

# P53DC


## Auto Blanks Changer



User Manual



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# 01 /Product information overview

## 1.1 UP3D dental CAD/CAM system

Shenzhen UP3D Technology Co., Ltd. began to carry out dental CAD/CAM system research in 2012. It has a group of professional technology development teams and a set of digital core technologies.

Now the company has built a complete set of dental CAD/CAM system, including: high-precision dental scanners (various models), dental CAD design software, dental CAM nesting software, dental milling machines, etc., all of which are independently developed and have patent of invention.

## 1.2 Brief introduction

Denture (or tooth, restoration) engraving machine, also is called denture processing machine, denture engraving, dental milling machine, denture CNC machine, denture cutting machine, tooth carving machine, etc.

UP3D intelligent auto blanks changing dental milling machine is an important product in the UP3D dental CAD/CAM system, and it is an intelligent dental milling machine.

Its intelligence is mainly reflected in the following three aspects:

First: The dental milling machine has an automatic calibration function, which can automatically compensate the machining deviation through calibration to ensure the machining accuracy;

Second: It has a highly integrated 5-axis motion control system and an intelligent and simplified upper computer operating software.

Third: It can realize unattended all-weather production and milling, and is used for multi-material level solutions. It supports a maximum of 12 material tray positions, loads multiple tasks at the same time, and automatically loads and unloads materials for continuous milling, saving time and worry.

## 1.3 Function characteristics

High reliability and stability: The spindle adopt vertical milling design, which has wider versatility. The key control components are originals from internationally renowned manufacturers, and the screw and guide rails are maintenance-free design to reduce equipment maintenance costs.

High-precision linear motion assembly: each linear motion axis is guided by high-precision linear guide rails, driven by small lead ball screws, and the positioning accuracy  $\leq 0.02\text{mm}$ .

(1) Breakpoint resume: recording breakpoint when milling, no need to worry about interruption of power failure, pop-up window prompts when restarts the machine, and resume milling tasks with one key;

(2) Low-power electricity consumption scheme: without fear of power outage and shutdown, you can easily cope with the peak electricity consumption in summer;

(3) Unattended, multi-material level solution: supports up to 12 material tray positions, loads multiple tasks at the same time, and Run the commands of getting and returning materials and continuous milling automatically, which saves time and worry, saving time and worry;

(4) Cleaning concept: The machine releases high concentration negative ion to reduce the adhesion of resin, and cleans the residual dusts of intracavity of the restorations for simple and high efficient daily cleaning;

(5) One-key automatic calibration system: equipped with automatic calibration system, automatic calculation and adjustment of the compensation value of each axis, intelligent and fast;

(6) Support 90-degree vertical milling: Furthermore, for pursuing the aesthetic restoration results, the machine supports 90 degree vertical milling to restore the details of labial and buccal side to the utmost extent;

(7) The external light bar indicates the working status: the working status of the machine is displayed by the external multi-color light bar, dsiplays the machine milling progress and status in real time.

The relationship corresponds to the following table:

Color	Indicator status
White	Standby mode
Orange	In milling progress
Blue	During automatic calibration
Green	When milling/calibration finished
Red	Warning

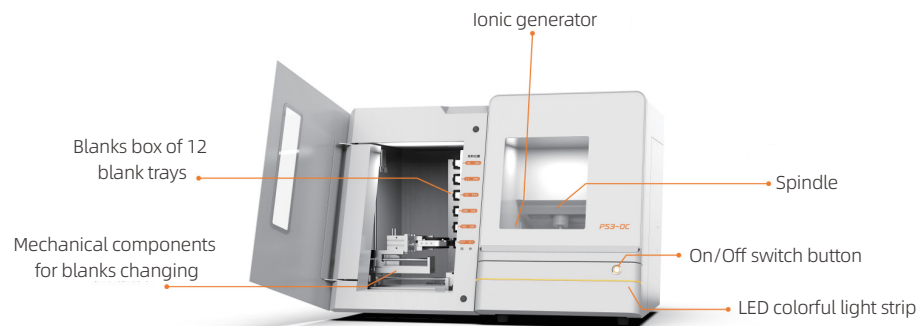
## 1.4 Applicable environment

The P53DC intelligent dental milling machine has certain requirements for its environment when running. After the indoor installation is completed, the environment should be:

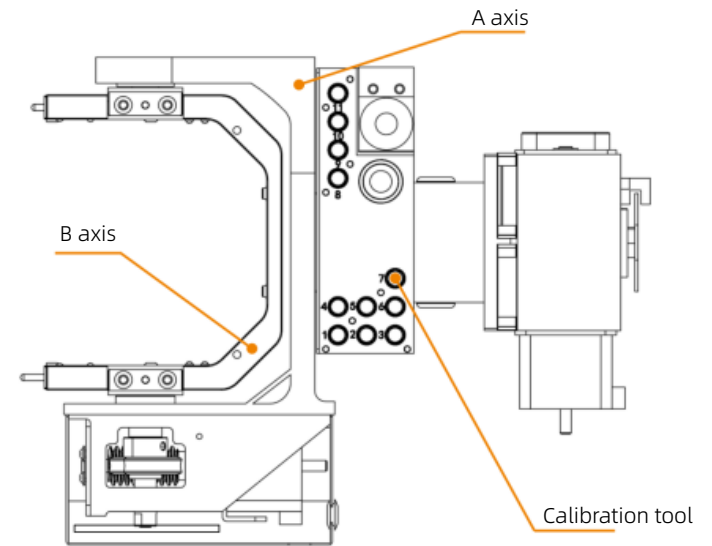
- A. The indoor temperature range is 5~40°C;
- B. Air humidity: 35-80% (without condensation);
- C. The altitude does not exceed 2000 meters;
- D. Grade of environmental pollution: 2 (according to IEC 60664-1);
- E. Instant excess voltage 1500V;

## 1.5 Main structure

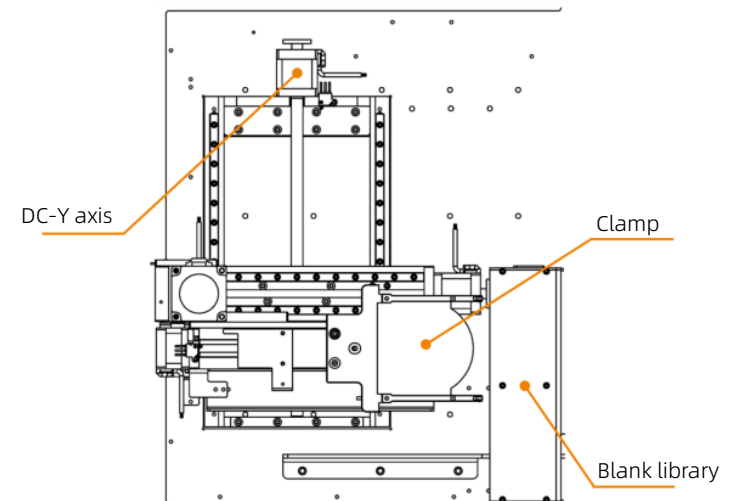
Product external view



P53DC machine internal working chamber



Auto blanks changer internal working chamber



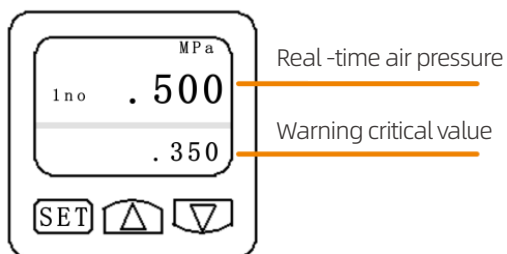
# 02/Product instructions

## 2.1 Device connection

(1) Take out the purchased product from the packaging box. And lift it lightly when moving. Place the product on the workbench to ensure that the workbench is stable and the product is placed smoothly. Open the front door of the milling machine and remove the foams used for protection and put it out in turn (kept for subsequent maintenance and transportation).

(2) Open the accessories box, take out the power cable, network cable, and connect them to the specified position in order.

(3) Take out the pressure regulating filter and fix it with two inner hexagon socket head M6×10 screws to the bolt holes reserved on the right side of the product. Convert the air tube from the self-prepared air compressor to 6mm diameter, and insert the identification position on the regulating filter. At the same time, cut one end of the 6mm tube (about 40cm long), and the pneumatic port is inserted from the right tube connector from the air outlet of the pressure regulating filter.



Real-time air pressure  $\geq 0.50\text{MPa}$

(4) Insert the tube of vacuum cleaner to the vacuum cleaner socket of milling machine

(5) Take out the  $\phi 4\text{mm}$  calibration tool,  $\phi 2\text{mm}$  milling tool,  $\phi 1\text{mm}$  milling tool,  $\phi 0.6\text{mm}$  milling tool, and put them into the specified position of the tools library

(6) Put the 12 blank trays in the blanks box according to the corresponding position

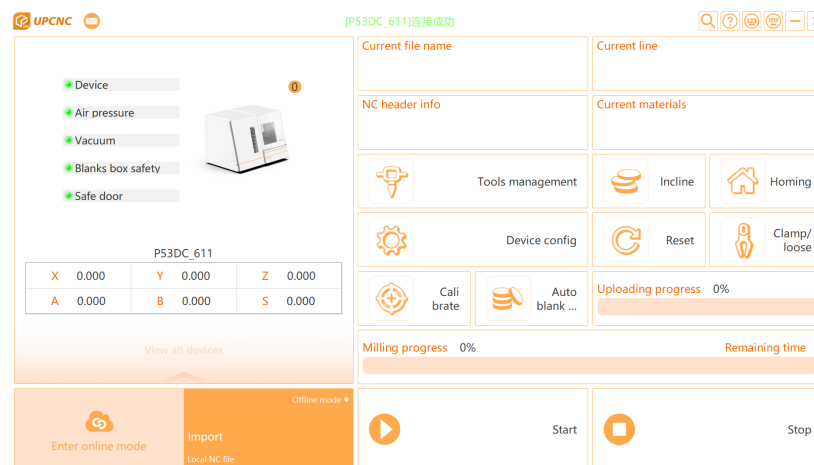
(7) Turn on the computer, the network cable is connected directly with the computer and the milling machine, or the router connects to the computer, and open the product power switch and button switch on the shell in turn

Install the UPCNC software and drivers, the basic parameters setting is as follows:

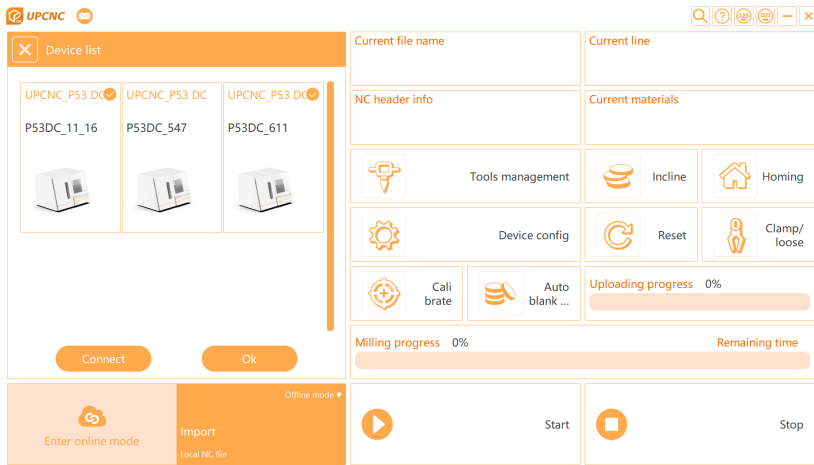


## 2.2 UPCNC operation instructions

### (1) Main interface



## (2) Connection and window functional area



The diagram is a connection and window functional area, 2 buttons are displayed on the left:



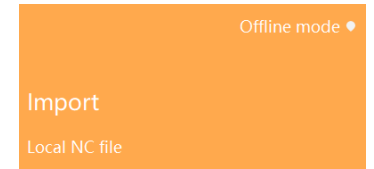
Devices icon button: Show the current operating device. If there are multiple devices, multiple icons are displayed.

[-] Minimum window button: after clicking, the current software interface is minimized to the taskbar.

[X] Close button: After clicking, turn off the current software.

## (3) File loading and start -stop operation area

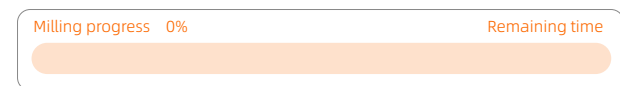
Import button: Used to load NC (G-Code) files, click this button to pop up the "Open NC File" dialog box, showing the loading file path and name on the information display area.



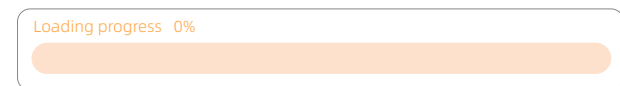
- ▶ Start button: Click the button to start the milling after loading the NC file
- ◻ Stop button: During the milling process, if you want to check the milling situation, you can click the button. At the same time, if you find the milling error during milling, you can also click the button. The main function is to stop milling and stop rotating the spindle.

## (4) Milling progress and information display area


This area mainly shows: During the milling process, the current axis coordinates, the spindle rotation speed, and the following progress bar shows the current milling progress and percentage rate.





The area is mainly displayed: NC file uploading progress





## (5) Main functional operation area


 [Calibration] button: that is, automatic calibration. After clicking the button, the device will perform automatic calibration according to the set process.


 [Reset] button: after clicking the button, clear the current equipment milling, calibration, and alarm status.

 [Homing] button: click the button, the device runs G28.2 instruction to return to the original point of the machine by touching each axis limit switch

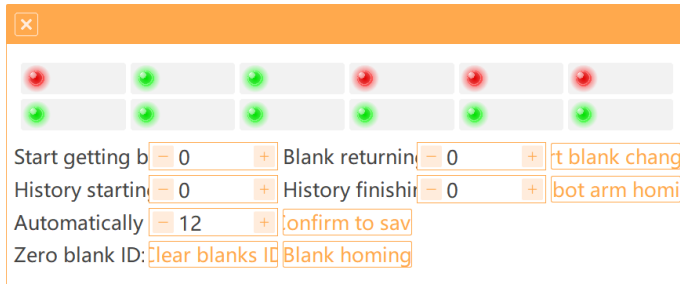
 [Load blank] button: click the button, axis A rotates to the material loading position to facilitate the disassembly of the blank.

 [Open/close] button: click the button to open the collet of spindle. If there is a tool in it, the tool drops directly, click again, close the collet and clamp the tool.

 [Machine config] button: click this button, input the password, and enter the device parameters setting mode.

 [Tools management]: count the milling time of each tool, and you can set the tool life through this window. When the time limit is reached, the software will intelligently prompt you to replace the tool

 Auto blanks changing area:



Red and green light display area: corresponds to the position of 12 pieces of materials in the auto blanks changing box.

If the material is placed in correct position, the relative coordinates of the software will display green.


If there is no material placed there, or if it is not in correct position, the icon will display red.

## 2.3 Advanced Mode Settings

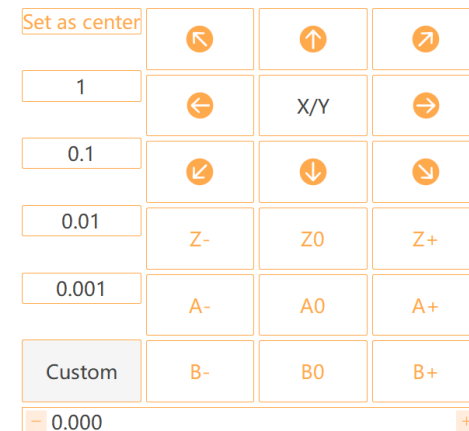
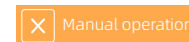
Click the [Machine Config] button and input the password to enter the advanced mode.

In this mode, there are 6 icon buttons at the bottom of the interface, which are used for switching and saving, returning and other operations of various options of the advanced model.



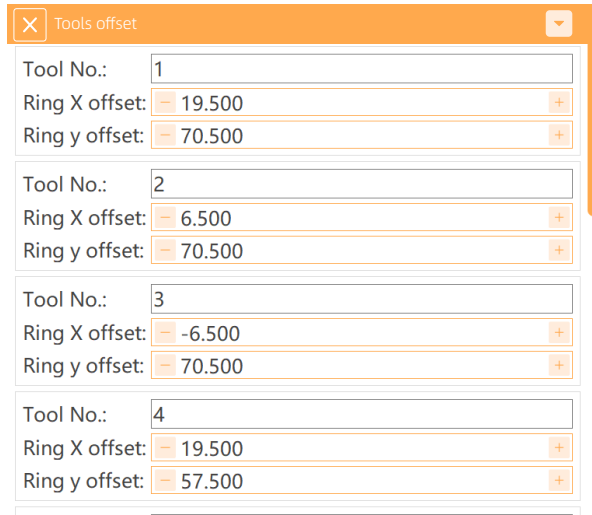
Save all button: After clicking this button, all parameters set or modified under the advanced model are saved and written to the motion control card of the lower computer. 

Interface 1: [Manual operation] button, given the fixed point distance setting (unit: mm), click the corresponding button to realize the micro-step adjustment of each axis;



Interface 2: [Parameters setting] button, the parameters of the current device are listed under this tab, which can be set and saved by clicking the [OK] button.

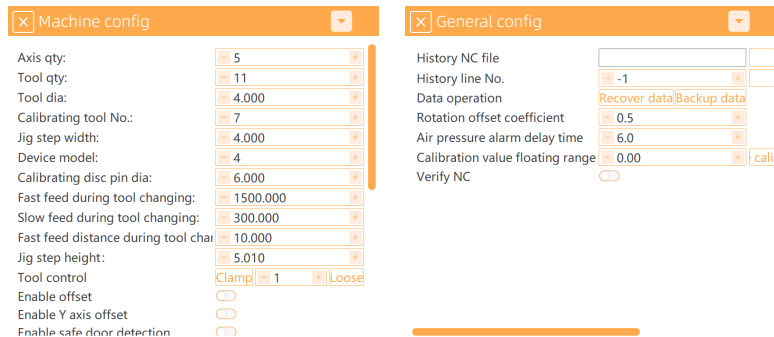
Interface 3: [Tools offset] button, the tools information of the milling machine is listed under this tab, by adjusting or filling in the tool positions in the tool library click the [OK] button to save.



Interface 4: [Machine config], the calibration configuration information, tools changing information, compensation method, etc. of the current milling machine are listed under this tab, and save by clicking the [OK] button.

Interface 5: [General config], you can view the following interface.

[Close] button: Exit the advanced settings mode.



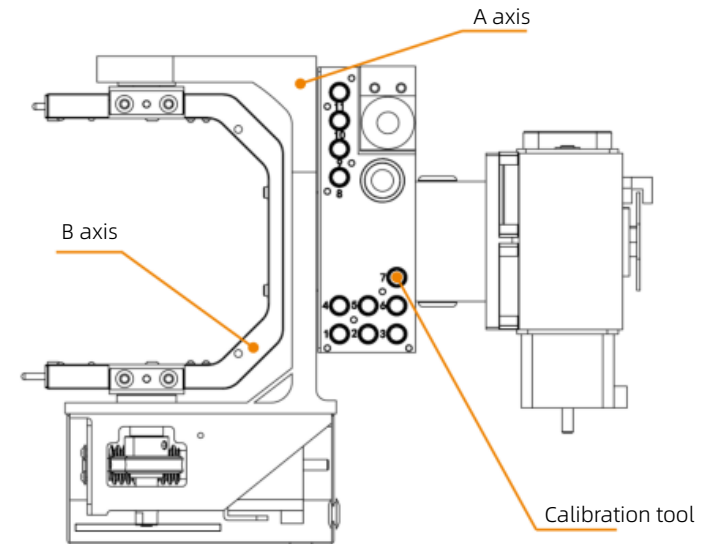
## 2.4 Automatic calibration operation

After successful connection to P53DC, automatic calibration is required to ensure the milling accuracy before the first milling, long-term milling (more than one week), abnormal milling, long-term shutdown (more than two weeks), or significant movement of the machine.

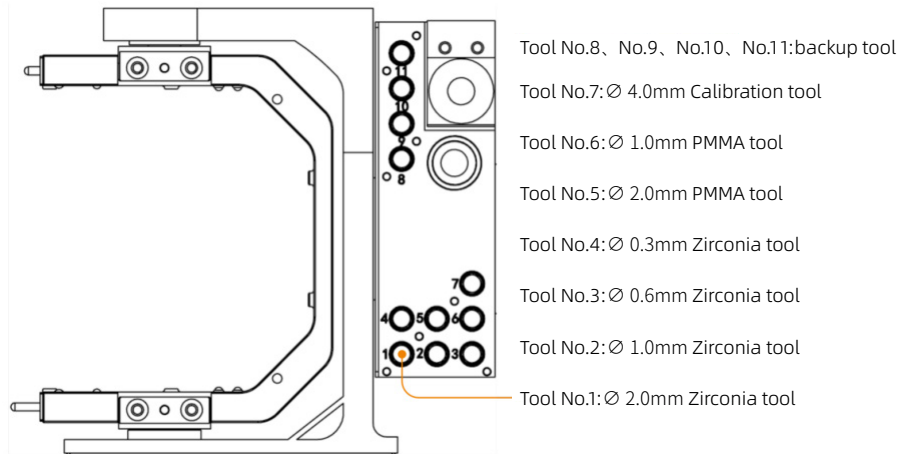
### 2.4.1 Check the parameters of the upper computer

Click [Machine Config] to check the key parameters of the interfaces of three buttons:

A. Calibration configuration interface: check the quantity of machine axis, quantity of tools, tool diameter, calibration tool ID, calibration plate pin diameter.



B.Tool configuration interface: Check the tool coordinates of tools No.1-7.



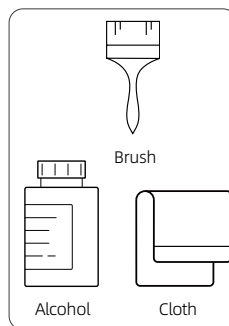
C.Parameter configuration interface: check the calibration ring coordinates

Note: If you make any change, you need to click [Confirm], otherwise the changes will be invalid.

Clean the tools library, calibration ring, tool sensor and jig

Main parts to be cleaned:

- The upper surface of the tool sensor;
- The upper surface of tools library;
- The inner side of the tool holder + the bottom surface;
- The inner side of the calibration ring;
- The upper surface of the jig+ the holder of the blank.



Cleaning method: Wipe the above main parts with a brush or cloth. If something cannot be cleaned, you can add alcohol to wipe.

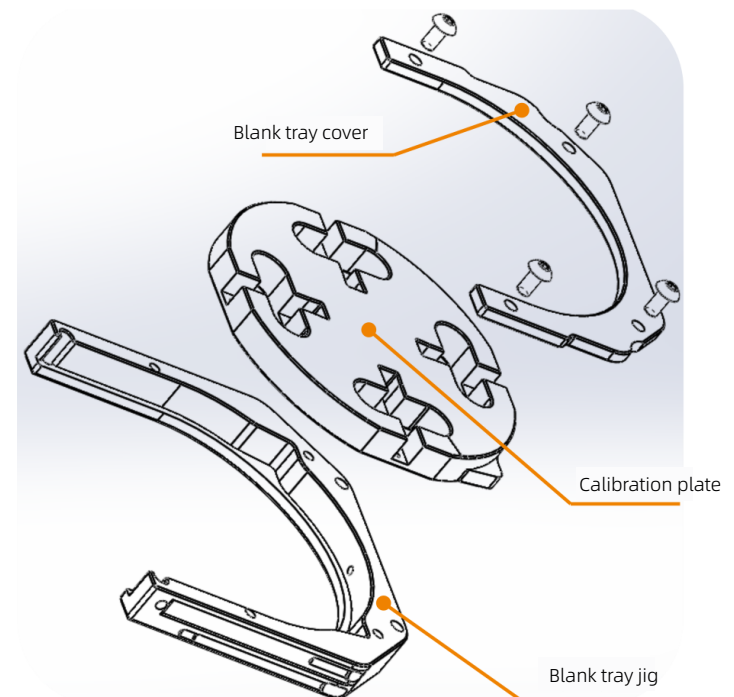
## 2.4.2 Install the calibration plate

(1) Find the calibration plate in the accessory box, then install and fix it on the jig by the following steps;

(2) Put the positioning ear of the calibration plate facing right side and make it even with the jig and on the bottom side

(3) Align the positioning ears of the calibration plate with the positioning groove, and gently push it into the jig from left to right, so that the calibration plate is close to the step surface of the jig

(4) Push the calibration plate to make the positioning ears fit closely with the positioning grooves



(5) Take out the jig cover so that its 3 corresponding bolt mounting holes are aligned with the corresponding threaded holes of the jig, and gently place it on the jig (note that the stepped side of the jig cover is placed downward).

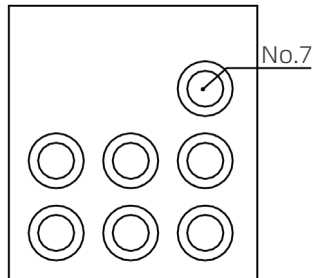
(6) Insert 3 hexagon socket head cap bolts M4×12 (stainless steel) into 3 bolt holes in sequence, during the tightening process, pay attention to coordination to ensure that the jig cover bears parallel force.

(7) Place the secondary jig of calibration plate into the No.12 tray to prepare for calibration.

Note: Before placing the calibration plate, remove the jig cover and bolts from the jig, remove all the sundries on them, ensure the cleanness.

#### 2.4.3 Install the calibration tool and place it in tools library

Please pay attention before start to calibration, place the calibration tool at the No. 7 tool position in tools library.



#### 2.4.4 Automatic calibration

After the above operations are completed, click the [Calibration] button in the main function operation area to automatically calibrate the milling machine. The automatic calibration process takes about 16 minutes.

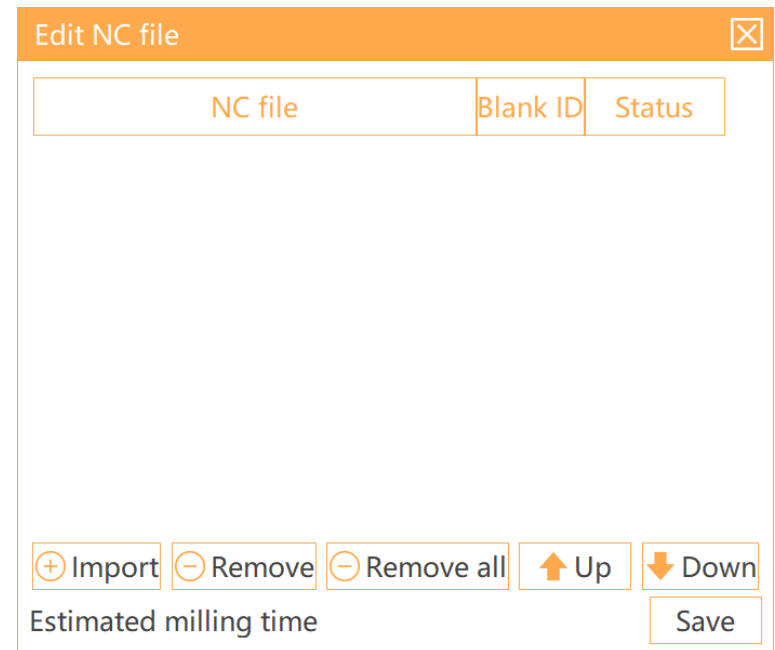


## 03/Milling operation instructions

### 3.1 Loading NC file

A. If you need to import a NC file for milling: click the [Import] button on the software interface, find the path of the NC file in the opened dialog box, select the file, click the [Open] button, and load the NC file of the restoration to be milled into the software;

B. If you import multiple files for milling at the same time: you can select multiple files at the same time, click [Import], after the importation is completed, the UPCNC software will pop out that the importation is successful; you can adjust the milling order of the NC files according to your needs, after confirm then click [Save].



Method 1: After selecting the NC file, flexibly drag and adjust the position arrangement

Method 2: After selecting the NC file, click the move up and down buttons on the interface to adjust the position.

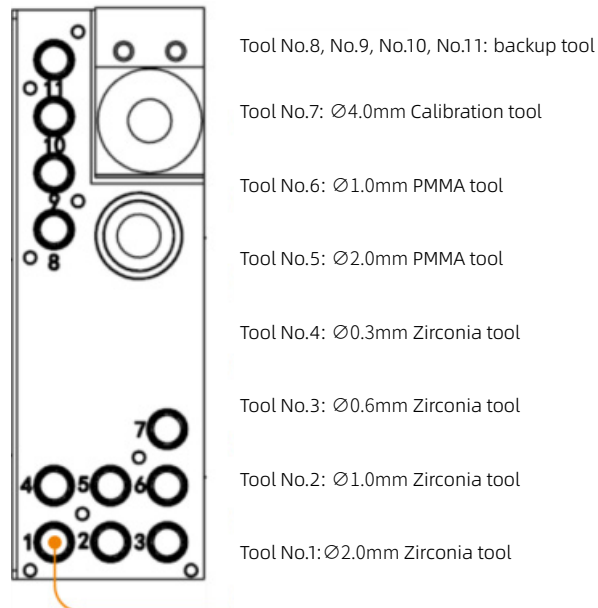
C. Delete NC file: If an importation error occurs or the occupied position needs to be removed after milling, you can selectively remove a single file or all lists;

Method 1: Select an NC file and click [Remove]

Method 2: Click [Remove All] to remove all NC files on the list

### 3.2 Tools installation

Before the milling, it is necessary to load the correct tools in tools library. The right positions of the tools in tools library (identified by numbers) are as follows:



No. 1 tool position:  $\varnothing 2\text{mm}$  diameter tool for rough milling

No. 2 tool position:  $\varnothing 1\text{mm}$  diameter tool for precise milling

No. 3 tool position:  $\varnothing 0.6\text{mm}$  diameter tool for tooth surface milling

No. 4 tool position:  $\varnothing 0.3\text{mm}$  diameter bur for tooth surface precise milling

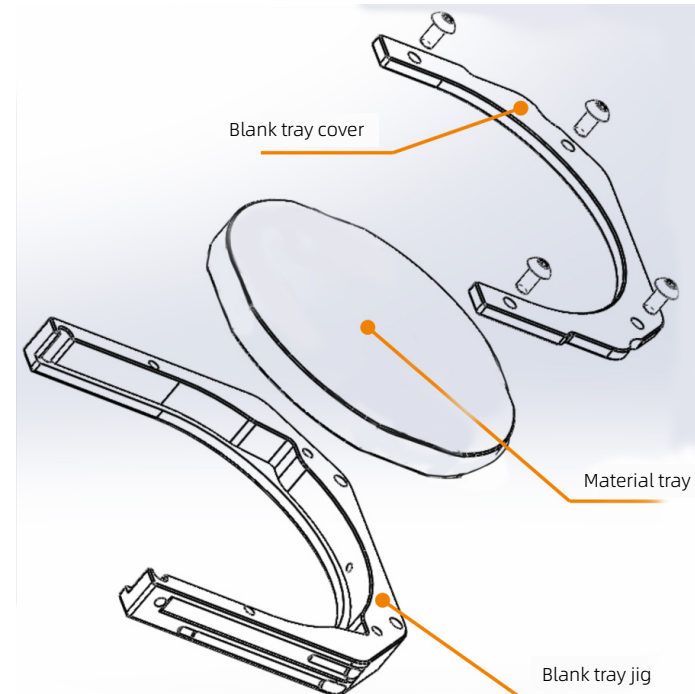
No. 7 tool position:  $\varnothing 4\text{mm}$  diameter calibration tool

To mill pmma materials:

No. 5 tool position:  $\varnothing 2\text{mm}$  diameter tool for pmma rough milling

No. 6 tool position:  $\varnothing 1\text{mm}$  diameter tool for pmma precise milling

### 3.3 Material loading



Select the corresponding blank tray number to install the blank material to be milled according to order built in UPCAM, then install the blank to the secondary jig, press it with the jig cover, and lock it with 4 pieces M4×12 stainless steel hexagon socket head bolts (You can refer to the operation of the calibration plate installation above).

After installation, put it back into the blank tray. At this time, you can check the indicator light corresponding to the tray number on the interface in the UPCNC; After the tray is placed right, the indicator turns green, otherwise the indicator light will show red.

After confirmation, you can proceed to the next step and make sure that the air pressure is stable at 0.4MPa-0.7MPa.

### 3.4 Milling operations

After the above operations are completed, click the [Start] button in the start and stop area of the software interface to start milling.

## 04/Common faults and handling

### Air pressure problem

When this fault occurs, the software interface pops up the box shown above, which indicates that the system detects that the air pressure does not reach the minimum air pressure set by the digital pressure switch, so warning message pops up. When this fault occurs, the current operation will be interrupted.

Solution: Click [OK] and check why the air pressure is insufficient.

- A. Check whether the air supply is sufficient and whether the air compressor is turned on;
- B. Check whether there is air leakage in the air tube;
- C. Check whether the pressure regulating filter is damaged.

### Tools changing problem

When this fault occurs, the software interface pops up a box as shown above, indicating that the milling machine fails to change the tool during the tool changing process.

Cause analysis:

- A. Under milling state: If this prompt box pops up during the milling, it may be that the tool is broken, or the tool clamping fails during the tool changing, this prompt will stop the milling, and it will resume after the error is eliminated.
- B. Non-milling state: the reason is the tool inspection fails during the process of clamping and returning the tool, including tool breakage, no tool placed in the tool position, and spindle collet is not open due to insufficient air pressure.

Solution:

Click [Open/close] button to check whether the spindle collet will be opened, if not, check the air pressure problem; if it is opened with a tool on the spindle, the tool will fall, so you need to manually catch the tool to prevent the tool damage from falling. Put the tool back in the tools library and run the milling again.

## Axis limit problem

When the fault occurs, the software interface pops up a prompt box shown above, indicating that the milling machine has touched the limit switch or moved beyond the travel during operation.

There are two types of limit problems, movement limit and mechanical limit.

### A. Mechanical limit

If the hardware limit occurs on X-axis, Y-axis, or Z-axis direction, then it is a mechanical limit, the reason for this limit is that the motion axis hits the limit switch under an abnormal state, resulting in an error in the machine;

Solution: Click [OK] to close this prompt box, then click the [Reset] button in the software interface and wait for ten seconds, or restart the machine.

### B. Software limit

When this prompt appears, it may indicate that the next movement of the milling program exceeds the limited travel, then it is the movement limit, and the prompt is a warning.

Solution: Click [OK] to close this prompt box, and then click the [Stop] button to revise the NC file or regenerate the NC before proceeding to the next step.

## UPCNC software reports a "Tool changing failed" error

Please check whether the tool is placed in the corresponding tools library.

## UPCNC software reports a "Tool damage" error

If the tool is broken, please click [Open/close] button, remove the broken tool, click the button again to turn off the air blowing out of the spindle collet.

## Accidental power failure during milling, and milling interruption

Restart the machine and UPCNC software, the software will pop up to prompt whether to continue milling, click [OK], and the milling machine will resume the previous milling.

## UPCNC software reports a "Blanks changing timed out" error

Please check whether the door of blanks box is closed. If it is not closed, please close it and click [Homing].

## UPCNC software reports a "Blanks obtaining status error" error

Please check whether there is a blank placed in the initial blank tray.

## UPCNC software reports a "Blanks returning status error" error

Please check whether there is a blank placed in the final blank tray.

## UPCNC software reports a "Communication error" error

Turn off the power button of the milling machine and restart after 10 seconds.

## Other faults

If you have any other questions, please contact our customer service thank you!

## 05/Daily maintenance

- A. The vacuum cleaner must be turned on during milling;
- B. The milling chamber and blanks box should be cleaned at least once a day for residues (do not use compressed air to clean);
- C. In order to ensure good milling accuracy, automatic calibration is performed once every 1~2 weeks. Before automatic calibration, please follow the prompts to clean the tools rack, calibration plate, spindle collet, and place the calibration tool at the No. 7 tool position;

Below is the daily maintenance record form:

Maintenance parts	Frequency	Tool	Result (√/×)
Compressed air $\geq 0.50\text{Mpa}$	While working	Eye inspection	
Vacuum cleaner is on	While working	Eye inspection	
Milling chamber cleaning	Once a day	Brush	
Blanks box chamber cleaning	Once in every 3 days	Brush、vacuum	
Automatic calibration	Once in every 1 to 2 weeks	UPCNC	

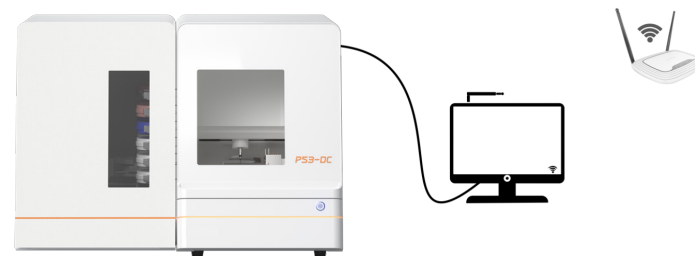
## 06/Application scenarios

Base on the user habits, we are practicing to match the different users' needs and usage habit to different

application scenarios. So as to reduce unnecessary waste of action and time. Your experience and convenience are the driving force to our progress!

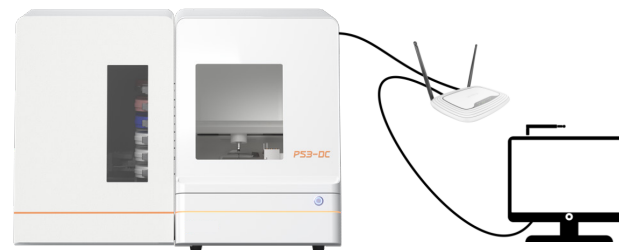
### 6.1 Diverse application scenarios

Computer's network cable directly connect and control the milling machine, computer connect to WiFi for remote technical support services.



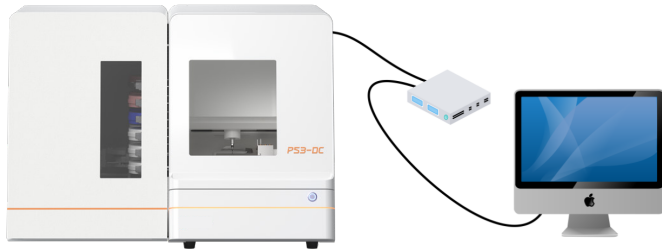
PS: Applies to PC and milling machine 1-to-1 using scenario.

Router establishes a local network, computer can be connected to all milling machines in the local network, router connected to Ethernet for remote technical support services.



PS: Applies to PC and milling machine one-to-multiple using scenario, which one PC control multiple milling machines.

Switch expansion port, PC can be connected to all milling machines in the expansion network, PC connected to Ethernet for remote technical support services.



PS: Applies to a single milling machine using scenario, UPCAM and UPCNC software are installed on the same computer; nesting and milling process happen simultaneously, applies to nesting station and milling machine spacing within 5 meters.

The milling machine network cable connect to router, computer by connecting this router WiFi can connect the milling machine, the router is connected to an external Ethernet network for remote technical support services.



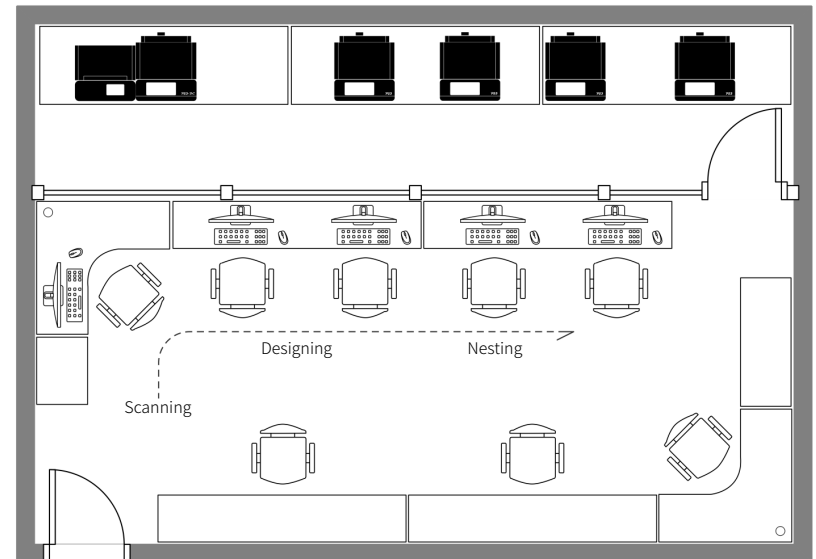
PS: Applies to a single milling machine using scenario, and the PC is spacing within 5 meters of the WiFi source or Router.

## 6.2 Typical application scenarios

### 6.2.1 Scenario One

A. By using connection 6.1.3, users can choose whether to connect to the WAN, for internet and remote control. It is not going to affect access to the LAN (to save and transfer NC files) and milling machine's connection status at any time.

B. PC operation and the milling machine are separated by a glass wall. The working status of the milling machine can be observed and indicated in real-time through the glass wall.

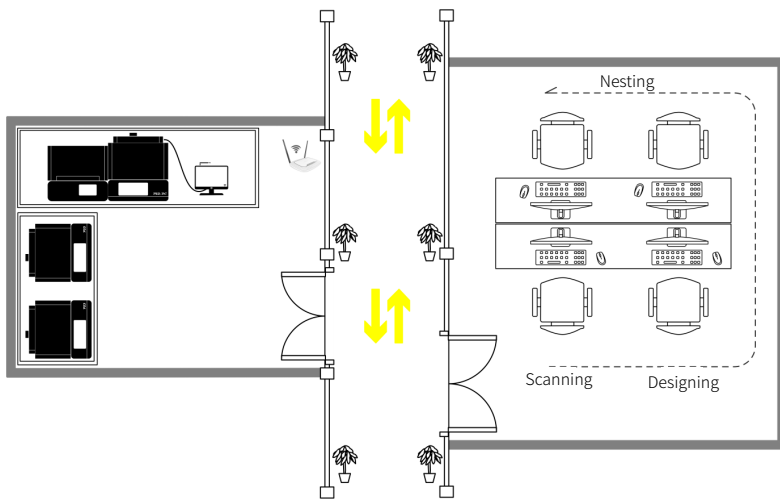


## 6.2.2 Scenario Two

A. By using connection 6.1.1, users can connect to WiFi for remote technical support and access the shared disk of NC file;

B. PC placed adjacent to the milling machine. The working status indicator can be observed in real-time through the glass wall;

C. The milling machine working area and office area are distributed on both sides of the corridor. The working status indicator can be observed in real-time through the glass wall.



## 07 / Product parameters

Model	P53 DC
Dimension	720×875×630mm
Weight	130kg
Input voltage	AC 200~240V 50~60Hz
Maximum power	1.1KW
Spindle power	0.35KW at max
Axis quantity	5-axis simultaneous motion
Milling range	X/Y/Z:167/206/104mm A:±30° B:±360°
Milling mode	Dry milling
Max rotation speed	60,000rpm
Max feed rate	3000mm/min
Tools quantity	11
Disc library quantity	12
Tools changing method	Automatic (Air pressure >0.5MPa )
Spindle cooling	Air cooling with compression air , air flow>50L/min
Milling materials	Zirconia, Wax, PMMA, PEEK and soft materials
Milling time	Coping : Zirconia-10min Wax- 4.5min Crown : Zirconia-13min Wax-5.5min
Tools diameter	2 + 1 + 0.6+0.3 ( Φ4 calibration bur )
Disc specification	Round disc with Φ98, 30mm max for thickness
Spindle clamping diameter	Φ4.0mm
CAM supported	UPCAM and Millbox
Data transmission	Network interface