100W Fiber Laser Cleaning Machine

Security Information

Before using this product, please read this user manual carefully.

In this user manual, we provide you with important product safety operation specifications and other reference information. In order to ensure your personal safety when operating this product, and to make this product achieve the best performance, please follow the following cautions and warnings and other relevant operating specifications in this manual during operation.

1. Laser safety

●   The output wavelength of this cleaner is 1064nm (invisible light), and the average output power of the laser >100W (peak power >10KW), which is a class IV laser, will cause irreversible damage to the retina and cornea and burn the skin, and the reflected and scattered light may also cause harm to the human body. Therefore, please wear OD4+ laser protective glasses during use (see Figure 1 for details).

2. Electrical Safety

●   Before connecting the power supply, please check the power supply voltage (220V/110V) and the machine power interface for no abnormalities, and then power on after making sure that there is no error. Wrong connection of the power supply may cause damage to the laser and cleaning machine

Must connect GND during operation, otherwise may hurt the operator.

Do not work in a high temperature, high humidity and high pressure environment, otherwise it may cause a short circuit and laser temperature alarm, affecting the normal use of the cleaning machine and the life of the laser.

3. Operation Safety

●   (1) When the power is on, do not look directly at the light outlet of the cleaning head;

(2) During the cleaning operation, avoid keeping the cleaning head outlet and the eye on the same level

(3) Do not use the laser cleaner in dark environment

(4) When calibrating or adjusting the focus, please operate it in low power first, then set higher power to work after completing the adjusting.

* Please do not disassemble this equipment without permission. All maintenance processing allowed in Cloudray laser only, and the upgrading work can be applied on site by Cloudray laser engineer. If the device is opened without permission, the damage caused will not be covered by the Warranty.

Table 1 Safety Symbols

Symbols	Information
	Laser Warning Triangle -Label of laser emission (at laser head)
Additional Description This product is intended as a component for incorporation into a laser product, and as such requires additional features for laser safety and to comply with 21 CFR1040.10	CAUTIONS IN USE (Attached on the cover plate)
必须戴防护眼镜	Laser protection symbol(must wear safety google)

Figure 1 Laser Safety Goggle

Contents

1．Product Introduction

1.1 Product description

The cleaning machine has many advantages such as portable and lightweight, flexible and adjustable parameters, wireless control, etc., which can efficiently remove rust, stains, and oil on the surface ofthe workpiece. , Plating, etc., can be applied to mechanical processing, cultural relics restoration, mold cleaning, food processing, electronic circuits and other industries. With the characteristics of precise positioning, it can meet the processing of a variety of modeling workpieces and achieve efficient cleaning.

The cleaning machine relies on the advantages of JPT's MOPA structure and is equipped with a 100W cleaning pulsed fiber laser as the cleaning light source. The laser adopts the MOPA (Master Oscillator Power Amplifier) structure. The main oscillation uses a semiconductor laser as the seed source. Amplification is realized by traveling wave fiber amplifier. This MOPA fiber laser has the characteristics of independently adjustable pulse width and frequency, and can still maintain a high and stable peak power output under the condition of changing the pulse width and frequency to adapt to a wider range of cleaning scenarios.

The hand-held laser head of the cleaning machine has a simple appearance, small and light weight, which can be used for a long time with handheld. The built-in scanning system uses a small high-speed motor and drive. The main body is integrated processing and molding, which is strong and dustproof, stable and durable. The laser head adopts an innovative red light auxiliary focusing design, which can easily find the focus position under different field lenses by using the red light indicator, which solves the problems of inaccurate focus and single adjustment method of existing products on the market, and satisfies different scenarios. Assisted focus needs.

The control system can control the laser parameters and the scanning system parameters at the same time. It is also equipped with a wireless control card. The control card communicates with The cleaning machine is connected to realize remote control of parameters such as scan shape, scan length, laser output power, frequency, and pulse width.

The cleaning machine is a portable integrated design, a super integrated injection molding chassis, a buffer design, compression, drop and wear resistance. Trolley-type chassis can be carried on high-speed train and flight.

Below the physical picture:

Figure 2 LC-100 Cleaning Machine

1.2 Product Features

- It can work offline and can be used immediately after power on

- Collimated laser beam output, beam size customizable (default 4mm).

- The cleaning head is extremely lightweight, 620g only (not include delivery cable), and can be operated by hand for a long time

- Patented red light assisted focus technology, can adjust the focus position according to different focus lenses

- Wireless control, can realize parameter setting and emission control remotely, and update parameters at any time

- Trolley-type chassis design, can be carried on high-speed train and flight easily with 28kg full weight.

- Super integrated injection molding chassis, cushioning design, stable structure, Wearable, shockproof and drop resistance.
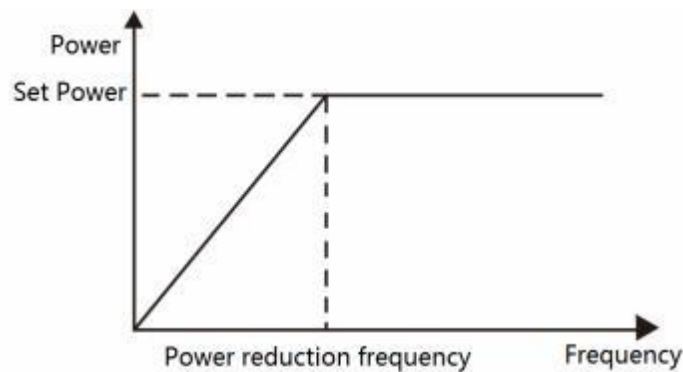
1.3 Technical Specifications

Table 2 Specifications of the LC 100w series pulsed fiber laser

Laser Type / Characteristic		YDFLP-CL- 100- 1-A
M²		<2
Delivery Cable Length	m	5
Average Output Power	W	>100
Maximum Pulse Energy	mJ	1.5
Pulse Frequency Range	kHz	1-4000
Pulse Width	ns	2-500
Output Power Instability	%	<5
Cooling Method		Air Cooled
Power Supply Voltage	V	48V
Power Consumption	W	<400
Power supply current requirement	A	>8
Central Wavelength	nm	1064
Emission Bandwidth (FWHM) @3dB	nm	<15
Polarization		Random
Anti-Reflection Protection		Yes
Output Beam Diameter	mm	4.0±0.5
Output Power Tuning Range	%	0 ~ 100
Ambient Temperature Range	℃	0 ~40
Storage Temperature Range	℃	-10 ~ 60
Dimensions	mm	350*280*112
Weight	Kg	13.2

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Table 3   LC 100W Fiber Laser Power Reduction Frequency Value （kHz）

YDFLP-CL-100-L-A		
Pulse Width (ns)	Threshold Frequency （kHz）	Max. Frequency （kHz）
1 （CW）	.	.
2	3000	4000
4	2000	4000
6	1500	4000
8	1000	4000
12	700	3000
20	400	3000
30	300	3000
45	250	2000
60	210	2000
80	190	2000
100	165	1000
150	80	1000
200	70	1000
250	65	900
350	65	600
500	65	500

＊Setting frequency above power reduction frequency, fiber laser will have full power output. Otherwise, power will drop accordingly. That means the fiber laser will reduce the output power to protect the fiber laser when below the power reduction frequency. Below chart shows the relationship between frequency and output power:

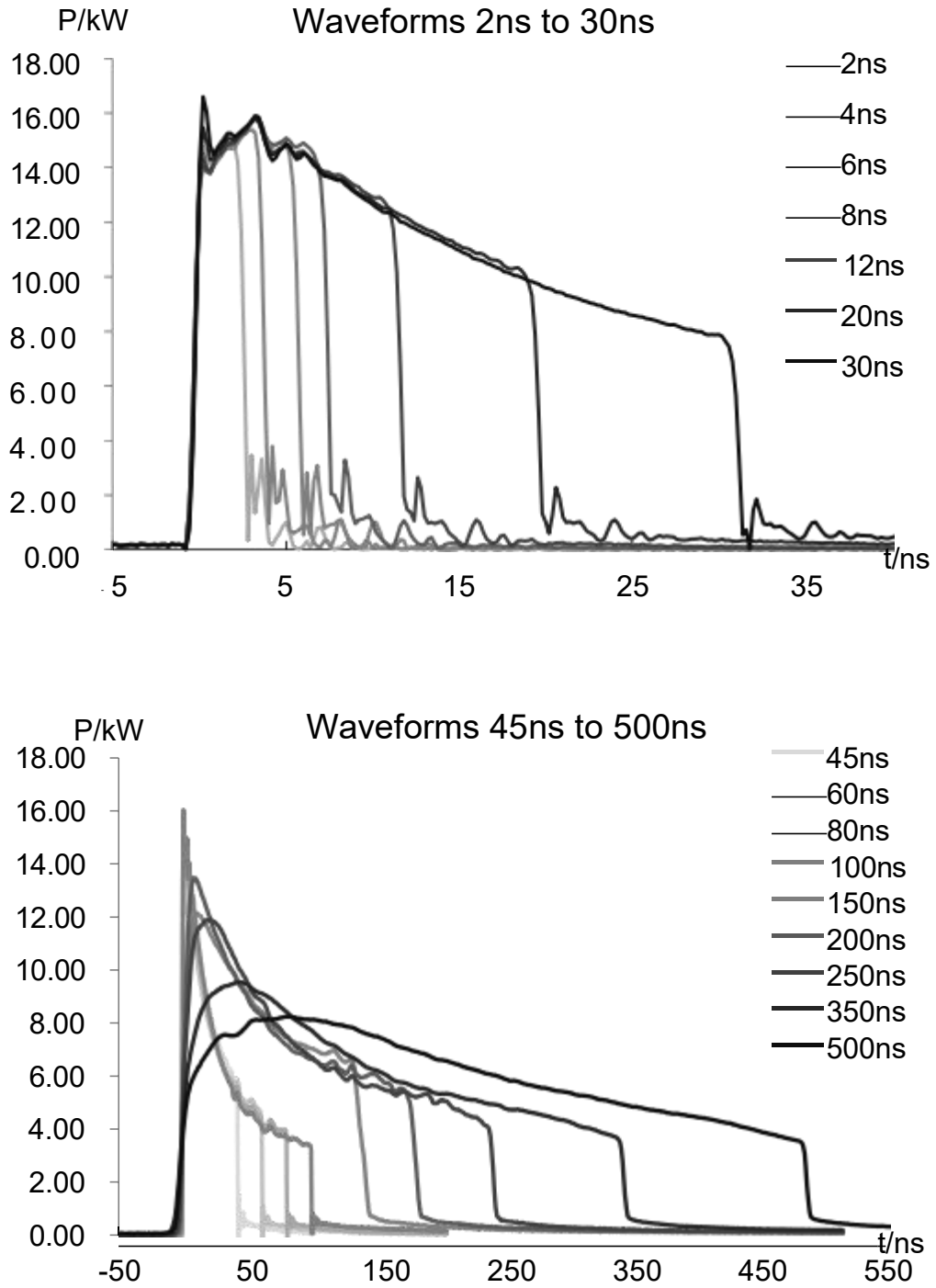**Figure 3   Power reduction frequency & Output power relationship charts**

Waveforms 2ns to 30ns

P/kW

18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00

——2ns
——4ns
——6ns
——8ns
——12ns
——20ns
——30ns

-5   5   15   25   35   t/ns

Waveforms 45ns to 500ns

P/kW

18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00

——45ns
——60ns
——80ns
——100ns
——150ns
——200ns
——250ns
——350ns
——500ns

-50   50   150   250   350   450   550   t/ns

Figure 4   YDFLP-CL-100-1-A Output waveform graph

*For more laser details, please refer to JPT 100W laser cleaning machine YDFLP-CL- 100- 1-A user manual.

1.4 Technical Specifications of laser cleaning machine

Table 4   Specifications of LC-100

| Laser Type / Characteristic		LC- 100
Output Method		Pulsed/CW
Delivery Cable Length	m	5
Average Output Power	W	>100
Cooling Method		Air Cooled
Power Supply Voltage	V	220V/110V
Power Consumption	W	<450
Anti-Reflection Protection		Yes
Ambient Temperature Range	℃	0 ~40
Storage Temperature Range	℃	- 10 ~ 60
Dimensions of machine	mm	617*469*291
Dimensions of package	mm	750*580*500
Weight	Kg	N.W: 28 G.W.: 46
Handheld laser head	Kg	0.62

1.5 Mechanical Design
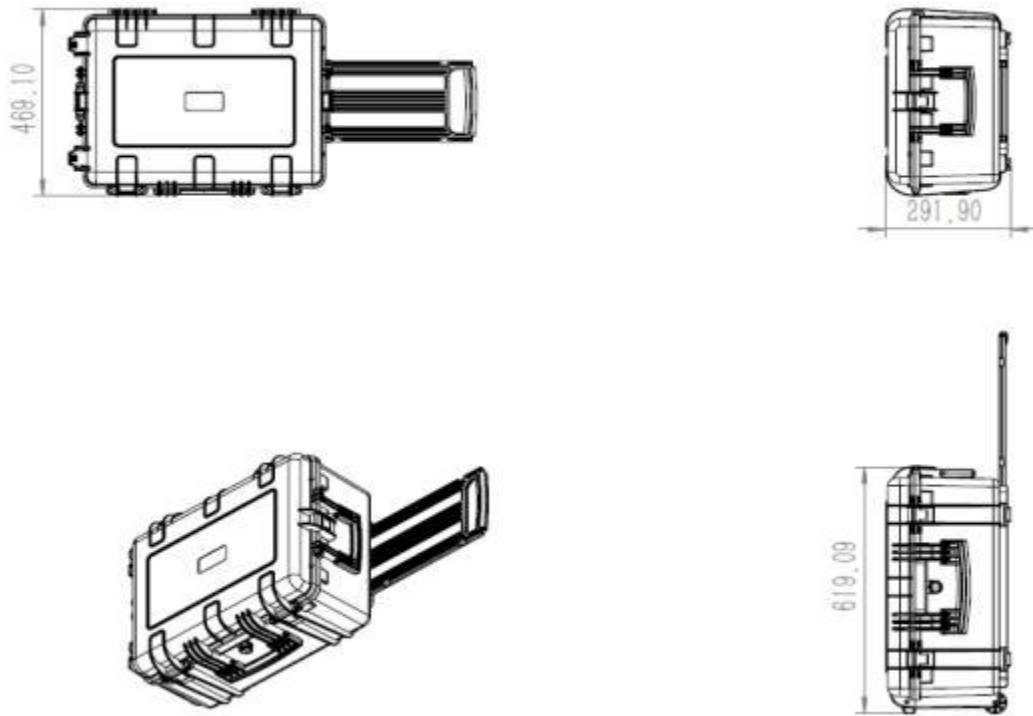
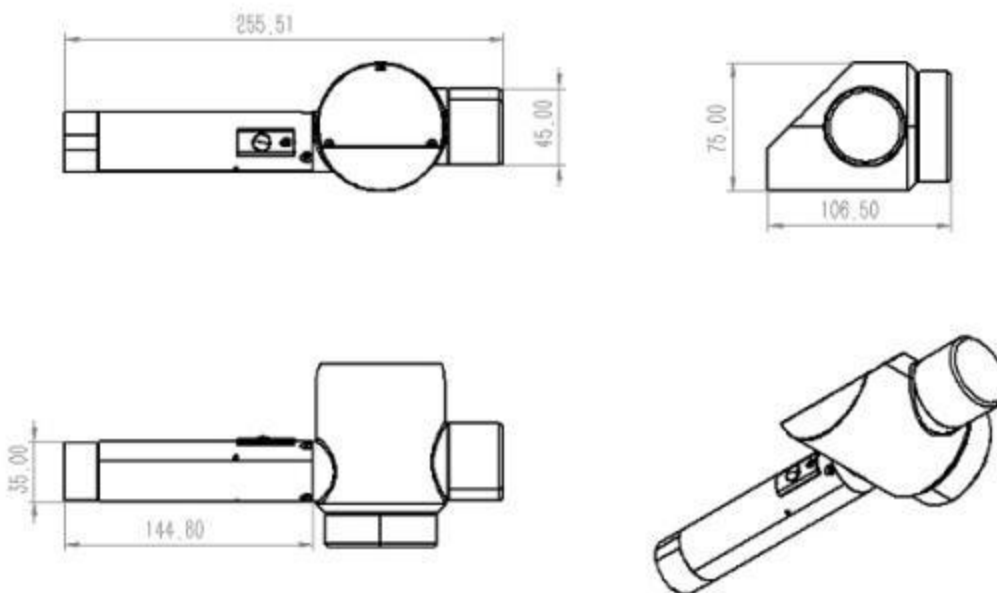**Figure 5 Machine Total View**

Figure 6 Machine Cleaning Head

1.6 Packaging List

Please refer to the packaging list according to table 5.

Table 5   Packing list of Handheld laser cleaning machine

Item	Quantity
Fiber Laser	1
Laser Safety Goggle	1
F-theta lens: f=163mm	1
F-theta lens: f=254mm	1
Remote control card	1
Power cord	1
USB TypeC cable	1
Micro short connector	1

1.7 Interface and status Description

Indicator light and interface button (Figure 7) function description:

1. AC power supply interface

2. Power switch, the button of power on and power off

3. Emergency stop button (When it is impossible to power off in an emergency, turn the knob clockwise to shut down)

4. Laser firing ready button (After power on the machine need active the ready button, then the machine can fire laser. While disable the ready button, it couldn't fire the laser)

5. Laser power on indicator light (While the machine get powered on and the power switch is on, the indicator will light up)

6. Foot switch (Connect the micro short connector, the machine will run while the two wirings are short connect)

7. Handle scanner switch, the green color means it's ready to fire laser. (Single click and hold the laser will fire aiming beam to find the right focus. Double click and hold it will fire laser beam)

Figure 7 Case interface and button

1.8 Cleaning sample

Table 6   Cleaning sample

	Cleaning the verdigris on copper alloy surface
	Cleaning the oxides and pollutants on steel tubes surface

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	Derusting on track

2．Operation Instructions

2.1 Power on

（1） Open the upper cover of the case and take out the power cord, insert one end into the power interface next to the air cooling duct, and connect the other end to the 220V/110V AC power supply.

（2） Take out the handheld laser head, hold the handle and keep the laser outlet downward, and then press the red power switch.

（3） Active the laser firing ready button, while the ready button and the handheld laser head switch light up, it mean the machine is ready to fire laser.

（4） Take out and switch on the remote control card, if English letters and numbers are displayed in the lower left corner of the control card start up interface, it means that the control card and the machine have been connected successfully; otherwise, it will be in disconnected state.

（5） After the control card is connected to the machine, the required parameters can be set through the remote control card.

（6） The handle button is one stages. Single click and hold the laser will fire aiming beam to find the right focus. Double click and hold it will fire laser beam. (While double click the handle button, the time interval need <0.35S. Or it can't fire laser)

2.2.1 Micro controller introduction

Micro controller has many functions such as marking parameter setting, drawing graph setting, alarm monitoring, state monitoring and so on. There are 6 interfaces: Current settings, graphical settings, cleaning parameters, status prompts, alarm monitoring, and function selection.

2.2.2 Interface and function description
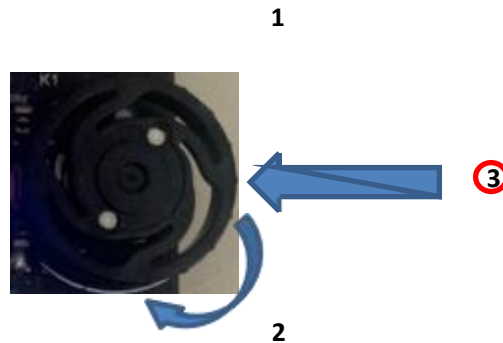
(1) wheel key function setting：

1

2

Figure 8 Wheel key

As shown in figure 8, there are three operation modes for the pulley module：①Sliding up means + ②Sliding down means- ③Pressing enter. ① can move the pointer up, and it can represent a + value when setting the parameter value, ②can move the pointer down, and it can represent a - value when setting the parameter value. The faster you slide up and down, the larger the value of the setting parameter change. When setting parameters with①and② , ③can enter the interface of parameter setting,you can use①②to set the value of the parameters you want, then use③to confirm the setting.

(2)Current settings: As shown in figure 9,it will enter the current interface when machine on. There are a total of 12 selections. Each option represents a group set of data. After selecting "Current Parameters" and confirming, it will enter the password page in Figure 10. Enter the correct password to enter the graphics and cleaning parameter settings, the machine will automatically read the template data saved in the control card.

Figure 9 Current settings

Figure 10 Password input

(3) Cleaning parameters： As shown in figure 11, interface shows laser power, laser frequency, pulse width, laser on delay, laser off delay, end time delay, cornering delay, jumping delay and so on. When you slid wheel key to select the corresponding parameters, press to enter the parameter page. Slid the wheel key to select the value, and press enter to confirm the setting.

Figure 11 Cleaning parameter

④：It shows a real-time connection status, showing Disconnect when the microcontroller is not connected with scanner control card, showing Connect when the microcontroller is connected with scanner control card, and scanner control card is not connected with laser. The SN number of the laser is displayed when micro controller, scanner control card and laser are connected.

⑤：It represents the current number of pages. Page2/2 indicates that there are altogether two interfaces, and it is currently in the second interface (cleaning parameter interface). When the pointer slides to "->" as shown in the figure above, press enter to switch down to the graphical Settings interface (page1/2). When the pointer slides to "<-", press enter to switch to the previous page.

⑥：It represents the progress bar for the current page.

Table 7 Cleaning parameters interface instructions

Parameter	Function	Value range
Laser power	Laser power setting	0~100%
Laser frequency	Laser frequency setting	0~4000khz
Pulse width	Laser pulse width setting	1~500ns
Laser on delay	Positive value: First switch on the scanner then delay the setting time of laser on. Negative value: First laser on then delay the setting time to move scanner. The current value can be adjusted if the laser marking at the beginning point is too heavy or if the scanner is moved for a period of light marking after laser on.	- 1000~+1000us
Laser off delay	The delay time of laser off after the scanner stops moving, to adjust the marking point when laser off is too heavy or too light.	0~1000us
End time delay	The time of scanner stops moving after laser off.	0~1000us
Cornering delay	The stay time at the corner of each row in rectangular	0~1000us

	mode, this value can be adjusted if the jumping takes an arc path in rectangular unidirectional mode.	
Jumping delay	A jump is required in rectangular bidirectional mode, jumping delay means it will delay some time after jumping in case of the abnormal pattern.	0~1000us

(4) Graph Setting: In this interface, could set graph mode are as BeeLine, Rectangle, Round, Sine, Double-string. For different graph type, the scan setting is different. The figure 12 show "Graph setting" marked "⑦" and confirm to back "current setting" （Figure 9）

1. Beeline settings

7

Figure 12 BeeLine

Parameter	Function	Value
GraphTpy	Select scan mode	Beeline/ Rectangle/ Round/ Sine/ Double-string
Mode	Continue cleaning mode	ON/OFF
Times	Set scan times (Disable continue mode at first)	1~10
Speed	Scan speed	0~10000mm/s
FocalLen	Set the lens type (According to the using lens)	F163/F254/F330
Length	Rectangle Mode: Length of rectangle BeeLine Mode: Length of line	F163:0~110、 F254:0~175、 F330:0~200
Direction	Rectangle Mode: NA. BeeLine Mode: X axis/ Y axis	X/Y
Focus x	X axis value of assumed focus point, system will set the value automatically, client don't need set it.	F163:±52mm F254:±84.5mm F330:±97mm
	Y axis value of assumed focus point,	F163:±52mm

Focus y	system will set the value automatically, client don't need set it.	F254:±84.5mm F330:±97mm

2. Rectangle settings

Figure 13 Rectangle

Figure 14 Filling settings

Parameter	Function	Value
Length	Length of rectangle	F163:0~110、 F254:0~175、 F330:0~200
Width	Width of rectangle	F163:0~110、 F254:0~175、 F330:0~200
CtrEn	Select mark the outline of the scan drawing	-
FillEn	Select mark the hatching of the scan drawing	-
FillOne	While enable the hatching, select use the 1st hatching layer	-
FillTwo	While enable the hatching, select use the 2nd hatching layer	-
Method	Scan type (FillOne and Filltwo are separate)	Uni-direction, Bi-direction, Arched
Space	Hatching line distance. (FillOne and Filltwo are separate)	0~9.9mm
Angle	The drawing scan angle (FillOne and Filltwo are separate)	0/ 45/ 90/ 135

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3. Round settings

Figure 15 Round

Parameter	Function	Value
Diameter	Diagram of the round	F163:0~110、 F254:0~175、F330:0~200

4. Sine/ Double-string settings

Figure 16 Sine and Double-Sine

Parameter	Function	Value
Length	The length of Sine/ Double-string.	F163:0~110、 F254:0~175、F330:0~200
Margin	The distance of highest position to the X axis	F163:0~110、 F254:0~175、F330:0~200
Cycle Cnt	The quantity of the cycle in the length duration	1~100

5. Text

Figure 17 TEXT

| Parameter	Function	Value
Length	The length of the text	F163:0~110、 F254:0~175、 F330:0~200
Width	The width of the text	F163:0~110、 F254:0~175、 F330:0~200
Space	The distance between two character	0- 100mm
Text	Click to enter the "Text modify"	-
Choose	The selected text	0~9，a~z，A~Z
Add	Add the selected text to the content	-
Delete	Delete one character from left side of the content	-
Confirm	Save the content	-
Back	Cancel the edition	-

6. Archimedean spiral
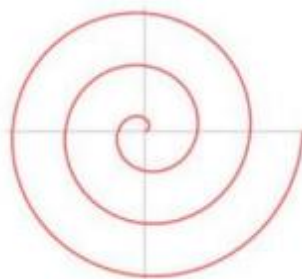
Figure 18.1 Spiral

The Archimedean spiral (also known as the arithmetic spiral) is aspiralnamed after the 3 rd-century BCGreekmathematicianArchimedes. It is thelocuscorresponding to the locations over time of a point moving away from a fixed point with a constant speed along a line that rotates with constantangular velocity. The below diagram shows the details.

Figure 18.2 Spiral settings

Parameter	Function	Value
Polar DM	The length from start point to the center point of the spiral	F163:0~11、F254:0~17.5、F330:0~20
PF	The distance between each small round	F163:0~11、F254:0~17.5、F330:0~20
Polangle	The dimension of the spiral	0~110mm

7. Lissajous curve

A Lissajous curve, also known as Lissajous figure or Bowditch curve, is the graph of a system ofparametric equations. The below diagram shows the details.
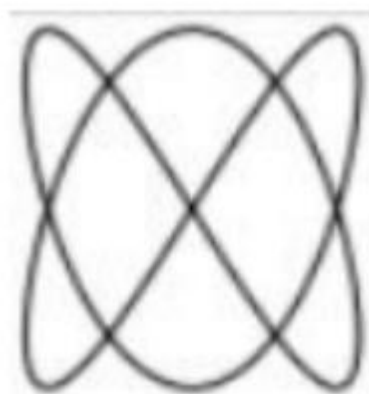

Figure 19.1 Lissajous curve

Figure 19.2 Lissajous curve settings

Parameter	Function	Value
Length	The length of Lissajous curve	F163:0~11、F254:0~17.5、F330:0~20
Width	The width of Lissajous curve	F163:0~11、F254:0~17.5、F330:0~20

Note: After modify the settings, need click the "Apply" icon to confirm the modification.

The filling type are as followed:

`Arch   Bi-direction   Uni-direction
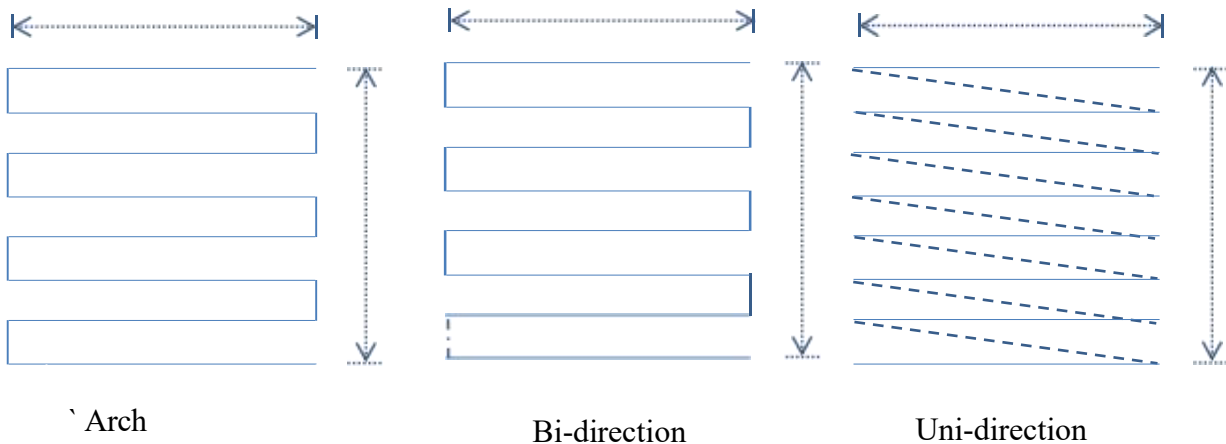
(5) **Status:** This interface can monitor the laser frequency, power, pulse width, PA, MO, RED beam, optical path temperature, and TEC temperature status. You can enter this interface by sliding down the pully on the alarm monitoring interface, as shown in Figure11

Figure20 Status

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(6) Alarm: This interface is used to monitor the Pump Temperature , Circuit Temperature, Voltage Error, TEC Error, Low Current, No Pulse error. It could record the alarm times and current alarm info. Long-press the enter key in the "Graph" or "Parameter" page to enter the "Alarm" page, As shown in Figure 21.
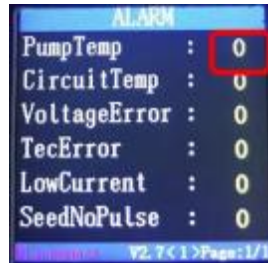

Figure21 Alarm

In the "Alarm" page, if the golden font turn to a red font, it means the current item is alarming, and the number shows total alarm times.

(7) Micro controller and main controller connection: the main controller and micro controller under one-to-one control term. If need exchange the main controller or the micro controller, need reset the connection for the remote control.

While powering on, long-press the enter till the "Function page" (Figure 22) appears, then choose "Connect Host" . Micro controller will wait the main controller send address info (as shown in Figure 23). After that restart the micro controller, the Figure 24 interface will appear (**If there are multiple cleaning devices around, please make sure that each device has a unique address**), set a unique address arbitrarily, press enter, the lower left corner will display "successful" if the connection set successfully. Otherwise it will display "Connection failed".

Note: The main controller and micro controller only need set at the first time use, after the first connection setting its can identify each other when it get power on. If you enter the "function" page accidentally, the connection information will get deleted that need to set the connection again.

Figure22 Function　　　　**Figure23 Host**　　　　**Figure24 Connect success**

(8) Modify the initialization image: The initialization image of micro controller can be modified. Long-Press enter key while powering on the micro controller, the "Picture" interface will appear. Select "Modify the initialization image" to enter, and the interface will turn to Figure 25 and display "Waiting For Data" . Connect micro controller to PC and upload the picture, the initialization picture will get changed.

Figure25 Picture settings

(9) Language Setting: While powering on, long-press the enter till the "Function page" (Figure 22) appears, then choose "Language", set the language to Chinese or English.

(10) Password Change: Enters to "password setting" at figure 22, fill in the old password first, then set new password. The default password be "000000" .

2.2.3 Function of micro-controller

(1) Data storage function

It has total 12 kinds of default settings can be saved. While enter the default settings page, it will read all parameter values, and the laser will set automatically according to the default setting. All modification for default settings will be saved automatically.

(2) Power off memory function

If the micro controller power off, it will read all the parameter from main controller while the micro controller power on again. If the main controller power off, when power on the system again, it will reload all the setting and restore to the previous state before power-off.

2.3 Running Environment and precautions

If not follow the usage guide of the manual, it might influence the reliability and lifetime of cleaning machine. Therefore, please read the following requirements and precautions carefully,

and refer to the relevant specifications when using it.

(1)The power supply of cleaning machine is 220V/110V AC, wrong connection of power supply may cause the damage to the machine

(2) When using the cleaning machine, make sure that the bending diameter of the delivery cable is greater than 15cm. Otherwise it might lead to the laser failure or abnormal laser output.

(3) The laser will adjust fan speed according to the ambient temperature. When using the cleaning machine, don't block the upper and bottom air gaps. The bottom of the machine housing is air inlet and the top is the air outlet. Keep at least 20cm free distance for air outlets. Too narrow distance may lead to the laser error and machine failure.

(4) The running ambient temperature for cleaning machine is 0~40℃, it will get system alarm if the temperature out of the range. The recommended ambient temperature range is 10~30℃, it could extend the machine lifetime under good heat dissipation.

(5) Cause most time the cleaning head works under dusty environment, please clean the lens and head with air blow or cotton. Cover the lens with a protective cover when the machine is not working.

(6) Make sure the cleaning machine is power-off before replacing the lens or other components.

(7) Do not watch the laser output directly, **wear laser goggle all through the operation process.**

3. Machine failure and solution

Table 8 Machine failure and solution

Order	Failure	Reason /Solution
1	Micro-controller and main controller connection failure	The address not matched, modify the machine address
2	No red beam	Switch failure or red beam failure, machine need maintenance

3	Cleaning result are different with same setting.	Laser power drop or the bend diameter of delivery cable too short.
4	Power supply normal and now warning, but there is no laser output	Switch failure or laser source failure, machine need maintenance
5	Temperature warning	Ambient temperature too high, need work under $0\sim40\mathbb{C}$
6	Other warning	Laser source issue, machine need maintenance

In addition to the above, if encounter any questions or failures during the usage, you can contact Cloudray laser for help

4. Maintenance and service

4.1 Maintenance term

After the order confirmed and source shipped to client, under the warranty period Cloudray laser offer free maintenance for the products that are defective in component and technical design. And Cloudray laser guarantees the machine works fine under the proper operation. Cloudray laser has the right to selectively repair or replace any product with material or technical problems during the warranty period. And provide repair or replacement services for products that get failure due to materials or production processes. Cloudray laser has the right to charge the maintenance cost if the machine get failure under improper operation.

4.2 Warranty limitation

(1) Machine dismantled or modified by other persons rather than Cloudray laser engineer.

(2) Damage caused by improper use, negligence or accident.

(3) Used the machine out of its' specifications and technical requirements.

(4) The interface or wiring problem lead to machine damage.

(5) Use the machine under improper installation and operation.

(6) Accessories are not covered by the warranty.

*This manual is for user operation. Official service and warranty will follow the actual sales contract and terms and condition. Thanks for your support