APPENDIX B: MATERIAL SETTINGS

Fusion M2 Suggested Material Settings (CO2)

Material	DPI/Freq.	30 watt	40 watt	50 watt	60 watt	75 watt	120 watt
Acrylic							
Photo Engraving	300 DPI	90s 60p	90s 55p	90s 50p	90s 45p	90s 40p	90s 30p
Text/Clipart Engraving	300 DPI	90s 80p	90s 75p	90s 70p	90s 65p	90s 60p	90s 55p
Text/Clipart Engraving	600 DPI	90s 75p	90s 70p	90s 65p	90s 60p	90s 55p	90s 50p
Cutting 1/8" (3 mm)	100 f	5s 100p	6s 100p	7s 100p	8s 100p	10s 100p	12s 100p
Cutting 1/4" (6 mm)	100 f	2s* 100p	3s* 100p	1s 100p	2s 100p	3s 100p	7s 100p
Cutting 3/8" (9.5 mm)	100 f			2s* 100p	3s* 100p	1s 100p	3s 100p
Cutting 1/2" (13 mm)	100 f						1s 100p

Cutting Note: Adjusting the standard focus distance so it is closer to the lens by about .080" (2 mm) will produce better edge quality when cutting 1/4" (3mm) acrylic and thicker. Two passes can be used for cutting thicker materials. There are two types of acrylic: cast is better for engraving (it creates a frosted look when engraved) and extruded acrylic produces a much better flame polished edge.

* The Fusion has two sets of Speed control for vector cutting applications. Checking the Speed Comp selection box in the print driver will reduce the speed setting you have selected by one half. Speed Comp is most useful for speeds of 1 to 10. Example: Cut a square at 5% speed. Then repeat the job at 5% speed and also select Speed Comp. The second square will take twice as long to cut as the first square. Speed Comp gives you more slower speed setting to work with. Always use Air Assist when cutting.

Material	DPI/Freq.	30 watt	40 watt	50 watt	60 watt	75 watt	120 watt
Alumamark							
Engraving	300 DPI	90s 55p	90s 45p	90s 35p	90s 25p	90s 20p	90s 15p
Engraving	600 DPI	90s 45p	90s 35p	90s 25p	90s 15p	90s 10p	90s 5p
Anodized Aluminum							
Photos/Clipart	400 DPI	90s 55p	90s 50p	90s 45p	90s 40p	90s 35p	90s 30p
Photos/Clipart	600 DPI	90s 50p	90s 45p	90s 40p	90s 35p	90s 30p	90s 25p
Text	600 DPI	90s 60p	90s 55p	90s 50p	90s 45p	90s 40p	90s 35p

We find when engraving anodized aluminum, text appears best at 600 DPI, but photos and clipart can be engraved with great detail down to 400 DPI.

Material	DPI/Freq.	30 watt	40 watt	50 watt	60 watt	75 watt	120 watt
Cork							
Engraving	300 DPI	90s 50p	90s 45p	90s 40p	90s 35p	90s 30p	90s 25p
Fleece							
Engraving	150 DPI	90s 35p	90s 30p	90s 25p	90s 20p	90s 15p	90s 10p

When engraving fabric, try changing the graphic to 80% gray and use the Jarvis dithering pattern for the best results. Every fabric you are cutting will need to have adjusted setting - find a small swatch of the fabric you can test first.

Material	DPI/Freq.	30 watt	40 watt	50 watt	60 watt	75 watt	120 watt
Glass							
Engraving	300 DPI	15s 100p	20s 100p	25s 100p	30s 100p	35s 100p	40s 100p

When etching glass, try changing the graphic to 80% gray before engraving and using the Jarvis dithering pattern. You can also diffuse heat by covering the glass with a thin sheet of dish soap.

Material	DPI/Freq.	30 watt	40 watt	50 watt	60 watt	75 watt	120 watt
Leather							
Photo Engraving	300 DPI	90s 40p	90s 35p	90s 30p	90s 25p	90s 20p	90s 15p
Text/Clipart Engraving	600 DPI	90s 45p	90s 40p	90s 35p	90s 30p	90s 25p	90s 20p
Cutting 1/8" (3 mm)	50 f	50s 100p	45s 100p	40s 100p	35s 100p	30s 100p	25s 100p
Mat Board							
Cutting	50 f	20s 60p	20s 50p	25s 40p	25s 30p	30s 40p	30s 30p

Fusion M2 Suggested Material Settings (CO2)

Material	DPI/Freq.	30 watt	40 watt	50 watt	60 watt	75 watt	120 watt
Marble							
Photo Engraving	300 DPI	90s 55p	90s 50p	90s 45p	90s 40p	90s 35p	90s 25p
Text Engraving	600 DPI	90s 65p	90s 60p	90s 55p	90s 50p	90s 45p	90s 35p
Every marble is very different for settings. Start low and increase the power with a second run if you haven't used that marble before.							
Painted Brass							
Engraving	300 DPI	90s 45p	90s 40p	90s 35p	90s 30p	90s 25p	90s 15p
Engraving	600 DPI	90s 40p	90s 35p	90s 30p	90s 25p	90s 15p	90s 10p
Plastics							
Engraving	300 DPI	90s 40p	90s 35p	90s 30p	90s 25p	90s 20p	90s 15p
These settings work well with many plastics, including plastic phones and covers. Even one color plastics can achieve a great look when engraved.							
Plastic (2 Layer Laser Engraveable)							
Engraving	300 DPI	90s 80p	90s 75p	90s 70p	90s 65p	90s 40p	90s 35p
Engraving	600 DPI	90s 75p	90s 65p	90s 50p	90s 35p	90s 25p	90s 20p
Cutting 1/16" (1.5 mm)	100 f	10s 85p	10s 75p	10s 65p	10s 55p	10s 40p	20s 40p
Rubber Stamps							
Engraving	600 DPI	15s 100p	20s 100p	30s 100p	40s 100p	60s 100p	80s 100p
Cutting	100 f	5s 100p	10s 100p	15s 100p	20s 100p	25s 100p	30s 100p
Stainless Steel w/Cermark							
Engraving	600 DPI	20s 100p	25s 100p	30s 100p	35s 100p	45s 100p	55s 100p
Twill							
Cutting	25 f	50s 40p	50s 35p	70s 100p	90s 100p	90s 80p	90s 60p
Wood							
Photo Engraving	600 DPI	30s 100p	40s 100p	50s 100p	60s 100p	70s 100p	100s 100p
Clipart/Text Engraving	300 DPI	20s 100p	30s 100p	40s 100p	50s 100p	60s 100p	90s 100p
Clipart/Text Engraving	600 DPI	25s 100p	35s 100p	45s 100p	55s 100p	65s 100p	85s 100p
Deep Engraving	600 DPI	5s 100p	10s 100p	20s 100p	25s 100p	30s 100p	60s 100p
Thin Veneer (Cutting)	10 f	30s 100p	30s 80p	40s 100p	40s 90p	50s 80p	50s 60p
Cutting 1/8" (3 mm)	10 f	3s 100p	6s 100p	8s 100p	10s 100p	20s 100p	40s 100p
Cutting 1/4" (6 mm)	10 f	3s* 100p	1s 100p	2s 100p	3s 100p	5s 100p	12s 100p
Cutting 3/8" (9.5 mm)	10 f			2s* 100p	3s* 100p	1s 100p	8s 100p
Cutting 1/2" (12 mm)	10 f						3s 100p

When cutting wood, multiple passes may allow cutting of thicker materials. Using Color Mapping you can adjust the focus point between passes down to the center point of the cut for the best results.

* The Fusion has two sets of Speed control for vector cutting applications. Checking the Speed Comp selection box in the print driver will reduce the speed setting you have selected by one half. Speed Comp is most useful for speeds of 1 to 10. Example: Cut a square at 5% speed. Then repeat the job at 5% speed and also select Speed Comp. The second square will take twice as long to cut as the first square. Speed Comp gives you more slower speed setting to work with. Always use Air Assist when cutting.

APPENDIX B: MATERIAL SETTINGS

- **These are only suggestions:** Every type of material will react differently with the laser, even from one plastic to the next. Use these settings as your starting point then adjust one variable at a time until you achieve the result you desire. Settings for any material are a matter of personal preference. Not every material that can be run at high speed should be run at high speed. A better mark can often be achieved by slowing your laser and giving the laser longer to react to your material.

- **Test your material:** If you have a small area of the material you won't be using, or an extra item, take advantage of this area to test out your settings by engraving a small square or cutting a small circle. You can fine tune your settings in these areas.

- **Similar materials use similar settings**: When you are working with a material you aren't familiar with, think about a similar material and what settings you would use with that product. Most anodized aluminums will react well with similar settings, as will most plastics.

- **When in doubt, start low**: Remember, you can always re-run your job as long as you don't move it in the machine. Let's say you're running a photograph in a one-of-a-kind wood plaque. Start with a lower power setting, look at the engraving, then run the project a second time at high speed and lower power a second time to add a little more depth if needed.

- **Run only one part of the file**: If running a job on a new material, you can always just select one piece of the engraving, like a piece of text, and run that part first to make sure your settings are perfect before running the whole file.

To print a copy of these settings to keep next to your laser, go to www.epiloglaser.com/material-settings.htm.

APPENDIX B: MATERIAL SETTINGS

Fusion M2 Suggested Material Settings (Fiber)

Material	DPI/Freq.	20 watt	30 watt	50 watt
Aluminum (Anodized)				
Etching/Marking	600 DPI	Speed: 30 - 40% Power: 100% Frequency: 1% Focus: +.06 to +07	Speed: 40 - 50% Power: 100% Frequency: 1% Focus: +.06 to +07	Speed: 50 - 60% Power: 100% Frequency: 1% Focus: +.06 to +07
The contrast / brightness of marks achievable on the fiber laser are excellent and can often be much brighter than marks from a C02 laser. Taking the fiber laser out of focus by +.06" - .09" broadens the beam and produces a very bright mark on anodized coating. Lower frequency and higher power settings help offset the change in focal point. Different grades of anodized & core aluminum alloy will affect how the final marks look.				
Aluminum (Bare)				
Etching/Marking	600 DPI	Speed: 20 - 30% Power: 100% Frequency: 50 - 60% Focus: -.01 to +.01	Speed: 30 - 40% Power: 100% Frequency: 50 - 60% Focus: -.01 to +.01	Speed: 40 - 50% Power: 100% Frequency: 50 - 60% Focus: -.01 to +.01
Engraving aluminum will result in various shades of gray, not black. Fine tuning the settings can provide a bit more contrast but the range of applicable marks is very narrow. If the application calls for a black etch, consider using an oxidizer after engraving. Oxidizers are used most commonly if the aluminum has a protective coating (urethane, clear coat, clear anodized) covering the area that is not engraved. Deep metal engraving on aluminum can be done using multiple passes. Consider deep engraving and using a black epoxy/color fill. Although the marks on aluminum are not black like they are on steel, we have no difficulty getting 2D, UID barcodes to scan and verify				
Brass				
Etching/Marking	600 DPI	Speed: 20 - 30% Power: 100% Frequency: 5 - 20% Focus: 0	Speed: 30 - 40% Power: 100% Frequency: 5 - 20% Focus: 0	Speed: 40 - 50% Power: 100% Frequency: 5 - 20% Focus: 0
Laserable Plastic				
Etching/Marking	600 DPI	Speed: 40 - 50% Power: 60-70% Frequency: 50% Focus: 0	Speed: 50 - 60% Power: 60-70% Frequency: 50% Focus: 0	Speed: 60 - 70% Power: 60-70% Frequency: 50% Focus: 0
Stainless Steel				
Annealing	600 DPI	Speed: 5-10% Power: 100% Frequency: 1% Focus: +.08 to +.110	Speed: 7-12% Power: 100% Frequency: 1% Focus: +.08 to +.110	Speed: 10 -15% Power: 100% Frequency: 1% Focus: +.08 to +.110
Etching/Marking	600 DPI	Speed: 20 - 30% Power: 100% Frequency: 1-5% Focus: -.01 to +.01	Speed: 30 - 40% Power: 100% Frequency: 1-5% Focus: -.01 to +.01	Speed: 40 - 50% Power: 100% Frequency: 1-5% Focus: -.01 to +.01
Polishing	600 DPI	Speed: 50 - 60% Power: 35 - 40% Frequency: 50 - 60% Focus: 0	Speed: 60 - 70% Power: 35-40% Frequency: 50 - 60% Focus: 0	Speed: 70 - 80% Power: 35 - 40% Frequency: 50 - 60% Focus: 0

Fusion M2 Suggested Material Settings (Fiber)

Material	DPI/Freq.	20 watt	30 watt	50 watt
Etching: Like our C02 counterparts, the slower the speed setting, the deeper the etching. However, many metal applications can be processed at higher speed settings in the range of 50-100%. Again, consider the marking requirements. If the only stipulation is permanency, you'll find the FiberMark can engrave a broad range of metals at higher speeds, regardless of laser wattage. Don't be afraid to turn up the juice! **Annealing:** To achieve an annealed mark, the focal point should be significantly away from zero. The unfocused, broader beam provides the heat to change the surface color without actually penetrating the metal. The focal point can be either closer to or away from zero. Focusing away from the material should be in the range of -.060" to- .090". Focusing closer to the material is generally in the range of +.070" to +.110". Both focusing methods will result in a dark black annealing of the metal. Focusing up typically results in a slight indentation of the metal. Multiple passes can darken the mark even more (no data to confirm whether multiple passes offer more permanency). **Polishing:** Some steel alloys are easier to polish than others. For best results, clean off the surface with alcohol prior to processing. Any leftover grease, oils or residue can affect how well the polished mark turns out. Polishing the metal where the final marks result in a bright white engraving requires finer tuning of settings, more so than the etched or annealed marks. Determine a base speed and frequency setting and adjust the power in small increments/decrements. If you are unable to get a white bright mark, increase the frequency setting and try again by adjusting only the power.				
Titanium				
Annealing	600 DPI	Speed: 5-10% Power: 100% Frequency: 1% Focus: +.08 to +.110	Speed: 7-12% Power: 100% Frequency: 1% Focus: +.08 to +.110	Speed: 11-15% Power: 100% Frequency: 1% Focus: +.08 to +.110
Etching/Marking	600 DPI	Speed: 20 - 30% Power: 100% Frequency: 1-5% Focus: -.01 to +.01	Speed: 30 - 40% Power: 100% Frequency: 1-5% Focus: -.01 to +.01"	Speed: 40 - 50% Power: 100% Frequency: 1-5% Focus: -.01 to +.01
Titanium and Ti alloys are highly amenable to marking at this wavelength. Similar to aluminum, a black mark from the etching process is difficult to achieve. Various shades of gray can be made, from very dark gray to light gray. Annealed marks can also be made on titanium materials using the same processing parameter described for stainless steel. Depending on the Ti alloy, marks of various colors can be achieved by changing the frequency values for 1% up to 100%. It is common to see red, blue, green, orange, yellows and purple marks, depending on the frequency selected.				
Plated Metals				

Etching/Marking	600 - 1200 DPI	Speed: 10-20%
		Power: 100%
		Frequency: 1-5%
		Focus: -.09 to -.100"
		    +.09 to .100"
			Speed: 20-30%
			Power: 100%
			Frequency: 1-5%
			Focus: -.09 to -.100"
			    +.09 to .100"
				Speed: 30-40%
				Power: 100%
				Frequency: 1 - 5%
				Focus: -.09 to -.100"
				    +.09 to .100"

Metals are often plated to assist with conductivity, to provide a protective coating against rust and elements and for aesthetic purposes. Plating thickness will depend on application and purpose. Most of the plated metals processed through the applications lab are electronic components (to enhance conductivity) and various fittings (protection against environment & rust). The typical plating thickness varies from .001" up to .005". Our recommended settings for general metal engraving works well for ablating through the plating; exposing the base metal. Ablating the plating will also provide high contrast. Using an oxidizer will enhance the look. Our recommended settings for polishing of metals are a good starting point where ablating through the plating isn't an option. This is likely the most common plated metal application as exposing the raw metal underneath will break continuity and / or expose the bare metal to rust and other elements. Note that the contrast of polishing of plated metals won't be as consistent or contrasting as a direct ablation. Multiple passes will help and end results will vary based on the metal used for plating, thickness of plating & size of mark. Our recommended settings for annealing will often work for plated metals where the plating has a thicker wall and material used has high levels of carbon or metal oxides.				

Fusion M2 Suggested Material Settings (Fiber)

Material	DPI/Freq.	20 watt	30 watt	50 watt
Powder Coating				
Etching/Marking	600 DPI	Speed: 30 - 40% Power: 100% Frequency: 100% Focus: +.05 to .07"	Speed: 40 - 50% Power: 100% Frequency: 100% Focus: +.05 to .07"	Speed: 50 - 60% Power: 100% Frequency: 100% Focus: +.05 to .07"

Two to three passes are suggested (one pass to ablate the powder coating, 2nd or 3rd pass to polish up the metal underneath). A little less power, higher frequency and less focus adjustment will be required for the 2nd or 3rd pass, depending on the base metal. The idea is to ablate then polish. An alternative to running two or more passes is to run one pass and then use a common cleaner such as Simple Green or a citric-based cleaner with short, stiff bristle brush to scrub out the residual material remaining in the mark area. If using this technique, it may be necessary to raise or lower the marking table from around 0.07" to 0.10".

- **These are only guidelines:** Brightness or darkness of a mark is a matter of personal preference and can be very dependent of the type of material being marked. As such, there is no "correct" setting. Working with the four different fiber settings becomes fairly intuitive in a very short period of time for most users. If you have a material that is not listed, try to compare it to similar materials listed and use those settings as your starting point.

- **Speed Settings:** The speed setting scale of 1% to 100% is not linear – i.e. 100% speed will not be twice as fast as 50% speed. This non-linear scale is very useful in compensating for the different factors that affect engraving time.

- **Power Settings:** The power settings are linear – i.e. 50% power is half as much as 100% power.

- **General Metal Engraving / Base Settings:** In the world of metals the grade, type, hardness and chemical composition are endless. Metal alloys are engineered for specific applications and have their own strengths and weaknesses. With such an unlimited selection, we've yet to come across a metal which proved to be incompatible with the FiberMark. Metals can be engraved at just about any settings. Of course, there are many variables to consider for metal engraving. The lasers wattage, hardness of metal, desired mark (etch, polish, anneal) and the required time/contrast/depth will have to be considered when deciding on the final settings.

- **General Annealing Settings:** Producing an annealed mark is very dependent on the material being out of focus. Run the laser at slow speed and full power then adjust the focus while the machine is running until you achieve the annealed mark you need.

- **Test your material:** If you do not achieve the results you are looking for with the recommended settings, try resending the job and start by changing only one variable at a time. Changing only one variable at a time will help to determine the correct setting for your material.

- Laser settings can sometimes be confusing because many materials can be marked over such a broad range of settings. If you have difficulty in finding the correct setting you can send a sample to the Epilog Laser Applications lab. We will determine if the material can be marked and provide appropriate setting for your laser.

To print a copy of these settings to keep next to your laser, go to www.epiloglaser.com/material-settings.