trotec®
laser. marking cutting engraving

# ENGRAVER'S GUIDE

# First-class laser system solutions make our customers more profitable.

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### How to use QR Codes

1. Download any ***QR Code Scanner*** from your App Store on your smartphone (most late-edition iPhones have QR Code scanners automatically built into their camera).

2. Open the app and hold your device over a QR Code so that it's clearly visible within your smartphone's screen. Two things can happen when you correctly hold your smartphone over a QR Code, (1) The phone automatically scans the code. (2) On some readers, you have to press a button to snap a picture, like the button on your smartphone camera.

3. Your smartphone reads the code and navigates to the intended destination, which doesn't happen instantly. It may take a few seconds on most devices.

# About Us

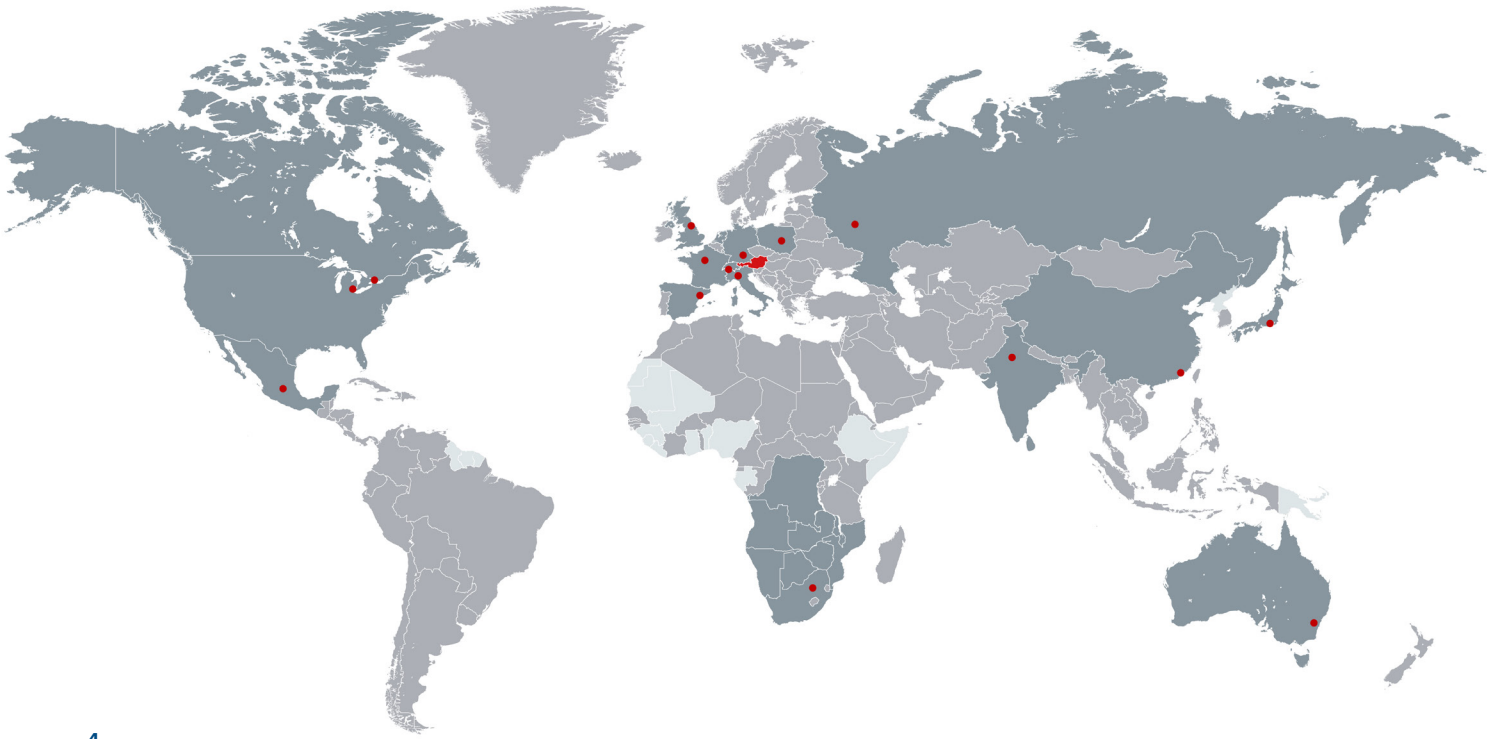

*Trotec Global Headquarters in Martrenk, Upper Austria*

Trotec is the world's leading manufacturer of laser machines for marking, cutting and engraving solutions. Founded in 1997 and owned by Trodat Trotec Group, Trotec boasts machines in over 90 countries across the world, 17 international subsidiaries and has more than 550 employees.

A recognized leader in its field, Trotec's range of laser machines includes desktop entry level solutions, the Speedy series, the SP large format flatbed laser machines as well as the SpeedMarker and ProMarker galvo lasers for high-speed marking and engraving applications.

Setting new standards is what we do. The Speedy flexx series is a statement of our commitment to pushing new boundaries. This series was the world's first laser machine to combine two laser sources, $CO_2$ and fiber, in one machine resulting in endless applications for our customers.

Trotec Laser Canada is the leading laser manufacturer across Canada. Trotec is the only laser machine and consumables company to have a presence across Canada, and with showrooms and training centers in Vancouver, Calgary, Toronto and Montreal. This is supported by a factory trained support team.



**Vancouver**
*20381 62 Ave #705,*
*Langley, BC V3A 5E6*


**Calgary**
*820 28 St NE #2,*
*Calgary, AB T2A 6K1*

**Toronto**
*1705 Argentia Rd #9,*
*Mississauga, ON L5N 3A9*

**Montreal**
*8096 Trans Canada Route, Saint-Laurent, QC H4S 1M5*


*Our entire technical service team takes great pride in providing our customers with the best laser service in the country.*

*Trotec has 4 service locations across Canada including Toronto, Vancouver, Calgary and Montreal. Each location comes with a service technician that can assist any issues that may arise with the laser machine or software.*

*In addition to the service hotline, we offer you fault diagnosis by a remote maintenance service. For this, a service technician will log into your PC via the Internet and will check the status of your laser software.*

*We also offer on-site installation of the laser machine as well as basic training by one of our service technicians.*

**Stephen Colley**
*Technical Director* | Trotec Laser Canada

# Flatbed Lasers Overview

| | | Working Area | Laser Power | Laser Type | Software |
|---|---|---|---|---|---|
|  | Rayjet 50 | 18" x 12" | 30w | $CO_2$ | Rayjet Commander |
|  | Rayjet 300 | 29" x 17" | 80w | $CO_2$ | Rayjet Commander |
|  | Speedy 100 | 24" x 12" | 30 - 60W | $CO_2$ | JobControl |
|  | Speedy 100 FL | 24" x 12" | 10 - 30W | Fiber | JobControl |
|  | Speedy 100 FLEXX | 24" x 12" | 30 - 60W $CO_2$<br>10 - 30W Fiber | $CO_2$ & Fiber | JobControl |
|  | Speedy 300 | 29" vx 17" | 30 - 120W | $CO_2$ | JobControl |
|  | Speedy 300 FL | 29" x 17" | 10 - 50W | Fiber | JobControl |
|  | Speedy 300 FLEXX | 29" x 17" | 30 - 120W $CO_2$<br>10 - 50W Fiber | $CO_2$ & Fiber | JobControl |
|  | Speedy 360 | 32" x 20" | 30 - 120W | $CO_2$ | JobControl |
|  | Speedy 360 FL | 32" x 20" | 10 - 50W | $CO_2$ | JobControl |
|  | Speedy 360 FLEXX | 32" x 20" | 30 - 120W $CO_2$<br>10 - 50W Fiber | $CO_2$ & Fiber | JobControl |
|  | Speedy 400 | 39" x 24" | 60 - 120W | $CO_2$ | JobControl |
|  | Speedy 400 FL | 39" x 24" | 10 - 50W | Fiber | JobControl |
|  | Speedy 400 FLEXX | 39" x 24" | 60 - 120W $CO_2$<br>10 - 50W Fiber | $CO_2$ & Fiber | JobControl |
|  | SP 500 | 49" x 28" | 60 - 200W | $CO_2$ | JobControl |
|  | SP 1500 | 59" x 49" | 60 - 400W | $CO_2$ | JobControl |
|  | SP 2000 | 66" x 98" | 60 - 400W | $CO_2$ | JobControl |
|  | SP 3000 | 87" x 126" | 60 - 400W | $CO_2$ | JobControl |

| Standards | | | | | | | | | | Options | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| InPak Technology | Ready for FLEXX | Harsh Environment Kit | Laser Pointer | Software Auto-Focus | Electro-Optic Auto-Focus | Exhaust System Control | Lighted Working Area | Air Assist | Job Control Vision | Rotary Device | Magnetic Table | Honeycomb Table | Vacuum Table | Pass-through | Additional Lenses | Multi-Colour Jet | Gas Kit | Quatro SPH 426 | Quatro CSA 626 | Quatro SPH 825 |
| | | | • | • | | • | | • | | • | | • | | | | • | | • | • | |
| • | | ○ | • | | ○ | • | ○ | • | | • | • | • | | | • | • | | • | • | |
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○ - optional

# Upgrade to a FLEXX!

flexx

## One Machine, Two Laser Sources, Endless Possibilities.

### Make just about anything!

The Speedy flexx series is unique. For the first time a $CO_2$ and a fiber laser source are integrated into a Speedy. This allows customers to perform endless applications. The $CO_2$ laser source is ideally suited for engraving and cutting plastics, wood, rubber, leather and many other materials. The fiber laser is the right tool for marking metals and plastics. Depending on the material, the two laser sources are activated alternately. The patented flexx function ensures maximum flexibility in the applications.


Every Speedy is „ready for flexx". This means that every laser can be equipped with an additional laser source at a later stage and you are well prepared for the future.
***Upgrade whenever you are ready!***





## $CO_2$ and Fiber Laser

The machines of the Speedy flexx series are equipped with both a $CO_2$ and a fiber laser. Choose a $CO_2$ laser with a power level from 25 to 120 Watts and combine it with a 10, 20, 30 or 50 Watts fiber laser of your choice (see page 4 for details about configurations). Use both laser sources in a single job without the need to manually change the laser source, lens or focus. The patented JobControl® laser software makes it possible: simply assign the desired laser source to each color of the graphic.

## Flexx Lens

Use the 2.85 inch flexx lens for finest detail engravings and markings with maximum quality. Suited for both wave-lengths - fiber and $CO_2$.

## Flexx Function

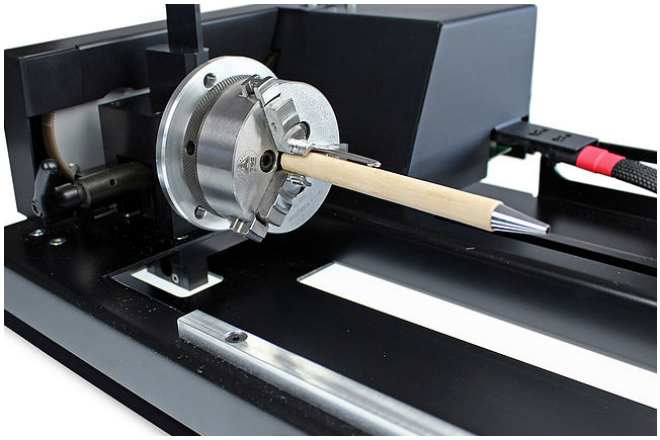
Thanks to the flexx function developed by Trotec two laser sources can operate in one job. In other words only a single process has to be initiated to process two materials. The $CO_2$ laser for example can be used to engrave leather goods, while the fiber laser can mark metal parts. Likewise you can control both laser sources independently of each other. This function is patented.

## Flexx Upgrade

Every Speedy can be equipped with an additional laser source. The Speedy 100, Speedy 300, Speedy 360 or Speedy 400, either as $CO_2$ or fiber laser, can be upgraded to a Speedy flexx at any time. You decide when!

| | Material | $CO_2$ | Fiber | FLEXX |
|---|---|---|---|---|
| **Non-metals** | Wood | • | | • |
| | Glass | • | | • |
| | Paper | • | | • |
| | Textiles | • | | • |
| | Leather | • | | • |
| | Stone | • | | • |
| | Food | • | | • |
| | Ceramics | | • | • |
| **Plastics** | ABS, PC, PA, PMMA, … | • | • | • |
| | Rubber | • | • | • |
| | Engravable Plastics | • | • | • |
| | Foam | • | • | • |
| **Metal** | Aluminum | | • | • |
| | Anodized aluminum | • | • | • |
| | Brass | | • | • |
| | Carbide | | • | • |
| | Chrome | | • | • |
| | Copper | | • | • |
| | Precious metals (gold, silver, platinum) | | • | • |
| | High speed steel | | • | • |
| | Stainless steel | | • | • |
| | Titanium | | • | • |

# Rotary Attachment



### Accessory that you can add to the laser in order to work in 360°

The rotary attachment is required for laser engraving round, cylindrical and conical objects, such as glasses or bottles. When the rotary attachment is inserted in the laser engraving machine, the movement of the axis in y-direction is replaced by a rotary movement. The Trotec JobControl software will provide you full support during this process. Simply enable the rotary attachment in the printer driver and enter the object diameter and the graphic will be adapted automatically.

| Work Table | Rayjet | Speedy 100 | Speedy 300 | Speedy 360 | Speedy 400 | SP 500 |
|---|---|---|---|---|---|---|
| Rotary attachment, (with tilt) | | | • | • | • | • |
| Rotary attachment with cone | • | • | • | • | • | • |
| Rotary attachment with rollers | | | • | • | • | |
| Combined rotary attachment (cone and rollers) | | | • | • | • | |
| Maximum workpiece length | 11.2“ | 13.8“ | 19“ (cone)<br>26.7“ (roller) | 21.6“ (cone)<br>29.3“ (roller) | 29.9“ (cone)<br>37.7“ (roller) | 33“ (cone)<br>40.9“ (roller) |
| Maximum workpiece diameter (depending on lens) | 3.85“ | 4.6“ | 7.3“ (cone)<br>3.7“ (roller) | 8.1“ (cone)<br>3.7“ (roller) | 10.6“ (cone)<br>7“ (roller) | 9.8“ (cone)<br>5.9“ (roller) |
| Maximum weight | 5 lbs | 6.6 lbs | 6.6 lbs (cone)<br>22 lbs (roller) | 6.6 lbs (cone)<br>22 lbs (roller) | 6.6 lbs (cone)<br>22 lbs (roller) | 6.6 lbs (cone)<br>22 lbs (roller) |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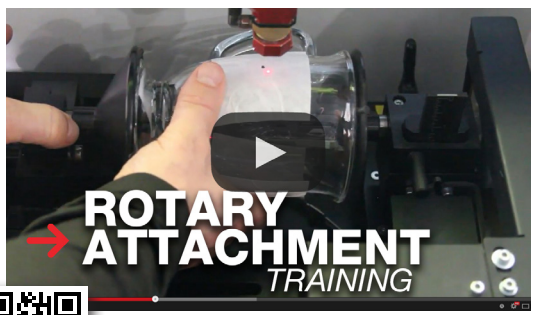


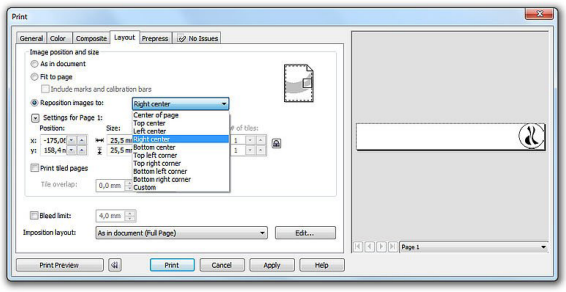

https://goo.gl/UYgk5X

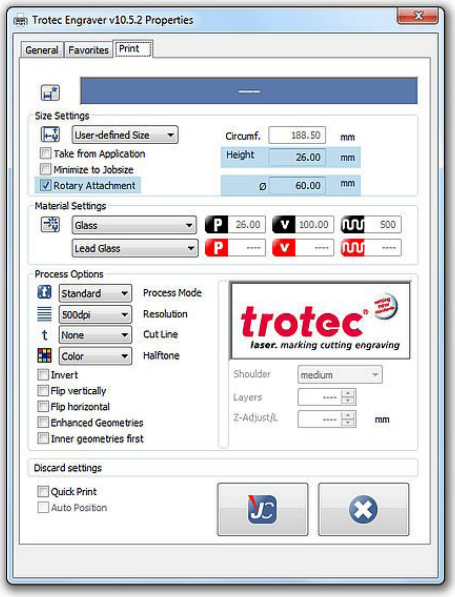
# Setting Up The Rotary Attachment

## Inserting the rotary engraving attachment into the laser engraving machine

First, move the laser machine table to its lowest position. On the Speedy 360 and Speedy 400, you can also open the front door to make it easier to insert the attachment. Then switch off the laser. Always switch the laser off when installing or removing the rotary engraving attachment to ensure safe handling in the processing area.

Now insert the rotary engraving attachment into your laser, and fix it with the clamps on the rulers of the ferromagnetic engraving table or vacuum table. Then connect the device to the connecting cable on the inside of your machine. Now switch on the laser again. This starts the homing process of the laser, and the rotary engraving attachment automatically rotates to the 0° position.




## Preparing the graphic

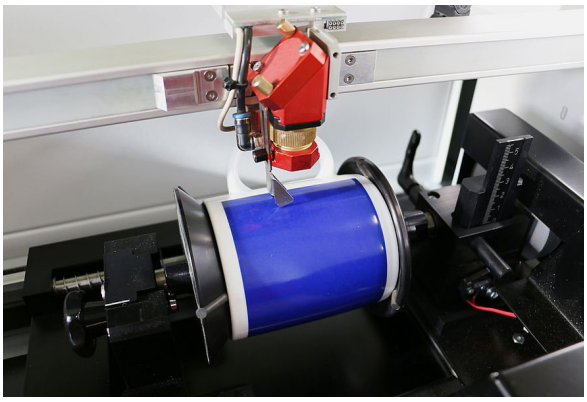
The next step is to prepare your graphic using your preferred graphics program. Print the finished graphic. In the Print dialog, go to the “Layout” tab, and set the positioning to “Center-Right.” This will automatically rotate the graphic by 90° in the software. Note that the change becomes visible only in JobControl®.

Next, go to the JobControl® Print window, check the “Rotary Attachment” option, and enter the height of your graphic and the diameter of the workpiece on the right-hand side. Measure the diameter at the point where you want to laser engrave your work piece. This causes the JobControl® software to calculate the circumference of the object and automatically adapt the job size.

Using these settings, the software also calculates the angle for rotation during the engraving. The height of the plate in JobControl® thus corresponds to the circumference of the workpiece.

Then select the desired parameter and send the job.

Tip: Select “Minimize to Job Size” to facilitate the positioning of the job in JobControl®.



## 3 Positioning the workpiece

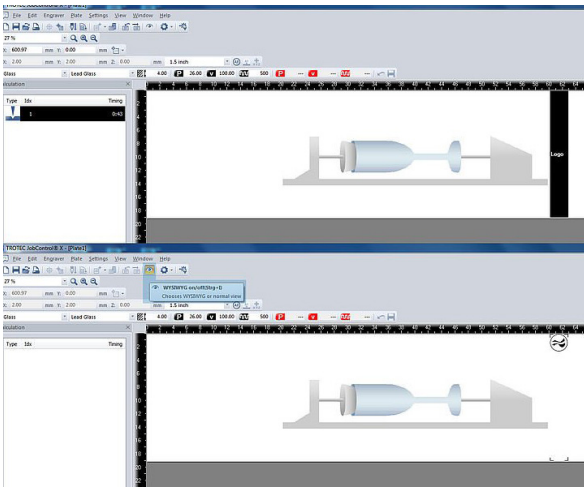
Now clamp the desired workpiece into the rotary engraving attachment and fix it with springs. Make sure the workpiece is not clamped too tightly or too loosely. This will allow quick exchange of the workpiece to be engraved as well.

If the workpiece is not cylindrical but conical, as wine glasses are, using the Speedy 300, 360 and 400, you can align the engraving area parallel to the working table using the rocker lever on the left side. In addition, the cones are height-adjustable on both sides in order to permit work with various workpiece diameters.

If you want to engrave glasses or cups with handles, they must be placed so that the handle is not rotated into the engraving field. First, move the Y axis (rotary motion) to the very top. Clamp the workpiece so that the handle is slightly above the laser beam. Since the workpiece is rotated backwards for the laser process, there is no risk of collision with the laser head.

For safety, detach the nozzle in order to avoid collision with the rotary engraving attachment. Then focus onto the engraving area of the workpiece.

Tip: If you want to engrave conical objects, the engraving area must be set parallel to the X axis to ensure a constant focus position. In the models Speedy 300, Speedy 360, Speedy 400, and SP 500, the rotary engraving attachment can be tilted to this end.



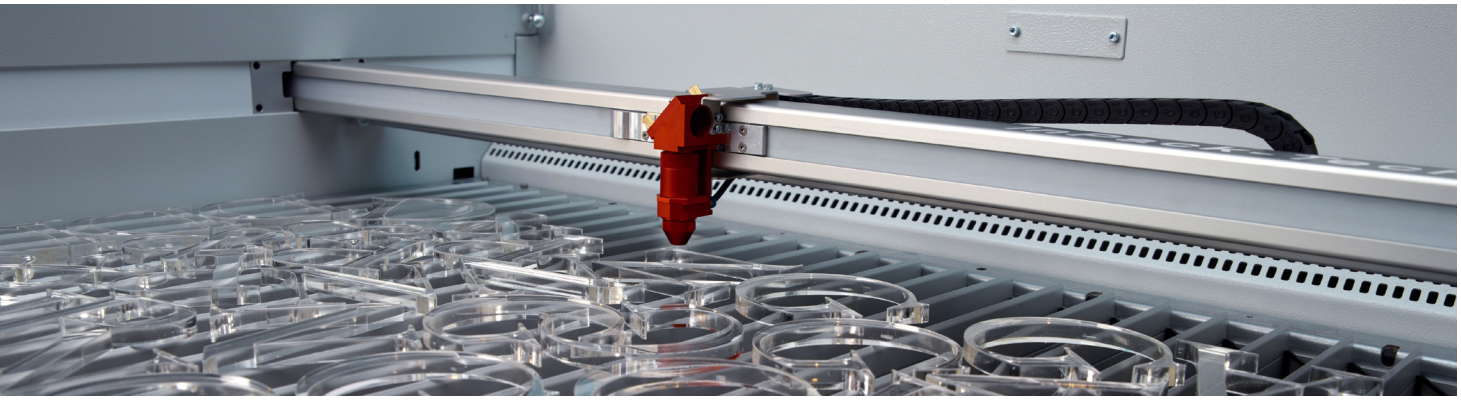
## 4 Laser engraving

Now position the job from the queue on the plate. As the job was sent with the “Cylindrical Engraving” option, the background of the plate in JobControl® likewise changes and displays a rotary attachment.

Now connect JobControl® to the laser. Use the crosshairs to position the job to your workpiece.

Now you are ready to start the job and create personalized laser-engraved workpieces on your Trotec laser engraving machine.

# Multi-Functional Tables



Depending on the application, it may be necessary to adjust the processing table. For example, foils or paper require a vacuum table with high exhaust power levels, in order to achieve optimum results. When cutting acrylic, however, as few contact points as possible are desirable, in order to avoid back reflections - here an acrylic cutting grid or lamella cutting table would be suitable. In the following paragraphs we have summarized all of the tables and matching applications.

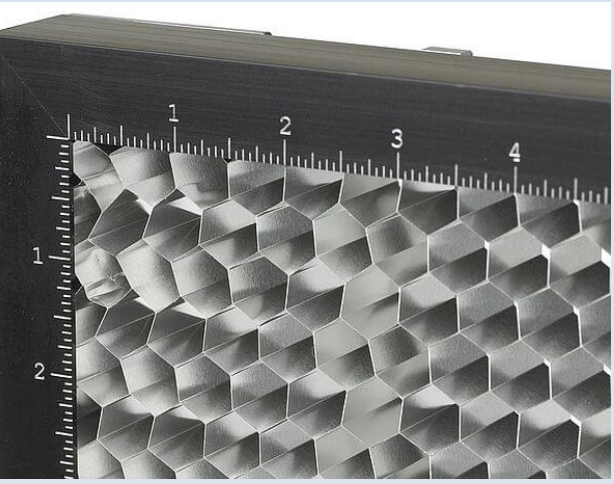
The ideal table for every application can be selected and replaced easily.


https://goo.gl/wDyDiU

### Engraving or standard table:

In laser engraving, cutting or marking the evenness of the processing table is an essential criterion for optimal results, since it is a prerequisite to achieving correct focus across the entire surface.

Consequently, the processing table is very robust and perfectly flat as well as being ferromagnetic across its entire surface. This means that you can easily fix thin materials, such as paper or foils in place using magnets.

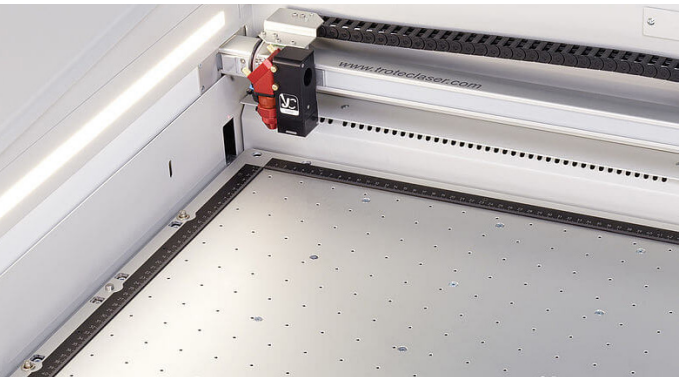


### Honeycomb table top:

• With small honeycombs: The fine honeycomb table provides greater stability thanks to more support points. Furthermore, very small parts, for example in model construction applications, can be processed more successfully using the fine honeycomb top as parts cannot fall between individual honeycombs as easily.

• With large honeycombs: The honeycomb table with large honeycombs has the advantage that the material rests on fewer points and therefore fewer back reflections arise. Due to the large distances between individual honeycombs this table does not offer as much stability as the fine honeycomb table and you should therefore avoid placing heavy materials on the large honeycombs, as this can cause damage.

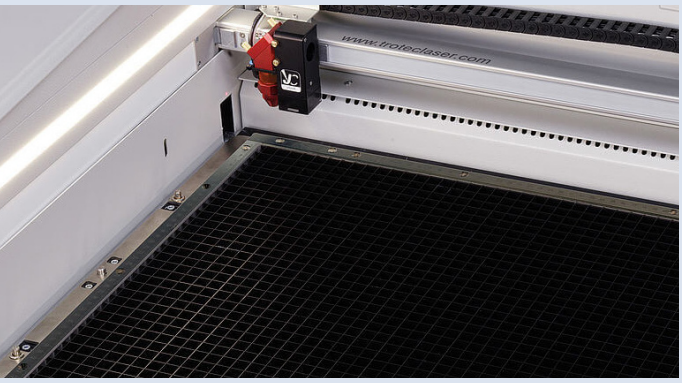
***Available for:*** *Rayjet, Speedy 100, Speedy 300, Speedy 360, Speedy 400, SP 500, SP1500*



## Vacuum Table

Fixes various materials to the working table using a light vacuum. This ensures correct focusing over the entire surface. Perfect for thin and light weight materials, such as paper, foils and films, that generally do not lay flat on the surface.

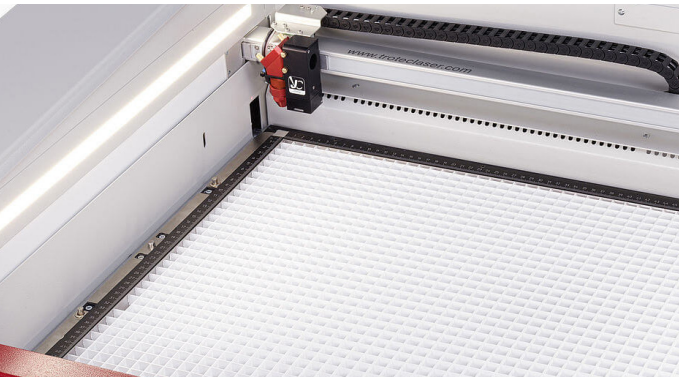
***Available for:*** *Speedy 300, Speedy 360, Speedy 400, SP 500*



## Aluminum Cutting Grid

This cutting table is the perfect solution for all general cutting. It is suitable for a variety of cutting tasks with parts smaller than 4", as these remain in a flat position after the cut.

***Available for:*** *Speedy 360, Speedy 400, SP 500, SP1500, SP2000, SP 3000*



## Acrylic Cutting Grid

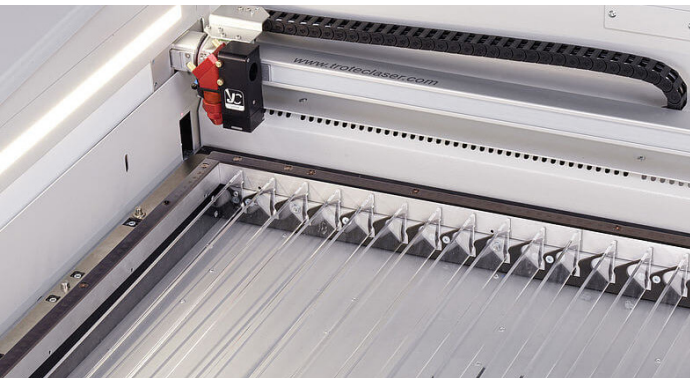
The special acrylic grid prevents back reflection. It is therefore ideal for cutting acrylics, laminates or plastic films with parts smaller than 4", as these remain in a flat position after the cut.

***Available for:*** *Speedy 360, Speedy 400, SP 500, SP1500, SP2000, SP 3000*

## Aluminum Slat Cutting

This table is perfectly suited to laser cutting thicker materials (5/16" thickness) and for parts wider than 4". Lamellas can be placed individually, consequently the table can be adjusted to each individual application.

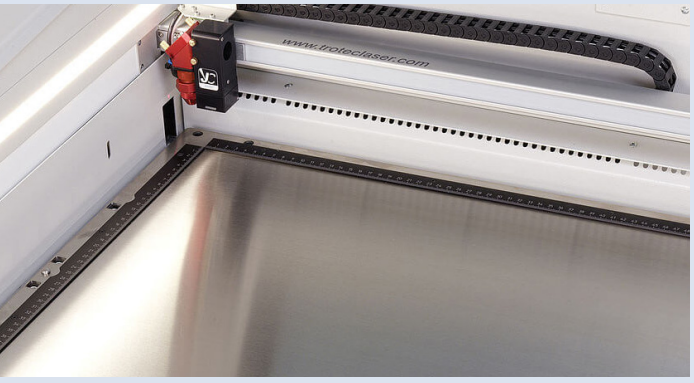
***Available for:*** *Speedy 360, Speedy 400, SP 500, SP1500, SP2000, SP 3000*



## Acrylic Slat Cutting

The cutting table with acrylic lamellas prevents reflection during cutting. This table is particularly used for cutting thicker materials (5/16" thickness) and for parts wider than 4". The number of supporting points can be reduced by removing some of the lamellas individually, depending on the job.

***Available for:*** *Speedy 360, Speedy 400, SP 500, SP1500, S P2000, SP 3000*



## Ferromagnetic Table

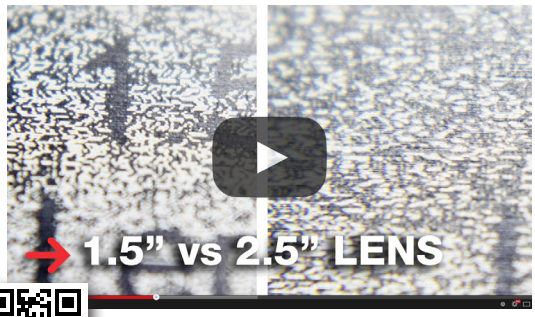
The ferromagnetic construction allows to mount thin materials such as paper, films or foils with magnets to ensure an even and flat surface. An even working table is essential for achieving optimal results for laser engraving and marking applications.

***Available for:*** *Rayjet, Speedy 100, Speedy 300, Speedy 360, Speedy 400*

| Work Table | Rayjet | Speedy 100 | Speedy 300 | Speedy 360 | Speedy 400 | SP 500 | SP 1500 | SP 2000 | SP 3000 |
|---|---|---|---|---|---|---|---|---|---|
| Ferromagnetic table | • | • | • | • | • | | | | |
| Aluminum Cutting Grid Table | | | | • | • | • | • | • | • |
| Acrylic Cutting Grid Table | | | | • | • | • | • | • | • |
| Acrylic Slat Cutting Table | | | | • | • | • | • | • | • |
| Aluminum Slat Cutting Table | | | | • | • | • | • | • | • |
| Vacuum Table | | | • | • | • | • | | | |
| Honeycomb Table Top | • | • | • | • | • | • | • | | |
| Honeycomb Cutting Table | | | | | | | | • | • |

# Lenses

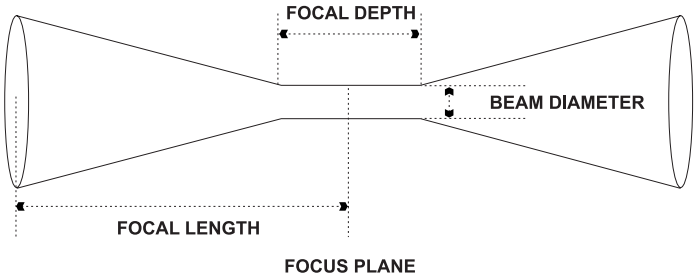
The best results in engraving or cutting are achieved by using specific lenses. This works in the same way as a camera that uses different lenses for close-up and wide angle photographs. The various lenses differ by their respective focal distances. This is the distance from the lens to the focus of the object being engraved/cut. The focus, in turn, is the smallest beam diameter hitting the material. A focal distance of 2 inches, for example, means that the maximum intensity is reached when the work piece surface that is to be cut or engraved is positioned 2 inches underneath the lens.




https://goo.gl/bSd8eM

### Beam diameter

The diameter of the laser beam which becomes greater and greater before and behind the focus. The longer the focal distance of the lens, the greater the beam diameter. The energy of the laser is focused by the lens onto a defined focal point. The greater the focal distance of the lens, the greater also the surface onto which the energy of the laser is applied. This may mean that if you use a large lens, the material is heated rather than cut.




### Focus tolerance (depth of focus)

The area in which the beam has the smallest diameter. The larger the lens (= the larger the focal length of the lens), the longer the focal tolerance. This means that the focus tolerance of a 5” lens will be twice that of a 2.5” lens. This is especially important if you want to cut through thick materials.

### Focal length

Distance between the lens and the point of the smallest beam diameter (= focus).

### Focus

The area where the laser beam is optimally focused and converges to the smallest possible beam diameter.

| Lens | Speedy 100 | Speedy 100 fiber | Speedy 100 flexx | Speedy 300 | Speedy 300 fiber | Speedy 300 flexx | Speedy 360 | Speedy 360 fiber | Speedy 360 flexx | Speedy 400 | Speedy 400 fiber | Speedy 400 flexx | SP 500 | SP 1500 | SP 2000 | SP 3000 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.5” $CO_2$ | ○ | - | ○ | ● | - | ○ | ○ | - | ○ | ○ | - | ○ | - | - | - | - |
| 2.0” $CO_2$ | ● | - | ○ | ○ | - | ○ | ● | - | ○ | ● | - | ○ | ● | - | - | - |
| 2.0” $CO_2$ CL | - | - | - | - | - | - | ○ | - | - | - | - | - | - | - | - | - |
| 2.5” $CO_2$ | ○ | - | ○ | ○ | - | ○ | ○ | - | ○ | ○ | - | ○ | ○ | ● | ● | ● |
| 2.5” $CO_2$ CL | - | - | - | - | - | - | - | - | - | - | - | - | ○ | - | - | - |
| 2.85” FLEXX | - | - | ● | - | - | ● | - | - | ● | - | - | ● | - | - | - | - |
| 3.2” Fiber | - | ● | ○ | - | ● | ○ | - | ● | ○ | - | ● | ○ | - | - | - | - |
| 3.75” $CO_2$ | - | - | - | - | - | - | - | - | - | - | - | - | ○ | - | ○ | ○ |
| 4.0” $CO_2$ | - | - | - | ○ | - | ○ | ○ | - | ○ | ○ | - | ○ | - | - | - | - |
| 5.0” $CO_2$ | - | - | - | - | - | - | - | - | - | - | - | - | ○ | ● | ○ | ○ |
| 5.0” Fiber | - | - | - | - | ○ | ○ | - | ○ | ○ | - | ○ | ○ | - | - | - | - |
| 7.5” $CO_2$ | - | - | - | - | - | - | - | - | - | - | - | - | - | ○ | ○ | ○ |

○○ - optional ○● - standard CL - Clearance Lens

### How to choose the right focus lens

The decision on what lens to use depends on a number of factors: laser power, type of material, degree of detail and resolution of the graphic (dpi), thickness of the material. Generally, the greater the detail of the graphic being engraved, the smaller the lens size needs to be applied. Consequently, the thicker the material for cutting, the larger lens size needs to be applied. Also, for curved and uneven objects, a large lens size will result in better quality engraving.

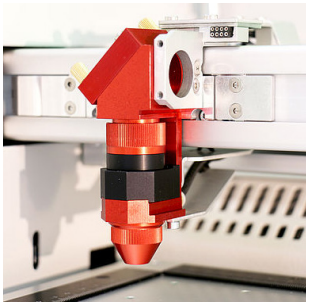
| Lens | Area of use engraving / marking | Area of use cutting |
|---|---|---|
| 1.5" $CO_2$ | Graphics with fine detail, (resolution > 500 dpi), rubber stamps with thin letters | Lower laser power, thin materials (e. g. paper), acrylic < 0.2", wood of medium hardness < 0.3" |
| 2.0" $CO_2$ | Graphics with medium detail and resolution (resolution 500 dpi; with reduced definition up to a resolution of 100 dpi), standard engraving | Medium laser power, acrylic < 0.3", wood of medium hardness < 0.47" |
| 2.0" $CO_2$ Clearance Lens | Mainly used for cutting | See 2.0 inch lens. Increases the distance between laser head and material. Is especially useful if the increased distance is required due to the material and the graphic |
| 2.5" $CO_2$ | Graphics with low detail, low resolution (< 500 dpi). Engraving on heat-sensitive materials (e. g. laminate) if large areas have to be removed completely | High laser power, acrylic < 0.47", wood of medium hardness < 0.6". Better quality of edges during laser cutting than for lower focal distances |
| 2.5" $CO_2$ Clearance Lens | Mainly used for cutting | See 2.5 inch lens. Increases the distance between laser head and material. Is especially useful if the increased distance is required due to the material and the graphic |
| 2.85" FLEXX | Standard lens for Speedy 300 flexx. Is transmissive for both CO2 lasers and fiber lasers. Both laser sources can be used without changing the lens.<br><br>Other characteristics as 2.5 inch CO2 lens or 3.2 inch fiber lens | Characteristics as 2.5 inch CO2 lens or 3.2 inch fiber lens |
| 3.2" Fiber | Standard lens for fiber lasers with extremely small focal diameter. Graphics with fine detail, ( > 500 dpi resolution) | |
| 3.75" $CO_2$ | Lens for SP500 rotary engraving unit. Permits engraving of round objects with diameters of less than 2" | |
| 4.0" $CO_2$ | Engraving by burning of wood, laser engraving of graphics with low detail with high laser powers | Foam rubber |
| 5.0" $CO_2$ | Is not used for laser engraving | High laser power, acrylic < 1", wood of medium hardness < 0.78"<br>Better quality of edges during laser cutting than for smaller focal distances |
| 5.0" Fiber | Lens for fiber lasers if materials that are not absolutely plane are to be labeled. The greater focal distance results in a greater tolerance during focusing. | |
| 7.5" $CO_2$ | Is not used for laser engraving | High laser power, acrylic < 1.5",<br>Better quality of edges during laser cutting than for smaller focal distances |

# Nozzles

The correct nozzle can be the crucial component needed to achieve your perfect laser result. The nozzle serves as the main dust protection for the lens as well as a crucial component for cutting.

## Short nozzle with large hole diameter (1/4")

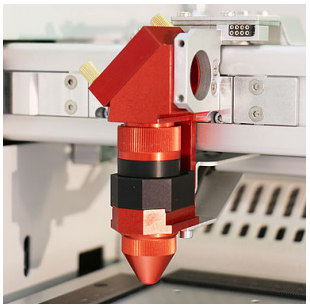
The standard nozzle, a short nozzle that has a large hole diameter (1/4"), may be used with both laser cutting and engraving. During cutting, the nozzle is mainly used with acrylic since the material doesn't cool down as quickly, making a lovely flame-polished edge.



## Short nozzle with small hole diameter (1/8")

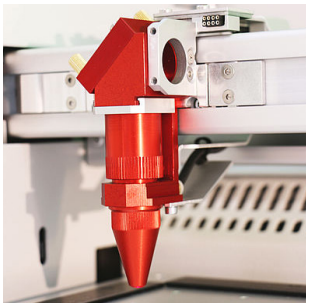
The short nozzle that has a smaller hole diameter (1/8") is primarily meant for cutting materials that generate too much smoke like wood. Thanks to the small opening, the concentrated airflow goes to the kerf and blows away any smoke or gases that result from cutting.

This nozzle does not work as well when engraving dust intensive materials like plastic or rubber stamps. Engraving dust can quickly settle on the opening of the nozzle and block it, causing a hole to be burnt into the lens.



## Short nozzle with small hole diameter (1/8")

Made specifically to be used alongside the 2.5" lens is the long nozzle with a smaller hole diameter (1/8"). This nozzle helps compensate for the bigger focal distance between the 2.5" lens and the laser material. The long nozzle has the same properties as its shorter version.



## Copper nozzles for laser cutting with compressed air

When laser cutting using compressed air on the SP500 there are extra copper nozzles that have a hole diameter of 0.07" for short nozzles. Because of the very small diameter, the airflow is even more focused towards the kerf. As a result, you gain the ideal laser cut with materials like thicker wood from around 3/16" thick or polycarbonate.

Depending on the lens you use and the resultant focal distance, these attachments come in four different sizes.

# Trotec Academy Launches In Canada!

We are proud to bring the new Trotec Academy to Canada with premium webinars, personalized one-on-one on-side and web demonstrations as well as class-room training and workshops. Trotec Academy will offer intermediate and advanced training for Trotec customers across the country.


## Premium Webinars

Basic webinars on our YouTube Channel (www.youtube.com/TrotecLaserCanada) are available for free. Trotec Academy will hold premium webinars for intermediate and advanced techniques for the laser and various design software. These premium webinars will be free for all Trotec customers and paid for non-Trotec customers.

## On-Site Trainning

We will send our Applications Engineer to your facility for a full-day training where you can choose from a variety of lesson plans with some examples of these lessons below. Our specialist will bring the appropriate materials, designs and knowledge to make sure you get the most out of the training.

## Web Demos

Web demos work like a private webinar where we will have a camera on one of our laser machines and we can switch between our screen and the laser. This will show the viewer both the software side (design and JobControl) and the application/laser side and the finish product. Web demos are ideal for customers in more remote locations.

## Hands-On Workshops

These workshops are made in a classroom environment where 4-5 groups of people will each work on their own laser machine at our facility. These workshops will be less expensive than individual on-site trainings and will help users experience the lasers and software with others to share their ideas and experiences.

## *Examples of Lesson Plans*

### Design Software

- Step & Repeat
- Photo Engraving
- Creating Mosaics
- 3D Engraving
- Vectorizing
- Print/Merge

### Consumables

- Out-of-Focus
- Reverse Engraving
- Inlaying
- Kiss-cut
- Masking Tape
- Hinges

### JobControl

- Positioning
- Pricing a job
- JC Vision Camera
- Parameters
- Rotary attachment
- Markers

### General

- Pass-Through
- Laser Theory
- Lenses
- Maintenance
- Beam Alignment
- Filters

# JobControl Vision® Camera System


## Create Print-to-Cut acrylics, paper, film or cardboard products.

Create amazing details and meet the tightest tolerances with Trotec JobControl® Vision. The Vision module uses registration marks to determine the position and rotation of printed sheet material on the working area of the laser. The system detects print distortions and adjusts the cutting path dynamically to match the artwork. No matter if it's flexible or rigid materials.

**JobControl® Vision is available for Speedy 300, Speedy 360, Speedy 400, SP500 and SP1500.**


https://goo.gl/gWXqhm


https://goo.gl/m64fYN

Contour cut UV-printed acrylics

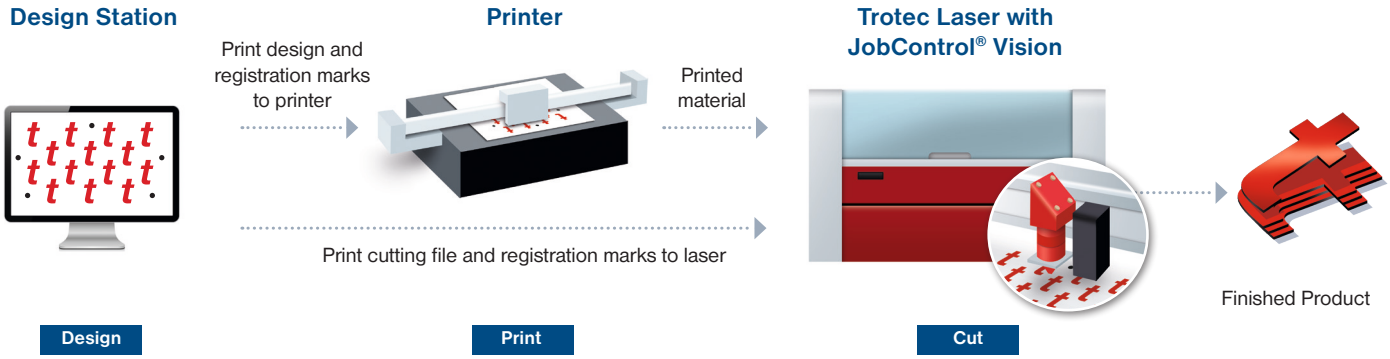
Unusual Finishing of business cards

Paper refinement of book covers and more

Technical film cuttig with tightest tolerances

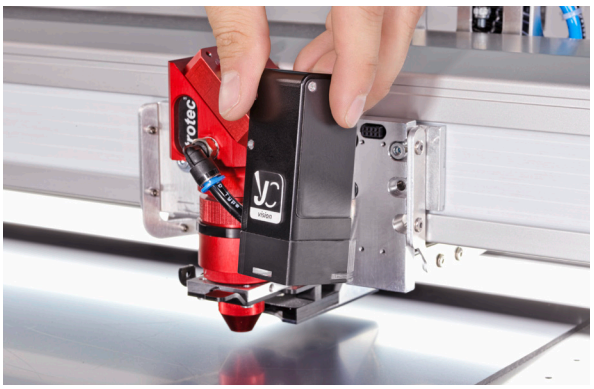
## How JobControl Vision® works

The registration marks are printed along the image. The camera - which is attached to the working head – "reads" the registration marks prior to the cutting process and compares the "read" positions on the printed design to the target positions in the original cut file. Any deviations are adjusted automatically. There is no need for manual alignment, speeding up your production and eliminating costly errors, guaranteeing a perfectly cut end product.

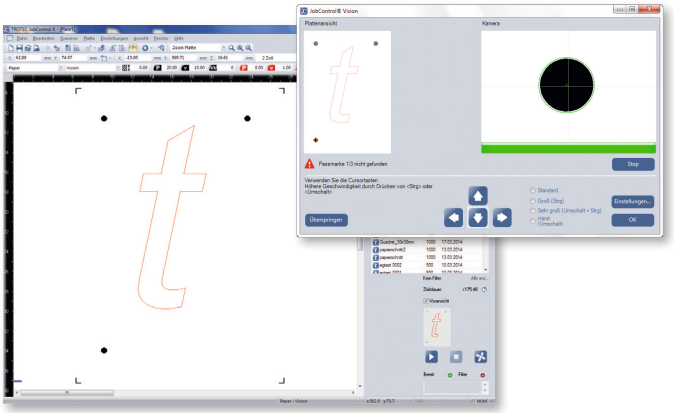



## JobControl® Vision Compensation Types

| Compensation Type | Print and original cutting file | Print and compensated cutting file |
|---|---|---|
| **Position and rotation**<br>Image position and rotation are compensated. Size and shape remain unchanged. | | |
| **Linear distortion**<br>Position, rotation and size are compensated. The size of the cutting path is changed linear. | | |
| **Non-Linear distortion**<br>Position, rotation, size and shape are compensated. The size and the shape of the cutting paths are adjusted. | | |



USB-Camera with digitally adjustable aperture and LED-lighting



Seamless integration in the known JobControl® workflow

# General Maintenance



## Cleaning and dust removal

When laser processing a variety of organic materials including plastic, wood or rubber, the surface material being removed will result in an excess of dust and debris settling in the laser machine. Dust can accumulate and if not removed from the components of the system, including the machining surface and laser lenses, can create undesirable processing results such as burnt debris, distortions and discolorations. Cleaning your laser machine regularly is imperative for the longevity of your system and your engraving quality.

## 5 tips to avoid dust in the laser machine

1. Regular cleaning of your laser machine is required regardless of use, but is especially important after extended periods of operation. Proper machine cleaning requires less time than having to repeat an engraving due to dust
2. Utilize an extraction system with the proper capacity for your machine and application. Extraction requirements will vary depending on the materials and quantities being processed, but these systems are designed to properly remove excess dust and debris and will help maintain good processing results.
3. Cover the unused areas of your machines workspace. This simple practice will boost extraction efficiency in the areas that are being engraved.
4. Reverse engraving direction, which is a setting available in the JobControl® software. This will result in the dust being extracted so that it does not get under the laser beam.
5. Utilize a Trotec service technician to service your system on a routine basis. The optimal maintenance and adjustment of all laser components increases the service life of your machine.

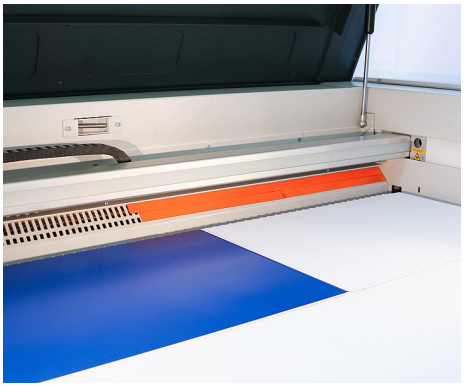
## Cleaning a Trotec laser engraver

Proper maintenance and routine servicing of your laser machine is essential for achieving and maintaining consistently high engraving results, and an extra-long system lifespan. By implementing just a few simple steps, you can ensure that your laser machine is well maintained.

| Frequency | What to check |
|---|---|
| x1 per day | Check the work space and thoroughly clean as necessary. |
| x1 per day | Inspect the mirror and lens on the machining head, which should always be free from dust and debris to avoid system damage. |
| x1 per day | Check all ventilation slots and make sure that they are free from contamination, which will allow for continuous flow of extracted air. |
| x1 per week | Check all optical and mechanical components for debris. |

## Cover unused areas of the work surface

Cutting and engraving results can be drastically improved by covering the unused portion of the rear exhaust vent, which will focus the extraction on the area being laser processed.



If a vacuum table is also being used, make sure to cover the vacant suction holes as well. This will allow for greater suction when working with thin workpieces (e.g. laminates), and ensure that the materials lie flat on the machines work table. Following this technique will ensure that the appropriate distance between the workpiece and lens is achieved consistently.

We suggest using masking tape and/or magnetic strips to properly cover the laser machines rear exhaust vents. For covering the table, use cardboard, paper or laminate boards to line the areas not being processed.

## Reverse the engraving direction

For materials that produce dust during the laser engraving process, we recommend reversing the engraving direction to "bottom to top," so that results are not compromised. This technique can be applied to a variety of materials but is especially helpful when engraving wood, acrylics or laminates.

| Color | Process | Power | Speed | PPI/Hz | | Auto | Passes | Air Assist | Z-Offset | Direction | Advanced |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Engrave CO2 | 20.00 | 10.00 | 500 | PPI | | 1 | On | 0.00 | Top down | Default |
| 2 | Cut CO2 | 20.00 | 10.00 | 1000 | Hz | | 1 | On | 0.00 | Top down | Default |
| 3 | Cut CO2 | 20.00 | 10.00 | 1000 | Hz | | 1 | On | 0.00 | Top down | Default |
| 4 | Skip | --- | --- | --- | --- | | --- | --- | --- | Bottom up | --- |
| 5 | Skip | --- | --- | --- | --- | | --- | --- | --- | Top down (Alternati | --- |
| | | | | | | | | | | Bottom up (Alternat | |

Adjusting the engraving direction will protect the freshly engraved materials from any dust settling on the still-warm workpiece. Depending on the laser machine model being used, the dust is alternatively extracted by the head extractor or by the extractor on the rear wall of the machining area. This ensures that the unprocessed part of the material does not accumulate dust on the warmed-up engraved surface, and that the materials remain clean. Using this technique will greatly cut down on any extra post-processing cleanup that might be required.

Additionally, changing the engraving direction will allow for greater visibility of the materials being processed and the engraving result, because the axis will not obscure the workpiece. For example, when laser engraving stamps you would typically use the standard engraving direction "top to bottom". This results in the engraving dust (which is heavier with this type of material) just settling on the workpiece instead of swirling upwards from extracted airflow suction.

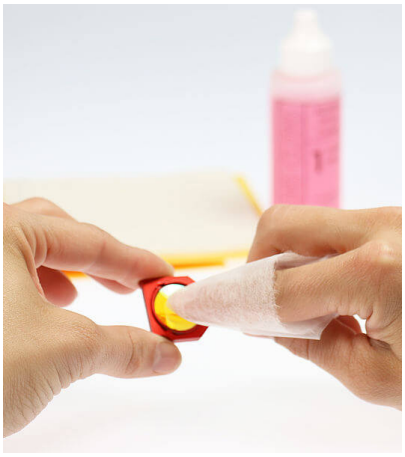
## Lens cleaning

Clean optics are a prerequisite for perfect engraving and cutting results. Certain materials, such as wood or stamp rubber, create more dust during engraving than other applications. Depending on the respective application optics should be cleaned at regular intervals. This ensures the longevity of the laser as well as consistently high quality of engraving.

**How does that work?**

It is really easy to keep optics in good condition. A brief check of the lens and the mirror on the processing head should be part of your daily laser care routine. It is best to check the side mirrors once a month. Depending on the material used these intervals may have to be shortened. Thanks to proprietary Trotec InPack Technology™ lenses and mirrors are protected from dust. This reduces the amount of cleaning required enormously.


https://goo.gl/Uu7L4U

**Step 1 - Blow away loose particles (dust, fluff)**
A small bellows helps to remove lint and dust. Alternatively, you can of course also use the laser's compressed air supply. If the optics are still dirty, just continue with step 2.

**Optics: More sensitive than glass**
It is very important to treat the optics extra carefully. Never use any kind of tool, which could scratch the surface. We recommend that you use the cleaning liquid and cloths supplied in the accessory box. Alternatively, you can also use cotton swabs.

**Step 2 – clean with cleaning fluid and cloths**
Carefully remove the optics from the laser device. Rinse the lens with cleaning fluid and place it on a clean cloth. Now wet the lens surface with cleaning fluid and leave to soak in for about a minute. Then dampen a cloth and wipe down the surface of the lens without exerting any pressure on it. If the lens or mirror is still dirty, simply repeat the process. That's it!

## Ideal environment conditions

Machine should be in room temperature between +15°C (+59°F) to +28°C (+82°F) with relative humidity between 40% and 70%. Also, make sure to protect your device from direct sunlight.

### Cold environment

Make sure that the environment for your laser does not get too cold. Conditions that are too cold can lead to condensation in the laser tube which causes damage. In addition, greases and oils can harden, affecting the mechanical parts.

*Ways to keep your laser machine warm*

Install a frost guard on the heater to keep the room conditions from falling below +15°C (+59°F) . You can also warm up the room slowly before using the laser machine. Do not place the laser too close to the heat source, since the warm air could be drawn in as cooling air, causing the laser machine to shut down due to overheating.

*Do you have a water-cooled device?*

Wrap it overnight into an insulating hood in order to maintain optimal temperature conditions. If the coolant is at a temperature below +15°C (+59°F), the laser machine cannot be switched on for safety reasons.

### Hot environment

In summer, laser machines are often exposed to extreme conditions such as the heat of the sun, and the cold from air conditioning systems. Either can lead to problems. High ambient temperature, in particular, can adversely affect the functionality of your laser machine.

- Avoid direct sunlight. If your laser machine is located near a window, close the blinds or shutters.
- Do not place the laser and its accessories directly into the air flow from an air conditioner either, as this could cool down the parts excessively.
- Good air circulation in the room avoids heat build-up – so just open the window once in a while and ventilate.

# TroCare & Support


## Installation & Commissioning

When you purchase a new system, the Trotec service team will assist you, even with the commissioning of the laser. Prior to delivery of the machine, you will receive detailed instructions to enable you to carry out all preparations necessary to ensure successful commissioning. We also offer you on-site installation of the laser machine as well as training by one of our service technicians.

## Troubleshooting Remote Maintenance

Trotec has 4 service locations across Canada including Toronto, Vancouver, Calgary and Montreal. Each location comes with a service technician that can assist any issues that may arise with the laser machine or software. In addition to the service hotline, we offer you fault diagnosis by a remote maintenance service. For this, a service technican will log into your PC via the Internet and will check the status of your laser software. Many problems can be solved in this manner in just a couple of minutes.

## Spare Parts Service

We keep permanent stocks of the most important spare parts for our laser machines. This guarantees short delivery times. We procure rare or discontinued spare parts at short notice so that we can respond promptly if necessary. This also applies to our refurbished laser sources.

## Service Hotline

Contact the Trotec service hotline where top qualified laser experts will assist you with any questions or problems. You can reach Trotec technical support via:

Phone: ***800-663-1149*** E-mail: ***techsupport@troteclaser.ca***

## TroCare Program

This program provides you with the security of top quality service and support of the standard operating costs for the life of your Trotec systems. The plan covers your machine for 12 months at a time for machines of up to 10 years of age.

- Full extension of the parts warranty including the laser tube (optics are excluded)
- Capped travel and labour costs for service calls
- Open Clinic training at a 20% discount
- Annual preventative maintenance call
- Free software upgrades within your current whole number version

# Filters & Exhausts

Filters that are designed to maximize your laser performance and keep your workspace environmentally clean.

- These filters use high power blower motors to pull the air through multiple stages of filtration consisting of a pre-filter for large particulates, a certified HEPA filter to capture 99.97% of all particulates greater than 0.3 micron and a chemical filter.
- Filters are easily accessible and can be changed in less than a minute (no tools required).
- Fully integrated, automatically turns on and off with the laser.
- Compact installation requiring no bulky and expensive ductwork.
- Hoses and clamps included.


https://goo.gl/uXgC34


## SPH - 426

**Ideal For Laser:**
Rayjet 50, Speedy 100, all Fiber lasers

**Motor:** 2 High Speed Turbines
**Amps:** 12.8
**Voltage:** 120V

**Height:** 24" (762mm)
**Width:** 12" (304mm)
**Depth:** 15" (381mm)
**Weight:** 70lbs (32 kg)
**CFM:** 280 (482m3 / hr)
**W.C.:** 90"
**Certified:** CE, CSA, HEPA Filters

| *Filter Replacement:* | | *SAP* |
|---|---|---|
| *AG168* | **Pre-filter pads (box of 12)** | *72555* |
| *F071* | **Pleated filter (box of 6)** | *72565* |
| *F074* | **HEPA filter** | *72568* |
| *NC-GPC* | **Replacement carbon pellets** | *72570* |


## CSA - 626

**Ideal For Laser:**
Speedy 100, Speedy 300

**Motor:** 2 High Speed Turbines
**Amps:** 12.8
**Voltage:** 120V

**Height:** 45" (1140mm)
**Width:** 21" (540mm)
**Depth:** 13" (330mm)
**Weight:** 140lb (63.50kg)
**CFM:** 282 (480m3 / hr)
**W.C.:** 90"
**Certified:** CE, CSA, HEPA Filters

| *Filter Replacement:* | | *SAP* |
|---|---|---|
| *AG128* | **Pre-filter bags (box of 5)** | *72553* |
| *F073* | **Pleated filter (box of 2)** | *72567* |
| *F074* | **HEPA filter** | *72568* |
| *AG110* | **Replacement carbon pellets** | *72549* |


## SPH - 835
*with pre-filter*

**Ideal For Laser:**
Speedy 360, Speedy 400, SP 500

**Motor:** 3 High Speed Turbines
**Amps:** 12
**Voltage:** 220V

**Height:** 30" (760mm)
**Width:** 16" (406mm)
**Depth:** 25" (635mm)
**Weight:** 165lbs (74.82 kg)
**CFM:** 360 (610m3 / hr)
**W.C.:** 90"
**Certified:** CE, CSA, HEPA Filters

| *Filter Replacement:* | | *SAP* |
|---|---|---|
| *AG128* | **Pre-filter bags (box of 5)** | *72553* |
| *AG168* | **Pre-filter pads (box of 12)** | *72555* |
| *F071* | **Pleated filter (box of 6)** | *72565* |
| *F074* | **HEPA filter** | *72568* |
| *NC-GPC* | **Replacement carbon pellets** | *72570* |

Maintaining a good exhaust flow is important for a number of reasons. These include:

- Cleaner engraving is possible when the smoke is extracted before it can deposit on the surface of the material
- Maintaining a healthy air quality in your working environment
- Keeping the optical paths and the optics themselves as clean as possible
- Preventing exhaust debris from contaminating the motion system

If you notice that the smoke is lingering in the cabinet, this is a usually a sign that one or more of the filters is nearly blocked.


https://goo.gl/pJNGng

### When do the motors in the Quatro system need to be serviced?

This depends on the style of motors in your system and you can tell this by looking at the colour of the lid and control panel on your system. If you have a white lid with a black control panel you have the standard brushed motors. If you have a red lid with a red control panel, you have the infinity brushed motors.

### Standard brushed motors

The brushes in these motors must be changed on a regular basis to keep the unit running. The brushes are rated at 500 working hours and the control panel keeps a count of this for us. If you notice the Service Motors light flashing slowly, you have 490+ hours on the brushes and you should order replacements if you don't have them in stock. At 500 hours, the unit will shut down so it's important to order these brushes and change them out as soon as you can. Just make sure to do the timer reset at the end so the 500 hour timer is reset for the new brushes. After 3 – 4 changes of the brushes, the motors should be replaced.

### Infinity brushed motors

The brushes in these motors last a full 4 times longer than the standard brushes (2000 hours!) but they are not meant to be replaced. Once this 2000 working hours has elapsed, the motor is at the end of its life and should be replaced. This is a similar lifespan to the standard brushed motors and the replacement cost is similar to the standard brushed motor plus a few brush changes. When it is getting close to the end of the 2000 hour life of the motor, the system will beep every 4 hours.

### The correct throttle setting for your application

The Trotec air throttle regulates the airflow between the exhaust system and the 3" suction connections on the Speedy 300, Speedy 400 or SP500 when using a vacuum table. By reducing airflow into this port, the table's extraction power level is automatically increased and higher vacuum pressure is thus created or rather the removal of vapors via the table is increased. This leads to an improved hold of films, paper and other thin materials. In addition, the cut quality of acrylic or other plastics is increased as resulting fumes are extracted immediately, which results in clear and shiny cutting edges.

| closed | partially open | open |
|---|---|---|
|  |  |  |
| Full exhaust performance on the vacuum table. No exhaust performance via the exhaust slits in the processing area | The less you open the throttle, the more pressure acts on the vacuum table and the fewer fumes are removed via the Speedy's back wall | Exhaust performance at the table and in the processing area is normal, as if no throttle had been installed |
| Ideal: Cutting | Ideal: Combined engraving and cutting with low dust generation | Ideal: Engraving with high dust generation (e.g. stamp rubber) |

# Making Money With The Laser

Nowadays, personalization and customization are essential. Uncommon and original gifts, signs or trophies with a customized dedication are becoming more and more popular. An engraver's field of application is very diverse and can best be supported with laser technology.

Additionally, lasers are a tool for multiple applications in the advertising material industry. With high quality laser engravings, giveaways and simple promotional items (usually available from almost any supplier) can be sold at a higher profit margin.


https://goo.gl/7WbYX9

## Example: Laser-engraved ballpoint pen with surcharge for laser engraving

End customers are usually willing to pay a higher price for personalized products. The price for these items, customized with a laser engraving, is thus typically determined from the price per product that's achievable in the market. It is common for consumers to pay 5 to 10 times the base price for customization.

For instance, high quality ballpoint pens with an engraving are sold for $24. The pens can be bought for as little as $2.50/unit depending on the purchased quantity. In the laser industry, "laser costs" are typically calculated at $1.50 per minute to cover for laser time. Different images and the time taken to engrave can quickly be quantified into costs. With the example of the ballpoint pen, the laser cost is 38 cents per unit in laser costs for an engraving time of 15 seconds. Even when allowing for labour costs, it is simple to see that laser engraving can make good profits.

| Laser engraving ballpoint pen: 1 unit | |
|---|---|
| Purchase price of a ballpoint pen: | $2.50 |
| Engraving duration for 1 unit: | 15 seconds |
| Engraving costs ($1.50/min): | $0.38 |
| Labor costs ($62/hour): | $0.26 |
| Retail price with engraving per order at 1 unit: | $24 |
| Profit per unit: | $20.86/unit |

| Laser engraving ballpoint pen: 150 units | |
|---|---|
| Purchase price of 150 ballpoint pens: | $375 |
| Engraving duration for 150 units: | 15 min |
| Engraving costs for 150 units ($1.50/min): | $22.50 |
| Labor costs ($62/hour) | $15.50 |
| Retail price with engraving per order at 150 units: | $3600 |
| Profit per order at 150 units: | $3187/order at 150 units |

Oftentimes, promotional items are mass produced. However, there are many suppliers and retailers of promotional items who carry a wide variety of products. These are usually imported from Asia in high quantities. For retailers, the challenge is in reselling these promotional items, ideally in large amounts. Often, the company's marked name or logo is the only additional value. This unfortunately means that profit margins are quite low. Successful suppliers of promotional items stand out from the rest by specializing in innovative processing technologies. With a high quality laser engraving, gifts and promotional items (typically available from almost every supplier) can profitably be sold with a higher margin. There are two approaches that allow you to realize these margins in your pricing.


https://goo.gl/oBNXTn

**1. Surcharge for the laser engraving (high-quality finish)**

The "usual" approach to getting higher margins is by adding a surcharge for the laser engraving. Using this method, the base price of the promotional item is low and comparable to other suppliers, but an extra surcharge is added for the engraving. Depending on the size and quantity, surcharges of around $1.50 per laser engraving are viable. This would mean that with orders giving 100 items a week, the purchase of a laser system (using the average value, depending on the size and equipment) is already economically feasible. Keeping in mind that significantly larger order volumes are realistic in the promotional items field and that there are no fixed costs with laser processing, promotional items retailers can raise their company's profitability with laser engravings and markings.

**2. Higher prices of mass-produced items by laser engraving**

Some promotional items suppliers will provide laser engraved markings for almost no extra charge (only a few cents per unit). The idea behind this is that profit is already made through the base product's price and the engraving add-on allows customers to feel like they are getting a high quality engraving for next to nothing. As laser processing does not have any variable costs (no consumables are necessary, excluding labour costs) and that promotional items are never really purchased without branding, the fixed costs can be included within the price of the unmarked product. Because of higher quantities, like with giveaways, retailers can create more sales and revenue with very low acquisition costs, increasing profitability.


https://goo.gl/TRVgTY


https://goo.gl/m46JF1

# Optimizing Your Laser Producivity

Higher laser power helps maximize efficiency in your manufacturing processes and gives your business greater flexibility. This means profitability for almost all laser engraving and cutting applications. Consider these two compelling examples:

**Cast acrylic**
0.4", plate size 40" x 20", 352 units with a height of 2" each

| Laser power: 80 w | Laser power: 120 w |
|---|---|
| Progress: 65 % finished | Pogress: 100% finished |
| Time/unit: 29 seconds | Time/unit: 29 seconds |

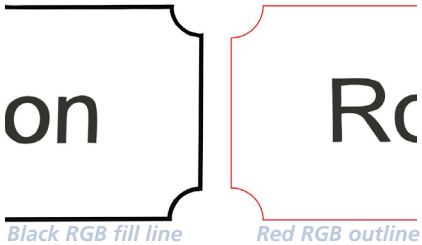
**Anodized aluminum**
Data plate, layout 27.5" x 16.5" 49 units per 4" x 2.4"

| Laser power: 30 w | Laser power: 80 w |
|---|---|
| Progress: 48% finished | Progress: 100% finished |
| Time/unit: 55 seconds | Time/unit: 55 seconds |

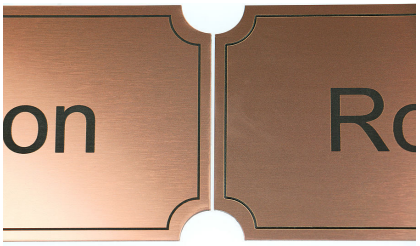

## Reduce processing time: Vector engraving versus raster engraving

Depending on your application, vector engraving is sometimes a better method. Edging a plate for example is faster if you score the frame (vector engraving) rather than engraving it (raster engraving). In this way the border line is created as a vector (hairline) in the graphic. When engraving, the vectors are traced, while raster engraving works line by line in x direction. In our example you could save up to 2/3 of your work time if you score the edge instead of raster engraving it.

As you can see in our example, the first image shows how the graphic will look like in your design file. The engraving line is represented by a thicker RGB black filled line, while the image on the right shows a RGB red outline (hair-line in CorelDRAW, 0.01" in Adobe Illustrator). Make sure the the score is done with very low power on your laser. In JobControl it will be a "cut" instead of "engraving".




*Black RGB fill line* *Red RGB outline*

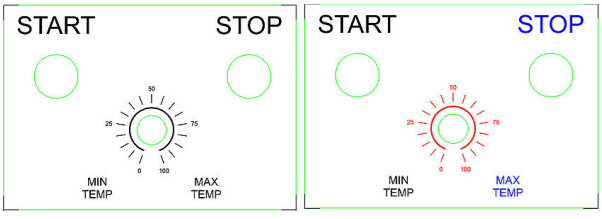



*Engraving the line* *Scoring the line*

## Reduce processing time thanks to the optimization of graphics

In our example, we want the metal plate to be marked using annealing techniques. There is a lot of blank space between individual graphic elements. However, because this space is traced during the engraving process, the processing time increases. To avoid this redundant movement and save time, we have divided the graphics into several different vertical color zones.

Due to the lower engraving speed required for this process, aligning the graphics saves time. In our example, we managed to reduce the processing time by 25% thanks to the optimized graphics.




*Not optimized* *Optimized*

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3. Redeem

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# Acrylic

There are almost no limits for the uses of acrylic. Laser cutting can be used to quickly and easily produce illuminated and neon advertising, signage or sales displays and many other plastic products. When laser engraving acrylic, the surface is removed by the laser. As a result, even the finest details can be displayed accurately. On transparent acrylic the result is a matte white engraving.


Acrylic is produced through two different methods, it can be **cast (GS)** and **extruded (XT)**. Each method produces its own set of material properties. In principle, both versions can be processed very well, however, they behave differently during the laser processing. It is useful to have basic knowledge about the differences when deciding on a suitable acrylic material for your application.

### Cast acrylic (GS)

Cast acrylic is poured as a liquid mass between two glass plates. The result is a homogeneous, tension-free material with equal mechanical properties in directions x and y. Due to this manufacturing process, however, the thickness tolerance is significantly higher and is approx. ±15%, which must be observed for applications with plug connections. The manufacturing process for cast acrylic is more expensive which is why it costs more than extruded acrylic.

Laser cutting cast acrylic creates burr-free cuts on both sides. Laser engraving also yields better results than with extruded acrylic - a perfectly white engraved image results. Currently, the Trotec material assortment only contains cast acrylic sheets.

### Extruded acrylic (XT)

Extruded acrylic is produced through an extrusion process that presses an acrylic mass through a nozzle with the desired thickness. This manufacturing method gives the extruded acrylic different mechanical properties in the x and y directions. In addition, it has a lower thickness tolerance of ±5% and is thus very well suited to applications with plug connectors.

When extruded acrylic is cut with a laser, it creates a flame polished cutting edge that is less sharp on one side. Extruded acrylic is cheaper to produce, and is thus cheaper as a series production. As a rule, extruded acrylic requires less laser power than for cast acrylic in the same sheet thickness. Laser engraving on extruded acrylic is not recommended because the result is only a matte gray.

### Machine setup for acrylic processing

In principle, all CO2 laser machines from Trotec are suitable for working with acrylic. For instance, a Speedy100 can cut and engrave acrylic just as well as the SP3000. The differences are only visible in terms of the speed of processing and the quality of the results.

The **laser power** needed for cutting acrylic depends on the thickness of the acrylic sheet and the desired productivity. For a productive work method, we recommend a laser power of 60 watts or more.

The rule of thumb is: 10 watt laser power per 1 mm sheet thickness for a high cutting quality (Up to a thickness of 20-25 mm)

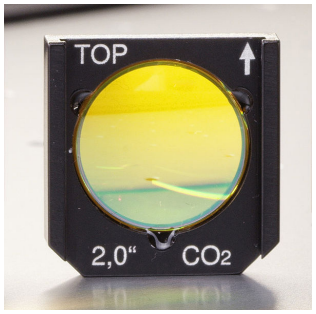
## Selecting the correct lens

Selecting the correct lens plays an essential role when cutting acrylic. The thicker the material, the longer the focal length of the lens should be.

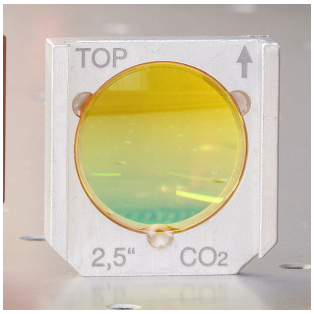
| Material Thickness | Speedy Series | SP Series |
|---|---|---|
| thin acrylic sheets < 5mm | 2“ lens | 2.5“ lens |
| thick acrylic sheets > 5 mm | 2.5“ lens | 5“ lens |

We recommend moving the focal point to the interior of the material when it is more than 6 mm thick to achieve an even, homogeneous cut.

The following guiding values apply: Move focus to about 1/3 of the thickness of the material.
For 6 mm acrylic, it would be a z value of - 0.8“.

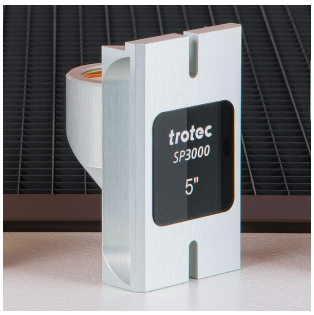


*2” CO2 lens for the speedy series*



*2.5” CO2 lens for the speedy series*

*2.5” CO2 lens for the SP3000*



*5” CO2 lens for the SP3000*

## Selecting the nozzle and setting the Air Assist

When cutting acrylic, you should definitely use the nozzle with the large diameter and – if controllable – lessen the Air Assist to a max. of 0.2 bar. That gives the material enough time to cool off - and glass-clear edges result. In contrast, if a nozzle with the small diameter is used or the air pressure is too high, the result is a dull, milky cutting edge because the material cools off too quickly.

## Selecting the correct table

Selecting the right cutting table is an equally important criterion for achieving perfect results in acrylic. There are several versions, depending on the size of your application. We recommend the acrylic slat cutting table or the acrylic cutting grid table depending on the size of the application.

The acrylic slat cutting table prevents kick-back during cutting and is thus especially suitable for cutting thicker acrylic sheets (6 mm or more) and for parts that are cut larger than 100 mm. Smaller parts can tip and are thus not suitable for this table design.

For parts smaller than 100 mm, the acrylic cutting grid table or the acrylic grid overlay on the vacuum table are suitable since the parts remain in a flat position after cutting. However, this work area is only recommended for acrylic up to 8 mm thick. For thicker acrylic, you should always use the other version.

| Cutting table | Material thickness | Size of parts |
|---|---|---|
| Acrylic slat cutting table | Acrylic sheets > 6 mm thick | Parts that are cut wider than 3.9“ |
| Acrylic grid cutting table | Acrylic sheets < 8 mm thick | Parts that are cut smaller than 3.9“ |

## Cutting Acrylic

Acrylic, as a material, requires a higher frequency when laser cutting it compared to wood, for example. The higher frequency brings the energy evenly into the material. This causes an even melting of the cutting edges which creates a glass-clear, flame-polished edge.

- For GS materials, we recommend a frequency of 5,000-20,000 Hz

- For cutting XT materials, a frequency of a max. of 5,000 Hz.

If the frequency is too low, fine ridges, so-called chatter marks, become visible on the cutting edges. To counteract these, increase or lower the frequency of the cutting speed. However, if the cutting speed is too slow, this can lead to a cutting kerf below - which increases the risk of fire.

Figuring out the perfect parameters is very important, in other words, when working with acrylic to work safely and efficiently.


## Engraving Acrylic

When engraving acrylic, the principle applies: less is more.

The best results are achieved when only the surface of the acrylic is scratched, creating a white engraved image. If too much power is used, the engraving results may be deep, however, they will no longer be white.

**TIP:** Engraving on the reverse side: Engraving the acrylic on the back gives the final result a higher quality and the engraving is better protected against external influences. Even with printed acrylic, the product looks better when printed on the back.

**Caution:** Don't forget to mirror the job! You can do this either in the graphics program or simply directly in the printer setting when you send the job to the laser.


https://goo.gl/d3VDiu


https://goo.gl/tXK1kF

## Graphic and software settings for acrylic processing

### *Minimum number of nodes*

The careful preparation of the graphics can also significantly improve quality when working with acrylic. First, the number of nodes in the cutting contour needs to be reduced to a minimum. This allows the laser to process homogeneously without unnecessary stops.

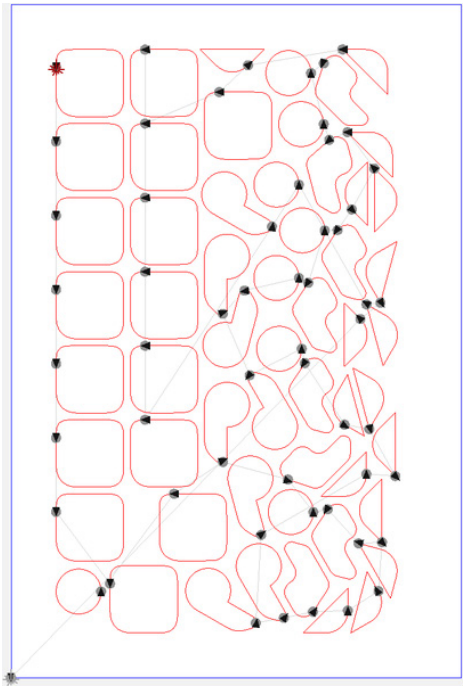
### *Optimal selection of the cutting start point*

The definition of the cutting start point is also essential. When the laser cuts into the material, it is visible at this point and cannot be avoided. Start points that are on a straight line or in the middle of a curve are especially noticeable. That's why a start point should always be placed in an unnoticeable corner.

The thicker the acrylic being used, the better it is to define the start point outside the actual graphic. This is a so-called lead-in. The lead-in should be about 3-8 mm outside the finished contour and go to the actual contour in a straight line. You can draw this lead-in easily with your graphic program, or use our supplementary software package TroCAM as part of the work preparation.

### *Defining the cutting sequence*

The cutting sequence for individual objects can also have an influence on the quality for larger quantities. If many small objects are being cut in the area, the material heats up relatively strongly at this spot, and the risk of fire increases. If you want to cut many small graphics from one large sheet, we recommend that you arrange the individual parts so that the material can cool off in between cuts. The cutting sequence is visible in the graphic program (CorelDraw, Adobe Illustrator) in the level window and is always processed from down to up.



### Suitable materials for laser cutting and engraving

- Plexiglas®
- Altuglas®
- Acrylite®
- TroGlass
- Madre Perla®
- Plazit®
- Perspex®
- Quinn®
- Oroglas®
- Plaskolite®

## Using an exhaust system

Using an appropriate exhaust system is indispensable with acrylic cutting, as with any laser application, so that the vapors in the machine room created during cutting can be suctioned out. Sufficient ventilation is absolutely necessary to achieve a high quality cut. A lack of ventilation can cause the vapors to ignite and lead to a fire. Laser machines should never be left operating unattended.

# Wood

Not all wood is created equal. Countless types of wood are available for sale, all of which in turn are processed and refined in a wide variety of ways. Because wood is a natural material, the user must think about various characteristics like the density and resin content of the wood when processing. The more consistent the colouring and grain of the wood is, the better and more even that the laser engraving will be.

### Overview Of Suitable Types Of Wood

| | |
|---|---|
| Soft woods | Soft woods, like balsa wood or poplar, need a lower laser power level and can be cut and engraved at a quicker speed. These engravings have less contrast and are lighter. |
| Hard woods | Dense woods, like oak and cherry, need to be cut and engraved with a higher laser power level. Engravings on hard wood have more contrast than engravings on soft wood. |
| Coniferous woods | Coniferous woods, like larch or fir, are not suitable for laser engraving. They typically have a large amount of hard, uneven grains. In addition, the surrounding wood ("non-graining") is very soft, making it hard to figure out the correct settings. |
| Veneers | Because these are created from real wood, they therefore have similar engraving properties to solid wood panels. |
| Plywood | Plywood is made from at least three layers of wood whose grains are glued and pressed at an angle of 90 degrees. Plywood comes in many kinds of wood and different thicknesses. The kind of glue used is important when it comes to laser processing, particularly during cutting. Select white-glued plywood panels or plywood panels that were made specifically for laser processing. |
| MDF (Medium density fiberboard) | A homogenous wood-based material, MDF is made from finely deliberated, mostly bark-free softwood that is lightly pressed both along the length and width. The surface and edges are smooth and solid, allowing MDF to easily be cut and engraved. However, please note that the cut edges become extremely dark when laser processed. |

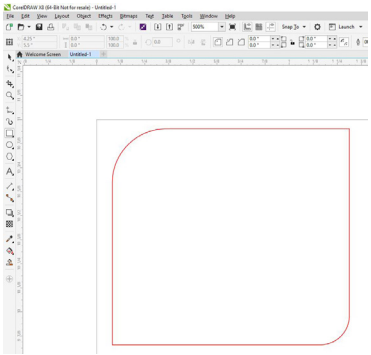
## Determining The Engraving Parameters

Using the grayscale matrix, it's easy to quickly figure out your desired engraving settings.

Tip: The more your lens are defocused (z-offset: approx. 0.5-2mm), the darker that your wood engraving will be. By defocusing the laser beam, the laser spot size enlarges, decreasing the performance density and burning more wood instead of letting it immediately turn into gas. The disadvantage of this is that details can be lost.


## Determining The Cutting Parameters

Your settings can be tested by drawing a rectangle with two differently rounded corners and sending this image to your laser. For 1/8" thick wood, begin with high power and a speed of 2-5%. Slowly lower the speed to reach your desired cutting quality.



## Inlays In Wood

Especially popular with wood as well are wood inlays (intarsia). For inlays, different woods are laid out on a flat surface in a way that creates a smooth surface containing different coloured and structured inlays. Typically, the base's material will be engraved before the material to be laid (veneer, usually) is cut and inserted. For the veneer, be sure that you change the width of the laser beam (cutting gap). The carrier must be slightly larger.

## Cleaning

When woodworking, it is crucial to clean the hardware and optics involved. Wood dust is extremely sticky because of the resins and oils contained within and dust tends to settle into the machine. For these reasons, it's important that the machine is cleaned regularly.

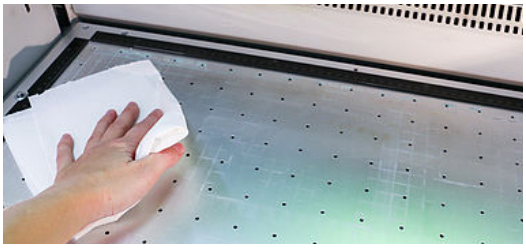
## Cold Cutting

When cutting wood please be aware that the material tends to get marked easily by smoke residues. Therefore, it is important to work at high speed (about 1-2%, depending on the material). Optimal results are achieved at low frequency, with a small lens and nozzle and activated Air Assist. As for almost all cutting projects, a honeycomb table is required (depending on application size). With the Speedy 400 or higher, you additionally have the opportunity to work with external Air Assist (recommended are 3 bar). All this makes it possible to remove heat generated by the laser during the cutting operation from the material as quickly as possible and consequently smoke residues are avoided.

## Deciduous wood rather than coniferous

Soft woods always have hard and soft growth rings, which influence engraving results. Deciduous hardwood is therefore better suited for engraving than conifers. The more uniform the grain of a wood species is, the better the engraving will show up. Of course, you can consciously choose to use the natural structure of the wood.


https://goo.gl/Sah8db



## Engraving - How To Create High Contrasts

When you engrave soft wood, e.g. poplar, you will achieve a deep engraving with relatively low contrast. Here we recommend that you defocus, which adds contrast to the engraving. In general, contrast levels in wood engravings can be influenced by defocussing, depending on the type of wood and the lens, it should be possible to defocus by 0.2" to 0.4" without any problems. The finer the details, the shorter the focal length of the lens should be. As a rule 1.5" or 2" lenses are suitable for almost any laser engraving on wood.

## Masking tape

Apply masking tape to the desired processing surface and you can engrave and cut through the tape without problems. Then just pull it off and remove unsightly traces of smoke residues at the same time. When selecting masking tapes ensure that they are made of PVC-free material and removable. Masking tapes are available from different manufacturers, such as 3M. For smaller areas you can also use commercial painter's masking tape from your local hardware store. When selecting masking tapes ensure that they are made of PVC-free material and removable.


https://goo.gl/fiJRBa


https://goo.gl/LY7d58

# Kerf Cutting

Rigid sheets of material like wood or acrylic can be made flexible by cutting bending cut geometries, or “kerf cuts”, into them. There are many different shapes and designs that each give different bending behaviours. We have tested a variety of materials like wood and acrylic from 1/8” to 3/16” thick and chosen a few for you.

## Cutting technique on wood

Wood is typically great for these bendable cutting techniques. However, the type of wood used must be carefully considered. The following notes should be followed:

**Plywood** works very well with flexible applications. If you glue the sheets, t wood becomes capable of bending in every direction within a very small radius.

When using **solid wood** sheets that have a thickness from 3/16”, cutting techniques that have recesses, like Kerf 6, are a lot more flexible than a straight cut or one without recesses (e.g., Kerf 1). With solid wood, make sure to always cut in the direction of the grain. If the cut lines are done across the grain, the wood becomes easier to break and is less bendable as a result.

**MDF**, like plywood, is really easy to work with. Because it has a mix of grains, you do not need to purposely align the cut lines.

## Cutting techniques on acrylic

Cutting techniques on acrylic best serve rigid bends (e.g., boxes) or where the bending radius does not change often. Putting a constant load on the cutting pattern, like a book, can cause the webs to break. When processing acrylic, pay attention to the following points:

- For the bendable cuts, use at least a 2” lens. Since the acrylic melts, if the lens has too small a focal length, the cutting area could immediately fuse back together.

- We suggest that you use a cutting distance that is roughly 0.04” to 0.02”. If the material still melts even though you have the correct lens, move the cut lines further from each other. However, if you put them too far apart, the bend will be less flexible.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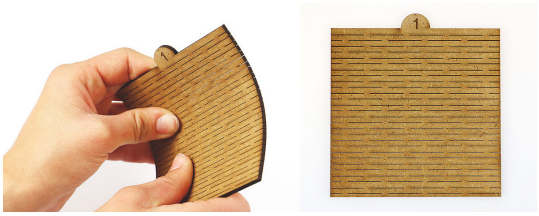
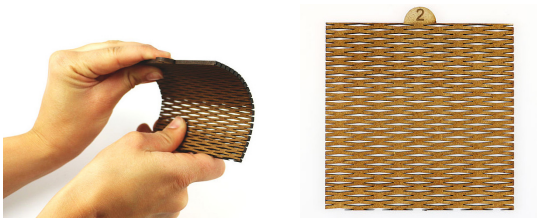
https://goo.gl/VLTZVv



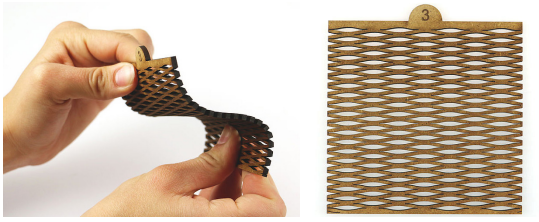
### Kerf 1: Straight Cut Lines

Straight cut lines provide a stable radius to bend around. The larger the distance between each cutting line, the wider the bending radius. Depending on the file and the material, a distance of up to 1/64" between each line can be used.



### Kerf 2: Small Waves

The small wave pattern is interconnected, making the rigid material bendable. This design can be used on materials that are up to 1/8" thick. The bending radius is very wide for this technique.



### Kerf 3: Large Honeycombs

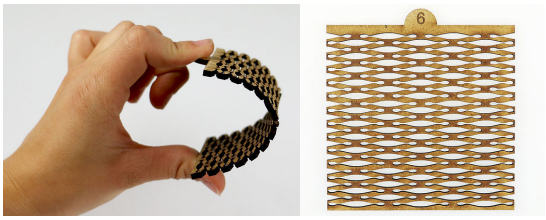
Using large honeycombs, the curves get tapered at either end and then are cut from the sheet. This technique is common in model making. Because the honeycombs are so large, even wooden boards up to 3/16" thick can be made flexible. The honeycombs can easily be pulled apart and bunched together, properties that work will with connections like those in bracelets.

### Kerf 4: Wavey Cut Line

Like the first kerf cut, this technique is made completely from cut lines, but has different, more flexible bending properties.

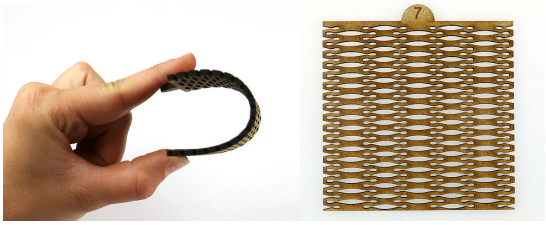
### Kerf 5: Honeycombed Cut Line

Because of the way that the pattern is designed, this cut allows for flexibility in every direction. This property makes it good for many different artistic applications, such as bag design.



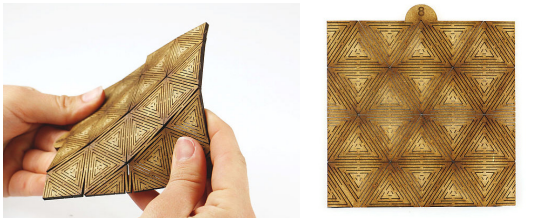
### Kerf 6: Wide Waves

These patterns are general purpose, well suited for a large variety of materials. The shape of each cut line gives both stability and flexibility.



### Kerf 7: Narrow waves

Same as Kerf 6.



### Kerf 8: Triangular Shape

This pattern's unique shape can be bent in every direction and is often used as a design element in itself. The triangular design for this technique works well with materials up to about 1/8" thick. From 3/16" on, the material becomes too rigid and inflexible.

**DOWNLOAD KERF FILES HERE!**
*https://goo.gl/qrHRjs*

# Relief Engraving

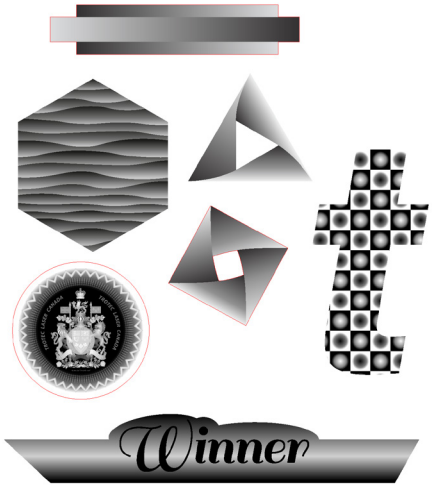
A relief engraving is a deep engraving consisting of different heights generated by the grayscale values of an image. Trotec lasers automatically regulate their power level through these values and can therefore create different depths in a single pass. Relief engravings are big eye-catchers that can instantly make any application more alluring. They are perfect for gift items, jewelery or add-ons to goblets and trophies.


https://goo.gl/2DVCQG

## Preparing Data And Sending It To The Laser

Data can be made through the usage of grayscale fillings and gradients sent to the laser with the "relief" process type. Shades of grey from 0 to 100% black can be used to create different depths in the material. A grayscale gradient can make a smooth transition to different depths.

Our lasers control the laser power through the image's grayscale values. The darker the graphic is, the more power that is used. The lighter it is, the less power that is used. For the laser, 100% black is 100% power. In other words, 100% black is 100% of the value given in the parameter database for power. 40% black is 40% of the defined power, 18% black is 18% power, etc.




**DOWNLOAD KERF FILES HERE!**
*https://goo.gl/JNJ79y*

## Relief engraving wood

Typically, relief engravings on wood create incredible results. We recommend that users use harder woods for relief engravings: Cherry, Maple, Walnut, MDF. Oak is less fitted for relief engraving, because its annual rings differ in density. This results in an engraving with an inconsistent pattern. Alder is also not recommended, because it is extremely soft and discolours quickly, making the relief hard to see.

## Relief software we recommend: Aspire

Aspire (by Vectric) is powerful drawing and production routing program, it has tools to let you transform 2D sketches, photos, drawing and digital artwork into detailed 3D relief models and then to calculate 3D Roughing and Finishing toolpaths to accurately cut these shapes.

Aspire is used by a wide variety of businesses and individuals to create a large range of products that include decorative panels and doors, ornamental flourishes, custom millwork, architectural moldings, dimensional signage, carved company logos, custom gifts and awards, plus many more applications.

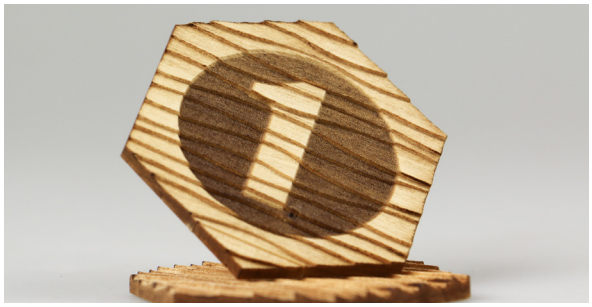
Aspire's unique 3D component modeling coupled with the comprehensive set of 2D design and editing tools make it easy to work with existing 2D data or imported 3D models as well as giving you the ability to create your own 2D and 3D parts from scratch.


https://goo.gl/W1SQnU

***CALL 800 663 1149 AND ASK ABOUT PURCHASING YOUR ASPIRE SOFTWARE FROM TROTEC!***

## Engraving Process

For relief engraving wood, we recommend using the following process (based on using a Speedy 360, 80W laser): Engrave your image in 3-4 passes with high power and low speed (p=100%, v=30%) to make your engraving the depth you want. Then, we recommend one or two rounds with low power and high speed (p=60%, v=100%) to remove any smoke residue. If you want an extremely deep engraving, we recommend you first engrave the cutting contour then only do the deep engraving.



## Cleaning

Clean your relief engraving with a toothbrush and soapy water or detergent. Liberally brush over the relief and scrub away any traces of powder. However, be sure not to use too much water and dry your workpiece well, for example by using a method like compressed air. Otherwise, the piece of wood could lose its original shape.


### TIP: Creating A Wood Relief Engraving With Color Change

It is also possible to make a relief engraving on wood and change its colour. For this, we recommend thoroughly cleaning the workpiece after engraving, as mentioned above. Doing this gets rid of any smoke traces that otherwise would impair the subsequent engraving result. Place the clean, dry workpiece back into your Trotec laser and engrave it with the standard Solid Wood "black" values in JobControl®. An integrated z-offset value of +0.2" is crucial for attaining a nicely discoloured engraving. If the effect is not enough, then increase the z-offset value.

## Relief engraving acrylic

Acrylic relief engravings create a nicely refined effect on trophies and other applications. When relief engraving acrylic, it is imperative to work without any Air Assist (= OFF) and with a z-offset value so that the acrylic does not become cloudy or gain a milky-white discolouration.

### Engraving process

This method is based on a Speedy 360, 80W laser: When engraving, use a slower speed mixed with a high power (p=90%, v=10%) and turn off Air Assist. This will give the material enough time to melt and, depending on your Trotec Laser's performance, produce an exceptional texture on the first pass. Additional passes will create an even deeper three-dimensional effect. Just as important is to use a z-offset value of between +2mm and +4mm. This will preserve the acrylic's transparency.

### Cleaning

To clean your finished acrylic workpiece, run it under water with a toothbrush to get rid of any dust from within the cracks.

# Glass

## What glass can be laser engraved?

With a CO2 laser engraver, you can laser engrave flat materials such as window glass or mirrors, round workpieces such as wine or champagne glasses, and conical items like bottles.

Cheaper, cast glasses are a good choice because they generally have lower lead content and are more homogeneous structure. Expensive, hand-blown glasses or crystal glasses may have stresses in the material that are aggravated by the heat during laser engraving, which may cause the glass to fracture.

You can also laser process mirror glass with a fiber laser by removing only the reflective layer on the back so that the glass itself is not engraved by the fiber laser, causing the surface to remain smooth.

The Trotec Speedy flexx has both a CO2 and a fiber laser source. Thus, you can easily combine both processing options with a single laser machine.

## What processing options are there?

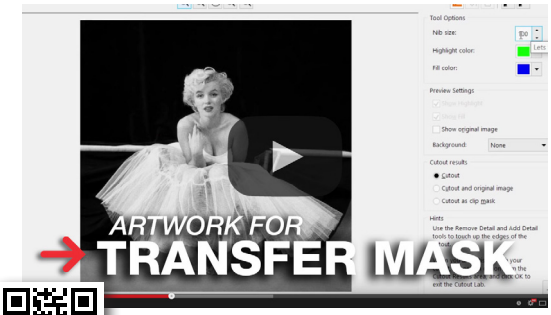
### 1. Moist paper towel


https://goo.gl/v1HnwT

Using a moist paper towel helps prevent the engraving area from becoming rough, and leads to a clear, white engraving result. Before you start engraving, apply a moist single-layer paper towel to the glass. Make sure there are no air bubbles or overlaps. This would affect the engraved image. Then switch the Air Assist to OFF to avoid premature drying of the paper during engraving. After engraving, the residue easily wipes off, also cleaning the engraving area is cleaned.

### 2. Application tape

In addition to moist paper towels, application tape can also be used to prevent the surface from roughening. With application tape, however, the engraving color is rather grayish and not bright white. As with the paper towel method, make sure that no air bubbles and overlaps are formed when you apply the tape. After engraving, clean the glass to remove any adhesive residue.




https://goo.gl/otmNH1

### 3. Engraving without auxiliary materials

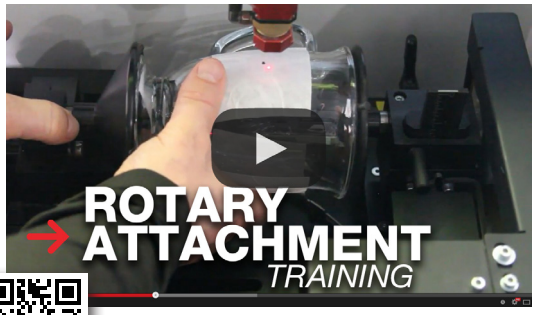
Moist paper towel or application tape are not required for processing glass. You can create effects by making adjustments such as changing the color in the graphic from 100% black to about 70% gray to minimize the effect of heat on large surface, to optimize engraving results. You can also go to the print settings, select the rasterization type "Ordered Dithering," but keep the same parameters. This change causes not quite as much heat to enter the material; hence, the surface is roughened less.

## How to engrave glasses with curves and handles?

Glasses with handles are also processed using the rotary engraving attachment. It is important to make sure that the glasses are accurately placed so that the handle is not rotated into the engraving field. First, move the Y axis (rotary motion) to the very top.

Clamp the workpiece so that the handle is slightly above the laser beam. Since the workpiece is rotated backwards for the laser process, there is no risk of collision with the laser head. For all workpieces with handles, make sure that circumference of the glass is large enough to accommodate the length of the graphic.

Otherwise the graphic will be placed too close to the handle. You can easily check the position in the JobControl® laser software by using the "What you see is what you get" function. (WYSIWYG).



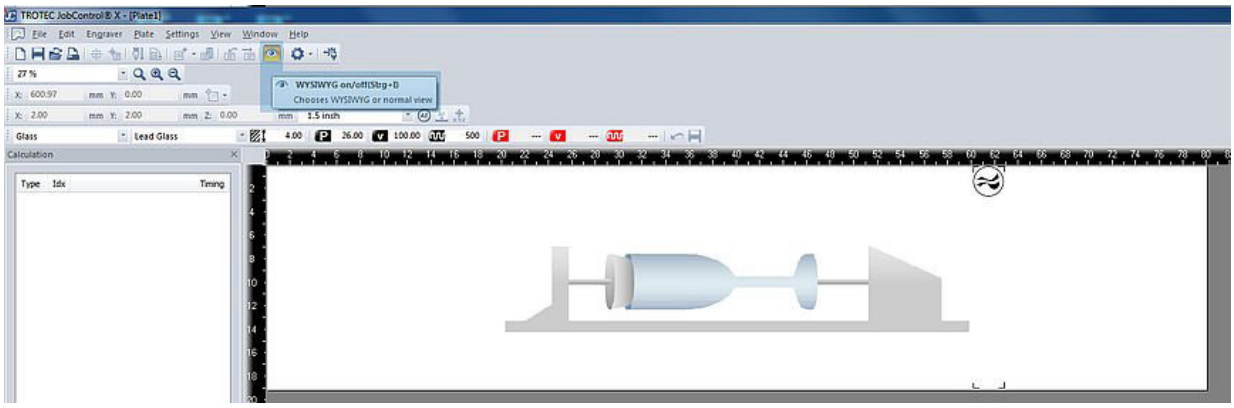

https://goo.gl/nKsMqx

## How can I see where my graphic will be lasered?

You can see the exact position of your graphics in the JobControl® laser software, by using the "What you see is what you get" function (WYSIWYG) and the crosshairs. If you are using the crosshairs, simply move the Y axis in the target position for lasering.

Then place the job on the plate to the crosshairs. By moving the Y axis again, you can check the dimension of the job on your workpiece and correct any faulty positions of the workpiece or the job.

**TIP:** Select the option "Minimize to Job Size" in the JobControl® Print window to help position the graphic on the workpeice.



## Photo engravings on glass

Photo engravings on glass are usually most beautiful when you send them to the laser with 500 dpi. Use the 'ordered dithering' rasterizing function, to adapt image data perfectly to the material. In addition, we recommend a 70% gray setting rather than black, whereby lower temperatures act on the glass and results are even better. Please note that these settings are only suitable for photos. For small images, such as logos or texts, 1000 dpi and full black are suitable.

# Laminates

## From the bottom up

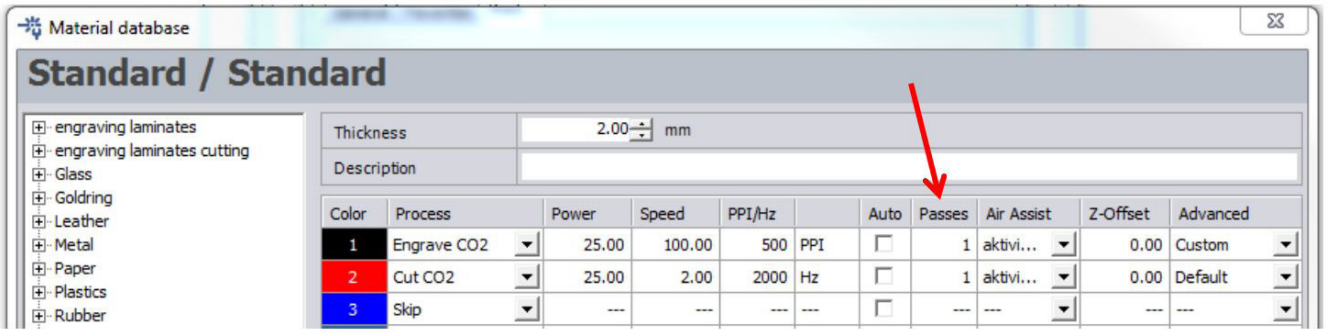
Engrave laminates from the bottom up, so dust is extracted upwards and the top layer is not discolored. In JobControl® under "Plate" -> "Set Plate" you can specify from which edge the laser should start the engraving.

## "Two is better than one"

Engrave high-quality workpieces twice, in order to prevent discoloration and to increase the contrast of the engraving:

1. Remove top layer
2. Cleaning

In JobControl® you can select how often a work step is repeated:

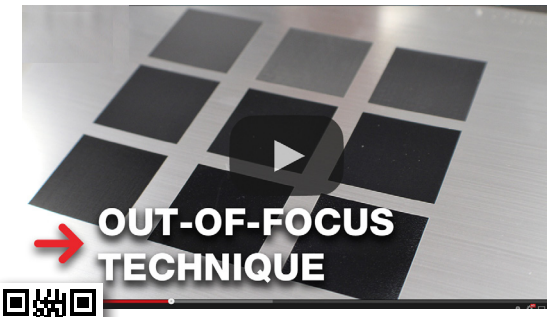



## Defocus to avoid grooves

Sometimes engravings seem to have slight grooves. A Z-offset of 0.2" to 0.8" avoids grooves and you will achieve smooth and clean results.

## Multiple cutting passes

2-3 cutting passes at low power are often better than 1 pass at a power level that is too high. Avoid sticky edges and unsightly bulges of material along the cutting edge.

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https://goo.gl/4UoeHc

## Dark laminate with a bright top layer

Are you familiar with this problem? You are engraving the bright top layer of a dark laminate, then cut the workpiece and by cutting it the remaining bright top layer gets dirty. Our tip: Engrave the desired motif and then apply masking tape or painter's masking tape, this protects the light-colored material during the cutting process and you can simply pull off the resulting dust along with the tape.

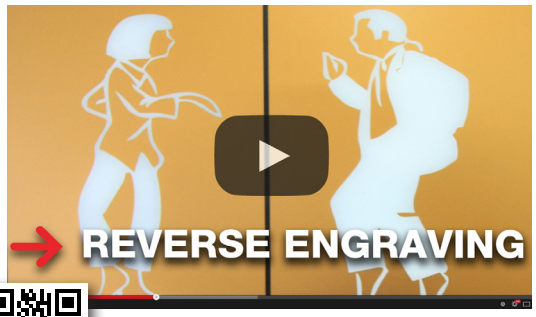
## How to clean laminates after laser processing

If smoke residue occurs on the workpiece during laser processing, we recommend that you clean them off using methylated spirits. Simply wipe off with a cloth moistened with methylated spirits, followed immediately by a wipe with a clean, dry cloth. Nano sponges (often referred to as dirt erasers) can also be very helpful when cleaning laminates. Caution on glossy surfaces: Please first carry out a test on a sample piece, in order to ascertain whether the surface is affected by the methylated spirits, i.e. whether it turns matte for example.


https://goo.gl/8wLLAq

## Reverse Engraving

TroLase Reverse comprises of a transparent acrylic fascia with a coloured coating on the reverse side. To reverse engrave, simply select your artwork and flip it (mirror image) horizontally in your design program. By reverse engraving your image into the coloured layer you expose clear text/image which can either be infilled with your choice of acrylic paint or backlit for an effective contrast.




https://goo.gl/8qBTWh


https://goo.gl/HvFmeg

## Textured Laminates

TroLase Textures are two-layer acrylic based materials, suitable for applications in demanding environments, where extra durability and scratch resistance are required. The textured, matt surface is generally harder to engrave than other laminate plastics because of its thick top layer. We recommend to engraving the material with 2 passes at a lower speed and with higher power.

## Marking plastics with MOPA/Fiber

The MOPA laser is one of the most flexible lasers on the market. The MOPA's pulse duration can simulate the properties of conventional fiber lasers (relatively long pulses) and those of classical solid state lasers (relatively short pulses) such as Nd:YAG or Nd:YVO4 (vanadate).

MOPA and regular Fiber lasers don't engrave plastics but change colour or foam the material. Essentially instead of taking off or burning material out, they change the composition of the material itself.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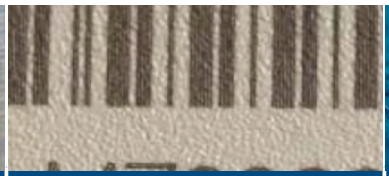
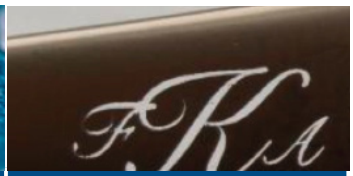
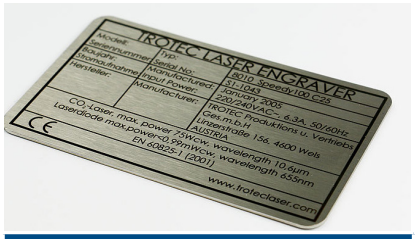
## Different engraving/marking options

| Engraving | Colour change | Foaming | Coating ablation |
|---|---|---|---|
|  |  |  |  |
| • Removal of material by melting and evaporation of the surface<br>• This creates a depression<br>• Very durable marking | • Results depend greatly on the composition setting of the plastic<br>• Special plastic compositions with good laser marking capabilities are available<br>• The surface will not be damaged during marking. | • Air inclusions in the material produce bulges in the material<br>• Dome-shaped marking is created | • "Day & Night Design" / marking of buttons<br>• Top layer is removed<br>• High speed during marking |

# Metal

In contrast to laser processing with a CO2 laser it is important to distinguish between different processes when marking metal with a fiber laser:

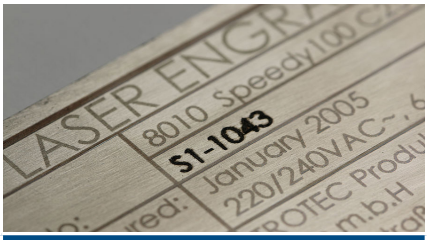



**Engraving**

- Metal is partially vaporized during the process
- This creates a depression
- Very durable marking
- High energy is required


**Annealing**

- Stainless steel, titanium,...
- Local temperature rises to just below the material's melting point
- An oxide layer is created just below the material's surface
- The surface is not damaged
- High contrast marking of material




**Coating ablation**

- Anodized aluminum, painted metal, foil
- Top layer is removed
- High contrast Marking of material
- High speed during marking

## Cleaning with a sponge and water

Smoke residues on the material surface are the result of rapid temperature rises during engraving and explosive vaporization. Consequently, engravings appear hazy. The edges of the engraving look washed out and the quality of the engraving seems inferior.


**Without cleaning**


**Cleaned with a sponge and then air-dried**


**Cleaned with a cloth**

For perfect results, the engraved workpiece must be cleaned with water and a sponge and then air-dried.

## Metal marking with a fiber laser

The perfect tool for metal marking in terms of productivity and quality is the fiber laser. Unlike marking using a $CO_2$ laser and marking paste, no preparation or follow-up is required when using the fiber laser. The marking result is uniform and very precise even for fine details.

Moreover, you can use certain parameter settings on the fiber laser to achieve other effects. For instance, the anneal marking can produce either a rich black or a white color. The metal engraving gives a depth to the metal that is extremely long-lasting and also counterfeit-proof.


https://goo.gl/iMkGrP

## Metal Marking With A $CO_2$ Laser

Blank metals can be marked with a $CO_2$ laser engraver only if you use a laser marking solution. The metal marking solution must be applied to the workpiece prior to processing with a laser machine. It first needs to dry and then will be burned into the material during the laser process. Once the laser process has finished, the excess marking paste must be washed off. (In our example, we use stainless steel.)

A laser marking spray is essential for cleaning sensitive surfaces or high-priced workpieces like watch markings. Furthermore, it is important to note that marking solutions are classified as hazardous materials. Be sure to adhere to the corresponding safety regulations to protect your own safety and that of your employees.

Without marking solutions, the $CO_2$ laser source with a wavelength of 10.6 µm is basically not suitable for marking metals. A high laser power is required for the metal to even react to the laser. At the same time, the process must be very slow. This results in a lot of energy being introduced into the material, which will make it heat up and become deformed. The resulting details on the engraving, for example small font, cannot be seen.

## Processing Times Of Different Marking Methods

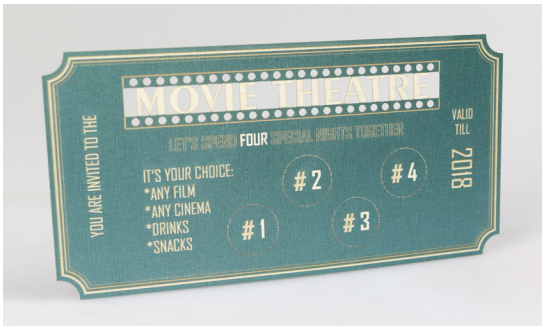
If you were to compare the time required to mark a data plate using the CO2 laser source from a Speedy flexx with the time it takes to mark the same data plate using the Speedy fiber/flexx, you would see right away that processing with the Speedy fiber/flexx is only 1 minute faster. However, you can also see that the Speedy fiber/flexx does not require any preparation or follow-up processes. The machine operator can use this time to work on other orders to increase the company's productivity. A SpeedMarker galvo laser marking machine is significantly faster.

| Process Steps | Speedy $CO_2$ + Laser Marking Paste | Speedy Fiber / Flexx | SpeedMarker |
|---|---|---|---|
| Preparation and applying laser marking paste | 4 min | - | - |
| Drying | 10 min | - | - |
| Laser processing | 5 min | 21 min | 2 min |
| Cleaning, Drying | 3 min | - | - |
| **TOTAL** | **22 min** | **21 min** | **2 min** |

# Paper & Cardboard

There are countless types of paper – with and without coating – in addition there are different types of cardboard, corrugated cardboard, dyed or multi-layered and many more. The paper below is based on a grammage of 290 g/m².

Paper removed during laser cutting at high speed will evaporate as smoke. The smoke transports the heat away from the paper, so the material is only minimally thermally burdened. With optimum parameters, Air Assist as well as Table Exhaust, the material can succeed smoke-free without burnt edges even with the finest contours.




## Deep Engraving

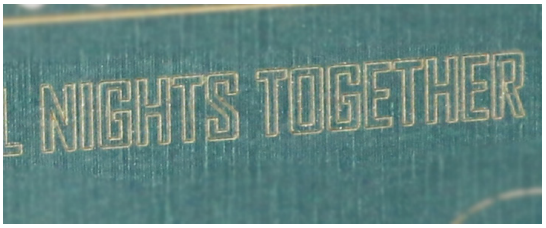
For deep engraving, you will need relatively more power output during engraving. Assign the first engraving color for this, in our case black. In the parameter database, assign the appropriate parameters for the color black. Use a higher power output and a lower speed for deep engraving compared to customary engraving to achieve depth.


## Light Engraving

For an elegant effect, you can bleach out the uppermost layer or the surface of some types of paper. Bleaching out involves engraving in a way so that little or no material is removed.

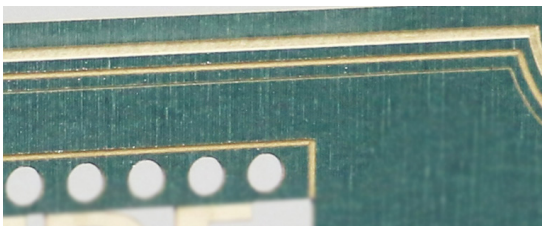

## Scratching

The scratching technique can be used for filigree and very fine markings. For this, assign a hairline using a different color (we used blue) as a contour to the object. In the parameter settings, select cutting as process and use a lower power output compared to the customary paper cut.



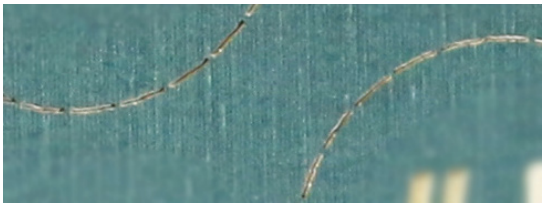

## Engraving Line

The engraving line technique is similar to scratching, but with a different thickness. This is defined by the parameter setting. Assign a hairline to the object again. (We used desert blue.) In the parameter settings, choose a Z-offset of about 2-5 mm for the cutting process, depending on the desired thickness of the line. The power output should be similar to the scratching line.



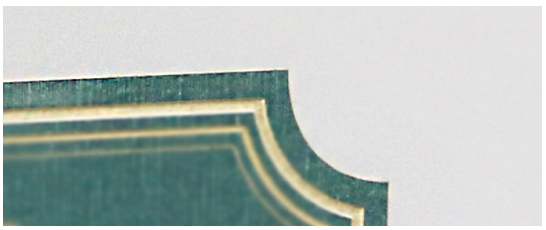
## Perforation

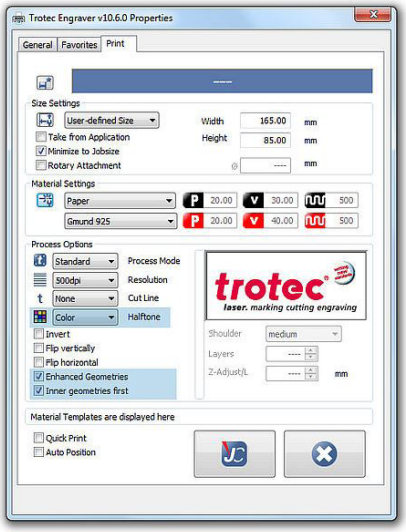
Parts of the card can also be separated with a perforation, which is a discontinuous cutting line. To create this, draw a cutting line (we used cyan) and convert it into a curve. Then select a a dashed line for the line style. Use the same parameter settings as with the filigree cut.



## Outer Cut

When cutting the card out you can use a separating cut if there are no elaborate curves in the design. Assign a hairline for this (see ours in green). Depending on the length of the straights to be cut, you can use up to 5% speed. Adapt the output power accordingly.






After you send the job to the laser with the following settings, make sure to use colour when screening so that all objects are processed.

We used a Speedy 360 with 80 Watt and a 1.5" lens. For processing paper, we generally recommend using a 1.5" lens because larger optics are not necessary for the minimal thickness of the paper. The 1.5" lens is also best suited for filigree laser engravings, as fine graphics can be represented in a detailed manner.

| Process type | Resolution | Cutting line |
|---|---|---|
| Standard | 500dpi | none |

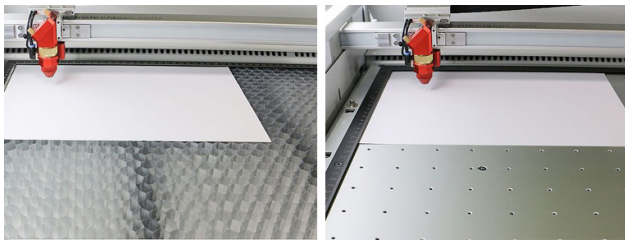
| Screening | Others |
|---|---|
| Colour | Optimized geometries, internal geometries first |

## Laser Parameter Settings In JobControl (Speedy 360 80w)

| Laser parameter | Colour | Process ($CO_2$) | Power | Speed | ppi/Hz | Air Assist | Z-Offset | Advanced |
|---|---|---|---|---|---|---|---|---|
| Deep engraving | Black | engraving | 36% | 30% | 500 | on | - | optimized quality |
| Light engraving | Red | engraving | 19% | 40% | 500 | on | - | optimized quality |
| Scratching | Blue | cutting | 2.8% | 0.6% | 1000 | on | - | - |
| Engraving line | Light blue | cutting | 5% | 1% | 1000 | on | +0.15" | - |
| Perforation | Cyan | cutting | 8% | 0.5% | 1000 | on | - | - |
| Outer cut | Green | cutting | 20% | 2% | 1000 | on | - | - |

### Which lens do I use for paper processing

For processing paper, we generally recommend using a 1.5" lens because larger optics are not necessary for the minimal thickness of the paper. The 1.5" lens is also best suited for filigree laser engravings, as fine graphics can be represented in a detailed manner.



### The correct table selection for paper

When you want to laser engrave paper, you only need a vacuum table, which provides optimum vacuum if you cover the remaining working surface. When you are ready to laser cut your paper, we recommend using a comb cutting support, best used in combination with a vacuum table.


https://goo.gl/m55gKN


https://goo.gl/RnNnLQ

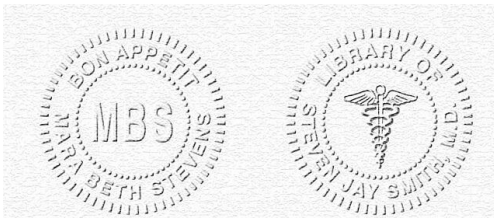
# Delrin

Delrin is used for the production of embossing presses. Embossing presses are used by notaries, companies, engineers and government agencies to add relief embossing, in addition to a signature, in order to protect quality documents from being copied fraudulently.

Furthermore, an elegant embossing adds a personal touch to stationery and invitations. Whether it is a logo, home address or something creative, there is no limit to the number of possible applications.

Delrin is a trade name for the material group polyacetal (POM). This material is highly suitable for laser cutting or engraving because it can easily be removed by the laser beam.

Delrin is used in the production of embossing presses. Embossing presses use a positive and a negative relief to emboss paper. The positive relief (male) is created with white letters on a black background and the negative relief (female) is inverted and mirrored. The Trotec JobCreator laser software can create the design of both reliefs automatically to make the creation process easy.




## How to prevent the press from cutting through the paper?

The problem with seal presses can be that Delrin often has too sharp edges, and the punch thus cuts through the paper. Our tip: Set the laser to be out of focus by around 2 mm (= Z-axis offset by 2 mm) – embossing results remain the same, but the edges become more rounded, and the process is therefore gentler to the paper.

## Which text size should be chosen for a perfect result?

Text or graphic elements should be at least 0.02" in size or no less than a five-point font. When using paper grades that are significantly heavier than 20 lb bond, the size of the graphic elements should also be increased.

## What requires special attention in the manufacturing of seal presses?

A good fit between the two forms is important. It is also necessary to ensure that the engraving has the correct depth. The engraving depth should be at least 0.01" , but a maximum depth of 0.2" must not be exceeded. If the engraving is too shallow, the embossing is barely visible. If the engraving is too deep, the paper may tear. Once determined, the parameters are stored in the materials database of the JobControl® software and can be retrieved at any time.


https://goo.gl/w8XonH


https://goo.gl/YMTjDG

# Leather

Leather is a versatile material. Whether artificial leather or genuine leather - with laser engraving you can give wallets, belts or bracelets an individual touch of elegance. Find here some tips and tricks for laser processing.

## Basics about the processing of genuine and imitation leather

For an optimal engraving result activate "Air Assist" and work with 500 ppi resolution. Both parameters can be adjusted in the material database in JobControl.


## Warning: PVC free leatherette

Please note that leatherette often contains PVC compounds and therefore cannot be laser processed. There is a danger that harmful gases may be released.


https://goo.gl/9fUcYK

## Masking tape

As already mentioned previously, masking tape can be very helpful when processing delicate materials. This is also the case with natural leather. When applying the masking is tape it is important to:

- Cover the entire engraving or cutting area
- Apply the tape without air inclusions or wrinkles
- Use a squeegee to press down firmly on the material

You can apply the tape just before cutting or engrave through it immediately, depending on the motif you choose. Particularly for very fine motifs, it is advisable to apply the tape only after the engraving process. In general, it can be said that relatively little power is required for engraving leather, in order to achieve best results.

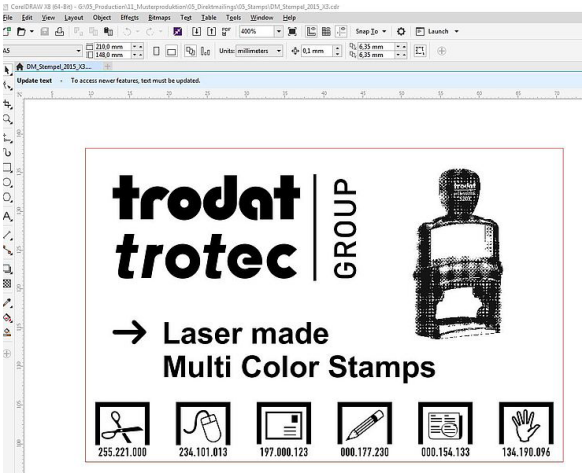

https://goo.gl/5hZaq6

## Genuine Leather vs. Imitation Leather

Genuine leather is a natural material and there are countless types and all react differently. Therefore, it is difficult to establish common rules for the laser processing. If genuine leather is deforming during laser processing, we recommend to reduce the laser power. You want to clean the finished workpiece? Since it is a natural material, we cannot recommend any cleaner. Aggressive cleaning agents may dry out the area or form spots on the leather.

Imitation leather usually has a fabric layer and is therefore form stable and easier to handle. It can be easily cleaned with a damp sponge or tissue. When engraving imitation leather, you can achieve a bright color change by defocusing. Defocus can be set via the Z-Offset in JobControl®.

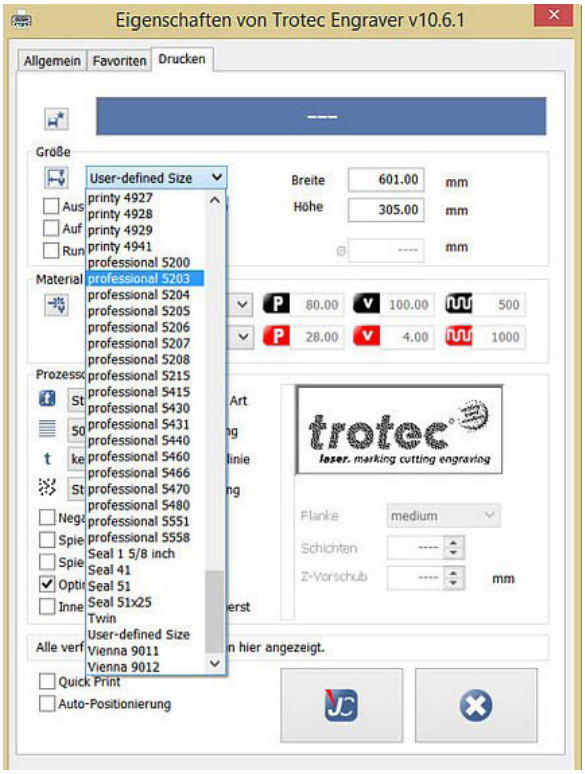
# Natural Rubber




## 3 steps to making the perfect stamp

### 1 Draw the stamp layout in the graphics program

First, create the design you would like to print on the paper. To create a stamp, no mirroring or inverting of the graphic in the graphics program is necessary. If the "Stamp" process type is selected in the printer driver, the graphic is automatically mirrored or inverted for laser processing. Even the cutting line can be selected in the printer driver for automatic cutting and does not have to be specially drawn.




### 2 Select the following settings in the printer driver:

**Size:** Enter the size of the stamp, or if a Trodat stamp is used, simply select it from the list

**Materials:** Rubber - here, we fall back on the tested laser parameters from our material database.

**Process type:** Stamp - the layout for the engraving is automatically mirrored and inverted

**Resolution:** 600 dpi or more

**Cutting line:** optimized - the cutting line is adapted to the layout and thus prevents an impression of the layout background

**Raster algorithm:** Black-white

**Shoulders:** Standard: medium

### 3 Laser process

Start the laser process. When finished, clean the rubber stamp in the ultrasonic bath or with water and a brush. Then stick the engraved rubber in the stamp.

**DOWNLOAD STAMP ENGRAVING**
*https://goo.gl/xJ28jj*


https://goo.gl/WBGL7G

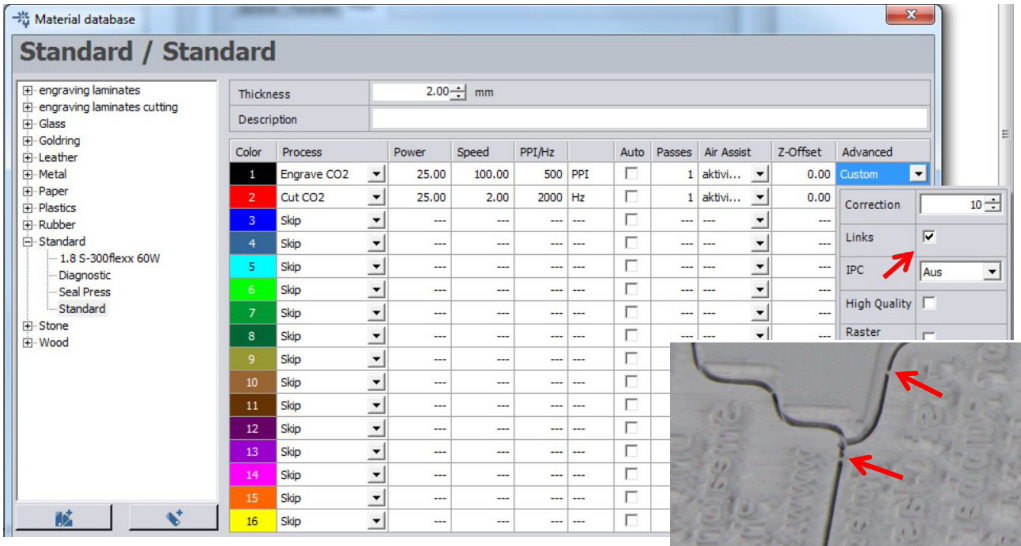

https://goo.gl/EgxAU7

## Direction of engraving and extraction

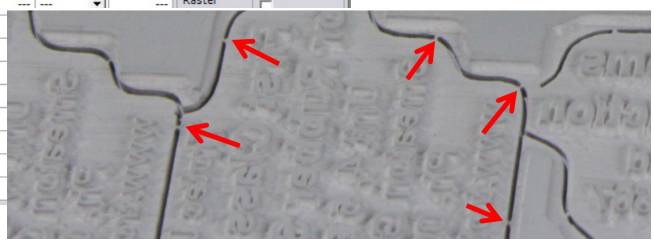
When processing stamp rubber, a lot of dust is created. It is, therefore, important that you engrave bottom up, so that dust and rubber parts are removed by the exhaust system and do not affect the rest of the engraving process. Please open the throttle, so that the exhaust system can operate at maximum.

## Webs

Do you want to engrave a whole plate with stamp designs? Then use the "web" function in JobControl®. Small connections between the stamp motif and the base plate are created automatically. You can break out individual parts easily from the plate as a whole without losing the other parts.



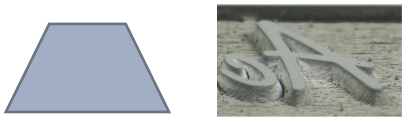
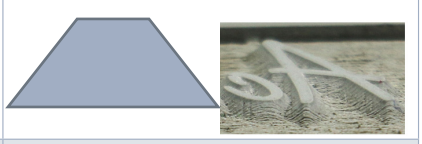

Activate the "web" check box



Webs on the stamp rubber hold individual stamp plates in place

## Flanks for a beautiful stamp imprint

Flanks, also called shoulders, can be set in JobControl® depending on the respective application. Shoulders are used to give the letters and characters of a stamp text plate more stability at the base. Depending on the fineness of the stamp, the following shoulder settings can be selected in the JobControl® software:

| Steep | Medium | Flat |
|---|---|---|
|  |  |  |
| Many elements in a confined space - there is a danger that flanks may overlap. | Generally well-suited to standard applications | Frames or tables<br>Whenever a lot of material is removed around an element and the element may otherwise become a little unstable. |

# Textiles

Laser machines and textiles are a wonderful combination. The focused usage of a laser gives fabrics a high quality finish. Patterns, too, can effortlessly be realized. Learn below about what must be considered when laser processing natural and synthetic textiles.

## Engraving dark natural textiles

Darker denim or cotton materials can be "bleached" with laser engraving. To do this, it is necessary to use **low laser power (up to approx. 20% at 100 watts)** and no Z-offset, depending on the material used.

**CAUTION:** If the laser power or the resolution is set too high, the fabric might tear or the fibers could dissolve immediately after the first wash, at the latest. Depending on the image used, a resolution of 250 to 500dpi will work.

## Laser engraving synthetic textiles

Certain fabrics, like synthetic leather, fleece, or synthetic felt, are very simple to engrave. Since synthetic materials melt during engraving, high contrast is easy to achieve. To get a homogenous engraving, use a Z-offset of 1 to 5 mm, depending on the fabric used. Use a resolution of up to 500 dpi for laser engraving.

Some textiles, such as thin synthetic fiber materials, will not work for engraving because they will melt during the process. You can quickly and efficiently see if your fabric will allow homogenous engraving by using the grayscale matrix.

**CAUTION:** Synthetic textiles—particularly synthetic leather—will often contain PVC. These materials should not be laser cut or engraved. If these materials are processed, hazardous gases or dust could be created, endangering the laser user or the functioning of the laser machine. Here, you can find an overview of unsuitable materials for laser processing.

## LaserFlex - as easy as ironing

LaserFlex is a high quality, multi-layered polyurethane film that has been specifically designed for processing with the laser. Finish textiles with designs of your choice, logos and lettering with a screen-like finish. Optimal laser settings vary depending on the laser power level and the speed of your laser plotter. We recommend processing from the bottom up while using the highest possible exhaust power level. This way any dust produced is no longer drawn across the already laser processed area. We also recommend that you work with a vacuum table, as the wafer-thin film may otherwise arch slightly.


https://goo.gl/sB2Nyv

## Laser engraving light natural textiles


To attain a dark laser engraving on lighter textiles, you must purposely defocus the laser. In other words, depending on the material, a Z-offset of roughly 0.07" to 0.4" must be used. The further away that the lens is from the surface, the larger the laser spot will be.

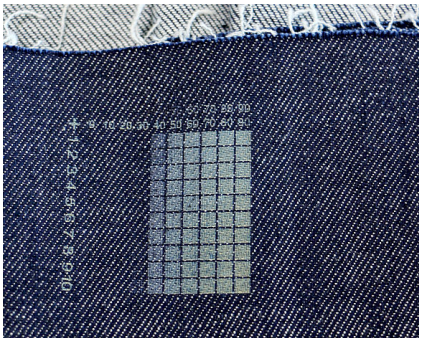
When laser cutting, use a frequency of 1000 to 3000 Hz. To prevent dark edges, we recommend that you turn on Air Assist while cutting and use the nozzle that has the smallest diameter.

## Determining cutting parameters

Textiles are made of either natural or chemical fibers, making them very diverse in composition. For larger pieces that have a lot of straight lines, typically, the higher the laser power, the quicker that the material can be cut. With Speedy lasers, speeds up to about 5% are possible. For small, intricate cutting edges, you may need to reduce the speed and laser power. With a Speedy laser, a maximum cutting speed of 3% can be used as a guide.

With an SP Laser Cutter, the built-in hardware and software support you even more as you figure out the settings. You can find the parameters with optimized speed for straight geometries. Depending on the laser power, speeds up to 100% are possible since the system automatically changes the actual values based on the contour and therefore achieves the perfect laser cutting result.

## Determining engraving parameters



By using the grayscale matrix, you can efficiently discover the necessary engraving parameters for your needs.

**TIP:** The more that the laser is defocused (Z-offset: roughly 0.02" to 0.8"), the darker that the textile's engraving will become. Defocusing the laser beam expands the laser spot size, lowers the power density and burns more material instead of allowing it to immediately turn into smoke and gas.


https://goo.gl/5pKSsN


https://goo.gl/bL7pE8

# Stone & Marble

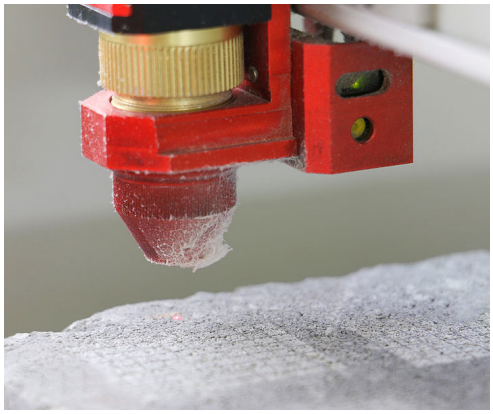
Laser engraving stone slabs or rocks with a polished texture or very smooth surface will provide the best results. To achieve the most desirable engraving result possible, place the stone on a flat surface to ensure that the finished product is not distorted by curves.

Natural stones with a round surface can still be laser engraved, just simply place the object on a horizontal plane. We also recommend using a support to assist with this process, such as modeling clay. When focusing the laser beam, you will want the engraving to be as uniform as possible, so input an average value of the engraving area for the best results.


https://goo.gl/ihxJsp

## What do you have to pay attention to when engraving stones?

Depending on the type of stone you engrave, it is possible that they produce stone dust, which can stick and cause stringing. With that being said, it is important to check the nozzle opening before each engraving job (even during the job if it is very long). The nozzle can be clogged by the stone dust and block the path for the laser beam. By wiping with a cloth or rinsing the nozzle with water, you will restore the optimal performance of your Trotec laser. The functionality of the lens and the mirror should also be checked at intervals during stone engraving.

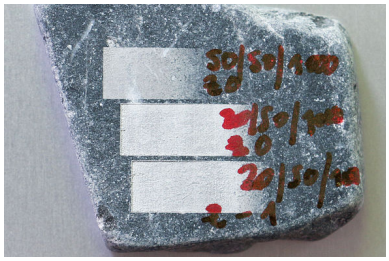


If you want to remove the natural dust layer of the stone or dirt, we recommend cleaning the stone before laser engraving. If you rinse the stone under running water only after the engraving, you may wash out a part of the stone dust from the engraving. However, this contributes to ensuring good contrast between stone surface and engraving.

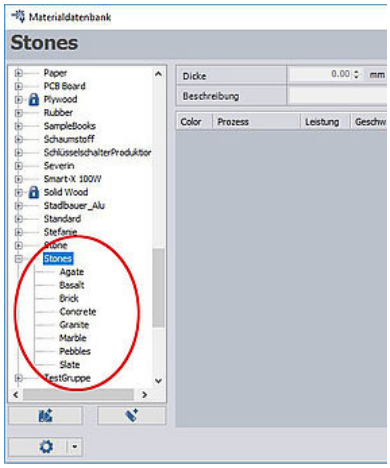
## Engraving Parameters for Stone

**Variant 1: The grayscale matrix**
We recommend using the grayscale matrix on page 75 for any stone applications where you have at least 1.18" x 1.18" (3cm x 3cm) of flat surface available as well sufficient testing areas. Unlike the full power at low engraving speed that is required for wood or paper processing, we recommend different settings for hard stone surfaces. As a starting value, use 100% power (p) with around 30% speed (v) for a laser engraver with 60 watts, and then 100% power and around 15% speed for any machines with less than 60 watts. If this does not produce the desired engraving results then reduce the speed and run the matrix again. The benefit of this technique is that it allows you to control and designate the exact power settings to each field being engraved.

**Variant 2: The grayscale gradient**
The grayscale gradient is an efficient processing method if you are working with a limited amount of testing area. Draw a rectangle with a gradient from 100% black to white, and note, the same parameter and printer driver configuration can be utilized as for the grayscale matrix method. With this method, the ideal power setting can only be estimated and the determined power value is 50%, if it is in the middle of the engraved area. Therefore, when closer to the black area, you will have more power as a result of your settings. An advantage of the grayscale gradient is that you can apply it to even the smallest areas.



## Downloadable Laser Parameters




Each stone listed below is a type that is very well suited for laser engraving, and provides the best processing results from our own experience. The accompanying values were determined using a Speedy 360, 100W, and ultimately, your specific laser system, available laser power, and unique stone and graphics will cause variations in results.

**Marble**: p50%, v20%, 1000dpi, Z = -0.5mm
**Slate**: p20%, v100%, 500dpi
**Concrete blocks**: p100%, v20%, 500dpi
**Pebble stones**: p80%, v30%, 500dpi, Z = +2
**Basalt**: p12%, v50%, 500dpi, Z = -1
**Agate**: p50%, v30%, 1000dpi, Z = +1.5
**Bricks**: p100%, v30%, 500dpi, Z = +1.5

Certain stones, such as bright granite, will not always engrave well and will be more limited when it comes to laser processing. Because of the lighter color of the stone, you will have to inlay the engraving with color post-processing to achieve a higher contrast.

## Tricks to improve the laser engraving

Some types of stones lead to no or only poor results in laser engraving due to their composition. With a few extra tricks that we explain here, you can nevertheless get useful results from your stones.


https://goo.gl/ihxJsp

### Change Z-offset value

A change in the Z-value can significantly improve the result of your engraving in many cases. The most striking thing is to try offset values of +0.04" (1 mm) and -0.04" (1 mm) and compare the results. For very hard stones, it may be better to choose a negative offset value, as this will allow more power to enter the engraving area.

### Inlaying the engraving with color

Some stones yield no or only poor results when being engraved. If this is the case, it is possible to fill the engraving with acrylic paint (or a similar type of paint), to ensure a high contrast. To do this, mask the surface to be engraved with an application tape, and engrave your desired motif. Then take acrylic paint and a bristle brush, and dab at the engraved areas with paint. Once the paint has dried thoroughly, you can peel off the tape and wash off the remaining, finer tape residue with water. The smoother or more finely polished, respectively, the surface of your stone is, the better the result will be after the filling. Porous or rough surfaces may cause the edges of your artwork to fray and not appear sharp.

### Engraving small stones

The stone should have an optimally flat and smooth surface, so the final result is not distorted by curves. It is possible to laser engrave other stones with rounded surface by placing the stone on a horizontal plane. Use a support for this, such as modeling clay. When focusing, use an average value of the area to be engraved, so the engraving becomes as uniform as possible.

# JobControl Overview

Work in your usual programs (CorelDraw, Photoshop, AutoCAD, Illustrator, InkScape, Word, etc.) and send your layout to the laser, no matter whether from your PC or Mac. The Trotec printer driver uses Quick Print to send the file directly to the laser or the laser software JobControl®. A host of clever features allow you to optimize your workflow.

### WYSIWYG:

„What you see is what you get." Check your print output with a true to original on-screen representation to avoid material wastage.

### Autofocus:

Extremely accurate automatic focusing with just one click. The engraving result, material thickness, focal length of the lens, cutting table, etc. can all be saved in the material database. The software calculates the correct position to engrave precisely at the focal point - this achieves the best engraving result.

### Bi-Directional Communication:

Your laser and JobControl® are in constant communication. Like that you know where your job is on the work surface, how it is progressing and you can control your laser.

### Guides:

Ideal for precision work, position your job exactly where your material is on the table and avoid material wastage.

### Duplicate and Rotate Jobs:

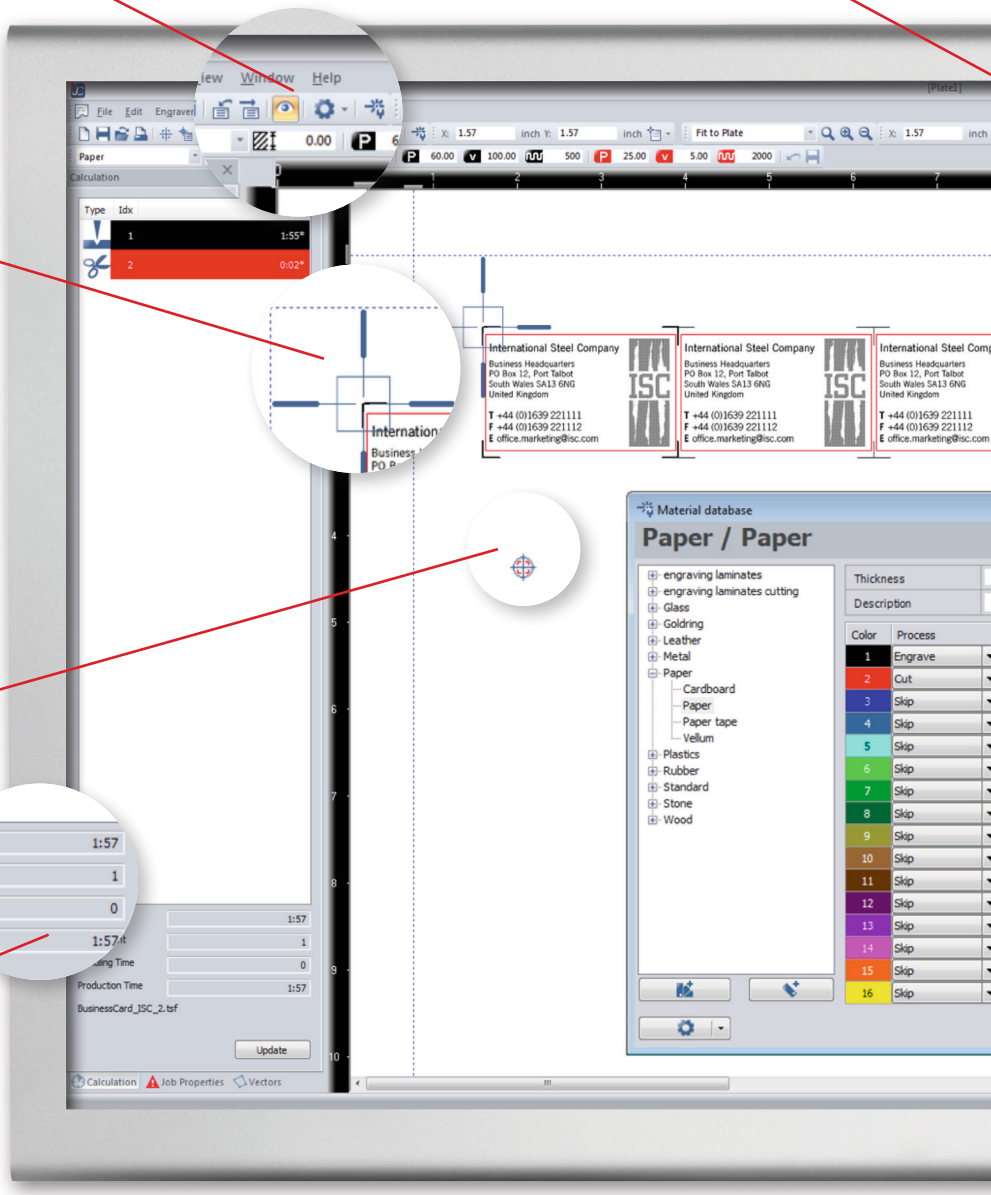
From the queue, a job can be placed on the work surface as often as required and in a space-optimized manner. Duplicate and rotate jobs easily.

### Marker:

Magnetic positioning aids allow you to quickly and easily create your own job templates. These can be saved and used for recurring tasks.

### Engraving Time Calculator:

Indicates how long laser processing will take in advance. This allows you to calculate and plan properly.

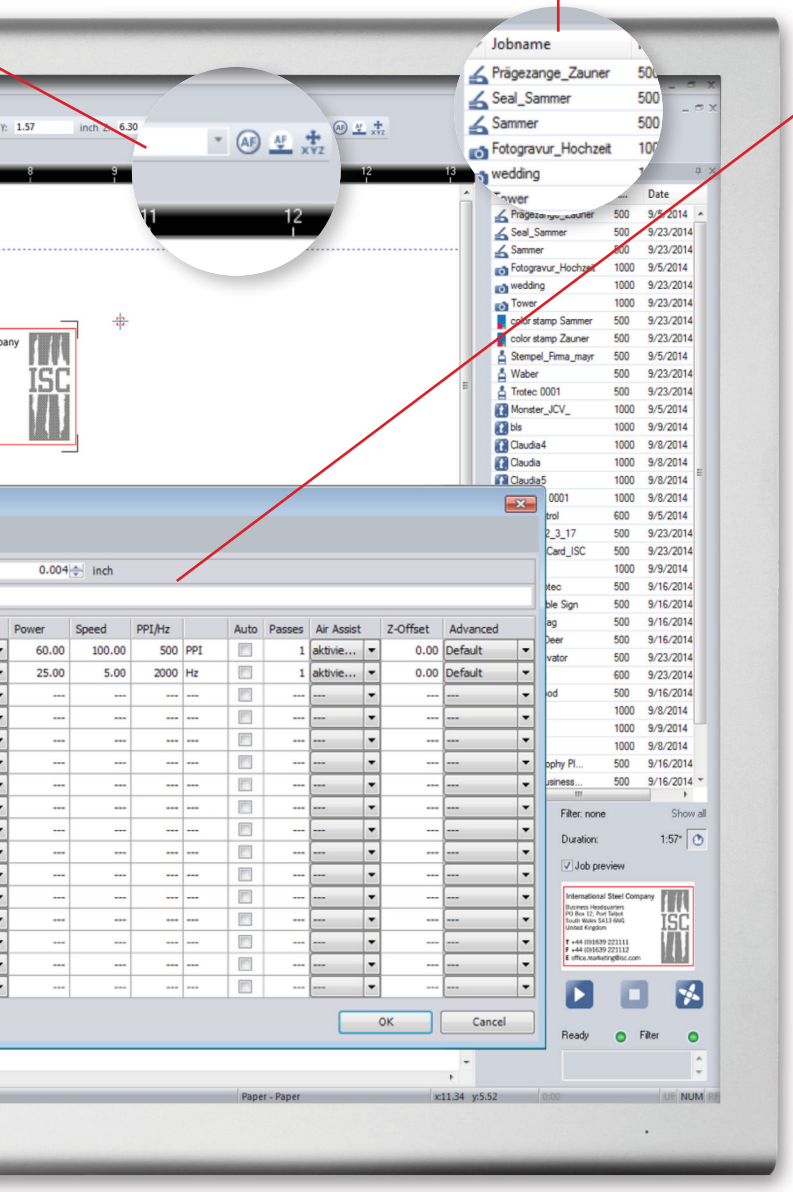


### Quick Print


### Printing with JobControl®


### Job Management:

Every job sent to your laser is stored in a clearly laid out list. Filter by name, date, process type, resolution, etc. All jobs can be repeated at any time with just one click.




### Material Database:

The Heart of JobControl®. Predefined settings for different standard materials help you achieve the best possible engraving and cutting results. In addition, you can also save and manage your own materials.

### Processing via Color Mapping:

Define processing settings such as engraving or cutting, speed, power level, number of passes, Z-offset, etc. by colors:

- **Automatic Z-Axis Control:**
  Helpful for objects with different focal point positions.
- **Multiple engraving passes:**
  Allows you to achieve the best possible engraving or cutting quality when dealing with sensitive materials
- **Webs:**
  By interrupting the cutting line at defined intervals cut parts do not fall away from the raw material. This is very useful when producing entire stamp plates or filigree cutouts.

All settings are carried out in a single production step. No additional work steps are required.

### Import/Export:

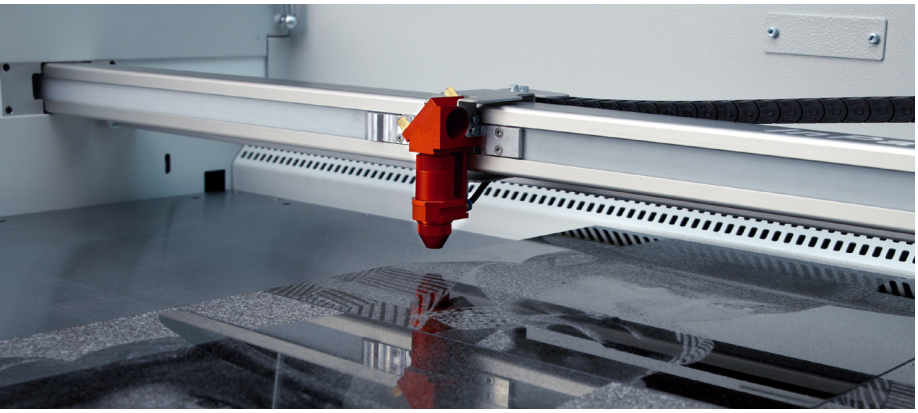
Easy import and export of your material parameters for creating a backup copy or for use on another PC.

### Administrator Mode:

The administrator is able to lock individual materials, material groups or the entire material database. Consequently, elaborated parameters will never be lost.

# What Can A Laser Do?

With an advanced laser engraver, you can process a variety of different materials. Wood, glass, leather, acrylic, natural rubber or stone are just a few of the wide range of materials used in applications such as signs, stamps, promotional items and more. With the wide range of laser engraving and marking systems offered by Trotec, you are ideally equipped for the future of your business!

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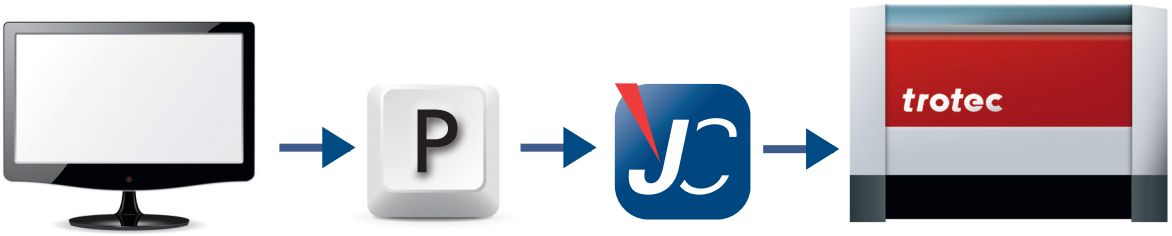
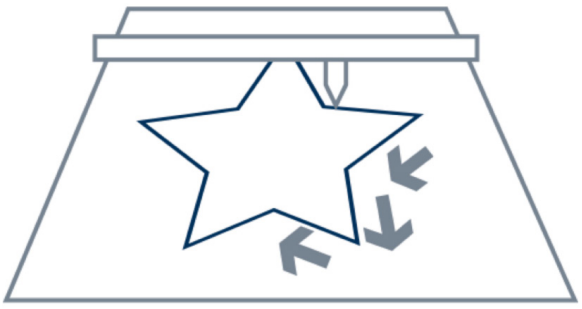
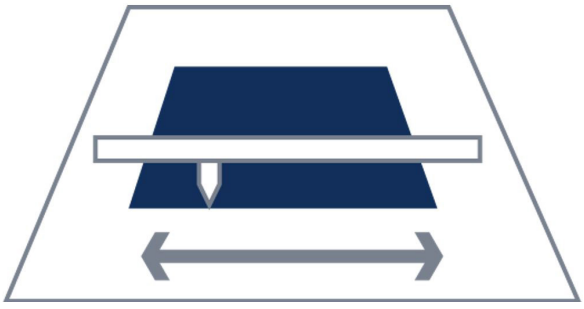
## De l'idée à la pièce fi nie




## How does the laser work?



Laser cutting process



Laser engraving process

### Process: Vector cutting

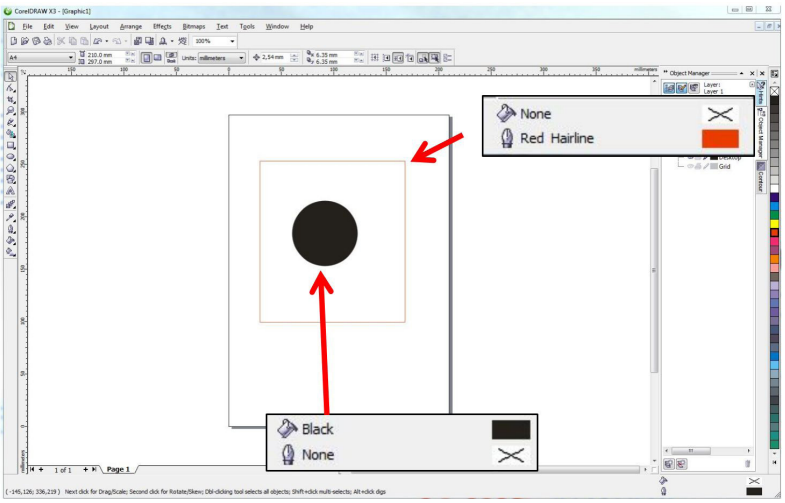
- How to use the milling head
- The processing head moves along a specific path (vector)
- Cutting paths are vector lines and arcs
- Vectors are processed one after the other
- Control via Hz (frequency)
- Slow X-axis and Y-axis movement

### Process: Raster engraving

- Similar to a printer
- The processing head moves along on the X-axis from left to right
- Graphics are traversed row by row
- Graphics are rasterized bitmaps
- Control via DPI (dots per inch) and PPI (pulses per inch)
- Very fast X-axis, slow Y-axis motion

# Creating a File For The Laser

In order for the laser to know which lines of the graphics need to be cut and which must be engraved, they must be set in the graphics as follows.

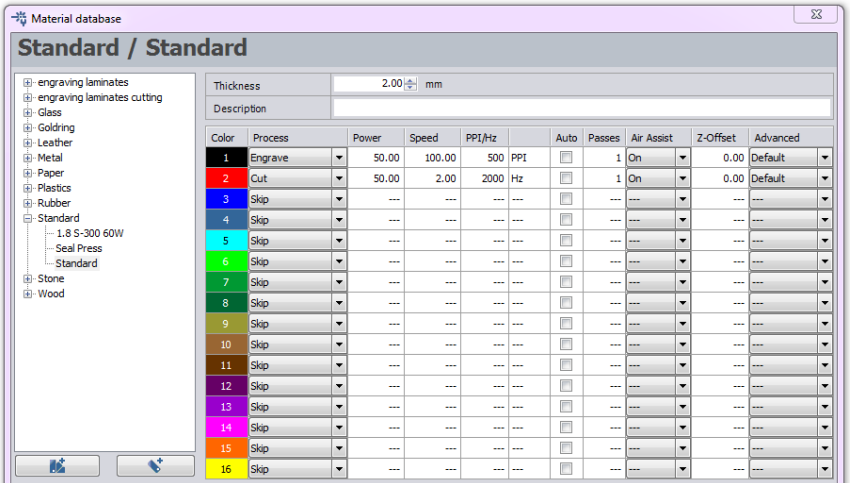



Cutting lines must always be red, engraving elements black

**Cutting lines:**
- Must always be vectors
- Line width = hairline
- Line color = red
(RGB from the Trotec color palette)

**Engraving area:**
- Vectors and pixel graphics
- Filling = black 100%s

Would you like to work with different laser parameters in a single processing step, for example to produce different engraving depths or effects? JobControl® can fill different laser parameters with up to 16 colors. Simply use the Trotec color palette to mark the areas in CorelDraw®.



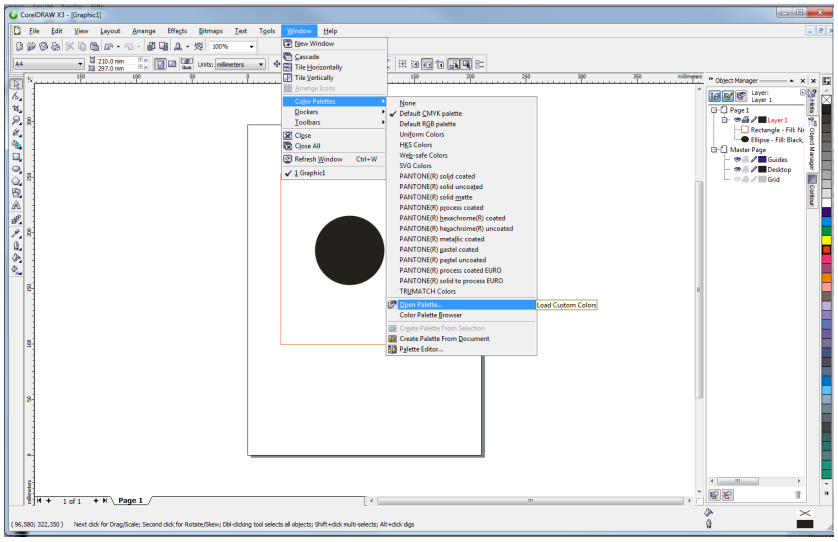

Overview of materials in JobControl®

# Import Trotec Colour Palette

As already mentioned in the previous chapter, the laser needs accurate color information in order to be able to process the data. To make creating these settings as quick and easy as possible, we have prepared a ready-made color palette, which you can import into your vector program in two easy steps, for example into Corel Draw®. You can find the color palette on the CD delivered with your laser.

## Step 1

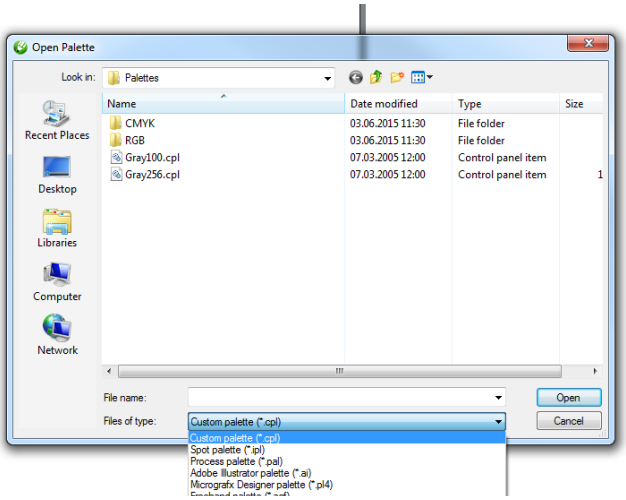
In the menu item “Window” under “Color palette” click on “Open color palette”. This will open a window where you can select the palette.




Overview of materials in JobControl®

## Step 2

Change the file type to *.cpl in the dropdown menu at the bottom of the window and choose the Trotec color palette. The Trotec color palette enables clear communication between the vector program, e.g. CorelDraw® and the JobControl® laser software. In this way you can process your workpiece using 16 different laser parameters in a single processing step.




Importing a new color palette - Step 2

# Materials For Laser Processing

| Material | Laser source | | Machinability | Process |
|---|---|---|---|---|
| | $CO_2$ | Fiber | | |
| Laminates | X | X* | XXX | Engraving, cutting, marking<br>* Color change on black base material |
| Acrylic | X | X* | XXX | Engraving, cutting *soak-dyed acrylic |
| Natural rubber | X | | XX | Engraving, cutting |
| PVC | **NO!** | **NO!** | **Cannot be processed** | Must not be processed! Laser processing produces dioxin! |
| Thermoplastics (PC, PI) | X | X | XXX | Cutting, marking |
| Thermoplastics (PMMA, ABS, PP, PE, POM, PA, PES) | X | X | XXX | Cutting, engraving, marking |
| Thermoplastics (PS, PETG) | X | | | Engraving, cutting |
| Thermoplastics (PI) | X | | XXX | Cutting |
| Thermoplastics (PBT, PPS) | | X | XXX | Marking |
| Ceramics | X | X | X | CO2 engraving, color change with fiber laser |
| Paper | X | | XXX | Engraving, cutting |
| Foamed plastics | X | | XXX | Engraving, cutting |
| Textiles | X | | XX | Engraving, cutting |
| Leather(ette) | X | | XXX | Engraving, cutting |
| Glass | X | | XXX | Engraving |
| Wood | X | | XX | Engraving, cutting |
| MDF | X | | XXX | Engraving, cutting |
| Veneer | X | | XXX | Engraving, cutting |
| Plywood | X | | XXX | Engraving, cutting |
| Fiberglass | X | | XX | Engraving, cutting |
| Stein | X | | XX | Engraving |
| Aluminium | | X | X | Engraving |
| Anodized aluminum | X | X | XXX | Engraving |
| Polished / unpolished brass | | X | XXX | Engraving |
| Hartmetall | | X | XX | Polishing |
| Chrom | | X | XX | Engraving |
| Polished / unpolished copper | | X | XX | Engraving |
| Gold | | X | XXX | Engraving |
| Silver | | X | XXX | Engraving |
| Platinum | | X | XX | Engraving |
| High-speed steel (HSS) | | X | XXX | Annealing / engraving |
| Brushed / polished stainless steel | | X | XXX | Annealing / engraving |
| Carbon | **NO!** | **NO!** | **Cannot be processed** | Must not be processed! |
| Titanium | | X | XXX | Annealing / engraving |

XXX Easy to process, even at high speed
XX Easy to process
X Difficult to process

Note: Laser marking results on plastics using a fiber laser depend on the pigmentation of the material.
Results may vary.

# Materials Database

You will find a wide selection of pre-tested laser parameters in the Trotec JobControl® software. Choose between 52 different materials and thereby save time testing for optimum parameters. JobControl® gives you the opportunity to export and import parameter files. This has the advantage that you can import pre-tested parameters into your database at a click of the mouse, which not only saves you time but also avoids mistakes.

**Are you already familiar with our sample database, which contains many creative ideas and examples for working with the laser? At www.troteclaser.com you will find templates and the corresponding JobControl® files for free download. Let yourself be inspired and discover more application options with which you can expand your portfolio.**

## Exporting a parameter file

Furthermore, it is also possible to export the entire materials database, individual groups of materials or single materials, in order to secure them for example on an external drive or to use them at another workstation.

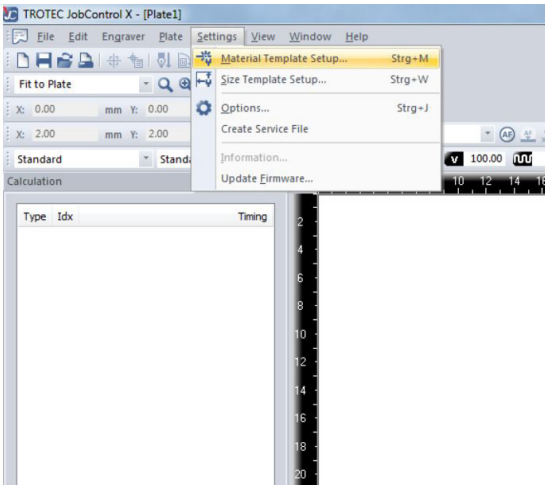
JobControl® files are stored in an .xml format and reimported. In order to export a file follow the step-by step instructions:

### Export the entire materials database, a material group or a single material

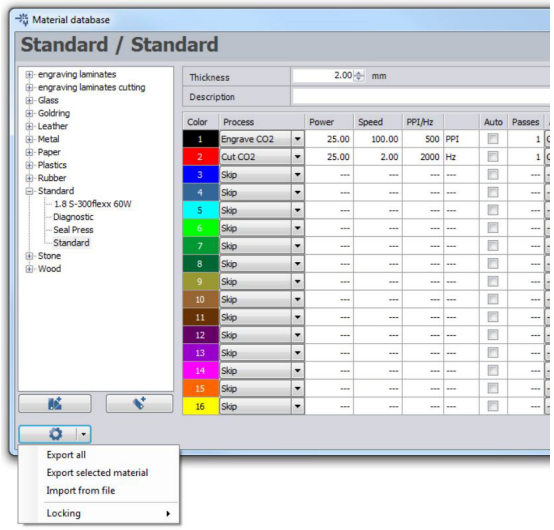
- Open JobControl® X on your computer
- Select "Settings"
- "Define material template Ctrl + M"
- The materials database opens

### You can also open the materials database by double clicking the processing area.

- Highlight the materials group
- Use the left mouse button to click on the arrow of the "Settings" symbol
- The selection window opens
- Now choose whether to
  - export the entire materials database, i.e. "Export All"
  - export the selected materials group, i.e. "Export the Selected Group"
- A dialog box opens and you can save the exported material data as an .xml file on your desktop or in a directory of your choice
- Click "Save"




JobControl® Settings --> Material template definition

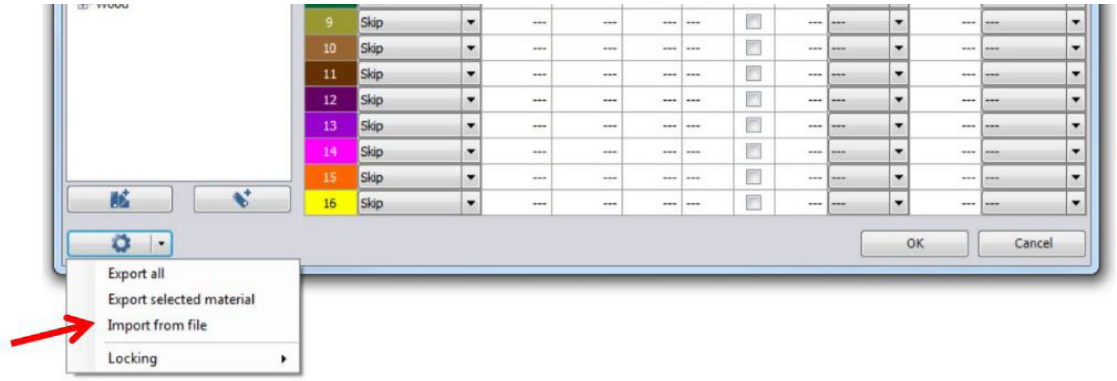



Export the desired material or even the whole database

# Importing a Parameter File

It is as easy to import of parameters as it is to export them, simply follow the steps and JobControl® will be ready to start laser processing immediately.

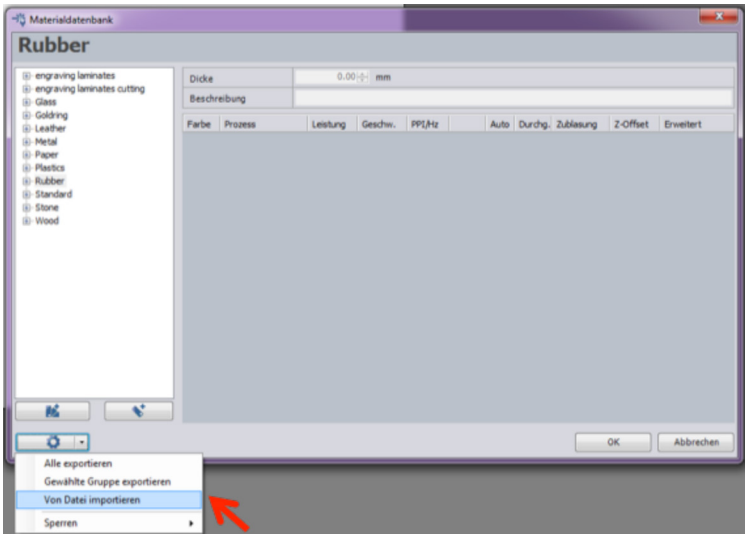
- Open JobControl® on your computer
- Select "Settings"
- Define material template (Ctrl + M)




**JobControl® Settings -> Define material template**

With a double-click on the processing surface, the material database opens.

- The JobControl® X materials database opens
- Create a new materials group by clicking on "Create Material Group" and
  - thereby creating said group in your directory (option 1)
  - Highlight a pre-existing materials group where you want to save your file to be imported (option 2)
- Now with the left mouse button click on the arrow of the "Settings" icon
- The selection window opens
- Click on "Import from File"

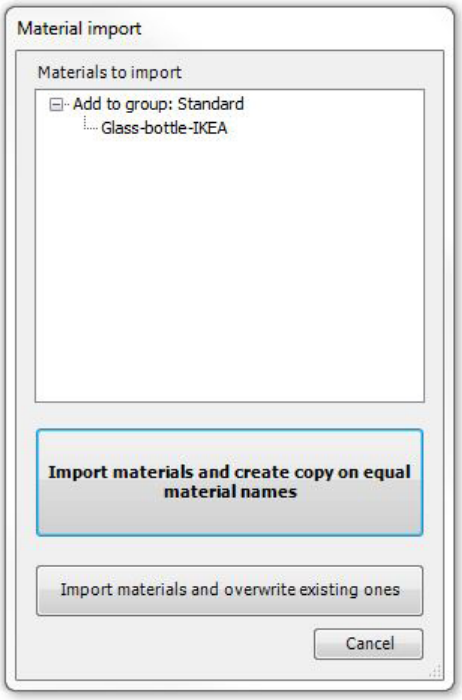



Import new parameters, for example from our pool of sample patterns available online at www.troteclaser.com

- Select your file and click on "Open"
- Another dialog box opens and the materials designation of the file to be imported is shown
- Now you can choose, whether

a) to import the desired material and create a copy using the same material designation or
(b) whether to import the desired material and replace an existing file with same material designation

**Tip: Select option a) in order not to lose existing settings, you can always administer changes to the materials database in JobControl® X manually at any time**




- the desired materials setting are now imported into the materials database and displayed by JobControl® X
- in order to save changes in the materials database, click on "OK"
- the .xml file held on the desktop can now be deleted (data is secured in JobControl®.)

Determine where your new parameters are to be stored

**Tip: When dealing with multiple files upload each file into the desired materials group separately and only click OK once the upload is complete.**

## JobControl® functions that make laser processing even easier

Standard: The most commonly used engraving and cutting process.

Photo-optimized: Optimizes high resolution images to maximum quality. A third-party image editing software is thus not required because the image is automatically rasterized.

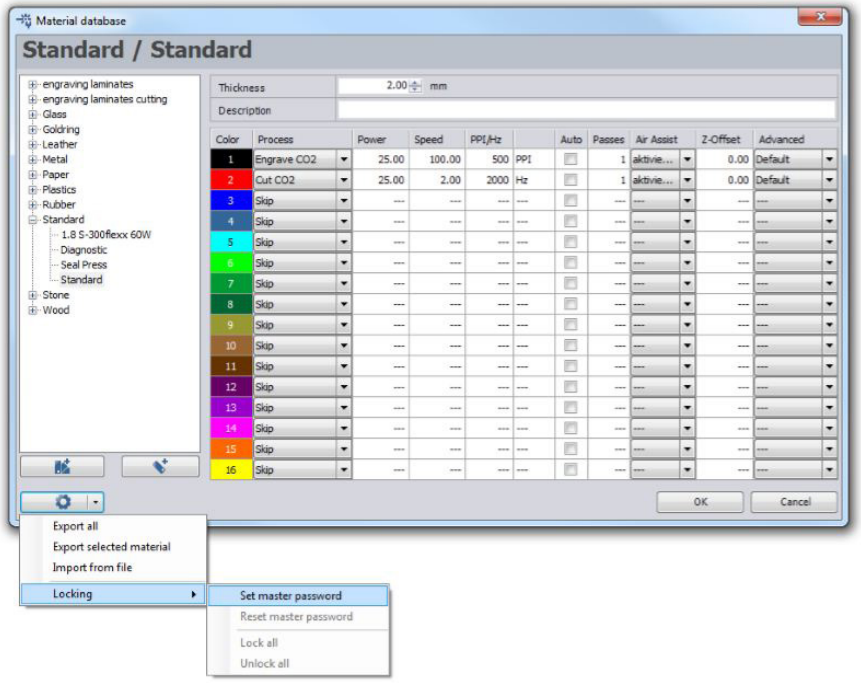
Stamp: Your layout is automatically mirrored and inverted, stamp edges can also be optimized. The webs function, in which the cutting line is automatically interrupted, so that the cut stamp plate remains connected to the raw material, further facilitates production.

Seal press: Is used in the production of laser engraved and cut seals for seal presses. Automatically creates positive and negative die plates to match the selected paper thickness as well as cutting lines and the positioning nose.

# Password Protected Materials

Has this happened to you? You have unintentionally overwritten the parameters in JobControl® and cannot remember the original values. No problem: As administrator you can password-protect individual materials or entire material groups.

- Use the left mouse key to click on the arrow of the “Settings” symbol
- The selection box opens, now select “Lock”
- “Set main password”
- With this function you as administrator can lock material groups or individual materials and / or unlock them, locked data is identified with a lock symbol
- Click on “OK” to save the changes

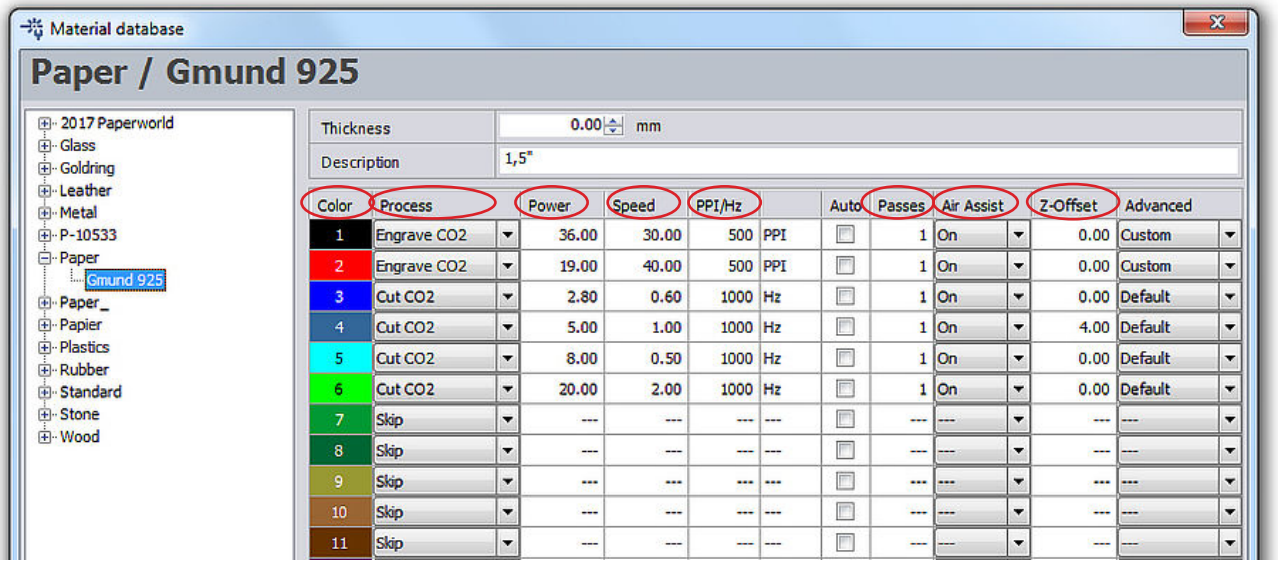



Lock materials or groups

# Laser Parameters

You will find a wide selection of pre-tested laser parameters in the Trotec JobControl® laser software. Save time testing your parameters by choosing from 50 different materials. For each product group, we offer 2 different parameter settings: one is optimized for time, and the other is optimized for quality.

The **"Quality"** parameter sets are recommended for engraving applications with fine details, small font sizes and high contrast. Thus, the laser cut is also optimized e.g. glossy, flame-polished edges with acrylic. The **"Speed"** parameter sets are recommended for time-optimized applications that include simple shapes and designs with fewer finer lines and details.




## Power

The power and speed laser parameters are the most important settings in the material database. They can be set as a percentage between 0 and 100%. The **Power laser parameter** describes the output power of the laser. 100% is the maximum power. For dark wood engravings or stamp engravings, you generally need a higher power, whereas low values are used for materials such as paper.

## Speed

The **Speed laser parameter** describes the movement of the laser head. Fast speeds lead to short exposure times, slow speeds lead to long exposure times. For example, large-scale engravings of TroLase materials are engraved at high speeds between 80 to 100%. But for photo engravings with lots of detail on wood, the speed should not exceed 10%. This setting also affects the quality of the laser cut. Note that cutting and engraving speeds are not comparable. Basically, cutting is slower than engraving. A "high" cutting speed is 10%.

## PPI

The **PPI parameter** (=pulses per inch) determines how many laser pulses per inch are used for engraving. To achieve a good result, this should be the same or a multiple of the dpi selected in the print setting. If you set this parameter to "Auto," JobControl automatically determines the optimal resolution of the laser pulses.

### Frequency

During the cutting process, the **Frequency parameter** is decisive and is given in Hz (=Hertz). It specifies the number of laser pulses per second. For a CO2 laser, the value can be set within a range of 1,000 to 60,000 Hz. For example, if you want to achieve a smooth edge when cutting acrylic, you need higher temperatures and thus this value is set to at least 5,000 to 20,000 Hz. On the other hand, when cutting wood, a low frequency of 1000 Hz is necessary in order to achieve an outcome such as the brightest possible cutting edge.

### Pass

The **Pass parameter** determines the number of engraving or cutting passes. For example, with some materials it can be advantageous to engrave with low power and high speed and then repeat this process several times. This means that the material is less stressed per pass. This approach can be appropriate for a relief engraving.

### Z-offset parameter

The z-offset describes the focus setting. If the z-offset is set to zero, it works "in focus," meaning the focus is exactly on the material surface. However, there are also applications in which deliberate defocusing is desired. For example, when engraving large areas on TroLase, we recommend defocusing 0.78" for a consistent engraving result. The following z-offset values are possible: - 0.19" (table moves up, i.e. closer to the material) up to 5" (table moves down, i.e. further away from the material).

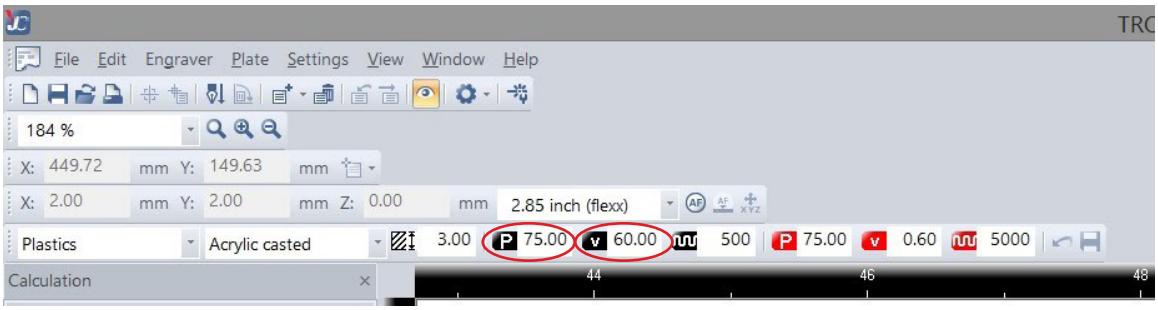
**DOWNLOAD PARAMETERS HERE!**
*https://goo.gl/L8sN8Z*

## Adapting parameters from the material database to achieve a darker or deeper engraving

All laser parameters in the material database have been carefully determined. Depending on the individual application, small adjustments to the parameters in the material database may be required in order to achieve visually different results. For example, if you increase the power value, more energy is introduced into the material, which leads to a darker engraving in wood. The engraving is thus also deeper. The reverse is also true -- reducing the power results in a lighter engraving. To find the perfect parameters for your application, we recommend making adjustments in small increments.

You can, of course, also create and manage the self-determined parameters in the material database.

**TIP:** Always change only one parameter in a test process. For example, start with the power by testing different values in 5-10% increments. Then repeat the same process with the speed. Only then should you combine both parameter settings. This will allow you to isolate variables and determine how individual parameters affect results.



## Material is not in the material database, what's the easiest way to determine laser parameters?

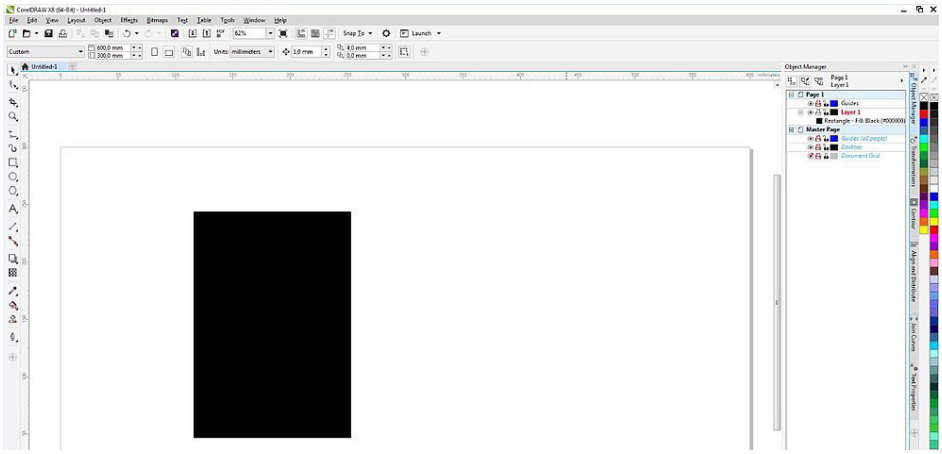
Generally, you start with high speeds and low power when engraving and cutting new materials. This ensures a low laser impact on the material.

Below are 2 ways to quickly and easily determine your laser parameters of new materials.

### Engraving template: black rectangle

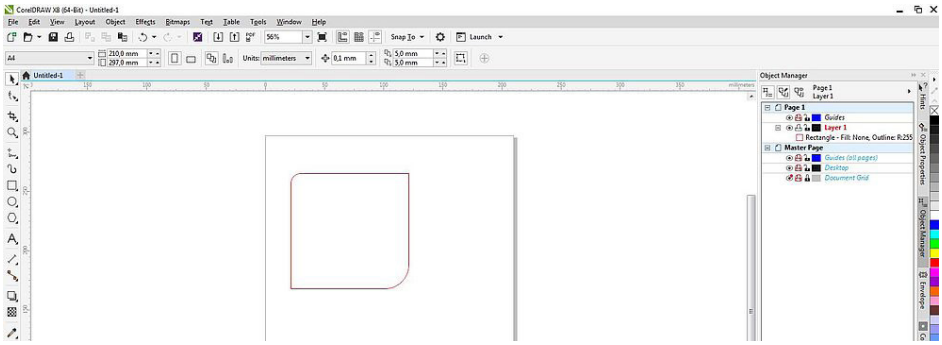
In order to find the best possible engraving parameters for an unknown material, draw a black contour-less rectangle in CorelDraw®. The size of the field depends on the size of the material; we recommend 1.96 x 1.96" as a standard size.

Send the field at low power (about 10-20 %), maximum speed and 500 dpi to the laser. As soon as you start the job, the bi-directional communication between the laser and the JobControl® laser software allows you to change the parameters during the engraving process. If no result is visible at low power, you can adjust the power or speed directly in JobControl®. We recommend doubling the power level as a first step. Depending on how the result looks, increase or reduce the power level to until you find the best settings for you.



### Cutting Template

The following graphic is a good reference for testing cutting parameters. The rectangle with two differently rounded corners makes it possible to have straight cutting lines and more complex shapes with the tested settings. Send the graphic to the laser. Start again with lower power and a higher speed (we recommend a start speed of 5-10%) and find your desired cutting quality. Note that cutting and engraving speeds are not comparable. Basically, cutting is slower than engraving. A "high" cutting speed means 10%.

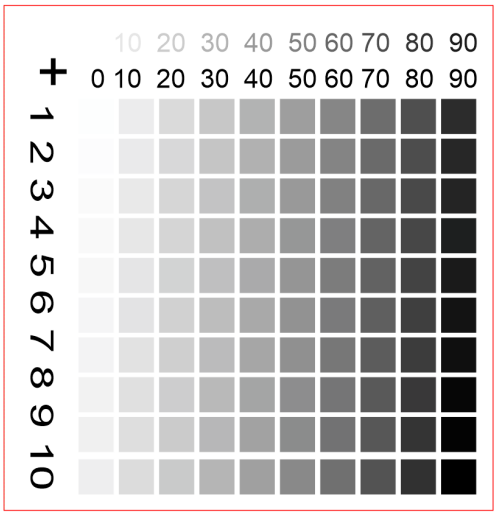


## Determination of laser parameters with the grayscale matrix

The test matrix consists of 100 different shades of gray. Using the Relief function in the JobControl® printer driver, the appropriate parameters can easily be determined.

The laser output is also adjusted according to the black tone. When a 100% black box is engraved, 100% of the set output can be used. If a 50% black box is engraved, this is engraved with 50% of the set output. The laser output is linear to the black tones, therefore the desired color tone can be selected using the test matrix engraving and the corresponding values can be directly transferred to the parameter database.

The speed of the machine always remains constant.




**DOWNLOAD MATRIX HERE!**
*https://goo.gl/u7uBkL*

## Creating the grayscale matrix

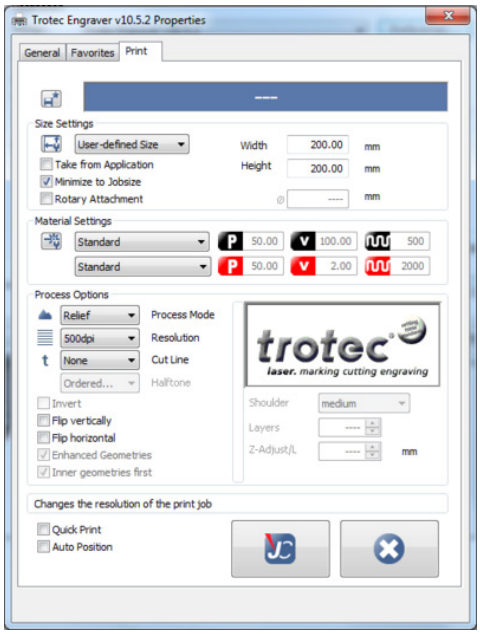
Paste the picture into your graphics program. In the printer settings of the JobControl® printer driver, set the process type to Relief. Select the resolution according to the material that you want to test; in the case of wood, for example, between 333 DPI and 500 DPI.

**TIP:**

For a laser output on a machine of 100 watts or more, start with P=80% output and v = 100% speed.

For a laser output on a machine between 40 and 100 watts, start with P=100% output and v = 100% speed.

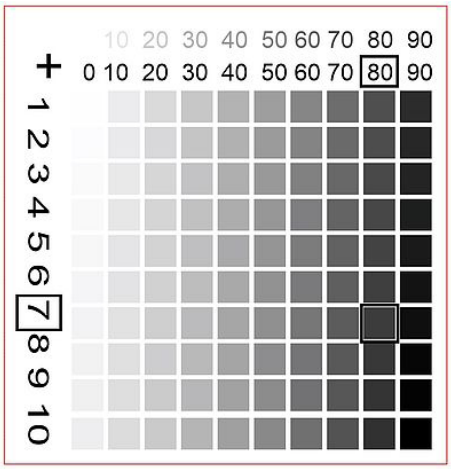
For a laser output on a machine below 40 watts, start with P=100% output and v = 50 - 80% speed.




## Selecting the laser parameters

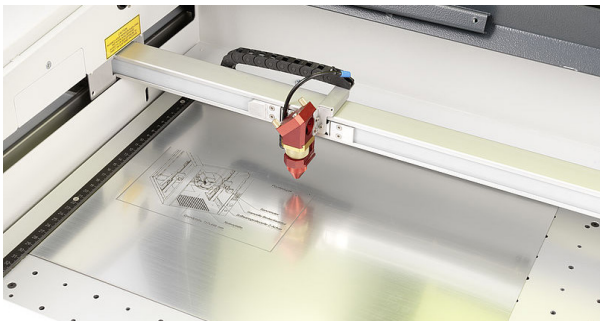
Select your desired color tone from the 100 different parameters of the engraved matrix and save it in your JobControl® database.

The selected parameter for P in this example is 80+7 i.e. 87% of the preset P-value (output).



# High Quality Mode

High-quality Mode is a function inside of our JobControl® laser software. With only a single mouse click, you can easily create high quality engravings. Because quality becomes the focus, the engraving takes longer to do. High-quality Mode is for when you need a high quality engraving and time is not critical.

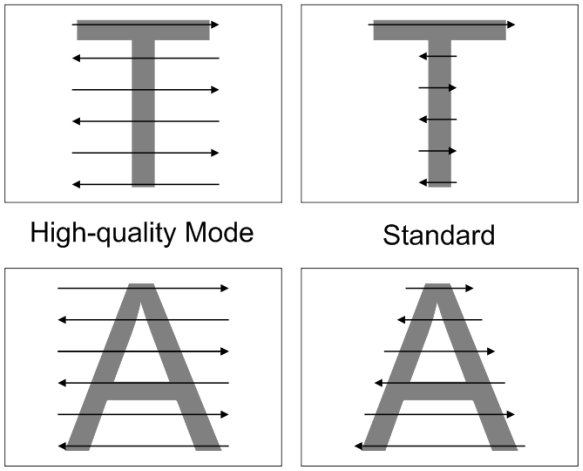


## How does the High-quality Mode work?

During High-quality Mode, the laser moves across the whole length of the job at a constant speed, marking only the defined areas for engraving. Jobs get engraved at the same speed through the entire engraving surface. The final result is an even, clean laser engraving.

When High-quality Mode is not active, the laser head typically moves at a faster speed but only over the width of the actual area to be engraved. The final result has different exposure times and deeper engravings in some sections.

Summary: When you want a high-quality engraving and the engraving time is not crucial, always activate High-quality Mode.



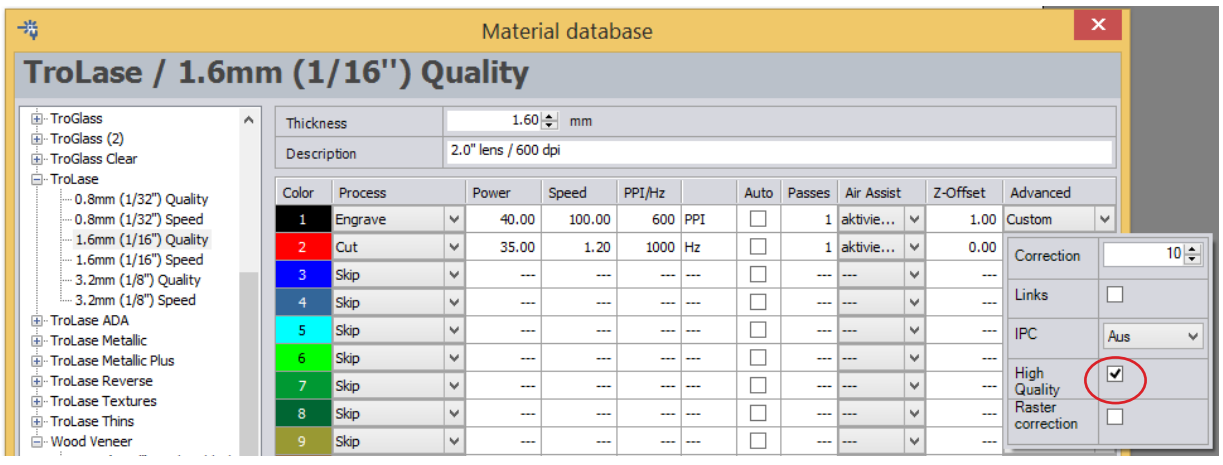

## How can I activate the High-quality Mode?

To activate the High-quality Mode, follow these steps:

- Open the materials database in the JobControl® laser software
- Open the drop-down menu under “Advanced” (right column)
- Put a check next to “Optimized quality”. The mode is now activated.

We recommend always using this function when the focus is on quality. This mode should not be used when the engraving needs to go quickly.

**TIP:** Lower resolution saves time but lowers the quality. The standard recommended laser parameters on our website always have the High-quality Mode activated for optimal quality requirements!



# Positioning Guides

Have you ever wondered what is the easiest way to position your graphic on your workpiece for laser processing? Correct positioning is important because it allows you to save material waste and handling time. JobControl® laser software provides a few options to help you quickly and reliably determine the best position for your graphic on your workpiece.

## 1. What you see is what you get"

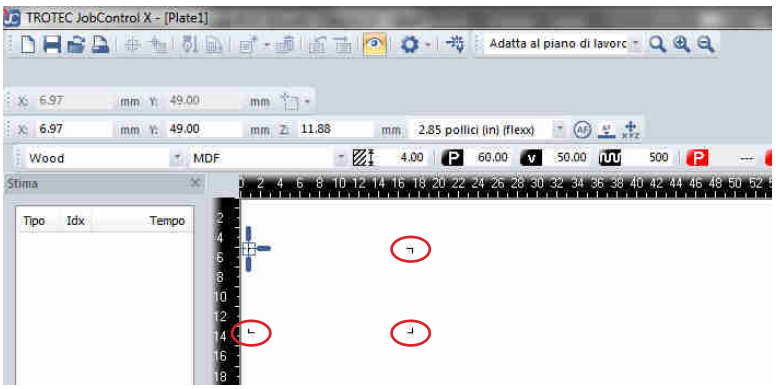
The "Eye" icon activates the job preview. If WYSIWYG is activated, all jobs positioned on the work surface are displayed with their graphical content. If you move the laser head in the machine, the cross hairs in the software will move accordingly. The bidirectional communication between laser and JobControl® software makes it easier to position the graphic on the workpiece and allows you to check the position before processing.

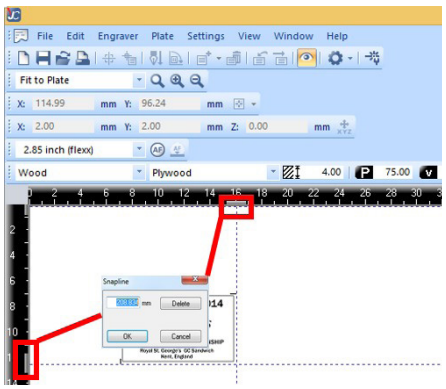
In the job preview, you can also see at a glance whether all the desired cutting, engraving, positioning lines and pass marks have been sent to the laser. If you deactivate a parameter in the material database (indicated by color) for example, it is not displayed in the "What you see is what you get" view either and is subsequently not processed by the laser. This is used to check whether all desired elements have been sent to the laser and indicates if there are any undesired cutting lines. However, the full view of the WYSIWYG displays all colors used in the graphic regardless of what you have defined with the parameters for the laser processing.


## 2. Guides

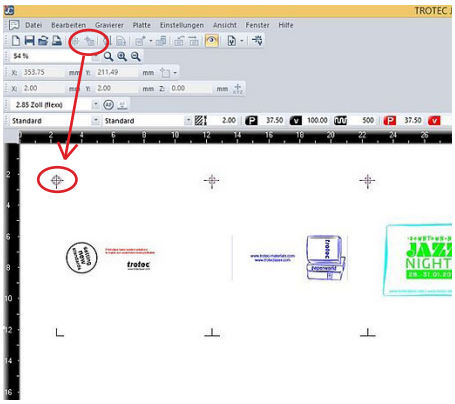
Guides make it easier to position the job on the work surface (if it is not in the 0/0 position). This allows you to save material waste and use the remaining material more efficiently. In recurring jobs, you can align these with leftover pieces on the upper edge to increase efficiency. You can also use guides to align your job to the right or center on your workpiece.

Creating your own guide is another simple and efficient way to precisely position your job where the material is on the table. To create a guide, press and hold the left mouse button on the respective work surface ruler while moving the mouse toward the work surface. You can also enter the exact position of the guide using coordinates.



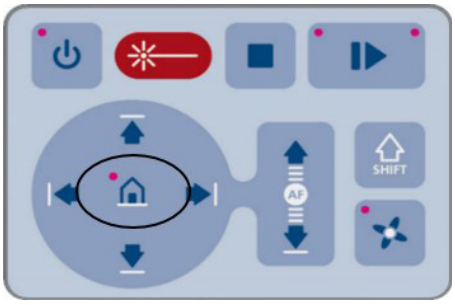



## 3. Marker

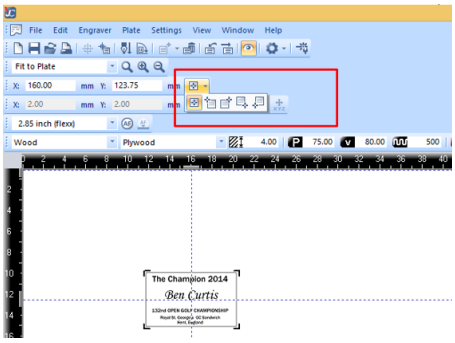


Markers are displayed on the work surface as blue crosses and serve as a positioning aid for jobs. Markers act “magnetically” on all corners and the center of a job.

If you have to process recurring jobs in large quantities, individually, or in a template, a marker helps determine and fix the positioning of the individual elements. Corner points or the center of a job on the work surface can also be fixed using markers, similar to the procedure with the guides. A marker is also particularly helpful for fixing the position on the work surface if the job is recurring and elements in the graphic have been forgotten and subsequently added. The prerequisite for this is that the job size remains unchanged.

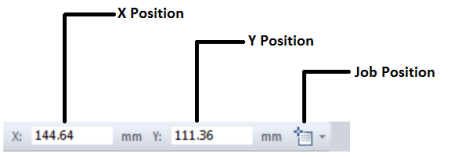



Markers can be set using the JobControl® laser software, or by using the Home key directly on the keyboard of the machine. Press the button for approximately 3 seconds to define the position of the laser head as a marker and a new (temporary) starting position. This saves time, especially when the computer is not directly next to the laser machine.




Once the new starting position is fixed, the JobPosition function can define whether the job should be positioned in the center or in the corners. Using the Home button, each job will then be automatically aligned in the desired position.

## 4. Job Position

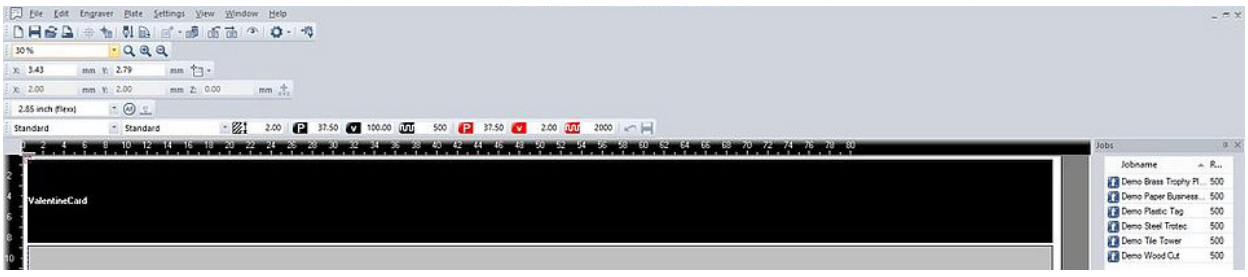



The job position bar provides information about the X and Y position of a selected job on the work surface. A precise job position is possible through the manual input of the desired coordinates.

Depending on the choice of import, the coordinates are displayed in the top left corner or the center of a job.

## 5. Do you often have recurring jobs? Save plate

Save the entire plate including the job, parameters, markers and guides as a pjx file. With just one click, you can open the job and all the settings will be automatically loaded. This not only saves time, but application errors can be kept to a minimum, even for untrained operators.



# Inner Geometries First

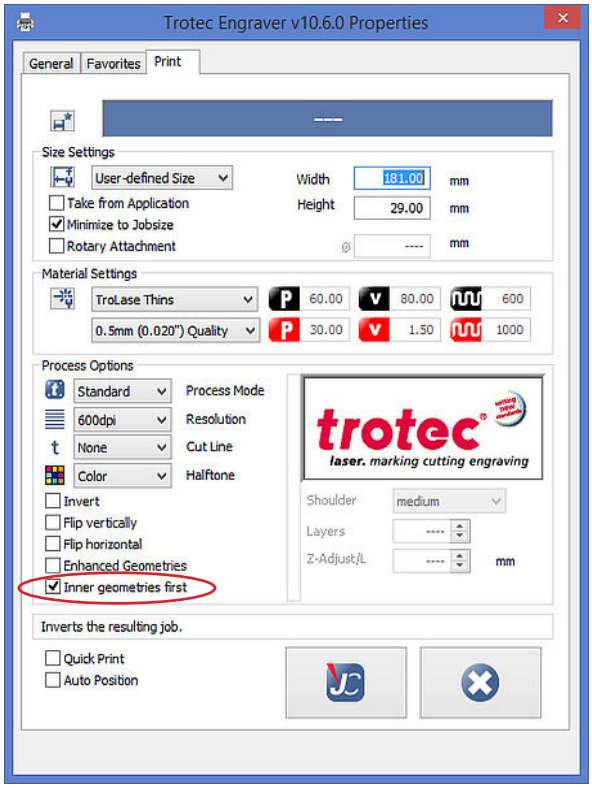
## Unsorted cutting lines can be a waste of time

When cutting and engraving graphics, the laser first carries out all engravings and then all cuts. Cutting is carried out in the order in which the outlines are drawn. However, this may lead to the external contour being cut first and the workpiece tilting, slipping or even falling through the cutting table. Cutting of the internal contours is then no longer possible.

## How to order the parts of your laser job

Conventional methods for ordering cutting lines:

- Draw cutting lines in the exact order in which they are to be cut
- Sort cutting lines manually in the graphic before the data is sent to the laser
- Assign the cutting lines different colors in the Trotec material templates, which are then cut in the exact order as listed in the templates.
- The **easiest and most convenient** way to sort your cutting lines is the "**Inner geometries first**" feature in the JobControl® Software. It can be activated with only a mouse-click and will automatically sort your cutting lines.




## Inner geometries first - featured in JobControl®

Activating this feature simplifies the working process many times over, because the cutting lines are automatically sorted and the internal cutting lines are cut first. This preset automatically improves the quality of your application, because internal parts remain firmly attached to the actual cut and thus cannot slip. The external contour is automatically cut at the end. In addition, this feature also saves time because the lines do not need to be manually sorted in the graphic.

# Resolution

The correct resolution can drastically affect your engraving result. The material you use, the image itself and the engraving time all play an important part.

*Laser engraving at 125 dpi*

*Laser engraving at 250 dpi*

*Laser engraving at 333 dpi*

*Laser engraving at 500 dpi*

*Laser engraving at 600 dpi*

*Laser engraving at 1000 dpi*

## Material impact

Workpieces absorb energy when laser engraved. Because of the high temperatures, the dots grow larger and may overlap (="dot bleed"). It is especially important to take this property into account when doing a photo engraving. The correct resolution is essential to avoid dot bleed.

| Used material | Preferred resolutions |
|---|---|
| wood, glass, textile, stone | lower resolutions: 125, 250 and 333 dpi |
| acrylic, TroLase materials, paper, cardboard | moderate resolutions: from 500 to 600 dpi |
| stamps, metal, processing with fiber laser | higher resolutions: from 600 to 1000 dpi |

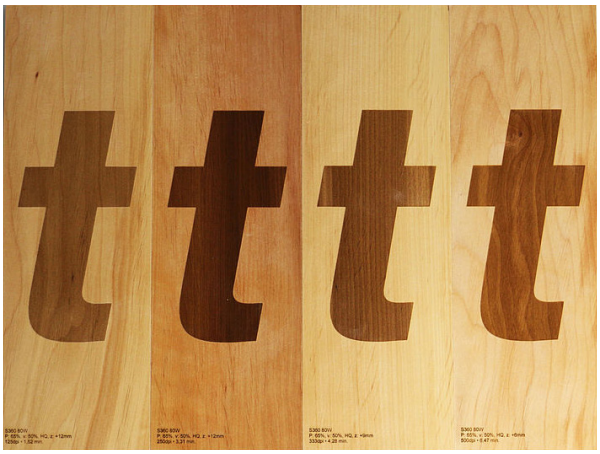
## Graphic content

Depending on how detailed your image is, we recommend that you increase the resolution to 600 dpi in spite of the aforementioned "dot bleed". This lets even the smallest of details be perfectly engraved.

## The time factor

The higher the resolution you choose, the more time it will take to laser engrave.

You can save time if you pick a different resolution. For example, if you are doing a large-scale engraving, you could pick a lower resolution and then use a higher Z-offset value to accommodate the resultant line spacing.



**Consistent engraving result - 1/4 of the original processing time**

View our sample to see how the same image can be engraved at 500dpi with the same result as 125 dpi in only a quarter of the time:

**Speedy 360, 80 Watt, P=65%, v=50%**

| ***Resolution*** | 125 dpi | 250 dpi | 333 dpi | 500 dpi |
|---|---|---|---|---|
| ***z-Offset*** | +0.5“ | +0.5“ | +0.3“ | +0.2“ |
| ***time [h]*** | 1:52 | 3:31 | 4:28 | 6:47 |

### Exception for laser engraving rubber stamps:

With stamps, a higher resolution will raise the energy density during engraving. If you engrave the stamp at 500 dpi, then you need to reduce the engraving speed so that you can get the recommended engraving depth of 1.1mm. To contrast, engraving can actually be quicker at 1000 dpi, saving time in spite of the larger resolution.

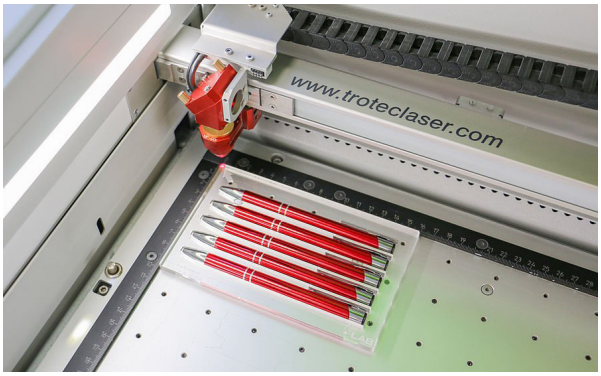
# Creating templates

Templates are a very useful tool if you want to laser engrave more than one section in one work process to save additional time. Find out more about what to consider when creating templates.

## Which material is suitable for creating templates?

In general, you can use any material that you can cut with the laser when creating your templates. TroLase is a particularly cost-effective option. It is dimensionally stable, easy to process and available in many designs.

Also pay attention to the thickness of the parts to be engraved when creating templates. For thin objects such as aluminum tags, use flat material for the template so that you can quickly and easily remove. For thicker workpieces such as pens, the material for the template also needs to be thicker so that the workpieces don't slip in the template.




## How do I create the layout for my template?

The layout of the template depends on the volumes that you have to make. If you produce small quantities at regular intervals, you can adapt the template to these smaller quantities. If you need to process large volumes in one single order, adjust the template to the work area of your Trotec laser machine.

For large order volumes, it is more economical to apply the template in duplicate and with a base. You can use your work time efficiently by placing the first template in the laser and engraving it while you are reloading the second template outside.

Thanks to the base, loaded templates can be easily moved from the work table into your Trotec laser. The base should therefore be made of solid material. When gluing the base and template, ensure that they are glued properly one above the other.


https://goo.gl/2k9stg


https://goo.gl/Y5AD6H

## How do I find the right contour for my workpiece?

The transfer of the workpiece contours is extremely important and should be a key factor for creating your template. There are several methods:

Option 1: Measure - If the outline of your workpiece is a simple geometric shape or letter, it is a easy and a good idea to measure the shape and trace it in your graphics program.

Option 2: Scan workpiece - If your workpiece consists of complex angles and radii, we recommend scanning the workpiece. Once scanned, simply transfer the file into your graphics program and trace the contours.

Option 3: Trace and scan If your workpiece is too bulky for your scanner, you can trace the contours with a pen on a piece of paper and then scan it. When you import the scanned image into your graphics program, you can try to automatically convert the image using flash-vectorization. However, we recommend that you trace the contours yourself as a large number of unnecessary nodes are embedded in the contour during the automatic conversion.

## What do I need to pay attention to when determining the contours?

When determining the contours of your workpieces, always ensure that you scan or align the shapes in a way that future engravings can run straight and don't have to be rotated. This makes it easier to align graphics and text fields on your workpiece.

It is helpful to trace special points in your workpiece (e.g. holes for bead chains, etc.) so that you don't accidentally position your engravings in these areas later.

Once the shape is determined, try cutting out the contour and insert your workpiece. If necessary, correct any unsuitable positions. Always use multiple workpieces when testing, as these can also be subject to production-related tolerances.

## More tips for creating templates:

- If you use lots of different templates, we recommend engraving the name of the corresponding graphics file on them. This makes it quick and easy to find the right work file and match it with the template.

- Mark the corner of the unit in the zero point on the template so that you can quickly and easily insert it in the machine with the correct orientation.

- If your template is rather small and handy, it is useful to file it in a folder. To do this, simply laser holes in your template. Thus, your templates are kept safe and are quickly at hand.

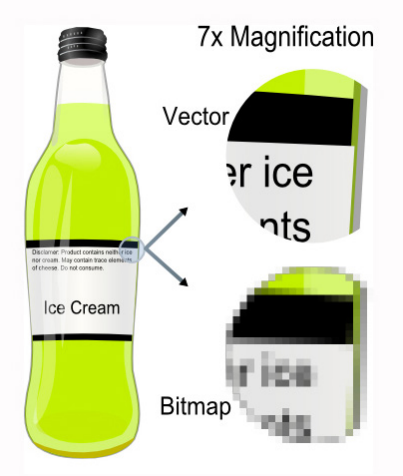
- When you send your future engraving jobs to the laser, always send the entire graphic including the outer contour of the template. Before engraving your workpieces, set the color "red" to "positioning" in the parameters in the material database. This makes it easy for you to check whether the template is properly positioned in the machine.

- In order to quickly and reliably determine the desired position for laser processing read our tips and tricks for positioning aids.

# Raster Algorithms

## What are raster graphics?

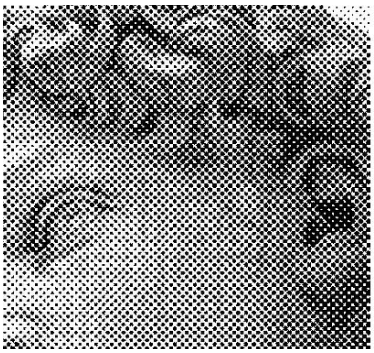
A raster graphic or bitmap (e.g. PNG or JPEG) consists of individual image points (often called “pixels“), which can have different colors. The image points or “pixels” in their entirety represent a colorful image. The smaller the image points and the more image points there are, the better the quality (resolution) of the image. However, a raster graphic has the disadvantage that it cannot be enlarged arbitrarily, without being able to see the individual pixels as small squares. The term “raster graphics” is also based on this effect, as the image has different points arranged in a raster.




## What does rasterizing mean?

During laser engraving, the grayscale or color images are converted to black/white images during rasterizing. The impression of a grayscale image is generated through different point sizes and point distances. However, the human eye perceives the raster as a mixture of colors.

During rasterizing, binary information is calculated from image data as: “1 = lasering / 0 = not lasering.” Grayscale or color images are then converted to a black-white image that can be engraved. There are different algorithms for the arrangement of the individual image points. In the JobControl® laser software, you can simply select the desired raster algorithms.



*Ordered Dithering*

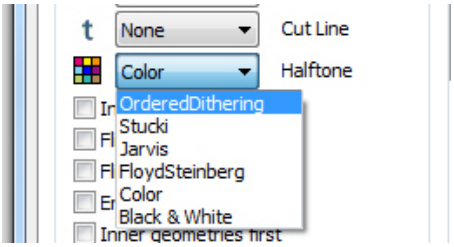
*Original*

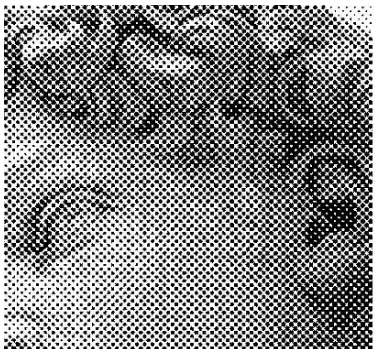
*Error Diffusion*

## Which raster algorithms are available?

The following raster algorithms/halftones are available in the JobControl® laser software:

1. Ordered dithering raster
2. Error diffusion raster (Stucki, Jarvis, FloydSteinberg)
3. Color
4. Black/white

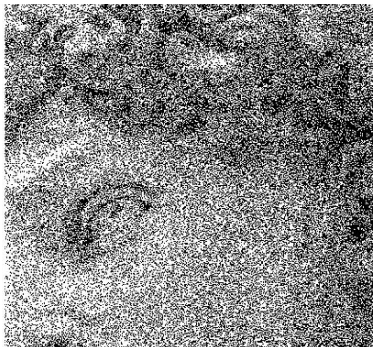




### Ordered Dithering

"Ordered Dithering" is an ordered raster structure. The individual points are placed along a virtual raster and differ in size depending on the grayscale value. The darker the grayscale value, the larger the point. However, the density and the position remain unchanged.

This raster can be compared with the print of large billboards. The four primary colors are presented as points and are printed above each other. The impression of an arial image results when they are viewed from a distance.

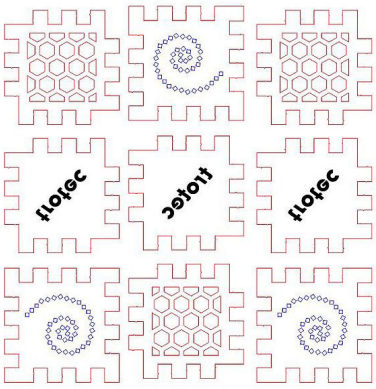


### Error Diffusion

These raster algorithms are a chaotic raster arrangement. In the JobControl® laser software, the following three error diffusion rasters can be selected: Stucki, Jarvis and FloydSteinberg.

The principle of these three algorithms is the same: the darker the grayscale value, the denser the points are set. The point size remains unchanged. They only differ minimally in coarseness and depth sharpness.

The error diffusion algorithms reach a better detail accuracy than the ordered dithering raster.



### Color and black/white

The two "halftones" color and black/white are used for engraving vector data. In contrast to the ordered dithering and error diffusion rasters, the data is not converted to grayscale here. Instead, the objects with the 16 predefined colors in the JobControl® are directly transferred to the laser software, where an individual parameter can be defined for each color. This allows for different performances, speeds or offsets to be processed in an engraving job.

## When do I use which raster algorithm?

For the most part, your preferences in material and design will determine which raster algorithms you should use. However, here are some general guidelines:

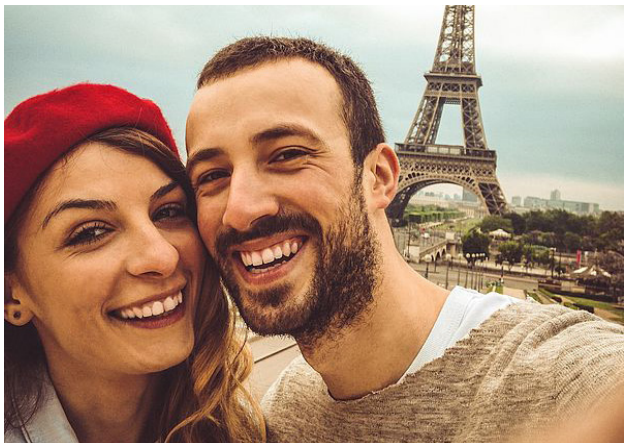
- Error diffusion algorithms let photos with lots of details become clear, such as buildings or animals with thick fur. Images with little contrast such as faces of babies or low-resolution photos can also be optimized in this manner.
- The ordered dithering raster is particularly suitable for images with fine grayscale courses, for example people or images which must achieve maximum visibility.
- Black-white is used for vector graphics where only a black engraving color is present in the graphics.
- Color: As soon as a second engraving color is assigned in the vector graphics, the raster color must be used; otherwise the parameter for black is automatically used for all engravings.

All these rasters do not have an effect on the cutting lines.

# Photo Engraving

A decisive factor for a good photo is the resolution. Images for laser engraving should generally have a resolution of at least 300dpi as the output size. If necessary, you can increase the resolution in your graphics software by re-establishing the bitmap (example in CorelDraw under “Bitmaps” - “Resample”). For example, Internet photos often have a resolution of 72 dpi.

Even these can be processed well with the laser, if the original images are large and are scaled down to workpiece size. You should avoid enlarging small images as this decreases the resolution (image raster becomes too large) and is therefore not a basis for a beautiful photo engraving.



*Suitable for photo laser engraving*

*Non-suitable for laser engraving*

**Above is an example of a well suited vs an ill-suited image for photo engraving**

The ***left image*** is well-suited for processing through the laser. It shows a good contrast, it is well exposed and the elements in the image stand out. The ***right image*** is less suited for processing with the laser. Although the people stand out from the background, the exposure is too weak which makes the people look like they are in the shadows. This makes it difficult for details to be perceived and will result in the people being engraved as a unitary surface.

## Material influence on the engraving quality

The process resolution is an essential influence factor for the engraving quality of different materials. For example, anodized aluminum can be engraved with 600 - 1000 dpi, as the raster point does not increase on this material during engraving. With wood or glass however, 333 dpi are completely sufficient, as every raster point becomes larger than in the graphics on these materials due to their surface quality. With acrylics or laminates, a resolution of about 500 - 600 dpi is suitable. In general, lower resolutions (333 -500 dpi) result in more plastic photo engravings, because the raster points do not overlap.


**https://goo.gl/Zs17ik**

## Photo Engraving Guide

Download our complete guide on photo engraving and see how you can start making beautiful photo engravings on wood, glass, plastic and more!

**DOWNLOAD GUIDE HERE!**
*https://goo.gl/dFQXcX*

# Shortcuts - Key Combinations

Everyone knows Copy and Paste nowadays. Other keyboard shortcuts and combinations can also help to make your everyday life easier and save you time. Here we have compiled a small selection of the most important key combinations for you and listed them on the following pages.

## JobControl®

| Keyboard shortcuts | Description |
|---|---|
| F1 | Help |
| Ctrl + - or Ctrl + + | Zoom out or in |
| Ctrl + 0 or Shift + F4 | Zoom on plate |
| Alt + 0 or F4 | Zoom on job |
| F8 | Marker to laser |
| Ctrl + N | New plate |
| Ctrl + O | Open plate |
| Ctrl + S | Save plate |
| Ctrl + P | Print |
| Ctrl + A | Select all jobs |
| Ctrl + R | Reset selected jobs |
| Ctrl + G or F12 | Start |
| Ctrl + F | Pause |
| Ctrl + E | Stop |
| Ctrl + D | Duplicate job (either on the plate or in the queue) |
| Remove | Delete selected jobs |
| Ctrl + delete | Delete selected marker |
| Ctrl + M | Open materials database |
| □ (back) | Job back in queue |
| Ctrl + space bar | Rotate job |

## CorelDraw®

### Align and arrange objects

| Keyboard shortcuts | Description |
|---|---|
| C | Align object(s) centrally and vertically |
| E | Align object centrally and horizontally |
| P | Align object centrally on the side |
| L or R | Left-aligned or right-aligned |
| T or B | Align at the top or bottom |
| Shift + A<br>or Shift + P | Distribute distances vertically or horizontally between objects |

### Text

| Keyboard shortcuts | Description |
|---|---|
| Ctrl + B | Bold |
| Ctrl + I | Italics |
| Ctrl + U | Underlined |
| Ctrl + 4 or Ctrl + 6 | Increase or decrease font size by one increment |
| Ctrl + L or Ctrl + R | Left-aligned or right-aligned |
| Ctrl + F12 | Spell checker |

### F-keys

| Keyboard shortcuts | Description |
|---|---|
| F1 | Help |
| F2 | Jump to zoom tool once |
| F3 | Reduce size of drawing |
| F4 | Show all objects |
| F5 | Draw lines and curves (freehand mode) |
| F6 | Rectangle tool |
| F7 | Circle / ellipse tool |
| F8 | Text tool |
| F9 | View full page |
| F10 | Node edit (anchor) |
| F11 | Color gradient |
| F12 | Contour pen |