UP3D

P53

SERVICE MANUAL

- All diagrammatize
- Error code Identification keys
- Operation Videio in QR code
- Professional Class

Digital Technology Improves Life

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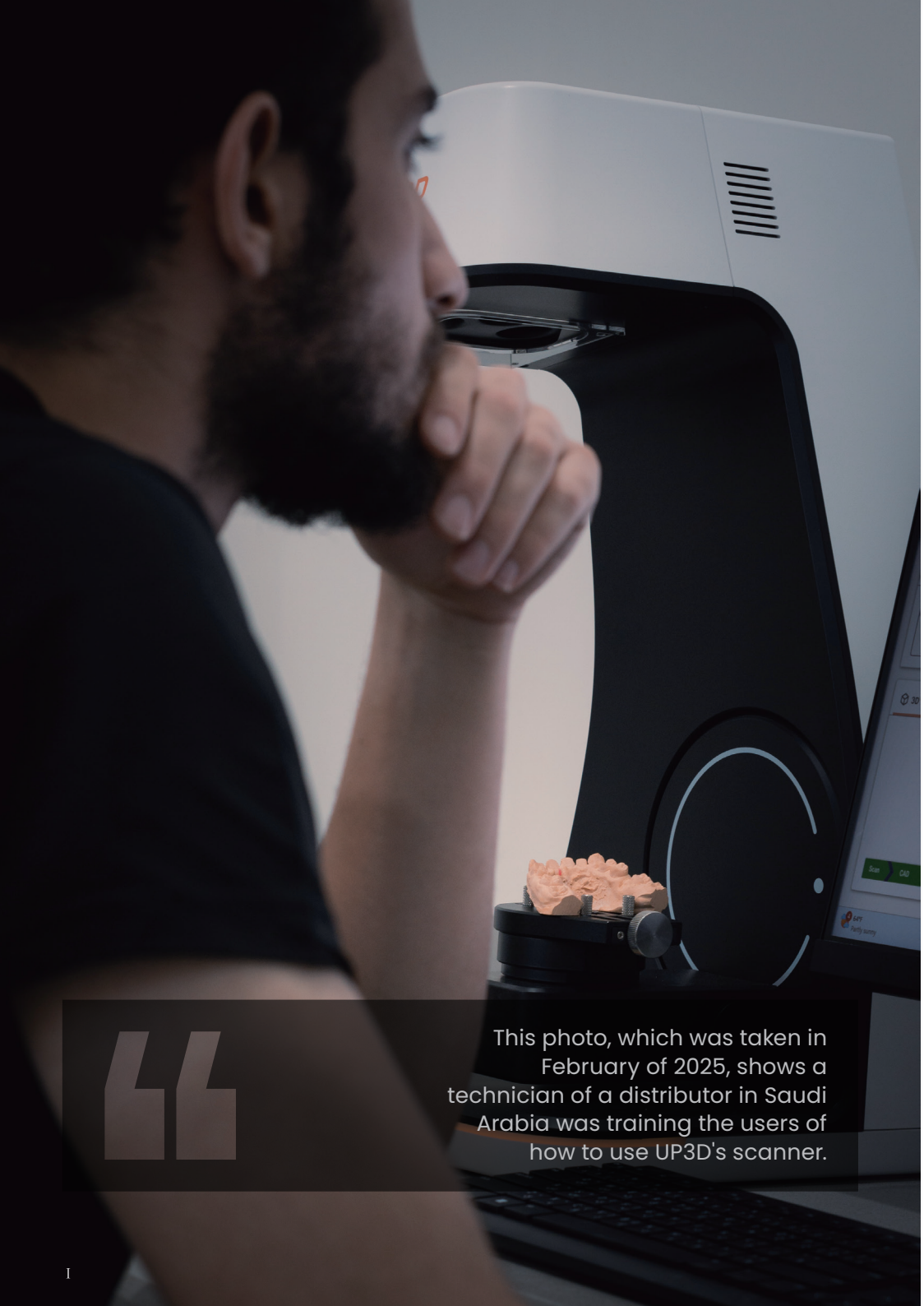

This photo, which was taken in February of 2025, shows a technician of a distributor in Saudi Arabia was training the users of how to use UP3D's scanner.

Confirmed by

UP3D TECHNOLOGY DEPARTMENT

UP3D GENERAL MANAGER OFFICE

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01

A Good Start of Service

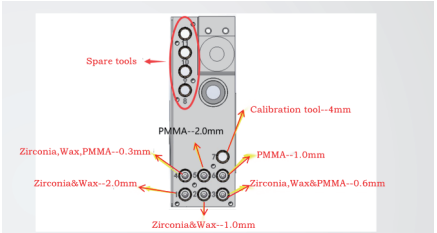
1. Use the burs properly

(1) P53 milling burs location:

Location N8:
Flat milling burs

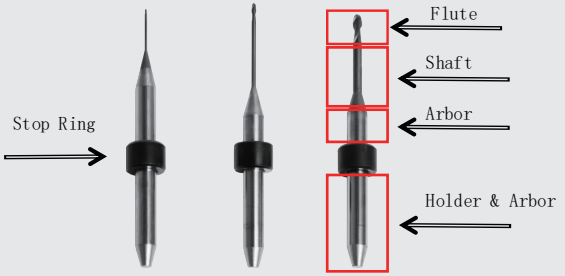
Location N7:
Calibration burs & T type milling burs

Location N9-N11:
Composite resin milling burs & Spare burs

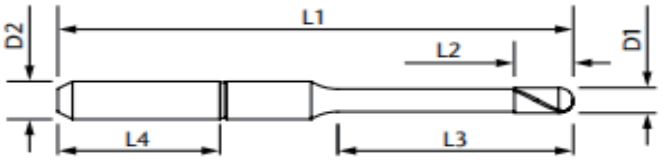


Tools location

(2) Components of the milling burs:

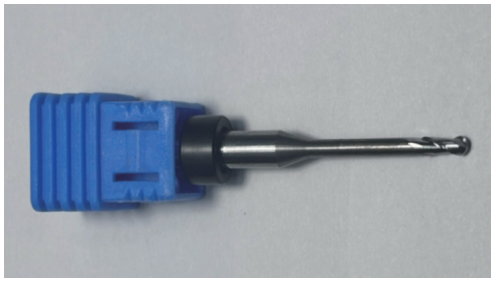


(3) Examples of detailed dimensions of the Zirconia 2 mm Milling bur:

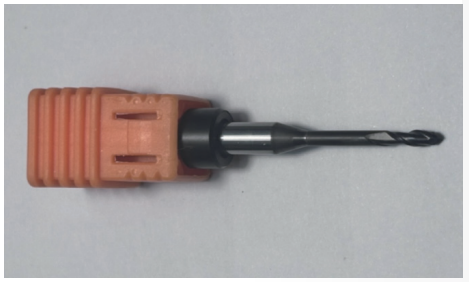


D1 (mm)	2.0
D2 (mm)	4.0
L3 (mm)	16.0
L4 (mm)	18.0
L1 (mm)	50.0

(4)Analysis of milling burs coating:



NO Coating



DC / DLC Coating

No coating burs: use it in PMMA/PEEK/Wax material
Coating burs: use it in Zirconia/Composite Resin

(5)DC&DLC milling burs different:

DLC means Diamond-Like Coated,It has a relatively low cost but weak durability.

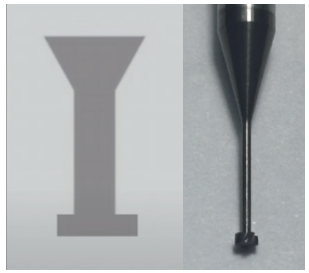
DC means Diamond Coated, It has excellent hardness and wear resistance, and can provide longer tool life and higher cutting efficiency.

Please scan the QR code to check corresponding operation video

(6)Milling burs shape type

Spherical burs

Flat burs (planting)

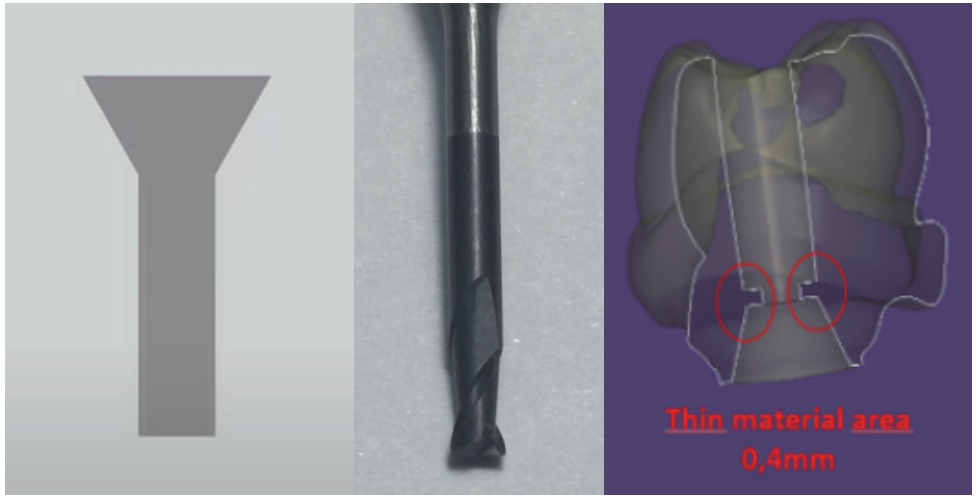


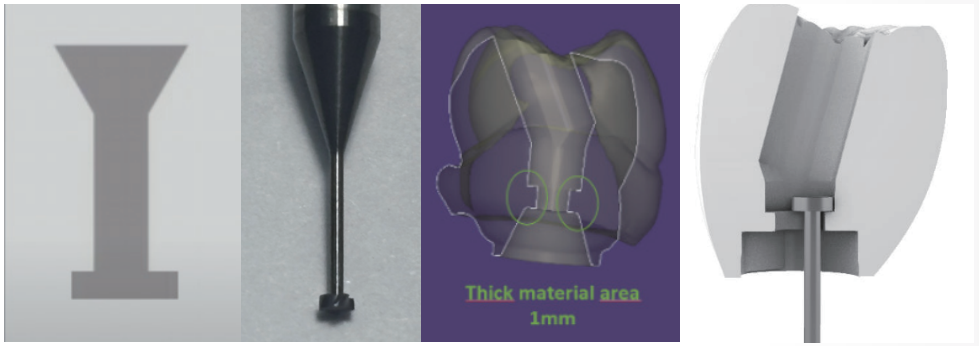
T-shaped burs (planting)

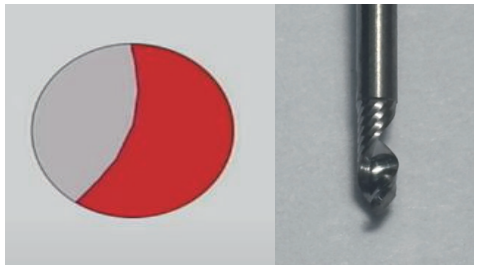
Flat burs:
It is applied in the processing flow of conventional implant restorations.

T-shaped burs:
For some implant restorations with angular deviations, traditional flat cutters cannot effectively remove residual material from chamfered areas due to the lack of cutting space, resulting in processing limitations.

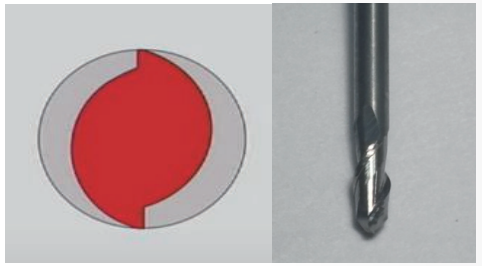
By adopting a cutting path that starts from the bottom of the crown and using a rotating cutting method, this approach can efficiently complete chamfering in angular areas, significantly improving processing adaptability for complex implant structures.







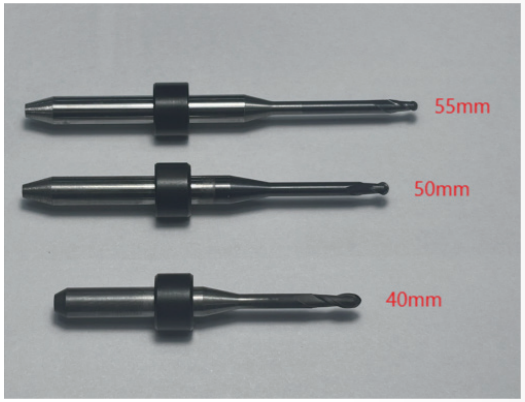
Single-edged type:
High precision machining, optimised cooling and chip removal



Double-edged type:
High-load cutting, stronger rigidity

(7)Special milling burs configuration - long and short burs solutions

Three standard milling burs lengths are available to accommodate different material thicknesses and cutting scenarios, 55mm/50mm/40mm, As shown in the figure below:



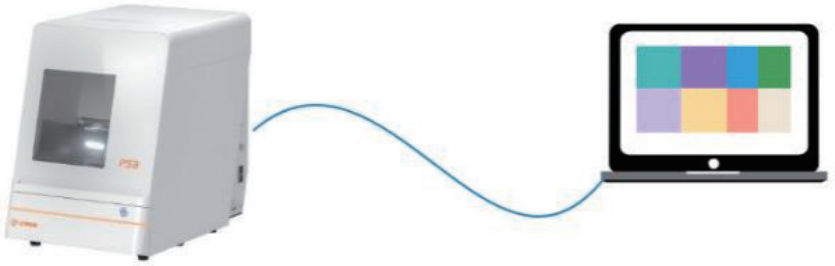
55mm Milling burs:
Application Scenario: Cutting materials with a thickness of ≥25mm to ensure processing integrity.

50mm Milling burs:
Application Scenario: Standard tool length design for processing materials of conventional thickness, suitable for most conventional materials and restorative structures;

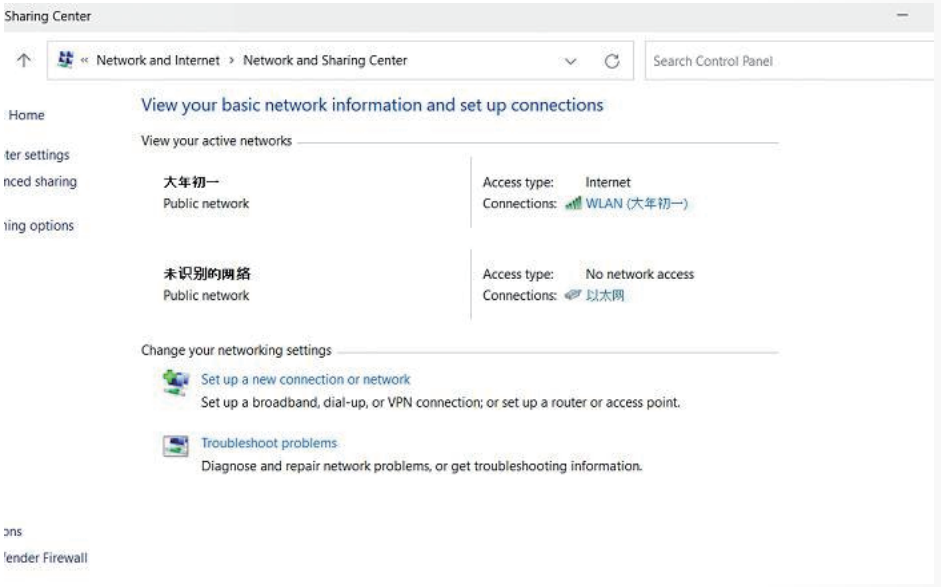
40mm Milling burs:
Application Scenario: Cutting high-hardness materials, such as composite resin tools. The overall length is shortened, significantly enhancing tool rigidity and vibration resistance;

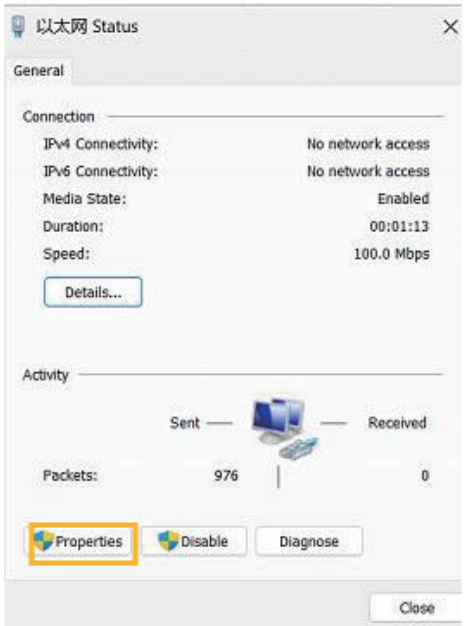
2. Connected to PC

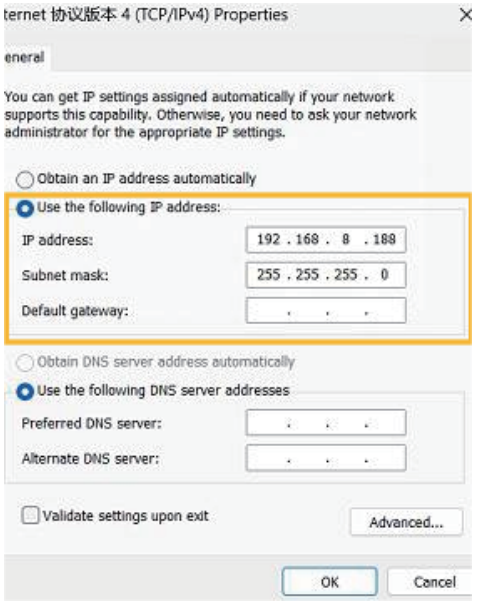
1. Use a network cable (accessory box) to connect the machine to the computer, then turn on machine power.

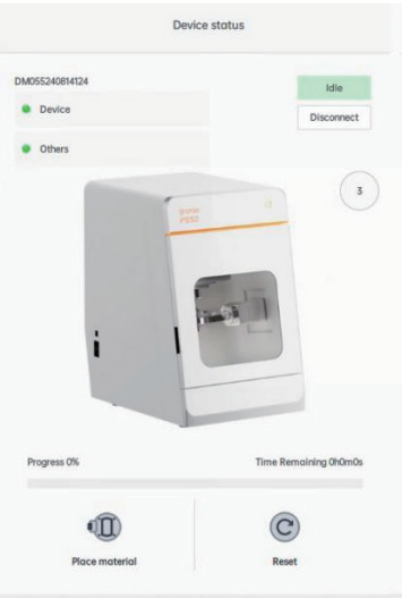


2. Change the machine IP in computer.









If machine is a OLD P53 machine, please try:

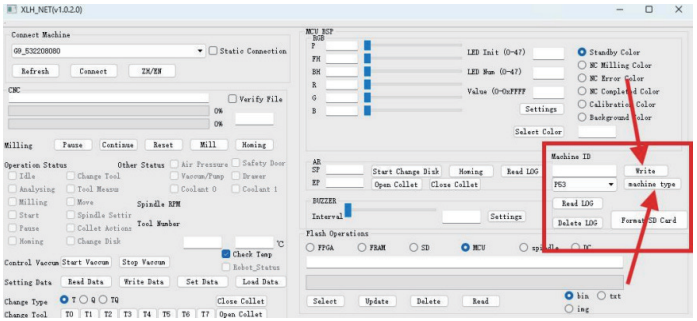
192.168.0.X

192.168.1.X

192.168.2.X

X belongs to 1~225,

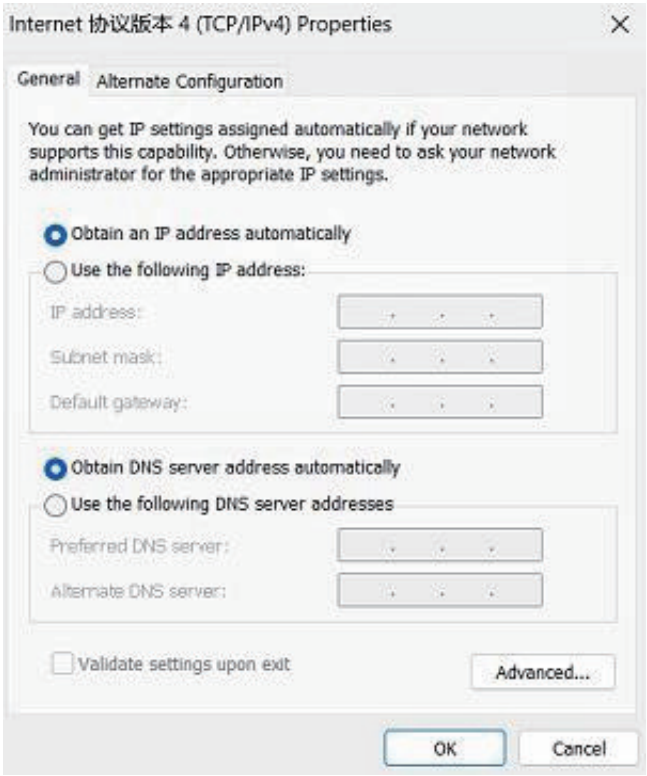
IF MMVH can connect machine, but cnc can not connect, please rewrite machine type and machine ID in the MMVH[1].



If use router to connect machine.

The IP need to be as shown below.

Please see How to use MMVH chapter to know more details.



3. Software and Firmware Matching

Milling Machine all Firmware and Software Matching		
Model	Firmware	CNC
P53-G7	V0413	0928CNC2
P53-G9	V0540	0315CNC2
P53-G10	V0612	0221CNC2
P52	2000.51	0914CNC
P52	2001.21	1123CNC
P53R	V0734	CNC3-2025-0618
P53RDC	V0734	CNC3-2025-0618
P54D	V0720	CNC3-2025-0618
P55D	V0734	CNC3-2025-0618
Earlier P53R	V0718	CNC3-2024-0725

02

Homing Issues

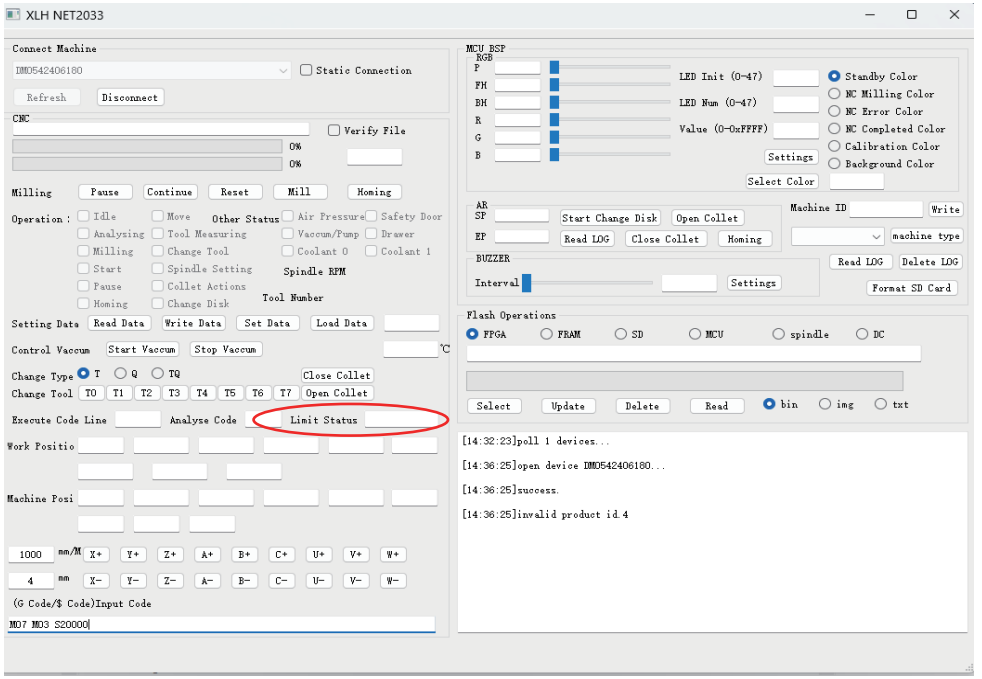
1. X, Y and Z Axis Limit Errors

Appearance:
Error prompt: X/Y/Z homing failed

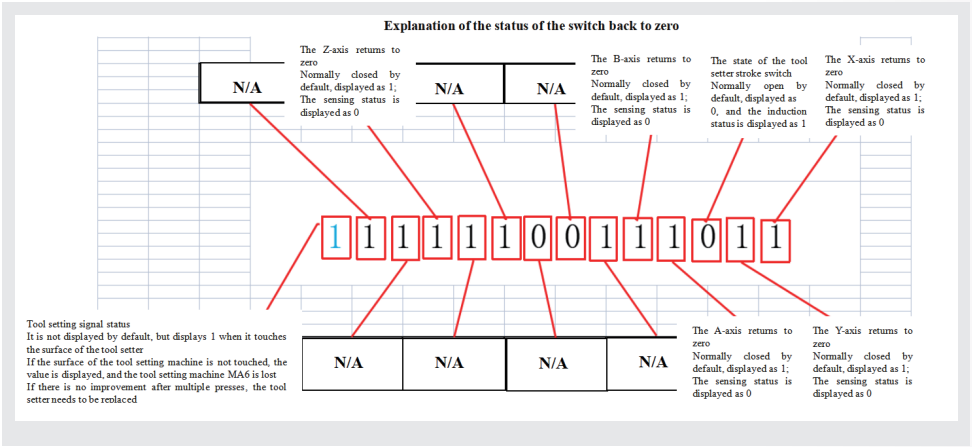
Abnormal cause:
The limit switch aging leads to the decrease of positioning accuracy.

Tools needed:
MMVH (CNC3 can also be used for limit switch troubleshooting, but it is too complex, so MMVH is recommended)

Troubleshooting operation:
Open MMVH, check the 'limit state' of the corresponding axis, and confirm that the limit state sensing of the axis is normal.



53Limit state



P53R limit status:
1101100111000. Since P53R XYZ adopts photoelectric limit switches, the state of all P53R's XYZ limits changes from 1 to 0 when not triggered.

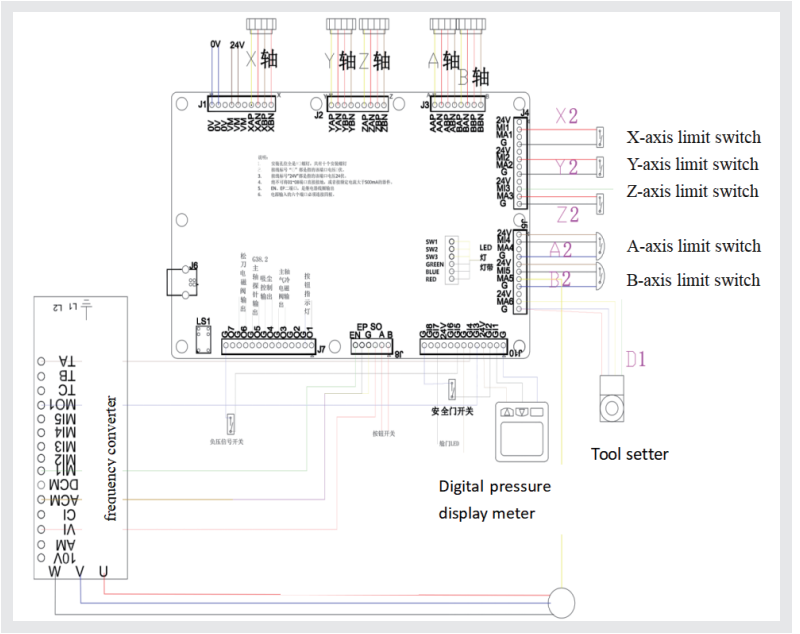
1. Manually tap or push the limit switch and observe the response of the limit switch state on MMVH.
2. If the manual triggering is normal, the homing speed parameter $X/Y/ZSV of the corresponding axis can be modified to 1200 (original 800).
3. If there is no response to manual triggering, the limit switch should be replaced normally.

XYZ negative direction hard limit error ERROR180-ERROR184

Appearance:
Triggering the limit switch by collision during homing is invalid.

Cause:
No feedback of the limit switch trigger signal.

Operation:
1. Swap the wiring of the faulty limit and the normal limit on the control card for testing.
2. For the detection of the control card output/input signal voltage, please refer to "Photoelectric Switch Inspection" / "Micro Switch Inspection".



2. A and B Axis Limit Errors

Appearance:
After clicking "return to zero", the A/B axis fails to return to zero, which is divided into two cases: the axis does not rotate, and the axis rotates without stopping.

Tools:
a set of hexagon socket wrenches, a Phillips screwdriver, a multimeter, MMVH/CNC
A/B axis does not rotate in the zero-return state

Operation:
Remove the three screws shown in the figure below, then the B-axis dust cover can be taken off to see the internal structure of the B-axis.

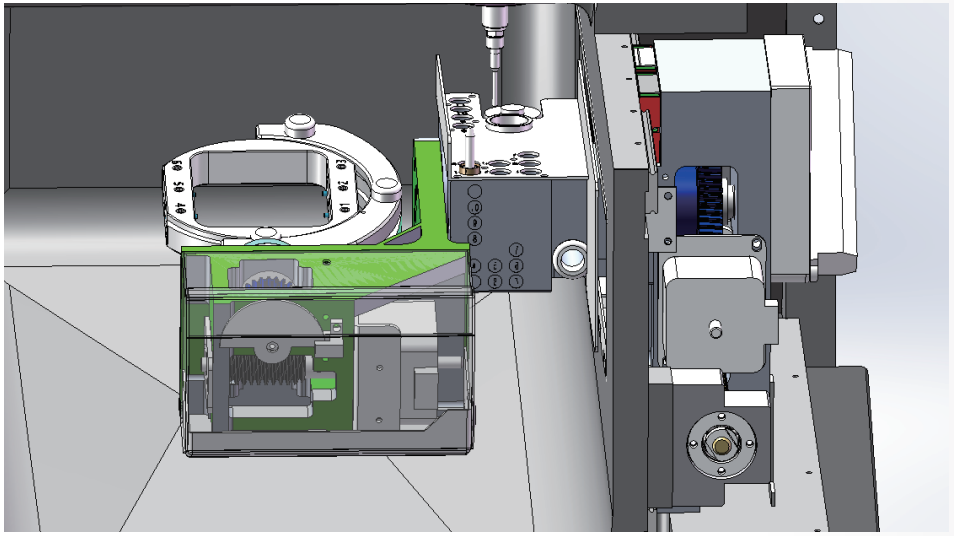
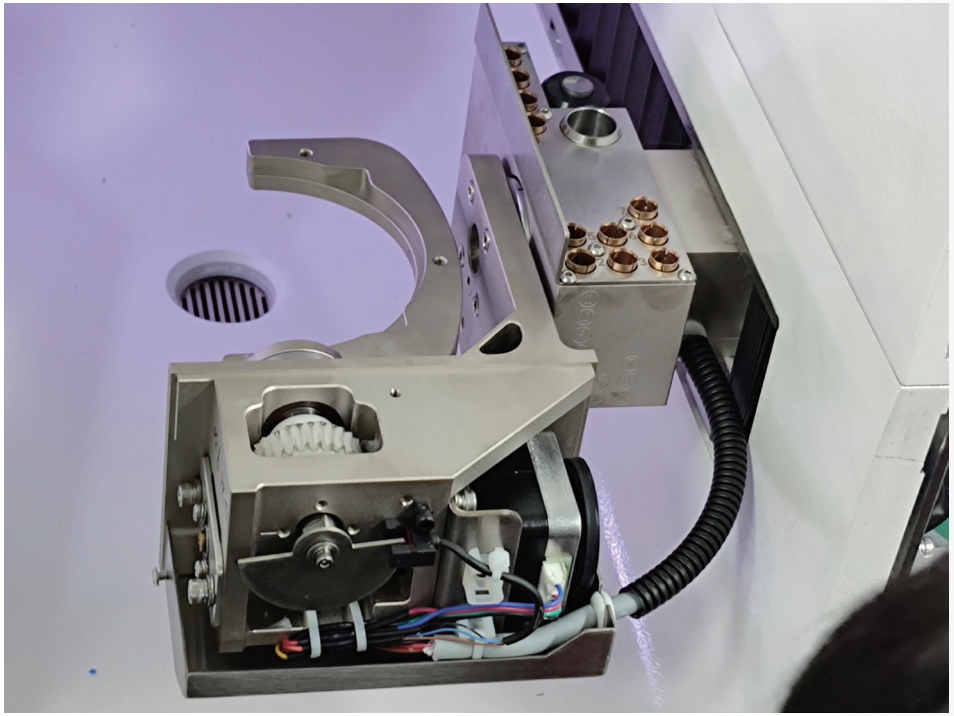
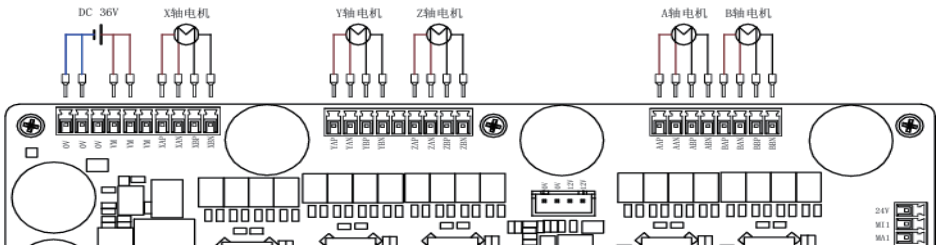
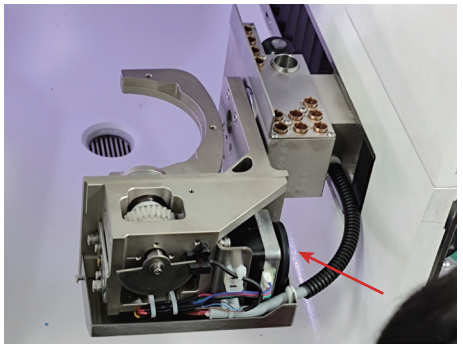
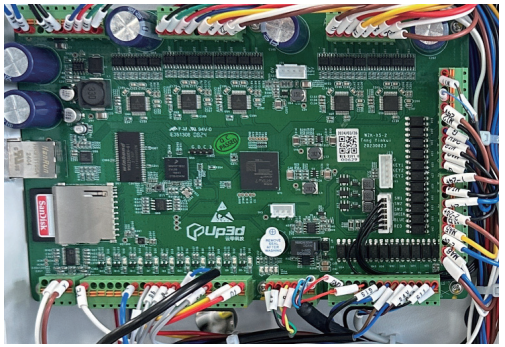


Photo after removal:







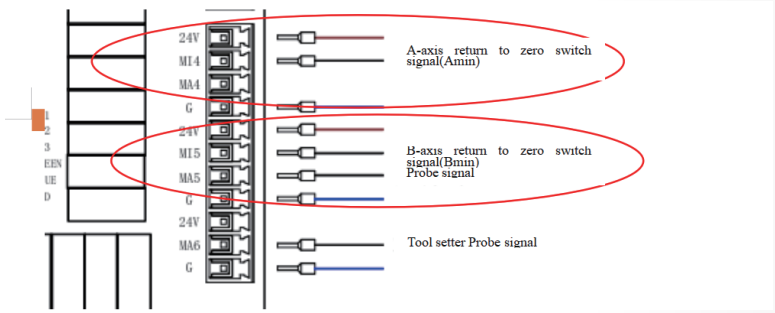


Rotate the motor rubber wheel (it cannot rotate when powered on, and the motor is locked. Test whether rotation is smooth when powered off). If rotation is difficult or locked when powered off, it is necessary to check the worm gear and worm for possible dust-induced locking (see A/B Axis Cleaning Document for details). If it can rotate when powered on, it indicates a motor system problem. It is necessary to confirm that the motor wires are normal, and at the same time swap the wiring of the normal motor on the control card to perform CNC operation tests for A/B axis movement.

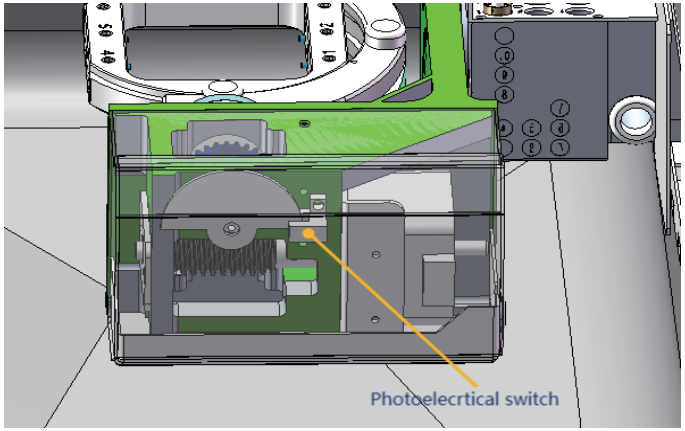
For example, if the B-axis motor cannot rotate, swap the wiring of the A/B axis motors on the control card, and operate the A and B axes respectively on the CNC to rotate. If after swapping, the A-axis can rotate but the B-axis still cannot, it is a motor problem. If the A-axis cannot rotate but the B-axis can, it is a control card problem (motor wire inspection must be completed before testing).

A/B axis rotates continuously in the zero-return state
Fault occurrence points: photoelectric limit switch itself, wires, control card. If the customer has replaced the control card recently, it is necessary to check the firmware and parameters.

Operation:



First, remove the external dust cover of the A/B axis, and check the status of the photoelectric switch with the MMVH software.



First, it is necessary to check whether the line to the control card is normal. If not, the line needs to be replaced.

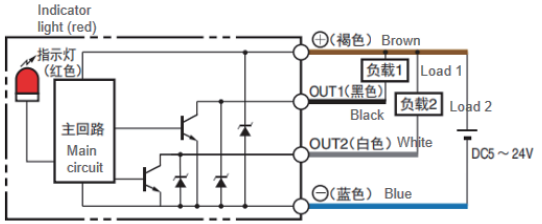
Secondly, it is necessary to check whether the signal feedback is normal when the photoelectric switch is triggered.

The wiring of the normal and faulty photoelectric switches on the control card can be swapped for testing.

If there is a problem with the photoelectric switch, a multimeter can be used for troubleshooting in accordance with the "Photoelectric Switch Inspection" Chapter

Please scan the QR code to check corresponding operation video

3. Photoelectric sensor check



NPN Output | EE-SX953-W 1M 1

Output circuit diagram

The photoelectric switch has four wires, of which the white circuit is not used, so it is a normally open type:

Normally open signal wire (black OUT1): Contacts that are open when not energized;

Power supply positive wire (brown): Connect to the positive terminal of the power supply

Power supply negative wire (blue): Connect to the negative terminal of the power supply

Measurement method:

Multimeter DC 200V Mode,

Use the Multimeter probe to touch the black and brown wires of the photoelectric switch, when not triggered, the voltage reading is 0V, after manually triggering the photoelectric switch, the voltage reading is 24V.

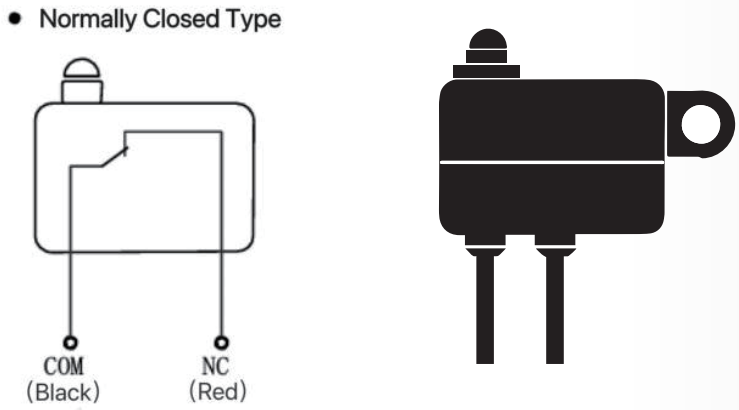
Touch the brown and blue wires of the photoelectric switch with the Multimeter probes,
When not triggered, the voltage reading is 24V.
After manually triggering the voltage reading is 0V.

The replacement method is to cut off the original limit switch wiring,and connect the new photoelectric switch wiring to the old wiring to complete the replacement.

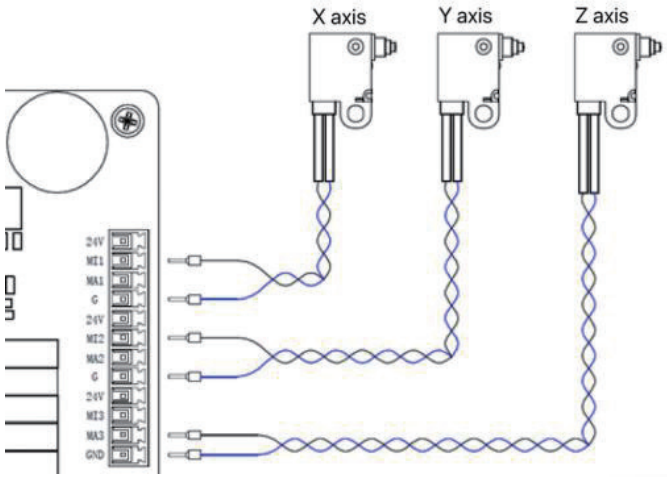
Please scan the QR code to check corresponding operation video

4. Mechanical limit sensor check

Microswitch:



Wiring diagram:



Measurement methods:

The multimeter DC 200V mode.

The probe touches the two wires of the limit switch separately. When not triggered, the voltage reading is 24V. Press the limit switch manually and continuously, the voltage reading is 0V.

Replacement is an option to completely replace the wiring from the microswitch to the control board.

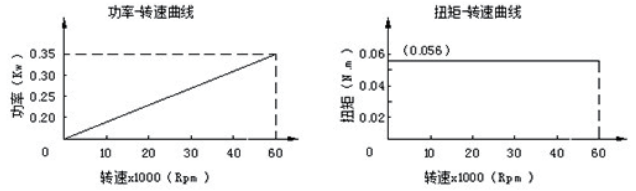
Simply cut off the original limit wires. Replace the microswitch by connecting the new microswitch to the old wires.

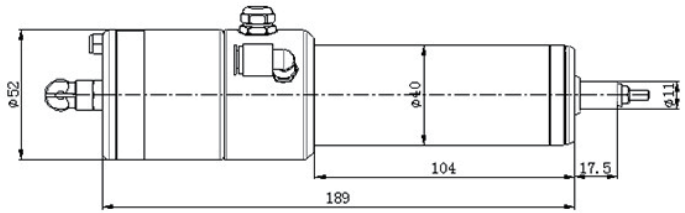
Please scan the QR code to check corresponding operation video

03

Spindle System

DC-40V5					
主轴参数 Parameters					
电机功率 Motor Power	KW	0.35	额定电压 Rated Voltage	V/AC	120 (3~)
最高转速 Max Speed	Rpm	60000	最大电流 Max Current	A	2.5
最高频率 Max frequency	Hz	1000	转矩 Chuck Torque	N·M	0.056
技术参数 Technical Parameter					
轴端锥面跳动 Shaft-end Cone Run-out	mm	≤0.001	松刀气压 Tooling Releasing Air	Kgf/cm²	5.0-6.0
换刀形式 Tooling Exchang	—	自动 ATC	前端气幕气压 Air Curtain	Kgf/cm²	—
拉刀力 Tooling Pulling Force	N	≥1000	回刀气压 Tooling back air pressure	Kgf/cm²	无 N/M
刀具接口 Tooling	—	Φ4筒夹 Collet Chuck	冷却方式 Cooling method	—	风冷 Air cooling
编码器 Encoder	—	无 N/M	冷却介质压力 Coolant	Kgf/cm²	2.5~3.0
接近开关 Approach Switch	—	无 N/M	轴承润滑方式 Bearing	—	油脂 Grease
主轴平衡等级 Balance Level	—	G1	安装方式 Instllation	—	抱夹 Mechanical clip
振动值 Vibration Value	mm/s	≤0.8	重量 Weight	Kg	1.35

Motor characteristic curve	
Application	Suitable for soft materials processing such as zirconia for denture machine.

Measurement	

1. Spindle Calibration Issue

Purpose:
Troubleshooting steps for abnormal spindle movement during calibration

Tools:
A set of L-shaped hex wrenches, CNC software, multimeter

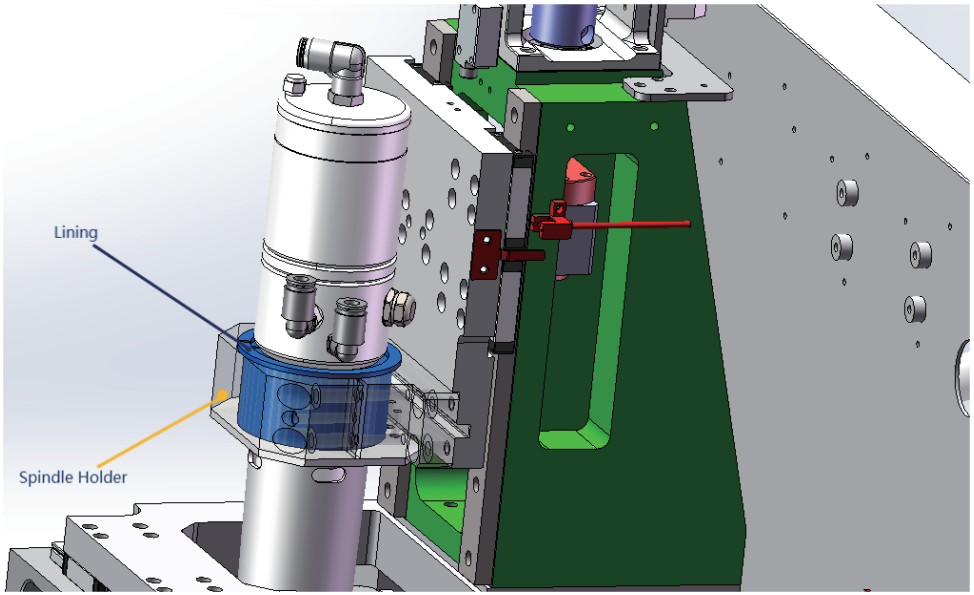
Appearance:
1.The spindle hovers above the tool post, remains stationary, and no error is reported.

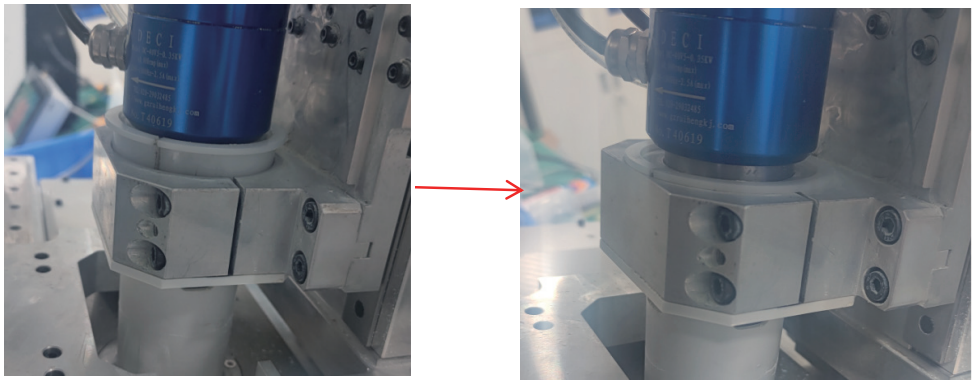
Parameter error, need to adjust - During the spindle calibration process, when moving to the relative height of the tool post to the surface of the tool aligner, if it does not touch the surface of the tool post and there is no MA5 (yellow-green wire) signal, it will only move 3mm in the negative direction of the Z-axis at most.

If it still does not touch the surface of the tool post and there is no MA5 (conduction) signal, the spindle will stop still on the surface of the tool post without associated error reporting (with reference to the processing machine position parameters)

Tool setter surface position (without knife) Z:	-71.800 ~ -69.800
Calibration ring absolute position X:	7.200 ~ 8.500
Calibration ring absolute position Y:	117.700 ~ 119.000
Tool holder (relative to tool setter surface) Z:	-71.000 ~ -69.900
Clamp offset height	2.000
Fixture center position (relative to calibration ring) X	106.700 ~ 107.300
Fixture center position (relative calibration ring) Y	27.800 ~ 28.400
Fixture Center Position (Without Knife) Z:	-97.600 ~ -96.100

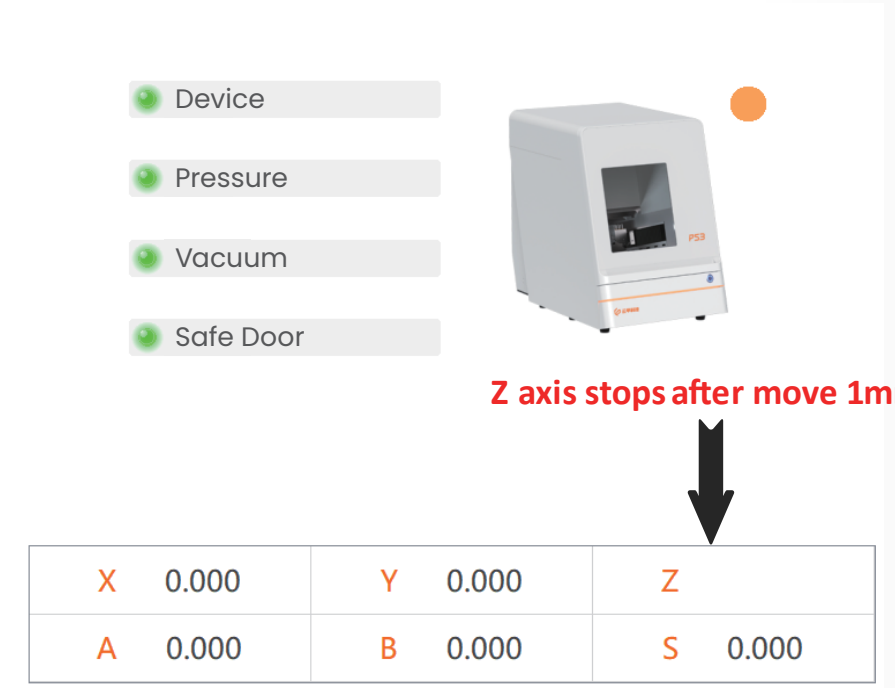
Spindle displacement, need to recover - readjust the spindle installation position and tighten the screws (3.0 N.m)





Abnormal spindle movement caused by Z-axis step loss (very rare) - Check the value of the Z-axis rapid movement parameter $zvm and adjust it to 2400.

2.The spindle hovers at the zero position, remains stationary, and there is no error report.



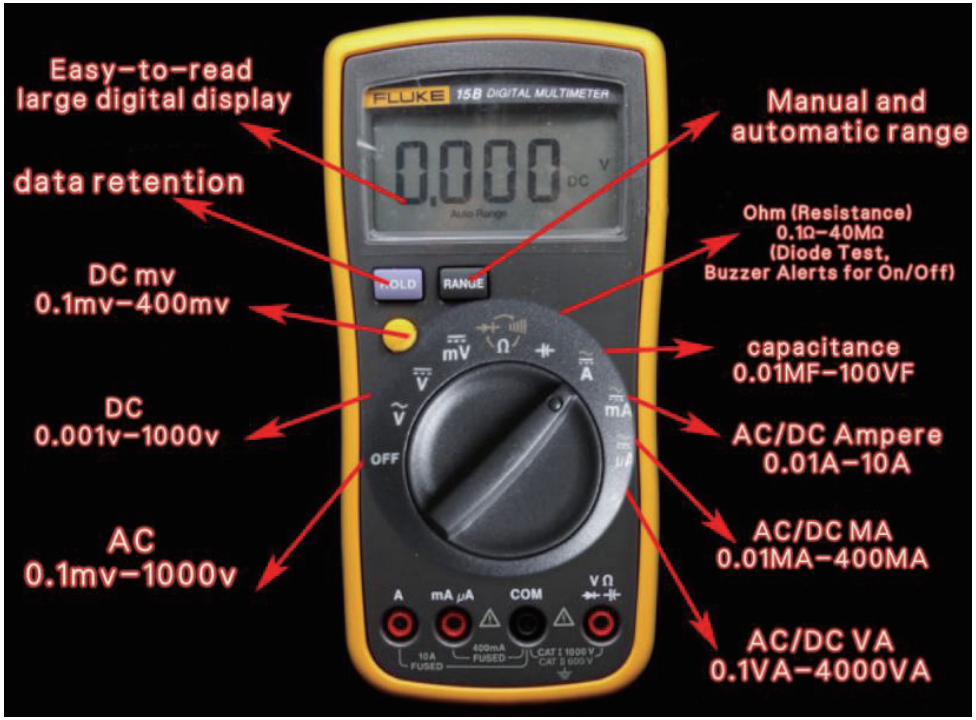
X	0.000	Y	0.000	Z	
A	0.000	B	0.000	S	0.000

(1) A short circuit in the spindle ground causes an abnormality in the MA5 (yellow-green wire) signal, resulting in the machine receiving the MA5 (conducting) signal during the downward probing process at the zero return switch position. At this time, the Z-axis coordinate on the CNC interface will display 1.00.

(2) Use a multimeter to check the spindle-related circuits and the ground conduction status, then check whether there is a conductor at the clamp contact position causing the spindle to be connected to the clamp. If the spindle itself is short-circuited, the spindle needs to be replaced.

(3)Set the multimeter to the conduction mode, and measure whether the spindle U, V, W, and MA5 are conducting to the ground respectively.

(4) Set the multimeter to the conduction mode, and measure whether the spindle is conducting to the ground under normal conditions.



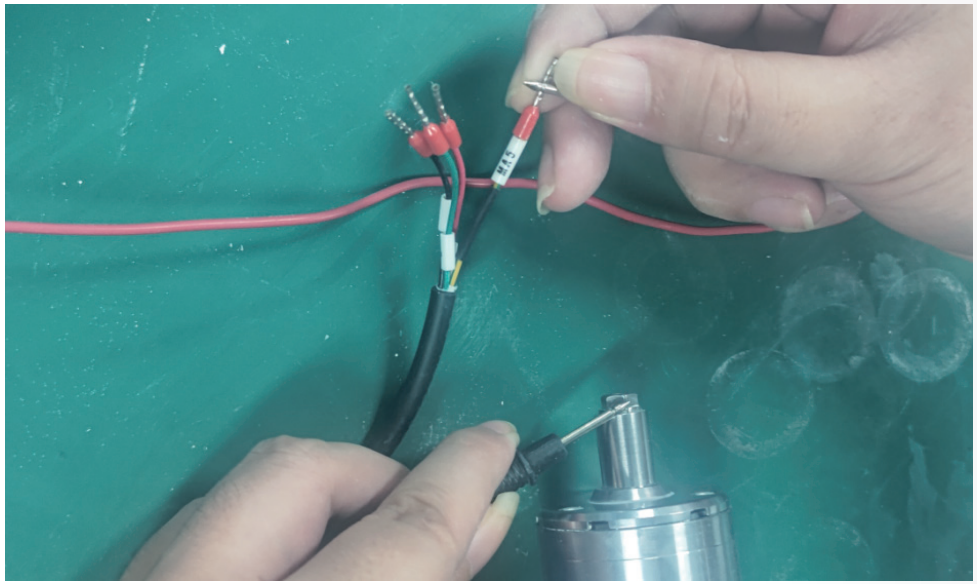
3. The spindle collides with the surface of the tool post, and automatic calibration is abnormal.

During the spindle calibration process, when moving to the height of the tool post relative to the tool aligner surface, if the MA5 (yellow-green wire) signal is received, it will continue to move 3mm in the negative direction of the Z-axis.

If there is still no MA5 (yellow-green wire) signal at this time, it will collide with the surface of the tool post.

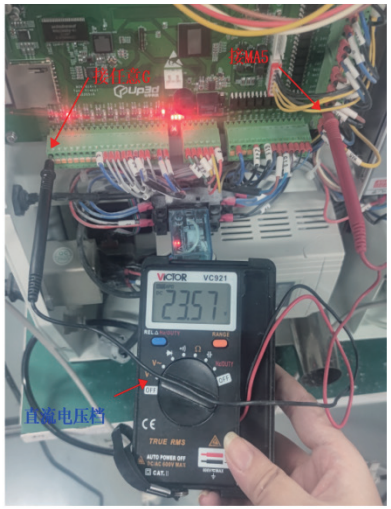
(1)The spindle is not conducting - set the multimeter to the buzzer mode, connect one end to the spindle MA5 (yellow-green wire) and the other end to touch the spindle collet, and check the conduction status of the spindle (multimeter buzzing).

If it is not conducting, connect the air pipe to the spindle, and confirm again after ventilation (the control code is G38.2).



(2)No signal output from the MA5 port of the control card - Power on the equipment, set the multimeter to DC voltage mode, connect one end to the MA5 pin of the control card and the other end to any G pin, and check the signal output of the control card (around 24V).

If the signal output of the control card is abnormal, replace the control card.



Please scan the QR code to check corresponding operation video

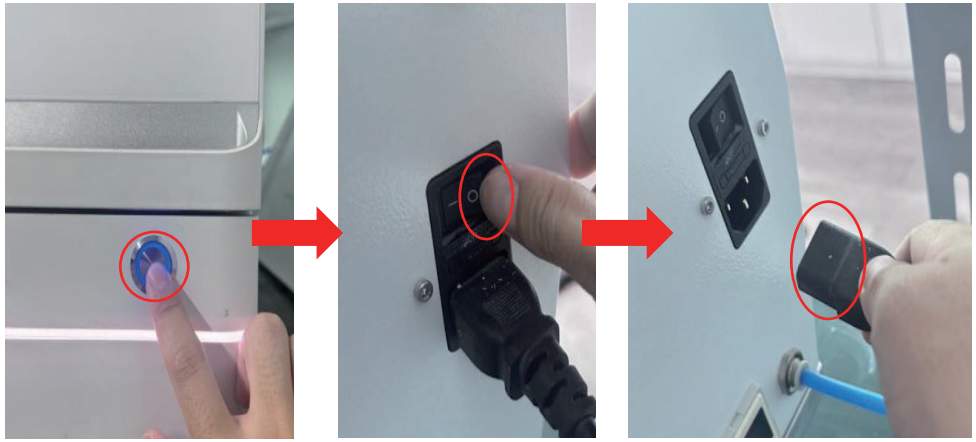
2. Spindle Rotation Issue

Purpose:
Check the spindle states, through manual inspection, software testing, and hardware testing.

Required tools:
Spanner, cross screwdriver, flat screwdriver, Multimeter, MMVH/CNC3 software.

Operation steps are as follows:
1.When machine showing the spindle does not rotate, the first time operation is turn off machine and take out power cable, wait 10 minutes, then restart.

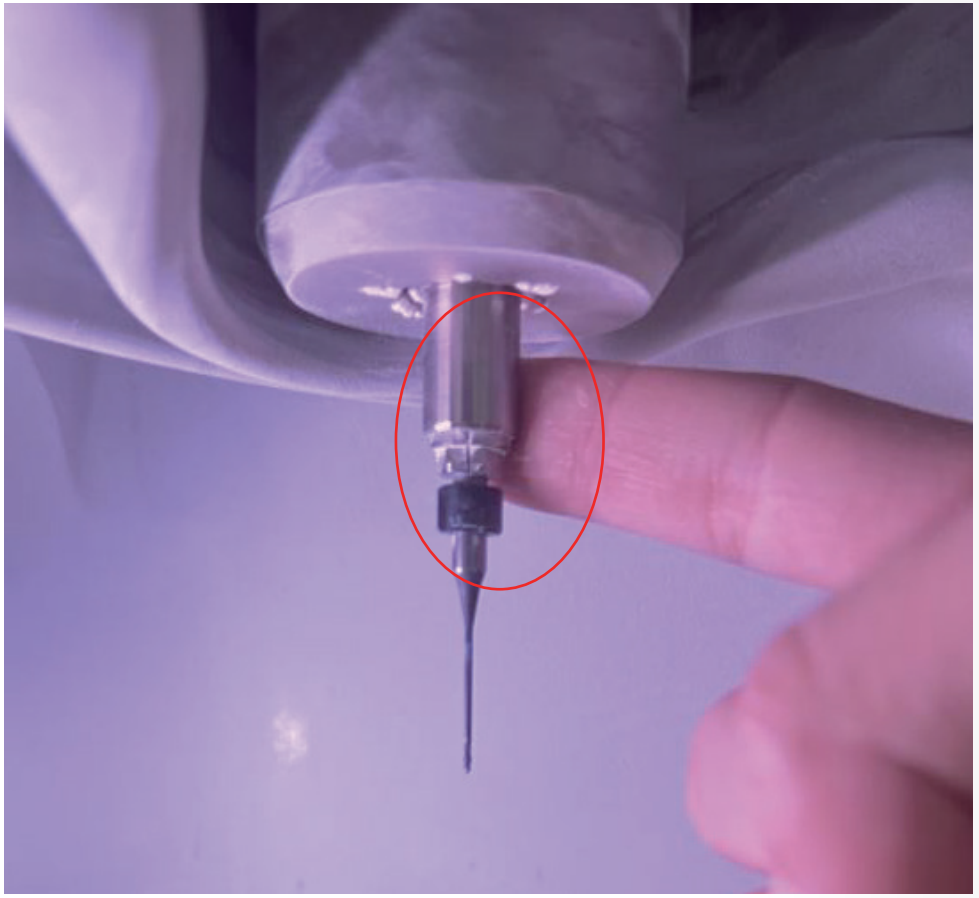
(1)Power off the device, unplug the power cable and wait 10 minutes,



(2)Then restart the device and test. If the spindle rotates normally, the problem is over, if it continues to report errors proceed to the next step.

2.Manually troubleshoot the spindle status:

(1)When the spindle is kept in the state of clamping the knife, gently rotate the spindle manually to observe whether it is smooth and without abnormal noise.

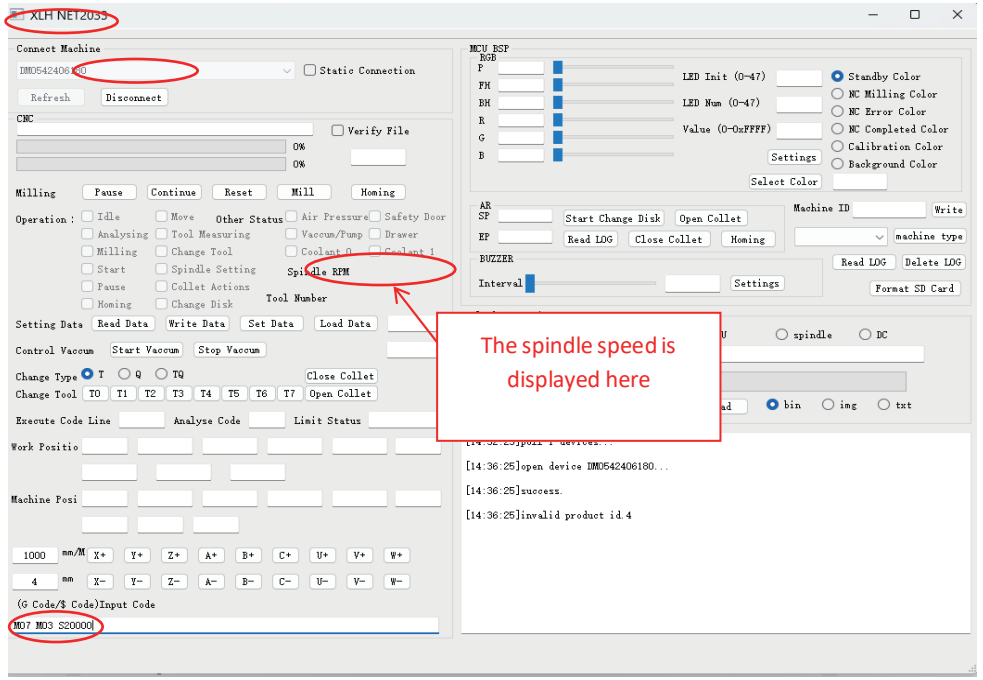


(2)If there is a stuck or a obvious resistance to rotate, or a loud strange noise, you need to replace the spindle, the problem is solved.

(3)If the rotation status is normal, then the next step in the troubleshooting should be carried out

3.Use MMVH/CNC3 software to input rotary commands and test whether the spindle can give feedback.

(1)Open MMVH/CNC3, input the command: M07 M03 S20000, observe whether the spindle starts to rotate and whether the rotation is normal. Note that you need to click reset within 10 seconds to pause the rotation, otherwise it will cause spindle damage.



(2)If the spindle can not rotate, MMVH page error, you need to check the error code and spindle inverter error code, compare the error code table for the next line of trouble-shooting, you can refer to the "spindle detection document" for the spindle itself:

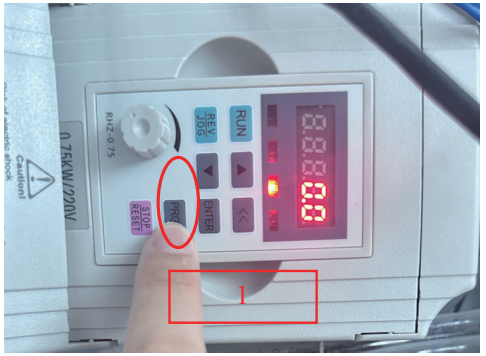
(3)If the spindle itself is found to have no problem after testing, you can carry out the following steps to manually operate the frequency converter for spindle rotation and check the parameters of the frequency converter

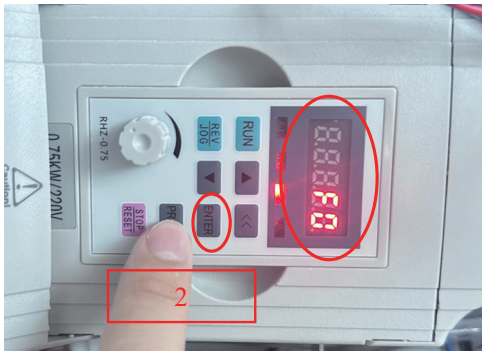
4.Frequency converter parameter check

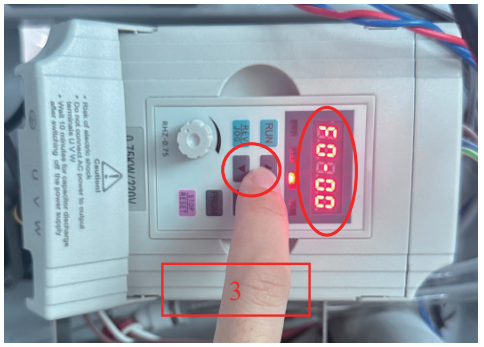
Check the inverter parameters against the inverter parameter table

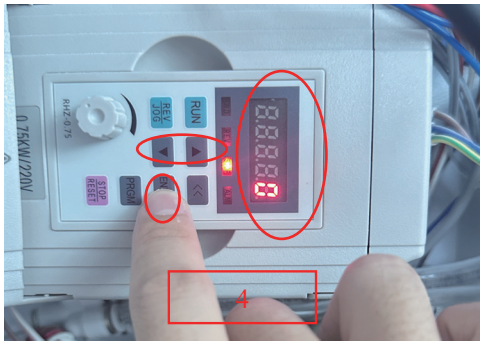
Press the PRGM button to enter the parameter page. The LED display initially shows F0. At this point, you can use the up/down buttons to adjust the F0-F6 series parameters. Press ENTER to enter the F0 series parameters. At this point, you can use the up/down buttons to adjust F0-00 to F0-18.

After selecting the parameter to be adjusted, click ENTER again to enter the parameter page. You can use the up/down keys to adjust the parameter. After confirmation, click ENTER to save the parameter and return to page 3. You can then use the up/down keys to adjust the next parameter, or click PRGM to return to page 2. Clicking PRGM again will return to page 1.









For complete instructions, please refer to the video.

5.Manually operate the variable frequency drive to rotate the spindle and check whether the variable frequency drive to the spindle is normal.

(1) Click the PRGM button to enter the parameter page.

(2)Click ENTER to enter the F0 series parameters.

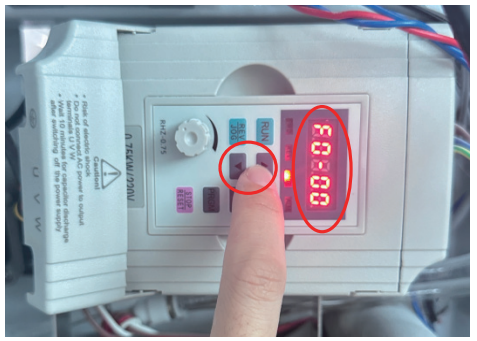
(3) Click the up and down buttons to adjust the F0-00 to F0-02 parameters, and click ENTER to enter this parameter setting.

(4) The default parameter is 1 (terminal command channel). We need to adjust it to 0 (operating panel command channel). Clicking ENTER will return to Figure 3. At this point, clicking PRGM will return to Figure 2, and clicking PRGM again will return to Figure 1.

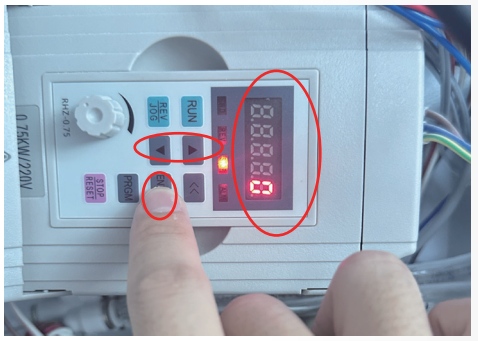
(5) Click RUN to start the spindle rotation (Figure 5), and click STOP to stop the spindle rotation (Figure 6).

1

2



3



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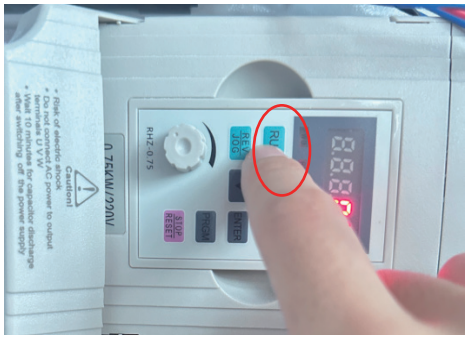


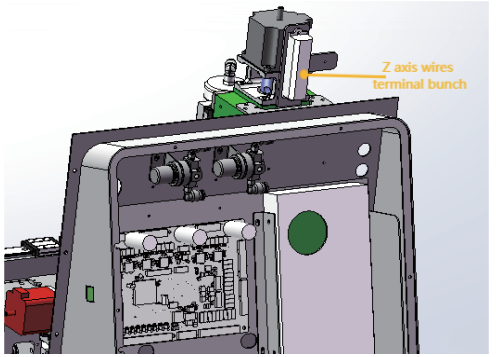
5

6

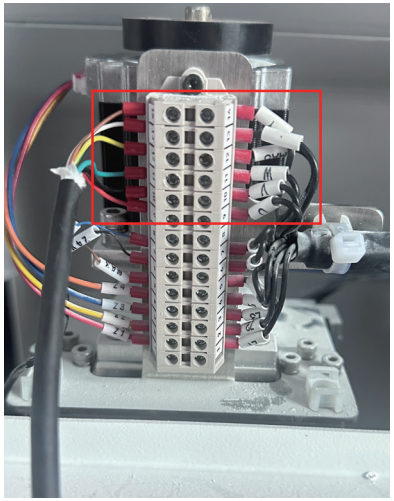
3. How to Check Spindle by Multimeter

Tools required:
Multimeter and Spanner

Operation:
Remove the top maintenance panel and rear maintenance panel.

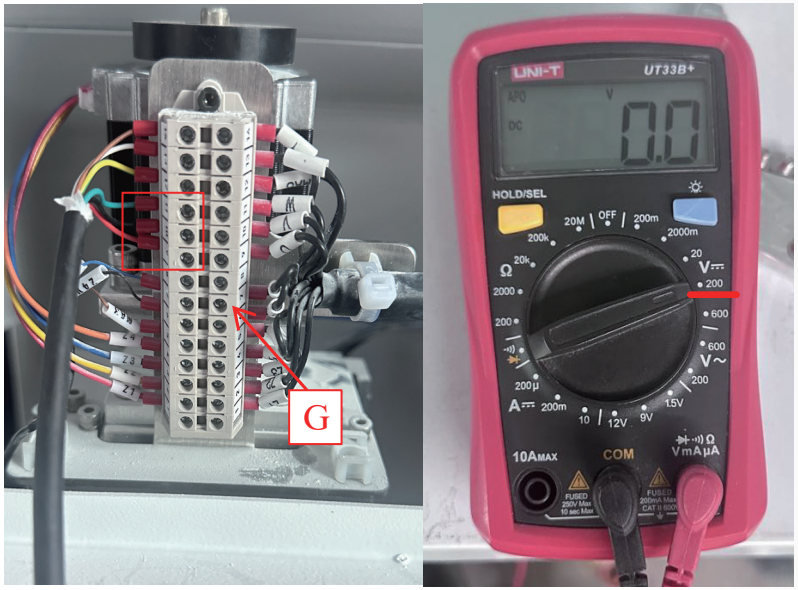


1. Locate the wiring for the spindle on the Z-axisadapter terminal strip.
P53 has 4 wires: U, V, W, MA5.
P53R has 6 wires: U, V, W, MA5, X, Y.



2.Measurement is divided into two steps:
measurement on the machine turn on and measurement on the machine turn off.

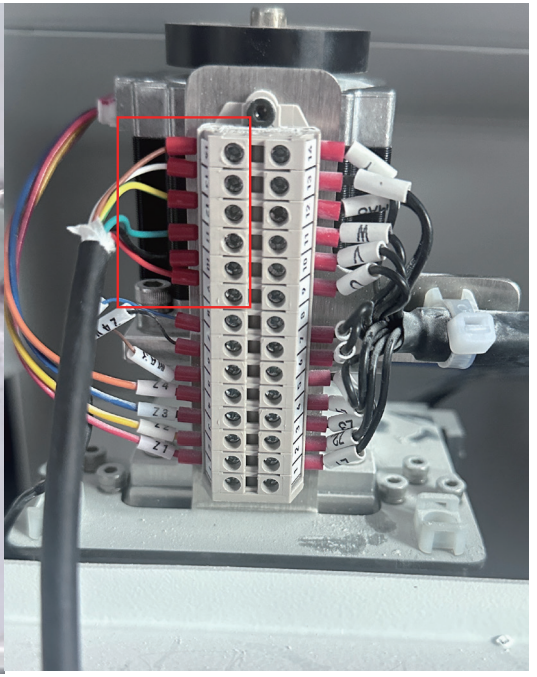
(1)Measure the voltage between the spindle wiring U/V/W and GND in the startup state. The normal measurement results should be the same and not be 0.



(2)Set the Multimeter to the 200V DC Model, find the GND/G port on the wiring terminal with the black pen, and touch U/V/W with the red pen to obtain the results for comparison.

3. Shutdown state

Set the Multimeter to the 200 ohm resistance Model, disconnect the main shaft UVW wiring from the adapter terminal block, and measure the resistance between each pair of UVW terminals (UV, UW, VW). The normal value should be around 14 ohms. If the values differ, there is a fault inside the main shaft, and it needs to be replaced.



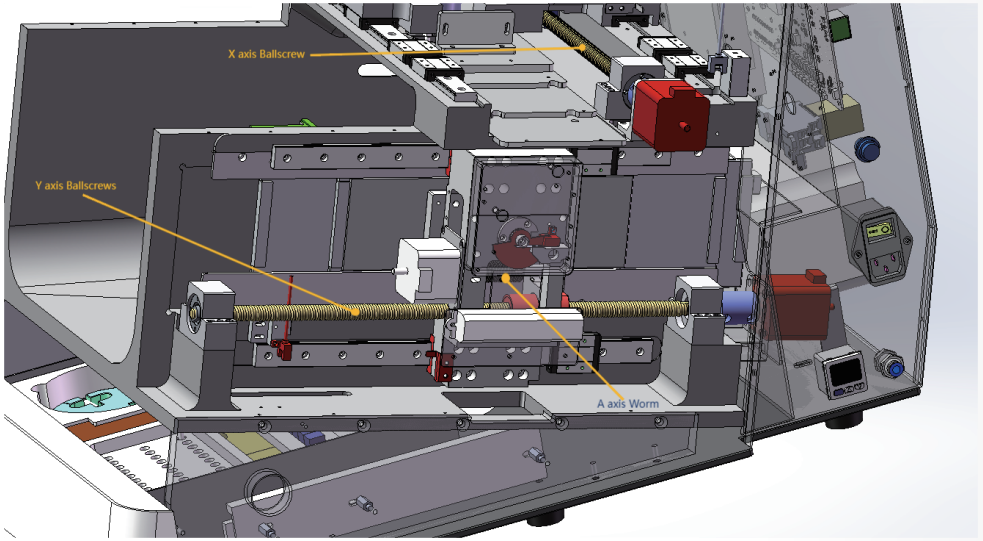
4.How to replace spindle

Tools:
Allen wrench (accessory box), Cross screwdriver, alcohol/WD40 cleaning fluid

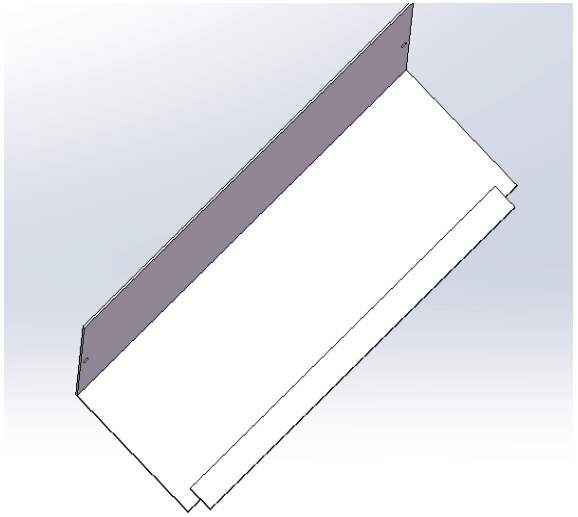
Parts to be removed:
Left side panel of the processing machine (button side), top maintenance panel.

Operating steps:

Turn off machine, take out power cable, Remove the left side panel of the processing machine (7 screws).

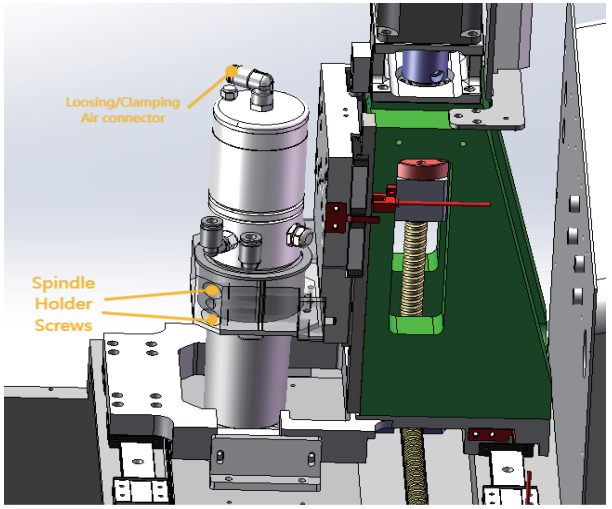


Remove the top cover

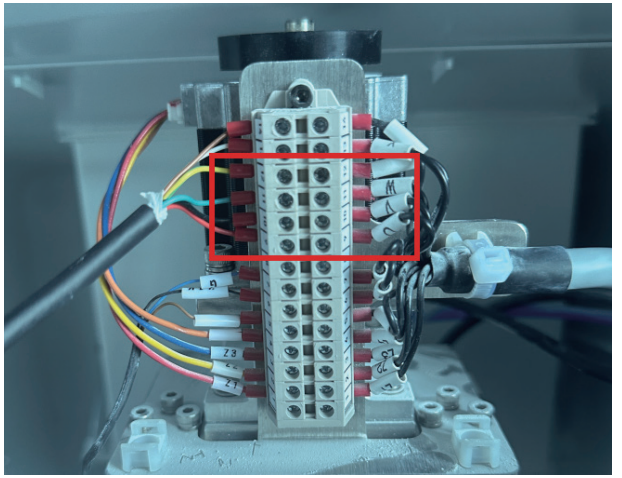


Remove the spindle holder screws and disconnect the three air tubes on the spindle. Take photos in advance to ensure correct installation later.

Please scan the QR code to check corresponding operation video



Disconnect the U, V, W, and MA5 cables from the spindle, then remove the spindle (the image below shows the latest P53R spindle, which has 6 wires; older models have 4 wires).



Clean the spindle installation location, install the new spindle, connect the wiring, connect the air pipe, and tighten the clamp screws (tightening force 3 Nm).

Every time after replace the spindle, calibration is needed.

04

Lines and Stages on the Surface

1. Common Lines on the Surface

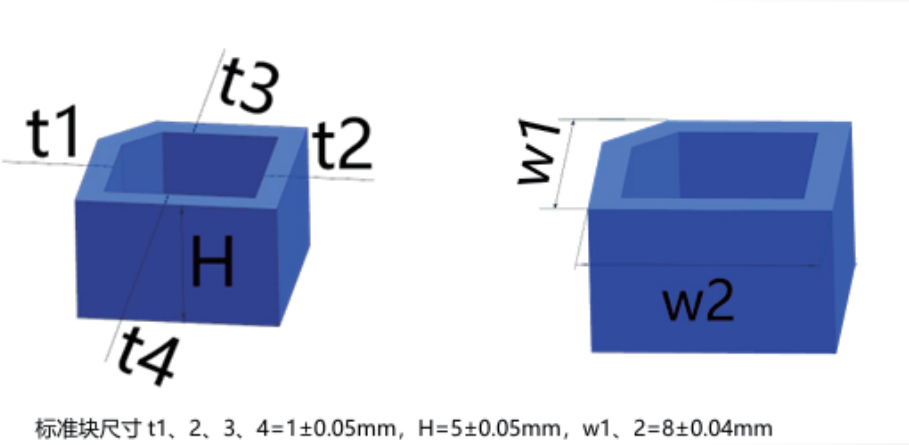
Appearance:
Equipment emerges broken margins and lines abruptly in the processing. Commonly it's caused by dust & the defective limited switch.

Causes:
commonly dental lines problems result from the accumlation of the dust in the equipment and calibration gap for long time

address methods:
Confirm whether cleaned inside of equipment and calibration recently firstly. Notice the cleaning about screw rods and the cover of aixs particularly for P53

The processing steps please refer to the chapter How to do the cleaning. And then, please calibrate after the cleaning. Additionally, Change a new kit of tool for processing test after calibration.

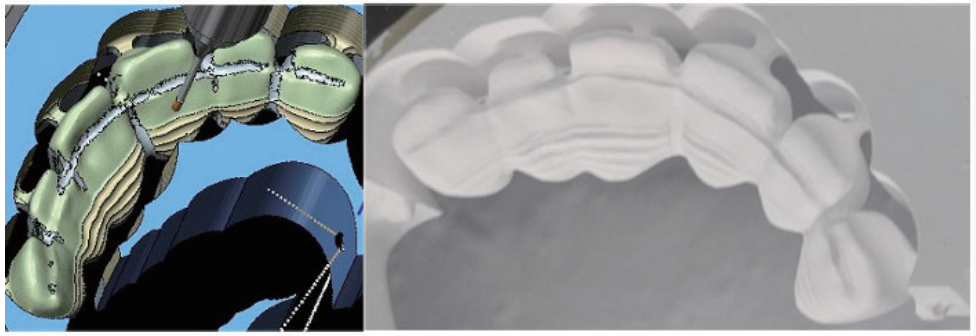
Then please process and measure the standard cubes too see if there still are some problems about the procession outcome



Finally, find the cause according to the measurement value, such as the problem of screw rods,limited switch,tool sensor.

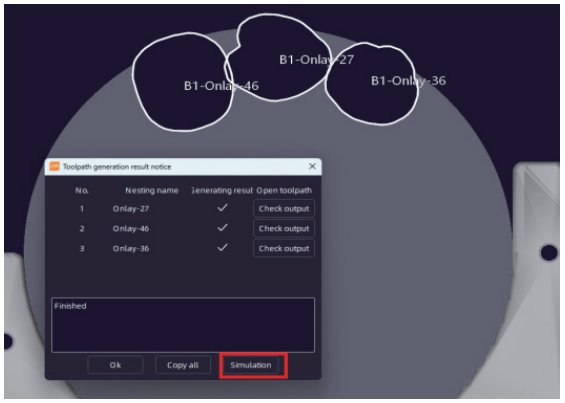
2. Lines from CAM Strategy

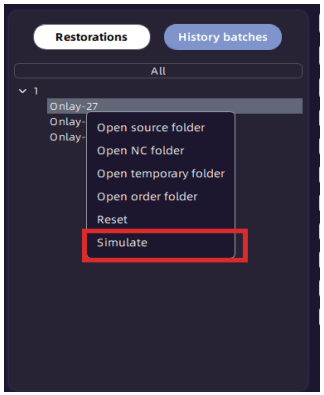
Appearance:
The restoration surface lines after machining are the same as those shown in the CAM simulation, as shown in the following figure.



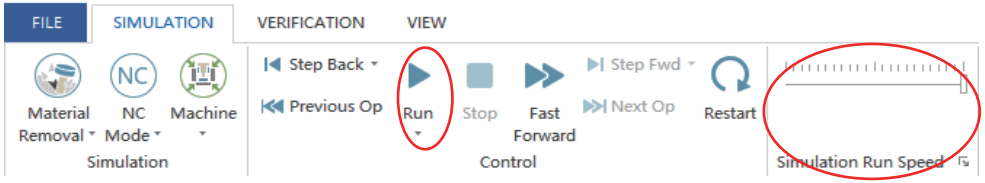
Cause of failure:
CAM strategy issue

Operation methods:
Open the CAM software, find the corresponding order, and enter the simulation.

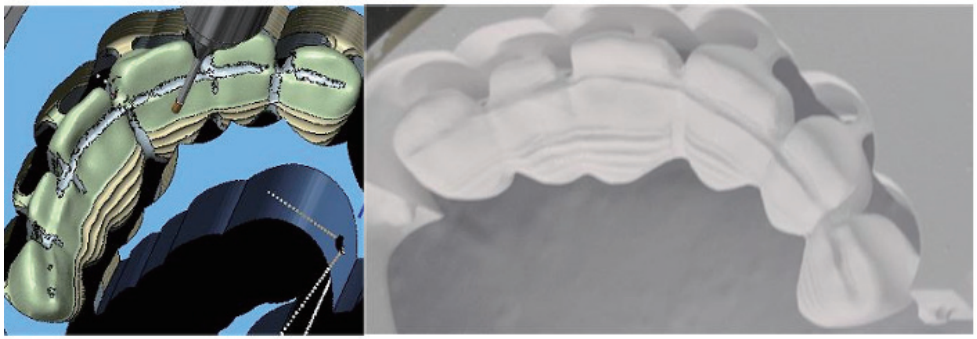




Click "Start", adjust the speed, and wait for the simulation result to finish.



Compare whether the software simulation results are consistent with the measured processing results.



Once the CAM problems is confirmed, please go to UP3D website, www.up3dtech.com, to download the latest UPCAM and install.

3. Deep Lines or Stages on the Surface

Phenomenon:
Poor machining results caused by problems with the accuracy or quality of the tool aligner have very obvious characteristics.

(1)During daily machining tool changes, errors such as tool broken' and 'tool too long' frequently occur.

(2)The machining results have very deep multi-layered dental lines.

(3)The machining results are unformed, as shown in the following figure.

Operation:
(1)Turn off the equipment, use compressed air to clean the dust accumulated around the tool aligner, and press it quickly 15 times (refer to tool aligner cleaning).

(2)Process a single crown for testing.

(3)If the machining effect has improved but there are still dental lines

(4)Clean the interior of the equipment, calibrate it, and process the standard block.

(5)Check the values of the standard block, adjust G92X or replace the corresponding axis limit switch.

(6)If the machining effect does not improve significantly, check the tool length in the log or use the CNC3 tool setter for detection to determine whether the tool aligner needs to be replaced.

4. Banded Single Line in the Middle

Appearance:
There is a linear/striated pattern on the restoration, and sometimes, a homing error occurs, as shown in the following figure.

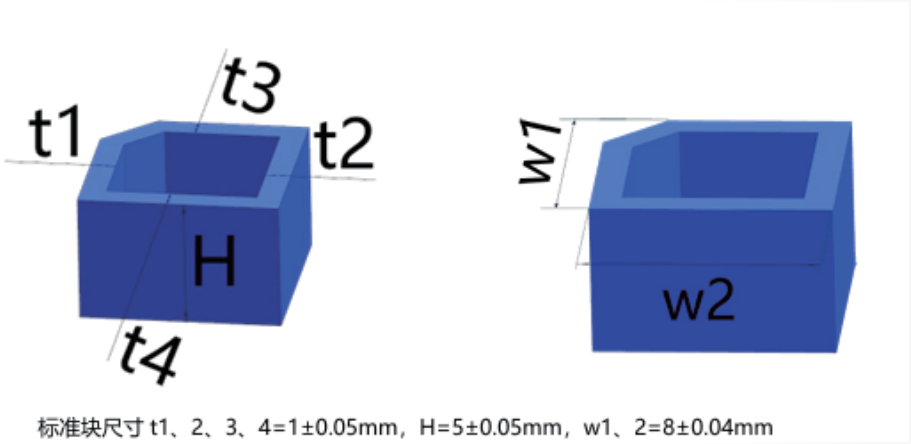
The position of the striation corresponds to the external high-point line shown in the CAM, meaning the processed result is layered vertically. When the equipment finishes processing the upper half, the position of the machining center shifts after the B-axis rotates 180°.

This phenomenon is generally caused by abnormal accuracy of the limit switch or incorrect previous calibration results which is effected by the internal dust. It can be addressed by re-calibrating and adjusting the G92X supplementary parameters through processing a standard block.

Operation:
(1)Clean the interior of the equipment(refer to the cleaning document), calibration.

(2)Process the standard block.

(3)Measure the standard block.



(4)If there is an obvious deviation in the wall thickness of the standard block in the X-axis direction, G92X can be used for adjustment. Adjust towards the side with the larger deviation: "+" for the left side and "-" for the right side.

(5)After adjustment, re-calibration is required.

(6)After re-calibration, process the standard block and measure it to ensure the values are correct.

(7)If the deviation of the value in step 4 is too large (greater than 0.15mm), the corresponding limit switch needs to be replaced.

(8)If the problems of frequent axis zero-return failure and dental lines occur in daily use (and the interior of the equipment has been cleaned), please directly replace the limit switch.

5. Slight and Parallel Tools Trail on the Surface

Appearance:
The result of the processing shows as parallel light lines through the surface, and the depth and width of each lines are different.

The possible reasons are: there is a problem with the screw rod in the corresponding axis, or the spindle has a large vibration amplitude, and there is a deviation in the vertical direction of the Z-axis, as shown in the figure below:

Operations:
(1)screw rod wear: Wear of the screw rod will cause unsmooth movement of the machine, resulting in deviations and machining dental lines. The axial screw rod with large fluctuations in the precision of the machined standard block is worn.

(2)Replace the lead screw of the corresponding axis (refer to the demonstration of disassembly of XY axis motor and lead screw of P53 equipment)
①Calibrate the machine and process the standard block
②Confirm that the measured value of the standard block is within the deviation range, and conduct machining tests

(3)Large spindle vibration: Excessive spindle vibration will cause tool deflection during machining, resulting in machining dental lines and precision deviations. Spindle vibration will cause the four sides of the machined standard block to be thin.
①Replace the spindle
②Calibrate and process the standard block
③Confirm that the measured value of the standard block is within the deviation range, and conduct machining tests

(4)Deviation in the vertical direction of the Z-axis occurs on old equipment that has experienced severe collisions - it is too difficult so that out of considersing

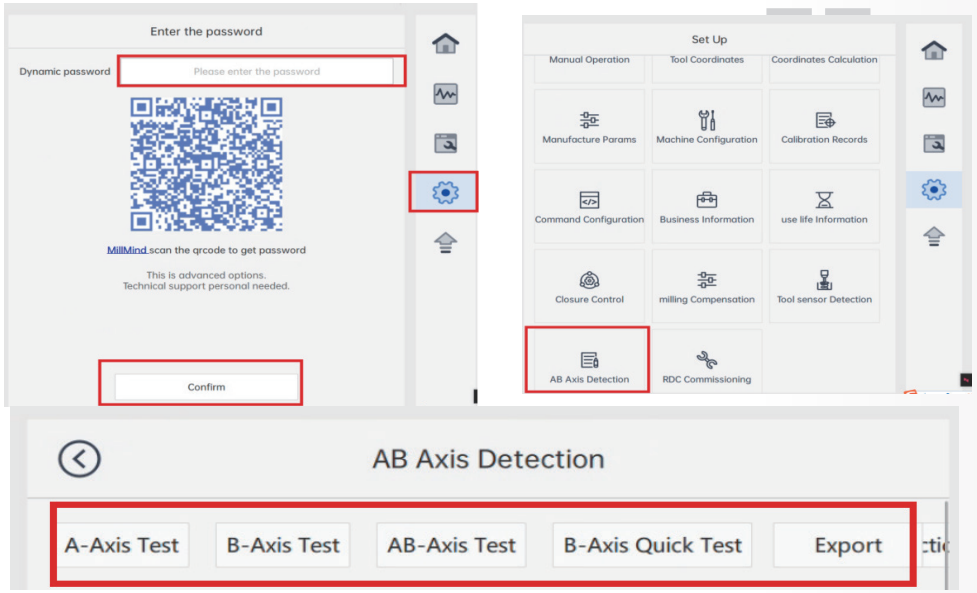
6. Slight Curved Tools Trail on the Surface

Appearance:

the outcome of procession shows regular ring-shaped dental lines, the reason is that the AB axis rotation is abnormal, causing the the AB axis flip position incorrect while equipment exzactly processing external cavity. It can not be solved by cleaning xyz axis & calibration & new tools, you need to clean the dust accumulation, even change the corresponding a/b axis components.

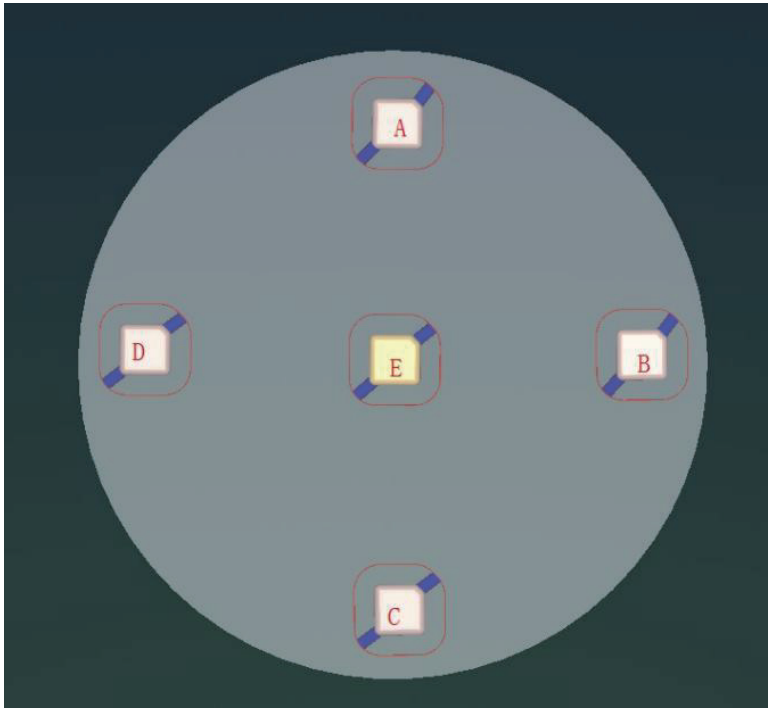
Operation:

(1)If the software used by the equipment is CNC3, the AB axis detection function can be used to determine whether the flipping position of the AB axis is accurate.



CNC3 - Settings - AB Axis Detection Function - Start AB Axis Detection. A calibration plate and a calibration rod need to be placed.

(2)If CNC3 cannot be used for AB axis detection, it is necessary to process a standard block for measurement after calibration to make a judgment.
①Clean the five-axis (refer to the five-axis cleaning document)
②Calibrate
③Process the standard block ABCD



(3)Measure the values of the standard block and compare the heights of the four positions to determine if there is an abnormality in the flipping of the A/B axes.
(4)For the abnormal rotating axis, a thorough cleaning of the worm gear and worm can be performed, and the installation clearance can be adjusted (refer to "Motor Worm Gear and Worm Clearance Adjustment").

(5)If there is a problem with the A-axis, the turbine angle can be adjusted (refer to the "A-axis Turbine Angle Adjustment Document").

(6)If there is a serious problem with the rotation of the B-axis, the only option is to replace it.

05

Error 21, Tool Broken

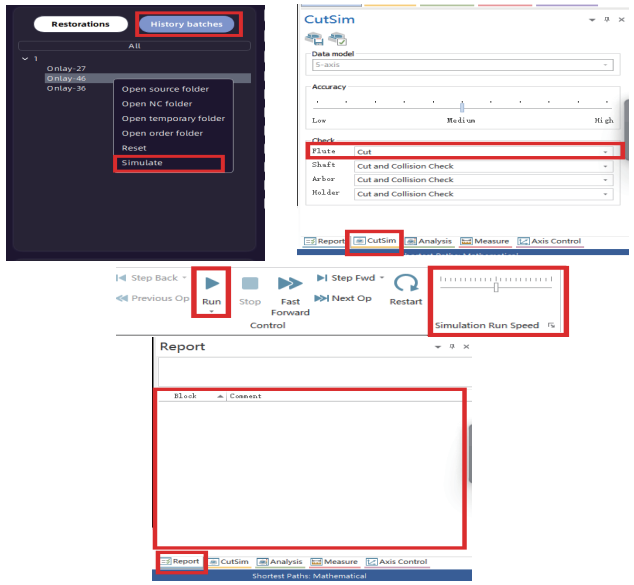
1. Tool Actually not Broken, only error reports

Appearance:
The CNC page displays error messages:
ERROR21: CNC_SYS_ERR_TOOL_BREAKED Tool broken (Cutting Tool Broken)
Or ERROR22: CNC_SYS_ERR_TOOL_LONG Tool too long (Cutting Tool is too Long), but the Cutting Tool is actually intact.

Operation:
Tool Breakage ERROR21: CNC_SYS_ERR_TOOL_BREAKED Tool broken
First, confirm whether the Cutting Tool is actually broken.

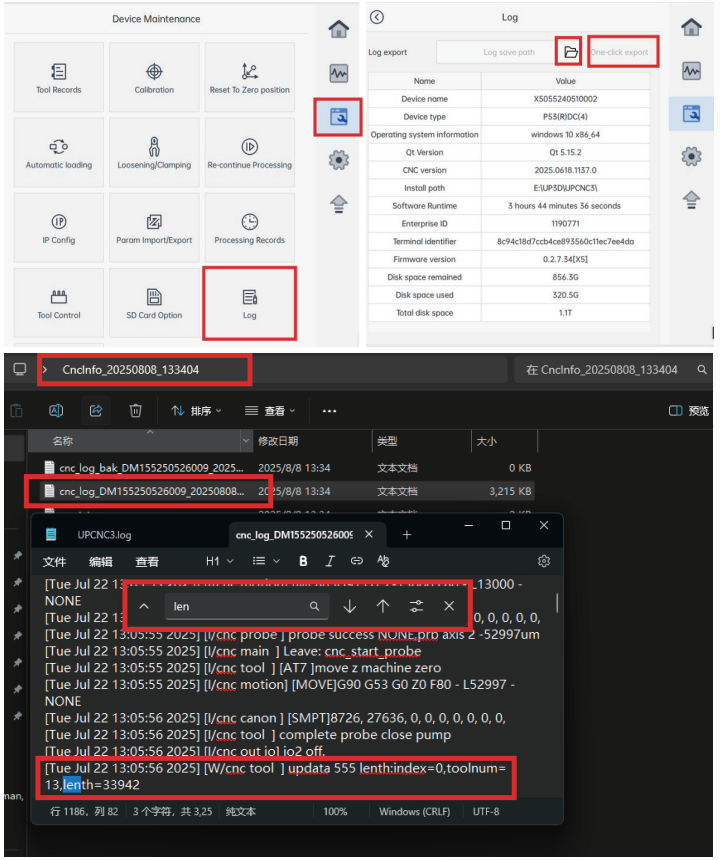
(1)If the Cutting Tool is broken:

①Click "Reset," "Home," and "Tool Release" to manually remove the broken Cutting Tool.
②Hardware aspect: Clean the 5-axis components and perform calibration.
③Software aspect: Open the CAM software, find corresponding order, start simulation. Check for collision error messages. In the simulation page's bottom-right "CutSim" panel, adjust "Check" → "Flute" → "CUT." Then, select "Report", click "Start Simulation," and observe the error messages in the "Report" section. Reposition the model to avoid collisions and resume machining.



(2)Cutting Tool is intact but error occurs

①Click "Reset", "Home", and "Tool Release" to manually remove the tool and return it to the tool magazine
②Power off and clean the tool setting instrument (refer to Tool Setting Instrument Cleaning Documentation)
③Export logs and check tool length values:
If the tool length parameters in the logs show minor variations with low frequency, perform calibration after cleaning.



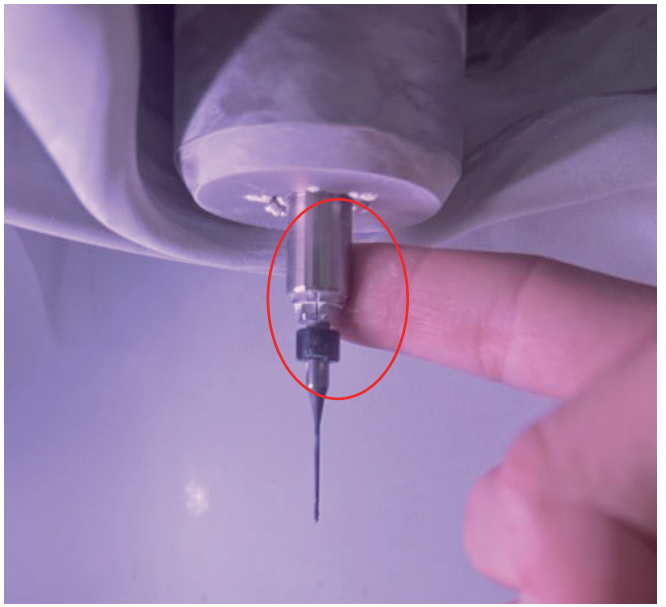
(3)If the tool length parameters exhibit significant fluctuations (e.g., consistent variations exceeding 700 units during each tool setting), replace the tool sensor. Use CNC3 to conduct a tool sensor test and verify whether its precision is abnormal.

2. Tool Broken Actually

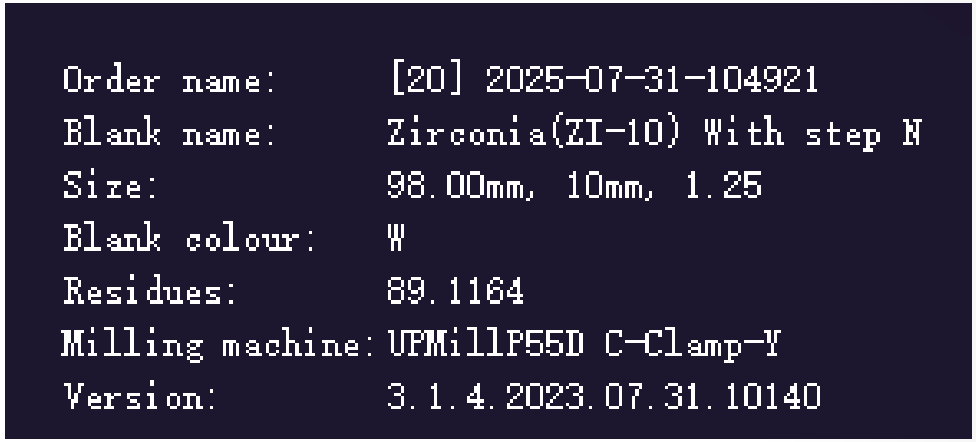
Appearance:
During machining operations, tool breakage occurs, mostly with 2mm & 1mm diameter tool.

Tool Breakage Checking - No.1 Tool:
(1)Spindle Status Verification. Confirm spindle operational state. Manually rotate spindle collet (must be in clamped position)

(2)Abnormal Condition Detection. If abnormal noises or resistance is detected during rotation:
→ **Immediate Action:** Replace spindle unit (indicates spindle seizure)



(3)Material & Tool Verification
Confirm burr needle specifications match CAM design
Verify material block compatibility



Ensure correct machine type is selected

(4)Layout Configuration Check. Validate restoration type settings. Inspect margin line positioning. Confirm insertion axis orientation

(5)Complex Model Simulation. Run mandatory simulation for complex geometries. Verify simulation shows minimal/no errors

(6)NC File Integrity Check. Inspect NC program for encoding errors, confirm file integrity before processing

(7)Hardware Change History. Inquire about recent hardware replacements:
• Spindle frequency converter
• Control cards
Rule out firmware/parameter mismatch issues

(8)Tool life monitoring. Check tools usage against recommended lifespan

(9)Tool length log analysis. Review historical tool length measurements

(10)Tool sensor Maintenance. Perform tool setter cleaning (Ref: Tool Setter Cleaning SOP)

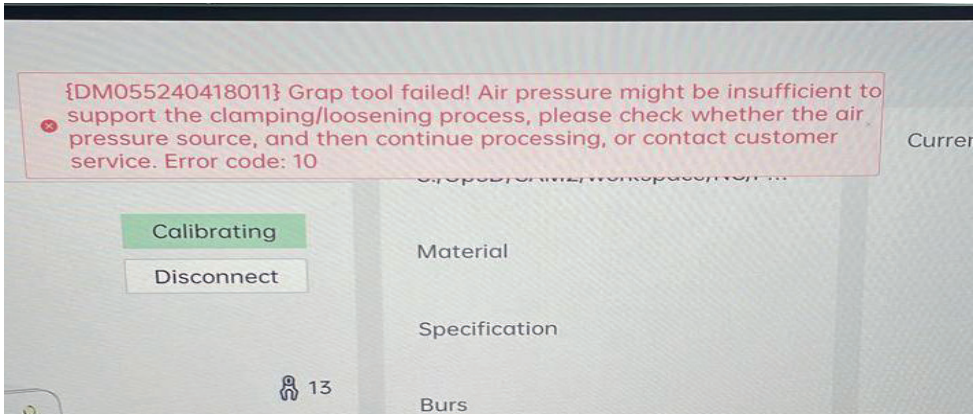
(11)Machine Internal Cleaning. Execute 5-axis system cleaning if overdue (Ref: Equipment Maintenance Manual)

Causes of No.2 Tool Breakage (refer to No.1 tool breakage troubleshooting):
①Tool-bit mismatch
②CAM design issues
③Powder accumulation on tool setter causing idle running
④NC code corruption

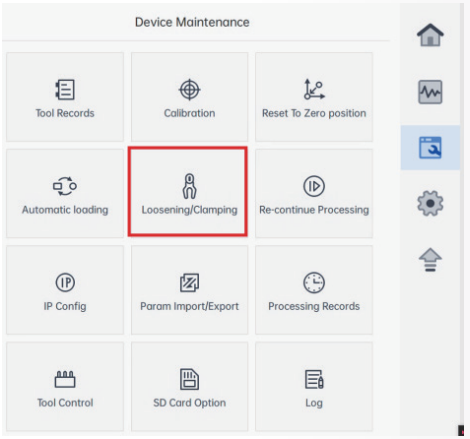
3. Loose/Take tools failure

Error Phenomenon:
During tool retrieval and changing, the collector fails to open/gets stuck, resulting in tool clamping or changing failure.
ERROR10: CNC_SYS_ERR_LOOSEN_CUTTER /Tool loss Failure/Tool Changing Failure

Troubleshooting Procedure:



(1)Ensure that the air pressure value on the digital pressure gauge of the equipment is greater than 0.5 MPa (the normal requirement for P53 is an air pressure value greater than 0.6 MPa). If the condition is met, proceed to the next step. If not, increase the air pressure first, then click “Release Chuck” to attempt opening the spindle chuck. If the spindle chuck still cannot be opened, proceed to the next step.



(2)Click [Tool Clamp/Release] and listen for airflow sound from spindle collet.

(3)If airflow is present:
①Gently tap tool shaft with small wrench.
②Slowly rock tool back and forth.
③Remove tool and clean spindle collet (Ref: Spindle Collector Cleaning Guide)

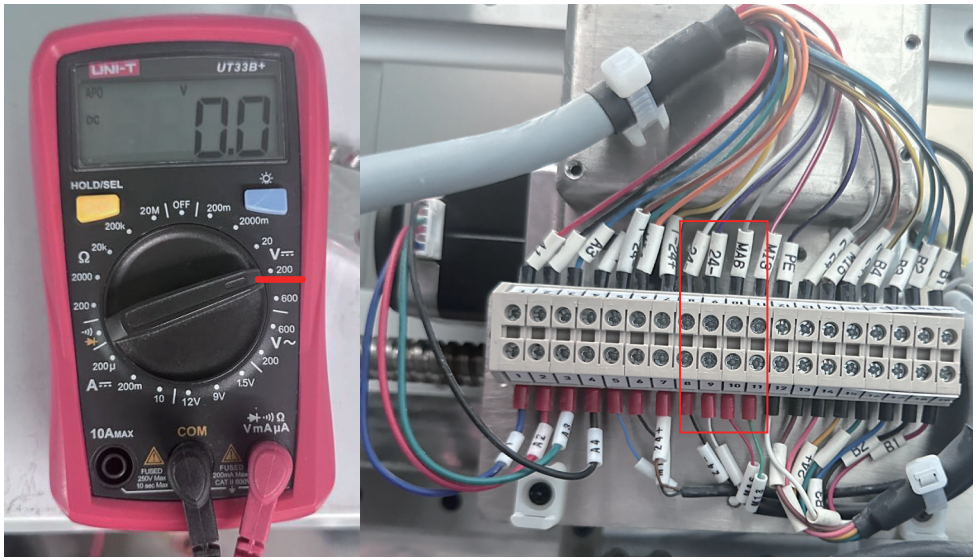
(4)If no airflow is detected:
①Click [Reset].
②Power off/on machine.
③Retry [Tool Clamp/Release] function.

(5)If issue persists:
①Inspect solenoid valve (Ref: Solenoid Valve Troubleshooting Manual)

4. Check the Tool Sensor

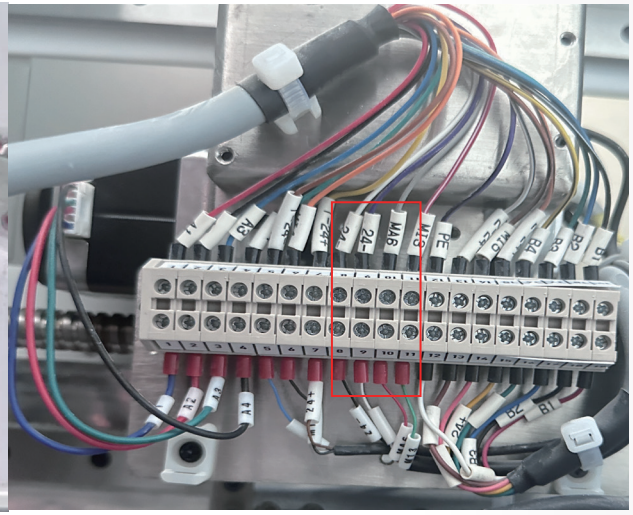
ShengYue Tool Sensor(Silver)			DaYang Tool Sensor(Black)		
Parameters	Tool sensor position Y = -2.5/X = -24		Parameters	Tool sensor position X= -1/Y = -26	
MA6	Red	Tool detection	MA6	Brown	Tool detection
24-	Black	Negative	24-	Orange	Negative
MI3	Green	Negative limit signal input	MI3	Green	Negative limit signal input
24-	White	Negative	24-	Blue	Negative

Multimeter DC 200V Model, measure MI3 to 24-, MA6 to 24-,
①MI3 normally measures 0 volts, and 24 volts when pressed down.
②MA6 normally measures 0 volts, and 24 volts when pressed down.



Use the conductivity mode of the multimeter to test MI3 to 24-, MA6 to 24-, which is green to blue and green to white (MI3 to 24-), brown to yellow and red to black (MA6 yo 24-).

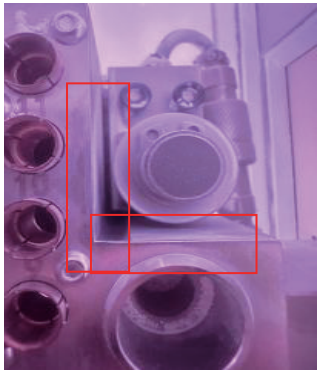
Normally, there will be a beeping sound, and pressing will cause a open circuit.



Clean the tool sensor

①Turn off machine, take out power cable.

②Use compression air gun to clean the accumulated powder around the tool sensor, then use a brush to remove the surface dust, and finally press quickly 15 times



Please scan the QR code to check corresponding operation video

5. Replace the Tool Sensor

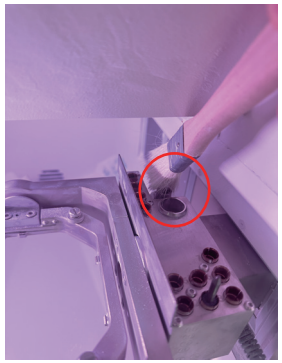
Tools:

Allen wrench (included in accessory box), Brush.

Operation:

(1)Click ‘homing’, after that turn off machine, and take out power cable.

(2)Find the tool sensor, clean the dust on the installation screws of the tool setting instrument, and prevent the screw holes from becoming blocked.bvv



(3)Use the corresponding L-shaped hex wrench to remove the two mounting screws (counterclockwise) while unscrewing the quick connector of the tool sensor.

(4)Take out old tool sensor, replace it.

(5)After install new tool sensor, connect machine power cable, turn on machine, do calibration.

Please scan the QR code to check corresponding operation video

06

Regularly Clean the Machine

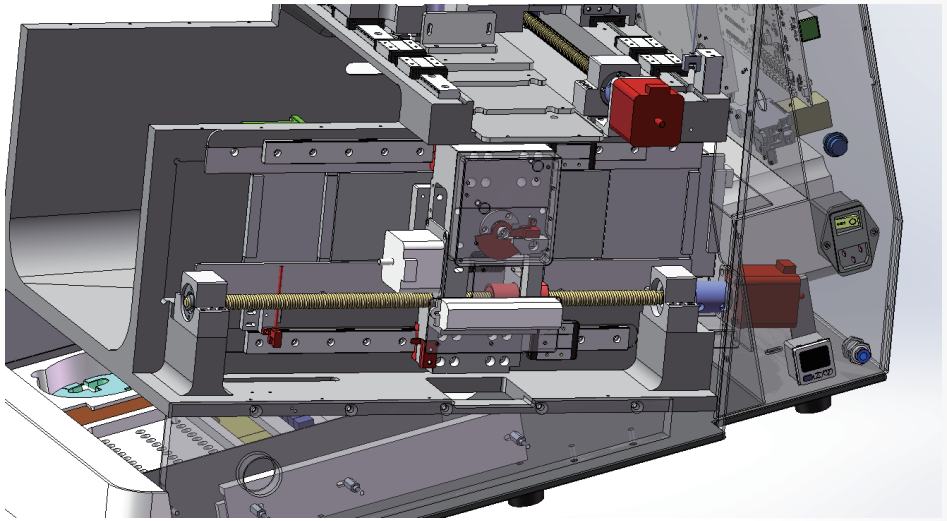
1. X, Y and Z axis Cleaning

Tools:
Inner hexagon spanner (accessory box), grease, Phillips screwdriver, a dust-free cloth, alcohol (or WD40 cleaning fluid).

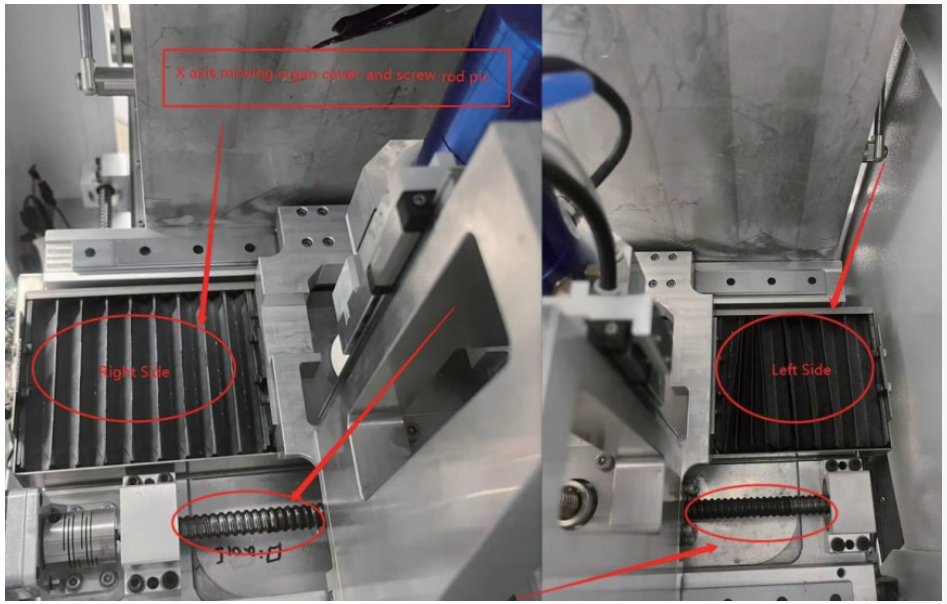
Parts that need to be disassembled:
milling machine side cover, top cover.

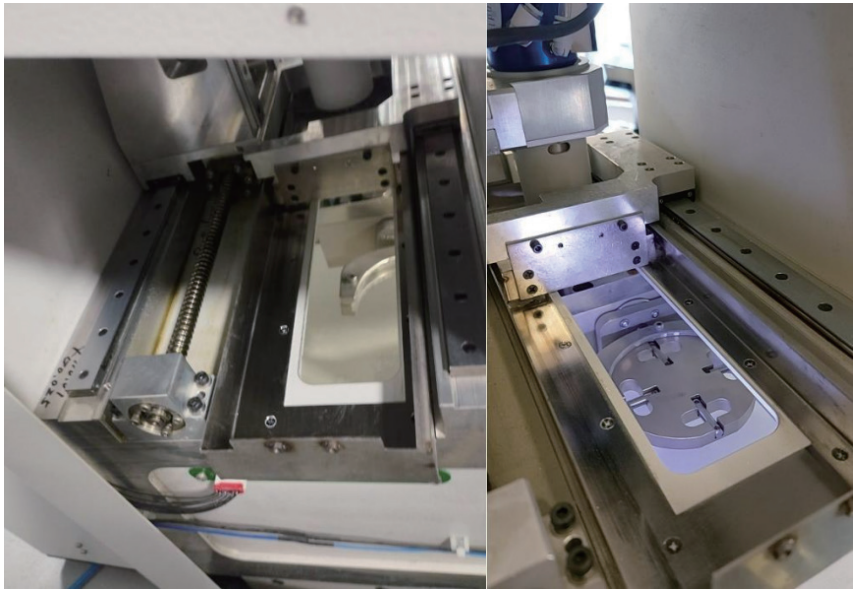
Operation:
(1)Remove the side panel of the processing machine (7 screws).

(2)Remove the top cover

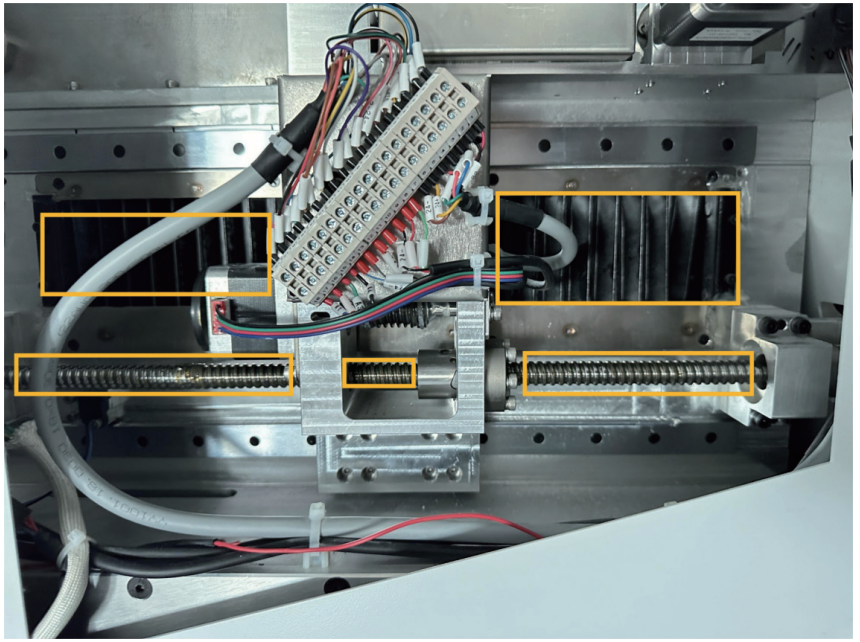


(3)X-axis cleaning,
Use dust-free cloth and alcohol to cleaning dust.
After cleaning need grease it.

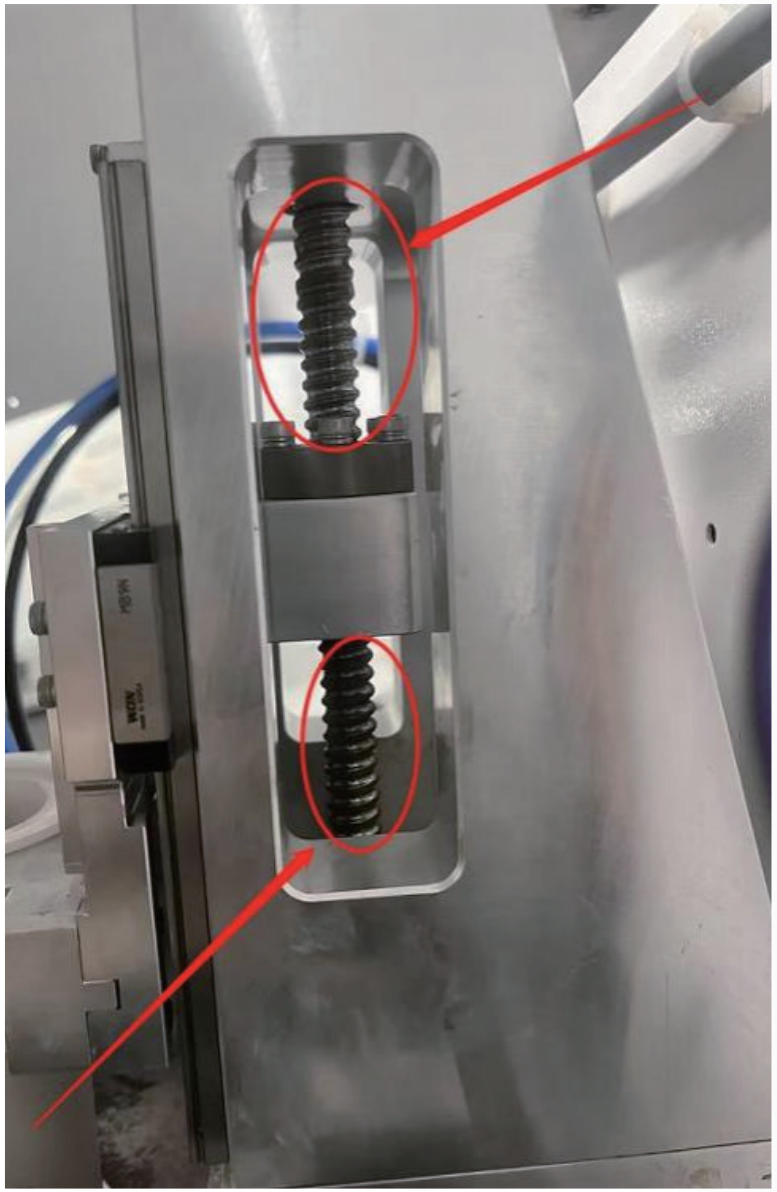




(4)Y-axis cleaning

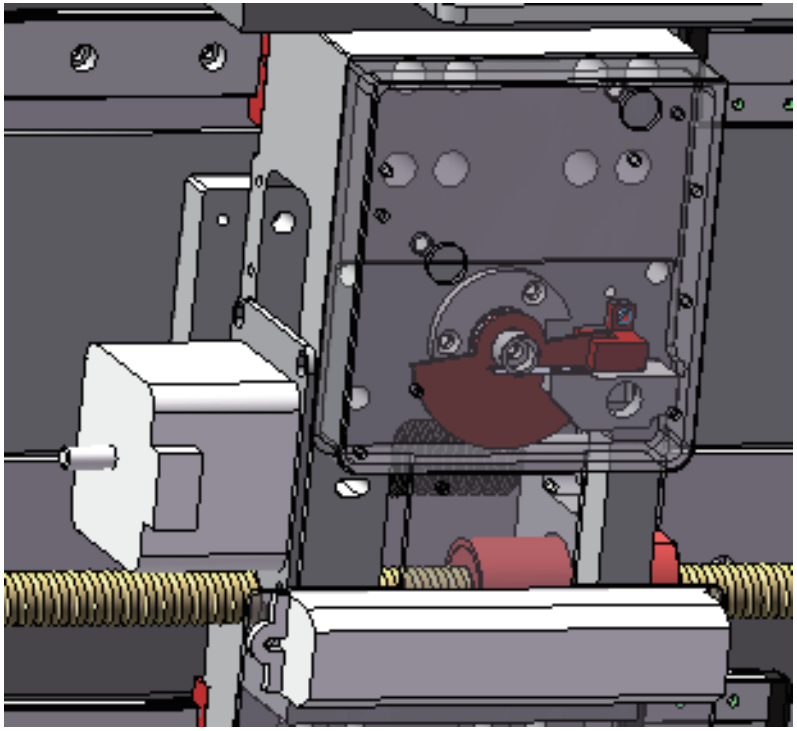


(5)Z-axis cleaning

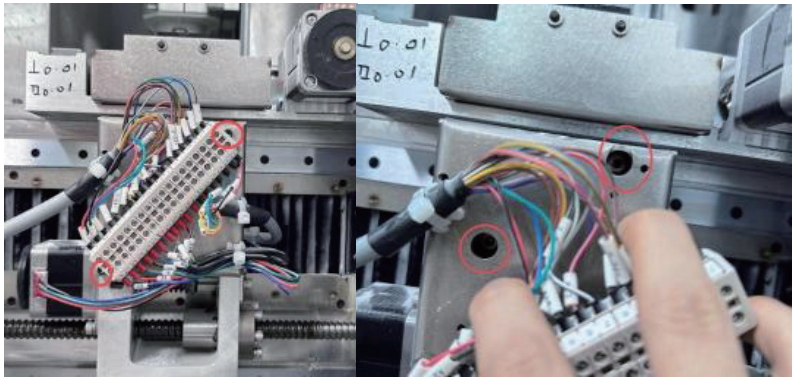


Use dust-free cloth and alcohol to cleaning dust. After cleaning need grease it.

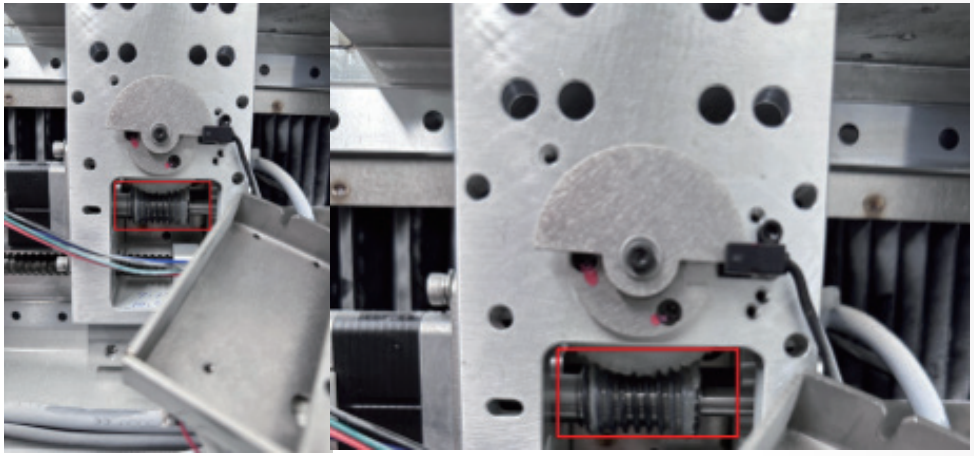
2. A Axis Cleaning



Remove the terminal block and dust cover (4 screws) from the A-axis assembly.



Photos after disassembling:



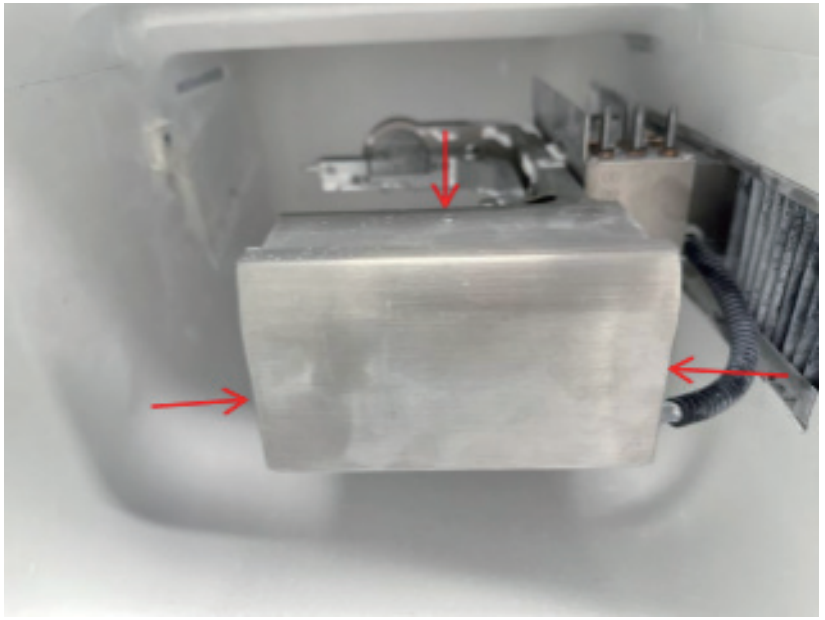
Use dust-free cloth and alcohol to cleaning dust. After cleaning need grease it.

3. B Axis Cleaning

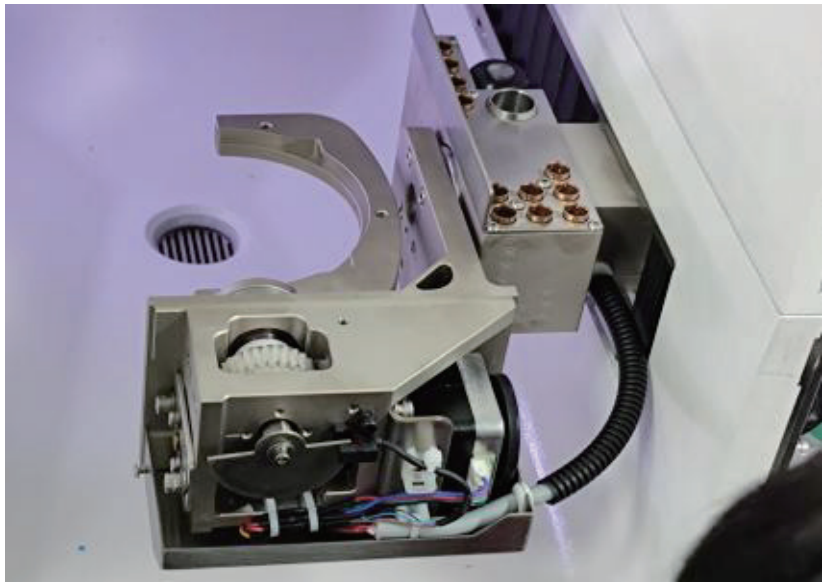
Tools:
Inner hexagonal wrenches (accessory box), grease, a dust-free cloth, alcohol (or WD40 cleaning fluid).

Parts that need to be disassembled:
B-axis dust dust proof cover.
(1)Remove the three screws on the cover first, and then you can remove the top cover of the B axis.

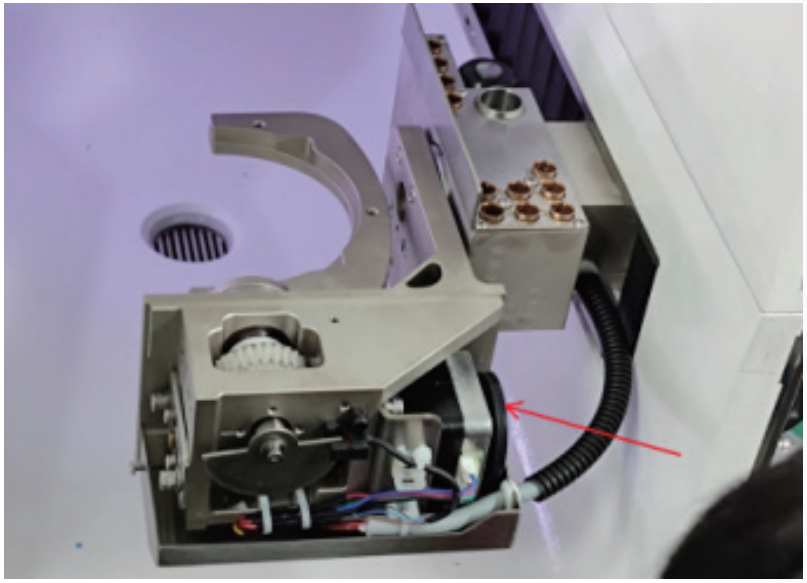
Please scan the QR code to check corresponding operation video



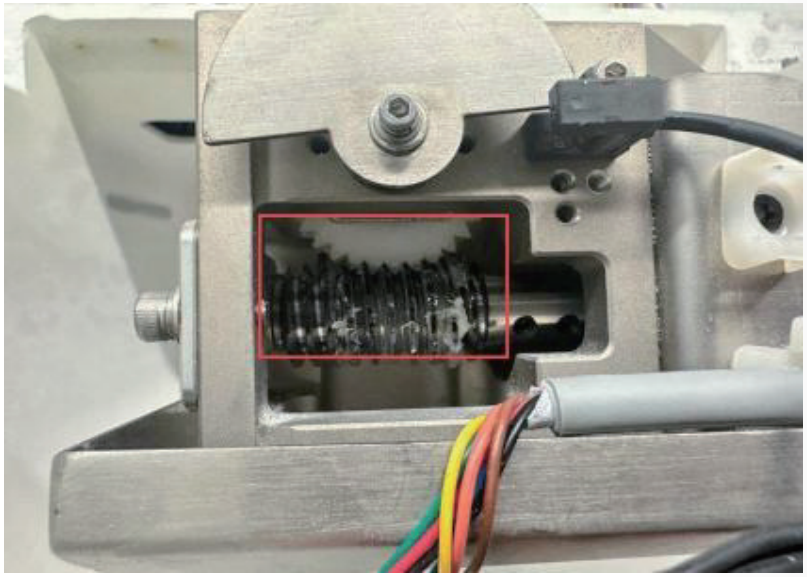
After remove screws:



Rotating motor, can see the worm gear area.



(2)Use dust-free cloth and alcohol to cleaning dust. After cleaning need grease it.



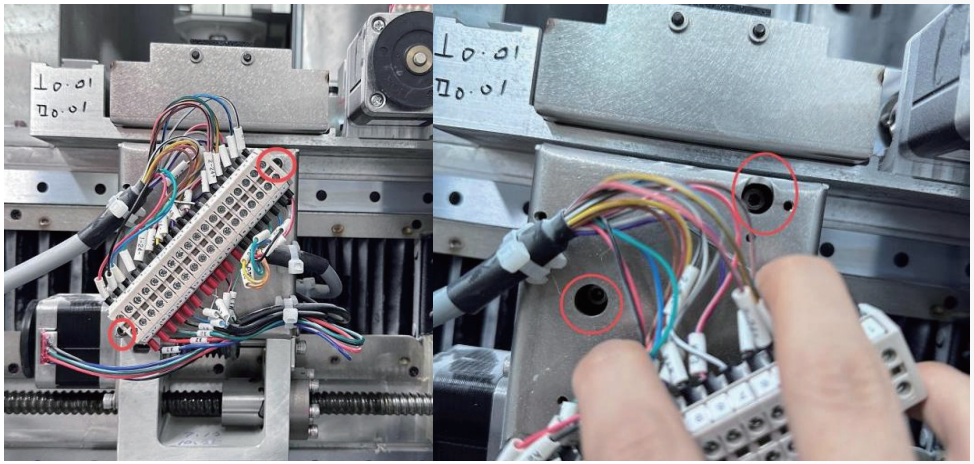
4. Adjust the Pretightening Force of Worm and Gear

Purpose:
To solve the problem of improper rotation caused by the gap between the worm and the turbine.

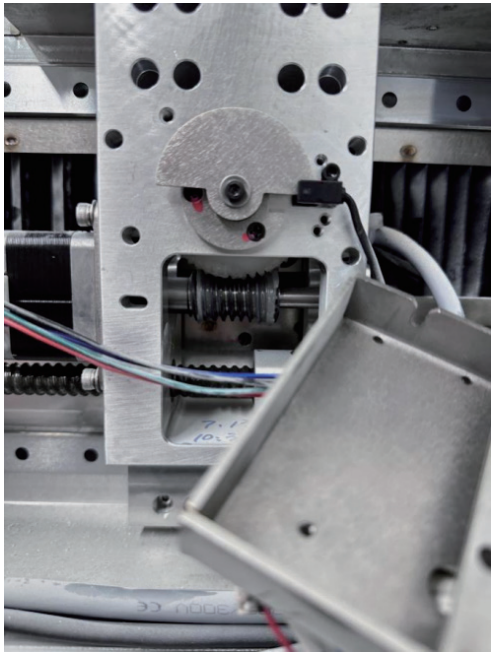
Tools:
Inner hexagonal wrenches (accessory box), alcohol/WD40 cleaning fluid, dust-free cloth, Cross screwdriver, grease, marking pen.

(1) Remove the side panel of the processing machine.

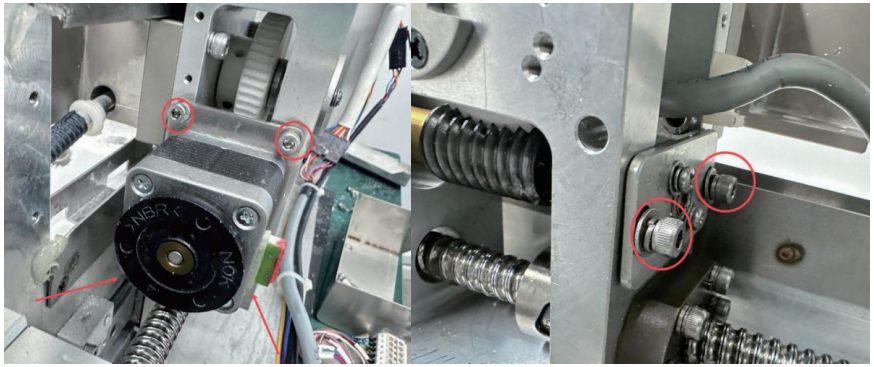
(2)Remove the terminal block and dust cover (4 screws) from the A-axis assembly.
Tool: Hex wrench



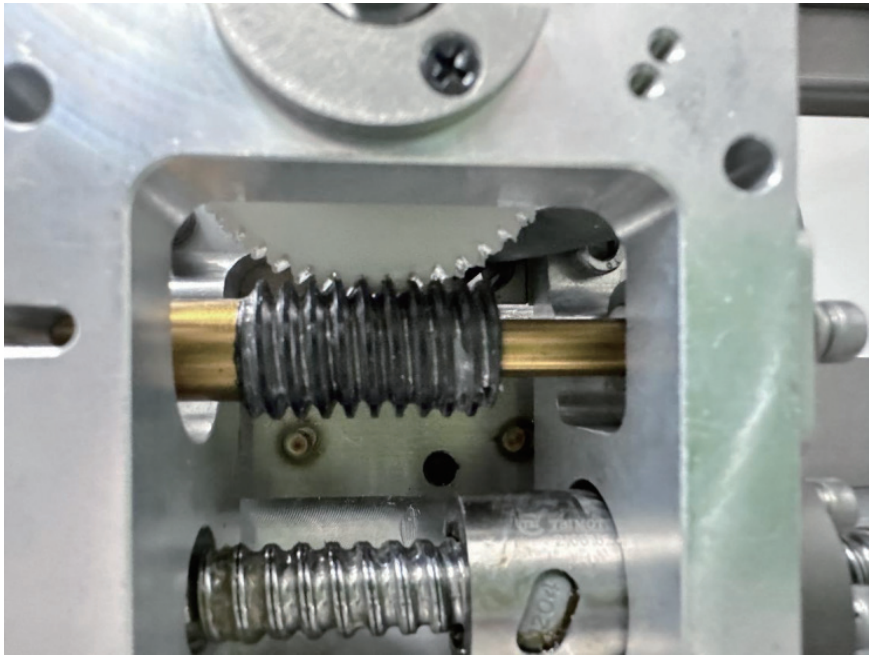
Photos after dismantling (we need to use a marker to mark the zero position of the sensor)



(3)Use a hexagonal wrench to loosen the fixing screws at both ends of the A-axis motor



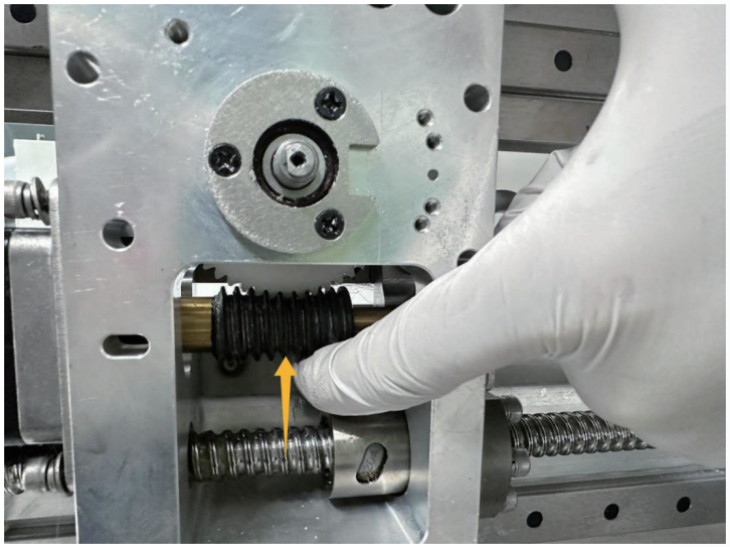
After loosening the fixing screws, you can see that there is a clear gap between the worm gear and the motor worm. As shown below:



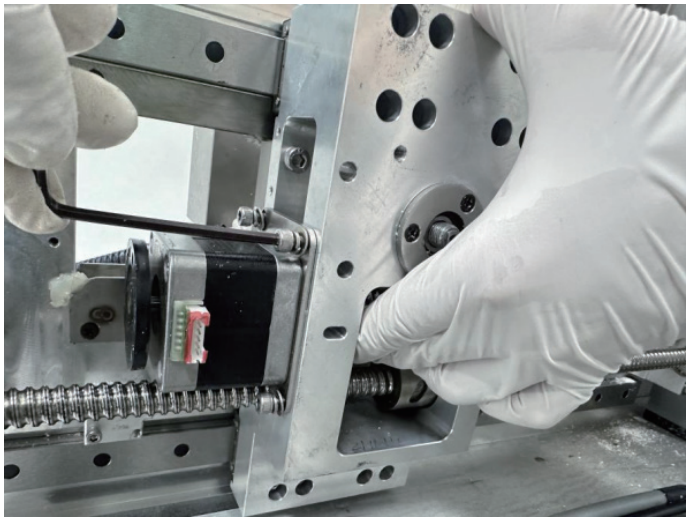
Use a dust-free cloth and alcohol to wipe off the mixture of dust and grease.

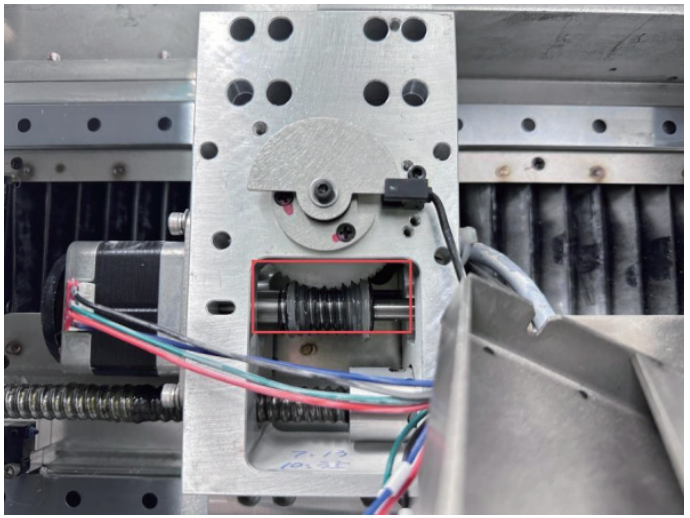
Please scan the QR code to check corresponding operation video

(4)Use your fingers to align the worm and worm gear together



(5) After the worm gear is completely fitted, tighten the fixing screws at both ends of the motor.





(1)After tightening the mounting screws, check whether the zero position is correct. If correct, then test again.
①Rotate the motor rubber wheel to check if it is too tight. If so, loosen the two fixing screws at the end of the motor (use a hexagonal wrench to loosen half a turn).
②Rotate the motor rubber wheel and shake the b-axis assembly up and down to check if there is any shaking or abnormal noise. If there is, repeat the previous adjustment steps and readjust.

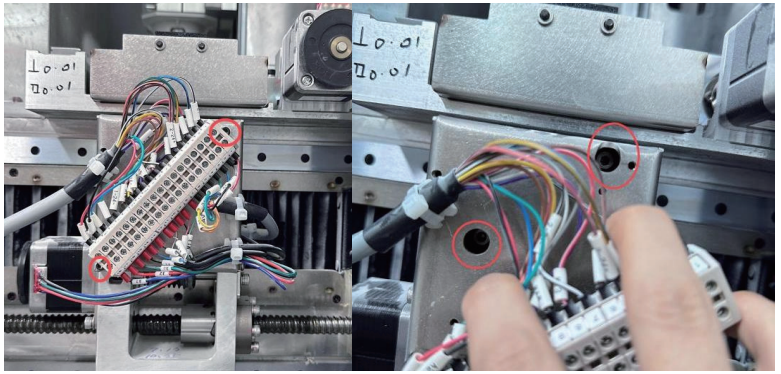
5. Adjust A Axis Worm Gear to Avoid Gaps from Abrasion

Tools:
Inner hexagonal spanners (accessory box), cross screwdriver, grease, a dust-free cloth, alcohol (or WD40 cleaning fluid), and a marking pen.

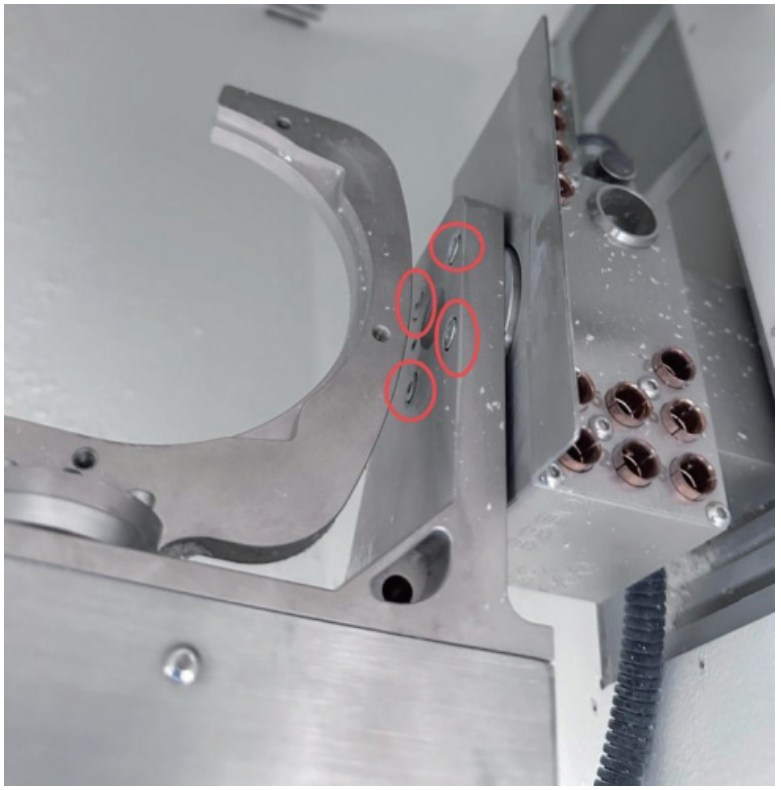
Parts that need to be disassembled:
processing machine side panel, b-axis assembly, a-axis terminal block, a-axis dust cover.

(1)Remove the side panel of the processing machine

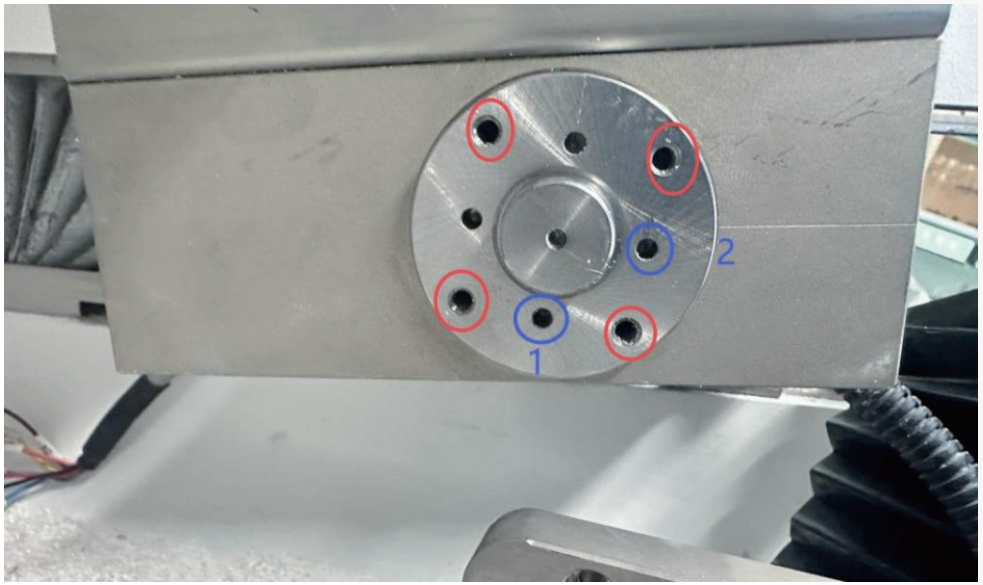
(2)Remove the terminal block and dust cover (4 screws) from the A-axis assembly.



(3)Remove the b-axis assembly (four screws). Tool: Hexagonal wrench

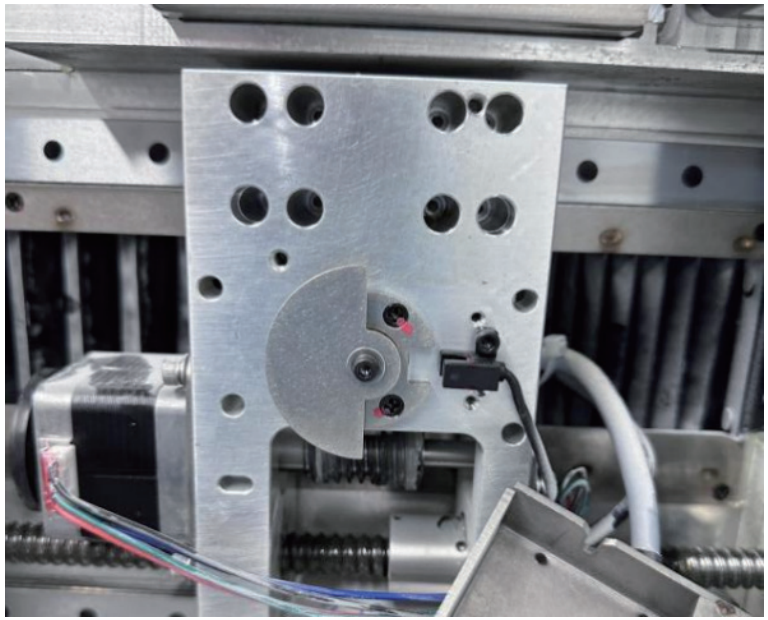


After removing the screws, you need to slowly shake the B-axis assembly to remove it (because there are locating pins installed).



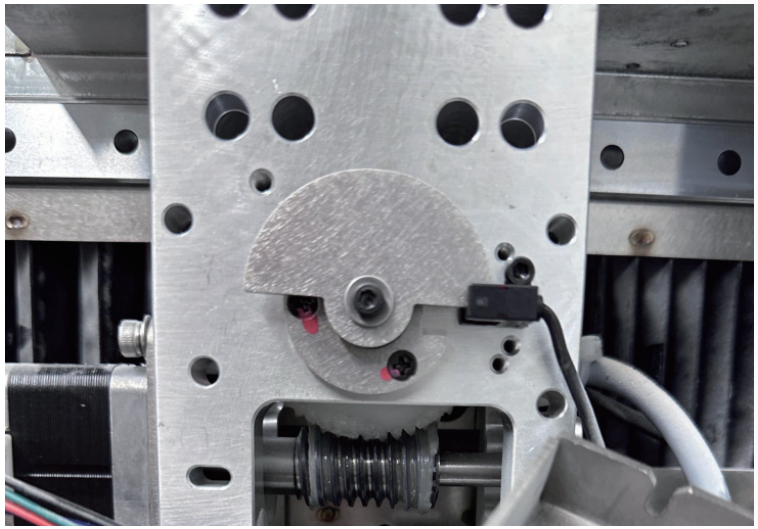
In the picture, red is the screw hole, and blue is the location of the locating pin installation. Now the position of the locating pin is 1. We need to rotate the A-axis motor to make the No. 2 locating pin reach the original No. 1 position.

At this time, the position of the A-axis limit sensor is as follows:

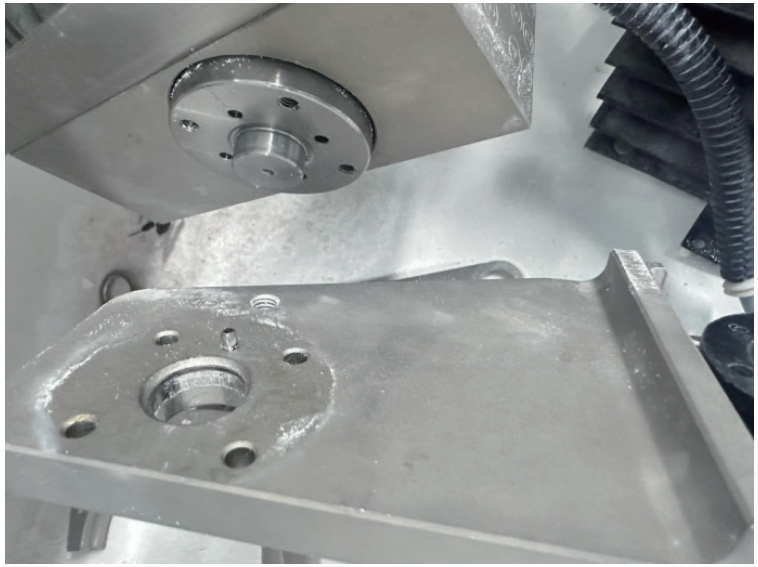


Please scan the QR code to check corresponding operation video

Then we need to adjust the A-axis limit sensor to the zero position (use a hexagonal wrench to loosen the sensor fixing screw), as follows



(4)Align the locating pin position and install the b-axis assembly.



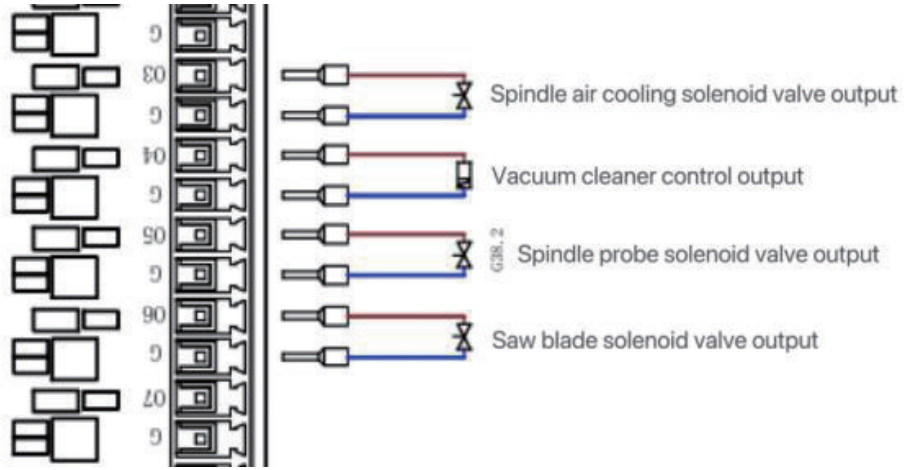
Align the locating pin position and use a rubber hammer to gently hammer the locating pin in completely. Make sure the B-axis is installed without any gap.

Install the screws and restore the A-axis dust cover and terminal block. Calibration is required after adjustment.

07

Air System

1. 3 Functions of Air

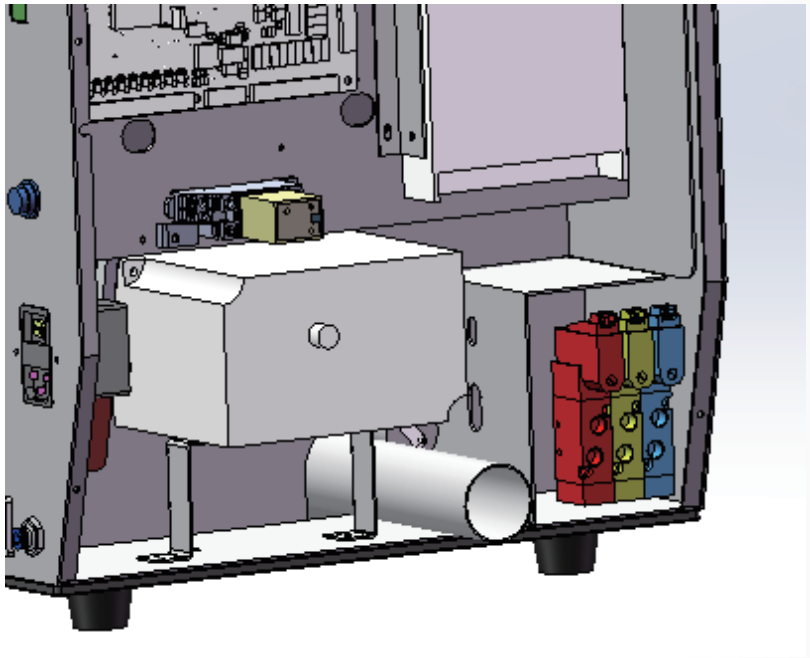


In the P53, the compressed air is supplied from out side, and all provided to spindle. The air is controlled by the 3 solenoid valves, when the valve is controlled by the main board to open, the high pressure air will flow. Each of them has a purpose to be opened, as the above diagram shows, one for cooling down the spindle, one for MA5 voltage supplied to spindle and last one for opening and closing the collet.

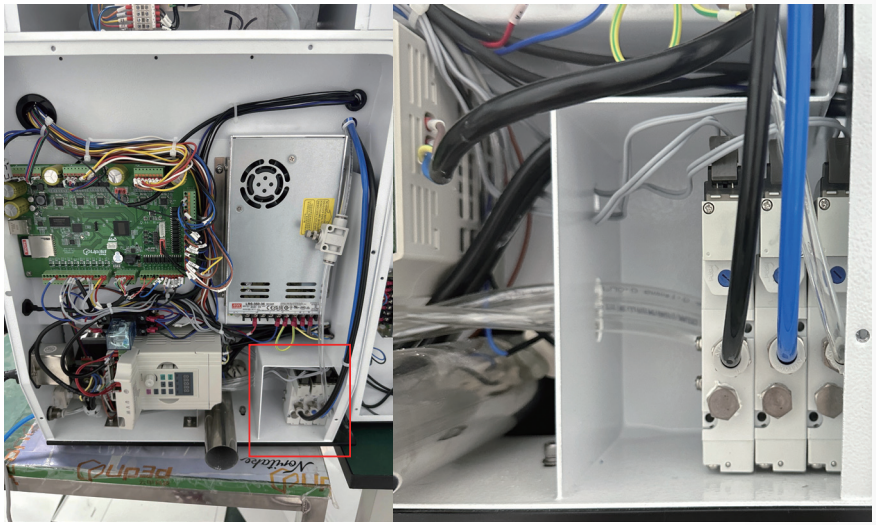
These 3 ways of air is separated from the main air port, and the air pressure of this main air port can be read in the pressure gauge of the air regulator and pressure meter.

2. How to Check the Solenoid Valves

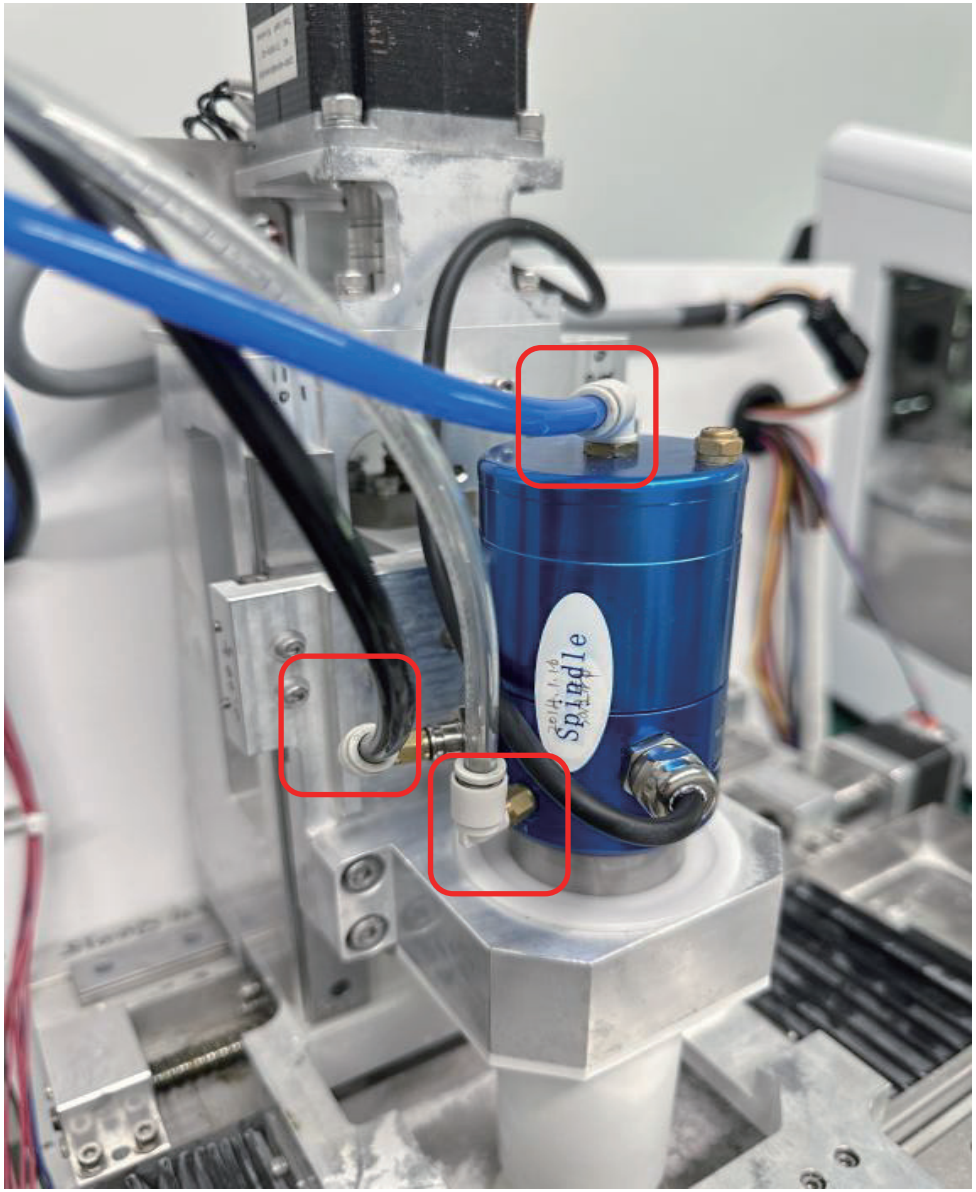
(1)Turn off the power of the machine and use a Phillips screwdriver to disassemble the side panels, back panel, and top maintenance panel of the machine.



(2)After dismantling we can see the whole electrical system, including the solenoid valve



(3)After removing the top plate we can see the spindle section



(4)Ensure that the machine air intake is normal, you can press the blue button on the solenoid valve, press the corresponding gas pipe will be compressed gas outflow

If no gas flows out, check the gas line for bends, debris.
If no gas flows after cleaning, the solenoid valve needs to be replaced.

(5)If the mechanical switch of the solenoid valve is pressed and the air comes out normally, it is necessary to measure whether the solenoid valve is normally controlled by the control card.

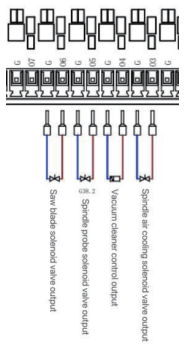
(6)Turn on the machine power to connect the cnc, click on the open/close cutter, under normal circumstances there will be compressed air from the spindle collet inside the outflow

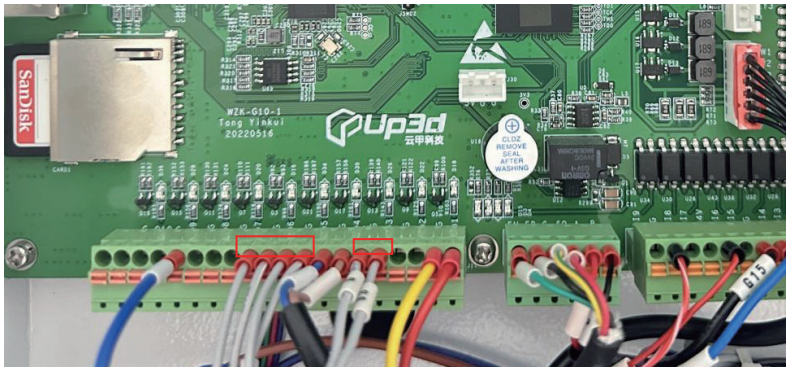
(7)Connect the MMVH (if CNC3, you don't need to use the MMVH), click reset, enter M07 (cooling air open command), you can clearly hear the sound of compressed air flowing out. G91 G38.2 z-40 f20 Calibration command, black air tube responds when entered

(8)We can switch the port of the solenoid valve and control card to check whether the solenoid valve problem or control card problem.

(1)If the cooling gas is normal output, loose clamping knife gas is not normal output, swap the two ports on the control card, and then input M07, check the blue gas pipe out of the gas is normal, if the gas pipe out of the gas is normal, and the wires are connected to the normal, it is the control card port problem, you can continue to measure the port voltage of the solenoid valve on the control card to determine the problem.

You can continue to measure the port voltage of the solenoid valve on the control card to determine the problem.





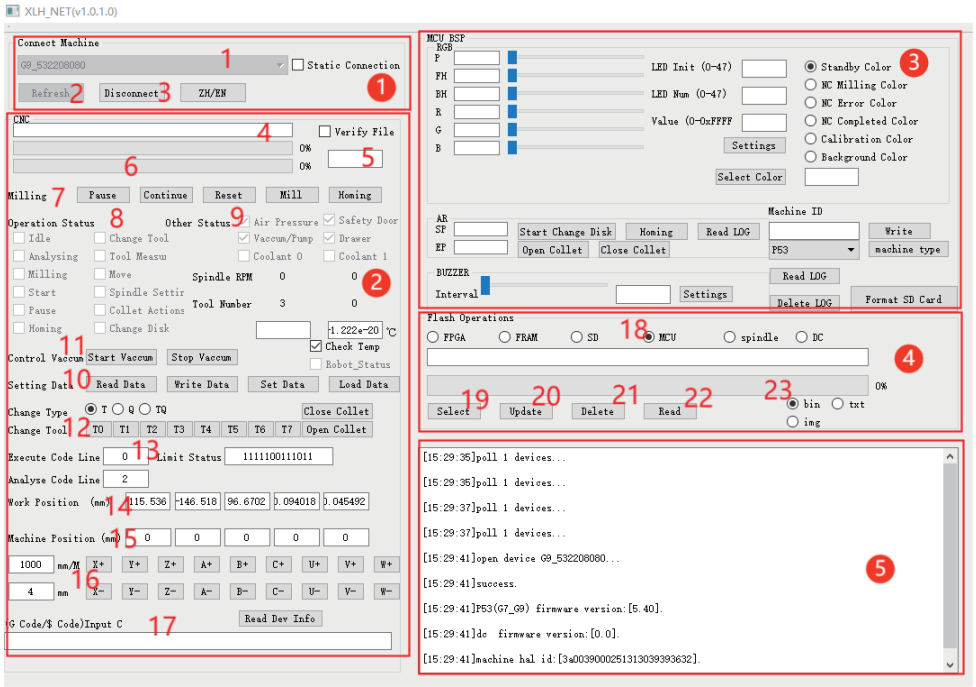
Attach 1. Update History

Version	Publish Date	Updated Content	Note
V0.1	2025.0825	First version/Draft	None disclosure
V0.2	0827	Attach 1 to 4	ND
V0.3	0910	Replace picture, add video QR code	Disclosable
V0.4	0930	Official Version	Publish
V0.5	/	Second Official Update	

Attach 2. How to use MMVH

MMVH tester is a debug tester for UP3D's milling machine, although it's being substituted by CNC3, but still it's widely used in the old version of milling machine which is under G10.

1. Software Interface



(1)Area ①:Machine Connection and Control

S1: After launching the software, click the 'Refresh' button to detect offline devices on the network.

S2: From the drop-down list, select the target offline device for connection.

S3: Click the 'Connect' button to connect to the specified offline device.

(2) Area ②:CNC Control

S1: Select the NC file to be processed.

S2: Start Normal Machining. Click the 'Process' button [7] to begin processing. The progress indicator [6] displays the current machining progress.

S3: Start machining from a specified line number. Click on the edit box [5], enter the line number from which to start machining the currently selected NC file, and then proceed to execute step S2.

S4: Pause processing. Click the 'Pause' button [7] to pause the current processing.

S5: Continue processing. Click the 'Continue' button [7] to resume the current processing from where it was paused; otherwise, it will be invalid.

S6: Reset the process. Click the 'Reset' button [7] to reset the current processing. The processing will immediately stop and be in the reset state. Click 'Processing' to process the currently selected NC file again.

S7: Operational Status [8] displays the current working state of the CNC system. The following are the only states currently supported:

Status MARK	Status Definition
NC	The milling machine is currently executing an NC file.
CONTINUE_NC	The milling machine is executing an NC file from a specified line.
PAUSE	The milling machine is currently in a paused state.
HOMING	The milling machine is currently in a homing status.
CHANGE_TOOL	The milling machine is currently performing a tool change.
PROBE	The milling machine is currently in a probing cycle.
MOVE	The milling machine is currently in motion.
PARSER	The milling machine is executing a user-input G-code command.

S8:Other status [9] shows the CNC input status information and tool number, speed, etc.

Status MARK	Status Definition
Air pressure is sufficient/insufficient	Pressure status
Safe door ON/OFF	ON: The safe door is open. OFF: The safe door is closed
Vacuum cleaner ON/OFF	ON: The vacuum cleaner is on. OFF: The vacuum cleaner is off
Cooling ON/OFF	ON: Spindle cooling is on. OFF: Spindle cooling is off
Tn	0: No tool currently in use, 1-N: tool number currently in use
Sn	0-N: The current spindle speed is n rpm/min

S09: CNC parameter table read/write control [10] operation is not required at this time.
S10: Vacuum cleaner switch control [11].
S11: Tool selection [12]. T0 indicates retraction, and T1-T7 indicates which tool to hold. Clamping the tool opens the spindle clamping tool air valve, and loosening the tool closes the spindle clamping tool air valve.
S12: Executing line number [13]displays the current line number being executed in the NC program.
S13: Work Position [14] shows the current work coordinates.
S14: Machine Position [15] shows the current machine position. Currently, the CNC system is based on the machine position.
S15: axis step operation control [16] defaults working coordinates (G54 reference frame) and G90 motion mode. To switch to incremental motion (G91 mode), manually enter "G91" in the edit box [17] and press Enter on the keyboard to confirm the change.
S16: User Command Input Interface [17]. Users can execute either the G command or the text $command through this edit box.

(3)Area ③:MCU BSP Control Area(Control Not Required)

(4)Area ④: FLASH Programming

flash Type	flash Instructions
FPGA	Update FPGA firmware
FRAM	Update FRAM
SD	Update SD card data
MCU	Update MCU firmware

S1: Select the type of flash that needs to be updated [18].

S2: Select the files that need to be updated. Click the Select button [19] and select the files you need.

S3: Write operation. After performing the S1->S2 operation, click the update button to write the file to the specified FLASH.Progress indicator [23]:displays the current update progress.

S4: Erase Operation. Click the Erase button to erase the specified FLASH in S1. To erase files from the SD card, perform the S2 operation to select the target filename, then click the Erase button.

S5: Read operation. Click the read button[22] to read the FLASH data specified by S1 and save it in the BIN/IMG/TXT format selected on the right

(5)Area ⑤:LOG Printing

S1:Print software execution logs and CNC returned data.

I.oftware Parameter Table Overview

1:$xxx=N sets the value of xxx to N
2:$xxx check the value of xxx

Command	Command Description
# Coordinate System	
$g54x/y/z/a/b/c	G54 coordinate system X/Y/Z/A/B/C axis coordinates (same for G54-G59)
# Motor	
$[0-5]am	The motor [0-5] maps to the axis definition (0-8 = x-w)
$[0-5]sa	Motor [0-5] Step Angle (°)
$[0-5]tr	Motor [0-5] Lead Per Pulse (mm)
$[0-5]mi	Motor [0-5] Microstepping
$[0-5]po	Motor [0-5] Direction Polarity (0 = CW, 1 = CCW)
$[0-5]cu	Motor [0-5] Current(A)

# Axis	
$[xyzabc]am	Axis [xyzabc] mode (temporarily not supported)
$[xyzabc]vm	Axis [xyzabc]G0 speed (mm/Min)
$[xyzabc]fr	Axis [xyzabc]G1 max feed rate (mm/Min)
$[xyzabc]tn	Axis [xyzabc]min travel (mm)
$[xyzabc]tm	Axis [xyzabc]max travel (mm)
$[xyzabc]ra	Axis [abc] radius (temporarily not supported)
$[xyzabc]sn	Axis [xyzabc]min limit switch mode
0	Prohibited
1	Homing
2	Limit
3	Homing and limit
$[xyzabc]sx	Axis [xyzabc]max limit switch mode

$[xyzabc]sv	Axis [xyzabc] homing search speed and zero retraction speed
$[xyzabc]lv	Axis [xyzabc] Homing Retraction and Homing Retract Rate
$[xyzabc]lb	Axis [xyzabc] retraction length
$[xyzabc]zb	Axis [xyzabc] zero retreat length
$[xyzabc]ma	Axis [xyzabc] maximum acceleration (mm/s ²)
$[xyzabc]dr	Shaft [[abc] reduction ratio
$[xyzabc]stn	Axis [xyzabc]min limit switch polarity (0: normally opened /1: normally closed)
$[xyzabc]stx	Axis [xyzabc]max limit switch polarity (0: normally opened /1: normally closed)

Command	Command Description
# Probe	
$prbe	Probe status (0: failure /1: success)
$prbx	Probe X-axis results

$prby	Probe Y-axis results
$prbz	Probe Z-axis results
$prba	Probe A-axis results
$prbb	Probe B-axis results
$prbc	Probe C-axis results
$prbu	Probe U-axis result
$prbv	Probe V-axis results
$prbw	Probe W-axis results
$prbsta	G38.1 Tool sensor polarity (0: normally opened /1: normally closed)
$prbstp	G38.2 probe switching polarity (0: normally opened /1: normally closed)
$prbah	G38.1 Tool Sensor Overtravel: additional distance to press and clean the tool sensor.
# Spindle n(n = 0/1) - Supports dual spindle parameters	
$spd[n]mt	Spindle type

0	Prohibit spindle
1	DECI spindle
2	UP3D spindle
3	Jaegar spindle
$spd[n]mc	Maximum spindle current (not supported temporarily)
$spd[n]mp	Maximum spindle power (not supported temporarily)
$spd[n]ms	Spindle maximum speed (rpm/min)
$spd[n]fv	Spindle firmware version (not supported temporarily)
$spd[n]hv	Spindle hardware version (not supported temporarily)
$spd[n]sct	Spindle to speed-reaching signal detection time (S)
$spd[n]zct	Spindle zero-speed signal detection time (S)
$spd[n]mda	Spindle MODBUS communication address
$spd[n]g	Spindle speed ratio

# Spindle machining temperature control parameters	
$spd0th	Spindle stop machining temperature
$spd0tl	Spindle machining pre-alarm temperature

Command	**Command Description**
$spd[n]fc	Select spindle driver
0	Spindle Driver (JT) are currently only supported for DECI spindles
1	Self-developed driver (UP)
2	TSD Domestic spindle driver (TSD)
$spd[n]ver	UP self-developed spindle driver firmware version
# Tool table n(n=0/1), double tool table corresponding to double spindles	
$t[n]pzzl	Tool sensor length (must be correct during initialization, will be automatically updated afterwards, positive value)

$t[n]pazl	Clamping/loosening tool movement distance (positive value: after subtracting tool post holder length, 80% rapid movement, 20% slow movement)
$t[n]pazo	Tool holder tool frame length
$t[n]pafv	Fast feed speed for tool setting
$t[n]pasv	Slow feed speed for the tool
$t[n]pasl	Not supported temporarily
$t[n]pabl	The retraction length of the tool setting
$t[n]pacx	Tool sensor X-axis position (relative to calibration ring position)
$t[n]pacy	Y-axis position of the Tool sensor (relative to calibration ring position)
$t[n]pcox	Calibrate the X-axis position of the ring (absolute position)
$t[n]pcoy	Calibrate the Y-axis position of the ring (absolute position)
$t[n]pfv	Clamping/loosening tool fast feed speed
$t[n]pplv	Clip/release slow feed speed

$t[n]ppsl	Not supported temporarily
$t[n]ppdt	Clamping/loosening tool delay (S)
$t[n]plst	Currently using tool number (0-11,0 for no tool)
$t[n]ptlx	Specified parameter for tool length upper limit
$t[n]ptlnz	Specified parameter for tool length lower limit
# Tool Position	
$t[n]l[t]x	Tool t-x-axis position (relative to calibration ring position),$t0l2x = tool table 0,2 tool x-coordinate
$t[n]l[t]y	Tool t-y-axis position (relative to calibration ring position),$t1l2y = tool Table 1 and 2 tool Y coordinates
$t[n]l[t]l	Tool t tool length (automatically updated for tool setting), $t1l10l = Tool Table 1,10 tool length

Command	Command Description
# Homing	
$h0seq	The first axis mask back to zero (0:1 x/y / 2:3: z/a / 4: b / 5: c / 6: u / 7:8: v/w)
$h1seq	The second homing axis mask
$h2seq	The third homing axis mask
$h3seq	The fourth homing axis mask
$h4seq	The fifth homing axis mask
$h5seq	The sixth homing axis mask
$h6seq	The seventh homing axis mask
$h7seq	The eighth homing axis mask
$h8seq	The ninth homing axis mask
# System Parameters	
$syssl	Software limit detection enable (0: disable /1: enable)

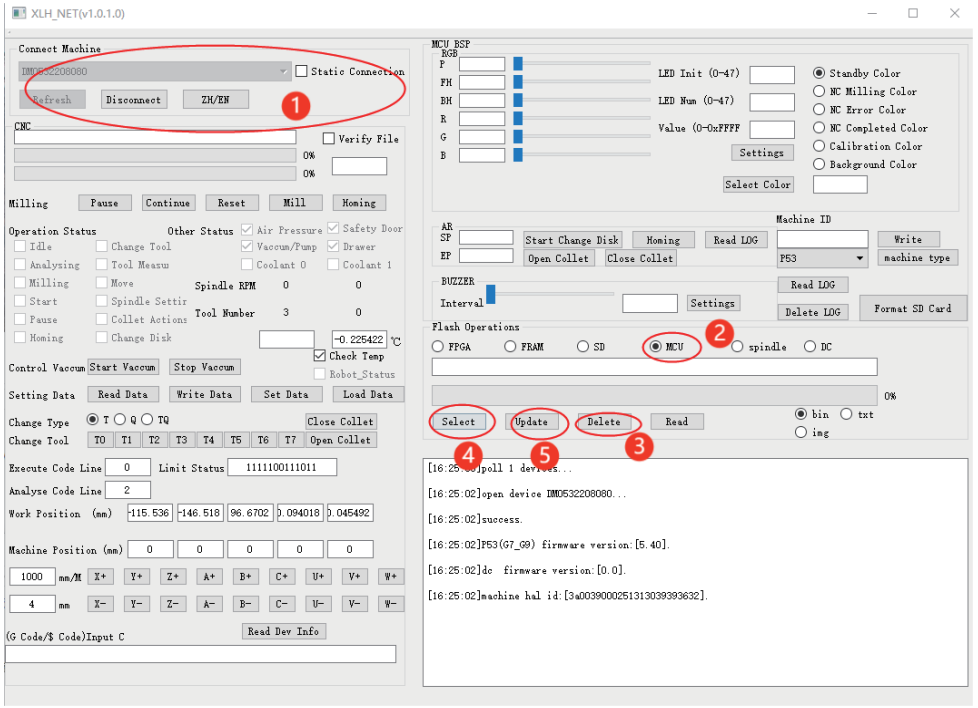
$sygco	Current working coordinate system selection (0:G54)
$sysfs	FPGA filter enable
$sysdre	Safe door detection enable (0: disable /1: enable)
$syspme	Air pressure detection enable (0: Disabled /1: enabled)
$syspmt	Under pressure detection time (S)
$syspre	Restore enable (0: disable /1: enable) after full air pressure
$sysprt	Air pressure sufficient detection time (S)
$sysdce	Vacuum cleaner detection enable (0: disable /1: enable)
$sysip0	Set up the Ethernet static connection IP segment. 192.168. Ip0 ip1
$sysip1	Set up the Ethernet static connection IP segment. 192.168. Ip0 ip1
$sysase	Enable stall detection
$sysfce	Enable water-cooling detection
$sysdwe	Enable drawer detection

# System runtime	
$tmlmt	Limit system running time (MIN)
$tmrun	Current system running time (MIN)
# Auto-reload	
$arpad	The tray number currently in use
Command	**Command Description**
$aron	Automatic material change function enable (1: enabled, 0: disabled)
$arpx	X-axis position of point 0
$arpy	Y-axis position of point 0
$arpa	A-axis position of point 0
$arpa	B-axis position of point 0
# Cross-segment parameter	
$plancrm	CNC transition speed; keep the default value of 2, no need for modification

$ncacc	NC file auto-cleanup cycle, unit: days, default 3 days. Set to 0 for no automatic cleanup
# Tool sensor height parameters	
$prbah	Tool sensor height parameter
#RGB color value parameters, color value generation reference Tiger	
$cr0	Normal state color, background color
$cr1	NC processing color
$cr2	NC processing abnormal color
$cr3	NC processing normal completion color
$cr4	Calibration state color
$cr5	Not in use
$cr6	Not in use
$crpso	Enable the on-power RGB light bar flashing sequence function on the machine

# Standby tool parameters	
$bkbte	Standby tool activation parameters (1: enable, 0: disable)
$bk1	tool Number 1 Spare tool number (Range 1-11)
$bk2	tool Number 2 Spare tool number (Range 1-11)
$bk3	tool Number 3 Spare tool number (Range 1-11)
$bk4	tool Number 4 spare tool number (Range 1-11)
$bk5	tool Number 5 spare tool number (Range 1-11)
$bk6	tool Number 6 spare tool number (Range 1-11)

II. MCU Firmware Update process



S1:Scan the connected devices within area ①

S2:Select the machine within area ②

S3:Click the erase button in area ③

S4:Wait for the device to go offline and reconnect, that is, repeat s1. At this time, click connect to identify that the firmware version should be 0.0. Usually, the waiting time does not exceed half a minute

S5:In area ④, click the selection button and choose the MCU firmware file to be updated, which is usually the one ending with .binfs file

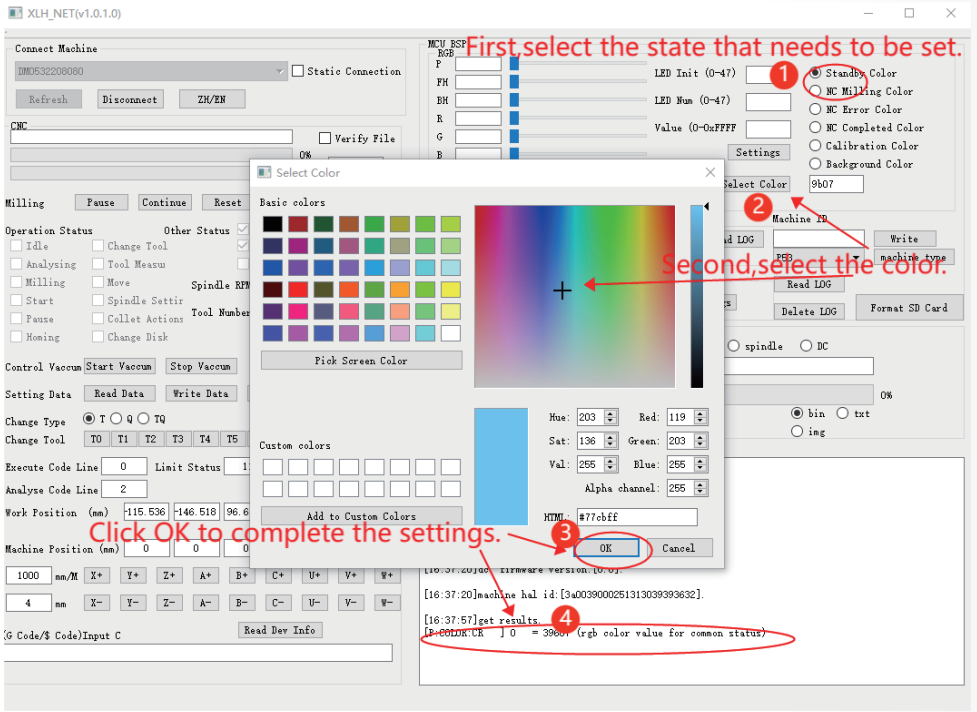
S6:Click the update button in area ⑤ to start the update and wait. During the update process, the software may lag. This is a normal phenomenon. Do not force it to close. The update time usually does not exceed 2 minutes

S7:After the update is completed, the device will disconnect normally. Simply repeat Step S1 to reconnect. At this point, the recognized firmware version should be the normal one and should not be 0.0.

Note
· Never update the firmware directly without erasing it, or it will become a brick.

III. DEMO Instructions

1 Update the RGB parameter values of the light bar



Attach 3. Error Code Identification Key

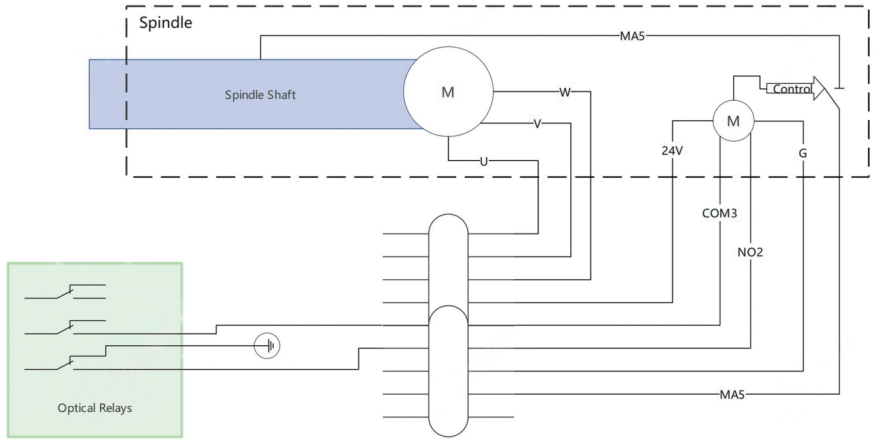
Error Code	Error Info	Refer to Page	Note
10	Loosing tool failed	39, 54	
12	NC file length abnormal	7	
13	Unsupported CNC command	/	
21	Tool broken	36 ~ 42	
22	Tool is too long	Att. 10	
180	Limit_Hit_X_MIN	8	
181	Limit_Hit_Y_MIN	9	
182	Limit_Hit_Z_MIN	10	
183	Limit_Hit_A_MIN	10	
184	Limit_Hit_B_MIN	11	

213	Spindle can’t start to spin	20 ~ 25	Note
214	Spindle can’t stop	/	
215	Spindle communication error	Att. 8	
216	Spindle parameter error	Att. 7 ~ 12	
233	X axis homing failed	8	
234	Y axis homing failed	9	
235	Z axis homing failed	10	
236	A axis homing failed	10	
237	B axis homing failed	11	
241~246	Homing parameter error	Att. 5 ~ 6	
1042	Tool number setting incorrect	/	
452~453	Tool sensor error	40~42	

Attach 4. Airless Spindle Check

1. Spindle Diagram

For the P53 Plus model, is using a totally different spindle system that the typical P53s, if your machine is this model, please refer to this attach to debug the spindle.collisions and resume machining.



2. Spindle System Analysis

From above diagram, we can see that there's 8 wires inside spindle cable, and there's two motors in one spindle. The bigger one powered by U, V, and W is a 3 phases AC motor which controls the rotation of spindle. And a smaller one in addition which powered by 24V and G is a Functional Motor, this motor is used to select different function such as closing or loosing spindle collet.

Additionally, there's a MA5 to provide the signal of calibration. When the spindle is on the Probe mode, the functional motor will control the switch close, so that the shaft inside and MA5 will be conductive, and when spindle touches the ground, the voltage will reduce to 0V.[Please refer to the electrical potential theory.[2]

3. How to check

In the above diagram and analysis, we can see all the spindle functions is controlled by different wires and their signals. So that we can use a multimeter to measure the voltage of those wires to make sure the function is ON or OFF.

[2]Please refer to the electrical potential theory.

Wires	ON Voltage	Off Voltage	Functions controlled	Start Place
NO2	24V	0	Loosing Coolet	Optical Relays
COM3	24V	0	Close MA5 Switch	Optical Relays
24V Spindle	24V	Always ON	Power	Control Board
G Spindle	0	0	Power Negative	Control Board/G
U	/	0	Rotation	Choke Card
V	/	0	Rotation	Choke Card
W	/	0	Rotation	Choke Card
MA5	24V	Always ON	Probe Signal	Control Board