BOSSLASER

QM-855-934 | 6/23/2025 | Rev. 001

BOSS LASER
FC Lumin X
Operators Manual

This Page is Intentionally Left Blank

WELCOME TO THE BOSS LASER FAMILY

Over the years, Boss Laser has provided quality laser solutions, and I am thankful that we have always focused on delivering value not only for our clients but also contributing positively to our community.

Our mission statement is "Boss Laser strives to honor God by positively impacting its clients, employees, and community by providing products and services with Integrity, Honesty, and Value."

Your continued support has allowed us to make an impact not only in our own backyard but yours as well. Boss Laser machines are owned and operated across the world by hobbyists, small businesses, educational institutions, and Fortune 50 companies, just to name a few. But do you know what truly makes Boss Laser successful? You!

You have given us the opportunity to provide for families both locally and around the globe, whether a Boss Laser is being used in a home-based business that enables a family to have financial freedom, allowing college students at the University of Central Florida to make their designs become a reality, or inching the aerospace industry closer to new explorations and discoveries, you as a Boss Laser owner are the reason why.

When you purchase a Boss Laser machine, you're not just getting the machine, you're getting us, and by us, I mean the 40+ employees who strive to provide top-notch products, services, and support, day in and day out because they want you to be successful.

Owning a Boss Laser machine makes you a part of our family and we are thrilled that you have chosen us to be your laser solution. I can promise you that you now have an army of 40+ people who are rooting for you to succeed and are here to help you along the way.

So, what are you waiting for? Let's get that machine fired up and put to work!

Dan Fox
Owner & Co-Founder

BOSS FC Lumin X

EXPLORE EVERY WAVELENGTH OF INNOVATION

We're thrilled you've chosen the BOSS FC Lumin X as your laser solution. Designed for ease of use, precision, and reliability, the BOSS FC Lumin X is ready to bring both your creative and professional projects to life.

We recommend printing out this manual to save time in the future. It will guide you through the basic setup of the machine, so keep it close to your computer or machine for easy access while designing files or operating the machine.

Be sure to read the manual in its entirety before operating the machine as this will give you a solid understanding of how it works. We know there can be a learning curve with any new equipment, but with a bit of effort and patience, you'll be running your new laser with confidence and efficiency in no time!

Our team is here to support you every step of the way. If you have any questions while reading the manual or setting up your machine, feel free to call us at 407-878-0880 or email techsupport@bosslaser.com. A member of our technical support team will be happy to help!

Welcome aboard, and here's to countless projects and endless possibilities!

BOSS LASER

CONTENTS

CONTENTS

Introduction

1.1 Definition of Procedures

This manual is provided with information specific to your BOSS FC Lumin X machine. The Boss Laser BOSS FC Lumin X is designed to remove contaminants, coatings, rust, paint, oil, or oxidation from surfaces, without damaging the underlying material, using high-energy pulsed laser beams.

To ensure you feel confident when operating your cleaner, we will go over everything you will need to know about the BOSS FC Lumin X in this manual, but most of these sections can be broken down into three basic categories: Operation, Maintenance, and Service. We will provide a general overview of each category below and go into depth throughout this manual.

1.1a Operation

To start operating the BOSS FC Lumin X, first, please make sure that you point the lens on the equipment to the material which needs cleaning and never directly point it at the human body to avoid injury.

When focusing on the material which needs cleaning, please reduce the power of the laser cleaning equipment (less than 10%) to find the appropriate height first and then gradually change the parameters such as power, pulse width and frequency to improve the cleaning effect.

During the cleaning operation, avoid looking directly at the lens and refrain from using the laser cleaning equipment in dark conditions.

1.1b Maintenance

The best way to keep your machine performing optimally is to keep up with maintenance by setting a schedule. Please do NOT disassemble the equipment without written permission from Boss Laser. All maintenance can only be carried out by trained Boss Laser technicians, or by the direction of a Boss Laser technician, and the upgrading process can be carried out on site by our technical support engineers only. If the equipment is dismantled without permission, all potential damage that could result will not be covered by the warranty.

Laser cleaning equipment has high requirements for environmental cleanliness. Handle the laser output head carefully when using or moving the laser cleaning equipment to prevent dust or other pollution. When the laser cleaning equipment is not operating, please cover the laser head's lens with a protective cover. The dust on the surface of the laser head's lens may cause the lens to over-heat and become damaged, resulting in the laser output power attenuation.

As a reminder, these procedures are to be performed with the machine off. Your safety is our number one priority.

1.1c Service

Service includes initial installation and alignment of the machine, as well as repair when needed. Your BOSS FC Lumin X should arrive mostly ready to go, but you will need some installation from our Boss Laser techs, replacement parts, or to conduct minor repairs in the future. Procedures during service may require the machine to be turned on.

Boss Laser recommends that only trained service personnel, such as Boss Laser Technicians, complete service or repair unless directed by a Boss Laser Technician. Always call Technical Support if you are unsure what to do when servicing your machine.

1.2 Warranty Disclaimer

This Limited Warranty applies to the laser machine itself, and all parts purchased from Boss Laser, LLC.

This Limited Warranty covers any defects in material or workmanship while the machine is operating under normal use and for its intended purpose during the warranty period.

During this Warranty Period, Boss Laser, LLC will repair or replace any part or product that is proven defective while the machine is being used under normal conditions and for its intended purpose. This does NOT include labor and/or on-site tech support.

The Warranty Period for the Laser Equipment will begin on the day of arrival and will be covered for 1 year unless an extended warranty is purchased.

All parts purchased, and replacement parts are under warranty for one year from the time of installation by Boss Laser. The only exception to this warranty is the regular maintenance items that include, but are not limited to, the protective window lens, ceramic insulator, and nozzles which have a 30-day warranty to be free of defects upon arrival.

This Limited Warranty does not cover any problem that is caused by: conditions, malfunctions or damage not resulting from defects in material or workmanship (ex. modifications done to the machine)

All modifications that are made to the machine must have written consent from Technical Support or the warranty will be voided.

Lack of proper maintenance of the machine will also result in a voided warranty.

To obtain a warranty service or part you must first contact Technical Support via phone at 407-878-0880 or email via techsupport@bosslaser.com to determine any issues and the most appropriate solution for the machine.

2. Safety Information

2.1 Laser Classification

The BOSS FC Lumin X Laser System is a Class 4 laser product, as defined in International Standard IEC 60825-1.

The BOSS FC Lumin X complies with 21 CFR 1040.10 and 1040.11, the Federal Performance Standards for Light-Emitting Products, except for deviations pursuant to Laser Notice No. 50, dated May 8, 2019. The Center for Devices and Radiological Health, of the US FDA, issued Laser Notice No. 50 to permit manufacturers to classify and manufacture their products in accordance with the International Standard.

During normal operation, the laser's output is safely contained within the BOSS FC Lumin X's laser head enclosure.

The visible beam from the Laser Diode Pointer (Red Dot Pointer) is accessible for positioning. This pointer uses similar technology to a laser pen pointer, so, like those, it is important to avoid direct eye exposure. We have taken every measure to ensure the Laser Diode Pointer (Red Dot Pointer) is as safe as possible. Its beam path is securely positioned inside the laser head enclosure, so under normal operation, no hazardous levels of laser radiation can escape. Once the shutter is open, the aiming is shut off.

The standard reference for laser safety is the American Standard for the Safe Use of Lasers, Z136.1-2000, developed by the American National Standards Institute (ANSI). This reference is the basis for many of the federal regulations for laser and laser system manufacturers, and for the Occupational Safety and Health Administration (OSHA) laser safety guidelines. It contains detailed information concerning proper installation and use of laser systems.

While the ANSI standard itself does not have the force of law, its recommendations, including warning signage, training, and the designation of a laser safety officer, may be compulsory under local workplace regulations when operating laser systems above Class I. It is the operator's responsibility to ensure that the installation and operation of the Boss Laser BOSS FC Lumin X Series Laser System is performed in accordance with all applicable laws.

Copies of ANSI Standard Z136.1-2000 are available from:

Laser Institute of America

12424 Research Parkway

Suite 125

Orlando, FL 32826

(407) 380-1553

2.2 Essential Safety Information Before Using Your Machine

Before setting up and turning on the machine, all operators are required to read this manual carefully and adhere to the operating requirements & specifications. As a reminder, the BOSS FC Lumin X is classified as a Class IV laser machine, meaning that radiation exposure is a possibility if proper safety precautions are not followed. We understand that the number of safety precautions can be overwhelming to first-time laser users, therefore, we have provided a bulleted list below to give you a quick reference guide.

2.2a Trained Personnel & Bystanders

Anyone who has not read this manual should abstain from using the laser machinery, as it can cause harm to the machinery, the operator, and bystanders.

- If using this laser machinery in a shared area, allow only qualified personnel or people to operate the laser machine, and each person who enters the area while the machine is in operation should have general laser safety knowledge and any person who operates the machine should read this manual first.
- Boss Laser cannot be held responsible for any direct or indirect damage, which results from using or working with the products, electric circuits or software described herein. The apparatus must be used only by trained and skilled personnel. Before use, the manual should be read and followed carefully. Furthermore, Boss Laser reserves the right to change or alter any product described herein without prior notice.

2.2b Pre-Operation & Environment Requirements

Prior to operating the machine, all doors, covers, hoods, and safety mechanisms should be in place.

- In this manual, we provide you with important product safety operation specifications and other reference information. To ensure your personal safety when operating this product and to maximize the performance of the product, please follow the precautions and warnings and other relevant operating specifications within this manual.
- Do not operate in high temperature, high humidity or high-pressure environment, otherwise it may cause a short circuit and/or a high laser temperature alarm, affecting the regular use of the cleaning machine and the life of the laser.
    - The ideal environment for the BOSS FC Lumin X is dry, free from pollution, vibration, high voltage, or strong magnets, and the machine should be in an ambient temperature of 39°- 104° Fahrenheit (5° - 40° Celsius) with 5% - 95% humidity, and with no dew.

- Before connecting the power, please check if the voltage of the external power supply meets the requirements and make sure there is no abnormality in the machine's power interface and ensure that the power interface is properly connected. Improper connection may cause unrecoverable damage to the equipment.

2.2c Material Hazards

While a multitude of materials can be cleaned with your BOSS FC Lumin X, it is important to be careful when processing new material.

The wavelength of the laser describes the spatial frequency of the emitted light wave. The optimal wavelength for the specified use case depends heavily on the application. During materials processing, different materials have unique absorption characteristics that depend on the wavelength, leading to different interactions between laser and material. Similarly, in remote sensing, atmospheric absorption and interference can have different effects on specific wavelengths, and in medical laser applications, different skin colors can absorb specific wavelengths in different ways. Shorter wavelength lasers and lasers optical components are advantageous for making small and precise features that produce little peripheral heat, but they are usually more expensive and prone to damage than longer wavelength lasers and lasers optical components.

2.2d Fire Hazard

Materials within the machine and surrounding areas can catch fire if not monitored closely. It is important that the machine is not left unattended while running. If you must leave the area where the machine is firing, press the "Pause" button, then start where you left off when you return. We recommend having an ABC fire extinguisher on hand and near the machine to minimize damage to the machine and the surrounding area in case of a fire.

2.2e Hazardous Fumes & Proper Ventilation

Ensure there is proper ventilation in the area the machine will be running in. Smoke, fumes, and particles can be produced from the use of the machine while cleaning materials. These should be exhausted via an external exhaust port to the outside or via a fume and odor extractor.

- Certain materials can produce toxic fumes and hazardous gases when processed by a laser machine, so it is important to review the MSDS of any material to ensure it is safe to be processed with a laser machine.

2.2f Electrical Safety

The BOSS FC Lumin X uses electricity to power the machine, which increases the risk of electrical shock if not handled properly.

- Ground wire is required during use.
    - Disconnecting of the ground wire may cause personal injury to operators and reduce equipment performance.
- Do not disassemble the machine without prior approval and direction from Boss Laser Technical Support, otherwise, the warranty may be voided and injury or death from electrical shock may occur.
- Ensure all sources of power are unplugged prior to conducting service and maintenance on the machine.
- The operating voltage of this machine should be 110v 60z

3. Fire & Hazardous Materials

⚠ WARNING: This machine uses focused energy to clean material. At no point should the machine be left unsupervised while it is in use. Leaving the machine unattended while in use can result in a fire and substantial damage to the machine and the building it resides in. Any damage caused by fire that is not due to defects in workmanship, or the machine itself will NOT be covered by the BOSSLASER, LLC Limited Warranty.

⚠ Hazardous Materials: All materials considered hazardous to the health of the machine, the health of the individuals operating the machine and the individuals surrounding the machine while in use are NOT recommended. These materials can produce toxic fumes or cause the machine to not function properly and need replacement parts. Processing hazardous materials can void the warranty of the machine.

Materials that should NOT be cleaned with the FC Lumin X:

- **Delicate or Soft Materials**
    - These can melt, warp, or degrade under high-energy pulses.
        - Thin plastics (e.g., polyethylene, polystyrene)
        - Soft rubbers or elastomers
        - Foams or spongy materials
- **Heat-Sensitive Materials**
    - Painted surfaces
        - May blister or peel
    - Adhesives
        - Can weaken or vaporize
    - Coated optics
        - E.g., anti-reflective coatings on lenses
- **Organic or Biological Materials**
    - Wood
        - Can scorch or crack
    - Leather or fabric
        - May burn or cause discoloration

    - Biological tissues
        - If used in medical or lab settings
- **Highly Reflective Metals (for laser pulse cleaners)**
    - Polished aluminum or copper
        - These can reflect the laser beam, pose safety risks and reduce cleaning efficiency
- **Fragile Electronics**
    - Microchips or PCBs with exposed components
        - High-energy pulses can cause electrostatic discharge (ESD) or thermal damage

Most materials have a Material Safety Data Sheet (MSDS), which can tell you whether materials are safe and/or be exposed to high heat. Any material containing chlorine is not safe for your laser, the machine operator(s), or bystanders. If you are still unsure about the material after reviewing the MSDS and its properties, contact Technical Support. We would be happy to try and identify the safety of the material and whether it can be processed with a laser machine.

4. Laser Safe Materials

Lasers use heat to cut, engrave, clean and etch. Some materials react beautifully while other materials can have less than a desirable effect. It is important to know the material with which you are working. For example, some materials like PVC are easy to cut but give off a chlorine gas that is not healthy for the machine or the operator.

New materials come out daily. If you are unsure if the material is safe, contact Technical Support, and we will try to identify its properties and determine if it is possible/safe to be processed with a laser.

To make this process a little bit easier, we have created a list of materials we know are safe for the machine. It is important to review the information below to ensure you are not attempting to cut or engrave a material that is not meant for your machine.

Materials that can be cleaned:

- Metals (Most Types)
    - These are commonly cleaned in industrial and precision applications
        - Stainless steel
        - Titanium
        - Brass
        - Aluminum (non-polished or anodized)
        - Copper (with care)
- Glass and Ceramics
    - Ensure coatings are compatible with pulse energy
        - Laboratory glassware
        - Optical lenses (uncoated or with durable coatings)
        - Ceramic components

- Hard Plastics
    - These can usually withstand ultrasonic or laser pulses, but always test a small area first
        - Polycarbonate
        - Acrylic (PMMA)
        - Nylon
        - PEEK
- Jewelry and Watches
    - Gold, silver, platinum
    - Gemstones (e.g., diamonds, sapphires—avoid porous stones like opals or pearls)
- Electronic Components (with caution)
    - Metal housing
    - Heat sinks
    - Circuit boards (only if designed for ultrasonic cleaning and without sensitive components)
- Medical and Dental Tools
    - These are often cleaned with ultrasonic systems for sterilization prep
        - Surgical instruments
        - Dental picks and mirrors
        - Orthopedic implants

5. Laser Safety & Policies

First, BE CAREFUL! Laser machines are a powerful tool, and the proper precautions should be taken, just as if you were working with any other high-powered tool or machinery. These machines are designed to clean with highly focused heat energy and can be dangerous. You should never leave your machine unattended while it is in operation and do not let an inexperienced or unfamiliar person operate your machine at any time. Maintenance should be done by professionally trained personnel.

1. Designate a Safety Administrator to determine the scope of their duties and provide training for safe operation and safety protection around the machine and for using the laser.
    a. A Risk Manager and/or Laser Safety Officer are recommended to be part of the safety administration.
2. Specify a laser safety management area and set warning signs at the entry and exit of the management area, including the following:
    a. Laser processing machine power.
    b. Laser Type.
    c. Use of Personal Protective Equipment (PPE), specifically use of laser safety goggles or glasses rated to block the laser wavelength.
    d. Signage prohibiting unauthorized persons from entering, and the name(s) of the safety administration personnel.

3. The operator of the laser processing machine must be trained to operate the machine safely with the consent of the safety administrator.
4. The main harm of the laser to the human body is to the eyes and skin.
    a. Any part of the body exposed to the laser can cause bodily harm or death.
    b. Avoid placing any part of your body in the working light path of the laser device to avoid injury.

Always keep any access covers on and the laser head enclosure closed whenever the machine is in operation. Avoid any direct exposure and do not stare at the laser beam while the machine is operating. Notice and understand all the warning labels located on your machine.

The BOSS FC Lumin X should be placed and prepared in accordance with the pre-installation checklist provided by Boss Laser. Care must be used when preparing to install as bending and moving cables on the machine can cause damage to the equipment.

Only trained operator(s) should operate the machine. It is recommended that the business establish a safety management area around the machine and provide warning signs as recommended above. Hazards from this machine include but are not limited to eye damage, skin burns, skin irritation, electrical high voltage, electric shock, LASER radiation, fire and exposure risk, noise, material damage, lifting and/or moving heavy metal pieces.

Never leave the machine unattended while it is running. The operator should not leave during the operation of the machine. If an abnormality occurs during the use of the device, immediately press the Emergency Stop button.

The following safety measures must be strictly implemented and be abided by to ensure the safety of the machine and the individual operating it. Boss Laser, LLC shall not be held responsible for any damage or injuries resulting from improper use or dismantling of the laser machine.

- NEVER operate laser machinery unless you have been professionally trained.
- ALWAYS use protective eyewear.
- ALWAYS operate the machine as designed.
- NEVER set anything on top of the laser and/or on the worktable while NOT in use.
- NEVER leave the laser unattended while it is running.
    - This will ensure that you are able to see or hear any abnormalities/potential hazards.
- ALWAYS maintain the machine's environment free of heavy pollution, such as strong magnetic electrical interference.
- NEVER use unapproved or unsafe materials, such as Polyvinyl Chloride (PVC) or any materials that emit noxious gases.
    - Unsafe vapor from these materials can cause harm to people.
        - These gases can cause harm to your central nervous system.
- NEVER operate the laser near flammable or explosive substances.
    - The light beam that is emitted is not visible and poses a fire hazard.
- NEVER try to cut reflective material as the laser beam can reflect and deviate (bounce around) which can cause blindness or severe injury, requiring medical attention.

- NEVER dismantle the laser machine as this can disrupt the laser and its high voltage / pressure parts.
    - This can also cause harm or injury.
- ALWAYS have a clean area around the machine to allow it to function properly.
- ALWAYS have an appropriate fire extinguisher and method of egress in case of an emergency.

In Case of a Fire:

1. Press the Emergency Stop button located on the top of the machine.
2. Quickly blow out the flame(s) with an ABC fire extinguisher for serious flames

Laser Safety

The human body is vulnerable to the output of certain lasers, and under certain circumstances, exposure can result in damage to the eyes and skin.

The laser used in the machine is a Class 4 classification with a wavelength of 1064nm (1.06µm). This means that people near and/or operating the machine must wear proper wavelength safety rated laser glasses. Laser safety glasses not rated for the proper wavelength given above will allow the laser to pass through as if no protection were worn. Other PPE needed can be determined by the owner/operator or site safety administrator of the machine as per company policy and as federal, state, and local laws mandate. We recommend the use of gloves and masks in addition to glasses.

It is recommended that warning signage is posted in conspicuous locations prior to people being exposed to the laser radiation. Anyone within viewing distance of the laser must be wearing safety rated laser glasses that can protect against the given wavelength of 1064nm.

Exhaust Safety

Exhaust gases generated during laser cleaning may be toxic. Review the Safety Data Sheet for the material you are cleaning to determine the hazards. Ensure that the exhaust fan(s) is operating normally, and the working site is ventilated.

Electrical Safety

Any time any electrical work is done, it should be done by a trained technician. Do not touch live components in the electrical cabinet during power-on, such as numerical control devices, servos, transformers, fans, etc. Whenever possible any electrical work should be done when the system is deenergized and a Lock Out Tag Out (LOTO) system is in place. If work must be done while the system is energized extreme caution must be used by trained personnel.

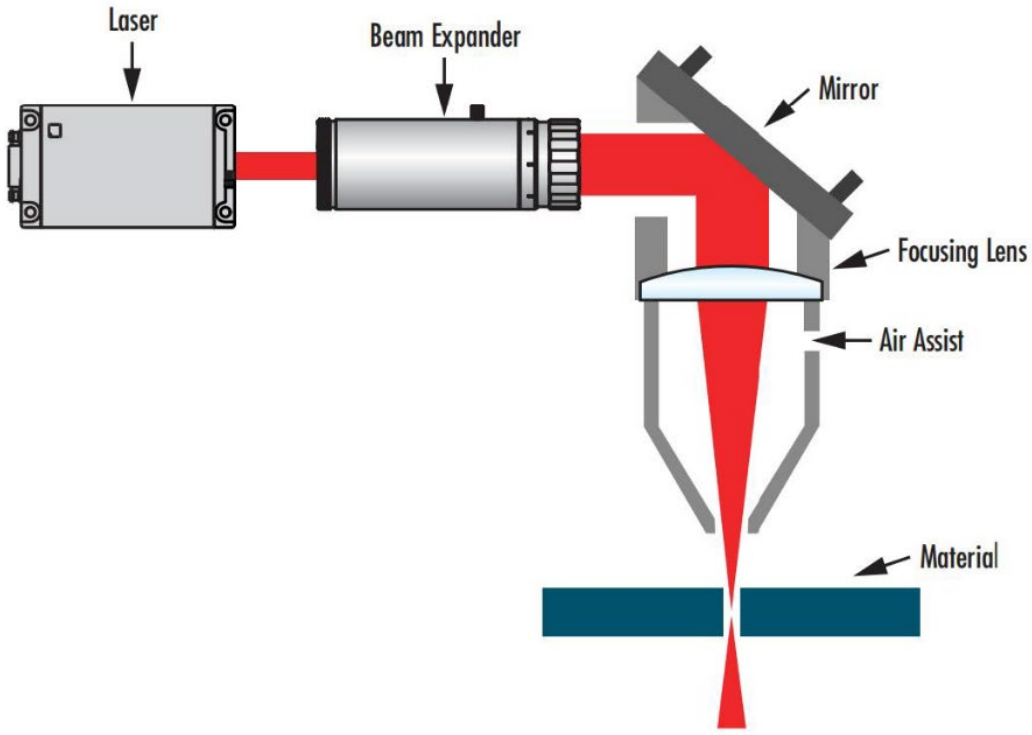
5.1 Understanding How Lasers Work

Understanding each component of a laser system and how they function is essential for achieving optimal performance, precision, and safety. As illustrated in the image, the system

includes a Laser, Beam Expander, Mirror, Focusing Lens, Air Assist, and the Material being processed. The laser generates the initial beam, which is widened by the beam expander to improve focus quality. The mirror redirects the beam toward the focusing lens, which concentrates it into a fine point for high-precision work. The air assist clears debris and cools the material, ensuring clean cuts or engravings. Each component plays a vital role, and understanding their interactions is key to maintaining system efficiency and achieving desired outcomes.

Equally important is safety—misalignment, improper focusing, or malfunctioning components can pose serious hazards, including eye injuries or fire risks. Proper training, regular maintenance, and the use of protective equipment are essential to ensure safe operation of the laser system.

Below is a graphical representation of the common laser components:



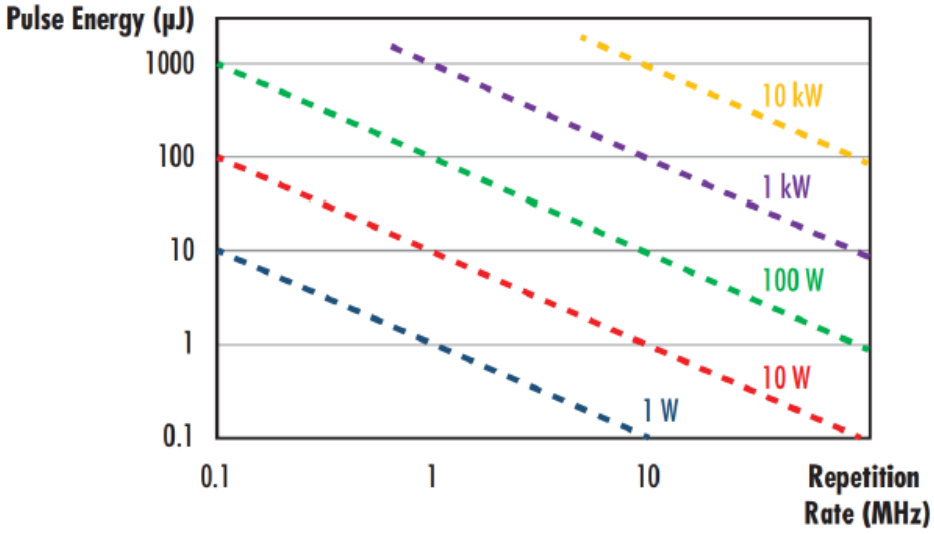
To fully harness the capabilities of a laser system, it's important to go beyond understanding its physical components and delve into its operational parameters. Three critical factors that influence laser performance are laser power, pulse duration, and repetition rate. These parameters determine how much energy is delivered, how long each burst of energy lasts, and how frequently those bursts occur. Together, they directly impact the precision, depth, and quality of material processing tasks such as cutting, engraving, or marking, or in the case of the FC Lumin X, cleaning.

Mastery of these settings allows users to tailor the laser's behavior to specific materials and applications, ensuring both efficiency and accuracy.

Please keep the following information in mind as it is useful in understanding how the laser operates:

- Laser power is measured in watts (W), used to describe the optical power output of a continuous wave (CW) laser or the average power of a pulsed laser. In addition, pulsed lasers are characterized by a pulse energy that is directly proportional to the average power and inversely proportional to the repetition rate of the pulse.

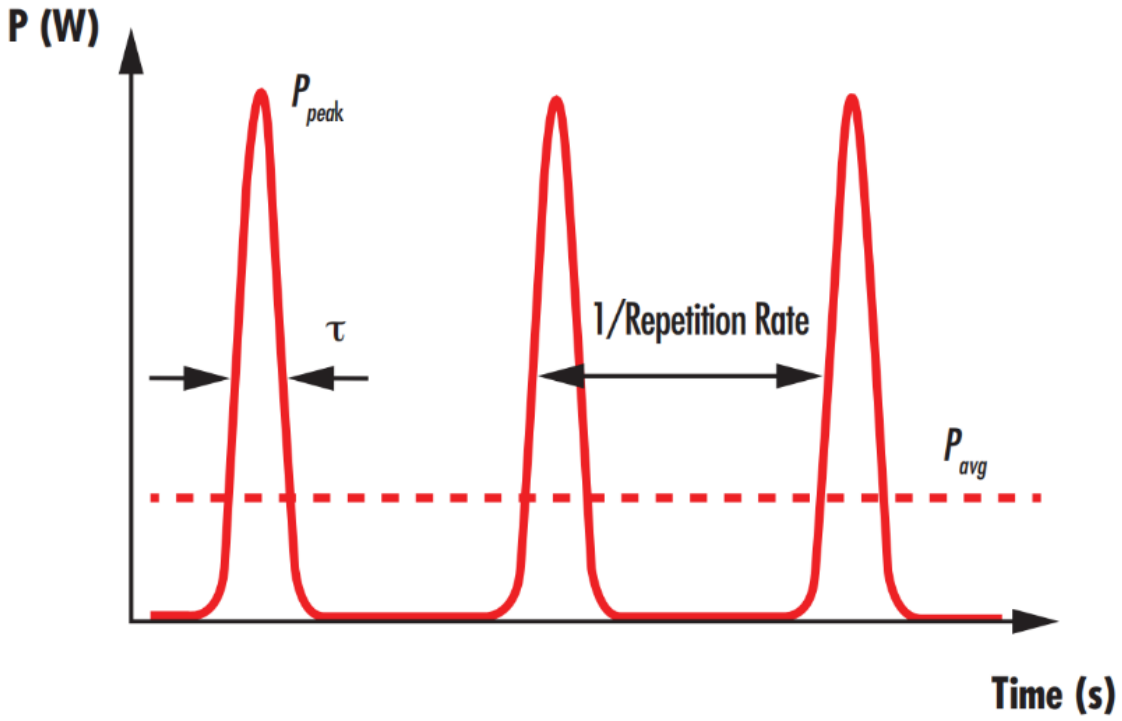
$$Pulse\ Energy = \frac{Average\ Power}{Repetition\ Rate}$$



  - Lasers with higher power and energy are usually more expensive, and they produce more waste heat.
    - With increasing power and energy, it is also increasingly difficult to maintain the high quality of the beam.
- The laser pulse duration (i. e., pulse width) is commonly defined as the time taken when the laser reaches half of the highest optical power (FWHM). The common units are fs to ms. The pulse duration of an ultrafast laser is very short, only in the order of picoseconds (10-12) to femtosecond (10-18), which can benefit a variety of applications, including precision material processing and medical lasers.
- The repetition rate of the pulsed laser (i.e., the pulse repetition rate) describes the number of pulses emitted per second, i.e., the reciprocal of the temporal pulse spacing. The common units are Hz to MHz. As mentioned above, the repetition rate is inversely proportional to the pulse energy and proportional to the average power. Although the repetition rate generally depends on the laser gain medium, in many cases, the repetition rate can be changed. A higher repetition rate leads to a shorter thermal

relaxation time on the surface of the laser optical element and at the final focus point, which in turn leads to a faster heating of the material.

- A graphical representation is shown below:



A thorough understanding of both the structural components and operational parameters of a laser system is essential for any operator aiming to use the equipment effectively and safely. From the alignment of optical elements to the fine-tuning of laser power, pulse duration, and repetition rate, each aspect plays a critical role in achieving high-quality results. Proper training, routine maintenance, and adherence to safety protocols not only enhance performance but also protect users and equipment. With this foundational knowledge, operators are well-equipped to handle a wide range of laser applications with confidence and precision.

6. Safety Features & Regulatory Compliance

6.1 Safety Features

Boss Laser has incorporated specific safety features into the BOSS FC Lumin X Laser System to meet the requirements of 21 CFR 1040.

These safety features include:

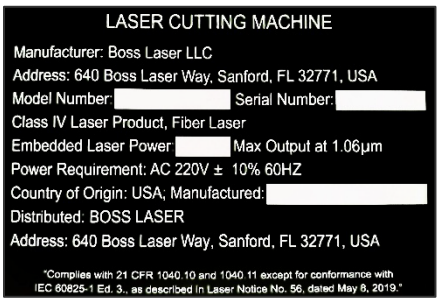
- 10 Safety Alarm Functions
  - The control software includes 10 built-in alarms to detect issues like overheating, system faults, or unsafe operating conditions.
- Protective Gear Requirements
  - Operators are required to use specified laser safety glasses, face shields, and protective clothing (heat-resistant gloves, aprons, etc.)
- Fume Hazard Warnings
  - The system warns about toxic fumes generated during cleaning (especially from paint, rust, or oil residues). Proper ventilation or fume extraction is recommended.
- Dual-Axis Galvanometer (Galvo)
  - Enhances beam control and stability, reducing the risk of accidental exposure or misfires.
- FDA Compliance
  - The system is FDA-compliant, meaning it meets U.S. laser safety regulations for industrial use.
- Training Requirement
  - Only trained personnel should operate the device.
    - This manual emphasizes full training and understanding of the user guide before use.

6.2 Safety & Regulatory Labels

21 CFR 1040 requires that certification, identification, and warning labels be placed on laser products. The labels affixed to the outside of the Boss Laser BOSS FC Lumin X system are shown throughout the following pages, with their locations specified. These labels are put in place for the safety of the machine and the operator. It is important that you pay attention to these warning labels and adhere to them. If these warnings are not followed, it could cause severe damage to the machine and injuries to the operator.

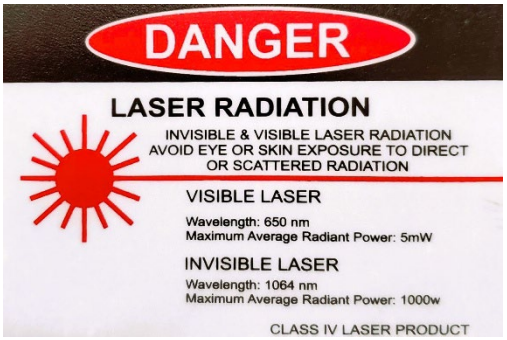
6.2a Certification & Identification Label

The “Certification" and "Identification” labels are combined into one label. The label can be found on the back left side of the machine.



6.2b Warning Logotype

The “DANGER: Visible & Invisible Radiation” warning label can be found on the front right side of the machine. Staring at the laser beam can cause damage to the eyes and touching the laser beam can cause serious injuries. Wearing safety glasses will protect your eyes from injury.

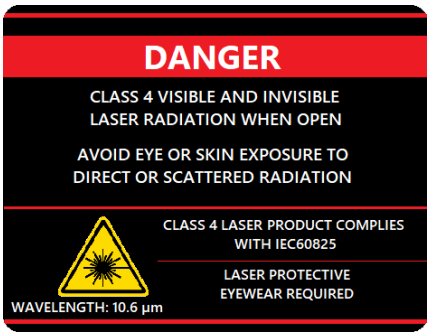


6.2c Laser Aperture

The “LASER APERTURE” warning label can be found on the laser head gun. The aperture warning label is there to identify where your laser beam will exit the laser head gun.

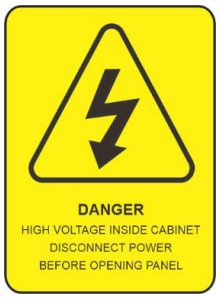
6.2d Danger: Visible and Invisible Radiation

The “DANGER”: Visible and Invisible Radiation warning label can be found on the front of the machine. Staring at the laser beam can cause damage to the eyes and touching the laser beam can cause serious injuries.



6.2e Electrical Safety

The "DANGER: High Voltage" sticker can be found on the inside of the Control Panel electrical cabinet. This warning indicates that precautions should be taken when touching or handling any electrical components of the machine. Please make sure to disconnect the laser from all power sources prior to opening these cabinets or handling the internal electrical components.



6.2f Non – Interlocked Protective Housings

The "DANGER" labels for non-interlocked doors are located on the machine body next to the doors that are accessible/removable. This machine produces laser radiation & all doors to the machine should be closed when the laser is operating.

6.3 Safety Design Features

6.3g Power Control (Master Switch)

The Power Control (Master Switch) is installed as part of the control panel. The Key Control switch controls the hot wire of the main circuit. When this switch is turned off, the machine is powered down.

6.3h Emergency Stop Buttons

The Emergency Stop buttons, which is located on the top of the machine, controls the live wire of the main circuit, and when the Emergency Stop Button is engaged (pressed down), the machine will power down.

6.3i Laser Status – Emissions Indicator Light

The machine comes equipped with an Emissions Indicator Light installed on the top side of the machine that shows the status of the machine. When the machine is firing, the Emissions Indicator light will light up Red. Otherwise, the Emissions Indicator Light will light up Green to indicate a Ready/Idle state.


6.3j Personal Protective Equipment (PPE)

Laser Safety Glasses are included with the machine, and they can be found inside the toolbox. All eyewear provided meet or exceed ANSI Standards for the Boss Laser Safety Systems. The Laser Safety Glasses should be worn when the machine is firing/operating. In addition, masks and gloves are also required when operating the machine to prevent injury from material handling and/or smoke and fumes generated from operations. The output laser wavelength of this equipment is 1064nm (invisible light), which belongs to class IV laser, that can cause great harm to the eyes and burn user's skin. Its reflected and scattered light may also cause harm to the human body. Therefore, please wear 1064 nm laser protective glasses above OD4+ during the use of the machine.

7. Accessing Our "How To" Videos and Manuals

We strive to provide support for our customers, which is why we have a variety of videos and manuals to assist our customers during the use or setup of their machine. In this manual, certain pages will contain a QR code. This will indicate that there is a video located on our website that will be able to guide you through this process or give you a better idea of how something is done.

Scan this QR code to access our Instructional Videos.

Scan this QR Code to access our Manuals Online

7.1 How to Access the Manuals on the USB

1. Your Boss Laser BOSS FC Lumin X will come with a USB that contains the Operators Manual. The first step is to plug in the USB that accompanied the machine.
2. The "USB (For Boss Laser BOSS FC Lumin X)" folder will contain the "BOSS FC Lumin X Manual," and other various information.

8. Receiving Your BOSS FC Lumin X

While most of our machines arrive unharmed, we urge you to inspect the machine upon delivery to ensure that no damage has occurred while in transit. Damage can include pierced or broken pallets, smashed sides, or components. If there seems to be any damage to the machine, take pictures prior to removing any bands.

If no damage is visible on the outside, proceed to removing the plastic wrap covering. If there is damage to the machine under the plastic wrap covering, contact your Sales Consultant or Client Services Coordinator and send them pictures so we can report that damage to the carrier. The machine is insured for its full value while in transit and if it is damaged to the point of needing parts or replacement, the carriers are particularly good at covering those costs. But the damage must be reported within 24 hours of delivery.

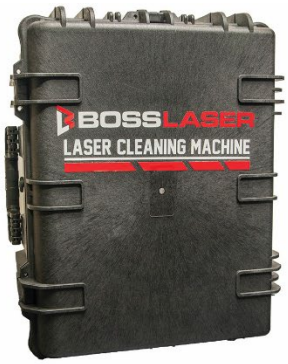
Some machines might come with a pallet. This pallet will contain any accessories that are part of the machine or were ordered in addition to the machine. If you expect to receive a pallet with the machine but receive only the machine and no extra pallet or boxes of components and/or accessories, contact your Sales Consultant or Client Services Coordinator as soon as possible.

Receiving Your BOSS FC Lumin X

After the machine has been inspected for damage and all the components/accessories have been accounted for, be sure to remove any foam or padding from inside or outside of the machine. Remove any plastic/Velcro ties used for securing the laser head from moving while in transit.

8.1 Toolbox Contents

Your toolbox will contain a variety of items. Be sure to put them back in the toolbox or in a designated area after use. The items in the toolbox are used for testing, maintenance, and operation of the machine. It is important not to lose these items.



Item	Quantity
Adapted F-Theta Lens	2
Laser Protective Glasses	1
Optical Cleaning Kit	1
Bracket for Laser Head	1
Complete Machine	1
Portable Travel Case	1

8.2 Exhaust & Fume Extractor Overview

The laser vaporizes material as it moves along the surface of the material. This could generate substantial amounts of smoke. Some materials generate even larger amounts of smoke than other materials, so the exhaust of your machine and its importance cannot be overstated as it is necessary to remove harmful fumes and smoke produced by the laser machine.

During the cleaning operation of the machine, smoke and particulates could be generated as the material is being vaporized by the laser. Many of the materials processed by the laser “off-gas” fumes and odors that are neither pleasant nor safe for the human respiratory system.

If you purchase a Fume Extractor with your BOSS FC Lumin X, the next section will go over the setup.

8.2a Setting Up Your Fume Extractor

A Fume Extractor allows you to exhaust your machine inside without needing to vent the fumes/exhaust externally. If you ordered a Fume Extractor for your BOSS FC Lumin X machine, it will be dropped shipped from the manufacturer and come separately from the machine.

If you would like to purchase a Fume Extractor or replacement filters for your current Fume Extractor, scan this QR code. The FiltraBOX Micro is recommended for the BOSS FC Lumin X.

To set up your Fume Extractor, remove the exhaust tubing (120mm & 150mm) from the crate/machine, as well as your exhaust hose clamp. You will take the **120mm exhaust tubing** from the crate/machine and place it on the exhaust port, located on the back side of the machine (this will be a 4" metal circle). Once the tubing is placed on the exhaust port, take the **one 120mm exhaust hose clamp**, and place it over the tubing and the exhaust port. Now that the exhaust hose clamp is properly placed, tighten it down so there is a snug fit with minimal room for fumes to escape.

After the first end of the exhaust hose has been placed and secured, take the second exhaust hose clamp, and place it on the other end of the exhaust tubing. Next, place the exhaust tubing and clamp on the intake port of the Fume Extractor **with the reducer attached to the intake port**. After it is correctly positioned, tighten down the exhaust clamp as you did the first time. Please remember that your Fume Extractor may look different than the photo in this manual. Some Fume Extractors have intake ports located on the top; others are located on the back.

To view the appropriate operator's manual for your Fume Extractor, scan the QR code below for your Fume Extractor.

FILTRABOX MICRO
OPERATORS' MANUAL

9. Operating Your BOSS FC Lumin X

9.1 Machine Operation

9.1a Inspection

Inspect the area of the machine to ensure it is safe to operate. The area should be free of debris.

Ensure the electrical area is clear and free of debris and plug in or turn on the circuit to the machine.

Turn on the machine in accordance with the process of the Power On/Off sequence that follows in this manual.

Power On/Off Sequence

Power On

- Inspect the area.
- Connect the power cord.
- Turn power ON at the breaker.
- Disengage the E-Stop button.
- Flip the switch at the back of the 300 W cleaner to the ON position.
- Complete Daily check of laser head.
- Take out the laser head
    - Hold the handle with your hand
    - Open the lid of the laser head
    - Point the head down to test the Red light
        - Exit the light down
- The handle button is a two-segment button
    - The first is held to provide the indicator Red light
    - The second is held to provide the Laser

Power Off

- Press E-stop.
- Turn the key OFF for power.
- Switch the breaker off.

9.1b Emission Indicator Light


The Emission Indicator Light can be seen on the top of the machine. The Emission Indicator Light is a safety feature and will glow Red when the machine is firing and emitting a laser beam and will glow Green when the machine is in an Idle or Ready state.

9.1c Emergency Stop Button

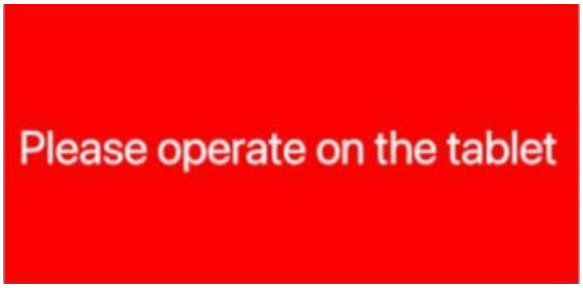
The Emergency Stop button can be seen in the image to the right. The Emergency Stop Button is a safety feature and should be used in case of an emergency. If the button is engaged, it will be pushed down. If the emergency stop is in the up position, it is disengaged. For your machine to turn on, the Emergency Stop Buttons must be disengaged.

9.2 Interface Description

The user interface has various functions such as marking parameter setting, drawing graphics setting, alarm monitoring and status monitoring.

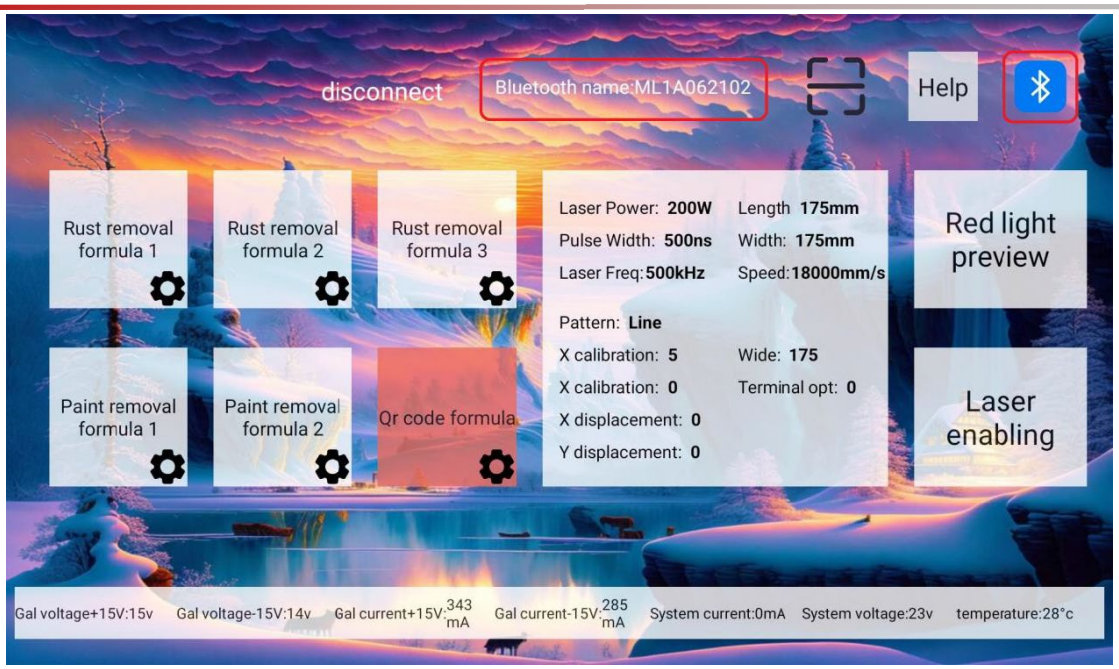
The FC Lumin X is equipped with two different control end options, respectively: laser cleaning equipment fixed industrial serial port screen, wireless flat plate. The operation process below is explained with the wireless tablet as an example.

(Note: For safety reasons, only one of the control ends can be selected for operation when using the laser cleaning equipment. If the wireless tablet is not connected to the device Bluetooth, the system will determine the serial screen. If the wireless tablet is connected to the device Bluetooth, the system will determine that the wireless tablet is the terminal. The serial screen will be unable to adjust the parameters and display the words “please operate on the tablet” as shown in the image below.

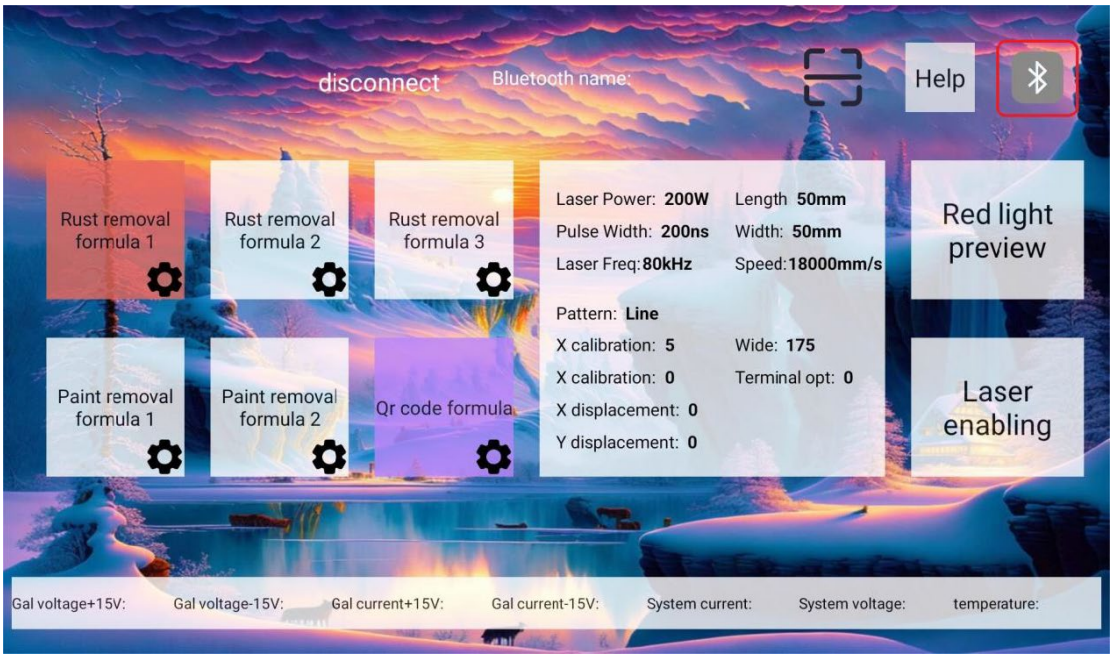


9.3 Interface Function and Introduction

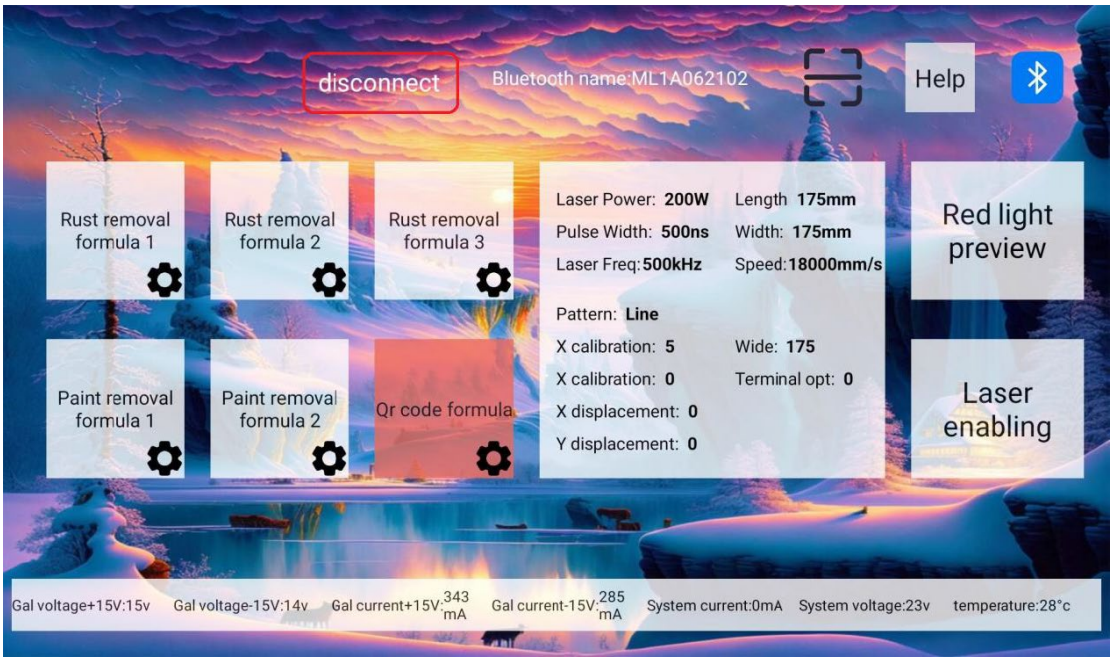
Open the control panel and open (MET-GUIDE) APP. When using the device, scan the QR code on the APP. Bluetooth will automatically connect, the Bluetooth icon will display blue, and the Bluetooth name will display as shown in the following image.



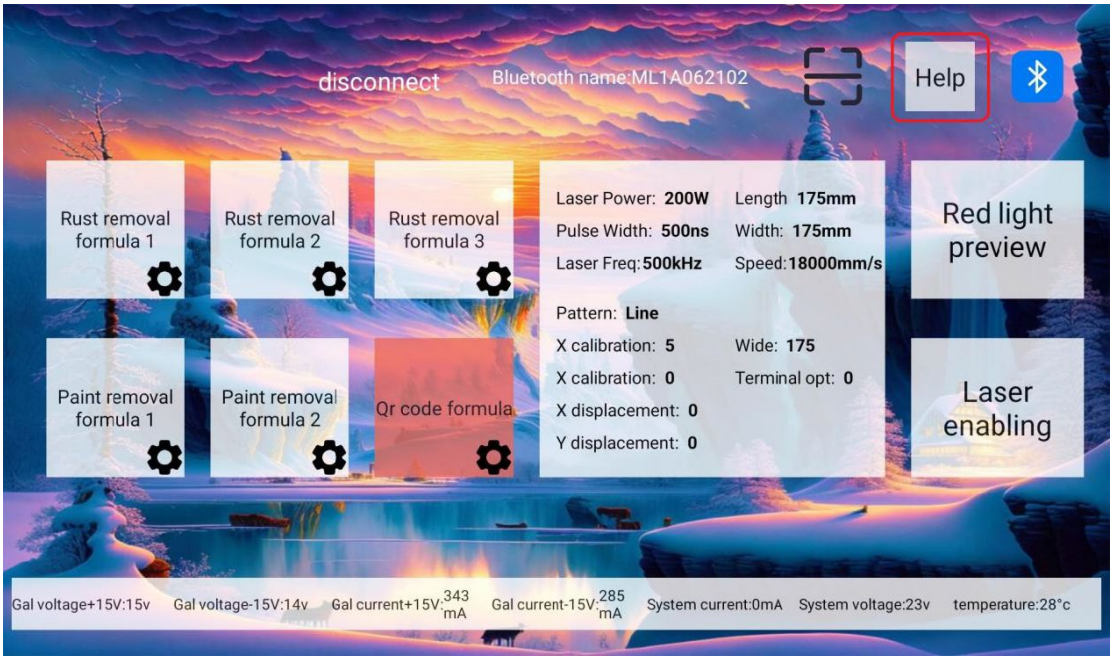
If the connection is not successful, a gray Bluetooth button will appear as shown in the following image.

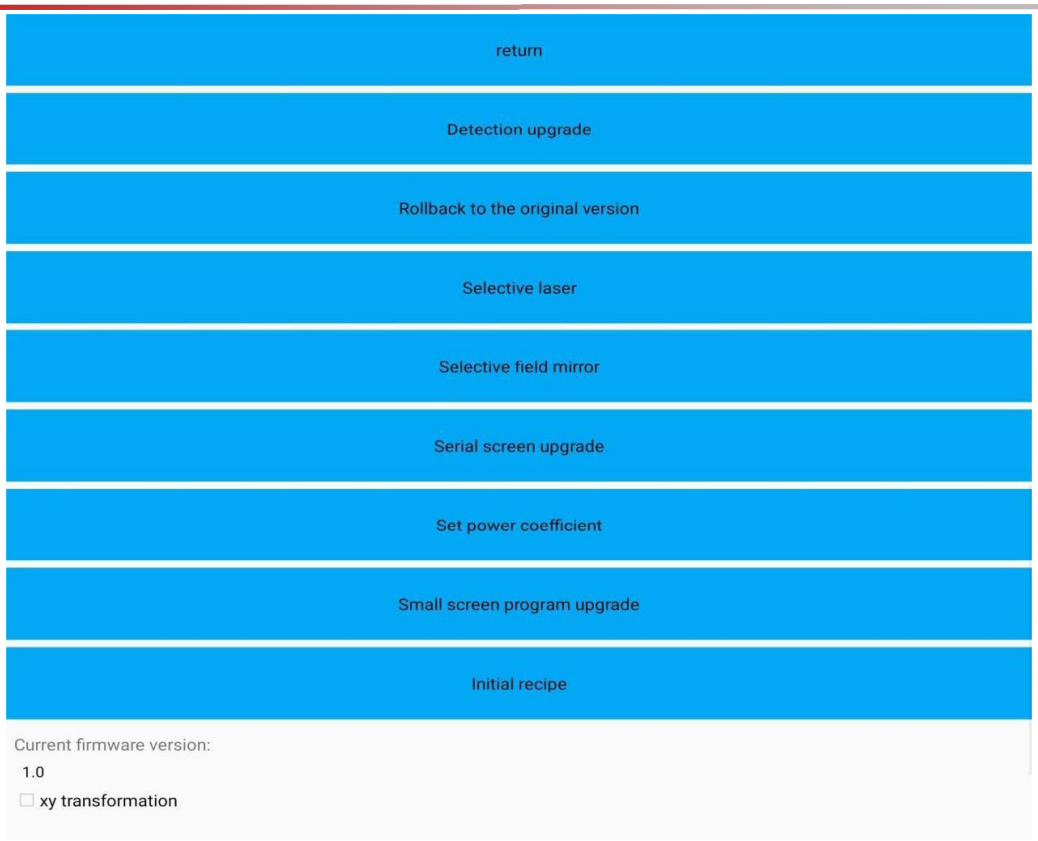


Click "Disconnect" as shown in the image below. Bluetooth will be disconnected, and the main control will be converted into a serial port screen.

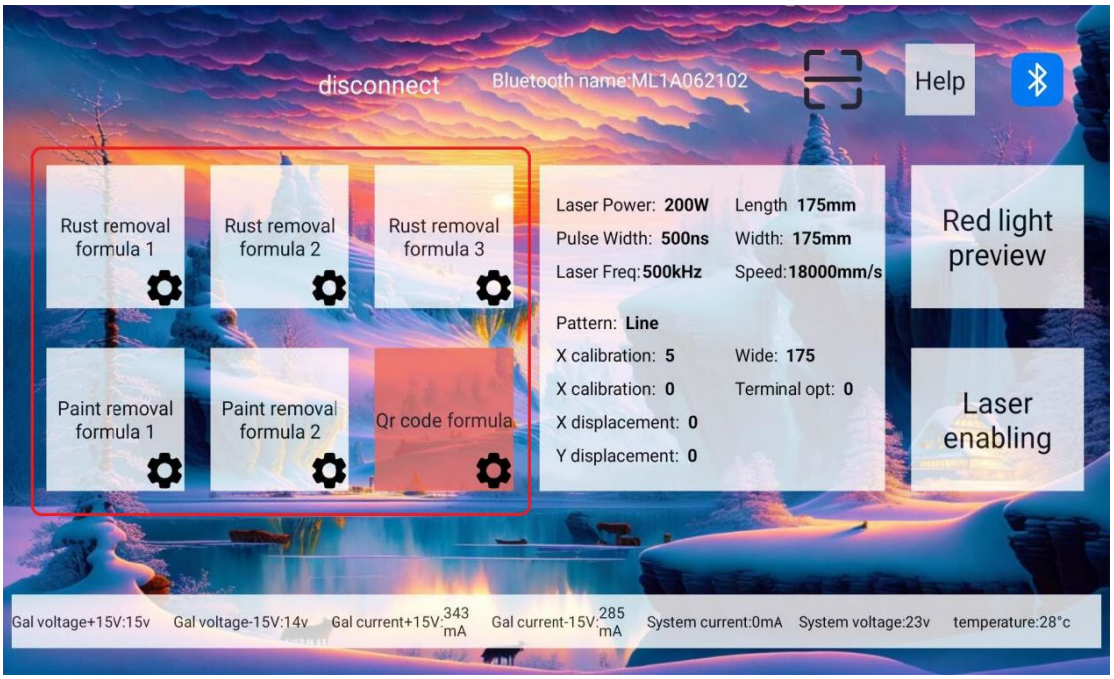


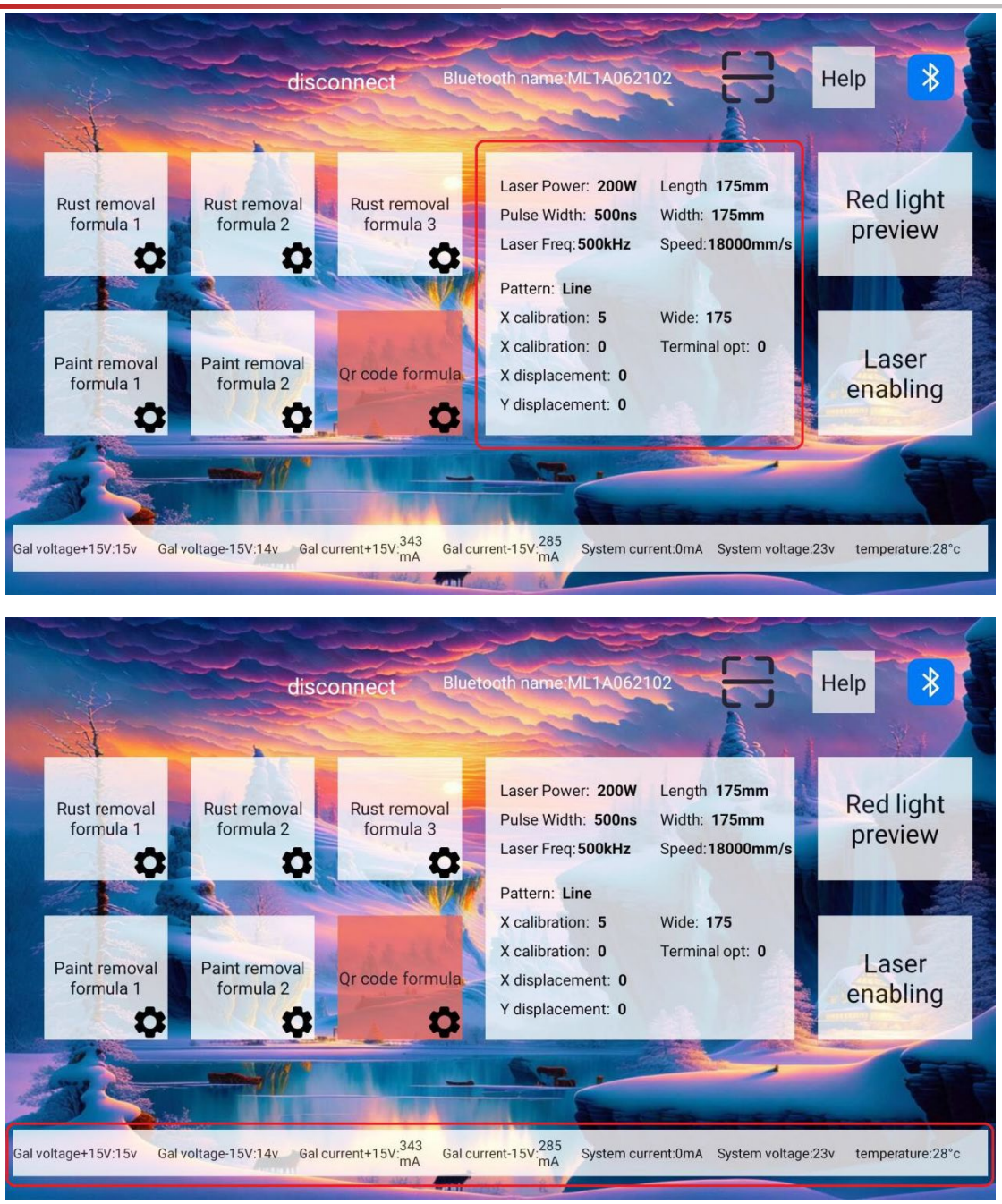
Click Help as shown below in the next two images to enter the APP setting interface, which can realize the system wireless upgrade of MET-TINY-J-300-1/5/10-A laser cleaning equipment, restore factory Settings, select laser, select field mirror and figure XY axis transformation.





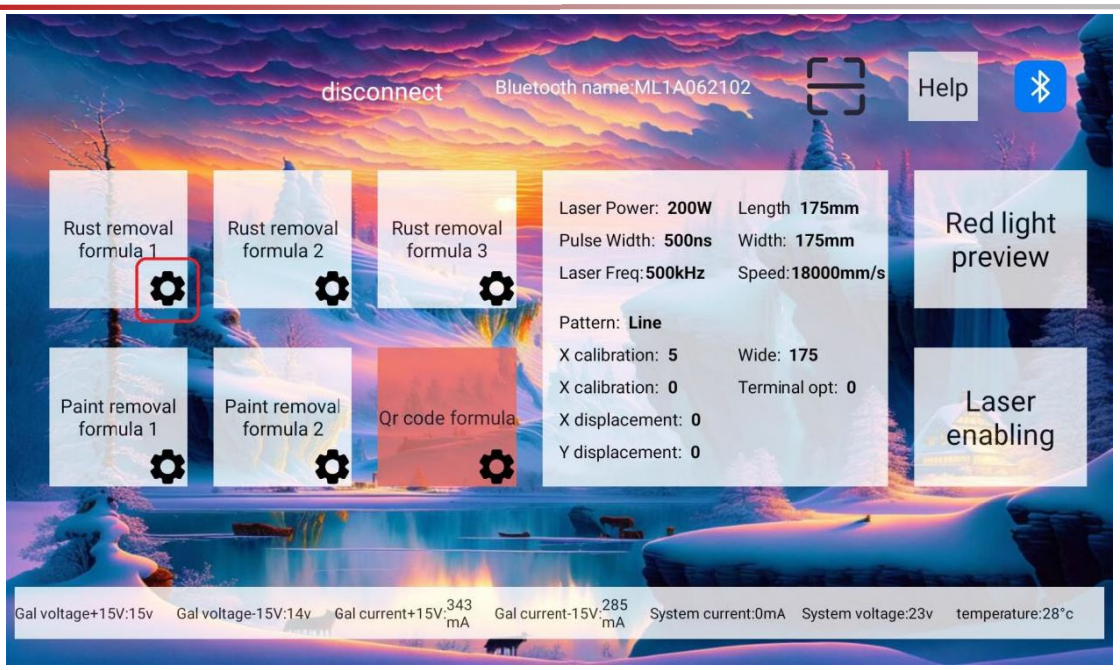
After opening the APP, the equipment control interface will be entered. The left half is divided into 6 formulations as shown below in the first image, and the right half is divided into formula parameters as shown below in the second image, and the bottom section is the return state of the laser cleaning equipment.



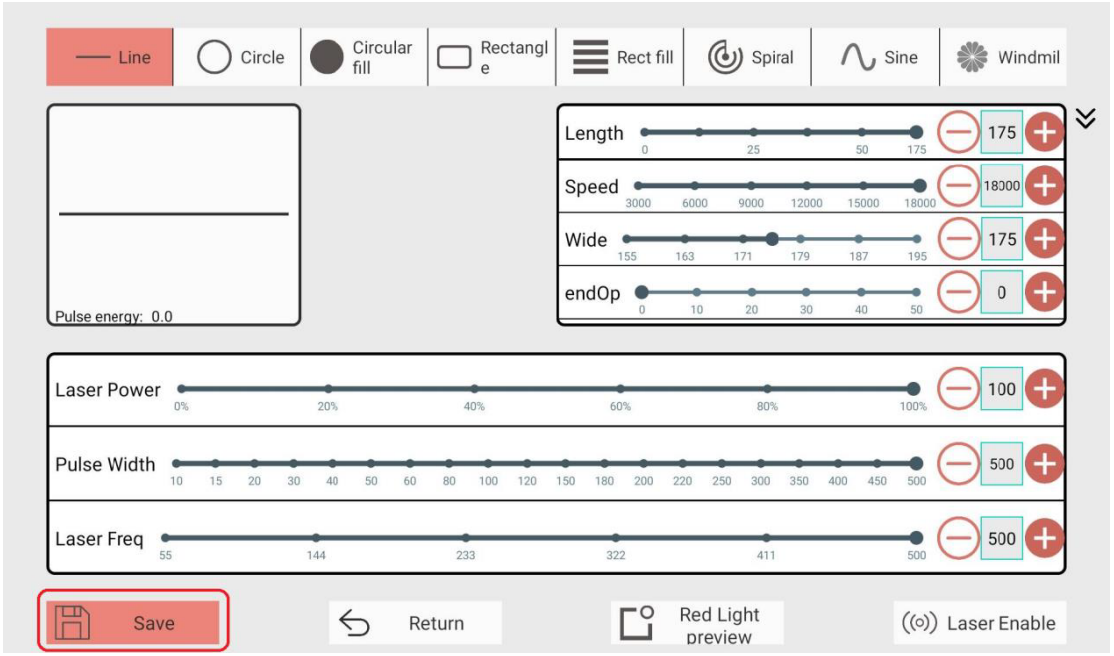


The formula has a memory function, convenient for customers to save the configured graphics and parameters for cleaning different types of substrates.

The user clicks the setting icon to enter the parameter configuration interface.

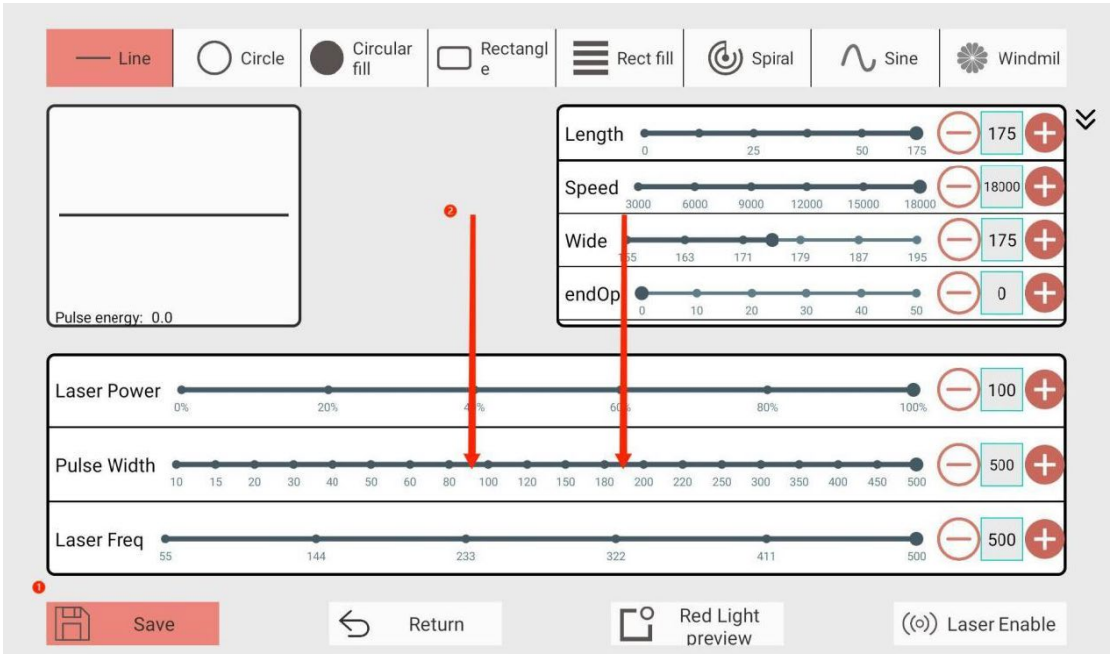


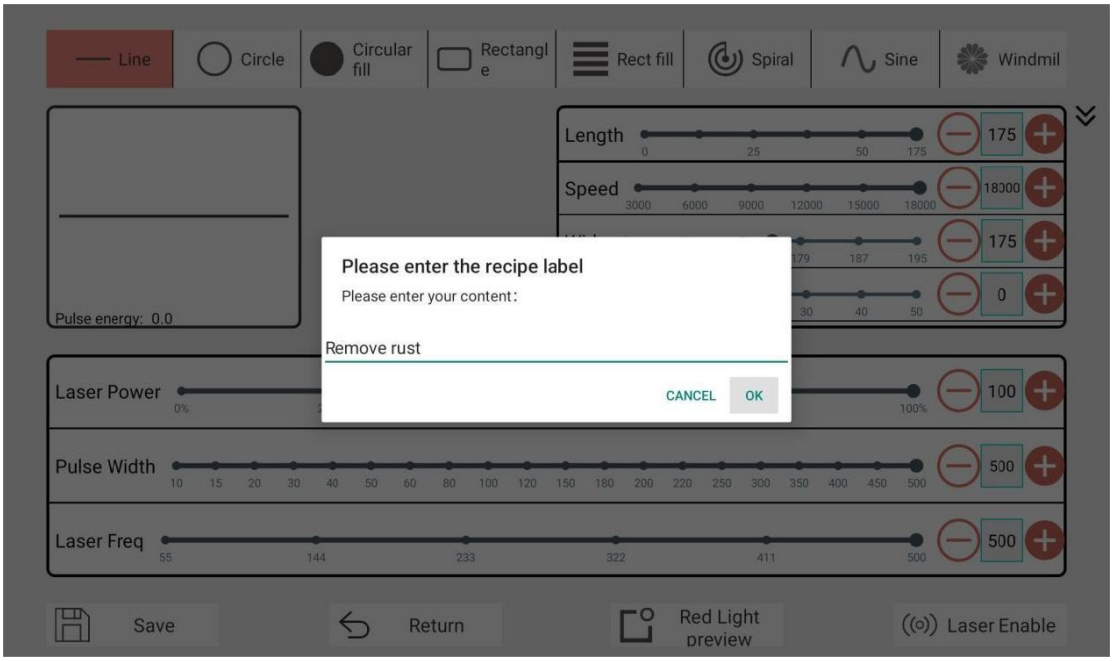
After configuring the parameters, click Save to generate the formula and the saved formula can generate the QR code and use it as a reserve formula.



9.4 Formula generation QR code tutorial

In the formula interface to configure the formula, after clicking save, you will notice this interface with double finger slides. Input the formula label name and click OK to generate the QR code to save to the album.



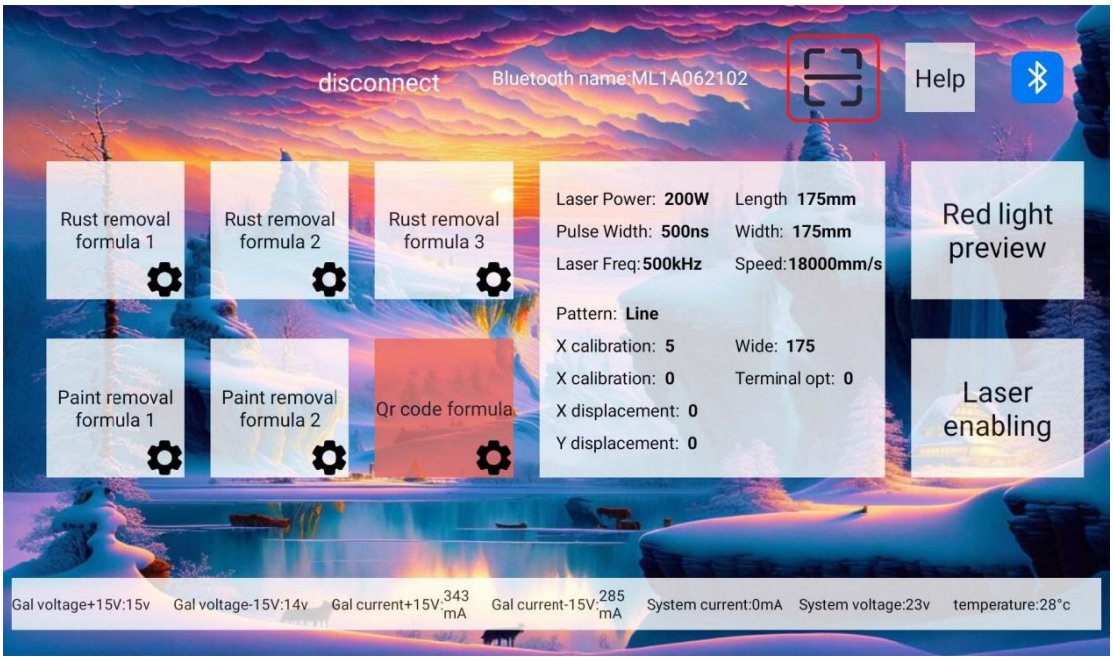


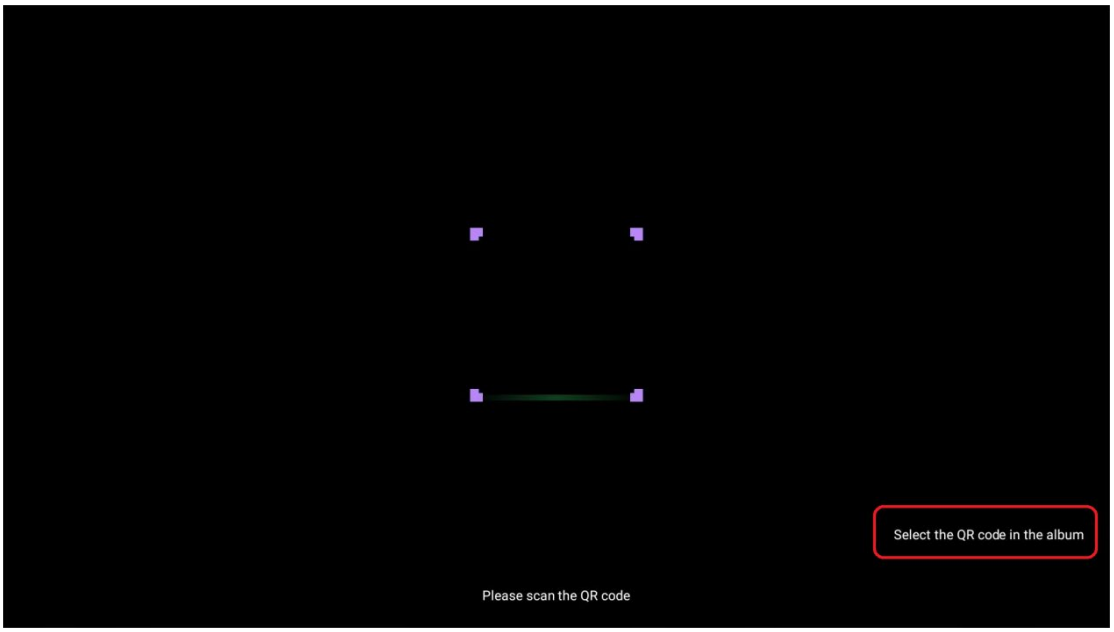
Remove rust

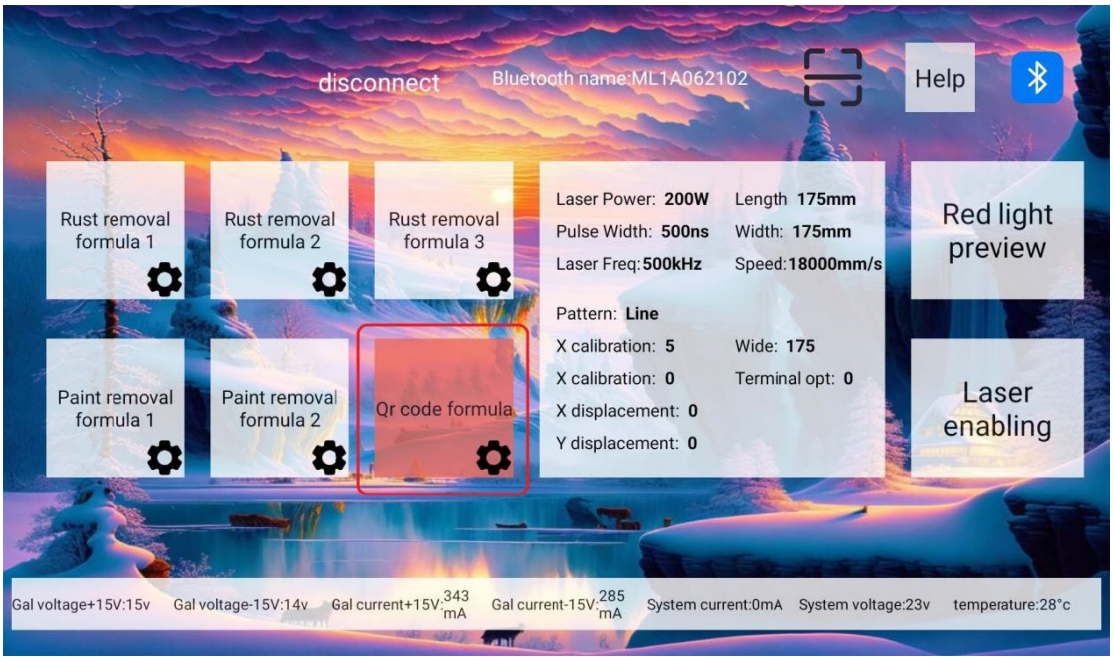
9.5 Formula QR Code Use Tutorial

To use the QR code, follow these steps.

- Click Scan
- Select the QR code in the album
- Select the QR code picture
- Select synchronization to the first interface of the APP [QR code formula]
    - If you get a red-light preview, the laser is enabled

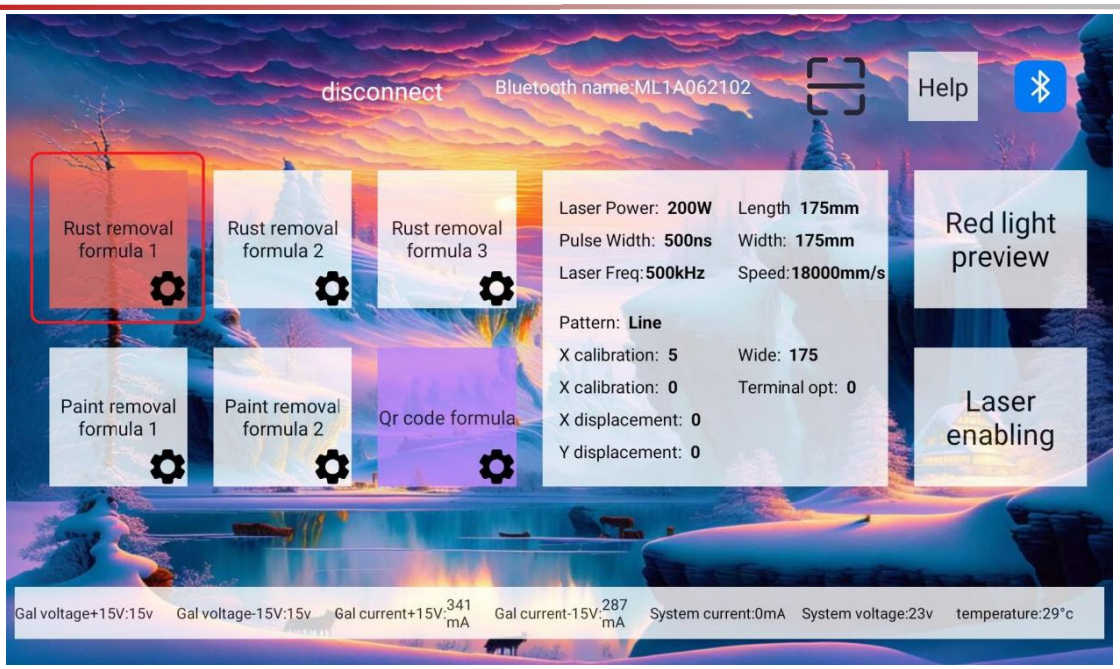


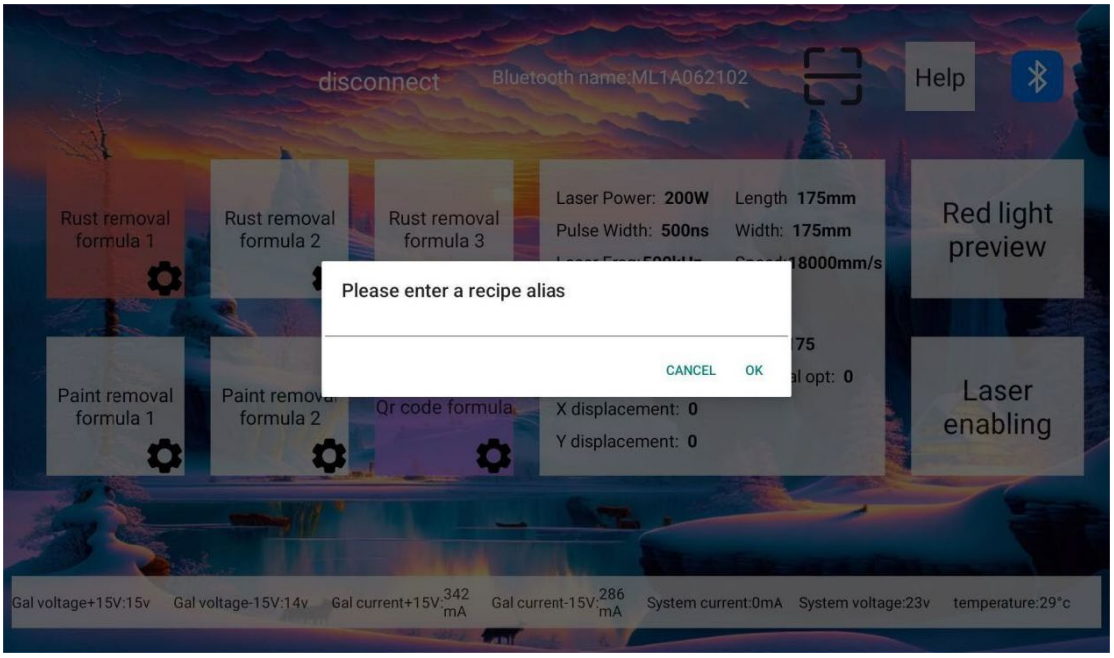


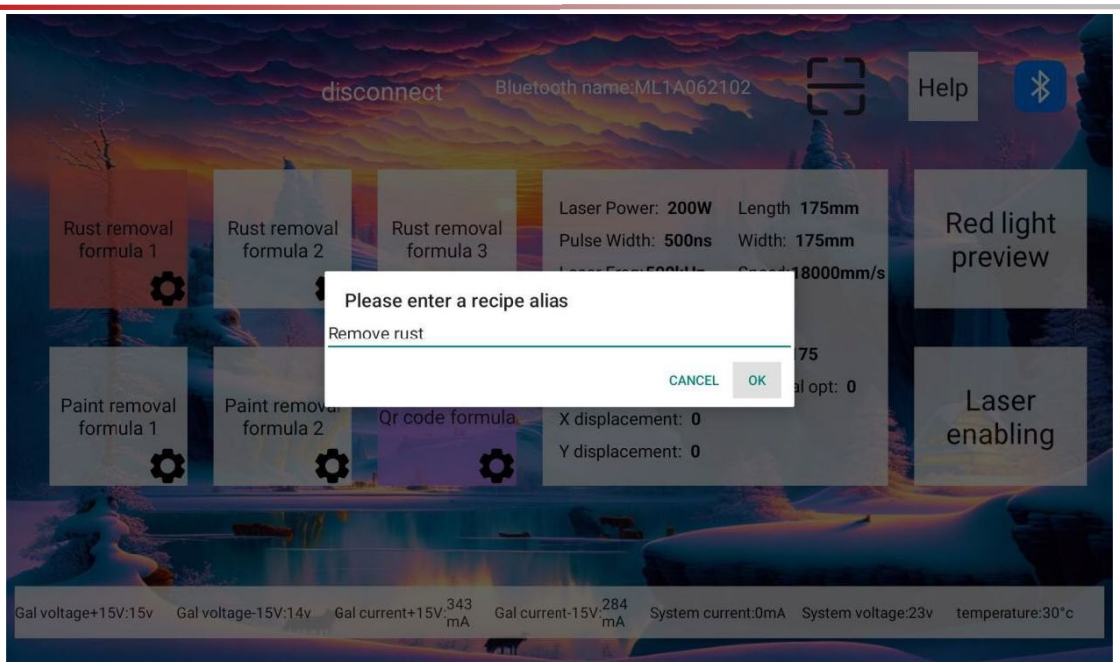


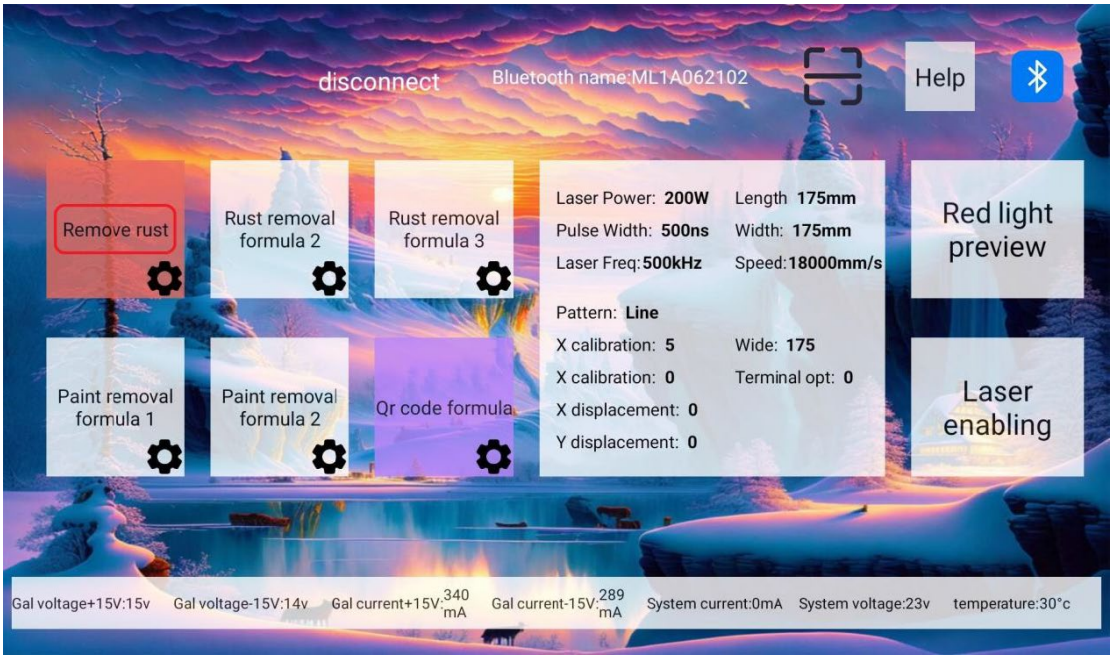
Follow the icon to enter the formula name interface.

The following two images are a demonstration of "rust removal". Other formulations 2, 3, 4 and 5 can do this.

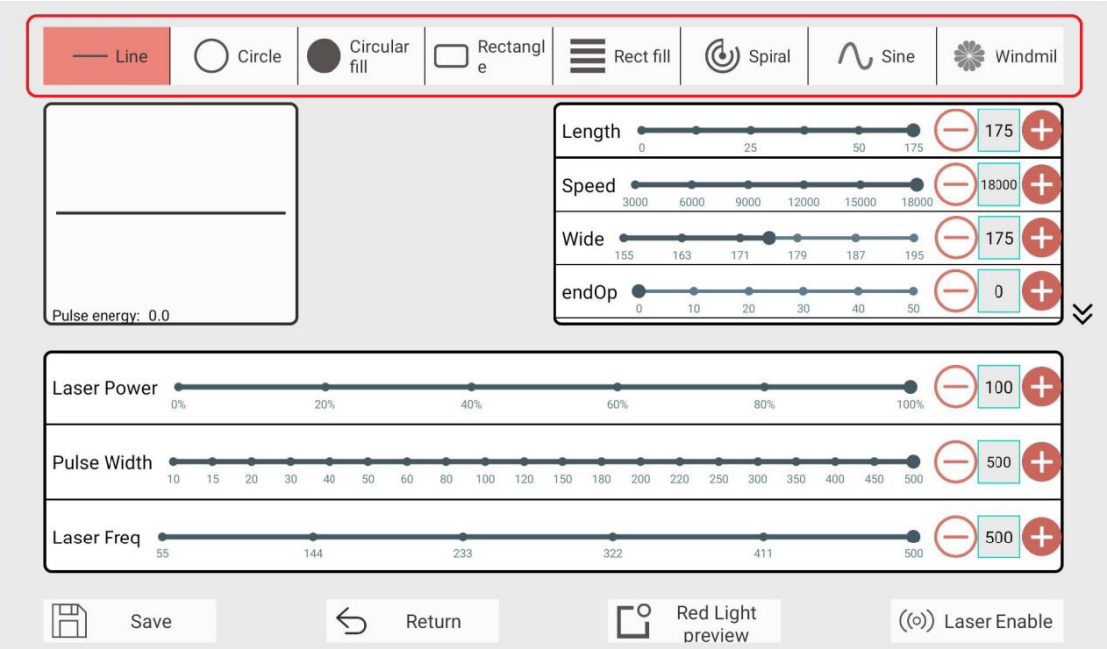

disconnect
Bluetooth name:ML1A062102
Help
Rust removal formula 1
Rust removal formula 2
Rust removal formula 3
Laser Power: 200W
Length 175mm
Pulse Width: 500ns
Width: 175mm
Laser Freq:500kHz
Speed:18000mm/s
Pattern: Line
X calibration: 5
Wide: 175
X calibration: 0
Terminal opt: 0
X displacement: 0
Y displacement: 0
Red light preview
Paint removal formula 1
Paint removal formula 2
Qr code formula
Laser enabling
Gal voltage+15V:15v
Gal voltage-15V:15v
Gal current+15V:341 mA
Gal current-15V:287 mA
System current:0mA
System voltage:23v
temperature:29°c


disconnect
Bluetooth name:ML1A062102
Help
Rust removal formula 1
Rust removal formula 2
Rust removal formula 3
Laser Power: 200W
Length 175mm
Pulse Width: 500ns
Width: 175mm
Red light preview
Please enter a recipe alias
CANCEL
OK
Paint removal formula 1
Qr code formula
X displacement: 0
Y displacement: 0
Laser enabling
Gal voltage+15V:15v
Gal voltage-15V:14v
Gal current+15V:342 mA
Gal current-15V:286 mA
System current:0mA
System voltage:23v
temperature:29°c



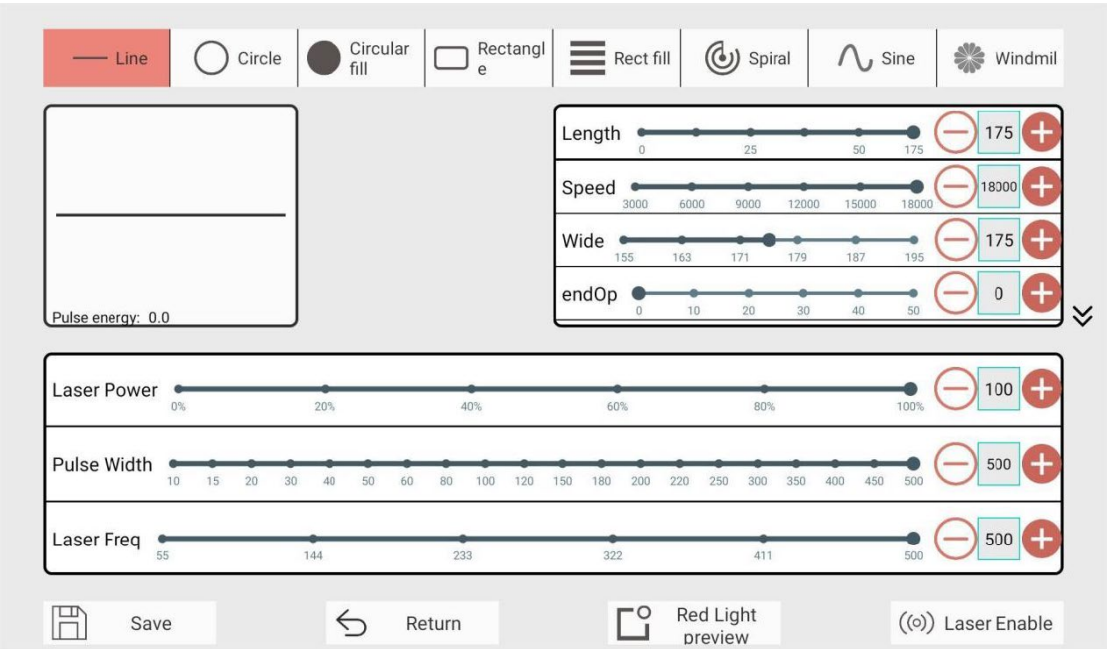


Laser cleaning equipment provides customers with 8 kinds of scanning graphics, namely linear, circular, circular filling, rectangular, rectangular filling, spiral, sinusoidal and windmill.

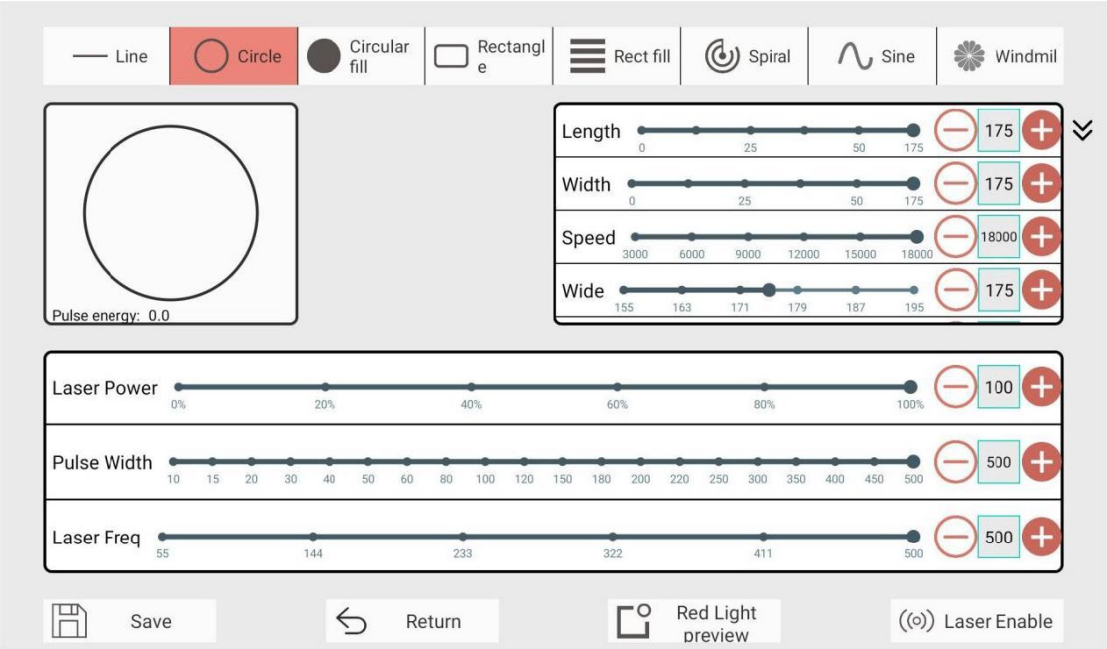


When the equipment leaves the factory, 6 cleaning parameters will be set for as a reference. Please refer to the laser cleaning parameter table for adjusting the laser cleaning parameters.

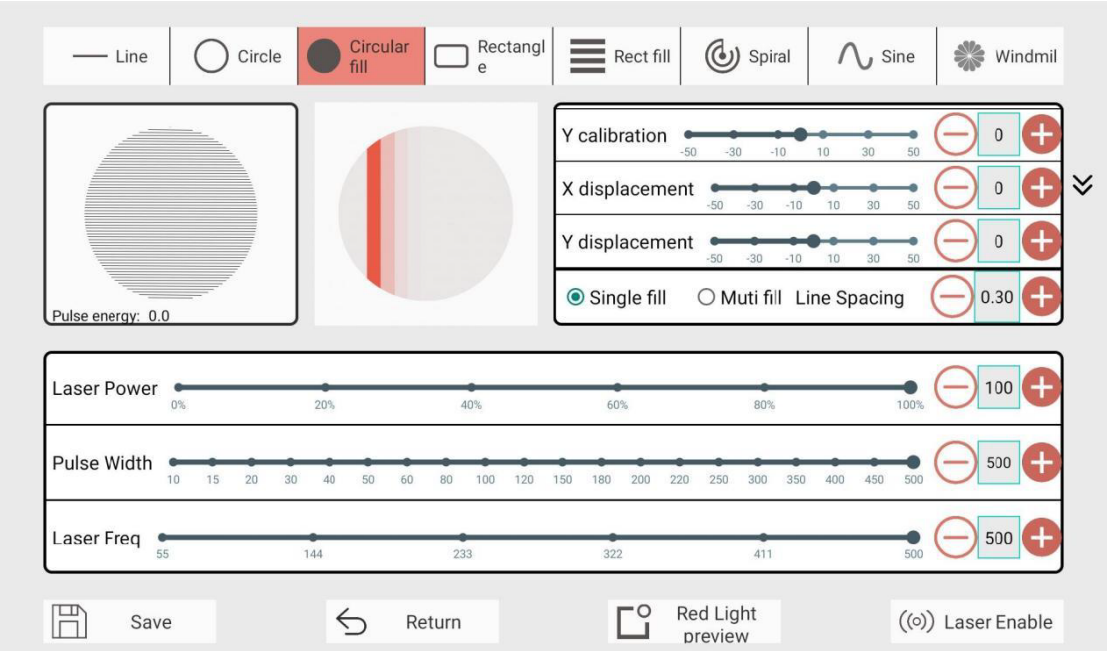
Line Mode



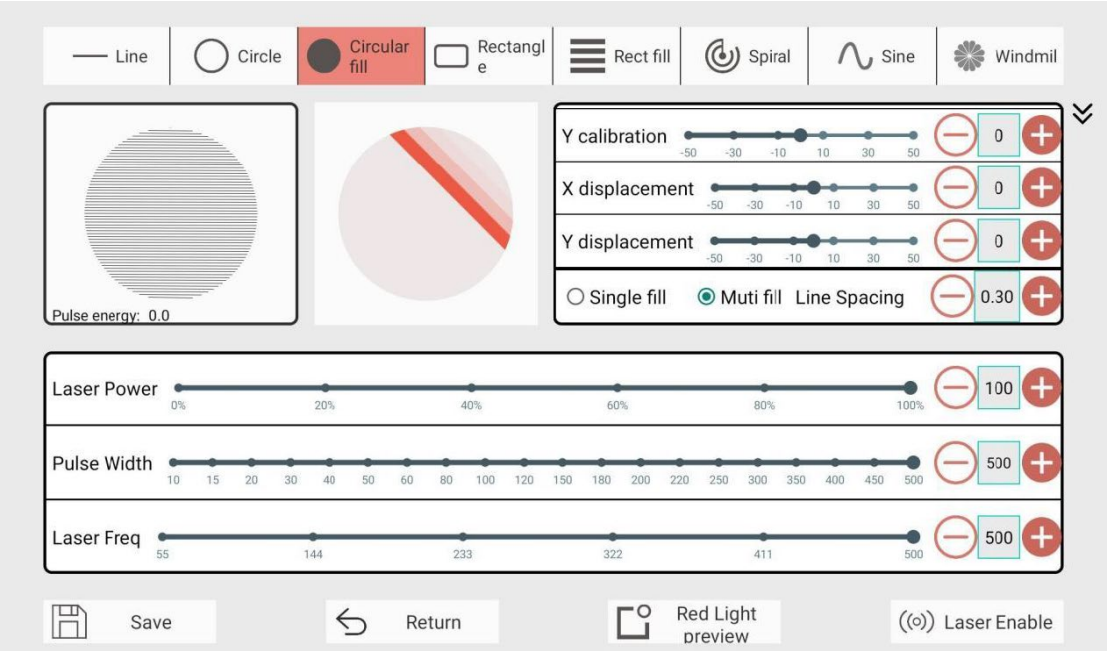
Circle Mode



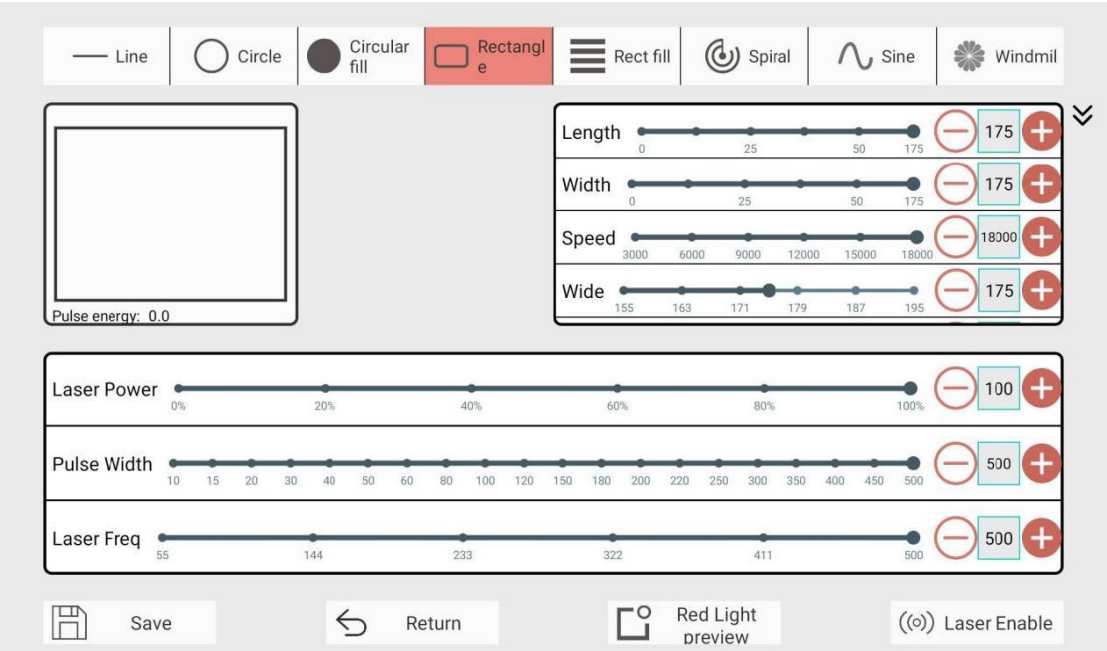
Circular Uni-Directional Filling Mode



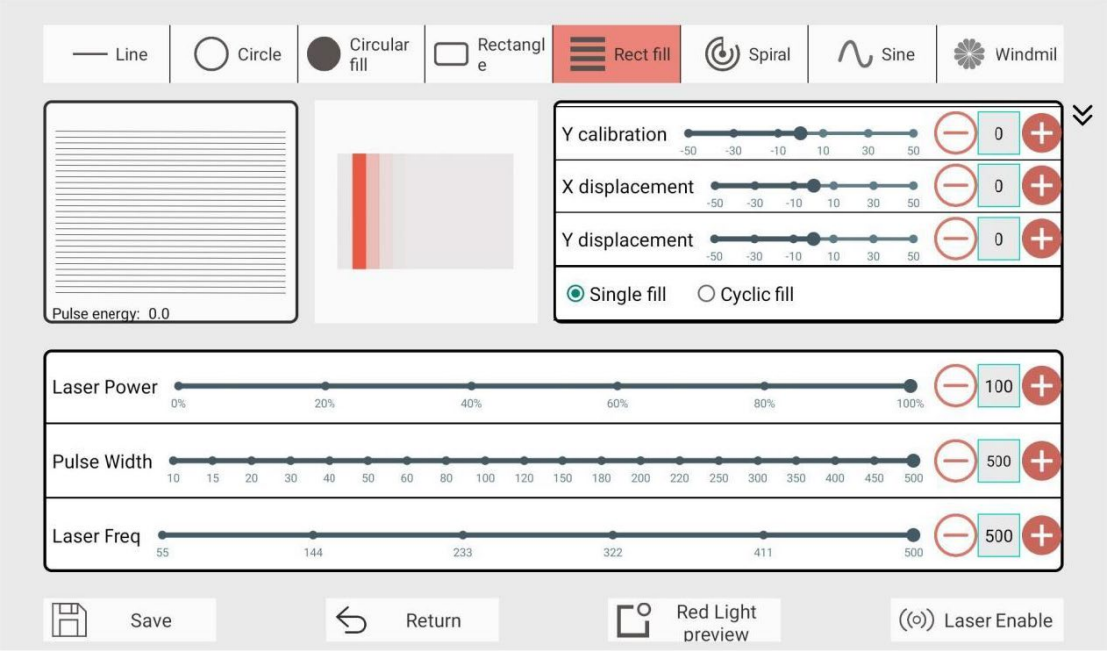
Circular Multi-Directional Filling Mode



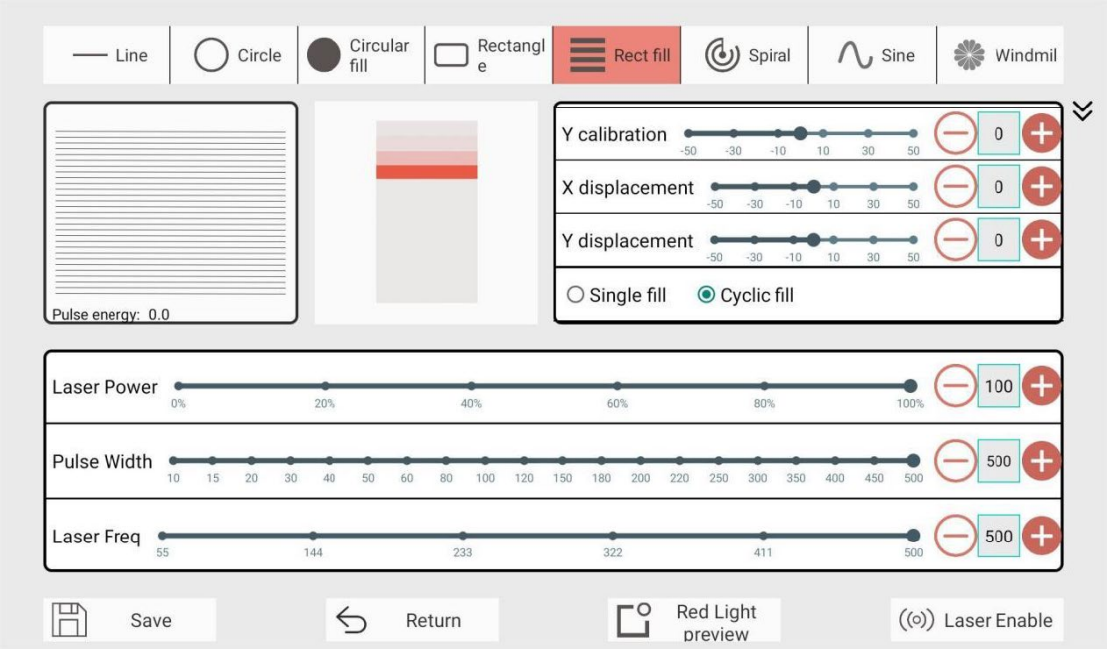
Rectangles Mode



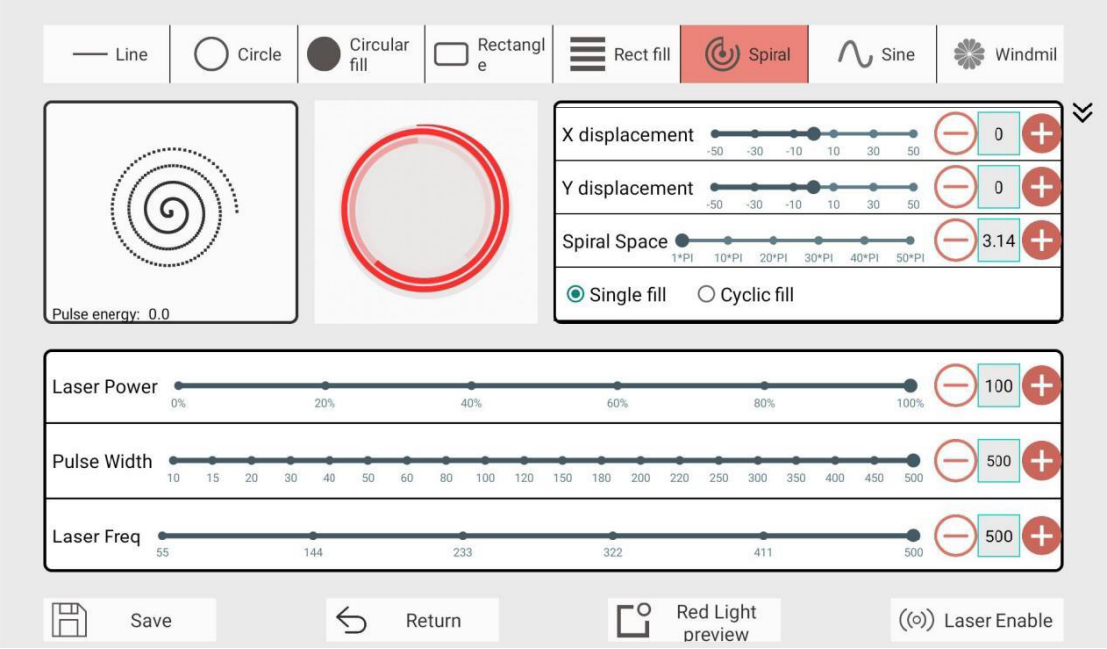
Rectangular One-Directional Mode



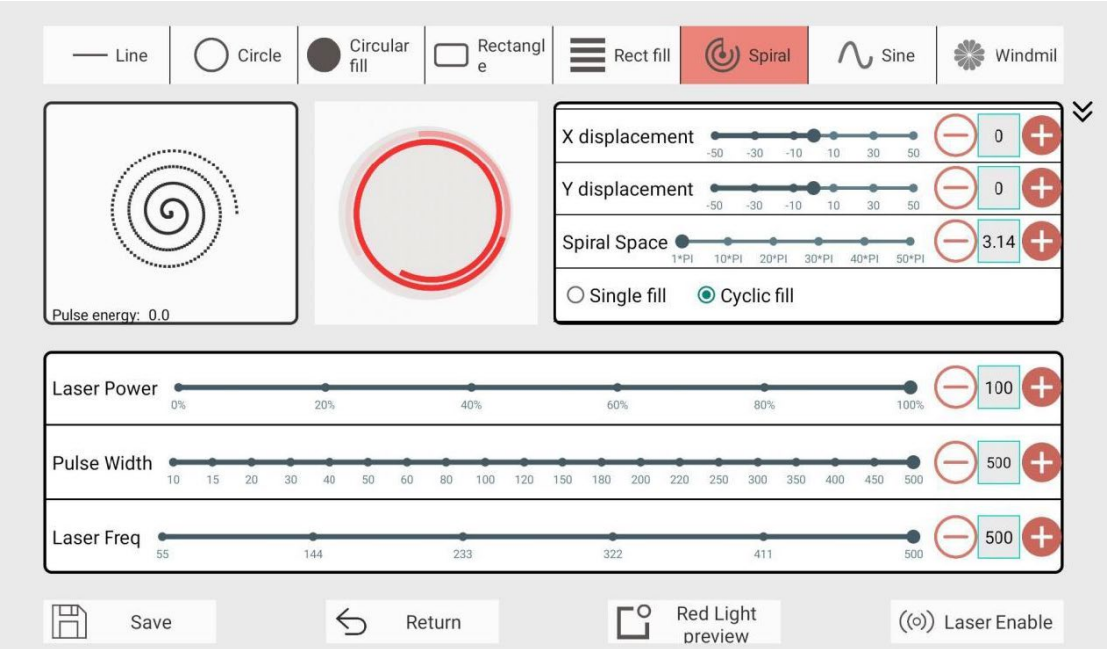
Rectangular Circle Filling Mode



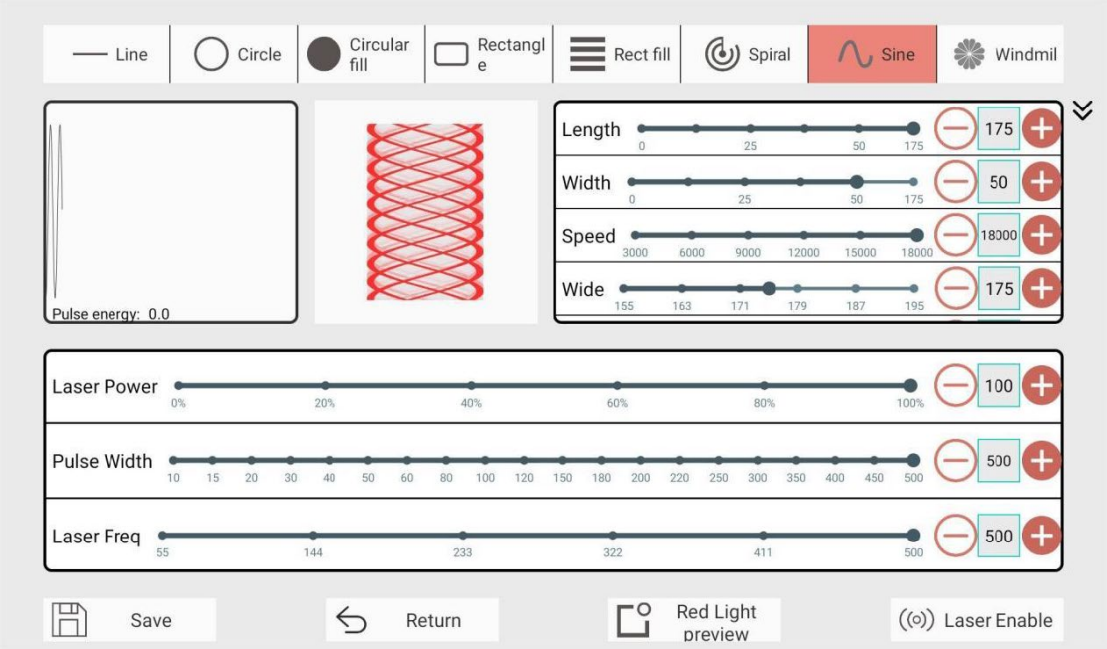
Helix Uni-Directional Filling Mode



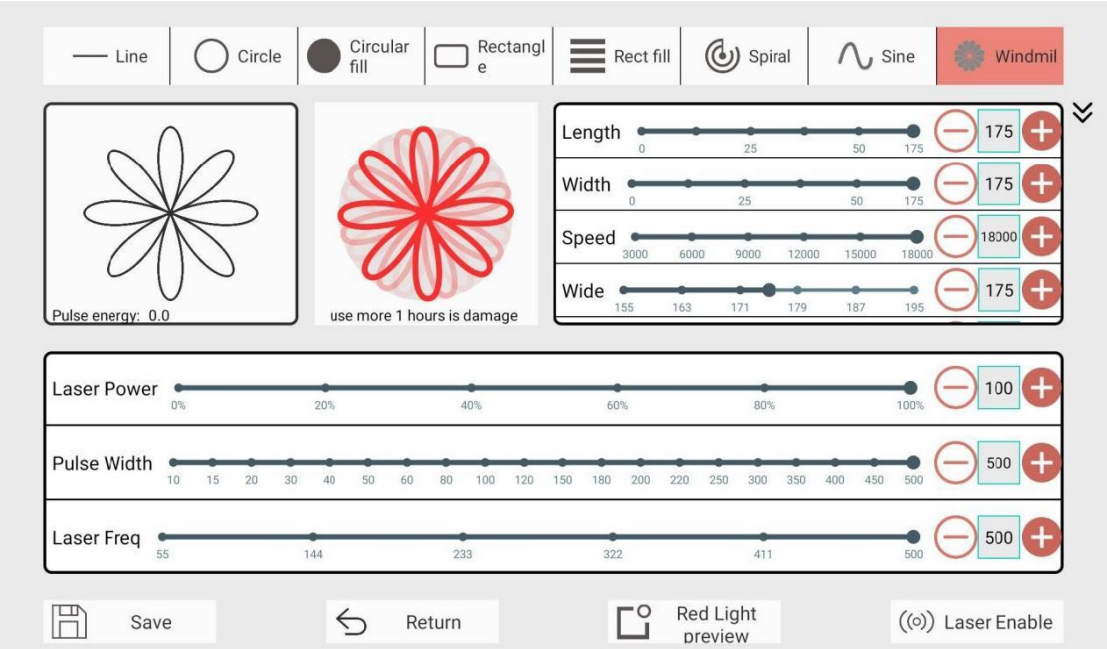
Helix Cycle Filling Mode



Sinine Mode



Windmill Mode



9.6 Laser Cleaning Parameter Table

parameter	function	span
Scan length (width) degree	Change the drawing size	0–100/175
Scanning speed	Change the scope scan graph speed	3000–18000
Area coefficient	Change the size of the area	90–130
End optimization	Optimize the end of the graph	0–50
X calibration factor	Scale oom the graph scan length	0–100
Y calibration factor	Scale up to the graph scan width	0–100
X displacement coefficient	Change the drawing X-direction displacement	-50–50
Y displacement coefficient	Change the drawing Y-direction displacement	-50–50
Vertical spacing	Change the line spacing within the fill drawing	0.01–1.00
Laser power	Laser cleaning equipment power settings	0%–100%
Laser pulse width	Laser cleaning equipment pulse width setting	10–500
Laser frequency	Frequency setting of the laser cleaning equipment	10–4000

9.7 Specific operation steps of the cleaning process

Please follow these specific steps for a successful cleaning process.

1. Turn the power ON
2. Open the software
3. Connect Bluetooth
4. Set the formula
5. Select graphics
6. Configuration parameters
7. Click save

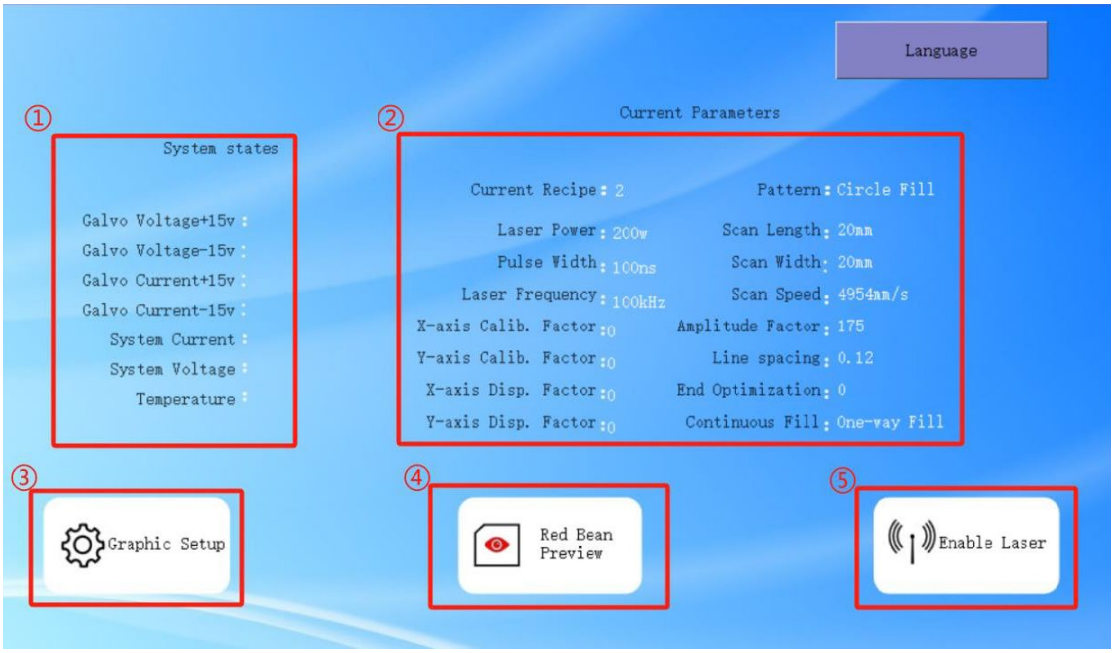
If you get a red-light preview, then the laser is enabled.

9.8 Introduction to the Interface Functions and Features of the Serial Port Screen

9.8a Introduction to the Main Interface of the Serial Port Screen

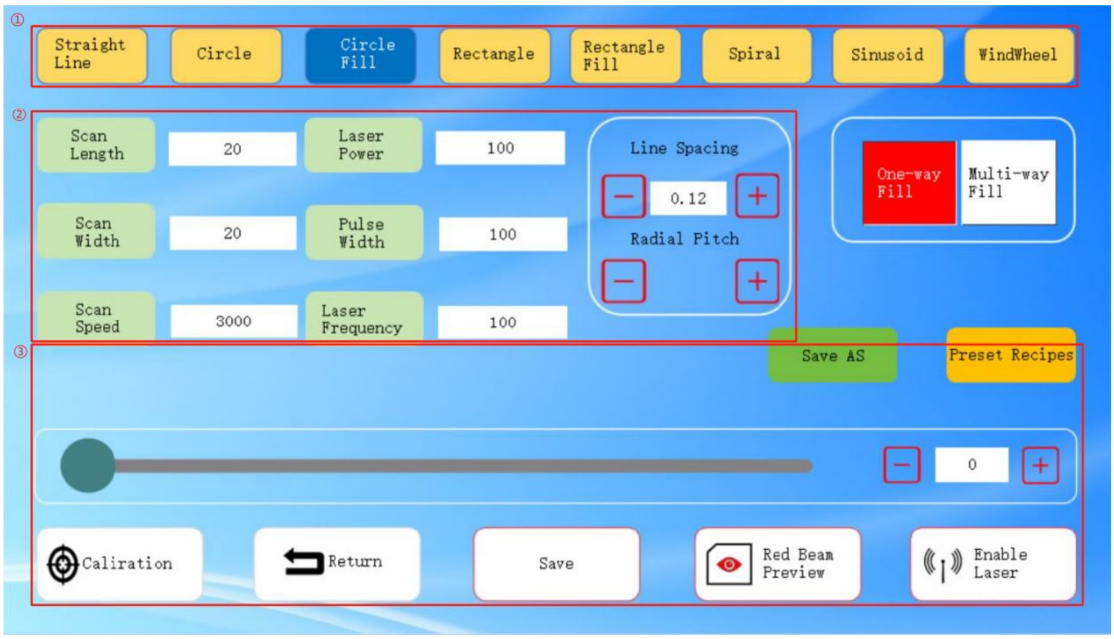
Here is an introduction to the control interface of the Serial Port screen for the laser cleaning operating system. Its basic logic is like that of the tablet interface. The main interface consists of five parts illustrated next:

1. This area displays the system status information
2. This area displays the current laser and its graphic parameter information
3. This area contains functional buttons for graphic setup
    a. Clicking on them allows you to enter the graphic parameter settings interface
4. This area is the red-light (Red Beam) preview control button
    a. Clicking it will enable the laser to display a preview red light (Red Beam) for the current graphic
5. This area is the laser enable control button
    a. Clicking it will turn on the laser enable feature
    b. In this state, pressing the two-stage switch will emit the laser beam



9.8b Introduction to the Parameter Settings Interface of the Serial Port Screen

Clicking "Graphic Settings" will bring you to the parameter settings interface shown here:



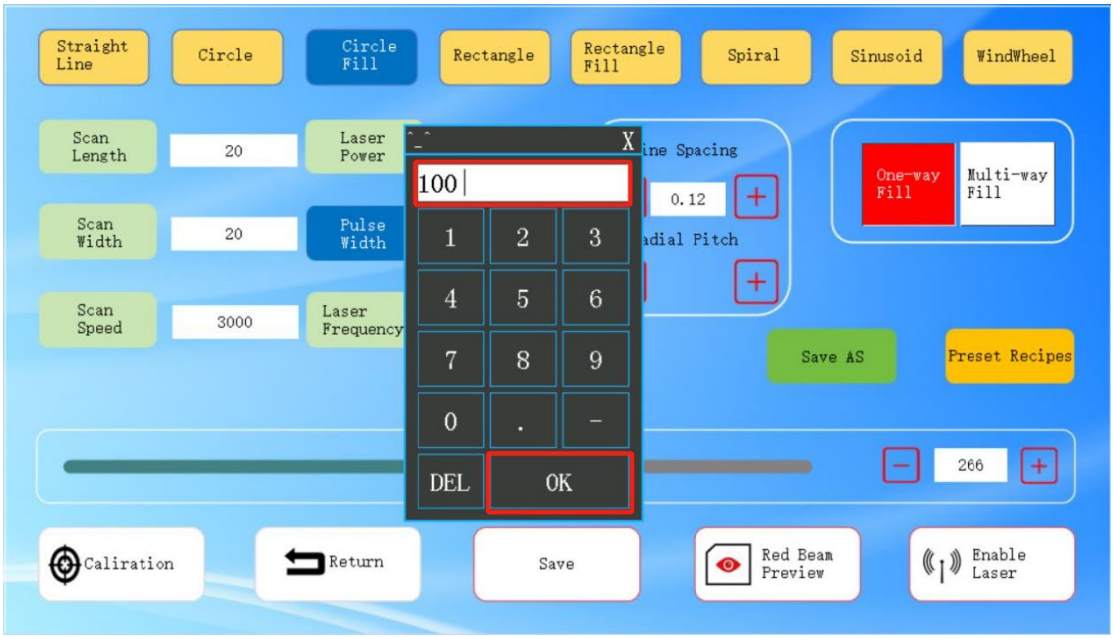
This interface consists of three areas:

1. This area is the graphic mode selection zone, offering eight different graphics for users to choose from
    a. The graphic modes are consistent with those on the tablet interface, so no separate introduction will be given here
2. This area is the parameter settings zone
    a. By clicking the "+" and "-" symbols, you can adjust the parameter values
    b. Alternatively, clicking on the numerical value between the plus and minus signs will bring up an input box as shown in Figure 29, allowing you to quickly enter the desired value
3. This area contains functional buttons.
    a. "Save"
        i. Saves the current settings.
    b. "Red Light (Red Beam) Preview"
        i. Controls the preview light switch
        ii. Clicking it will display the red-light preview indication for the current recipe
    c. "Laser Enable"
        i. Controls the laser switch
        ii. After clicking, the laser will be enabled, and pressing the two-stage switch on the handle will emit the laser beam
    d. "Back":
        i. Clicking it will return you to the main interface of the Serial Port screen
    e. "Parameter Calibration"
        i. Enters the parameter calibration interface
    f. "Save As"

i. Saves the current parameters as a preset recipe

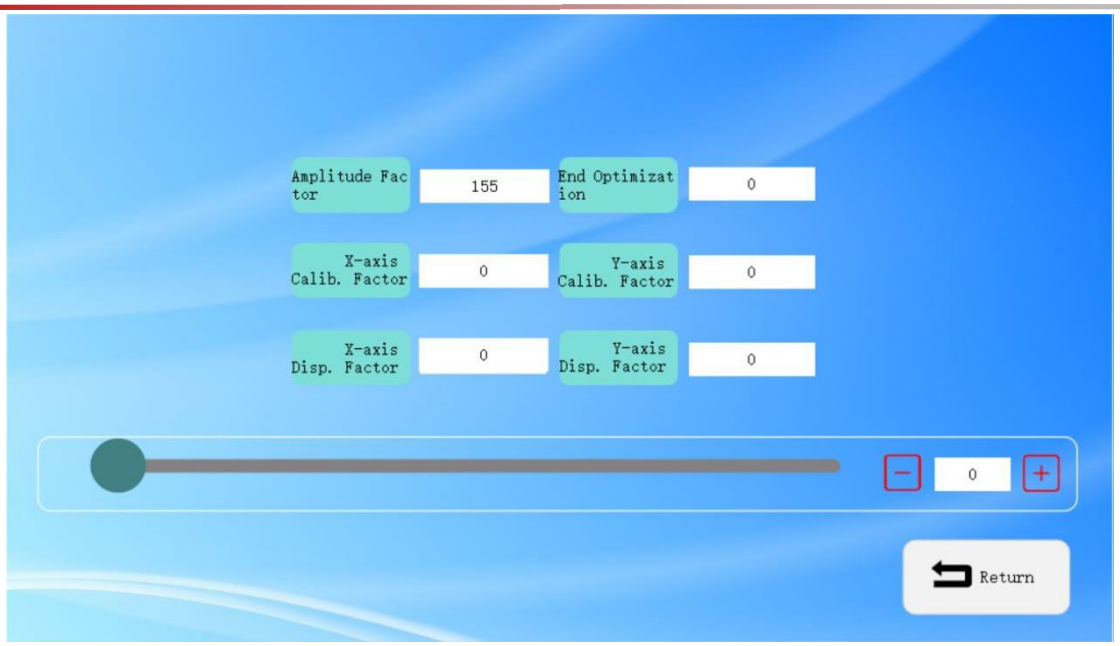
g. "Preset"

i. Opens the preset recipe interface, which contains six archived recipes



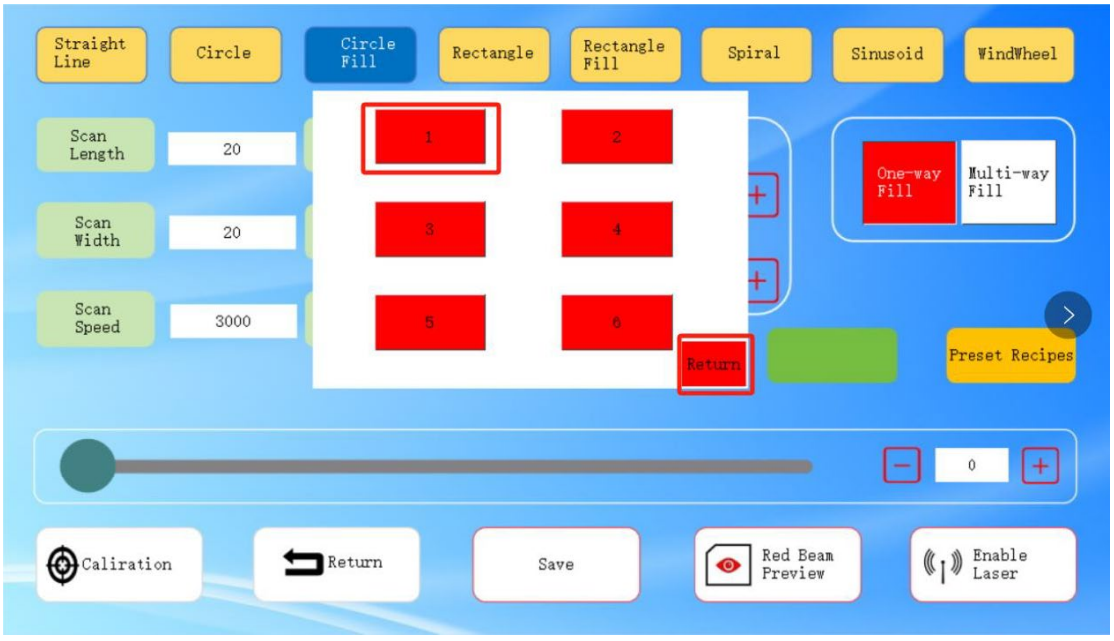
9.8c Introduction to the Parameter Calibration Interface of the Serial Port Screen

By clicking "Parameter Calibration", you can enter the parameter calibration interface of the Serial Port screen as shown below. By clicking the "+" and "-" buttons, you can adjust the parameter values. Alternatively, clicking on the numerical value between the plus and minus signs will bring up an input box, allowing you to quickly enter the desired value. Clicking "Back" or “Return” will take you back to the parameter settings interface. For the specific meanings of each parameter, please refer to the "Laser Cleaning Parameter Table."

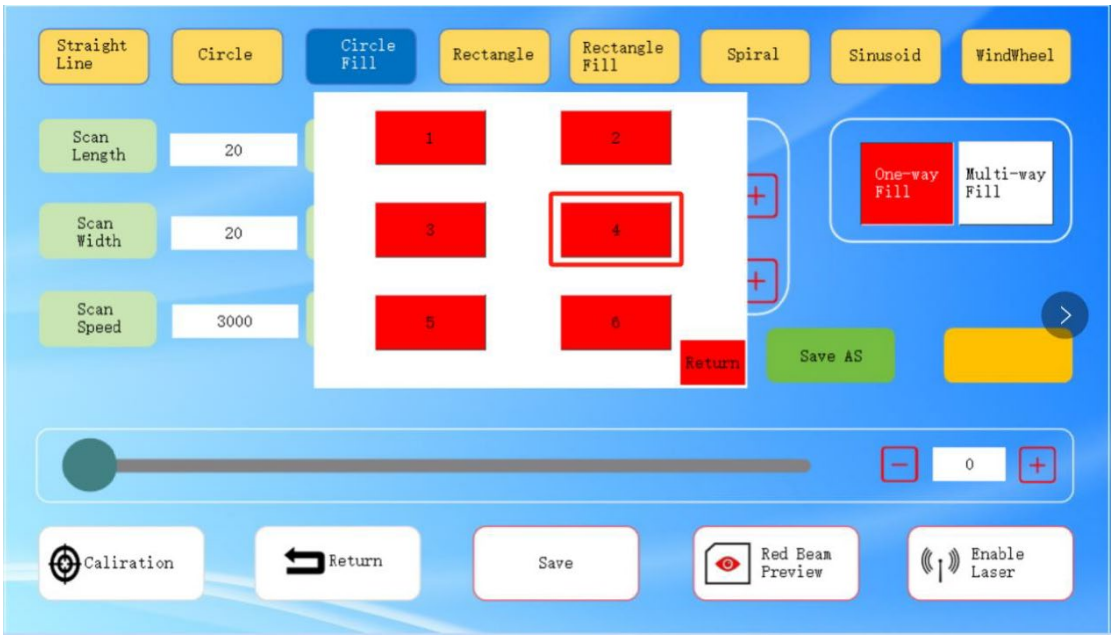


9.8d Introduction to the “Save As” & “Preset” Functions

The "Save As" & "Preset" function buttons are located on the right side of the 3 area. After setting the graphic parameters and clicking "Save," you can use the "Save As" button to store the parameters in the Serial Port screen's archive. The memory supports a total of six slots. Clicking "Save As" will bring up the interface shown below. By clicking the button labeled "1," you can save the current parameters into Archive 1, which will replace the parameters in "Preset" Archive 1.



If the user needs to retrieve previously saved parameters, they can do so through the "Preset" button. Clicking "Preset" will bring you to the archive retrieval interface shown below (which has the same interface as the "Save As" interface). By selecting a slot, such as Slot "4," you can retrieve the recipe parameters from Preset Recipe 4.



9.8e Laser Cleaning Parameter Table

Parameter	Function	Scope
Scan Length/Width	Change the Size of the Graphic	0–100/175
Scan Speed	Adjust the Speed of the Galvanometer Scanning Graphic	3000–18000
Amplitude Factor	Alter the Scanning Area Size	90–130
End Optimization	Optimize the Terminal of the Graphic	0–50
X-axis Calib. Factor	Scale up the Scanning Length of the Graphic Proportionally	0–100

Y-axis Calib. Factor	Scale up the Scanning Width of the Graphic Proportionally	0–100
X-axis Disp. Factor	Change the Displacement of the Graphic in the X Direction	-50–50
Y-axis Disp. Factor	Change the Displacement of the Graphic in the Y Direction	-50–50
Line Spacing	Adjust the Line Spacing within the Filled Graphic	0.01–1.00
Laser Power	Set the Power of the Laser Cleaning Equipment	0%–100%
Pulse Width	Set the Pulse Width of the Laser Cleaning Equipment	10–500
Laser Frequency	Set the Frequency of the Laser Cleaning Equipment	10–4000

9.8f Language Change

The (MET-GUIDE) APP supports switching between two languages (Chinese and English). The language of this APP is synchronized with the language of the tablet. Language switching can be done within the settings function of the tablet. The APP and the laser head display screen can synchronize the language automatically. Currently, the Serial Port screen only supports a Chinese interface.

10. Maintaining Your BOSS FC Lumin X

10.1 Operating Environment Requirements and Precautions

Failure to use this cleaning machine according to the methods specified in this user manual may lead to a decrease in the reliability and service life of the product. Therefore, please carefully read the following requirements and precautions, and follow the relevant specifications when operating.

1. This cleaning equipment uses a 110V AC power supply.
    a. Incorrect connection of the power supply may result in the laser cleaning equipment malfunctioning and failing to operate!
2. When using the cleaning equipment, ensure that the bending diameter of the armored cable is greater than 15cm.
    a. Failure to wind the armored cable as required may lead to abnormal or damaged laser output, preventing the cleaning equipment from operating normally!
3. The operating temperature range of the cleaning equipment is 0~40℃.
    a. Operating outside this range may trigger internal system alarms.

   b. It is recommended that the cleaning equipment operate within a temperature range of 10~30℃, as good heat dissipation helps extend the service life of the cleaning equipment.
4. Since the laser cleaning head often operates in an environment with a large amount of dust, it is recommended to wipe it with a lens cloth after each use to prevent dust or other contaminants.
   a. When the cleaning head is not in use, please cover the field lens with a protective cover.
5. Before replacing the field lens or other components, please inspect the equipment first to ensure that it is powered off.
6. Do not look directly at the laser output head and always wear laser protective glasses during operation!

10.2 Environment, & Maintenance Schedule

10.2a Environment & Humidity

Humidity can cause the metal parts of the laser machine to rust. All metal at some point can rust. One unexpected metal surface is the laser mirrors. It is best to try and control the humidity level in the laser work area. Clean the mirrors and check for oxidation as a problem. Replace the mirrors that do not meet your expectations of performance.

10.2b Maintenance Schedule Practices

The easiest way to follow a cleaning schedule is to use a calendar, keep it close to your machine, and write the dates that you want/need to do maintenance on. Some maintenance is needed on a regular basis while other cleaning could be an immediate requirement after a fire, or a large amount of smoke or fumes as previously stated.

A laser machine that has a lack of maintenance could result in a laser that is not working properly, or at all, and remember that lack of maintenance can void your warranty.

As with most pieces of equipment, preventive maintenance is an important part of owning a fiber laser cutting system. Keeping your laser system running is easy.

Recommended daily cleaning

Because it is best practice to always keep your machine clean, we recommend ***daily*** cleaning. These daily cleanings include, but are not limited to:

1. Ensuring the area around the laser is free of clutter
2. Ensuring there are no combustible materials in the area
3. Ensuring that volatile solvents such as acetone and alcohol are clear of the area
4. Ensuring the working area is free of dust and debris

5. Ensuring that the area around the machine and accessories are clean and clear of clutter so that air can circulate and that none of these can become a hazard to the operator.

Laser Source Maintenance

There are no user maintainable or serviceable parts on the laser module. Contact Boss Laser Technical Support with any questions.

11. Common Diagnostic Solutions

11.1 Laser is Not Turning On

First, make sure that the electrical outlet is working. Plug in a lamp or phone charger to ensure that it is the machine and not the outlet.

Check the simple stuff first.

- Are the Emergency Stop buttons pressed down?
- Is the On/Off power switch turned into the off position?
- Is the cord plugged into the machine and electrical outlet?

11.2 Faults and Handling Measures

The laser has multiple protection modes built in to prevent injuries or damage to the machine. Problems with any of these modes can prevent the machine from firing. The table below will help you remedy the most experienced faults

Number	Common Faults and Issues	Possible Causes and Solutions
1	Indicator red light is not on & no red light	The button is malfunctioning or the red light is damaged. The device needs to be returned to the factory for repair.
2	Inconsistent results under the same conditions	The field lens is damaged. Contact the manufacturer to replace the field lens.
3	Normal power supply with no alarms, but no light output	The button is malfunctioning or there is a fault with the laser cleaning equipment. The device needs to be returned to the factory for repair.
4	Temperature alarm	The environmental temperature is too high. The device needs to be operated within the suitable working temperature range.
5	Other alarms	There is a fault with the laser cleaning equipment. The device needs to be returned to the factory for repair.

Additional Troubleshooting Assistance

You can contact Boss Laser Technical Support via phone at 407-878-0880 or via email techsupport@bosslaser.com

Some common issues can be caused by being out of sequence for the Startup/Power On procedure. Many issues can be remedied by shutting the system down, pause for about 1 minute, and then going back through the Startup/Power On process again.