DIKAI U6010 & U6005

UV Laser Marking Machine

User Manual

Shanghai Dikai Coding Technology Co., Ltd

Warning

The laser machine is a Class 4 laser product. During operation, it emits invisible pulsed laser radiation with a wavelength of 355nm to 11μm and a maximum power of 10W. Direct or scattered laser radiation can cause permanent retinal damage, skin burns, and other serious personal injuries.

Before operating or preparing to use the laser marking machine, it must be equipped with a Class 1 laser protection device to prevent accidental exposure to direct or scattered laser light. It is strictly forbidden to operate, control, or adjust the equipment in ways not specified in this manual. Strictly avoid exposing eyes or skin to the laser radiation path.

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I. Preface

Welcome to use the U6010&U6005 laser marking machine developed and manufactured by Shanghai Dikai Coding Technology Co., Ltd. (hereinafter referred to as "Dikai Tech").

This manual serves as the official technical document for the equipment, specifically written for authorized operators, maintenance personnel, and technicians who have undergone Dikai Tech's training. It systematically provides equipment operation specifications, daily maintenance procedures, basic troubleshooting guidelines, and safety protection requirements. To ensure stable equipment operation, extend its service life, and protect operator safety, it is essential to read this manual thoroughly before installing, commissioning, or using the equipment and to strictly follow all instructions.

Important Notice:

1. Dikai Tech shall not be held liable for any direct or indirect losses resulting from failure to comply with the operation specifications in this manual, unauthorized modification of the equipment, misuse, or use for non-designated purposes.

2. Dikai Tech reserves the right to continuously improve its products and this manual. Related modifications will not be announced separately. The latest version of the manual can be obtained through official after-sales channels.

3. The copyright of this manual belongs to Shanghai Dikai Coding Technology Co., Ltd. No unit or individual may reproduce, disseminate, or adapt its content, in whole or in part, in any form without written permission.

4. If you have any questions during equipment use, please contact your sales representative or the nearest Dikai Tech branch office directly.

II. Safety Regulations

WARNING: This equipment is a Class 4 laser product as defined by standard IEC 60825-1. Its UV laser beam (355nm) is of high energy. Direct exposure or exposure to scattered light can cause permanent retinal damage, skin burns, and other serious personal injuries. Before using the equipment, the following safety regulations must be strictly observed. All operations must be performed by authorized personnel.

2.1 Laser Safety Classification and Protection Requirements

Laser equipment is classified into 5 main safety classes according to the international standard IEC 60825-1: Class 1, Class 2, Class 3R, Class 3B, and Class 4. Class 1 equipment is harmless under normal use, while Class 4 laser radiation is extremely hazardous to humans. Its direct or scattered beams can cause permanent retinal damage and blindness. High-intensity radiation can cause localized extreme heating and tissue burns.

This device is classified as Class 4 equipment, and is not supplied with a fully enclosed safety enclosure. The user needs to install a safety enclosure meeting Class 1 laser safety standards before use (the enclosure is not included in the standard supply scope).

Mandatory Protective Measures:

1. All operators must wear dedicated laser safety glasses matching the 355nm wavelength (with an Optical Density ⩾ 0D6+). It is strictly forbidden to operate the equipment without proper protective gear.
2. The equipment working area must be equipped with a closed protective fence and posted with laser danger warning signs. Unauthorized personnel are strictly prohibited from entering.
3. Strictly avoid exposing any part of the human body within the laser beam path. Never look directly at the laser beam or any reflective surface (e.g., metal, glass).

2.2 Safety Labels and Instructions

Label	Instruction
	***Laser Danger!*** Invisible or visible laser radiation is present here. Personnel must not look directly at or physically contact this area, as it can cause severe bodily and visual injury.
	***Electric Shock Hazard!*** Voltage or current capable of causing human injury is present here. Please follow the relevant instructions for operation, otherwise personal injury may occur.

Note: All safety labels on the equipment must remain clear and legible. If worn or detached, contact after-sales service for replacement immediately. Removal of labels is strictly prohibited.

2.3 Proper Use

This equipment is specifically designed for printing on various material surfaces (e.g., date, batch number, serial number, barcode, QR code, etc.), achieved through the physical/chemical interaction of the 355nm UV laser beam with the material surface. The following requirements must be met during use:

1. The equipment must be used only after installing a safety enclosure meeting Class 1 laser safety standards.
2. Only authorized and safety-trained personnel are permitted to operate and maintain the equipment. Operators should undergo regular safety re-training.
3. Laser safety operation procedures, emergency response processes, and other relevant documents must be posted in the work area and strictly implemented.
4. The following hazardous behaviors are strictly prohibited:

- ✷ Using the laser beam to irradiate humans, animals, or non-target materials.
- ✷ Irradiating flammable or explosive materials (e.g., paper, solvents, gas cylinders). If processing flammable materials is necessary, smoke alarms, fire extinguishers, and other protective equipment must be provided.
- ✷ Irradiating highly reflective objects (e.g., polished metal sheets), as reflected beams may cause secondary harm.
- ✷ Irradiating materials with unknown properties (some materials may transmit the laser beam or generate toxic fumes when heated).
- ✷ Storing flammable/explosive solvents, cleaners, or similar items within the laser work area.

2.4 Electrical Safety

1. The equipment's rated operating voltage is 220VAC single-phase, 50/60Hz. The power supply shall comply with the above rated parameters and the power outlet must be equipped with reliable protective grounding ,with a ground resistance $\leqslant 5\Omega$.

2. Only authorized technical personnel are allowed to perform live operations. Power must be switched OFF and the plug disconnected before equipment repair or cable connection.

3. In case of a power supply fault, stop the equipment operation immediately. Do not resume use until authorized personnel have investigated and repaired the issue.

4. NEVER connect or disconnect any plugs at the rear of the equipment while power is ON (including interfaces for the control screen, encoder, power supply, etc.), as this may directly damage the mainboard and related components.

5. Safety warning labels are affixed to the top of the equipment. Confirm they are legible and understand their content before operation.

2.5 Disclaimer

Dikai Tech shall not be liable for any personal injury or property damage resulting from the following circumstances:

1. The equipment is used for purposes other than those specified in this manual.
2. Installation, commissioning, operation, or maintenance is not performed in accordance with the manual's requirements.
3. The equipment is used while its safety protection devices are faulty, not installed, or not functioning properly.

4. Relevant instructions regarding transportation, storage, maintenance, or repair in the operation manual are not followed.
5. Equipment components are dismantled without authorization or structural modifications are made.
6. Losses are caused by force majeure factors such as natural disasters or war.

III. Equipment Description

3.1 Equipment Composition

The U6010 laser machine consists of the following components, which work together to achieve marking functionality, with the specific composition as follows.

NO.	Category	Description
1	Print Unit	Contains the 355nm UV laser tube, galvanometer scanning system, and F-Theta lens. This is the core unit for printing.
2	Control System	Includes the control screen and control board, responsible for parameter setting and motion control.
3	Bracket (optional)	Select based on application scenarios to secure the laser unit and ensure marking stability.
4	Cooling System	Chiller unit, used for laser heat dissipation.
5	Others	Connecting cables such as power cable and 7-core wires.

3.2 Working Principle

A pulsed UV laser tube (1) generates a small-diameter, invisible laser beam.This beam passes through a beam expander to increase its diameter and reduce divergence (2). The beam then enters the galvanometer scanning system (3). Two high-speed oscillating mirrors inside the system adjust their angles according to pre-set commands, guiding the laser beam

to scan along the designed marking pattern path.The control software parses the marking pattern into vector paths (sequences of X and Y coordinates). The control card drives the galvanometer movement and synchronously controls laser parameters such as on/off and pulse energy. The laser beam reflected by the galvanometers is focused by the F-Theta lens (4) into a very small spot before reaching the product surface (6), significantly increasing energy density. Printing typically occurs at the laser beam's focal point (5). The focused UV laser pulses interact physically/chemically with the material surface. After continuous scanning along the vector path, a clear, permanent mark is formed.

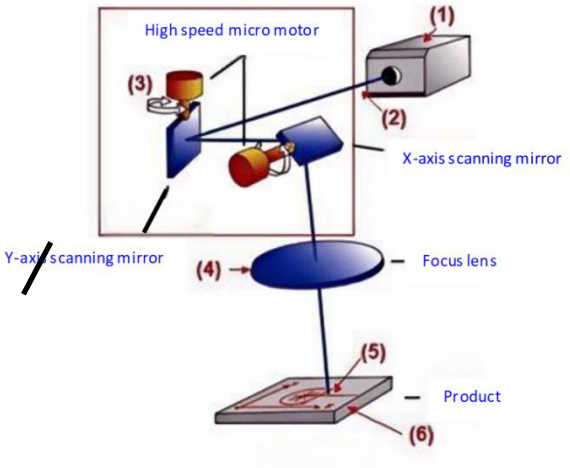


Figure 3-1 Schematic Diagram of Laser marking machine Structure

3.3 Technical Parameters

Model	U6005	U6010
Laser type	355nm UV laser	355nm UV laser
Laser power	⩾5W@30KHz	⩾10W@50KHz
Frequency Range	30KHz - 300KHz	30KHz - 300KHz
Scanning Speed	8000 mm/s	12000 mm/s
Marking Field /Working Distance	110X110mm / 213mm, 175X175mm / 300mm, 250X250mm / 430mm, 400X400mm / 580mm	
Fonts	Single-line font, Double-line font, Dot-matrix font	
Machine Readable Codes	Various standard 1D barcodes (e.g., Code128, EAN) and 2D codes (e.g., QR Code, Data Matrix)	
Supported Graphic Formats	DXF/PLT/BMP/PNG/JPG	
Input/Output	2 Inputs / 3 Outputs	
Interface	USB, Ethernet, RS232	

Beam Orientation	All directions
Cooling System	Water-cooled; Coolant: Deionized water, distilled water, or purified water
Power Supply	200 - 240 VAC (Optional 100-120VAC), Single-phase, 50/60Hz
Power Consumption	< 600W
Operating Ambient Temperature	5° C - 40° C
Operating Ambient Humidity	20% - 80% (non-condensing)
Approximate Weight	Print Unit: 15.5kg; UI: Approx. 0.55kg; Chiller: 20kg.
Dimensions (L×W×H)	Print Unit: 625mm × 190mm × 144mm Control Screen: 252mm × 168mm × 36mm Chiller: 580mm × 290mm × 520mm
Optional Accessories	Custom mounting bracket, Fume extractor/purifier, etc.

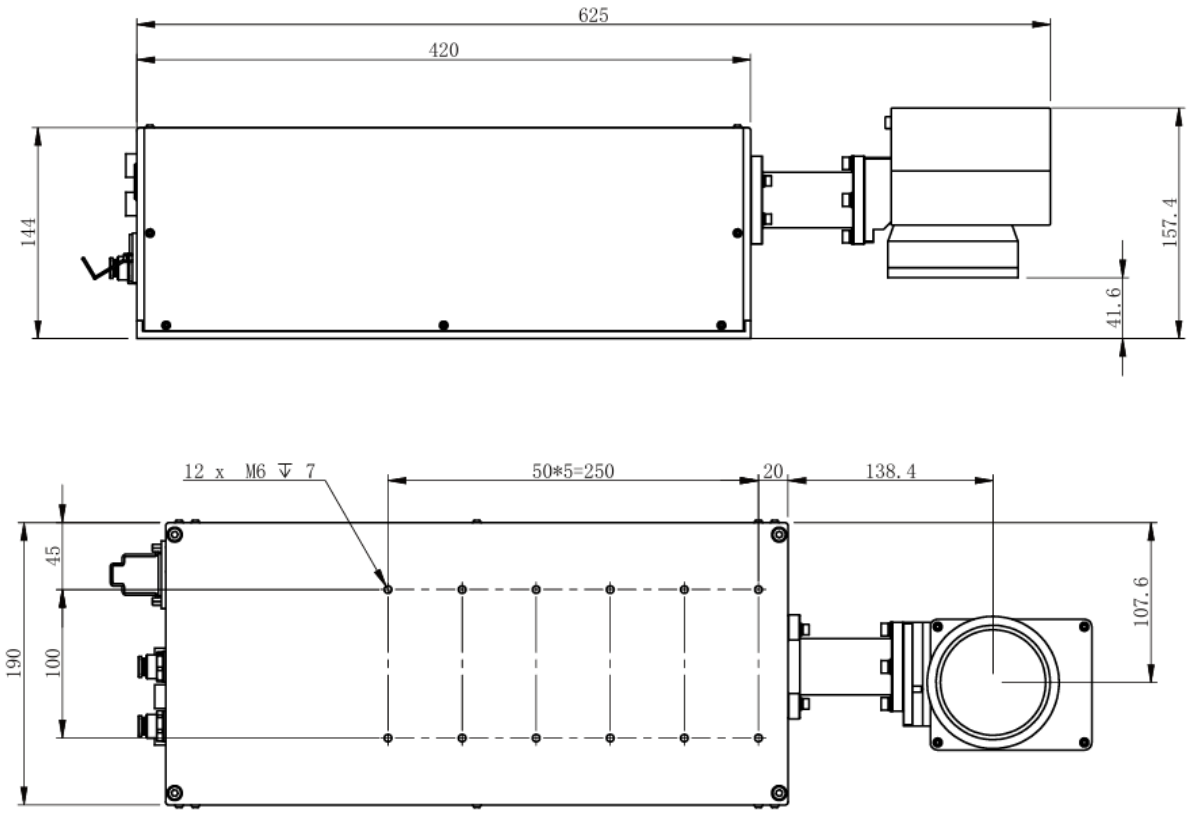


Figure 3-2 Laser Unit Size Diagram

IV. Installation and Commissioning

4.1 Unpacking Inspection

1. After opening the packaging, first confirm that the equipment model matches the purchase order.

2. Check all components against the packing list to ensure completeness.

3. Inspect the appearance of all components to ensure no bumps, scratches or deformation, and check that all cables are free of damag. Please contact sales or after-sales service immediately If any abnormalities are found.

4.2 Installation Conditions

When installing the laser marker, ensure the current environment meets the following requirements.

No.	Item	Installation Conditions	Precautions
1	Ambient Temperature	5° C ~ 40° C	Avoid direct sunlight or proximity to other heat sources.
2	Ambient Humidity	20% ~ 80%, non-condensing	If moving the equipment from a cold to a warm environment, let it acclimate for at least 30 minutes to prevent internal condensation from damaging components.
3	Power Requirements	200-240VAC, Single-phase, 50/60Hz, Ground resistance ⩽ 5 Ω	Standard power cable length is 3 meters.
4	Installation Space	Reserve ⩾50cm operating space around the laser head; Reserve ⩾1.5m ventilation space around the chiller.	Ensure unobstructed operation, maintenance, and heat dissipation.
5	Environmental Cleanliness	No significant dust, smoke, or corrosive gases	A dust cover is recommended for dusty environments. A fume extractor is necessary when marking materials that produce smoke.
6	Vibration Requirement	Vibration acceleration at the mounting surface should be ⩽ 0.1g	-

4.3 Cooling System

The equipment dissipates heat via a chiller. The chiller installation must meet the following requirements:

1. The chiller must be placed horizontally in a well-ventilated area. The distance from its air outlet to obstacles should be ⩾1.5m, and from its air inlet to obstacles should be ⩾1m (as shown below).

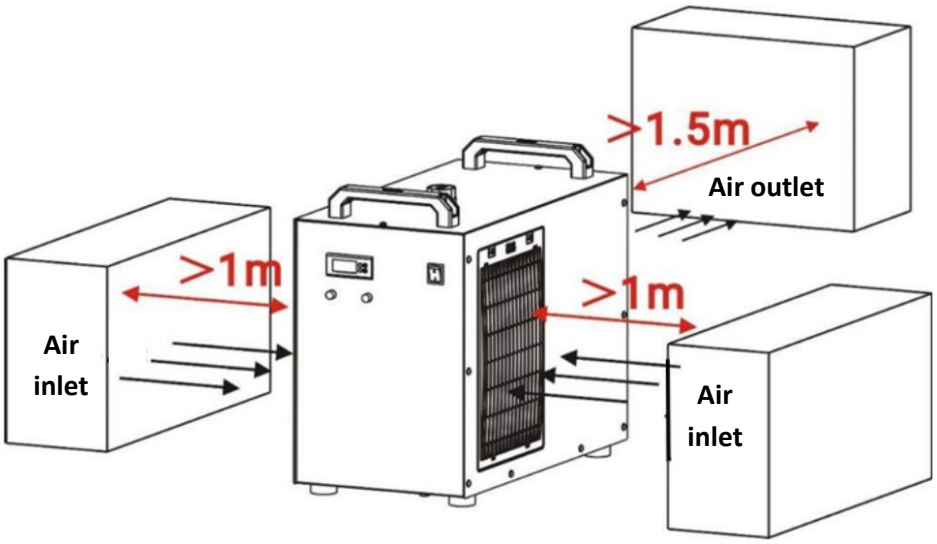


Figure 4-1 Schematic Diagram of Chiller Installation Space

2. Fill the chiller tank with coolant (deionized water, purified water, or distilled water). The liquid level should be within the "NORMAL" marking range. NEVER use tap water, mineral water, or any liquid containing impurities.

3. Check that the chiller power connection is correct and grounding is reliable. Do not place portable sockets, power adapters, etc., behind the chiller.

4.4 Interface Description

The following interfaces are provided on the rear panel of the laser head (see Figure 4-2) for connecting components such as the control screen and encoder.

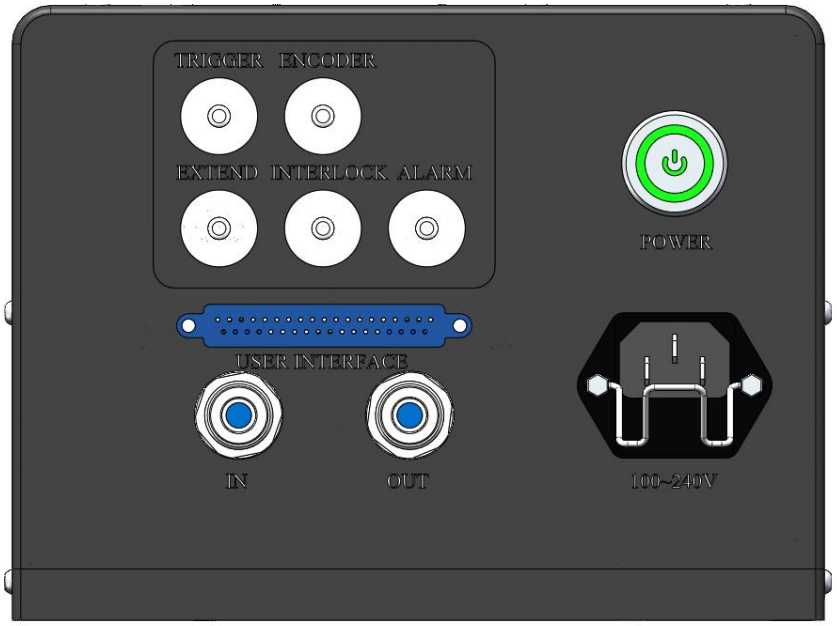


Figure 4-2 Rear Panel Ports Diagram

Name	Function	Description
USER INTERFACE	Control Screen Interface	Ensure the connector is fully inserted and locked.
TRIGGER	Trigger Signal Interface	Connect to external trigger sensors or control signal sources.
ENCODER	Encoder Interface	Ensure the encoder wheel maintains even contact with the production line conveyor/roller without slippage.
INTERLOCK	Interlock Signal Interface	Connect to the chiller interlock switch to ensure the laser alarms if the chiller is not running.
ALARM	Alarm Output Interface	Can be connected to external alarm devices.
EXTEND	Multi-function Extension Interface	RS232 and future function expansion interface.
POWER	Power Switch	Main power switch for the laser head.
IN	Coolant Inlet	Connect to the chiller outlet.
OUT	Coolant Outlet	Connect to the chiller inlet.

4.5 Installation and Commissioning

4.5.1 Mechanical Installation

1. Choose a suitable location and fix the mounting bracket to a stable base (add shock-absorbing pads if necessary).

2. Secure the laser head to the bracket using the bottom screw holes. Ensure the laser head is level, stable, and the beam is vertically aligned with the center of the marking area.

3. Adjust the bracket height so the distance between the laser head's F-Theta lens and the marking material surface meets the Focal Length requirement of the selected F-Theta lens (refer to the "Marking Field / Focal Length" parameters in Section 3.3).

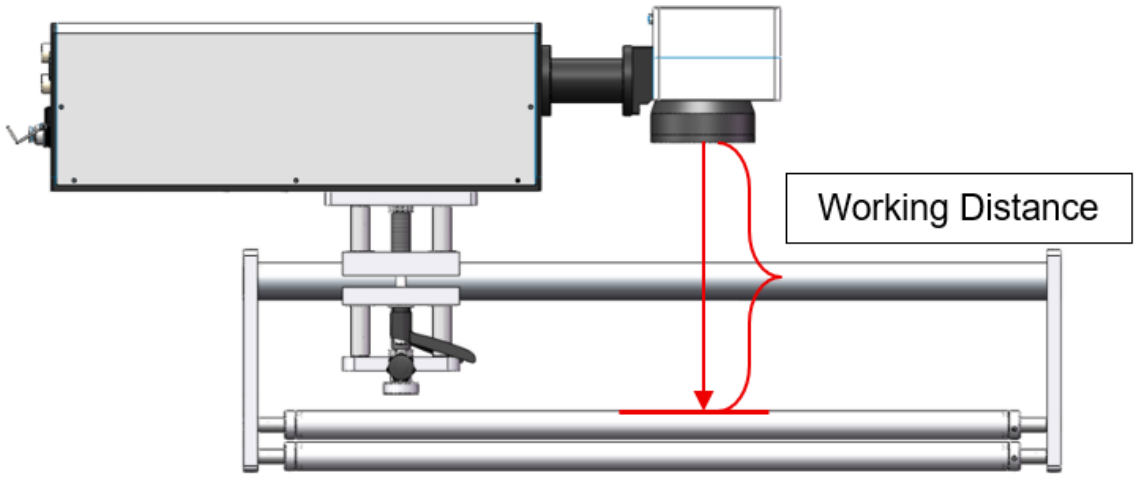


Figure 4-3 Installation Schematic Diagram

4.5.2 Cable Connection

1. Connect the cables for each component (control screen, encoder, interlock switch, power supply, etc.) according to the interface descriptions. Ensure all connectors are locked securely and cables are not twisted or pinched.

2. Verify all cable connections are correct, with no misconnections or omissions. Pay special attention to the reliable connection of the power ground terminal.

3. Organize the cables and secure them with cable ties, avoiding proximity to the laser emission port or high-temperature areas.

4.5.3 Power-On Commissioning

1. Turn on the power in the sequence of "Chiller first, then Laser Marker" (detailed power-on procedure in Section 5.1).

2. Wait for the equipment to complete its warm-up (approx. 2 minutes) and enter

standby mode. Create a simple test file (e.g., text, graphic) in the control screen software.

3. Adjust marking parameters (e.g., power, speed, frequency) based on material properties and perform a test mark. Observe the marking result.

4. If the marking is blurry or misaligned, adjust the focus by raising/lowering the bracket or adjusting the focus knob, or further optimize the marking parameters until the result is clear and accurately positioned.

5. After commissioning, save the parameter settings for future production use.

V. Operation Guide

5.1 Power-On Procedure

Note: The power-on sequence of "Cooling system ON first, then laser marking machine ON" must be strictly followed. Otherwise, the laser tube may be damaged due to overheating.

1. Pre-power-on Checks:

★ Check that the chiller liquid level is within the "NORMAL" range and hose connections are leak-free.

★ Check that all cable connections for the laser head and components are secure, with no looseness or damage.

★ Ensure the marking area is clear of obstacles and the laser safety enclosure is installed.

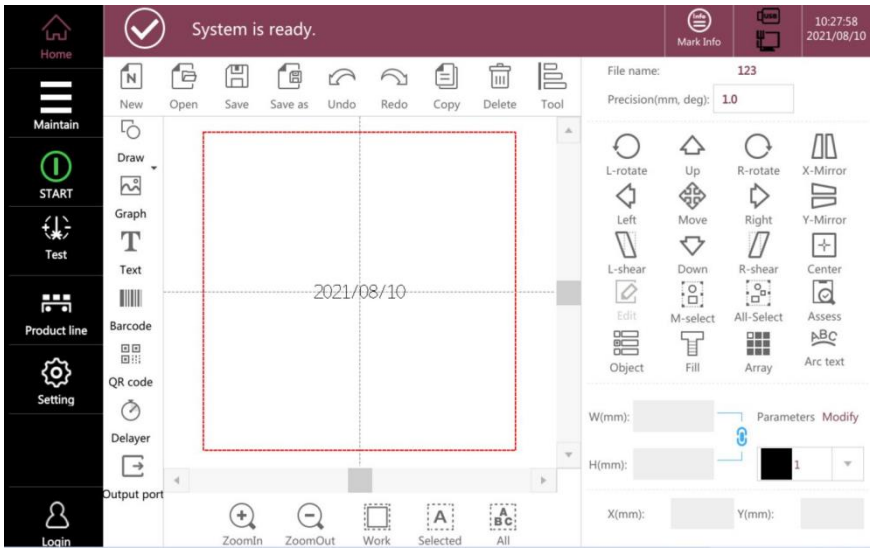
★ Operators must wear dedicated laser safety glasses for 355nm.

2. Turn on the chiller power switch to start the cooling system. Set the water temperature to 20° C - 25° C (default 25° C) .

3. Wait for the chiller to run stably (water temperature reaches set point, no alarm indications). Then turn ON the power switch on the laser head.

4. The laser marker enters warm-up mode. The control screen may display "System Warning: Laser not ready". The warm-up process takes approximately 1 minute.

5. After warm-up, the control screen should display "Marking System Ready", indicating the equipment is in standby mode and ready for marking.



5.2 Printing Procedure

1. Edit Printing File:
   - Create a new file in the control screen software interface. Import or draw the marking pattern (text, barcode, graphic, etc.).
   - Set variable parameters (e.g., date, serial number, counter) and preview the marking effect.
2. Adjust Printing Parameters:
   - Set key parameters like power, scanning speed, frequency, etc., according to the characteristics of the material to be processed (e.g., plastic, metal, glass).
   - If the marking is too light, appropriately increase the power or decrease the scanning speed. If it's too deep or charred, decrease the power or increase the speed. Parameter optimization through incremental testing is recommended.
3. Start Printing:
   - Confirm the protective cover on the laser head is removed. Ensure only the material to be processed is in the printing area, with no other objects.
   - Click the "Start" or "Run" button on the control screen to initiate marking.
   - Operators MUST monitor the process throughout. NEVER touch the laser work area or look directly at the laser beam during printing.

For detailed operations of the control software (file editing, parameter saving, variable setting, etc.), please refer to the accompanying Dikai Laser Marking Software User Manual.

5.3 Power-Off Procedure

Note: The power-off sequence of "Laser Marker OFF first, then Cooling system OFF" must be strictly followed to ensure the laser is adequately cooled.

1. After completing the marking tasks, click the "Stop" button on the control screen to end printing.

2. Turn OFF the laser marker power switch. Then, install the lens protective cover to prevent dust contamination.

3. Keep the chiller running for at least 1 minute to allow the laser internal temperature to drop to a safe level. Afterwards, turn OFF the chiller power.

VI. Maintenance

6.1 Maintenance Notice

Regular maintenance is key to ensuring stable equipment operation and extending its service life. All maintenance work must be performed by authorized maintenance personnel.

CRITICAL: All maintenance work must only be performed after the equipment power is switched off and the power plug is disconnected. Live operation is strictly prohibited.

6.2 Maintenance Schedule

This maintenance cycle is based on conditions of "10 hours of daily operation in a moderately polluted environment". If operating hours are extended (e.g., 24-hour continuous operation) or the environment is dustier, the maintenance cycle should be shortened accordingly.

Frequency	Item	Action
Daily	F-Theta Lens	Visually inspect the outer surface of the F-Theta lens for cleanliness (focus on dust, dirt, or spatter residue). Clean immediately following Section 6.3 if contaminated.
	Chiller	1. Check coolant level is within the "NORMAL" range. 2. Confirm displayed temperature matches set point. Check for leaks, unusual noises, etc.
Monthly	F-Theta Lens	Perform a standard cleaning following the procedure in Section 6.3, using anhydrous ethanol and F-Theta lens cleaning tissue.
	Chiller	1. Re-check coolant level. Top up with deionized water if below the "NORMAL" lower limit. 2. Check coolant for cloudiness or discoloration. If present, perform the quarterly water change procedure early.
Quarterly	Chiller	Replace the coolant. Check cleanliness of water circuit and air filter; clean as needed.
	Laser Tube	Measure the laser output power. Contact after-sales service if power drops by more than 2W for cause investigation.
Annually	The Whole Machine	Contact after-sales service for annual professional maintenance, including: 1. Optical path alignment (collimation adjustment of

		galvanometer and beam expander). 2. Laser power attenuation testing and evaluation. 3. Key component aging assessment and replacement recommendations. 4. Control software version update and overall system commissioning.

6.3 Cleaning the F-Theta Lens

The (focusing) lens directly affects marking precision and laser transmission efficiency. Contamination can lead to blurry marks, power attenuation, and in severe cases, laser damage. It requires focused maintenance.

Normally, only the outward-facing side of the lens needs cleaning. However, also check the other side for dirt and clean it if necessary.

Cleaning Steps:

- Remove and hold the lens securely. Use a dust blower (never blow with your mouth) to gently blow air from the center to the edges to remove loose dust.
- Wear clean gloves. Moisten a piece of lens cleaning tissue with a small amount of anhydrous ethanol (just enough to dampen, not drip). Gently wipe in a single direction from the center of the lens to the edge. Never wipe back and forth or in circles. Use a fresh piece of tissue for each wipe.
- After cleaning, inspect the lens carefully under light to confirm no residue, fingerprints, or scratches remain before reinstalling.

6.4 Chiller Maintenance

1. **Coolant Requirements:** Must use deionized water, purified water, distilled water, or high-purity water.

2. **Prohibited Fluids:** Tap water, mineral water, oily liquids, liquids containing solid particles, or corrosive liquids.

3. **Replacement Procedure:** Drain the old coolant, clean the internal tank, then refill with new coolant.

4. **Antifreeze Use (Ambient Temperature < 2° C):**

- Ethylene glycol or propylene glycol type antifreeze can be used, with a concentration not exceeding 30% recommended.
- The antifreeze MUST be drained immediately when ambient temperature rises above 5° C. Then, use deionized water, purified water, or distilled water as coolant and run

the chiller for at least 30 minutes to flush out residual antifreeze. Drain again and refill with the specified coolant.

6.5 Maintenance for Long-Term Storage

If the equipment will be out of service for more than 1 month, perform the following maintenance steps:

1. Power off the equipment following the procedure in Section 5.3 and drain all coolant from the chiller.

2. Perform a thorough external cleaning of the laser head, control screen, chiller, etc., to remove dust and oil.

3. Wrap the equipment using the original packaging materials or dust/moisture-proof covers. Store in a dry, ventilated, non-corrosive gas environment (recommended temperature: -20° C ~ 50° C, humidity: 20% ~ 80%).

4. Power on the entire system and let it run for about 2 hours every month to keep internal components active and prevent moisture damage.

5. If regular power-on is not possible, place desiccant inside the equipment storage area to prevent moisture absorption.

VII. Troubleshooting

7.1 General Troubleshooting Principles

1. Troubleshooting must be performed by authorized technical personnel. Always disconnect equipment power and wear necessary protective gear before starting. Never disassemble core components like the laser source or control card without authorization.

2. Follow the principle of "Start Simple, check software first, then hardware". Prioritize checking simple issues like cable connections and parameter settings before considering hardware faults.

3. If the fault persists after following the methods in this manual, or if serious conditions occur such as smoke, abnormal sounds, or burning smells, immediately stop using the equipment and contact Dikai Tech After-sales Service. Provide information such as equipment model, fault phenomenon, and alarm codes.

7.2 Common Troubleshooting Table

No.	Fault Phenomenon	Possible Cause	Handling Method
1	Software operates normally, but no laser output	Incorrect laser model setting in software	Check and correct the laser model in the software to match the current equipment, then restart.
		Marking file corrupted or incompatible format	Create a new simple test file for marking to rule out file issues.
		Incorrect trigger parameter setting or sensor fault	Check trigger parameter settings. Check if external sensor is working.
		No encoder signal input in "Flying Marking" mode	Check encoder cable connection is secure, and wheel contact with conveyor/roller is good. Replace encoder if faulty.
		Internal laser fault	Do NOT disassemble yourself. Contact Dikai After-sales Service.
2	Poor marking result (blurry, uneven depth)	Material not at the focal plane	Adjust working distance.
		F-Theta lens surface contaminated	Clean the F-Theta lens following the standard

			procedure in Section 6.3.
		Incorrect marking parameter settings	Re-adjust power, speed, frequency, etc., according to material properties.
		Software output anomaly	Restart the marking software. If ineffective, contact after-sales for the latest software version upgrade.
3	Laser marker never enters "Ready" state	Loose cable connection	Check and firmly reconnect all cables. If problem persists, contact Dikai Tech.
		Laser marker hardware fault	Contact Dikai After-sales Service.
4	After power-on, control screen stays on "Connecting to Controller" screen	Device IP address does not match the controller IP address setting	Check and ensure the controller's IP address is set correctly. If not, set the controller's IP address to match the current controller, then restart the equipment.
5	During marking, laser stays at one point, cannot scan full pattern	Incorrect laser model setting	Change laser type setting to the current equipment model, then restart.
		Incorrect marking file path or coordinate setting	Create a new test file and reset marking origin coordinates to rule out file coordinate issues.
		Loose/damaged control screen cable	Power off, check control screen cable, reconnect firmly. Replace cable if damaged via after-sales.
		Galvanometer system fault	Do NOT disassemble galvanometer yourself. Contact Dikai After-sales Service to replace with original galvanometer. Professional optical path collimation is required after replacement.

7.3 Alarm Codes and Handling Methods

During operation, the control screen displays real-time fault alarm codes. Refer to the table below for handling methods corresponding to each code. If the alarm persists after

following the steps, or if the fault is complex, do NOT disassemble the equipment yourself. Contact Dikai Tech After-sales Service immediately for professional support.

Alarm Code	Alarm Description	Solution
000001	Pump Source High Temperature Alarm	1. Check if laser heat dissipation is adequate; ensure good ventilation. 2. Check if the internal cooling fan of the laser is functioning.
000002	Pump Source Low Temperature Alarm	1. Check if ambient temperature is too low; turn on heating (e.g., A/C in heat mode) if necessary. 2. Check if the temperature sensor connection is loose.
000003	Laser Head High Temperature Alarm	1. Check if the laser head housing heat dissipation is adequate. 2. Check if the laser head cooling fan is working.
000004	Laser Head Low Temperature Alarm	1. Check if ambient temperature is too low; turn on heating if necessary. 2. Check if the temperature sensor connection is loose.
000005	Ambient Temperature High Alarm	1. Check if ambient temperature is too high; turn on air conditioning for cooling if necessary. (Note: Some modes have auto-recovery with ~2° C hysteresis. E.g., alarm at >50° C, clears automatically when temp drops below 48° C.)
000006	Ambient Temperature Low Alarm	1. Check if ambient temperature is too low; turn on heating if necessary. 2. Check if the temperature sensor connection is loose. (Note: Some modes have auto-recovery with ~2° C hysteresis. E.g., alarm at <20° C, clears automatically when temp rises above 22° C.)
000007	Safety Interlock Open Alarm	Check if the INTERLOCK interface connector at the equipment rear is detached. Check if the two pins connected to the interlock interface are shorted (e.g., is the chiller interlock switch closed?).
000009	Crystal 1 Temperature High Alarm	Power cycle the laser tube (turn OFF and ON). Ensure ambient temperature is within the allowed operating range (5° C - 40° C).
000010	Crystal 1 Temperature Low Alarm	
000011	Crystal 2 Temperature High Alarm	
000012	Crystal 2 Temperature Low Alarm	

VIII. Appendices

Appendix A: Glossary

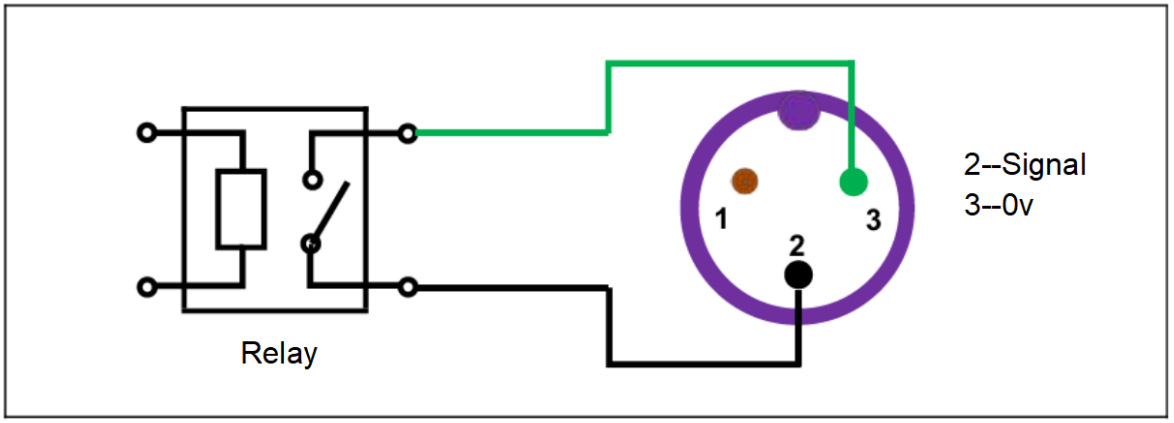
Term	Description
UV Laser	Laser with a wavelength of 355nm. Features small focused spot size and minimal heat-affected zone, suitable for precision marking and micro-processing.
Galvanometer Scanning System	A system comprising two high-speed oscillating mirrors (galvanometers), used to precisely control the 2D scanning path of the laser beam.
F-Theta Lens	A flat-field focusing lens. Used to focus the scanning laser beam onto the working plane and determines the marking field size and focused spot size.
Flying Marking	A marking mode where the equipment marks on products moving continuously on a production line, synchronizing with the line speed via an encoder.

Appendix B: Interface Details

1.TRIGGER Signal Interface

Pin	Function	Description
Pin1	IF_12-24V	Power Output
Pin2	TRIGGER	Trigger Signal Input
Pin3	GND	Ground

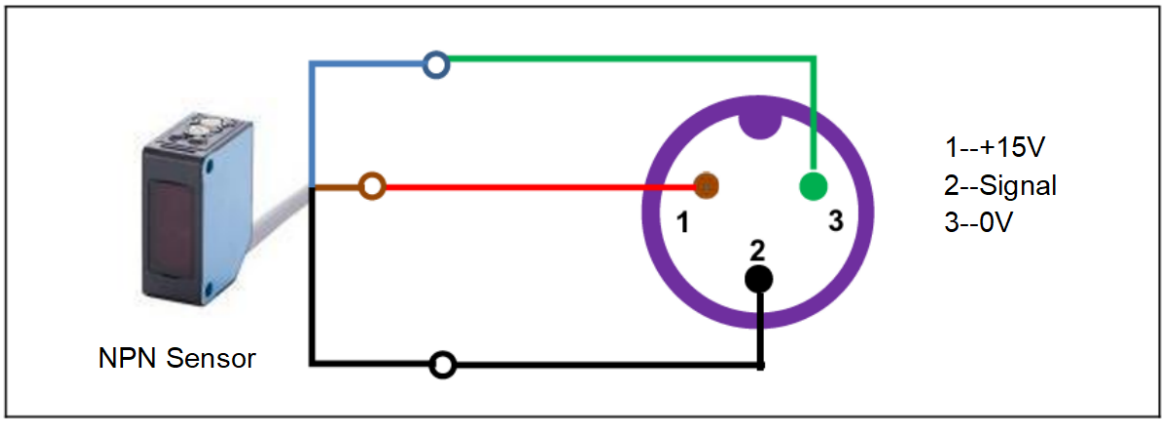
- NPN Dry Contact Connection



Note: When connecting a dry contact signal, the print signal provided by the packaging machine must be passive (dry contact). If it's an active signal, add a relay or optocoupler for isolation when connecting to the laser marking machine. Connect the active signal to the

relay coil, and connect the laser marking machine's trigger signal to the relay's normally open (NO) contacts.

- NPN Sensor Connection



2. Encoder Interface

Pin	Function	Description
Pin1	IF_12-24V	Power Output
Pin2	EnCo_SA	NPN encoder A-phase input
Pin3	EnCo_SB	NPN encoder B-phase input
Pin4	GND	Ground

The NPN encoder is used, with an output voltage of 15V. It is recommended to use a resolution of 2000 pulses or higher. The standard encoder is 10-30V, 2500 pulses, and 2-meter connecting wire.

3. Alarm Interface

Pin	Function	Description
Pin1	IF_12-24V	Power Output
Pin2	OUT0	Output port 0, open collector (NPN type) output, maximum 500mA
Pin3	OUT1	Output port 1, open collector (NPN type) output, maximum 500mA
Pin4	OUT2	Output port 2, open collector (NPN type) output, maximum 500mA
Pin5	GND	Ground

This interface contains three error signal outputs, all of which are active signals. To link with the packaging machine, an external 12V relay is required to avoid signal interference.

4. Extend Interface

Pin	Function	Description
Pin1	IN3	Control input 3 is an NPN type input that can be used together with the Pin7 emergency stop control pin as an alarm input during emergency stop
Pin2	LASER_TX	Laser RS232 communication serial port sends output
Pin3	LASER_RX	Laser RS232 communication serial port sending input
Pin4	S_OUT0+	Isolate the output port MYOUT0+and form a dry contact output with MYOUT0-, 60V, 500mA
Pin5	GND	Ground
Pin6	TSEL	Communication options include pin, floating and touchscreen communication, low-level and external device communication
Pin7	ESEL	External emergency stop control pin, internal PWM connected when pulled down, otherwise disconnected
Pin8	S_OUT0-	Isolation output port S_OUT0-, form a dry contact output with S_OUT0+, 60V, 500mA
Pin9	S_OUT1+	Isolate output port S_OUT1+, and form a dry contact output with S_OUT1-, 60V, 500mA
Pin10	S_OUT1-	Isolated output port S_OUT1-, and form a dry contact output with S_OUT1+, 60V, 500mA

5. Interlock Interface

Pin	Function	Description
Pin1	IN3	Input port 3, NPN type input
Pin2	IN4	Input port 4, NPN type input
Pin3	GND	Ground
Pin4	RS232_TX	RS232 communication serial port sending output
Pin5	RS232_RX	RS232 communication serial port receives input
Pin6	LASER_OUT	Laser shutdown signal, collector open circuit (NPN type) output, maximum 500mA
Pin7	IF_12-24V	Power output, directly connected to the power supply input of PL14-Pin1

Appendix C: Contact Information of Dikai Tech

- Email: info@dkcoding.net
- Website: https://www.dkcoding.net/

Appendix D: Document Revision Record

Revised Version	Revision Date	Revision Content	Reviser
V1.0	March 2026	Initial version	Dikai R&D Department