

# Material Settings Guide

This section provides sample driver settings and helpful hints to get started engraving and/or cutting the materials listed.

## Safety



**NEVER LEAVE THE LASER SYSTEM RUNNING UNATTENDED FOR ANY REASON.** Exposure to the laser beam can cause ignition of combustible materials. All laser cutting and engraving should be constantly supervised.

**NEVER OPERATE THE LASER SYSTEM WITHOUT A PROPERLY INSTALLED AND OPERATING EXHAUST SYSTEM.** Some materials when cut or engraved can produce fumes that are hazardous in concentrated amounts. Also make sure that your room is adequately ventilated as some materials will continue to produce fumes for several minutes to possibly hours after the cutting or engraving process has been completed. Since many materials can produce toxic and possibly caustic fumes or residue, it is advisable to obtain the Material Safety Data Sheet (MSDS) from the materials manufacturer. The MSDS discloses all of the hazards when handling or processing that material. The law requires all manufacturers to provide this information to anyone who requests it.

**DO NOT ENGRAVE OR CUT PVC (Polyvinylchloride) BASED MATERIALS.** The fumes are extremely toxic if you inhale them. The fumes are so caustic that it can chemically destroy the metal parts of the laser system. Damage to the laser system from this type of abuse **ARE NOT** covered under warranty.

**DO NOT ENGRAVE OR CUT UNCOATED METALS OR REFLECTIVE SURFACES.** The laser beam can reflect off of these materials causing damage to the laser system as well as being a safety hazard. Damage to the laser system from this type of abuse **ARE NOT** covered under warranty.



- Laser engraving or cutting materials other than those described in this manual can be a safety hazard and can damage the laser system.
- Damages to the laser system due to neglect, misuse, or operator error ARE NOT covered under warranty.
- Damage to the laser system due to an inadequate or improper operating environment is considered abuse and **ARE NOT** covered under warranty.
- In no event will ULS be liable for any damages caused, in whole or in part, by customer, or for any economic loss, physical injury, lost revenue, lost profits, lost savings or other indirect, incidental, special or consequential damages incurred by any person, even if ULS has been advised of the possibility of such damages or claims.

## Materials

There are many variables that can affect the cutting and engraving process such as differences in the thickness of the material, density of the material, composition of the material, and the manufacturing processes used to make the material.

**Please use these settings as a guideline or starting point, in most cases these settings should work out well, but sometimes may have to be adjusted to produce desirable results.**

## PRINTER DRIVER SETTING TIPS

### Power Setting

- Higher burns deeper. Too much power sacrifices detail. Has no effect on running time.
- Lower burns shallower. Too little power sacrifices detail. Has no effect on running time.

### Speed Setting

- Higher saves time. Burns shallower and reduces detail.
- Lower increases time. Burns deeper but too deep may reduce detail.

### PPI Setting

- Higher increases the burning or melting effect. Produces finer detail if speed is not too fast. Has no effect on running time and very little effect on depth.
- Lower decreases the burning or melting effect. Reduces image detail if set too low. Has no effect on running time and very little effect on depth. Very low settings are used to perforate the material.

### Rule of Thumb

- Doubling the power doubles the depth and halving the power halves the depth.
- Halving the speed doubles the depth and doubling the speed halves the depth.

**NOTE**

When engraving very small objects, top speed cannot be achieved because acceleration and deceleration of the motion system requires time and distance. The laser system will automatically adjust itself to a maximum engraving speed that it can achieve due to the size and position of the graphic. This is why you might notice that there might be no difference in engraving time on certain graphics whether you choose 100% speed or less.

The following materials were tested with the laser system set at an Image density of 5 and in Single Beam mode using one laser (except where noted otherwise). The following pages will fully describe the results of these tests and will offer helpful hints when choosing materials, setting parameters, and using different techniques to provide the best laser cutting and engraving results.

**If your system is equipped with two lasers, total the power of the two lasers and refer to the charts. For example, if you have two 30-watt lasers, refer to the settings of a single 60-watt laser. If the total wattage is more than the charts show, then refer to the setting of one laser and either reduce the power setting in half or double the speed (if speed is 50% or less). If you are using a SuperSpeed, and running in Dual Beam mode, use the settings of the wattage of one laser.**

**Please use these settings as a guideline or starting point, in most cases these settings should work out well, but sometimes may have to be adjusted to produce desirable results.**

ACRYLIC - CAST AND EXTRUDED

ACRYLIC – MIRRORING

ALUMINUM – ANODIZED

BRASS – PAINTED

CORK

CORIAN / AVONITE / FOUNTAINHEAD

DELRIN (SEAL PRESS)

GLASS / CRYSTAL

LEATHER

MARBLE

MAT BOARD

MELAMINE

PLASTIC – MICROSURFACED

RUBBER STAMPS

VINYL – SIGN (3 MIL)

WOOD / WOOD INLAY

**ACRYLIC - CAST AND EXTRUDED**

**LIGHT RASTER ENGRAVING**

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	53	100	500	1	.002"
30	44	100	500	1	.002"
35	38	100	500	1	.002"
40	34	100	500	1	.002"
45	30	100	500	1	.002"
50	27	100	500	1	.002"
55	24	100	500	1	.002"
60	22	100	500	1	.002"

**DEEP RASTER ENGRAVING**

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	100	60	500	1	.010"
30	100	64	500	1	.010"
35	100	68	500	1	.010"
40	100	73	500	1	.010"
45	100	77	500	1	.010"
50	100	81	500	1	.010"
55	100	86	500	1	.010"
60	100	90	500	1	.010"

**VECTOR ENGRAVING**

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	6	4.0	1000	1	.005''''
30	5	4.0	1000	1	.005''''
35	4	4.0	1000	1	.005''''
40	3	4.0	1000	1	.005''''
45	3	4.0	1000	1	.005''''
50	3	4.0	1000	1	.005''''
55	2	4.0	1000	1	.005''''
60	2	4.0	1000	1	.005''''

**VECTOR CUTTING**

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	100	0.1	1000	1	.25"
30	100	0.4	1000	1	.25"
35	100	0.6	1000	1	.25"
40	100	0.9	1000	1	.25"
45	100	1.2	1000	1	.25"
50	100	1.5	1000	1	.25"
55	100	1.7	1000	1	.25"
60	100	2.0	1000	1	.25"

## COMMENTS

There are two types of acrylic available, cast and extruded. Cast turns white or frosted and extruded remains clear when engraved. Use extruded acrylic for paint filled engraving and cast for regular engraving. Cast engraves better without masking. Lightly engrave the surface to frost it with a low power setting such as the first setting listed above. If deep engraving is desired, it is necessary to mask the acrylic with transfer tape to prevent the smoke from damaging the clear surface of the acrylic. However, another problem with deep acrylic engraving is that the intense heat creates a white, crusty, deposit that accumulates along the edges of the area that was just engraved and is impossible to remove without causing damage. Engraving lightly and without masking seems to be the better all around alternative.

If only cutting acrylic, extruded works better and is less expensive than cast. The cut edges of extruded acrylic will appear to be more highly polished and clearer than cast acrylic when laser cut. When cutting acrylic, it might be necessary to remove both sides of the original masking and re-mask with transfer tape if cutting through the original masking produces flaming. The original masking is coated with wax and will not absorb water. If cutting through very thick acrylic, re-mask both sides with transfer tape and dampen the masking on both sides of the acrylic with water from a spray bottle. Elevate the acrylic off the table at least 1/2 inch, re-focus, and then proceed to cut. Elevating the acrylic will allow the beam to completely pass through the material which allows the smoke and heat to escape from underneath. If cutting directly on the engraving table, the trapped heat might cause the bottom edge of the cut to pit and distort. Re-masking and dampening with water will act as a heat sink to pull the laser heat away from the cutting area resulting in less distortion or heat affected zones (HAZ). When dampening, be sure not to leave puddles of water. Puddles of water will reduce cutting depth significantly. For the best results when combining engraving and cutting on the same piece, first engrave lightly and unmasked. Then mask with transfer tape, dampen, elevate, re-focus, and cut as a second step.

Paint filling the engraved area is possible by first masking the acrylic or leave on the original masking then engraving through the masking. Before removing the masking, brush or spray on some acrylic based or water based paint right on to the masking. When the paint is dry, remove the masking and the paint will remain in the recessed area of the engraving. Remember to use extruded acrylic when paint filling and cast acrylic when simply engraving.



**Acrylic is extremely flammable. Do not leave the laser system unattended when cutting or engraving.**

**ACRYLIC - MIRRORED**

**LIGHT RASTER ENGRAVING**

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	58	100	500	1	.003"
30	49	100	500	1	.003"
35	43	100	500	1	.003"
40	40	100	500	1	.003"
45	35	100	500	1	.003"
50	32	100	500	1	.003"
55	29	100	500	1	.003"
60	27	100	500	1	.003"

**DEEP RASTER ENGRAVING**

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	100	60	500	1	.010"
30	100	64	500	1	.010"
35	100	68	500	1	.010"
40	100	73	500	1	.010"
45	100	77	500	1	.010"
50	100	81	500	1	.010"
55	100	86	500	1	.010"
60	100	90	500	1	.010"

**VECTOR ENGRAVING**

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	6	4.0	1000	1	.005''''
30	5	4.0	1000	1	.005''''
35	4	4.0	1000	1	.005''''
40	3	4.0	1000	1	.005''''
45	3	4.0	1000	1	.005''''
50	3	4.0	1000	1	.005''''
55	2	4.0	1000	1	.005''''
60	2	4.0	1000	1	.005''''

**VECTOR CUTTING**

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	100	0.1	1000	1	.25"
30	100	0.4	1000	1	.25"
35	100	0.6	1000	1	.25"
40	100	0.9	1000	1	.25"
45	100	1.2	1000	1	.25"
50	100	1.5	1000	1	.25"
55	100	1.7	1000	1	.25"
60	100	2.0	1000	1	.25"

## COMMENTS

Engraving mirrored acrylic is similar to engraving regular acrylic. The idea is to engrave through the mirrored backing enough to begin to penetrate into the acrylic. Engraving deeply will cause a crusty residue to form just like with non-mirrored acrylic. A double image will appear if engraving on the front side of the mirror. It is not necessary to mask the backside when engraving because the mirrored backing shields the acrylic from smoke damage. To cut mirrored acrylic, it might be necessary to remove all original masking, re-mask with transfer tape, and dampen the tape with water from a spray bottle. Next, place the acrylic in the laser with the mirrored surface facing upwards and elevate at least 1/2 inch above the table. The laser beam will not reflect off of the mirrored surface because it is absorbed by the acrylic first. Sometimes cutting the acrylic from the backside will cause the mirrored backing to distort and crack from the intense heat required to cut. If the combination of engraving and cutting is desired, our suggestion is to engrave the backing, unmasked, remove the acrylic, mask both sides with transfer tape, flip the acrylic over, dampen, elevate, re-focus, and cut from the front side. When paint filling the engraved area, make sure to use an acrylic-based paint or paint that does not contain acetone or alcohol, as these chemicals will crack the acrylic. Water based paints also work very well. Since the mirrored backing serves as a masking, it is not necessary to mask the backside before engraving.



**Acrylic is extremely flammable. Do not leave the laser system unattended when cutting or engraving.**

**ANODIZED ALUMINUM**

**RASTER ENGRAVING**

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	72	100	500	1	.001"
30	60	100	500	1	.001"
35	52	100	500	1	.001"
40	45	100	500	1	.001"
45	40	100	500	1	.001"
50	36	100	500	1	.001"
55	32	100	500	1	.001"
60	30	100	500	1	.001"

**VECTOR ENGRAVING**

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	12	4.0	1000	1	.001"
30	10	4.0	1000	1	.001"
35	9	4.0	1000	1	.001"
40	8	4.0	1000	1	.001"
45	7	4.0	1000	1	.001"
50	6	4.0	1000	1	.001"
55	5	4.0	1000	1	.001"
60	4	4.0	1000	1	.001"

**COMMENTS**

There is a process called Laser Color Marking, which enables the color filling of anodized aluminum. First, coat or spray the aluminum with a clear acrylic finish. After the finish has thoroughly dried, laser engrave the graphic onto the aluminum. Then take a water based marker, such as those found in an art supply store, and swab on the ink into the engraved area. You can actually see the ink get absorbed into the engraved area but not the unengraved area. The ink will appear lighter in color because the white engraved area tends to lighten the shade. Use a darker tint marker to compensate for the lighter effect. Wipe off the excess with a soft, lint free cloth. Finish the piece by applying another coat of clear acrylic finish and let dry.



**DO NOT ATTEMPT TO ENGRAVE DEEPLY OR ATTEMPT TO CUT THIS MATERIAL WITH THE LASER SYSTEM.** High Power and low Speed settings can cause the laser beam to reflect off of this material, which can damage the laser system and can be a safety hazard. Damage caused by this type of abuse **ARE NOT** covered under warranty.



**ENGRAVING THIS MATERIAL PRODUCES ABRASIVE PARTICLES.** Clean the laser system more frequently to reduce wear and tear on the motion system components and optics. Damage to the laser system from inadequate or insufficient maintenance **ARE NOT** covered under warranty.



**BRASS - PAINTED**

**RASTER ENGRAVING**

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	29	100	500	1	.001"
30	27	100	500	1	.001"
35	25	100	500	1	.001"
40	23	100	500	1	.001"
45	21	100	500	1	.001"
50	19	100	500	1	.001"
55	17	100	500	1	.001"
60	15	100	500	1	.001"

**VECTOR ENGRAVING**

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	6	4.0	1000	1	.001"
30	5	4.0	1000	1	.001"
35	4	4.0	1000	1	.001"
40	3	4.0	1000	1	.001"
45	3	4.0	1000	1	.001"
50	3	4.0	1000	1	.001"
55	2	4.0	1000	1	.001"
60	2	4.0	1000	1	.001"

**COMMENTS**

The manufacturing process for coated brass varies from one vendor to another. Some manufacturers do not polish the brass before coating it. Since CO<sub>2</sub> lasers at this power level do not engrave into metals when the coating is removed, the tarnished brass underneath will have a dull appearance that will need to be polished with a brass polishing compound. This type of brass is designed for mechanical engravers that actually remove the metal when engraving which gives the brass a shine without polishing. Brass that is produced for the laser engraving industry is polished, then clear coated, and finally coated with paint. When laser engraving this type of material, adjust the power so that the laser beam removes the painted coating but not the clear coating. This will expose the polished, clear-coated brass without penetrating all the way down to the metal. Since the brass is already clear coated and polished, it will not require any cleanup after engraving nor will it ever oxidize. If too much laser power is used, the brass the clear coat will be removed and the brass underneath will be exposed to the heat of the laser beam causing instant tarnish. If polishing the brass, use a soft, non-abrasive cloth or tissue (not paper towels) and good quality brass polish. Do not rub too hard, as this will scratch the painted coating.



**DO NOT ATTEMPT TO ENGRAVE DEEPLY OR ATTEMPT TO CUT THIS MATERIAL WITH THE LASER SYSTEM.** High power and low speed settings can cause the laser beam to reflect off of this material, which can damage the laser system and can be a safety hazard. Damage caused by this type of abuse **ARE NOT** covered under warranty.

**CORIAN / AVONITE / FOUNTAINHEAD**

**RASTER ENGRAVING**

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	100	44	500	1	.005"
30	100	53	500	1	.005"
35	100	61	500	1	.005"
40	100	70	500	1	.005"
45	100	79	500	1	.005"
50	100	88	500	1	.005"
55	100	95	500	1	.005"
60	100	100	500	1	.005"

**DEEP RASTER ENGRAVING**

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	100	13	1000	1	.015"
30	100	15	1000	1	.015"
35	100	18	1000	1	.015"
40	100	20	1000	1	.015"
45	100	23	1000	1	.015"
50	100	26	1000	1	.015"
55	100	28	1000	1	.015"
60	100	30	1000	1	.015"

**VECTOR ENGRAVING**

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	60	4.0	1000	1	.010"
30	50	4.0	1000	1	.010"
35	43	4.0	1000	1	.010"
40	38	4.0	1000	1	.010"
45	34	4.0	1000	1	.010"
50	30	4.0	1000	1	.010"
55	27	4.0	1000	1	.015"
60	25	4.0	1000	1	.015"

**COMMENTS**

If paint filling, mask the material first, then engrave through the masking. In this way, when ready to paint fill, the material is already masked. Spray painting seems to be the easiest. Use the paint sparingly. Excess paint can accumulate on the edges of the engraving, which will make mask removal difficult and leave unsightly ridges. It is best to apply several lighter coats than one heavy coat of paint. Remove the masking after the paint has dried.



**ENGRAVING THIS MATERIAL PRODUCES ABRASIVE PARTICLES.** Clean the laser system more frequently to reduce wear and tear on the motion system components and optics. Damage to the laser system from inadequate or insufficient maintenance **ARE NOT** covered under warranty.

**CORK**

**RASTER ENGRAVING**

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	80	38	500	1	.010"
30	80	45	500	1	.010"
35	80	52	500	1	.010"
40	80	60	500	1	.010"
45	80	67	500	1	.010"
50	80	75	500	1	.010"
55	80	84	500	1	.010"
60	80	90	500	1	.010"

**VECTOR ENGRAVING**

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	12	4.0	500	1	.010"
30	10	4.0	500	1	.010"
35	9	4.0	500	1	.010"
40	8	4.0	500	1	.010"
45	7	4.0	500	1	.010"
50	6	4.0	500	1	.010"
55	5	4.0	500	1	.010"
60	4	4.0	500	1	.010"

**VECTOR CUTTING**

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	60	1.6	100	1	.060"
30	50	1.6	100	1	.060"
35	43	1.6	100	1	.060"
40	38	1.6	100	1	.060"
45	33	1.6	100	1	.060"
50	30	1.6	100	1	.060"
55	27	1.6	100	1	.060"
60	25	1.6	100	1	.060"

**COMMENTS**

Cork is not very popular for engraving but it does engrave and cut nicely. Cork is mainly used for making gaskets by vector cutting the gasket patterns.



**LASER CUTTING THIS MATERIAL CAN CAUSE FLAMING AND SPARKING.** Use caution when attempting to cut this material. It would be better to use a longer focal length lens to prevent the lens from being damaged during processing. **NEVER** leave the machine unattended while processing any material. Damages caused by processing any material **ARE NOT** covered under warranty.

**DELTRIN**

**RASTER ENGRAVING**

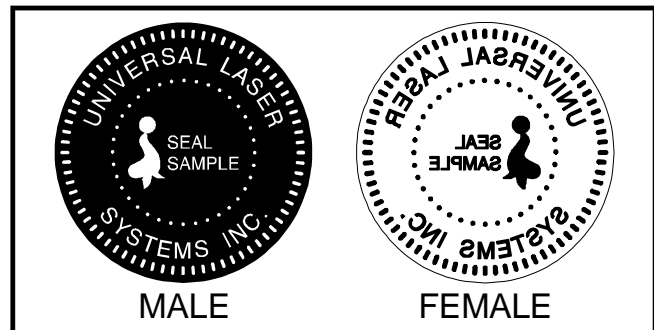
LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	100	22	500	1	.015"
30	100	26	500	1	.015"
35	100	30	500	1	.015"
40	100	35	500	1	.015"
45	100	39	500	1	.015"
50	100	44	500	1	.015"
55	100	48	500	1	.015"
60	100	52	500	1	.015"

**VECTOR CUTTING**

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	75	2.0	200	1	.060"
30	75	2.4	200	1	.060"
35	75	2.8	200	1	.060"
40	75	3.2	200	1	.060"
45	75	3.6	200	1	.060"
50	75	4.0	200	1	.060"
55	75	4.4	200	1	.060"
60	75	4.8	200	1	.060"

**COMMENTS**

The laser system can be used to make dies for seal presses. It can engrave and cut out a typical Notary Seal in less than 5 minutes. Create the male with a white graphic and a black background. Mirror the image and invert it by making the background white and the graphic black. Add a .010 inch black outline to the graphic portion of the female side. This will give the greater clearance to the female side to prevent the paper from piercing through when the male side of the seal presses into the female side. Once the seal is made and fastened to the press, make several impressions onto 400-grit sandpaper to smoothen out the edges of the plastic. Make sure you turn the sandpaper over to get both sides of the seal.



**LASER CUTTING THIS MATERIAL CAN CAUSE FLAMING.** Use caution when attempting to cut this material. Make sure that the flame does not come in contact with any part of the laser system. **NEVER** leave the machine unattended while processing any material. Damages caused by processing any material **ARE NOT** covered under warranty.

**GLASS / CRYSTAL****RASTER ENGRAVING**

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	100	13	300	1	.001
30	100	15	300	1	.001
35	100	18	300	1	.001
40	100	20	300	1	.001
45	100	23	300	1	.001
50	100	26	300	1	.001
55	100	28	300	1	.001
60	100	30	300	1	.001

**COMMENTS:** Engrave at Image Density 4.

**VECTOR ENGRAVING**

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	10	3.3	300	1	.001
30	10	4.0	300	1	.001
35	10	4.6	300	1	.001
40	10	5.3	300	1	.001
45	10	5.9	300	1	.001
50	10	6.6	300	1	.001
55	10	7.3	300	1	.001
60	10	7.9	300	1	.001

**COMMENTS**

Glass engraving is different from other types of engraving. A CO<sub>2</sub> laser cannot engrave into the glass nor can it cut glass. Instead, laser interaction with glass causes the surface of the glass to appear frosted. Sometimes, placing a piece of newspaper on the glass and dampening it with water will improve the appearance of the engraving. Another method is to apply transfer tape to the glass, wet it with water from a spray bottle, and laser engrave it. The transfer tape and water will act as a heat sink and pull the heat away from the glass as the laser system engraves it. This helps reduce chipping or flaking of the glass.

Be especially careful when engraving leaded crystal. The lead in crystal conducts heat, which can cause much more flaking or even the cracking of the crystal. Use a lower power setting to try to reduce the chance of damage. It is always good to have at least one extra piece to use as a test piece to get the right settings especially if you have never tried to engrave that material before.



**ENGRAVING THIS MATERIAL PRODUCES ABRASIVE PARTICLES.** Clean the laser system more frequently to reduce wear and tear on the motion system components and optics. Damage to the laser system from inadequate or insufficient maintenance **ARE NOT** covered under warranty.

**LEATHER****RASTER ENGRAVING**

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	45	100	500	1	.001"
30	38	100	500	1	.001"
35	33	100	500	1	.001"
40	28	100	500	1	.001"
45	25	100	500	1	.001"
50	23	100	500	1	.001"
55	20	100	500	1	.001"
60	19	100	500	1	.001"

**VECTOR ENGRAVING**

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	6	4.0	500	1	.001"
30	5	4.0	500	1	.001"
35	4	4.0	500	1	.001"
40	4	4.0	500	1	.001"
45	3	4.0	500	1	.001"
50	3	4.0	500	1	.001"
55	3	4.0	500	1	.001"
60	3	4.0	500	1	.001"

**VECTOR CUTTING**

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	50	1.7	200	1	.1"
30	50	2.0	200	1	.1"
35	50	2.4	200	1	.1"
40	50	2.7	200	1	.1"
45	50	3.1	200	1	.1"
50	50	3.4	200	1	.1"
55	50	3.7	200	1	.1"
60	50	4.1	200	1	.1"

**COMMENTS**

Leather is a very simple material to engrave and most types of leather engrave very well with the laser system. Simulated leather engraves well also, but the results are not as nice as with the real thing. Engraving lightly will turn the surface of the leather dark brown giving it a high contrast in appearance. Try engraving at a light power setting first. If the result is not deep enough the job can be run again over the same spot. Experiment with different depths of engraving and note the results.

**MARBLE**

**RASTER ENGRAVING**

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	100	35	500	1	.003"
30	100	42	500	1	.003"
35	100	48	500	1	.003"
40	100	55	500	1	.003"
45	100	62	500	1	.003"
50	100	69	500	1	.003"
55	100	77	500	1	.003"
60	100	82	500	1	.003"

**VECTOR ENGRAVING**

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	24	4.0	500	1	.003"
30	20	4.0	500	1	.003"
35	17	4.0	500	1	.003"
40	15	4.0	500	1	.003"
45	13	4.0	500	1	.003"
50	12	4.0	500	1	.003"
55		4.0	500	1	.003"
60		4.0	500	1	.003"

**COMMENTS**

Most marble and polished stones will turn white when engraved. Masking is not necessary and light engraving works out better than heavy and deep engraving. Engraving deeply will cause a highly detailed image to appear washed out. The objective is to engrave deep enough to turn the marble white and provide a good contrast. Too much power can also cause the material to discolor and turn brown as if it were burned. Photographs look great when engraved on marble, especially darker marbles where the whiteness of the engraving really stands out. Avoid using marble that is very textured looking. The texture washes out the details of the engraving. Try to use uniformly colored marble and related stones. Marble can also be paint filled by using a wax based paint. Rub the paint on with a fingertip, let dry and then buff with a soft cloth. The paint will only adhere to the engraved surface and not the surrounding areas.



**ENGRAVING THIS MATERIAL PRODUCES ABRASIVE PARTICLES.** Clean the laser system more frequently to reduce wear and tear on the motion system components and optics. Damage to the laser system from inadequate or insufficient maintenance **ARE NOT** covered under warranty.

**MAT BOARD*****RASTER ENGRAVING***

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	72	80	250	1	.005"
30	60	80	250	1	.005"
35	52	80	250	1	.005"
40	45	80	250	1	.005"
45	40	80	250	1	.005"
50	36	80	250	1	.005"
55	32	80	250	1	.005"
60	30	80	250	1	.005"

***VECTOR ENGRAVING***

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	24	4.0	250	1	.005"
30	20	4.0	250	1	.005"
35	17	4.0	250	1	.005"
40	15	4.0	250	1	.005"
45	13	4.0	250	1	.005"
50	12	4.0	250	1	.005"
55	11	4.0	250	1	.005"
60	10	4.0	250	1	.005"

***VECTOR CUTTING***

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	60	3.2	200	1	.050"
30	50	3.2	200	1	.050"
35	43	3.2	200	1	.050"
40	38	3.2	200	1	.050"
45	34	3.2	200	1	.050"
50	30	3.2	200	1	.050"
55	27	3.2	200	1	.050"
60	25	3.2	200	1	.050"

**COMMENTS**

Mat board (thick cardboard) is an excellent material to use for architectural modeling and for picture framing. It cuts and engraves very neatly and cleanly. It comes in a variety of shades and colors. Patterns can be engraved on the surface with a power setting for light engraving, which just breaks through the very thin top layer and exposes the lighter colored underlying substrate. When engraving, a low PPI setting is used to prevent overexposure of the underlying substrate material, which causes excessive dark discoloration. Masking is not necessary on the top surface when engraving. When cutting, both sides might need to be masked and the material elevated above the engraving table. This will produce an extremely clean edge on both sides of the material.



**MELAMINE - STANDARD ENGRAVING*****LIGHT RASTER ENGRAVING***

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	100	25	500	1	.015"
30	100	30	500	1	.015"
35	100	34	500	1	.015"
40	100	39	500	1	.015"
45	100	44	500	1	.015"
50	100	50	500	1	.015"
55	100	55	500	1	.015"
60	100	59	500	1	.015"

***DEEP RASTER ENGRAVING***

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	100	17	500	1	.020"
30	100	21	500	1	.020"
35	100	24	500	1	.020"
40	100	27	500	1	.020"
45	100	31	500	1	.020"
50	100	35	500	1	.020"
55	100	38	500	1	.020"
60	100	41	500	1	.020"

***VECTOR ENGRAVING***

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	24	4.0	500	1	.010"
30	20	4.0	500	1	.010"
35	17	4.0	500	1	.010"
40	15	4.0	500	1	.010"
45	13	4.0	500	1	.010"
50	12	4.0	500	1	.010"
55	11	4.0	500	1	.010"
60	10	4.0	500	1	.010"

**COMMENTS**

Engraving melamine is very similar to engraving regular wood with the added benefit of a consistent surface finish and uniform base material composition. Unlike regular wood that has grain patterns and density variations, melamine, when laser engraved, produces a flat and even engraved area. This characteristic gives this material superior engraving and paint filling qualities. Masking can be used if desired but it is just as easy to spray the engraved area with water and wipe down with a chamois cloth to remove the smoke residue. Since the top surface material is consistent in texture and color, engraving photographs or highly detailed images produces exceptional results. Refer to the next example on engraving photographs and/or ClipArt.

**MELAMINE - PHOTO/CLIPART ENGRAVING****RASTER ENGRAVING**

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	80	38	500	1	.008"
30	80	45	500	1	.008"
35	80	52	500	1	.008"
40	80	60	500	1	.008"
45	80	67	500	1	.008"
50	80	75	500	1	.008"
55	80	84	500	1	.008"
60	80	90	500	1	.008"

**COMMENTS:** Engrave unmasked. Use an Image Density of 5.

**RASTER ENGRAVING**

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	80	25	500	1	.008"
30	80	30	500	1	.008"
35	80	35	500	1	.008"
40	80	40	500	1	.008"
45	80	45	500	1	.008"
50	80	50	500	1	.008"
55	80	56	500	1	.008"
60	80	60	500	1	.008"

**COMMENTS:** Engrave unmasked. Use an Image Density of 3.

**COMMENTS**

Engraving photographs can be challenging at first but becomes easier once there is an understanding of what to look for and how to achieve the desired results. In an image processing software, scan the image in at 300 DPI. Adjust the brightness and the contrasts to brighten the light colors and darken the dark colors. The photo might look better by using a sharpening filter to sharpen up the image slightly. The next step is to select a halftone pattern. Usually, imaging software gives the choice of using different halftone patterns including frequency of lines per inch and pattern angles. Use a line frequency above 20 and below 100. The size of the dots decreases as the line frequency increases. Experiment to see which pattern looks the best. Big dots look good on some materials and small dots look better on others. If it is not possible to assign a halftone pattern in the imaging software, the printer driver will automatically default to a predetermined pattern based on **Image Density**. When using the Clipart mode switch, which prints all Clipart or drawings as grayscale bitmaps, use the same parameters and techniques as for engraving photographs.

**PLASTIC - ENGRAVERS MICROSURFACED**

**RASTER ENGRAVING**

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	29	100	500	1	.001"
30	27	100	500	1	.001"
35	25	100	500	1	.001"
40	23	100	500	1	.001"
45	21	100	500	1	.001"
50	19	100	500	1	.001"
55	17	100	500	1	.001"
60	15	100	500	1	.001"

**VECTOR CUTTING**

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	60	1.2	150	1	.060"
30	50	1.2	150	1	.060"
35	43	1.2	150	1	.060"
40	38	1.2	150	1	.060"
45	34	1.2	150	1	.060"
50	30	1.2	150	1	.060"
55	27	1.2	150	1	.060"
60	25	1.2	150	1	.060"

**COMMENTS**

Laser engraveable plastic comes in many different colors, thickness, coatings, and surface textures. Most engravers plastic will engrave and cut well with the laser system as long as it is microsurfaced and formulated for laser engraving. Removal of large amounts of material will warp the plastic. You might need to tape it down or hold it down flat somehow to prevent it from curling as you engrave. Since these plastics have low melting point, a low PPI setting is used when cutting to reduce the possibility of melting. Masking and dampening with water also helps to reduce melting and keeps the plastic clear of smoke residue. Always remove the original clear masking from the plastic because it does not react well with the laser. Since there are so many types of engravers plastics, the only true way to find out if a particular brand and type will work well with the laser is to experiment. Use these power settings as a guideline for experimentation and adjust as necessary. Thicker top coated plastics are not recommended because it requires too much power to remove the material and the large amount of smoke created usually stains the substrate.



**LASER ENGRAVING OR CUTTING PLASTIC CAN IGNITE THE MATERIAL.** Never leave the laser system running unattended for any reason.

## RUBBER STAMPS

### RASTER ENGRAVING

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	100	10	500	1	.030"
30	100	12	500	1	.030"
35	100	14	500	1	.030"
40	100	16	500	1	.030"
45	100	17	500	1	.030"
50	100	20	500	1	.030"
55	100	22	500	1	.030"
60	100	23	500	1	.030"

### PERFORATED VECTOR CUTTING

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	60	1.3	90	1	.040"
30	60	1.6	90	1	.040"
35	60	1.8	90	1	.040"
40	60	2.1	90	1	.040"
45	60	2.3	90	1	.040"
50	60	2.6	90	1	.040"
55	60	2.9	90	1	.040"
60	60	3.1	90	1	.040"

## COMMENTS

To create a rubber stamp, use the Rubber Stamp Mode the printer driver. In the above example, only one pass is necessary to achieve a deeply engraved rubber stamp. When cutting out the rubber stamp, we recommend using a very low PPI setting. This setting spreads the laser pulses far enough apart that they just touch at the edges. The result is a perforated cut that allows the rubber stamp to remain attached to the entire sheet but easily removed by simply tearing it off. The advantage to this is that the possibility of distortion or melting while cutting is virtually eliminated and the entire sheet of rubber stamps can be removed from the machine at one time instead of having to pick them up one by one.



### WARNING

- **LASER ENGRAVING OR CUTTING RUBBER CAN IGNITE THE MATERIAL.** Never leave the laser system running unattended for any reason.
- **LASER ENGRAVING OR CUTTING RUBBER CAN PRODUCE FOUL ODORS.** You might need to particulate filter and/or odor filter your exhaust depending on your environment, installation location, and/or your local air quality control laws.
- **LASER ENGRAVING OR CUTTING RUBBER PRODUCES ABRASIVE DUST.** Clean the laser system more frequently to reduce wear and tear on the motion system components and optics. Damage to the laser system from inadequate or insufficient maintenance **ARE NOT** covered under warranty.

**SIGN VINYL**

**RASTER ENGRAVING**

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	100	19	500	1	.015"
30	100	23	500	1	.015"
35	100	26	500	1	.015"
40	100	30	500	1	.015"
45	100	34	500	1	.015"
50	100	38	500	1	.015"
55	100	42	500	1	.015"
60	100	45	500	1	.015"

**VECTOR CUTTING (KISS CUT)**

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	5	3.3	500	1	.003"
30	5	4.0	500	1	.003"
35	5	4.7	500	1	.003"
40	5	5.3	500	1	.003"
45	5	6.0	500	1	.003"
50	5	6.7	500	1	.003"
55	5	7.4	500	1	.003"
60	5	8.1	500	1	.003"

**COMMENTS**

Sign vinyl comes in a wide variety of colors, patterns, thickness, finishes, and reflectivity. There are a few methods for using sign vinyl with the laser system. One method is to vector cut (unmasked) through the vinyl but not through the backing. This technique provides results equivalent to a vinyl cutter machine. Once the vinyl has been cut, remove the excess vinyl, apply transfer tape and use a squeegee to remove trapped air bubbles. The transfer tape can then be lifted off and the vinyl lettering or objects that were vector cut will be stuck to the transfer tape and maintain their correct spacing with respect to each other. Now apply the tape to the desired surface and squeegee, peel off the transfer tape, and the lettering will remain adhered to the surface. The other method is to apply a piece of vinyl to the desired surface (unmasked) and adjust the laser power so as to cut through the vinyl without engraving into the material below. Another example is to cover the entire surface of a wooden plaque with vinyl, use a squeegee to remove all air bubbles, and then mask the entire surface with transfer tape to protect the vinyl from smoke damage. In the graphics software, color the background black and place white filled text on top of the colored background. Since the laser system does not engrave white filled objects, the background will be engraved and the lettering will be untouched. Peel off the excess vinyl and transfer tape to reveal the final product.



**MOST SIGN VINYL IS MADE FROM PVC (Polyvinylchloride). DO NOT USE PVC BASED VINYL.** The fumes are extremely toxic if you inhale them. The fumes are also caustic and can chemically destroy the metal parts of the laser system. Damage to the laser system from this type of abuse **ARE NOT** covered under warranty.

## WOOD

**RASTER ENGRAVING**

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	100	25	500	1	.020"
30	100	30	500	1	.020"
35	100	34	500	1	.020"
40	100	39	500	1	.020"
45	100	44	500	1	.020"
50	100	50	500	1	.020"
55	100	55	500	1	.020"
60	100	59	500	1	.020"

**VECTOR ENGRAVING**

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	80	4.2	500	1	.030"
30	80	5.0	500	1	.030"
35	80	5.9	500	1	.030"
40	80	6.7	500	1	.030"
45	80	7.6	500	1	.030"
50	80	8.4	500	1	.030"
55	80	9.2	500	1	.030"
60	80	10.1	500	1	.030"

**VECTOR CUTTING**

LASER WATTAGE	POWER	SPEED	PPI	PASS	DEPTH
25	50	1.3	250	1	.125"
30	50	1.6	250	1	.125"
35	50	1.8	250	1	.125"
40	50	2.1	250	1	.125"
45	50	2.3	250	1	.125"
50	50	2.6	250	1	.125"
55	50	2.9	250	1	.125"
60	50	3.1	250	1	.125"

**COMMENTS**

When engraving wood with a laser, a brown, maple syrup like residue will deposit on the surface of the wood. This is normal and impossible to eliminate by **POWER**, **SPEED**, or **PPI** changes. More residue will be present when engraving deeper and/or slower. This residue washes off with water and a sponge. We recommend using a kitchen sponge with a nylon string mesh wrapped around it. Dampen the sponge and wipe off the residue. A damp chamois cloth works well also. Do not use paper towels or a regular sponge because these materials will get lodged in the engraved area when wiping and are extremely difficult to remove. A method to avoid cleanup is to mask the wood with transfer tape and peel off the tape after engraving. If desired, after engraving and before peeling off the tape, spray paint can be applied to color fill the engraved areas. After the paint dries, peel off the tape. If an intricate drawing has been engraved and there are many small pieces of tape to remove, it may be easier to flood the masking, after engraving, with water. This will loosen the tape and it can be easily removed by rubbing it off by hand. In the vector cutting example, the wood was elevated from the table to let smoke and heat escape from underneath. If you elevate the wood, mask and/or dampen the bottom side of the wood very lightly, in which the water acts as a heat sink to prevent the underside from flaming and charring.

Elevating the wood also helps to determine whether the laser has passed completely through since the cut pieces will fall through to the table when cutting is finished. Also, set up the drawing so that the inner pieces of the drawing are cut first, otherwise pieces may fall through at the wrong time.

Not all wood finishes are created equal. When ordering wood from a supplier, be sure to specify that it is being used for laser engraving. Some finishes cannot handle the heat from the laser and will bubble, blister, and possibly turn white. For engraving softer woods such as pine or balsa, reduce the power settings to acquire the best depth. Engraving too deep on soft woods will reduce quality. Every type of wood will engrave differently. It is better to engrave woods that are finished. If engraving unfinished wood and it is not masked with transfer tape, the smoke residue tends to embed in the wood and is impossible to remove without sanding. To prevent this, mask all unfinished wood with transfer tape.

## WOOD INLAYS - VENEERS

Create a drawing with no outlines, only filled areas. Engrave the filled areas almost as deep as the thickness of the veneer (usually about .003 inches (.1 mm) or less). With some water and a nylon brush, remove all residue from the engraved area. When cutting veneers make sure they are lying absolutely flat. In the drawing, give the objects an outline of .001 inches (.1 mm) and remove the fill. Adjust the power so that there is just enough power to cut completely through the veneer. Overpowering the cut will cause too much material removal and the fit will not be snug. Some software programs allow outline offsetting to compensate for the thickness of the beam called contouring. Usually, a contour to the outside of the vector line of .006 inches provides a tight fit. Remember if using more power to cut through the veneer, compensate for the thicker width of the laser cut by contouring a little further to the outside.

Another method is to first create your graphic and fill it with the color black. Then give it a white outline of .012 inches (.3 mm). If you look at the graphic when you add the outline, you will see that it appears to shrink. Now raster engrave the graphic to a depth slightly shallower than the thickness of the veneer. When the engraving is finished, place the veneer into the laser system. Remove the black fill and change the outline to a different color. Cut out the veneer with the laser system, add glue to the veneer, and apply the veneer into the engraved area of the other piece of wood and let dry. After the glue has thoroughly dried, sand the veneer until it is flush with the base wood. A good veneer to use is one with an adhesive backing. Once cut, place the veneer into its proper place on the engraved wood block and with a clothes iron, and iron the veneer into the engraved wood. This melts the glue and causes the veneer to stick to the engraved area. Finish the wood as you desire and the finished product will look fantastic. The veneer can now be sanded flush with the surface and a finish coat applied.



**LASER ENGRAVING OR CUTTING WOOD CAN IGNITE THE MATERIAL.**  
Never leave the laser system running unattended for any reason.