

Operation and maintenance manuals



1000 watt 1500 2000 watt laser cleaning system

Manual Version Number : 1500-RCP2-2022-CN-V2

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1 Introduction to the manual

The laser cleaning system is a set of industrial cleaning equipment integrated by the laser, laser cleaning head. The set of non-contact cleaning equipment maximum average output power of 1500 watts, with a safe, efficient, environmentally friendly industrial processing advantages. The equipment can be used for a variety of metal base materials (titanium alloy, aluminum alloy, high-temperature alloy, stainless steel, carbon steel, etc.), semiconductor materials and other complex-shaped surface parts inside and outside the surface of the oxidation layer, coating, oil, rust spots, coatings and other handheld or fully automatic cleaning. Laser cleaning can effectively remove contaminants when working within the range of window parameters. The equipment has been used in many fields such as aviation, aerospace, shipping, automotive, electronics industry, etc.

This manual is an important operation manual for laser cleaning systems. This manual includes important contents such as equipment start-up, equipment daily operation, and equipment maintenance. Before operating the laser cleaning system, please read and familiarize yourself with the contents of this manual. During the operation of the laser cleaning system, please strictly follow the safety rules in this manual to avoid safety accidents.

2 Operation safety code

The operator should read and familiarize himself with this manual before operating the laser cleaning system. If there are any omissions from this manual, or if you have any questions about the installation or use of the product, please contact the supplier immediately.

2.1 Security rules

When replacing parts, use only original parts approved by the supplier. Observe the safety regulations in this manual regarding the operating environment, operating procedures, and maintenance conditions. Do not add, remove, or modify any parts of the product (including the software and hardware) without your knowledge.

Any private alterations increase the risk of safety and will void the warranty. The supplier also declines any responsibility for any resulting damage to the product.

This laser cleaning system is strictly forbidden to be used in the following situations:

- Cleaning of flammable and explosive materials (gasoline, arms and ammunition, etc.)
- Cleaning of high-pressure storage containers (spray tanks, propane gas cylinders, etc.)
- Cleaning of medical products that come into direct contact with patients

2.2 Operators

Product installation, operation and maintenance personnel must meet the following conditions :

Electrical Technician

- Plan and execute the installation of electrical components, as well as check the functional integrity of the components
- Ensure normal power supply and circuit safety of the equipment
- Check the electrical system, check for functional integrity and eliminate faults
- Maintenance of electrical, electrical/pneumatic, electrical/hydraulic components and drive components
- Ability to read and master circuit diagrams to troubleshoot accordingly
- Ability to evaluate and master specialized technical documentation

Industrial Engineer

- Launching technology projects
- Inspect, maintain and record maintenance records of equipment

- Evaluate and master control techniques
- Storage and safekeeping of shipped items

Mechatronics Engineer

- Identification of faults, troubleshooting, equipment repair, and preventive maintenance
- Install electrical equipment and make it meet safe operation requirements;
- Check and assemble the parts
- Plan and organize your work
- Installation and setup of network environment, system bus and software updates
- Ensure all work meets environmental requirements

Product Installation and Removal

- Personnel qualified or trained in the installation and removal of power and safety equipment
- Personnel who are qualified or trained in the installation and removal of lasers (including laser cables, optics, etc.)

Product Operation

- Personnel qualified to operate laser cleaning equipment or receive relevant training











Product Maintenance

- Personnel with maintenance or training on laser cleaning equipment (we recommend that all maintenance personnel receive maintenance training from the supplier)

Any maintenance items not mentioned in this manual can only be maintained by the supplier's maintenance personnel (please contact the supplier for specific product maintenance matters and related training)

2.3 Safety warning signs

Safety warning signs

Warning sign illustration	Illustrated content
	General warning signs
	Laser radiation warning signs The mark indicates that exposure to laser radiation can cause injury or death or cause a fire. During operation Laser goggles and protective gloves should be worn at all times during laser operation.
	Voltage warning signs This sign indicates the risk of electric shock during operation and that operation without following safety instructions can cause significant injury or death to personnel.
	High temperature surface warning signs Operators must not touch the hot surface with their hands to avoid injury. Do not remove the motor, engine The casing of the motor and engine.
	Noise warning signs The logo indicates the possibility of damage to the operator's hearing. Failure to follow safety instructions can result in hearing loss. Noise protection earplugs must be worn during operation.
	Rotating parts warning signs The marking indicates the danger of the rotating parts. Failure to follow safety instructions can result in injury to the operator. The operator can be injured.
Warning sign illustration	Illustrated content
	General Instruction Identification This logo contains potential material damage at the laser source location.
	Wearing safety goggles instruction mark This logo requires the wearing of laser safety goggles. The goggles must correspond to the appropriate laser protection wavelength length.
	Read and follow the manual's instruction markings This logo requires that the manual documentation (including maintenance tasks and other instructions, etc.) be read and followed.
Warning sign illustration	Illustrated content
	This logo contains important information

2.4 Laser radiation warning



Dangerous

The high energy radiation from the laser can cause severe skin burns or blindness!

- Wear laser goggles (wear goggles only to protect the laser scattering, do not look directly at the laser light path)
- Do not expose your body to laser radiation

This laser is a Class IV laser, and its 1064nm radiation can cause damage to human skin and eyes. The 1064nm radiation can cause damage to human skin and eyes (diffuse laser reflection can also cause injury). This laser can cause fire hazards when delivering high energy laser light. Laser goggles and work gloves must be worn throughout the operation of this laser. This laser is a Class IV laser, and its 1064nm radiation can cause damage to human skin and eyes. The 1064nm radiation can cause damage to human skin and eyes (diffuse laser reflection can also cause injury). This laser can cause fire hazards when delivering high energy laser light. Laser goggles and work gloves must be worn throughout the operation of this laser. This laser is a Class IV laser, and its 1064nm radiation can cause damage to human skin and eyes. The 1064nm radiation can cause damage to human skin and eyes (diffuse laser reflection can also cause injury). This laser can cause fire hazards when delivering high energy laser light. Laser goggles and work gloves must be worn throughout the operation of this laser.

Operation of this laser in a flammable environment poses the risk of fire and explosion. Therefore, this laser should not be used in flammable or explosive environments.

The gases and fumes produced during laser radiation may be harmful to humans. In particular, highly toxic substances are released during the evaporation of plastics. Therefore, a compliant exhaust ventilation system must be installed when operating this type of laser.

2.5 Circuit Warning

Dangerous

Electrocution can lead to serious injury or even death

- Electrical parts of the equipment can only be maintained by qualified electricians
- Disconnect the laser light source prior to maintenance
- Do not touch electrical parts before the equipment is powered off

2.6 Equipment protection

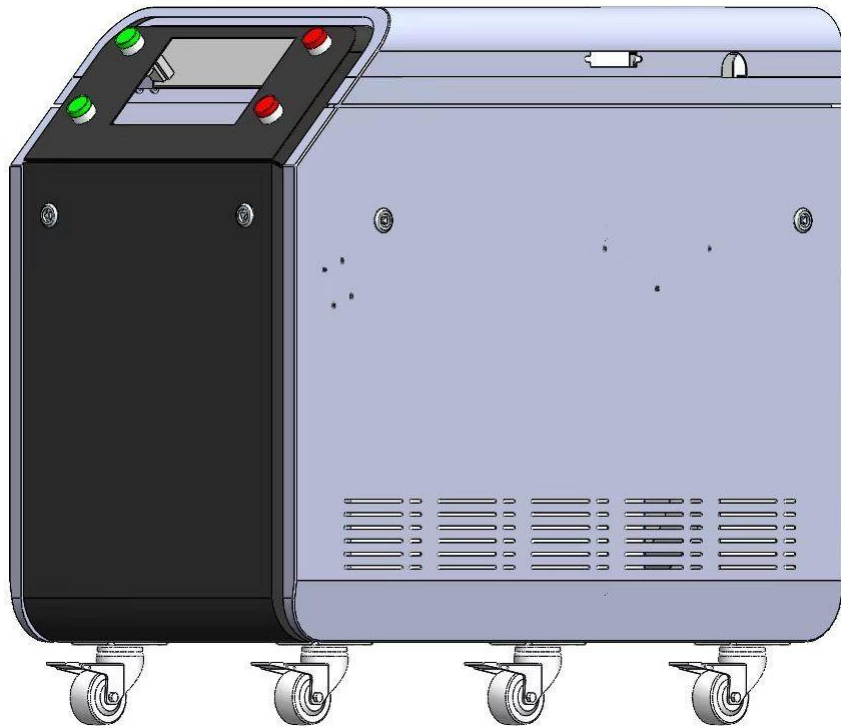
Beware

High temperature and humid environment can damage the equipment

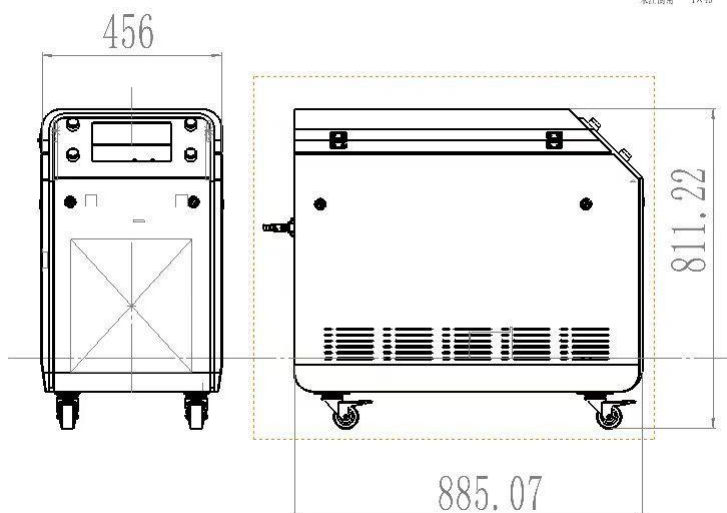
- Ensure that this laser cleaning system is used in a suitable working environment

3 Introduction to laser cleaning system components and installation

3.1 System host cabinet



未注比例 1X15°



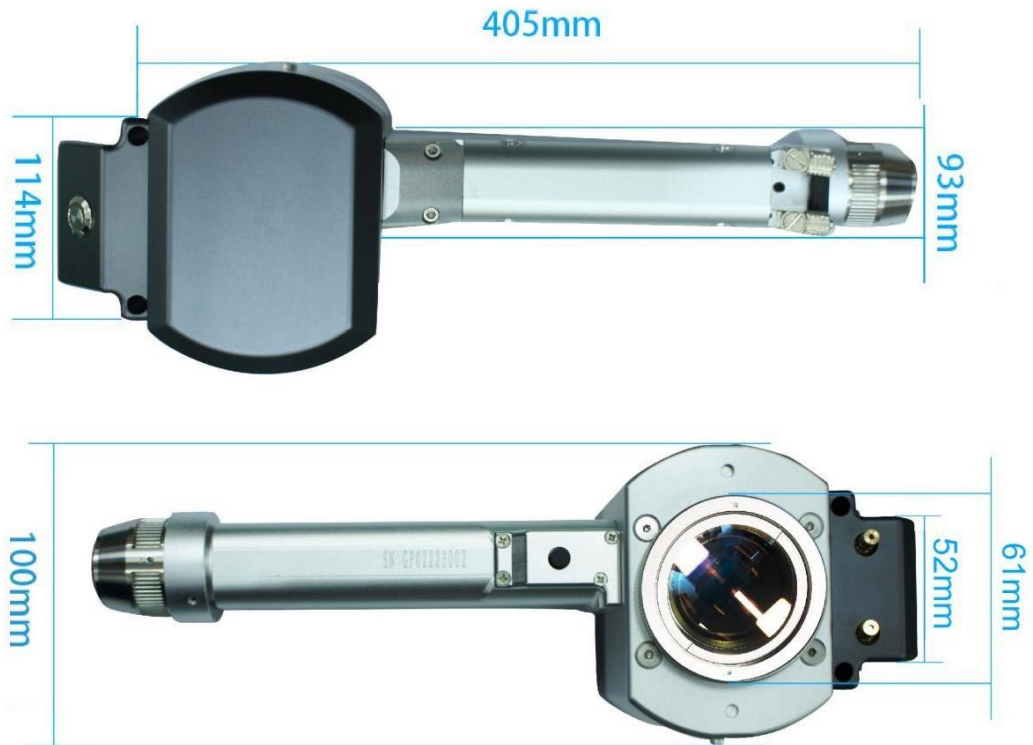
3.2 System chassis external front control panel

The external front panel of the system chassis contains a key switch, an emergency stop button and a touch screen control system, the location and functions of which are described in the following figure and table



Serial number	Name	Function Description
1	Key Switch	Turning clockwise turns the system on and vice versa.
2	Emergency stop button	In case of emergency, tap the emergency stop button to disconnect the working power of the laser.
3	Touch Screen System	Specific instructions for use are described below
Remarks	Laser system start-up	Main power on completion) When the power switch button is pressed, the key is turned on, not in the emergency stop state. Then the laser equipment can be operated by the touch screen system for operation.

3.3 Laser cleaning head



The cleaning head is a two-dimensional oscillating mirror cleaning head, which contains two reflective oscillators. The laser beam is directed through the fiber optic connector to the laser head, where it is reflected by the mirrors and focused by the focusing mirrors onto the working spot for laser processing.

4 Transportation and handling code

Caution : When signing for the equipment, please check the outer packaging of each part carefully, if there is any damage to the packaging or If there is any damage to the packaging or parts caused by transportation, please contact HL immediately.

This laser cleaning system has an anti-vibration monitoring label on the external packaging to monitor and warn against non-compliant transport and handling. If there are signs of serious damage to the outer packaging or if the anti-vibration monitoring label turns red (as shown below), please inform the logistics company and HL immediately.



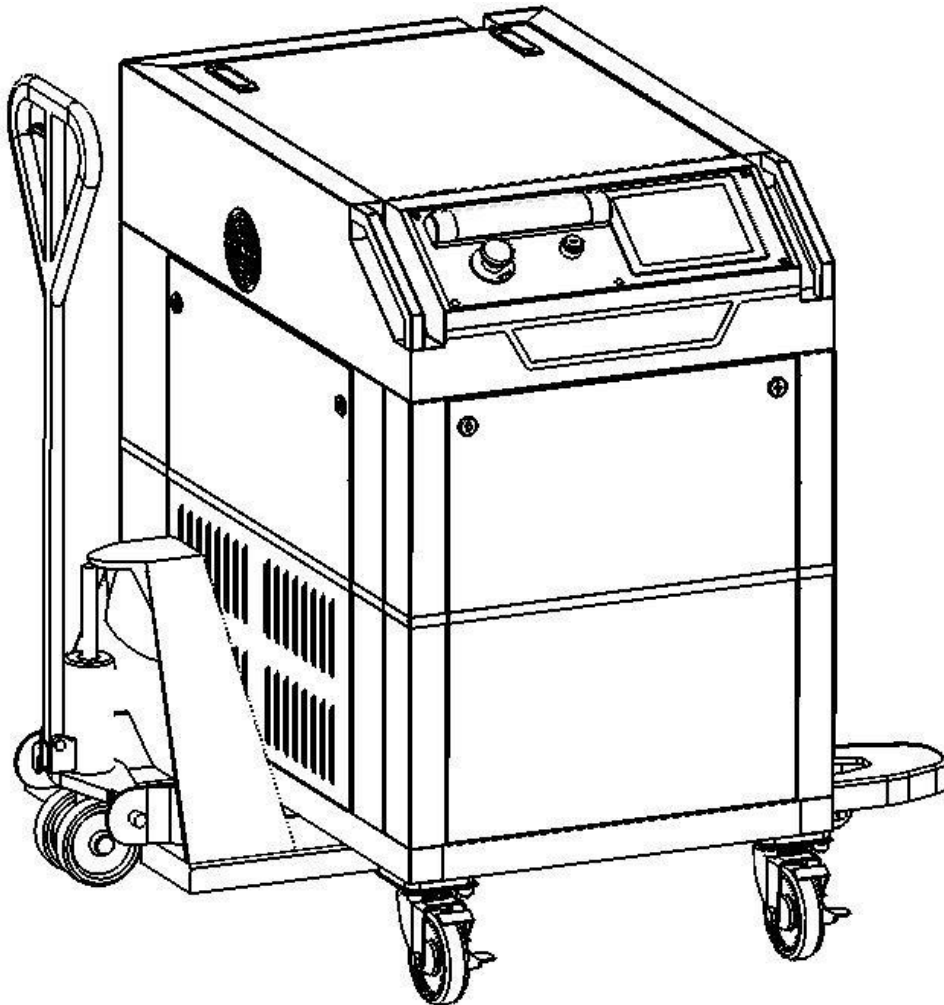
Warning

Operation not in accordance with this handling code can cause damage to the equipment during transport.

- Ensure that the airline box containing the mainframe laser cleaning system is secured on a suitable shipping pallet. The pallet needs to be stored properly for reuse in subsequent shipments.
- The fiber, cable, and connecting wire must be transported separately in the fixing box provided with the HL. During shipment, the fiber and wire protection sleeves must be tightly locked.
- To ensure that the equipment is not damaged during transportation, the equipment must be handed over to a specialized logistics company for transport.

4.2 Transportation and handling requirements

The equipment needs to be shipped in its original packaging. Once the equipment arrives, the original packaging (including the shipping pallets) must be removed and the equipment placed in its final location by means of a pallet truck or forklift. The floor must be level in the loading and unloading area and at the final location.



Loading and unloading area

- The ground in the loading and unloading area must be level, and the equipment must be locked and fixed in the parking device during the loading and unloading process to prevent the equipment from suddenly sliding.
- The load bearing capacity of the floor in the loading and unloading area must be greater than the total weight of the equipment.

4.2.1 Unloading cabinet steps

- i. Remove the wooden box packaging. As the wooden box is made of multiple boards and wooden strips fixed by screw locking, so the wooden box should be dismantled in the order marked on the outer packaging, first remove the front board, then remove the reverse board, and finally remove the top and left and right sides of the board. The dismantled boards, strips, and pallets need to be properly stored so that they can be reused in the subsequent transportation process.
- ii. Remove the foam protective cover wrapped around the surface of the equipment.

4.2.2 Lifting steps

Use the forklift to move the equipment from the pallet to the floor. First operate the forklift and pass the lift arm between the front and rear casters of the equipment, then raise the lift arm to raise the equipment from the pallet and slowly lower it to the floor by the pallet.

4.2.3 Equipment movement in the place of use

The equipment is equipped with bottom wheels to facilitate the movement of the equipment. Before moving the equipment, the operator must ensure that:

- ✓ Disconnect all power
- ✓ Disconnect all interfaces
- ✓ Disconnect the compressed air connection
- ✓ Drain the cooling water inside the tank (note that there may be icing environment need to use compressed air to thoroughly drain the cooling water inside the equipment)



Warning

The fiber can be damaged by excessive bending.

- Before moving the fiber, check the manual for the maximum bend angle of the fiber to avoid damage to the fiber due to excessive bending during the movement.

4.3 Unloading and packing steps

Operation steps :

- 1) Disconnect the power to the host device at the main switch position.
- 2) Disconnect all circuit connections (power connections, interface connections, fieldbus).
- 3) Drain the equipment cooling circulating water, and disconnect the cooling circulating water circuit. (Note that there may be icing environment need to use compressed air to thoroughly drain the internal cooling water of the equipment)
- 4) Disconnect all compressed air connections.

4.3.1 Laser head, fiber and wire packaging

During transportation and loading and unloading, the laser head, fiber must be wound and firmly placed in the protective compartment located on top of the laser cleaning system.

4.3.2 Laser cleaning equipment host packaging steps

- 1) Lift the equipment onto the pallet.
- 2) Securely fix the equipment on the pallet.
- 3) Wrap the foam protective film around the outside of the device.
- 4) Secure accessories (such as fiber optic boxes, cables, etc.) to the back of the equipment with wrapping film.
- 5) Install and seal the vertical boards on the pallet.
- 6) Install and seal the top wood panel cover.
- 7) Install and seal the last board.

5 Product initial launch

5.1 Initial start-up safety code



Dangerous

- Before using this laser cleaning system, make sure that the circuit part of the system is free from any defects.
- **4-pin waterproof plug must be inserted before using the device**
- Before using the system, make sure that the ground wire is connected. Failure to ground the wire poses a risk of injury.
- The laser light source of this system should only be used by operators who comply with the Code of Operational Safety in Chapter 2 of this operation manual.
- The power-up procedure of this system should be started according to the relevant steps in 6.3 System Power-Up Flowchart.
- The working location of the laser light source must meet the requirements of Chapter 4, Transport and Handling Code, of this operation manual.

5.2 Basic requirements for initial start-up

Before starting this laser cleaning system for the first time, please ensure that the following requirements can be met:

- 1) Make sure the tank cooling water is at the normal position of the level indication.
- 2) The 4-pin waterproof plug must be plugged in before using the device.
- 3) Ensure stable voltage and current input and equipment grounding.
- 4) laser cleaning head lens at the uncovered, not aimed at people, not aimed at flammable and explosive objects.
- 5) Personal protective equipment has been worn (laser safety goggles, safety gloves, and anti-noise ear plugs)

5.3 Equipment circuit connection

The laser cleaning equipment rated input voltage is 220 volts, rated input current 14 amps.

5.4 Initial start-up of the equipment

Laser cleaning system start-up steps

Note: The laser cleaning system can automatically control the water tank and the laser switch under normal circumstances, please do not operate it additionally.

- (1) Connect the main power cord.
- (2) Open the internal power master control switch of the front door of the equipment.
- (3) Check that the emergency stop switch is not in the emergency stop state, turn the key switch to ON, and the equipment will be powered on at the same time the water tank will be automatically powered on.
- (4) ensure that the water tank has not read the second (the water tank is normally opened about 5 seconds later) to display the normal water temperature reading, click the system open button on the upper left corner of the main interface of the touch screen system to open the operating system, while the laser will also automatically Power on (laser normal start about 10 seconds, the laser laser light will automatically light), the laser laser light can be normal light, other operations refer to the
- (5) press the safety button at the top of the laser head, press the handle at the laser launch button normal light use

5.5 Emergency equipment shutdown operation procedures

- (1) In case of emergency, immediately tap the emergency stop button.
- (2) Press the safety button at the top of the laser head and close the safety button.
- (3) Turn the key switch to OFF.
- (4) Turn off the internal power master control switch at the front door of the equipment.
- (5) Disconnect the main power cord of the equipment.

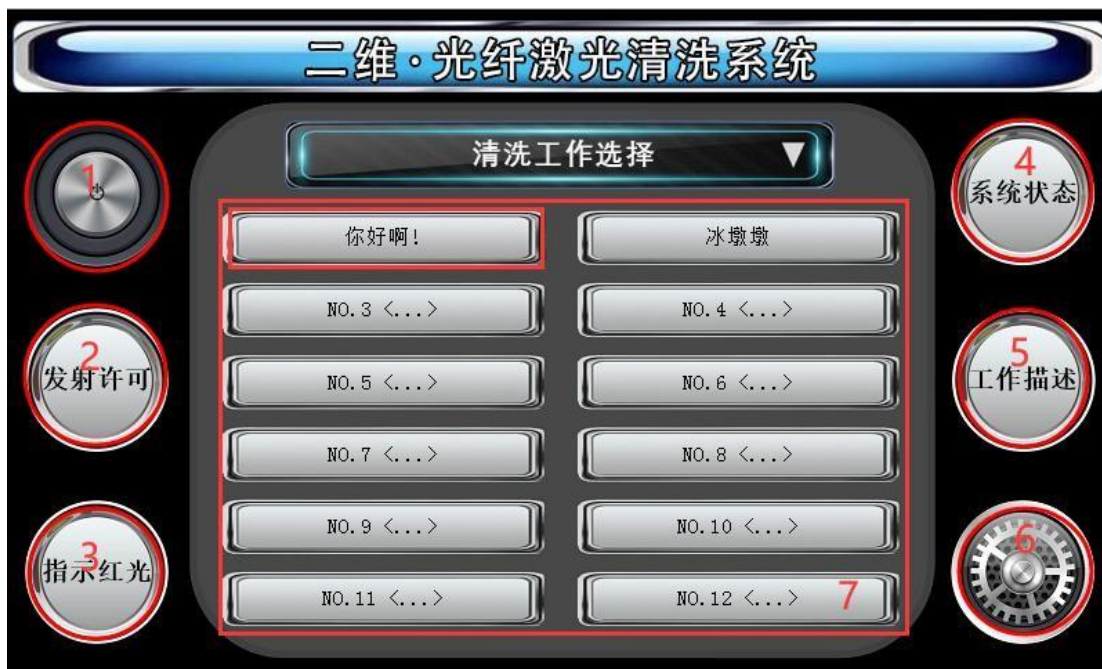
5.6 Equipment shutdown operation steps under normal conditions

- (1) Press the safety button at the top of the laser head to close the safety button.

- (2) Click the system start button in the upper left corner of the main interface of the touch screen system to shut down the operating system, and the laser will be automatically shut down at the same time.
- (3) Turn the key to OFF to disconnect the power of the equipment, and at the same time, the water tank will be automatically disconnected.
- (4) Turn off the internal power master control switch at the front door of the equipment.
- (5) Disconnect the main power cord of the equipment.

6 System operation instructions

6.1 General user interface operation in detail



Serial number	Name Definition	Function Description
1	Master Switch	Screen master switch, the other buttons are effective only when pressed.
2	Launch license	Emitting the laser in preparation. Cooperate with the button on the laser head part to realize the cleaning work.
3	Indicates red light	The laser emits red light for previewing before cleaning work. Including cleaning position, pattern size and other parameters of the preview.
4	System Status	The control system reads the alarm information of the laser and determines whether the laser is in alarm or not, this control only displays the status and cannot eliminate the alarm.
5	Work Description	Click to go to the current system working hours statistics page.
6	Premium Users	Click Enter Password to enter the advanced settings page. (The initial password is 123456)
7	Working Groups	The system initializes 12 groups of cleaning process parameters, each group of parameters is independent of each other, each group of process parameters Each group of parameters is independent of each other, and each group of process parameters can be named simply by customization (click the group name 6 times in succession to enter the edit page).

6.2 Advanced user operations in detail

6.2.1 Basic parameters page



Serial number	Name Definition	Function Description
1	Graphic body	Set the pattern of cleaning out the light, there are 6 types.: ①直线Straight line: — ②Spiral: 8 ③Round: ○ ④Rectangle: □ ⑤Round filling: ● ⑥Rectangular Fill: ■
2	Graphical Direction	Set the direction of the pattern: (straight line / spiral / rectangle, and filled graphics) (There are horizontal and vertical directions, in addition to fill graphics to increase the effect of alternation)

		<p>①Horizontal: —</p> <p>②Vertical: </p> <p>③alternate: +</p> <p>④No direction: \</p>
3	Graphic effects	<p>The fill effect is mainly contested for the fill graphics setting, other graphics have no fill function:</p> <p>①No padding: \</p> <p>②Single filling: ↓</p> <p>③Continuous filling: ↑ ↓</p>
4	Laser power	Adjusting the specific wattage needs to be converted to a percentage (0-100%) by the user.
5	Laser frequency	It needs to be used in agreement with other parameters such as pulse width and power, which are adjusted according to the laser's operating instructions.
6	Laser pulse width	Adjustable pulse width for most lasers, specific values are selected based on the values supported by the laser.
7	Scan length	The length of the outgoing light pattern.
8	Scan Width	The width of the outgoing light pattern.
9	Scanning speed	The scanning speed is an adjustment factor, the larger the value, the stronger the light continuity; the smaller the value, the weaker the light continuity. smaller the value, the weaker the continuity of the light. The user can set the corresponding value according to the effect.
10	Preview	Same function as "red light".
11	Switch	Same function as "launch permit".
12	Save	Save the modified process parameters and continue to use the saved parameters the next time you turn on the machine.
13	Advanced Settings	Go to the Advanced Parameters page.
14	Back	Returns the normal user interface.

6.2.2 Advanced parameters page



Serial Number	Name Definition	Function Description
1	XY ratio (± 80)	0 is the default value, above 0 is lengthening the default value, below 0 is shortening.
2	XY Displacement (± 80)	0 is the default value, above 0 is offset in the positive direction, below 0 is offset in the opposite direction.
3	End optimization (0-10)	Diminish the focus problem caused by too much light coming out of the ends of the graph, the higher the value, the better the effect.
4	Filling spacing(0-200)	The larger the value, the faster the fill and the less dense the fill; the smaller the value, the slower the fill and the more dense the fill.
5	Laser Selection	Enter the laser selection interface, select the laser used by the system, and match the After that, the corresponding laser pulse width and frequency range will appear in the corresponding limited range.
6	Lens Selection	Enter the focus lens selection interface and select the specifications of the focus lens on the laser head.

7	Language selection	Enter the language selection screen and select the language of the entire interface. (Currently available in Simplified Chinese, Traditional Chinese, English, Japanese, and Spanish, continuously updated)
8	Save	Save the modified data.
9	Back	Returns to the parameter settings.

6.3 Laser cleaning system main technical parameters

6.3.1 Laser cleaning system

Parameter Name	Parameter values
Laser output wavelength (nm)	1064
Working mode	Continuous / Modulated
Laser pulse frequency (kHz)	50 - 10k
Maximum output power (W)	1500
Power adjustment range (%)	10-100
Output power instability (%)	≤3
Conducting fiber length (m)	10 (Customizable)
Minimum fiber bend radius (mm)	≥300
Laser protection level	4
Operating temperature (°C)	+10 – +40
Storage temperature (°C)	-10 – +60
Relative humidity (%)	≤ 70

6.3.2 Cooling water system

Parameters	Unit	RFL-A1000D	RFL-A1500D	RFL-A2000D
Cooling capacity	W	≥3000 (1.2 hp)	≥4000 (1.6 hp)	
Minimum flow rate	L/min	8	10	
Maximum input pressure	Bar	7		
Water hose fitting types and sizes	mm	Straight through quick plug (connects to outer diameter Φ10, PU water pipe)		
Type of water cooler	/	Dual-temperature dual-control type		

a) Cooling system water temperature setting:

Summer (ambient temperature above 30°C) $25 \pm 0.5^\circ\text{C}$

Winter (ambient temperature below 30°C) $22 \pm 0.5^\circ\text{C}$.

b) Coolant requirements:

1) The cooling water is pure water, and it is recommended that pure water for drinking can be used.

2) In order to prevent the growth of mold in the water in the chiller leading to blockage of the pipeline, it is recommended to add ethanol when filling pure water, the volume ratio of ethanol is 10%.

3) When the ambient temperature around the equipment is at -10°C to 0°C , ethanol solution with a volume ratio of 30% must be used and replaced every two months.

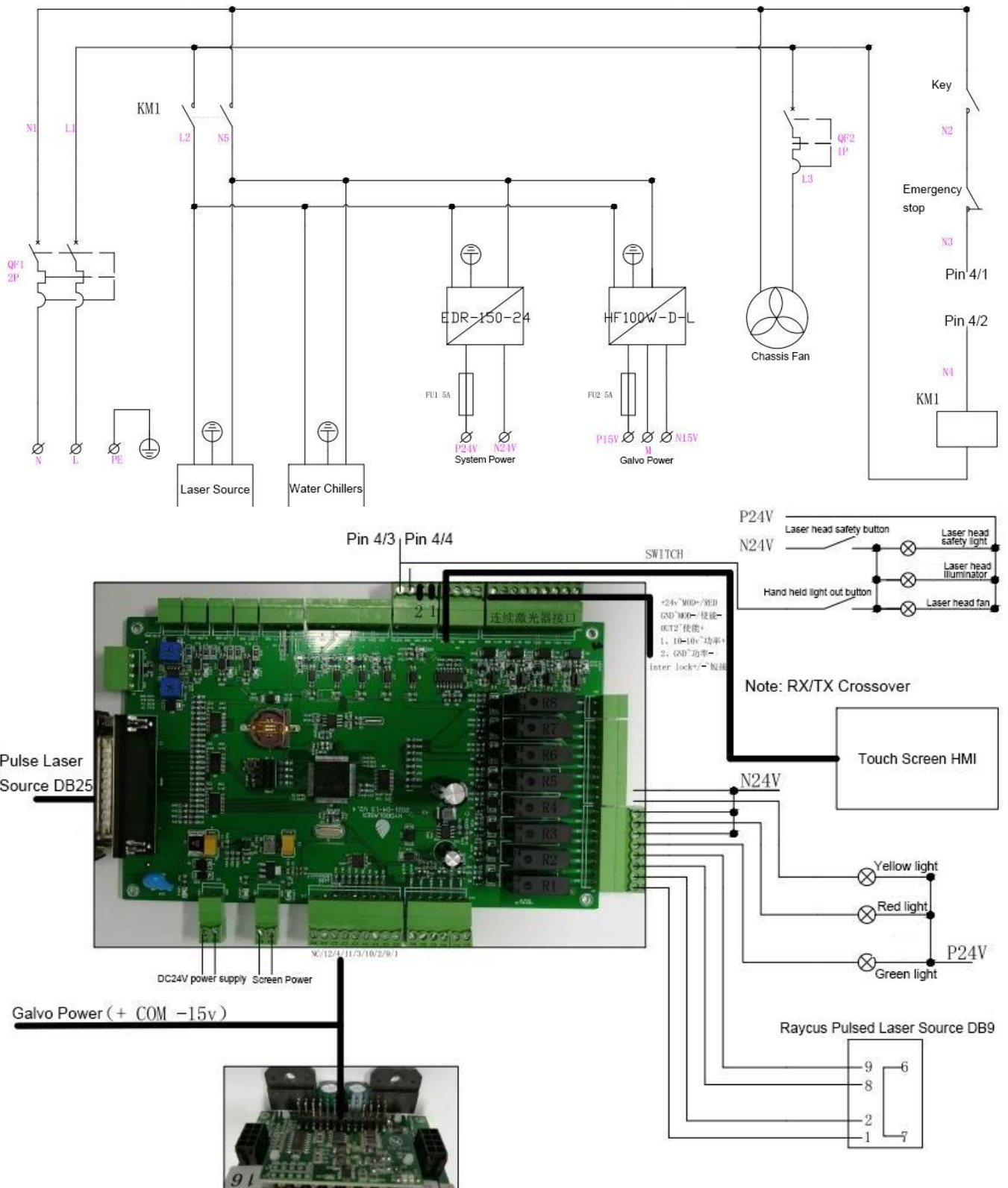
4) When the ambient temperature around the equipment is lower than -10°C , a dual system (with heating function at the same time) chiller must be used, and the cooling system must run uninterruptedly.

c) Other requirements for cooling systems:

1) When starting the cooling system for the first time, the entire water system and joints should be checked for leaks. External water pipes must be installed and connected according to the water inlet (IN) and water outlet (OUT) marked on the laser, otherwise the laser may not work properly.

2) If the laser is not used for a long time, the cooling water inside the cooling system and inside the laser should be emptied, otherwise it will cause irrecoverable damage to the laser equipment.

6.3.3 Electrical schematic

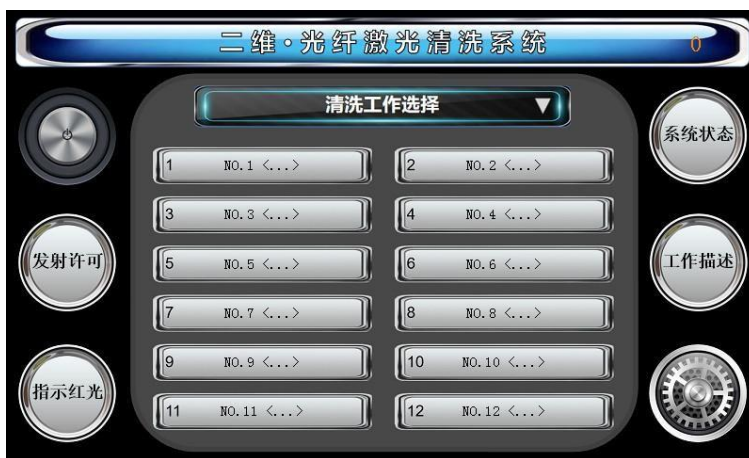



6.4 Instructions for use

6.4.1 Power-on page

No operation is required after the screen is powered up, wait for a few seconds and the screen will automatically jump to the user operation page.

6.4.2 User operation page




After the screen jumps to this page, you need to press  button to operate the screen, if not pressed, other buttons will be invalid.

The first time you use the screen, the cleaning job automatically defaults to the first, as shown below



6.4.3 Launch license




Press  button to fire the laser ready to work with the button on the laser head area to achieve cleaning.

Note: If the Send Permit button is pressed, the system is waiting for the button on the laser head to be pressed to operate, while the other buttons are disabled.

6.4.4 Indication of red light



Press  button to preview the cleaning work before the laser emits red light, including the preview of the cleaning position, pattern size and other parameters.

Note: When the red button is pressed, all buttons on this page will be disabled, except for the send permit button, which will not be disabled, and when the send permit button is pressed, the red button will automatically turn off and the transmit permit will turn on.

6.4.5 Parameter modification



To make parameter changes, press  button.



Enter the password (please see the normal user operation page for details on the password) to enter the basic parameters page and modify the parameters you need.




Press **图形:** to modify the laser scan graphics, currently there are six.








Press **方向:** to modify the laser scanning direction, there are currently three.








Press  to modify the fill method, there are currently three.



The parameters of laser power, laser frequency, laser pulse width, scan length, scan width and scan speed are modified in the same way e.g. Press  button for laser power, The value of  display will be -1, Press  button for laser power, The value of  display will be +1, The plus and minus buttons support long presses, and the value will continue to increase or decrease when pressed for a long time. Clicking on  display box will show a small keyboard that allows you to directly enter the parameters you need to set.



Under that page, The function of  button is the same as  under the user action page,  button has the same function as  button. So once we have adjusted the relevant parameters, we can use it directly to see if it is the effect you need, without returning to the user action page.

If you need more precise parameter settings, press  button to go to our advanced parameter settings page.



This page allows you to set the parameters for X-ratio, X-displacement, end-optimization, Y-ratio, Y-displacement, and fill spacing in the same way as the parameters for laser power on the Basic Parameters page. In this page, the laser, lens and system language can also be modified.

For example:

6.4.6 Modifying lasers




Press  button to enter the laser modification page



Just choose the laser manufacturer you need.

6.4.7 Modifying lenses



Press  button to go to the lens modification page



Just select the lenses you need.

6.4.8 Modifying the system language


Press  button to enter the system language change page



Just select the language you need.

Note: Currently this system only supports 7 languages (Chinese, Traditional Chinese, English, Italian, Japanese, Spanish, Polish).

6.4.9 Password change

To make a password change, press  button.




Click **修改密码** button to go to the password change page



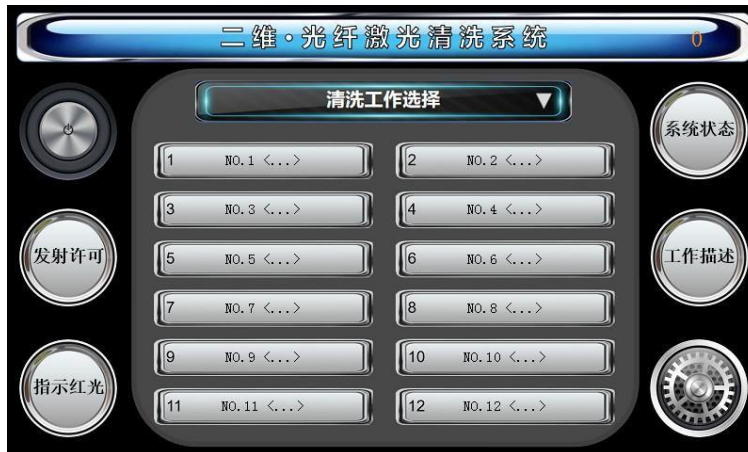
Follow the prompts and set the password you want to set


The factory password is 123456




Press  and your password is changed. The next time you enter the basic parameter setting page, your password will be the one you changed.

6.4.10 System Status



This control  is only a display control. The control system reads the alarm information of the laser and determines whether the laser is in alarm or not.


6.4.11 Work description

Click  button to go to the following page.



This page only records the current power-on usage time and the accumulated usage time.

6.4.12 System activation

Note: Basic parameter setting page, advanced parameter setting page, laser modification, lens modification, There is a separate  button for each language modification page. After each parameter setting or language setting, if the save button is not pressed, the setting will be valid only for the current time, and the system will restore the last saved setting or the language setting when the power is turned off and on next time.

Initial settings, in case the parameters you have set are lost, it is recommended to press the Save button after each change.

7 Laser cleaning system maintenance

Regularly check whether the various components of the laser cleaning system are working properly, and contact the supplier's engineer if problems are found.

This laser cleaning system should only be maintained by personnel who are qualified or trained in laser cleaning equipment maintenance. Do not power up a laser cleaning system that has not been connected to the circuit or has a defective circuit system to avoid accidents. All system cleaning and system maintenance must be done with the system off and power off. Strictly follow the system shutdown procedures in this manual and ensure that labor protection supplies are available for post-production use after maintenance work is completed. When the operator finds that the system (including the laser, laser cleaning head) has a power failure, please shut down the system immediately. Please do the appropriate safety checks and product maintenance on a regular basis.



Dangerous

The maintenance process carries the risk of serious injury.

- This laser cleaning system can only be maintained by personnel who are qualified or trained in the maintenance of laser cleaning equipment.
- The electrical components of the equipment may only be maintained by a qualified electrician.
- Read the safety precautions in the operating instructions carefully before starting maintenance work.
- Turn off the equipment and disconnect the power before starting maintenance work.

8 Common troubleshooting

Failure	Possible causes of failure	Troubleshooting methods
The device is not powered on and the screen does not light up	Poor external power supply	Confirm that the external power supply is stable and normal
	Fuse abnormalities	Verify that the fuse is working
	Emergency stop is "off"	Make sure the emergency stop switch is "on".
		Make sure the four-pin waterproof plug is properly installed
	The system security key switch is "Off" state	Make sure the security key switch is "on"
Laser cleaning head does not radiate laser light	Safety button above the laser head is "off"	Make sure the safety button above the laser head is "on"
	Abnormal system parameter setting	Confirm that the system parameters laser power, frequency, pulse width and other settings are normal
	Obscured at the laser head lens	Confirm that there is no obstruction at the laser head lens
	Laser anomaly	Confirm that the laser out of the red light no abnormal, laser no alarm
	Laser head lens abnormal	Confirm that the laser head lens is clean, undamaged and free of abnormalities
Outgoing light power is unstable or attenuated	Poor external power supply	Confirm that the external power supply is stable and normal
	Fiber bending or twisting over large	Check that the fiber is not twisted more than 180° and that the fiber bend radius is greater than than 150mm
	External electromagnetic interference	Confirm that there is no electromagnetic interference in the surrounding environment of the equipment
	Abnormal system parameter setting	Confirm that the system parameters laser power, frequency, pulse width and other settings are normal
	Fiber End Isolator /QCS/QBH Abnormalities	Verify that the lens at the fiber end isolator/QCS/QBH is clean and free of dirt, No damage, no abnormalities
	Laser anomaly	Check laser status via laser host software