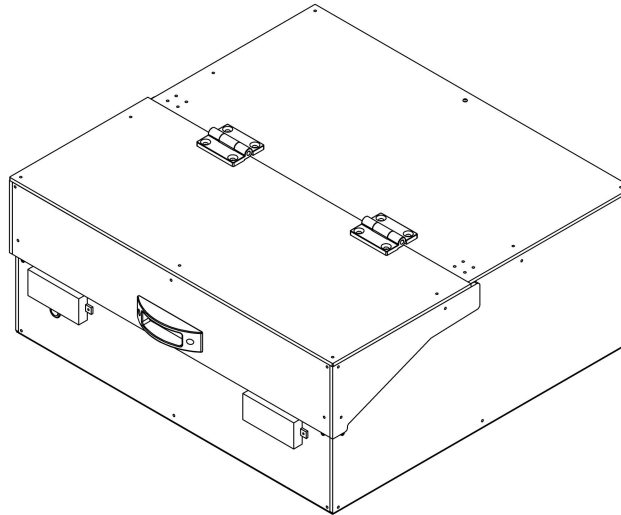




Laser Engraving Machine

L1

Original Version:V1.0.0



Manufacturer:Laservii (Shenzhen) Technology Co., Ltd.

Address: Factory 201, Nankeng Second Industrial Zone, Nankeng Community, Bantian Street, Longgang, Shenzhen, Guangdong, China

All operators shall thoroughly read, comprehend and follow all contents of this instruction manual prior to any machine operation, commissioning, adjustment or maintenance.

EC Declaration of Conformity (Summary)

Manufacturer: Laservii (Shenzhen) Technology Co., Ltd.

Address: Factory 201, Nankeng Second Industrial Zone, Nankeng Community, Bantian Street, Longgang, Shenzhen, Guangdong, China, 518000

Product: Laser Engraving Machine

Model: L1 (3W / 7W / 12W / 24W)

Year of manufacture: 2026 onwards

Hereby, Laservii (Shenzhen) Technology Co., Ltd. declares that the radio equipment type Laser Engraving Machine (L1 Series) is in compliance with Directive 2014/53/EU.:

- - Applicable Directives:

(1) Machinery Directive 2006/42/EC

(2) Electromagnetic Compatibility Directive 2014/30/EU

(3) Radio Equipment Directive 2014/53/EU

- - Radio Equipment Directive (RED):

(1) EN 301 489-1 V2.2.3 (EMC – General)

(2) EN 301 489-17 V3.3.1 (EMC – Broadband)

(3) EN 300 328 V2.2.2 (2.4 GHz RF Testing)

(4) EN IEC 61000-6-3:2021 (Emission)

(5) EN IEC 61000-6-1:2019 (Immunity)

(6) EN IEC 62311:2020 (Human Exposure)

--Laser Safety:

(1) IEC 60825-1:2014&EN 60825-1:2014+A11:2021&EN 50689:2021 (Consumer Laser Products)

(2) CAN/CSA-E60825-1:15

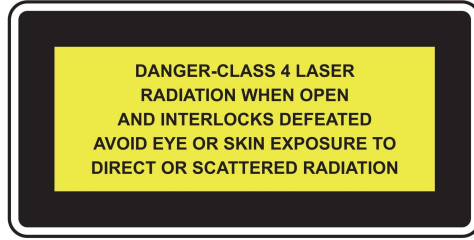
--Electrical Safety:UL/CSA 62368-1

- - Machinery Safety:EN ISO 12100:2010、 EN 60204-1:2018

--The full signed original version of the EU Declaration of Conformity is archived by the manufacturer and is available upon written request.

--This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Safety Warning Instructions



This residual risk warning label is affixed to safety doors and optical maintenance covers. It indicates that Class 4 dangerous laser radiation will be emitted when protective covers are opened or safety interlocks are bypassed. Avoid eye and skin exposure to direct or scattered laser radiation. Cut off the main power supply before any disassembly or maintenance. Complies with IEC 60825-1:2014, EN 60825-1:2014+A11:2021.



This information marking is mounted on the front operation panel. It declares the unit is a Class 1 laser product with fully enclosed optical path, no laser hazard under normal operation. It lists applicable IEC and EU laser safety standards, complying with marking requirements of Machinery Directive 2006/42/EC and EN 60204-1.



This primary laser danger warning label is attached to the main laser protective housing. It warns of invisible Class 4 laser radiation which can cause permanent eye and skin injury. It specifies maximum laser output 24 W, wavelength 450 nm and relevant standards. All operators shall stay away from direct and scattered laser beams during operation and service.



This beam direction warning marker is fixed beside optical channels and laser emitters. The arrow clearly shows the outgoing direction of laser beam. Operators and service staff shall not look along the beam path to prevent scattered light from entering eyes, with the standard laser hazard triangle symbol to mark radiation risky zone.



This ISO standard universal laser hazard triangular symbol is placed prominently on laser outlets and protective covers. The yellow triangular hazard sign with laser radiation graphic globally indicates laser injury risk. It is the primary visual safety reminder that all personnel must take protective precautions when seeing this marking.

Safety Warning Instructions



This high voltage shock warning label is fitted on electrical cabinets and high-voltage terminals. High voltage parts inside may cause fatal shock. Disconnect main power before opening covers. Only qualified personnel may remove electrical guards, compliant with EN 60204-1 and 2006/42/EC.



This combined prohibition label is mounted on the operation panel, containing six core safety prohibitions with graphics and English captions. Operators shall comply with all restrictions to avoid laser, mechanical and fire hazards, compliant with EN 60204-1, EN 60825-1 and 2006/42/EC.

Safety Warning Instructions

Caution: The user is cautioned that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FCC Radiation Exposure Statement: This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

This equipment should be installed and operated with a minimum distance of 20cm between the radiator and your body.

Machine Definition and Introduction

Product Definition

A laser engraving machine is equipment that uses a high-energy-density laser beam to irradiate material surfaces, triggering physical or chemical changes on materials to form permanent markings or cuts on their surfaces.

Intended Functions

Engraving: Create patterns, texts and QR codes on the surface of wood, leather, acrylic, paper, metal and other materials

Cutting: Cut thin wood, acrylic, fabric and other materials

Marking: Make permanent markings on various material surfaces

Working Principle

The control system drives the laser head to move along the X and Y axes, and simultaneously controls the laser switch and power, so that pre-designed patterns or texts are engraved on the material surface following set paths.

Machine Nameplate

L1

FCC ID: 2BVDR-L1L5

Product Name: Laser Engraving Machine

Rated voltage: 24 Vd.c.

Phase: 1P

Full-load current: 2.4A

MANUFACTURER: Laservii (Shenzhen) Technology Co., Ltd.

ADDRESS: Factory 201, Nankeng Second Industrial Zone, Nankeng Community,
Bantian Street, Longgang, Shenzhen, Guangdong, China

Year of manufacture: 2026.07

SERIAL NO: C5320260226001

Mass: 12.6KG

Short-circuit current: 6A

Total power: 120W

MADE IN CHINA



804295



Laservii

Machine Technical Parameters

Basic Specifications	
Product Name	Laser Engraving Machine
Forming Technology	Laser Engraving / Cutting
Working Area	300×300mm
Engraving Accuracy	±0.1mm
Positioning Accuracy	0.01mm
Max. Engraving Speed	12000mm/min

Mechanical Parameters	
Product Dimensions	483×487×184mm
Net Weight	12.6kg
Transmission Mode	Timing Belt Drive
Motor Type	Stepper Motor

Laser Parameters	
Laser Type	Diode Lase
Laser Wavelength	450±5nm
Optical Output Power	3W / 7W / 12W / 24W
Spot Size	0.08×0.15mm
Focal Length	3.6mm / 8mm

Environmental Parameters	
Operating Temperature	5℃ ~ 40℃
Operating Humidity	20%~80% RH (non-condensing)
Storage Temperature	-10℃ ~ 60℃

Electrical Parameters	
Total Power	120W
Rated voltage	24 Vd.c.
Short-circuitcurrent	6 A

Mainboard Information	
Frequency Band	2402 MHz – 2480 MHz
Maximum Transmit Power (EIRP)	2.65 dBm
Antenna Gain	2.0 dBi

Operating Environment

Power Supply Requirements

Rated voltage: 24V d . c .

Only the original factory matching power adapter shall be used.

Earthed power sockets are recommended.

Temperature Requirements

Operating Ambient Temperature: 5°C ~ 40°C

Optimal Operating Temperature: 15°C ~ 30°C

Excessively high temperature will reduce laser power and accelerate component aging.

Humidity Requirements

Operating Ambient Humidity: 20%~80% RH (non-condensing)

Excessively high humidity may cause electrical short circuits and lens mildew.

Altitude Requirements

Recommended operating altitude: below 1000 m

Heat dissipation performance deteriorates at high altitudes; reduce laser power during operation.

Other Environmental Requirements

Keep away from strong electromagnetic interference sources

Prevent vibration and impact

Keep clear of strong magnetic fields

Maintain a clean and dust-free working area

Conditions, Methods and Precautions for Storage, Transportation, Handling and Packaging

Storage Conditions

Storage environment: Dry, ventilated and dust-free

Storage temperature: $-10^{\circ}\text{C} \sim 60^{\circ}\text{C}$

Storage humidity: $\leq 80\%$ RH (non-condensing)

Dust-proof and moisture-proof measures shall be taken for long-term storage

The laser head shall be properly protected to prevent lens contamination

Transportation Requirements

Transport the machine with original factory packaging

Avoid severe vibration and collision during transportation

Prevent rain soaking and direct sunlight exposure

Stacking height shall not exceed the specified layers

Ensure even weight distribution

Handling Precautions

Disconnect all connecting wires before handling

Carry the machine horizontally with two people cooperating

Hold the machine frame instead of the laser head or moving parts

Handle with care and avoid impact

Packaging Requirements

Inner package: Wrapped with shockproof foam / EPE foam

Outer package: 5-layer corrugated carton

Package marks: Fragile, This Side Up, Keep Dry, Stacking Limit

Accessories included: Accessory kit, tools, user manual

Noise Level

Noise Emission Statement

Sound pressure level (operator position): Reference value < 70 dB(A)

Measurement standard: ISO 11201 / EN ISO 11201

Measurement conditions: Rated power, 1 metre distance from the equipment

Precautions

Hearing protection equipment is recommended for prolonged operation.

Stable placement of the equipment can reduce noise output.

Regular inspection and lubrication of moving parts can lower noise levels.

Vibration and Noise Reduction Installation Measures

To minimize vibration transmission and noise radiation during equipment operation, the following installation measures shall be followed:

1. Vibration isolation base: Place 3–5 mm thick rubber damping pads under the four corners of the machine base to isolate structural vibration transmission to the workbench and floor, and reduce secondary structure-borne noise.

2. Workbench selection: Use a heavy, rigid workbench with sufficient load-bearing capacity. Lightweight thin-plate workbenches prone to resonance are not recommended, as they will amplify operating noise.

3. Layout optimization: Avoid placing the equipment in corners or close to large reflective walls, where sound reflection will increase the noise level at the operator's position. Reserve sufficient ventilation space around the equipment to avoid wind noise caused by poor heat dissipation.

4. Fixed installation: For long-term fixed-station use, the machine may be fixed to the workbench through mounting holes to avoid vibration displacement and abnormal noise caused by loose placement.

Power Supply Requirements and Connection

Power Supply Requirements

Rated voltage: 24V d . c .

Total power:120W

The socket must be reliably earthed

An independent power supply is recommended; do not share the socket with high-power equipment

Connection Steps

Ensure the machine power switch is turned off

Insert the DC plug of the power adapter into the machine power port

Plug the power adapter into the mains socket

Check that all connections are firm without looseness

Precautions

Only the original factory-supplied power adapter shall be used

Keep power cords away from heat sources and sharp objects

Inspect power cords regularly for damage

Hold the plug when connecting or disconnecting power; do not pull the cable directly

Environmental Requirements

Installation Environment Requirements

Temperature: 5°C ~ 40°C, avoid drastic temperature fluctuations

Humidity: 20%~80% RH, no condensation

Ventilation: Good air circulation; an exhaust smoke extraction system is recommended

Lighting: Sufficient lighting for operation and observation

Space: Reserve at least 20 cm clearance around the machine for heat dissipation

Work Area Requirements

Flat and horizontal workbench

Load-bearing capacity ≥ 3 times the machine weight

Anti-slip and corrosion-resistant workbench surface

Keep away from flammable and explosive substances

Prohibited Installation Environments

Outdoor or open-air locations

Humid, dusty sites with corrosive gas

Areas subject to severe vibration or impact

Vicinity of strong electromagnetic interference sources

Areas accessible to children

Site Requirements: Foundation, Space, Lighting, Equipped Accessories, etc.

Site Requirements

Workbench Size: Recommended to be at least 100 mm larger on all sides than the machine

Floor Load Capacity: Capable of supporting the total weight of the machine and workbench

Flat floor without obvious inclination

Space Requirements

Front of machine: ≥ 500 mm (operating space)

Rear of machine: ≥ 200 mm (heat dissipation and wiring)

Both sides of machine: ≥ 200 mm (maintenance space)

Above machine: ≥ 300 mm (space for cover opening)

Lighting Requirements

Illuminance of working area ≥ 300 lux

Avoid strong light shining directly on the laser head

Local lighting is recommended

Mandatory & Recommended Accessories

Smoke exhaust system / air purifier (strongly recommended)

Laser safety goggles

Fire extinguisher (ABC dry powder type)

Smoke alarm

First-aid kit

Requirements for Equipment and Installers

Requirements for Installers

- Possess basic mechanical and electrical knowledge
- Read and fully understand the complete installation manual
- Master basic laser safety knowledge
- Wear required personal protective equipment

Tool Requirements

- Hex key set
- Phillips screwdriver
- Spirit level
- Multimeter (optional, for electrical inspection)

Pre-installation Inspection

- Check whether the packaging is intact
- Verify the accessory list to ensure no missing parts
- Inspect the machine exterior for transportation damage
- Check all connecting cables for integrity

Post-installation Inspection

- Verify all screws are tightly fastened
- Check smooth movement of moving parts
- Confirm correct electrical connections
- Test the function of the emergency stop button
- Carry out the initial power-on test

Commissioning and Dismantling

Mechanical Commissioning

- Check smooth movement of X/Y axes
- Adjust timing belt tension
- Verify limit switch functions
- Test homing function

Optical Commissioning

- Check alignment of the laser optical path
- Adjust laser focal length
- Test laser output power

Electrical Commissioning

- Inspect all function buttons
- Test emergency stop function
- Check indicator light status
- Test connection functions (USB/Bluetooth)

Function Test

- Perform test engraving
- Check engraving accuracy
- Verify engraving depth
- Test engraving effects on different materials

Disassembly Instructions

- Disassemble in reverse order of installation
- Cut off power supply before disassembly
- Keep removed screws and components properly stored
- Separate and protect the laser head with independent packaging
- It is recommended to retain the original packaging for transportation

Operator Requirements: Training, Qualifications, Dress Code, etc.

Qualification Requirements for Operators

- Aged 18 or above with full civil capacity
- Completed safety training and passed assessment
- Read and fully understood all safety instructions and operation manuals
- Possess basic knowledge of laser safety

Personnel Prohibited from Operation

- Minors
- Persons with impaired reaction capacity after drinking alcohol or taking medication
- Pregnant women (exposure is recommended to be avoided)
- Wearers of cardiac pacemakers (consult a doctor prior to use)
- Untrained personnel

Dress Code

- Wear matching laser safety goggles
- Wear close-fitting work clothes; loose clothing is prohibited
- Long hair must be tied up or covered with a work cap
- No easily entangled items such as jewellery and watches
- A dust mask is recommended
- Gloves are forbidden during operation to prevent entanglement hazards

Operating Rules

- Operation under the influence of alcohol or in a fatigued state is strictly prohibited
- Do not leave the workstation unattended during operation
- No horseplay near the equipment
- Keep the working area neat and tidy

Operation Panel Introduction

Operation Panel Components (Typical Configuration)

Power Switch

Function: Control the main power on/off of the equipment

Location: Side of the machine

Marking: Power

Emergency Stop Button

Function: Immediately stop all movements and laser output in case of emergency

Location: Prominent position on the machine side

Marking: Red mushroom head button with yellow base

Operation: Press down to stop; twist to reset

Status Indicator Light

Power Indicator: White, steady on when power is connected

Interfaces

Type-C Port: Data transmission and power supply

Power Port: DC power input

TF Card Slot: Offline engraving

Others

Cover Interlock Switch: Safety interlock device

Position of Main External Switch, Normal Power-on / Shutdown Sequence, Standard Functions

Normal Power-on Sequence

Inspect the surrounding environment of the machine to confirm safety

Clear irrelevant objects from the working area

Connect the power adapter

Turn on the power switch

Wait for the machine to finish initialization

Check if the indicator lights are in normal status

Connect a computer or insert a TF card

Perform homing operation

Start engraving work

Normal Shutdown Sequence

Wait for the ongoing engraving task to complete

Move the laser head back to the safe position

Close the control software or stop laser output

Turn off the machine power switch

Disconnect the power adapter

Clean up the working area

Organize tools and materials

Emergency Stop Operation

Press the emergency stop button

The machine immediately halts all movements and laser output

Rotate the emergency stop button to reset after troubleshooting

Execute homing operation again before reuse

Standard Function List

Laser engraving function

Laser cutting function

Automatic homing function

Limit protection function

Emergency stop function

Cover safety interlock function

Offline engraving function

Bluetooth connection function

Emergency Stop: Position, Operation, Release and Reset Procedures

Emergency Stop Button Location

- Prominent position on the right side of the machine
- Red mushroom-head button with yellow base
- Reachable by the operator without moving
- Free of any obstructions

Emergency Stop Operation Steps

- Press the emergency stop button firmly with the palm immediately once an emergency occurs
- A "click" sound indicates the button is locked
- All machine movements stop instantly
- Laser output cuts off immediately
- All motors power off

Applicable Emergency Scenarios

- Fire or smoke emission
- Risk of personal injury
- Abnormal movement of the machine
- Displaced or flying workpieces
- Any other potentially hazardous conditions

Emergency Stop Release and Reset Procedure

- Confirm the hazard has been eliminated
- Rotate the emergency stop button clockwise
- A "click" sound means the button is released
- Press the reset key or restart the equipment
- Perform the homing operation
- Verify all machine functions work properly
- Resume operation after full confirmation

Precautions

- The emergency stop is only for emergencies; do not use it for routine shutdown
- Test the emergency stop function regularly to ensure normal operation
- Homing must be performed again after emergency stop before resuming work
- The emergency stop does not cut off the main power supply; disconnect mains power for maintenance work

Parameter Settings

Main Parameters and Setting Methods

Laser Power Setting

Range: 0% ~ 100%

Setting Method: Configured via engraving software

Adjustment Principle: Adjust according to material type and thickness

Reference power for common materials:

Wood: 30% ~ 80%

Leather: 20% ~ 50%

Acrylic: 40% ~ 70%

Paper: 10% ~ 30%

Engraving Speed Setting

Range: 100 ~ 12000 mm/min

Setting Method: Configured via engraving software

Adjustment Principle: Higher speed results in shallower engraving depth; lower speed results in deeper engraving depth

Engraving Modes

Bitmap Mode (for engraving photos and images)

Vector Mode (for cutting and line marking)

Mixed Mode (integrates both engraving and cutting functions)

Origin Setting

User Origin: Custom working origin set by the user

Setting Method: Move the laser head to the target position via software or control panel and confirm the origin

Other Parameters

Fill Interval: Affects engraving precision and speed

Engraving Direction: Bidirectional

Acceleration Setting: Affects motion smoothness

Stepper Motor Current: Affects torque and heat generation

Precautions for Parameter Setting

Always perform a test engraving when using new materials for the first time

Start testing with low power and high speed

Record optimal parameter values for different materials

Calibrate laser power regularly

Personnel Requirements

Qualification Requirements for Maintenance Personnel

- Have received professional training and be familiar with the structure and working principle of the equipment

- Possess basic electrical safety knowledge

- Be aware of laser safety protection requirements

- Master standard maintenance procedures and tool operation

Classification of Maintenance Personnel

Routine Maintenance Personnel (Operators)

- Clean the outer surface of the equipment

- Inspect the machine appearance and connecting wires

- Clean the worktable

- Check the emergency stop function

Professional Maintenance Personnel (Technicians)

- Clean and calibrate the optical system

- Adjust and lubricate the mechanical system

- Inspect and repair the electrical system

- Complete firmware upgrade

- Diagnose and eliminate faults

Safety Requirements for Maintenance

- Disconnect the power supply before carrying out any maintenance work

- Wait for at least 5 minutes to allow capacitors to discharge completely

- Wear an anti-static wrist strap or take other anti-static precautions

- Use special tools and materials to clean optical lenses

- Inspect all safety functions to ensure normal operation after maintenance

- Record maintenance items and replaced parts

Inspection Intervals for All Components

Maintenance Schedule

Daily Maintenance

Equipment Exterior Cleaning

- Clean the machine housing and worktable
- Remove engraving debris and dust
- Inspect the machine exterior for any abnormalities

Safety Inspection

- Test the function of the emergency stop button
- Verify the safety interlock function
- Check the integrity of the power cord

Weekly Maintenance

Optical System Inspection

- Check the surface cleanliness of the focusing lens
- Inspect the surface of reflectors (if fitted)
- Clean lenses if contaminated

Mechanical System Inspection

- Check the cleanliness of guide rails
- Inspect the wear status of timing belts
- Check belt tension

Ventilation System Inspection

- Clean air intake and outlet vents
- Check whether fans operate normally
- Clear smoke exhaust ducts

Monthly Maintenance

Mechanical System Lubrication

- Remove dust from profiles and POM wheels
- Check the running condition of bearings

Electrical System Inspection

- Check all wiring terminals for tightness
- Confirm reliable earthing connection
- Test all functional switches

Precision Calibration

- Inspect engraving accuracy
- Inspect positioning accuracy
- Make adjustments if necessary

Quarterly Maintenance

Deep Cleaning

- Remove dust from the entire machine interior
- Clean dust accumulated on circuit boards

Comprehensive Inspection

- Check wear of all moving components
- Inspect all fasteners
- Verify all safety protection devices

Inspection Intervals for All Components

Annual Maintenance

Professional Inspection & Testing

- Laser power measurement

- Optical path calibration

- Electrical safety testing

- Overall machine performance evaluation

Wear Part Replacement

- Replace laser tube / laser diode according to service conditions

- Replace focusing lens and reflectors

- Replace timing belts

- Replace bearings

Recommendation

- Establish an equipment maintenance record sheet to log the date, maintenance items, replaced parts, and maintenance personnel for each service.

Machine Cleaning

Cleaning Precautions

- Disconnect the power supply before cleaning
- Allow the machine to cool down completely
- Do not use corrosive cleaning agents
- Do not flush the machine directly with water
- Optical lenses must be cleaned with dedicated procedures

Machine Housing Cleaning

- Tools: Clean soft cloth, neutral detergent
- Method: Dip the soft cloth in a small amount of detergent and wipe gently
- Frequency: After daily use

Worktable Cleaning

- Tools: Brush, vacuum cleaner, soft cloth
- Method: Remove engraving residues and wipe the table surface
- Frequency: After each use

Guide Rail Cleaning

- Tools: Dust-free cloth, anhydrous ethanol
- Method: Wipe the rail surface with a dust-free cloth to remove dust and grease
- Frequency: Once per week

Optical Lens Cleaning

- Tools: Special lens paper, lens cleaning fluid, air blower
- Procedures:
 - Blow off loose surface dust with an air blower first
 - Dip lens paper in a small amount of cleaning fluid
 - Wipe gently in a spiral motion from the center outward
 - Repeat wiping with a fresh piece of lens paper
- Frequency: Inspect weekly, clean when necessary
- Note: Never touch the lens surface with bare hands

Fan & Ventilation Opening Cleaning

- Tools: Brush, vacuum cleaner, compressed air
- Method: Remove dust accumulated on vents and fan blades
- Frequency: Once per month

Electrical Component Cleaning

- Tools: Anti-static brush, vacuum cleaner
- Method: Gently brush dust off circuit boards and electronic components
- Frequency: Once per quarter
- Note: Power must be disconnected and anti-static protection measures taken

Function Test Procedures

Routine Function Test (Before Daily Startup)

Power System Test

- Turn on the power switch and check whether the power indicator lights up normally
- Test the emergency stop button: confirm the machine cuts power immediately after pressing and resumes operation after reset

Motion System Test

- Perform homing operation and verify normal completion
- Manually control X/Y axis movement to check smooth travel
- Test limit switch function to confirm instant stop upon triggering

Safety Function Test

- Cover interlock test: confirm laser output shuts down immediately when the top cover is opened
- Emergency stop test: confirm all movements halt instantly when the emergency stop button is pressed

Laser Function Test

- Conduct low-power test to verify normal laser emission
- Inspect the laser spot for normal condition
- Verify validity of different power settings

Periodic Function Test (Monthly)

Precision Test

- Engrave standard test patterns
- Measure dimensional accuracy to confirm it is within tolerance
- Check repeat positioning accuracy

Power Test

- Measure laser output power with a power meter
- Verify the power reaches the rated value
- Test linearity of power adjustment

Speed Test

- Check machine operation under various speed settings
- Verify stable movement at high speeds
- Confirm normal acceleration and deceleration performance

Annual Function Test

Comprehensive Performance Inspection

- Test all functions item by item
- Full evaluation of safety performance
- Electrical safety inspection
- Issue an inspection report

Test Records

- It is recommended to maintain a function test record form
- Log test date, test items, test results and tester information
- Record and resolve any faults found in a timely manner

Function Test Procedures

Annual Electrical Safety Test Procedures & Acceptance Criteria

All electrical safety tests shall be performed by qualified electrical personnel, with the machine fully disconnected from the mains power supply.

1. Protective Earth (PE) Continuity Test

- Test method: Use a low-resistance ohmmeter to measure the resistance between the protective earth terminal of the power input and all accessible conductive metal parts of the machine (frame, motor housing, electrical cabinet shell, etc.).
- Test current: ≥ 10 A DC
- Acceptance criterion: The resistance between any accessible conductive part and the PE terminal shall be $\leq 0.1 \Omega$, with no open circuit or poor contact.

2. Insulation Resistance Test

- Test method: Use an insulation resistance tester to measure between the live circuit (all live terminals connected together) and the protective earth circuit.
- Test voltage: 500 V DC
- Acceptance criterion: Insulation resistance shall be $\geq 1 \text{ M}\Omega$ under normal ambient temperature and humidity.

3. Residual Voltage Verification

- Test method: Power on the machine at rated voltage, then cut off the main power supply. Measure the voltage at the main capacitor terminals after 5 minutes of power-off.
- Acceptance criterion: Residual voltage shall be ≤ 60 V DC after 5 minutes of power failure, confirming that the discharge circuit meets safety requirements.

4. Power Supply Wiring Inspection

- Verify that all wiring terminals are tightened to the specified torque, with no loose strands or exposed copper.
- Confirm that the power cord and internal wiring are free of aging, cracking or abrasion damage.

All test results shall be recorded in the equipment maintenance file. If any item fails the test, the equipment shall not be put into operation until the fault is rectified and re-tested to be qualified.

Lubrication

Lubrication Points & Intervals

Timing Belt

Lubrication point: Generally no lubrication required

Note: Keep timing belts dry and clean. Lubricant will reduce friction and cause belt slipping.

Motor Bearings

Sealed bearings normally adopted, maintenance-free for the whole service life

Replace the motor if abnormal noise or unsmooth rotation occurs

Fan Bearings

Oil-impregnated bearings normally adopted, maintenance-free

Add proper lubricating oil if noise increases

Or replace the fan directly

Lubrication Precautions

Use only the specified lubricant model; do not mix different types of lubricants

Thoroughly clean surfaces before lubrication to avoid foreign matter ingress

Apply lubricant in moderate quantity; excessive lubrication causes adverse effects

Wipe off surplus lubricant after lubrication

Record lubrication date and lubricant model

Inspect the root cause promptly if abnormal wear is detected

Record-Keeping

It is recommended to establish complete equipment maintenance archives including the following contents:

Basic Equipment Information

- Equipment Model
- Equipment Serial Number
- Purchase Date
- Warranty Period
- Supplier Contact Information

Daily Operation Records

- Operation Date
- Operation Duration
- Main Processed Materials
- Applied Power Range
- Operator
- Operating Status (Normal / Abnormal)

Maintenance Records

- Maintenance Date
- Maintenance Type (Daily / Weekly / Monthly / Quarterly / Annual)
- Maintenance Items
- Detailed Description of Maintenance Works
- Name and Model of Replaced Parts
- Maintenance Technician
- Post-maintenance Equipment Status

Fault Repair Records

- Fault Occurrence Date
- Description of Fault Phenomenon
- Root Cause Analysis
- Solutions Adopted
- Replaced Components
- Repair Technician
- Repair Completion Date
- Verification Result

Calibration Records

- Calibration Date
- Calibration Items
- Pre-calibration Data
- Post-calibration Data
- Calibration Operator
- Next Scheduled Calibration Date

Record-Keeping

Wear Part Replacement Records

Replacement Date

Part Name

Part Model

Service Life Before Replacement

Reason for Replacement

Replacement Operator

Record Management Recommendations

Paper logbooks or electronic spreadsheets are recommended for record keeping

All records shall be filled in timely, accurately and completely

Review records regularly to summarize operating patterns

Serve as the basis for evaluating equipment operating conditions

All repair records within the warranty period shall be properly retained

Common Faults and Troubleshooting Procedures

1. No Laser Output

Possible Causes:

- Power disconnected or poor contact
- Faulty laser power supply
- Damaged laser tube / laser diode
- Loose or disconnected wiring cables
- Activated safety interlock (open cover, emergency stop triggered)
- Incorrect software parameter settings

Solutions:

- Inspect power connections and ensure power supply is connected properly
- Confirm emergency stop is reset and the top cover is fully closed
- Check software settings to verify laser power is not set to 0%
- Tighten all connecting cables
- Contact after-sales service if the issue persists

2. Insufficient or Uneven Engraving Depth

Possible Causes:

- Laser power set too low
- Incorrect focal length
- Contaminated or damaged optical lenses
- Aging laser tube
- Uneven workpiece surface
- Excessively high engraving speed

Solutions:

- Appropriately increase laser power
- Readjust focal length
- Clean or replace optical lenses
- Reduce engraving speed
- Secure the workpiece flat and firmly
- Replace the laser tube if it is aging

3. Blurry or Jagged Engraving Patterns

Possible Causes:

- Misaligned focal length
- Contaminated optical lenses
- Loose or worn timing belt
- Excessively high movement speed
- Overly high acceleration setting
- Excessive mechanical clearance

Solutions:

- Recalibrate focal length
- Clean optical lenses
- Adjust tension or replace the timing belt
- Lower speed and acceleration values
- Inspect and adjust mechanical clearances

4. Offset or Dislocated Engraving Position

Possible Cause:

- Incorrect origin setting
- Unstable workpiece fixation
- Slipping timing belt
- Motor step loss
- Wrong software parameter configuration
- Defective engraving file

Solutions:

- Reset the working origin
- Fix the workpiece securely
- Adjust timing belt tension
- Reduce speed and acceleration
- Verify software parameter settings
- Check the engraving file

Common Faults and Troubleshooting Procedures

5. Machine Fails to Connect to Computer

Possible Causes:

- Damaged or poorly connected USB cable
- Uninstalled driver software
- Occupied communication port
- Machine powered off
- Incorrect software port configuration

Solutions:

- Check USB connection and test with a new USB cable
- Reinstall the driver software
- Check port status in device manager
- Ensure the machine is powered on
- Verify port settings in control software

6. Emergency Stop Alarm Cannot Be Reset

Possible Causes:

- Emergency stop button not fully reset
- Unclosed safety interlock
- Fault in control system

Solutions:

- Rotate the emergency stop button clockwise for full reset
- Confirm all safety covers are tightly closed
- Restart the machine
- Contact after-sales service if the alarm remains

7. Abnormal Noise During Movement

Possible Causes:

- Over-tight or loose timing belt
- Damaged bearings
- Loose screws
- Interference between moving components

Solutions:

- Adjust timing belt tension
- Inspect and tighten all screws
- Check for component interference points
- Replace bearings if damaged

8. Automatic Shutdown During Engraving

Possible Causes:

- Triggered emergency stop or safety interlock
- Motor overheat protection activated
- Unstable input voltage
- Poor data cable contact
- Software malfunction

Solutions:

- Check whether any safety protection device has been triggered
- Stop operation and cool down the machine before reuse
- Use a regulated power supply
- Inspect data cable connections
- Restart the control software and the machine

Note:

If the fault cannot be resolved independently, please contact the manufacturer's technical after-sales support. Do not disassemble or repair the machine without authorization.

List of Components and Spare Parts

Standard Parts List

- 1. Mechanical Components
 - Main frame ×1
 - X-axis module ×1
 - Y-axis module ×2
 - Laser head assembly ×1
 - Worktable plate ×1
 - Outer housing / protective cover ×1
- 2. Electrical Components
 - Main control board ×1
 - Laser driver board ×1
 - Power adapter ×1
 - Stepper motor ×2
 - Limit switch ×2
 - Emergency stop button ×1
 - Status indicator light ×1
- 3. Optical Components
 - Laser diode / laser tube ×1
 - Focusing lens ×1
 - Reflector (if equipped) ×1
 - Beam expander (if equipped) ×1
- 4. Transmission Components
 - Timing belt ×3
 - Timing pulley ×10
 - Linear guide rail set ×2
- 5. Standard Accessories
 - USB data cable ×1
 - Power cord ×1
 - TF card ×1
 - Pair of laser safety goggles ×1
 - Tool kit ×1
 - Wrench ×3
 - Screw pack ×1

Wear Parts List(Components requiring periodic replacement)

- 1. Optical Wear Parts
 - Focusing lens: Service life approx. 500~2000 hours
 - Reflector: Service life approx. 1000~3000 hours
 - Laser diode / laser tube: Service life approx. 5000~10000 hours
- 2. Mechanical Wear Parts
 - Timing belt: Service life approx. 2000~5000 hours
 - Bearing: Service life approx. 5000~10000 hours
- 3. Electrical Wear Parts
 - Cooling fan: Service life approx. 20000 hours
 - Switches & buttons: Service life depends on operation frequency

Spare Parts Purchasing Recommendations

- Purchase spare parts from original manufacturer or authorized distributors
- Confirm full matching of model and specifications before purchase
- Store spare parts properly with moisture and dust protection
- Record replacement date and accumulated service hours after installation

Disassembly, Decommissioning and Scrapping Information

In accordance with Clause 1.7.4.2 Annex I of Directive 2006/42/EC and Clause 17 of EN 60204-1:2018, all procedures for machine decommissioning, safe disassembly and end-of-life disposal shall be followed by skilled authorized personnel only.

Decommissioning: Isolate all energy sources with LOTO lockout-tagout procedure, release residual energy, apply anti-rust protection for short/long-term storage.

Disassembly: Discharge capacitors fully prior to electrical disconnection; dismantle hydraulic/pneumatic circuits after pressure relief; use specified lifting points and PPE as listed. Separate electrical components, cables and hazardous materials during disassembly.

Scrapping & Disposal: Classify waste per WEEE Directive 2012/19/EU. PCB, batteries, capacitors, waste oil shall be handed over to authorized EU recycling operators. Do not discard with general household waste. All hazardous substance handling records shall be retained for inspection.

Electrical Waste Classification & Disposal Details

In accordance with WEEE Directive 2012/19/EU and applicable local waste management regulations, electrical components shall be classified and disposed of as follows:

1. Printed Circuit Boards (PCBs)

Contain trace heavy metals and hazardous substances. Shall be handed over to authorized WEEE recycling operators for professional dismantling and material recovery. Do not incinerate or discard with general waste.

2. Lithium-containing Components & Batteries

Risk of fire and electrolyte leakage if damaged. Shall be fully discharged and separately packaged before disposal, and handed over to specialized lithium battery recycling institutions.

3. Electrolytic Capacitors

Contain electrolyte and heavy metal electrodes. Shall be removed intact and delivered to qualified hazardous waste treatment agencies. Do not puncture or disassemble without authorization.

4. Power Cables & Wiring Harnesses

Shall be collected separately for copper and plastic material recycling. Do not burn cables to extract metal.

5. Oil-bearing Fans & Lubricated Parts

Contain residual lubricating oil. Shall be treated as oil-containing waste and handed over to qualified hazardous waste operators.

All hazardous substance disposal records shall be retained for at least 3 years for regulatory inspection.