

# Laser Cutter Guide

Laser cutting and engraving using the Trotec Speedy 300



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**Additional materials resources available in the folder at TAP lab**

# Introduction and basic specifications



## **Trotec Speedy 300**

Laser cutter and engraver

Working area: 726 mm x 432 mm

80 Watt CO2 laser

2 inch focal lens (focus point is 2 inches from the lens)

Includes a rotary attachment for engraving curved surfaces (e.g. glasses or jars)



## **Atmos**

A Trotec Atmos air filter is used to extract fumes and particles to make the air that comes from the laser cutter safe. There is no external venting.


## Using it at TAPlab

You must use the desktop computer at TAPlab and be logged in as a member or admin to access the laser cutter software (Trotec Job Control).

Only approved people may use the laser cutter. Approved people have a restricted or full license. Others may use it when closely supervised by someone with a license. The lists of people with a license can be found next to the laser cutter. See 'Training Process and License Levels' of this guide for more information.

This guide contains key information you need to know. Full **operational manuals** from Trotec can be found on the desktop of the computer you use to run the laser cutter.

# Safety when using the laser cutter

RESTRICTED EQUIPMENT	The laser cutter can only be operated by approved people. The lists of people with a restricted and full license can be found next to the laser cutter.
NO HACKING	Never override any safety interlocks on the laser. It is designated a class 2 laser because it is fully enclosed.
<p>FIRE</p> 	<p>Check the fire extinguisher is next to the laser cutter Make sure you know how to use the fire extinguisher</p> <p><b>Small fires:</b> lift the lid and it should extinguish itself. <b>Large fires:</b> use a CO2 fire extinguisher.</p>
MATERIALS	<p>Check your material is suitable (there is a poster of approved materials next to the laser cutter).</p> <p><b>NEVER use PVC or VINYL in the laser cutter</b> It releases toxic gas and also damages the laser cutter</p> <p>Do not cut or engrave highly reflective materials (e.g. a mirror).</p> <p>For a more comprehensive list of materials that cannot be cut or engraved refer to the 'Materials' section of this guide.</p>
MONITOR	<p><b>Monitor the laser cutter for the WHOLE time it is cutting or engraving.</b> You do not need to stare directly at the laser, but you need to make sure it doesn't start a fire. Do not get distracted and walk away while it is running.</p>
OFF	Turn off the laser cutter when not in use.
AIR FILTER	There is no outside ventilation for the laser cutter. Instead it goes through the air filter unit next to it. It should be on 185-250 for general use.
REPORT ANY ISSUES	If you notice anything you think is out of the ordinary, for example: too much smoke, unusual noise, unexpected odour, warning messages etc, please report it to a TAPlab member. Stop use of the machine if you think it could be anything that could cause a health and safety problem or damage to the machine. It should be posted in slack in the #equip_lasercutter channel so others are aware of the problem and can

	take measures to resolve it. If you don't think anyone should be using the machine until it is resolved then put a sign on it to let anyone know who isn't on slack.
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TIPS:

If you see a flame that is anything other than a normal yellow then be wary of what you are cutting. For example if the flame is green it is most likely creating a toxic gas.

Engraving releases less toxic fumes/particles than cutting does. Some things that cannot be cut safely may be ok to engrave if done on a low enough power.

# Training process and license levels

Refer to the lists of names that are displayed next to the laser cutter for who has which level of license.

<b>Restricted License</b>	
<b>Key Points</b>	<ul style="list-style-type: none"><li>● You <b>MUST</b> have someone with a full license present when using the laser cutter. Remember to ask that person first so they are aware they are supervising you.</li><li>● You cannot do maintenance on the laser cutter.</li><li>● You will lose your restricted license if you don't use the laser cutter for 3 months.</li></ul>
<b>Training Process</b>	<ol style="list-style-type: none"><li>1. Read the Safety section of the TAPlab Laser Cutter Guide.</li><li>2. Read the Materials List poster that is displayed next to the laser cutter</li><li>3. Ask a trainer to train you (check the full license list to see who is a trainer). Your trainer will cover:<ul style="list-style-type: none"><li>○ Using a fire extinguisher</li><li>○ Quiz you on what materials you must NEVER use. You must know the main two (hint: they are on the safety posters around the machine)</li><li>○ Take you through a basic cut and engrave. You can refer to the TAPlab Laser Cutter Guide for this when you use it as well.</li><li>○ Ensure you know you must monitor the cutter when it is running. You cannot walk away.</li><li>○ Make sure you know about the Job log and to fill it in whenever you use the laser cutter.</li></ul></li></ol> <p>If your trainer is happy that you have understood the safety and can do a basic cut and engrave they can add you to the Restricted License list.</p> <p><b>TRAINER:</b> Please post in Slack to the <b>#equip_lasercutter</b> channel so the list can be updated and re-printed. In the meantime you can write it on the list.</p>

*Full license on next page*

## Full License

<b>Key Points</b>	<ul style="list-style-type: none"><li>● People with a full license are generally TAPlab members and/or people who run workshops.</li></ul>
<b>Training Process</b>	<ul style="list-style-type: none"><li>● You must get a trainer to show you how to do maintenance.</li><li>● To move from restricted to full you must be approved by another trainer (not the trainer who initially trained you), who is ALSO a member of the exec.</li><li>● Training checklist:<ul style="list-style-type: none"><li>○ Knows how to use the fire extinguisher and checks it is present before using the laser cutter.</li><li>○ Quiz on what materials you must NEVER use (must know not to use vinyl and PVC)</li><li>○ Can do a basic cut and engrave. They may refer to the TAPlab Laser Cutter Guide for this.</li><li>○ Must know they have to monitor the cutter when it is running. They need to know they cannot walk away.</li><li>○ Make sure they know about the Job log and to fill it in whenever using the laser cutter.</li><li>○ Maintenance: must be able to clean the lens and nozzle; and clean away debris from underneath the honeycomb.</li><li>○ To pass this person you must believe that they can competently and safely operate the laser cutter if they were to use it alone.</li></ul></li></ul> <p><b>TRAINER (EXEC MEMBER):</b> Please post in Slack to the <b>#equip_lasercutter</b> channel so the list can be updated and re-printed. In the meantime you can write it on the list.</p>

*Trainer on next page*

## Trainer

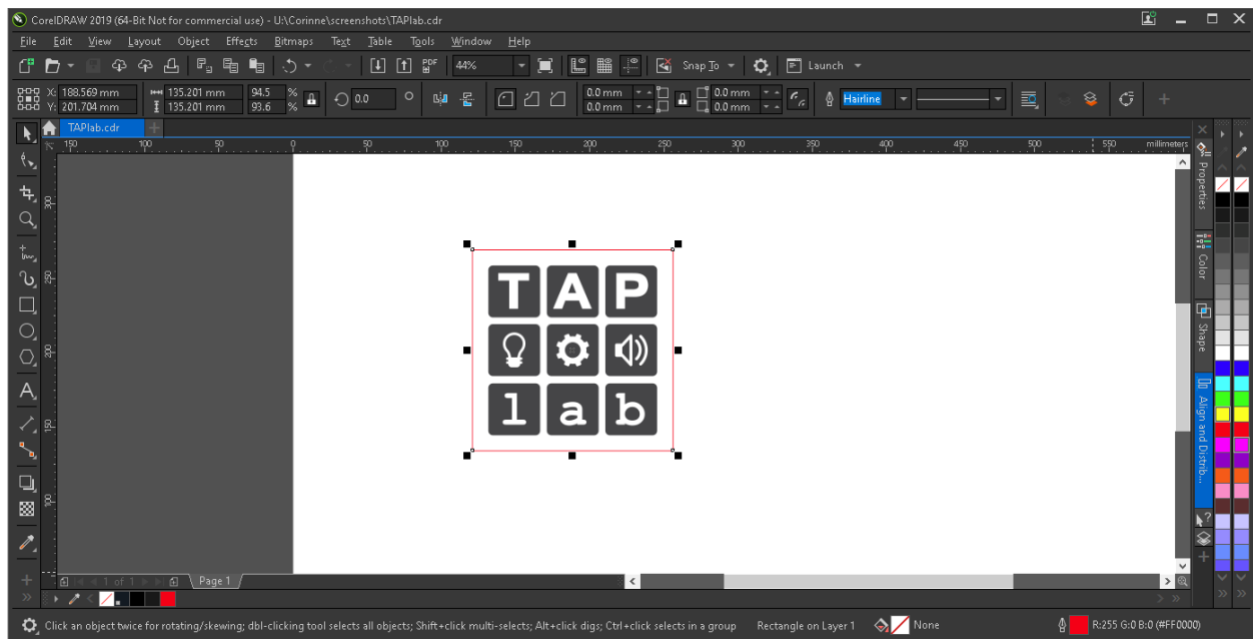
<b>Key Points</b>	<ul style="list-style-type: none"><li>• You must have a full licence to become a trainer</li></ul> <p>Please note, not all trainers can give out full licences, some are only able to do training up to the restricted level. See the Full licence list displayed at TAP lab for who can train to which level.</p> <p><b>Trainers who can give out full licences:</b> Must either be on the exec or staff that have been approved by the exec (e.g. technician). This is for accountability reasons, the decision to approve someone to use the laser cutter alone (full licence) should be made by someone with accountability to TAP lab.</p>
<b>Training Process</b>	<ul style="list-style-type: none"><li>• To become a trainer an exec member will need to ask on your behalf. Ask in slack in the <b>#_executive</b> channel. There doesn't need to be a formal vote but there should be some approvals and no objections made.</li><li>• When deciding on whether someone should be a trainer you should believe they will be able to train others well. If you have seen them working on the laser cutter and know them well you could usually make this judgement without a formal 'trainer' training session.</li><li>• Ensure the trainer knows to reference this section of the guide when training others.</li></ul> <p><b>EXEC MEMBER:</b> Please post in Slack to the <b>#equip_lasercutter</b> channel so the list can be updated and re-printed. In the meantime you can write it on the list.</p>

# Creating a file for laser cutting and engraving

*This guide briefly shows how to create a file for laser cutting and engraving using CorelDraw. Other common programs to use are Inkscape and Adobe Illustrator.*

Open CorelDraw (Installed on the desktop computer).

Create a new file. Set your document colour mode to RGB.



Draw or drag in your design.

Engraved Areas:

- Vector or bitmap (see below for an explanation)
- Black (or greyscale for different levels of engraving)

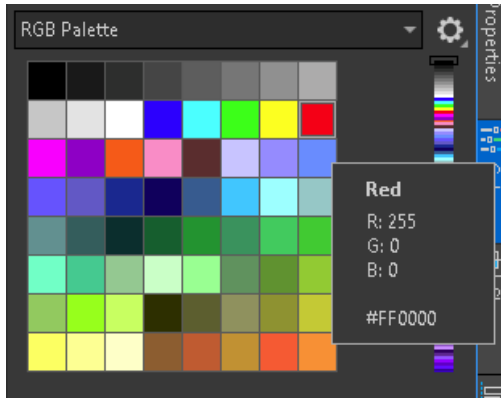
Cut lines:

- Vectors
- Red (RGB: 255, 0, 0)
- Stroke width set to 'hairline'



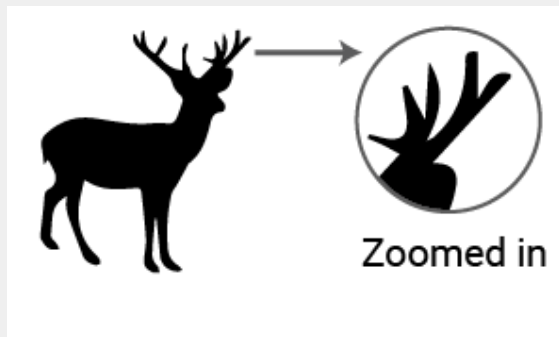


Use this shade of red:



## The difference between vector and bitmap images

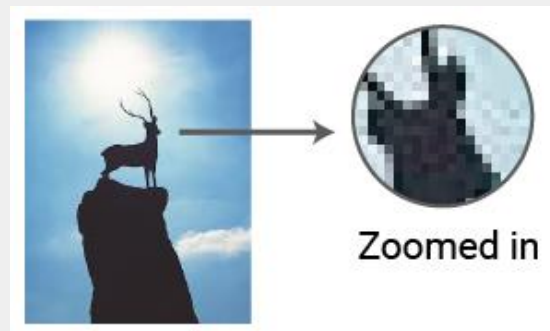
*Vector image*



A vector graphic uses geometric formulas to represent images. Because of this a vector graphic is scalable without any loss of resolution. The lines (often called paths) make clear cut lines for the laser cutter to follow.

Common file types are SVG, AI and EPS.

*Bitmap image*



A bitmap (often called raster) is made up of pixels. When you zoom in enough you will see the pixels the image is made up of. Photos are a common type of bitmap image.

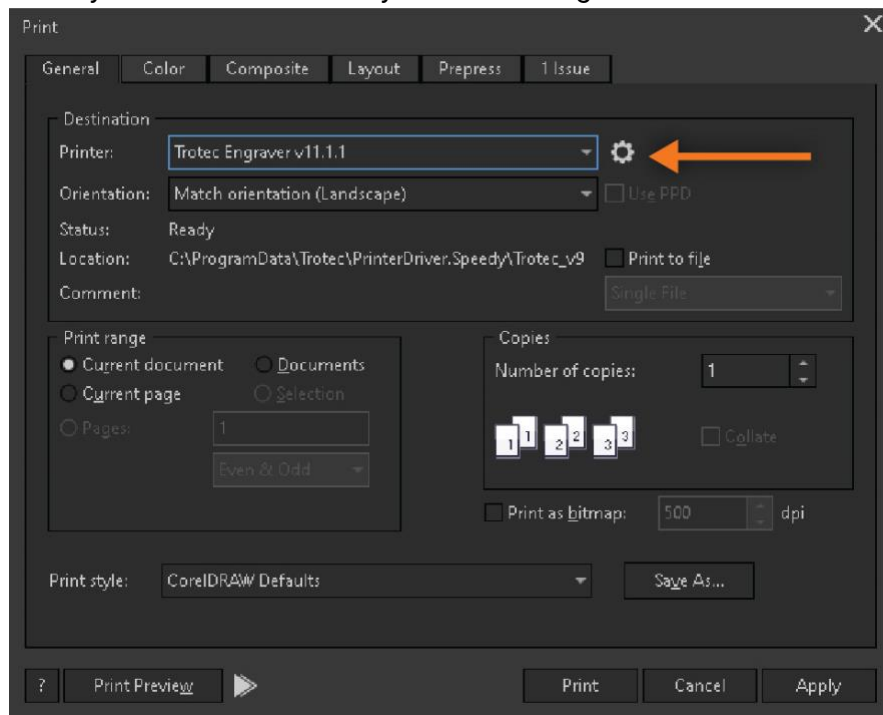
Common file types are JPG and PNG.

# Sending your file for cutting and engraving

You must be logged in as either MEMA (TAP lab Members account) or Admin to use the TROTEC Job Control software.

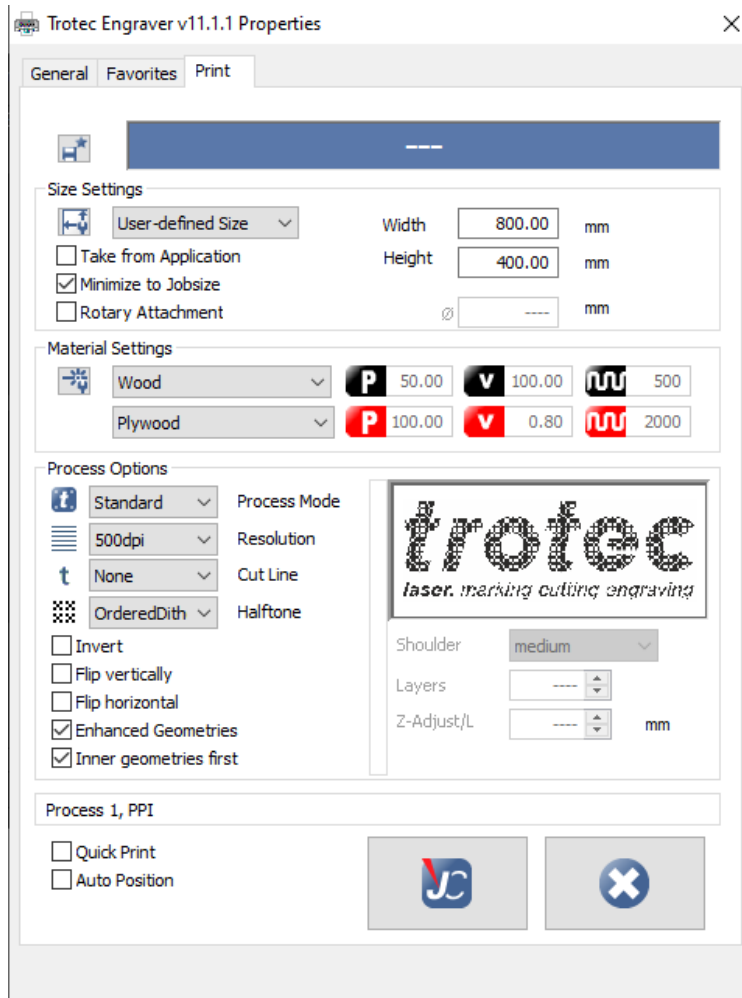
## 1. Send to printer From CorelDraw

When your document is ready in CorelDraw go to File > Print



Select 'Trotec Engraver v11.1.1' as the printer.

Click on the settings icon next to the printer menu to bring up the advanced settings.



Refer to the Job Control Operation Manual for full details. Below are a few of the key settings to note.

### Size Settings:

'Minimise to jobsize' will only bring your job through, it will ignore the page it was on. If you carefully positioned your design on your page then untick this setting.

### Material settings:

You can set these here or later on when Job Control opens.

### Process Options:

Process Mode: Use standard for general use. If your are doing photos there is a photo option available.

Halftone: If engraving from a bitmap image use 'OrderedDithering' or another of the dithering options, this will give shades of grey. If engraving black only from a vector image or text you can use 'black and white'.

Click the 'JC' button to close the advanced setting.

Click 'Print'.

TROTEC Job Control will open.

2. **Turn on the laser cutter**

The power button is at the back of the machine on the top left (behind the purple power symbol).



3. **These are the main controls you will need:**

**Tip:** you can put the laser cutter into standby until you are ready to use it to reduce the noise. You can also manually position the laser head by putting it in standby, opening the lid and moving it around with your hand.

Take it out of standby before turning it off (instruction from the manufacturer).

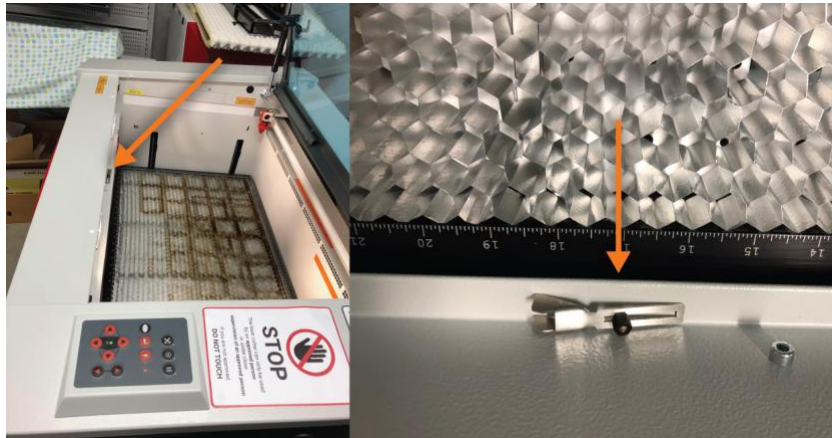


4. **Put your material in and focus the laser cutter, ensure you material is suitable for laser cutting**

It is recommended to manually focus the laser.

- a. Put your material in
- b. Move the laser head away from the edges (to prevent the focusing tool falling somewhere difficult to get)
- c. Find the focus tool. It goes on the ledge inside the machine at the front. Make sure you return the focus tool back to the correct place in the machine

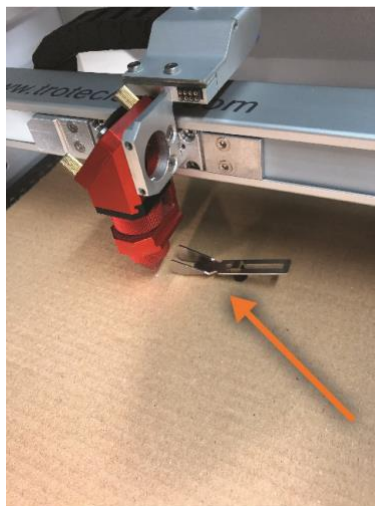
for the next person to use.



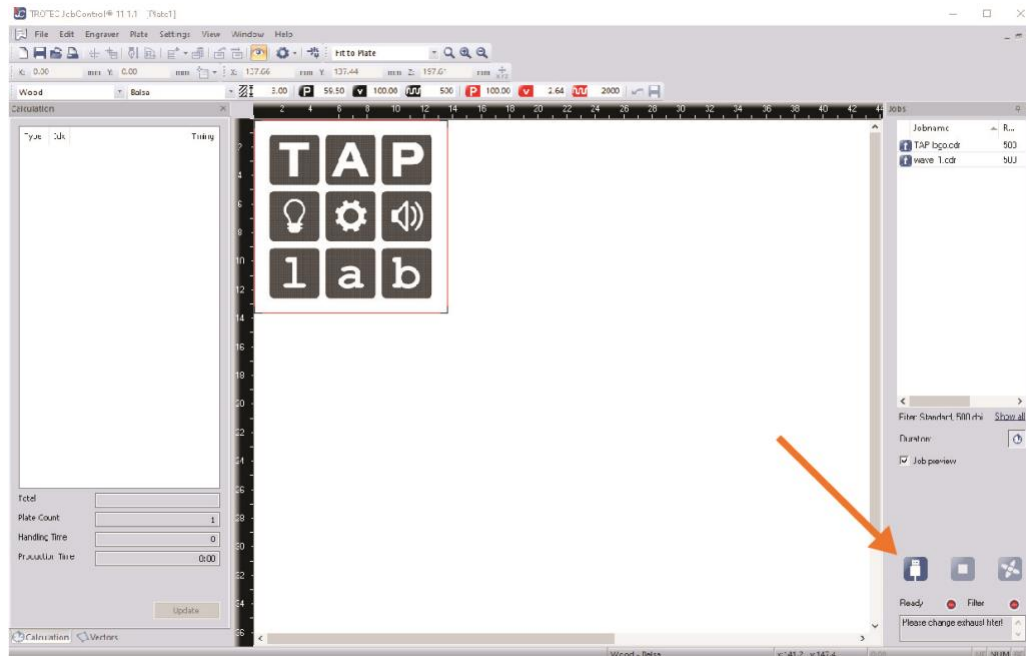
- d. Balance the focus tool on the laser head as shown below.



- e. Use the black up arrow to move the engraving table up until the focus tool falls off. Now it is at the correct height for the laser to focus on your material.

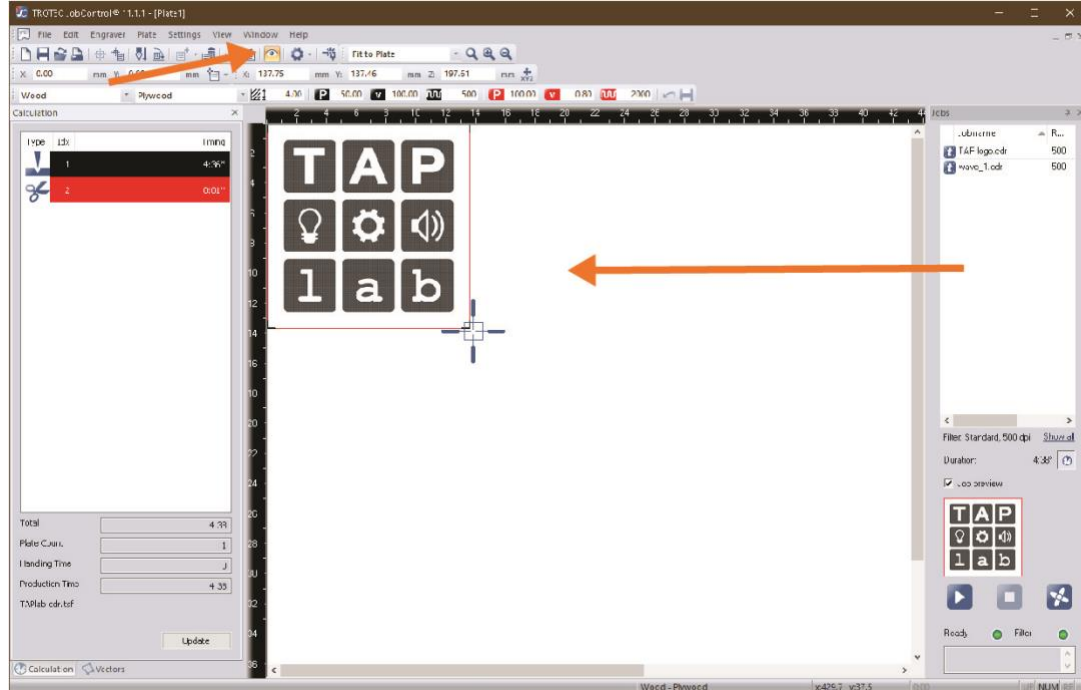


## 5. Connect to the laser cutter from the computer



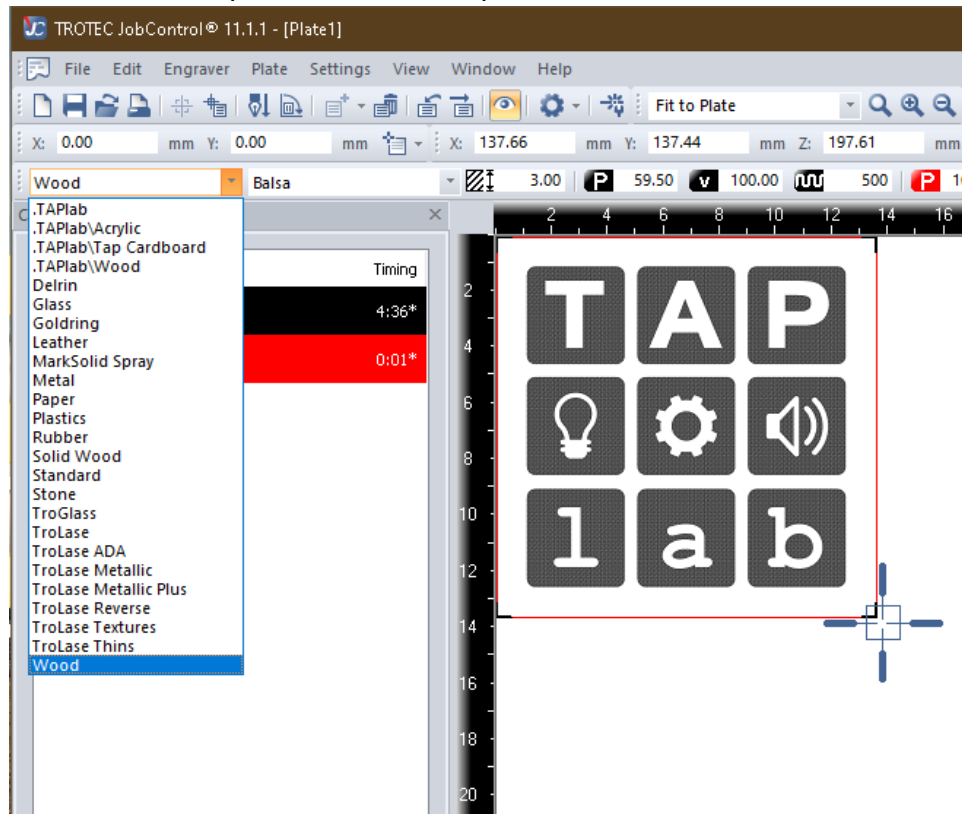
## 6. Drag your design in

Your file should be in the 'Jobs' section on the right. Drag it into the main window. You can click the eye button from the top toolbar to preview your design.



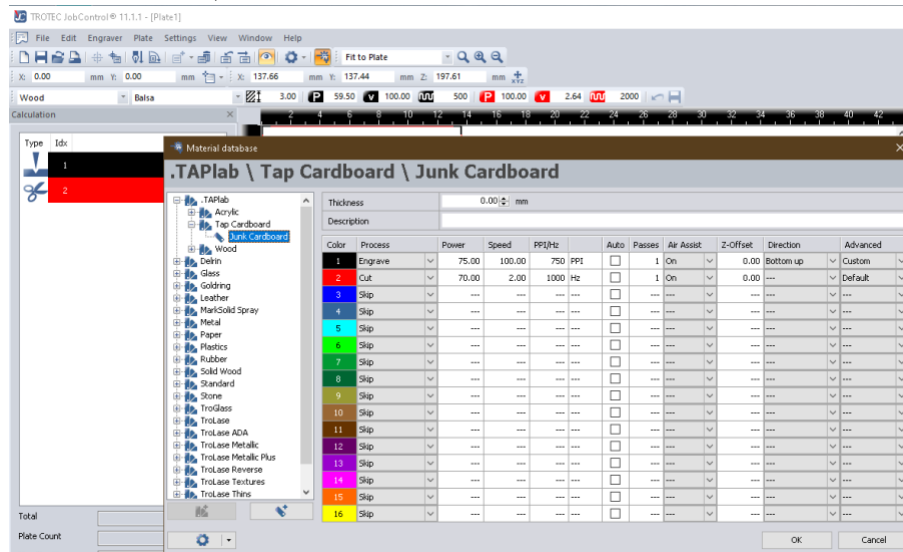
## 7. Select the material settings you want to use

You can select a preset from the drop down here:



Then refine in the next drop down to the right of that one. You can adjust the settings in here but **DO NOT SAVE THEM TO OVERWRITE THE PRESETS.**

If you want to save your own setting open the material database (Settings > Material Template Setup):



You can create new ones in '.TAPlab' or in the '.Users' folder under your name.

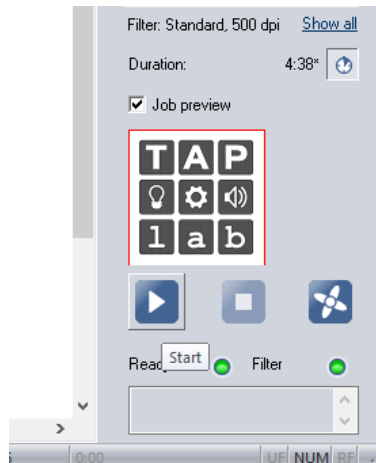
## 8. Position your design

The cross hairs on the screen show the position of the laser head.

**On the laser cutter:** You can change the position of the laser head by using the red arrow buttons. Or by putting it in standby, opening the lid and moving it around with your hand. Remember to take it out of standby when you are ready to use it.

**On the computer:** Move your design to where you want it in relation to the crosshairs you see on the screen.

## 9. Press the 'play' button to start cutting/engraving



## 10. Monitor the laser cutter while it is working

You do not need to stare directly at the laser, but you need to make sure it doesn't start a fire. Do not get distracted and walk away while it is running.

## 11. Check your work before moving it

Before moving it try to see if your cut lines are all the way through. If they aren't you can re-run them until they are. Go to TROTEC Job Control and right click on your design, select 'Repeat cut line'

## 12. When you are finished remove your material and turn the laser cutter off

Remember to take it out of standby before turning it off (instruction from the manufacturer)



## Tips and tricks

- Do a sample of your material and settings before starting your job. For example cut a small circle to test.
- It is better to do a cut in one pass than multiple passes. One reason is the gas and debris will be sucked away through the honeycomb underneath your material when done on one pass. Your ideal cut setting should have enough power to cut through in one pass but not excessively more power.
- You can use masking tape or transfer tape on your material to protect the surface from smoke when cutting. Only do this for cutting, if you do it when engraving it will bake the adhesive into your engraved area.
- If you have a material you have no idea what settings to use try cutting with power 30-40 and speed 1.5. Do a small test (e.g. try cutting a small circle). Adjust the power setting accordingly (more power if not cutting through, less if it did it easily or it burnt/melted etc)
- Engrave from bottom to top. If you engrave from top to bottom the smoke and debris will be pulled by the air intake over your engraved area. In most cases this won't matter but for some materials it will discolour your engraving. When engraved bottom to top the smoke and debris never passes over your engraving.
- When engraving photos use a lower PPI e.g. 300. It seems counterintuitive but using a higher resolution means there will be more blasts from the laser which can create too much dark areas and blow out the details.

# Using the rotary attachment

Refer to the Trotec manual for instructions.

Before use find a member who has experience with the rotary attachment to assist you. You can go on the slack [#equip\\_lasercutter](#) channel to ask.

## Materials List

APPROVED MATERIALS		
	Material	Conditions and warnings
✓	<b>Plywood</b>	Not exterior or treated. Max thickness for cutting is 6mm (ideal is 4mm or less). You can cut thicker with approval. See page 24 of the Laser Cutter Guide for more details.
✓	<b>Other timbers</b> (balsa, softwoods, hardwoods)	No treated exterior timber. See plywood advice around thicknesses if cutting. Avoid cutting or engraving if it's been polyurethaned (bad for filters). Research suitability before use, be careful of oily woods.
✓	<b>MDF</b>	Max thickness for cutting is 6mm (ideal is 4mm or less). You can cut thicker with approval. See page 24 of the Laser Cutter Guide for more details. Post in slack if intending to use MDF, it is very harsh on filters so mats might need changing.
✓	<b>Acrylic</b>	
✓	<b>Cardboard</b>	Be careful of fire risk when cutting thick or multilayered corrugated cardboard.
✓	<b>Paper / cardstock</b>	
✓	<b>Fabric</b>	Nothing plastic coated or plastic infused, no pleather, no PVC/vinyl fabrics, no neoprene, nothing with metallic threads.
✓	<b>Leather</b>	Real leather only, NO PLEATHER, no chromium-tanned leather.
✓	<b>Trotec brand laser materials</b>	
✓	<b>EVA foam</b>	Flammable, use with caution. Get an experienced user to help you when starting out.
✓	<b>Mylar/PET</b>	Use thin sheets only.
✓	<b>Stone</b> (including natural stones, ceramic, porcelain)	Engrave only, no cutting.

✓	<b>Glass</b>	Engrave only, no cutting. Normal glass only, no hardened glass.
✓	<b>Aluminium</b>	Engrave only, no cutting.
✓	<b>Polypropylene (PP)</b>	Engrave only, or cut very thin sheets. Test first as fillers, additives and flame retardants may react unpredictably.

### Approving new materials:

If there is something you would like to use that isn't on the approved list you must first research the suitability and safety. Then go on Slack and ask on the **#equip\_lasercutter** channel. If you aren't on Slack you can ask a TAP lab member to do it for you.

<b>PROHIBITED MATERIALS</b>	
✗	<b>PVC, Vinyl, Any unknown material</b> - you must know what you are cutting
✗	<b>More prohibited materials:</b> Carbon; Beryllium oxide; Any material containing halogens: fluorine, chlorine, bromine, iodine & astatine; Carbon fibre; Epoxy- or phenolic resins; Polystyrene / polypropylene foam; Polycarbonate or Lexan; PTFE (Teflon)

## Cutting thicker plywood and MDF

There are many different types of plywood, what will laser well will depend on the thickness, type of wood and the glue used. DO NOT use treated or exterior grade plywood.

If you are wanting to cut plywood or MDF thicker than 6mm do some quick test cuts to determine if it is suitable. Factors to consider:

- Is it cutting nicely? Laser cutting should be a very quick and precise burning process (essentially vaporising the material). The edges will be darkened but shouldn't have any thick charring as though they have been set alight in order to cut through. Look out for excessive smoke or excessive residue left behind.
- Will cutting the material cause damage or excessive wear to the laser cutter? (e.g. honeycomb or filter mats).

If you think your plywood or MDF is suitable you need to get another full license laser cutter user to check it as well before proceeding. If they agree that it is suitable you can use it.

**IMPORTANT:** You must post in the Slack **#equip\_lasercutter** channel that you are using a thick plywood or MDF and say who has approved it.