

LASERCUTTER

INSTRUCTION MANUAL

AND

MATERIALS & SPEEDS GUIDE



A digital version of this tutorial can be found at: <http://www.fablab-brussels.be/fablab-english/tutorials/>

Please do not remove the physical copy from the lab.

Version 2021-02-26 – fablab@vub.be

REFERENCE SHEET

MACHINE SPECS

Focus height: 11 mm

Bed size: 1200 x 800 mm

Stock sheet size plexi: 1000 x 800 mm

We cut max 6 mm in plywood. Up to 1 cm in thickness in plexiglass.

FILETYPE NEEDED FOR LASERS

Filetype: DXF

From AutoCAD: export as DXF r14

From inventor: Use "Export face as" feature or make a drawing. Export as DXF. Under options choose File Version "Acad 2000" or "Autocad r12"
Optionally import DXF in AutoCAD to do a layout.

From illustrator: Use DXF. We do not get good results with ai-files

MATERIAL PRICE LIST/LASERCUTTING SPEED AND POWER

NOTE:

The software does not support Splines.

When you save to an old DXF-version all lines automatically get converted to splines, and your file will import ok.

MATERIAL	DIMENSION	PRICE	CUTTING		ENGRAVING		
			SPEED	POWER		SPEED	POWER
MDF 3 MM	800x1000 MM	€ 5	15-24 mm/s	90%	LIGHT	+/- 250mm/s	20%
MDF 4 MM	800x1000 MM	€ 5	8-14 mm/s	90%	MEDIUM	+/- 200mm/s	25%
BIRCH 3 MM	750x1000 MM	€ 12	12-25 mm/s	90%	HEAVY	+/- 150mm/s	30%
BIRCH 6 MM	750x1000 MM	€ 15	3-10 mm/s	90%			
PLEXI 3 MM	N/A	€ 30/m ²	10-15 mm/s	90%			
PLEXI 4 MM	N/A	€ 40/m ²	8-15 mm/s	90%			
PLEXI 6 MM	N/A	€ 60/m ²	5-10 mm/s	90%			
CARDBOARD	N/A	N/A	30-50 mm/s	90%			
CLOTH	N/A	N/A	50-80 mm/s	90%			

DON'T USE THE FOLLOWING MATERIALS IN THE LASERCUT MACHINE

PVC – PC – Thermosets

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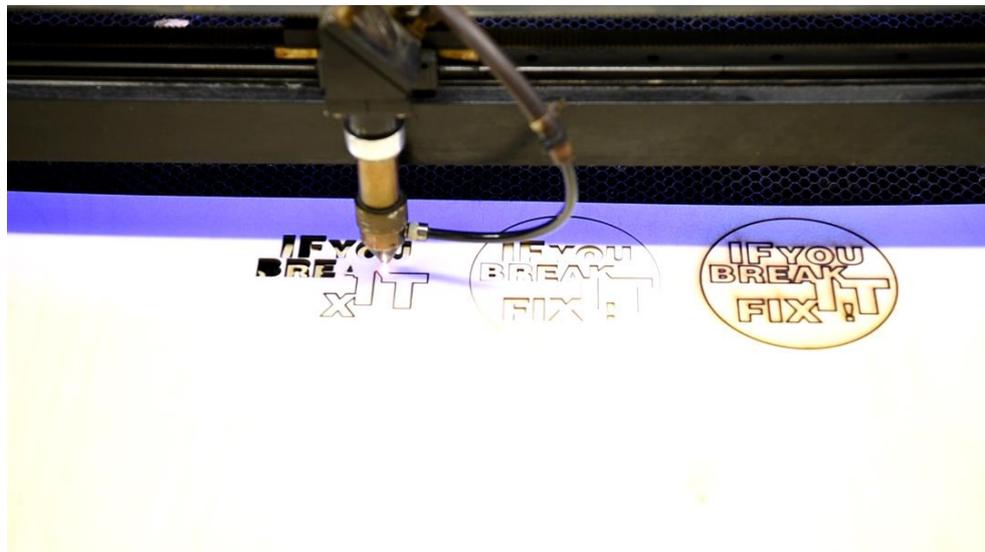
1. ABOUT THIS TUTORIAL

This tutorial is designed to allow you to learn to use the machine on your own.

When you run into this STOP sign you should find a lab supervisor to help or check your work.



In this tutorial you will cut a coaster from 3mm MDF.



You will then cut it 2 times more with wrong settings to experience what happens.

After completing this tutorial, you should be able to show 3 pieces to the lab supervisor.

2. LAB RULES AND ACCESS

The full document with lab rules can be found here: <http://www.fablab-brussels.be/fablab-english/lab-rules-english/>

Rules for the lasercutter:

- Stay with the machine while cutting. Since you're burning away material, there is a real danger of starting a fire.
- Clean the machine when done (remove cut pieces from the honeycomb bed).
- Don't leave leftovers in/on the machine.
- If you don't use a full plate of material, break off the parts you can't use anymore, throw them in the correct container and put the sheet on the correct shelf.

Access:

- Visitors and VUB students/personnel not affiliated to the department of Engineering Technology (INDI) have access on Wednesday afternoon from 1 p.m. to 8 p.m.
- Before you can use the machine you need to have followed the introduction. The introductions are on Wednesday at 2 p.m.
- After you followed the introduction, you'll get a badge that grants you access to the machine. **This badge is personal, do not give it to other people.** Should you give it to someone who doesn't know how to use the machine and he breaks it, you can be held responsible.

If something is not clear or you're afraid that something is wrong with the machine, please tell us.

Fablab Team

3. BEFORE WE BEGIN: SAFETY

Never leave the machine unattended. Period. You can work in the main space while cutting, but you keep an eye on the machine.

YOU DO NOT LEAVE THE FABLAB WHEN YOU ARE CUTTING ON THE LASERS.

The laser cuts by putting material on fire. If the compressed air flow fails, the sheet can catch fire. If you cut a lot of small details, the sheet can catch fire.

Each machine has a fire extinguisher next to it.

The Lasers have a fire blanket attached to the front.

Please take a second to verify the location of these tools, so you can quickly find them when needed.



4. TURNING THE MACHINE ON & CHECKS



Push the green button to turn on the machine.

Twist the black knob to turn on the exhaust system, cooling and blower.

COOLING



To the right of the machine is the cooler.

Check if it just turned on; you should see the temperature on the display.



The red numbers in front of the water cooler indicate the temperature.
If you ever see a rise above 40°C, stop laser cutting and allow the laser tube to cool.

AIR

IMAGE TO BE ADDED

EXTRACTION SYSTEM



The smoke gets extracted through the raster in the back of the machine.

Hold a hand there and check if you can feel a draft.

Over time this raster can clog up. If you notice this, use a brush from the cleaning stations to clean the raster.

5. PLACING THE MATERIAL ON THE BED



Ask the lab supervisor for a piece of material. The tutorial example is intended to be cut from a piece of 3mm MDF.

1. Use the green arrow keys on the control panel to move the cutting head to the back of the machine so you do not bump into it.
2. Make sure the bed is free of debris
3. Place your material. Make sure it lies flat.
If it does not, there are some tricks we can show you, ask for help



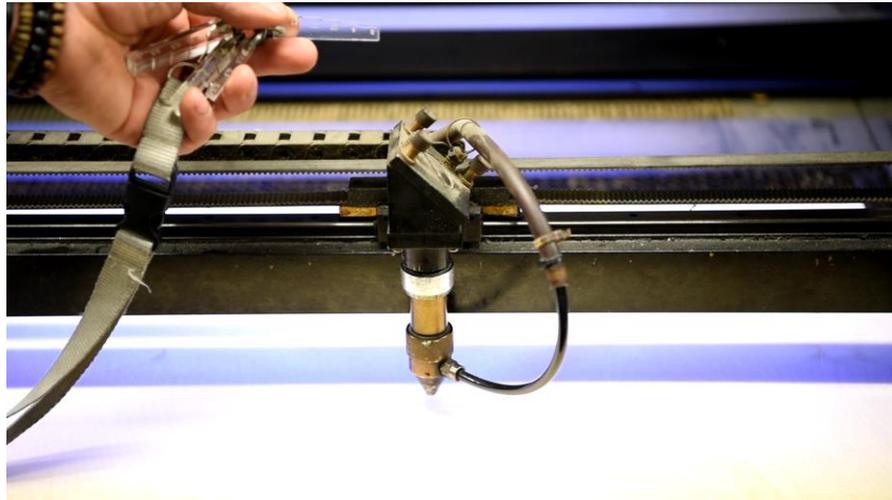
6. FOCUS THE LENS

The cutting head has a lens with a small focus length.

You should think of that cutting head more like a magnifying glass than like a laser pointer.

The laser will only cut cleanly if the focus distance is set correctly. For the current lenses the bottom of the cutting head needs to be **11 mm** above the material.

1. Look for the height gauge tool shown in the picture below.



2. Use the arrow keys to place the cutting head above your material.
3. Unfasten the clamping ring (see image below)
4. Place the tool with the step marked 11mm under the head.
5. Lower the cutting head
6. Tighten the clamping ring again. Hand-tight is fine.



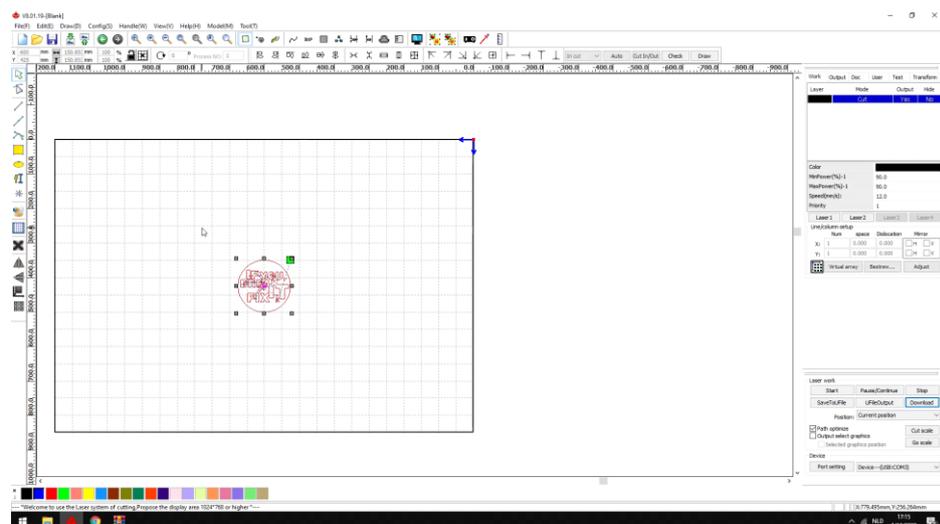
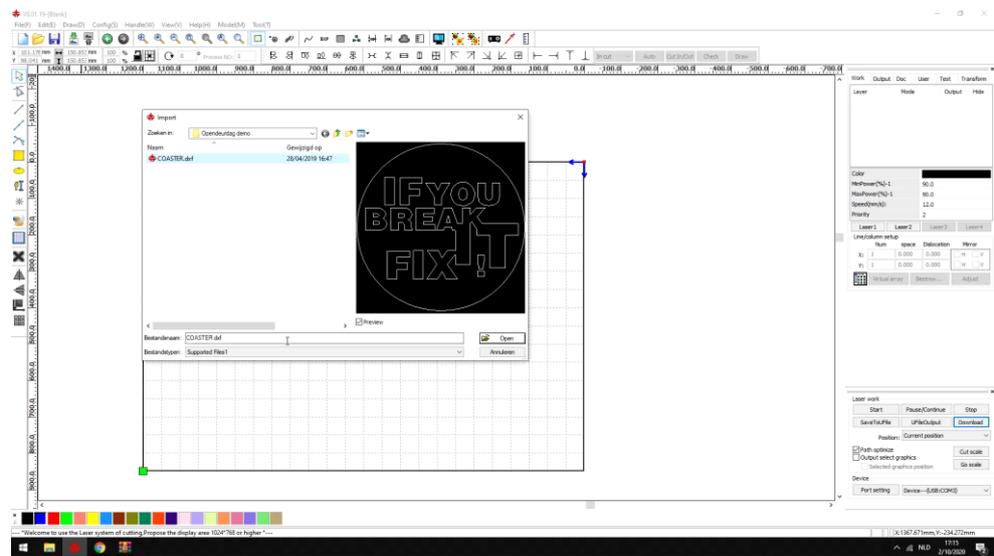
7. SOFTWARE

The BRM laser cutters are operated from the computers next to them. The software is called **Rdworks**

If the software is not open yet, find it on the desktop.

Select File > Import

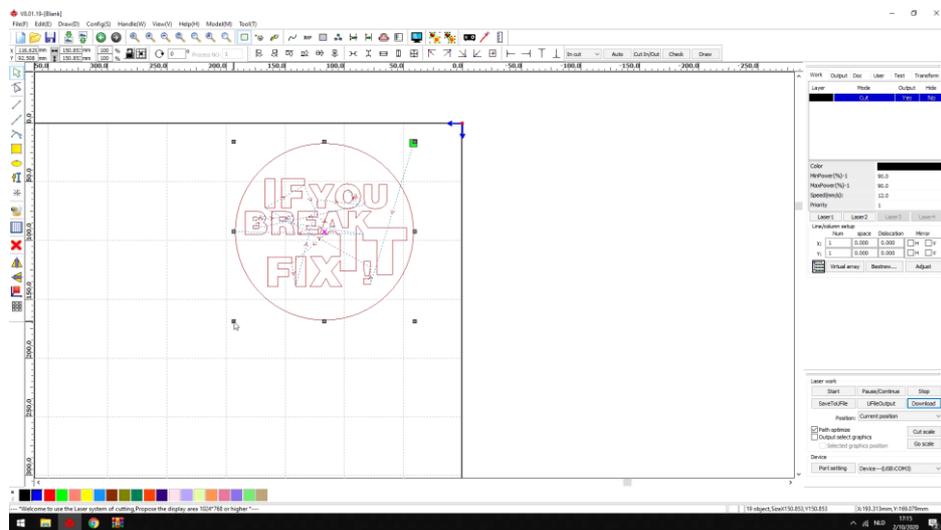
Browse to c:\Opendeurdag demo en open **coaster.dxf**



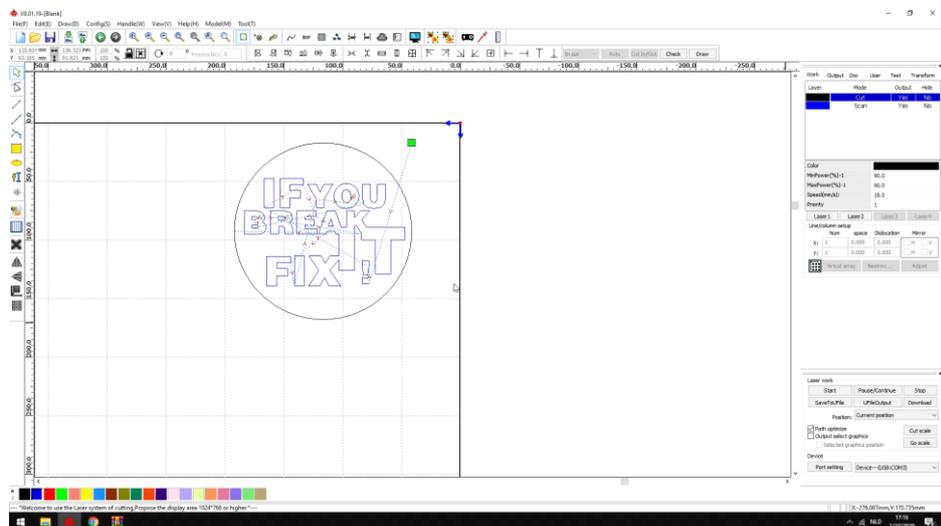
When you select the drawing, you can resize and/or move the drawing using the square dots.

Move the drawing to the top right corner of the sheet.

Resize the coaster to about 100x100mm. Use the measurements on the rulers at the edges of the screen as reference.



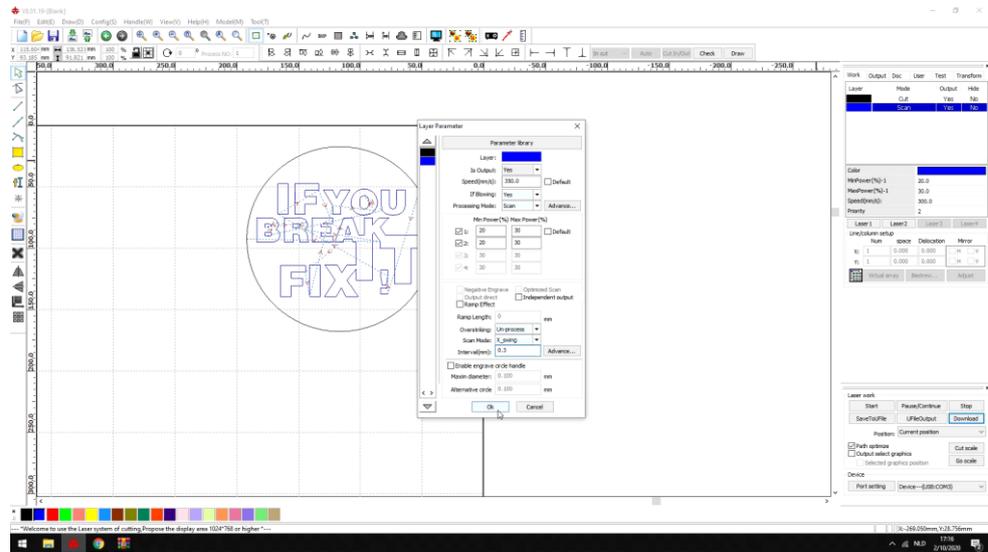
Change part of the drawing to a different layer /color.



1. Select the words, but not the contour.
2. Click on the blue square on the bottom left of the screen. (or any other color)
3. You should now see a new Layer in the top right; you can now assign different cutting parameters to the blue and the black layer.

You can now cut the letters with different speeds/settings than the contour:

ENGRAVING SETTINGS



1. Double click on the blue layer in the OUTPUT window top right.

In the popup window select following settings to engrave the letters:

Speed: **350mm/s**

Processing Mode: **scan**

Min power: **20%**

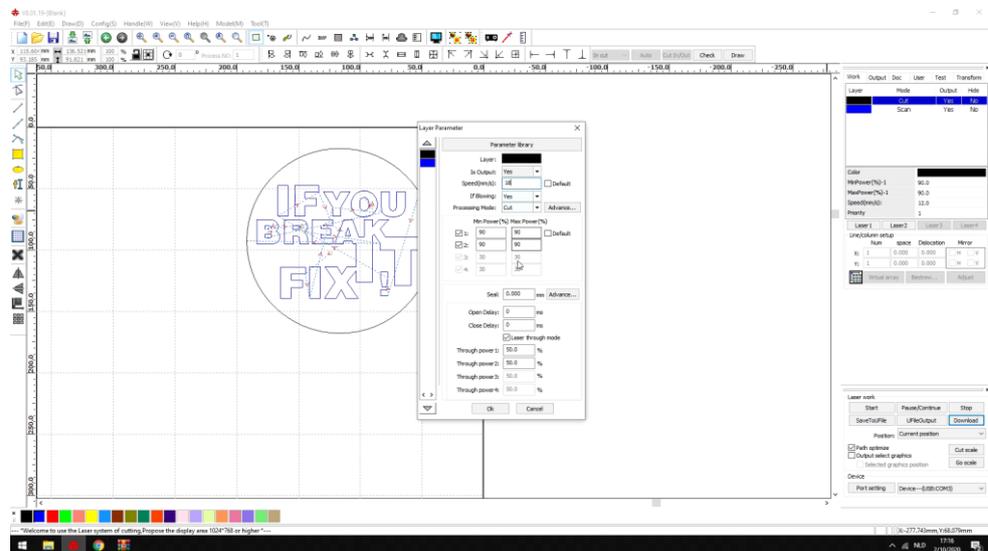
Max power: **30%**

Interval: **0.3mm**

NOTES ON ENGRAVING SETTINGS

- You can adjust speed and power to achieve a darker / lighter effect
- Interval is the distance between two engraving lines and has a large impact on engraving time.
- Engraving can take a long time (multiple hours) if a fine interval and low speed is chosen. Consider using a large interval if you are just shading shapes.
- Results differ with laser focus & different materials. Do a test before engraving a long file.
- Min- min and maximum power correspond to lightest and darkest greyscale values when engraving a photo.
When engraving one solid color these values can be the same.

CUTTING SETTINGS



1. Double click on the black layer in the OUTPUT window top right.

In the popup window select following settings to cut the contour

Speed: 18mm/s

Processing Mode: cut

Min power: 90%

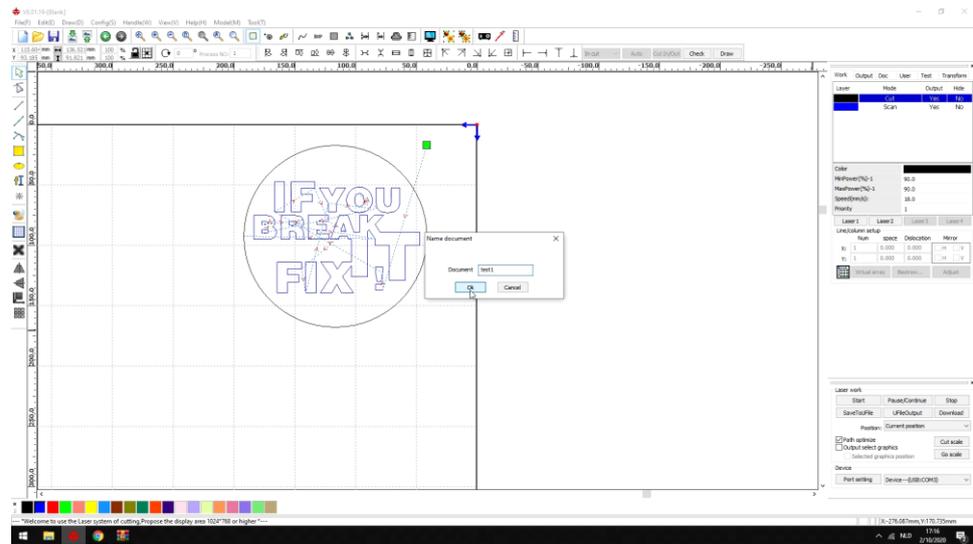
Max power: 90%

Leave other values as is.

CUTTING SETTINGS

See reference sheet on page 3 of this manual.

DOWNLOAD THE FILE TO THE MACHINE



1. Click the download button (bottom right)
2. The software asks for a document name. This must be a unique name, 8 characters or less)

8. THE CONTROL PANEL



Let's go back to the machine and have a look at the control panel:

By default, the last file uploaded is the one the machine will cut. You should see the name of your file in the top right corner of the screen.

ARROW KEYS These move the cutting head

ORIGIN sets the origin. This means the current position of the cutting head will correspond to the top right corner of your drawing:

START/PAUSE starts or pauses cutting

FRAME runs the head around the contour of your drawing. This is very convenient to see if your drawing will fit on the material.

FILE Select a file from memory. Press this to then select a file using the arrow keys. Press **Enter** to confirm.

Z/U When pressing this the side buttons now control table height. Press again to exit..

9. SETTING ORIGIN & CHECK DRAWING POSITION

1. Move the cutting head to the top right corner of the material using the arrow keys.
2. Press ORIGIN to set the origin.
3. Press FRAME to check where the machine will cut the file.

Observe the machine, it will run the cutting head in a rectangle around the contours of the drawing.

10. CHECKLIST

Before you start cutting, run through this checklist:

- Did you set the ORIGIN correctly & checked with FRAME?
- Is the water cooler on? Temperature display should be readable.
- Is the exhaust system working? Check for a draft at the raster in the back of the machine.
- Is air coming out of the cutting head? Feel for airflow with a finger.
- Did you set the correct focus height? It should be 11 mm



Ask the lab supervisor to check your work before continuing.

11. BADGE IN & START CUTTING



Use the lab supervisor badge to activate the machine. Press start.



The end result should look something like this.
Leave the piece in the machine for now.

12. PIECE TWO: OUT-OF-FOCUS

Execute following steps:

1. Move the origin to the left of the cut piece (or somewhere on the sheet where there is room for another coaster)
2. Loosen the clamp nut as shown in chapter 5 Focus and raise the cutting head by about 3 millimeters.
3. Close the lid and press start.

You do not need to reupload the file, just cut with the same settings.

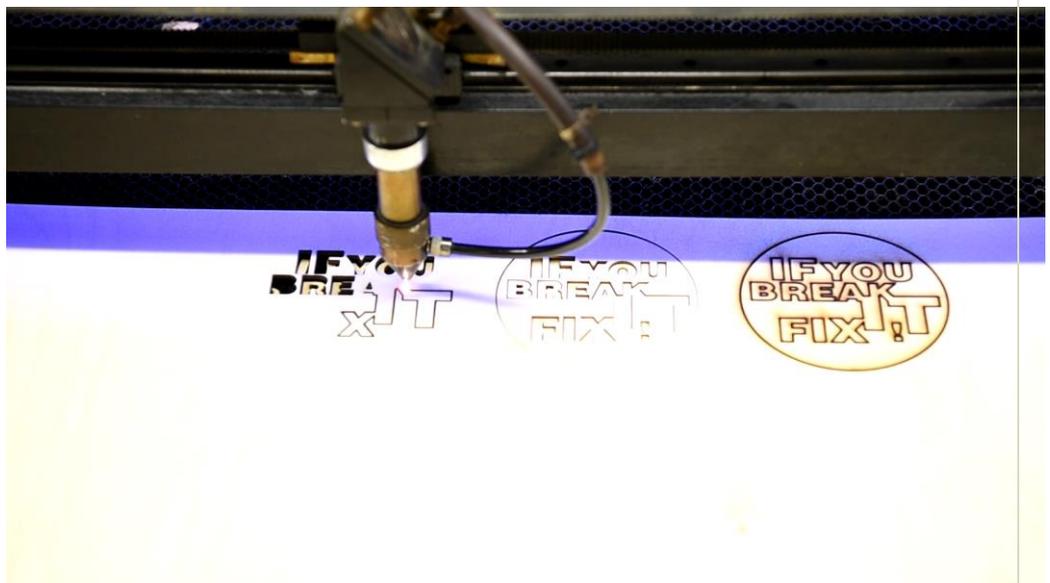
You may need to badge in again.

The width of the cut is called “**KERF WIDTH**”

While very narrow when cutting in focus, it is not zero.

For 3mm MDF with a good speed and focus it is about 0.15mm

Observe the kerf width in this test, compare with the previous piece.



In the image the leftmost cut is the out-of-focus one

If you observe this kind of cutting line when cutting a part, you should stop the machine and adjust your focus.

13. PIECE THREE: CUT SLOWLY

For part 3 execute following steps:

Adjust cutting speed for the contour to 9 (the black layer)

Adjust engraving speed and power to any setting you would like to try

Send the file to the machine

Move the origin again.

Cut this file.

When done, take out the first piece and this one.

Compare the edges and the backs of the parts.

Notice the back of this part has more soot on it, and the edges of the part are charred more than the first part.

14. PLEASE CLEAN UP

Left-over pieces of material go in the shelf next to the machine:

The BRMs have honeycomb tables. These need to be cleaned up and all little cutout parts need to be removed. If you do not, they will get under the next sheet you want to cut, and that sheet will not lay flat.



The easiest way is to take the vacuum cleaner. There should be one next to each BRM machine. If there is not, go look for it.

If the vacuum cleaner does not suck, empty it out. There is no tutorial for this, but it is not rocket science....

15. TURN OFF THE MACHINE

Unless somebody will be cutting immediately after you, turn off the exhaust and air by turning the black knob.

The machine and pc can remain on during the day.

16. CONGRATS

You made it to the end.



Please go find the lab supervisor and show your parts.

17. APPENDIX: TROUBLESHOOTING

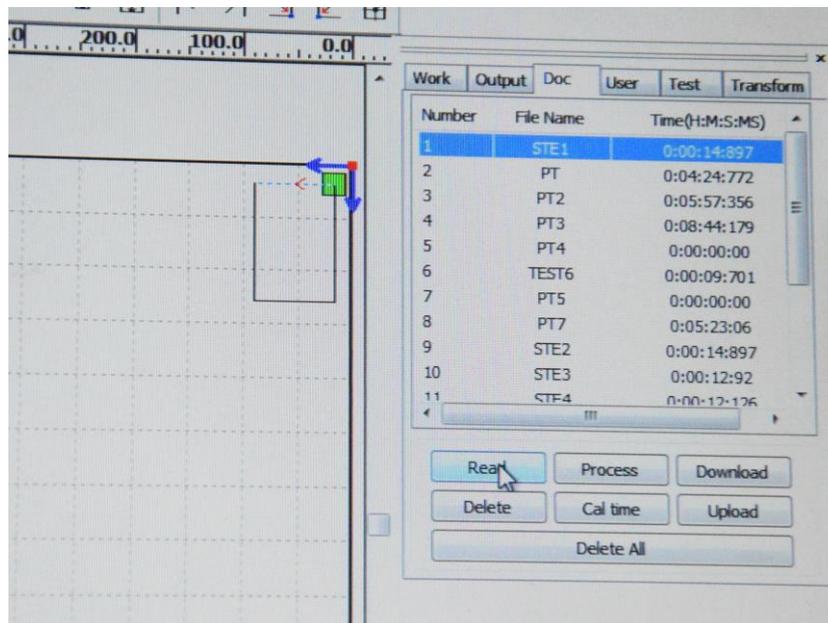
I GET AN ERROR WHEN TRYING TO UPLOAD A FILE.

The memory of the controller is probably full.

If the memory on the laser is full, you will get an error message and will not be able to upload your file.

To solve this, you need to erase the stored files from the laser.
Here is how you do this:

1. In RDWORKS at the right side of the screen, click on the third tab named 'Doc'.



2. Click 'Read'
After a couple of seconds a list of the files in memory will be loaded and displayed.
3. Click 'Delete All'

Done. You should now be able to upload your file.