LASER CLEANING PARAMETERS

LC-CLEAN 300W P

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1. INTRODUCTION

The system used is a JPT pulsed fiber laser (>300 W average power), with:

- Maximum pulse energy: 10 mJ
- Wavelength: 1064 nm
- Pulse width: 2–500 ns
- Frequency range: 1–4000 kHz

This is a MOPA laser, allowing independent adjustment of pulse width and frequency to optimize cleaning depending on the material and contamination.

In practical use, the process is not based on continuously changing all parameters, but on maintaining a stable base and adjusting mainly:

- Pulse width
- Frequency (respecting cut-off)
- Scan width
- Speed
- Pattern
- And, if needed, the lens

Standard production configuration is based on:

- 100% power (except wood or sensitive materials)
- 20,000–30,000 mm/s speed
- 250–500 ns pulse width
- lowest possible frequency above cut-off

2. GENERAL PARAMETER EXPLANATION

2.1 POWER

Power defines the average energy available.

- Range: 0–100%
- Standard use:
    - Metals, rust, paint, resins → 100%
    - Wood / sensitive materials → reduced

In practice, power is kept constant and adjustments are made using other parameters.

2.2 PULSE WIDTH (NS)

One of the most critical parameters.

Available range: 2–500 ns, with predefined modes including 250 ns, 350 ns, and 500 ns.

Practical behavior:

- 250 ns → faster cleaning, lighter layers
- 350 ns → balanced (most commonly used)
- 500 ns → higher thermal input, better for thick layers

Regarding short pulses:

Short pulses are not forbidden, but in this working method they do not provide fast cleaning results, as they require higher frequencies and reduce productivity.

Therefore, the practical working range is 250–500 ns.

2.3 FREQUENCY (KHZ)

Defines how many pulses are emitted per second.

- Range: 1–4000 kHz

In industrial cleaning:

- Frequency should be as low as possible
- Always above the cut-off limit

Higher frequency = lower efficiency per pulse
Lower frequency = higher effective energy per pulse

2.4 SPEED (MM/S)

Defines interaction time with the surface.

Working range:

- 20,000 – 30,000 mm/s

Adjustment is not based on slowing down excessively, but on combining:

- Pulse width
- Scan width
- Pattern

- Lens

2.5 SCAN WIDTH

Defines the effective cleaning width.

Typical values:

- 40–50 mm → higher energy density (more aggressive)
- 50–60 mm → standard
- 80–100 mm → light cleaning / maximum productivity

Reducing scan width increases energy density without changing power.

2.6 LENSES

Available lenses include:

- **F160, F210, F254, F300**

When changing the lens, the corresponding value must also be updated in the software so the system adapts correctly.

Smaller lens (e.g. F160)

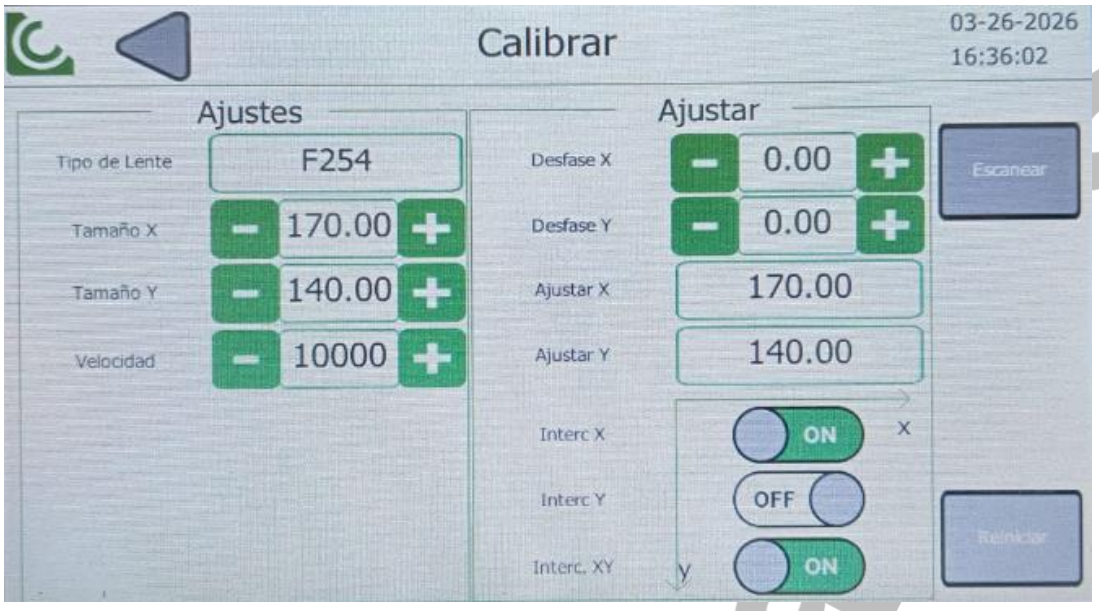
- Smaller field
- Higher energy density
- More aggressive cleaning
- Better for small areas or strong adhesion

Larger lens (e.g. F300)

- Larger field
- Lower energy density
- Softer cleaning
- Better for sensitive materials

Standard lens

- **F210** → best balance between:
    - performance
    - stability
    - working area



3. CUT-OFF EXPLANATION

The laser includes a power reduction threshold (cut-off).

This means:

- Above a certain frequency → full power output
- Below that frequency → automatic power reduction

Even if set to 100%, real output power decreases below cut-off.

Cut-Off Table (JPT 300W)

Pulse (ns)	Cut-off Frequency (kHz)	Max Frequency (kHz)
20	170	3000
30	120	3000
45	80	3000
60	70	2000
80	55	2000
100	50	2000
150	34	1000

200	30	1000
250	25	900
350	22	600
500	20	500

Practical Working Values

- **250 ns → 25 kHz**
- **350 ns → 22 kHz**
- **500 ns → 20 kHz**

Frequency must always be kept at or above these values.

4. PATTERN EXPLANATION

Based on your system, three patterns are used:

4.1 SINUSOIDAL

Main working pattern.

Advantages:

- Uniform energy distribution
- Better surface finish
- Reduced marking
- Stable performance

Use:

- General cleaning
- Rust
- Paint
- Resins
- Light contamination

Default pattern for most applications

4.2 LINE

Used for higher aggressiveness.

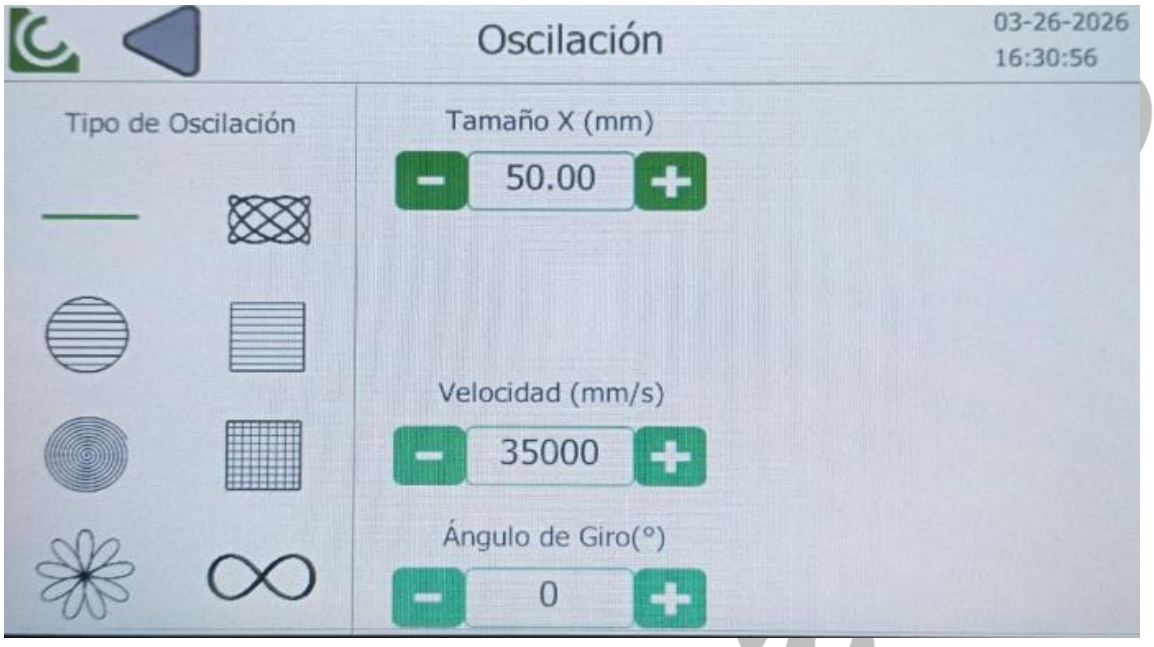
Advantages:

- More concentrated energy
- Stronger impact
- Better for hard layers

Use:

- Heavy rust
- Strong adhesion
- When sinusoidal is not sufficient

Line = more aggressive



4.3 PETAL PATTERN

Used for delicate applications.

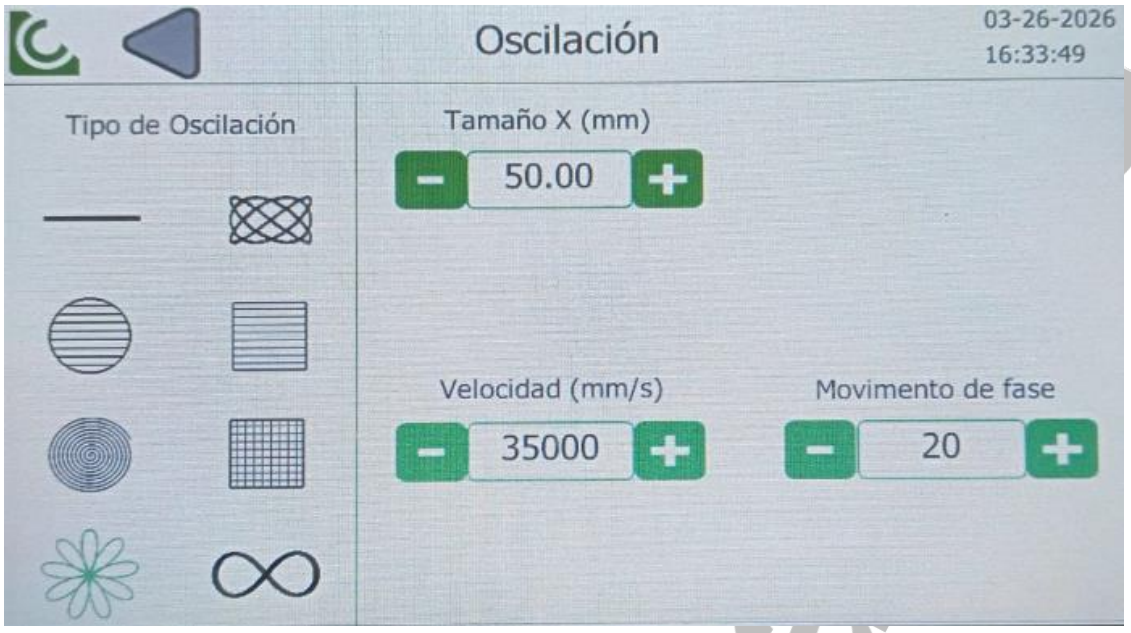
Advantages:

- Soft energy distribution
- Reduced marking risk
- Smooth interaction

Use:

- Wood
- Sensitive materials
- Finishing processes

Petal = gentle cleaning



5. FINAL PARAMETER TABLE

General Conditions

- Lens: F210
- Speed: 20,000–30,000 mm/s
- Power: 100% (except wood)
- Frequency: at cut-off
- Scan width: typically 50–60 mm (up to 100 mm)

Operating Table

Application	Pattern	Power	Pulse (ns)	Frequency	Speed	Scan Width
Light rust	Sinusoidal	100%	250 ns	25 kHz	25,000–35,000	50–60 mm
Medium rust	Sinusoidal	100%	350 ns	22 kHz	22,000–28,000	50–60 mm
Heavy rust	Sinusoidal	100%	500 ns	20 kHz	20,000–25,000	40–50 mm

Surface paint	Sinusoidal	100%	350 ns	22 kHz	25,000–35,000	50–60 mm
Thick paint	Sinusoidal	100%	500 ns	20 kHz	20,000–25,000	50–60 mm
Resins / adhesives	Sinusoidal	100%	500 ns	20 kHz	20,000–25,000	40–50 mm
Light cleaning / film	Sinusoidal	100%	250 ns	25 kHz	25,000–35,000	80–100 mm
Wood	Petal	20–100%	80–500 ns	20–50 kHz	20,000–28,000	60–100 mm

6. KEY OPERATING RULES

6.1 GENERAL RULES

- Use 100% power (except wood)
- Work in 250–500 ns range
- Keep frequency at cut-off level
- Speed between 20,000–35,000 mm/s
- Use F210 lens as standard
- Use sinusoidal pattern as default
- Use line pattern for aggressiveness
- Use petal pattern for sensitive materials

6.2 ADJUSTMENT PRIORITY

When results are not optimal:

1. Pulse width
2. Scan width
3. Speed
4. Pattern
5. Lens

Frequency should not be used as a free adjustment parameter.

6.3 IF CLEANING IS INSUFFICIENT

- Increase pulse width (250 → 350 → 500 ns)
- Reduce scan width
- Reduce speed (within range)
- Use line pattern
- Use smaller lens if necessary

6.4 IF TOO AGGRESSIVE

- Increase scan width
- Increase speed
- Use sinusoidal or petal pattern
- Use larger lens

6.5 ABOUT SHORT PULSES

Short pulses can be used, but in this working method they do not provide fast cleaning performance, so they are not the preferred option in production cleaning.

7. CONCLUSION

Optimal cleaning with this system is achieved by:

- Working at maximum power,
- Using 250–500 ns pulse width,
- Keeping frequency at cut-off level,
- And adjusting performance using:
  - Scan width
  - Speed
  - Pattern
  - And lens when required

The standard approach is:

- **Sinusoidal pattern for most applications**
- **Line pattern for higher aggressiveness**

- **Petal pattern for delicate materials**