



**Laser Marking and
Programming Manual**



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Introduction

Welcome to the TYKMA laser parameters guide. This guide is designed to provide generalized laser parameters for a variety of marking styles on various materials.

Laser marking and processing have several parameters that are programmable and can affect the results you achieve on a specific material or substrate.

Different combinations are ideal for specific materials.

There are 5 primary parameters that will affect the marking result:

- Loop Count or Passes (number of times to repeat)
- Power
- Frequency
- Speed
- Fill

Please see the following definitions for each parameter.

1. **Laser Power** – The percentage of available power you are utilizing. For example, if I run a 20 watt fiber laser at 50% power setting in my software, I am running at approx. half the available power of the laser.
2. **Frequency** – The pulse repetition rate of the laser. The laser light is delivered in pulses or pieces of light, and the frequency controls the number of pulses delivered per second. In general, lower frequencies produce less heat but are more aggressive while higher frequencies produce more heat but are less aggressive.
3. **Scanning Speed** – The speed in which the beam is traveling across the surface during processing. This speed is controlled by the laser scan head beam delivery system. This speed can range from as slow as 10 mm/sec to 7000+ mm/sec.



4. **Passes / Loop Count** – The number of times that the material is processed using the settings combination listed above.
5. **Fill** – How objects to be marked are made solid, as opposed to only an outline of the object. This is user programmable. Users can control the density, angle and type of fill pattern. The fill is equally important to achieve the proper type of mark.

This guide is laid out by showing the type of marking and the materials that can be affected by it. The laser settings charts are listed in the end of this document.

NOTE: These parameters are provided as a general guideline and should serve as a starting point. Individual materials and preference will determine the final combination of settings for each application. You will notice that some parameters are provided as a “general range” and therefore some user testing and experimentation is required.

Customers should feel free to consult TYKMA at any time for assistance on fine tuning their laser parameters or marking difficult or unusual materials and substrates.

Burning / General Marking



Materials: Steel, Stainless Steel, Aluminum, Brass, Copper, Titanium, Carbide

This type of mark is created by aggressively burning the surface of the material. Depending on the substrate, the mark will vary in color from medium brown to black or black/grey. The surface of the material will feel rough to the touch and feature areas of rise and fall of material.

Examples of Burning / General Marking



Annealing / Black Surface Marking



Materials: Steel, Stainless Steel, Titanium

This type of mark is created by applying a large amount of heat to the surface the material while minimizing the aggressiveness of the mark. The result is a solid black mark with a smooth surface finish. This type of marking is very common for medical applications.

Examples of Annealing / Black Surface Marking





Ablating / Material Removal



Materials: Anodized, Black Oxide, Painted or Coated Materials

This type of mark is created by removing the surface coated layer of a material, such as burning the anodized layer off of aluminum. This usually results in a bright or white colored mark when contrasted with the coating. The mark is relatively smooth with minimum surface penetration.

Examples of Ablating / Material Removal



Foaming / Color Change (Plastics)



Materials: Various Plastics

This type of mark is created by creating a controlled burn on the surface of plastic. This usually results in white, tan or dark colored mark depending on the plastic. The mark is relatively smooth with minimized surface penetration. Controlling the heat is very important.

Examples of Foaming / Color Change on Plastics



Frosting / White Surface Marking



Materials: Carbide, Aluminum, Stainless Steel, Chrome Plated, Nickel Plated, Galvanized

This type of mark is created by frosting the surface of the material at high speeds. This usually results in a bright or white colored. The mark is may have a slight texture to the touch, but the surface or coating penetration is minimal if none at all.

Examples of Frosting / White Surface Marking



The photo below shows an example of the frost look being used to create a white background with burned laser marking over the top to create high contrast.



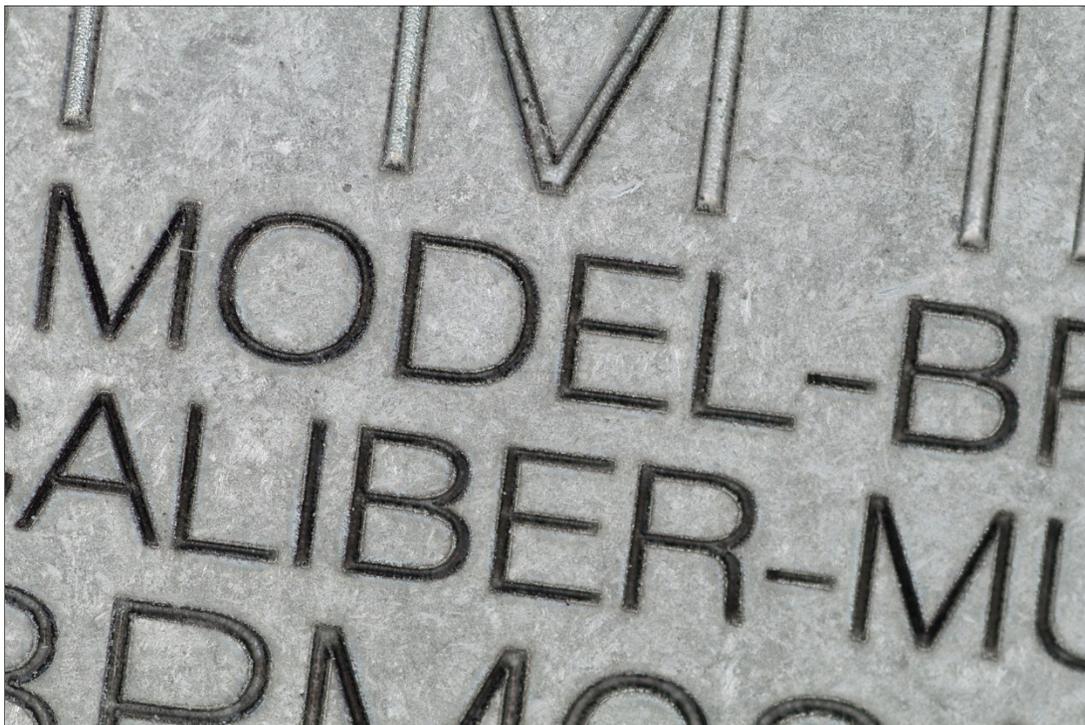
Deep Engraving / Material Removal



Materials: Steel, Stainless Steel, Aluminum, Rubber, Various Other Substrates

This type of mark is created by removing material to create a mark that has depth. The resulting mark has an embossed look. The mark depth can vary from minimum to extreme depending on the time allowed for the marking process. Stripping small layers to get desired depth is preferred.

Deep Engraving / Material Removal Examples



Laser Settings - Stainless Steel / Steel / Titanium / Carbide / Various

Material		Various Metals, Carbide		Mark Type		Silver		
Fill	Angle	Mark Contour	Type	Line Space	Loops	Speed	Power%	Frequency
1	90°	No		0.03	2	2000	100	65
2								
3								

NOTES:

Material		Steel, Stainless, Titanium		Mark Type		Anneal		
Fill	Angle	Mark Contour	Type	Line Space	Loops	Speed	Power%	Frequency
1	90°	No		0.01	5	2000	100	200
2	180°	No		0.02	2	100	50	125
3	315°	No		0.02	2	100	50	125

NOTES:

Material		Steel, Stainless, Various		Mark Type		Deep Engrave		
Fill	Angle	Mark Contour	Type	Line Space	Loops	Speed	Power%	Frequency
1	90°	No		0.02	25	1500	100	35
2	180°	No		0.02	25	1500	100	35
3	315°	No		0.02	5	2000	100	75

NOTES:

Material		Steel, Stainless, Titanium, Carbide, Etc.		Mark Type		Burn		
Fill	Angle	Mark Contour	Type	Line Space	Loops	Speed	Power%	Frequency
1	90°	No		0.03	1	100	100	20
2								
3								

NOTES:

Laser Settings – Brass

Material		Brass		Mark Type		White		
Fill	Angle	Mark Contour	Type	Line Space	Loops	Speed	Power%	Frequency
1	90°	No		0.03	4	2000	100	60
2	180°	No		0.03	4	2000	100	60
3								

NOTES:

Material		Brass		Mark Type		Red		
Fill	Angle	Mark Contour	Type	Line Space	Loops	Speed	Power%	Frequency
1	90°	No		0.01	3	200	100	55
2	180°	No		0.01	3	200	100	55
3	315°	No		0.01	2	200	100	200

NOTES:

Material		Brass		Mark Type		Pink		
Fill	Angle	Mark Contour	Type	Line Space	Loops	Speed	Power%	Frequency
1	90°	No		0.04	2	200	100	20
2	180°	No		0.02	1	200	100	55
3	315°	No		0.02	2	200	100	200

NOTES:

Pink is a bit faster than red, it is a reaction to a different type of burn on the material.

Material		Brass		Mark Type		Deep Engrave		
Fill	Angle	Mark Contour	Type	Line Space	Loops	Speed	Power%	Frequency
1	90°	No		0.02	25	1500	100	35
2	180°	No		0.02	25	1500	100	35
3	315°	No		0.02	5	2000	100	75

NOTES:

Material		Brass		Mark Type		Burn		
Fill	Angle	Mark Contour	Type	Line Space	Loops	Speed	Power%	Frequency
1	90°	No		0.03	1	100	100	20
2								
3								

NOTES:

Laser Settings – Anodized Aluminum / Painted / Black Oxide

Material		Anodized, Coated, Painted		Mark Type		White		
Fill	Angle	Mark Contour	Type	Line Space	Loops	Speed	Power%	Frequency
1	90°	No		0.03	1	2000	100	55
2	180°	No		0.03	1	2000	100	55
3								

NOTES:

Laser Settings -Aluminum

Material		Aluminum		Mark Type		Frost		
Fill	Angle	Mark Contour	Type	Line Space	Loops	Speed	Power%	Frequency
1	90°	No		0.03	2	2000	100	45
2								
3								

NOTES:

Material		Aluminum		Mark Type		Deep Engrave		
Fill	Angle	Mark Contour	Type	Line Space	Loops	Speed	Power%	Frequency
1	90°	No		0.02	25	1500	100	35
2	180°	No		0.02	25	1500	100	35
3	315°	No		0.02	5	2000	100	75

NOTES:

Material		Aluminum		Mark Type		Burn		
Fill	Angle	Mark Contour	Type	Line Space	Loops	Speed	Power%	Frequency
1	90°	No		0.04	1	50	100	20
2								
3								

NOTES:

Laser Settings -Plastics

Material		Black ABS		Mark Type		Lite		
Fill	Angle	Mark Contour	Type	Line Space	Loops	Speed	Power%	Frequency
1	90°	No		0.03	1	2000	20	45
2	180°	No		0.03	1	2000	20	45
3								

NOTES:

Material		Black Nylon		Mark Type		Lite		
Fill	Angle	Mark Contour	Type	Line Space	Loops	Speed	Power%	Frequency
1	90°	No		0.02	1	2000	65	35
2								
3								

NOTES:

Material		Black Delrin			Mark Type		Lite		
Fill	Angle	Mark Contour	Type	Line Space	Loops	Speed	Power%	Frequency	
1	90°	No		0.02	1	4000	30	55	
2	0°	No		0.02	1	4000	30	55	
3									

NOTES:

Material		High Temp CPVC			Mark Type		Lite		
Fill	Angle	Mark Contour	Type	Line Space	Loops	Speed	Power%	Frequency	
1	90°	No		0.02	1	4000	22	200	
2	0°	No		0.02	1	4000	22	200	
3									

NOTES:

Material		Nylon		Mark Type			Lite	
Fill	Angle	Mark Contour	Type	Line Space	Loops	Speed	Power%	Frequency
1	90°	No		0.02	1	2000	26	55
2	180°	No		0.02	1	2000	26	55
3								

NOTES:

Material		Moisture Resistant LDPE		Mark Type			Black	
Fill	Angle	Mark Contour	Type	Line Space	Loops	Speed	Power%	Frequency
1	90°	No		0.02	1	1000	100	20
2	0°	No		0.02	1	1000	100	20
3								

NOTES:

Material		White Delrin			Mark Type		Raised		
Fill	Angle	Mark Contour	Type	Line Space	Loops	Speed	Power%	Frequency	
1	90°	No		0.01	10	25	100	20	
2									
3									

NOTES:

Material		HDPE Polyethylene			Mark Type		Black		
Fill	Angle	Mark Contour	Type	Line Space	Loops	Speed	Power%	Frequency	
1	90°	No		0.02	4	2000	100	20	
2									
3									

NOTES:

Material		Optically Cast Acrylic		Mark Type		Contrast		
Fill	Angle	Mark Contour	Type	Line Space	Loops	Speed	Power%	Frequency
1	90°	No		0.03	7	2000	100	200
2								
3								

NOTES:

Material		Black Acrylic		Mark Type		Lite		
Fill	Angle	Mark Contour	Type	Line Space	Loops	Speed	Power%	Frequency
1	90°	No		0.03	10	2500	22	20
2								
3								

NOTES:

Material		White Acrylic			Mark Type		Dark	
Fill	Angle	Mark Contour	Type	Line Space	Loops	Speed	Power%	Frequency
1	90°	No		0.03	10	2500	73	55
2								
3								

NOTES: