BOSSLASER

QM-855-927 | 04/14/2025 | Rev. 003

BOSS LASER

FC EXT

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 EXT

EXPLORE EVERY WAVELENGTH OF INNOVATION

We're thrilled you've chosen the BOSS FC EXT as your laser solution. Designed for ease of use, precision, and reliability, the BOSS FC EXT 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

CONTENTS

1.1 Definition of Procedures

This manual is provided with information specific to your BOSS FC EXT machine. The Boss Laser BOSS FC EXT is designed for cutting materials like steel using a Fiber Laser. Inside its protective housing, the laser beam focuses high energy on your material to create precise cuts.

To ensure you feel confident when operating your laser, we will go over everything you will need to know about the BOSS FC EXT 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 EXT, first, program the controller with your desired cutting pattern using the software provided. This involves designing your file, creating layers, adjusting settings, and sending the file to the machine.

Once your files are ready, place your materials on the worktable as required. After positioning the material, you are all set to initiate the cutting process.

When the BOSS FC EXT is finished, simply remove your completed work.

1.1b Maintenance

The best way to keep your machine performing optimally is to keep up with maintenance by setting a schedule. Maintenance includes routine cleaning and lubricating of rails and drives, cleaning the protective windows, cutting nozzles, ceramic sensors, and removing any dust or particles.

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 EXT 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 2 years unless an extended warranty is purchased.

All parts purchased, and replacement parts are under warranty for two years 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 EXT Laser System is a Class 4 laser product, as defined in International Standard IEC 60825-1.

The BOSS FC EXT 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 EXT'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 EXT Series Laser System is performed in accordance with all applicable laws.

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

LIA™
THE LASER INSTITUTE

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 EXT 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.

2.2b Pre-Operation & Environment Requirements

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

- The ideal environment for the BOSS FC EXT 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% with no dew.

2.2c Material Hazards

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

- Do not place any reflective material or objects in the machine as reflective material can cause the laser beam to deflect, causing damage to the machine, surrounding areas, or bystanders.
- Do not stack materials in the laser machine to be cut, this can increase the chance of a fire.
- Do not put flammable or explosive materials near the machine, this can increase the risk of fire or explosion.

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 exhausted from the machine while processing 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 EXT uses electricity to power the machine, which increases the risk of electrical shock if not handled properly.

- 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 220v 60Hz.

3. Fire & Hazardous Materials

⚠ WARNING: This machine uses focused energy to cut 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 cut:

- Non - Metal Materials – Specifically, the materials listed below:
  - Polycarbonate – Fumes produced by polycarbonate can cause irritation to eyes, skin, and respiratory tract.
  - PVC Compounds – Fumes produced by Polyvinyl Chlorine when exposed to elevated temperatures can cause irritation to eyes, skin, and the respiratory tract.
  - Vinyl – Fumes produced by Vinyl that has Chlorine can cause irritation to eyes, skin, and respiratory tract. This material should not be exposed to elevated temperatures.
- Helpful Hint:

- Do not cut materials other than metals and their protective covering that is laser safe. An example is a metal sheet covered in Novacel®.

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 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. 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 cut:

- Metals

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 cut 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. 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 EXT (open cutting frame) 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 electrical high voltage, LASER radiation, mechanical movement, hot metal, compressed gases, 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.
- ALWAYS be sure to keep the exhaust fan running while the machine is in use.
- 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 push or pull the laser head and its gantry while the laser is running.
- 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 clean out the collection tray(s) to prevent accidental hazards.
- 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 front and/or right side 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 the 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 cutting may be toxic. Review the Safety Data Sheet for the metal you are cutting 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.

Chiller Safety

Because of the Chiller containing water the Chiller should be connected to a GFCI outlet or an inline GFCI attachable plug. Although regulatory jurisdictions may not require a GFCI, many Insurance companies may require this in a warehouse or factory space. This will help to prevent electric shock to an employee and is good safe practice.

Confined Space Safety

The main cutting frame is an enclosed space that has moving parts and can be considered as a confined space. You are responsible for ensuring the safety of personnel and following local, state, and federal regulations for a confined space if service is to be completed inside the machine. At no time shall anyone be inside the machine while it is energized as severe injury or death can occur.

6. Safety Features & Regulatory Compliance

6.1 Safety Features

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

These safety features include:

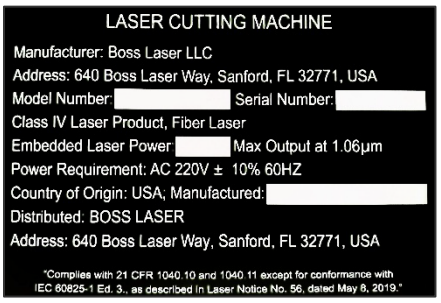
- A fully enclosed laser head enclosure that contains the cutting laser and its beam path
  - Human access to all laser radiation from the laser product that is more than the accessible emission limits of Class I and table VI shall be prevented.
- A visible Emission Indicator Pendant Light illuminating when the laser is firing/operating.
- Manual reset that enables the laser to resume operation after an interruption of firing caused by a remote interlock or a power loss lasting over 5 seconds.
  - A remote interlock functions when the terminals of the connector are not electrically joined.
- An Emergency Stop button to instantly halt laser emission.
- Laser safety glasses are provided to limit radiation exposure to the eyes.

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 EXT 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.

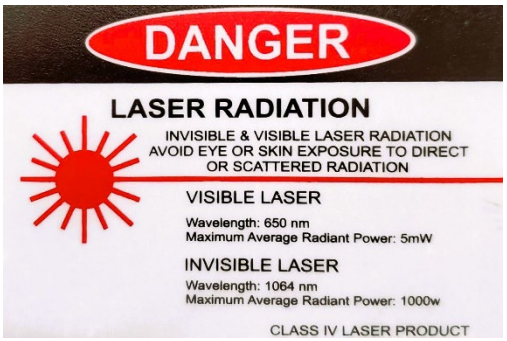
6.2a Certification & Identification Label

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.

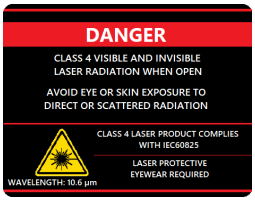


6.2c Laser Aperture

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

6.2d Danger: Visible and Invisible Radiation

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

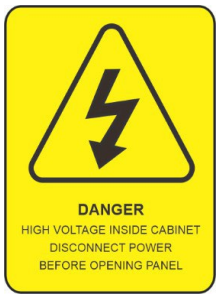


6.2e Danger: Crush or Injury

The “DANGER” labels for being crushed or injured during the machine gantry movement process can be found around the machine. It is important to make sure the machine is not running prior to placing your hands or other body parts into the machine.

6.2f Electrical Safety

The "DANGER: High Voltage" sticker can be found on the inside of the Control Panel electrical cabinet and the external Control 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.

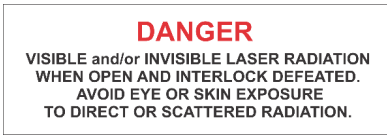


6.2g Non – Interlocked Protective Housings

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.

6.2h Interlocked Protective Housings

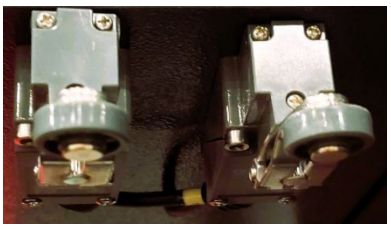
The "DANGER" labels for interlocked protective housings are located on the machine body next to every door that are accessible, and interlock is defeated.



6.3 Safety Design Features

6.3a Safety Interlocks

There are redundant Mechanical Safety Interlock Switches on the front access door of your BOSS FC EXT machine. These are designed to stop the machine from firing when the front access door of the machine is in an open state. Please use the necessary caution as written on this manual when operating.



6.3b Key Control (Master Switch)

The Key Control 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.

6.3c Emergency Stop Buttons

The Emergency Stop buttons, which are located on the front and right side of the machine, control the live wire of the main circuit, and when the main control switch is turned off, the machine will power down.

6.3d Laser Status – Emissions Indicator Pendant Light

The machine comes equipped with an Emissions Indicator Pendant Light installed on the top right-hand side of the machine and/or on top of the Control Cabinet that shows the status for the machine. The Emission Indicator Pendant Light is a safety feature and will glow Green when the machine is firing and emitting a laser beam. It will glow Red when the machine is in an error state, and it will glow Amber/Yellow when the machine is in an Idle or Ready state.

6.3e Personal Protective Equipment (PPE)

Laser Safety Glasses are included with the machine, 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.

6.3f Remote Interlocks

The machine incorporates a remote interlock connector located at the back of the machine enabling the end user to have the option of implementing a remote interlock with the included In-Use Connector. An optional Remote E-Stop Box is also included with the machine to be used as a remote interlock Emergency Stop, if desired.

Remote Interlock Connector

Optional Remote E-Stop

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 EXT will come with a USB that contains the CYPCUT software and a few of our manuals. The first step is to plug in the USB that accompanied the machine.
2. Next, there should be two folders within the USB, a “USB CYPCUT” folder and “USB (For Boss Laser BOSS FC EXT)” folder. There will be respective manuals in each folder.
3. In the “USB CYPCUT” folder, there will be the manuals for the CYPCUT software and a "READ ME" (for installing CYPCUT).
4. The “USB (For Boss Laser BOSS FC EXT)” folder will contain the “BOSS FC EXT Manual,” and other various information.

8. Receiving Your BOSS FC EXT

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.

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.

1. Various adapters and unions, depending on the size of the laser wattage.
2. Accessory Gas connector ¼" NPT to 10mm (x2)
3. High Precision Proximity Switch
4. Keys (Laser PSU, Panel, Power)
5. Chiller and remote bypass plugs
6. One pair of Laser wavelength safety glasses
    a. *Nozzle Kit (nozzle sizes may vary per machine type and wattage)
    b. An example includes:
        i. Nozzle – 1.2 Single and Double
        ii. Nozzle – 1.5 Single and Double
        iii. Nozzle – 2.0 Single and Double
        iv. Nozzle – 2.5 Single and Double
        v. Nozzle – 3.0 Single and Double
        vi. Nozzle – 3.5 Single and Double
        vii. Nozzle – 4.0 Single and Double
        viii. 1 Ceramic Disk
        ix. 1 Lower Protective Window
        x. 1 Upper Protective Window

8.2 Machine Remote

The remote is quite easy to use. It has many of the same features as the control panel portion on the main screen of your CYPCUT software. You can control the X, Y, and Z axis of the machine and be able to see where your gantry and the head are located. You can Start, Stop, and Pause a job as well. The remote allows mobility to inspect and to remain safe from the table and the cutting operation.

These features will be covered by the Boss Laser trainer during the initial training. Should you forget, remember these things.

- X-Axis Moves the laser head left and right across the table.
- Y- Axis Moves the gantry, which holds the laser head, to the front and back on the table.
- Z-Axis Moves the laser head up and down.

8.3 Exhaust Fan & Fume Extractor Overview

The laser vaporizes material as it moves along the axis. 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 cutting operation of a laser, smoke and particulates are generated as the material is being vaporized by the laser. The laser system exhaust is designed to facilitate the efficient removal of the smoke and particulates by drawing them into the exhaust system to be removed from the laser operation area to a safe exhaust location.

Many of the materials processed by the laser “off-gas” fumes and odors that are neither pleasant nor safe for the human respiratory system. A correctly working exhaust will keep the air around the laser safe to breathe.

The BOSS FC EXT machine uses a single phase 220v AC exhaust fan that pulls the exhaust from the machine. Exhaust is then moved via the 6” hose to be evacuated into a safe area and environment.

If you purchase a Fume Extractor with your BOSS FC EXT, skip to section 8.3b on page 25. If you do not purchase a Fume Extractor, the exhaust must be ducted to the outside and away from any area where animals or humans congregate. When ducted correctly, a laser can be placed in an office, garage, or spare room.

If you are cutting materials that will produce substantial amounts of smoke or fumes, industrial-size in-line fans can be purchased from websites like Grainger and other industrial supply warehouses. All BOSS FC EXT machines will need a 6" exhaust fan with a minimum of 250 CFM's (**included with the machine**).

The exhaust fan must be turned on and used each time the laser is running and operating.

8.3a Types of Gas Assist

During the cutting process, an assist gas is used to process the cut. Most of the time either oxygen or nitrogen is used, depending on the type of material being cut. Clean dry compressed air or Argon can be used as well for some metals. Metals can be separated into two categories: ferrous and non-ferrous. Simply put, ferrous metals contain iron and non-ferrous metals do not.

Other than the choice of gas, the cutting process typically remains the same for all materials.

Oxygen Assist

Oxygen amplifies the effect of the laser's heating of the material, allowing the laser to pierce through quickly. This is especially important in highly reflective material as you want to pierce through before it has a chance to reflect any of its energy back to the laser. Some of the benefits include less gas used in the process, which can lower operating costs. The limitations of using oxygen include the creation of an oxide layer, which may or may not need to be removed before continuing onto the next step of the process. The oxide layer requires post cut processing which can include chemical passivation or abrasive grinding for removal. Some examples include Cold Rolled Steel, Copper, Brass, Bronze.

Nitrogen Assist

Nitrogen is used to blow the molten material through the cut. This provides a "clean" edge on parts like stainless steel and aluminum. Nitrogen however is used at high pressures from typically 200 psi to 325 psi and can be consumed very quickly during parts cutting. The advantage of using nitrogen is that many parts can be cut in a way that does not require post processing. Some examples include Aluminum, Stainless Steel, and thin Cold Rolled Steel.

Compressed Air Assist

This process can provide quality cuts since air is approximately 78% nitrogen by volume and 21% oxygen with the remaining percentage that is other gases and water vapor. To effectively use an air-assist the air must be filtered, cleaned of particulates, and dried to the

extreme. Nitrogen is still the best gas to use when looking for clean cuts and anyone who is cutting for either the Aerospace industry or Food Processing industry.

The typical components in an air system consist of a large capacity compressor tank (80 gallon or more) oil and water separator, desiccant dryer with pre and post filter, a pressure booster, and a dry tank. Annual maintenance costs must also be included for the system as this keeps the system optimally running for air assist. Most cutting can be done using less than 200 psi. The customer should consult a professional in their area that can help them to meet the requirements needed for the usage of compressed air.

8.3b Setting Up Your Fume Extractor

A Fume Extractor is an upgrade to the standard exhaust fan and would allow you to exhaust your machine inside without needing to vent the fumes/exhaust externally. If you ordered a Fume Extractor for your BOSS FC EXT 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 EXT.

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.

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. Please remember that your Fume Extractor may look different than the photo on the previous page, some Fume Extractors have intake ports located on the top, others 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

8.3c Water Chiller

The Chiller is a single phase 220v AC 20-amp accessory required to operate your machine. The Chiller circulates water throughout the machine and the laser. There are two outputs and two inputs. The larger diameter tubing or hoses typically circulates water throughout the laser PSU. The smaller diameter tubing or hoses circulates water from the Chiller to the laser head.

The Chiller will circulate water at a specified water temperature and must be kept running if the temperature drops below the recommended environmental temperature of 40°F. This will help to keep the water from freezing inside the machine and laser head and therefore keep it from causing damage.

Note: The Chiller model may differ from the one shown due to product change or the power of the laser.

8.3d Control Cabinet

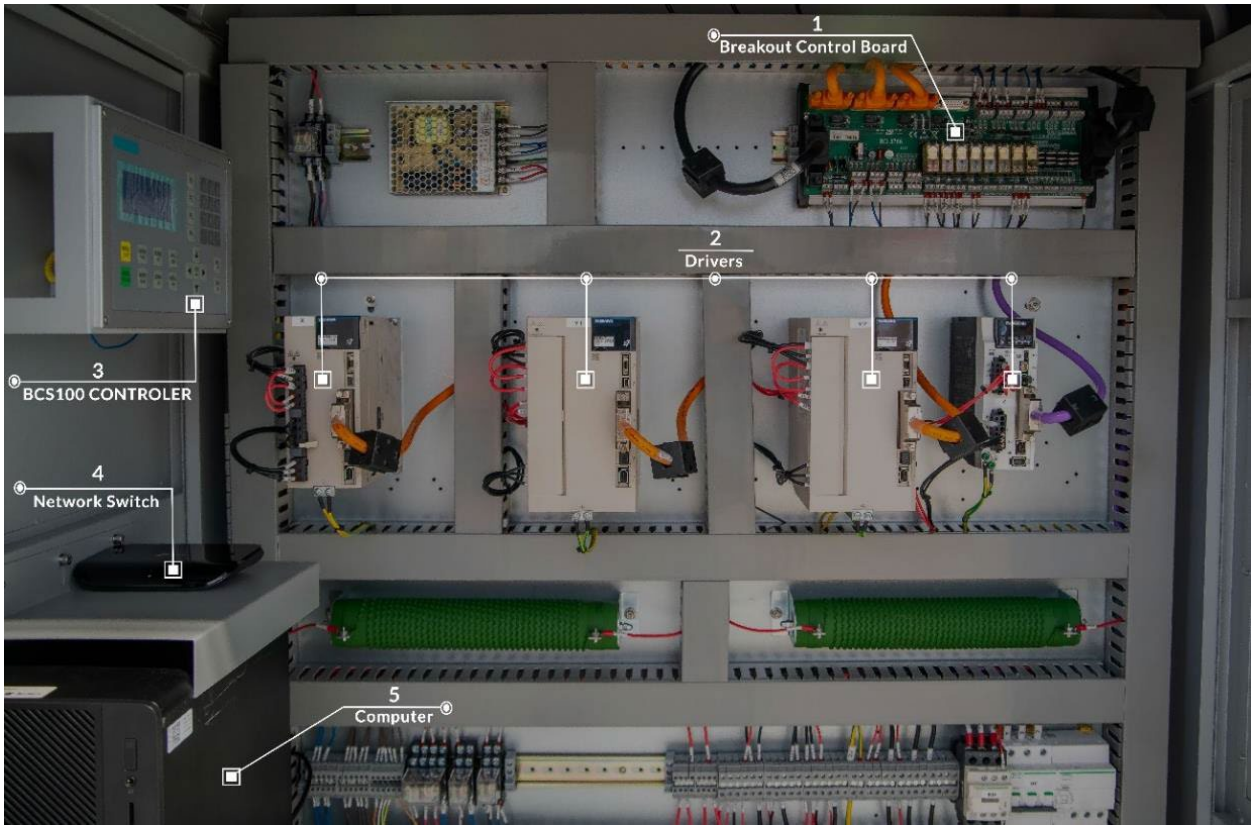
Use extreme caution when working in and around this Control Cabinet. Also note that should you have to power down this cabinet for any reason it is best to do so at the Voltage Stabilizer as this will deenergize all power in the cabinet.

If you have the BOSS FC EXT model with the new slimline profile, this cabinet has been added to the back body of the machine. It still houses the same components as the cabinet and care should be taken to access this cabinet.

Note: It is especially important to note that should you have to access this cabinet for any reason while the unit is powered on; there is High Voltage.

The machine Control Cabinet has an Emergency Stop, Laser PSU power on/off key switch, power light and "Computer On" button.

Machine Control Cabinet (Continued)



While it is best to only access this cabinet when it is turned off there are components that can provide valuable information for troubleshooting problems in the machine while the system is energized. Those items include the items shown in the picture above. The machine cabinet interior layout can vary depending on the laser wattage, but all the components shown above will be in the cabinet. The laser power supply unit (PSU) will also be in the same cabinet at the bottom of the main control cabinet unless it is 6kW or over, or the new slimline model, which will then have its own location for where it is mounted. The laser will also provide valuable information as well on the display, either on the front of the unit or on the back.

1. Breakout Control Board – Interfaces with the computer PCI card and the rest of the machine.
2. Drivers – Controls the motors for precision movement.
    a. X, Y, Z axis drivers labeled and can display errors.
3. BCS100 - Capacitance Height Controller for the laser head.
4. Network Switch – 5 port network Switch for communication between the PC, the Laser, and the BCS100

5. Computer – Contains the software and PCI interface board to control the machine.

8.3e AC Unit

If equipped, then on one side of the Machine Control Cabinet, there is an AC unit mounted to the cabinet. The A/C unit filter will need to be cleaned regularly, and the drip hose needs to be located to provide water discharge.

8.3f Voltage Stabilizer

The Voltage Stabilizer ensures a constant power supply for the proper operation of the Boss FC EXT. Stable voltage is essential for accuracy and quality. The voltage stabilizer is connected to the cutoff panel that is installed by the customer. The power cord is then connected from the customer supplied panel to the voltage stabilizer. In almost all instances the required input voltage is 208vAC WYE 5 wire with three hot, one neutral, and one ground.

The voltage stabilizer monitors the power and cleans and conditions the AC waveform before it is sent to the machine cabinet and to the laser PSU if it is separate.

The voltage stabilizer is turned on from the front with a circuit breaker or inside after opening the front VS cabinet door. Once turned on it will indicate its working properly with a green LED or a display indicating it is operating within normal voltage. If there is an error, then the display will indicate an alarm or there is a red LED.

Note: The voltage stabilizer may differ from the one shown due to product change or the power of the laser.

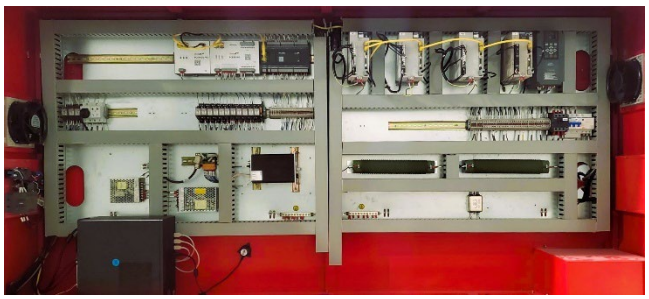
8.4 Machine Table

The machine table is constructed of high strength steel and the gantry is made of a high strength Aluminum to improve strength and to have a lighter weight.

8.5 Machine Control Panel

Prior to turning on your BOSS FC EXT for the first time, ensure that all components have been removed from the worktable, including any plastic/Velcro ties used for securing the laser head from moving while in transit.

The ability to access this Control Panel electrical cabinet is important. The door on the back of the machine opens and allows access to the Computer, the PLC control card, and the drivers for the table motors. It also houses a Z-axis controller and power connections for the machine components. Use caution while in this cabinet as items are energized and live electrical is to be expected unless the breaker is off, and the machine is unplugged from its power source.



The Input / Output and Power Control Panel is located on the right-hand side of the machine near the back and allows for data inputs via multiple USB ports, machine and laser power controls, emergency stop and beam attenuator controls.

Once all power connections are verified correctly, we can flip the Key Control power switch on the machine.

After turning the Key Control power switch ON, we must ensure the Emergency Stop button on the machine is in the "up" position and not pressed down. To do this, locate the Emergency Stop buttons on the front and right-hand side of the BOSS FC EXT. Once the buttons are located, start by pressing down on the Emergency Stop buttons. If the buttons will not press down any further, then the Emergency Stop is already engaged. If you were able to press down on the Emergency Stop buttons and hear a faint "click," you have now engaged the Emergency Stop. To disengage the buttons, turn the buttons clockwise until they "pop up" and release, at which point the Emergency Stop buttons are no longer engaged.

Now that the Emergency Stop buttons are disengaged, locate the machine ignition switch located on the right-hand side of the machine. Next, locate the ignition key from your toolbox. Insert the key into the ignition switch and turn it clockwise to turn the machine ON.

9. Operating Your BOSS FC EXT

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 and catch trays should be emptied.

Inspect the Chiller first. Check the water level gauge and ensure it is at the green level. Turn the Chiller on. The Chiller should beep after it does its self-check and begins to flow water. Inspect the hose lines at the coupling for leaks and observe if you see any water pooling on the ground that would indicate a leak. If an alarm is on the Chiller, the error codes given are listed on the

front of the Chiller and can indicate how to clear the alarm. If you follow these recommendations and fail to resolve the error, contact Boss Laser technical support for additional assistance.

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.
- Turn power ON at the breaker.
- Turn the Chiller on and allow time for the Chiller to circulate water and reach an optimal operating temperature at approximately 25°C.
- Turn Gases ON at the gas valves.
- Disengage the E-Stop buttons.
- Turn the key on for power.
- Press Computer button.
- Complete Daily check of laser head

Power Off

- Shut off Gases at source valves.
- Shut Gas assist off.
- Purge lines to release pressure in system lines using the Blow button on the remote.
- Shut down laser cutting software.
- Shutdown Computer
- Press E-stop.
- Switch the breaker off.
- Shut down the chiller unless the environment's temperature dictates it to remain on.
- Inspect the area to ensure it is safe.
    - Note: The Exhaust can be turned on and off at any time during the power on or off sequence

Once you have powered on the machine and the computer is operational you should have a Windows desktop screen with a shortcut to the CYPCUT laser cutting software. Once you open the laser cutting software you now have control of the operation of the machine. You can refer to the CYPCUT software manual for information that was covered in the training you received, and you can refer to the CYPCUT document for additional information that may not have been specifically covered in the training provided.

Origin the head if you did not do so at the software startup. This will find your limits on the table.

Load your material on the table. Ensure material is beneath the head prior to doing the calibration. Try and calibrate the middle of the sheet instead of near the edge. Calibrating at the edge can cause the calibration to be slightly degraded.

CYPCUT uses a Six Step Process to run a job to its full potential:

- Import the File – Bring the file into CYPCUT or create a file in the software.
- Pre-processing – Graphics Processing, close lines, remove duplicate lines, etc.
- Cutting Technique – User can set layer setting for the material.
- Tool path planning – Sorting will allow for setting the cut path.
- Pre-(machining) Operation check – User can simulate the job and frame it on the material.
- Start (Machining) Operation – Start the cut job (note: Prior to pressing the start button ensure you have your PPE on and anyone else around is at a safe distance or wearing appropriate PPE

9.1b Metals & Cutting

The Boss Laser BOSS FC EXT Fiber Cutter can process diverse types of metal including both ferrous and non-ferrous metals. The wattage of the fiber laser will be the biggest determining factor in its ability to cut a certain type of metal. The thickness of the material that can be cut is also determined by the laser wattage.

The most common metal processed on the fiber laser machine includes those listed below:

- Stainless Steel – A family of alloy steel that contains 10% to 30% chromium.
  - The chromium allows the steel to have a resistance to corrosion.
- Carbon Steel – Steel that is manufactured using varying amounts of carbon and iron which imparts hardness and strength into the metal.
- Aluminum – A lightweight nonferrous metal used in many applications today.
- Other metals that can be processed include alloy steel, tool steel, galvanized steel, copper, and brass.
  - Care must be taken when cutting copper and brass.

Cut charts are given for some material for the laser wattage and the thickness of the material. Not all materials will perform the same on the machine and the settings are to be used as a guide. Stainless Steel for example can be grouped into five major types and have over 100 different grades. Settings for Stainless Steel can then be adjusted by the customer to find the best results.

You can contact Boss Laser Technical Support for guidance concerning materials if you have additional questions.

9.1c Emission Indicator Pendant Light

The Emission Indicator Pendant Light can be seen on the top of the machine and/or the Control Cabinet. The Emission Indicator Pendant Light is a safety feature and will glow Green when the machine is firing and emitting a laser beam. It will glow Red when the machine is in an error state and it will glow Amber/Yellow when the machine is in an Idle or Ready state.

9.1d Emergency Stop Button

The Emergency Stop button can be seen in the image to the right. The Emergency Stop 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. There are at least 2 buttons on your machine.

9.2 Software Installation

Your BOSS FC EXT machine will come standard with the CYPCUT software, as cutting operations of the machine is done through the CYPCUT software. The on-site tech will go through the basic use of the machine and how to dial in cutting parameters for certain materials using the software if installation and training is being provided. A digital copy of the software manual is provided on the computer desktop as well. The idea is to teach you how to use the software and to reference the manual as necessary for both basic and advanced features. Many further details in the software manual can be referenced and found.

The software is already installed on the computer. If needed, plug the USB drive into the computer you will be using to send files to the BOSS FC EXT. On this USB drive, there will be different folders and files. It is important to keep this USB drive somewhere safe, so you do not lose it.

10. Maintaining Your BOSS FC EXT

10.1 Optics

Before any machine leaves our facility, it is put through a quality assurance process and these optics are already aligned and ready for use. Therefore, there should be no need for adjustment. There is a possibility that the optics may have shifted in transit, but we recommend calling technical support prior to making ANY adjustments if that is the case.

The laser and optics are the heart of the machine. It is important to understand the basics which will allow you to get the most out of your machine. Once tuned, the laser machine should stay aligned for months of work.

The optical system of your fiber laser includes protective windows, lens, and Collimator.

Protective Windows

There are two protective viewing windows located on the laser head.

The lower protective window needs to be inspected daily. To do so simply press the release latch and gently pull the window out. It should be free of spots, scratches, or debris.

The upper viewing window is located between the QBH interface and the Collimator. This item rarely needs to be inspected. Regular observation should only be every 6 months with heavy usage, and once a year for light to moderate usage. It may need to be removed and checked for spots, scratches, or debris after you are experiencing cutting issues, and you have spoken with Boss Laser Technical Support. These are not items that need to be changed often. If maintenance is needed, you may need tools to gain access.

Note: Ensure the area surrounding the laser head area is clean before removing the protective window. Visually inspect it under a light. The surface should be perfectly clean and free of debris or scratches. If needed, use soft free cloth to gently clean the window. There should be no dust or debris on the window when remounted to the head.

Inside Lens

The protective window is designed to isolate the lens from any contaminant. There is no need for any visual check of the lens.

Collimator

The Collimator is located between the laser lens and the QBH interface. This component is isolated from contaminants. The only way for any debris to encounter the Collimator is if the laser lens or QBH connector is removed. There is no need for an inspection of this component.

10.2 Mechanical Components

10.2a Nuts & Bolts

If you are concerned about these items rusting, then you should apply a thin coating of silicone base grease. One application per year should suffice.

10.2b Axis Gear Drive

The Axis Gear Drive should be checked for appropriate lubrication at least every six months. These Axis Gear Drives work together to move the gantry from front to back and the laser head from left to right. If one Axis Gear Drive is lubricated more often than the other, it could lead to potential performance issues and/or undesired production quality. It is difficult to describe the

appropriate lubrication amount, but there should be no rough, grinding, scraping, or squeaking sounds coming from any axis movements. It should always be smooth.

10.3 Machine Component Maintenance

10.3a Air Filters

If a Fume Extractor was purchased with the machine, there will be filters installed within that Fume Extractor. These air filters work best when air can move freely from one side to the other while catching dust, fumes, and other debris within the air. If the air filter is dirty, the air pressure will be reduced. The main application of a Fume Extractor is to clean the air and absorb the dangerous smells and fumes that some material can produce. Some of these gases can be caustic, nauseating, volatile, corrosive, or even deadly. It is best to use multiple stages of filters to catch particles of varied sizes. New filters can be ordered from Boss Laser by contacting sales.

10.3b Exhaust Fan & Tubing

Cleaning the exhaust fan and tubing is crucial for maintaining proper ventilation, ensuring optimal performance, and preventing fire hazards. Be sure to clean your exhaust system every 1-3 months to ensure the longevity and safety of your BOSS FC EXT.

To start, turn off and unplug the BOSS FC EXT, disconnect the tubing from the machine and the exhaust fan. Use a vacuum cleaner to remove dust and debris from the fan blades, housing, and tubing. Be gentle to avoid damaging the components. If necessary, use a soft-bristled brush to clean the fan blades and hard-to-reach areas. For tubing, a pipe-cleaning brush works well to remove residue. After cleaning, inspect the fan and tubing for any damage. If you notice damage, contact Technical Support to see if any components should be replaced.

Reassemble the exhaust system, ensuring all connections are secure and aligned properly. Finally, power on the machine to verify that the exhaust system is functioning effectively.

10.3c Water Chiller & Coolant

Monthly inspections of the water connections will assist in keeping the water Chiller system in good operating condition. Inspect coolant hoses, fittings, and connections for wear, cuts, nicks, corrosion, or leaks. Repair leaks and replace worn hoses immediately. The water should be drained and replaced every 3 months.

First, automotive antifreeze should NEVER be used as a laser coolant, only distilled water. In the absence of distilled water, tap water can be used as a last resort.

The coolant should always be clean and clear. It is a frequent problem for the coolant to become infested with mold. This often will look like murky green water with algae built up on the inner walls of the hoses. This issue can be solved in just a few steps.

1. Flush out the bad water from the water reservoir.
2. Create absolution of water and 20% bleach.

i. Cycle the bleach-water solution for about 30 minutes then flush out this water.

3. The safety flow sensor could also be full of mold.
    i. The best solution is to take it apart and clean it with a soft brush or pipe cleaners.
    ii. Make sure to re-assemble the sensor correctly and without leaks.
    iii. It is possible that harsh cleaners could creep into the sensor electronics and cause permanent damage.

✎Note: The water should be changed AT LEAST every three months.

10.4 Storage, Environment, & Maintenance Schedule

10.4a Storage of the BOSS FC EXT

Keep the laser machine in a clean, dry, and warm location with no vibration. Make sure there are NO MATERIAL(S) left on the worktable when the machine is not in use.

10.4b 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.

10.4c 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. Emptying the collection trays.
3. Ensuring there are no combustible materials in the area.
4. Ensuring that volatile solvents such as acetone and alcohol are clear of the area.
5. Ensuring the working area is free of dust and debris.

6. 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 have been moved or positioned where they can be struck by the table gantry when in motion or 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.

Exhaust System Maintenance

Clean the exhaust blower and duct system ***monthly*** to remove built up debris. Inspect the exhaust system for leaks and obstructions. Ensure all connections are properly secured. Check for loose or broken duct connections. Inspect and clean the exhaust ports in your machine to ensure there are no obstructions within the machine itself.

Linear Bearing and Rails Maintenance

The rails should be inspected and wiped clean ***daily***. Once cleaned you can use any metal lubricant such as white lithium grease, or even better, a lubricant that is equivalent to the Mobil SHC 629 Synthetic Lubricant that we use.

Cutting Nozzle and Ceramic Sensor

The copper cutting nozzle is a consumable part. This nozzle will be replaced multiple times through the life of your machine. The frequency of replacement will vary depending on the material being processed. Daily visual inspection is recommended. If there is any metal residue from the cutting process, it should be cleaned off with a soft wire brush. Carefully inspect the nozzle orifice and remove any blockages. The ceramic sensor should be cleaned weekly or monthly depending on the use of the machine.

10.4d Machine Memory

There should always be little to no files stored on your machine's memory. A large number of files can cause the controller card to have a slower reaction time. If the machine's memory is pushed to its limits, it has the possibility to crash the control card and or lock up the entire machine. This machine is just like a computer, if you acquire a large number of files over time, it will cause the operating system to slow down.

11. Common Diagnostic Solutions

11.1 Laser is Not Turning On

These machines are all hardwired into the Voltage Stabilizer, which is hardwired into the electrical source from the wall.

Check the simple stuff first.

- Are the Emergency Stop buttons pressed down?
- Is the On/Off power switch turned into the off position?

11.2 High or Low Temperature Alarms

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 but the laser head will still move around as if the machine is working correctly.

High or Low Temperature Alarms

If you have either high or low temperatures, then the laser may not be able to power up without an alarm.

- Alarm: Overheat Power Supply Off.
  - Solution: Shut off laser PSU and check the Chiller to ensure it has no alarms and that it is running.
  - If you just turned it on let the chiller run for 5-10 minutes to cool the water and then turn laser PSU back on.

11.3 Axis Alarms, Chiller Alarms, and Inadequate Cuts

Axis Alarms

- Alarm: X-Axis, Y Axis.
  - Solution: Check the E-Stop button. Try to origin the machine.

Chiller Alarm:

- Alarm: A given error code will show on the display. Most of the Chillers now have a sticker on the front with the Error code numerical value and a solution to clear the alarm. If you are unable to clear the alarm with the remedy given you can follow the steps below.
  - Solution: If the chiller is in an alarm state, identify what the error code is and then shut it off.
    - Check the water level on the gauge and ensure it is at the green level.

- Isolate the chiller from the machine by disconnecting the water lines from the machine and recirculating both output lines of the chiller right back into the inputs of the chiller.
    - This will determine if the issue is related to just the chiller or the machine.
    - Turn the chiller back on.
        - If the alarm clears on the chiller, the issue is related to the machine.
        - If the alarm clears, contact Boss Laser Technical Support for additional assistance.
        - If the alarm is not clear, then try the troubleshooting steps suggested on the front sticker of the chiller.
            - If your Chiller does not include the error codes and steps to clear the alarm, or you have tried these steps without success, then contact Boss Laser Technical Support for assistance.

Inadequate Quality / Cuts:

- Check your consumables first.
    - The Nozzle, Lower Protective Window, or the Ceramic Disk may need to be replaced.

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.