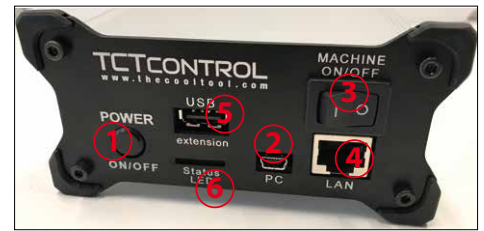


## General advice on how to handle the TCTControl box

The TCTControl boxes are available in 4 or 6 axes option. Both versions come with stepper motor outputs and: 1x USB client, 1x USB host, 1x 10/100 ethernet, 1x E-stop input, 6x Signal input (i.e. for limit switches), 1x spindle control output, 2x relais output, 1x UniPrint3D port and 1x Power supply connector (AC adapter included in delivery).

Note the following:

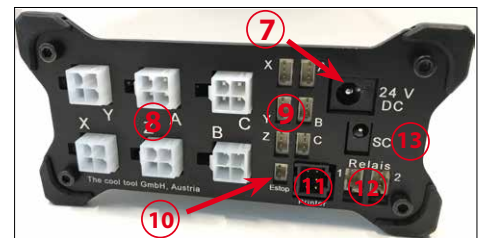
- 1) Never use the TCTControl box without the 24 V power supply. (24 V, 5A power adapter include )
- 2) Never plug or unplug the step motors during operation. The "MACHINE" [3] must be switched off first. This also applies to all other inputs and outputs on the rear panel.
- 3) Use the box in a dry environment. The ambient temperature should be between -10 and +35 degrees celsius (14 and 95 degrees Fahrenheit).
- 4) Only use the step motors supplied by us.
- 5) Turn on "MACHINE" only after the control software machinekit® (Cetus/machineface®) has been started. To simulate projects on the screen turn off "MACHINE".



- 1 ... boot/shut down button (software part)
- 2 ... connection to the PC (USB)
- 3 ... ON/OFF (stepper motor driver part)  
*The stepper motor drivers part is independent from the software part and must be switched on/off separately.*
- 4 ... network connection
- 5 ... USB port to connect Wlan adapter, flash drives, .....
- 6 ... status LEDs:



- Blue LED shine**  
TCTControl software part is running
- Blue and red LED shine**  
CNC application is running  
software status -> machine power on (ON/OFF button without function)



- 7 .... power connector (24 V / 5 A adapter)
- 8 .... machine axes (stepper motor)
- 9 .... input eg. reference switches
- 10 ... E-stop (art.no. 164 425 CNC)
- 11 ... connection to UniPrint3D
- 12 ... relais outputs 1 + 2 (signal 24 V)
- 13 ... spindle control output (0 - 10 V)



Connect the 24 V power supply to the TCTControl.

Use the supplied USB cable to connect TCTControl to a free USB port.

Wait until it shows under Windows.

(PC with Windows 7 or higher)



## ADMINISTRATOR RIGHTS ARE REQUIRED.

**For Win8 or higher user:**

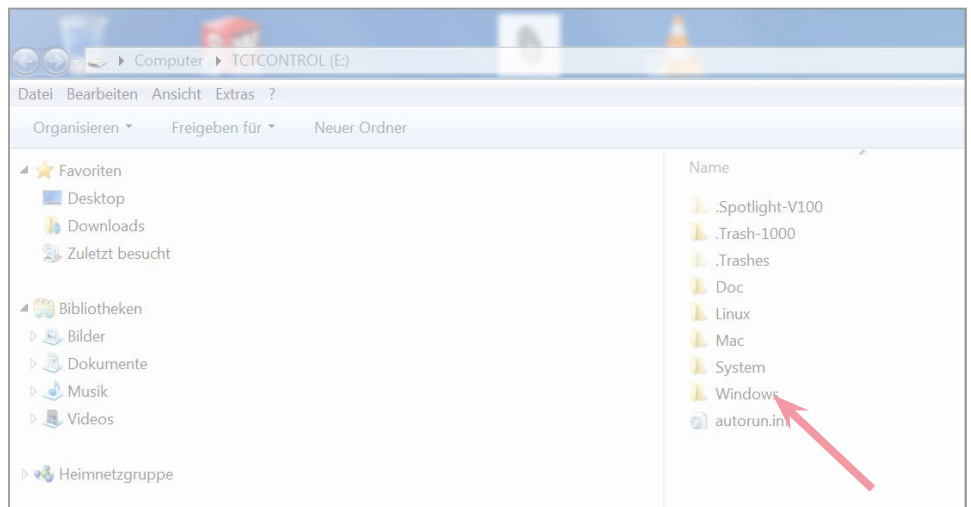
**a) We recommend following this video tutorial**

**<https://vimeo.com/518159161>**

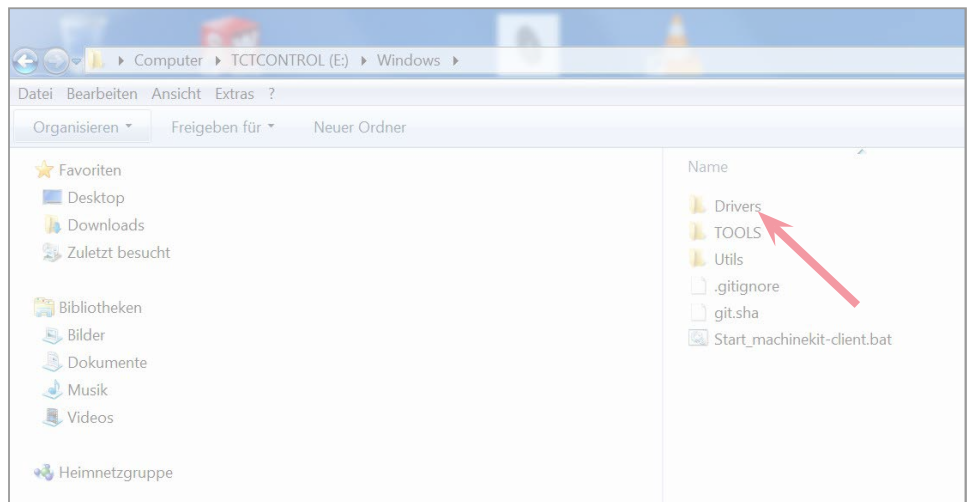
(After installing the Windows driver, continue with „**Start CNC application 4.2.2**“.)

**b)** The alternative method described on the following pages is more complicated because it is necessary to disable the driver signature enforcement before you continue. You can find many tutorials on the internet.

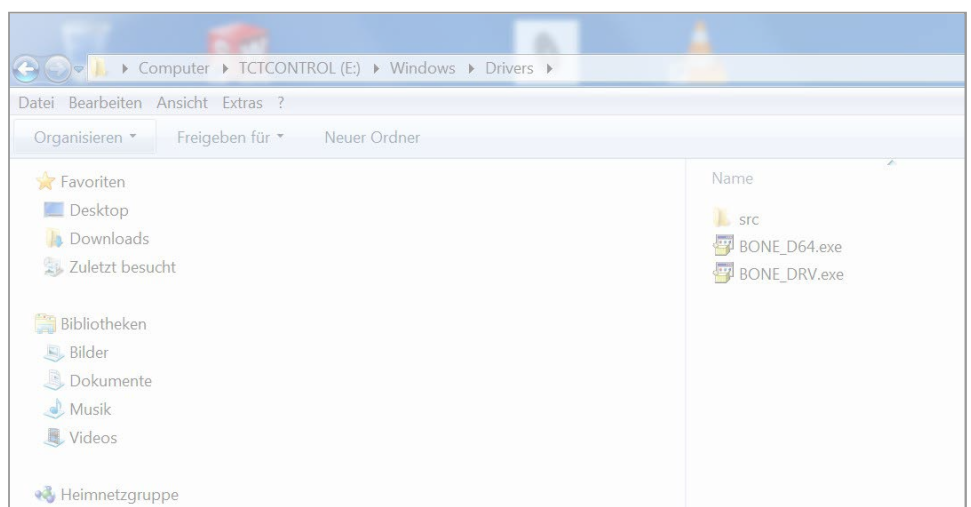
open folder „Windows“  
on TCTControl



go to „Drivers“

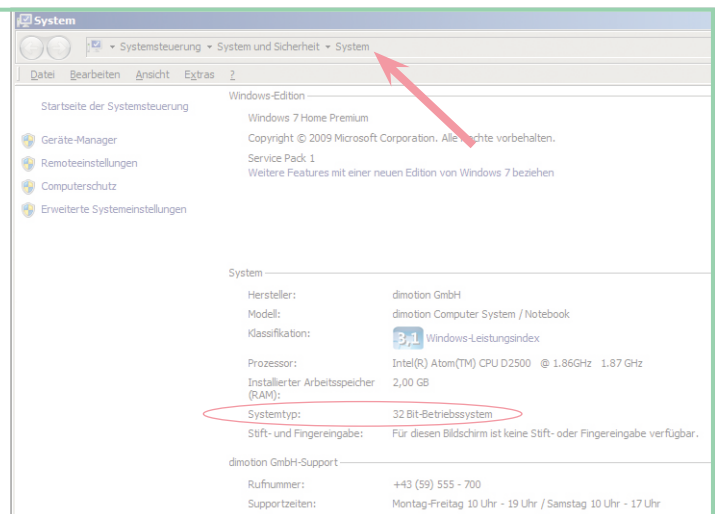


start „BONE\_DRV“ for 32bit OS  
start „BONE\_D64“ for 64bit OS

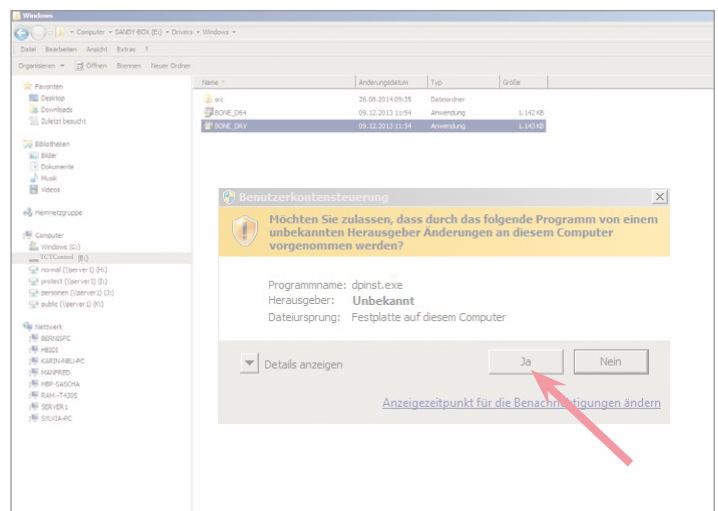


## OPTIONAL

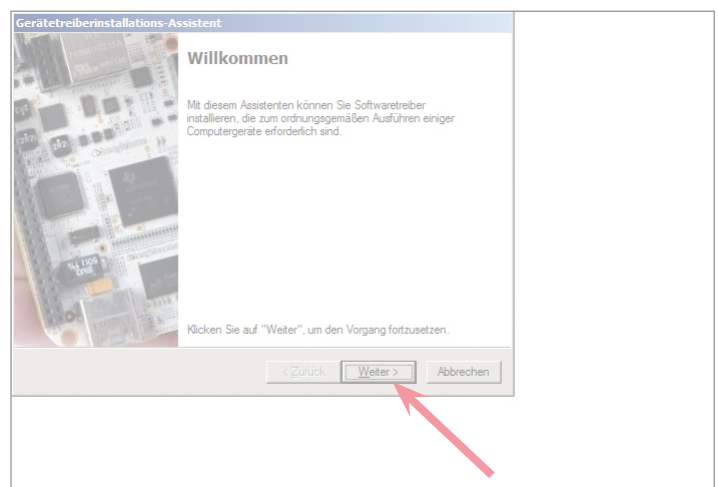
*Under „Systeminformation“ you can find the information.*



click YES



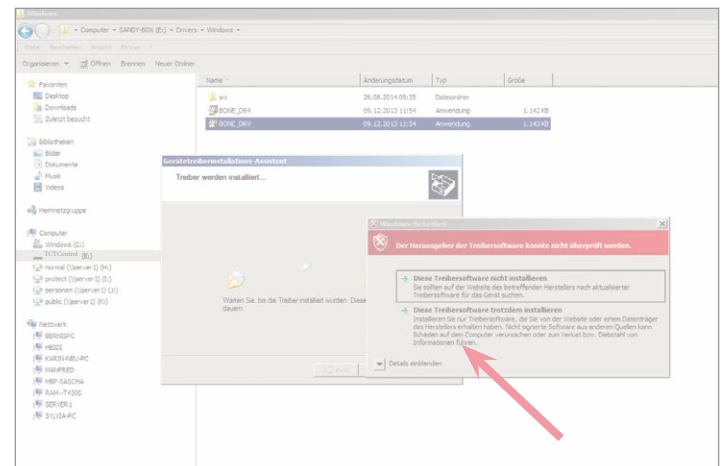
click CONTINUE



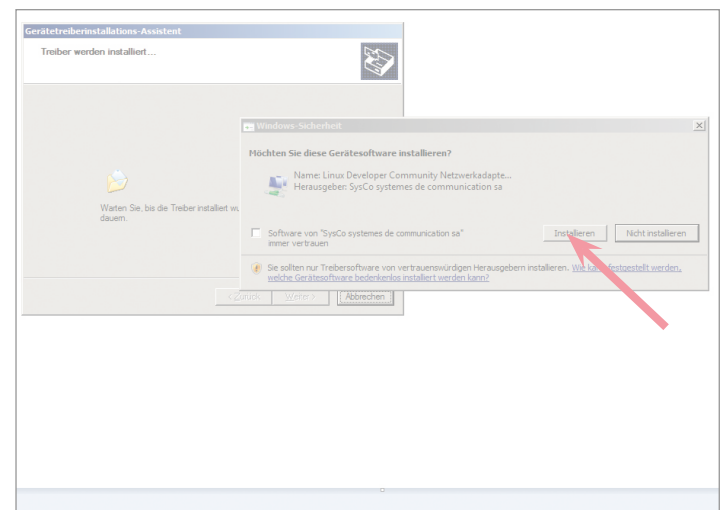
YES install this driver!

(This needs to be continued several times.)

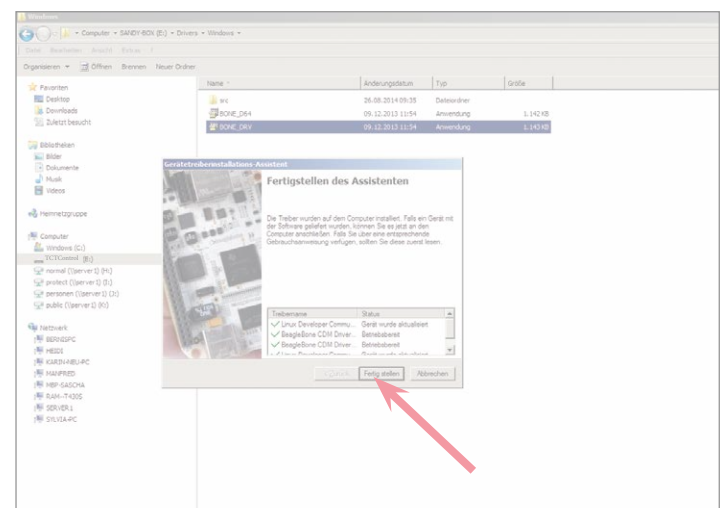
Also confirm all firewall and virus scanner messages concerning TCTControl.



click INSTALL



click COMPLETE

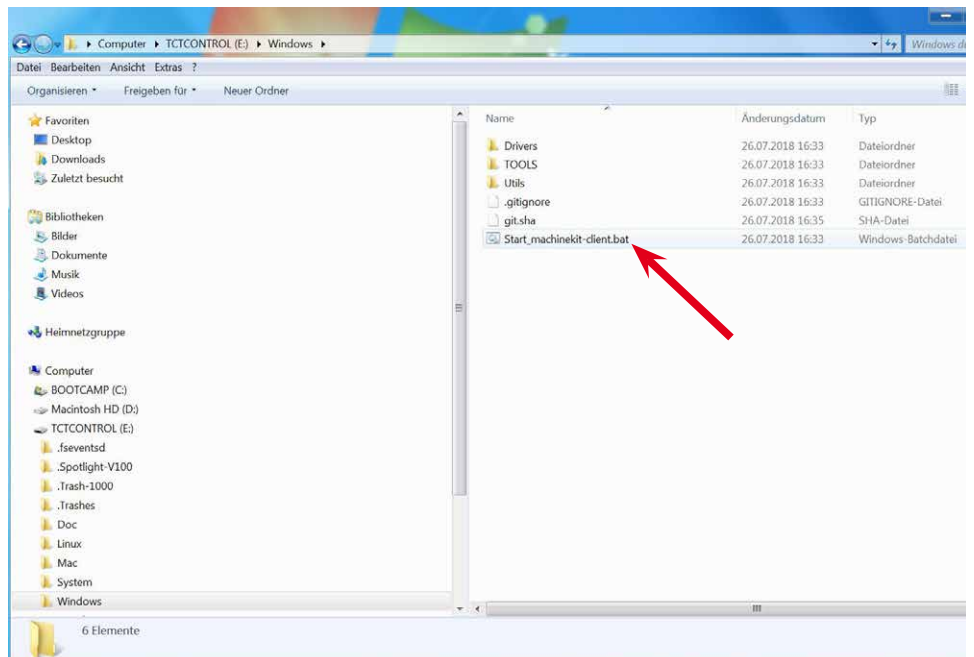


### Variant A:

Run the machinekit-client directly from TCTControl.

Go to  
TCTControl\Windows\  
start “Start\_machinekit-client.bat”

*We recommend **Variant A** for quick tests or if you are using a PC on which the machinekit client should not or may not be copied.*



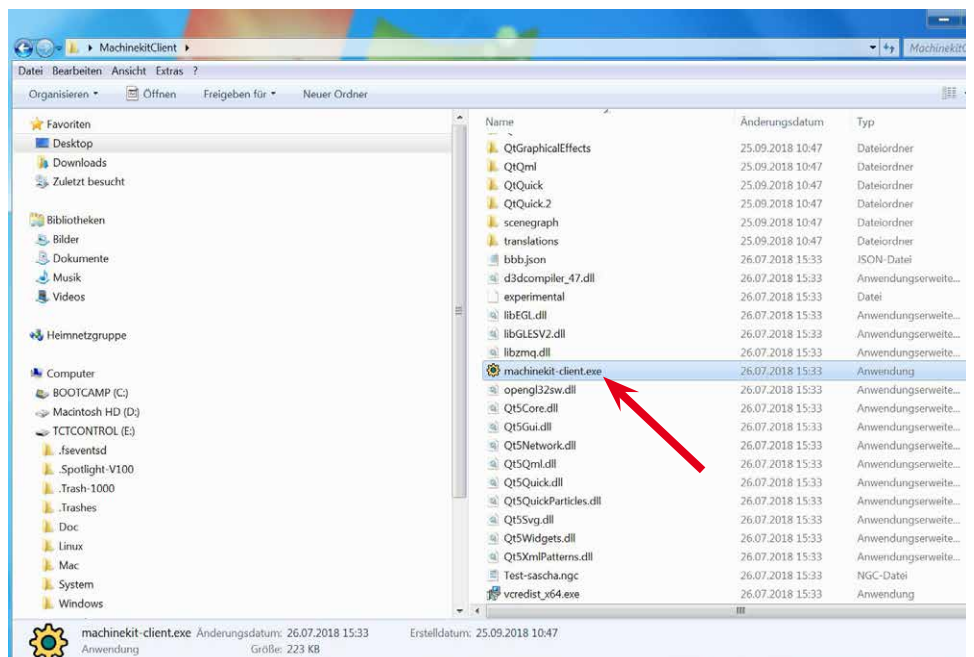
### Variant B:

Run the machinekit-client from your Windows system.

Go to  
TCTControl\Windows\Utils\  
copy the folder “MachinekitClient”  
to you system (eg.: to the Desktop),  
Open the folder and start  
“machinekit-client.exe”

### Advantages of **Variant B**:

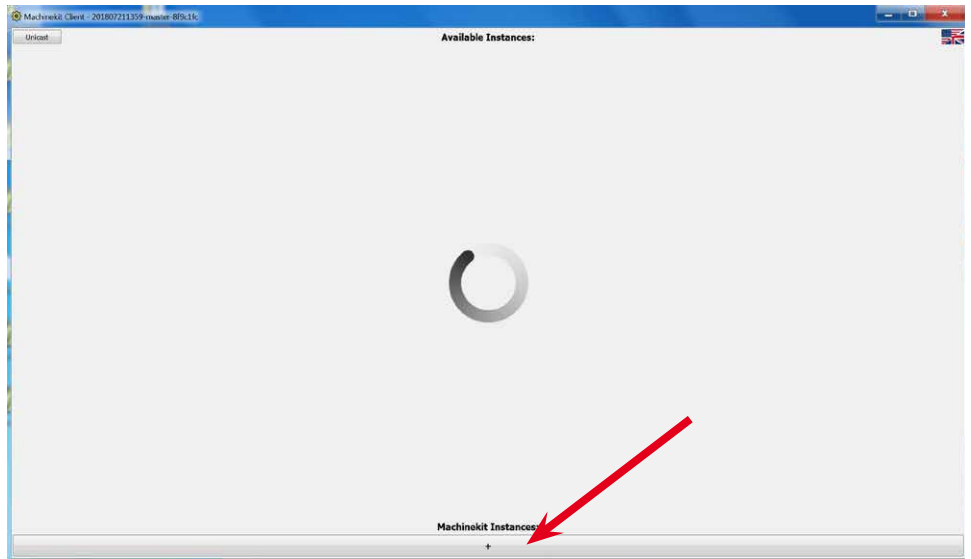
- *The client language can be changed*
- *A LAN connection can be established*
- *The client can be disconnected from the TCTControl and reconnected to the TCTControl (machine configuration continues on the TCTControl).*



Machinekit-client starts

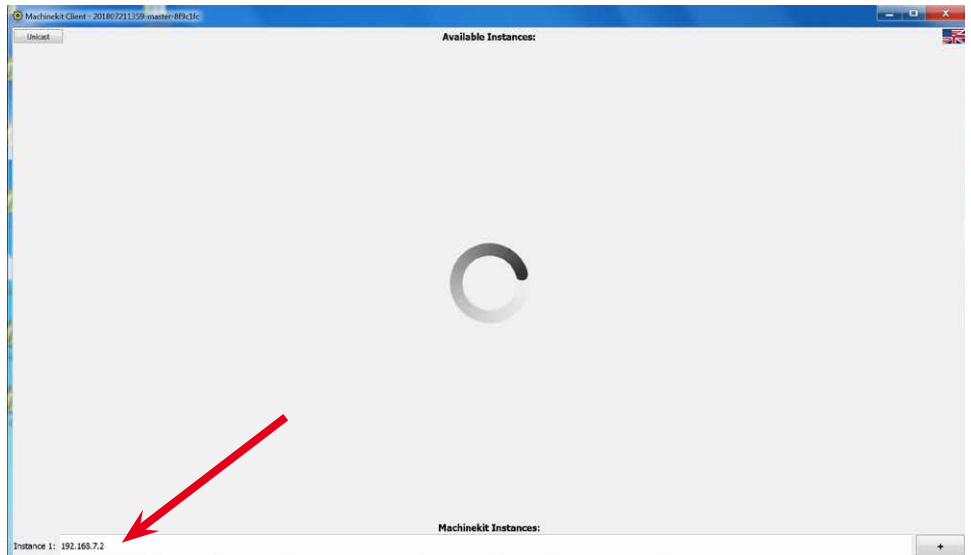


If you used variant B, then you must enter the IP of the TCTControl, at the first start. Click at “+”

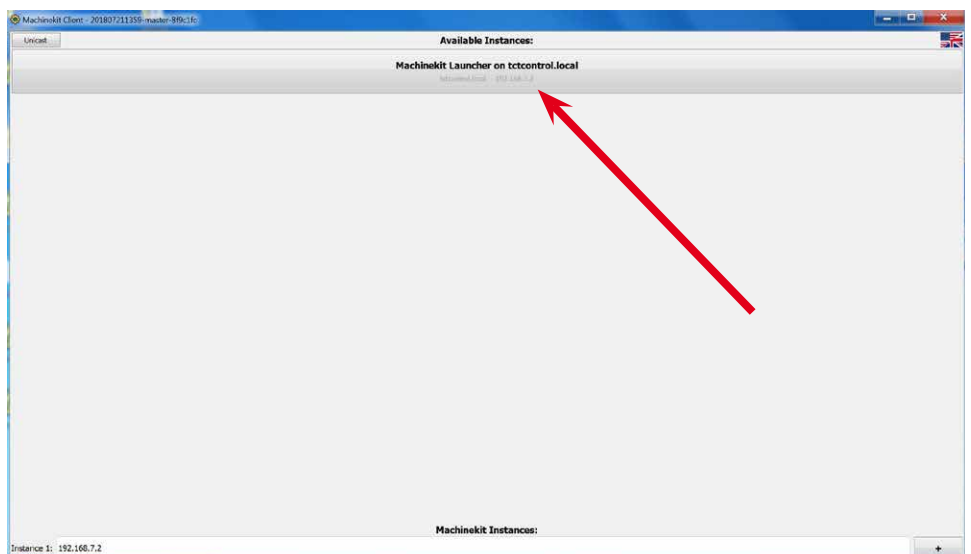


The standard IP of the TCTControl is: **192.168.7.2** (USB connection)

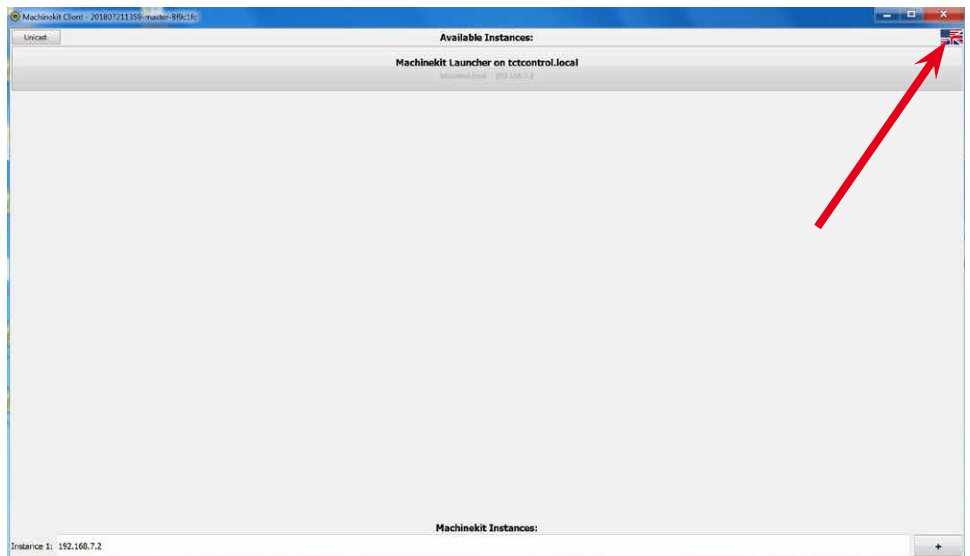
For LAN:  
192.168.60.3



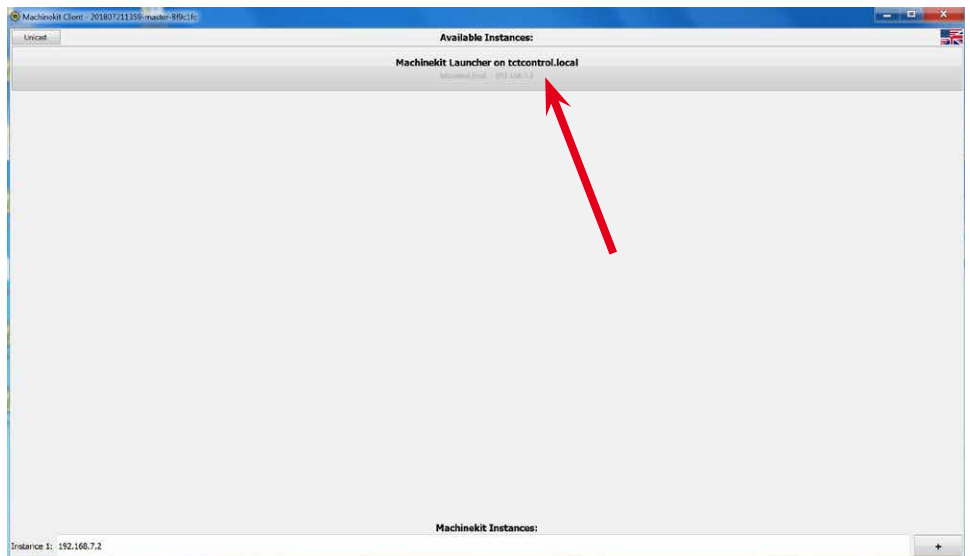
Few seconds later, the machinekit-client shows the connected TCTControl.



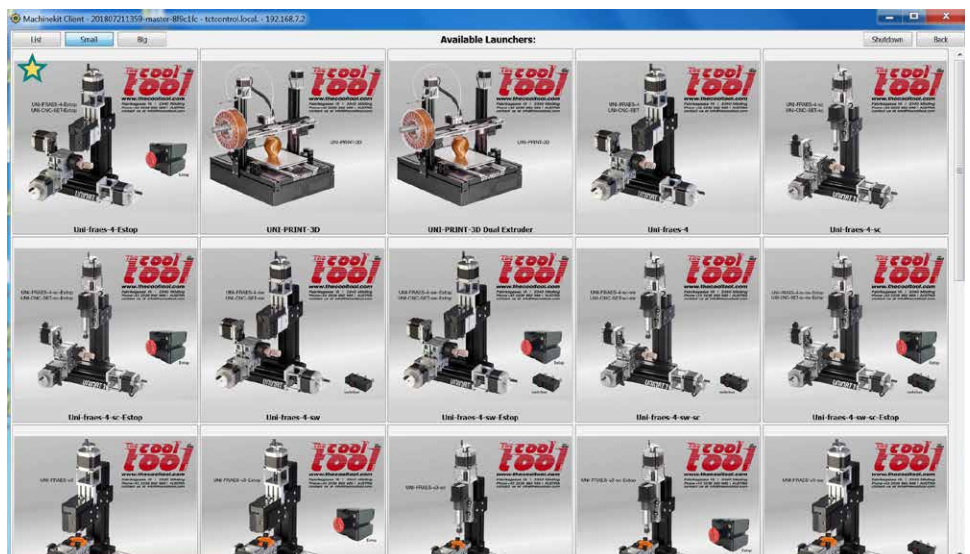
To change the language, click on the flag and select your preferred language.



Go to the machine menu.  
Click on  
“Machinekit Launcher .....”



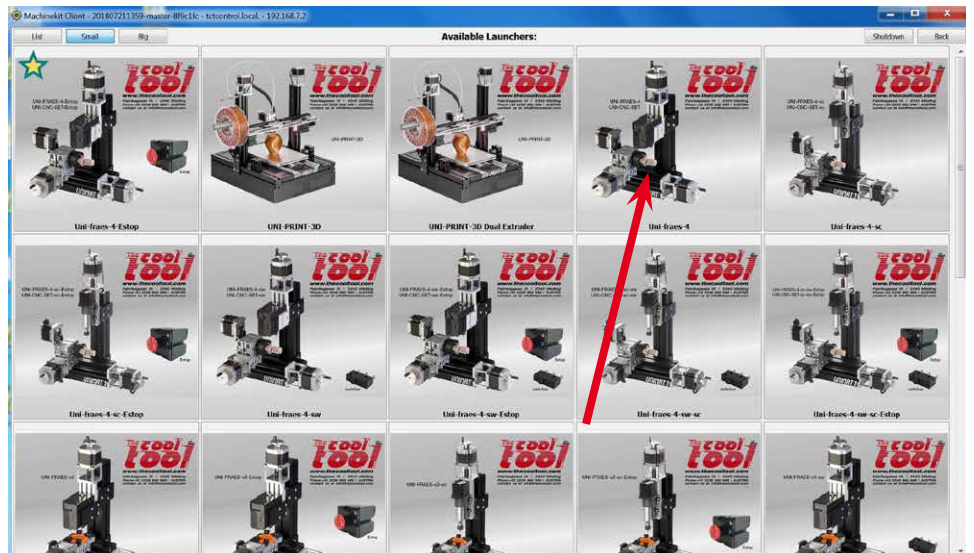
All available machine configurations are now being displayed.



Use the STAR to rank machines up.

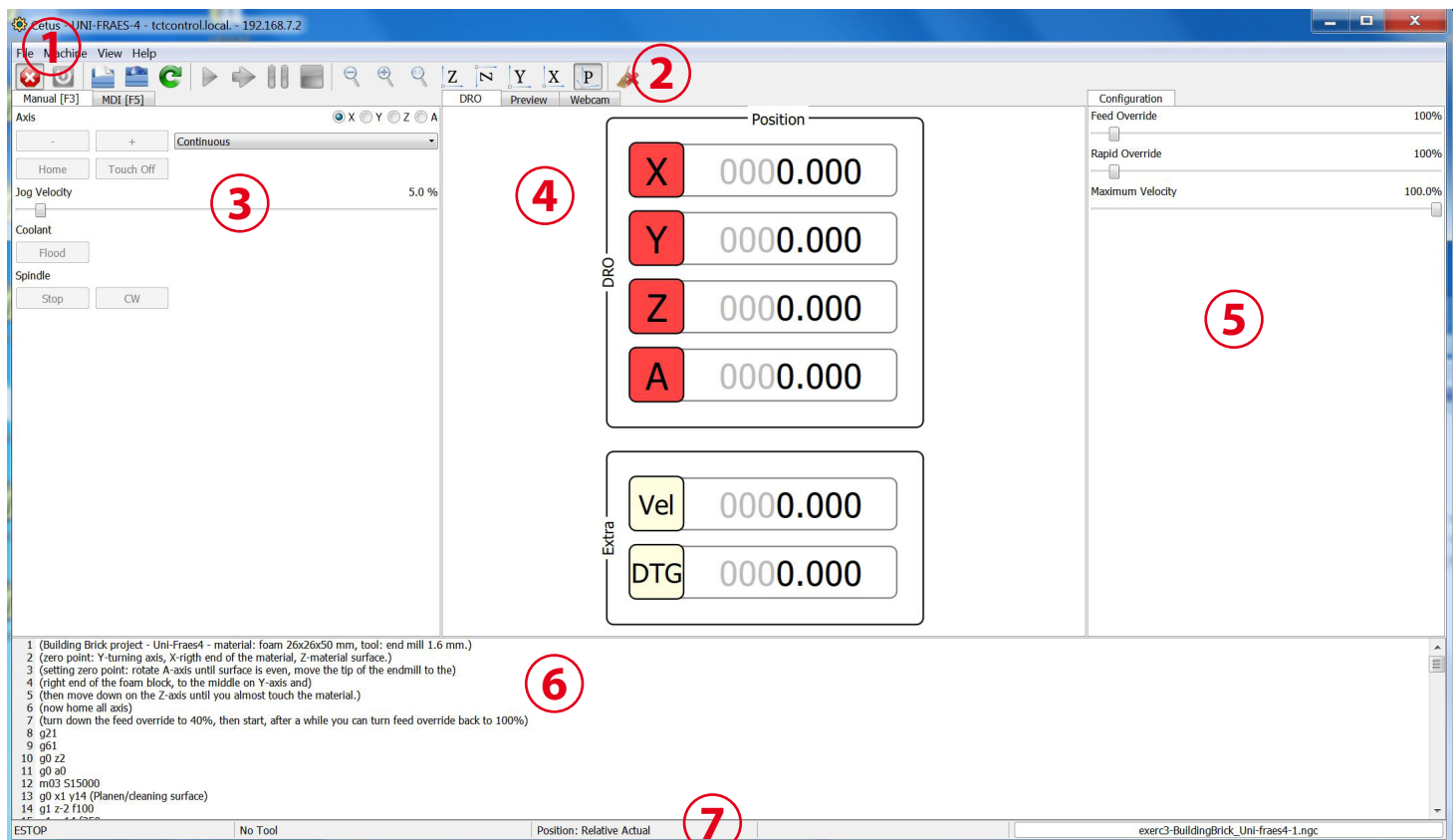


To start a machine configuration click on it.



The starting process takes some seconds.





### 1 .... menu bar

- A1) File -> Open File --- To open file from PC or network and upload it to the TCTControl
- A2) File -> Open File from Machine ---- To open file that already stored on TCTControl
- A3) File -> Edit File with System Editor --- To edit the currently loaded G-Code file.
- A4) File -> Reopen file --- After editing an open file, reopen it to update.
- A5) File -> Edit Tool Table --- Add and remove tools.
- A6) File-> Disconnect from Session --- Go back to the Launcher; without shutting down the running machine configuration.
- A7) File-> Shutdown Session --- Shut down the machine configuration and go back to launcher.
- A8) File-> Exit User Interface --- Closes the machinekit-client application, the machine configuration remains running.
- B) Machine --- For more details take a look at point 2 „icon bar“
- C) View --- Setup the user interface

### 2 .... icon bar

- |  |                           |  |                       |  |                       |
|--|---------------------------|--|-----------------------|--|-----------------------|
|  | E-Stop ON/OFF             |  | machine ON/OFF        |  | open file from PC     |
|  | open file from TCTControl |  | reload open file      |  | start working process |
|  | process only next line    |  | working process pause |  | stop working process  |
|  | zoom function for preview |  | change preview view   |  | reset live plot       |

### 3 .... control area

Can only be used if E-Stop is OFF and machine is ON.

#### A) Manual

May slightly vary depending on the machine configuration.



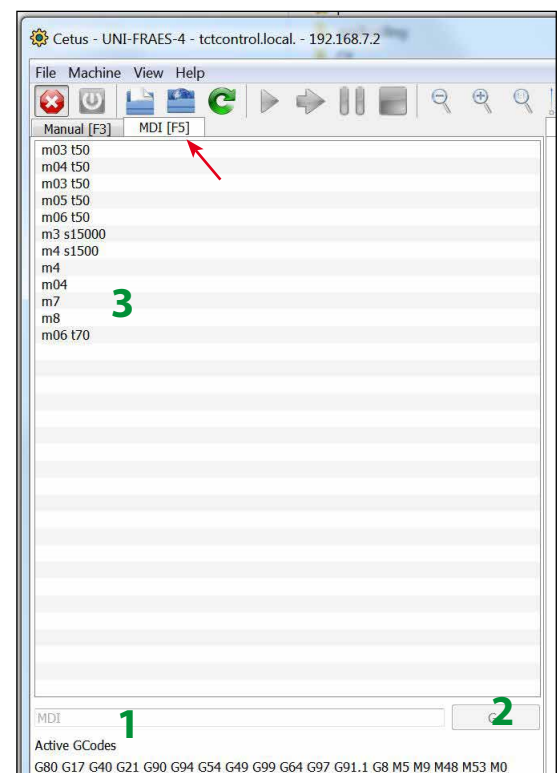
- 1 ..... axis selection
- 2 ..... direction of movement
- 3 ..... distance of movement (0.001 up to continuous)
- 4 ..... referencing the axis (e.g. set zero point, ....)
- 5 ..... speed of the movement (feed rate)
- 6 ..... relais (cooling, dust extraction, ...)
- 7 ..... headspindel (ON/OFF, rpm, direction of rotation  
available functions depend on the motor used.

#### B) MDI (manual data input)

Can only be used if all axes are referenced.

- 1 ..... enter one command line (e.g. G0 X10 y10)
- 2 ..... to execute inputted command, click here
- 3 ..... history of entered command lines

If you click on a line in the history, the line will be entered again (1).



### 4 .... information area

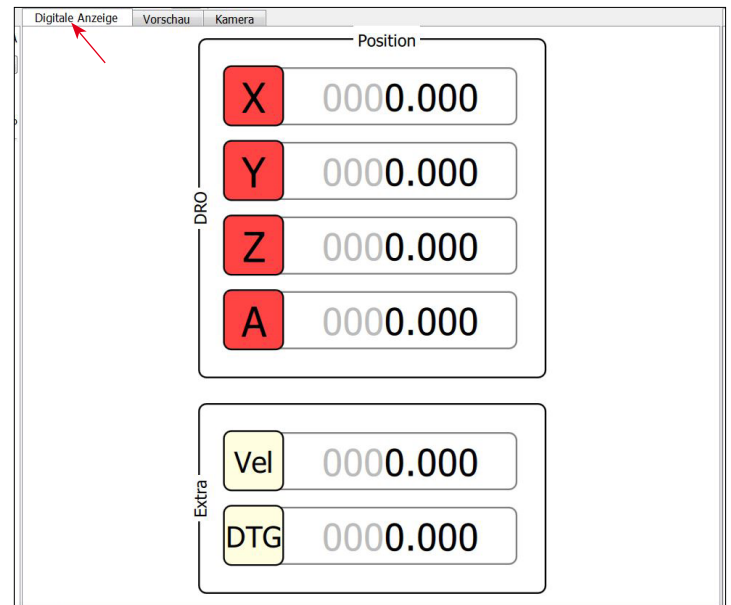
DRO (digital readout)

X, Y, .... (depends on the machine used)

show the actual positions of the axes. If the background is red, the axis is not referenced (homed). If the background is green, the axis is homed.

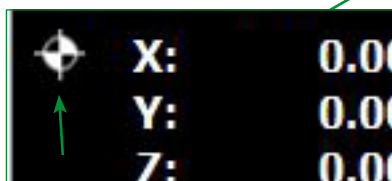
Vel .... actual speed of the machine movement.

DTG .... distance to go

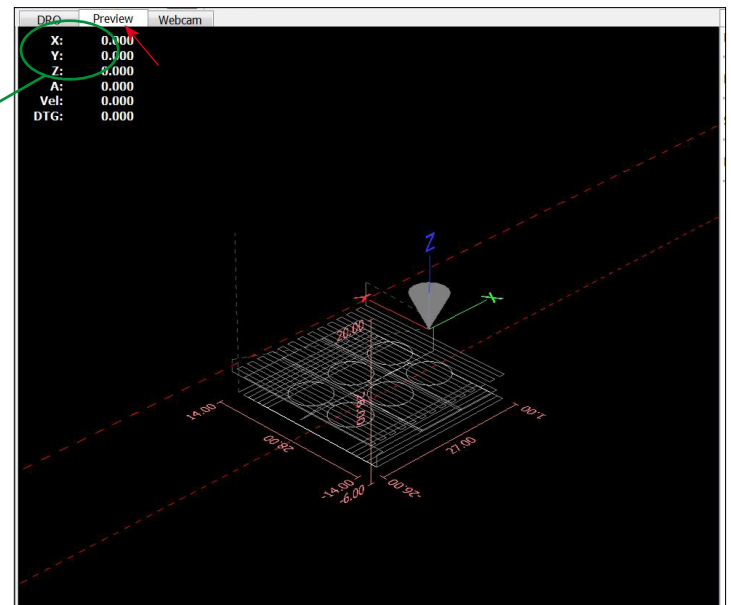


Preview

shows additionally all tool paths of the open G-Code files

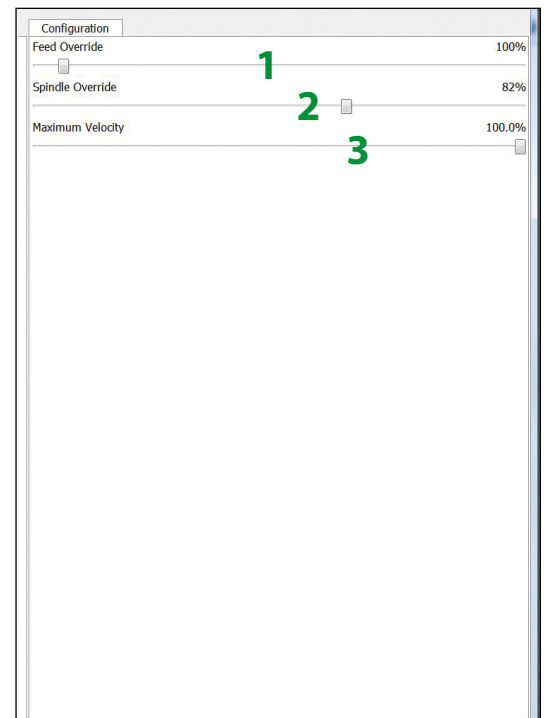


marks referenced (homed) axis.

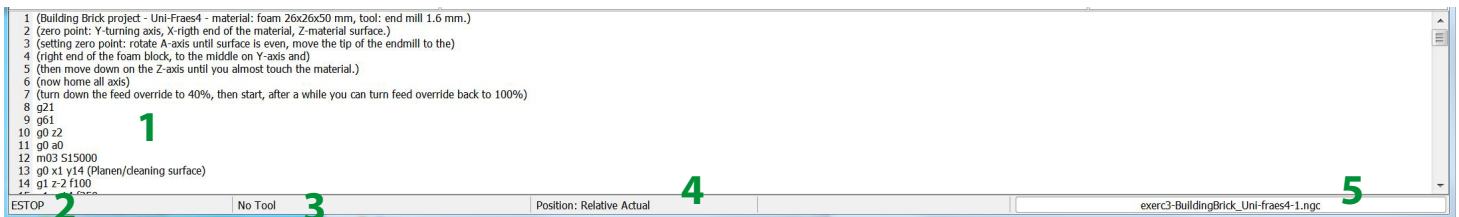


### 5 .... Configuration area

- 1 ..... Feed Override (override programmed feed rate [F] of loaded G-Code file)
- 2 ..... Spindle Override (override programmed spindle speed [S])
- 3 ..... Maximum Velocity (override the maximal speed of the machine)



### 6 .... loaded G-Code file and 7 .... info line



- 1 ..... Currently loaded G-Code file
- 2 ..... Machine status ON/OFF
- 3 ..... Currently loaded tool
- 4 ..... Position mode
- 5 ..... File name of the currently loaded G-Code file.

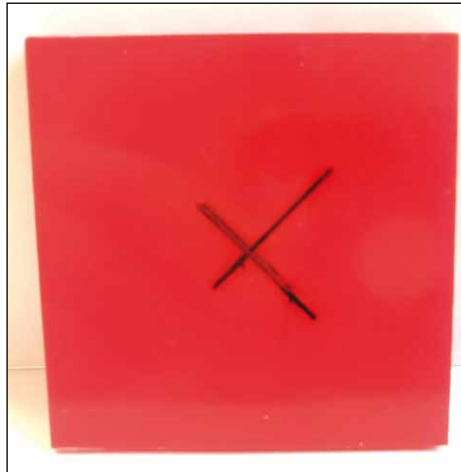
**Machine:** UNI-FRAES-V3

**File:** Sample\_M1.ngc

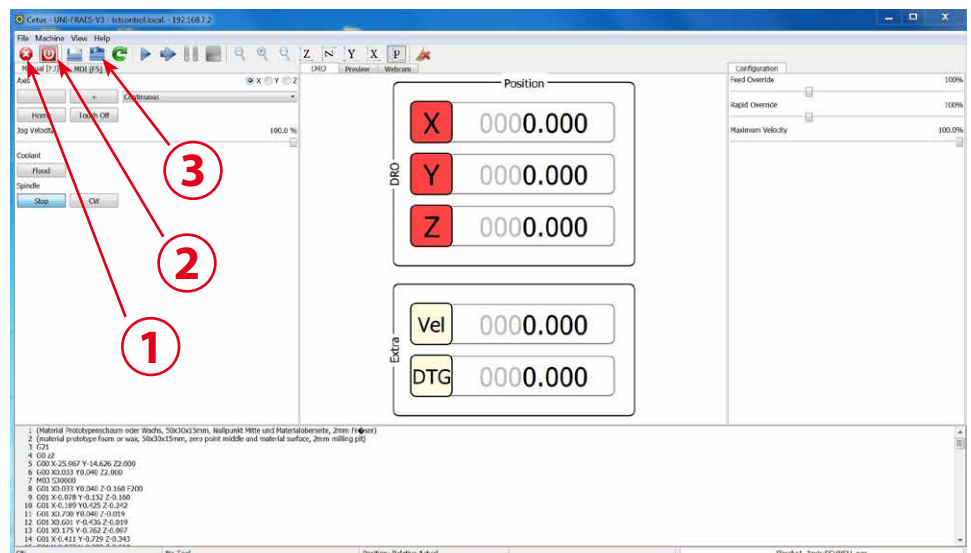
**Raw material:** Special colored Acrylic, 50x50x3 mm[art.no.: 166PLEXS]

**Tool:** 1.6 mm end mill

- ) Mark the center of the square (raw material)
- ) Use the clamping jaws to fix the raw material. Protect the machine table by placing a second plate (plywood or acrylic, thickness min. 3 mm) beneath the raw material.



- ) Start UNI-FRAES-V3 (machinekit-client)
  - 1) Deactivate the E-Stop
  - 2) Machine power ON
  - 3) Open G-Code file stored on machine



The screenshot shows a Windows File Explorer window with the address bar displaying the path: `C:\Users\user\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\...`. The file list contains the following items:

| Name            | Size   | Last Modified    |
|-----------------|--------|------------------|
| Content.IE5\... | 5728   | 20.06.2018 14:27 |
| Content.IE5\... | 3 KB   | 21.11.2017 09:50 |
| Content.IE5\... | 112 KB | 11.12.2018 15:17 |
| Content.IE5\... | 140 KB | 03.07.2018 09:14 |
| Content.IE5\... | 13 KB  | 04.12.2018 09:05 |
| Content.IE5\... | 14 KB  | 03.07.2018 09:53 |
| Content.IE5\... | 712 KB | 03.07.2018 15:12 |
| Content.IE5\... | 405 KB | 17.12.2018 13:16 |
| Content.IE5\... | 907 KB | 03.07.2018 15:11 |
| Content.IE5\... | 4 KB   | 11.12.2018 15:21 |
| Content.IE5\... | 4 KB   | 17.12.2018 14:02 |
| Content.IE5\... | 2 KB   | 11.12.2018 15:39 |
| Content.IE5\... | 277 KB | 03.07.2018 11:51 |
| Content.IE5\... | 4 KB   | 04.12.2017 09:50 |

A red arrow points to the `index.dat` file in the list.

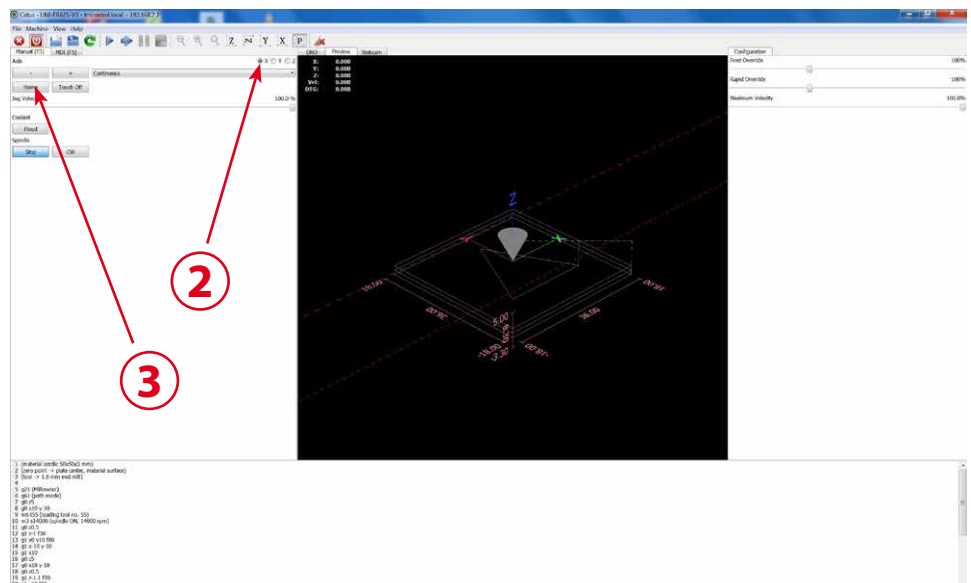
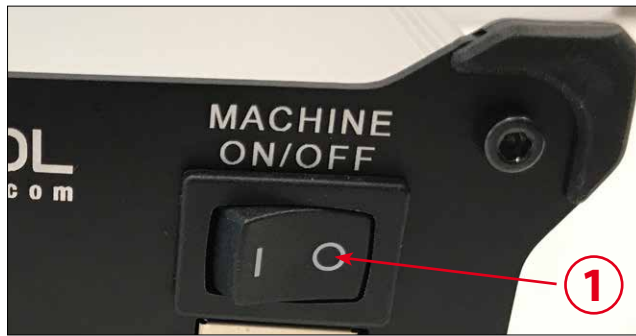
- [illegible]

### •) Simulate the G-Code

- 1 ... Turn MACHINE OFF!
- 2 ... Select the X axis
- 3 ... click HOME

Repeat the process with Y and Z axis.

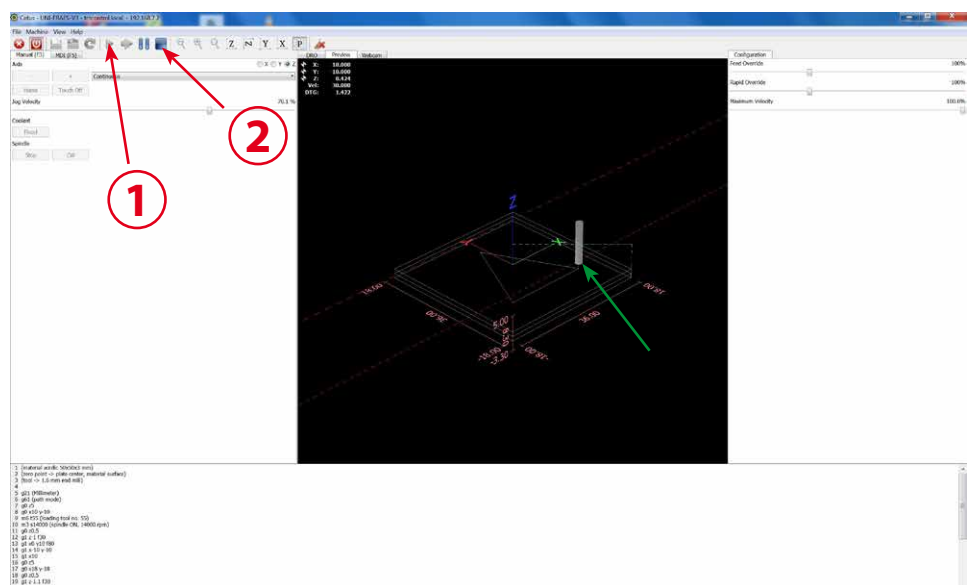
Now all 3 axes are homed.



- 1) click on „PLAY“

The simulation is running.

- 2) click on „STOP“ to stop the simulation



# Cetus - start a sample file

[milling • cutting • turning]

4.2.2.2

•) Run the G-Code at the milling machine

1 ... move the milling head (X/Y axis) to the zero position at the raw material.

2 ... put a thin paper between raw material and milling head. Go down with the Z axis and stop if the paper get stuck.

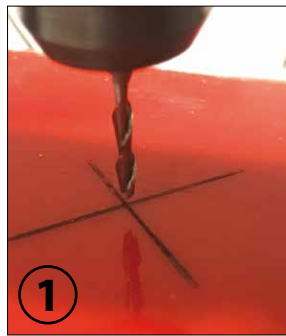
3 ... now the milling head stay at the zero position.

For that work you can move the axes manual (using the hand wheels - MACHINE at the TCTControl must be OFF!

or

Use the Cetus software interface to move the axes - MACHINE at the TCTControl must be ON!

4 ... turn MACHINE ON at the TCTControl



5 ... select the X axis

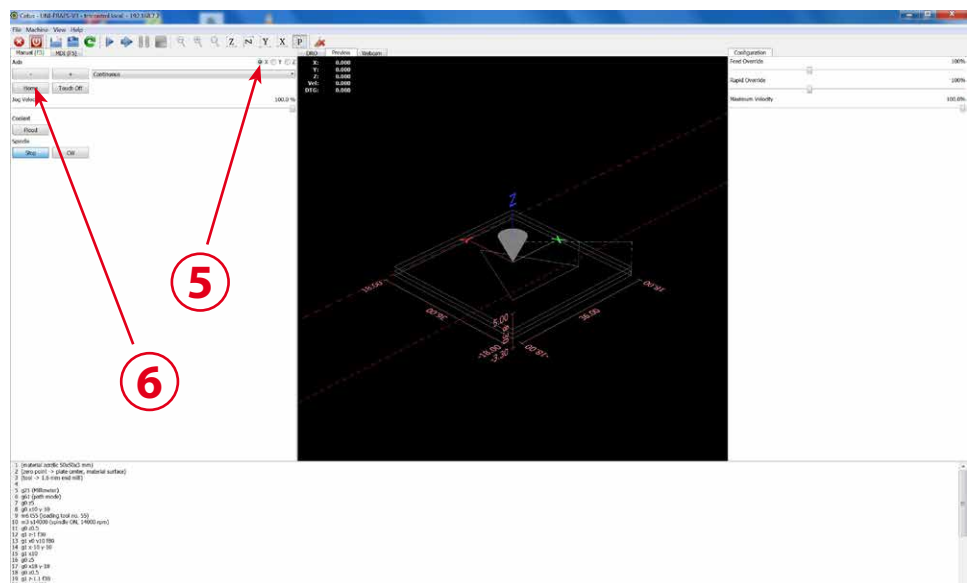
6 ... click HOME

Repeat the process with Y and Z axis.

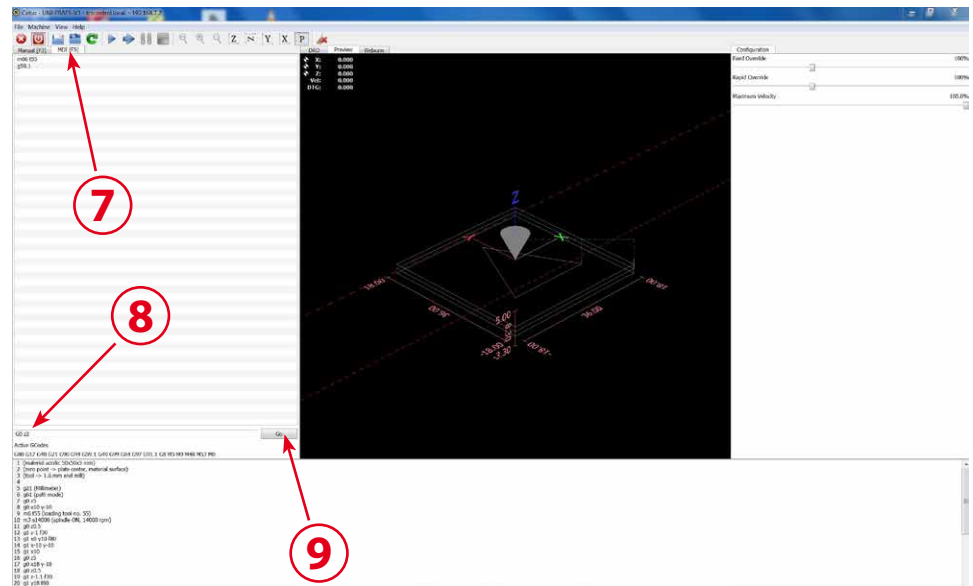
Now all 3 axes are homed.



If a axis is already homed, no problem, home it again.



- 7 ... switch to MDI
- 8 ... enter: G0 z2
- 9 ... click GO



- 10 ... turn the milling motor ON

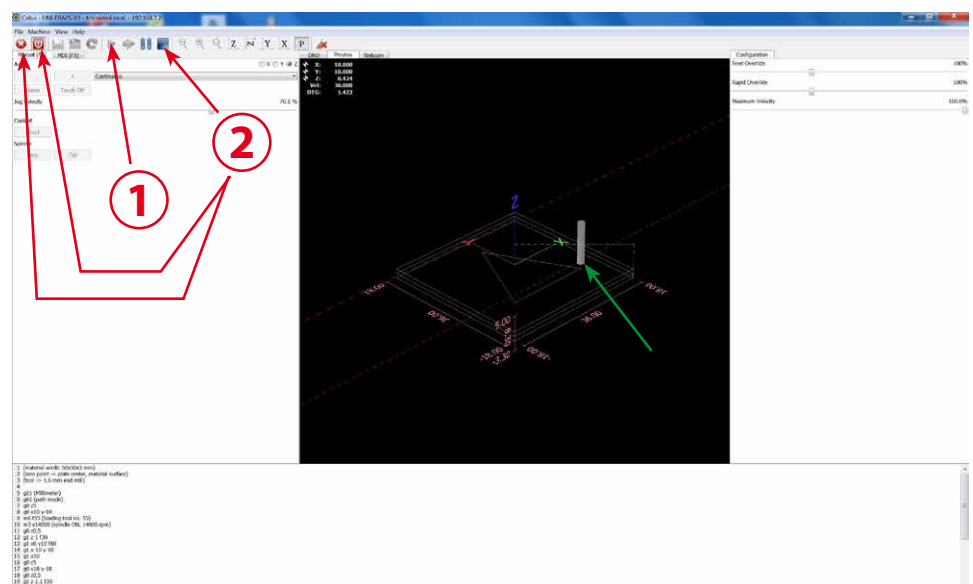


- 1) click on „PLAY“

The milling process starts.

- 2) to stop the machine (milling process) click on one of the three icons

- a) E-stop
- b) Machine power
- c) Stop



When the milling operation is finished turn the milling motor OFF!



### Exercise 1

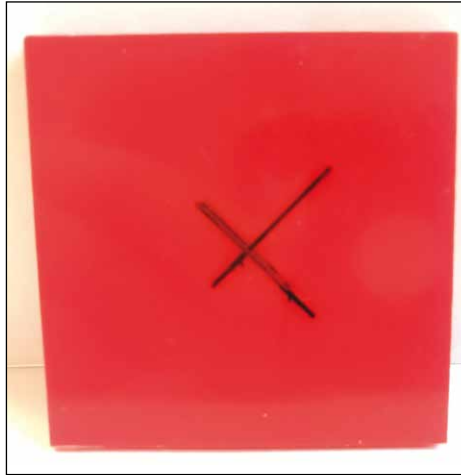
**Machine:** UNI-FRAES-V3

**File:** ../examples/exerc1-simple-square.ngc

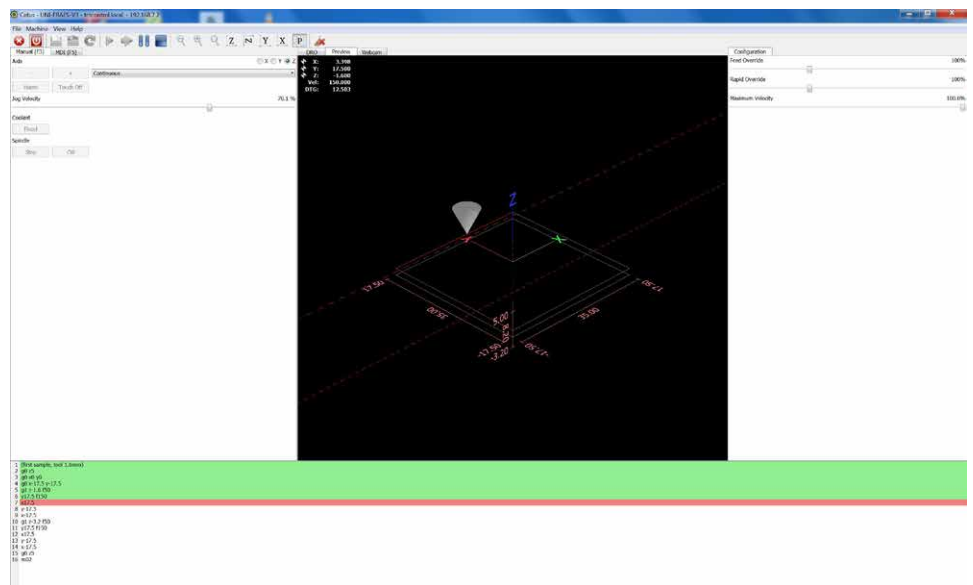
**Raw material:** Special colored Acrylic, 50x50x3 mm[art.no.: 166PLEXS]

**Tool:** 1.6 mm end mill

- ) Mark the center of the square (raw material)
- ) Use the clamping jaws to fix the raw material. Protect the machine table by placing a second plate (plywood or acrylic, thickness min. 3 mm) beneath the raw material.



It is similar to the Sample\_M1.ngc file



## Exercise 2

**Machine:** UNI-FRAES-V3

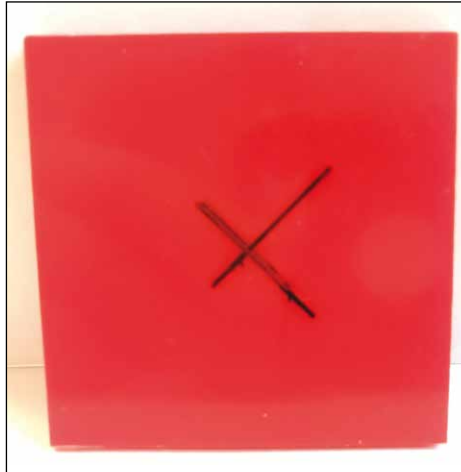
**File:** .../examples/exerc2-3circlrs-g41\_g42.ngc

**Raw material:** Special colored Acrylic, 50x50x3 mm[art.no.: 166PLEXS]

**Tool:** 1.6 mm end mill

- ) Mark the center of the square (raw material)
- ) Use the clamping jaws to fix the raw material. Protect the machine table by placing a second plate (plywood or acrylic, thickness min. 3 mm) beneath the raw material.

Programmed diameter of the circles is 6 mm.



**1st circle** (on right position):

It is without tool diameter compensation. The diameter of the cut out part is  $6 - 1.6 = 4.4$  mm

The diameter of the cut hole at the raw material is  $6 + 1.6 = 7.6$  mm

**2nd circle** (in the middle):

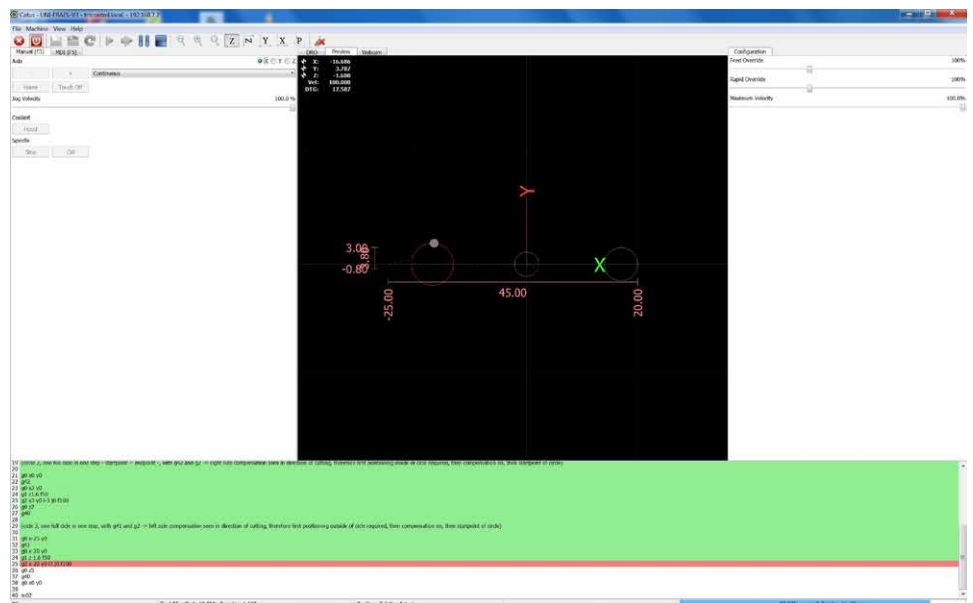
With tool diameter compensation. The diameter of the cut out part is  $6 - 1.6 - 1.6 = 2.8$  mm

**The diameter of the cut hole in the material is 6 mm**

**3rd circle** (on the left position):

It is with tool diameter compensation. **The diameter of the cut out part is 6 mm.**

The diameter of the cut hole in the material is  $6 + 1.6 + 1.6 = 9.2$  mm



## Experiment

Now replace the milling head at your milling machine - use for example a 1.2 mm end mill.

For tool number take a look at your tool table (t50 = 1.2 mm end mill)

Now „File => Edit file with System Editor“, change the tool number from T55 to T50

**Save as => exerc2-3circlrs-g41\_g42-A.ngc ==> on the Desktop ==> open the new files in CETUS**

Use a new raw material and cut the circles again (don't forget to update the zero point).

The diameters of the cut hole (circle 2) and the cut out part (circle 3) will be also 6 mm.

It was only one small change at the G-Code file necessary!

### Exercise 3

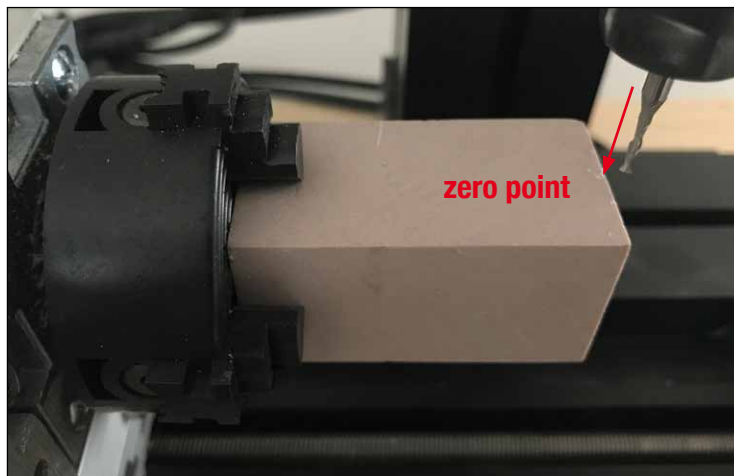
**Machine:** UNI-FRAES-4

**File:** ../examples/exerc3-BuildingBrick\_Uni-fraes4-1.ngc

**Raw material:** Special milling foam, 50x25x25 mm[art.no.: 166FOAM S]

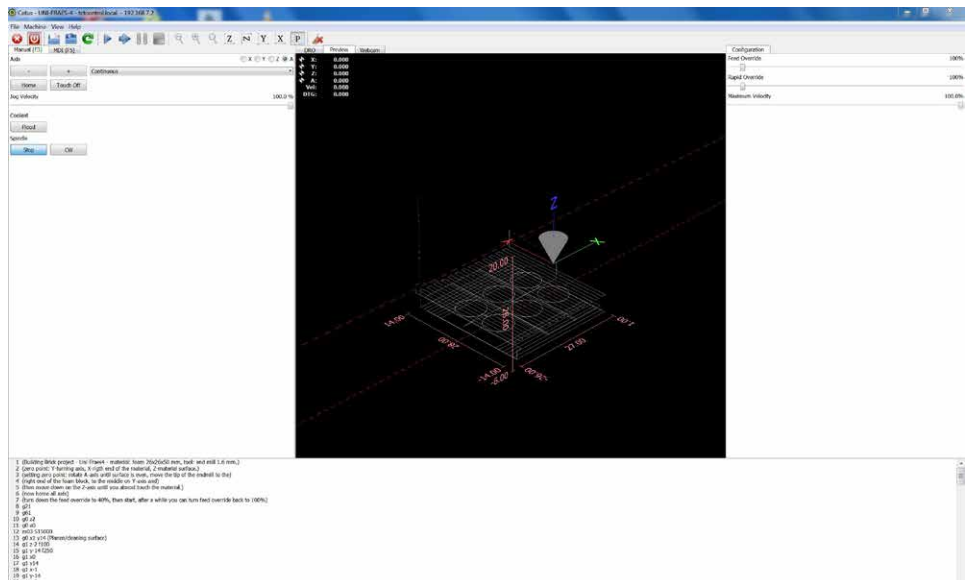
**Tool:** 1.6 mm end mill

- ) Mark the zero point (raw material)
- ) Use the 4 jaw chuck to fix the raw material.



After successfully milling this project the first time, try the following:

- Go to „MDI“
- Enter  
`G0 a180 => „GO“`
- Go to „MANUAL“
- Home A axis again!
- Now you can start the milling file again.



## Exercise 4

**Machine:** UNI-FRAES-V3

**File:** ../examples/exerc4-100-call-a-subroutine-sample.ngc

**Raw material:** plywood or acrylic, dimensions depending on the selected parameters

**Tool:** 1.6 mm end mill

### Preparation

•) Start the files.bat file at TCTControl/Windows/TOOLS/

•) When asked for a password use: machinekit

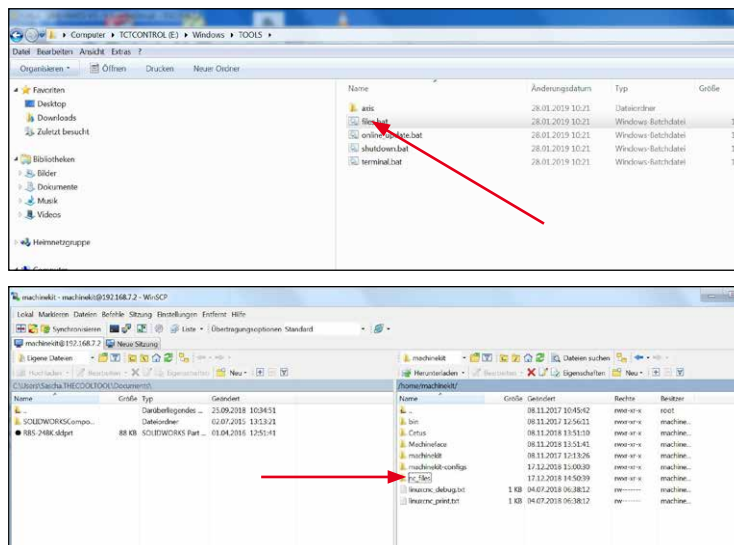
The left part of the „WinSCP“ window is the file system of your PC. The right part is the file system of the TCTControl.

•) Go to nc\_files/examples

•) Copy following files to the folder nc\_files:

100.ngc

exerc4-100-call-a-subroutine-sample.ngc

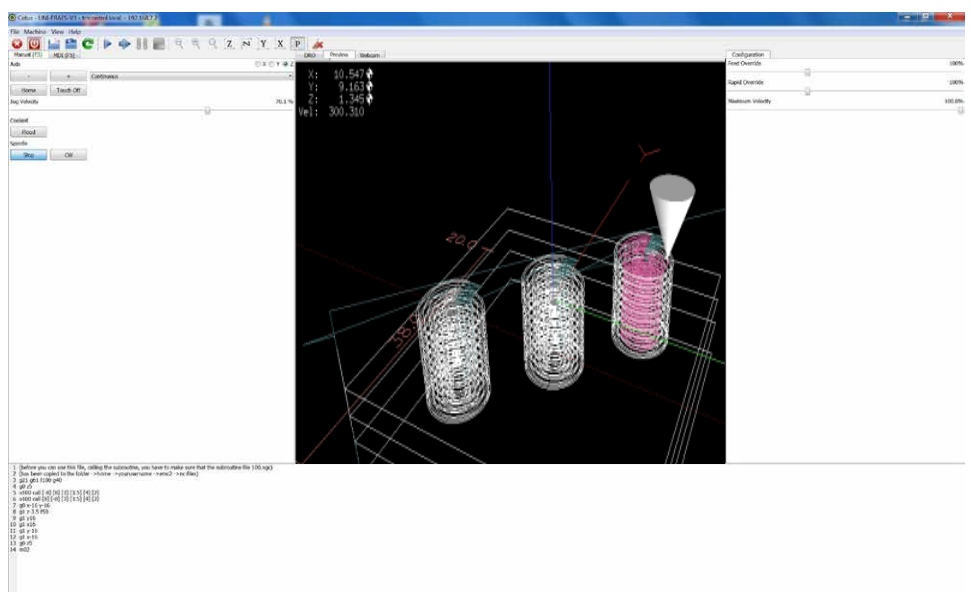


•) Open the exerc4-100-call-a-subroutine-sample.ngc file in CETUS

See comments in file exerc4-100-call-a-subroutine-sample.ngc !!!

To learn what the parameters like [-8] [8] [3] [3.5] [4] [2] mean, please read the comments in 100.ngc.

Experiment with different parameters.



### Exercise 5

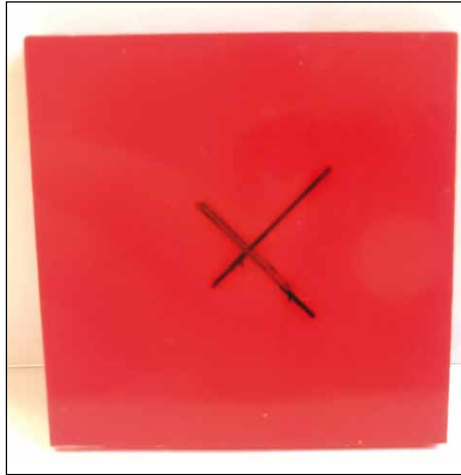
**Machine:** UNI-FRAES-V3

**File:** ../examples/exerc5-var-cicles.ngc

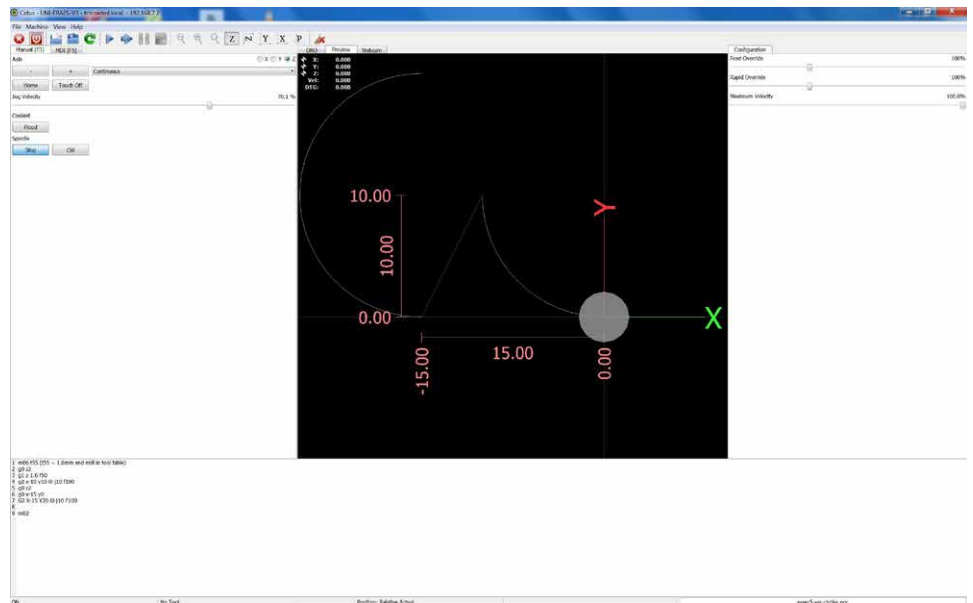
**Raw material:** Special colored Acrylic, 50x50x3 mm[art.no.: 166PLEXS]

**Tool:** 1.6 mm end mill

- ) Mark the center of the square (raw material)
- ) Use the clamping jaws to fix the raw material. Protect the machine table by placing a second plate (plywood or acrylic, thickness min. 3 mm) beneath the raw material.



Showing circle segments with G2.



### Required hardware

Unimat CNC 3-axis vertical milling machine, CNC-rotating axis [164300 CNC], clamping device (e.g.: collet, 3-jaw chuck, .....), TCTControl [TCTCONT4 or TCTCONT6]

### Requirements for the workpiece

The area to be engraved must have a consistent diameter.

#### 1) Calculating the "SCALE" for the machine configuration (.ini file)

- ) CNC-rotation axis [164300CNC]: 1 (micro) Step  $\triangleq$  17,7°
- ) cylinder diameter  $\varnothing$  ..... D [mm]  
circumference ..... U [mm] ( $U \triangleq 360^\circ$ )  
 $\pi$  ..... 3,14159

$$U = D \times \pi$$

$$1 \text{ mm} \triangleq 360 / U = S$$

$$\text{SCALE}_{[\text{step/mm}]} = 17,7^\circ \times S$$

##### 1.1) Example of a cylinder with $\varnothing$ 14 mm

$$U = 14 \times 3,14159 = 43,98226$$

$$S = 360 / 43,98226 = 8,18512$$

$$\text{SCALE} = 17,7 \times 8,18512 = \underline{144,87662}$$

#### 2) Customize the machine configuration file (e.g.: Uni-fraes-v3v2.ini)

- ) Start files.bat  
[TCTCONTROL\Windows\TOOLS\files.bat]  
In the right area is the Linux file system of the TCTControl  
**password:** machinekit
- ) The machine configurations files folder is  
/home/machinekit/machinekit-configs/

- ) Mark the configuration to be edited -> right mouse click -> Edit
- ) Scroll to „#Second axis“

```
# Second axis
[AXIS_1]

TYPE = LINEAR
HOME = 0.000
MAX_VELOCITY = 5.0
MAX_ACCELERATION = 20.0
STEPGEN_MAX_VEL = 6.0
STEPGEN_MAX_ACC = 22.0
STEPGEN_MIN_VEL = 0.001
BACKLASH = 0.000
SCALE = -3200
MIN_LIMIT = -50.0
MAX_LIMIT = 50.0
FERROR = 0.500
```

- ) Comment out the line „SCALE -3200“ with #

```
STEPGEN_MIN_VEL = 0.001
BACKLASH = 0.000
# SCALE = -3200
MIN_LIMIT = -50.0
MAX_LIMIT = 50.0
FERROR = 0.500
```

- ) Add the following lines and save the file

```
STEPGEN_MIN_VEL = 0.001
BACKLASH = 0.000
# ORIGINAL - cross slide Y-axis
# SCALE = -3200
# diameter 14 mm
SCALE = 144.87662
MIN_LIMIT = -50.0
MAX_LIMIT = 50.0
```

- ) Open Machinekit client and start machine configuration

**3) Connect the Unimat CNC-rotating axis [164300CNC] to the Y-axis of the TCTControl**

**4) It is now possible to engrave a design (G code / X, Y, Z values) on the cylinder surface.**

<https://inkscape.org>

## Sample 1 - engraving into acrylic

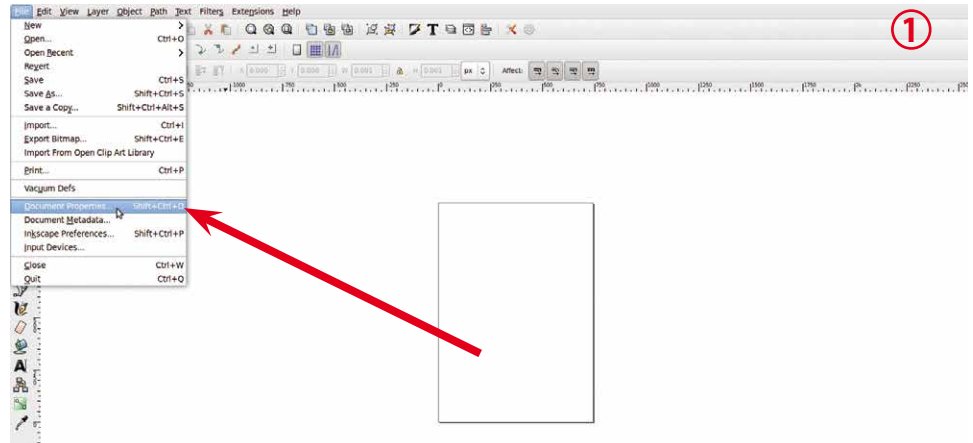
raw material: acrylic plate ~ 50 x 50 x 3 mm

tool: end mill  $\varnothing 1.0$  mm

optional: end mill  $\varnothing 1.6$  mm

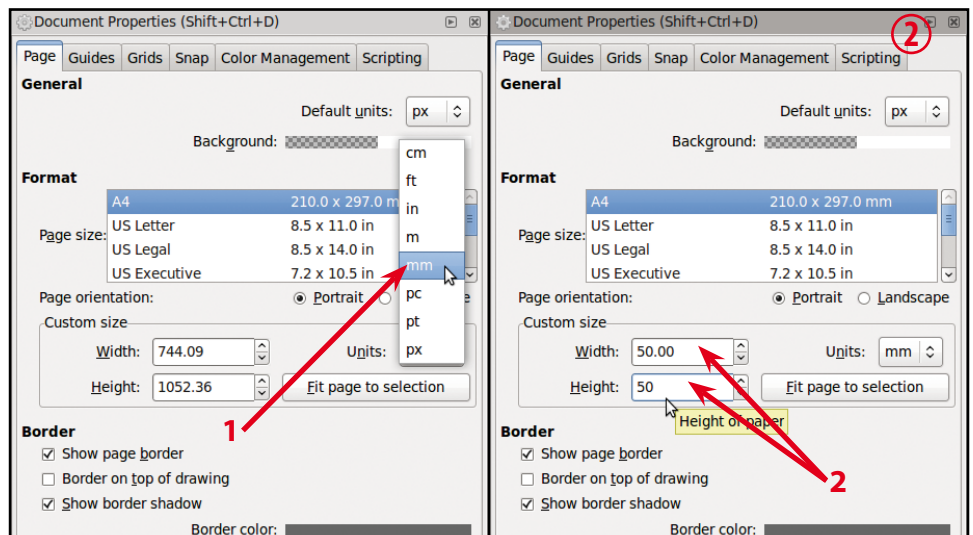


1) open "Inkscape®" then click on "File" --> "Document Properties..."

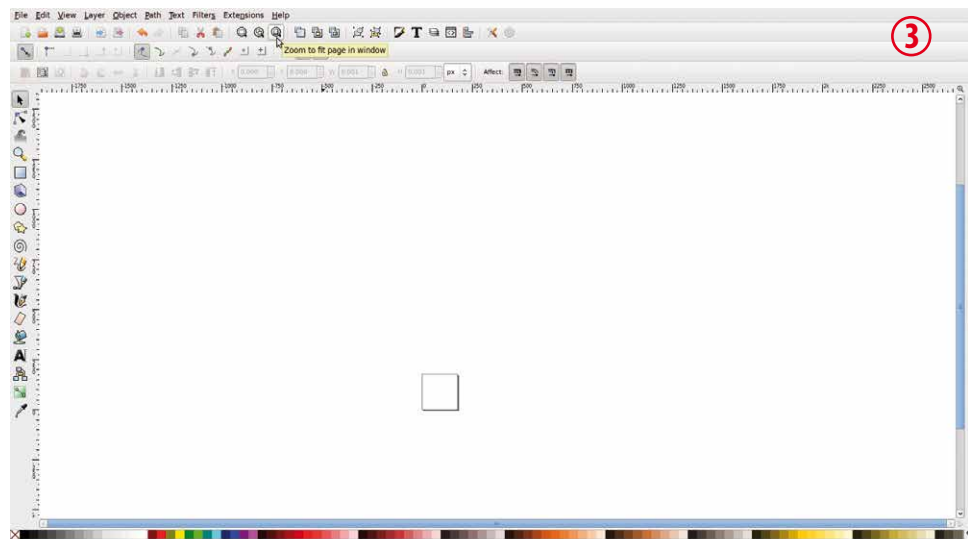


2) select at "Custom size" --> "Units" --> "mm".

enter for both "Width" and "Height" 50 after that close the window.

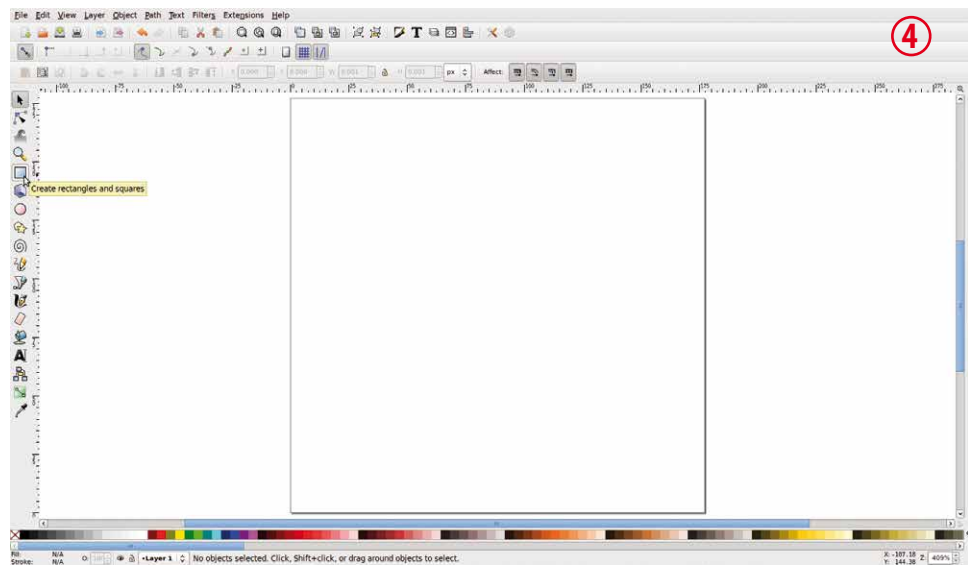


3) click on the magnifier icon "Zoom to fit page in window".

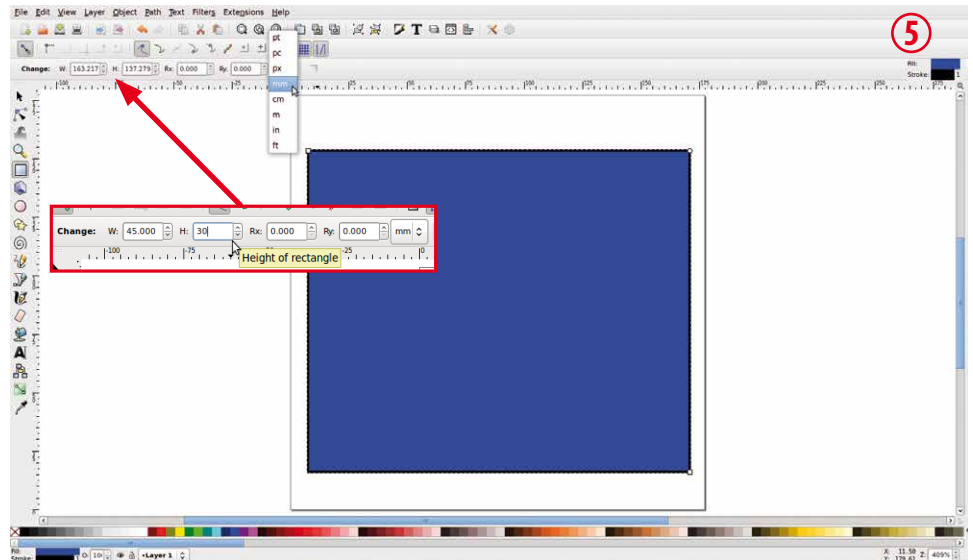


<https://inkscape.org>

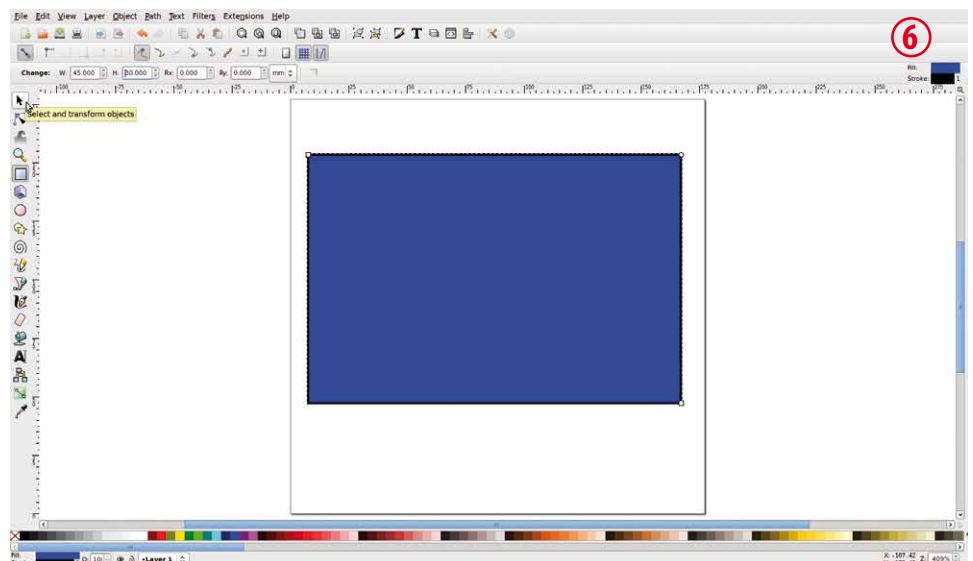
4) click on the square icon "Create rectangles and squares".



5) at "Change" select "mm" then enter for "W" (width) 45 and for "H" (height) 30.

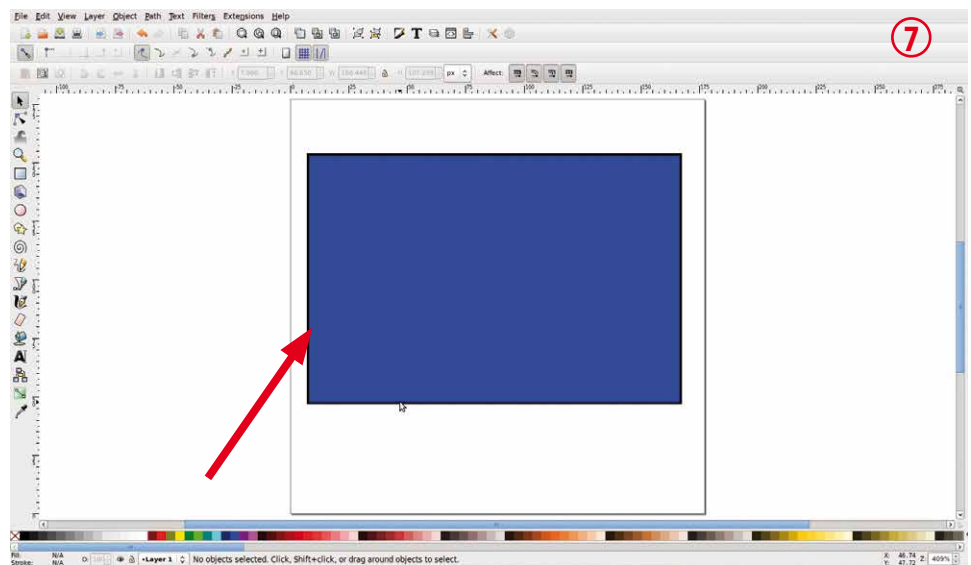


6) click on the arrow "Select and transform objects".

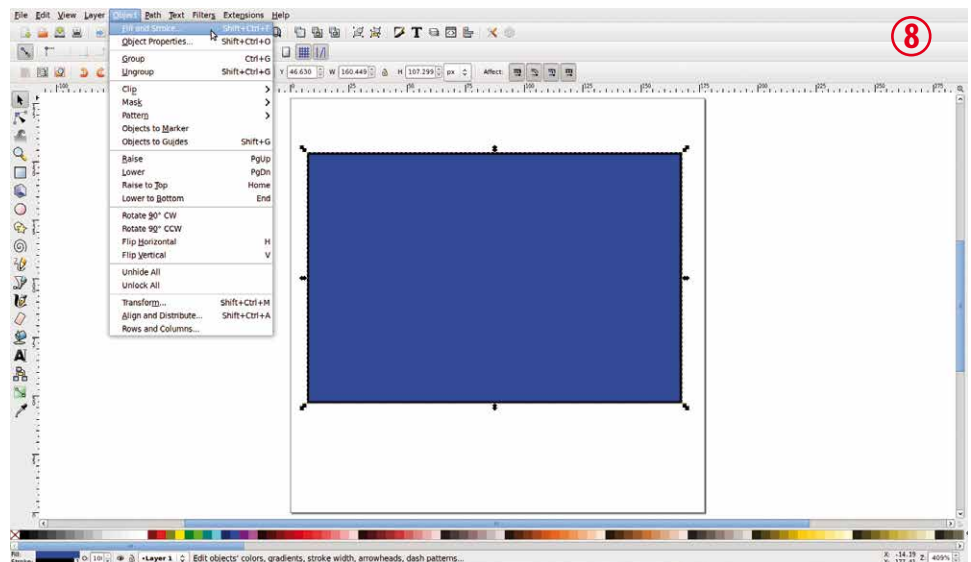


<https://inkscape.org>

7) select the rectangle (click on it).



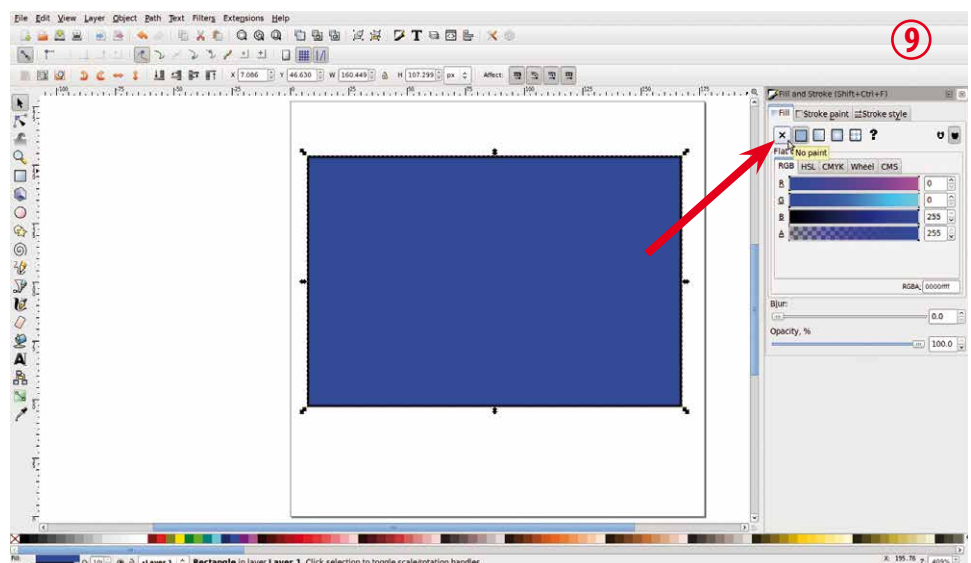
8) Now that the rectangle is marked click on "Object" --> "Fill and Stroke".



9) in the window "Fill and Stroke" select "Fill" and click on "X" (No paint).

Attention:

The rectangle must be selected (marked).

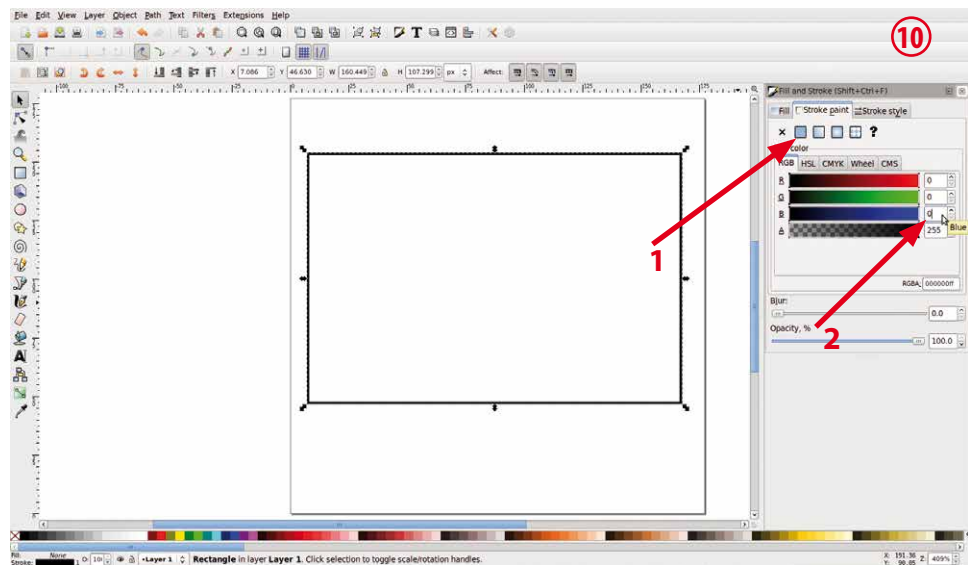


<https://inkscape.org>

10) switch to "Stroke paint" and click on "Flat color" (1), then click "Blue" (2).

Attention:

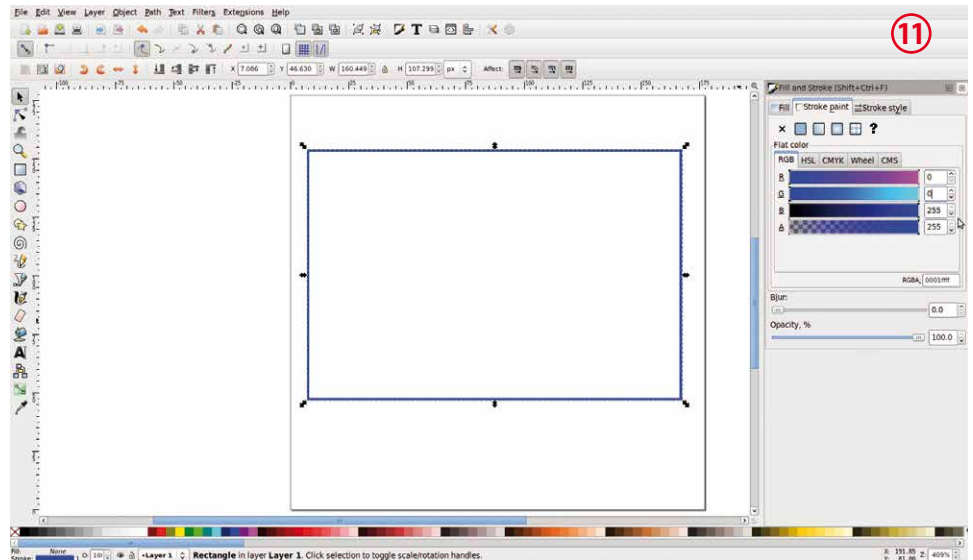
The rectangle must be selected (marked).



11) write "255" and press "Enter". The contour color of the rectangle is now blue.

Attention:

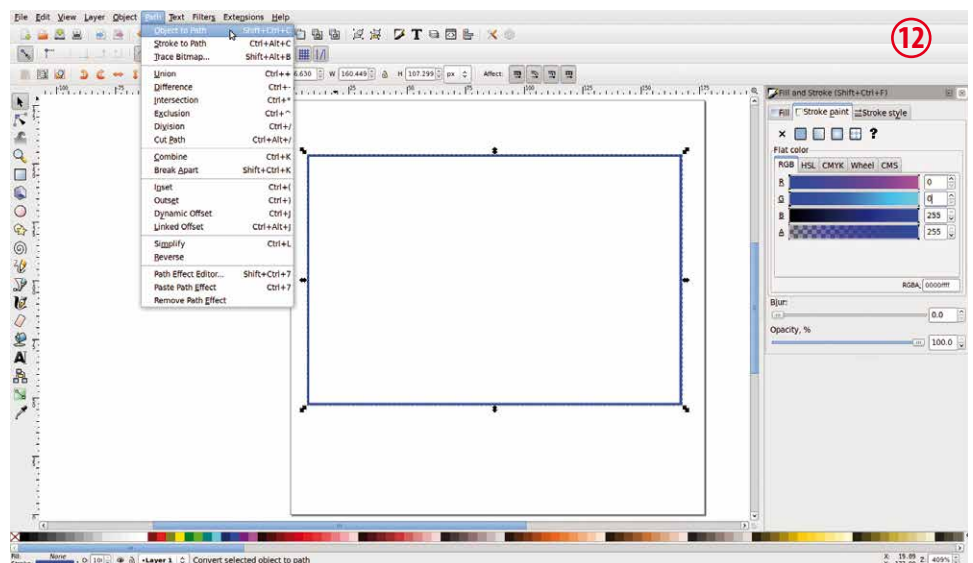
The rectangle must be selected (marked).



12) click on "Path" --> "Object to Path" (vector). Now the rectangle is a vector graphic.

Attention:

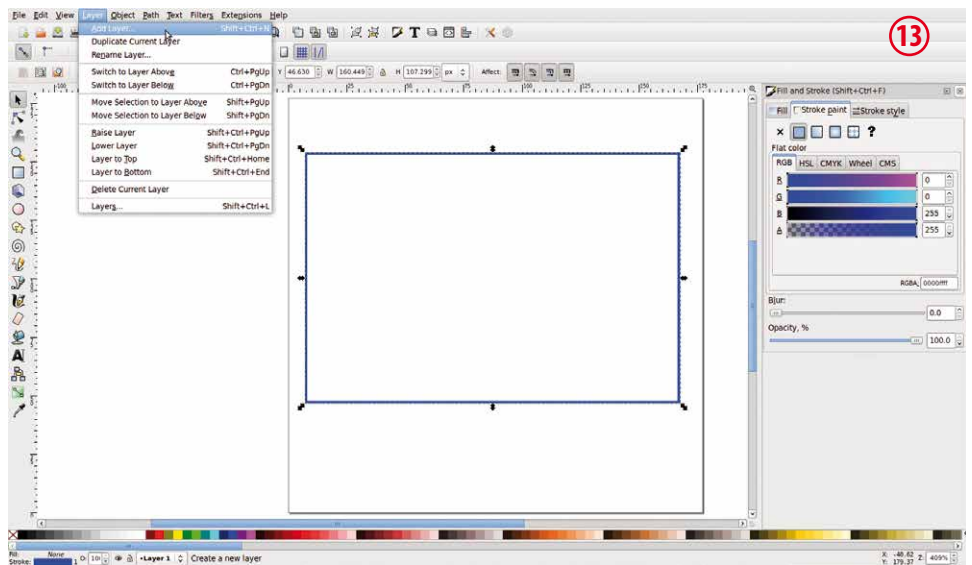
The rectangle must be selected (marked).



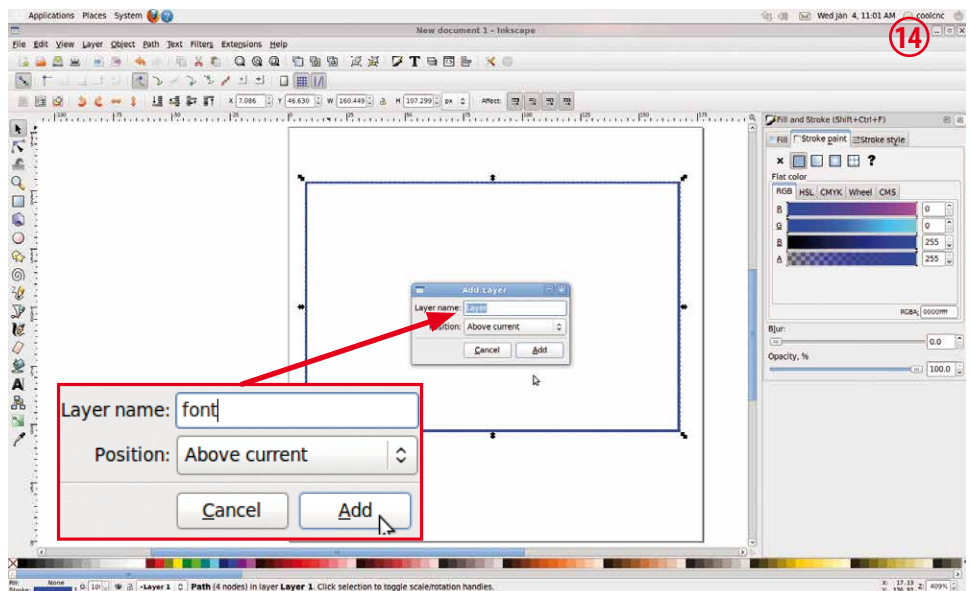
<https://inkscape.org>

Create a new layer for the labeling:

13) click on "Layer" --> "Add Layer".



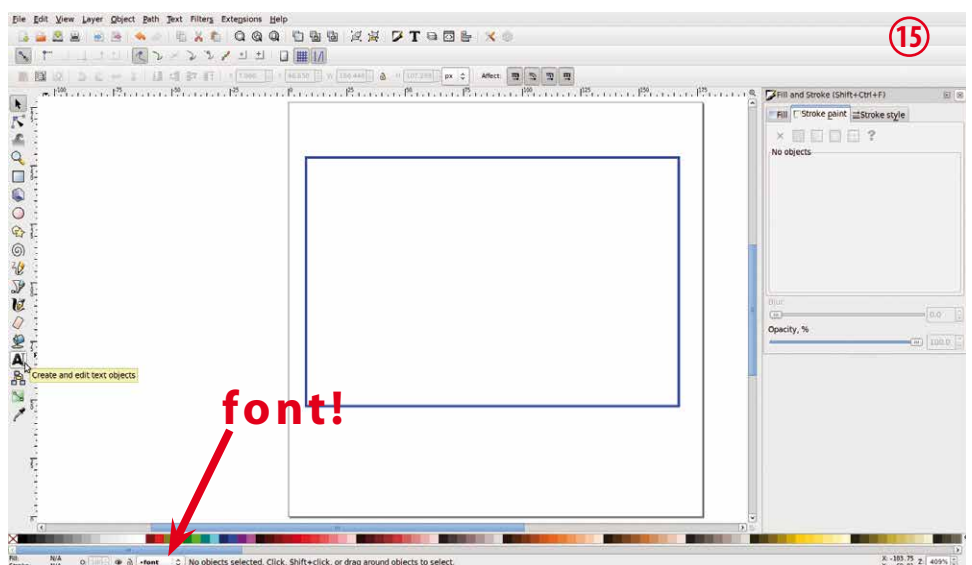
14) enter following name for the layer "font", then click on "Add".



15) click on "A" icon "Create and edit text objects".

Attention:

Layer "font" must be activated.

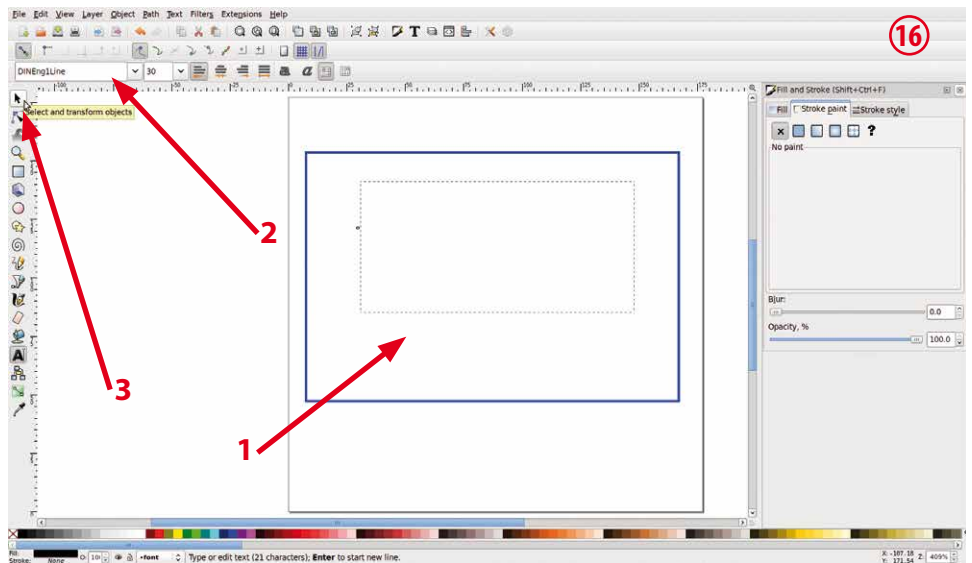


<https://inkscape.org>

16) click into the blue rectangle, then select a (Single Line Fonts) - for example "DINEng1Line". Write your text - for example:

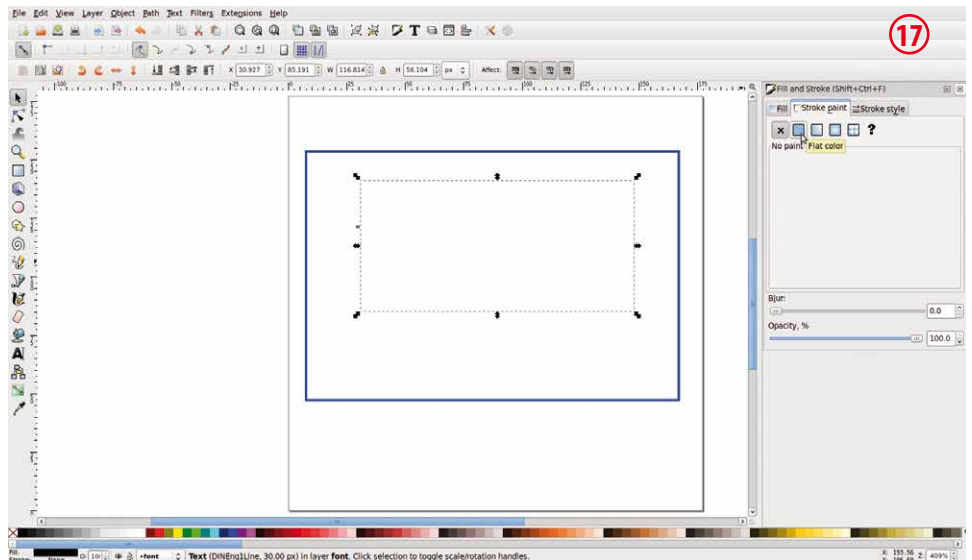
**The Cool Tool**  
**CoolCNC**

After that click on the arrow icon "Select and transform objects".

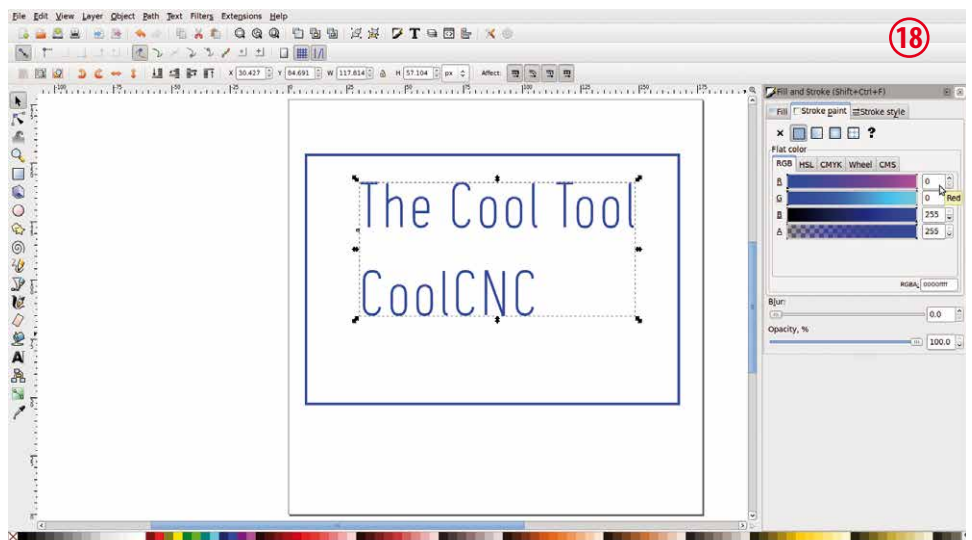


17) click on "Stroke paint" --> "Flat color".

Attention:  
The text field must be activated (marked).



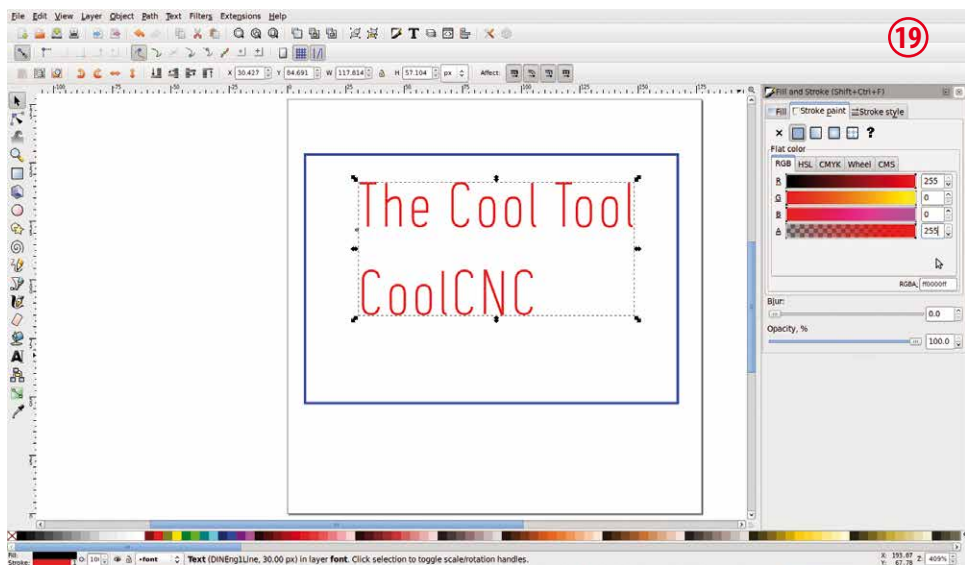
18) click on "red"



<https://inkscape.org>

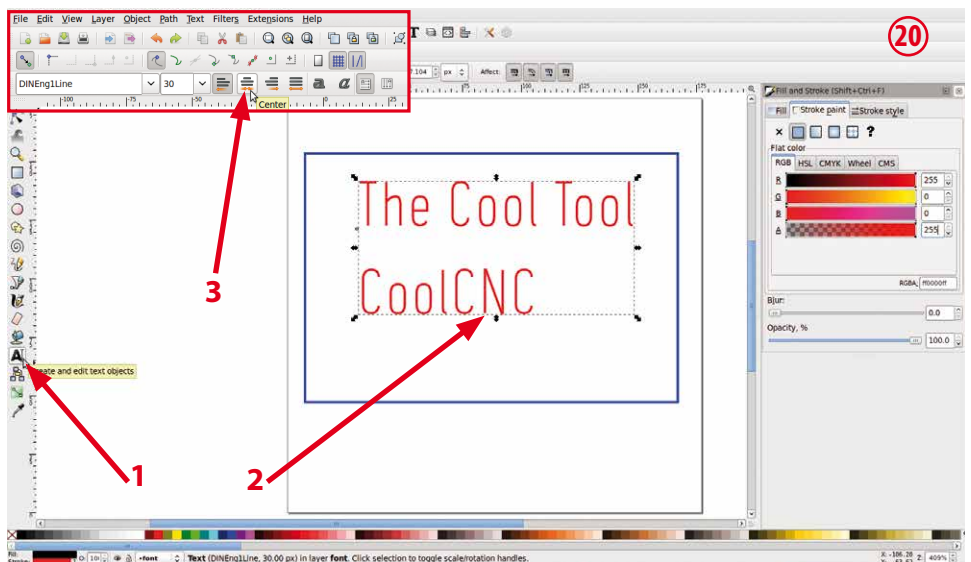
19) enter "255" then click on "blue" and change value to "0" and press "Enter".

Attention:  
The text field must be activated (marked).

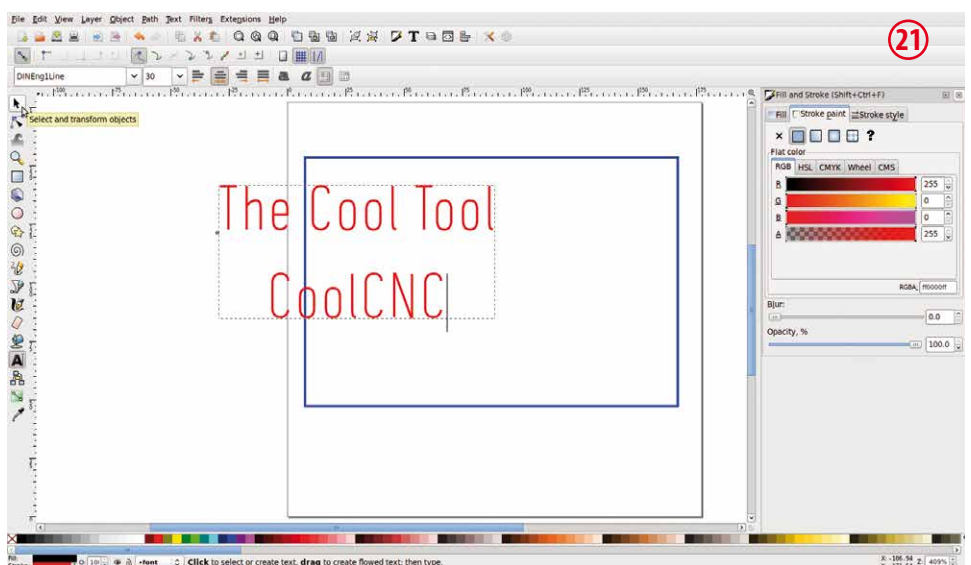


20) click on "A" icon "Create and edit text objects", then click into the text field (The Cool Tool ...).

After that click on "Center".



21) click on the arrow icon "Select and transform objects".

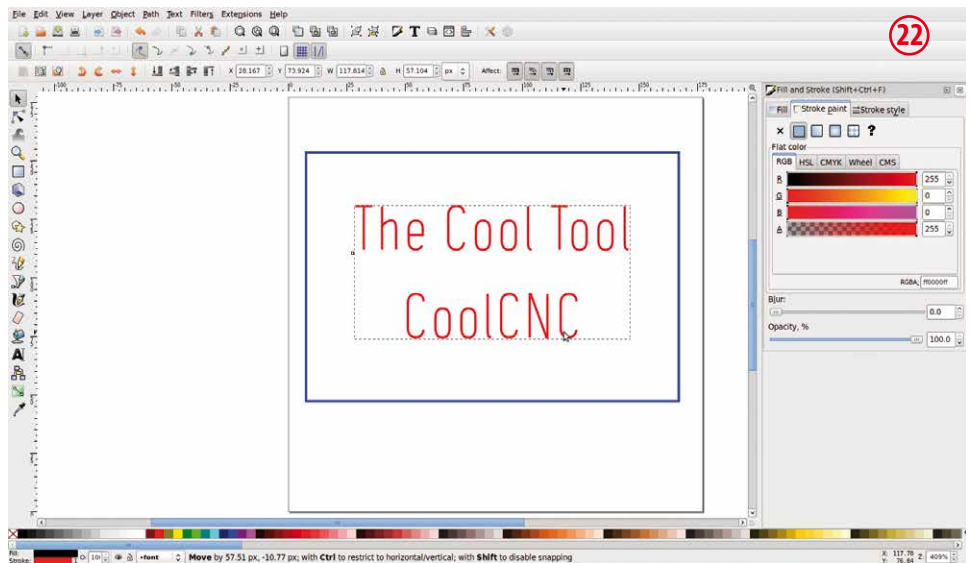


<https://inkscape.org>

22) select the text field and place it in the middle of the blue rectangle.

Attention:

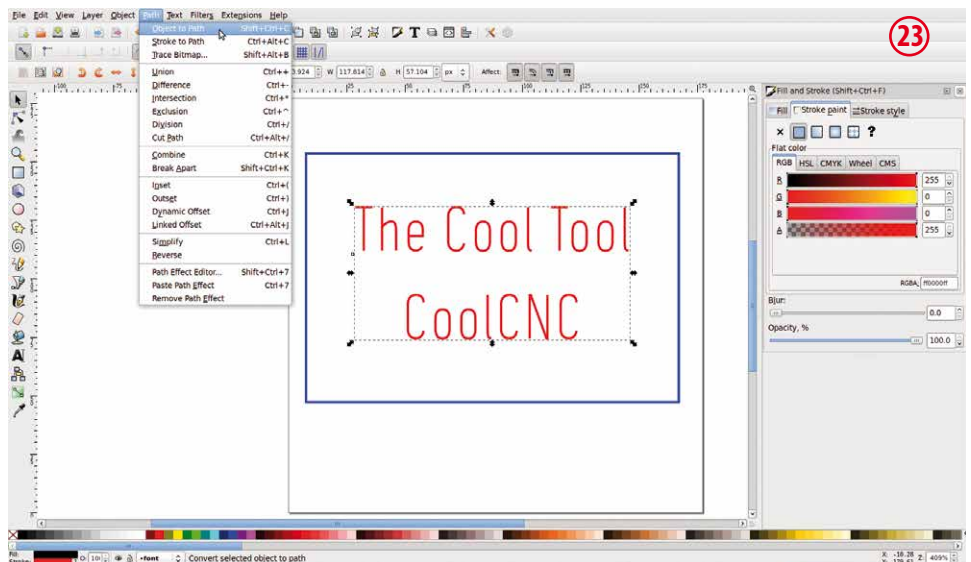
Please take care that the blue rectangle is at the center of the raw material. If it is not at the center, select the blue rectangle and the text field and place it again.



23) click on "Path" --> "Object to Path" (vector). Now the font is converted to a vector graphic.

Attention:

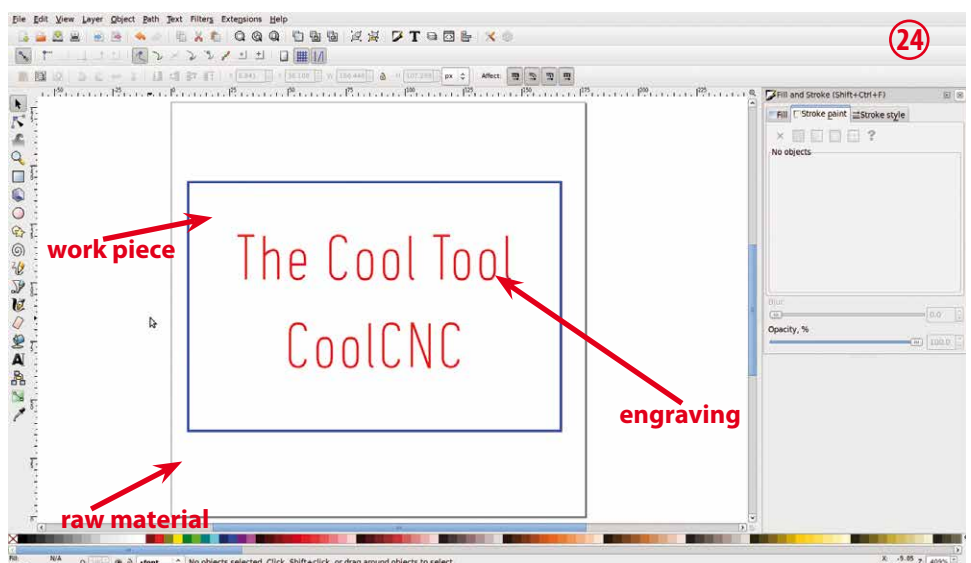
The text field must be activated (marked).



24) Why two layers?

For each cutting depth you need a separate layer. Here we have two different depths:

- 1) red text: 1.0 mm (engraving)
- 2) blue rectangle: 4.5 mm (raw material 4.0 mm - acrylic)



<https://inkscape.org>

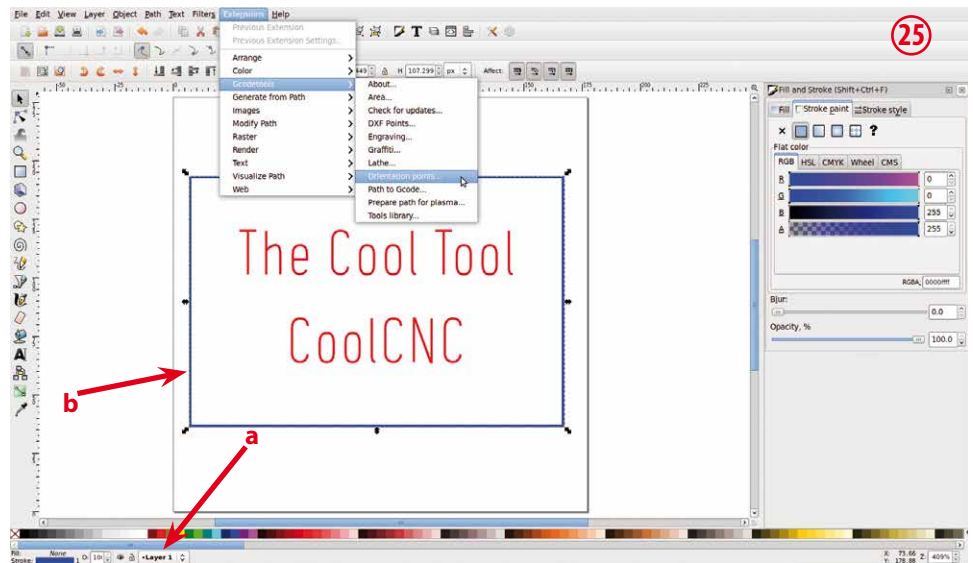
## Gcode Tools®

25) Orientation points  
(zero point for the blue rectangle)

click on "Extensions" --> "Gcode tools" --> "Orientation points ..."

Attention:

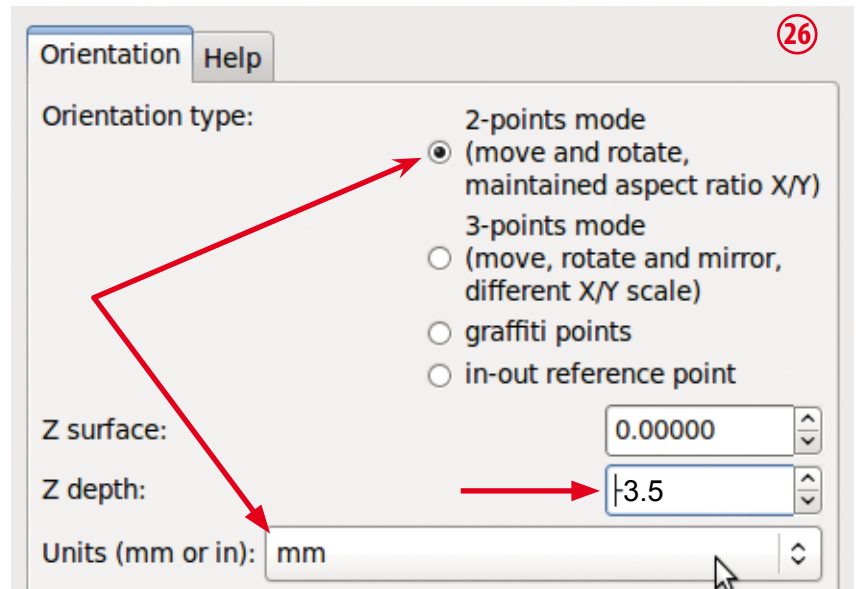
- a) layer "Layer 1" must be activated.
- b) blue rectangle must be selected.



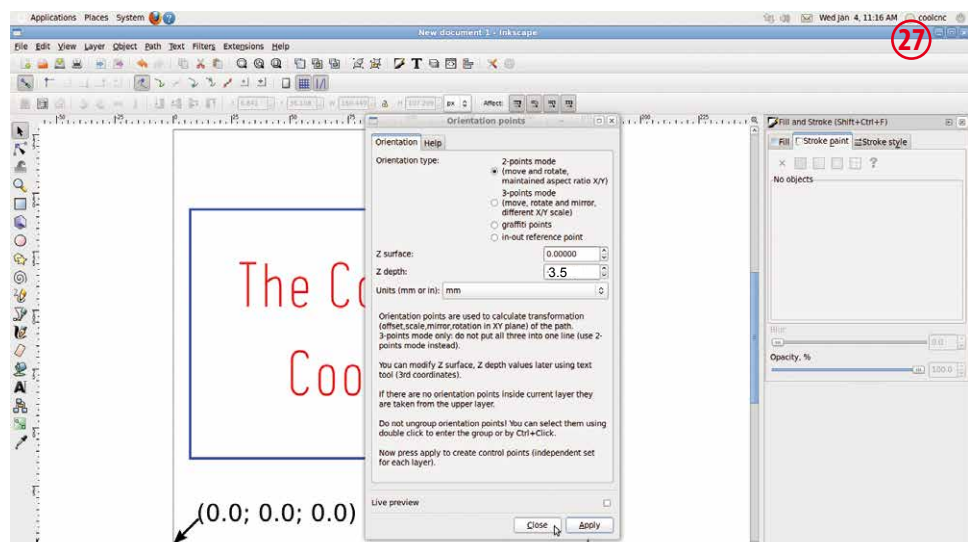
26) select "2-points mode" and  
"mm". enter at "z depth" "-3.5".

Attention:

"z surface" remains "0.0".

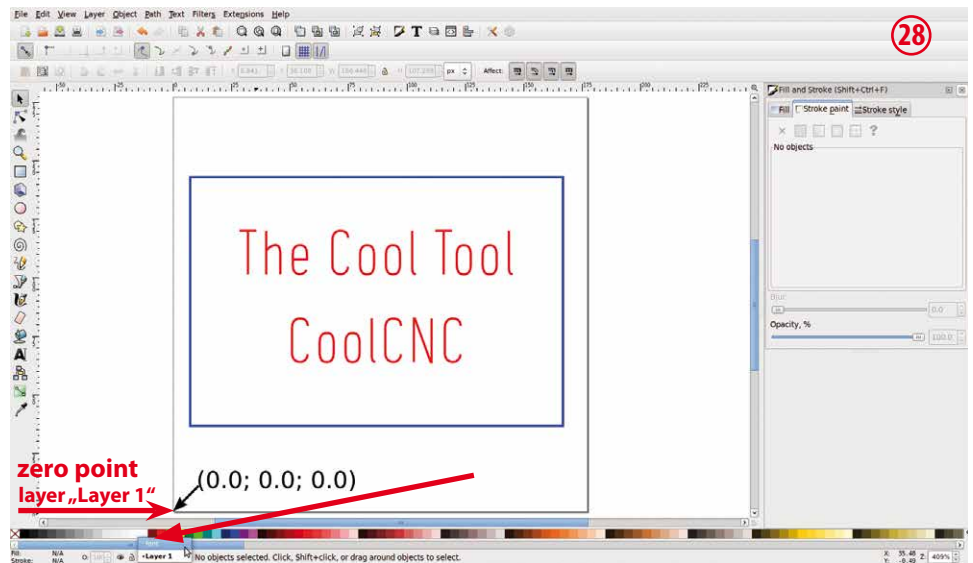


27) click on "Apply" and then  
"Close"



<https://inkscape.org>

28) select the layer "font"

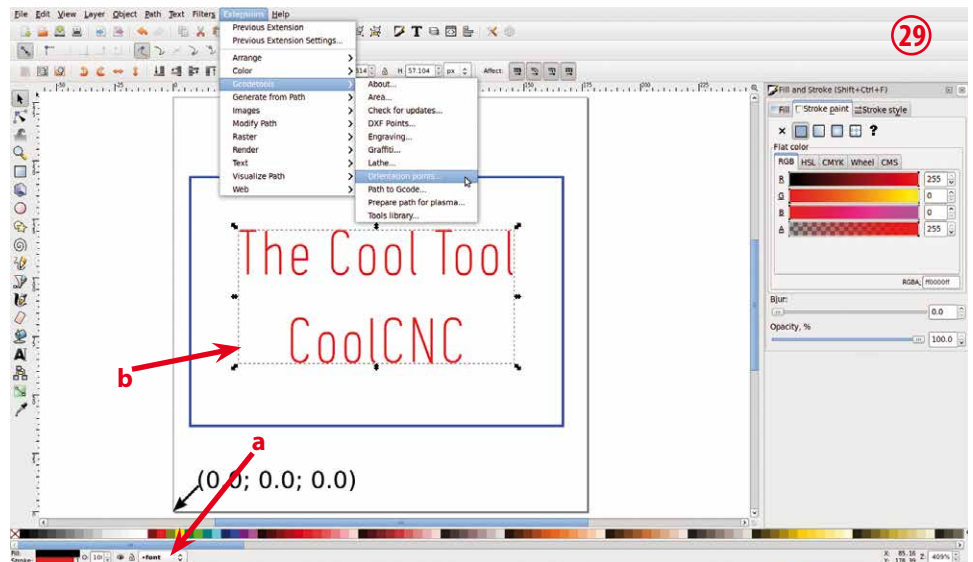


29) Orientation points  
(zero point for the red text)

click on "Extensions" --> "Gcode-  
detools" --> "Orientation points ..."

Attention:

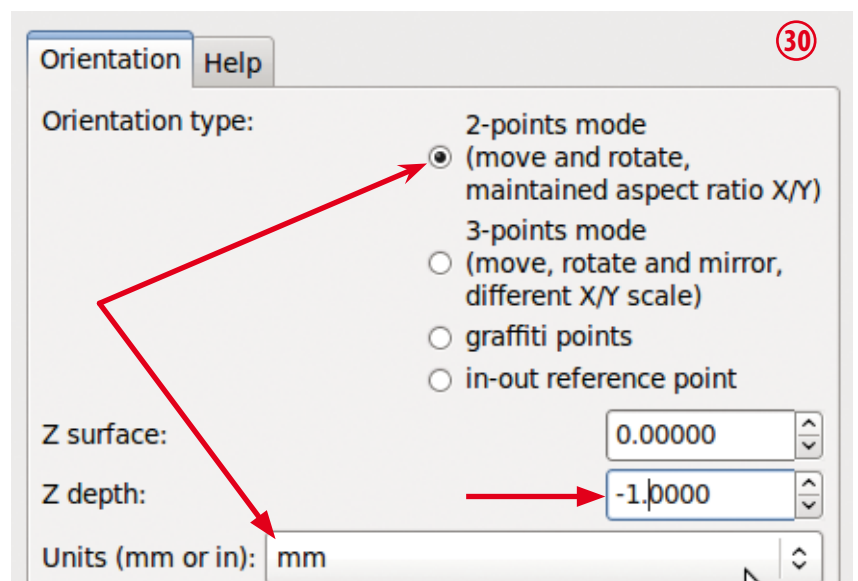
- a) layer "font" must be activated.
- b) red text must be selected.



30) select "2-points mode" and  
"mm". enter at "z depth" "-1.0".

Attention:

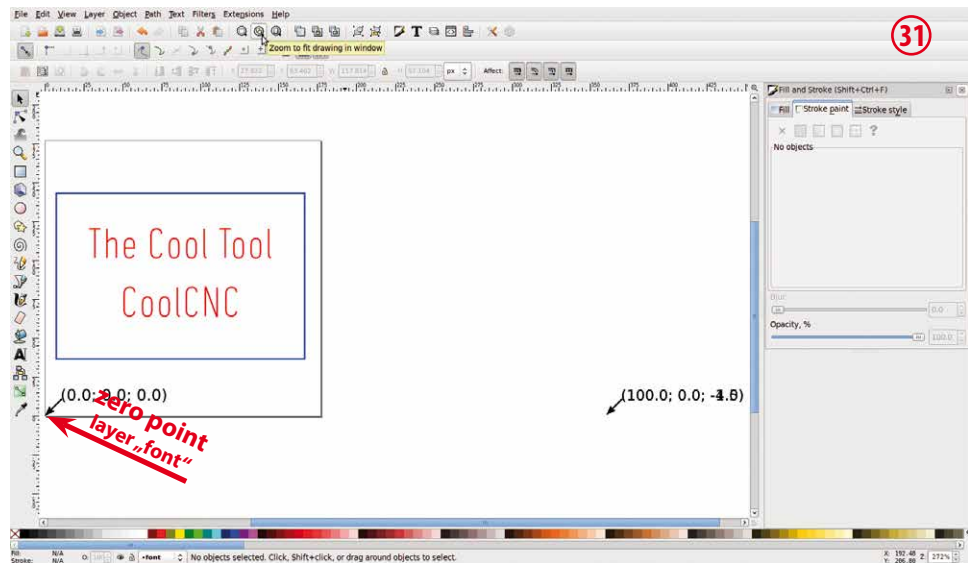
"z surface" remains "0.0".



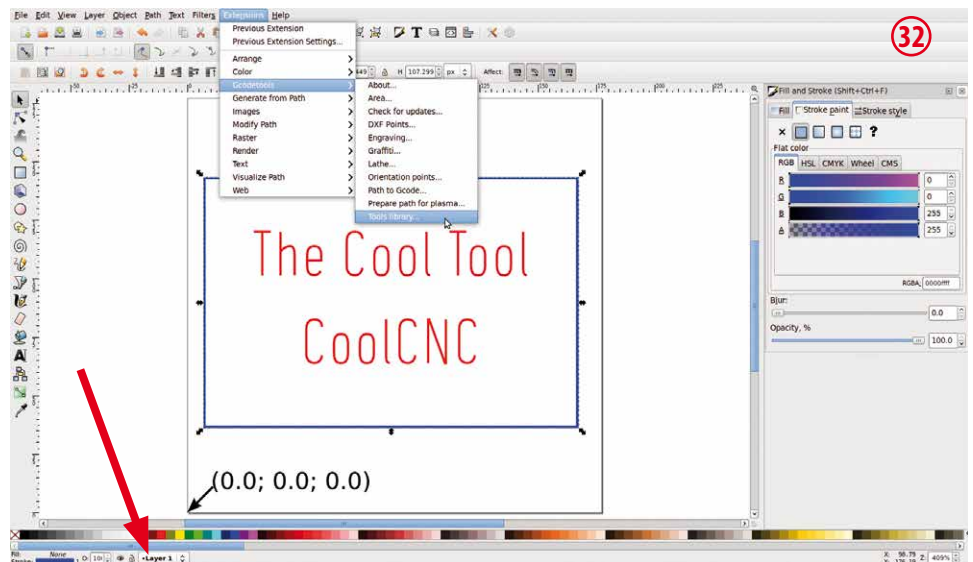
<https://inkscape.org>

31) The position of the zero point for layer "Layer 1" and layer "font" is the same (congruent).

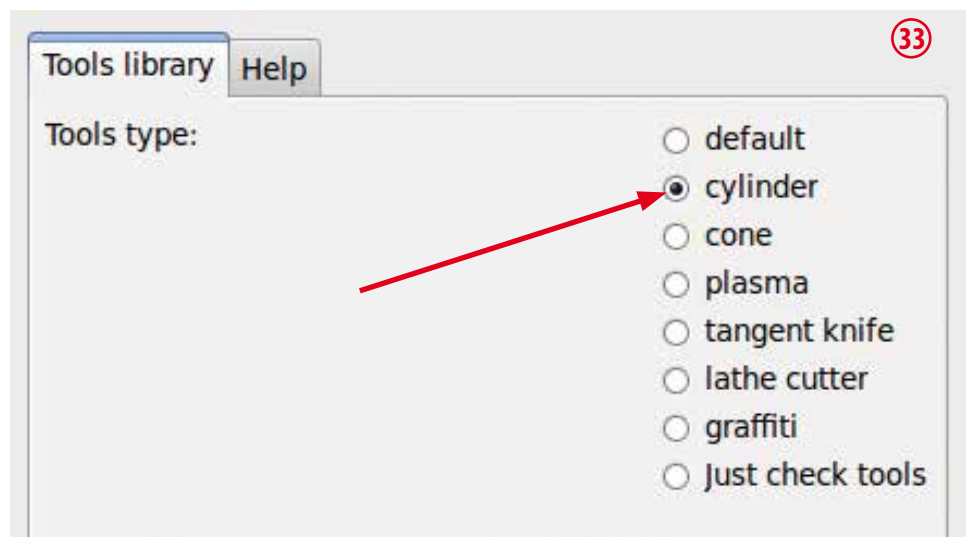
Attention:  
Do not move this point!



32) Tools library  
activate "Layer 1" and select the blue rectangle (marked), then click on "Extensions" --> "Gcodetools" --> "Tools library"

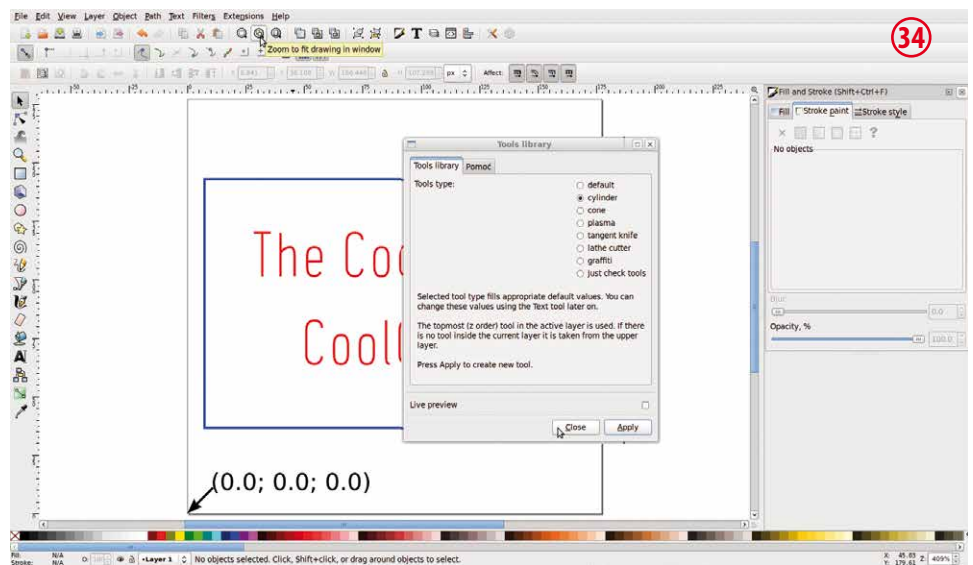


33) select "cylinder"

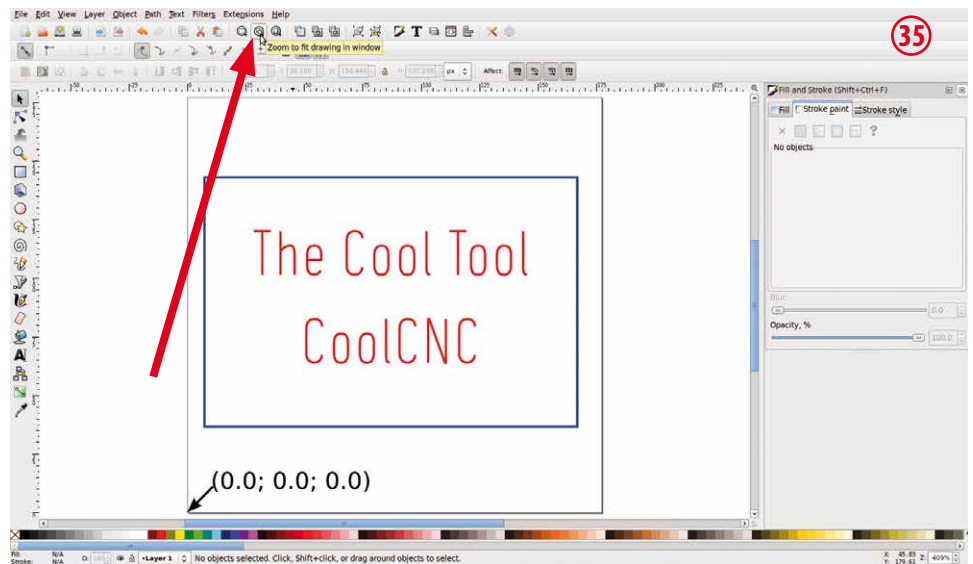


<https://inkscape.org>

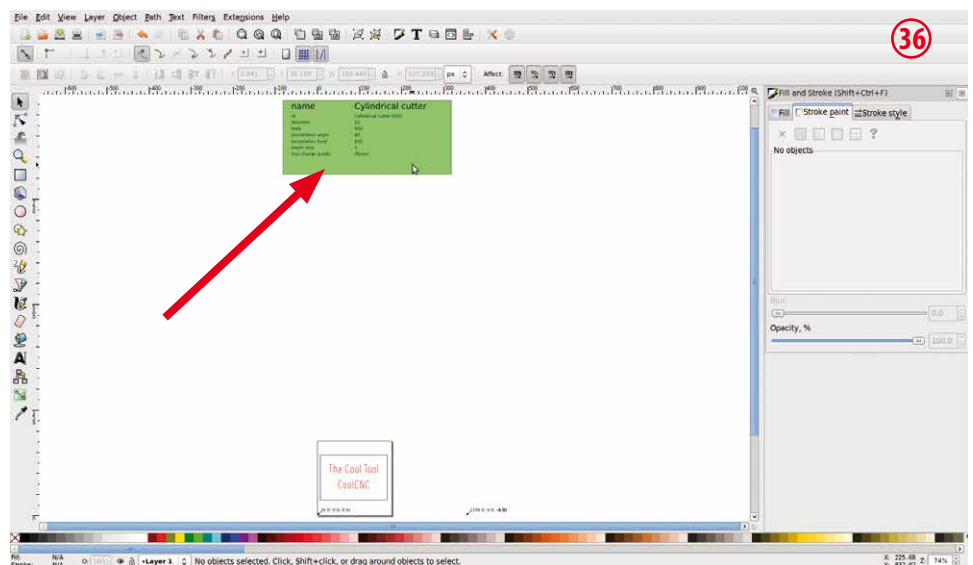
4) click on "Apply" then close the window - click on "Close"



2) click on the magnifier icon  
"Zoom to fit drawing in window"

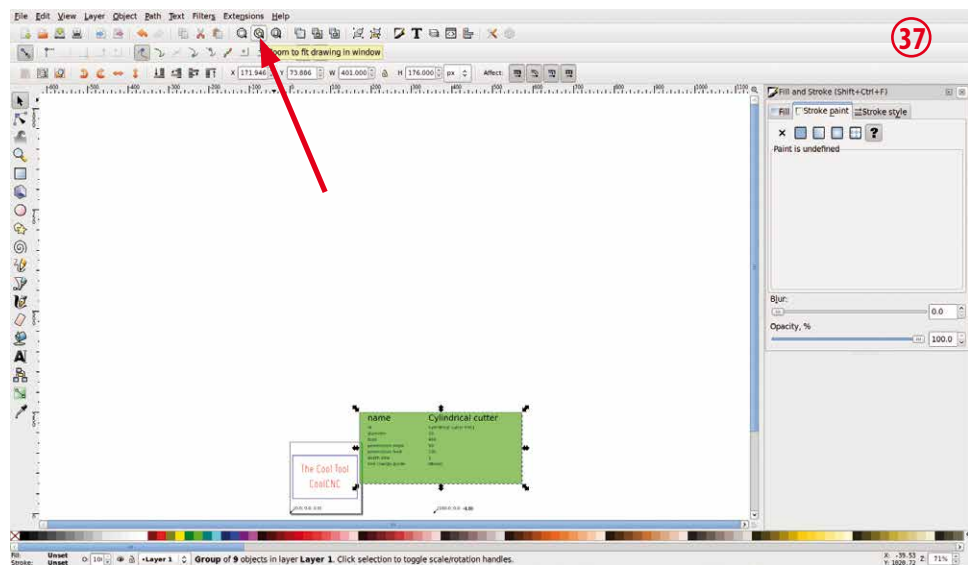


36) now you can see the "Tool window" for "Layer 1".

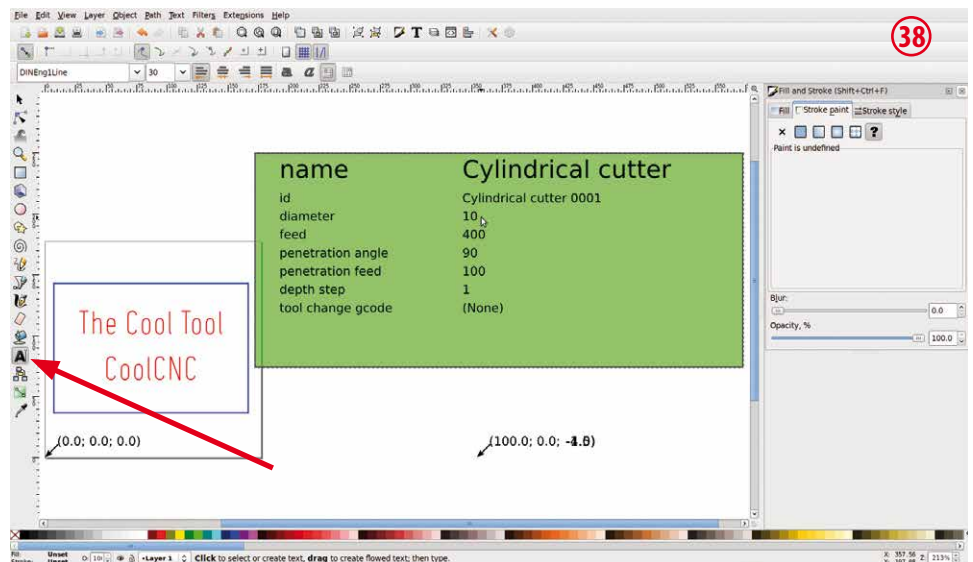


<https://inkscape.org>

37) place the "Tool window" near the blue rectangle, then click on the magnifier icon (Zoom to fit drawing in window).

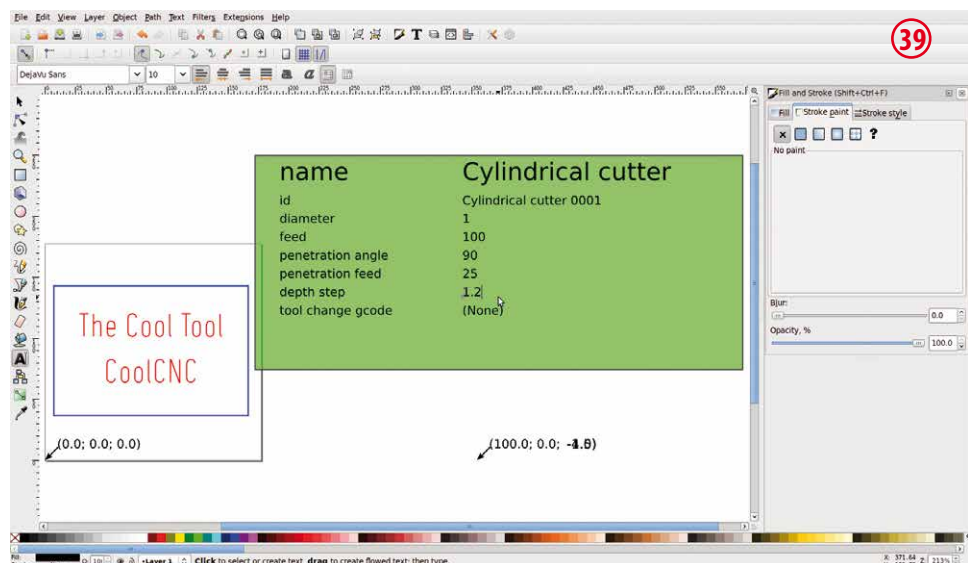


38) click on the "A" icon (Create and edit text objects)



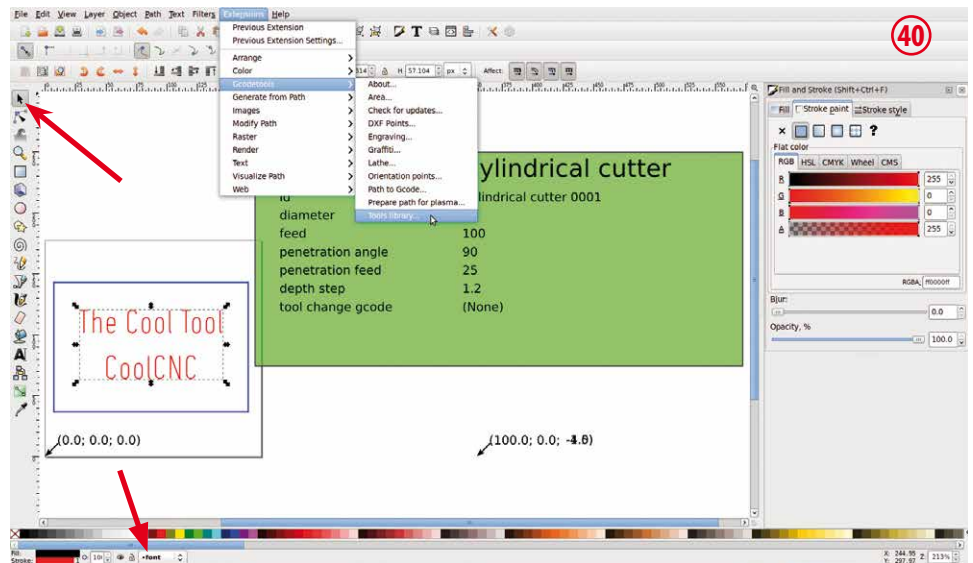
39) edit the following parameters in the "tool window":

diameter = 1  
feed = 100  
penetration feed = 25  
depth step = 1.2

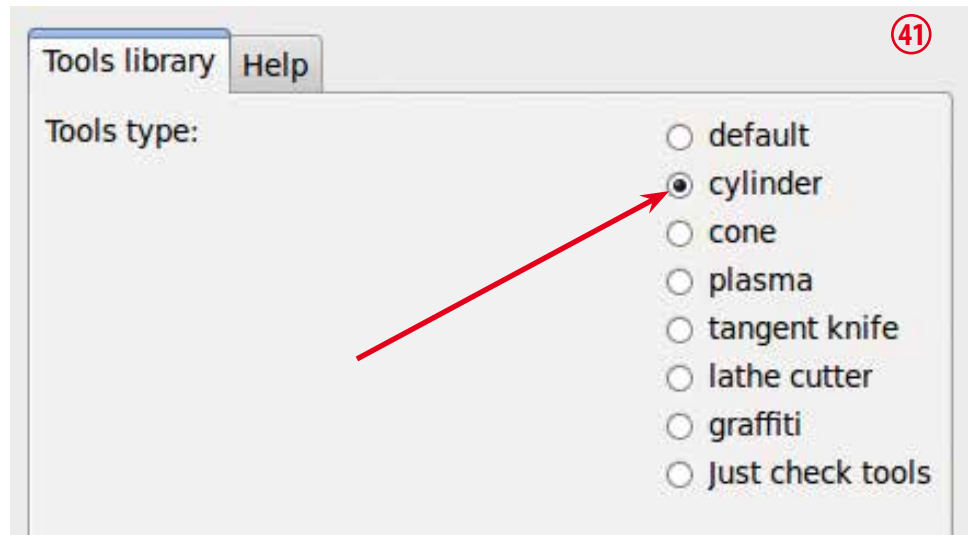


<https://inkscape.org>

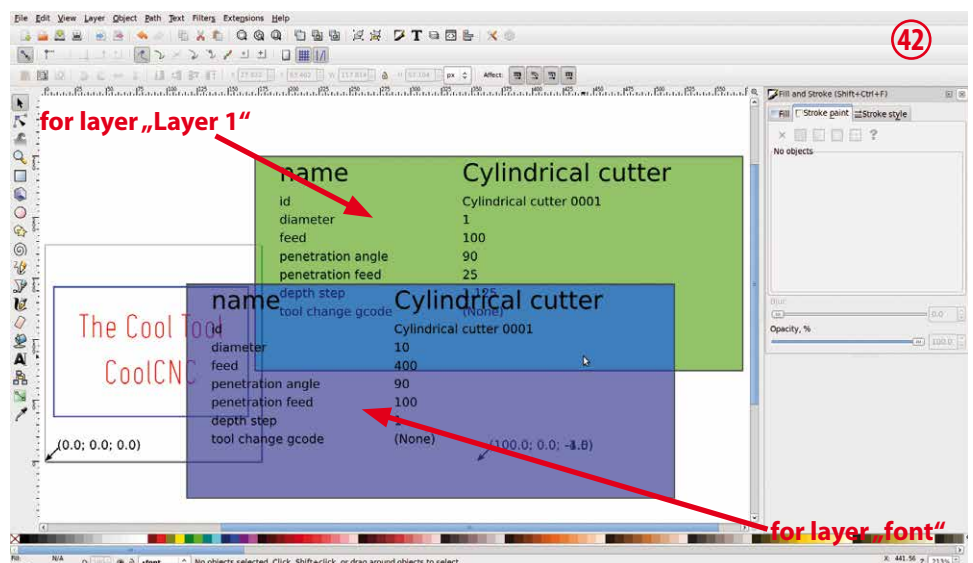
40) activate layer "font" and select the red text (marked), then click on "Extensions" --> "Gcodetools" --> "Tools library"



41) select "cylinder" and click on "Apply" then close the window - click on "Close".



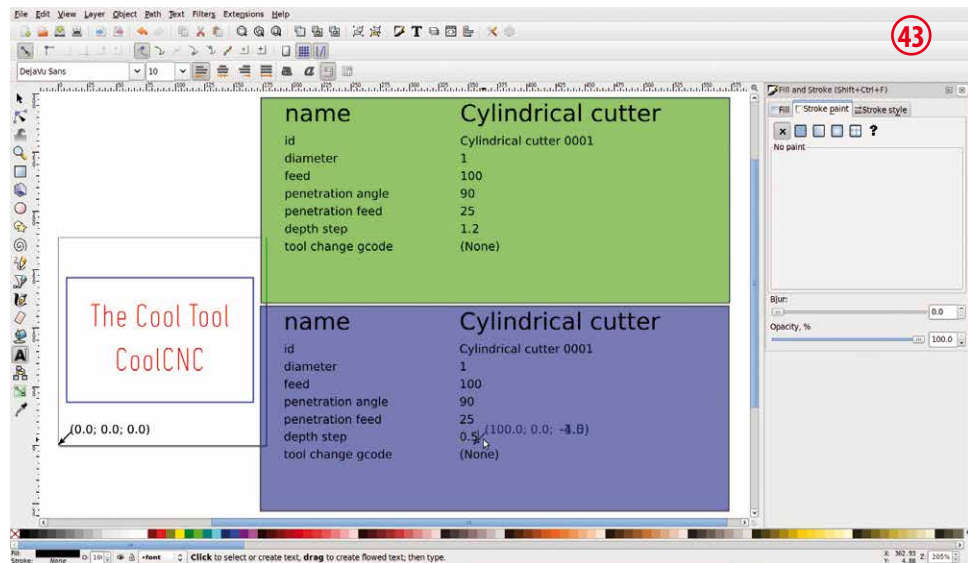
42) the new "Tool window" (window for layer "font") is magenta.



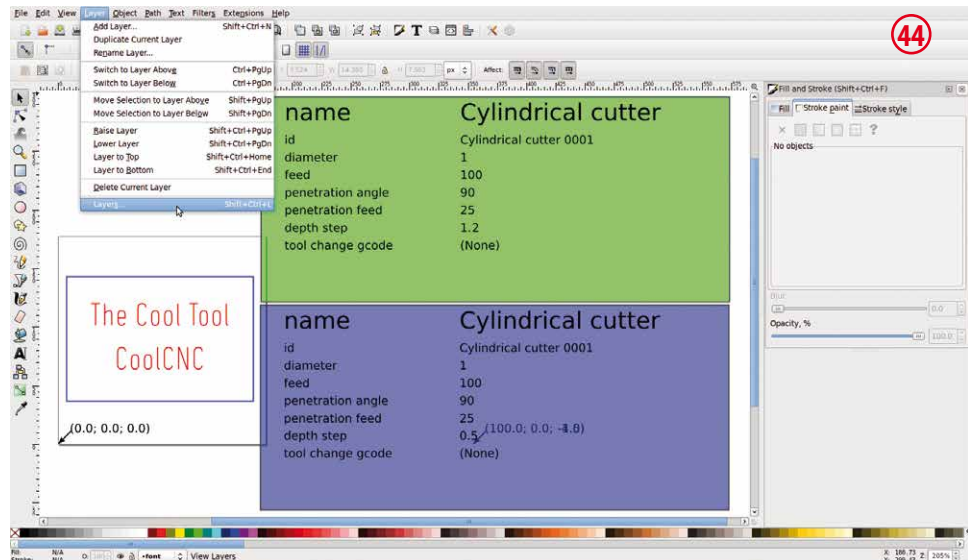
<https://inkscape.org>

43) click on the "A" icon (Create and edit text objects) and edit following parameters:

diameter = 1  
feed = 100  
penetration feed = 25  
depth step = 0.5

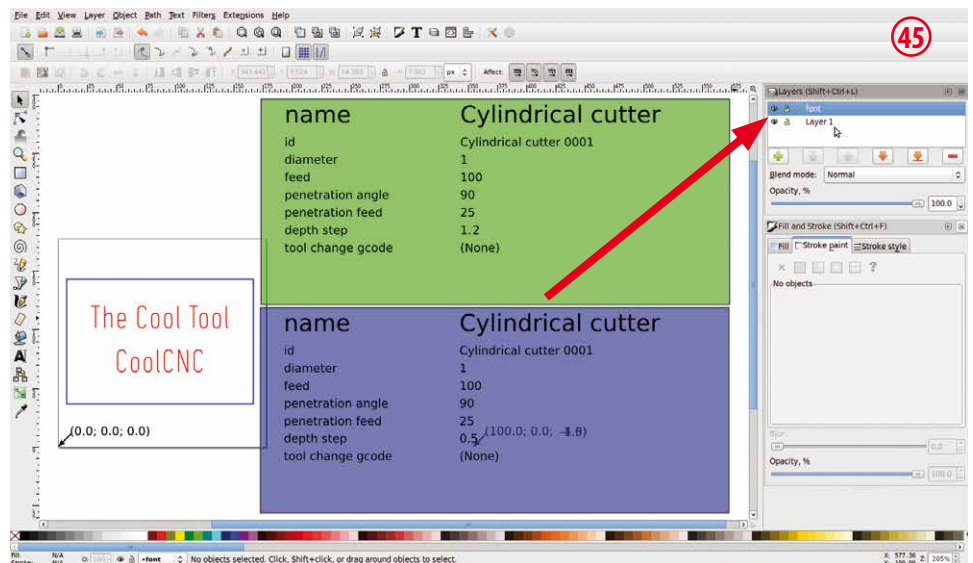


44) check the order of the layers. click on "Layer" --> "Layers ...".



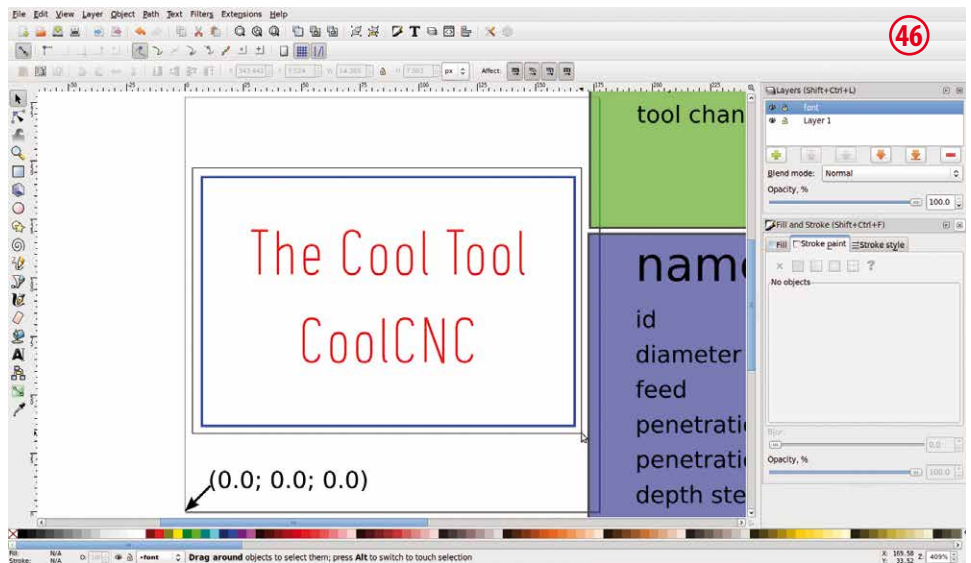
45) correct order: 1) font  
2) Layer 1

If the order isn't correct, you can change the order. Select one of the two layers and then move it (with the arrows) up or down.

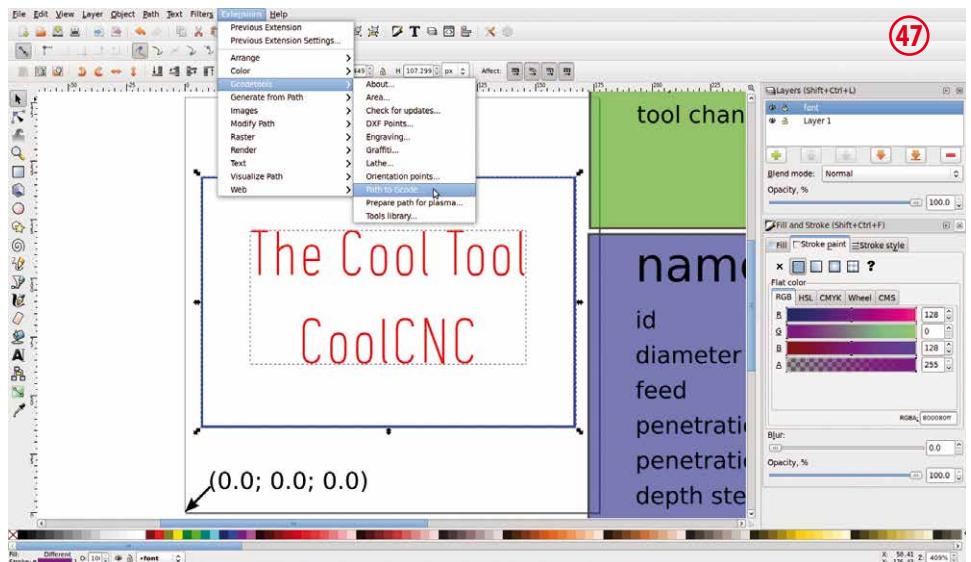


<https://inkscape.org>

46) click on the arrow icon "Select and transform objects", then select the engraving (red text) and the work piece (blue rectangle).



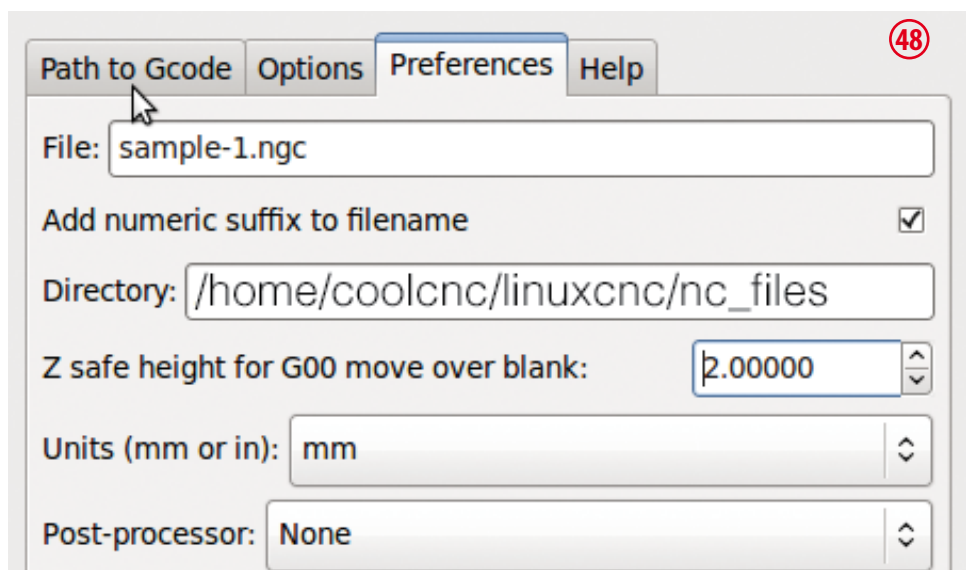
47) click on "Extensions" --> "Gcode Tools" --> "Path to Gcode ...".



48) click on "Preferences" and enter following parameters:

File: **sample-1.ngc**  
Add numeric..... **"activate"** ☒  
Directory: **/home/coolcnc/linuxcnc/nc\_files**  
("coolcnc" = username)  
Z safe height .... **2.00**  
Units **mm**  
Post-processor **None**

click on "Path to Gcode"!

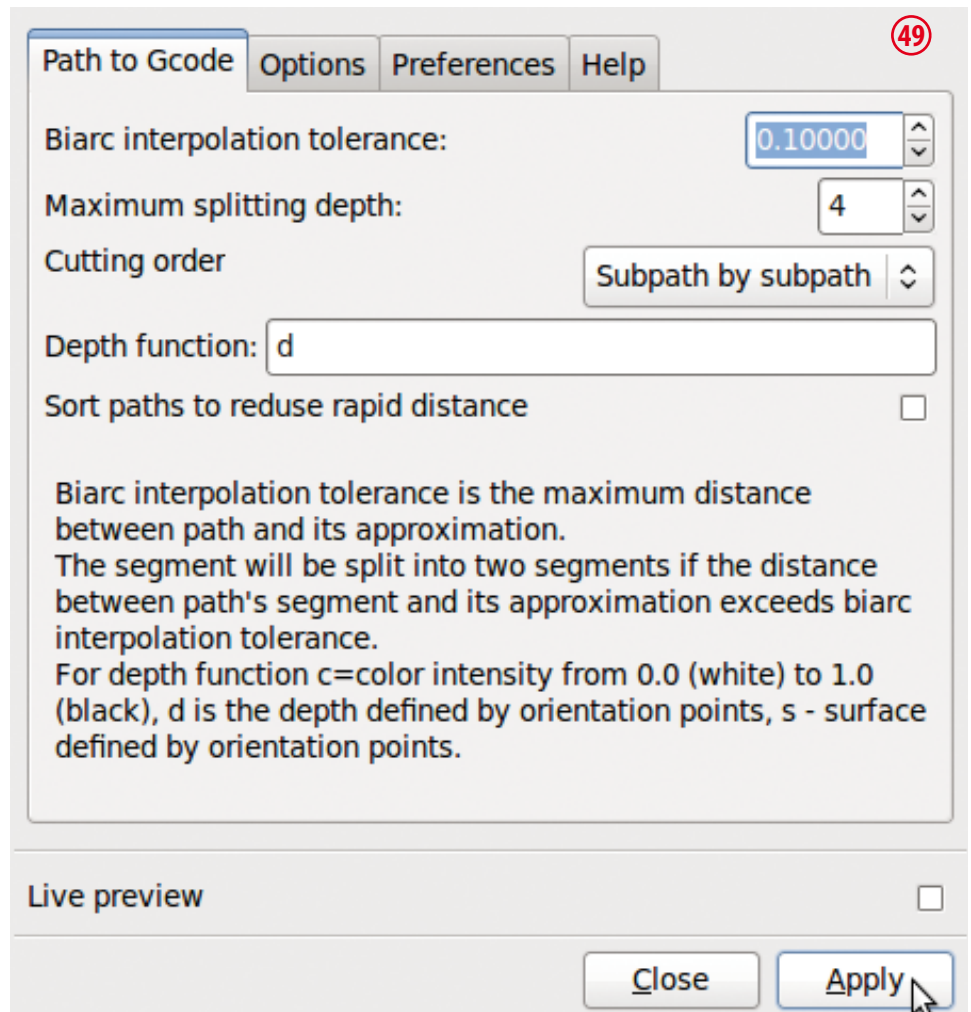


<https://inkscape.org>

49) check the parameters:

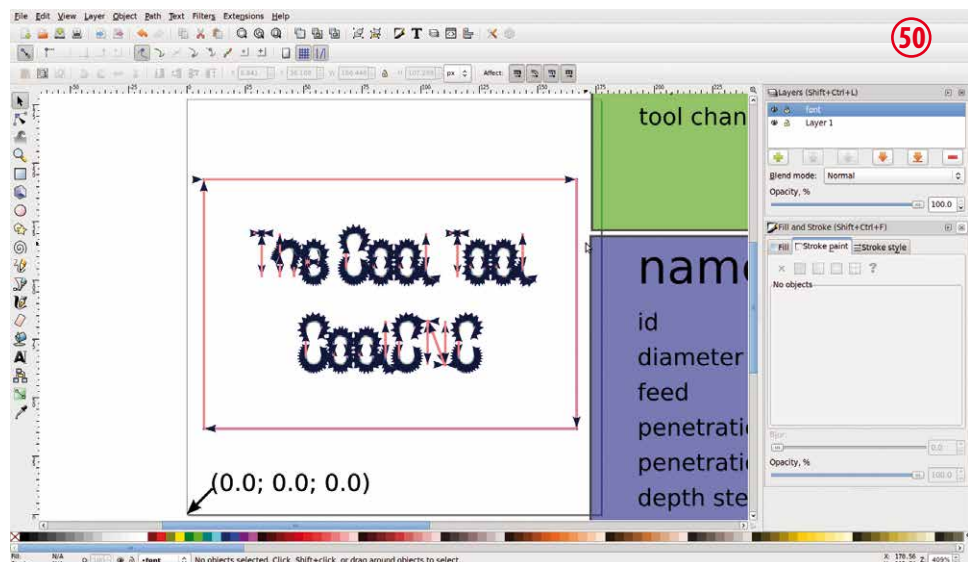
Biarc inter..... **0.100**  
 Maximum splitting **4**  
 Cutting order  
**subpath by subpath**  
 Depth funktion: **d**

click on "Apply" and then close the window- click on "Close"!



50) finished!

Now you can save the Inkscape file (click on "File" --> "Save"), after that you can close Inkscape®.



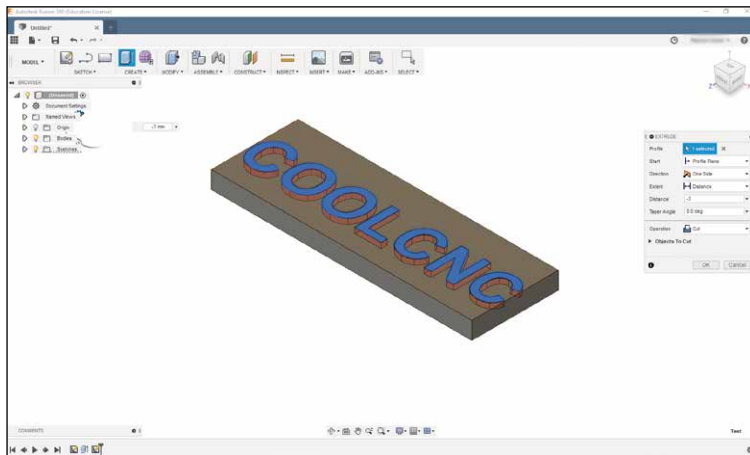
51) Open the generated G-Code file in CETUS (UNI-FRAES-V3).

<https://www.autodesk.com/products/fusion-360/students-teachers-educators>

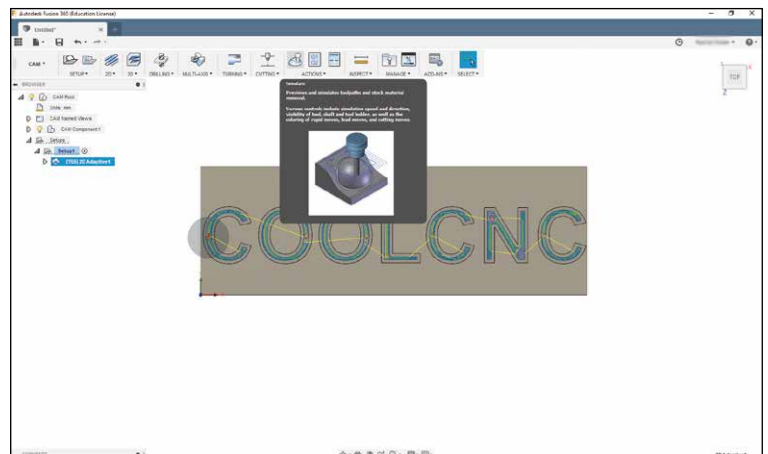
Fusion 360 is a professional 3D CAD/CAM software for which AUTODESK offers free licenses for education.

Advanced designs, 2.5D drawings or 3D models can be constructed, the CAM functionality allows for generating G-code files.

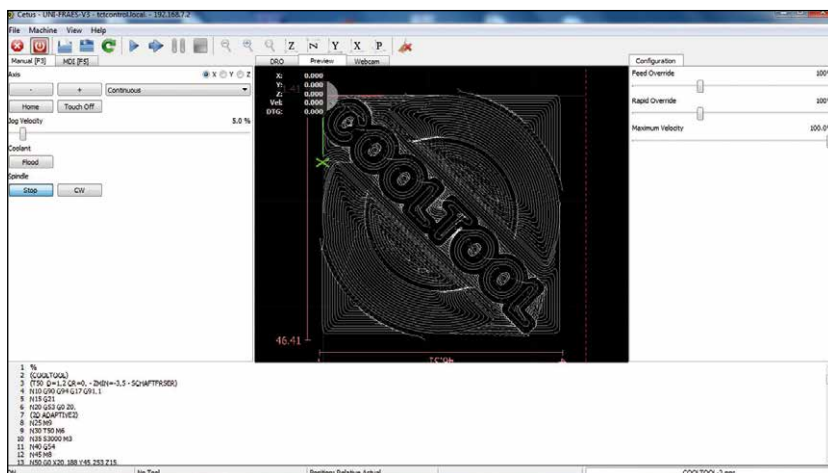
**Suitable post-processors and tool-tables make it compatible to the Machinekit CNC software.**



**Fusion 360 - CAD**  
(design process)



**Fusion 360 - CAM**  
(set machining parameters)



**Cetus - machinekit**  
(loaded G-Code)

Autodesk® Inventor® can also be used.

Cetus - UNI-FRAES-4 - tctcontrol.local. - 192.168.7.2

File Machine View Help

Manual [F3] MDI [F5]

Axis X Y Z A

- + Continuous

Home Touch Off

Jog Velocity 88.1 %

Coolant

Flood

Spindle

Stop CW

1 2 3 4 5 6 7 8

9 10 11 12 13 14 15 16

17 18 19 20 21 22 23 24

25 26 27 28 29 30 31 32

33 34 35 36 37 38 39 40

41 42 43 44 45 46 47 48

49 50 51 52 53 54 55 56

57 58 59 60 61 62 63 64

65 66 67 68 69 70 71 72

73 74 75 76 77 78 79 80

81 82 83 84 85 86 87 88

89 90 91 92 93 94 95 96

97 98 99 100 101 102 103 104

105 106 107 108 109 110 111 112

113 114 115 116 117 118 119 120

121 122 123 124 125 126 127 128

129 130 131 132 133 134 135 136

137 138 139 140 141 142 143 144

145 146 147 148 149 150 151 152

153 154 155 156 157 158 159 160

161 162 163 164 165 166 167 168

169 170 171 172 173 174 175 176

177 178 179 180 181 182 183 184

185 186 187 188 189 190 191 192

193 194 195 196 197 198 199 200

201 202 203 204 205 206 207 208

209 210 211 212 213 214 215 216

217 218 219 220 221 222 223 224

225 226 227 228 229 230 231 232

233 234 235 236 237 238 239 240

241 242 243 244 245 246 247 248

249 250 251 252 253 254 255 256

257 258 259 260 261 262 263 264

265 266 267 268 269 270 271 272

273 274 275 276 277 278 279 280

281 282 283 284 285 286 287 288

289 290 291 292 293 294 295 296

297 298 299 300 301 302 303 304

305 306 307 308 309 310 311 312

313 314 315 316 317 318 319 320

321 322 323 324 325 326 327 328

329 330 331 332 333 334 335 336

337 338 339 340 341 342 343 344

345 346 347 348 349 350 351 352

353 354 355 356 357 358 359 360

361 362 363 364 365 366 367 368

369 370 371 372 373 374 375 376

377 378 379 380 381 382 383 384

385 386 387 388 389 390 391 392

393 394 395 396 397 398 399 400

401 402 403 404 405 406 407 408

409 410 411 412 413 414 415 416

417 418 419 420 421 422 423 424

425 426 427 428 429 430 431 432

433 434 435 436 437 438 439 440

441 442 443 444 445 446 447 448

449 450 451 452 453 454 455 456

457 458 459 460 461 462 463 464

465 466 467 468 469 470 471 472

473 474 475 476 477 478 479 480

481 482 483 484 485 486 487 488

489 490 491 492 493 494 495 496

497 498 499 500 501 502 503 504

505 506 507 508 509 510 511 512

513 514 515 516 517 518 519 520

521 522 523 524 525 526 527 528

529 530 531 532 533 534 535 536

537 538 539 540 541 542 543 544

545 546 547 548 549 550 551 552

553 554 555 556 557 558 559 560

561 562 563 564 565 566 567 568

569 570 571 572 573 574 575 576

577 578 579 580 581 582 583 584

585 586 587 588 589 590 591 592

593 594 595 596 597 598 599 600

601 602 603 604 605 606 607 608

609 610 611 612 613 614 615 616

617 618 619 620 621 622 623 624

625 626 627 628 629 630 631 632

633 634 635 636 637 638 639 640

641 642 643 644 645 646 647 648

649 650 651 652 653 654 655 656

657 658 659 660 661 662 663 664

665 666 667 668 669 670 671 672

673 674 675 676 677 678 679 680

681 682 683 684 685 686 687 688

689 690 691 692 693 694 695 696

697 698 699 700 701 702 703 704

705 706 707 708 709 710 711 712

713 714 715 716 717 718 719 720

721 722 723 724 725 726 727 728

729 730 731 732 733 734 735 736

737 738 739 740 741 742 743 744

745 746 747 748 749 750 751 752

753 754 755 756 757 758 759 760

761 762 763 764 765 766 767 768

769 770 771 772 773 774 775 776

777 778 779 780 781 782 783 784

785 786 787 788 789 790 791 792

793 794 795 796 797 798 799 800

801 802 803 804 805 806 807 808

809 810 811 812 813 814 815 816

817 818 819 820 821 822 823 824

825 826 827 828 829 830 831 832

833 834 835 836 837 838 839 840

841 842 843 844 845 846 847 848

849 850 851 852 853 854 855 856

857 858 859 860 861 862 863 864

865 866 867 868 869 870 871 872

873 874 875 876 877 878 879 880

881 882 883 884 885 886 887 888

889 890 891 892 893 894 895 896

897 898 899 900 901 902 903 904

905 906 907 908 909 910 911 912

913 914 915 916 917 918 919 920

921 922 923 924 925 926 927 928

929 930 931 932 933 934 935 936

937 938 939 940 941 942 943 944

945 946 947 948 949 950 951 952

953 954 955 956 957 958 959 960

961 962 963 964 965 966 967 968

969 970 971 972 973 974 975 976

977 978 979 980 981 982 983 984

985 986 987 988 989 990 991 992

993 994 995 996 997 998 999 1000

1001 1002 1003 1004 1005 1006 1007 1008

1009 1010 1011 1012 1013 1014 1015 1016

1017 1018 1019 1020 1021 1022 1023 1024

1025 1026 1027 1028 1029 1030 1031 1032

1033 1034 1035 1036 1037 1038 1039 1040

1041 1042 1043 1044 1045 1046 1047 1048

1049 1050 1051 1052 1053 1054 1055 1056

1057 1058 1059 1060 1061 1062 1063 1064

1065 1066 1067 1068 1069 1070 1071 1072

1073 1074 1075 1076 1077 1078 1079 1080

1081 1082 1083 1084 1085 1086 1087 1088

1089 1090 1091 1092 1093 1094 1095 1096

1097 1098 1099 1100 1101 1102 1103 1104

1105 1106 1107 1108 1109 1110 1111 1112

1113 1114 1115 1116 1117 1118 1119 1120

1121 1122 1123 1124 1125 1126 1127 1128

1129 1130 1131 1132 1133 1134 1135 1136

1137 1138 1139 1140 1141 1142 1143 1144

1145 1146 1147 1148 1149 1150 1151 1152

1153 1154 1155 1156 1157 1158 1159 1160

1161 1162 1163 1164 1165 1166 1167 1168

1169 1170 1171 1172 1173 1174 1175 1176

1177 1178 1179 1180 1181 1182 1183 1184

1185 1186 1187 1188 1189 1190 1191 1192

1193 1194 1195 1196 1197 1198 1199 1200

1201 1202 1203 1204 1205 1206 1207 1208

1209 1210 1211 1212 1213 1214 1215 1216

1217 1218 1219 1220 1221 1222 1223 1224

1225 1226 1227 1228 1229 1230 1231 1232

1233 1234 1235 1236 1237 1238 1239 1240

1241 1242 1243 1244 1245 1246 1247 1248

1249 1250 1251 1252 1253 1254 1255 1256

1257 1258 1259 1260 1261 1262 1263 1264

1265 1266 1267 1268 1269 1270 1271 1272

1273 1274 1275 1276 1277 1278 1279 1280

1281 1282 1283 1284 1285 1286 1287 1288

1289 1290 1291 1292 1293 1294 1295 1296

1297 1298 1299 1300 1301 1302 1303 1304

1305 1306 1307 1308 1309 1310 1311 1312

1313 1314 1315 1316 1317 1318 1319 1320

1321 1322 1323 1324 1325 1326 1327 1328

1329 1330 1331 1332 1333 1334 1335 1336

1337 1338 1339 1340 1341 1342 1343 1344

1345 1346 1347 1348 1349 1350 1351 1352

1353 1354 1355 1356 1357 1358 1359 1360

1361 1362 1363 1364 1365 1366 1367 1368

1369 1370 1371 1372 1373 1374 1375 1376