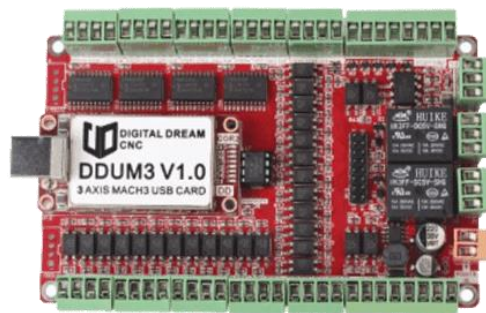




## DrufelCNC DDUM3 V1 Installation Manual



DrufelCNC, 2021

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## **Annotation**

This document is the user guide for the DrufelCNC software. The information contained in this document may be modified by employees of the company with the subsequent notification. Your changes are reflected in the document version. The company does not guarantee the absence of errors or typographical errors in this document, but will work to eliminate them, and will also be grateful to everyone who finds them and points to them.

Comments and suggestions to this document are accepted by email: [social@drufelcnc.com](mailto:social@drufelcnc.com). Document version - V.1.17.

## **NOTICE OF LIABILITY**

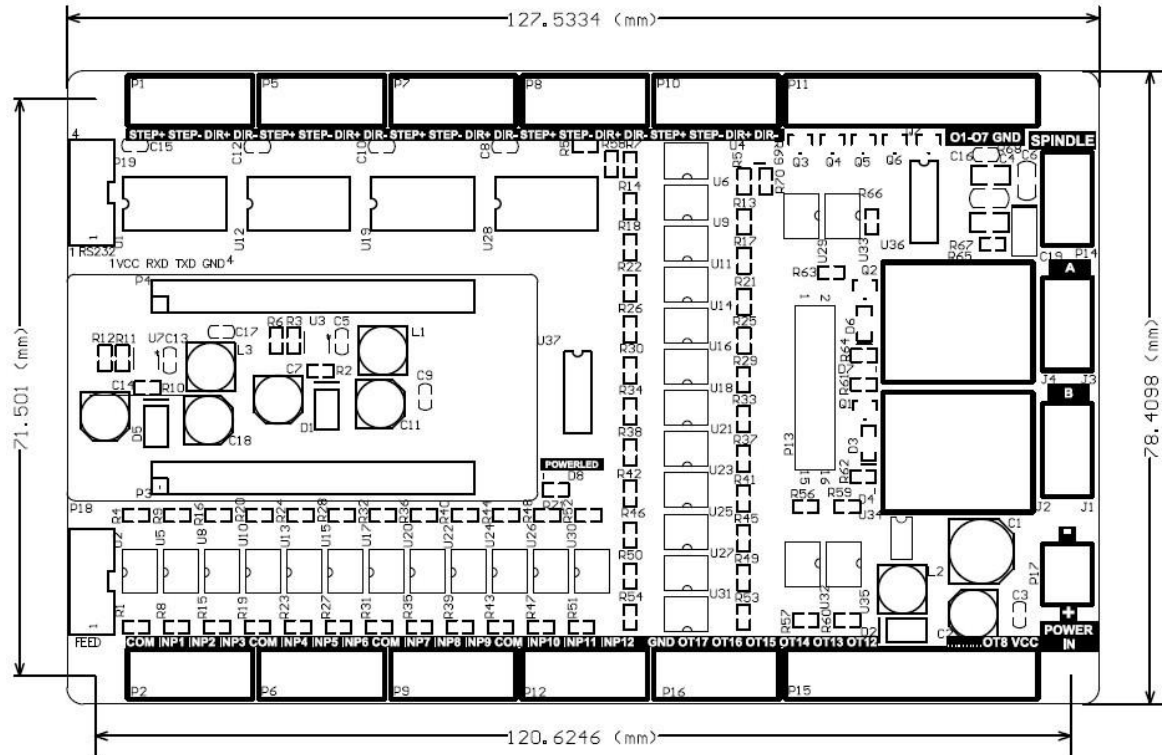
Using any CNC machine is a dangerous operation. All precautions must be taken, as the machines may turn on at any time, the software MAY malfunction at any time, any user of the Software must understand and take this into account, and must immediately uninstall the Software and not proceed with the installation if they are not fully understand all the consequences of the use, as well as the fact that in case of misuse, the wrong code, unexpected movement or any damage caused by the aforementioned consequences mi, there is no legal protection.

## 1. Features

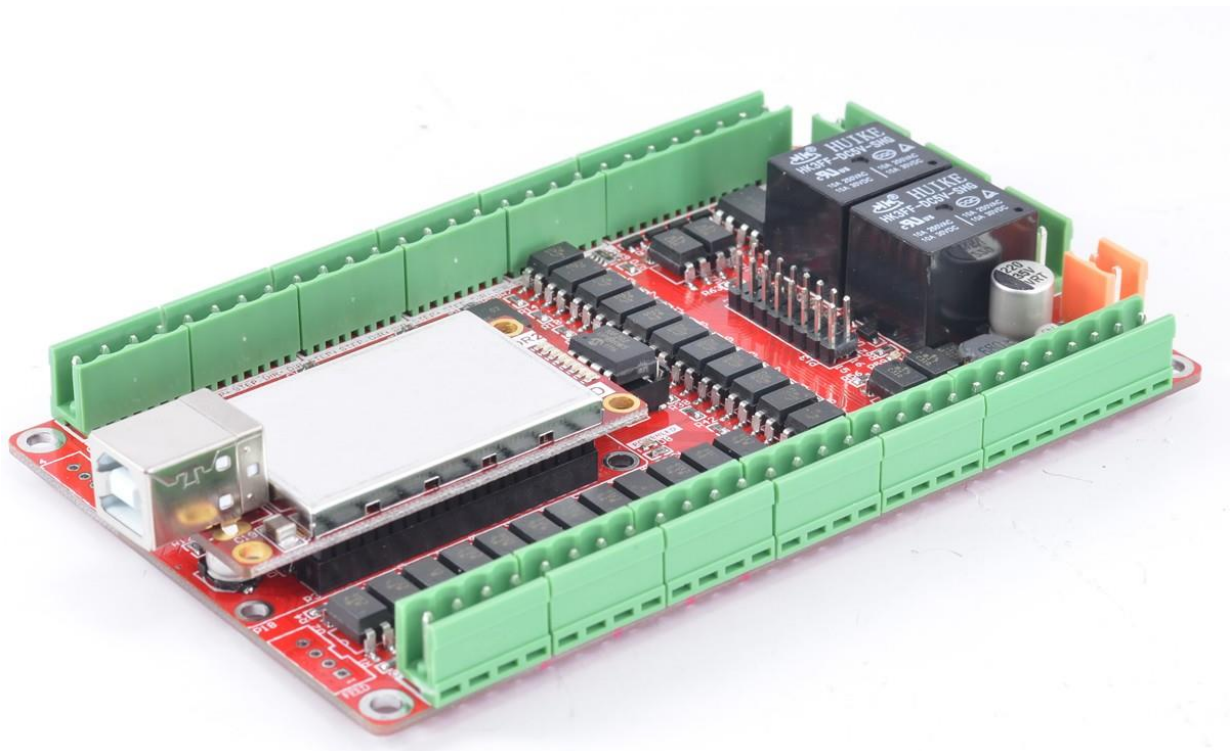
- Support for CNC controlled 3-Axis, can connect five stepper motor drivers or servo drives.
- 1 USB communication interface and power supply for the board.
- 26 IO input, opto-isolated. It Can be configured to limit the emergency stop and other functions 12 of them are 2edg port 14 of them are 2.54mm are standard double-Pin port.
- High 8 IO outputs.
- Power input with 12~36VDC. The power supply only to optocoupler and relay.
- 2 Relays output port.
- Spindle control output with Change from 0 to 10V by software.
- Low 8 IO outputs, O1-O5are set as Open drain. They can driver Equipment within 100mA current.
- Support for the operating system Windows XP, Windows 7 (32 / 64bit), Windows 8, Windows 10.
- Applicable to all versions of DrufelCNC software.

## 2. Appearance

The board Size is 127\*78mm.

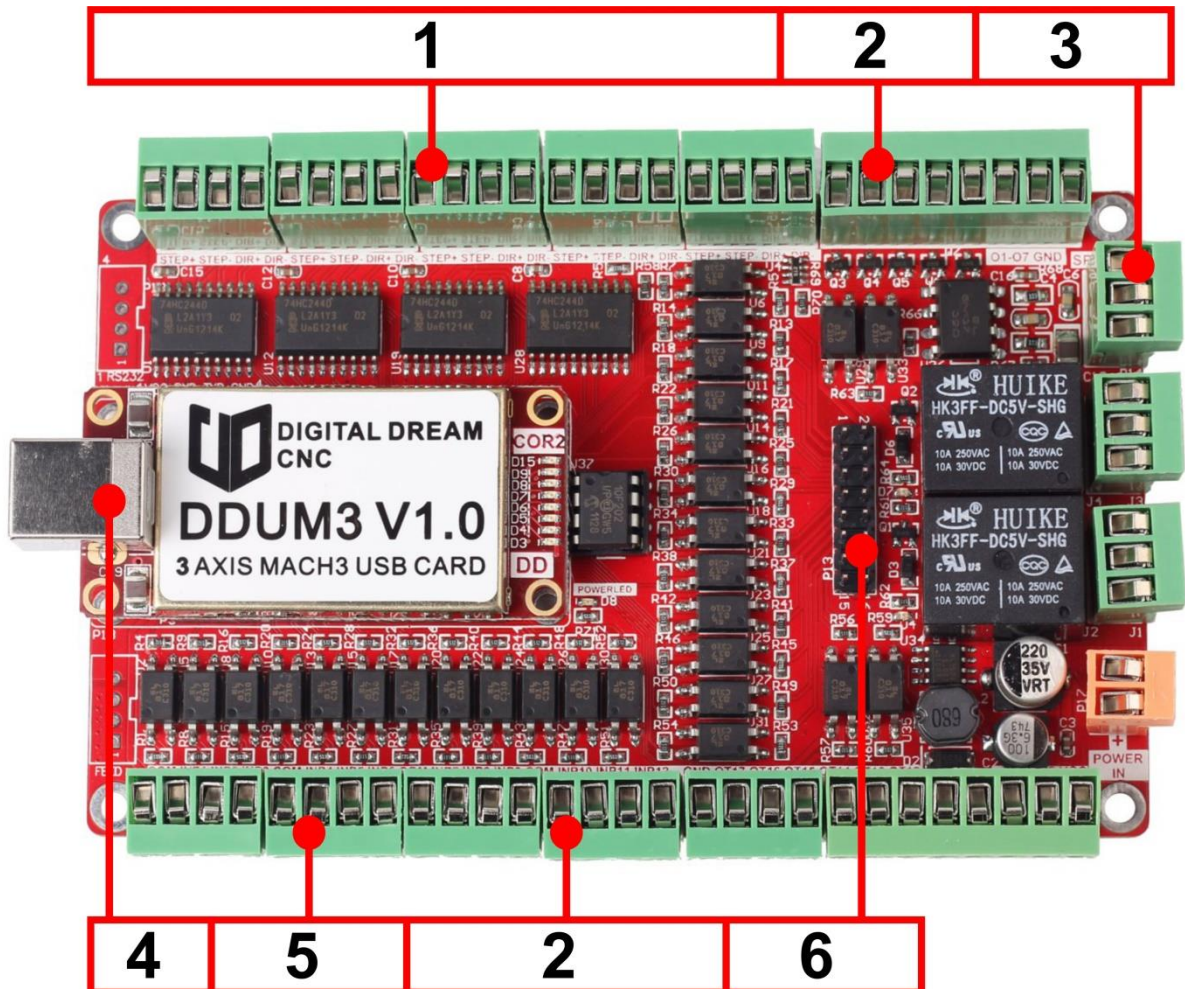


Product positioning holes size is 120.6\*71.5mm.



### 3. Product connection define and method

The controller connection includes a power supply interface, a USB connection interface, an MPG interface, a Stepper / Servo control output interface, a spindle control output interface, Estop and a limited switch input and tool settings interface and so on.



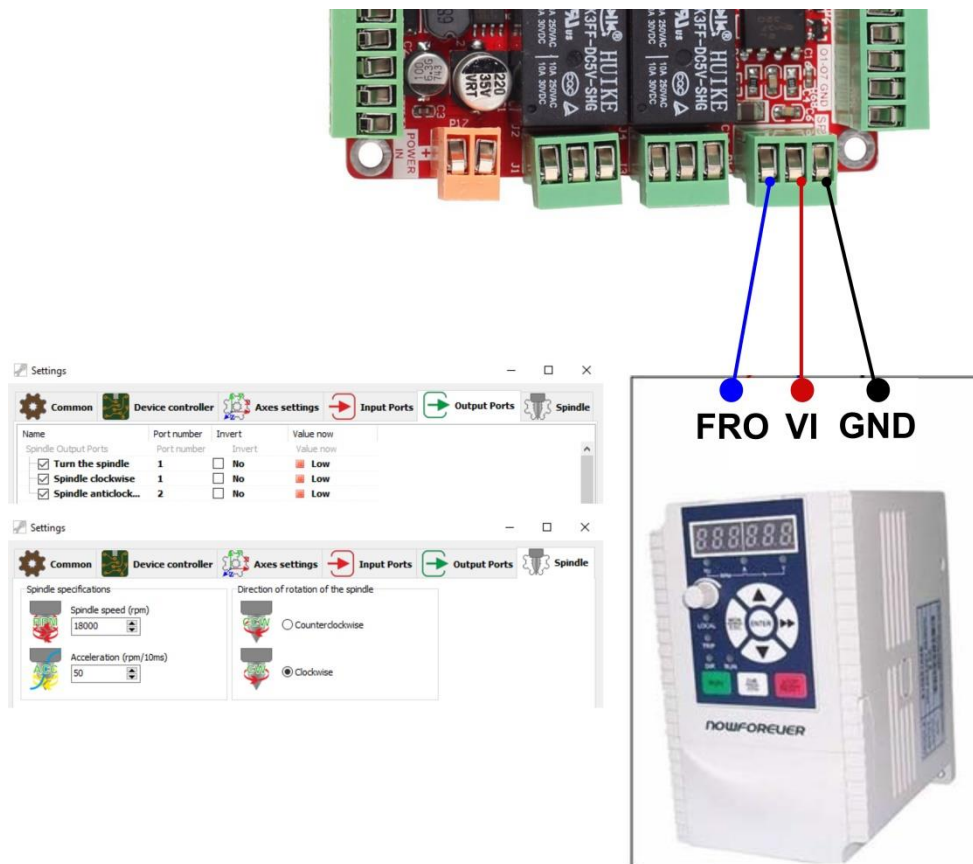
#### 1 - Stepper motor control interface.

5-axis stepper motor control signal output, defined as CK+ \ CK- \ DIR+ \ DIR-. There are positive pulse, negative pulse, positive direction, negative direction. These ports are common positive connection. Therefore, on the board of CK + and DIR + are linked together to 5V. So this board does not support the common negative connection. Wiring method:



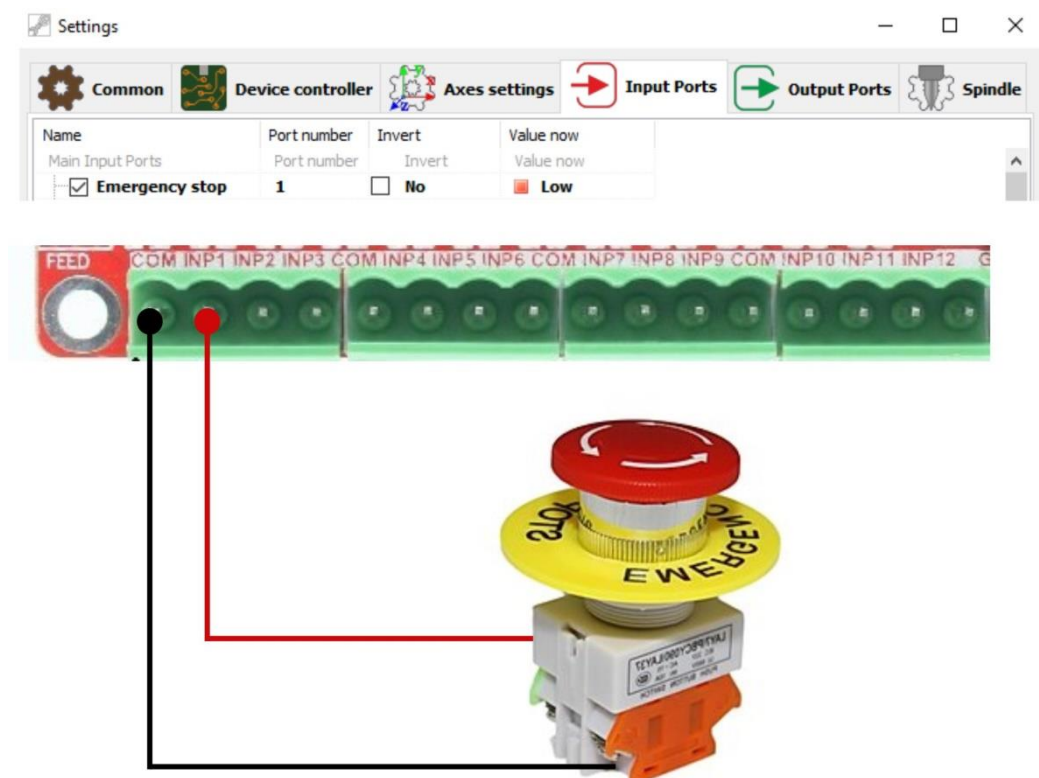


### 3- Spindle Control Output Port.

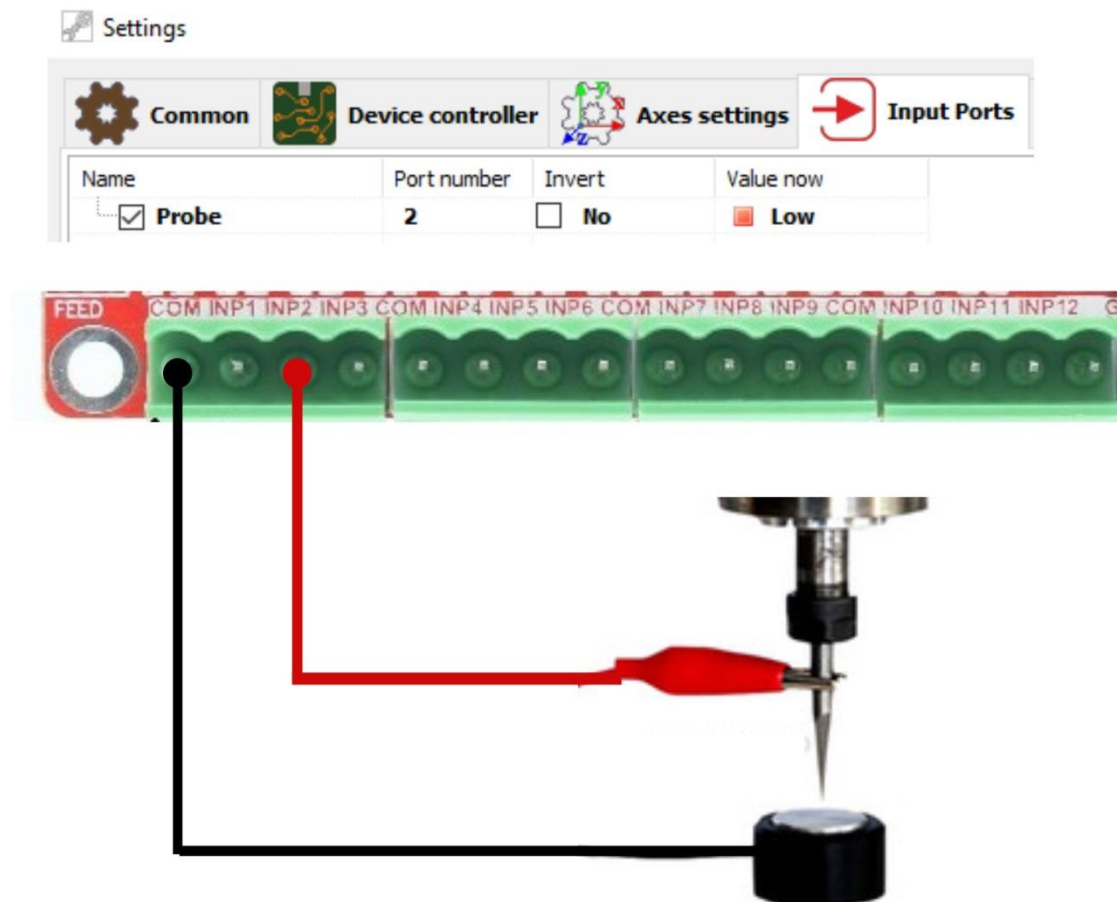


### 4 - USB Port.

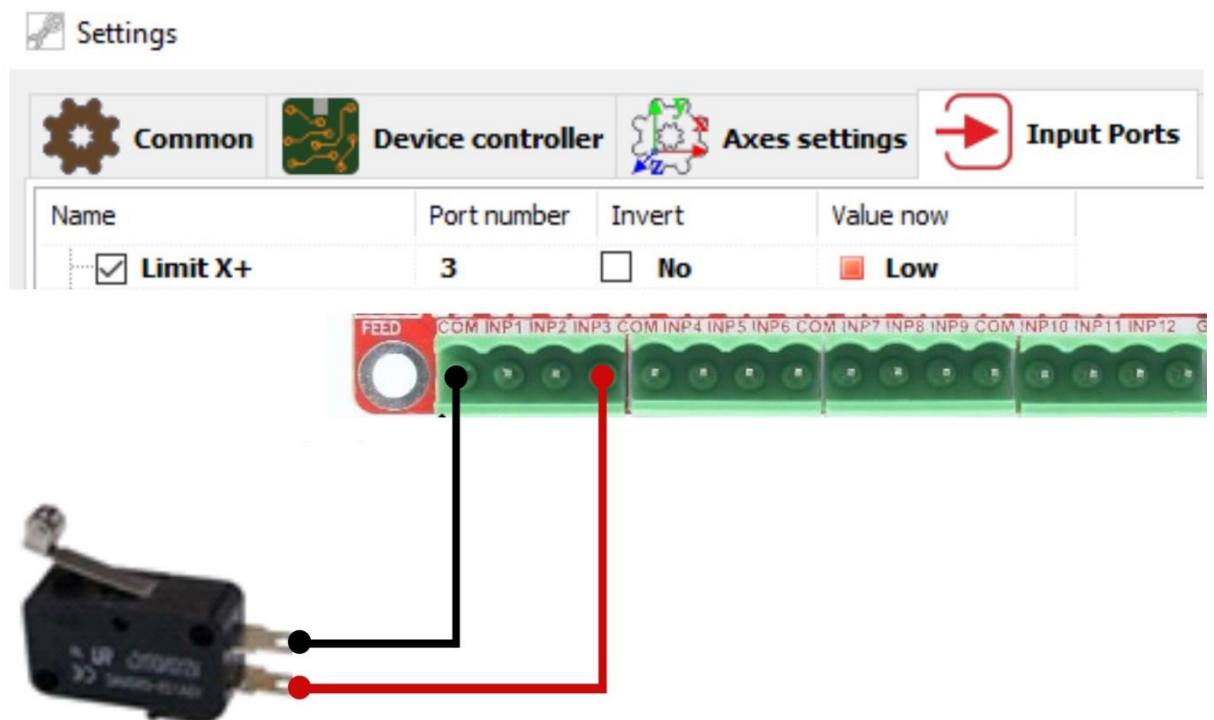
### 5 - Input Ports. Estop input connection



## Probe input connection

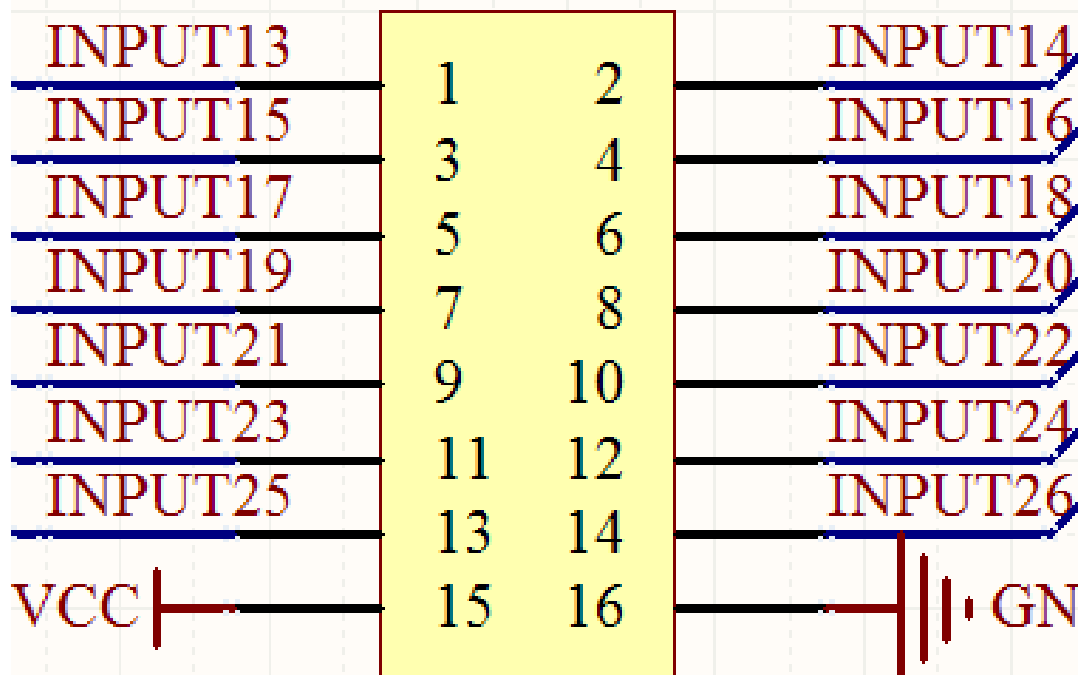


## End switch input connection



## 6 – MPG Interface

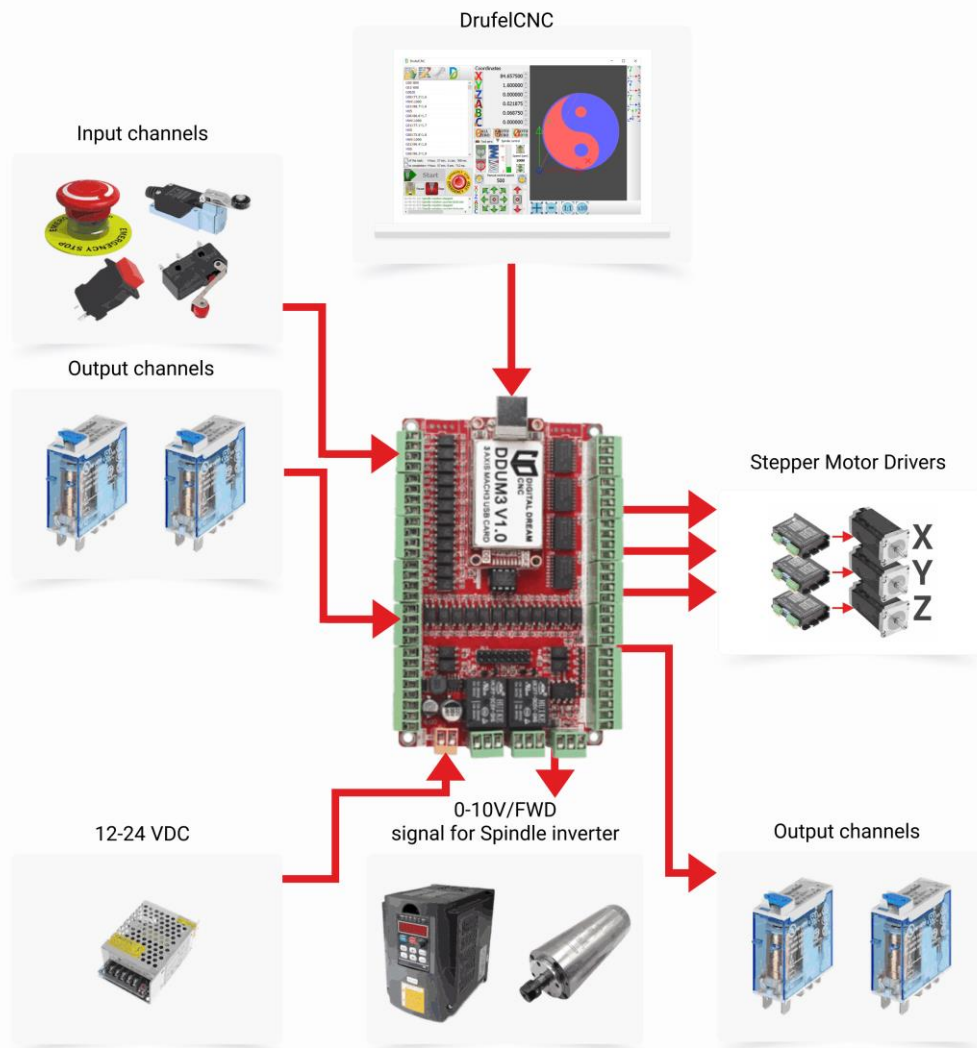
5V General INPUT PORT IN13-IN26, it's a 2.54mm double pin port. The first left Pin is Pin1,PIN1-PIN 16.



## 4. Basic connection diagram

DrufelCNC

Connection diagram DDUM3 of DrufelCNC

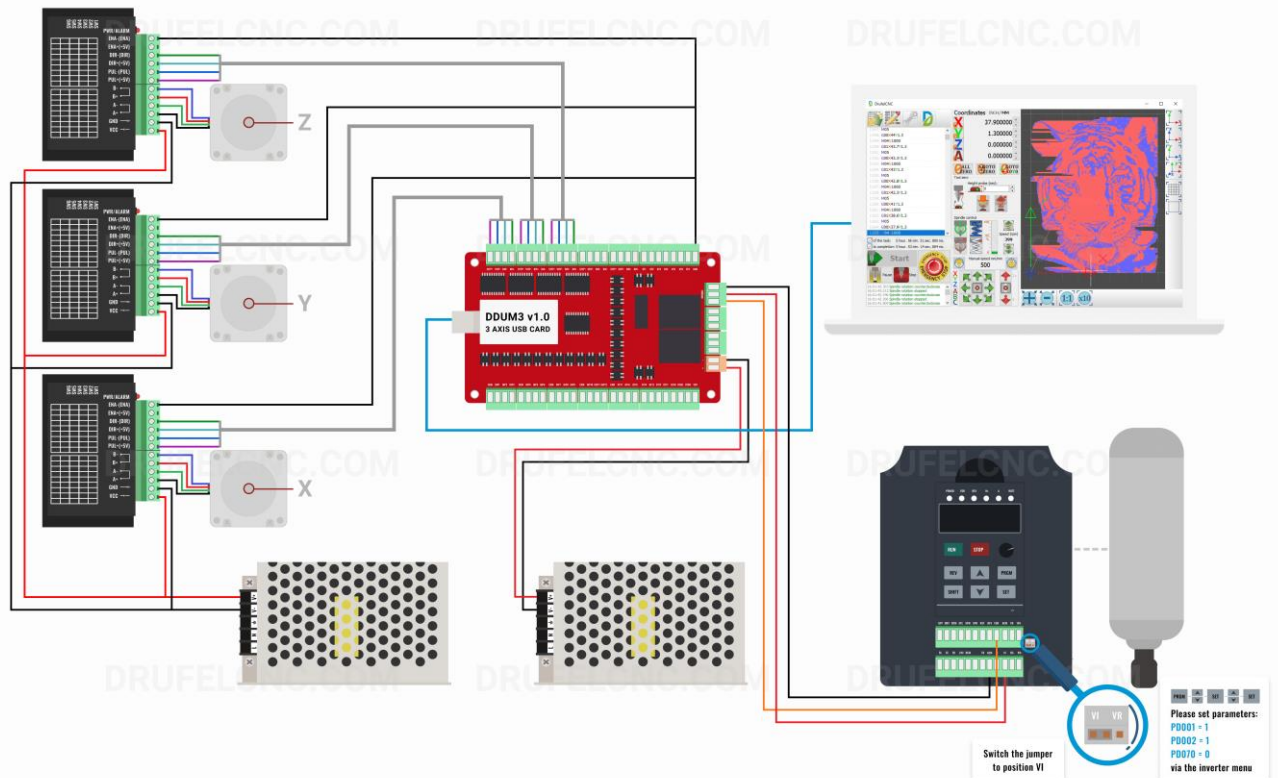


Using any CNC machine is a dangerous operation. Before use, all safety measures must be taken. If you do not have complete information, if you do not have an engineering background, then do not use this diagram. In case of improper connection, unexpected movement or any damage caused by the aforementioned consequences, there is no legal protection.

## 5. Connection diagram stepper motors and spindle



Connection diagram for DDUM3 v1.0, stepper motors and spindle in DrufelCNC



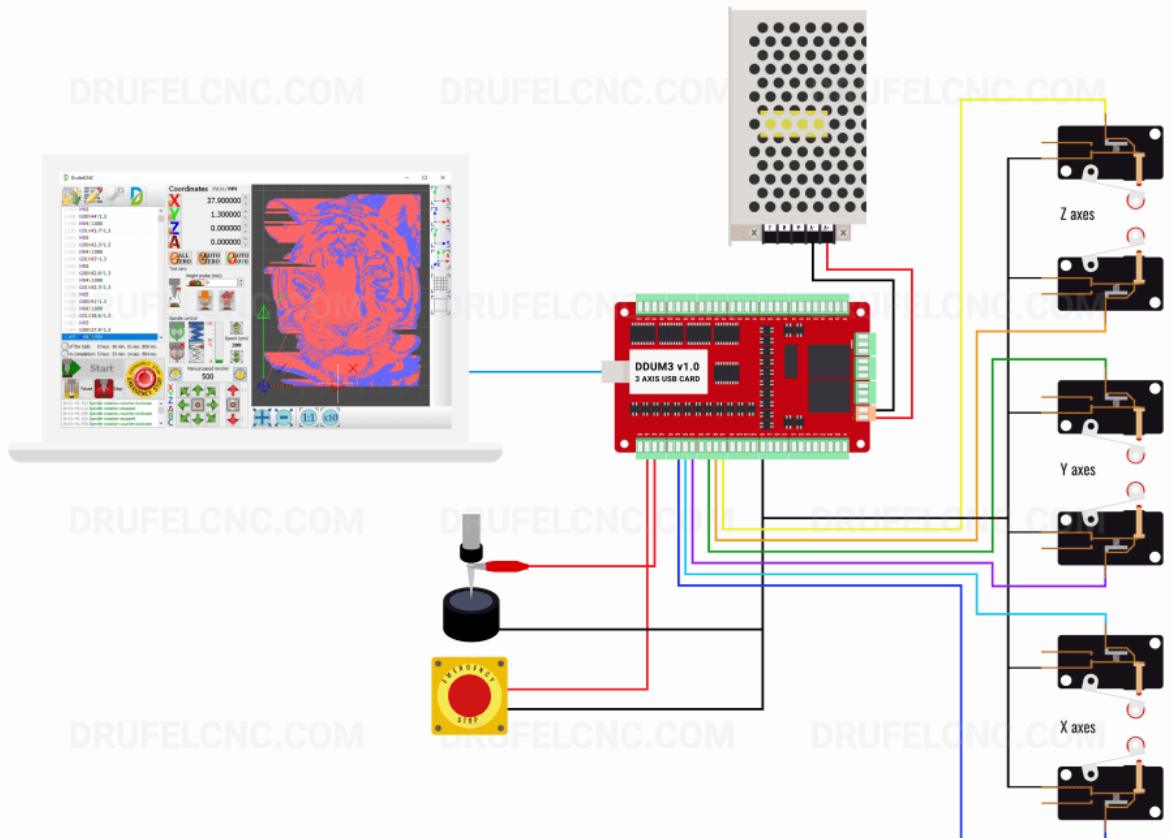
Using any CNC machine is a dangerous operation. Before use, all safety measures must be taken. If you do not have complete information, if you do not have an engineering background, then do not use this diagram. In case of improper connection, unexpected movement or any damage caused by the aforementioned consequences, there is no legal protection.



## 6. Connection diagram input ports



Connection diagram for DDUM3 and input ports DrufelCNC



Using any CNC machine is a dangerous operation. Before use, all safety measures must be taken. If you do not have complete information, if you do not have an engineering background, then do not use this diagram. In case of improper connection, unexpected movement or any damage caused by the aforementioned consequences, there is no legal protection.

## 7. Installing DrufelCNC

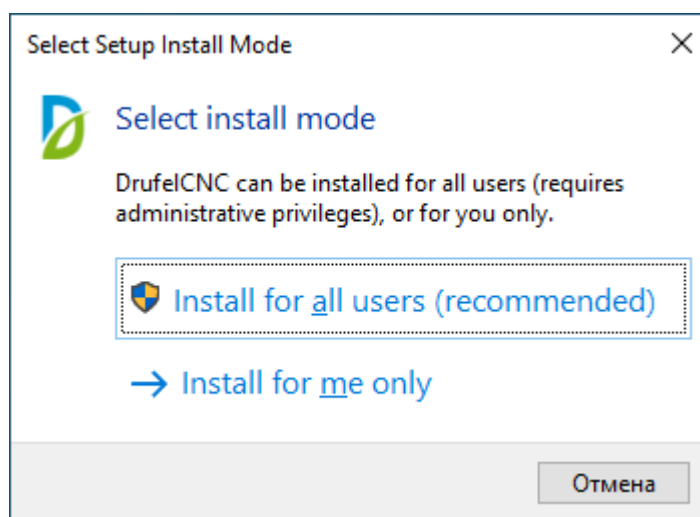
To install the program you need to download the installation files on the official website [www.drufelcnc.com](http://www.drufelcnc.com). You can use one of the following files:

- DrufelCNC\_installer\_x64.exe, DrufelCNC\_installer\_x32.exe - this installation file will automatically install DrufelCNC on your computer documentation and examples of g-codes;
- DrufelCNC.zip - archive with DrufelCNC x32 and x64 with examples and documentation.

Run the desired file and follow the installation instructions.

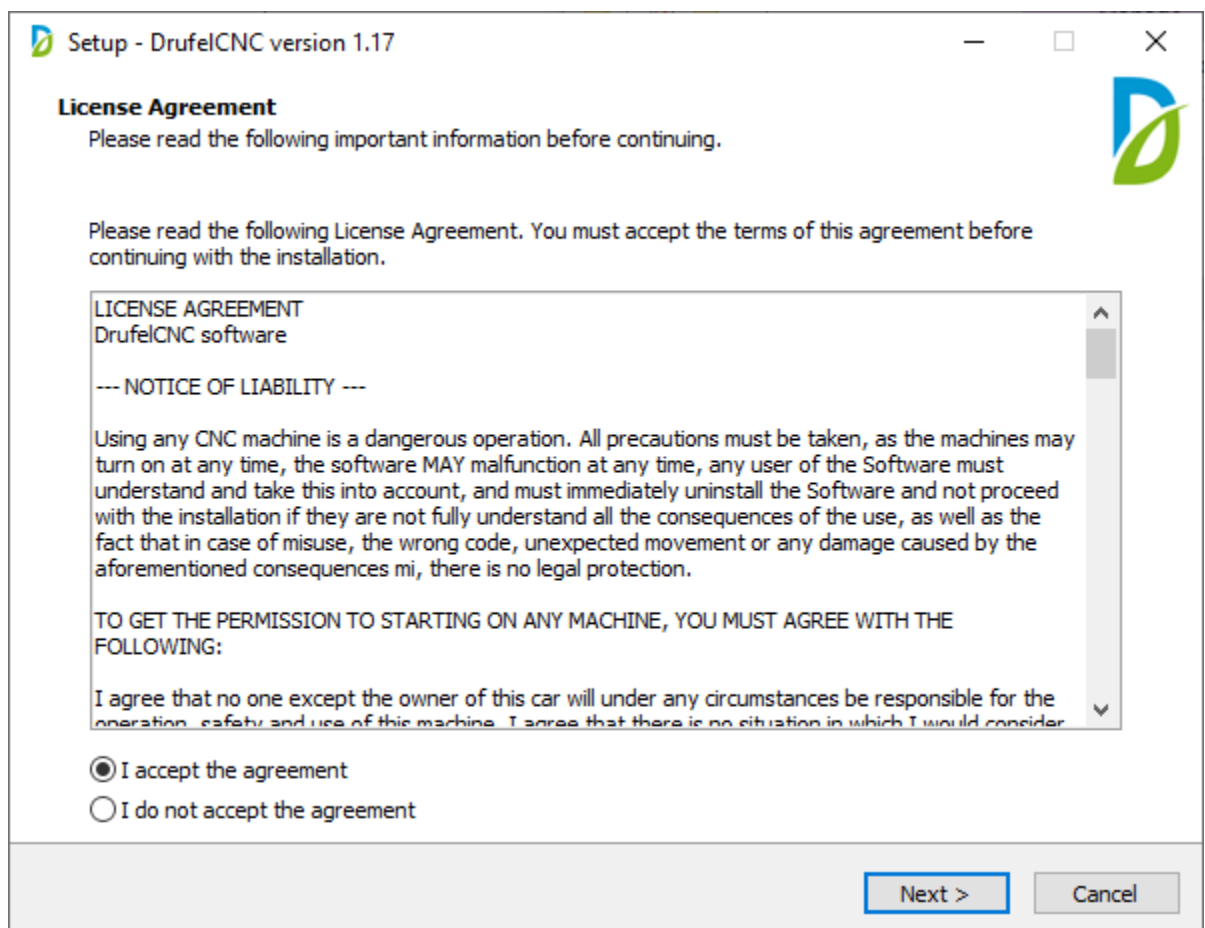
### Description of the installation process

1. *Start the installation process.* In this installation window you need to select the program installation mode.

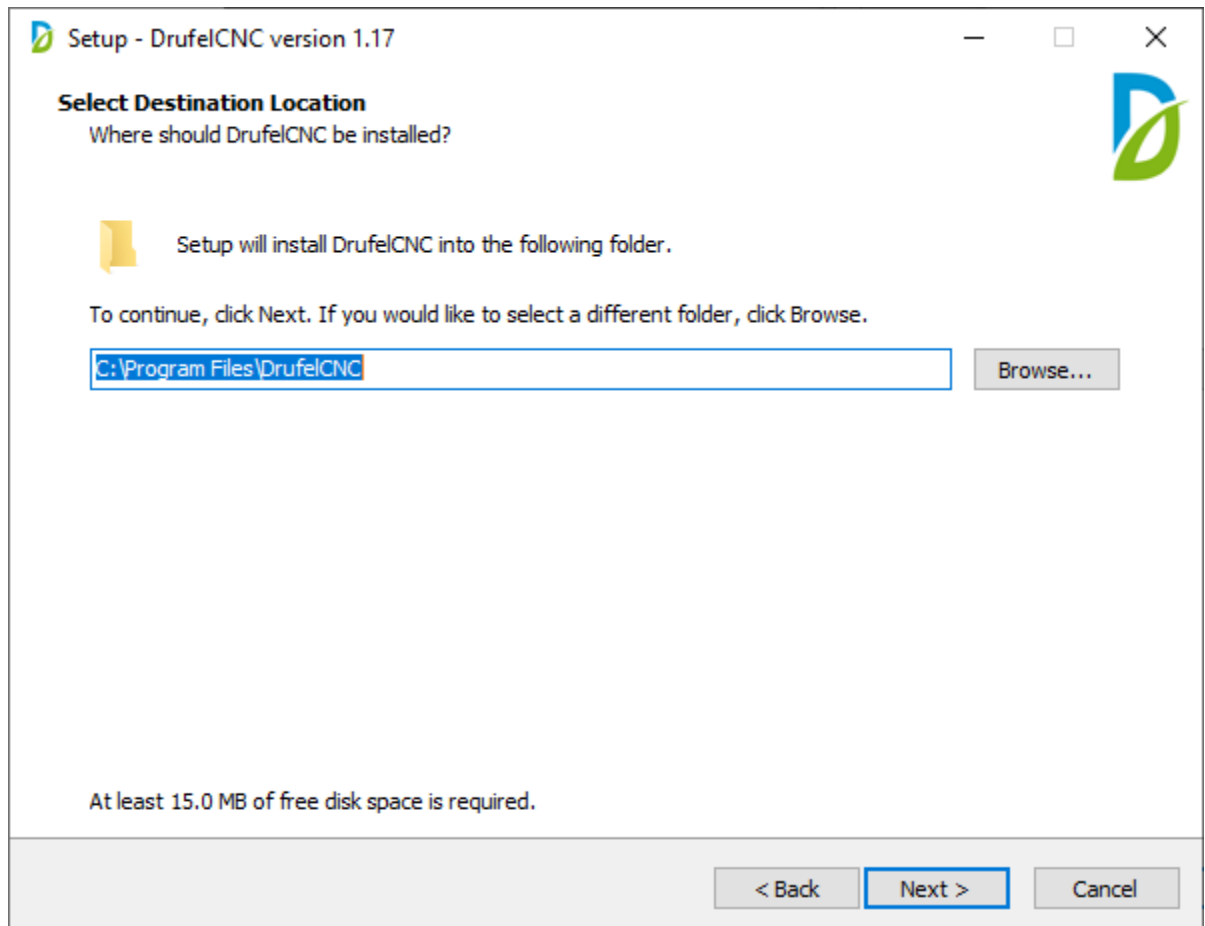




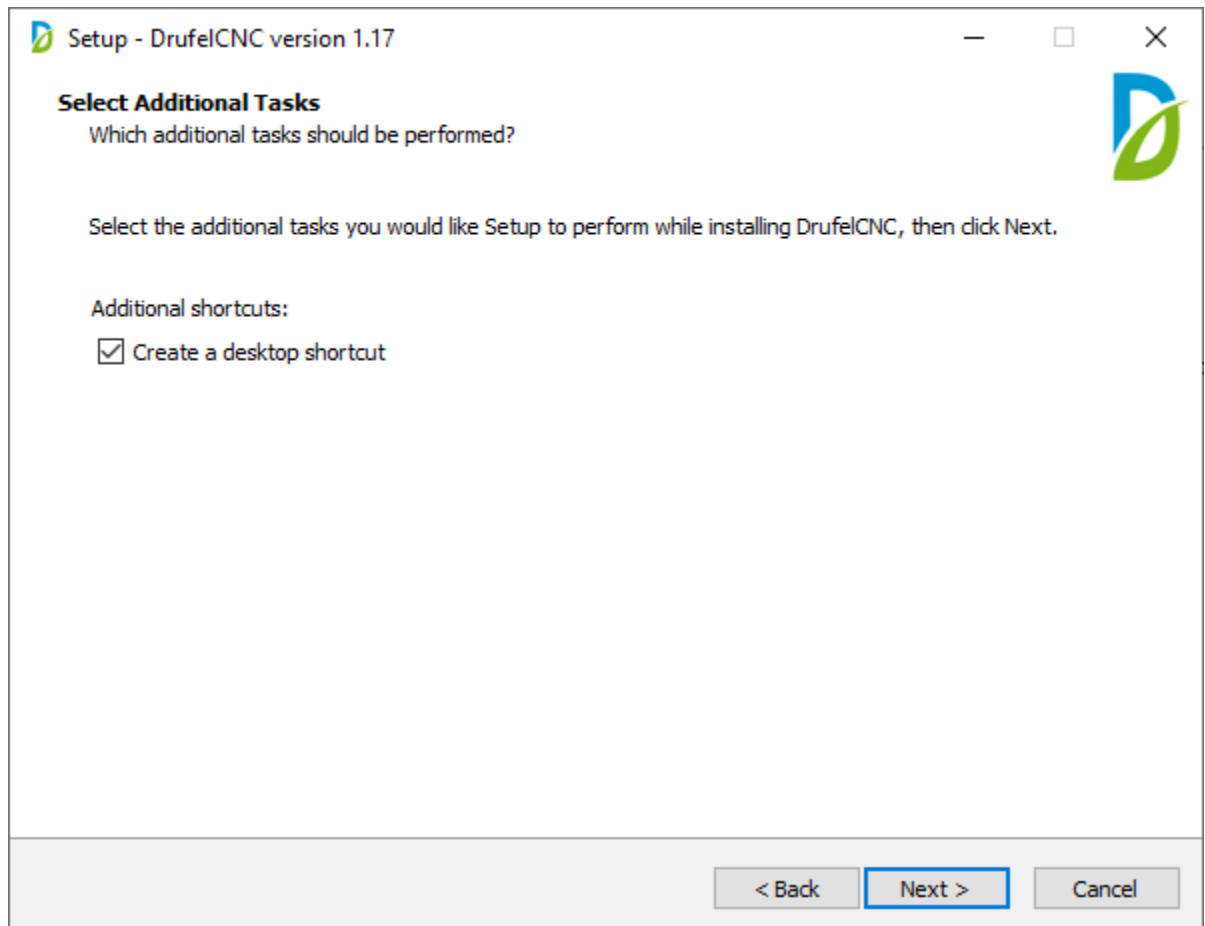
**2. License Agreement.** The License Agreement installation window contains the text of the license agreement for the use of the DrufelCNC software product. Please read the agreement and select "I accept the terms of the license agreement". To continue the installation, click "Next." During the entire installation process, to return to the previous installation step, click the Back button. To exit the installer, click Cancel.



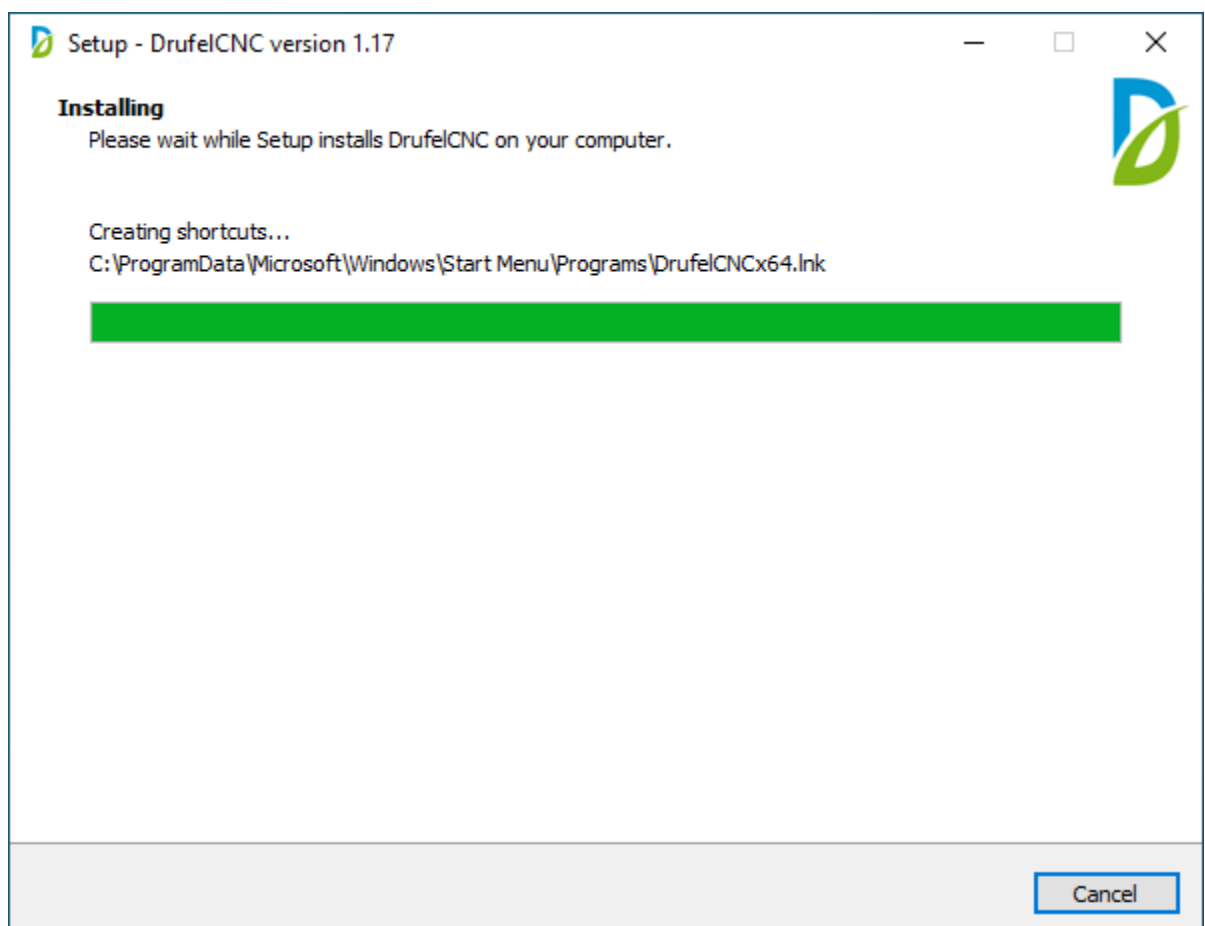
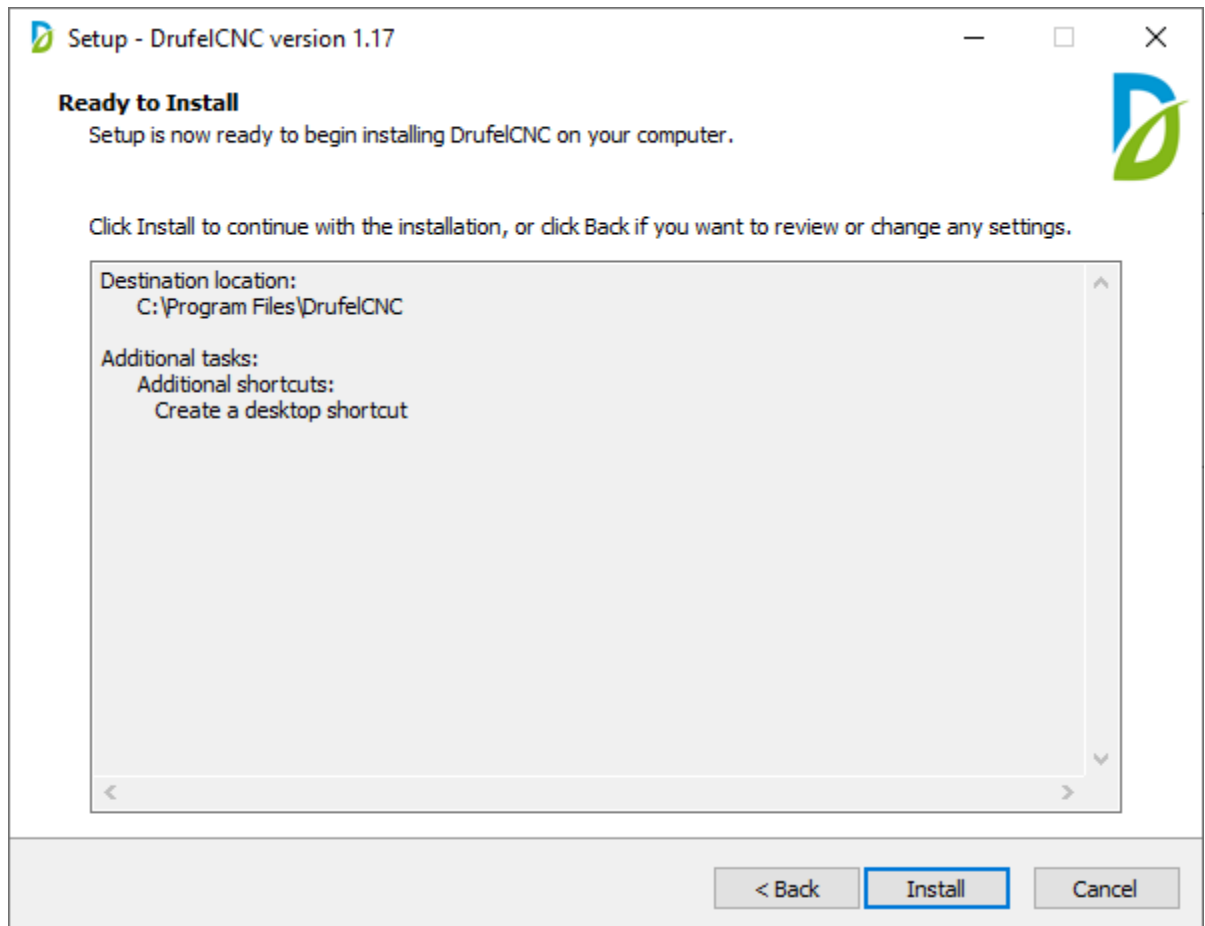
**3. Select the directory in which the installation will be made.** At this stage of the installation, you must specify the directory in which DrufelCNC will be installed. The default installation directory is "C:\Program Files\DrufelCNC". If you wish, you can specify any other path. Depending on the version of Windows, the default path may be different. To continue the installation, click "Next."



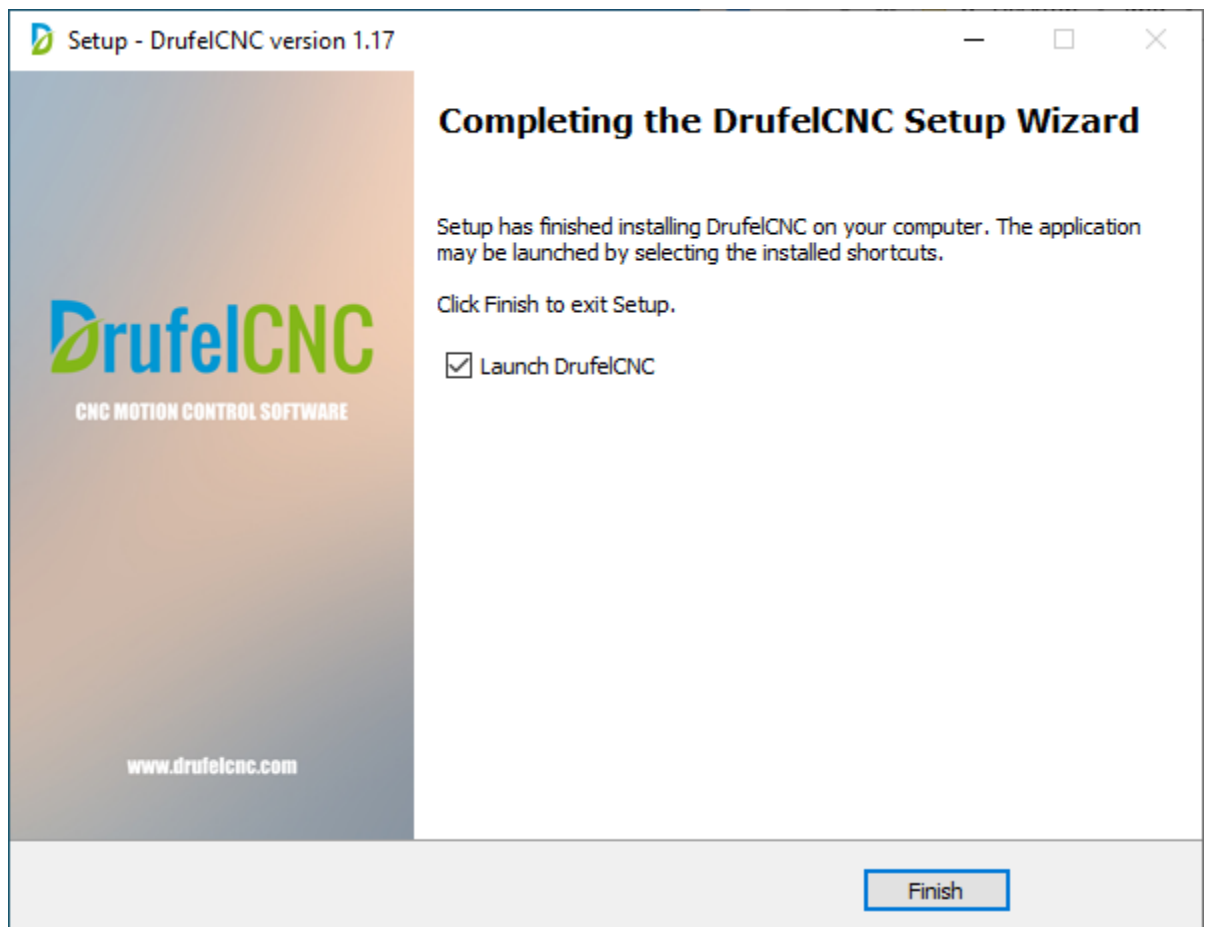
**4.** *Selection of additional installation parameters.* At this stage of installation, it is necessary to determine the need to create program shortcuts on the desktop. By default, a program shortcut will be created. To continue the installation, click "Next."



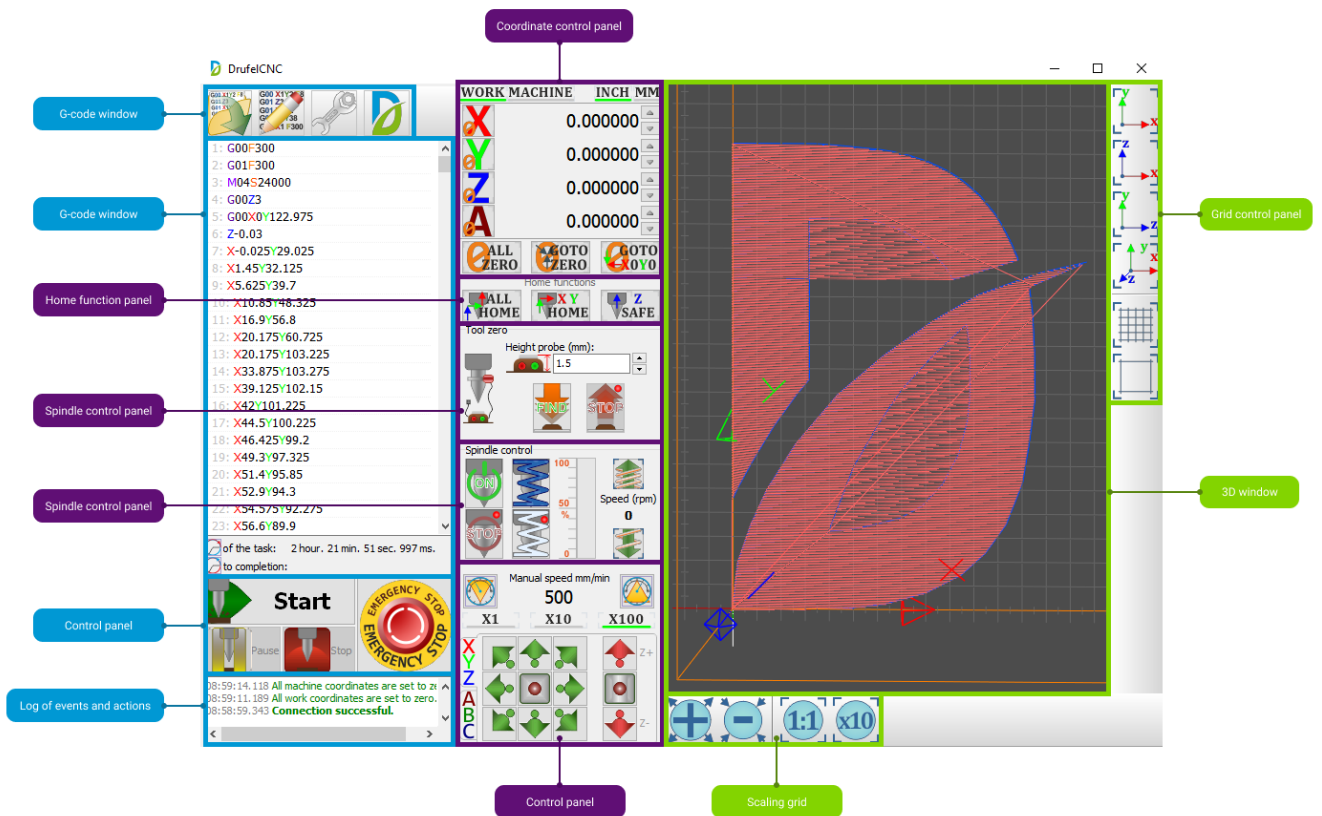
- 5.** *Preparing for installation.* A window with information about the selected installation type, selected components and installation directory will be displayed. Check the information and click "Install."



**6.** *The final stage of installation.* At the last stage, the installation program will report the result and will offer to start the programs depending on the type of installation selected earlier. By default, you can run the program. To complete the installation, click Finish.



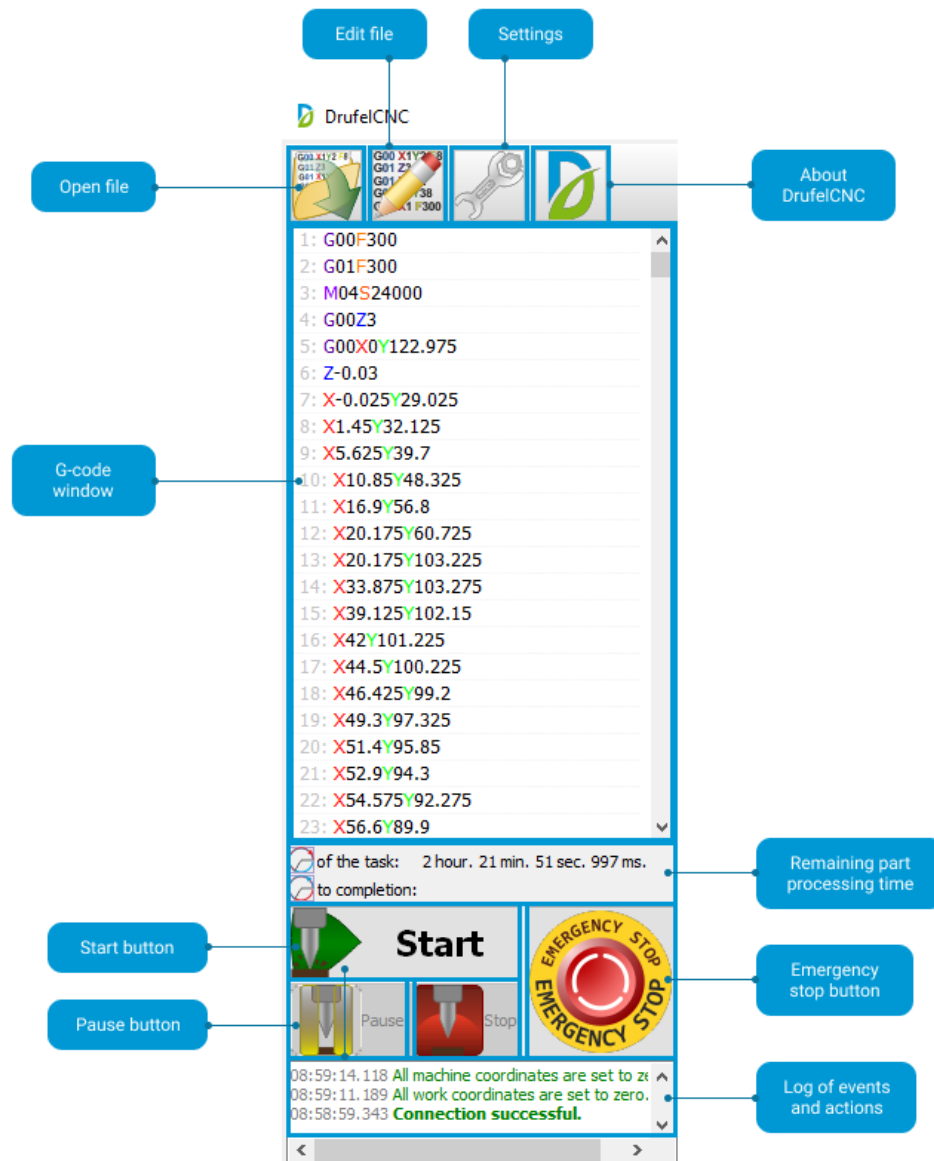
## 8. DrufelCNC interface



The DrufelCNC interface can be divided into three blocks:

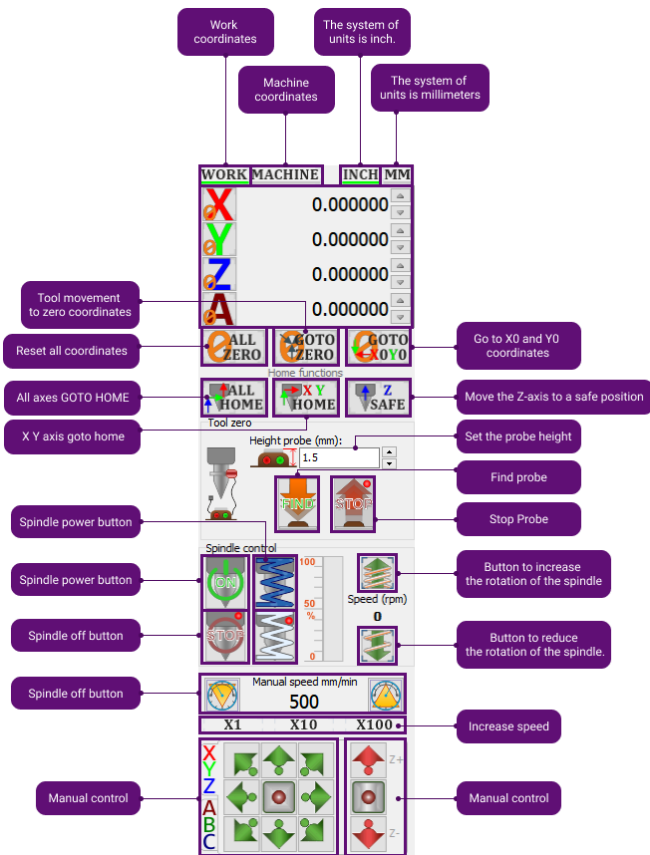
1. G-code window
2. Base functions
3. 3D window

## G-code-window:



| Functions                 | Description                    |
|---------------------------|--------------------------------|
| Open file                 | Open file button               |
| Edit file                 | Edit g-code file button        |
| Settings                  | Function setting button        |
| About DrufelCNC           | DrufelCNC information button   |
| G-code window             | Display of G-code              |
| Start                     | Start button                   |
| Pause                     | Pause button                   |
| Remaining time part       | Remaining part processing time |
| Emergency stop            | Emergency stop button          |
| Log of events and actions | Log of events and actions      |

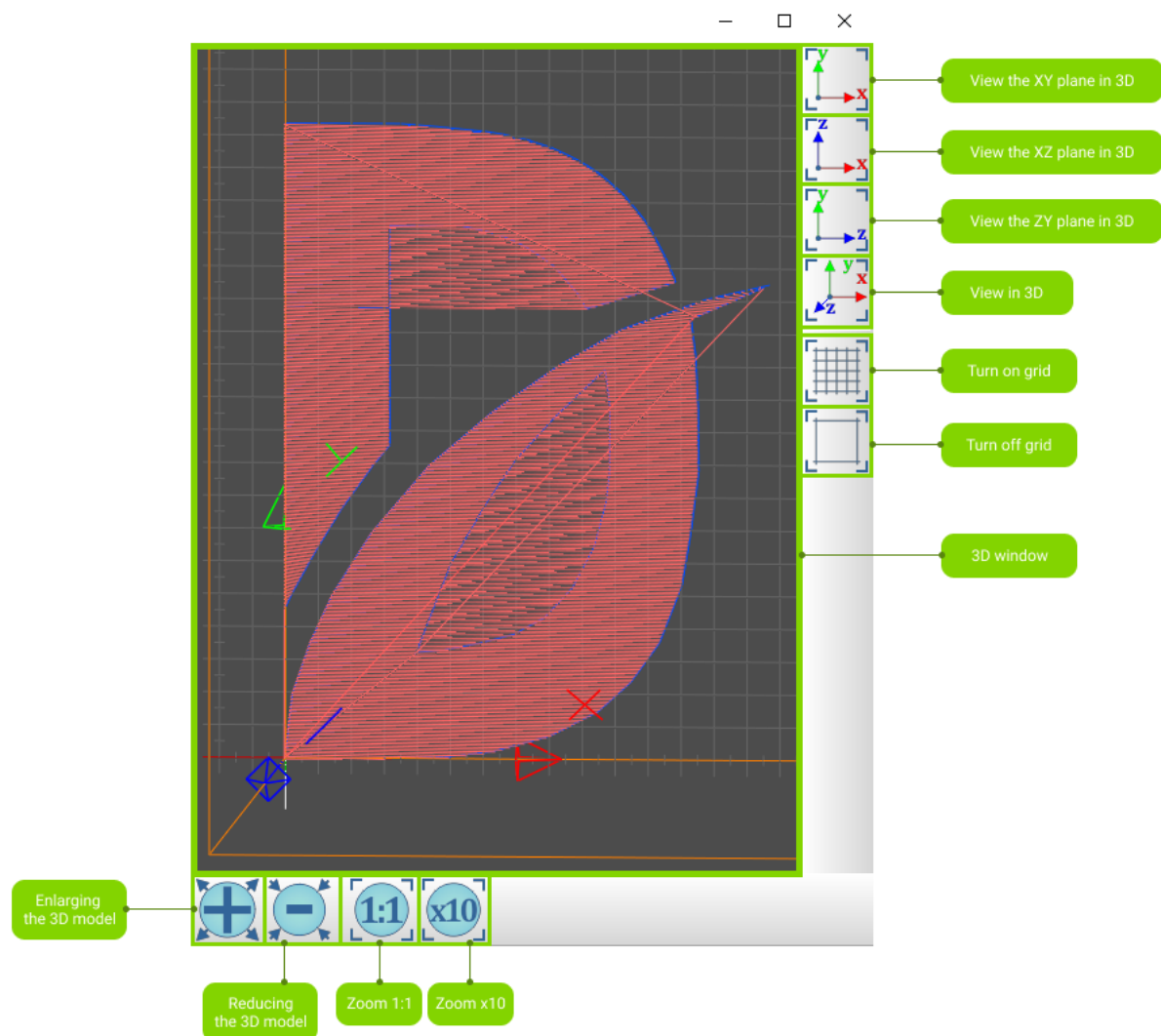
## Base functions:



| Functions                                      | Description                                    |
|--|--|
| Work coordinates                               | Activating work coordinate mode                |
| Machine coordinates                            | Activating machine coordinate mode             |
| Inch   | Activating inch mode                           |
| Millimeters                                    | Activating millimeter mode                     |
| All zero                                       | Reset all coordinates                          |
| Go to home                                     | Tool movement to zero coordinates              |
| Go to X0 Y0                                    | Go to X0 and Y0 coordinates                    |
| All home                                       | All axes GOTO HOME                             |
| X Y home                                       | X Y axis goto home                             |
| Z safe   | Move the Z-axis to a safe position             |
| Set the probe height                           | Set the probe height                           |
| Find probe                                     | Find probe                                     |
| Stop Probe                                     | Stop Probe                                     |
| Button to increase the rotation of the spindle | Button to increase the rotation of the spindle |
| Button to reduce the rotation of the spindle.  | Button to reduce the rotation of the spindle.  |
| Spindle power                                  | Spindle power button                           |
| Spindle off                                    | Spindle off button                             |
| Turn on cooling                                | Turn on cooling button                         |
| Turn off cooling                               | Turn off cooling button                        |
| Panel manual speed                             | Panel manual speed                             |
| Manual control axes                            | Manual control axes                            |
| Manual control z axes                          | Manual control z axes                          |
| Increase speed                                 | Increase speed                                 |
| Decrease in spindle rotation                   | Button to reduce the rotation of the spindle   |
| Increase spindle rotation                      | Button to increase the rotation of the spindle |
| Stop Probe                                     | Stop Probe button                              |
| Find probe                                     | Find probe button                              |
| Set the probe height                           | Probe height button                            |



## 3D window:



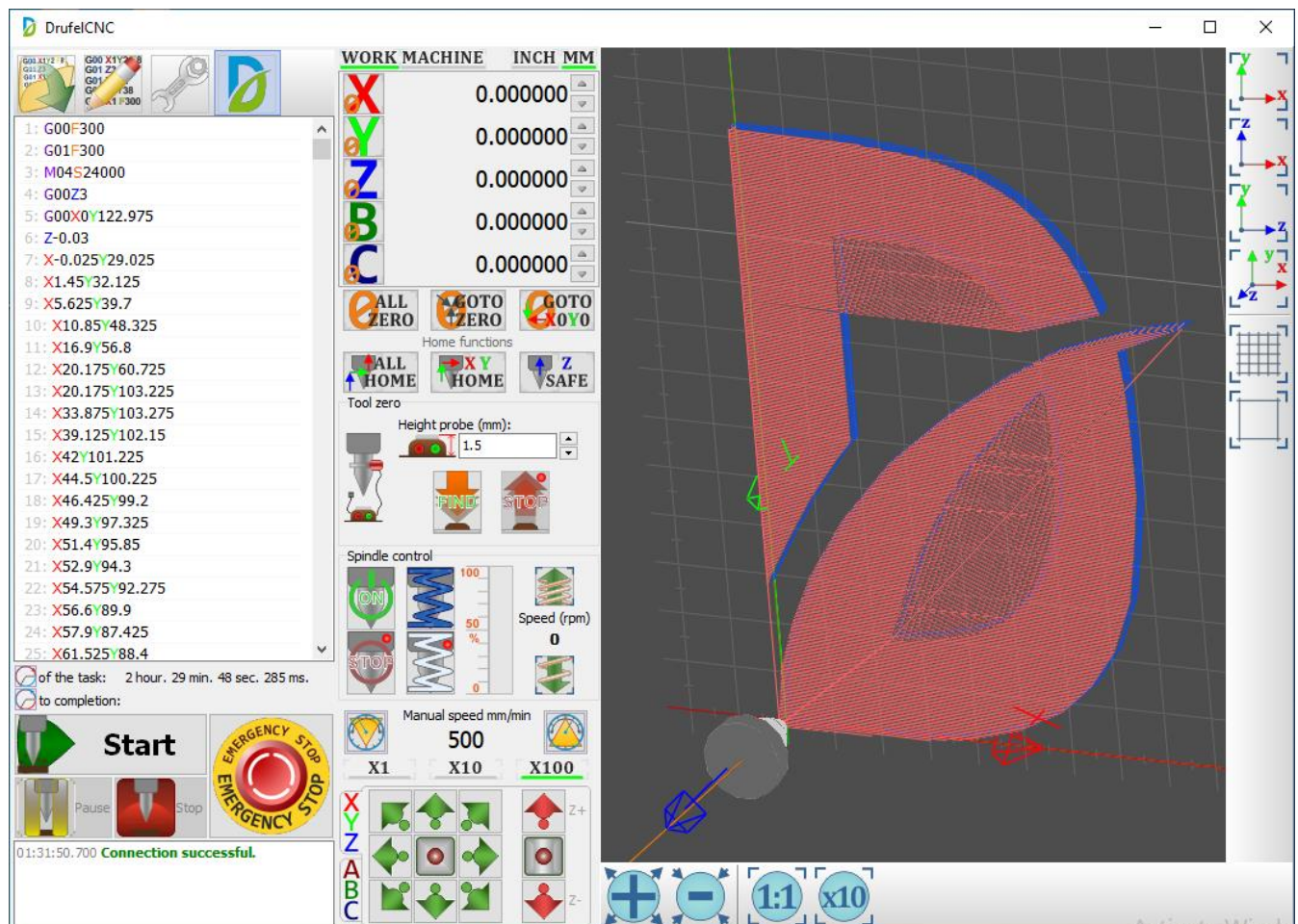
| Functions             | Description                  |
|-----------------------|------------------------------|
| Scale 3D model        | Scale 3D model button        |
| Reducing the 3D model | Reducing the 3D model button |
| Zoom 1:1              | Zoom 1:1 button              |
| Zoom x10              | Zoom x10 button              |
| 3D window             | Display of 3D-model          |
| Turn off grid         | Turn off grid button         |
| Turn on grid          | Turn on grid button          |
| View in 3D            | View in 3D button            |
| ZY plane in 3D        | View the ZY plane in 3D      |
| XZ plane in 3D        | View the XZ plane in 3D      |
| XY plane in 3D        | View the XY plane in 3D      |

## 9. Run the program

To run the program, use the version depending on the bitness of your operating system:

- DrufelCNCx32.exe - version for 32-bit operating systems
- DrufelCNCx64.exe - version for 64-bit operating systems

The main window of the program.



In the lower left corner displays the status of the connection to the USB controller, and other informational messages.

## 10. Customization

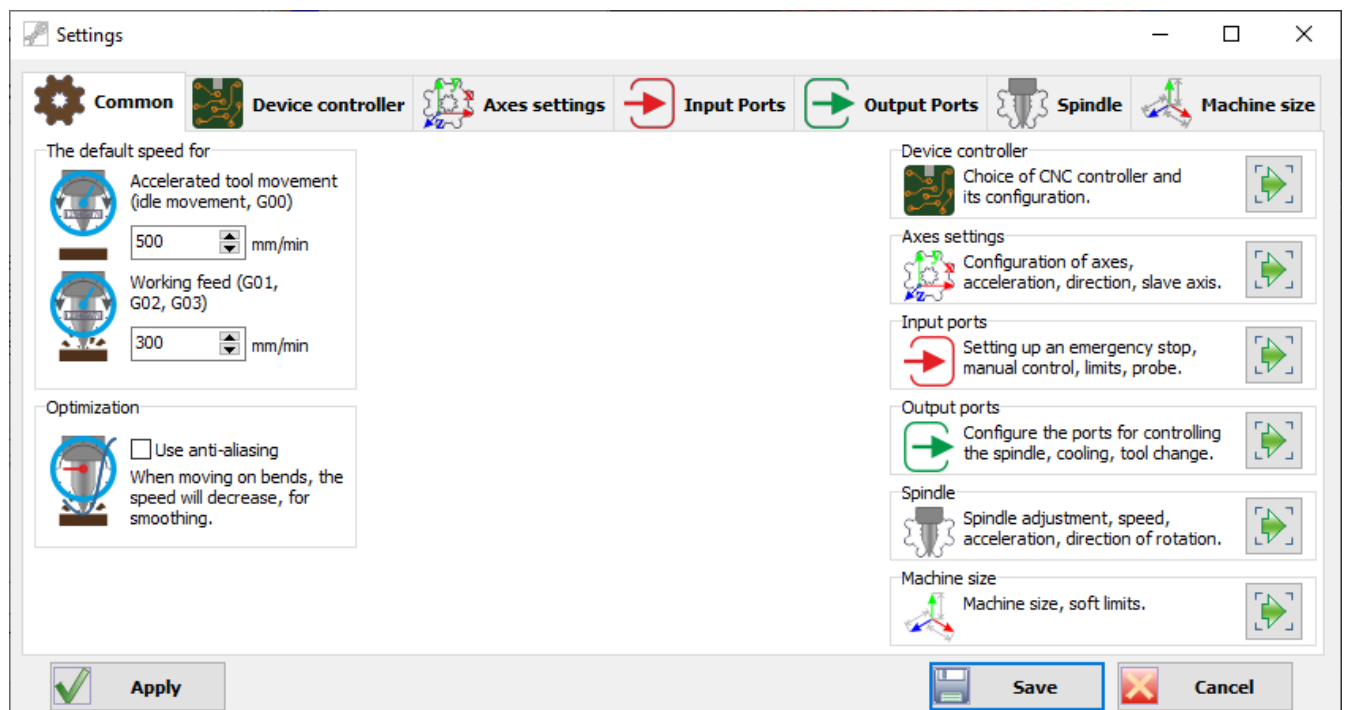
To configure DrufelCNC you must click on the button with the image of the key





. Next, go to the section of settings that interests you.

### 10.1.Common

In the common tab, you can set values for accelerated tooth movement (idle movement, G00), working feed (G01, G02, G03) and use anti-aliasing.



|  |   |
|--|---|
| <br>Accelerated tool movement<br>(idle movement, G00)<br>500 mm/min | Default speed for G00 commands. If no speed for G00 is specified in the G code file, then G00 commands will use that speed. |
| <br>Working feed (G01,<br>G02, G03)<br>300 mm/min                   | Default speed for G01, G02, G03 commands.   |

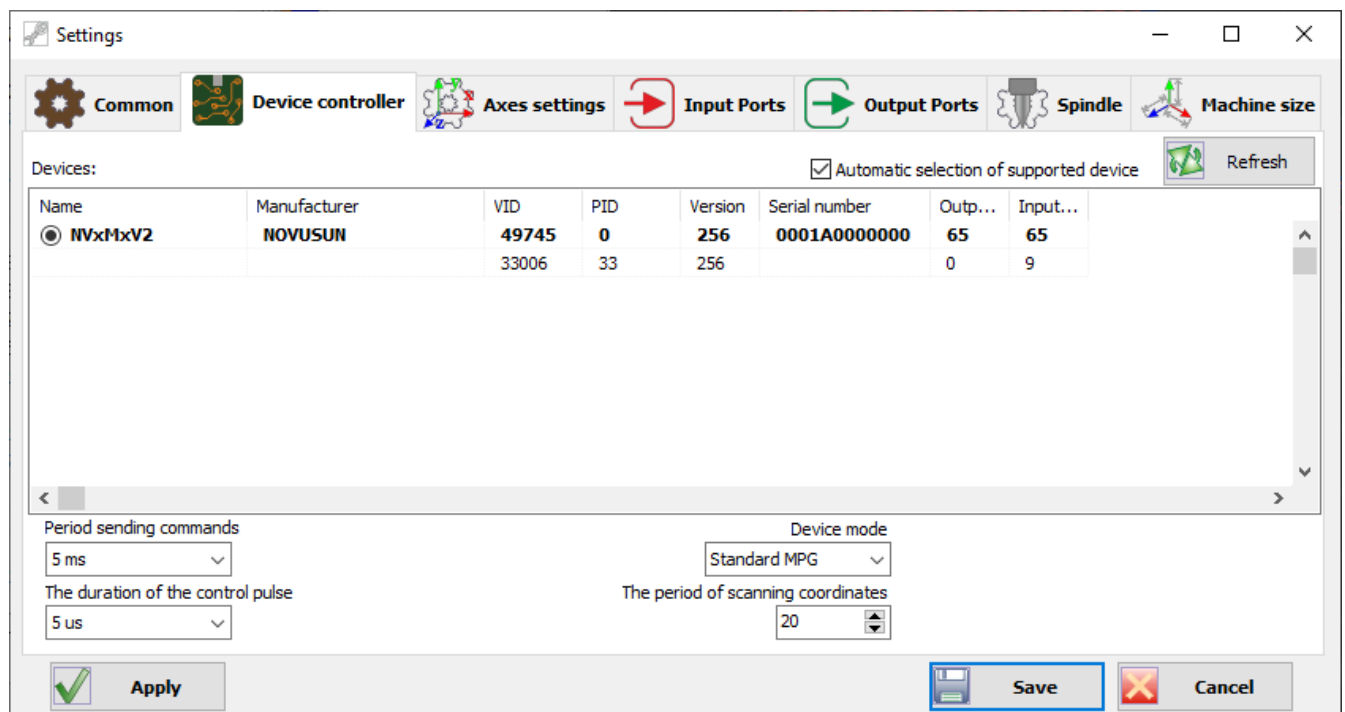


☐ Use anti-aliasing  
When moving on bends, the speed will decrease, for smoothing.

When moving along curved vectors, the speed of movement will decrease.

## 10.2.Controller Configuration

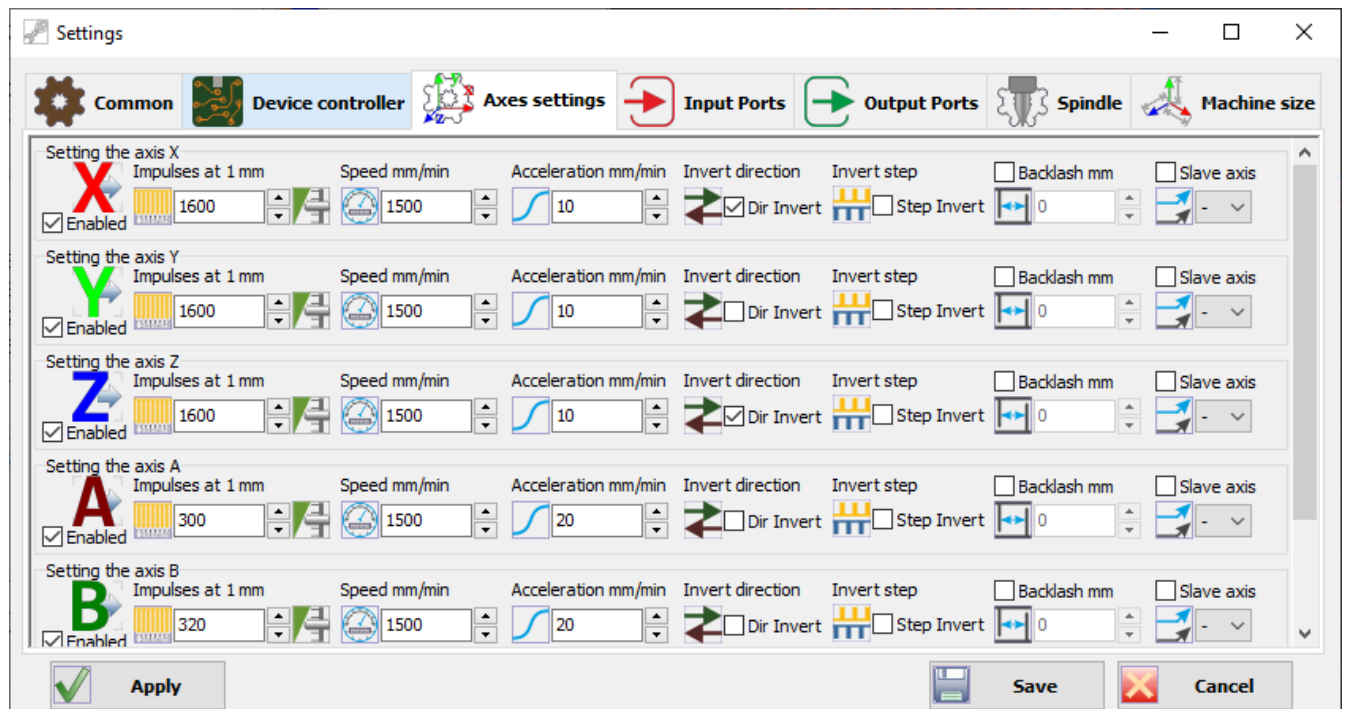
In the window that opens, go to the «Device Controller» tab.




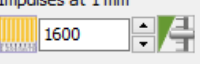
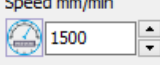
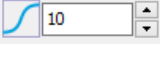
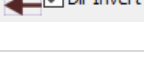
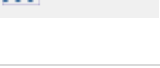
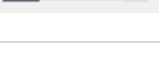
In the hardware section, you must select a controller by setting a point in the radio button block opposite the USB controller. Save the settings.

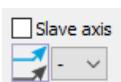
## 10.3. Axis Setup

To configure a stepper motor or servo drive, go to the Axis Settings tab.




Set the required number of pulses for each axis. Save the settings. If necessary, specify the submission of the axes. Use the inversion setting to change the direction of rotation of the motor.

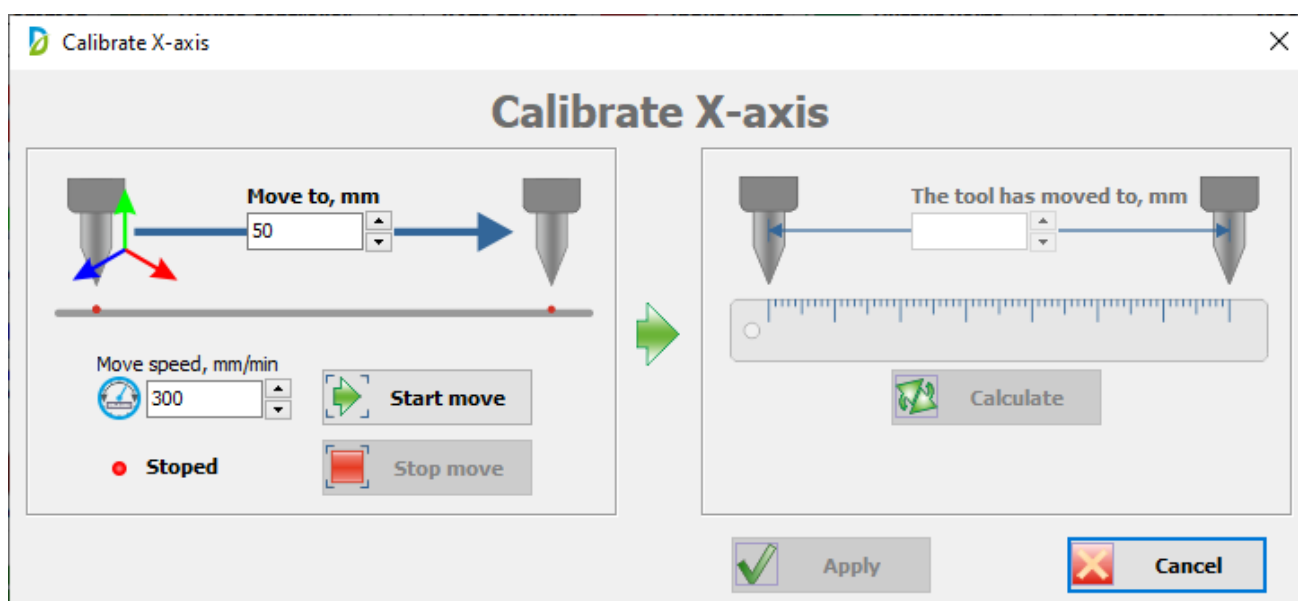
|   |   |
|---|---|
|  | Enables the axis to be displayed in the coordinate list.                                |
|  | The number of pulses per millimeter. You can use the calibration function to calculate. |
|  | Maximum speed of the axis movement.   |
|  | Smooth acceleration of the axis movement.   |
|  | Invert the direction of movement of the axis.   |
|  | Invert the step signal when transmitting the axis movement commands.                    |
|  | Backlash of the ball screw.   |

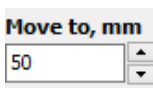
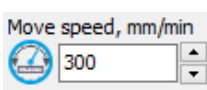


A slave axis can be defined for an axis. Then, the slave axis will move along with the current.

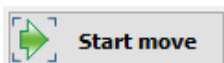
### 10.3.1. Calibrate axis

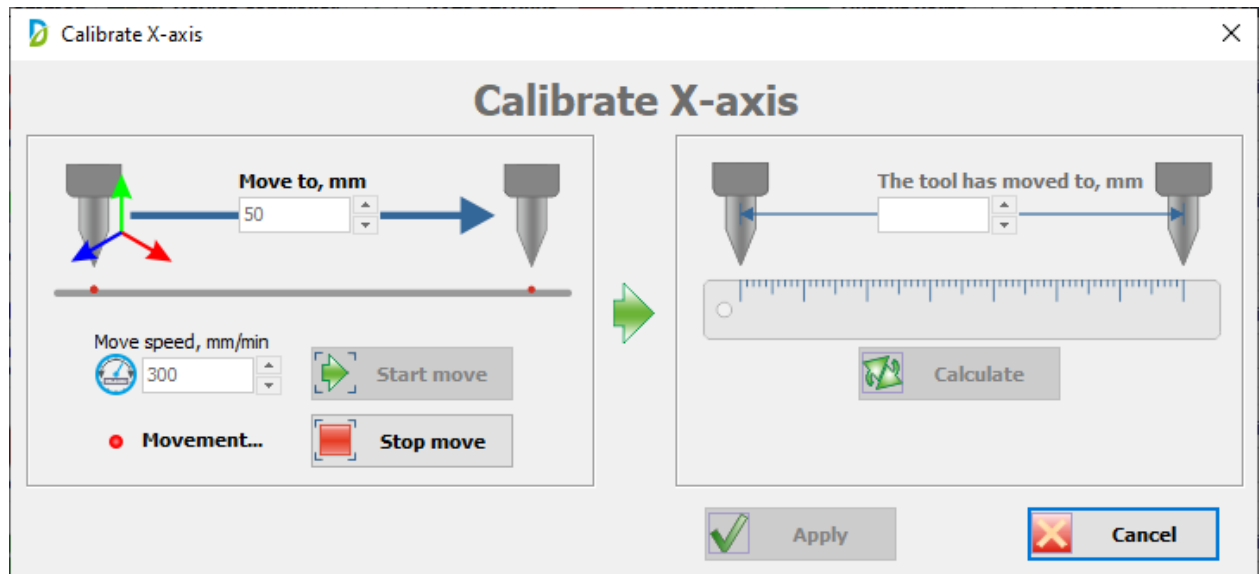
By clicking on the calibration button  for a specific axis, the axis calibration window will open. This window is for calculating the number of pulses per mm.



In the "Move to" field , enter a value for the distance by which you want to move the tool. In the "Move speed" field , set the speed of movement.

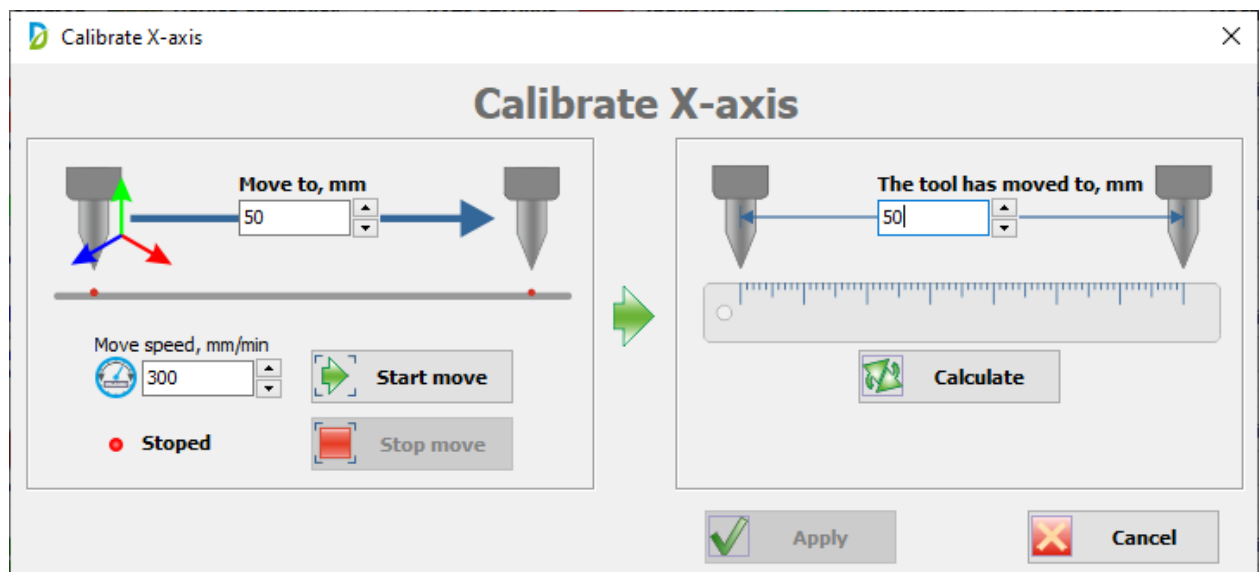
Attention! This speed must be slow! This is necessary so that you can quickly respond to an emergency and not damage the machine.

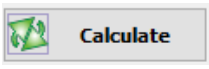
After that click on the «Start move»  button. After pressing the button, movement will begin for the specified segment.



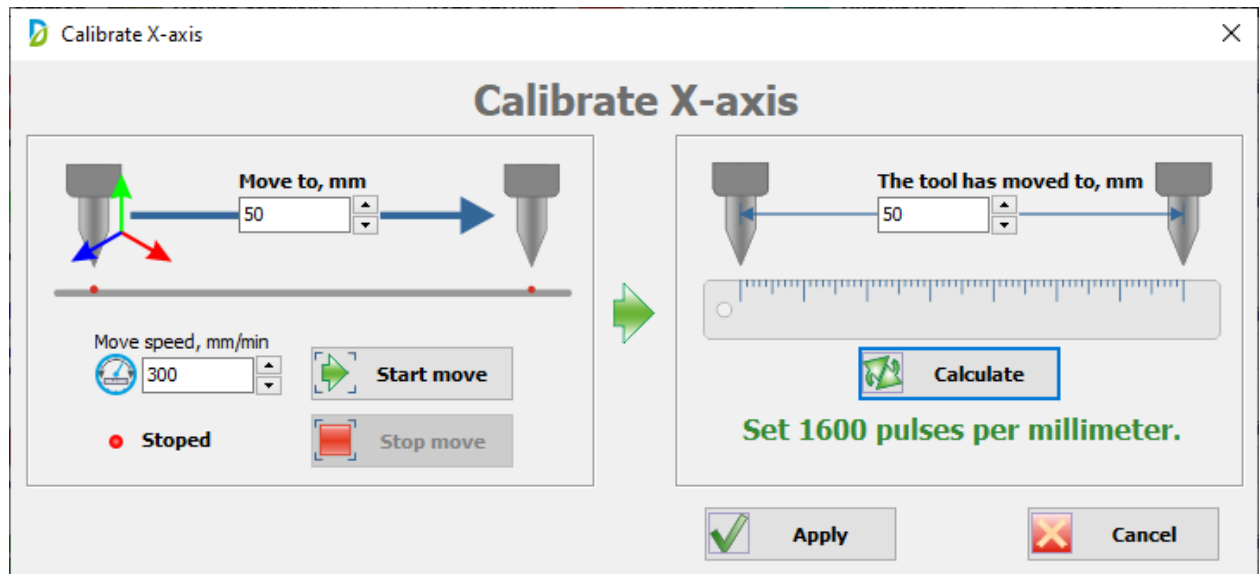
After the tool has finished moving, use the ruler to measure the actual distance the tool moved.

Enter this value in the «The tool has moved» to field.



Click the «Calculate»  button. After pressing, the number of pulses per 1 mm will be calculated that you need to set for the axis to be calibrated.

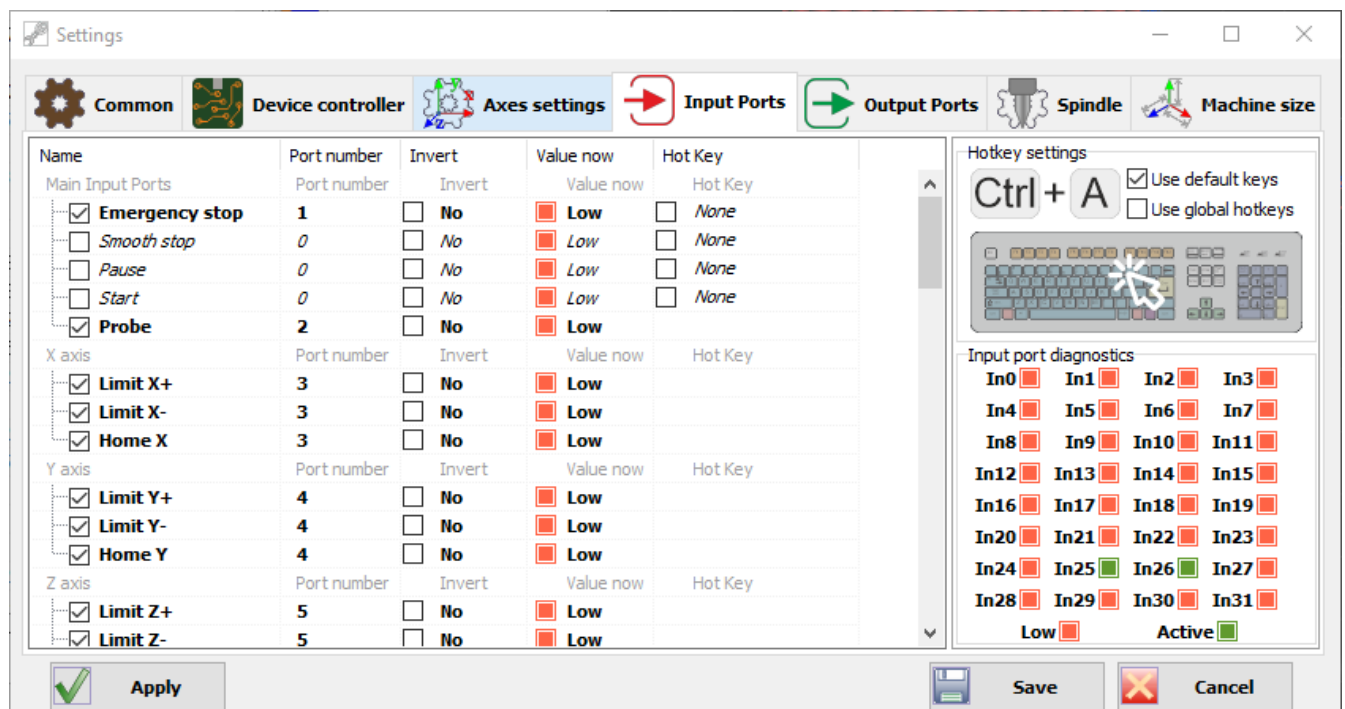




Click the «Apply»  **Apply** button to apply the calculation results.

## 10.4. Configure Input Ports

To configure input ports, go to the Input Ports tab.



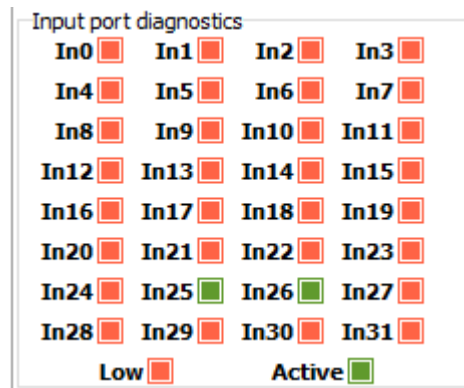
Set the input port numbers according to the configuration of the machine and the CNC controller. Save the settings.



### 10.4.1. Input port diagnostics

DrufelCNC - software for controlling CNC machines. Read more: <https://drufelcnc.com>



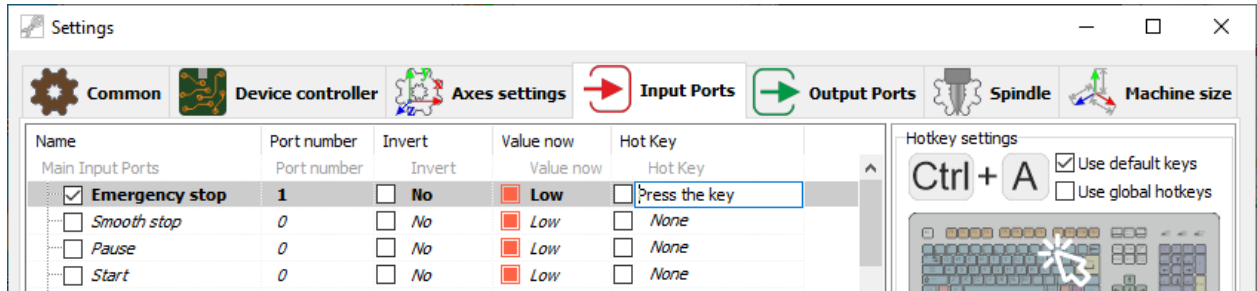
This panel displays the current state of the controller input ports.



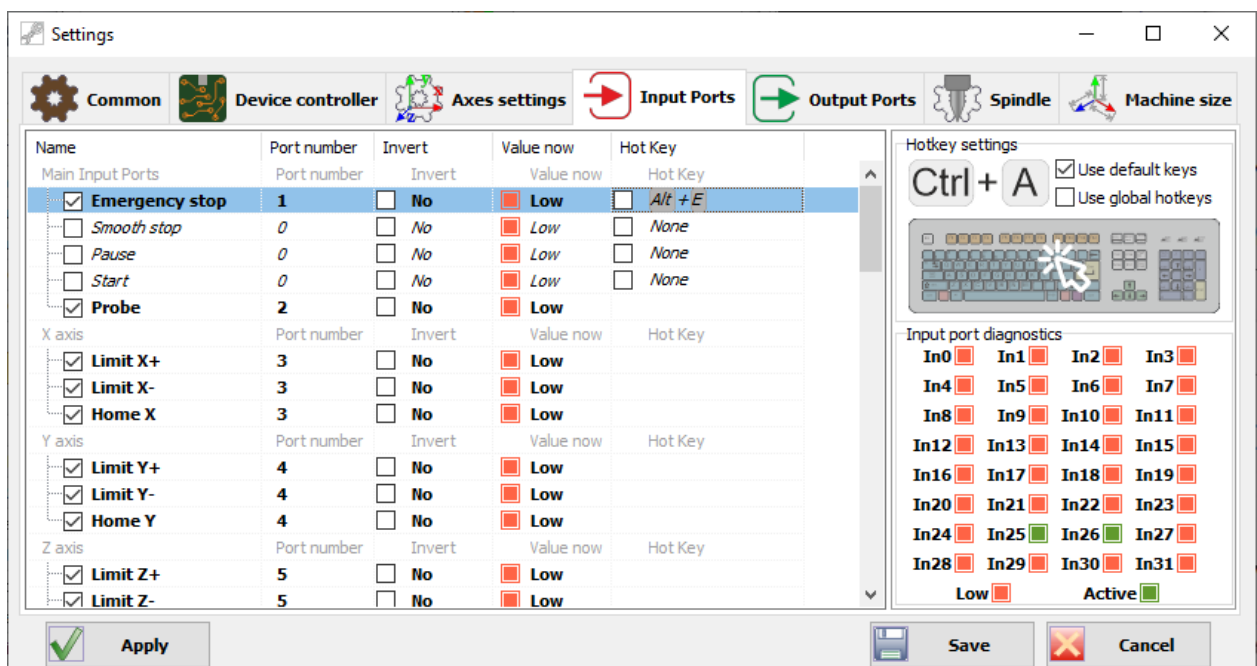
A red LED indicates  there is no signal on the input port.  
A green LED indicates  signal is present on the input port.

### 10.4.2. Hot keys

In order to set your hot keys, you need to click on the Hot Key column of a specific input port.



Next in this field you must specify your keyboard shortcut that you want to use.



«Use global hotkeys» - this function in which if the DrufelCNC window is not active, then hotkeys will still go to DrufelCNC.

«Use default hotkeys» - this function for hotkeys will work according to the following list:

## Default hotkeys

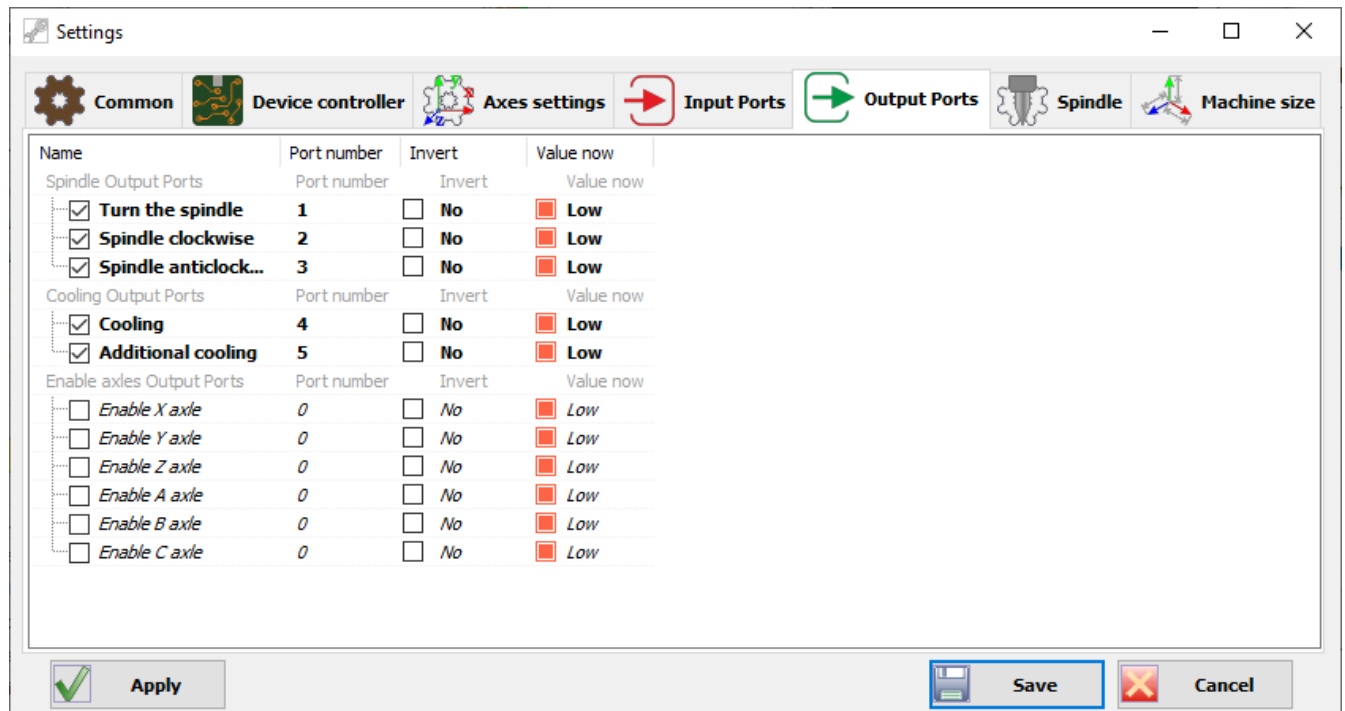
The image shows a 'Default Hotkey Info' window with a keyboard layout. The function keys (F1-F12) are highlighted in orange. The arrow keys are highlighted in green. The numeric keypad has several keys highlighted in blue. Below the keyboard layout, a list of default hotkeys is provided, organized into three columns.

| Key        | Action         | Key         | Action  | Key        | Action             |
|------------|----------------|-------------|---------|------------|--------------------|
| [Blue Box] | Emergency stop | [R]         | Start   | [F5]       | Spindle On/Off     |
| [Esc]      | Smooth stop    | [Page Up]   | Jog Z++ | [+]        | Spindle Speed +10% |
| [→]        | Jog X++        | [Page Down] | Jog Z-- | [-]        | Spindle Speed -10% |
| [←]        | Jog X--        | [End]       | Jog A++ | [Blue Box] | Jog Speed +100     |
| [↑]        | Jog Y++        | [Insert]    | Jog A-- | [Blue Box] | Jog Speed -100     |
| [↓]        | Jog Y--        |             |         |            |                    |

Attention! Custom shortcuts take precedence over the default keys.

## 10.5. Configuring output ports

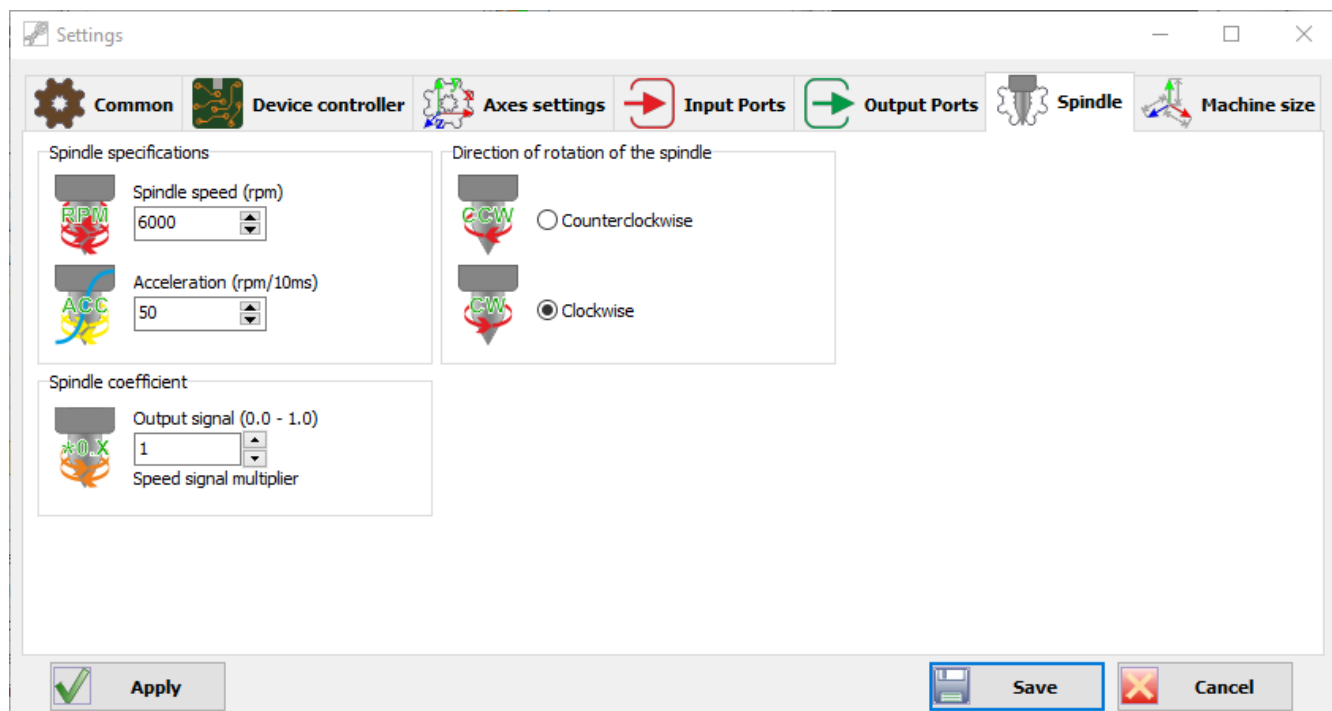
To configure output ports, click the Output Ports tab.



Set the output port numbers according to the configuration of the machine and the CNC controller. Save the settings.


## 10.6.Spindle adjustment


To configure the spindle parameters, you need to go to the "Spindle" tab.




Set the speed and acceleration parameters according to the spindle specification. Set the default spindle rotation direction.

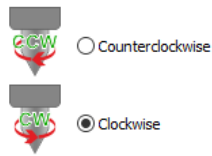
Set the spindle coefficient. Save the settings.


**Spindle speed**  - the nominal number of revolutions per minute for your spindle.

**Acceleration**  - when the spindle is turned on, the spindle rotation speed will be smoothly set in accordance with the specified acceleration.

**Spindle coefficient**  - if you need to calibrate the output value of the port 0-10V then change this multiplication factor.

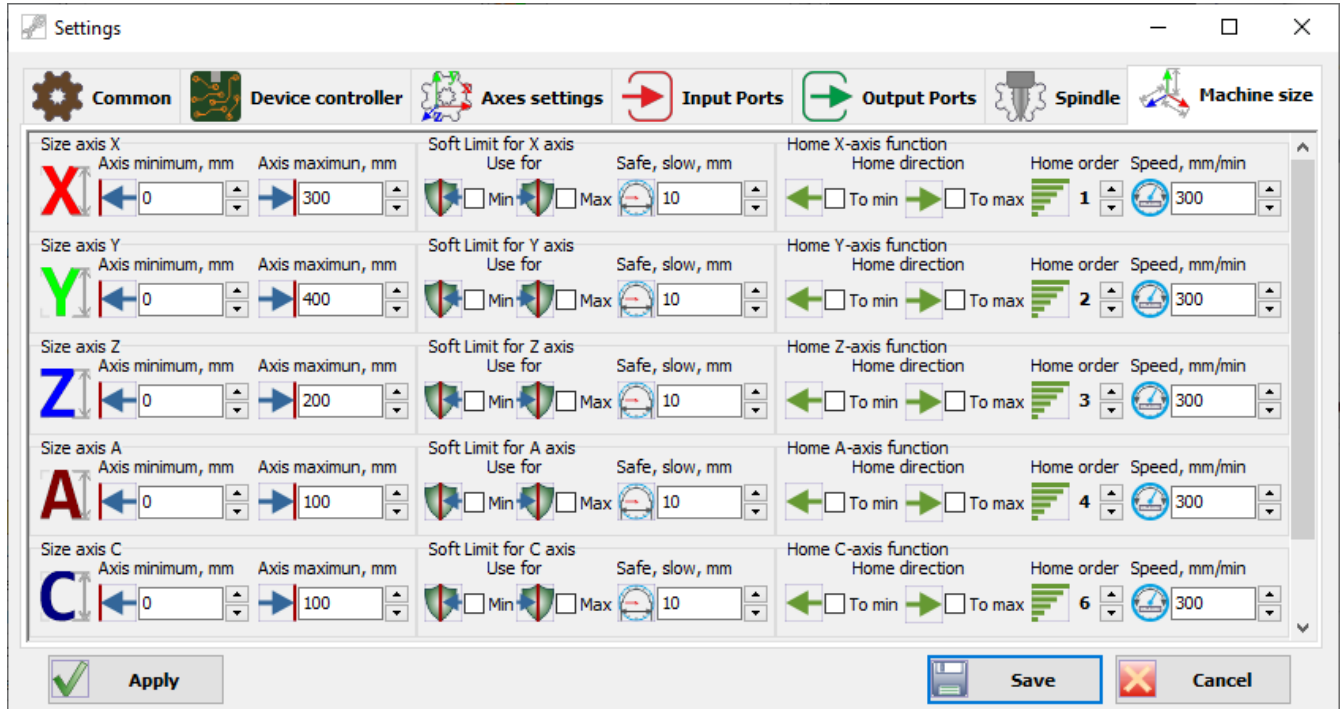
With this **Counterclockwise/Clockwise** setting,



you can set the direction of rotation of the spindle when you press the «Turn the spindle»  button in the main window.

## 10.7.Machine size

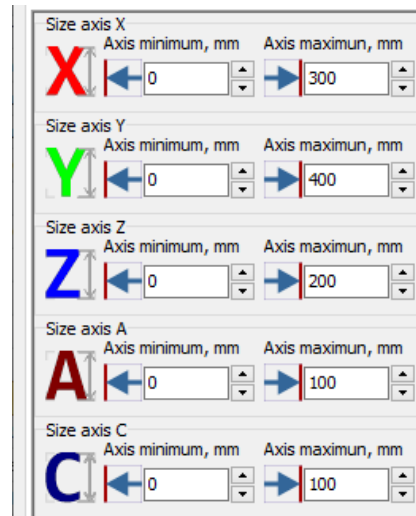
With these settings you can customize the machine dimensions, soft limits, home function.



### 10.7.1. Size axis

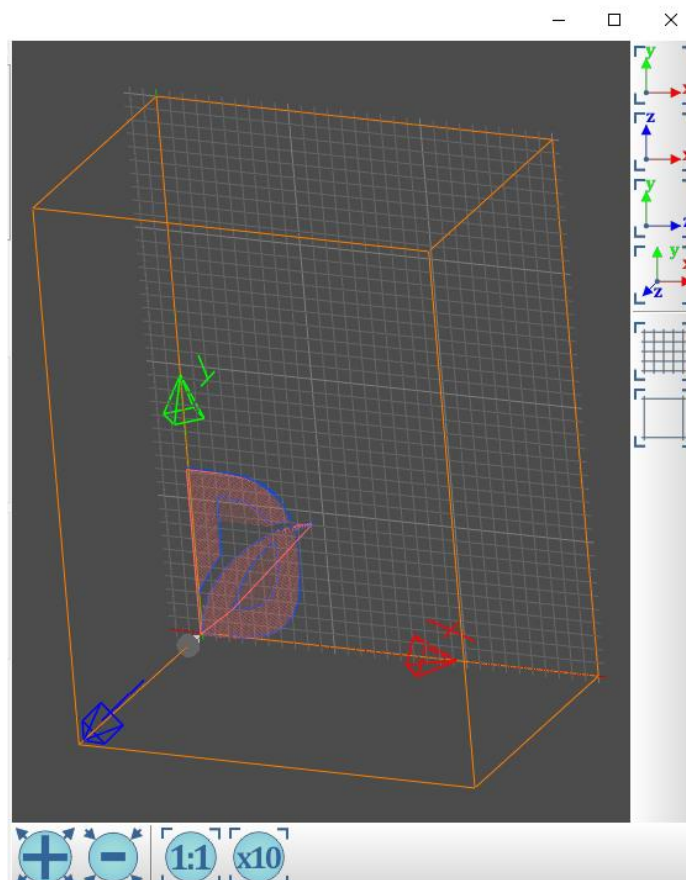
Set the min / max limits for your machine.

Attention! The limits are specified in machine coordinates. The difference between the min and max should be the actual axis length of your machine.



| Axis        | Axis minimum, mm | Axis maximum, mm |
|-------------|------------------|------------------|
| Size axis X | 0                | 300              |
| Size axis Y | 0                | 400              |
| Size axis Z | 0                | 200              |
| Size axis A | 0                | 100              |
| Size axis C | 0                | 100              |

According to these settings in the 3D model window, the dimensions of the axis will be displayed as a quadrilateral in each plane.





### 10.7.2. Soft limit

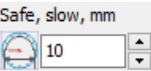


If you want the tool to stop when it reaches the minimum and maximum of your axis, use the appropriate constraints. These settings are designed to not damage your machine.

The screenshot shows a software window titled 'Soft Limit' with five sections for different axes: X, Y, Z, A, and C. Each section contains a 'Use for' label, a 'Min' checkbox with a left arrow icon, a 'Max' checkbox with a right arrow icon, and a 'Safe, slow, mm' input field with a value of 10. The 'Min' and 'Max' icons are represented by a blue square with a red arrow pointing left or right, and a green square with a red arrow pointing left or right. The 'Safe, slow, mm' input field is a text box with a blue border and a small up/down arrow on the right.

 - when the minimum limit of your axis is reached, the tool movement will stop and prevent it from moving towards the minimum.

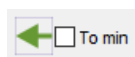
 - when the maximum limit of your axis is reached, the tool will stop moving and prevent it from moving towards the maximum.

 - if the specified value remains before reaching the minimum or maximum, the tool speed is reduced to the minimum.

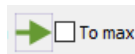
### 10.7.3. Home function

With these settings you can set the driving direction, priority and speed.

These settings are for buttons    on the main window.

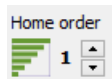


- when searching for the home position, the instrument will move to the minimum.



- when searching for the home position, the instrument will move to the maximum.

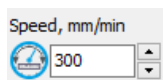
**Attention!** If you have turned on both the “To min” and “To max” settings, then when searching for the home position, the instrument will first move to the minimum and then to the maximum.



- allows you to specify the order in which the search for the home position is performed for each axis.

home order = 1 will be executed very first.

home order = 6 will be executed most recently.



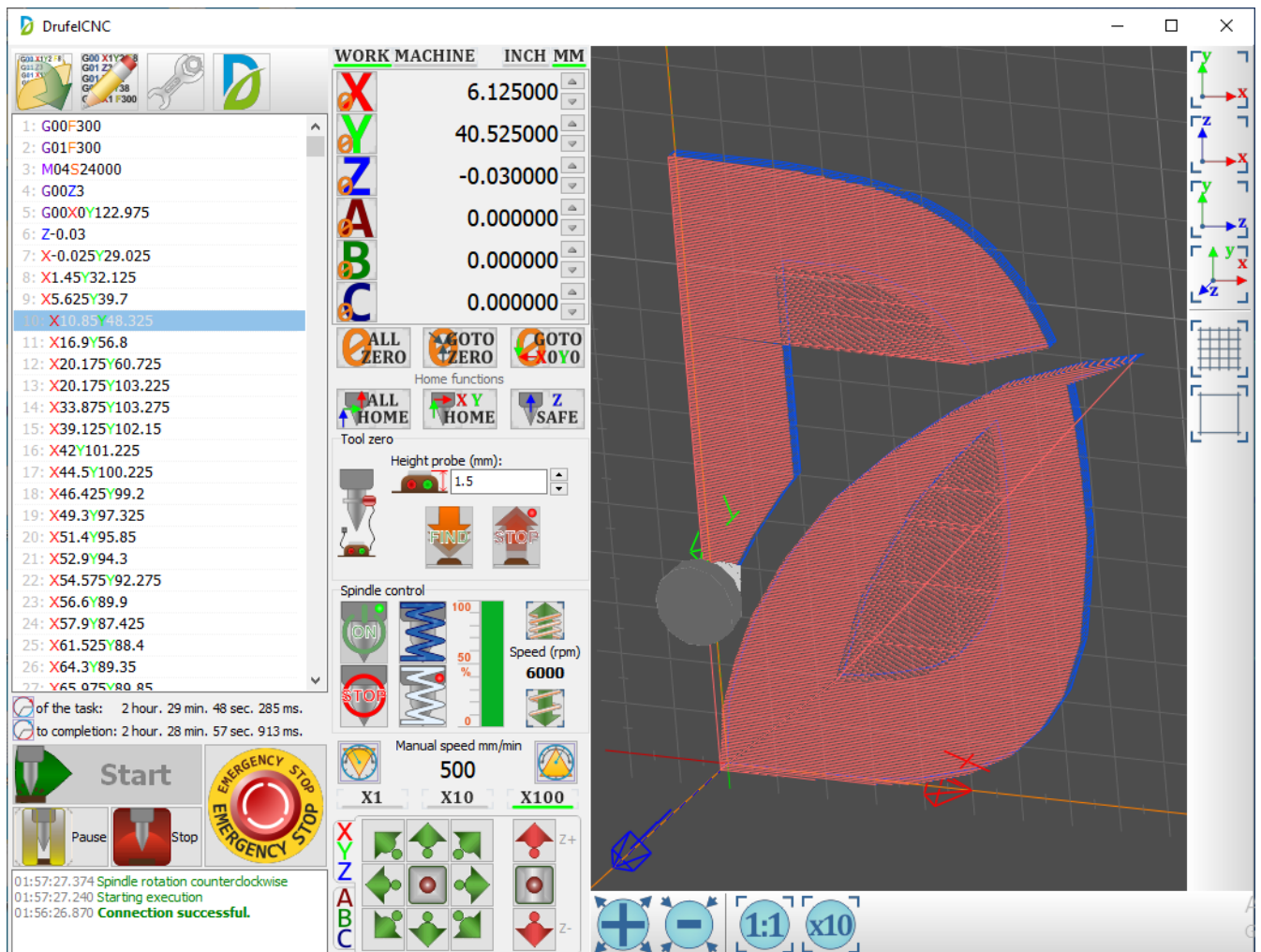
is the speed of the tool when searching for the home position.

## 11. Run the control program (G-code)

To run the control program in the language of G-code, you must click on the

button with the image of the folder , then select the file.

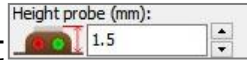
If the file is recognized successfully, the three-dimensional model of the file will be displayed in the right part of the main window.




To start processing, click "Start"



## 12. Search tool zero

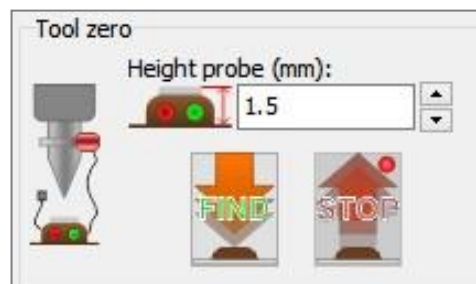
To begin searching for a tool zero, set the height  of the probe

used. Next, click . Wait until the end of the process.

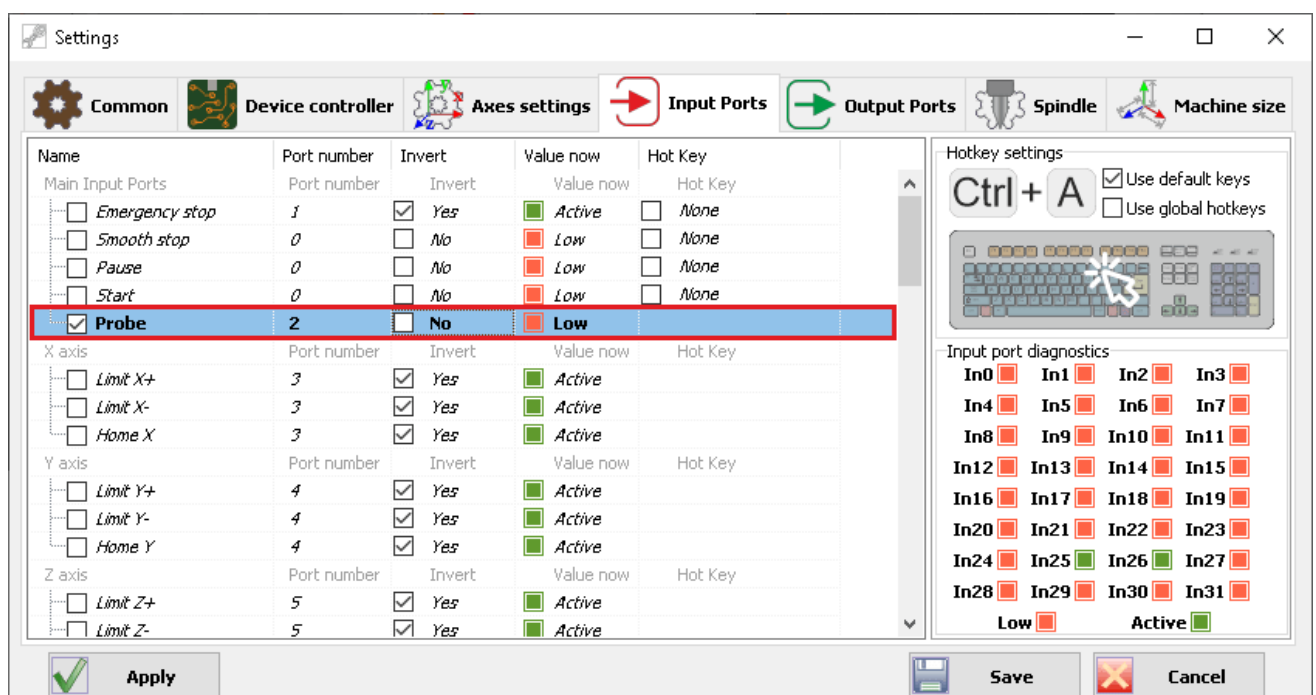
First you need to configure the input port number for the probe. The Z axis is assigned according to the value found and the height of the probe.

After completing the tool zero search, the tool will return to its original position.

To cancel the tool zero search, click .



For the tool zero search to work correctly, you must set the input port number in accordance with the port number on the controller where your probe is connected. Set "Invert" so that the "Value now" in the normal state of the Probe is "Low".



### 13. Manual control



This field sets the speed of movement of the instrument during manual operation.



- Speed reduction button.



- Speed increase button.

**X1**

- 1% of the set speed or minimum speed.

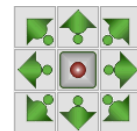
**X10**

- 10% of the set speed.

**X100**

- 100% of the set speed.

The current speed is highlighted in green ( **X100** ).



For manual control, press the corresponding joystick button



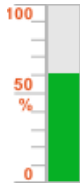
## 14. Spindle control and cooling



- Spindle power button.



- Spindle off button.



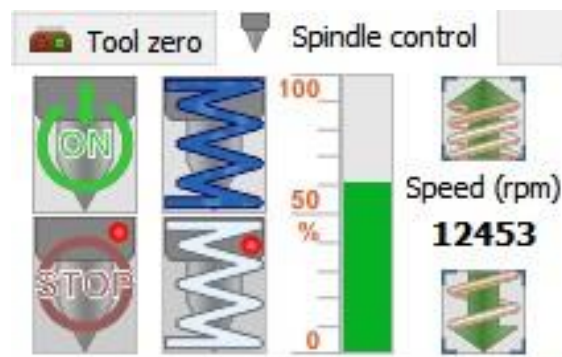
To set the spindle speed, click on the progress bar area.




- Button to increase the rotation of the spindle.









- Button to reduce the rotation of the spindle.





## 15. Assignment of coordinates












To reset the x-axis, click the button . To reset the remaining coordinates, click on similar buttons.

To set your own X coordinate axis, click the digital value of the X coordinate axis.    . In the field that appears, enter the desired value and click on the button . To cancel the entry, click .

Use the buttons to set more accurate coordinates . To set the values of the remaining coordinates, use the same action algorithm.

To reset all coordinates, click on the button .

To move the tool to zero coordinates, click . To go to the coordinates X0 and Y0, click on the button .

| WORK MACHINE  |   | INCH   | MM  |
|---|---|--|---|
|  |   | 88.783750  |  |
|  |   | 33.080000  |  |
|  |   | 12.545625  |  |
|  |   | 12.871875  |  |
|  |  |  |   |

## 15.1.Measurement system

The default system of units is millimeters. To set the units in inches, click **INCH** **MM**. To set the system of units in millimeters, click **INCH** **MM**. The current coordinate system is highlighted in green.



## 15.2. Machine coordinates

| WORK | MACHINE   | INCH | MM |
|------|-----------|------|----|
| X    | 0.746250  |      |    |
| Y    | 0.000000  |      |    |
| Z    | 5.000000  |      |    |
| A    | -0.871875 |      |    |

The machine coordinates are the actual coordinates of your axes.

These coordinates are used to define the limits and dimensions of the machine.

If machine coordinates are activated for display, they are highlighted in green

MACHINE.

## 15.3. Work coordinates

| WORK | MACHINE   | INCH | MM |
|------|-----------|------|----|
| X    | 88.783750 |      |    |
| Y    | 33.080000 |      |    |
| Z    | 12.545625 |      |    |
| A    | 12.871875 |      |    |

Work coordinates are relative to machine coordinates.

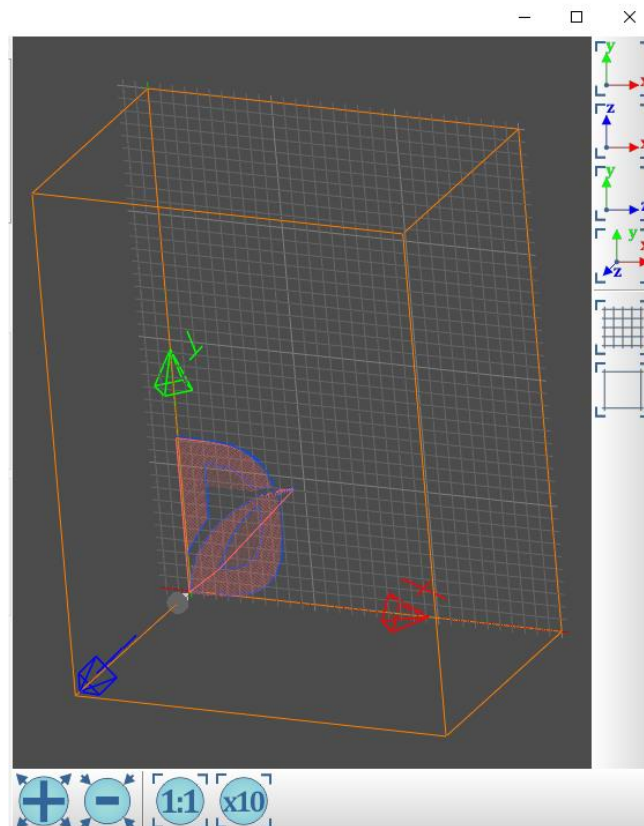
These are the coordinates at which the g-code is executed by default.

If work coordinates are activated for display, they are highlighted in green

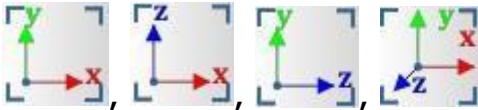
WORK.

## 16. Display 3D model

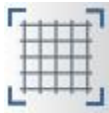
The code you downloaded is displayed as a 3D model on the right side of the application window.



To rotate the 3D model, move the mouse pointer to the display area of the 3D model. Right-click and hold to move the mouse pointer. You can also use

additional buttons. . To zoom the 3D model, use

the mouse wheel or . To move the model in the plane, use the left mouse button.

To turn on the grid, click on the button . In order to turn off the grid, click

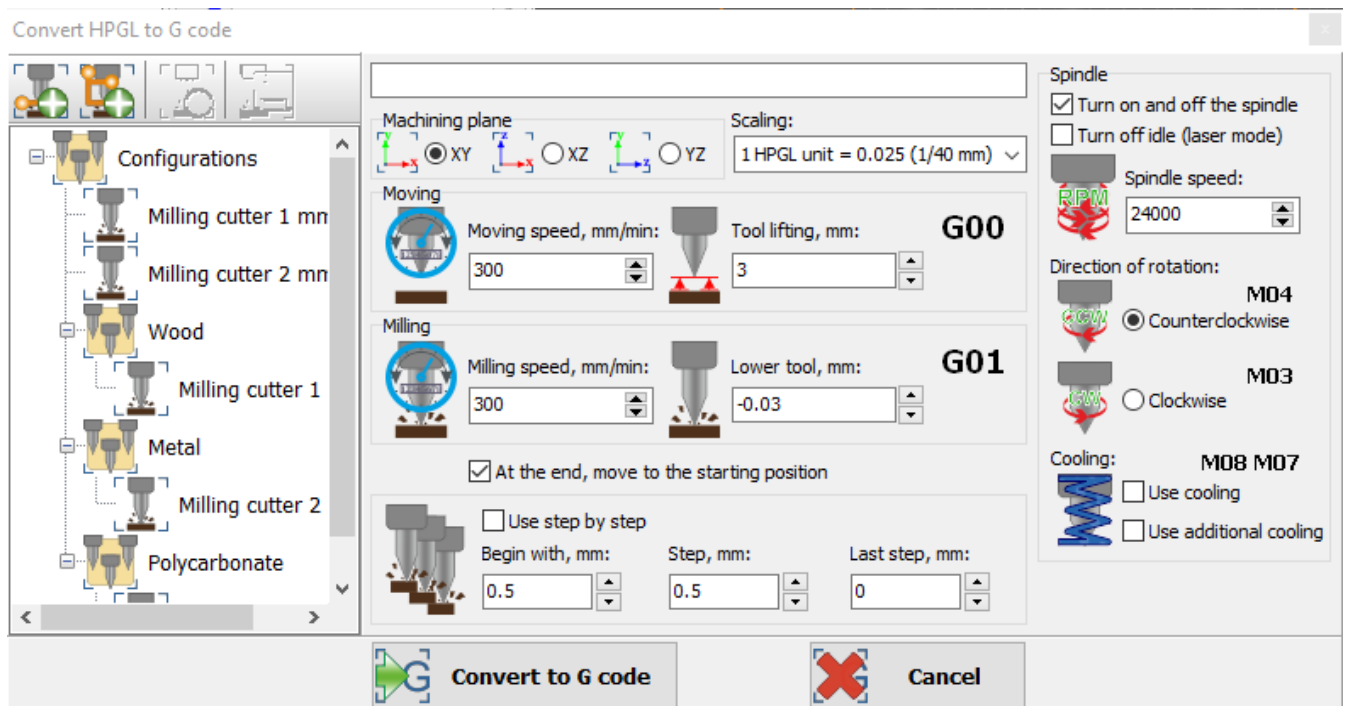
on the button . Grid enabled by default.

## 17. Opening HPGL files

To open files in HPGL format, you must click on the button with the image of

the folder , then select the file.

In the window that opens, you must select the parameters for converting HPGL to G-code.



After successful conversion, you will see a three-dimensional model of the file.

## 18. Basic parameters of the HPGL file converter

The screenshot shows the HPGL file converter settings. At the top, there's a 'Machining plane' section with three radio buttons: XY (selected), XZ, and YZ. To the right is a 'Scaling' section with a dropdown menu showing '1 HPGL unit = 0.025 (1/40 mm)'. Below these are two main sections: 'Moving' and 'Milling'. The 'Moving' section includes a 'Moving speed, mm/min' input field set to 300, a 'Tool lifting, mm' input field set to 3, and a 'G00' label. The 'Milling' section includes a 'Milling speed, mm/min' input field set to 300, a 'Lower tool, mm' input field set to -0.03, and a 'G01' label. At the bottom, there is a checkbox labeled 'At the end, move to the starting position' which is checked.

|  |  |
|--|--|
|  | The plane in which the HPGL file will be executed.                   |
|  | The scale corresponds to one HPGL unit per millimeter.               |
|  | Tool travel speed without milling. Moving between milling areas.     |
|  | The speed at which the tool moves when milling. Model milling speed. |
|  | Tool position when moving to the milling area.                       |
|  | Tool position when milling the model.                                |

## 18.1. Spindle settings of HPGL file converter

Spindle

☒ Turn on and off the spindle  
☐ Turn off idle (laser mode)

Spindle speed: 24000 RPM

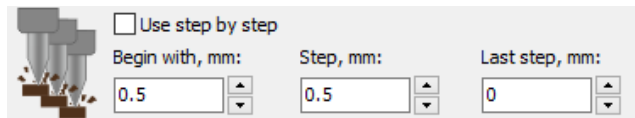
Direction of rotation: M04  
☒ Counterclockwise  
M03  
☐ Clockwise

Cooling: M08 M07  
☐ Use cooling  
☐ Use additional cooling

|   |  |
|---|--|
| <input checked="" type="checkbox"/> Turn on and off the spindle   | The spindle will turn on when the HPGL file starts executing, the spindle turns off when the HPGL file finishes executing. |
| <input type="checkbox"/> Turn off idle (laser mode)   | The spindle will only work when milling. This setting is suitable for laser or plasma operation.                           |
| Spindle speed: 24000 RPM  | The spindle speed while executing the HPGL file. When using a laser, sets the laser power.                                 |
| Direction of rotation: M04<br><input checked="" type="radio"/> Counterclockwise                             | The direction of rotation of the spindle is counterclockwise when executing the HPGL file. Corresponds to command M04.     |
| M03<br><input type="radio"/> Clockwise  | The direction of rotation of the spindle is clockwise when executing the HPGL file. Corresponds to command M03.            |
| Cooling: M08 M07<br><input type="checkbox"/> Use cooling<br><input type="checkbox"/> Use additional cooling | Cooling will be turned on before executing the HPGL file. Corresponds to commands M08 and M07.                             |


## 18.2. Use step by step

With the help of "Use step by step" you can set up step-by-step milling (cutting) of models. This will reduce the negative impact on the cutter.

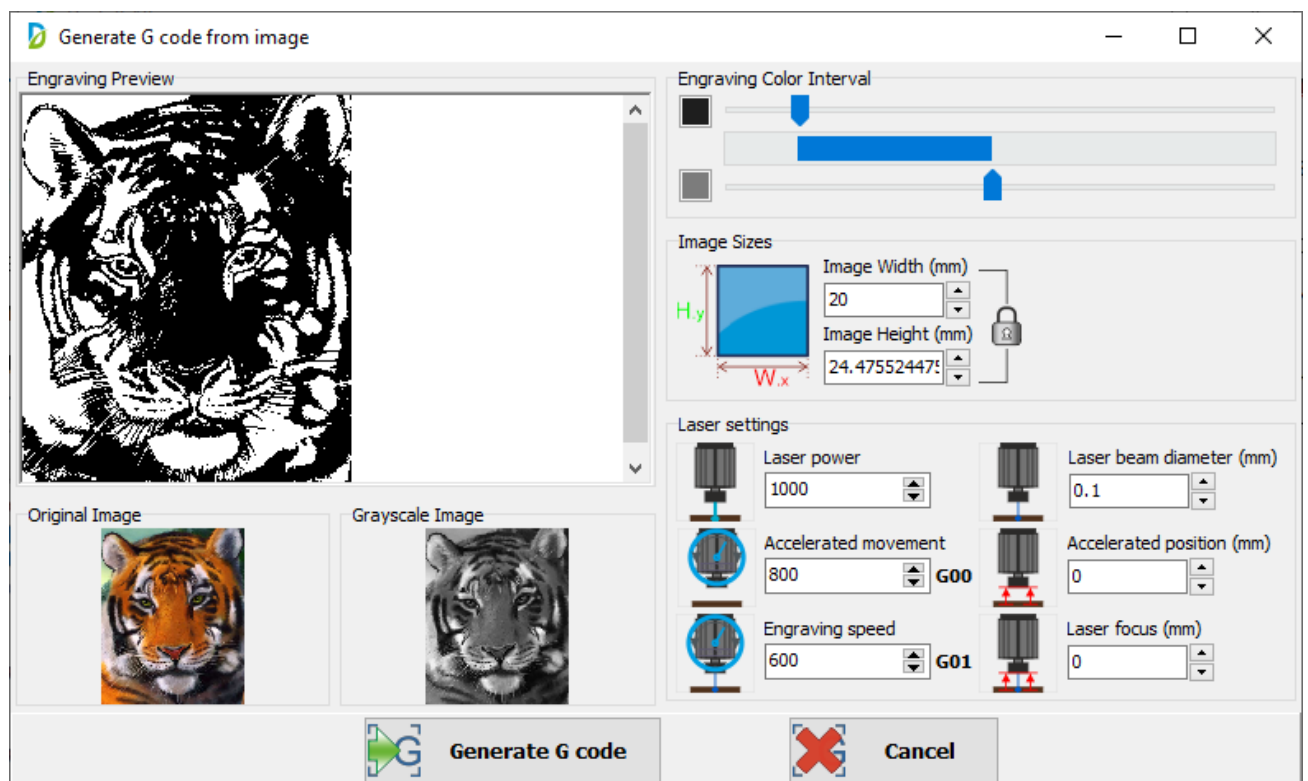


|   |  |
|---|--|
| <div>Begin with, mm:<br/><input type="text" value="0.5"/></div> | After this axis position, the step milling algorithm will start. For example after $Z = 0.5$ mm.       |
| <div>Step, mm:<br/><input type="text" value="0.5"/></div>       | The cutter will move this distance after each cycle through the entire HPGL file. For example, 0.5 mm. |
| <div>Last step, mm:<br/><input type="text" value="0"/></div>    | If necessary, you can set a fixed distance for the last step.  |

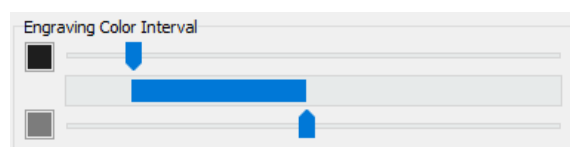
## 19. Generating a G-code from an image

To open a file in the format (png, jpeg, gif, bmp), you must click on the button with the image of the folder , or select the necessary file and transfer it to the G-code field.

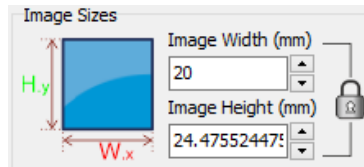
In the window that opens, you must select the options for converting the image into a G-code.




In the engraving color interval block, you can adjust the color interval.



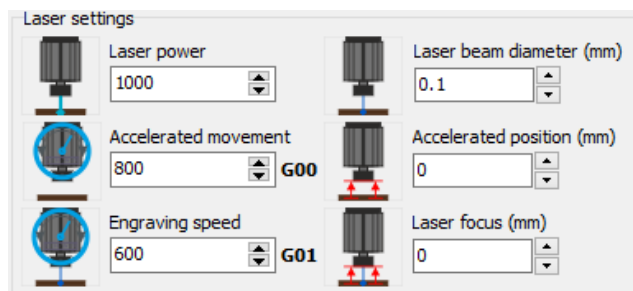
In the Image Sizes block, you can adjust the image size.




 - proportional image resizing.


 - not proportional image resizing.


In the Laser Settings block, you can configure the laser settings.




 - laser power setting

 - laser beam diameter adjustment (mm)

 - accelerated motion setting (G00)

 - accelerated position adjustment (mm)

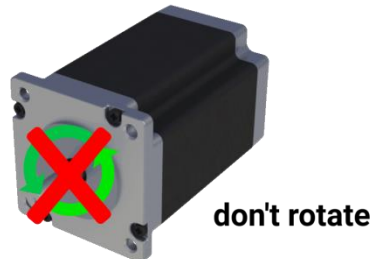
 - engraving speed setting

 - laser focus adjustment

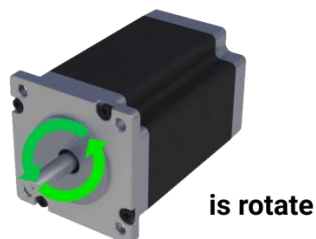


## 20. Stepper motors

If your stepper motors don't rotate



Turn on Step Invert ☒ Step Invert



If you doubt the correct connection of ENA + ENA- then temporarily do not connect it. Make sure your motors spin. The default ENA port is activated on most stepper motor drivers.

