MC Series CO_2 Laser Cutting Machine User Manual

Machine Model：MC43

Chapter 1: Product Overview

1.1 Product Introduction

The MC series CO_2 laser cutting machine is a high-performance device designed for precise cutting of non-metal materials, with added engraving capabilities. It is widely used in industries like advertising signage, craft gifts, model making, leather processing, and acrylic products, especially where smooth cutting edges and high accuracy are essential.

1.2 Design Features

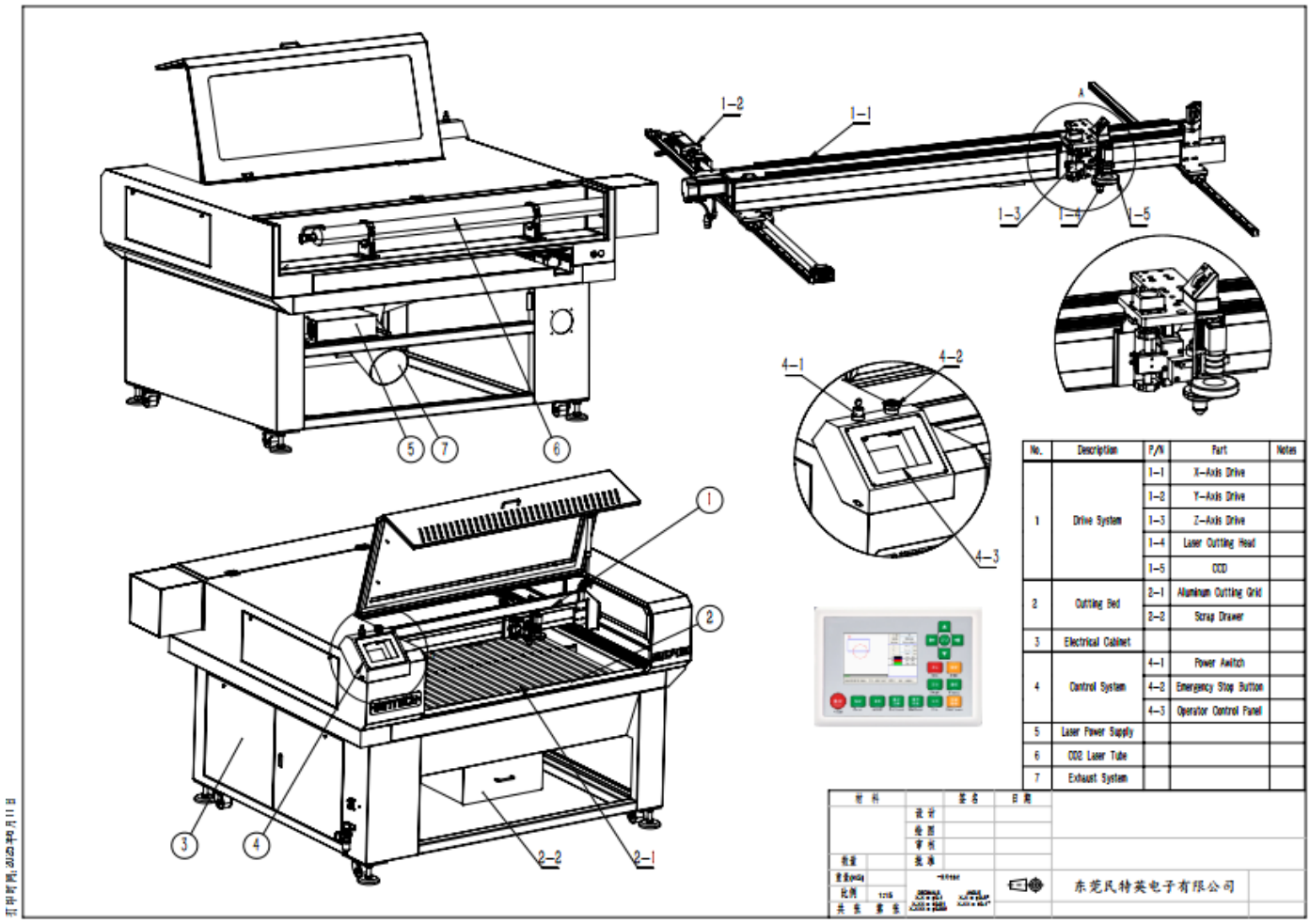
To ensure superior cutting quality and system stability, the MC series incorporates optimized mechanical and control systems:

- **Full Servo Drive System:** Utilizes high-precision servo motors and drivers with closed-loop control for stable, high-speed, and accurate motion control. This enhances positioning accuracy and response speed.
- **Ball Screw Drive Structure:** Core transmission uses ball screws and linear guide rails for high mechanical precision and stability, ideal for materials like acrylic with strict edge smoothness requirements.
- **High-Quality Laser Source:** Equipped with a stable-output DC glass tube CO_2 laser, available in 150W or 300W, suitable for medium-to-high-power applications.
- **Constant Temperature Water Cooling:** Features an industrial-grade water chiller system using deionized water or coolant to maintain laser stability and extend lifespan.
- **Advanced Control System:** Uses Ruida industrial-grade laser controller supporting multiple vector formats and optimized cutting paths. An optional CCD camera system enables print recognition and auto edge-tracing for integrated printing-cutting workflows.
- **Engraving Functionality:** Supports both vector and raster engraving on various non-metal materials for texturing and surface detailing.

1.3 Structural Components

The MC series comprises a rigid steel frame, CNC drive platform, gantry beam system, precision cutting head, laser source, cooling system, and auxiliary gas systems. These modules work in sync for high-precision non-metal cutting.

1.3.1 Key components include:

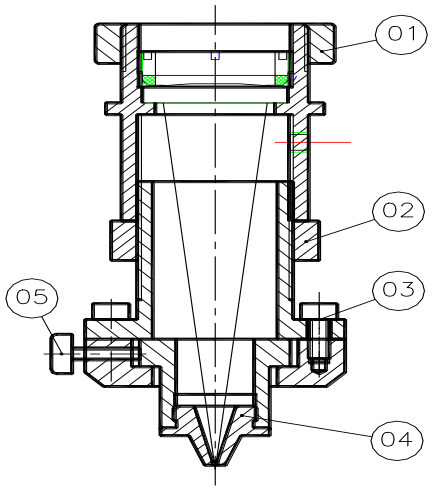


1-1	X-Axis Drive	3	Electrical Cabinet
1-2	Y-Axis Drive	4-1	Power Switch
1-3	Z-Axis Drive	4-2	Emergency Stop Button
1-4	Cutting Head	4-3	Operator Control Panel
1-5	CCD Camera （Option）	5	Laser Power Supply
2-1	Aluminum Cutting Grid	6	CO^2 Laser Tube
2-2	Scrap Drawer	7	Exhaust Port

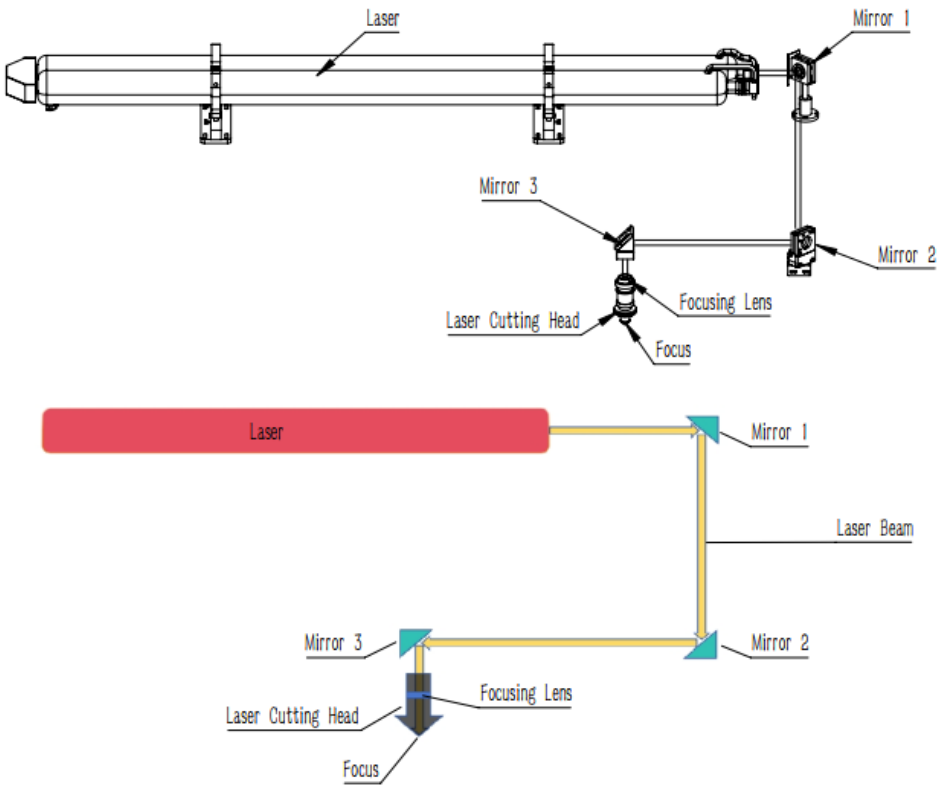
1.4 Cutting head structure

The cutting head is the core component of laser output and processing quality, as shown in the figure:

01	Cutting head locking nut	04	Nozzle
02	Nozzle locking nut	05	Adjusting nut
03	Locking screw		



1.4.2 Laser system and optical transmission path



As shown in the figure: the laser system consists of a laser, three sets of reflective mirrors (1/2/3) and a focusing mirror.

1.4.4 Water Cooling System

Laser cooling relies on a closed-loop water cooling system, with an industrial chiller as standard, using deionized water or special coolant for circulating cooling.

- The cooling water system ensures the stability of the laser operating temperature, improving the light source life and output stability.
- The cooling system should be kept running continuously to prevent the laser tube from overheating and damage.
- The water should be clean and free of impurities

1.4.5 Auxiliary gas system

During the cutting process, auxiliary gas is ejected from the nozzle at high speed, which has the functions of blowing away slag, isolating oxidation, and improving the quality of the cutting section.

• Supports compressed air, nitrogen and other gas input, which must be purified by filtering and drying devices.

• Recommended particle filtration accuracy ⩽5μm, maximum oil content ⩽ 0.1mg/m^3.

• When the gas source is insufficient, the device will prompt the alarm through the pressure gauge switch.

• Pressure reducing valve pressure adjustment steps: pull up the knob, rotate to the required air pressure, and then press down to lock.

Chapter 2 Technical Specifications

This chapter lists in detail the key technical parameters of the MC series CO2 laser cutting machines to help users understand equipment performance, selection and installation configuration.

2.1 Basic Equipment Parameters

Item	Description
Model	MC Series CO_2 Laser Cutting Machine
Laser Type	DC-excited glass tube CO_2 laser
Laser Wavelength	10.6 μm (infrared spectrum)
Laser Power	150W / 300W (optional)
Working Area	1250mm × 900mm (customizable)
Travel Range (X/Y/Z)	1250mm, 900mm, 40mm
Machine Dimensions	1550mm × 1750mm × 1250mm

Item	Description
Max Cutting Thickness	Acrylic ≤ 30mm, Wood ≤ 18mm (varies with material)
Engraving Function	Supported (raster or vector engraving)

2.2 Mechanical System Specifications

Item	Description
Drive System	Full servo motor drive
Transmission Method	Ball screw + precision linear guide
Positioning Accuracy	±0.05 mm per 1000mm
Repeat Accuracy	±0.05 mm
Max Idle Speed	20 m/min
Max Cutting Speed	Depends on material type and thickness

2.3 Control and Software System

Item	Description
Control System	Ruida laser controller
Interface Language	Switchable between English and Chinese
Measurement Units	Metric/Imperial switchable
Supported File Formats	DXF, AI, PLT, BMP, JPG, etc.
Operation Mode	Offline / Online
Additional Features	Resume from break, power-failure recovery, layered processing

2.4 Laser and Auxiliary Configuration

Item	Description
Cooling Method	Industrial chiller with constant temperature control
Exhaust System	Industrial turbine fan with external ducting (filter optional)
Gas Assist System	Supports compressed air or nitrogen assist
Optics System	3-mirror reflection + focusing lens
Focus Adjustment	Motorized or manual focusing options
CCD Vision System	Optional industrial-grade camera with edge-tracing

2.5 Electrical and Environmental Requirements

Item	Description
Power Supply	AC 220V ±10%, 50/60Hz
Total Power Consumption	≤ 2500W (150W) / ≤ 4000W (300W)
Compressed Air	0.6 MPa
Working Temperature	10°C – 35°C
Relative Humidity	20% – 80%, non-condensing
Floor Space Required	~3200mm × 3200mm
Machine Weight	Approx. 350kg (varies by configuration)

Chapter 3: Safety Precautions

To ensure user safety and reliable machine operation, read this chapter carefully and strictly follow all operational protocols. CO_2 laser systems involve high energy,

powerful beams, and high-voltage components—improper use may result in serious injury or equipment damage.

3.1 Safety Symbols and Their Meaning

The following safety warning signs are mentioned in this manual:

Symbols	Explanation of meaning
	**Laser Radiation Symbol** – Indicates potential laser radiation hazards.
	**High Voltage Symbol** – Warns of areas with dangerous electrical voltages.
	**Fire Hazard Symbol** – Signifies areas with possible fire or high-temperature risks.
	**Eye Protection Symbol** – Indicates that laser safety goggles must be worn.

3.2 Laser Safety Guidelines

- This device is a **Class 4 laser product**, meaning the laser output is powerful enough to cause severe damage to eyes and skin.
- **Never view the laser beam or its reflections directly.** Always wear protective eyewear specifically rated for CO_2 lasers (10.6 µm wavelength).

- **Never open the laser tube cover or optical housing** while the machine is powered. If maintenance is required, **power off and wait at least 5 minutes** before servicing.
- Set up a **dedicated laser work zone** with clear signage, and prevent unauthorized personnel from entering during operation.

3.3 Electrical Safety Precautions

- The machine contains high-voltage components. **Only trained electrical professionals** should perform internal maintenance.
- Before use, confirm the **ground wire is properly connected** to prevent electric shock or system faults.
- **Never operate** the equipment in wet or flooded environments.

3.4 Fire & Material Safety

- Laser cutting generates high heat. **Keep away from flammable materials** or environments with explosive gases
- **Do not cut materials** like PVC, PU, or polyurethane, as they emit **toxic or corrosive fumes.**
- Ensure materials are laser-compatible, and confirm that **ventilation, smoke extraction, and cooling systems** are functioning before cutting.

3.5 Exhaust & Cooling Requirements

- The laser tube must be **cooled continuously with water** before startup. Activate the water chiller system prior to powering on the laser.
- Proper **exhaust flow is critical** for cutting performance and environmental safety. The exhaust duct must not be blocked or backflowing.
- **Supplementary ventilation** near the machine is recommended to maintain air circulation.

3.6 Operator Requirements

- Operators must receive **comprehensive training**, including machine structure, software operation, and emergency response procedures.
- Always wear **protective clothing, insulated gloves, and laser safety goggles.**

- **Do not operate** under the influence of alcohol, when fatigued, or in an emotionally unstable state.
- Never leave the machine unattended during operation. If leaving is necessary, **power down the machine first** to avoid risks like fire.

3.7 Emergency Response Procedures

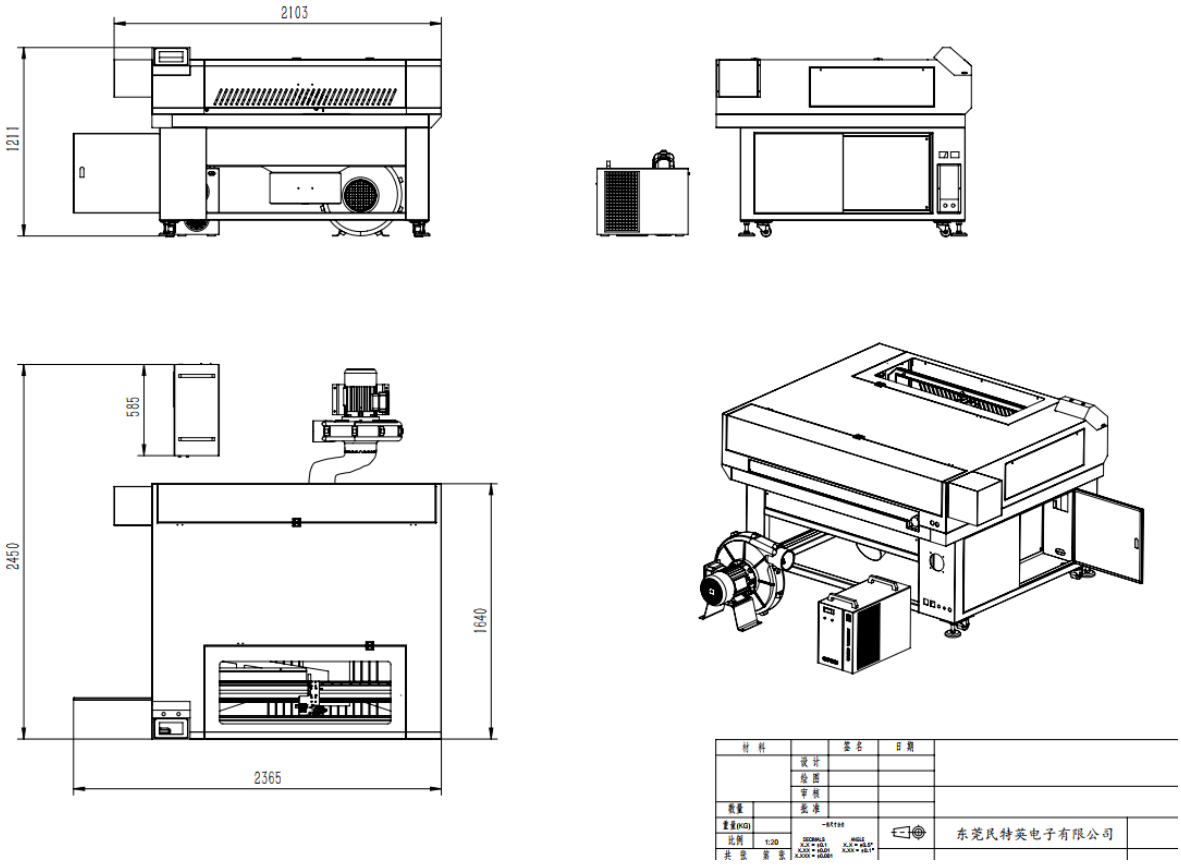
- In an emergency, **press the red emergency stop button immediately.** Disconnect power and investigate the issue.
- If there are **sparks, smoke, or strange odors**, turn off the power supply, evacuate the area, and ventilate thoroughly.
- If a person is **exposed to the laser beam**, especially the eyes or skin, **seek medical attention immediately**.

Chapter 4: Installation Guide

To ensure the safe, stable and efficient operation of the MC series CO2 laser cutting machine, please strictly follow the following installation process. This section applies to the initial installation or the reconfiguration process after the equipment is relocated.

4.1 Installation Preparation

4.1.1 Installation Environment Requirements



• Floor requirements: The equipment must be placed on a flat, solid, vibration-free floor. Concrete floor is recommended.

• Space requirements: A space of no less than 800mm is reserved around the equipment for operation and maintenance.

• Temperature and humidity requirements: Ambient temperature 10°C – 35°C, relative humidity 20% – 80%, avoid condensation and frost.

• Ventilation conditions: A good indoor ventilation system must be provided, and the smoke exhaust system of the equipment must be used to discharge harmful gases.

4.1.2 Power preparation

• Power supply configuration: AC 220V ±10%, 50/60Hz, independent power supply circuit, air switch protection is recommended.

• Grounding requirements: The equipment must be well grounded to prevent static electricity and high-voltage leakage from interfering with the control system.

4.2 Unpacking and Inspection

1. Carefully remove the outer packaging of the equipment. When using the lifting equipment, pay attention to the center of gravity and load-bearing direction to prevent tipping.

2. Check the appearance of the host for transportation damage and confirm that the laser, control panel, display and other peripherals are intact.

3. Check the random accessories: chiller, fan, exhaust pipe, air pump, laser lens, tool kit, manual, etc.

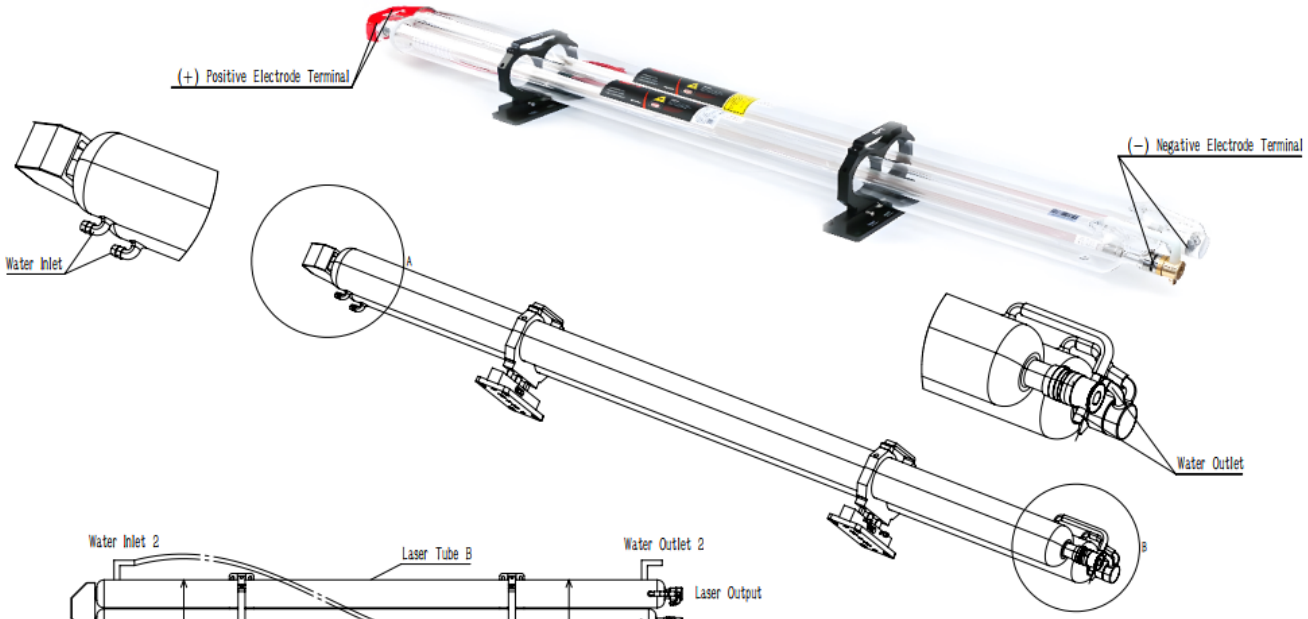
4.3 Equipment placement and leveling

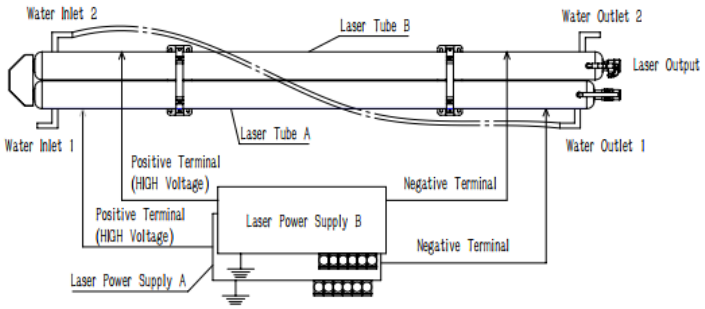
1. Move the equipment to the designated installation location and use a level to confirm that the platform is level.

2. If the bottom of the equipment is equipped with adjustment feet, rotate the foot pads to adjust the level to avoid affecting the cutting accuracy due to uneven ground.

4.4 System connection

4.4.1 Cooling system connection





• Connect the chiller to the water inlet and outlet of the laser and fix them with flexible water pipes.

• Add pure water to the chiller and start the cooling system to ensure smooth water flow and no leakage.

4.4.2 Connection of exhaust and air source system

• Connect the industrial exhaust fan to the exhaust hose to ensure smooth exhaust and the outlet facing the outdoors.

• Connect the air pump/compressed air source to the air path interface of the laser head. Auxiliary air blowing is used to prevent slag from adhering to the lens.

4.4.3 Electrical system wiring

• Connect the main power cord according to the instructions, and then turn on the power after checking that the wiring is correct.

• Connect the control system to the computer (if using online operation), and install the driver and control software.

4.5 Optical path adjustment and focal length setting

1. Turn on the laser channel, adjust the angles of the three sets of reflectors under low power test, and ensure that the spot is centered and focused.

2. The focus height can be adjusted by the focal length ruler or the electric lifting platform to ensure that the material surface is in the best focus position.

4.6 First start-up and testing

1. After power on, turn on auxiliary systems such as chillers, exhaust fans, and air pumps.

2. Start the main power supply of the laser cutting machine and observe whether the control system self-checks normally.

3. Use the system's built-in test pattern to perform the first cutting test to check whether the optical path and drive system are stable.

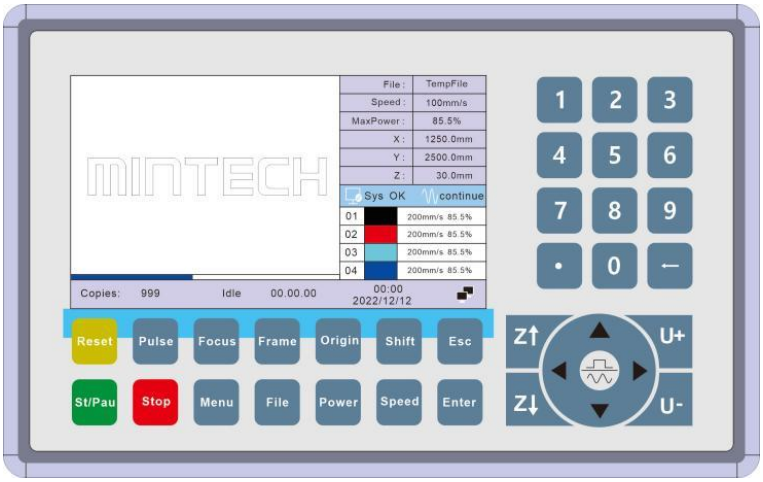
Chapter 5: Operation Instructions

This chapter will introduce the control panel functions, control software usage steps, and standard cutting and engraving processes of the MC series CO2 laser

cutting machine in detail. After users are familiar with the contents of this chapter, they can successfully complete daily processing tasks

5.1 Control panel function description

The MC series laser cutting machine is equipped with the Ruida laser control system, with an intuitive operation interface and a simple and reasonable button layout. The following is a brief introduction to the main panel buttons and their functions:



Start/Pause button

Control the start/pause of processing tasks

Arrow keys

Manual adjustment of laser head movement

（↑↓←→）

Origin

Set the current laser head position as the processing starting point

Frame

Preview the cutting path to confirm whether the processing area is correct

Stop

Interrupt the current processing task

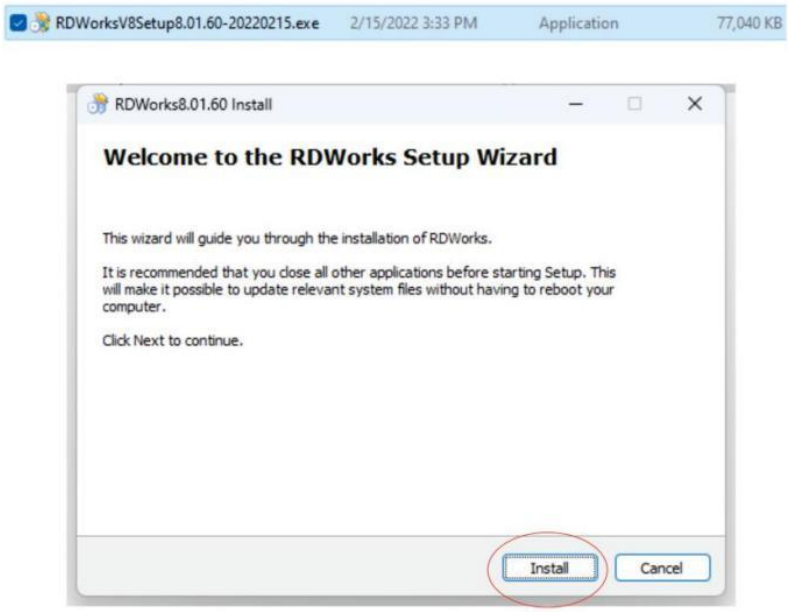
5.2 Control software usage process

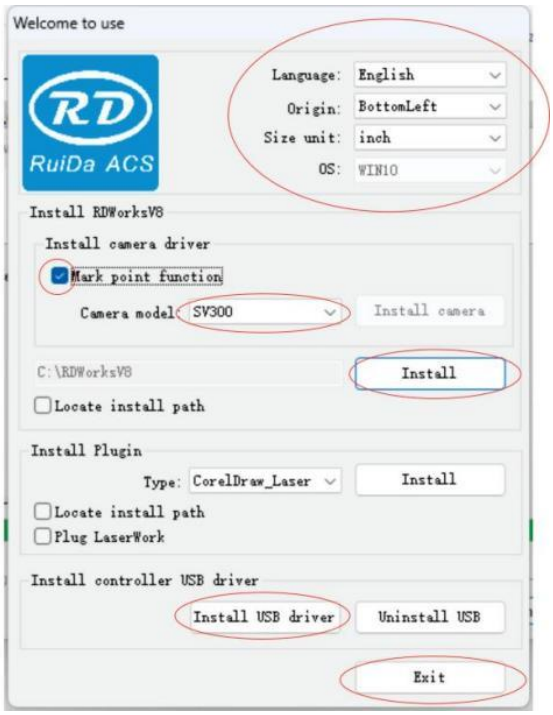
5.2.1 Software Installation

• The control software comes with the device (usually RDWorks or LightBurn), which supports Windows system;

• Please turn off the firewall/anti-virus software before installation to avoid blocking the driver program writing;

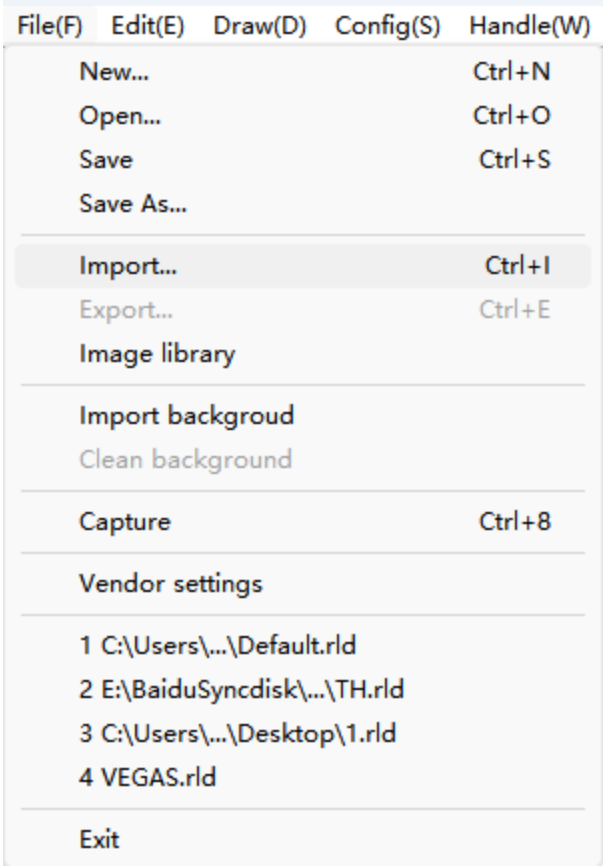
• Follow the prompts to complete the USB driver and main program installation.



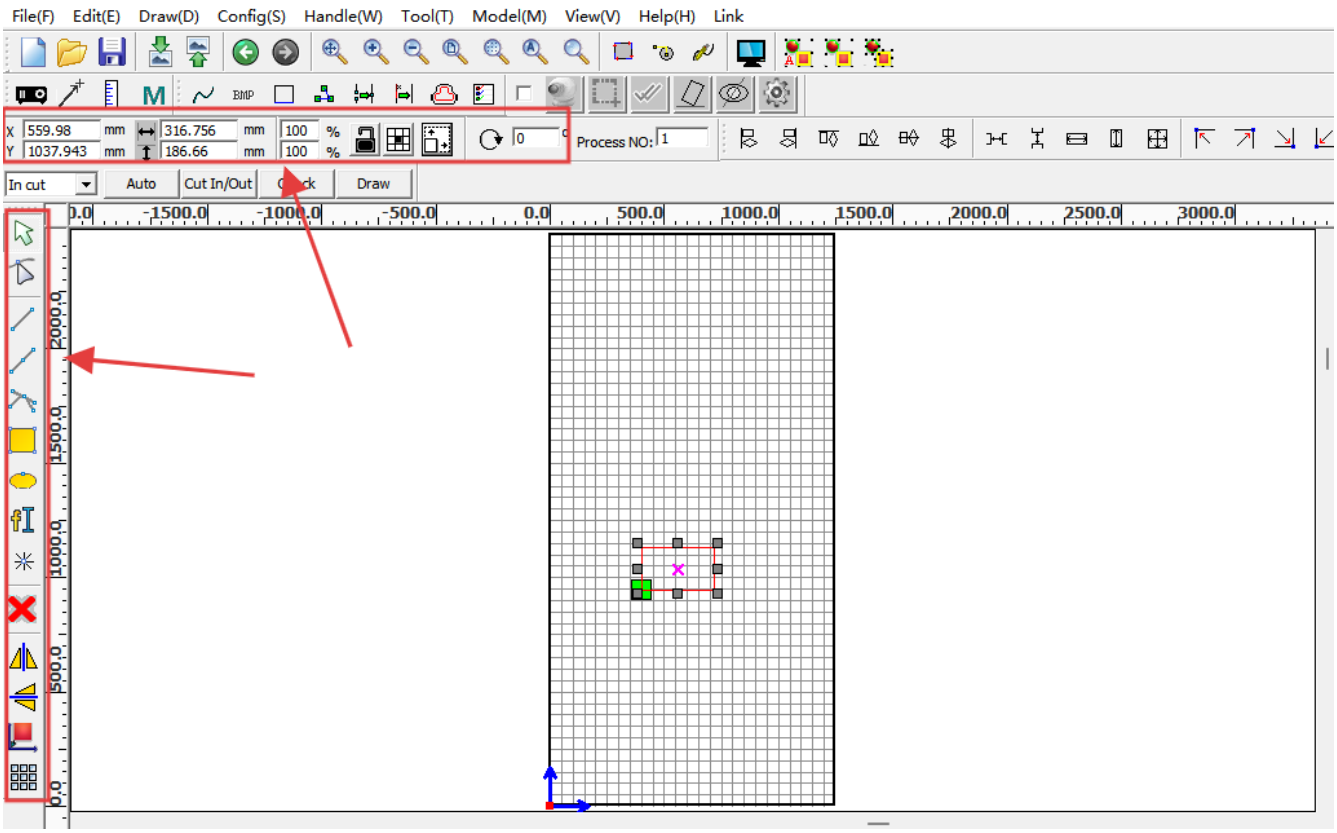


5.2.2 File import and editing

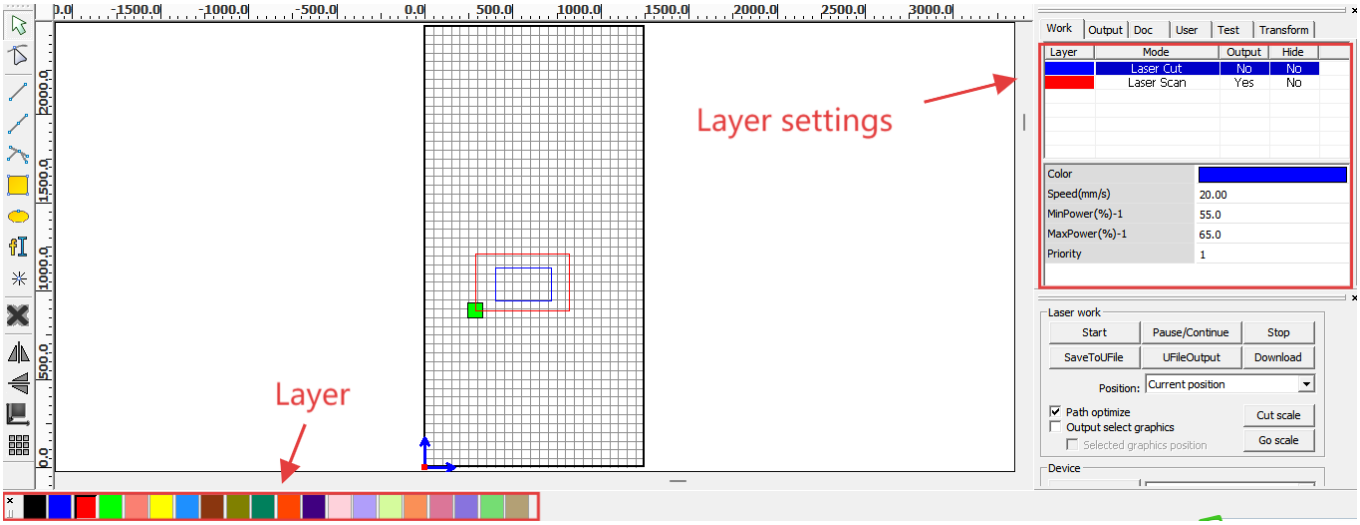
1. Open the software, click "Import" to select the graphic file (supports DXF, AI, BMP, JPG and other formats);



2. Use the toolbar to adjust the size, position, and rotation angle of the graphic;



3. Set the graphic to "cutting" or "engraving" layer, and set the power and speed parameters respectively.



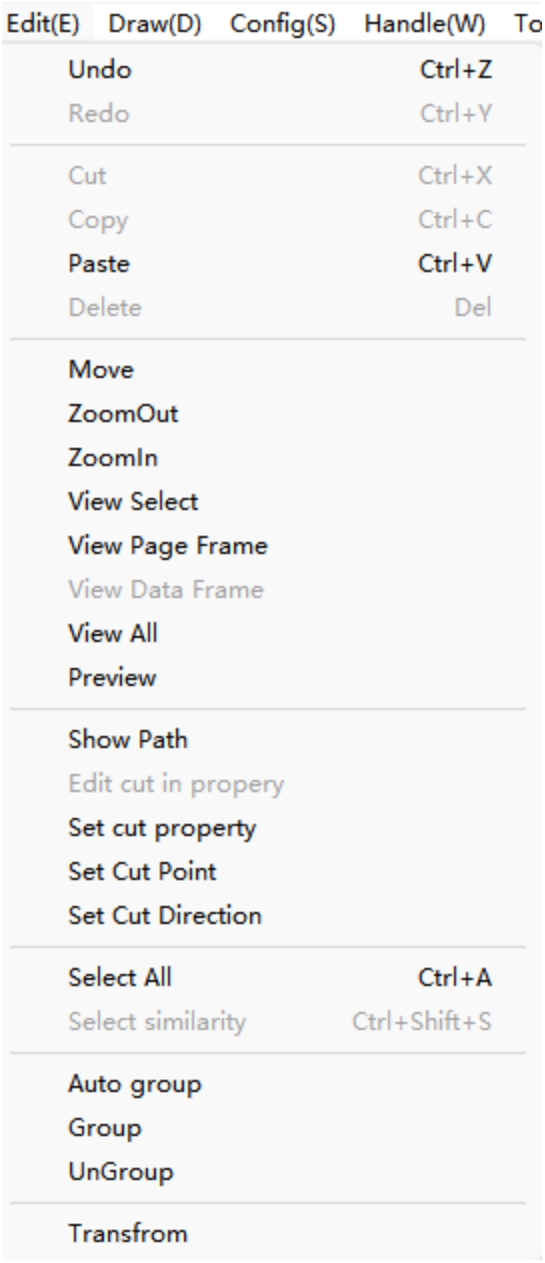
5.2.3 Parameter settings

- Cutting power: set according to the thickness and type of material (e.g. 70% is the recommended power for acrylic 12mm);

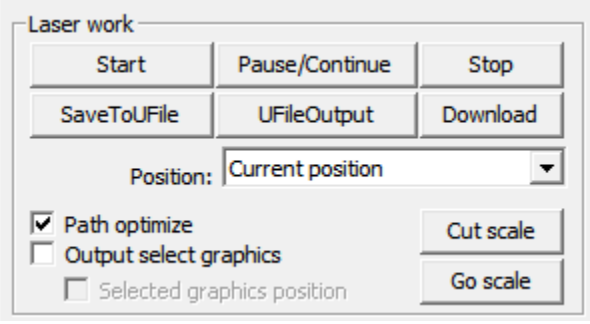
- Cutting speed: The speed should be slowed down for thicker materials to ensure a smooth section;
- Layer management: The software supports multi-layer color separation and cutting, and different process parameters can be defined for each layer.

5.2.4 Path preview and download

- Click “  ” Can preview the processing path and total time;
- Adjust the graphic sequence and starting point to optimize the cutting sequence;



- After confirmation, click “Download to Machine” or “Start Processing”.



5.3 Cutting process

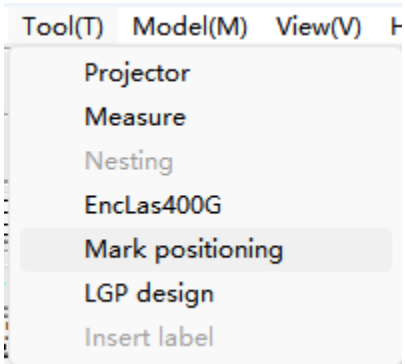
1. Material preparation: Place the processing materials on the working platform;
2. Laser focus: Manually adjust the focal length, the distance from the lens mount to the material surface is 3-3/4 inches;
3. Path Tracing Box: Click "Frame" Button to check the graphics drop area;
4. Turn on auxiliary systems: start fans, etc.;
5. Start processing: Click "St/Pau" or control software "Start" Start and observe the cutting process;
6. Processing completed: Wait for the laser head to return to the origin and then turn off the laser and power.

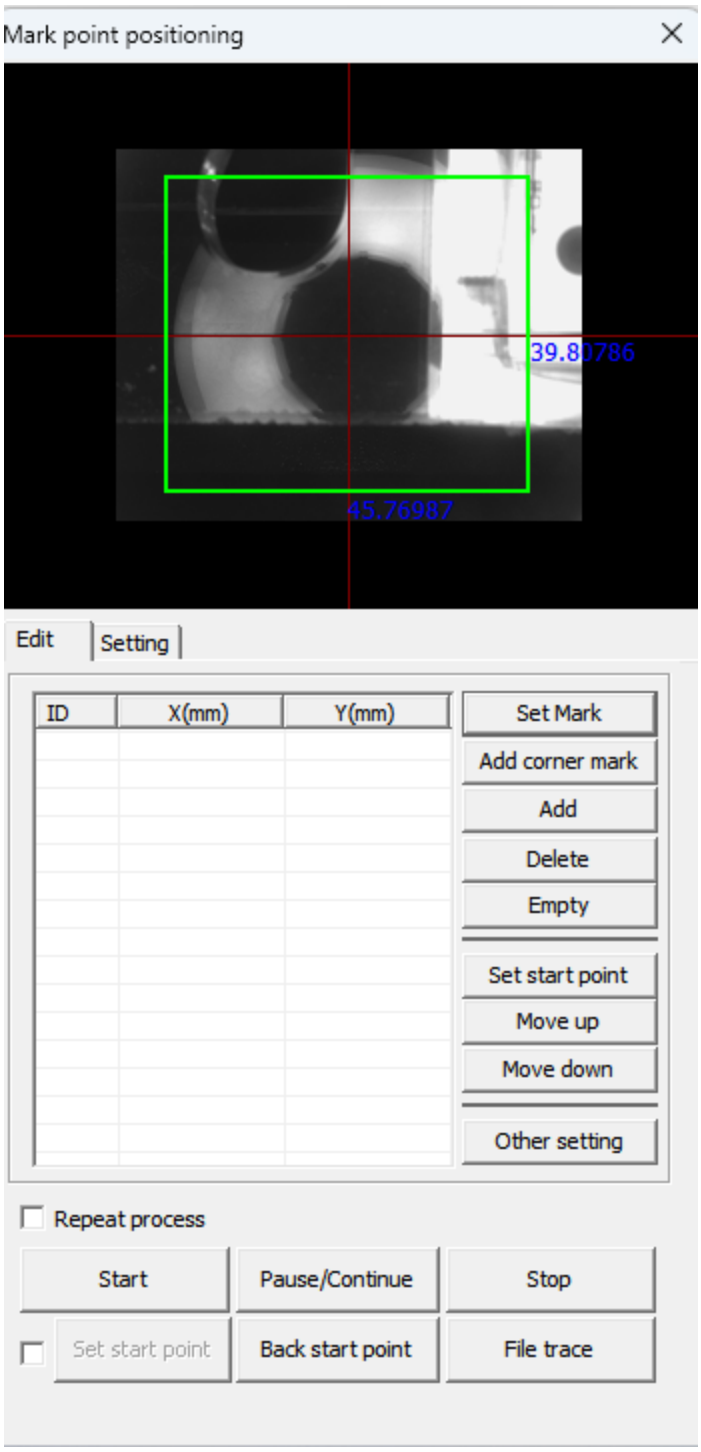
5.4 CCD Operation Instructions

• Import selected graphic files (graphic files and printed patterns need to have Mark points for positioning, 1/4 dot is recommended);

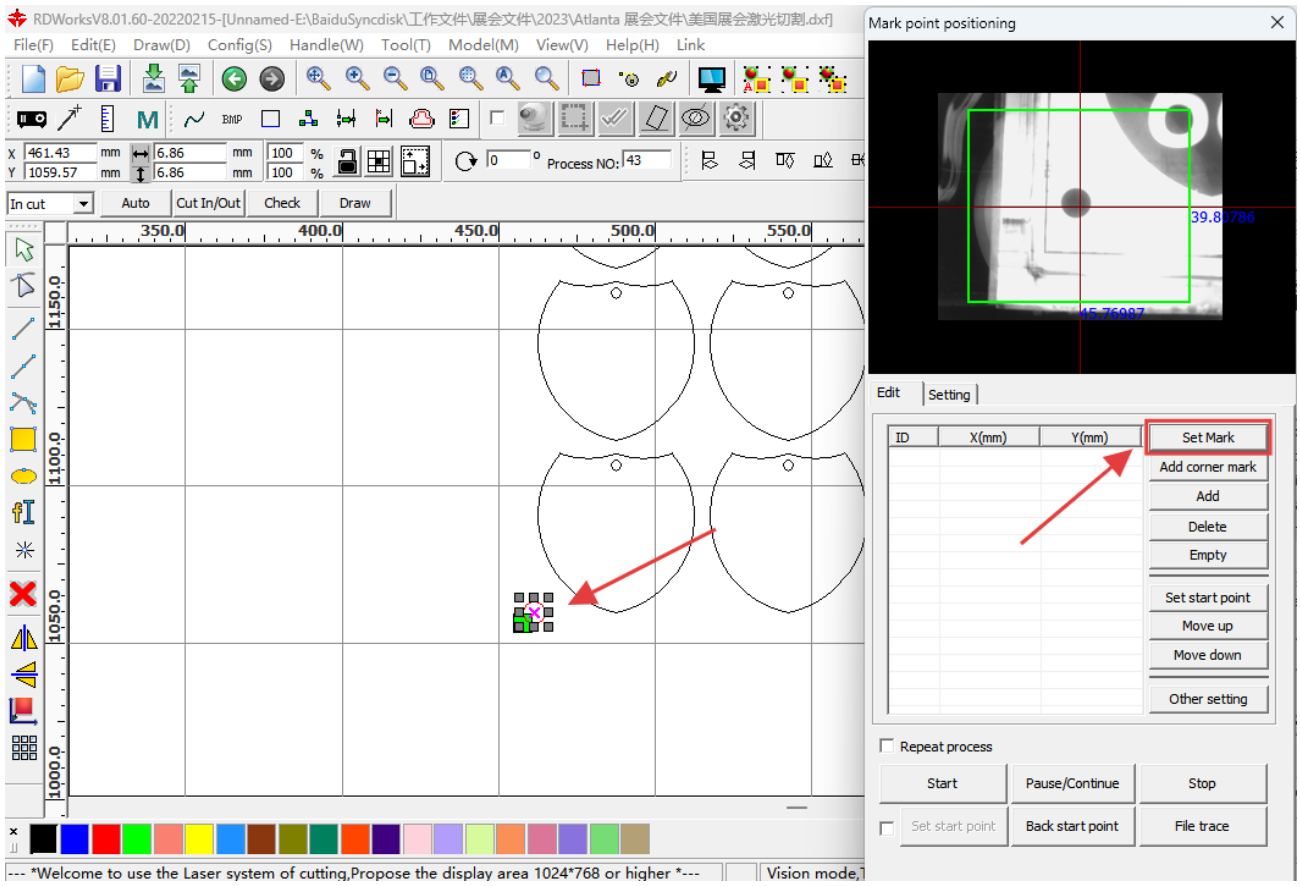
• Set processing layers and processing parameters;

• Select "Mark positioning" to open the CCD operation interface;

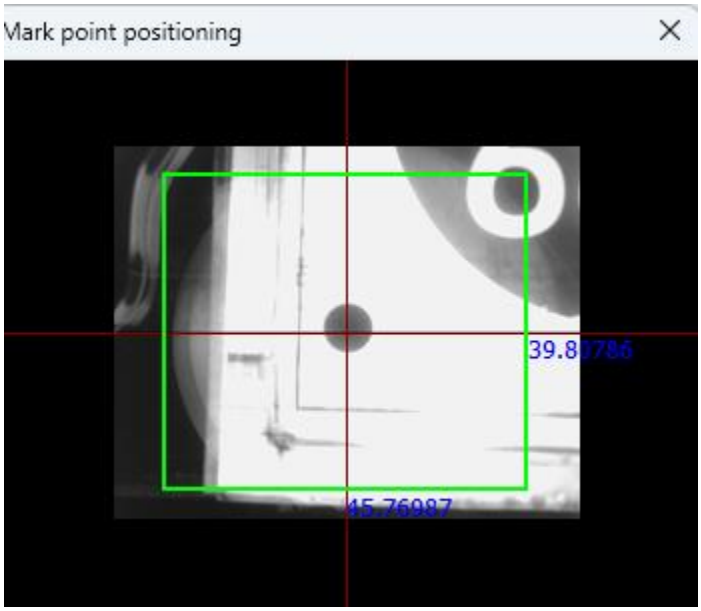




- Select the Mark point on the graph, "Set Mark" Set the Mark point;



- Move the camera to the first Mark point;



- Click to control software "Start" start up

6.1 Daily inspection items (before and after daily operation)

Inspection Item	Frequency	Inspection Requirements & Procedures
Chiller Operating Status	Daily	Ensure water temperature is stable, water flow is normal, and there are no leaks.
Exhaust System Function	Daily	Confirm proper airflow, no blockages, and secure hose connections.
Laser Beam Path	Daily	Perform a laser penetration test to verify continuous and consistent output.
Laser Lens Cleanliness	Daily	Check for dust or oil on lenses and clean if necessary.
Work Platform & Guide Rails	Daily	Remove debris, dust, and scrap materials to prevent resistance during movement.
Power Cables & Plug Connections	Daily	Ensure plugs are firmly connected, with no looseness or signs of overheating.

6.2 Periodic maintenance content

Maintenance Item	Frequency	Instructions
Guide Rails & Ball Screws Lubrication	Every 2 weeks	Lubricate the linear guides and ball screws using the specified lubricant.
Lens Cleaning	Weekly or every 50 hours	Gently clean mirrors and focus lenses with lens paper and anhydrous alcohol.
Cooling Water Replacement	Monthly	Replace with purified water or designated coolant to prevent bacteria and scale.

Electrical Cabinet Dust Removal	Monthly	Open the control cabinet and use dry compressed air to remove accumulated dust.
Air Pump & Fan Maintenance	Quarterly	Clean intake filters and check motor noise and temperature for anomalies.
Laser Tube Condition Check	Quarterly or every 1000 hours	Monitor for power decline to assess whether tube replacement is needed.

6.3 Laser system maintenance points

• Laser lens: Keep the lens clean. If the lens turns yellow, burns or cracks, replace it immediately;

• Focusing lens: Check the focusing lens for deformation or focal shift every month;

• Laser tube: The service life is about 6000-10000 hours. Pay attention to the change of laser intensity and evaluate whether to replace it in time;

• Cooling system: Do not use well water or tap water to avoid scaling and clogging the waterway;

• Spare laser tube storage: It should be placed in a dry and dark environment to avoid high temperature and vibration.

6.4 Common exceptions and handling suggestions

Issue	Possible Cause	Recommended Solution
Laser Not Emitting	Misaligned mirrors or damaged laser tube	Realign optical path or replace laser tube
Rough or Incomplete	Improper focus or dirty lenses	Adjust focus or clean optical lenses

Issue	Possible Cause	Recommended Solution
Cut Edges		
Blurry or Misaligned Engraving	Incorrect layer settings or driver malfunction	Check layer parameters and motor driver connections
Cooling Water Alarm	Low water level or clogged water pump	Refill coolant or clean water pump filter
Poor Smoke Extraction	The exhaust vent is blocked or the fan is abnormal.	Clean ductwork and inspect fan operation

Chapter 7 Troubleshooting and Repair Guide

When an abnormal situation occurs during the operation of the MC series CO2 laser cutting machine, the user can refer to the contents of this chapter for basic fault identification, preliminary troubleshooting and simple maintenance operations. For more complex problems or problems involving high-voltage components, please contact professional technicians for processing.

7.1 Troubleshooting Flowchart (Brief)

The device cannot be powered on

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Check whether the power supply is connected → Yes → Check whether the emergency stop button is pressed → No → Check the control power fuse

↓

Laser does not emit light

↓

Check if the water cooling is working properly → Yes → Check the laser power indicator → Check if the optical path is offset

↓

Poor cutting quality

↓

Check whether the lens is contaminated → Check whether the focus is accurate → Check the surface flatness of the material

7.2 Common Faults and Solutions

Fault Condition	Possible Cause	Inspection & Handling Method
Machine fails to start	Loose power cable / Emergency stop not reset / Blown fuse	Check the power outlet, power switch, and fuses inside control panel
No laser output	Damaged laser tube / Faulty laser power supply / Cooling failure	Inspect power output, cooling water flow, and laser tube condition
Rough or incomplete cutting edge	Insufficient power / Poor focus / Contaminated lenses	Increase power, adjust focal point, clean or replace optical lenses
Shifted or misaligned graphics	Loose driver or motor coupling / Incorrect commands	Inspect mechanical linkages on all axes and reload the design file
Sticking or jerky X/Y axis motion	Dust on rails / Lack of lubrication / Damaged bearings	Clean rails, add lubricant, and inspect bearings or sliders
Cooling water alarm	Low water level / Blocked pump / Faulty sensor	Refill the tank, clean pump inlet, test or replace the temperature sensor
Poor exhaust performance	Disconnected or blocked exhaust pipe / Unstable fan voltage	Check ducting, clear obstructions, or replace the exhaust fan
Significant laser power drop	Aging laser tube or power supply / Misaligned optics	Replace tube or power supply and realign the optical path

7.3 Special fault tips and suggestions

• Frequent laser startup failure: This may be due to abnormal temperature control or laser power supply protection. Try to power off and restart before running again;

• The control system does not recognize the graphic file: Please confirm that the file format is correct (DXF, AI is recommended) and avoid layer names containing special characters;

• CCD edge recognition error: You can adjust the image contrast, increase the intensity of the lighting source, or recalibrate the camera position;

7.4 Users are not allowed to repair parts without authorization

The following equipment parts involve high voltage or precision components. Unauthorized disassembly is strictly prohibited:

Component Name	Reason User Must Not Attempt Repairs
Laser Power Supply	Outputs high voltage up to **25kV**, posing a serious electric shock hazard
Control Mainboard	Contains **encrypted configuration data**—unauthorized access may crash the system
Laser Tube	Filled with **pressurized gas** inside fragile glass—risk of breakage and injury
Electrical Wiring Box	Includes **multiple AC contactors** and protective relays—requires expert handling

It is recommended to contact our technical support team or authorized dealers to handle advanced faults or parts replacement issues.