## Fusion Edge Suggested Material Settings (CO2)

| Material | DPI/Freq. | 30 watt | 40 watt | 50 watt | 60 watt | 80 watt |
|---|---|---|---|---|---|---|
| **Acrylic** | | | | | | |
| **Photo Engraving** | 300 DPI | 100s 75p | 100s 70p | 100s 65p | 100s 60p | 100s 50p |
| **Text/Clipart Engraving** | 300 DPI | 100s 75p | 100s 70p | 100s 65p | 100s 60p | 100s 50p |
| **Text/Clipart Engraving** | 500 DPI | 100s 70p | 100s 65p | 100s 55p | 100s 50p | 100s 40p |
| **Cutting 1/8" (3 mm)** | 100 f | 6s 100p | 8s 100p | 12s 100p | 20s 100p | 30s 100p |
| **Cutting 1/4" (6 mm)** | 100 f | 3s 100p | 4s 100p | 6s 100p | 8s 100p | 10s 100p |
| **Cutting 3/8" (9.5 mm)** | 100 f | | 2s* 100p | 3s 100p | 4s 100p | 5s 100p |
| **Cutting 1/2" (13 mm)** | 100 f | | | | 1s 100p | 2s 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" (6mm) 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. | | | | | | |
| **Alumamark** | | | | | | |
| **Engraving** | 500 DPI | 100s 35p | 100s 30p | 100s 25p | 100s 15p | 100s 10p |
| **Anodized Aluminum** | | | | | | |
| **Photos/Clipart** | 400 DPI | 100s 65p | 100s 55p | 100s 45p | 100s 35p | 100s 30p |
| **Photos/Clipart** | 500 DPI | 100s 60p | 100s 50p | 100s 40p | 100s 30p | 100s 30p |
| **Text** | 500 DPI | 100s 70p | 100s 60p | 100s 50p | 100s 40p | 100s 30p |
| We find when engraving anodized aluminum, text appears best at 500 DPI, but photos and clipart can be engraved with great detail down to 400 DPI. | | | | | | |
| **Cork** | | | | | | |
| **Engraving** | 500 DPI | 100s 70p | 100s 60p | 100s 50p | 100s 40p | 100s 20p |
| **Fleece** | | | | | | |
| **Engraving** | 200 DPI | 100s 50p | 100s 40p | 100s 30p | 100s 20p | 100s 15p |
| 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. | | | | | | |
| **Glass** | | | | | | |
| **Engraving** | 500 DPI | 30s 100p | 40s 100p | 50s 100p | 60s 100p | 70s 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 layer of dish soap. | | | | | | |
| **Leather** | | | | | | |
| **Photo Engraving** | 300 DPI | 100s 80p | 100s 70p | 100s 60p | 100s 50p | 100s 40p |
| **Text/Clipart Engraving** | 500 DPI | 100s 70p | 100s 60p | 100s 50p | 100s 40p | 100s 30p |
| **Cutting 1/8" (3 mm)** | 50 f | | 10s 100p | 15s 100p | 20s 100p | 25s 100p |
| **Mat Board** | | | | | | |
| **Cutting** | 50 f | 25s 40p | 25s 30p | 30s 40p | 30s 30p | 30s 25p |

| Fusion Edge Suggested Material Settings (CO2) | | | | | | |
|---|---|---|---|---|---|---|
| Material | DPI/Freq. | 30 watt | 40 watt | 50 watt | 60 watt | 80 watt |
| **Marble** | | | | | | |
| **Photo Engraving** | 300 DPI | 100s 90p | 100s 80p | 100s 70p | 100s 60p | 100s 50p |
| **Text Engraving** | 500 DPI | 100s 80p | 100s 70p | 100s 60p | 100s 50p | 100s 40p |
| 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 | 100s 35p | 100s 30p | 100s 25p | 100s 15p | 100s 10p |
| **Engraving** | 500 DPI | 100s 30p | 100s 25p | 100s 20p | 100s 15p | 100s 10p |
| **Plastics** | | | | | | |
| **Engraving** | 300 DPI | 100s 45p | 100s 40p | 100s 35p | 100s 30p | 100s 25p |
| 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 | 100s 70p | 100s 65p | 100s 40p | 100s 35p | 100s 25p |
| **Engraving** | 500 DPI | 100s 60p | 100s 50p | 100s 40p | 100s 30p | 100s 20p |
| **Cutting 1/16" (1.5 mm)** | 100 f | 10s 65p | 10s 55p | 10s 40p | 20s 40p | 20s 25p |
| **Stainless Steel w/Cermark** | | | | | | |
| **Engraving** | 500 DPI | 15s 100p | 20s 100p | 25s 100p | 30s 100p | 40s 100p |
| **Twill** | | | | | | |
| **Cutting** | 25 f | 70s 100p | 90s 100p | 90s 80p | 90s 60p | 90s 50p |
| **Wood** | | | | | | |
| **Photo Engraving** | 500 DPI | 50s 100p | 60s 100p | 70s 100p | 80s 100p | 90s 100p |
| **Clipart/Text Engraving** | 300 DPI | 40s 100p | 50s 100p | 60s 100p | 90s 100p | 100s 100p |
| **Clipart/Text Engraving** | 500 DPI | 30s 100p | 40s 100p | 50s 100p | 60s 100p | 80s 100p |
| **Deep Engraving** | 500 DPI | 20s 100p | 30s 100p | 40s 100p | 50s 100p | 60s 100p |
| **Thin Veneer (Cutting)** | 10 f | 40s 100p | 40s 90p | 50s 80p | 50s 60p | 50s 40p |
| **Cutting 1/8" (3 mm)** | 10 f | 20s 100p | 30s 100p | 40s 100p | 50s 100p | 30s 40p |
| **Cutting 1/4" (6 mm)** | 10 f | | 2s 100p | 3s 100p | 4s 100p | 12s 100p |
| **Cutting 3/8" (9.5 mm)** | 10 f | | | 5s 100p | 6s 100p | 8s 100p |
| **Cutting 1/2" (12 mm)** | 10 f | | | | | 4s 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. | | | | | | |

# 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.

## Fusion Edge Suggested Material Settings (Fiber)

| Material | DPI/Freq. | 30 watt |
|---|---|---|
| **Aluminum (Anodized)** | | |
| **Etching/Marking** | 800 DPI | Speed: 30%<br>Power: 100%<br>Frequency: 1%<br>Focus: 0 |
| **Polishing** | 800 DPI | Speed: 75%<br>Power: 60%<br>Frequency: 1%<br>Focus: +.003" |
| 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 +.03" - .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 - 25%<br>Power: 100%<br>Frequency: 1%<br>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 - 25%<br>Power: 100%<br>Frequency: 1%<br>Focus: 0 |
| **Laserable Plastic** | | |
| **Etching/Marking** | 600 DPI | Speed: 60%<br>Power: 60%<br>Frequency: 60%<br>Focus: 0 |
| **Stainless Steel** | | |
| **Annealing** | 600 DPI | Speed: 5-7%<br>Power: 100%<br>Frequency: 1%<br>Focus:   +.06 to +.12" |
| **Etching/Marking** | 600 DPI | Speed: 15 - 20%<br>Power: 100%<br>Frequency: 1%<br>Focus: 0 |
| **Polishing** | 800 DPI | Speed: 75%<br>Power: 25%<br>Frequency: 75%<br>Focus: 0 |

## Fusion Edge Suggested Material Settings (Fiber)

| Material | DPI/Freq. | 30 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. Again, consider the marking requirements.

**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 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 | 600-1200 DPI | Speed: 5-7%<br>Power: 100%<br>Frequency: 1%<br>Focus: +.08 to +.110" |
|---|---|---|
| Etching/Marking | 600-800 DPI | Speed: 20 - 25%<br>Power: 100%<br>Frequency: 1-5%<br>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: 15 - 20%<br>Power: 100%<br>Frequency: 1 - 5%<br>Focus: -.09 to -.100"<br>       +.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.

# APPENDIX B: MATERIAL SETTINGS

## Fusion Edge Suggested Material Settings (Fiber)

| Material | DPI/Freq. | 30 watt |
|---|---|---|
| **Powder Coating** | | |
| **Etching/Marking** | 600 DPI | Speed: 25 - 30%<br>Power: 100%<br>Frequency: 100%<br>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”. | | |
| **Deep Metal Engraving** | | |
| | 1200 DPI | Speed: 20%<br>Power: 100%<br>Frequency: 1%<br>Focus: 0 |
| Multiple passes. Slower speeds tend to erupt material rather than ablate. | | |

- **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. 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.