MR Series CNC Router

User Manual

MR48 / MR510

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SINCE 2001

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Chapter 1: Safety Instructions

1.1 General Safety Guidelines

- Please read this manual carefully before operation to ensure a thorough understanding of the equipment's structure and operation methods.
- Only qualified personnel are permitted to operate this equipment.
- Appropriate personal protective equipment (PPE) must be worn during operation, such as safety goggles, earplugs, and dust masks.
- It is strictly forbidden to perform maintenance or replace tools while the equipment is in operation.

1.2 Explanation of Warning Symbols

The safety signs on the equipment are divided into the following categories according to the hazard class and type, and all operators must be familiar with them:

- DANGER Marking: Affixed to the location of the electrical box to warn of the danger of electric shock

- WARNING: Collision protection warning signs are posted on fast-moving machine beams

- Do not touch the warning sign and post it on the spindle unit

- Protection Requirements Labeling: Reminds operators that they must wear personal protective equipment (PPE), such as safety goggles, earmuffs, and gloves.

1.3 Personal Protective Equipment (PPE)

When operating the equipment, the following protective gear must be worn:

- **Safety Goggles**: To protect the eyes from flying debris or splashes.
- **Earplugs**: To reduce the impact of noise generated by the machine during operation.
- **Dust Mask**: To prevent inhalation of dust generated during the machining process.
- **Cut-resistant Gloves**: To protect hands from injury when replacing cutting tools.

1.4 Emergency Response Procedures

- In case of an emergency, immediately press the emergency stop button to cut off the power supply to the equipment.
- The emergency stop buttons are located at both ends of the gantry.
- In the event of a serious incident such as fire or electric shock, contact professional emergency services immediately.

1.5 Prohibited Actions

- Do **not** machine any workpieces that are not securely fixed in place.
- Do **not** process materials that are incompatible with this equipment.
- Do **not** perform maintenance or replace cutting tools while the equipment is powered on.
- Do **not** modify the electrical system or control software of the equipment without authorization.

Chapter 2: Product Overview

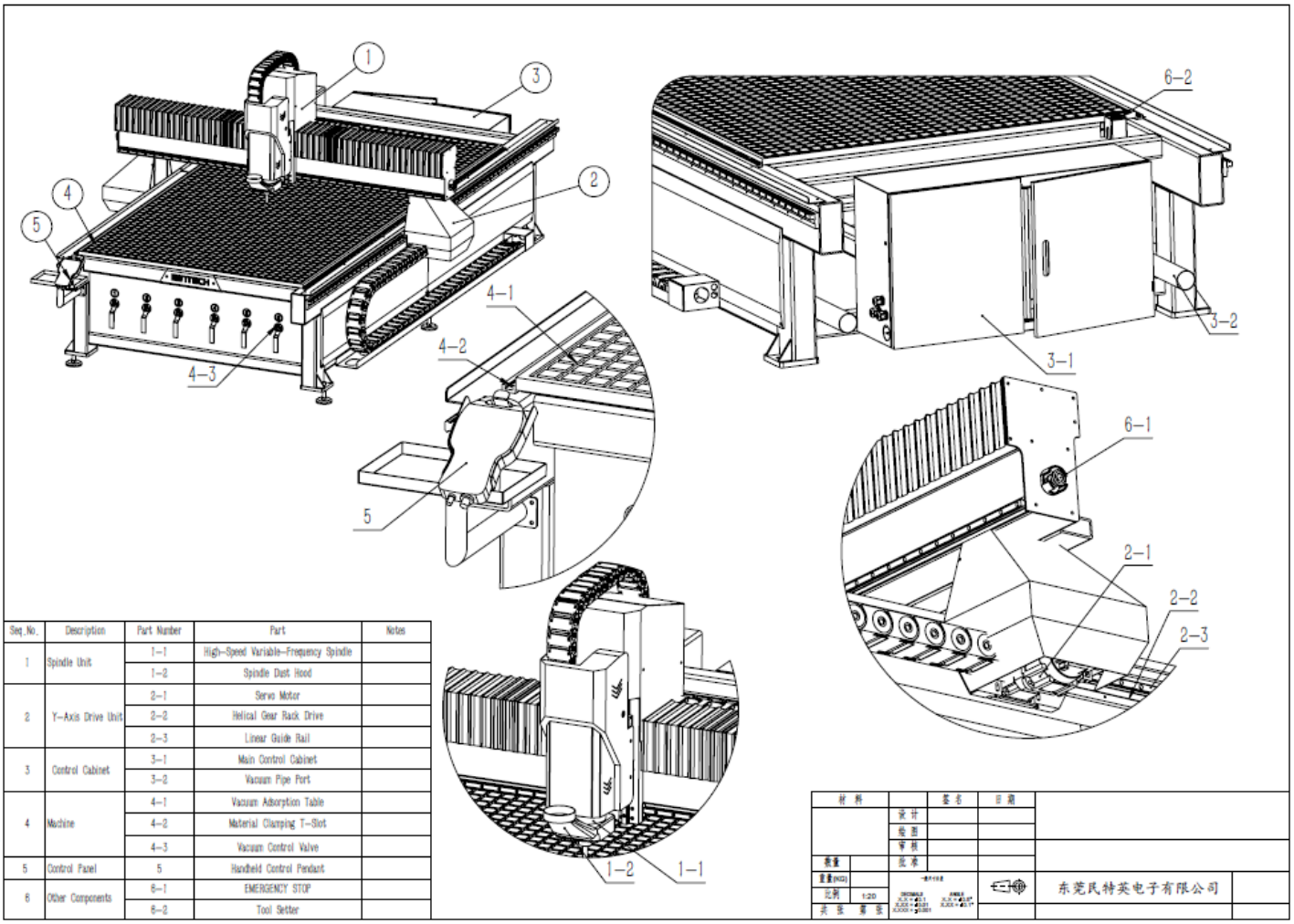
2.1 Product Positioning and Intended Use

The MR Series CNC Engraving Machine is a three-axis engraving device designed for entry-level users. It is suitable for light-duty machining scenarios such as woodworking, advertising, crafts, and small-batch customization. The control system features a handheld controller with an intuitive interface, making it easy for beginners to operate and quickly get started.

2.2 Product Structure and Components

Illustrative Description:

The diagram illustrates the overall structure of the MR Series CNC Engraving Machine, including its main components such as the spindle, electrical control box, worktable, and handheld controller.



Seq.No.	Description	Part Number	Part	Notes
1	Spindle Unit	1–1	High-Speed Variable-Frequency Spindle	
		1–2	Spindle Dust Hood	
2	Y-Axis Drive Unit	2–1	Servo Motor	
		2–2	Helical Gear Rack Drive	
		2–3	Linear Guide Rail	
3	Control Cabinet	3–1	Main Control Cabinet	
		3–2	Vacuum Pipe Port	
4	Machine	4–1	Vacuum Adsorption Table	
		4–2	Material Clamping T-Slot	
		4–3	Vacuum Control Valve	
5	Control Panel	5	Handheld Control Pendant	
6	Other Components	6–1	EMERGENCY STOP	
		6–2	Tool Setter	

材料		签名	日期	
	设计			
	绘图			
	审核			
数量	批准			
重量(KG)				
比例	1:20			东莞民特英电子有限公司
共 张 第 张				

1-1 High-Speed Variable Frequency Spindle
1-2 Spindle Dust Cover
2-1 Y-Axis Servo Motor
2-2 Y-Axis Helical Gear Rack

2-3 Linear Guide Rail
3-1 Main Control Cabinet
3-2 Vacuum Hose Connector

4-1 Vacuum Adsorption Table
4-2 Material Fixing T-Slot
4-3 Vacuum Control Valve
5 Handheld Controller

6-1 Emergency Stop Button
6-2 Automatic Tool Setter

2.3 Model

Model	Work Size	Machine Dimensions	Spindle	Power Supply
MR48	1300×2500mm	122"×87"×69" (3100×2200×1750mm)	3.5KW Water Cooing	220V/60Hz
MR510	1530×3060mm	158"×97"×69" (4000×2450×1750mm)	3.5KW Water Cooling	220V/60Hz

2.4 Supported Materials

The MR Series Engraving Machine is specifically designed for processing soft metals and non-metallic materials. It supports cutting and engraving of the following sheet materials:

Supported Materials:
Aluminum, MDF, Plywood, PVC, ABS, Acrylic, Plexiglass, Foam Board, KT Board, and similar materials.

Not Recommended Materials:
Steel, Marble, Ceramic, Metal Composite Panels, and other high-hardness materials.

Using unsuitable materials may result in tool wear, damage to the machine, or safety hazards.

Chapter 3: Technical Specifications

Machine Model	MR48	MR510
Machine Dimensions	122"×87"×69" (3100×2200×1750mm)	158"×97"×69" (4000×2450×1750mm)
Work Size	4’×8’(1250×2500mm)	5’×10’(1530×3060mm)
Net Weight	2690 lbs (1220 kg)	3858 lbs (1750 kg)
Z-Axis Travel	7 inches（180mm）	
Maximum Material Thickness	Up to 5 inches (130 mm)	
Maximum Cutting Thickness	Up to 4 inches（100 mm）, depending on material type and cutting tool specifications.	
Mechanical Structure	The frame is constructed from fully welded square steel tubing and undergoes high-temperature stress relief treatment to eliminate internal stress.	
Table Surface	The worktable features a precision-milled phenolic composite grid-style vacuum adsorption surface, with T-slot aluminum extrusions mounted on both sides for additional material clamping.	
CNC System	Supports file formats such as DXF, AI, CDR, NC, and G-code. The system can automatically generate G-code and supports both 2D and 3D machining operations.	
User Interface	Handheld Controller	
CAM Software Compatibility	Overview, Alphacam, Coreo, EngView, EnRoute, ProNest, SigmaNEST, VCarve, Aspire, and others.	
Dive System	Servo Drive System	
Transmission System	• XY Axis: Helical rack and pinion + square linear guide rails， • Z Axis: Ball screw + square linear guide rails	
Spindle	4.7HP(3.5KW),24000RPM, Water Cooling	
Tool Change	Manual Tool Changing	
Collet Type	ER20	
Moving Speed	82 Ft/min(25M/min)	
Machining Accuracy	±0.004 inches（±0.1 mm）	
Repeatability	±0.002 inches（±0.05 mm）	
Power Supply	• Main Machine: 208–240V, Single Phase, 30A • Vacuum and Dust Collection Systems: Power requirements depend on the selected models and configurations.	
Air Supply	0.6 - 0.8 MPa（87-116 psi） ≥3-5 CFM（85-140 L/min）	
Vacuum Adsorption	• Airflow Rate: 117.7–176.6 CFM (200–300 m^3/h) • Vacuum Pressure: ≥ 85 mbar (8500 Pa)	
Operating Environment	• **Ambient Temperature:** 10°C to 40°C (50°F to 104°F) • **Relative Humidity:** 40% to 60% (non-condensing)	

Chapter 4: Installation and Wiring

4.1 Installation Environment Requirements

- **Footprint Clearance:** Leave at least 1 meter of free space around the equipment for safe operation and maintenance.
- **Power Supply:** 220V, 60Hz, single-phase stable power source.
- **Temperature & Humidity:** Ambient temperature 10–40°C, relative humidity < 70%.
- **Floor Requirements:** Flat and solid surface capable of bearing at least 2000 kg (4400 lbs). Ensure vibration-free installation.

4.2 Unpacking and Inspection

- **Packing List:** Main machine, handheld controller, cutting tools, tool kit, cables, warranty card, and related accessories.
- **Shipping Damage Inspection:** Check for signs of deformation, spindle looseness, cracks in the electrical cabinet, or other visible damage.
- **Documentation:** Record any damage and take photos for verification and future reference.

4.3 Machine Positioning

- **Placing the Machine:** Position the equipment at the designated location. Adjust the leveling feet to ensure the machine is stable and level.
- **Grounding:** Proper grounding is essential to prevent static buildup and ensure operational safety. Verify the ground connection before powering on.

Chapter 5: Control System Operation (DSP Handheld Controller)

5.1 Handheld Controller Layout Description

- **Single key function**

All operations can be realized by single key or combination keys on the panel. The method of using a single key is to press and hold the key until the required function call is completed and then release the key. The mode switch key is valid when the mode switch key is up.

Key name	Function Description
<<	Auxiliary function shift left.
K1	Auxiliary function key.
K2	Auxiliary function key.
K3	Auxiliary function key.
K4	Auxiliary function key.

Auxiliary function shift right.

In the standby state, the opening and closing of the spindle will automatically turn on when performing automatic processing, and automatically turn off when the end is completed.

Measuring tool length.

Perform file management operations, such as loading, copying in, copying out, deleting, etc.

Enter the function interface such as parameter configuration.

In the standby state, the A axis moves in the positive direction.
Input of number key "1".

In the standby state, the Y axis moves in the positive direction.
Input of number key "2".

Select upward in the function options.

In the standby state, the Z axis moves in the positive direction.
Input of number key "3".

Increase processing speed ratio.

In the standby state, the X axis moves in the negative direction.
Input of number key "4".

Select left in the function options.

In the standby state, the switch between high-speed and low-speed motion during manual operation.

Input of number key "5".

In the standby state, the X axis moves in the positive direction.
Input of number key "6".

Select right in the function options.

Switch mobile mode.

	In the standby state, the A axis moves in the negative direction. Input of number key "7".
	In the standby state, the Y axis moves in the negative direction. Input of number key "8". Select down in the function options.
	In the standby state, the Z axis moves in the negative direction. Input of number key "9".
	Reduce processing speed ratio. Input of number key "7".
	Set the current X mechanical coordinate as the X axis workpiece origin. Input of minus sign "-".
	Set the current X mechanical coordinate as the Y axis workpiece origin. Input of number key "3".
	Set the current X mechanical coordinate as the Z axis workpiece origin. Input of decimal point "."
	Set the current X mechanical coordinate as the A axis workpiece origin. Return to the superior interface.
	Empty key, the main key of the combination key.
	Move to X, Y axis the workpiece origin, Z axis raised to a safe height. Confirm operation in function options. Enter and confirm operations.
	Processing start or pause. Modification and deletion of function options.
	Stop current processing. Back to main menu. Exit without saving.

- **Combination key function**

How to use the key combination: hold down the "  " key, press and release other keys, and finally release the "  " key.

Key 1	Key 2	Function Description
Shift		Spindle speed up 10%.
Shift		Spindle speed down 10%.
Shift		Y axis back to mechanical zero point alone.
Shift		Z axis back to mechanical zero point alone.
Shift		X axis back to mechanical zero point alone.
Shift		A axis back to mechanical zero point alone.
Shift		All axis back to mechanical zero point.
Shift		1.In the high-speed state, set the manual high speed. 2.In the low-speed state, set the manual low speed.
Shift	手动模式 Manual	1.In the high-speed state, set the jog high-speed distance. 2.In the low-speed state, set the jog low-speed distance.
Shift		Enter the advanced processing menu, you can choose "Line number processing", "Breakpoint processing", "Repeated processing", "Array processing".
Shift		Open the tool library settings window.
Shift	K1	Set the tool length of T1.
Shift	K2	Set the tool length of T1, Unlock the external clamp release button.
Shift	K3	Set the tool length of T1.
Shift	K4	Set the tool length of T2.

Take a screenshot and save the picture to a U-disk.

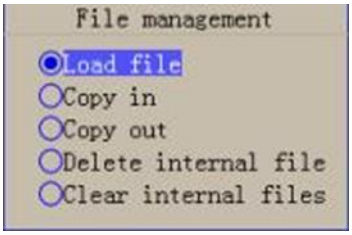
5.2 Power-On Procedure

- Plug in the power cable and switch on the main control cabinet.
- Follow the on-screen prompt and press the 

button to return the machine to its mechanical origin.

5.3 File Loading Procedure

- Use a USB flash drive to import G-code files.
- Insert the USB drive into the USB port on the handheld controller.
- Press the 
key to enter the file management interface.



- Select the desired file and press **[OK]** to confirm.

Ensure the file is in a supported format (e.g., nc, Gcode) and stored in the root directory of the USB drive.

5.4 Coordinate Zeroing and Setting

- **Mechanical Origin:**
  Press the 

+ 
keys simultaneously to automatically return the machine to its mechanical origin.
- **Workpiece Origin:**
  Use the 
, 
, 
, 
, 
, 
keys to manually move the X, Y, and Z axes to the starting point of the workpiece.
  Then press 

, 

, and 

to set the current position as the workpiece origin.

Ensure there is no obstruction before homing and confirm tool clearance during Z-axis zeroing.

5.5 Control Menu Overview

The DSP handheld controller provides a multi-level menu system for managing machining operations, parameter adjustments, and system settings.

Main Menu Functions:

- ***View the toolpath, real-time coordinates, and simulate machining operations.***
- **Parameter Settings**
  Adjust feed rate, spindle speed, Z-safe height, and other key machining parameters.
- **System Settings**
  Configure system language, measurement units (mm/inch), screen brightness, keypad tone, and more.

Tip: After adjusting parameters, confirm and save to ensure they take effect during operation.

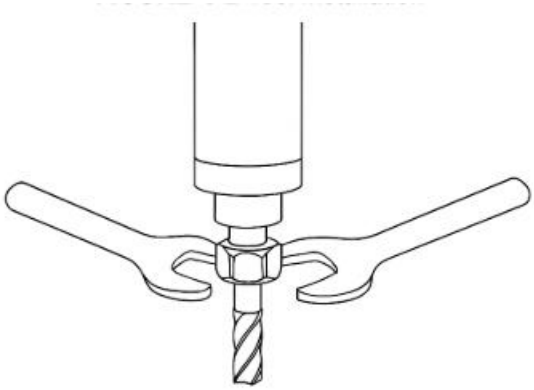
Chapter 6: Tool Installation and Tool Setting

6.1 Tool Types Overview

To meet various machining needs, the machine supports a variety of engraving tools suitable for different materials and processing methods:

- **Three-Flute Straight Bit**
  Ideal for cutting MDF, PVC, and other soft sheet materials.
- **Single-Flute Spiral Bit**
  Used for harder materials like acrylic and ABS plastic; provides smooth finishes and efficient chip removal.
- **V-Bit Engraving Tool**
  Best for text engraving, relief carving, and fine detail work.
- **Ball Nose End Mill / Round Nose Bit**
  Designed for 3D surface machining and smooth contouring.

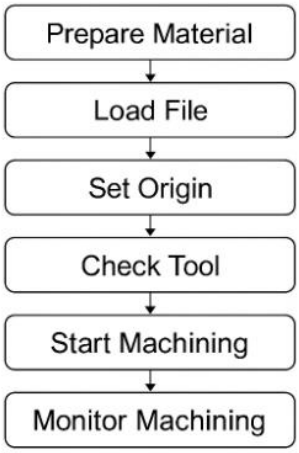
6.2 Manual Tool Changing Procedure



- ***Stop the spindle and disconnect the power supply.***
- ***Use two wrenches to hold the spindle collet nut and the tool holder.***
- ***Loosen the collet counterclockwise and remove the old tool.***
- ***Insert the new tool to an appropriate depth and tighten the collet clockwise.***
- ***Verify that the tool is secure.***

⚠ ***The tool must be inserted vertically and should not wobble after tightening.***

Chapter 7: Machining Operation Procedure



- Place the material on the worktable and secure it using vacuum or clamps.

- Import the machining file (e.g., .nc or .tap) via a USB drive.
- Set the X/Y/Z origin point.
- Ensure the tool is securely installed and correctly set.
- Press the 

button to start the machining operation.
- Observe the machining progress. Press 

if necessary, or press 

or the emergency stop button to halt the operation.
- Once the spindle stops, remove the finished workpiece and clean the work area.

⚠️ ***Do not approach the spindle or move the workpiece during operation. Ensure personal safety at all times.***

Chapter 8: Maintenance and Care

8.1 Daily Maintenance

- Clean residual chips and dust from the machining area.
- Check whether the spindle is overheating.
- Inspect the linear guide rails for any debris or contamination.
- Tighten any bolts that may have become loose.

8.2 Periodic Maintenance (Weekly / Monthly)

- Apply lubricating oil (recommended: N32/N68) to linear guides and ball screws.
- Check cables for signs of aging, wear, or detachment.
- Inspect the connection between the handheld controller and the mainboard.
- Turn on the control cabinet fan and clean out dust buildup.

8.3 Spindle Maintenance

- Turn off the power and clean the spindle housing after each use.
- Ensure that the air-cooling or water-cooling system is functioning properly.
- Check for unusual noise or vibration from the spindle bearings.

Chapter 9: Troubleshooting

Issue	Possible Cause	Recommended Solution
Spindle not rotating	Power supply or VFD connection issue	Check VFD settings and output terminals
File cannot be loaded	USB drive damaged or format incompatible	Replace USB drive or re-export a standard G-code file
Machining misalignment	Origin not set or tool loose	Reset work origin and check tool clamping
Z-axis tool breakage	Incorrect tool setting or excessive depth	Re-calibrate tool height and use step-by-step cutting
Handheld controller unresponsive	Loose interface or connection	Inspect and secure data cable connections

Chapter 10: Warranty and After-Sales Service

10.1 Warranty Policy

- The entire machine is covered by a one-year free warranty starting from the date of purchase (excluding man-made damage).
- Warranty coverage includes: spindle motor, electrical control system, drivers, and handheld controller.
- Not covered under warranty: cutting tools, fixtures, consumables, unauthorized disassembly, and damage caused by natural disasters or other force majeure events.

10.2 After-Sales Support Options

- Technical Support via Phone
- Remote Diagnosis via Email
- Video-Based Guidance Service
- Spare Part Replacement via Mail

For any service request, please contact our support team with your machine model, serial number, and a description of the issue.

Chapter 11: Legal Disclaimer

11.1 Usage Liability Disclaimer

This equipment is intended solely for processing non-metallic materials under the conditions and purposes specified in this manual.
The manufacturer shall not be held liable for any damage, accidents, or economic losses resulting from improper use or operations not in accordance with the manual.

11.2 Software Compatibility Notice

The manufacturer guarantees compatibility and stability only with the officially recommended software versions.
The use of unauthorized or unofficial CAM software may result in operational errors, and users assume full responsibility for any associated risks or consequences.

11.3 Intellectual Property Statement

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