Product Manual

Laser Marking Machine

Applicable model: MC180-D-A

Version : 1.0
Copyright Statement

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Disclaimer and Responsibility Statement

Whole using the machine from our company, users are required to ensure integrity and independence of the product including but not limited to: mechanical, electrical, optical, control software and accessories. Unauthorized modification is strictly prohibited. It is a must to satisfy operating environment and operating specifications specified in the owner’s manual. For the followings:

1. Machine modified with no authorization (including but not limited to: add, remove, modify, unauthorized disassembly, replacing parts);

2. Use the machine in the environment failing to satisfy the operating requirements;

3. Operate disobeying the specifications of our company;

4. Unauthorized use the machine parts, accessories and auxiliaries on to other machine or in other places;

5. Viciously disassemble, destroy, decode hardware and software of the machine from our company

Our company shall not undertake any direct, indirect or joint responsibility. Our company reserves the rights to ascertain legal responsibility for the serious consequences or economic losses or reputation losses caused by what mentioned above.
Foreword

Thanks for purchasing the laser engraving machine control system of our company.

Before operating, please read this manual carefully to ensure proper operation.

Please keep the manual properly for reference.

Since the configs are different, certain models do not have the functions listed in this manual. Please refer to the specific functions for details.

Due to the constantly tech update, the specification for reference only, subject to the real standard.

Tags in this book:

| Alarm | Special Attention: User must follow and perform as the manual. Otherwise, it could lead to errors or relatively serious problem. |
| Note  | Note: User should comply with the attention and suggestion in this manual. It could bring much easier operation. |
Safety Precautions

Attention
Before using the machine, users are required to carefully read this manual and other operating requirements, strictly abide by the operating specifications. Professional are required for operating the machine.

Alarm
◆ The machine uses class 4 laser (strong laser radiation). The laser radiation may possibly cause the following accidents:
1) emblaze the surrounded flammable materials;
2) generate other radiations and toxic or hazardous gas by processed objects during laser processing;
3) direct irradiation of laser radiation cause harm to human body. Therefore, firefighting devices are required in the operating place of the machine. Stacking flammable or explosive objects near the machine is strictly prohibited. Good ventilation is a must. Only the qualified personnel are authorized to approach the machine.

Note
◆ The processed objects and discharged materials are required to satisfy requirements as per local laws and regulations.

Attention
Before using the machine, users are required to carefully read this manual and other operating requirements, strictly abide by the operating specifications. Professional are required for operating the machine.

Alarm
◆ Laser processing is with potential risks. Users should carefully make sure if the processed objects are suitable for laser processing.
◆ There is high voltage and potential risk in the laser machine. Unauthorized disassembly by unqualified personnel is prohibited.
◆ Reliable earthing is required for the machine and related other machine before power-on.
◆ During operating, removing any cover of the machine is strictly prohibited.
◆ During operating, the operators are required to observe working status of the machine all the time. In case of any abnormality, it is immediately to disconnect power supply and take active and corresponding measures.
◆ After power-on, special personnel are required for monitoring. Unauthorized leaving is strictly prohibited.
◆ It is a must to disconnect the power supply before leaving.

Alarm
◆ It is strictly prohibited to placing any unrelated all-reflective or diffusion reflective objects in the machine to prevent laser reflecting to human body or flammable materials.

Attention
◆ The environment for the machine should be dry, free of interference and influences from pollution, vibration, high voltage and strong magnet. The operating ambient temperature ranges 5-40 ℃, and the humidity ranges 5-85% (no dew);
◆ The machine should be far from electric appliances sensitive to electromagnetic interference;
◆ Operating voltage: AC220V, 50Hz. Power-on is strictly prohibited in case of unstable voltage of the power grid or unspecified voltage.

Chapter two of this manual is for Safety Rules. Please refer to the chapter more details concerning safe operation of the machine. Users are required to carefully read and abide by all the requirements of safety.
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Chapter 1. **Machine Introduction**

- MC180-D-A laser marking machine is a new economic type three-axis dynamic laser marking machine of our company.
- Use imported Rofin laser, the power of which is 180W; equipped with excellent three-axis dynamic marking system, featuring excellent performance and stability.
- All-aluminum chassis, compact body design, light weight, small footprint.
- Optical bench can be adjusted and lifted manually, which can meet the processing format from 300mmX300mm to 600mmX600mm.
- Matts honeycomb panel and fine blade panel are optional for working platform to meet the process requirements of different customers.
- Excellent semi-enclosed design and hydrodynamic design, removing the processing dust effectively.
- Equipped with self-developed professional control system SmartScanner, featuring simple and practical, small footprint and fast data processing. Also compatible with AutoCAD, CorelDraw and other graphics software, featuring processing speed and high processing efficiency.

Description of equipment model:

<table>
<thead>
<tr>
<th>Equipment series:</th>
<th>Laser power:</th>
<th>Auxiliary model description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>MC: CO2 Laser Marking Machine Series</td>
<td>180: 180W</td>
<td>D: Three-axis dynamic marking</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A: Series code</td>
</tr>
</tbody>
</table>

**Equipment series:**
- **MC:** CO2 Laser Marking Machine Series

**Laser power:**
- **180:** 180W

**Auxiliary model description:**
- **D:** Three-axis dynamic marking
- **A:** Series code
1.1 Equipment Composition

Due to different machine models and product update, some models may have different appearances and details. The actual product shall prevail.

1.1.1 Overall Components

- The front view of the machine is as shown in Fig. 1-1:

  ![Fig.1-1 Front View](image)

  ① Optical path marking system
  ② Water chiller
  ③ Table (including lower ventilation)
  ④ Lifting system
  ⑤ Chassis
  ⑥ Upper ventilation system
  ⑦ Fan (for upper and lower ventilation)
  ⑧ Console

- The overall control diagram of the equipment is shown in Fig. 1-2 below:
1.1.2 Composition of motion system

- The motion system is the lifting part of the optical path cavity.

As shown in Fig. 1-3:

1.1.3 Optical system composition

In addition to the standard configuration (180W laser with three-axis dynamic galvanometer of 9mm light path, as shown in Fig. 1-4) of MC180-D-A marking system, you can also choose 180W laser with...
galvanometer of 15mm light path with electric focusing (as shown in Fig. 1-5) or 15mm light path without electric focusing (as shown in Fig. 1-6).

Fig.1-4  Standard Configuration Diagram of Optical Mechanism
① Laser  ② Reflector 1  ③ Reflector 2  ④ Three-axis dynamic galvanometer

Fig.1-5  Optional Configuration Diagram 1 of Optical Mechanism
① Laser  ② Reflector 1  ③ Reflector 2  ④ Optional reflector 1  ⑤ Beam expander
1.1.4 Auxiliary accessories

To ensure proper operation, the laser equipment also needs some auxiliary accessories, such as fan and water chiller. Different models have different auxiliary accessories. Please refer to the equipment for detailed configuration.

![Fan](image1.png) ![Water chiller](image2.png)

Fig.1-7 Auxiliary Accessories
1.2 Equipment Parameters

The equipment parameters are different due to the model and configuration. The actual product nameplate and attached factory parameters shall prevail. The nameplate is usually on the back or the left side of the machine. Below is the nameplate of MC180-D-A:

![Machine Nameplate](image)

The machine parameters on the nameplate are as follows:

- **Model:** The machine model;
- **Laser Type:** The machine is equipped with carbon dioxide laser tube;
- **Laser Power:** Rated power of the laser;
- **Operating Area:** The processing format of the equipment; the largest single marking area is 600mm x 600mm;
- **Power Supply:** The total input power of the equipment, typically AC 220V; export models vary by country;
- **Total Power:** The rated power of the equipment while operating;
- **Manufacturing No.:** a unique number of each machine;
- **Date of Manufacture:** The production date of the machine;

**Manufacturer:** GD Han’s Yueming Laser Group co., LTD.
**Website:** [http://www.ymlaser.com](http://www.ymlaser.com)
**E-mail:** yueming@ymlaser.com
### 1.3 Product Configuration

<table>
<thead>
<tr>
<th>NO.</th>
<th>Item</th>
<th>Configuration</th>
<th>Specification</th>
<th>Quantity</th>
<th>Manufacturer</th>
<th>Matching Item</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Laser</td>
<td>●</td>
<td>SR-10i</td>
<td>1</td>
<td>rofin</td>
<td></td>
<td>180W RF laser</td>
</tr>
<tr>
<td>2</td>
<td>Laser power</td>
<td>▲</td>
<td>RSP-3000-spec</td>
<td>1</td>
<td>Domestic</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Dynamic galvanometer</td>
<td>●</td>
<td>3D Scanhead-300-9D-10600-32</td>
<td>Domestic</td>
<td></td>
<td></td>
<td>Beam diameter 9mm</td>
</tr>
<tr>
<td>4</td>
<td>Dynamic galvanometer</td>
<td>○</td>
<td>3D Scanhead-300-15D-A</td>
<td>Domestic</td>
<td></td>
<td></td>
<td>Beam diameter 15mm, electric focusing</td>
</tr>
<tr>
<td>5</td>
<td>Dynamic galvanometer</td>
<td>○</td>
<td>3D Scanhead-300-15D-10600-32</td>
<td>Domestic</td>
<td></td>
<td></td>
<td>Beam diameter 15mm,</td>
</tr>
<tr>
<td>6</td>
<td>Reflector</td>
<td>●</td>
<td>25mm</td>
<td>2</td>
<td>Impot</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Beam expander</td>
<td>▲</td>
<td>2X</td>
<td>1</td>
<td>Impot</td>
<td>4, 5</td>
<td>Water cooling, material: zinc selenide</td>
</tr>
<tr>
<td>8</td>
<td>Work platform</td>
<td>●</td>
<td>Grid board</td>
<td>1</td>
<td>Han’s Yueming</td>
<td></td>
<td>Maximum processing format 600mm X 600mm</td>
</tr>
<tr>
<td>9</td>
<td>Work platform</td>
<td>○</td>
<td>Fine blade</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Computer</td>
<td>●</td>
<td>Qitian M4360</td>
<td>1</td>
<td>Lenovo</td>
<td></td>
<td>English Win7 Professional Edition is optional</td>
</tr>
<tr>
<td>11</td>
<td>PC software</td>
<td>●</td>
<td>SmartScanner</td>
<td>1</td>
<td>Han’s Yueming</td>
<td></td>
<td>SmartScanner dongle (WD9)</td>
</tr>
<tr>
<td>12</td>
<td>Water chiller</td>
<td>●</td>
<td>CW-6100AN</td>
<td>1</td>
<td>Domestic</td>
<td></td>
<td>220V/50Hz/3650W</td>
</tr>
<tr>
<td>13</td>
<td>Fan</td>
<td>●</td>
<td>220V/50Hz/550W</td>
<td>2</td>
<td>Domestic</td>
<td></td>
<td></td>
</tr>
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●: Standard configuration; ○: Optional configuration; ▲: Configuration can be added; ▲: Used in conjunction with other items; ★: No such configuration

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<td>Domestic</td>
<td></td>
<td></td>
<td>Beam diameter 9mm</td>
</tr>
<tr>
<td>4</td>
<td>Dynamic galvanometer</td>
<td>○</td>
<td>3D Scanhead-300-15D-A</td>
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### 1.4 Operating environment

- Humidity: 5% - 85%; non-condensing; install dehumidifier if too wet;
- Ambient temperature: 5-40°C, install air-conditioner if the temperature is too high;
- Power input: AC220V; 50Hz;
- Grid electricity fluctuation: ± 5%; grid complies with international standards. Install automatic digital regulator to stabilize the system equipment if the voltage amplitude range exceeds 5%;
1.5 Suitable materials

- Textile fabrics, leather carving and marking;
- Plastic material marking;

1.6 Application

Clothing accessories, footwear industry, rubber products, fabric marking, etc.
Chapter 2. Safety Rules

This chapter mainly introduces safety warnings for protecting personnel and the machine, and makes an introduction to signs used in the owner’s manual. The machine is already equipped with sufficient safety guarantee, yet it is still with certain risk. All the operators are required to carefully read through and well understand the safety rules.

2.1 Product safety

The following conditions are required to be satisfied to ensure safe work:

- Abide by operation manual and instruction signs;
- Operators and maintenance personnel have received training held by machine manufacture;
- In case of operation by couples of person at the same time, division of responsibility should be made and followed;
- No admission to the working area for the unauthorized personnel;
- Avoid any working method breaking the safety rules;
- Timely eliminate all the failures possibly causing lower safety coefficient;
- Abide by maintenance regulations of the machine.

2.2 Safe equipment

Safety equipments are used for protecting personnel, and unauthorized disassembly, bridge-group or by-pass connection are strictly prohibited; in case of failure with the safety machine, professional are required for repair. If part replacement is needed, the product with same model, specification and from the same manufacture is required; otherwise, written consent from the manufacturer is required.

2.3 Safety awareness

The machine can be operated only by skilled personnel or under supervision of them. Improper use or operation may possibly be very dangerous and cause damage to the machine. Therefore, the followings are strictly prohibited:

- Placing heavy objects or stepping on the working table of the machine;
- Used for processing the materials unapproved by manufacturer;
- Staying of unauthorized personnel in the dangerous area (It is the responsibility of operators to ensure keeping unauthorized personnel away from the working area.);
- Block of using emergency stop button (Regular check is required to ensure a good condition for the emergency stop button.)
2.4 Requirements for personnel

After trail operation, maintenance personnel from the manufacturer may perform training on the operators. It is the responsibility of machine owner to have operators trained at corresponding level.

We have prepared ready a series of training course for your option. Please make phone call to our Customer Training Center for details.

2.4.1 Definition of terms

All the personnel using or operating the machine are called User in the manual;

Different requirements are for different users. Users are classified into the followings:

- **Owner**

  Owner means the authorized person or representative to sign contract with the manufacturer. With authorization, the owner has rights to sign the agreement with binding force of law;

- **Operator**

  Operator means the personnel trained for operating the machine. Training of the operator includes participation of training held by the manufacturer.

- **Maintenance personnel**

  Maintenance personnel mean the technicians having received formal training for machine and electric engineering. The maintenance personnel are responsible for daily maintenance of the machine, and repair at low level if needed. Training on the maintenance personnel contains participation training held by manufacturer.

2.4.2 Qualifications

The operator is required to accept guidance and training of the owner, and the operator is responsible for the safety of a third party in the working area; the personnel required for further training and guidance are required work or operate the machine under supervision of the operators.

2.4.3 Responsibility

It is a must to clarify the related responsibilities of each performance (operation, maintenance, parameter setting), and carry it out. Unclarified responsibilities will cause safety hidden risks.

Owner is required to provide operation manual for the operators and maintenance personnel, and ensure that they have read and understood the operation manual.

2.4.4 Personal protective devices

When technology or measures fail to absolutely avoid risk of health, the owner is required to provide personal protective devices for operator and maintenance personnel. For example,

- **Protective gloves**;

- **Laser-proof goggle**;

- **Light respirator**
2.5  Special product risks

2.5.1  Laser radiation risk

Based on level of potential risk of laser radiation, the national standard GB 7247.1-2001 makes classification for them. Laser class applicable for this laser marking machine depends on operation mode. The followings are abstract of laser device classification prescribed by the state:

Class 1: safe laser device under reasonable and foreseeable working conditions

Class 2: laser device is emitting visible light at wave length of 400nm-700nm. Generally, avoidance response including blink reflection provides protection.

Class 3A: safe laser light visible to naked eyes. Generally, avoidance response including blink reflection provides protection. Harm to naked eyes of other wave lengths will be less Class 1 laser device. Class 3A light beam internal observation with optical device (e.g. glasses, telescope, and microscope) may be dangerous.

Class 3B: dangerous laser device is to directly and internally see light beam. Generally, observation of diffuse reflection is safe.

Class 4: laser device with diffuse reflection causes danger. They may possibly cause skin burn, or fire accident. Great care is required to use this kind of laser device.

2.5.2  Common mode

In the normal operating mode, the laser marking cutting machine equals to Class 4 laser radiation. In this operating mode, there will harm of laser radiation to eyes and skin; you are required to wear goggles with antiglare filter.

Note: This machine is a class 4 laser device. Placing high reflection objects (e.g. glass, mirror) in the laser working table is prohibited.

2.5.2.1 Direct laser

You are required to pay attention to the followings while operating the laser machine:

- It is strictly prohibited to directly expose any parts of human body, explosive object and flammable objects to direct laser;
• Modification of fasteners on the optical parts is strictly prohibited;
• Unauthorized change of light route is strictly prohibited;
• Abide by all instructions prescribed in the operation manual.

2.5.2.2 Reflection and diffuse radiation

Avoid exposing eyes and skin to mirror reflection and diffuse radiation. In the maintenance mode, the maintenance personnel are required to wear laser-proof glasses, and the laser-proof glasses should satisfy the requirements as per EU standard EN207A1:2002.

2.5.3 High voltage risk

The external power supply is at 220V.

<table>
<thead>
<tr>
<th>Attention</th>
</tr>
</thead>
<tbody>
<tr>
<td>◆ You are prohibited to directly watch strong light and laser even with laser-proof glasses on;</td>
</tr>
<tr>
<td>◆ Laser-proof glasses are made from high polymer material, and dipping into organic solvent or cleaning with it are prohibited;</td>
</tr>
<tr>
<td>◆ It is a must to replace the laser-proof glasses at the expiration.</td>
</tr>
</tbody>
</table>

2.5.4 Risk of electric shock

<table>
<thead>
<tr>
<th>Attention</th>
</tr>
</thead>
<tbody>
<tr>
<td>◆ High voltage 220V!</td>
</tr>
<tr>
<td>◆ The voltage over 50V and the current over 20mA are with the risk of danger and may cause death.</td>
</tr>
<tr>
<td>◆ Only the maintenance personnel from the manufacturer are permitted to perform operation on the inner parts</td>
</tr>
</tbody>
</table>
The followings are required for operating of installing the electric machine:

- It is a must to use the specified fuse provided by the manufacture;
- Immediate pressing the emergency stop button is required in case of power failure;
- Unless otherwise prescribed, power disconnection of the electric part is required for maintenance;
- First check if there is live power on the insulated part, and then perform the treatment of earthing and open circuit, and perform insulation for the nearby live (charge) parts;
- Make regular check on the electric machine. Timely correct failure like poor contact or burnt power cord;
- While operating live (charge) parts, minimum two persons are required at the site for pressing the emergency stop button or disconnecting power supply if necessary; Mark the working area with red-and-white band and warning sign;
- It is a must to use insulation tools.

### 2.5.5 Risk of process by product

During laser processing, outgrowth may possibly generate, and their hazard must satisfy the requirements specified in Appendix A for example of processing outgrowth as national standard GB 18490-2001 laser processing machine. The abstract is as below:

**A1.1 china processing**
The oxide of Al2O3, Mg, Ca and Si; BeO (virulent).

**A1.2 silicon slice processing**
Crumb of silicon and silicon monoxide suspended in the air (possibly breathed into lungs causing silicosis);

**A1.3 metal processing**
In a view of medicine, the following metals and their compounds are influential: Mn, Cr, Ni, Co, Al, Zn, Cu, Be, Pb, Sb.

Medical influences are as below:

- **Toxic** Cr6-, Mn, Co
- **Allergic reaction, burn caused by metal smoke** Zn, Cu
- **Lung fibrosis** Be
- **carcinogenic** Cr6+, NiO

Metal beryllium is very dangerous, especially cutting alloy or metal containing Zn in atmosphere will generate heavy metal smoke.
A1.4 plastic cutting

Various kinds of substances with potential risks may be generated when cutting the plastic. At lower temperature, aliphatic hydrocarbon will be produced; at higher temperature, aromatic hydrocarbon (e.g. benzene PAH) and polyhalo-polynuclear hydrocarbon (e.g. dioxin, furan) will be increased. Some of these substances may possibly generate cyanide, isocyanate (PU), acrylate (PMMA) and hydrogen chloride (PVC).

Medical influences include:

--------Toxic: Cyanide, CO, derivative of benzene
--------Allergy source/irritation: isocyanate, acrylate
--------Respiratory stimulating: formaldehyde, acrolein, amine;
--------Carcinogenesis: benzene, some PAH substances

A1.6 Surface modification

Generally, there is no noticeable outgrowth, but sometimes heavy metal steam is generated.

A1.8 paper and wood cutting

General fibrin outgrowth, ester, acid ethanol, benzene-

<table>
<thead>
<tr>
<th>Attention</th>
</tr>
</thead>
<tbody>
<tr>
<td>✦ During laser cutting, the smoke generated may be very toxic. The smoke is removed by upper exhaust blower system;</td>
</tr>
<tr>
<td>✦ Cutting with abnormal blower system is prohibited.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>✦ Make frequent check on the ventilation system;</td>
</tr>
<tr>
<td>✦ Clean and maintenance the blowing system regularly;</td>
</tr>
<tr>
<td>✦ Foreign matter coming into duct of the blowing system is strictly prohibited;</td>
</tr>
<tr>
<td>✦ Ensure a good ventilation and the exhaust gas expel from the working room;</td>
</tr>
<tr>
<td>✦ Ensure a necessary disposal of the exhaust gas to satisfy emission requirements prescribed by the state and local government</td>
</tr>
</tbody>
</table>

2.5.6 Risk of optical system

2.5.6.1 Routine operation

The reflector of the optical system adopts glass as reflector medium, and the focus lens of the marking head is made of seleniumzinc material. In normal condition, these optical parts are free of danger.

However, polluted focus or focus with damaged coating will cause thermal reducing by laser beam over 400°C, the xic smoke is generated. At this time, the laser device must be powered off, mechanical movement must be stopped and blowing air to the lens. At this moment, cleaning and parts replacement should be performed after the dust subsiding please do not raise dust.

<table>
<thead>
<tr>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>✦ During cleaning, please wear on goggle and gloves. The damaged parts must be sealed in a container and properly packaged, and then returned to the manufacturer.</td>
</tr>
<tr>
<td>✦ Good ventilation is required in case of any damage of the parts.</td>
</tr>
</tbody>
</table>
2.5.6.2 Warning for fire accident

Damaged machine or improper operation of the machine will cause risk of fire accident. Fire extinguisher must be equipped according to fire control regulations prescribed by the state.

Attention: Atomizer or flammable or explosive substances are strictly prohibited to approach the machine, make regular check on the fire extinguishers to ensure a good condition.

2.5.7 Other risks

To ensure safety, modification or changing use of the machine with no consent from the manufacturer is strictly prohibited; any change of operating software or function to the machine is strictly prohibited, or it is strictly prohibited to perform integration of the machine with other system.

2.5.8 Measures for emergency

2.5.8.1 Measures for personal injury

In case of personal injury, the followings should be performed:

- Stop hurting (e.g. stop the machine, disconnect the power supply);
- It is a must to take first aid measures;
- Notify professional medical personnel;
- Notify the competent management department;
- Abide by the related regulations prescribed by the state and the company

2.5.8.2 Measures for fire accident

In case of fire accident, the following measures should be taken:

- Emergency stop of the machine, disconnection of power supply;
- Control of fire with the fire extinguisher, evacuation of personnel;
- Notify the competent management department;
- Abide by the related regulations prescribed by the state and the company
Chapter 3. Equipment Installation and Commissioning

3.1 Equipment Installation

3.1.1 Unpacking Steps

Before installation, disassemble the wooden for the machine in the following steps:

- Prize up the packing case of the machine with a crowbar. Unpack in the following order: top cover, left and right side covers, front and rear side covers, fastening ropes or fixing plate.

- Loosen the upper nuts of the feet with a wrench, and raise the feet to make the distance to the pallet greater than to the casters.

![Fig. 3-1  Loosening Castor and Foot Cup](image)

- Fork the machine from the pallet with a forklift, deliver to the destination, and unscrew the feet.

- Then, unpack the console and water chiller in the same way as unpacking the host / fan.

Refer to the machine for the packaging.

3.1.2 Unpacking and inspection

After unpacking, check the equipment and auxiliary accessories to ensure that the product isn’t damaged during transport. Check the contents as follows:

1. Check equipment model

   Please confirm if the model complies with the equipment you have ordered.

2. Check equipment appearance

   Please check if the equipment has defects such as scratch, damage, deformation and corrosion.
3. Open each door of the machine and confirm if the equipment has accidentally detached parts, thread or internal damage.

4. Check spare parts and accessories of the equipment

Unpack the boxes of auxiliary machine and accessories, and check if the parts comply with the packing list, and if the accessories are damaged or deformed.

| Attention | Do not attempt to unpack without permission
If you want to unpack, first obtain the consent of our customer service or business personnel, or else we will assume no responsibility for the unexpected events. |
| Attention | If any problem occurs after unpacking, please inform our customer service or business personnel, or call the company directly
Do not attempt to handle without permission |

3.1.2.1 Preparation

The preparations required before installation are as follows:

1. Site

   ➢ Dimensions of MC180-D-A host (L x W x H): 1710 x 1400 x 1610mm; to ensure proper use of the machine, ensure that the machine's working space is at least 3710 x 3400 x 3000mm;

   ➢ The laser equipment has requirements on site conditions and work environment. Please confirm if the site is appropriate according to Section 1.4 and relevant requirements of our Company.

2. Personnel

The equipment must be installed by our professional service personnel. If the customer wants to install the machine, the installer must have received the full installation training and have mastered the key points of laser equipment installation.

3. Tools

The installation tools have been provided. In addition, the user should prepare some installation and testing tools if necessary, such as screwdrivers, multimeter, etc.

4. Others

The user needs to prepare the water, electricity, smoke exhaust channels, proofing materials, computer and power outlets associated with the equipment.
3.1.3 Adjust the level of the machine

After the machine is moved from the crate to the workplace, the level of the machine should be re-adjusted as follows due to differences in the workplace:

- First, adjust four feet to completely hold up the machine (casters off the ground);
- Then, put the spirit level catty-cornered at the top of the laser cavity, and observe the offset direction of bubbles in spirit level, as shown in Figure 3-2. If the bubbles shift left, the lower left side of the machine is higher than the upper right side. Adjust the level of the machine by reducing the height of the lower left foot cup or increasing the height of the upper right foot cup. When the bubbles in the spirit level are in the center, the horizontality of the line between the lower left corner and upper right corner of the cavity of the light path has been adjusted; then, put the spirit level along the line between the upper left corner and lower right corner of the laser cavity, observe and adjust the foot cups in the same way, put the spirit level horizontally, and check if it is still level until both the horizontal direction and vertical direction are level, and the level adjustment of the laser cavity completes.
- Then, put the spirit level on the front end of the honeycomb plate or blade, and make the front end level by adjusting the screws beneath the workbench (Figure 3-3), and adjust the rear end, left side and right side in the same method until these four positions are horizontal, indicating that the level of the workbench has been adjusted, and the installation can be carried on.

![Fig.3-2 the level adjustment of the laser cavity](image)
3.1.4 The installation of computer/display and keyboard and mouse

- Take out the monitor and fix it on the console.
- Put the keyboard and mouse on the console in the position shown in Fig. 3-4, pass the wire through the main frame of the monitor and connect to the keyboard/mouse adapter wire in the chassis.
- Take out the computer and put it on the mounting board, and connect the wires to appropriate ports of the computer, as shown in Fig. 3-4 & 3-5:

   - Monitor
   - Keyboard
   - Mouse
   - Monitor bracket
   - Computer host

Fig.3-4 Console Installation Diagram

Attention: The machine level adjustment is necessary. The subsequent operation of the machine will be affected if the machine level is quite different.
3.1.5 Installing fan and water chiller

- Fill up the industrial chiller with distilled water or deionized water.
- Connect the fan, water chiller and the machine as shown in Fig. 3-6, and lock the connections with hose clamps.
3.1.6 Equipment grounding

MC180-D-A laser equipment has strict requirements on safe grounding of user power system, which must comply with local safety standards:
**Fig. 3-7 Power Outlet**

- **L**: 220V mains system phase line; must be equipped with safety electrical switch (switch must be installed in the phase line).
- **N**: commonly known as the neutral line, supply power to the equipment with the phase line.
- **E**: earth wire; the enclosures (earth terminals) of all electrical equipment are connected to this wire to ensure safety. Resistance to earth should be less than 5Ω.
- The user must consult professional electrical installer (electrician), and ask the electrician to check and ensure that the earth wire is securely connected!

<table>
<thead>
<tr>
<th>Attention</th>
<th>Improper grounding can cause high failure rate, and may lead to other accidents! The Company assumes no responsibility and obligation for such failures and accidents</th>
</tr>
</thead>
</table>

If the power supply system does not have earth wire, ask the electrician to install grounding grid according to the following method:

- The grounding device must be knocked into a humid place around the house with 2-4 pieces of 4×35×1500mm angle steel, the distance between each other is 1m, then lead each piece of angle steel out of the earth with 3×30mm flat iron and form a grounding grid.
- Lay the ground grid properly, and measure its resistance to ground with the instrument (standard resistance: 3-5 ohms).
- The machine is equipped with a piece of RVV2.5mm2 yellow-green copper wire, of which one end is connected to the grounding line terminal and the other end is connected to the earth wire of the etching machine, as shown below:

![Equipment Grounding Diagram](image)

**Fig. 3-8 Equipment Grounding Diagram**
3.2 Equipment button instruction

![Fig.3-9 Master Power Switch](image)

① Air switch  ② Key switch lock  ③ Laser control switch  ④ Emergency stop switch

- Air switch: pull up the air switch to turn on the main power, ensure that all buttons pop up before connecting the power to avoid damage to the electrical parts and optical parts due to large transient current.
- Key switch lock: the power switch of all control buttons of the machine and the computer; when the key is turned clockwise, the control buttons and the computer are turned on; when the key is turned counterclockwise, the control buttons and the computer are turned off.
- Laser control switch: self-locking illuminated pushbutton, CO2 RF laser power; when it is pressed down, the LED is on and laser emits.
- Emergency stop switch: located on the main stand of the monitor; when the emergency stop button is pressed down, the system power won’t be cut off, RF laser is protected and laser emission is prohibited; when the emergency stop button is rotated and popped up, the laser emission is effective.

<table>
<thead>
<tr>
<th>Attention</th>
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<tbody>
<tr>
<td>● After press down emergency stop button, all equipment of the power will be cut off, necessary if need to power off the machine, should be shut off the main power switch and unplug the power cable.</td>
</tr>
<tr>
<td>● Only in has ruled out an emergency and correct all defects or repaired the failure cases can loosen the stop to continue operating the machine</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>● After emergency rule out will be pressing the stop button clockwise rotate its automatic reset, will be terminate the stop state.</td>
</tr>
<tr>
<td>● Must be restart software after removed stop condition, equipment shall be resumed work.</td>
</tr>
</tbody>
</table>
3.3 Equipment debugging

After installation, the equipment needs debugging and processing test. Equipment debugging mainly completes state detection of each module of the machine, including motion module, laser module and electrical I/O module.

3.3.1 Switching sequence

The switching on sequence follows:

Connect master power -> connect fan power -> connect chiller power, start the chiller and set the temperature properly -> pull up the air switch -> turn the key switch clockwise -> press the laser button

Shutdown in opposite order, successively:

Press the laser button -> turn off the computer -> turn the key switch counterclockwise -> pull down the air switch -> turn off the chiller and disconnect the chiller power -> disconnect fan power -> disconnect master power

Attention

Please operate in accordance with the required sequence, or else it may cause equipment malfunction.

3.3.2 Chiller settings

For the water temperature setting of the chiller, please refer to the Manual of the chiller.

Note

The difference between water temperature of the chiller and room temperature should be within ±5 ℃.
3.3.3 Laser debugging

3.3.3.1 Adjusting method of each section and regulation of main optical path

3.3.3.1.1 Preparation for optical path adjustment

- First adjust the working distance and measure the distance from lower surface of the galvanometer to upper surface of the grid screen, as shown in Fig. 3-10:

![Fig.3-10 Working Distance Adjusting Diagram](image)

If the marking range is 600mmX600mm, the working distance is 660mm; if the marking range is 300mmX300mm, the working distance is 350mm; if the distance is too short or too long, please adjust the lifting mechanism of the machine.

- Remove the connector board and optical path cover of the optical path marking system in order to adjust reflector 1 and reflector 2, as shown in Fig. 3-11.

![Fig.3-11 Diagram of Removing Rear Cover Plate of the Optical Path Cover](image)
The entire side plate of the galvanometer needs to be removed only for preliminary light adjustment. If the dynamic axis needs to be adjusted to change the marking format when the optical path has been adjusted, just open the box portion shown in Figure 3-12 and adjust the dynamic axis.

The laser path has been adjusted in the factory. However, prolonged transport or violent shaking may lead to changes in laser path, so when the machine arrives at the client site, and preparation for laser path adjustment is done, check if the laser path changes according to laser path calibration 1 and laser path calibration 2 according to section 3.3.3.1.3. If there are any changes, adjust the laser path according to section 3.3.3.1.2 and 3.3.3.1.3; if there are no changes, follow section 3.3.3.1.4 directly.

### 3.3.3.1.2 3D reflector

To ensure that the transmitting direction of the laser beam is parallel to the corresponding axial direction and the transmission process is accessible, the optical path should be adjusted when the optical lenses are first installed. The outer optical path doesn’t need to be re-adjusted after the lenses are removed and washed because the reflector holder of the outer optical path uses a more advanced design. As shown in Figure 3-13, the reflector
holder has three adjusting bolts, and XY axis coordinate system is established in the plane of the three bolts. Generally, bolts A and C are adjusted respectively basing on bolt B, so that the reflector rotates around axis X and Y to adjust the beam direction. For example, rotate the adjustment bolt C counterclockwise, and the reflector will rotate around axis Y inward, i.e. the light moves in the negative direction of axis X. By the same token, rotate the adjustment bolt A clockwise, and the reflector will rotate around axis X outward, i.e. the light moves in the negative direction of axis Y.

Whether the optical path is adjusted properly can be determined by "target burning" method. To burn target, put the photosensitive paper in the center of next reflector holder, burn the paper with laser pulse of 5% power, adjust the reflector holder according to the mark of burning target, until the mark falls in the center of the reflector holder.

3.3.3.1.3 Dynamic focusing scanning galvanometer

Fig.3-14 Galvanometer Interior

Fig.3-15 Optical Calibration 1 Diagram
When the side plate of the galvanometer is opened, first remove the built-in focus lens (as shown in Figure 3-14), then loosen the screws of the vernier caliper, move to the far right, put optical path calibrator 1 in the light inlet of the galvanometer, and insert into light-sensitive paper (as shown in Figure 3-15) in the optical path calibrator 1. In power on state, run Han's Yueming marking software, turn on laser, and adjust the parameters to make the marking have relatively light marks in photosensitive paper. Observe whether the image formed on the photosensitive paper has four equal quadrants as shown by the standard pattern in Figure 3-17, and re-adjust 3D reflector 1 if not. After the incident light passes through the center of the light inlet of the galvanometer on the rear panel, another point needs to be identified to ensure the correct optical path, and thus the optical path calibrator 2 is designed. After adjusting the first point as shown in Figure 3-15, affix the photosensitive paper to the surface of optical calibrator 2 (as shown in Figure 3-16), turn on the laser and check if the image formed on the photosensitive paper has four equal quadrants, and re-adjust 3D reflector 2 if not (if the optical path deviation is too large and beyond the adjustment range of 3D reflector 2, adjust the trimming table in a wide range and then trim the 3D reflector 2). When the second point has been adjusted, check if the optical path image of the first point still has four equal quadrants; if not, repeat the adjustment of the two optical points, until the images of both points have four equal quadrants, which indicates that the incident laser is coaxial with the optical axis.
The dynamic focusing scanning galvanometer is marked with three state lights, X, Y and Z, of which X and Y indicate the working status of 2D scanning module XY galvanometer, and Z is the working condition of dynamic axis. When the light turns green, the system is working properly; if the light turns red, it indicates a failure.

### 3.3.3.1.4 Dynamic axis adjustment

Reinstall the focusing lens group after adjusting the optical path of the galvanometer. The focusing lens group is locked, and the dynamic axis module can slide freely. Non-electric focusing galvanometer needs the following adjustment of dynamic axis:

1. Place a piece of black cardboard on the working platform, draw a 200*200 rectangle with the software, set the fill spacing to 1mm, and then set the processing parameters as shown below:

<table>
<thead>
<tr>
<th>Layer Para</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Work Para</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mark Times</td>
<td>1</td>
</tr>
<tr>
<td>Mark speed (nm/s)</td>
<td>4000.000</td>
</tr>
<tr>
<td>Jump speed (nm/s)</td>
<td>8000.000</td>
</tr>
<tr>
<td>Jump Delay (us)</td>
<td>430</td>
</tr>
<tr>
<td>LaserOn Delay (us)</td>
<td>-120</td>
</tr>
<tr>
<td>LaserOff Delay (us)</td>
<td>230</td>
</tr>
<tr>
<td>Polygon Delay (us)</td>
<td>60</td>
</tr>
<tr>
<td>Polygon Kill Time (us)</td>
<td>10</td>
</tr>
<tr>
<td>Frequency (Hz)</td>
<td>20.000</td>
</tr>
<tr>
<td>Energy (%)</td>
<td>35.000</td>
</tr>
<tr>
<td>FPE Width (%)</td>
<td>30.000</td>
</tr>
<tr>
<td>Increment Step (%)</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Fig.3-18 Dynamic Axis Adjustment Parameters

2. The galvanometer has a vernier caliper connected to the dynamic axis. First loosen the screws on the calipers, push the calipers to the zero position far left, then click Mark and move the dynamic axis back and forth. When the marking sound is the most strident, the dynamic axis is in focus position, and the dynamic axis can be locked with the screws. (Do not move the dynamic axis with hand while marking because it is very dangerous when laser passes through) Since the machine is relatively high, the operation requires at least two persons, with one person adjusts the dynamic axis in the above, and the other operates the console and listens to the marking sound. After adjusting, fix the dynamic axis and seal the entire optical path.

### 3.3.3.2 Galvanometer correction

For the correction of galvanometer, please refer to the operation manual of the machine and related host software manual.

### 3.3.4 Commissioning

After the above steps, the commissioning of motion and laser completes, and drawing test can be started.
➢ First start the equipment in sequence;

➢ Then, prepare the materials to be processed, and put the materials on the work surface horizontally;

➢ Import or draw graphics to be processed;

➢ Set the processing parameters (layer parameters) and the related data process (such as path optimization);

➢ Move the marking system to the starting point of processing (search for the starting point);

➢ Start processing;

The above is the basic processing steps. For detailed processing operations, please refer to the operation manual of the machine and related host software manual.
Chapter 4. System Maintenance

Stable and normal operation of the machine is inseparable from the proper operation and routine maintenance. This chapter describes the routine maintenance of the equipment.

4.1 Mechanical maintenance

4.1.1 Lubrication of transmission parts

When the machine is in use, the main task of maintenance is to lubricate the components. The lubricating positions include the connections of the trapezoidal screw and nut of the optical lifting frame and linear rails and sliders of the lifting frame. The lubrication time depends on the operating environment of the machine. If the environment is dusty, conduct maintenance every half month; in general, conduct maintenance once per month, i.e., clean the lubrication sections and lubricate.

4.2 Electrical maintenance

4.2.1 Electrical components

The machine frame is equipped with electrical control components inside, and there should be no debris in the control box. It shouldn’t be uses as "toolbox" or "locker".

After running 1~2 months (if in harsh environments or the processed materials are dusty, the dust clean-up period should be once a week), blow and clean the electric control box with clean dry air; keep the inside of the control box clean to prevent failure of the electrical equipment caused by too much dust.

After running half a year, check and fasten the wiring of the electrical components with a screwdriver to prevent loose and falling of the wire.

4.2.2 Emergency Stop button

Emergency Stop button is safety emergency components for laser marking machine, property related to personnel and equipment safety. Must be within the provisions of this operating manual maintenance interval according to the following steps to test the its function

- Switch on laser marking machine, and process the work.
- Press on the Emergency stop button, if all the power for the machine is cut off, means the emergency stop button in function, if one machine with two or more than two emergency stop button, need check it one by one.
- Reset Emergency button, the device will be restart.
- Emergency stop button is one optional device, whether have this device need check the configuration.
4.3 Maintenance of Optical Path and Optical Devices

The beam path system include beam combiner and the lens. After long time working or the mechanical shake, the beam path will be changed, so suggest that check the laser beam path first before start the work. Correctly, and regular maintenance of the optical system, which can effectively extend the service life of laser device and decrease the cost of the use of the lens.

In the process of replacement, the placement of optical lenses, testing, installation, should pay attention to the lens from damage and contamination. A new lens installation after in use, should be regularly cleaned. The correct cleaning methods, will prolong the service life of the lens, and reduce the costs; On the contrary, will reduce the service life.

When laser working, inevitably optical element contact suspension. When the laser was cutting or engraving on the part of the cutting dust generating material cutting, carving, marking, material surface could release a large number of corrosive gas and dust, the gas and dust will cause harm to the lens. When pollutants fell on the surface of the lens, will absorb energy from the laser beam, lead to the thermal lens effect. If the lens have not form the thermal stress, the operator can be disassembled and cleaned. Of course, shall be made in a certain way to avoid damage to the lens and further pollution.

- General Operation Principles

In the installation and cleaning process of lens, any sticky material, even nail print or oil droplets, will increase the absorption rate of the lens and reduce service life.

Therefore, the following precautions are required:

- Do not use suction device or inflatable equipment to avoid scratching the lens surface;
- Hold the edge of the lens rather than the film when take lens;
- The lens should be stored in a dry and clean place for testing and cleaning. A good console should have several layers of cleaning tissue or lens tissue on the surface;
- The operator should avoid talking over the lens, and keep food, beverages and other potential contaminants away from the working environment.

- The correct cleaning method

① Against mild pollution (dust, fiber particles) for flexible clean

Before the following steps, use a balloon blowing off the dust on the lens surface, if still can not remove the pollutant, please go to step②.

| Note | Avoid using workshop air pipes, because they contain a lot of water and oil. These pollutant can be harmful in lens surface absorption layer. |

② for mild pollution stains, fingerprints) for flexible clean

With acetone or isopropyl alcohol extract infiltrates an unused degreased cotton swabs about 30 seconds on the mirror surface cleaning, cleaning swab with slight pressure do from the center of the circle to the outside
of the spiral movement. Swab control when dragging drag speed and strength, left behind a swab of liquid can evaporate immediately, so it cannot leave streaks, as shown in Fig 4-1. If still can not remove the pollution, please go to step ③.

![Fig.4-1 mirror cleaning](image)

A: movement direction for cotton swab  
B: movement track for cotton swab

<table>
<thead>
<tr>
<th>☑️</th>
<th>Must control the operating strength, force will damage the lens coating film</th>
</tr>
</thead>
</table>

③ for moderate pollution (saliva, oil) of the lens to the cleanliness of moderate intensity

USES distilled white vinegar soak a unused degreased cotton swabs, cotton swabs with slight pressure to do from the center of the circle to the outside of the spiral movement (see operating technique step (2), with an unused degreased cotton swabs to wipe the lens on the extra distilled white vinegar. With an infiltrating acetone degrease cotton swabs gently wipe the surface of the lens, remove all of the acetic acid, please go to step ④.

④ for severely contaminated (splash) lenses must try super clean

<table>
<thead>
<tr>
<th>☢️</th>
<th>Only the lens in use process by high levels of pollution, and perform steps 1, 2, 3, still failed to achieve acceptable cleaning effect. This method can be used.</th>
</tr>
</thead>
<tbody>
<tr>
<td>☢️</td>
<td>If removed the coating film, the performance of the lens will be completely destroyed. If the color of the lens has obvious changes, the coating has been completely destroyed.</td>
</tr>
</tbody>
</table>

After fully shaking the container which fill with polish, open the container, dropout 4 or 5 drops, Drop in cotton ball. move the cotton ball as draw circle path, when process please do not press the cotton ball, continuously rotate the mirror, avoid the over polish, the time no over 30 seconds. during this process, once find the color changed, must stop the operation, changed color, means the coting film damaged.

A. After use polish, use an unused degreased cotton swabs infiltration with distilled water. And then clean the mirror surface. Thoroughly wet the lens surface, remove the polishing residue as much as possible, do not make the lens surface becoming to dry, because it will be hard to remove the polishing residue.
B. Prompt use one unused degrease cotton swab soak with isopropyl alcohol, and then soft clean the mirror surface. Put the head of the cotton swab on the surface as much as possible to clean the polish residue.

C. Use one unused degrease cotton swab soak with acetone, clean the mirror surface for remove the residual acetone and polish residue.

<table>
<thead>
<tr>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>The last step must work at somewhere, which have good light and the black background, check the mirror surface carefully, if still have the polish residue, please repeat step ④B-④D</td>
</tr>
</tbody>
</table>

For the above procedures, please pay attention to the following precautions:

- Should always wear no powder finger or rubber/latex gloves, dirt and grease stain on the skin can lead to serious pollution optical element, make its performance fell sharply;
- Prohibit to use any tools for the procedures, including the tweezers;
- For the purpose to protect the lens should always be placed on the lens wiping paper (in the case of lenses removed clean up), it is forbidden to put the lenses on a hard or rough surface, it will make the lens scratches.

Focus lens (mirror) cleaning: the lens wiping paper folded several times, with a cleaning fluid (anhydrous ethanol) dip, dip in with the presence of water ethanol wipe mirror paper with spiral linear graze focus lens from inner to outer surface, repeated several times, until the mirror clean.

4.4 Auxiliary equipment maintenance

4.4.1 Cleaning the fan

Clean the air ducts and fans every week to prevent affecting the ventilation effect due to debris accumulation. Check for leaks and foreign materials, and repair or clean up. Prolonged use of fans will accumulate a lot of solid dust inside and cause a lot of noise, which is not conducive to the exhaust and odor removal. If the suction of fans is insufficient or the exhaust is impeded, turn off the power, remove the air inlet duct and outlet duct of the fan, clean the dust inside, put the fan upside down, turn the blades inside until clean and then install the fan, as shown below:
4.4.2 Water chiller maintenance

The quality and temperature of cooling water directly affect the life of the laser. The cooling water must be distilled water, and the temperature must be controlled at 10°C~35°C according to the ambient temperature (±5°C); the cooling water should be kept clean and changed regularly (at least once every two months), check if the cooling water is turbid, if there is sediment, and if the water temperature is too high, and replace the water; while processing, always check if the water level is adequate and if the water temperature is too high (above 35°C).

- Replace the cooling water in the following steps:
  1. Turn off the laser power, and stop the machine;
  2. Unscrew the drain valve of the water chiller, and drain the cooling water from the water chiller;
  3. Open the protective cover of the water chiller, and fill the new distilled water into the water chiller;
  4. Start the machine, and it will work properly when the laser tube is filled with cooling water.

4.4.3 Work platform maintenance

The work platform of the machine is honeycomb plate splicing table. Note the following in the course of use:

- In daily work of the machine, do not touch the honeycomb plate or scratch the surface of the plate directly with a hard object;
Because the materials to be processed are flexible materials, clean the surface of the honeycomb plate with brush after processing, or else it will affect the suction effect of the work platform and thus affect the processing;

The work platform should avoid contact with corrosive liquids or gases;

If the work platform is damaged or deformed, please contact our personnel for replacement.

Do not put heavy objects on the honeycomb plate, or else it will cause deform of the work platform.

The work platform should be cleaned every day. Blow the scrap in the holes of the honeycomb plate into the scrap collection drawer of the work platform with an air gun, and discard the scraps from the collection drawer.

### 4.5 Auxiliary equipment maintenance

<table>
<thead>
<tr>
<th>Item</th>
<th>Maintenance</th>
<th>Cleaning cycle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water chiller</td>
<td>Replace the circulating cooling water.</td>
<td>1 month</td>
</tr>
<tr>
<td>Filter screen</td>
<td></td>
<td>15 days</td>
</tr>
<tr>
<td>Shielding window</td>
<td>Clean with alcohol and lens paper.</td>
<td>Every week</td>
</tr>
<tr>
<td>Optical system</td>
<td>Reflective and beam expander</td>
<td>1 month</td>
</tr>
<tr>
<td></td>
<td>Clean with alcohol and lens paper.</td>
<td></td>
</tr>
<tr>
<td>Laser output window</td>
<td>Clean with alcohol and lens paper.</td>
<td>2 months</td>
</tr>
<tr>
<td>Internal lens of galvanometer</td>
<td>Need to be cleaned by on-site trained professionals.</td>
<td>3 months</td>
</tr>
<tr>
<td>Air duct system</td>
<td>Lower adsorption exhaust fan</td>
<td>Every week</td>
</tr>
<tr>
<td></td>
<td>Upper dust removal fan</td>
<td></td>
</tr>
<tr>
<td>Processing platform and inner walls of the machine</td>
<td>Clean with damp cloth and air gun</td>
<td>Every day</td>
</tr>
</tbody>
</table>
# Troubleshooting

<table>
<thead>
<tr>
<th>Failure</th>
<th>Analysis</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Can’t turn on the power</td>
<td>The power cord of the plug isn’t inserted tightly</td>
<td>Insert the power cord tightly</td>
</tr>
<tr>
<td></td>
<td>The main power switch isn’t turned to the ON position</td>
<td>Turn the main power switch to the ON position</td>
</tr>
<tr>
<td></td>
<td>The joint inside the electrical box is loose or poor contact</td>
<td>Check the line to ensure proper wiring</td>
</tr>
<tr>
<td>No laser emitting</td>
<td>The emergency stop button isn’t unscrewed</td>
<td>Unscrew the emergency stop button, and cancel the emergency stop state</td>
</tr>
<tr>
<td></td>
<td>The laser isn’t powered on</td>
<td>Check if the water chiller is turned on</td>
</tr>
<tr>
<td></td>
<td>Optical path is sheltered</td>
<td>Check the optical path</td>
</tr>
<tr>
<td></td>
<td>Control card driver is not installed properly</td>
<td>Install the hardware drivers according to the driver installation guidelines</td>
</tr>
<tr>
<td></td>
<td>Control card failure</td>
<td>Repair or replace the control card</td>
</tr>
<tr>
<td>Can’t mark</td>
<td>Calibration parameters of the galvanometer are inappropriate</td>
<td>Select or modify the calibration parameters</td>
</tr>
<tr>
<td></td>
<td>The galvanometer isn’t turned on</td>
<td>Check the power of the galvanometer to ensure compliance with the requirements</td>
</tr>
<tr>
<td></td>
<td>Scanning galvanometer failure</td>
<td>Repair or replace the scanning galvanometer</td>
</tr>
<tr>
<td></td>
<td>Poor wiring of galvanometer digital signal</td>
<td>Check if the wiring meets the requirements for electrical wiring</td>
</tr>
</tbody>
</table>
Chapter 6. Appendix

6.1 Electrical Control System Block Diagram of Main Power
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