

GY-QBFXYP500

User Manual of Laser Cleaning System

**Scope of application QBH
Connector and QCS Connector,
20mm**

1. Preface

1.1 Welcome

Thank you for choosing our GY-QBFXYP500 laser cleaning system. This user manual provides essential safety, operation, and maintenance guidelines. Before using the product, please read this manual carefully and keep it properly. To ensure safe operation and optimal performance, please follow the precautions and warnings below.

This user manual is not a quality guarantee. Our company reserves the right to correct printing errors, modify the information, or improve the product without prior notice. The corrections will be included in the revised version of the user manual.

2 Product Introduction

Laser cleaning is a novel technology based on the interaction between laser and materials, capable of effectively removing surface contaminants and adherent substances. Compared to traditional cleaning methods, laser cleaning offers advantages such as non-contact operation, substrate integrity preservation, precise cleaning, environmental friendliness, and online feasibility, making it particularly suitable for high-speed online cleaning in designated areas.

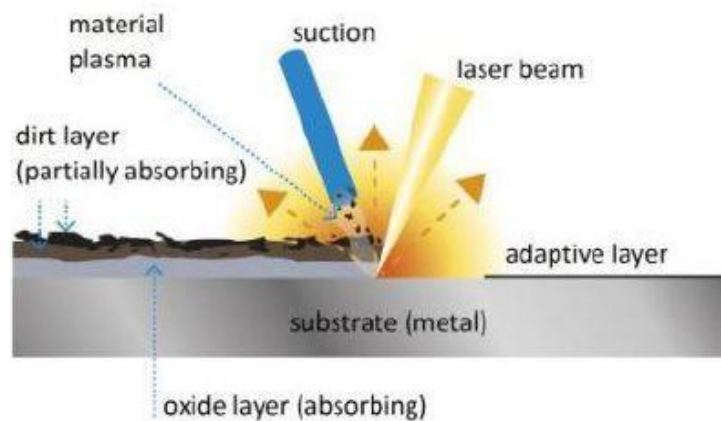


Figure 2.1 Schematic diagram of laser cleaning

Our company's laser cleaning equipment represents the latest generation of high-tech surface treatment solutions, featuring easy installation, intuitive operation, and automated functionality. With a single power switch, the system performs chemical-free, medium-free, dust-free, and water-free cleaning while adapting to curved surfaces. It delivers exceptional surface cleanliness, effectively removing resins, paint, oil stains, dirt, rust, coatings, plating, and oxidation layers. Widely used in industries such as shipbuilding, automotive repair, rubber molds, precision machinery, rail systems, and environmental protection, our equipment meets diverse industrial demands.

2.1 Characteristics and Implementation Standards of Laser Cleaning

(1) Characteristics of laser cleaning

- ◎Non-contact cleaning without damaging the component substrate;
- ◎Precision cleaning enables targeted cleaning at exact positions and dimensions;
- ◎No chemical cleaning agents required, no consumables needed, safe and eco-friendly;
- ◎Easy to operate, suitable for manual handling or automation with robotic arms for cleaning;
- ◎ Ergonomic design significantly reduces operational labor intensity;
- ◎The laser cleaning system operates stably with minimal maintenance requirements;

(2) Product Implementation Standards

Our company has obtained ISO9001 international quality management system certification, establishing a comprehensive quality assurance system covering design, production, and service for small and medium power laser processing equipment.

Our company has established detailed standards for the working environment and conditions, basic technical requirements, cooling requirements, laser radiation safety, electrical safety, test methods, inspection and acceptance, as well as packaging and transportation during the production process. The national standards referenced in these standards include:

GB10320 Electrical Safety of Laser Equipment and Facilities

GB7247 Radiation safety, equipment classification, requirements and user guide for laser products

GB2421 Basic Environmental Test Procedure for Electronic Products

GB/TB360 Specification for testing instruments for laser power and energy measurement

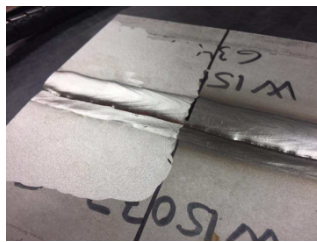
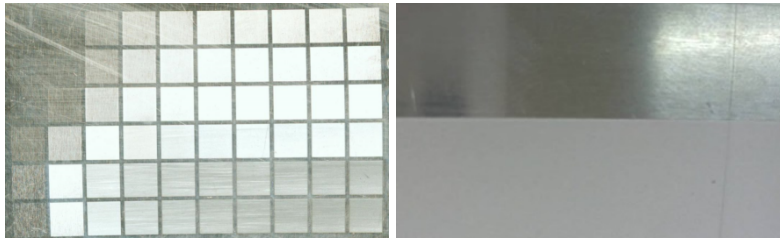
GB/T13740 Test method for divergence angle of laser radiation

GB/T13741 Test method for laser beam diameter

GB/T13862-92 Test method for laser radiation power

GB2828-2829-87 Batch Cycle Inspection Count Sampling Procedure and Sampling Table

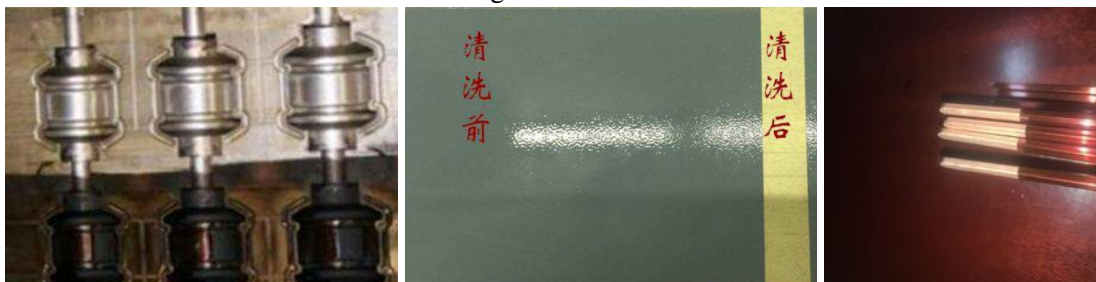
2.2 Applications of Laser Cleaning Products



Laser Cleaning of Aluminum Alloy before and after Welding



Laser Cleaning of Metal Surface Oxide



c Laser cleaning of oil stains and paint



d laser rust removal
Figure 2.2 Typical laser cleaning applications

2.3 Product Technical Features

The laser cleaning system independently developed by our company features the following characteristics:

(1) Independently developed laser cleaning dedicated underlying control system and application software

- Perfectly compatible with the majority of laser cleaning light sources available on the market.
- The interface of the software is clear and simple, and the operation is convenient.
- Built-in database system, can save and edit 50 sets of process data;
- The laser power, laser repetition frequency and other laser parameters are freely adjusted;
- With online pulse width modulation capability (if the laser supports), it optimizes process parameters according to on-site conditions.
- Optimization of galvanometer control and positive sine wave signal control effectively reduce the heat generation of the galvanometer, thereby extending its service life.
- The dual-axis version offers 13 cleaning modes: straight, rectangle 1,

rectangle 2, circle, sine wave, spiral, free mode, ring, rotation, triangle, rotating circle, rotating straight line, and linear rotating circle, meeting diverse application needs.

- Adjustable scanning speed, up to 30 meters per second.

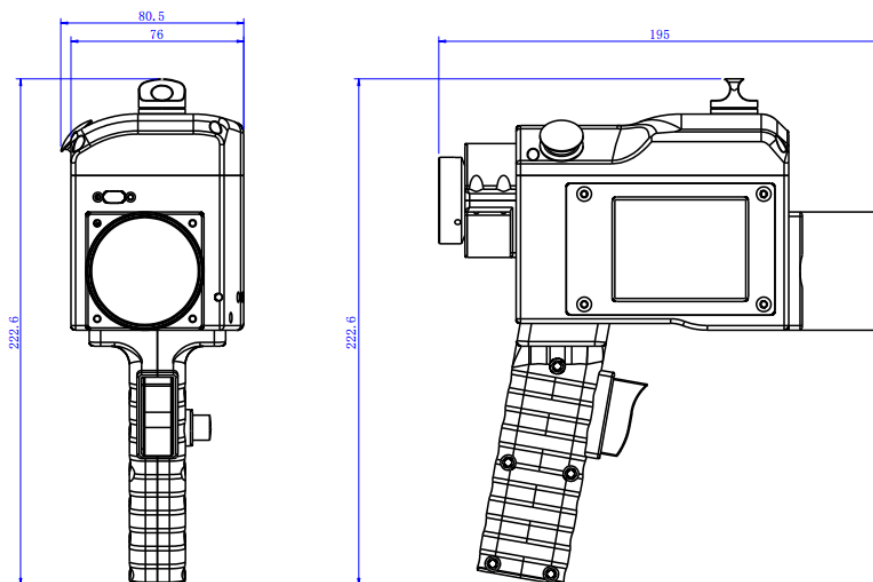
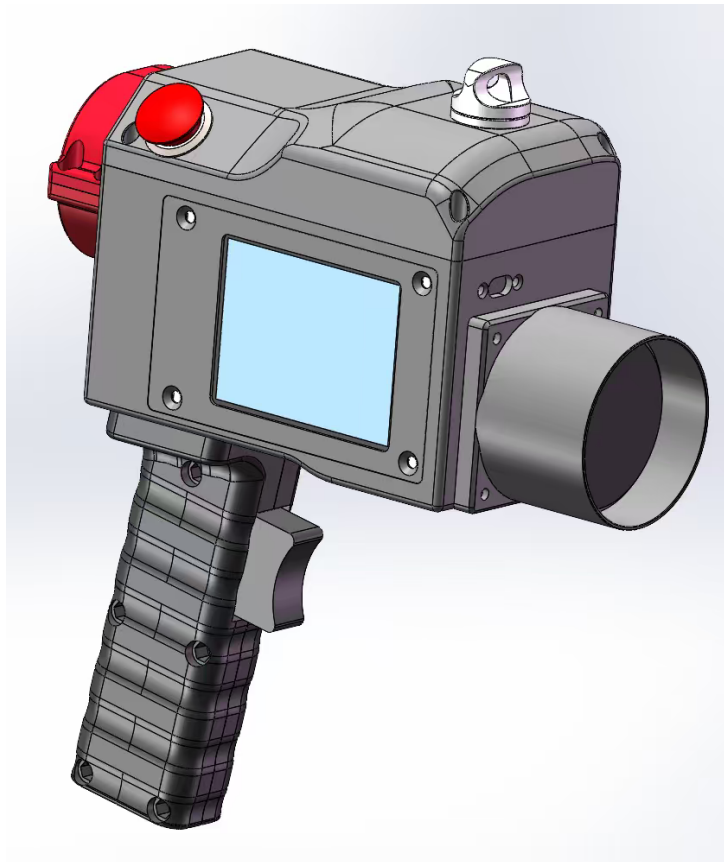
(2) Professional Optical Design for Laser Cleaning

- The galvanometer mirror with high damage threshold, the field mirror with high light transmittance and large focal depth, can meet the long-term operation of high-power laser cleaning;
- The high-performance laser galvanometer features rapid scanning speed and high precision, combined with professional control software systems, to meet diverse laser cleaning application requirements.

(3) Lightweight design of the cleaning head

- Portable design: The cleaning head is compact and portable, with a moderate handle for comfortable use.
- Lightweight design: The cleaning head weighs under 1.25kg, making it easier to hold for extended periods.
- Dustproof sealing design: The outer optical path is sealed and dustproof to effectively prevent contaminants such as dust generated during cleaning from entering the optical path and cleaning head, thereby avoiding performance degradation or damage.
- The front-end dust-blowing curtain design of the field mirror effectively protects it from airborne dust or oil contamination.
- Removable dusting nozzle bracket (optional): features an independently adjustable nozzle with flexible height and angle settings for enhanced dusting performance.
- Anti-interference design: Enhance the anti-interference capability of the cleaning head through measures such as signal reinforcement, signal line shielding, gel-coated galvanometer, and metal shielding housing design. Ensure that the integration of robots and vacuum cleaners does not interfere with the stability of light output.

2.4 Cleaning Head Structure and Dimension Diagram



graph 2.3 GY-QBFXYP500

2.5 Main Technical Parameters of the Product

Java runtime environment Java	
content	parameter
service voltage	Single-phase 220V $\pm 10\%$, 50/60Hz AC Customizable air-cooled laser: 110V, 50Hz alternating current (AC)
System power consumption	less than 120W
operating ambient temperature	0°C~40°C
Humidity of the working environment	$\leq 80\%$
optical parameters	
laser average power tolerance	$\leq 500W$
optical transmittance	$\geq 98\%$
laser power modulation	Adjustable continuous gradient from 10% to 100%
laser pulse frequency modulation	1kHz-4000kHz continuous gradient adjustable (customizable)
Laser pulse width modulation function	support
focal distance	Standard 210mm (available in 160mm/254mm/330mm/420mm)
incident spot diameter	$\leq 10mm$
Cleaning of the head and parameters of the galvanometer and field lens	
Cleaner head size	As shown in Figure 2.3, the special QCS connector supports customization.
Cleaner head weight	$< 1.5Kg$ (excluding optical head)
run-length	0mm-300mm available
scan frequency	No less than 300Hz
maximum scan line speed	approximately 30000/min
material of galvanometer	quartz
mirror material	quartz
filed lens	quartz
Other parameters	
screen size	Standard 7-inch display (4.3-inch optional) with 2.8-inch front-facing camera

Cable length	Standard length10 meters
mode of operation	Handheld/Automated

2.6 Configuration List

name	ts	unit	quantity	remarks
laser cleaning head	GY-QBFXYP500	individual	1	
Control card/box	GY-FLCS	cover	1	including vibration-bearing mirror system
touch screen	7 inches	individual	1	Includes a 2.8-inch small screen
Process Database	built-in	cover	1	
filed lens	Standard F210 field lens	individual	1	160mm-420mm available
protective lens	43*2	a flat	2	

3 Installation and Use of Laser Cleaning Machine

Precautions before use:

- Inspect the product appearance for abnormalities and check for damage to output cables or other related phenomena.
- Connect the quick connector correctly according to the control box label.
- Connect the power supply correctly and ensure proper wiring contact.
- Inspect and ensure that the cleaning head protective lens is free of dust and contaminants inside and outside.

3.1 Operation Steps

Step 1: Remove the handheld cleaning gun, ensure the button switch on the handle is released, and remove the dust cover from the front lens of the laser cleaning gun.

Step 2: Connect the external power cord to power on and activate the emergency stop switch;

Step 3: Press the 'Start' button to power on and initialize the system.

Step 4: After system startup, configure laser cleaning parameters via the touchscreen interface.

Step 5: After completing the laser parameter settings, press the laser enable button on the laser cleaning operation screen (make sure the button switch on the handheld head handle is released before pressing).

Step 6: Put on laser safety goggles, align the laser head with the workpiece, press the orange button on the handheld handle, and the laser will emit light to start cleaning.

Step 7: After use, sequentially close the enable button, cover the field lens dust cover, pop up the 'Start' button, turn off the emergency stop switch, return the cleaning nozzle to the main unit storage box, and disconnect the main power supply.

3.2 Software Control Interface

3.2.1 Boot Screen

When the device is powered on, it enters the Power-On Wait Interface (as shown in Figure 3.1); the display of this interface indicates that the screen and the control board are currently connected. If the connection is normal (this process takes approximately 5 seconds), the system will transition to the operation interface. If the transition does not occur within a reasonable time frame, it may indicate an abnormal connection between the screen and the control board; in this case, please power off the device and check whether the connectors are properly and securely seated.



Figure 3.1 – Software Startup Interface

Note: The software interface logo, device model, company information, etc., can be customized; this illustration is for descriptive purposes only (the same applies below).

3.2.2 Setup Interface

After the system initialization is complete, the operation interface will be displayed. Before using the cleaning equipment, first click the "Settings" button located in the lower-left corner of the operation interface to access the Cleaning System Settings interface, as shown in Figure 3.2. The System Settings interface displays the control card version number and the touchscreen version number. From

this interface, you can configure settings such as the safety distance, laser type, and the laser output control mode (selected by single-or double-tapping the temperature button); additionally, you can specify the mirror type (single-axis or dual-axis).



- Automatic Shutdown Enable: Set the automatic shutdown enable duration (in minutes). When the preset time is reached while the laser is active, clicking "Enable" will disable the automatic shutdown function; clicking "Disable" will reactivate it.
- Timed laser shutdown: Set the duration of a single laser pulse (unit: seconds); once the single laser pulse reaches its set duration, the laser output will stop;
- Safety Distance: The ranging sensor's operating range is set by default to a minimum of 10 cm and a maximum of 50 cm; when the distance is less than 10 cm or greater than 50 cm, the ranging alarm will not emit light; however, the laser will emit normally within the range of 10–50 cm.
- Single-click: Press the Cleaning Head button once to emit a laser beam; after clicking "Single-Click", switch to Double-Click mode. Double-axis: The cleaning head operates on both X and Y axes; if the cleaning head is single-axis, click "Double-Axis" to switch to Single-Axis mode. Distance Measurement: Activates the distance measurement sensor; Mirror Activation: Activates the mirror alarm switch; Chiller Activation: Activates the chiller alarm switch; if the equipment is not equipped with a chiller, click "Chiller Activation" to disable the chiller alarm.
- X/Y Coefficients: Used for field lens/focusing lens configuration; when the focal length or actual working distance of different field lenses/focusing lenses differs, the actual scanning width and height can be corrected using the field lens coefficient. Password: 123;

Field Lens Model	wide in width(mm)	focal distance(mm)	coefficient	remarks
F150	120	150	100	F150 requires customization.
F200	150	200	120	
F250	180	250	140	
F300	220	300	170	
F350	260	350	195	The F350 requires customization.
F400	290	400	220	
F500	360	500	280	

- Language Switch: Configure your system language settings; 15 languages are currently supported – additional languages can be customized if needed.
- Distance function: Default – enabled;
- Temperature setting: Default – 50°C;

3.3 User Interface

3.3.1 Scanning Method

The operating interface offers 13 cleaning modes, which can be switched via the "Scan Mode" option on the screen (with cyclic switching): Linear Mode, Rectangular Mode 1, Rectangular Mode 2, Circular Mode, Sinusoidal Mode, Spiral Mode, Free Mode, Ring Mode, Rotation Mode, Triangle Mode, Rotating Circle Mode, Rotating Linear Path, and Linearly Rotating Circle.

(1) Linear Mode

In this mode, the scanning method is linear; the interface is shown in Figure 3.3.



Figure 3.3 – Linear Scan Mode Operation Interface

- Laser power: Set the average laser output power within the range of 10%–100%;
- Frequency: Laser pulse repetition frequency setting, range: 1–4000 kHz;
- Scanning speed: The speed at which the laser spot focused on the workpiece surface moves; the maximum scanning speed depends on the scanning width;

run-length(mm)	Scanning speed (mm/s) (Upper limit)
Over 50	30000
40-49	18000
30-39	14000
20-29	12000
10-19	6000
5-9	3000
3-5	2000
1-3	1000

- Scan width: Set the linear scan width, ranging from 5 mm to Mx (the Mx value depends on the size of the field lens or focusing lens);

Scene type	Scanning range: Mx (mm)
F150	120
F200	150
F250	180
F300	220
F350	260
F400	290
F500	360

- Scan count: To be used under special circumstances; the number of scans can be set; when the specified number of scans is reached, the light output will stop; the default value is 0;
- Enable: After completing the parameter settings, click the Enable button; the system and laser will then enter the light output preparation state.
- Pulse width: Set according to actual field requirements; range: 1–500 ns;
- Edge Coefficient: Edge Extinction – eliminates the intense light spots at both ends of the laser beam; default value is 0; maximum setting is 2000 – adjust this value according to actual field requirements; when using this function, it is recommended to set the value to 500; Password: 123;
- Damping Delay: When combined with the Edge Coefficient, this feature effectively eliminates strong light spots on both sides; the default value is 0 – it is recommended to set this to 0.5 when using this function. Password: 123;
- Chiller alarm: The chiller's fault output signal is connected to the control card; when an alarm is triggered, the interface will display it. For air-cooled equipment, please short-circuit this signal to suppress it or disable the chiller alarm signal on the screen interface.

(2) Rectangular Mode

In this mode, the scanning method is rectangular; the interface is shown in Figure 3.4. The definitions and ranges for power, frequency, pulse width (duty cycle),

scanning speed, scanning width, and number of scans are the same as those in the linear mode; they will not be repeated here (the same applies below).



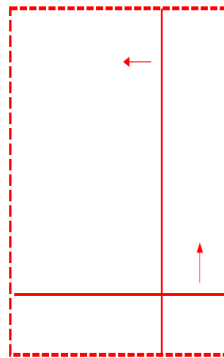
Figure 3.4 – Rectangular Scanning Mode Operation Interface

- Fill Distance: Sets the laser filling distance within the rectangle (range: 0.01–1 mm); affects the spot overlap rate along the Y-axis; default value: 0.1;
- Scan Height: Sets the scanning height for the rectangle; range: 1 mm – Mx (the Mx value depends on the field lens coefficient);

Scene type	Scanning range: Mx (mm)
F150	120
F200	150
F250	180
F300	220
F350	260
F400	290
F500	360

(3) Rectangular Two-Mode

The Rectangular Mode II is essentially the same as Rectangular Mode I; it adds a horizontal cleaning mode to the vertical cleaning mode of Rectangular Mode I.



(4) **Circular Mode**

In this mode, the scanned shape is circular (as shown in Figure 3.5); the scanning range is defined solely by the circular diameter and the fill spacing;

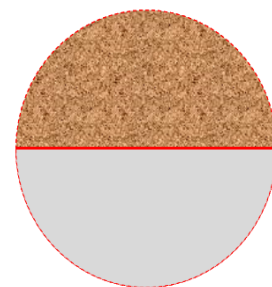
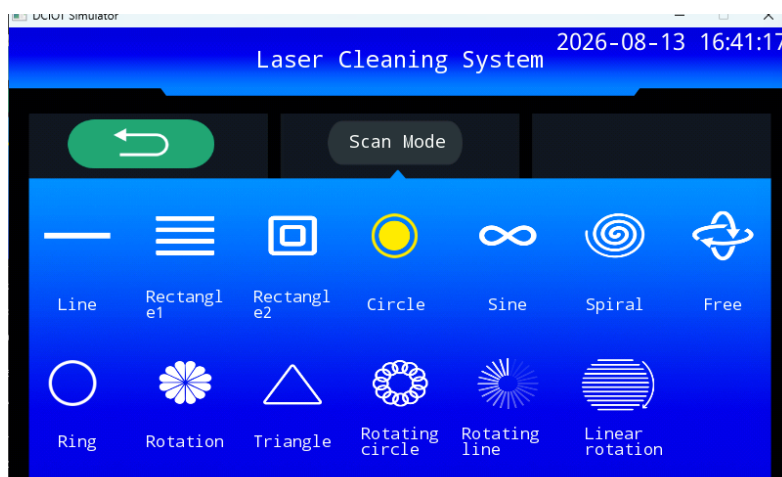


Figure 3.5 – Circular Scanning Mode Operation Interface

(5) Sinusoidal Mode

In Sinusoidal Mode, the scanning waveform is a sine curve; the operating interface is shown in Figure 3.6. In Sinusoidal Mode, the sinusoidal period must be set: this represents the period of the sine wave along the X-axis; a smaller numerical value corresponds to a higher waveform oscillation frequency, with a range of 1 mm–100 mm;

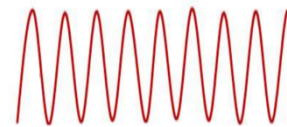
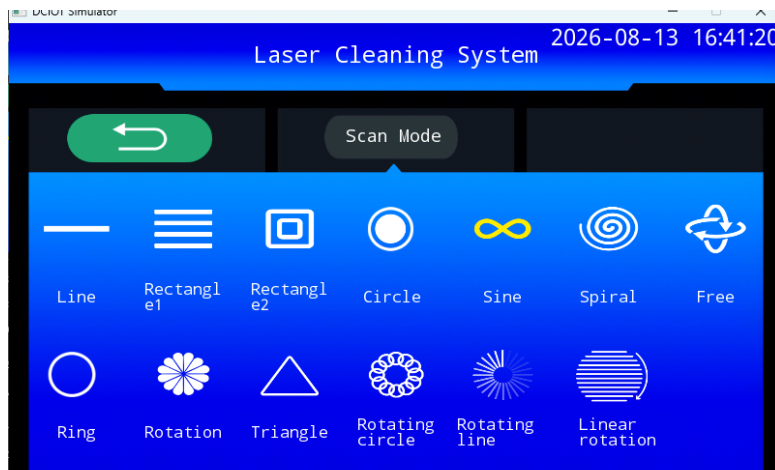


Figure 3.6 – Sinusoidal Scanning Mode Operation Interface

(6) Spiral Mode

In the spiral mode, the scanning waveform follows a spiral curve; the operating interface is shown in Figure 3.7. The parameter settings are identical to those in the sine wave mode.

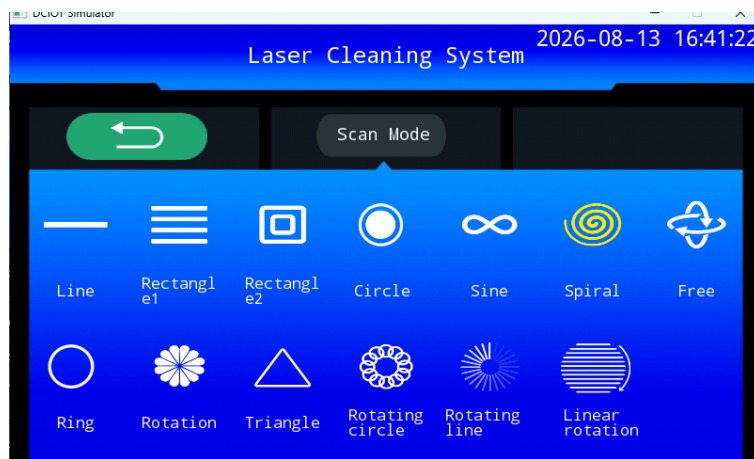


Figure 3.7 – Helical Scanning Mode Operation Interface

- Series: Number of waveforms in spiral mode (range: 1–16);

(7) Free Mode

In Free Mode, the width and frequency of the X-and Y-axis motors can be freely configured within specified ranges. In this mode, the scanning speed is not constant and may not be accurately calculated; moreover, various scanning waveforms are possible. This mode serves as a supplement to the aforementioned five modes, enabling it to accommodate a wider range of application scenarios.



Figure 3.8 – Free Scan Mode Operation Interface

- X/Y frequency: less than 100 Hz;
- Scan Height: Set the scan height for Free Mode; range: 1 mm – 50 mm;

(8) Circle

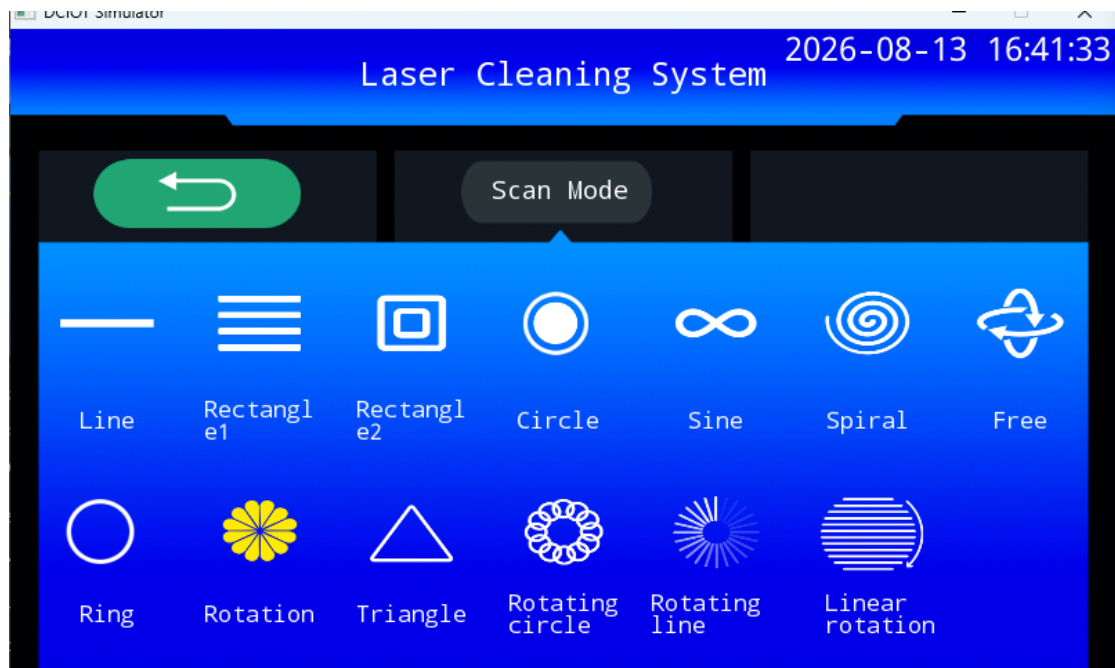
This mode represents a scenario where a ring gradually contracts inward, as shown in Figure 3.9; here, the fill spacing corresponds to the rate of the ring's contraction.



Figure 3.9 – Ring Mode Operation Interface

- Edge coefficient: Adjustable inner circle size (range: 0–100%);

(9) Rotation



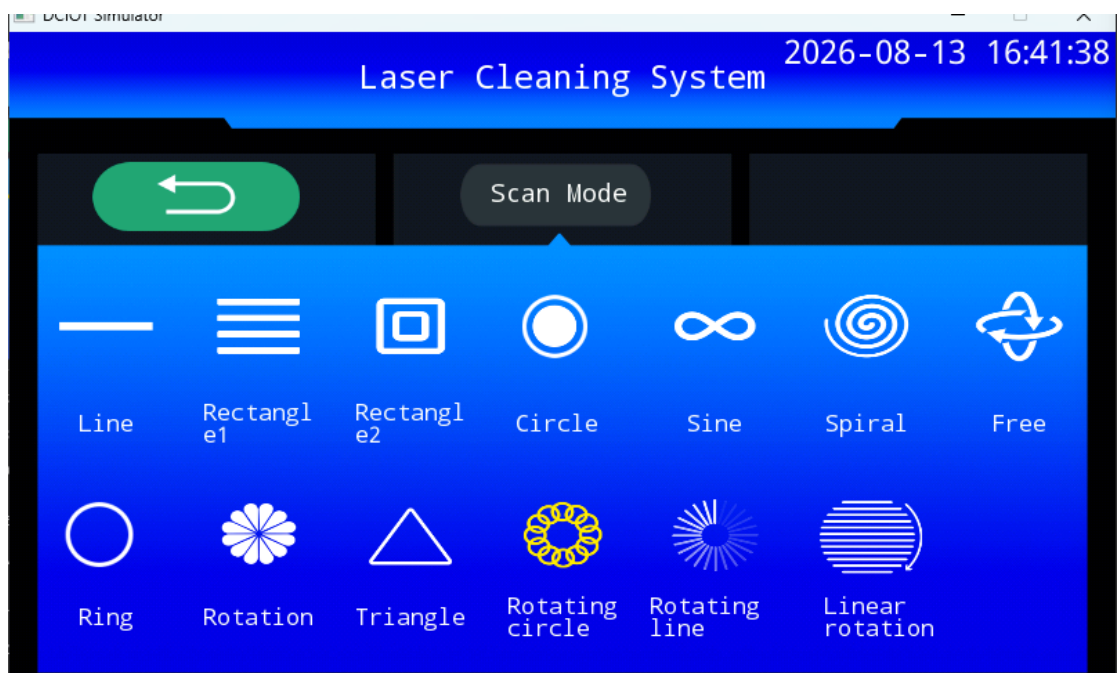
- The graph can be customized based on parameters such as period and series;

(10) Triangle



- Scan Parameters Interface – Adjust triangle size;

(11) Rotating circle



- Multiple circular elements are seamlessly connected and arranged in a 360° circle; their size can be adjusted on the scanning interface;

(12) Rotating line



- The endpoints of the straight line segment point toward the center; rotating the segment by 360° enables rotational scanning cleaning;

(13) **Linear rotating circle**

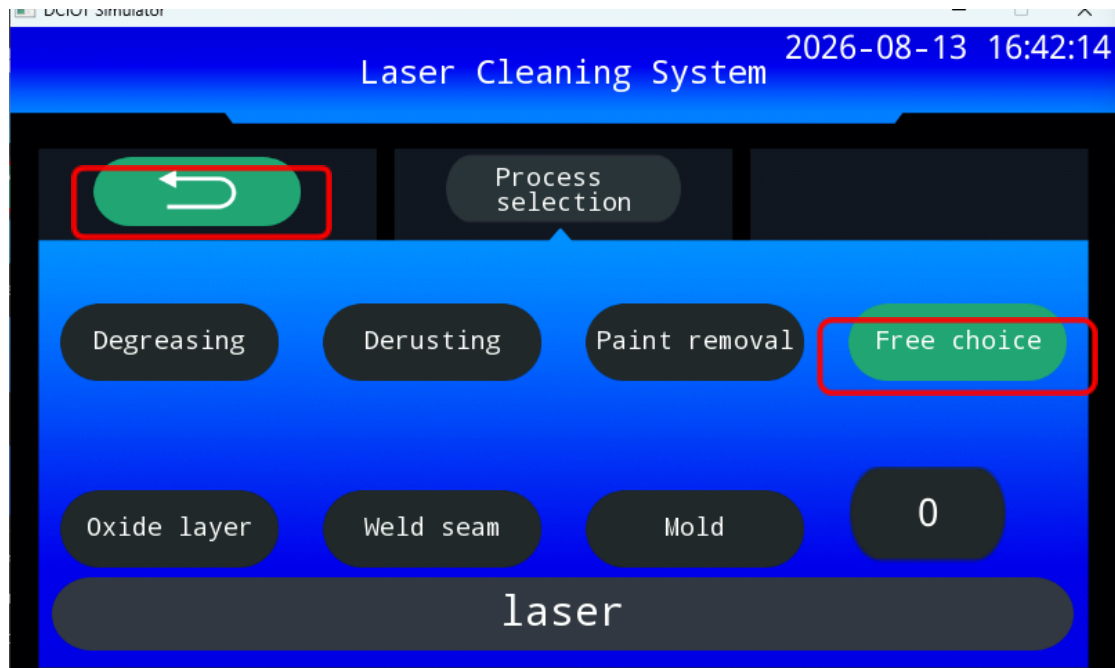


- The linear path performs a multi-angle 环绕 scan; in this mode, no fill spacing needs to be configured.

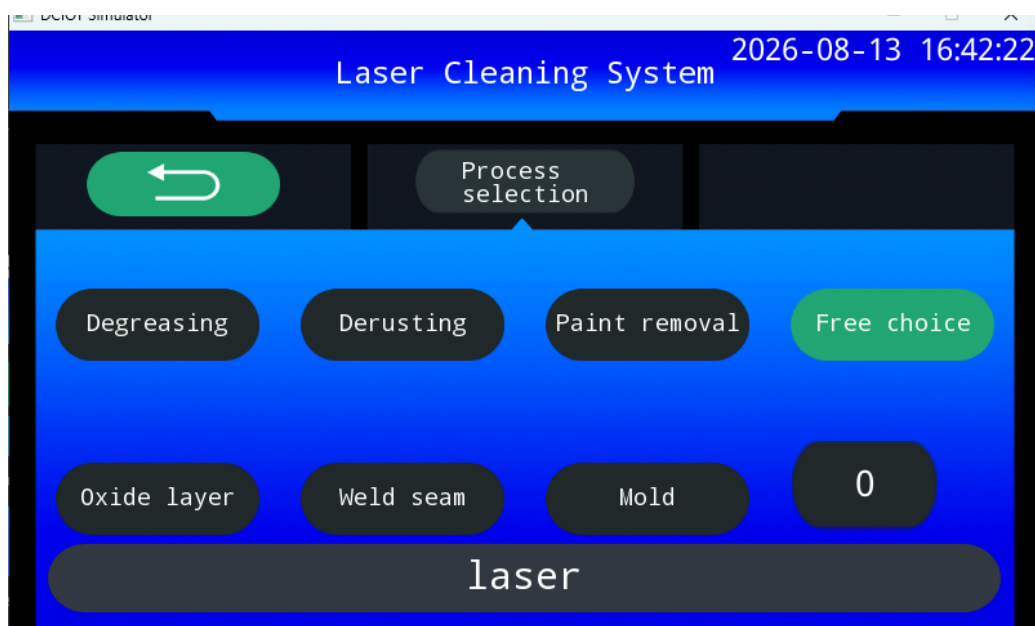
3.3.2 Database

(1) Custom Database

Custom cleaning parameters: This system provides a total of 100 customizable parameter sets (ranging from Set 1 to Set 100), with Set 1 designated as the default set and Sets 2–21 supporting custom cleaning parameter labels (Chinese/English; other languages are not currently supported). By configuring different process set parameters, users can quickly retrieve the appropriate parameter set to meet specific cleaning requirements, eliminating the need for manual reconfiguration.



- Enter the "Process Selection" menu, then click the "Free Selection" button. In the numeric input field below "Free Selection," enter your custom parameter set. Based on the actual cleaning conditions, adjust the parameters to suit your needs, then sequentially input the relevant parameters. Finally, enter the process tag "wood" in the "Process Tag" field (Chinese/English support is currently available).



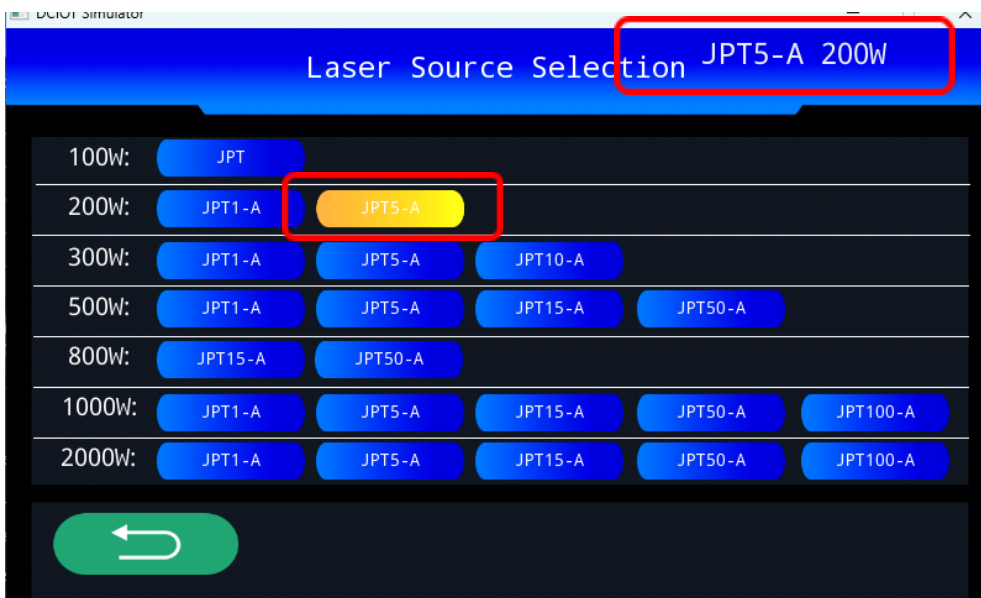
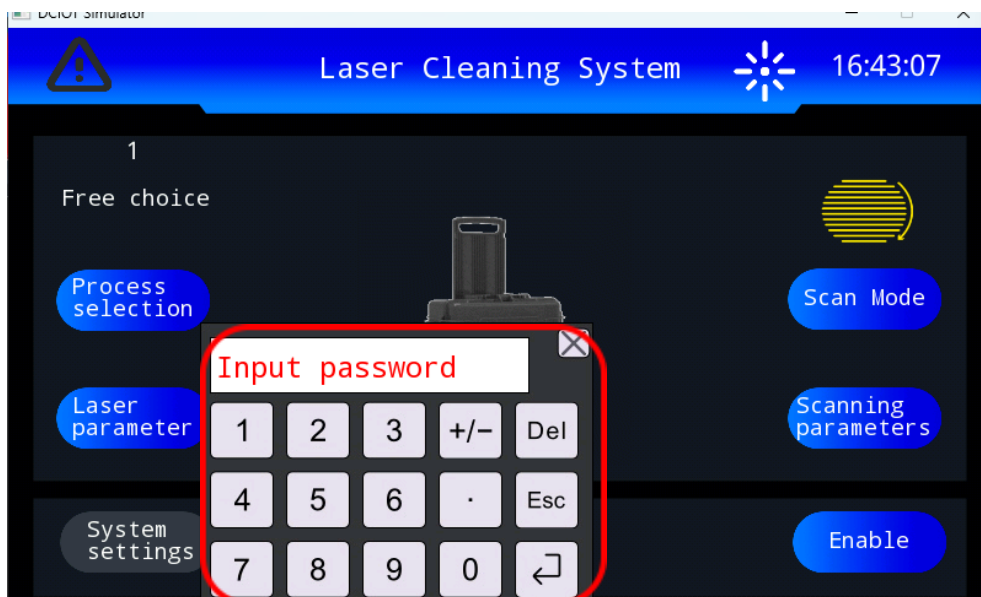
(2) Default Process Library

- The default process library is a system-integrated process database designed to accommodate lasers from various brands and specifications. By selecting and invoking the appropriate parameters, the parameter adjustment process can be effectively streamlined, the equipment's compatibility improved, and the operational complexity for personnel reduced.
- Serial Number: Select the database ID to retrieve the process data stored for that serial number (default: ID 1); Password: 123.
- Step 1: Before using the device, please verify the laser brand, single-pulse energy, and other parameters according to the data provided by the laser supplier. Refer to the JPT Laser Example to confirm the relevant laser parameters.

指标 \ 型号		YDFLP-CL-200	YDFLP-CL-300	YDFLP-CL-200	YDFLP-CL-300	YDFLP-CL-300
		-1	-1	-5	-5	-10
M ² 典型值		2		5		12
输出靶缆长度	m	5				
平均输出功率	W	>200	>300	>200	>300	>300
最大脉冲能量	mJ	1.5		5		15
频率可調范围	kHz	1-4000				
脉冲宽度	ns	2-500				

- Step 2: After powering on the device, access the Laser Cleaning System and click the "System Settings" option. A password entry window will appear;

enter the primary password ("123") to access the Device Management Interface. Then, click "Laser Selection" to enter the Laser Selection page. Based on the supplier's documentation, select the appropriate laser option; the laser model selected for the machine will be displayed in the top-right corner. At this point, the default parameters (corrosion removal, degreasing) have been applied, and the data is ready. (To switch to the default process library automatically, simply click the "Free Selection" button on the process library page to return to the Custom Process screen.)



Select the appropriate laser type.

- Step 3: Return to "Process Selection." Depending on the workpiece, simply click the "Rusting Removal" button; the corresponding process label will then appear on the label line. This indicates that the system has already prepared the process parameters for the rust removal operation. Return to the "Main Page," click "Enable," and then press the "Lighting" button to initiate the rust removal process. The same procedure applies to other default process operations.

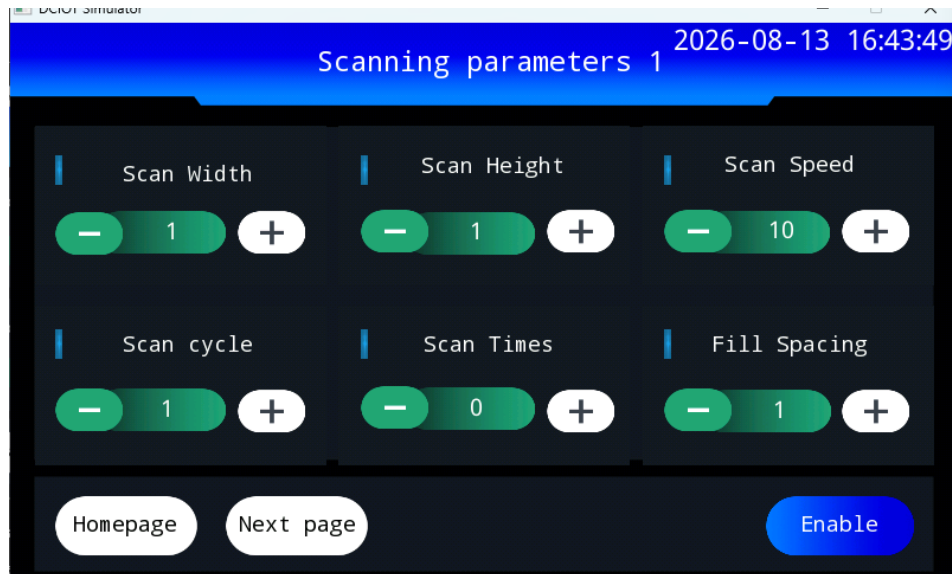
3.3.3 Parameter Settings

(1) laser parameter



- Laser power: Set the average laser output power within the range of 10%–100%;
- Frequency: Laser pulse repetition frequency setting, range: 1–4000 kHz;
- Pulse width: adjustable from 1–500 ns;

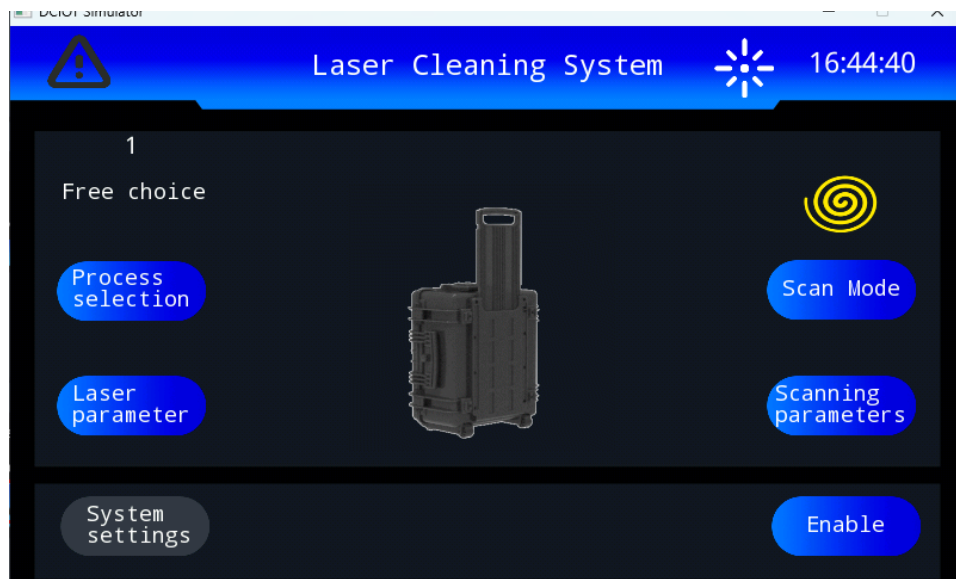
(2) Scanning Parameters

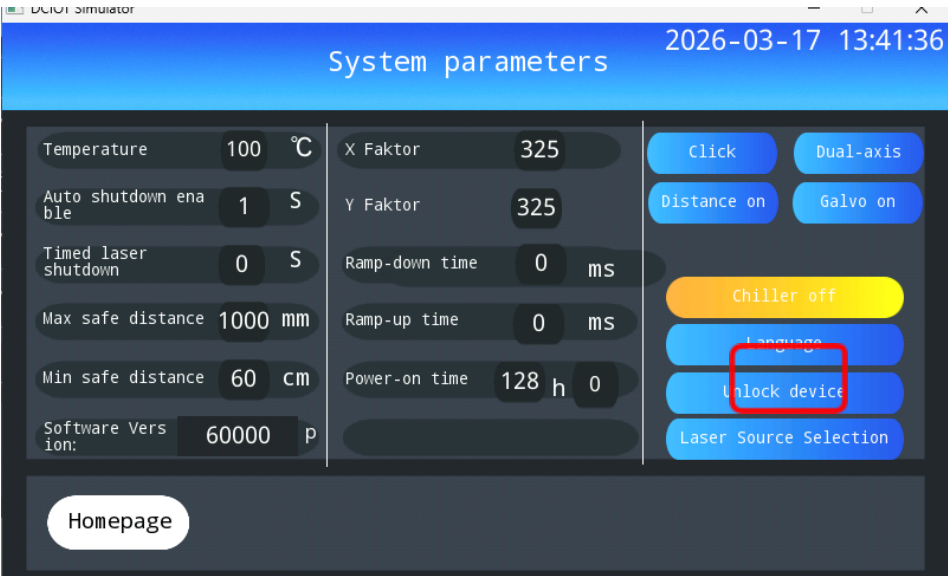


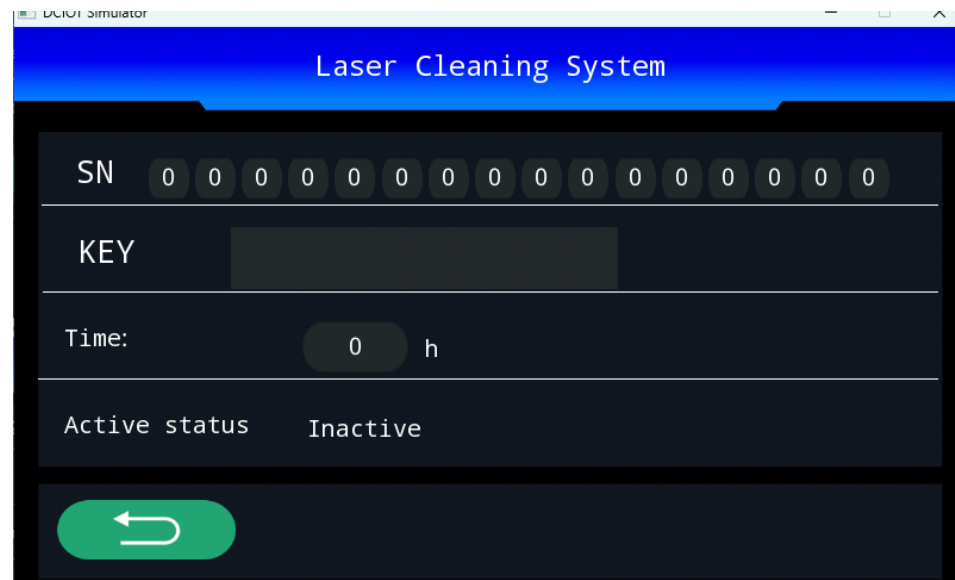
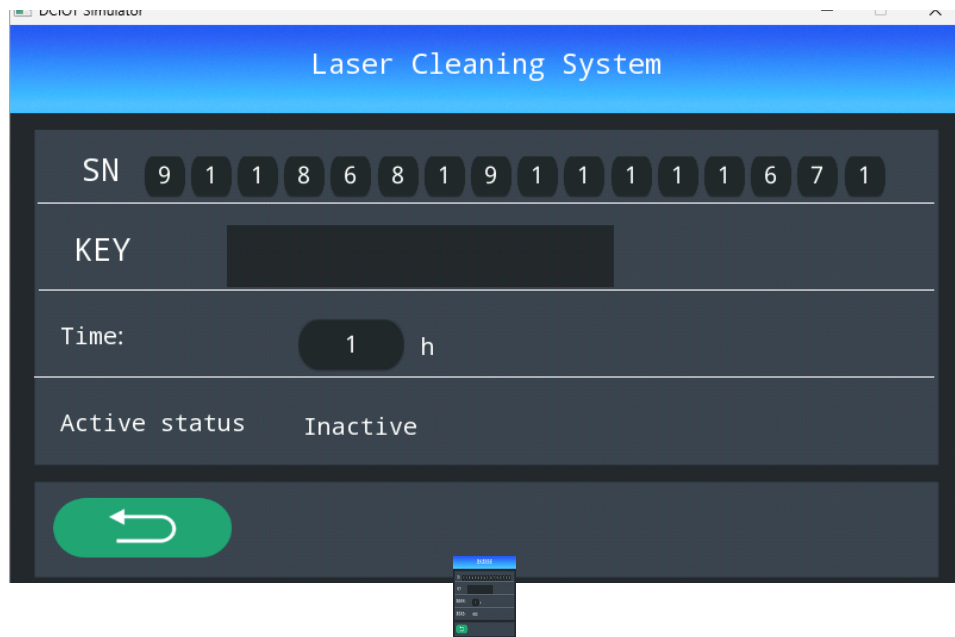
- **Scanning Parameters:** This interface allows you to configure parameters such as scanning width, scanning height, scanning speed, scanning cycle, number of scans, and fill spacing;

3.3.4 Decryption and Password Setup

- During the trial period, the phrase "Please activate" will appear in the top-right corner, indicating that the trial period has expired and the software needs to be activated.

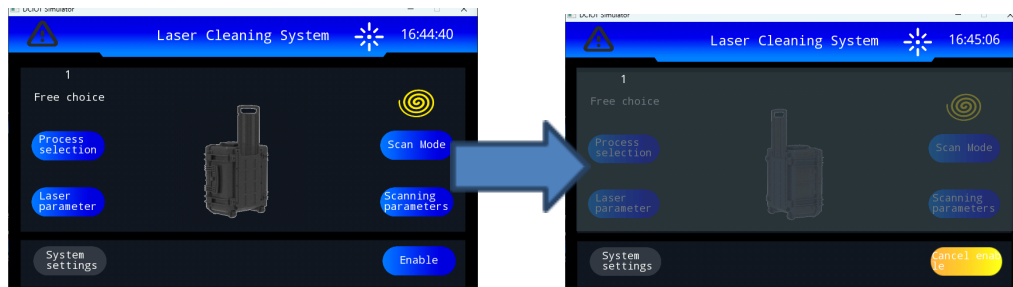






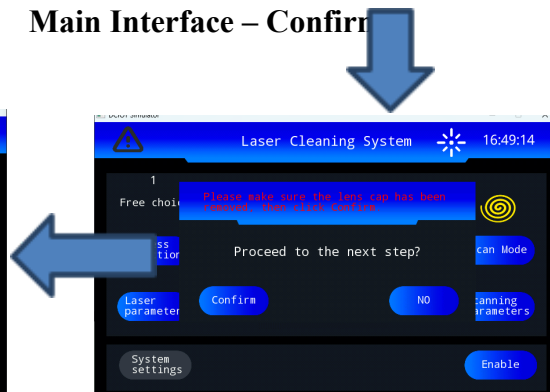
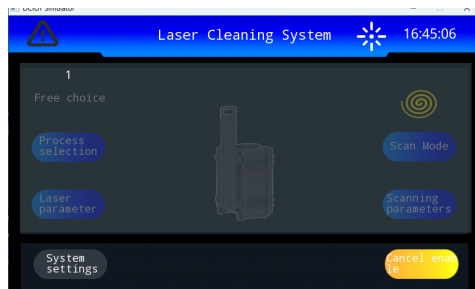
- Users can set a trial period or enable permanent decryption based on their specific on-site requirements.

(12) Other (Light Extraction Step)



Main Interface – Confirm

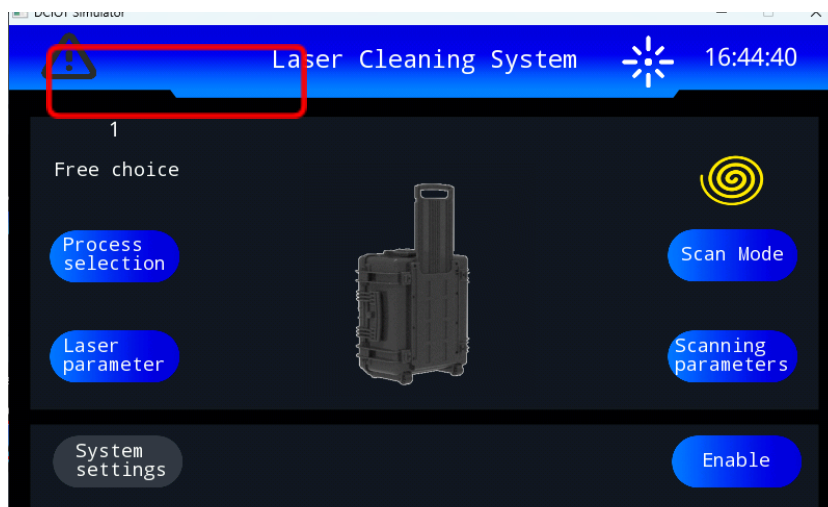
Main Interface – Confirm

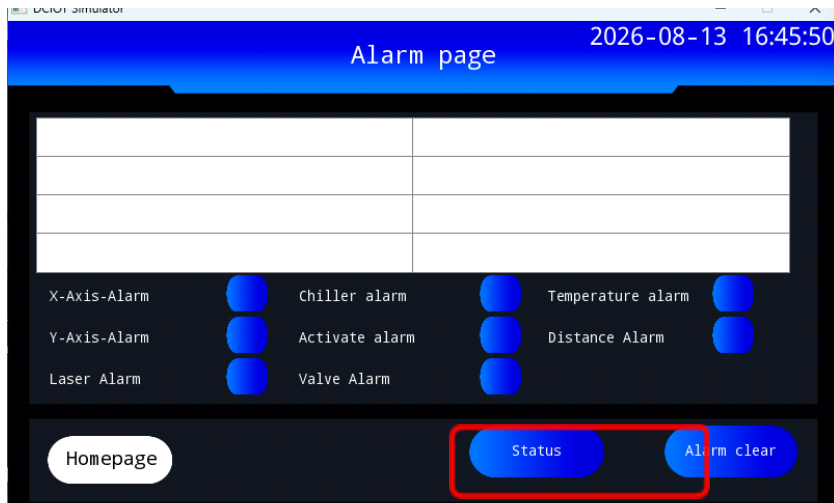


Hikari Nakazawa –After enabling

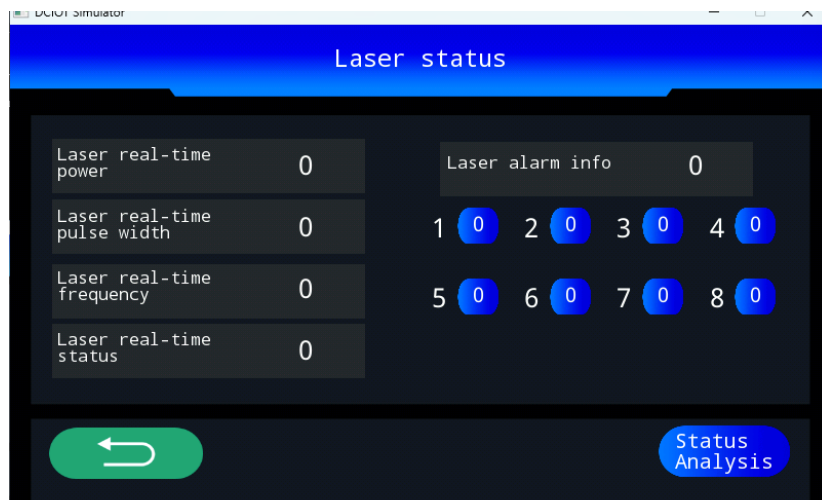
Hikari Nakazawa – After enabling

(14) Alarm View



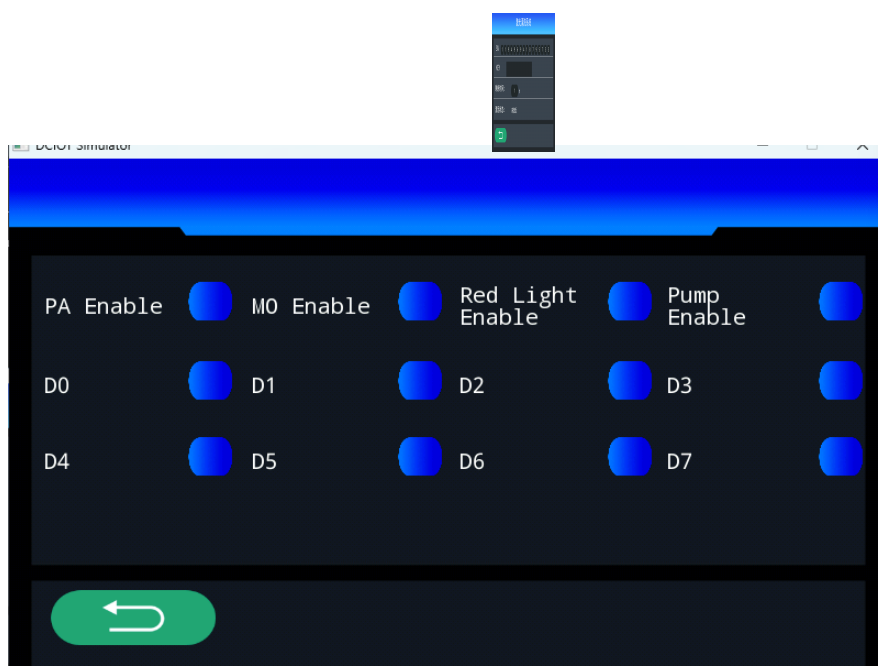


- This interface displays the alarm status of each component; red indicates an alarm, while blue indicates normal operation.



- This interface also allows you to monitor the laser's operating status during light output, displaying the laser power, pulse width and frequency, as well as the laser signal status in real time.

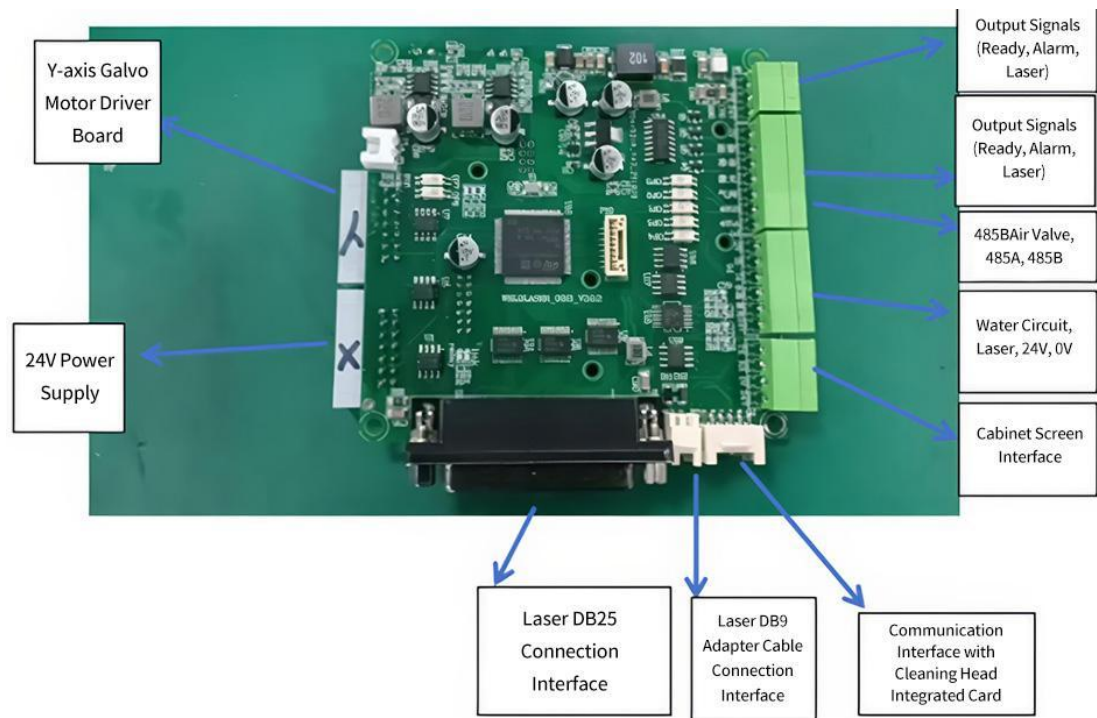
表【1.5】监控信息		
Byte	描述	单位
1	传感器 2 (L_Byte)	0.1℃
2	传感器 2 (H_Byte)	
3	传感器 1 (L_Byte)	0.1℃
4	传感器 1 (H_Byte)	
5	种子源 TEC 温度(L_Byte)	0.1℃
6	种子源 TEC 温度(H_Byte)	
7	二级电流 (L_Byte)	0.1A
8	二级电流 (H_Byte)	
举例：读取激光器的传感器 1		



- The operational status of each laser signal can be viewed directly on this interface without requiring a physical connection to the laser device.

4. Wiring and Installation Instructions

4.1 Definition of Card Interface for Cleaning



P6: Power interface

order number	Input/Output	voltage	remarks
1	import	24V	+24V power input
2			empty
3	import	0V	GND

P8: Touch screen interface

order number	Input/Output	voltage	remarks
1	output	24V	+24V power output
2	output	0V	GND
3			RX
4			TX
4			TX

J1: Scanning Electron Microscope Interface

order number	Input/Output	voltage	remarks
2	output		Y-axis $\pm 5V$
3	output		GND
15	output		X-axis $\pm 5V$
16	output		GND
9.10.22	output		+15V
11.23.24	output		GND
12.13.25	output		-15V

J2: Pulse Laser Interface (25-pin DB connector and laser coupling)

pin	Input/Output	electrical level	function
1-8			Power control pins, with pins 2 and 3 for pulse-width serial signals
9			latch signal
10.14			0V
17			+5V
18			MO switching signal
19			AP laser excitation signal
20			frequency modulated signal
22			Red light enabled, pulse width modulation ENABLE
23			ESTOP

P5: External Control Interface

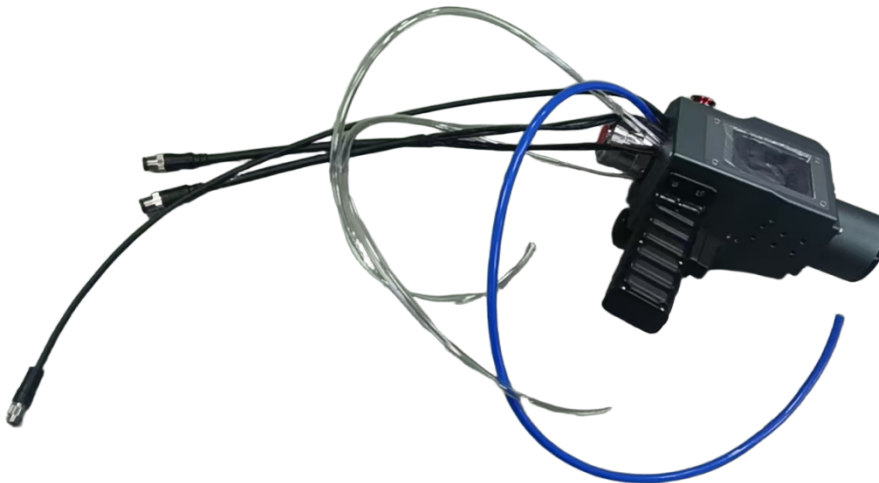
pin	Input/Output	electrical level	function
1	output		24V
2			The laser switch is connected to pin 1 (24V) for light output, and disconnected to stop the light.
3	import	24V	Position switch alarm input (distance sensor)
4	import	24V	Cold water machine alarm signal input (short P5-1 and P5-4 if not connected)

5			continue to have
6			continue to have
7		0V	

P7: Signal Output Interface

pin	Input/Output	electrical level	function
1	output	0V	GND
2	output	24V	Valve output, 24 V
3	output	24V	laser output
4	output	24V	Ready to output
5	output	24V	Alarm output
6	output	24V	24V output (for chiller and laser alarm signal source)

4.2 System Wiring Description



- Intake pipe: Supplies compressed air for nozzle cooling and front air blowing.
- Five-pin aviation connector: Integrated communication connection with the cleaning card.
- X/Y-axis galvanometer: galvanometer connection line joint

5 Pre-sales and After-sales Services

5.1 Service Commitment

Our company is committed to a customer-centric approach, thoroughly understanding clients' cleaning requirements, and providing comprehensive, personalized services including installation, commissioning, training, and maintenance, both pre-sales and post-sales.

(1) Pre-sales service

Prior to contract execution, the company provides clients with comprehensive production process solutions, technical consultation on laser cleaning equipment, sample testing, and equipment selection services.

(2) Installation and Commissioning

In accordance with the contract, our company will safely deliver the equipment to the user's designated installation site free of charge within the stipulated timeframe, with technical service engineers on-site for installation. Once the user has prepared the necessary spare parts for installation and commissioning, the engineers will complete the machine setup and debugging within two working days, ensuring the installation site remains tidy, clean, and well-organized throughout the process.

(3) After-sales training

The company provides complimentary technical training. Upon completion of installation and commissioning, the buyer's operators will receive on-site training at the buyer's location or at the seller's domestic training and maintenance center, continuing until they achieve basic operational proficiency with the equipment.

(4) After-sales Commitment

- The device comes with a one-year free warranty (excluding damage caused by human error or lens failure).
- Free technical consultation, process and software upgrade services;
- The response time for customer service is within 8 hours;
- Lifetime maintenance service, with only accessory replacement fees charged.
- Provide extensive software and hardware support throughout your lifetime.

5.2 Limitations of Warranty

The warranty does not cover product or component damage caused by unauthorized tampering, opening, disassembly, improper installation, or modifications by non-company personnel; damages resulting from misuse, negligence, or accidents; or damage caused by exceeding specification ranges, improper installation, maintenance, abuse, or failure to follow user manual instructions and warnings. Customers are responsible for understanding and operating in accordance with the user manual and operational guidelines. Damages caused by incorrect operations are not covered. Accessories and other components are excluded from warranty coverage.

Within the warranty period, if the buyer identifies any issues, they must submit a written request within 30 days from the date of discovery. This warranty does not cover third parties (including the specified buyer, end-user, or customer), nor does it include parts, equipment, or other products not manufactured by our company.

5.3 Technical Support and Product Maintenance

This product does not include any built-in maintenance accessories for user servicing. Therefore, all repairs outside the provided accessories must be performed by our company's technical personnel.

If any malfunction occurs during product use, please notify our technical team immediately for troubleshooting.

All repair and replacement products must be placed in the original packaging provided by our company. Otherwise, we reserve the right to refuse free repairs for

any product damage caused by improper handling.

Upon receiving our products, please verify their integrity and complete accessories. Should any abnormalities be detected, please contact both the carrier and our company immediately.

Our company will continue to develop new products. The product information listed in the manual may change without prior notice. All technical specifications shall be subject to the terms of the contract.

The warranty and service terms provided by our company are for reference only. The official service and warranty terms shall be subject to the provisions in the contract.