HORIZON LASER

500W PULSE FIBER LASER CLEANING MACHINE

U S E R G U I D E

Horizon Laser Technology Co., Ltd

Company Profile

Horizon Laser Technology Co., Ltd is a new high-tech enterprise integrating technical services, technology promotion, laser equipment modular design, sales and integration services. Horizon Laser has many senior technical experts (Covering machine tool design, optics, automation integration, laser process development) from well-known laser companies. Horizon laser is mainly committed to promoting laser processing technology, popularizing laser applications, and reducing the asymmetry of client information through modular sales and integration services of laser equipment, and strives to achieve an satisfaction for customers to buy and use.

More informations，please visit our website：

http://www.horizonlaser-tech.com

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1. General Safety Information

Thank you for choosing a pulse fiber laser cleaning machine from Horizon Laser Technology Co., Ltd. This user guide provides you with important safety, operation, maintenance and other information. Therefore, please read this user guide carefully before using this product. To ensure safe and optimum operation, please note the following cautions, warnings and other information in this manual.

1.1. Laser Safety Class

The laser cleaning machine is classified as a Class IV laser product, with an output laser power ranging from 500W and a wavelength range of 1060nm to 1100nm, and are invisible light. Direct or indirect exposure to the laser can cause harm to the eyes or skin, and staring directly at the laser can result in irreversible damage to the retina and cornea. Horizon Laser strongly recommends that you always wear qualified and safe protective goggles when operating the laser equipment.

1.2. Optical Safety

(1) For the safety of you and others, do not point the cleaning head at yourself or others.

(2) Appropriate and certified 1064nm near-infrared band laser protective glasses and safety gloves must be worn before the handheld laser cleaning machine is used.

(3) The cleaning operation of the hand-held laser cleaning machine needs to be carried out in an independent space with laser protection; when the hand-held laser cleaning machine is used, non-operators should stay away from the hand-held laser cleaning machine for more than 5 meters.

(4) Wear a mask when cleaning highly reflective materials.

1.3. Electrical Safety

(1) Please ensure that the equipment is properly grounded. Reliable grounding is a prerequisite for the normal operation of the product. Otherwise, it may cause hidden faults such as laser alarms, failure to emit light, and unstable laser cleaning. A broken ground connection can result in the product's casing becoming electrified, potentially causing harm to the operator.

(2) If the circuit breaker trips frequently, please contact technical personnel as soon as possible to ensure the safe use of the equipment.

(3) Ensure that the AC power supply voltage is functioning normally.

Note: There are no components inside the laser product that require operator intervention. Do not attempt to open the product casing, as this may result in electric shock and void the laser product's warranty.

1.4. Safety Conversions

Symbols	Description
	WARNING: Refers to a potential Electrical Hazard to human body; It requires a procedure that, if not correctly followed, may result in bodily harm to you and/or others. Do not proceed beyond the WARNING sign until you completely understand and meet the required conditions.
	CAUTION: Refers to a potential hazard on product. It requires a procedure that, if not correctly followed, may result in damage to the product or components. In order to ensure normal use of equipment, do not violate the requirement of the CAUTION sign.
	WARNING: Refers to a potential Laser Hazard. The symbol represents laser radiation. The symbol is pasted on laser output end.
NO SYMBOL	IMPORTANT: Refers to any information regarding the operation of the product. Please do not overlook this information.

1.5. Additional Safety Information

(1) Do not work in high temperature and high humidity environment, otherwise it may cause short circuit and affect the normal life of the laser.

(2) Do not use the device in dim or dark environments.

(3) Please strictly follow the operation manual of the product, otherwise any damage to the equipment will not be covered by warranty.

(4) There are no built-in and usable accessories in this product, all repairs should be carried out by

professionals, in order to prevent electric shock, please do not damage the label and open the cover, otherwise any damage to the product will not be covered under warranty.

1.6. Laser Safety Protection

Laser safety goggles should be selected based on the ability to shield the entire wavelength range of laser light emitted by hand-held laser cleaning machines. When operating the equipment, please choose the safety glasses reasonably according to the emitted laser wavelength of the laser equipment and ensure that they are always worn. Horizon Laser recommends materials or equipment from the following laser safety equipment suppliers: LaserVision USA, Kentek Corporation, RochweLL Laser Industries, etc.

2. Product Description

2.1. Product Introduction

The pulsed laser cleaning machine utilizes a laser specifically designed for cleaning, enabling non-contact cleaning operations. The laser is transmitted through an optical fiber and paired with a handheld cleaning head, allowing for flexible and oscillating cleaning. The handheld cleaning head can also be integrated with automated production lines, facilitating efficient and large-scale cleaning and refurbishment of products.

The pulsed laser cleaning machine features a cleaning head with a dual oscillating mirror structure, delivering high peak laser power, substantial single-pulse energy, and uniform beam energy distribution. Compared to traditional cleaning methods such as dry ice, chemical etching, and sandblasting, it offers advantages such as no damage to the product substrate, minimal heat input, no consumables, and no pollution. It can effectively remove rust, coatings, rubber, paint, resin, oil stains, and other contaminants from product surfaces.

This machine is primarily used in industries such as mold manufacturing, mechanical component refurbishment, rail transportation, shipbuilding, petrochemical pipelines, automotive manufacturing, and cultural heritage restoration.

2.2. Cleaning principle

The laser is generated by the laser source and transmitted through an optical fiber into the cleaning head. Inside the cleaning head, the oscillating mirrors cause the laser to form various cleaning trajectories. After being focused by the focusing lens, the laser acts on the surface of the product to be cleaned. The laser is absorbed by the contaminant layer on the product's surface, forming rapidly expanding plasma (a highly ionized and unstable gas), which generates shockwaves. These

shockwaves break the contaminants into fragments and remove them. (Note: During the cleaning process, assisting with air blowing or dust extraction at the laser cleaning position can further facilitate the rapid removal of contaminants.)

2.3. Product Advantages

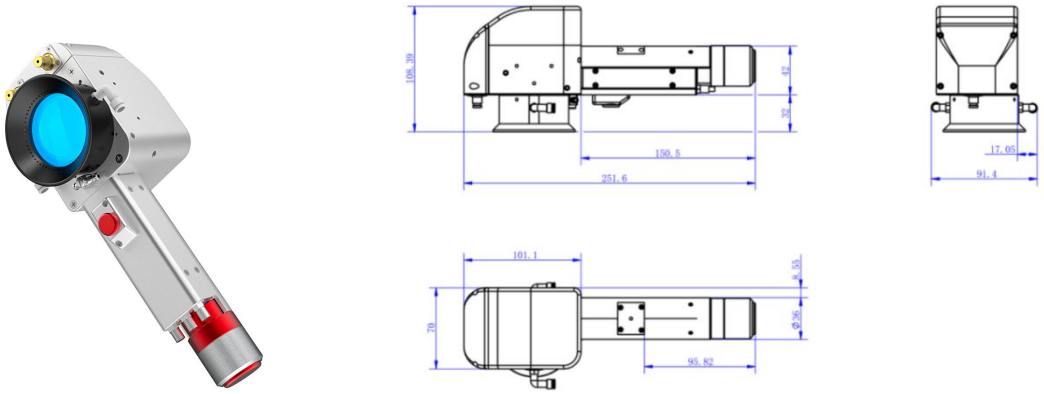
- The solution combines a pulsed laser with a dual oscillating mirror cleaning head. Compared to continuous laser cleaning, it features lower heat input, higher peak power, and stronger penetration, making it more suitable for cleaning precision products with delicate and refined results.
- The dedicated cleaning laser ensures uniform beam energy distribution, delivering a fine cleaning effect without damaging the substrate and leaving no underlying patterns.
- The cleaning head utilizes an ultra-high-speed dual oscillating mirror, enabling more efficient and thorough cleaning.
- The cleaning width can reach up to 120mm @ F300 (100mm @ F254), meeting the requirements for efficient cleaning of large-sized products.
- It comes with 9 sets of cleaning process parameters and 8 types of cleaning trajectory patterns, which can be directly applied to clean different products.
- The cleaning head can be switched between handheld and fixed modes, catering to a wider range of cleaning scenarios.
- With long-distance fiber transmission, it supports mobile operation and can clean large fixed equipment, products with complex shapes, and hidden areas.
- It is capable of cleaning a wide range of materials, including rust, coatings, rubber, paint, resin, oil stains, and more.

2.4. Structural Layout

2.4.1. Machine structure

Dimensions of the cabinet of machine

2.4.2. Cleaning head structure



500W

2.5. Technical Parameters

Item	Characteristics	Typical Value	unit
Electrical Characteristics	Supply Voltage	220V (customizable 110V)	V
	Maximum Power Consumption	4150	W
General Characteristics	Laser Power	500	W
	Laser Wavelength	1064	nm
	Maximum Single Pulse Energy	15&50	mJ
	Fiber Cable Length	10m (customizable 15m)	m
	Cooling Method	Water Cooling	
	Adjustable Cleaning Width	120mm@F300、100mm@F254	mm
	Cleaning Head Weight	< 1.3	kg
	Product Size	L*W*H：980*550*720	mm
	Total Weight	107	kg

3. Equipment operation process

3.1. Machine disassembly

The handheld laser cleaning machine is a valuable item, and Horizon Laser recommends that you follow the steps below to unpack and assemble the packaging box.

Please proceed according to the following steps:

Place the packaging box containing the equipment on a level ground.

(1) Open the main packaging box, remove the foam cover, and take out the accompanying items.

(2) Carefully remove the cleaning head and fiber optic cable from the equipment, ensuring that the minimum bending radius of the fiber optic cable is greater than 200 mm. Use qualified equipment to lift the cleaning machine out of the packaging box, or gently remove it with a forklift. Release the wheel brakes and push the equipment to the installation location on a flat surface, then secure the wheel brakes.

(3) Ensure that the equipment is placed in a dry, well-ventilated area with no obstructions around it. The front of the equipment and the operator's position should have a clear, unobstructed view. There should be no falling objects above the equipment, and the location should have proper drainage to prevent water accumulation.

Note:

◎ If you notice any damage to the external packaging or internal components upon receiving the product, please contact Horizon Laser or the designated agent immediately.

◎ The handheld laser cleaning machine must not be laid flat during transportation, lifting, or use; it must always remain upright.

◎ The equipment should be placed away from sources of vibration.

3.2. Machine operation steps

(1) Remove the cleaning head and fiber optic cable from the side panel bracket.

(2) Connect the main power cable of the equipment to the power cabinet. The equipment operates on single-phase AC220V (customizable to AC110V). Ensure the ground wire is properly connected, as poor grounding may cause potential harm to the equipment and personnel.

(3) When external control is required for automation, insert the external control signal cable into the aviation socket labeled "EXT-CTRL." The signal cable includes two sets of signals: "Safety Lock" and "Trigger Emission," both of which are "active when connected." In "external control mode," first short-circuit the "Safety Lock" signal or connect it to an "external safety door." The "Trigger Emission" signal is used for automated cleaning (in internal control mode, the "Safety

Lock" and "Trigger Emission" signals are invalid. Switching between internal and external control modes is done in the software settings page).

(4) Turn the main power switch on the back of the device clockwise, release the "Emergency Stop" button on the front, and press the "Start" button. The entire machine will power on, the status light will flash yellow, the operation screen will open, and the home interface will appear.

(5) Turn the "Key Switch" clockwise to activate the laser. The status light will stay solid yellow, indicating the cleaning machine is in "Ready" mode.

(6) Enter the cleaning page, set the cleaning path and laser parameters, click to open the "Shutter" on the cleaning page, and operate the cleaning head switch button to start cleaning. Click once for red light preview, and double-click to emit light for cleaning.

(Note: Before emitting light for cleaning, remove the lens cover of the cleaning head.)

Front

Rear

(7) After cleaning, turn off the key switch, press the "Stop" button, and turn off the main power switch. Use a lint-free cloth dipped in alcohol to clean the lens of the cleaning head, cover it with the protective cap, store the fiber optic cable on the side panel bracket, and secure the cleaning head on the cleaning head bracket.

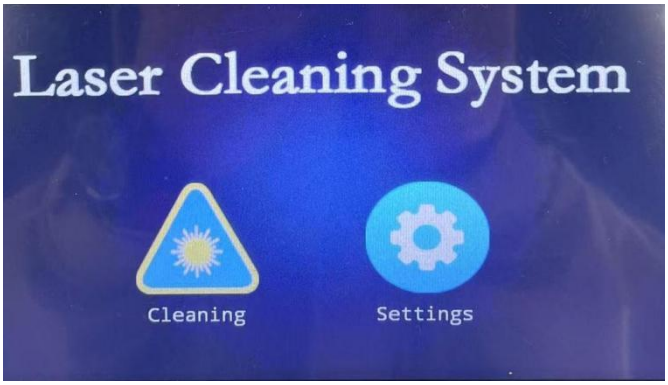
Remarks:

- The 500W cleaning head has built-in dual red light assistance for aligning the cleaning height. The focal height is achieved when the two red dots overlap, at which point the cleaning energy is maximized (after replacing the field lens, the dual red lights need to be readjusted. First, find the height with the strongest cleaning laser energy, then adjust the dual red lights to overlap).
- The 500W cleaning head features an air curtain function. Before cleaning, insert the air tube into the air inlet labeled "GAS" on the back of the device. Filtered compressed air passes through the air tube, which is connected to the air curtain around the field lens. Air is blown during laser emission to prevent dust from contaminating the cleaning head lens during the cleaning process.

3.3. Cleaning Instructions

The control operation interface is divided into three main sections: Home Page, Cleaning Page, and System Settings.

3.3.1. Home Page

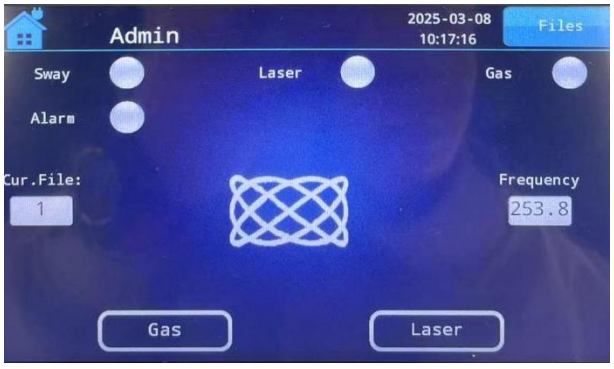


System Settings:Allows configuration of language, switching between internal and external control, selection of cleaning field lenses, monitoring, and more.

Cleaning Page:Enables adjustment of cleaning paths, laser parameters, switching of process groups, and more.

Password and Permissions:User Password: 123456,administrator Password: 258369

3.3.2. Cleaning Page



- Operation Status Description

(1) Sway: indicator light indicating whether the cleaning head is swinging.

(2) Alarm: system alarm indicator light.

(3) Gas: protective gas indicator light.

(4) Laser: Laser running indicator light.

- Control buttons

(1) Gas: manual gas blowing button, used to debug the equipment (during normal cleaning, the

opening and closing of the gas is automatic, no need to manually press the button).

(2) Laser: Laser shutter switch. In "internal control mode", you need to turn on this button to emit light (in "external control mode", this button does not work).

3.3.3. Parameter files

Click the "Process File" button in the upper right corner of the interface to edit and save up to 9 process groups. By selecting and importing the corresponding process, you can switch the cleaning process parameters.

- Scan trajectory parameters

Trajectory Types:There are a total of 8 cleaning scan trajectories. Switching between different trajectory types requires corresponding adjustments to the trajectory parameters.

Scan Width X/Y:The width of the cleaning head's scan trajectory, determined by the field lens model, with a maximum size limit.

Scan Speed (mm/s):The speed of the cleaning head's scan trajectory, ranging from 0 to 30,000 mm/s (speed limits vary depending on the trajectory type).

Rotation Angle:The overall rotation angle of the scan pattern.

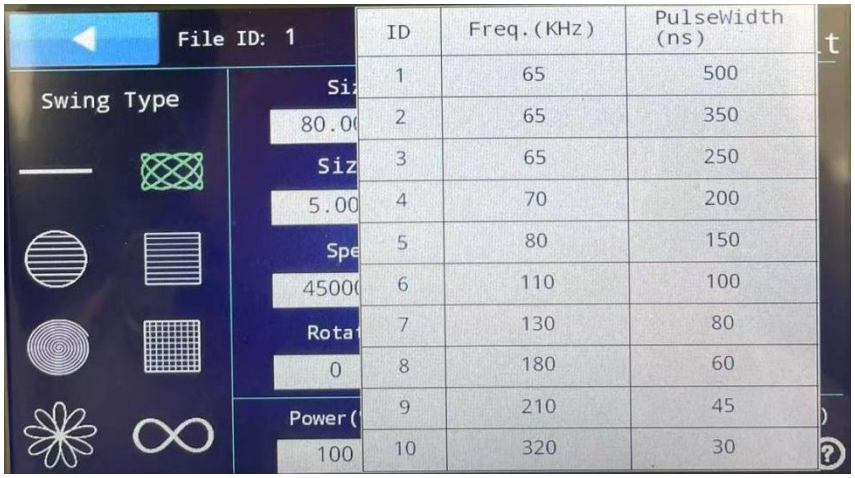
- Laser parameters

Power:Controls the output power of the laser, adjustable from 10% to 100%.

Frequency:This parameter is set based on the laser's pulse width-frequency table.

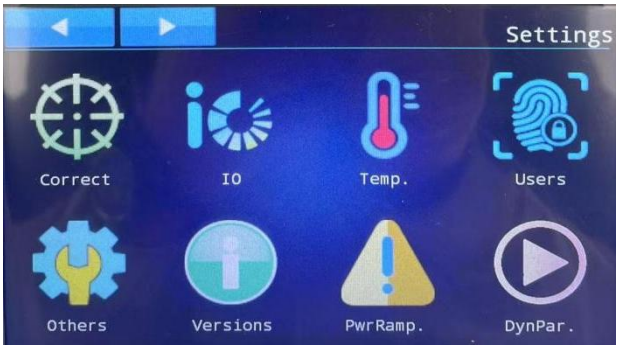
Pulse Width:Controls the pulse width of the laser. This parameter is also set based on the laser's pulse width-frequency table.

To access the process editing page, click the "?" symbol in the lower right corner to bring up the pulse width-frequency table for the current cleaning machine.



ID	Freq.(KHz)	PulseWidth (ns)
1	65	500
2	65	350
3	65	250
4	70	200
5	80	150
6	110	100
7	130	80
8	180	60
9	210	45
10	320	30

3.3.4. Settings

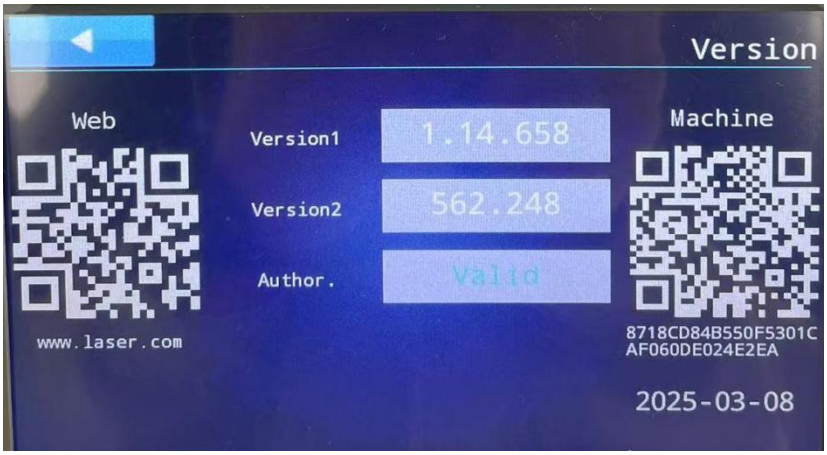


(1) Correct:When switching to field lenses F254 or F300, you need to select the corresponding "Field Lens Model" on this page, which will limit the cleaning width (X/Y dimensions). The correction value field is not recommended for user modification, as it has been pre-configured at the factory.

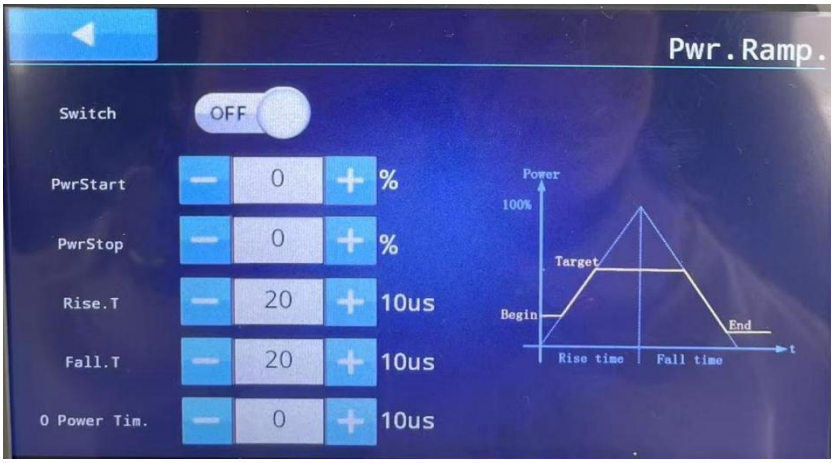
(2) IO setting: It has been set at the factory and cannot be changed.

(3) Others:The system language can be switched, and the internal control mode or external control mode can be switched (other parameters have been set by default at the factory).

(4) Version:Device version information, you can view the serial number and decryption settings of the device.



(5) PwrRamp:Set the switch light delay function of the laser.



3.4. Usage precautions

(1) Power Connection and Grounding:Ensure the power connection is accurate and the equipment is properly grounded to prevent electric shock or damage to the device components.

(2) Operator Protection:Operators must take necessary precautions and wear laser safety goggles.

(3) Fiber Optic Cable Handling:Hang the fiber optic cable with a bending radius greater than 200 mm.

(4) Cleaning Head Care:The cleaning head is a precision component. Handle it with care, avoid dropping or impact, and do not disassemble it yourself.

(5) Gas Supply:Ensure the gas supply is turned on before emitting the laser for cleaning.

(6) Parameter Confirmation:After setting parameters such as cleaning length and width, first activate the red indicator light to confirm the settings. Only proceed with laser cleaning after verifying accuracy.

(7) Work Area Protection:Implement necessary protective measures for the cleaning area. It is recommended to isolate the work area. When cleaning highly reflective materials such as copper or aluminum, tilt the cleaning gun to avoid perpendicular alignment with the workpiece. Ensure no one stands opposite the cleaning direction.

(8) Regular Maintenance:Regularly clean the protective lens under the cleaning head. When the device is powered off, use a lint-free cloth dipped in alcohol to clean the surface of the protective lens. Proper maintenance can extend the lifespan of this consumable component.

4. Application Cases

Rust removal on railway

Mold cleaning

Car tire mold cleaning

Precision parts

5. After-Sales Service and Warranty

Starting from the date of equipment acceptance, the entire machine is covered by a one-year quality warranty, while the warranty period for the laser follows the manufacturer's regulations. Consumables and wear-prone parts on the equipment are not covered under the warranty. The after-sales service for auxiliary equipment is executed according to the respective manufacturer's service standards.

During the equipment warranty period, Horizon Laser Technology Co., Ltd. is responsible for providing free replacement parts and services for any damage or malfunction caused by the equipment's inherent quality issues. However, this excludes regular consumables (such as fiber optics, protective lenses, etc.; see the consumables list for details) and cases resulting from user misuse or operational errors.

Horizon Laser Technology Co., Ltd. offers lifetime maintenance services for the provided products and is always available for daily consultation and guidance related to the equipment. Beyond the warranty period, we continue to provide extensive and preferential technical support and spare parts supply. We guarantee a response within 4 hours and on-site personnel within 24 hours (excluding overseas locations).

Horizon Laser Technology Co., Ltd. maintains an ample inventory of spare parts and accessories to promptly offer technical services and spare parts support, ensuring the repair needs of the equipment are met.