

# 450W Router User Manual

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## Catalog

1. Summary.....	2
2. Risk control warning.....	2
3. Milling system composition and working principle.....	3
4. Technical parameter.....	4
5. Essential of Router installation.....	4
5.1. Installation of the suction pipe bracket of the cutting head.....	4
5.2. Connection of router spindle with cable and air pipe.....	5
5.3. Emergency stop cable connection.....	6
5.4. Gas source connection.....	6
5.5. USB communication cable connection.....	7
6. Router debugging.....	7
6.1. Driver initialization.....	7
6.2. Spindle running-in.....	10
6.3. Communication settings between Router and computer.....	11
6.4. Spindle rotating direction confirmation.....	13
7. Router operation.....	13
7.1. Power on.....	14
7.2. Cooling air pressure inspection.....	14
7.3. Blade installation.....	15
7.4. Router parameter setting.....	15
7.5. Communication serial port settings.....	16
7.6. Knife cutting depth setting.....	16
7.7. Router rotating speed setting.....	17
8. Precautions for spindle use.....	17
9. Daily maintenance of Router.....	18
10. Router driver alarm and troubleshooting.....	19
10.1. Warning light .....	19
10.2. Warning codes and error codes.....	20
10.3. Common faults and solution to Router.....	25
Statement.....	27

## 1. Summary

The 450 Router adopts German imported electric spindle as the core body of the milling tool, with stable speed and superior performance. It is suitable for engraving and engraving of non-metallic hard materials, such as acrylic board, MDF board, aluminum-plastic board, Foam board and other materials. The operation is simple and it can be widely used in industries such as advertising and composite materials.

## 2. Risk control warning

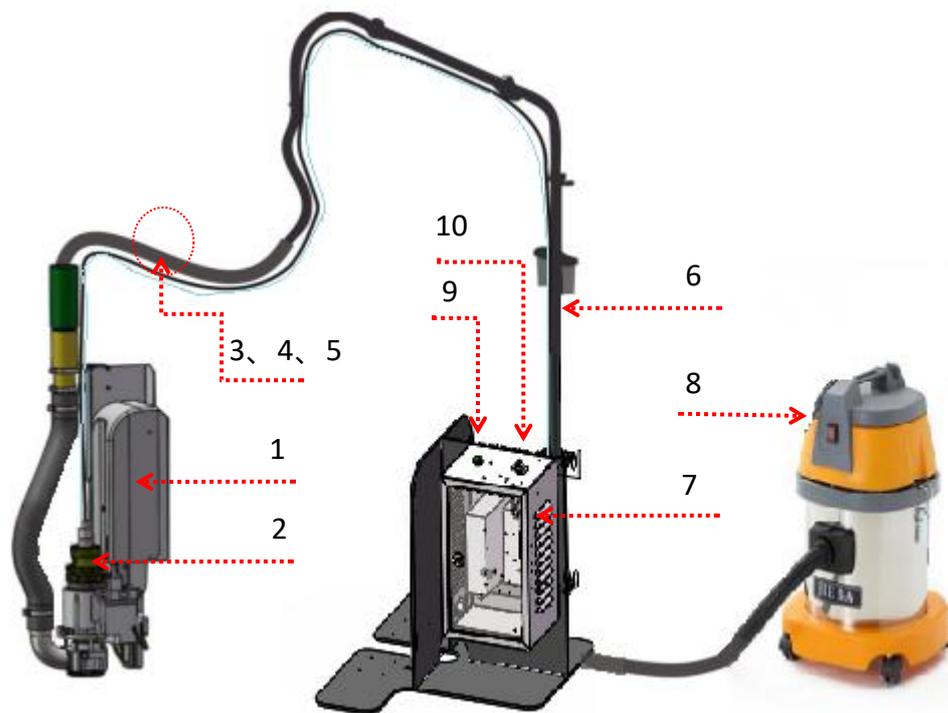


- ❖ If there is a safety hazard, please immediately press the emergency stop button!
- ❖ Do not touch the router bit with your hands when it is rotating!

## 3. Milling system composition and working principle

450 milling system is composed of 450 milling tool (including spindle), Router controller, vacuum cleaner, dust suction pipeline, air cooling pipeline and other components. As shown in Figure 1 for the connection diagram of the main parts of the milling system, the milling tool is installed on the universal head, and it is connected with the driver in the router control box through a flexible cable. A milling system suction device is installed on the universal head, and the suction device is directly connected with an external vacuum cleaner through a vacuum hose.

In the system, when the milling tool is running, the external driver provides the required power, and then the cutting head controls the height of the router to engrave and mill the material to be cut. During the working process, the milling system suction component sucks the waste and dust cut by the milling tool. With the vacuum cleaner, it generates a negative pressure suction to the vacuum cleaner, to achieve the purpose of clean production table.



- |                          |                           |
|--------------------------|---------------------------|
| 1- Cutting head          | 6- Router hose holder     |
| 2- Milling tool          | 7- Router controlling box |
| 3- Dust suction pipeline | 8- Dust cleaner           |
| 4- Driver cable          | 9- Power Indicator        |
| 5- Air cooling pipeline  | 10- Power switch          |

**Figure -1 · Connection Diagram of Router Parts**

## 4. Technical Parameter

Items	Parameters
Output Power	S1:420W,max.500W
Range of rotation	6000-60000rpm
Motor type	Three-phase asynchronous motor
Motor protection level	IP55
frequency	100-1999Hz
Voltage	49V
Current	S1:6.6A,max.8A
Torque	S1:8.4Ncm,max.8.4Ncm
Air pressure requirement	min0.04MPa
Collet	max $\phi$ 5.0mm

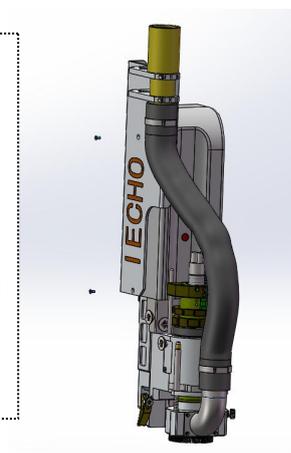
## 5. Essential of Router Installation

### 5. 1. Installation of the suction pipe bracket of the cutting head

Remove the two original M3×3 countersunk head screws on the side of the cutting head cover, and use M3×6 countersunk screws to fix the suction tube bracket on the cutting head.

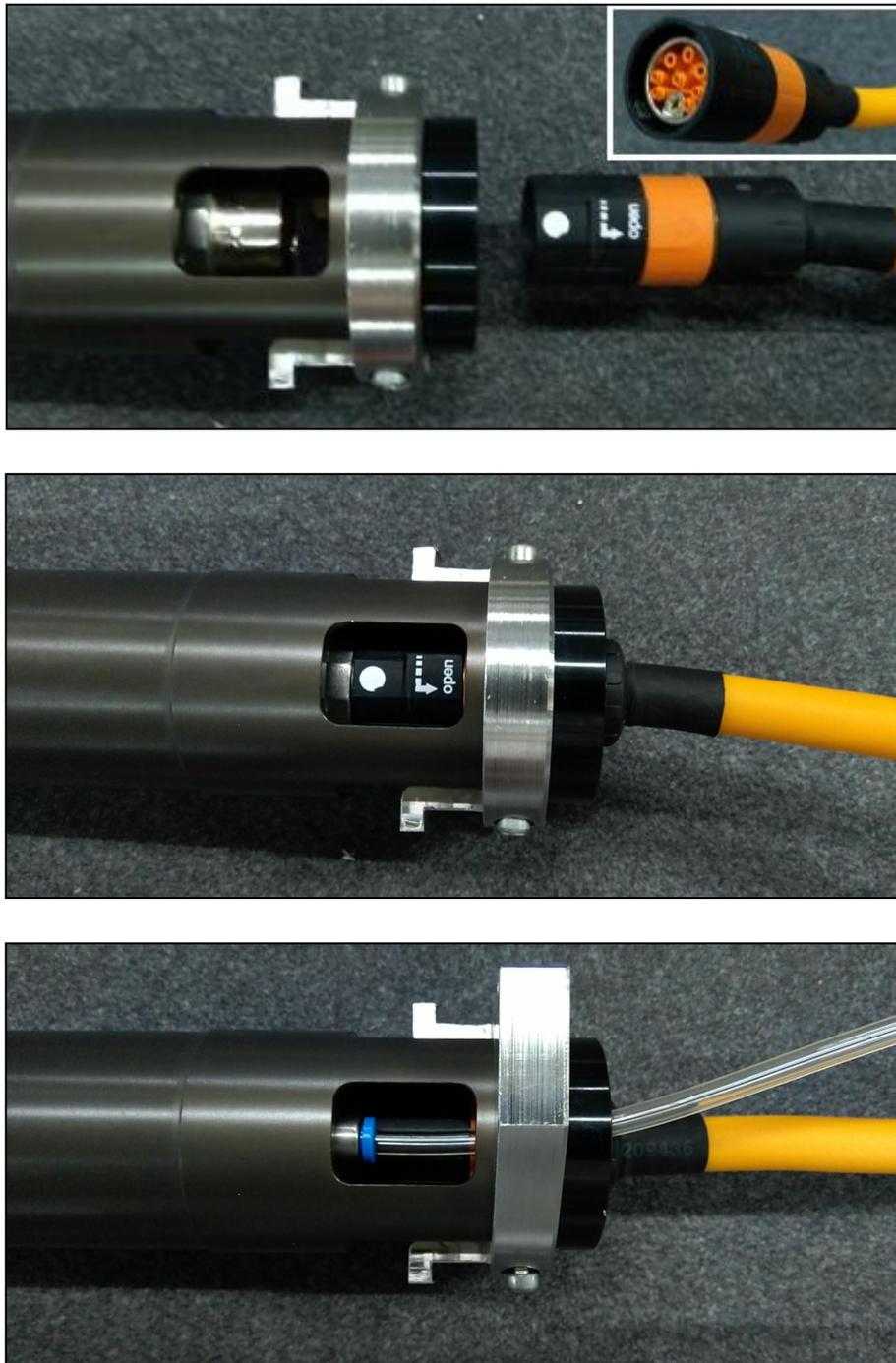
Replace the two M3×3 countersunk head screws of the cutting head cover with M3 × 6 countersunk head screws, to fix the milling tool suction tube holder.

**Note:** Please select the correct screws type to avoid damage to the cutting head.



**Pic 2 Installation of the suction pipe bracket of the cutting head****5. 2. Connection of router spindle with cable and air pipe**

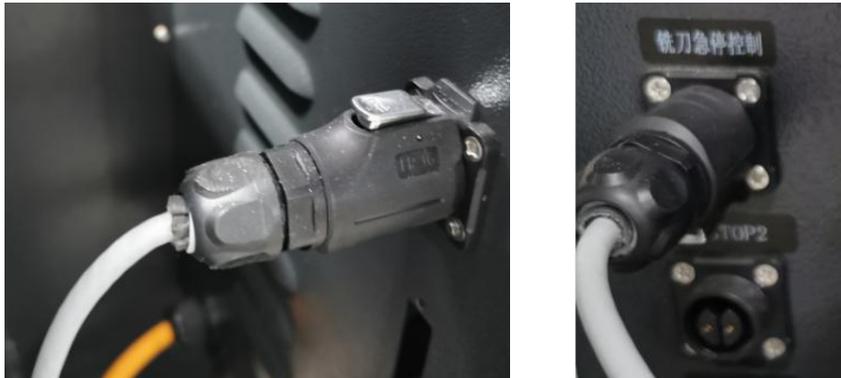
Before connecting the milling spindle and the drive cable, please check whether there is anything in the plug and clean, then insert the plug straight to the end after aligning the position. When you hear a "click" sound, it means that the plug is locked. Then insert a 4.0mm air pipe and connect with the milling spindle.



**Figure 3 The connection between the milling spindle and the cable & air pipe**

**5. 3. Connection of emergency stop cable**

The three-pin plug of the emergency stop cable is connected with the emergency stop control interface on the outside of the milling tool control box, and the two-pin plug is connected with the emergency stop control interface of the milling tool on the electrical box of the cutting machine.

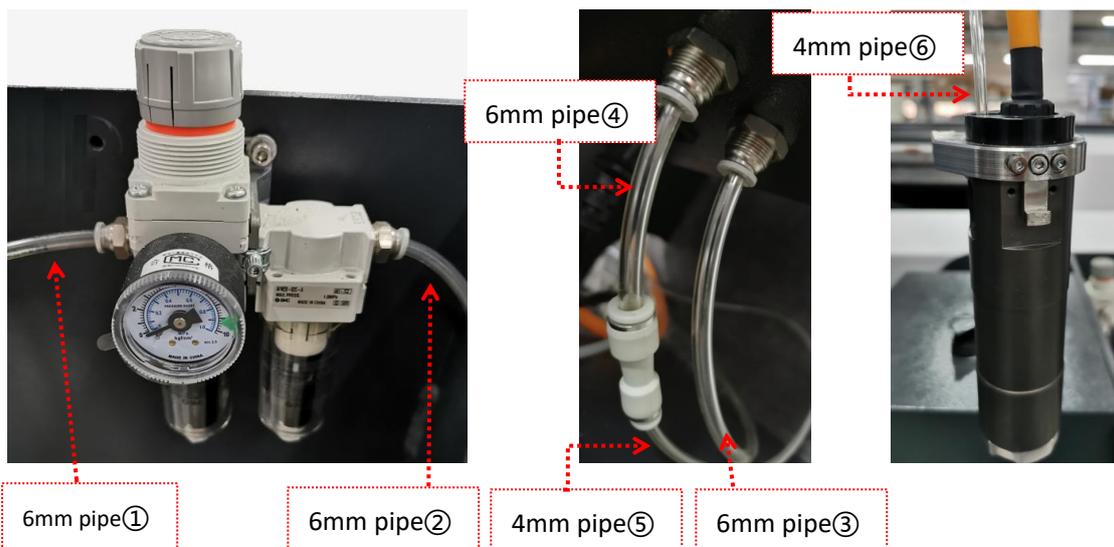


**Figure 4 · plug Emergency stop cable into milling tool control box connection**

**Figure 5 · Connect the emergency stop cable to the electrical box of the machine**

**5. 4. Gas source connection**

Use a 6mm intake pipe to connect the intake end of the filter. The cooling air is controlled by a solenoid valve. When the milling tool is powered on, the solenoid valve opens automatically. The output interface is on the outside of the milling tool control box, and the spindle cooling air is connected through this. (Note: The pipe connected to the electric spindle is 4mm.)



Gas path: ①→②→③→④→⑤→⑥

**Figure 6 Air connection**

## 5. 5. USB communication cable connection

Pass one end of the mini USB data cable through the wire hole of the milling tool control box and connect it to the milling driver. Connect the USB plug of the data cable to the USB port of the computer.

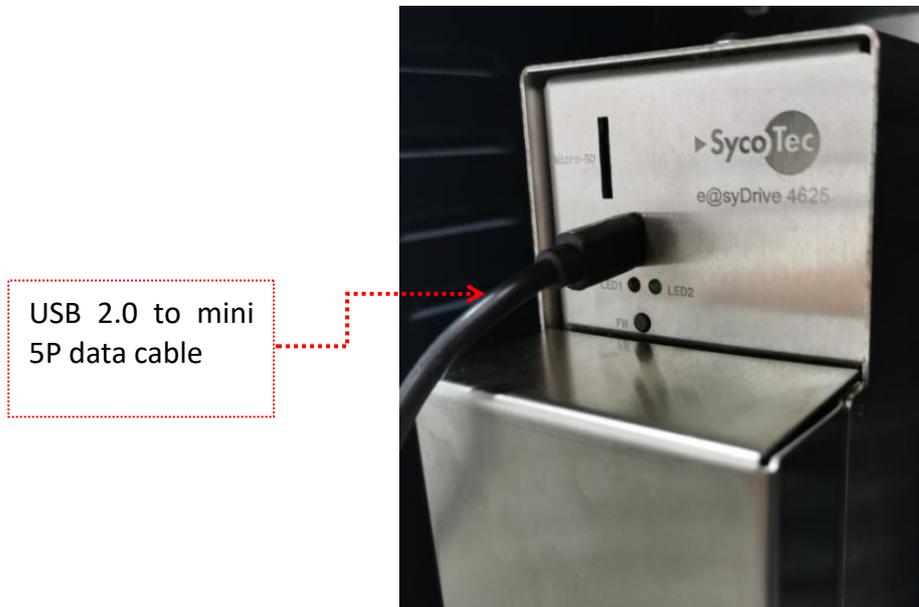


Figure 7 • USB communication cable connection

## 6. Milling tool debugging

❖ **Note:** The 0.04MPa clean air source must be connected before the spindle runs.

### 6.1. Driver initialization

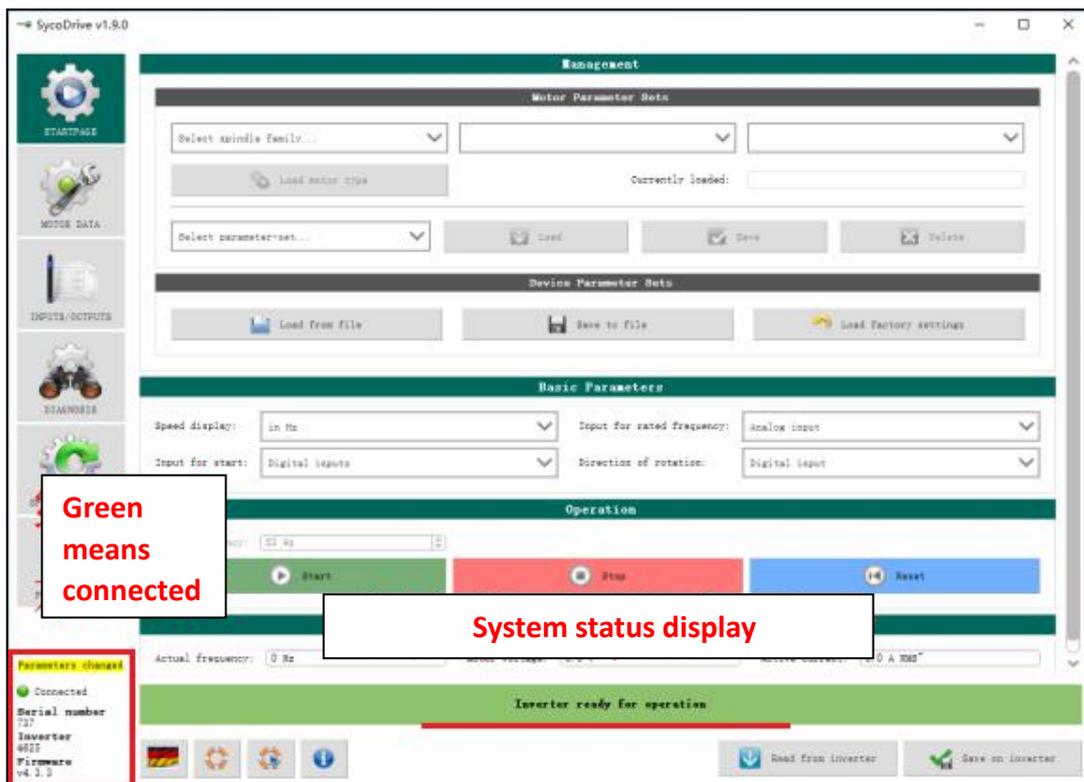
The driver initialization is completed when the device is debugged first time in the factory, and SycoDrive software must be installed before the operation. (<https://www.sycotec.eu/en/about-sycotec/downloads2/>)

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Title	Description
Operating Manual - easyDrive 4624, 4625, 4626	PDF, 1.8 MB (english)
Short Instruction For Use - easyDrive 4624, 4625, 4626	PDF, 1.2 MB (english)
Operating Manual - Operating Software SycoDrive	PDF, 1.9 MB (english)
Object Description CANopen - easyDrive 4624, 4625, 4626	PDF, 1.1 MB (english)
Interface Description RS232 - easyDrive 4624, 4625, 4626	PDF, 1 MB (english)
<b>Software SycoDrive. v1.9.5</b>	ZIP file
Firmware easyDrive 4624,4625,4626, v4.4.3	ZIP file

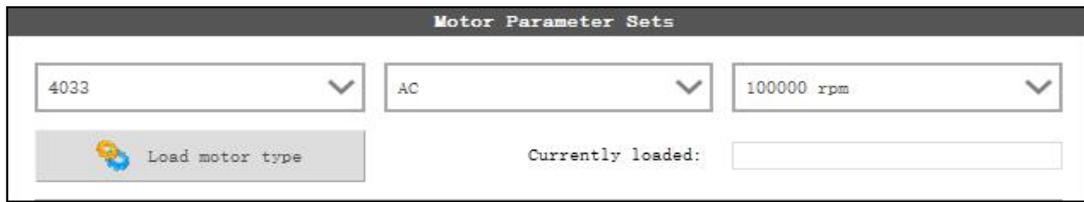
**(Figure. 8)**

Start the SycoDrive software, as shown in Pic 9, a green light is displayed in the lower left corner of the page, indicating that the drive is successfully connected to the computer.



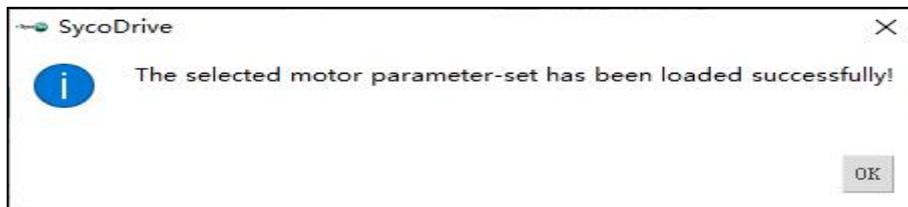
**(Figure. 9)**

(1) In the Motor Parameter Sets column, set the spindle model according to Pic 10.



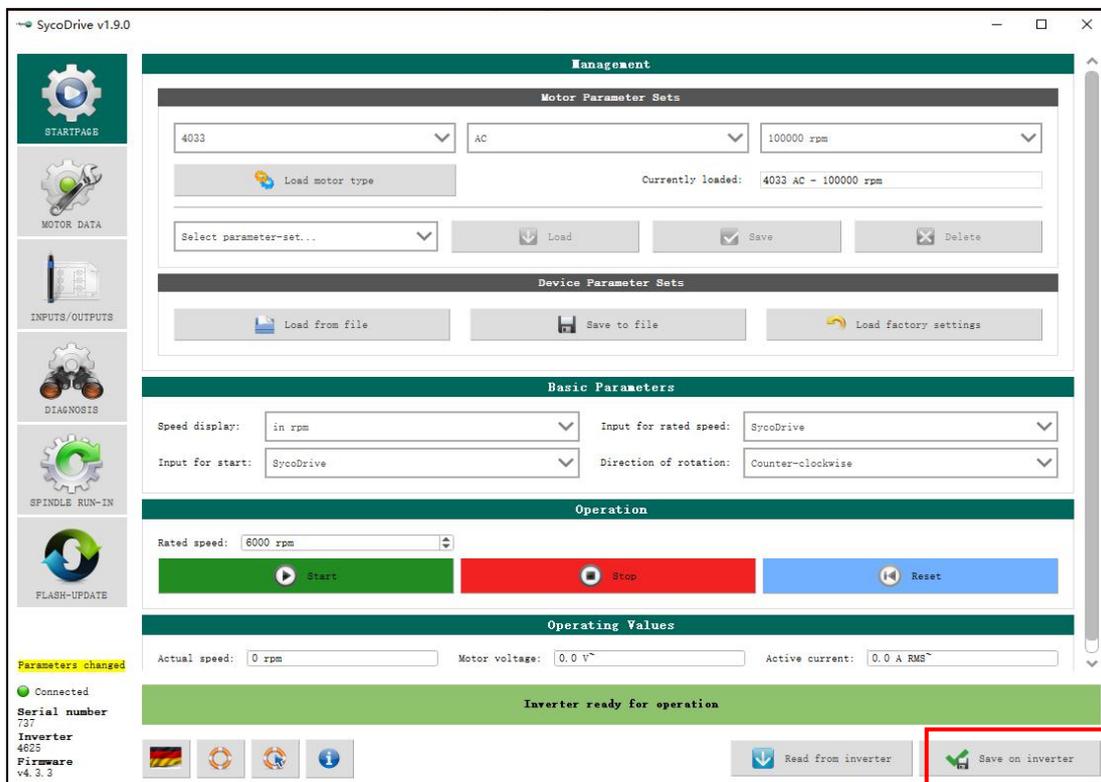
(Figure. 10)

The 450 milling spindle model is 4033-AC, and the maximum speed is set to 100000rpm. Click the [Load motor type] button on the page. The following prompt pops up, indicating that the import was successful.



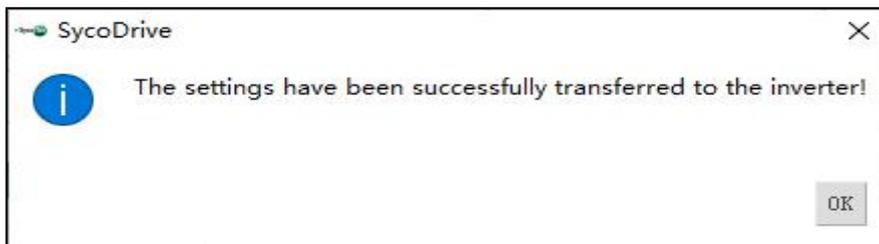
(Figure. 11)

(2) After setting the above parameters, click the [Save on inverter] button at the bottom right corner of the main page.



(Figure. 12)

The following prompt pops up, indicating that the save is successful.



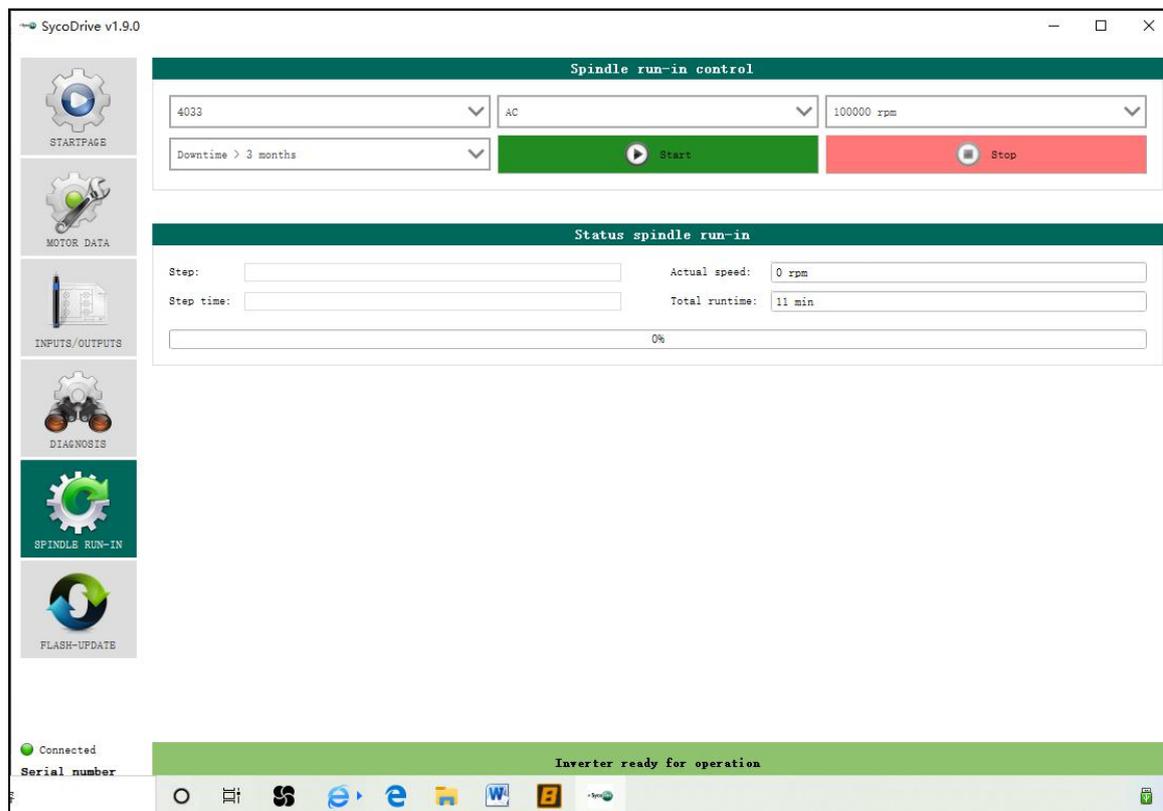
(Figure. 13)

## 6.2. Spindle running-in

To start the milling tool for the first time, the spindle must be run-in. The spindle manufacturer has done the initial run-in before the product leaves the factory. However, if the spindle is out of service for a long time (more than 3 months), it must be re-run-in before using it again.

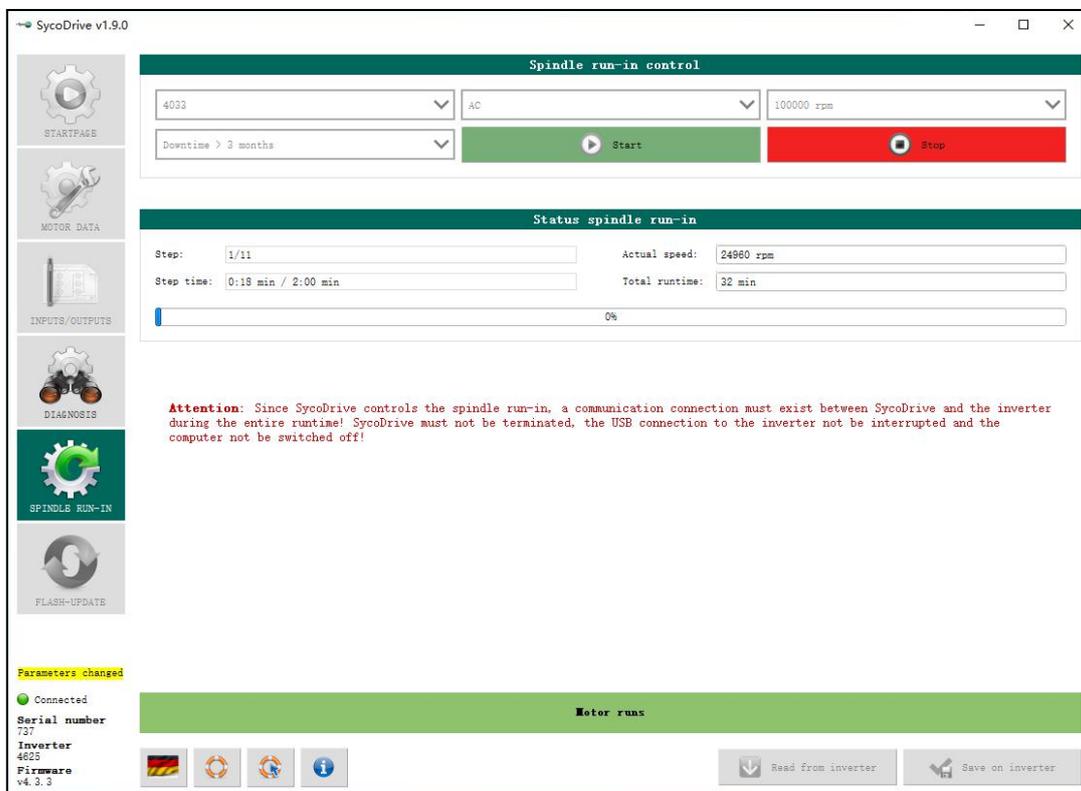
Operation method :

Start the Sycodrive software, on the SPINDLE RUN-IN page, first set the spindle model 4033-AC-100000rpm in the Spindle run-in control column, then select the running-in method as Downtime>3 months, and click [START] to start running-in.



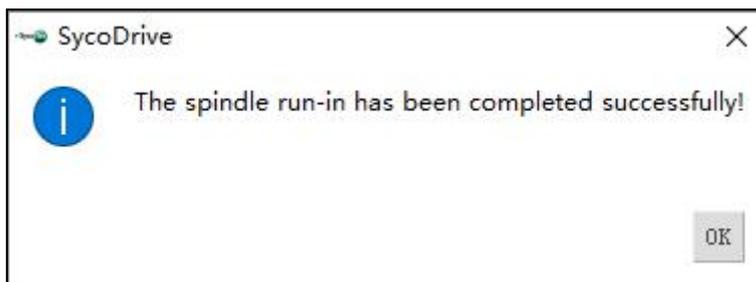
(Figure. 14)

During the running-in process, you can view the progress bar to display the running-in progress, as shown in the picture.



(Figure. 15)

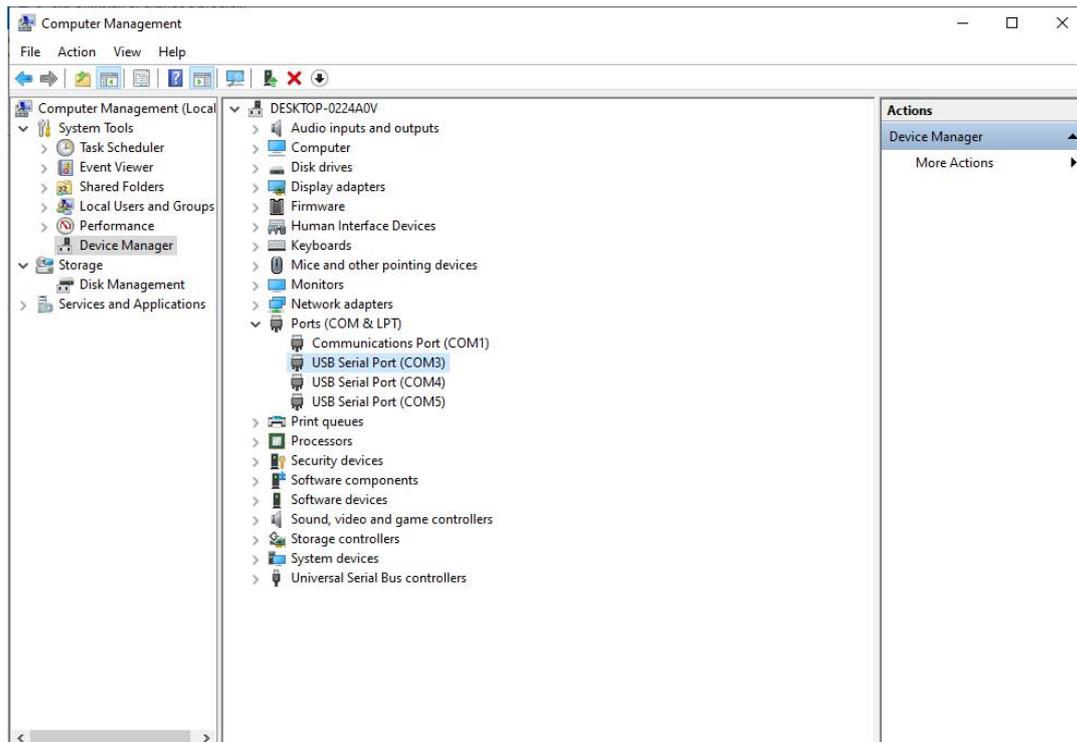
Until the following window pops up, indicating that the running-in is complete.



(Figure. 16)

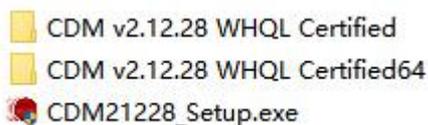
### 6.3. Communication settings between milling tool and computer

After the USB communication line is connected, WINDOWS will automatically discover the hardware and automatically generate a serial port, as shown in the picture, USB Serial Port (COM3) will appear in the device manager, and the serial port number will be randomly generated.

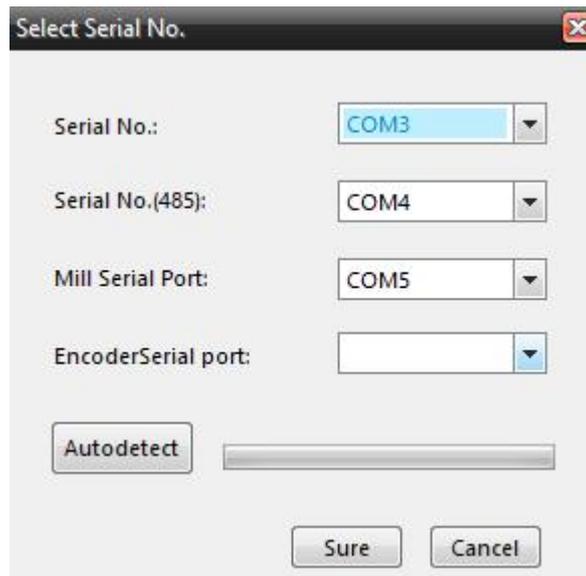


(Figure. 17)

- ❖ Note: Normally, WINDOWS 7/10 system can automatically recognize and install the driver. If the driver cannot be installed automatically, you need to install the serial port driver manually, and the serial port number will be generated after installation.



There is no need to set the serial port number when connecting the milling tool, it can be automatically connected after startup. When using the CutterServer software, the milling tool communication serial port must be set first. **Note: Sycodrive software and CutterServer software cannot be connected at the same time. Before running one of them, you need to close the other program.**

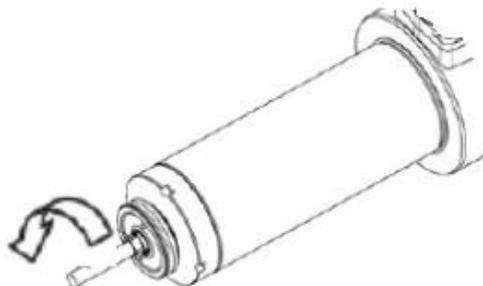


(Figure. 18)

#### 6.4. Confirm spindle rotation direction

When first time using, please make sure whether the spindle direction is correct (as shown in the figure). If it is not correct, please check if the cable connected properly. The software can not change the rotation direction setting.

Router rotation direction



(Figure. 19)

### 7.The use of router

450W Router software version requirements:

DSP program version: DSP2.2.8-6A180903M and above

CutterServer software version: V4 (2019.9.4.511) and above

iBrightCut software version: V4 (2020.4.3.2373) and above

**Steps for usage:**

- (1) Preparation (including installing the blade, setting the spindle speed, cutting speed and other parameters);
- (2) Edit cutting data in iBrightcut software and send it to Cutterserver.
- (3) Place the material, turn on the suction and fix it;
- (4) Turn on the power of the vacuum cleaner and start cutting.

**7.1. Power ON**

When the knob switch is turned ON, the power of the router is turned on, and the power indicator light is on.



(Figure. 20)

- ❖ Note: when using emergency stop function, before turning on router power, please turn on machine power firstly, otherwise the drive will report an error.

**7.2. Cooling air pressure checking**

Before starting the machine, please turn on the air source and check the air pressure. The minimum air pressure required for router 0.04MPa. Too low or too high air pressure will damage the spindle.



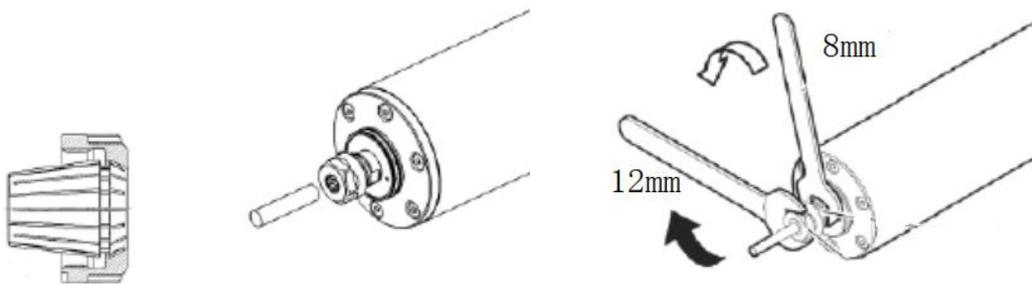
(Figure. 21)

### 7.3. Blade installation

The 450W router is equipped with 3.5mm or 4mm blade collet, corresponding to the blade ER1 or ER2 respectively. Please select it correctly when using it.

Blade installation steps:

- (1) Place the blade collet into the spindle nut;
- (2) Manually screw the blade collet and spindle nut onto the spindle (no need to tighten);
- (3) Insert the router blade into the blade collet (keep a distance of about 1mm between the cutting edge and the collet);
- (4) Use 8mm and 12mm wrenches to tighten the nuts.



**(Figure. 22)**

- ❖ Note: Please follow the blade installation steps above. The wrong installation sequence may cause damage to the collet.

### 7.4. Router parameter setting

In the Cutterserver software parameter table, the tool name is selected as MILL450, the tool lifting angle is set to 180, and the rotating direction should not be chosen.

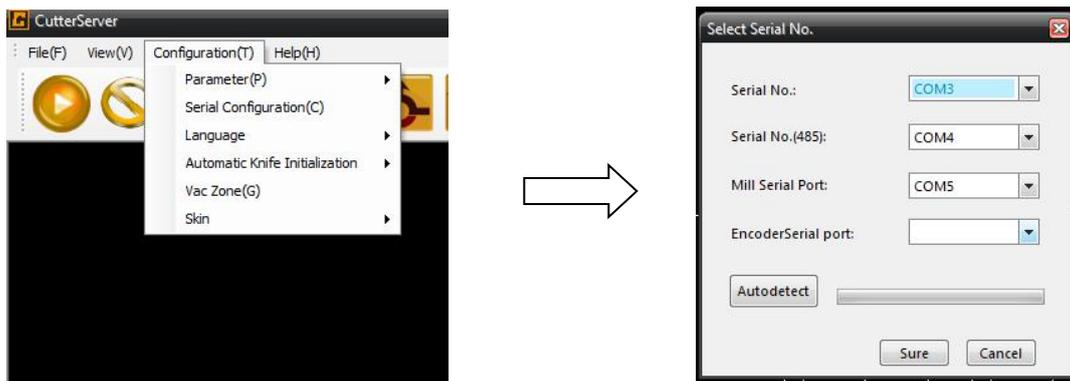
Set appropriate cutting parameters: such as XY motion speed, knife drop speed, motion acceleration, etc.

Parameter Set			
Knife holder/knife tool modification			
Parameter item	Value	Unit	Range Of Value
SOCKET1	MILL450		
Positive angle of knife and X axis	0.000	limit	-360.000 ~ 360.000
Knife-up compensation	0.000	mm	-30.000 ~ 30.000
Knife-down compensation	0.000	mm	-30.000 ~ 30.000
Knife lifting angle	180	limit	0.000 ~ 360.000
X,Y movement speed	0.1	m/s	0.010 ~ 1.500
Knife-lower speed.	10	mm/s	0.010 ~ 1000.000
Knife lifting speed	100	mm/s	0.010 ~ 1000.000
Movement acceleration	0.200	G	0.010 ~ 1.500
Setting acceleration	0.200	G	0.010 ~ 1.500
The maximum knife setting depth	2.000	mm	0.000 ~ 67.680
Waiting time before setting	20.000	ms	0.010 ~ 10000.000
Waiting time before knife lifting	20.000	ms	0.010 ~ 10000.000
Waiting time after setting	20.000	ms	0.010 ~ 10000.000
Waiting time after knife lifting	20.000	ms	0.010 ~ 10000.000
Direction to rotate	<input type="checkbox"/>		
The distance between former knife p	0.000	mm	-20.000 ~ 100.000
The distance between later knife poi	0.000	mm	-20.000 ~ 100.000
Eccentricity enable	<input type="checkbox"/>		
X eccentric distance	0.000	mm	-100.000 ~ 100.000
Y eccentric distance	0.000	mm	-1.270 ~ 1.270
Circle + Angle	0.000	limit	-5.000 ~ 5.000

(Figure. 23)

**7.5. Communication serial port settings**

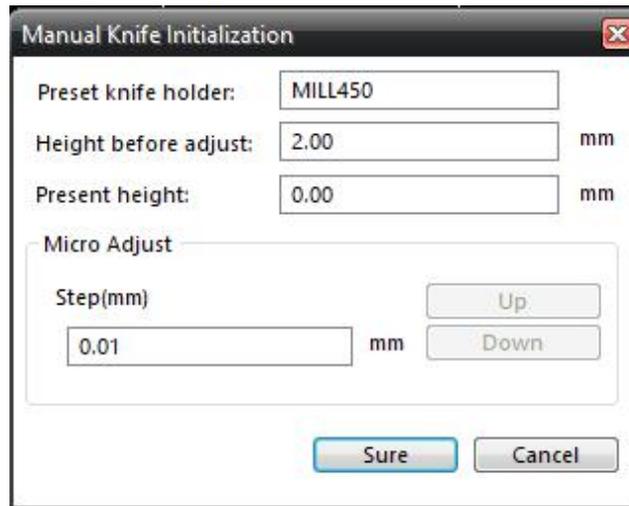
With Cutterserver software, open [System Configuration]-[Serial Configuration] to set the milling router serial port.



(Figure. 24)

**7.6. Set knife depth**

Select the milling router icon and click the manual tool setting icon to open the manual tool setting window. Press the down arrow on the keyboard and the milling router will start to fall. Stop when it is adjusted to the upper surface of the cutting mat, click [OK] to complete the knife setting.

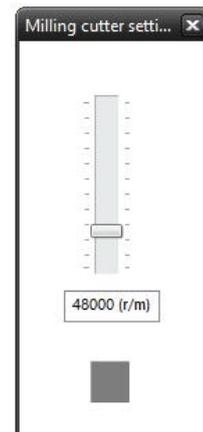


(Figure. 25)

- ❖ **Note: The knife must be adjusted again after each blade change. Hold down the Ctrl key of the computer keyboard during manual tool setting to speed up the cutting speed**

### 7.7. Set milling router speed

Drag the slider of [Milling Router Setting] up and down, the speed will change in the range of 6000rpm-60000rpm.



### 8. Precautions for using spindle

- ❖ The main shaft is self-closed and dustproof when working, and is permanently lubricated. Any act of adding grease and using cleaning solvents will damage the spindle.
- ❖ The tapered surface of the chuck must be kept clean and free from scratches, otherwise the accuracy of the tapered surface of the front end of the spindle rotor will be changed, resulting in the inability to lock the tool, resulting in failures such as tool drop or tool breakage. The chuck must be cleaned before installing.
- ❖ After the spindle is ventilated, the sealed state can be reached, and the sealing air flow rate is 25L/min (the sealing air pressure must be strictly controlled at

0.04MPa). Excessive air pressure can damage the grease or lubrication system of the bearing. If the bearing loses lubrication, the bearing will be damaged under the high-speed state of the spindle; if the air pressure is too small, the sealing effect cannot be achieved.

- ❖ The air source of the spindle must be filtered. Using an unqualified air source will seriously damage the spindle stator coil and bearings, and affect the spindle life.
- ❖ The main shaft cannot be hit by any kind of impact in any direction. After the main shaft is hit, the dynamic balance will be destroyed, and even the bearing will be damaged, affecting the service life of the main shaft.
- ❖ Please use the matching professional tools for disassembly and assembly of the chuck; if the bearing is damaged due to man-made reasons, no warranty treatment will be done; if there is any problem with the spindle, please do not disassemble and install it privately.

## 9. Daily maintenance of milling router

Check item	Check content	Require
Water separator	<ol style="list-style-type: none"> <li>1. Check the installation</li> <li>2. Check the standing water</li> <li>3. Check the air pressure</li> </ol>	<ol style="list-style-type: none"> <li>1. Must be installed vertically</li> <li>2. Check whether the automatic drainage is normal every day</li> <li>3. Keep the normal pressure at 0.04Mpa</li> </ol>
Milling router body	<ol style="list-style-type: none"> <li>1. Check whether the position limiter is installed</li> <li>2. Check the bottom of the cutter body</li> <li>3. Check the position of the milling cutter chuck</li> </ol>	<ol style="list-style-type: none"> <li>1. The position limiter must be installed before use</li> <li>2. Clean the bottom with a brush or wire every day Residue</li> <li>3. Frequently clean up debris from the milling cutter chuck</li> </ol>

Router bit	<ol style="list-style-type: none"> <li>1. Check whether the router is installed correctly</li> <li>2. Check for nicks or residues on the router</li> </ol>	<ol style="list-style-type: none"> <li>1. When installing the bit, it is necessary to leave a row groove Bit exposed length = Bit flute length + 1mm</li> <li>2. If the bit is notched, please replace the bit; if there is debris, blow with an air gun or clean it with a brush</li> </ol>
Milling router cable	Check whether the cable is twisted	No wire entanglement
Suction line	<ol style="list-style-type: none"> <li>1. Check whether the pipeline is loose</li> <li>2. Check whether the pipeline is flattened</li> <li>3. Check whether the pipeline is blocked</li> <li>4. Check whether the debris in the vacuum cleaner bucket is full</li> </ol>	<ol style="list-style-type: none"> <li>1. Confirm that the pipeline is installed in place</li> <li>2. Straighten out the pipeline, do not flatten</li> <li>3. Do not block, the blockage can be taken out by shaking the suction tube</li> <li>4. Clean up in time when the vacuum cleaner bucket is full</li> </ol>

## 10. Milling router driver alarm and troubleshooting

### 10.1 The meaning of warning lights

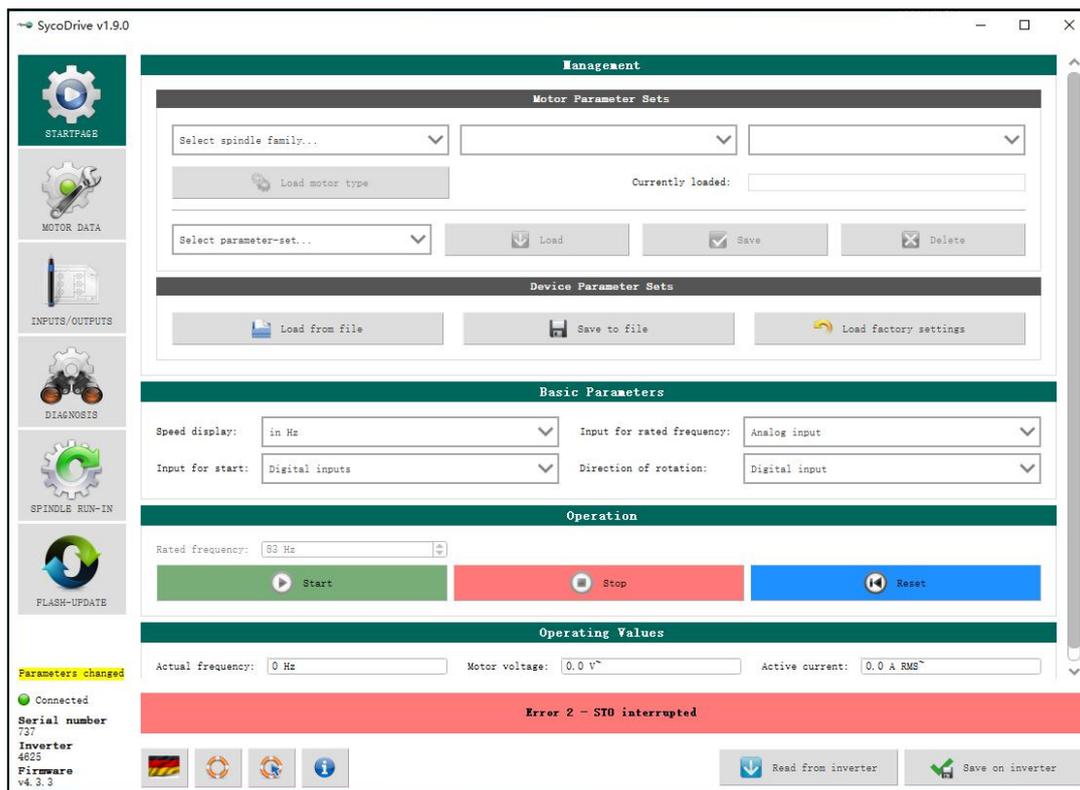
Red light(LED1)	Green light(LED2)	Meaning	Remarks
OFF	OFF	No power	
OFF	ON	Ready to work	
OFF	Blink	Spindle work	
Blink	On or Blink	Warning:the code is less than 6 (the number of flashes is the code number)	Can continue to use in warning state

ON	On or Blink	Warning: code is greater than 6	
Blink	OFF	Error, the code is less than 6 (the number of flashes is the code number)	In the error alarm state, a serious problem has occurred and will not be available
ON	OFF	Error, code is greater than 6	
OFF	Blink 2 times	Transfer parameters from micro-SD card successfully	
Blink 2 times	Blink 2 times	Failed to transfer parameters from micro-SD card	
OFF	Blink 3 times	Transfer parameters to micro-SD card successfully	
Blink 3 times	Blink 3 times	Failed to transfer parameters to micro-SD card	

## 10.2. Warning codes and error codes

When the drive alarms, you can read more detailed alarm information in the SycoDrive software to solve the problem.

The alarm state during emergency stop as shown in Figure 26:



(Figure. 26)

When a warning message appears, the milling cutter can still run, and the warning message can be reset during operation.

Warning code	Fault	Reason	Solution
1	Motor current exceeds current limit	The motor load is too high, the parameter "acceleration ramp" is too short or the	If possible, reduce the load and modify the parameters
8	Exceed the I <sup>2</sup> t threshold	Load is too high	Reduce the load, check the parameters "I <sup>2</sup> t time" and "I <sup>2</sup> t threshold"

18	Rated speed limit activated	Parameter "rated speed" or analog value input is too high	Check the parameter "rated speed", limit the rated value "minimum speed" and "maximum speed", adjust the fixed frequency 1 to 4
22	10 V output voltage output range	10V output voltage AIN is not acceptable range ( $\pm 3\%$ )	Check the wiring, there may be a short circuit
23	24 V output short circuit	24 V short circuit	Check wiring
24	Error during parameter import or export	No/bad SD card or the parameter file on the SD card is incomplete or does not exist	Use a complete parameter file (parameter import) and a complete SD card
27	Generator running	The motor runs on the inverter and stops	Wait until the motor is stationary
28	Comparator's own error test	Internal fault	If the fault still exists after the power is turned off and on, send the inverter for repair.
45	Watchdog reset control on the motor	Strong EMC interference of motor control	Restart the motor
54	Brake chopper failure, or interruption during brake resistor self-test	Performance component failed	Switch twice. If the fault still exists, send the inverter for repair. The motor can still be operated

55	The offset self-check circuit in current measurement is too large	Internal fault	Switch twice. If the fault still exists, send the inverter for repair.
57	Actual motor spindle is too high	The actual refractive index exceeds 10% of the rated speed. The motor cannot follow the normal speed. The motor is driven externally	Set the rated speed to the expected level

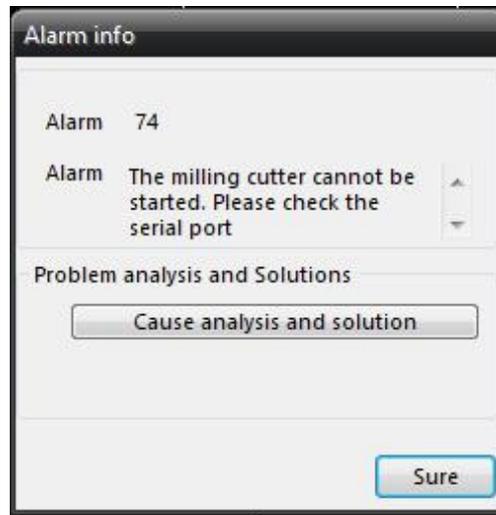
When an error message appears, it means that a serious failure has been encountered and the drive will not be able to operate and must be reset.

Warning code	Fault	Reason	Solution
2	STO interrupt	STO port open	Check STO port
3	Motor ground leakage	Short circuit of motor or power cord	Replace or repair the motor; Check the power cord
4	Radiator temperature High (inverter)	Inverter overload; Insufficient cooling	Reduce load Check the output current
5	Inverter failure during self-test	Performance component failed	Switch twice. If the fault still exists, send the inverter for repair.
6	Overcurrent detection input	Inverter performance component failure; motor or power cord failure	Replace the motor or cable; Switch twice. If the fault still exists, send the inverter for repair.
7	I <sup>2</sup> t closed	I <sup>2</sup> t load is too high, so Motor is off	Cool down the motor and reduce the load; check the parameters "I <sup>2</sup> t time" or threshold"

Warning code	Fault	Reason	Solution
9	No motor type designation	The parameter "motor type" is set to "no motor"	Check the parameter "Motor Type"
11	Temperature monitoring (motor)	The engine may be excessive; Broken sensor cable	Cool the motor and reduce the load; test the sensor; Check the parameters "temperature monitoring" and "resistance value"
14	Monitoring-power supply under voltage	Power supply voltage is too low	Test power supply voltage, test power connection
15	DC voltage is too high	The power supply voltage is too high or the motor deceleration ramp is too low	Test the power supply voltage and power connection; Check the parameter "Deceleration ramp"
17	Motor connecting screw	No motor connection or motor phase loss	Check the motor connection; Adjust the parameter "motor type"
29	Error during parameter import/export	Digital configuration error DIN6 and DIN6 input	Check the signal values at DIN5 and DIN6 and their configuration
53	Short circuit or grounded DC inverter leakage	Performance component failed	Check the wiring; Please turn off the power, if the fault still exists, please send it for repair
58	Permanent magnet synchronous motor failed to start after repeated attempts	The motor cannot start	Check the motor and power cord; If possible, adjust the parameters "acceleration ramp", "start time" and "start current"

### 10.3. Common faults and treatment of milling cutters

(1) An error is reported when starting the milling cutter.



(Figure. 27)

Possible reasons: the communication port is set incorrectly; the power of the milling cutter is turned off; the drive is in an error state.

Solution: Set the correct serial port number of the milling cutter in CutterServer; check the power supply of the milling cutter; eliminate the error according to the drive error report method.

(2) An error is reported when the milling cutter is turned on.

Possible cause: The emergency stop line is disconnected; the cutting equipment is not turned on.

Solution: Check the emergency stop line and eliminate the line problem; first turn on the power of the machine, then turn on the power of the milling cutter.

(3) The milling cutter is disconnected.

Possible cause: The power of the milling cutter is turned off under normal conditions; the USB communication line is disconnected.

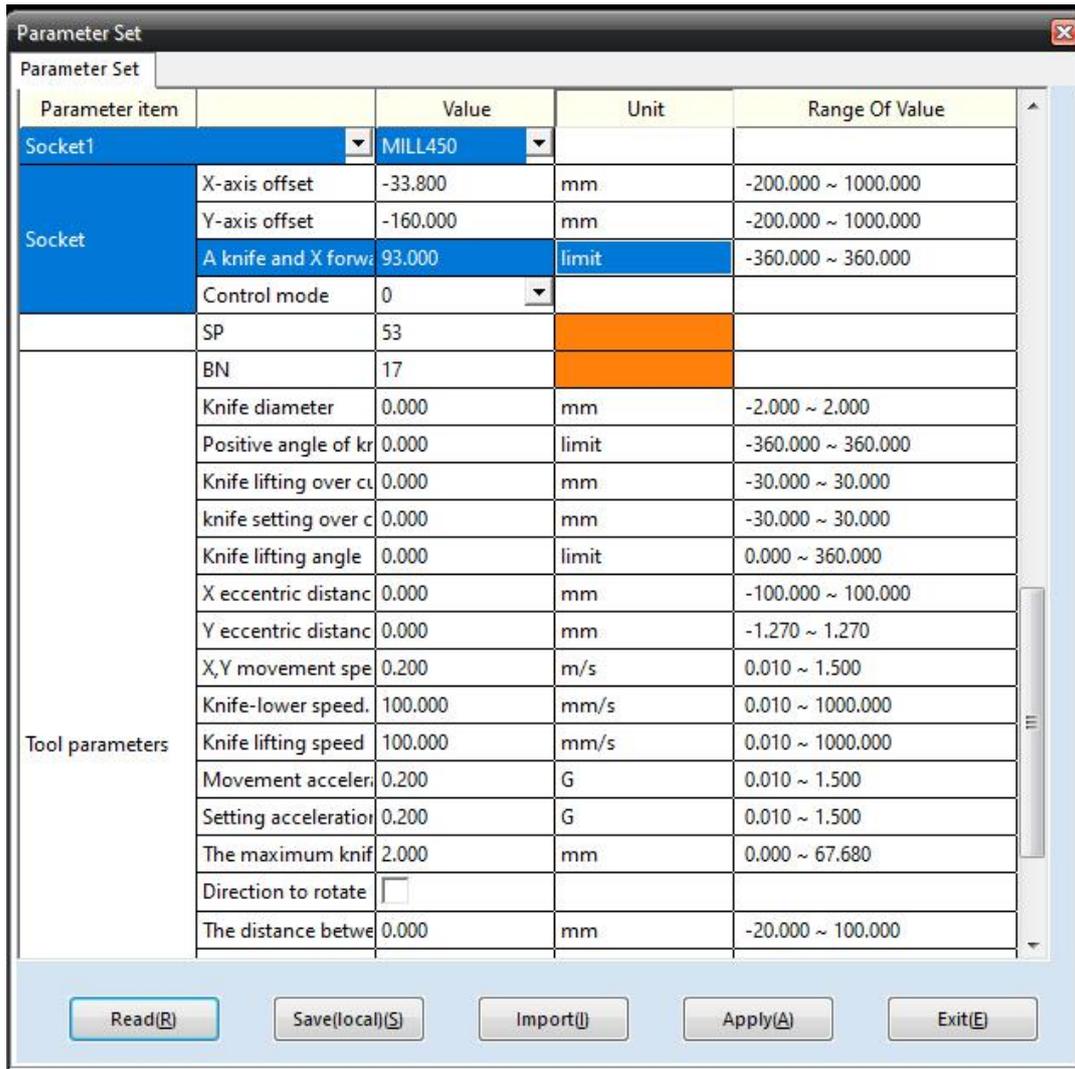
Solution: Check the status of the milling cutter; check whether the USB communication line is properly connected.

When changing from another tool to a milling cutter tool, the lock catch cannot be installed in the positioning rod.

(4) When changing from other tools to milling cutters, the lock catch cannot be installed in the positioning rod.

Possible reason: The direction of the tool holder of the machine head needs to be modified (non-tool direction parameter).

Solution: Modify the machine parameters, "the angle between the knife and X positive direction" under the tool holder.



(Figure. 28)

## Statement

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