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I. Introduction

⚠WARNING Before using the equipment, please read the instruction manual carefully to fully understand the relevant functions of the equipment. This ensures the correct use of the engraving machine and prevents accidents. Failure to comply with safety precautions and the instruction manual may result in electric shock, fire, or other dangers. Please keep the manual properly for future reference.

1.1 Safety Instructions

1.1.1 Work Area Safety Guidelines

◆ Always keep the work area clean, orderly, and well-lit. Cluttered or dimly lit areas can easily cause accidents. All tools and materials should be stored in designated locations. Clean up waste and debris promptly to ensure a clean and unobstructed area. Never misuse cables; Do not use cables for lifting, dragging, or directly unplugging the controller.

◆ Strictly prohibit operating the equipment in flammable or explosive environments, including but not limited to places with flammable liquids, gases, or dust (such as wood chips, metal powder, organic particles, etc.). Equipment operation may generate electrical sparks or high temperatures, posing a combustion risk. The work area must be equipped with fire prevention facilities, and smoking or open flames are strictly prohibited.

◆ During operation, all unrelated personnel—especially children and bystanders—must maintain a safe distance from the equipment. The operator should concentrate and strictly avoid talking to others, using mobile phones, or engaging in any activity that may distract attention, to prevent loss of control and accidents.

◆ The work area must have good ventilation to promptly exhaust smoke and dust generated during processing. Simultaneously, ensure there is sufficient operating and evacuation space around the equipment, and avoid operating the equipment in cramped or enclosed environments.

1.1.2 Equipment Electrical Safety Guidelines

◆ The engraving machine must use the original plug that exactly matches the power socket specifications. Modifying, removing, or adapting the original plug and wiring of the equipment in any form is strictly prohibited. All electrical connections must ensure reliable grounding. Using plugs or sockets without grounding function is forbidden. It is recommended to install a Ground Fault Circuit Interrupter (GFCI/RCD) in the power supply circuit to significantly reduce the risk of electric shock.

◆ Strictly prohibit operating or storing the equipment in damp, rainy, or liquid-prone environments. Water droplets or moisture entering the equipment may cause serious electric shock accidents. During operation, keep hands, feet, and the working environment dry. Avoid direct body contact with grounded objects (such as metal frames, water pipes, etc.) to prevent increased risk of electric shock.

◆ Do not pull, twist cables, or move the equipment or unplug by dragging the power cord. Power cords should be kept away from heat sources, oil contamination, sharp edges, and moving parts of the equipment to prevent insulation damage or wire breakage. Regularly inspect the cable condition. If aging, cracks, deformation, or overheating are found, stop use immediately and contact professionals for replacement.

◆ Non-professionals are not allowed to disassemble or modify the control box and motor parts. Any electrical repairs and component replacements must be performed by qualified electricians. If equipment leakage, abnormal heating, burning smell, arcing, or frequent circuit breaker tripping is detected, immediately cut off the power, contact after-sales service, and strictly prohibit operating with faults.

◆ It is recommended to install independent overcurrent and short-circuit protection devices in the equipment's power supply circuit. If the working environment has potential liquid splash risks, use waterproof sockets and cable protection sleeves additionally. When not in use for extended periods, disconnect all connections between the equipment and the power source.

1.1.3 Personnel Safety Guidelines

◆ Please maintain a high level of vigilance, strictly adhere to operating procedures, and master basic usage knowledge before using the engraving machine.

◆ Strictly prohibit operating the engraving machine when fatigued, or after consuming alcohol, medication, or any substance that may impair judgment. Any negligence during operation, even for a moment, may lead to serious personal injury.

◆ To ensure safety, always use Personal Protective Equipment (PPE) correctly. Safety glasses must be worn during operation to prevent debris from entering the eyes; Select and use dust masks, anti-slip safety shoes, helmets, and hearing protection appropriately based on the working environment to effectively reduce injury risks.

◆ Before connecting the power, confirm the switch is in the "OFF" position to prevent accidental startup; Promptly remove wrenches, cutting tools, and other items from the rotating parts of the spindle motor to avoid ejection injuries.

◆ Always maintain a stable stance and body balance during operation, ensuring quick control of the equipment in case of emergencies.

◆Wear appropriate work clothes, avoiding loose clothing and jewelry; Tie up long hair and keep it away from moving parts of the equipment to prevent entanglement.

◆Adopt effective dust removal measures to reduce dust inhalation and explosion risks, and regularly check the equipment status to ensure all safety protection devices are intact and usable.

◆Strictly prohibit untrained personnel from operating the engraving machine. Conduct daily safety drills and risk education to comprehensively improve accident prevention capabilities.

1.1.4 Usage Safety Guidelines

◆Do not force the installation of the engraving machine. During installation, use appropriate power tools. The specified tools not only improve installation efficiency but also ensure the safety and reliability of the installation process.

◆Pay attention to regular maintenance of the engraving machine. Check for misalignment or binding of moving parts, broken components, and any other conditions that may affect engraving machine operation. If the equipment is damaged, the engraving machine must be repaired before use. Many accidents are caused by lack of equipment maintenance.

◆It is recommended that a single machine be operated primarily by one person. If others need to assist or observe, they should maintain a safe distance to avoid accidental contact caused by multiple people operating simultaneously.

◆Used, damaged tools that have been replaced should be placed in dedicated, puncture-resistant containers for centralized disposal. Random placement is strictly prohibited to prevent cuts.

◆Before any inspection, maintenance, cleaning, or adjustment (including tool changes), the "Lockout-Tagout" procedure must be strictly implemented. This means disconnecting all energy sources (electrical) and attaching warning tags to prevent accidental activation by others.

◆If the power switch cannot be turned on or off normally, immediately stop using the equipment. A machine that cannot be controlled by its switch poses a serious safety hazard and must be reported for repair and inspected by professionals promptly. Before making any adjustments, replacing accessories, or storing the equipment, always unplug the power plug. This preventive measure effectively avoids accidental startup of the equipment.

◆Idle engraving machines should be placed in areas inaccessible to children. Operation by personnel who have not read and understood the manual is strictly prohibited. Operating an engraving machine by untrained users is highly likely to cause danger.

◆Perform regular maintenance on the engraving machine, focusing on whether moving parts are misaligned, stuck, or have abnormalities such as breakage. Once damage is found, it must be repaired before continued use. Many accidents stem from lack of daily equipment maintenance.

◆Keeping cutting tools sharp and clean is also very important. Well-maintained, sharp tools are less likely to break and cut more smoothly and safely.

◆Before operation, fully assess the processing environment, material characteristics, and equipment capabilities, strictly following the instructions in the manual. Non-standard operations may cause serious accidents. Additionally, work in a well-lit and ventilated environment, ensuring the work area is tidy and free of clutter that may interfere with the operator's line of sight and movement path.

Please refer to the above safety instructions. When using engraving machines, accessories, cutting tools, and other equipment, carefully consider the working environment and the products to be processed. **Failure to operate according to this manual may lead to dangers.**

1.2 Unpacking the Equipment

Upon receiving the engraving machine equipment, first check if the outer packaging is intact and undamaged. Exercise caution during unpacking to avoid damaging the equipment. After removing the main unit, immediately inspect the **Safety Precautions** label affixed to a conspicuous location on the machine body, focusing on reading the equipment operation safety regulations.

The side of the machine body features a QR code for the "JingZhiNiuYun" learning platform. Scan this code with a mobile phone to access the teaching platform and watch relevant video tutorials on equipment operation, maintenance, and troubleshooting.

Special Note: Before initial startup, check for and remove any protective devices used to secure the equipment during transportation, ensuring the machine is in a ready-to-use state.

The equipment comes with an accessory box bearing a detailed accessory list. Please verify all accessories against this list item by item to ensure all components are complete and undamaged.

Checklist Steps:

① Cross-reference the accessory list and check item by item for completeness.

② Inspect the appearance and functionality of the accessories. If any damage or missing items are found, record and take photos for documentation.

③ If accessories are missing or abnormal, promptly contact after-sales customer service. Provide relevant photos and equipment information to facilitate the arrangement of replenishment or replacement.

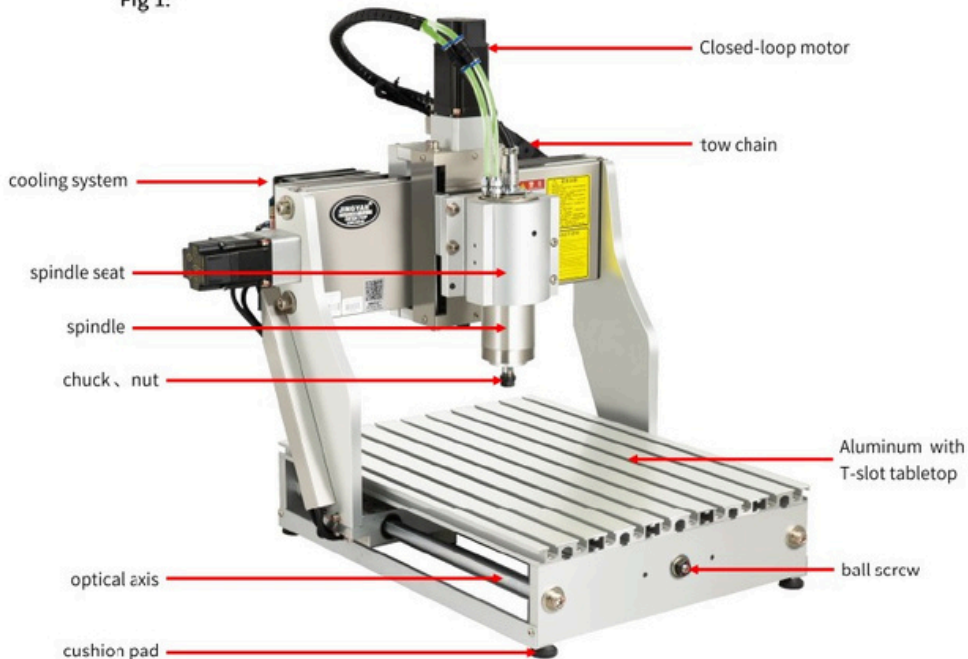
II. Equipment Overview

This section primarily introduces the components, technical parameters, installation, and commissioning of the engraving machine.

2.1 Equipment Components Introduction

A schematic diagram of the main components of the engraving machine (Fig 1) is as follows:

Fig 1:



The electrical control system of the engraving machine primarily consists of the JYH04 offline handle system, Mach3 control system, JYS4 offline electrical control system, JYSE4 offline electrical control system, and JYX4 offline electrical control system. The control boxes for each system and their corresponding handwheels are listed in the table below:

Name	Mach3 Control System	JYH04 Offline Handle System	JYS4 Offline Control System	JYSE4 Offline Control System	JYX4 Offline Control System
Handle					
Control Box					

2.2 Equipment Parameters

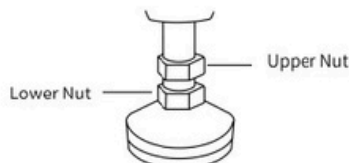
M-Series Parameter					
Product Model	CNC3020-300W	CNC3020-800W	CNC3040/4030-800W	CNC4030-1.5/2.2KW	CNC3040-1.5/2.2KW
Working Voltage	220V			220V	
Control System	Mach3 System / J YH04 System /JYS4System JYSE4System /JYX4System				
Spindle Power (w)	300W	800W	800W	1.5KW/2.2KW	1.5KW/2.2KW
Spindle Speed (RPM)	12000	24000	24000	24000	24000
Collet Size (mm)	ER11 1-7mm	ER11 1-7mm	ER11 1-7mm	ER11 1-7mm ER20 1-13mm	ER11 1-7mm ER20 1-13mm
Cooling System	Spindle Fan Cooling	Circulating Water Cooling System	Circulating Water Cooling System	Circulating Water Cooling System	Circulating Water Cooling System
Overall Dimensions (mm)	560*450*510	590*500*550	690*620*650	690*620*650	610*710*650
Table Size (mm)	450*240	450*240	540*400	540*400	450*480
Stepper Motor - X-Axis	57 Type 3A	Closed-Loop 57 Type 3A	Closed-Loop 57 Type 3A	Closed-Loop 57 Type 3A	Closed-Loop 57 Type 3A
Stepper Motor - Y-Axis	57 Type 3A	Closed-Loop 57 Type 3A	Closed-Loop 57 Type 3A	Closed-Loop 57 Type 3A	Closed-Loop 57 Type 3A
Stepper Motor - Z-Axis	57 Type 3A	Closed-Loop 57 Type 3A	Closed-Loop 57 Type 3A	Closed-Loop 57 Type 3A	Closed-Loop 57 Type 3A
Slide Unit - X-Axis	16mm Chrome-Plated Hardened Linear Shaft	16mm Chrome-Plated Hardened Linear Shaft	20mm Chrome-Plated Hardened Linear Shaft	20mm Chrome-Plated Hardened Linear Shaft	20mm Chrome-Plated Hardened Linear Shaft
Slide Unit - Y-Axis	16mm Chrome-Plated Hardened Linear Shaft	16mm Chrome-Plated Hardened Linear Shaft	20mm Chrome-Plated Hardened Linear Shaft	20mm Chrome-Plated Hardened Linear Shaft	20mm Chrome-Plated Hardened Linear Shaft
Slide Unit - Z-Axis	12mm Chrome-Plated Hardened Linear Shaft	12mm Chrome-Plated Hardened Linear Shaft	16mm Chrome-Plated Hardened Linear Shaft	16mm Chrome-Plated Hardened Linear Shaft	16mm Chrome-Plated Hardened Linear Shaft
Transmission Unit	1605 Ball Screw				
Limit Switch	Proximity Limit	Magnetic Encoder Electronic Limit	Magnetic Encoder Electronic Limit	Magnetic Encoder Electronic Limit	Magnetic Encoder Electronic Limit
Repeatability Positioning Accuracy (mm)	0.02				
Machining Speed (Max)	≤3500mm/min	≤6000mm/min	≤6000mm/min	≤6000mm/min	≤6000mm/min
Machine Weight (kg)	38kg	43kg	60kg	65kg	65kg
Packing Dimensions (cm)	49*59*60	49*59*60	68*58*62	68*58*62	68*58*62
*Data based on factory internal testing standards					

2.3 Installation and Commissioning

2.3.1 Equipment Installation

①Equipment Leveling Move the machine to a flat and solid floor that can support its weight. Adjust the leveling feet to ensure the machine is perfectly level. First, loosen the upper nut of each foot to unlock it. Then, adjust the lower nut to level the machine. Finally, tighten the upper nut against the machine base to lock the foot in place, ensuring stability. Use a spirit level to measure the levelness of the machine from all directions.

②Removal of Shipping Safety Devices Use the provided tools to loosen the shipping fixation screws at the front of the machine. Ensure all shipping protection components (e.g., spindle locking block, Z-axis anti-fall nut) have been removed. After removal, manually check that all motion axes move smoothly without mechanical obstruction.



③ **Electrical Grounding System Installation** Ensure the equipment is reliably grounded. If the power supply system lacks grounding, use the provided grounding wire. Connect one end to the equipment's grounding terminal and the other end to a safety-standard compliant grounding device (e.g., building grounding network). After grounding, verify its reliability.

④ **Cooling System Filling** Open the coolant tank cap. Use dedicated tools to add the specified type of coolant. Note: The fluid level should not exceed 80% of the nominal capacity, leaving expansion space. After initial filling, start the coolant circulation pump to bleed air from the lines.

⑤ **Spindle Unit Installation** Remove the spindle from its packaging. Clean the mounting surface, then vertically lower the spindle into the spindle holder. After adjusting to the appropriate height, use tools to tighten the fixation screws. After installation, manually rotate the spindle to confirm smooth operation.

⑥ **Electrical Connection** With the power OFF, connect all the equipment's aviation plugs to their corresponding sockets and tighten the locking rings. Ensure all connections are secure, and organize the wiring harness neatly to avoid interference with moving parts.

Note: The installation process must be performed by qualified personnel to ensure standard procedures are followed.

2.3.2 Equipment Commissioning

① Turn the emergency stop button clockwise to release it. Press the power button to switch on the machine. Wait for the system interface to load completely.

② After the system loads, a prompt "Return to Machine Origin?" will appear. Click the confirm button on the operation panel to return to the machine origin.

③ Click the mode switch button to change the movement mode to the handwheel mode. After selecting the X, Y, or Z axis on the handwheel, use the X1, X10, X100 multiplier switches to control the movement of the respective axis. Check if the movement function for each axis is normal. Then perform a reverse movement.

④ Move each axis to its maximum and minimum travel limits to check if the travel limit protection function is working correctly.

⑤ Click the spindle button on the panel to turn the spindle on/off, testing whether the spindle rotation function is normal.

⑥ Check if the spindle water cooling fan and coolant pump are working normally. Check if the automatic lubrication pump functions correctly upon startup. Verify the operation of the coolant switch function. After the above basic checks, the machine's fundamental functions should be confirmed normal. If any issues are encountered during commissioning, please contact after-sales service for resolution.

III. Equipment Operation Process

3.1 Startup and Preliminary Checks

① Before starting, check all machine connections and external equipment for normal condition. After verification, turn the emergency stop button clockwise to release it, press the power button to energize the machine, and wait for the system interface to load completely.

② After the CNC system loads, a prompt "Return to Machine Origin?" will appear. Click **[OK]** in the operating system to return to the machine origin.

③ Use the **[X-]**, **[X+]**, **[Y-]**, **[Y+]**, **[Z-]**, **[Z+]**, **[A+]**, and **[A-]** buttons in the operating system or use the handwheel to move the respective axes. Check the movement function of each axis.

④ Move each axis to its maximum and minimum travel limits to test the machine's travel limit protection function.

⑤ Press the spindle ON/OFF button in the operating system to control the spindle start/stop, testing the spindle function. (**⚠Caution:** If a tool is installed on the spindle, ensure it is securely clamped to prevent the tool from flying out and causing injury.)

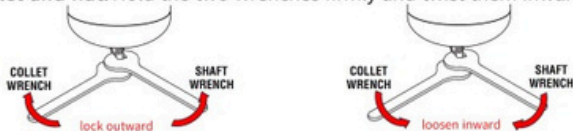
⑥ After startup, check if the spindle water cooling fan and coolant pump start and operate normally.

3.2 Tool Installation

⚠To prevent personal injury, always ensure the spindle has completely stopped rotating before installing or removing tools and accessories. Confirm that no one can start the spindle during the installation process.

To tighten the collet and nut: Hold the two wrenches firmly and twist them outward away from each other to tighten.

To loosen the collet and nut: Hold the two wrenches firmly and twist them inward towards each other to loosen.



① First, move the spindle to a position convenient for tool changing. Then, use the spindle wrench and the collet nut wrench to engage the spindle's tool mounting slot and the collet nut slot, respectively.

② Using the spindle wrench and the collet nut wrench, turn them inward (towards each other) to loosen the collet nut assembly.

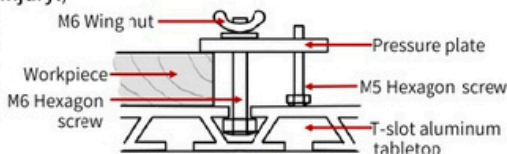
③ Confirm that the shank diameter of the tool to be installed matches the collet diameter. Then, insert the collet into the collet nut, and insert approximately two-thirds of the tool's shank into the collet.

④ Tighten the collet nut assembly (with the tool installed) onto the spindle using the two wrenches, turning them outward (away from each other). To ensure normal cutting performance, ensure the cutting edges are not inserted into the collet.

3.3 Securing the Workpiece Material

The method for securing the workpiece should be chosen based on the workpiece shape, material characteristics, machining operations, and required precision. Typically, thin sheets are fixed using double-sided tape; and irregularly shaped workpieces are fixed with custom fixtures. The pressure plate is the most commonly used fixture in engraving processing, and its usage should follow the instructions below for standardized operation: (⚠Caution: Always ensure the workpiece is securely clamped to prevent it from coming loose and causing personal injury!)

Use M5 hexagon screws for support and M6 hexagon screws to clamp the workpiece. Place the M6 hexagon screws into the I-slots of the I-slot tabletop, and position the M5 support screws on the surface of the T-slot tabletop. Tighten the wing nuts clockwise to clamp the workpiece in place.



3.4 Setting the Workpiece Zero Point

Setting the workpiece zero, also known as zeroing the workpiece coordinates, refers to resetting or redefining the origin point (0,0,0) of the workpiece coordinate system (typically G54) currently recorded by the engraving machine's control system to a new physical location. Besides defining the workpiece origin, this function simplifies resume-after-interrupt operations, multi-task machining, and batch production, making them more efficient.

The "Center Finding" function is used to set the coordinate value to half of the current coordinate value. This function is typically used for setting the workpiece origin.

For convenience when programming, the machining origin is usually set at the lower-left corner of the material or at the center of the material.

If the origin is set at the lower-left corner in the program, use the "Set Work Zero" function. Move the spindle so the tool tip coincides with the desired origin, then execute "Set Work Zero" to save this point. If the origin is set at the center of the material, use both the "Set Work Zero" and "Center Finding" functions. X-axis: Touch off the left side of the material and set X to zero. Then touch off the right side and use the "X-Axis Center Finding" function. Y-axis: Similarly, touch off the front side (set Y zero), then the back side, and use "Y-Axis Center Finding". Z-axis: Finally, move the spindle to touch the top surface of the material and set the Z zero.

Consider the tool diameter when setting the origin. For pointed tools, zero directly. For tools like end mills, offset the zero point by half the tool diameter after touching off.

3.5 Loading the Program

After setting the workpiece zero, select the machining program. Copy the program to a USB drive, save the code to the system's local disk, and then load it into the control system.

3.6 Starting Machining

Once the program is loaded, click the **【Start】** button to begin machining.

3.7 Tool Changing and Tool Setting

When a tool breaks, wears out, or other situations require a tool change, proceed according to the following scenarios:

① No Tool Changer, No Tool Setter:

Engage the spindle wrench on the spindle flats and the collet wrench on the collet nut. Turn the collet wrench counterclockwise (inward towards the spindle wrench) to loosen the collet nut.

Continue unscrewing the collet nut until it is completely removed. Withdraw the old tool (push it out as shown in the left diagram) and place it in a safe area to avoid scratches.

If the new tool has a different diameter than the old one, or requires a different collet size, the collet must also be replaced. To replace the collet, gently push it to one side to loosen it (Fig2), remove it, place the new collet into the nut, and press it down firmly. Finally, insert the new tool into the collet (as shown in the left diagram), with the tool tip facing down (Fig3).

⚠The collet nut and collet use a self-locking design. Do not attempt to remove the collet by forcibly knocking it out.

Fig 2:

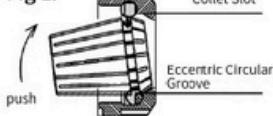
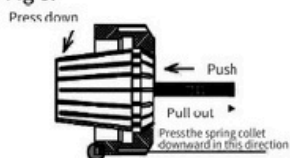


Fig 3:



After replacing the tool, the workpiece zero point for the X and Y axes remains unchanged. However, the Z-axis workpiece zero point must be reset. Move the spindle so the tool tip approaches the material surface. Just as the tip is about to contact the surface, click [Z Zero] and then confirm by clicking [OK]. This establishes the new workpiece zero point after the tool change.

② **No Tool Changer, With Tool Setter:**

First, return the machine to its home position. Change the tool using the method described in scenario ① above. After the new tool is installed and tightened, perform a fixed tool setting operation. The engraving machine will automatically move to a position above the tool setter for automatic tool measurement. Finally, reset the workpiece Z-axis zero point on the material surface. The specific operation is the same as the zero-setting method described in step 4 of scenario ①.

③ **With Tool Changer, No Tool Setter:**

First, return the machine to its home position. Change the tool using the tool changer, following the appropriate method for your machine. After the new tool is installed and tightened, perform a one-touch tool setting operation. The engraving machine will automatically move to a position above the tool setter for automatic tool measurement. Finally, use any tool from the tool changer to reset the workpiece Z-axis zero point on the material surface. The specific operation is the same as the zero-setting method described in step 4 of scenario ①.

IV. Fault Diagnosis and Troubleshooting

4.1 Pre-Troubleshooting Preparations

Before starting to troubleshoot faults with the engraving machine, the following preparations must be made to ensure the process is safe and efficient:

① **Safety Precautions:** Operators must wear insulated gloves, safety goggles, and anti-slip work shoes. Disconnect the engraving machine's main power supply to prevent electric shock. If the machine was in operation, first press the emergency stop button and wait for all movement to cease completely before proceeding.

② **Tool Preparation:** Prepare the necessary tools, including: Multimeter (for checking circuit voltage, current, resistance), Set of hex key wrenches (various sizes to fit screws on different machine components), Screwdrivers (Phillips and flat-head, with insulated handles), Clamp meter (for measuring motor current), Spirit level (for checking worktable levelness), Feeler gauge (for measuring component gaps), Brush (for dusting), Compressed air gun (for blowing out dust from components)

③ **Documentation Preparation:** Have the machine's instruction manual (containing electrical diagrams, mechanical drawings, parameter settings) and operational logs (recording daily operation status, past faults, and maintenance history) ready for reference during troubleshooting.

4.2 Common Fault Classification and Troubleshooting Methods

① **Carving Head Does Not Move Normally**

Symptom: No response, abnormally slow movement, or stuttering when attempting to move the carving head.

Possible Causes:

- ◆ Motor power circuit fault (e.g., broken wire, loose connection).
- ◆ Motor driver fault, unable to drive the motor properly.
- ◆ Poor ball screw and nut engagement (e.g., rusted screw, debris jam, severe nut wear).
- ◆ Guide rail obstructed by foreign object or damaged guide rail block.
- ◆ Z-axis brake relay or contactor fault, failing to release the brake.

Troubleshooting Steps:

1. Disconnect power. Use a multimeter to check the motor power circuit. Look for broken wires, then measure circuit resistance. Infinite resistance indicates a break (replace wire/reconnect). If wires are OK, check for loose connections, reseat and tighten.

2. Reconnect power. Command movement and measure the driver's output voltage with a multimeter. Zero or abnormal voltage indicates driver fault (replace driver). If voltage is OK, proceed.

3. Remove protective covers. Inspect the ball screw and guide rails. Clean screw with a brush; if rusty, polish lightly with fine sandpaper and apply special screw grease. Check the ball nut for excessive wear (scoring, large backlash) and replace if necessary.

4. Inspect guide rails for obstructions; clear with compressed air. Check guide blocks for damage (e.g., fallen balls, deformation) and replace if necessary.

5. Open the electrical cabinet. Locate the Z-axis brake relay/contacter. Check contacts for burning/oxidation. Test contact operation with a multimeter. Replace faulty relay/contacter. If contacts are OK, check coil voltage. If no voltage, check control circuit; if coil is faulty, replace the component.

② **Driver Alarm**

Symptom: Control software shows X/Y/Z axis driver alarm; driver displays a specific fault code.

Possible Causes:

- ◆ Machine was not properly homed on startup, soft limits inactive, movement exceeded allowable range causing motor stall.
- ◆ Mechanical fault (e.g., ball screw, guide rail, bearing) preventing motor rotation, causing stall. Faulty connection between motor and driver or broken encoder cable, preventing proper motor control.
- ◆ Motor fault causing driver alarm.
- ◆ Driver fault causing driver alarm.

Troubleshooting Steps:

1. Power cycle the machine. Home the machine as prompted upon startup. Check if movement is normal within the travel range.
2. Disconnect the motor from the load (e.g., via coupling). Run the motor unloaded. If it runs normally, the alarm is caused by a mechanical fault; check the ball screw, guides, bearings etc., for that axis. If it still fails, proceed.
3. Check the driver alarm code against the Panasonic A6 servo drive fault code table. If the code indicates a motor wiring issue, check corresponding motor cables for breaks or poor contact. If an encoder fault is indicated, check encoder cables.
4. Check the alarm code. To isolate a motor fault, temporarily swap motors between axes (if possible). If the fault follows the motor, replace the motor.
5. Check the alarm code. To isolate a driver fault, temporarily swap drivers between axes (if possible). If the fault follows the driver, replace the driver.

③ Abnormal Motor Operation (Noise, Overheating, Not Rotating)

Symptom: The motor produces abnormal noise (e.g., screeching, grinding), the motor casing is overheated (exceeding normal operating temperature, typically 60-70°C), or the motor does not rotate at all.

Possible Causes: (*The original text ends here. Common causes for these symptoms include:*)

Noise: Bearing failure, misalignment, loose components, foreign debris inside motor.

Overheating: Overloading, incorrect driver current settings, poor ventilation, failing bearings, high ambient temperature.

Not Rotating: Power supply issue, driver fault, brake failure (Z-axis), motor winding failure, severe mechanical binding.

Possible Causes:

- ◆ Unstable motor supply voltage (too high or too low).
- ◆ Motor winding short circuit or open circuit, preventing normal operation.
- ◆ Severely worn or damaged motor bearings, causing noise and heat during operation.
- ◆ Motor overload, exceeding its rated load capacity.
- ◆ Incorrect motor driver parameter settings, or driver malfunction.

Troubleshooting Steps:

1. Use a multimeter to measure the motor supply voltage and compare it to the motor's rated voltage (typically 220V or 380V for engraving machines). If the voltage is too high or too low, inspect the power supply circuit to resolve the instability issue (e.g., install a voltage stabilizer).
2. Disconnect the motor power and remove the power cables. Use a multimeter to measure the resistance of the motor windings. A reading of zero indicates a short circuit; an infinite reading indicates an open circuit. In either case, the motor windings need to be replaced, or the entire motor must be replaced.
3. Check the motor bearings. Manually rotate the motor shaft. If rotation is not smooth, feels sticky, or produces noise, the bearings are likely worn or damaged. Disassemble the motor end cover, remove the old bearings, and replace them with new bearings of the same specification. After replacement, apply an appropriate amount of bearing grease, and reassemble the motor end cover.
4. Check the motor load. Review the current machining parameters (e.g., engraving speed, depth) to see if they exceed the motor's rated load capacity. If overloaded, adjust the parameters (reduce speed/depth) or complete the engraving in multiple passes. If the overload is caused by mechanical binding (e.g., obstructed guides, stuck ball screw), resolve the mechanical fault to restore normal load.
5. Check the motor driver parameters. Refer to the equipment manual to verify that the driver parameters (e.g., motor model, current limit, micro stepping settings) are correct. If parameters are wrong, readjust them. If parameters are correct, operate the motor and use a multimeter to measure the driver's output current and voltage. If the output is abnormal, the driver is faulty and needs replacement.

④ Engraving Pattern Deviation or Misalignment

Symptom: The finished engraving pattern is misaligned (e.g., shifted left/right, up/down), has size inaccuracies (enlarged/shrunken), or has internal misalignment between pattern parts, preventing proper registration.

Possible Causes:

- ◆ Incorrect machining origin setting, causing misalignment.
- ◆ Mechanical fault causing loss of position during machining.
- ◆ Workpiece not securely clamped or fixtured.
- ◆ G-code error causing incorrect machine movement.

Troubleshooting Steps:

1. Check if the workpiece is placed upside down or mispositioned. The system can automatically correct positional deviations of less than 2mm.
2. Check for abnormal parameter values. If found, restore factory default parameters and then fine-tune as needed.
3. Check for backlash in mechanical transmission components (e.g., ball screw backlash, gear backlash). For ball screw backlash, adjust the nut's preload mechanism to reduce it. For excessive gear backlash, adjust the gear mesh or replace the gears. After adjustment, perform a reversal movement test to check for remaining backlash error.
4. Check the clamping of the engraving material, ensuring it is firmly secured to the worktable. If not secure, readjust the clamps or use a more reliable method (e.g., add clamping points, use vacuum table). After securing the material, re-run the engraving to check for deviations.

4.3 Post-Troubleshooting Testing and Verification

1. **No-Load Test:** After resolving the fault, first conduct a no-load operation test. Start the machine and command each axis (X, Y, Z) to move back and forth. Observe if the motors run smoothly without abnormal noise and if the movement accuracy meets requirements (check via scales or a dial indicator). Also, test functions like spindle raising/lowering and the emergency stop button to ensure they work correctly.
2. **Test Engraving:** Select a test piece of material identical or similar to the actual working material. Perform a test engraving using a simple pattern (e.g., lines, circles, text) with appropriate parameters (speed, depth, feed rate). During the engraving, closely monitor the machine's status, including motor operation, spindle cutting, and workpiece fixation. After completion, inspect the test piece's accuracy (dimensions, position, surface finish) to confirm the fault is fully resolved and machine performance is restored.
3. **Continuous Run Test:** If the test engraving is successful, perform a continuous run test. Select a more complex pattern and run the machine continuously for 1-2 hours (adjust based on actual workload). During the test, periodically check the machine's status: motor temperature, bearing temperature, component temperatures inside the electrical cabinet, and the movement accuracy of each axis. After the test, check the quality of the engraved work to ensure stable performance and no fault recurrence during extended operation.

V. Maintenance of the Engraving Machine

5.1 Ball Screw, Guide Rail, and Bearing Maintenance

Developing good machine usage habits is crucial. It is recommended to perform a cleaning and maintenance session approximately once a month, focusing particularly on the ball screws, linear shafts (rods), and bearings. During cleaning, first manually wipe the surfaces of the ball screws and linear shafts with a clean cloth. For hard-to-reach areas like bearings, use a small brush for careful cleaning. After cleaning, evenly apply an appropriate amount of lubricating oil to the ball screws, linear shafts, and bearings using an oil can. Next, start the machine and command it to move back and forth several times to ensure even distribution of the lubricant. If black residue continues to appear on the ball screws, wipe them clean again with a cloth. Repeat this "lubricate-wipe" process until the ball screw surfaces are restored to a bright and oily condition.

5.2 Spindle and Water Cooling System Maintenance






During machining, the spindle collet, collet nut, and threads are prone to dust accumulation or rust. It is recommended to regularly apply anti-rust oil to these areas and promptly remove any rust from the threads. If the collet or nut is severely rusted, they should be replaced immediately to ensure clamping accuracy and spindle concentricity. For 800W and 1.5KW water-cooled spindles, the internal bore and cooling chamber can also rust due to the internal water cooling structure. For cleaning, first completely drain the existing coolant. Then, fill the reservoir with a dedicated cleaning fluid, start the pump, and circulate it for 1-2 hours for cleaning. If the spindle has been idle for an extended period, consider extending the cleaning time to 4-5 hours. After cleaning, drain the cleaning fluid completely, refill with standard spindle coolant, and the spindle can resume normal operation.

5.3 Electrical Control Cabinet Maintenance

Dust can easily accumulate inside the control cabinet and machine during use, especially when processing metal materials. Conductive metal dust entering the control cabinet can cause short circuits or burn out circuits. Therefore, regular internal cleaning of the control cabinet is recommended. For this operation, first open the control cabinet cover. Use a blower set to the cool air setting or a cold air gun. Tilt the cabinet upside down and blow away dust from the surfaces of circuit boards and components. For corners that are

difficult to clean, use a small brush to gently remove dust, ensuring all conductive particles are eliminated. After cleaning, ensure the interior is completely dry before closing the cover and restarting the equipment.

VI. Common Consumables

Name	Image	Function
Spindle Collet Nut		Installed on the spindle. Works in conjunction with the tool collet to secure the tool.
Tool Collet		Installed on the spindle. Works in conjunction with the spindle collet nut to clamp and secure the tool.
Cutting Tool		Common consumables such as engraving bits, end mills, and drill bits. Can be replaced when broken or worn.
Ball Screw Lubricant		Used for lubricating ball screws, bearings, and linear shafts. Extends machine life and helps maintain precision.
Spindle Coolant		Cools the spindle. The high-speed rotation generates heat; coolant removes this heat, provides anti-rust and anti-corrosion properties, and increases spindle lifespan.

VII. Warranty and Technical Support for the Engraving Machine

Warranty Description: The entire engraving machine, including the frame, control cabinet, and hand-wheel, is covered by a one-year warranty, excluding consumable parts. Consumables include: couplings, spindle collets, spindle collet nuts, cutting tools, and the water spray system pump and nozzles. Additionally, the 300W spindle has a 3-month warranty, while the 800W and 2.2KW spindles have a 6-month warranty.

Technical Support Description: Technical support includes machine installation, basic function usage, engraving machine software installation, software programming guidance, and machining process guidance. It does not include drawing lessons or programming services (free learning materials can be provided). Free technical support is provided for six months. After the support period expires, customers can purchase extended technical support.

Any quality issues caused by transportation will be fully borne by us. If you encounter any problems while using this product, you must first contact our after-sales personnel. Please do not attempt repairs yourself, as this will void the warranty. If our after-sales team determines that a faulty part needs replacement, the replacement will be processed only after we have received and inspected the faulty component.

Failures caused by the following reasons will be subject to chargeable repair, even during the warranty period:

- ◆ Problems caused by incorrect operation, unauthorized disassembly, repair, or modification.
- ◆ Problems resulting from using the engraving machine beyond standard specifications.
- ◆ Damage caused by impact or improper storage (e.g., water ingress) after purchase.
- ◆ Operational failures caused by unauthorized modifications to the machine.
- ◆ Failures occurring due to use in environments that do not meet the requirements specified in this manual.
- ◆ Damage to the control cabinet caused by incorrect voltage connection or voltage instability.
- ◆ Failures caused by earthquakes, fires, lightning strikes, abnormal voltage, or other force majeure events.
- ◆ Scan the "Jingyan Technology" WeChat Mini Program QR code to obtain after-sales support.

VIII. Disclaimer

The information contained in this manual is for reference only and does not constitute any operational specifications or technical guarantees. Due to differences in actual equipment models, operating environments, and specific working conditions, users must make adjustments and judgments based on the actual status of the equipment during the actual commissioning and use process. For special circumstances or technical issues not covered in the manual, do not handle them on your own; instead, contact the manufacturer or authorized service provider to obtain professional support. Product specifications and information are subject to change without prior notice, and the manufacturer also reserves the right to improve the products and documents at any time and hold the final right of interpretation. The manufacturer shall not be liable for any consequences directly or indirectly caused by operations not in accordance with this statement.