Hard- und Software Burkhard Lewetz

Technical Software Engineering
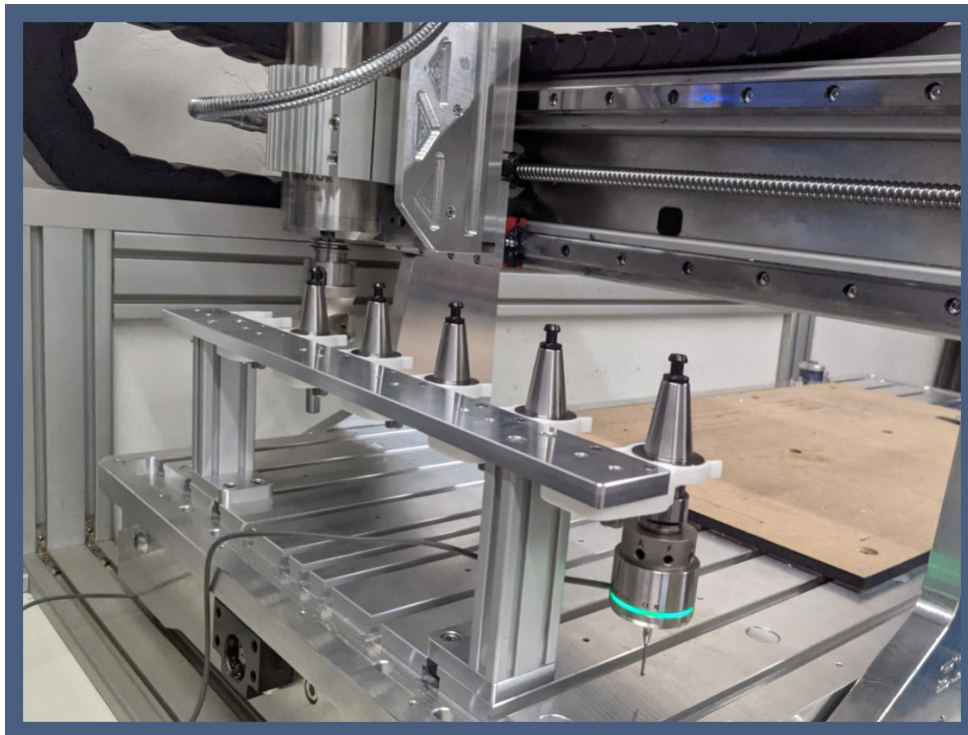
How does it work…
… with *WinPC-NC* ?

Setting up the automatic tool changer (ATC)

| Light |
| ✓ USB |
| ✓ Professional |

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TMü + LW

In this manual you will learn how to set up an automatic tool changer with *WinPC-NC* and how to realise the changing process.

Table of contents

Checklist for tools and materials

Tools and equipment needed:

- ✓ 3- or 4-axis CNC milling machine

- ✓ Spindle motor with controllable tool holder / collet chuck

- ✓ Tool magazine with up to 30 positions

- ✓ *WinPC-NC USB* or *WinPC-NC Professional* software as of version V3 or V4

> **Note:**
>
> **Before starting, please make sure that all the above requirements are fulfilled in order to complete the project successfully.**
>
> **Please read these instructions completely first and only then start with the project.**

Additional and extended functions with *WinPC-NC- Professional* :

Compared to *WinPC-NC USB*, *WinPC-NC Professional* offers additional functions and monitoring or setting options for automatic tool change.

- ✓ Monitoring of the magazine positions with a sensor to prevent placement in already occupied holders

- ✓ Monitoring of the molette with a sensor to detect if a tool has been picked up correctly

- ✓ Additional measurements of the tools at the length sensor after grab and before release to detect tool breakage and correct tool handling, output of corresponding error messages and possibility of correction and subsequent further processing

- ✓ Definition of critical and protected area in the machine room, which is constantly monitored and accidental overrun is prevented. This makes it easy to protect and monitor the magazine area.
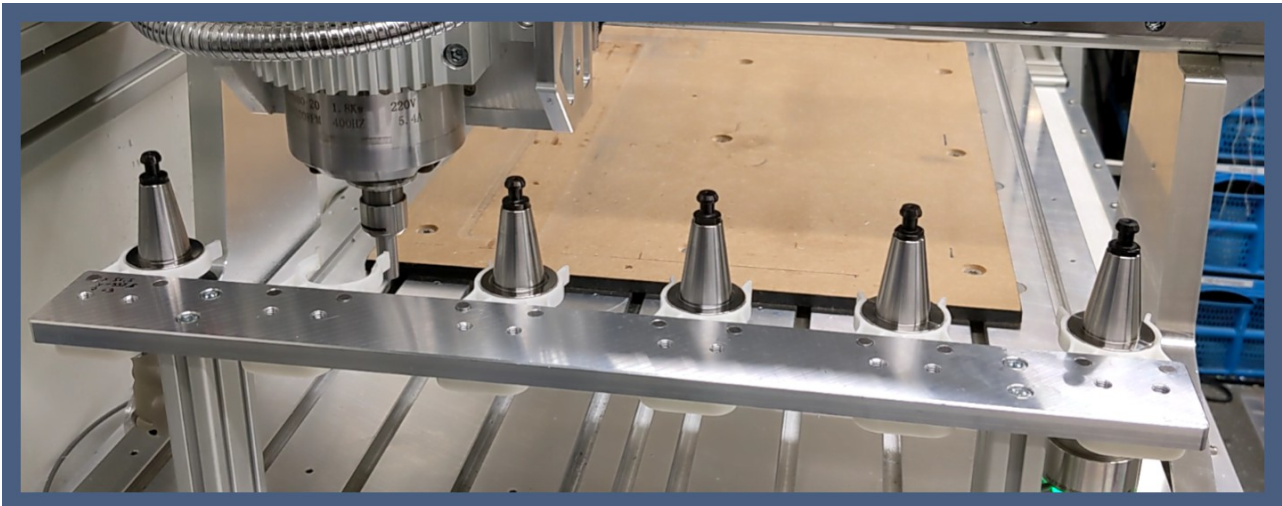
Introduction: Automatic tool change in *WinPC-NC*

In *WinPC-NC* is it possible to realise an automatic tool change.

With the help of these functions, milling jobs with more than one tool can be fully automated.

The extensive options for automatic tool change allow up to 30 different tools to be picked up from a magazine and automatically put away again after use.

It is possible to use both a linear tool magazine (tool rack) and axial designs using the 4th axis, e.g. a turret magazine.

In this manual we would like to give you an overview of which functions are available and how you can available and how you can set them up on your machine.

Fundamentals:

In order to be able to use the automatic tool change in *WinPC-NC*, we would first like to give you a general overview of the individual functions and processes that are used here.

Due to the enormous flexibility of the possible tool positions and magazine variants, commissioning takes place in two steps.

First, the settings in the **changer magazine** are used to specify the positions of the individual tools in front **of** or **above** the actual tool magazine.

Then the sequence for **picking up** and **placing** the tools is programmed using the macro functions. This procedure allows very flexible sequences to be programmed and also various additional signals, such as **collet open** or **taper cleaning**, to be controlled individually.

On the following pages, we would like to provide you with step-by-step instructions for putting the automatic tool change into operation on your machine.
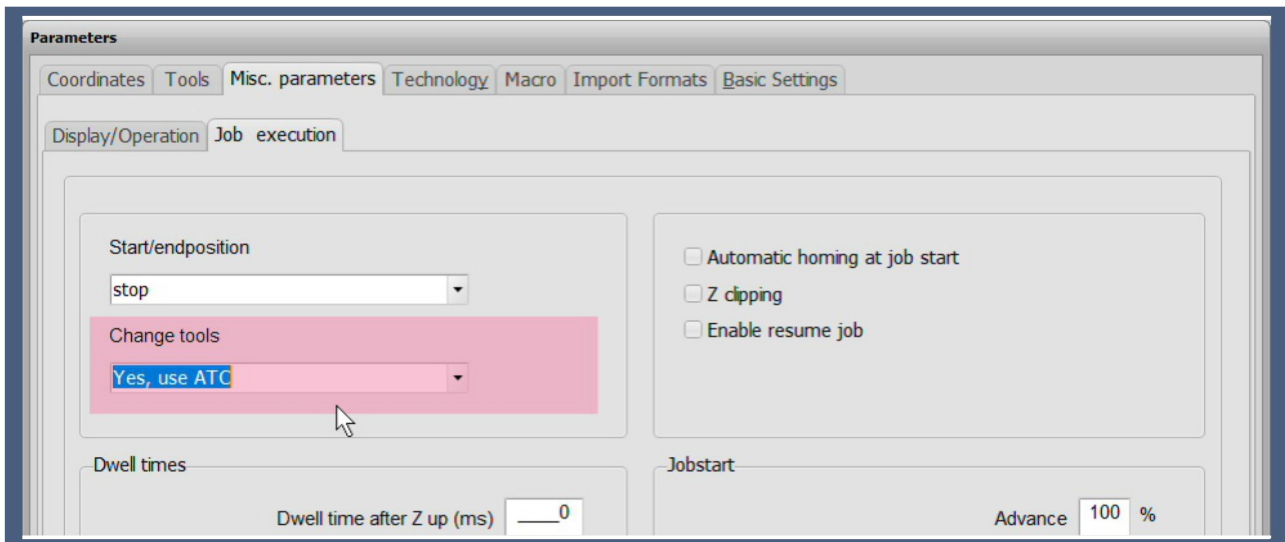
Step 1: Activate the option for automatic tool change

Activate the automatic tool changer in **Parameter-Basic Settings-Equipment** and, if required, also with 4th axis.
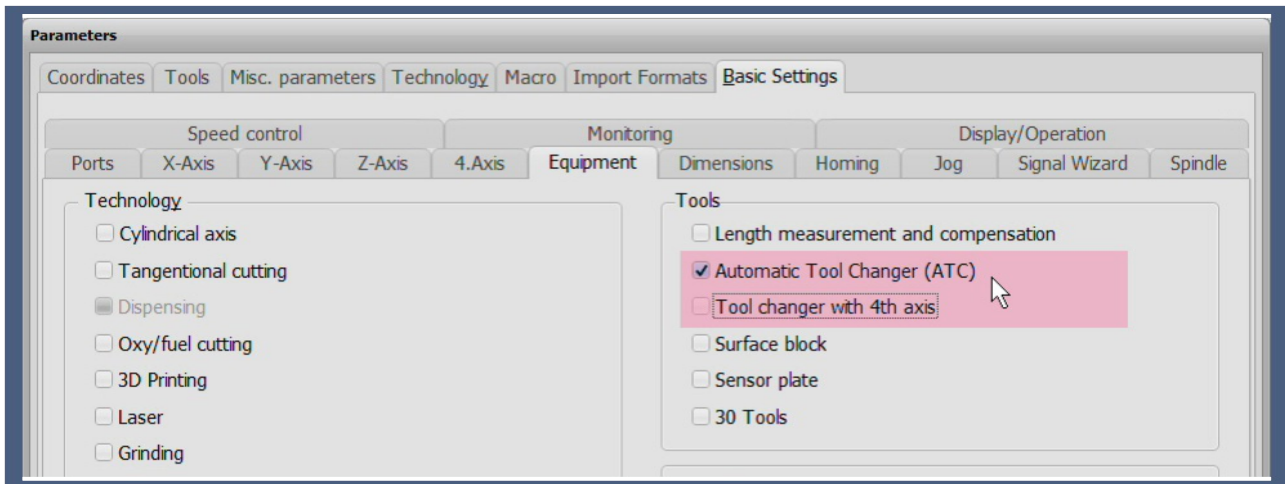
Activate the option **Change tools** = **Yes, use ATC** in **Parameter-Misc.** under the **Job execution** tab.
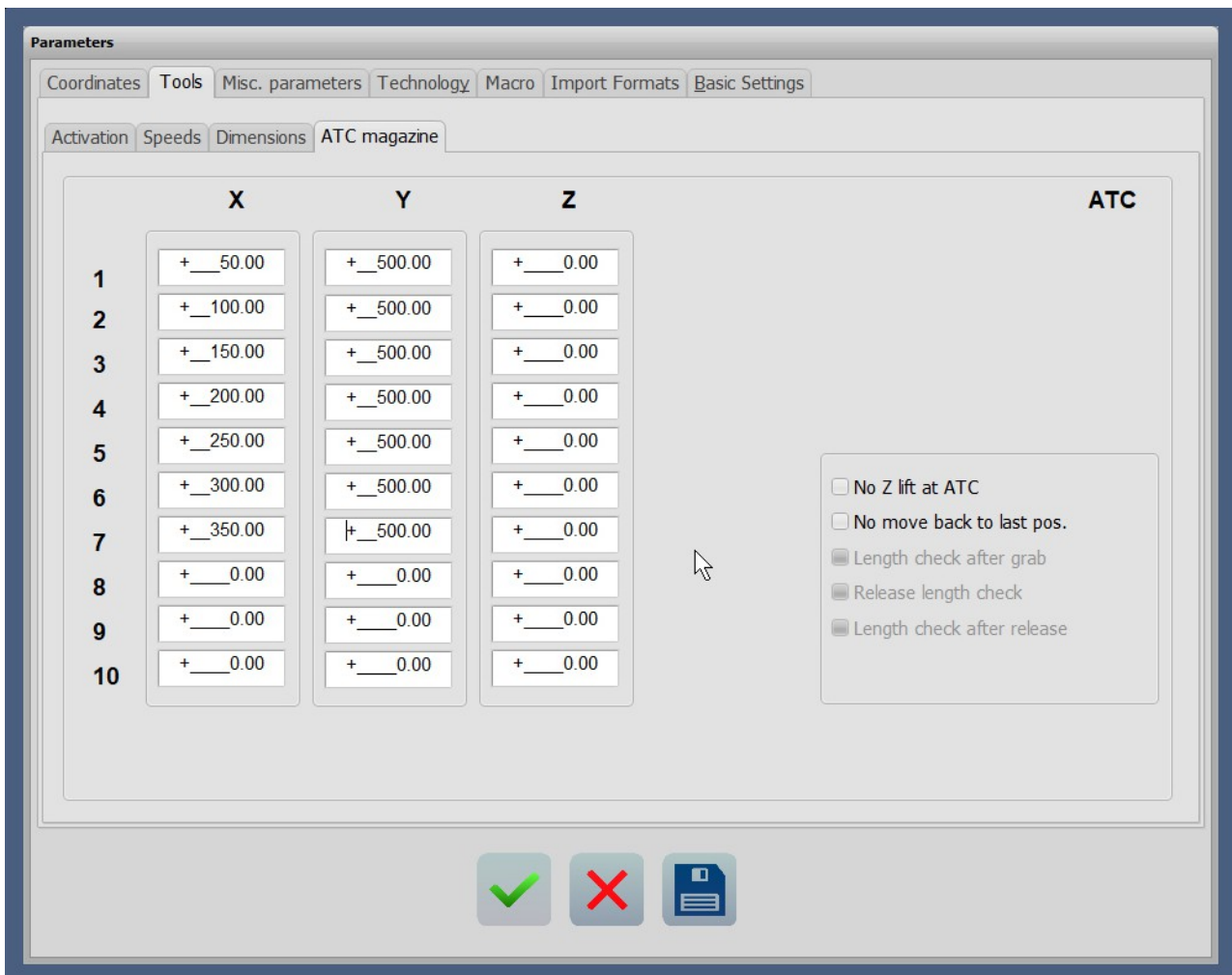

Then save the new settings with **Save....**

To configure an automatic tool change using the 4th axis, please also activate the options **Tool changer with 4th axis** and **4th axis**.

Step 2: Set the magazine positions

To be able to set the positions of the individual tools, open the **Parameter-Tools** menu and **s**elect the **ATC magazine** tab here:

	X	Y	Z	ATC
1	+ 50.00	+ 500.00	+ 0.00	
2	+ 100.00	+ 500.00	+ 0.00	
3	+ 150.00	+ 500.00	+ 0.00	
4	+ 200.00	+ 500.00	+ 0.00	
5	+ 250.00	+ 500.00	+ 0.00	
6	+ 300.00	+ 500.00	+ 0.00	
7	+ 350.00	+ 500.00	+ 0.00	
8	+ 0.00	+ 0.00	+ 0.00	
9	+ 0.00	+ 0.00	+ 0.00	
10	+ 0.00	+ 0.00	+ 0.00	

Parameters

Coordinates | Tools | Misc. parameters | Technology | Macro | Import Formats | Basic Settings

Activation | Speeds | Dimensions | ATC magazine

☐ No Z lift at ATC
☐ No move back to last pos.
☑ Length check after grab
☑ Release length check
☑ Length check after release

In the dialog above it is possible to enter the positions of the individual tool magazine holders.

When entering the tool positions, please note that **only the position in front of or above the tool magazine** should be entered. The procedures for moving to the final position are then set up using macros.

The following graphic illustrates this procedure again. In our example, **tool 1** is in the magazine at position **X = 50** and **Y = 500**.
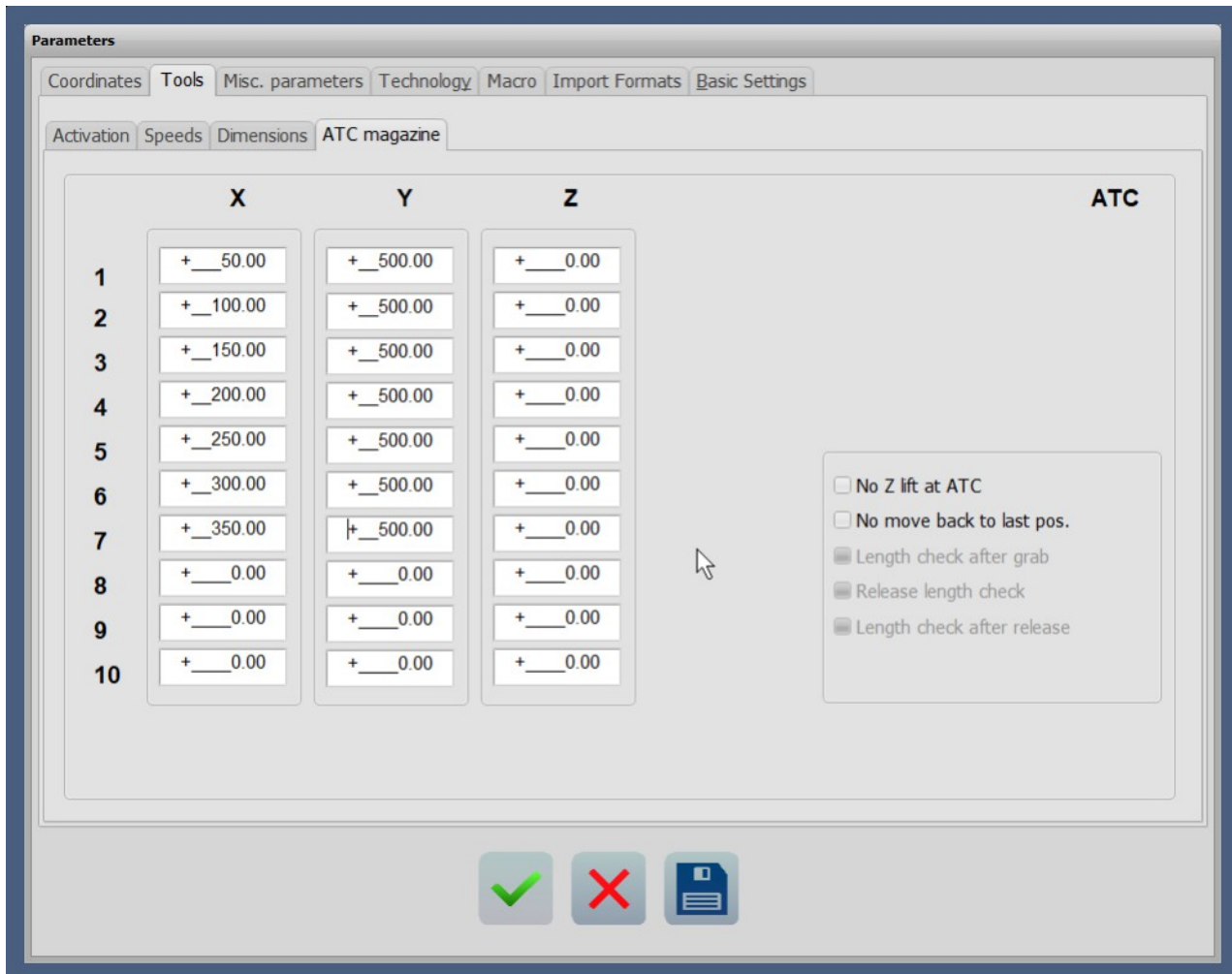
Since the tool is to be inserted into the tool holder from the front, we define the magazine position to be approached as **X = 50** and **Y = 400**.
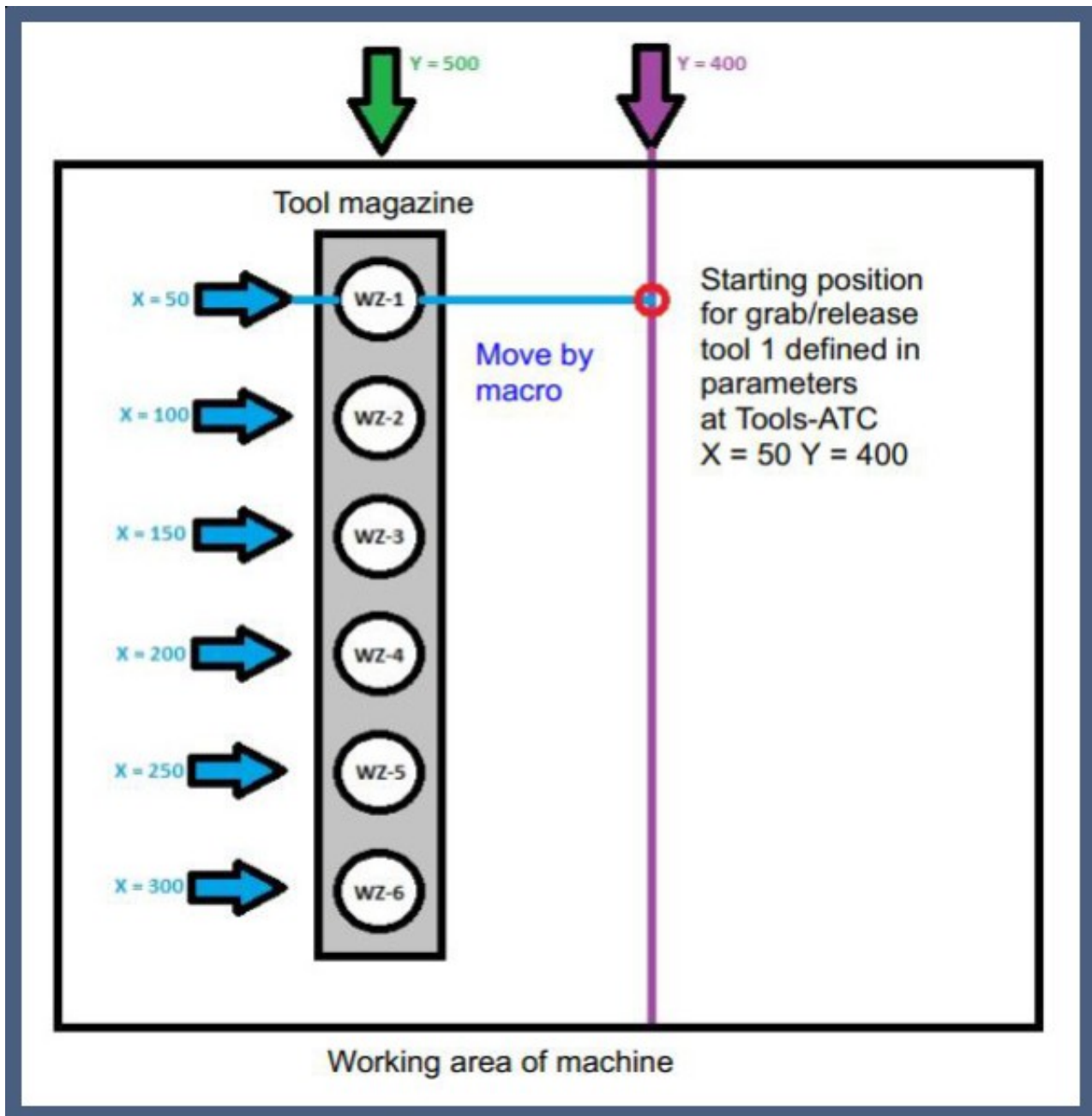
When the positions for all tools have been determined and entered, the settings can be saved using **Save....**

Example: Positions from the graphic shown above:

	X	Y	Z	ATC
1	+___50.00	+__500.00	+____0.00	
2	+__100.00	+__500.00	+____0.00	
3	+__150.00	+__500.00	+____0.00	
4	+__200.00	+__500.00	+____0.00	
5	+__250.00	+__500.00	+____0.00	
6	+__300.00	+__500.00	+____0.00	☐ No Z lift at ATC
7	+__350.00	+__500.00	+____0.00	☐ No move back to last pos.
8	+____0.00	+____0.00	+____0.00	☑ Length check after grab
9	+____0.00	+____0.00	+____0.00	☑ Release length check
10	+____0.00	+____0.00	+____0.00	☑ Length check after release

Note:

If there are fewer magazine positions in your tool magazine than would be possible in *WinPC-NC*, leave the position specifications at 0 in each case.

Please note that the tools may then not be called up in the milling job!

Step 3: Grab and release tools using macros

To move from the **start positions** in the parameters to the actual **changer magazine positions**, it is necessary to move these sequences using the macro functions.
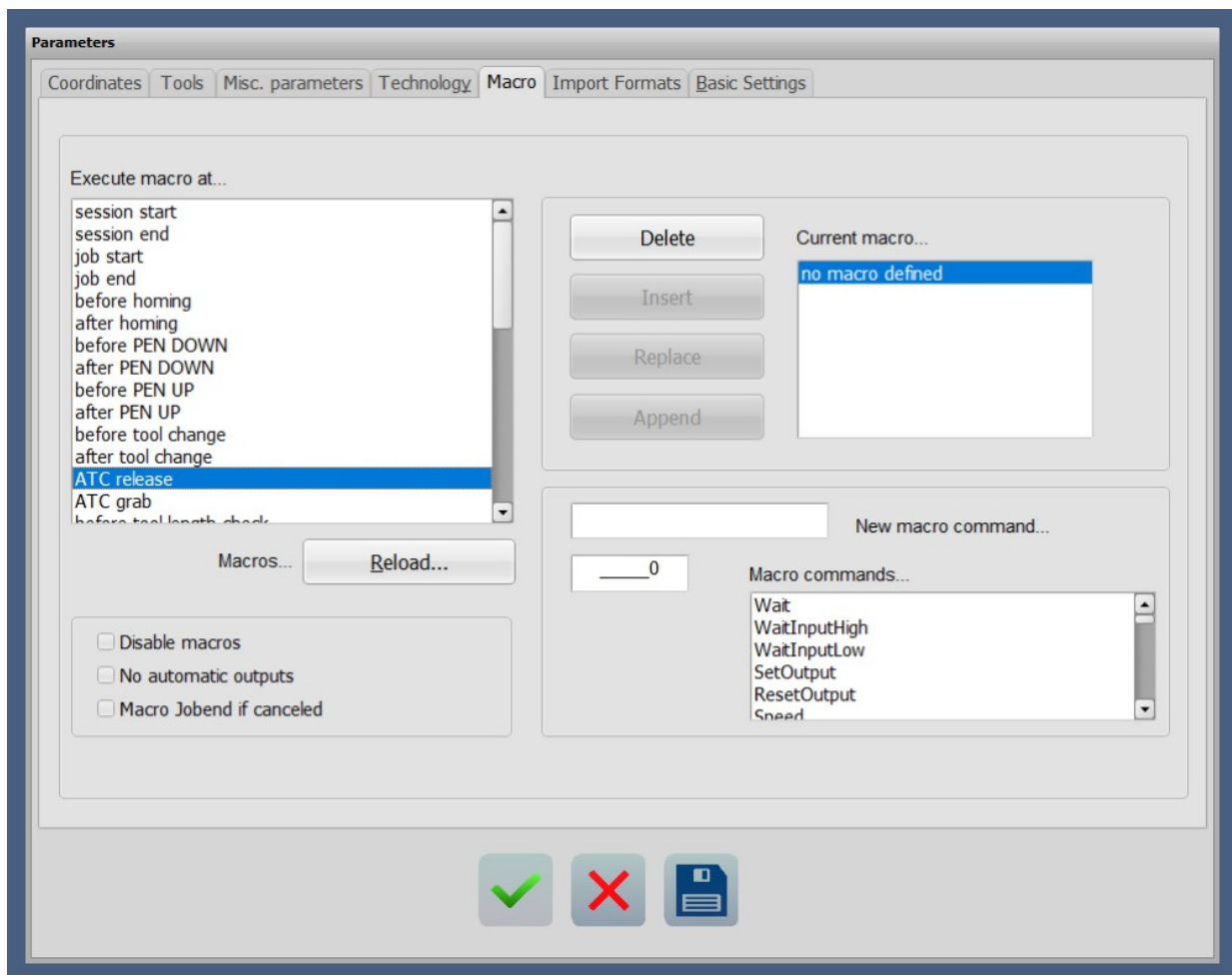
The macros are also used to control the additional signals such as collet chuck or taper cleaning.

Note:

It is not possible or intended to use the automatic tool changer without the macro programming.
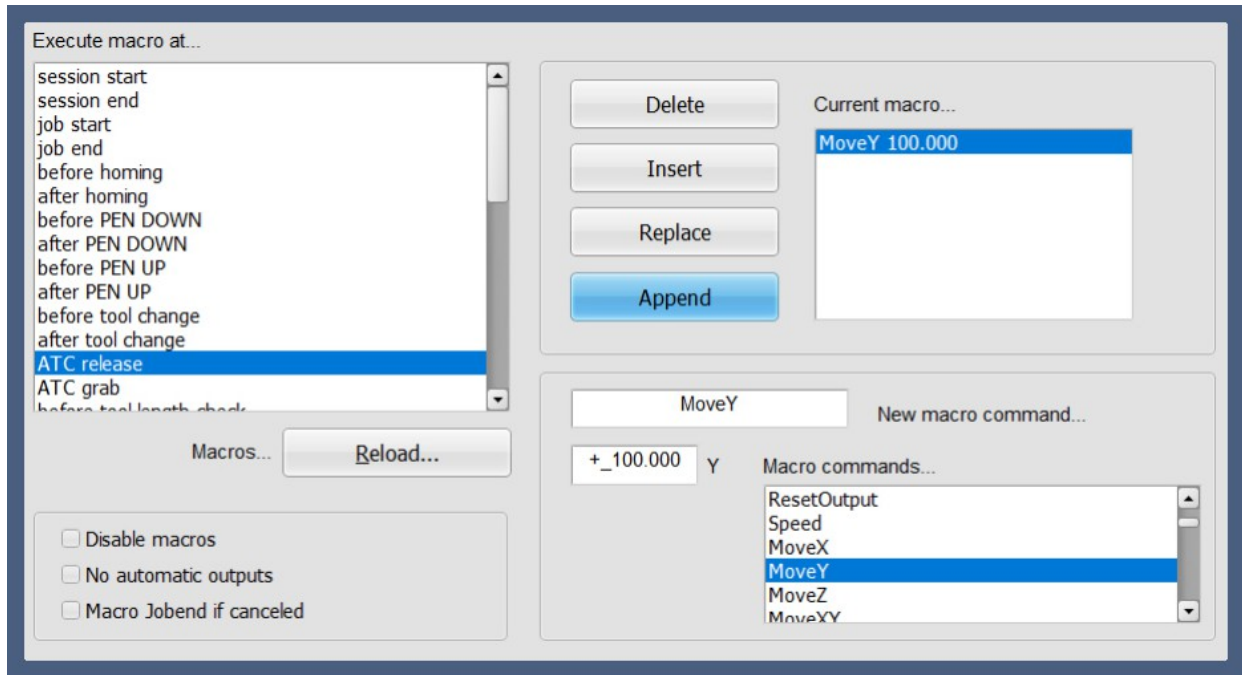
The macro programming is done in the parameter dialog under the tab **Macro**. You should now see this menu displayed:
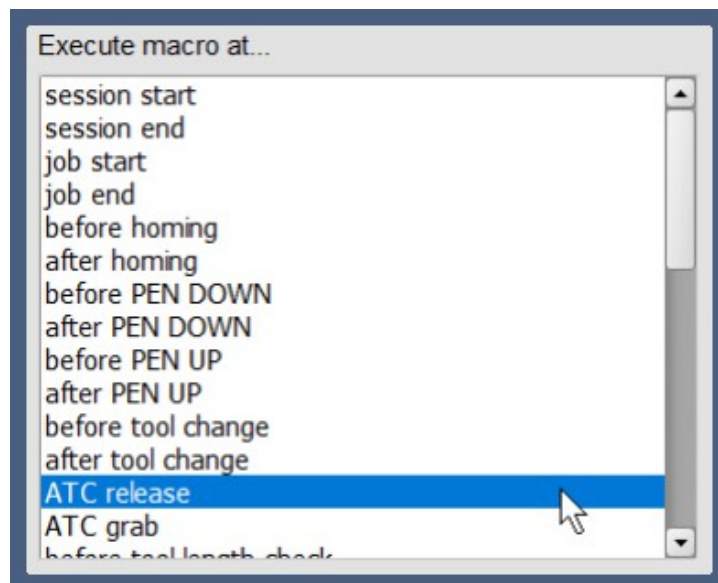
Basics of macro programming:

The macro functions in *WinPC-NC* are a very extensive and powerful tool for realising automatic processes. Because of the many possibilities that result from this, we would first like to go into the basics.

In general, the macro menu is divided into two areas:

On the left side you will find the so-called entry points for the macros:

The entry points **ATC release** and **ATC grab** are relevant for the additional traverses and processes during the tool change.

To select an entry point, click on it until it is highlighted in blue.

On the right-hand side of the menu, you will find the editor for programming the sequence of the individual macro commands:
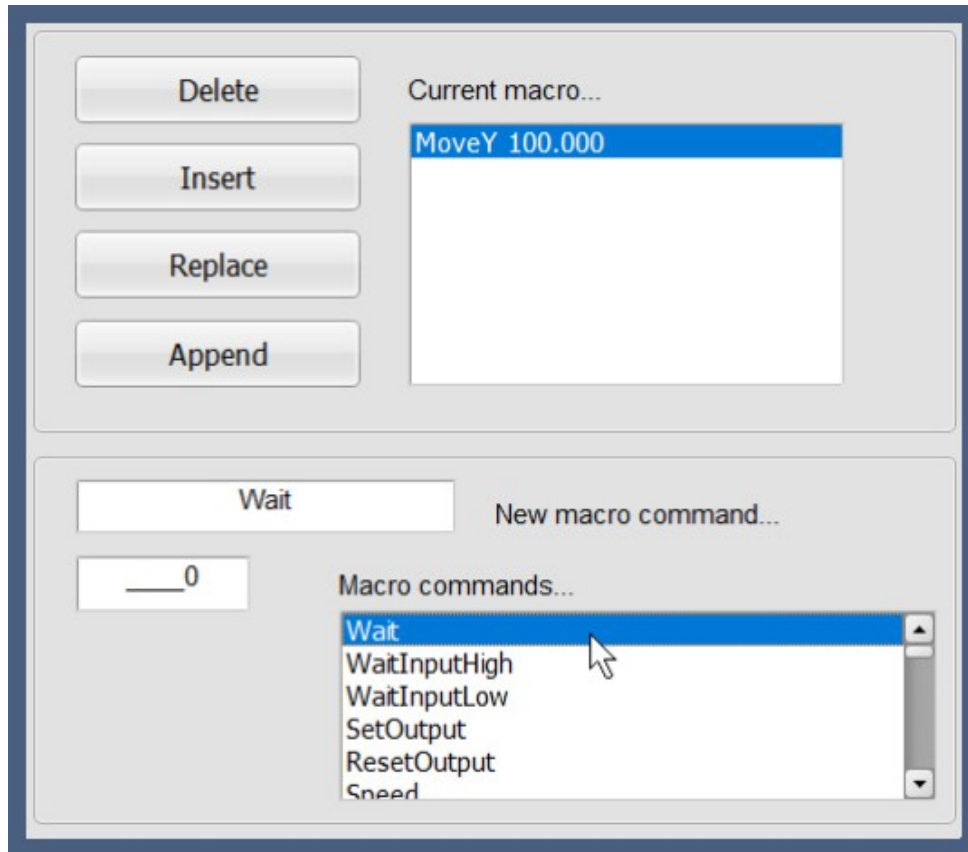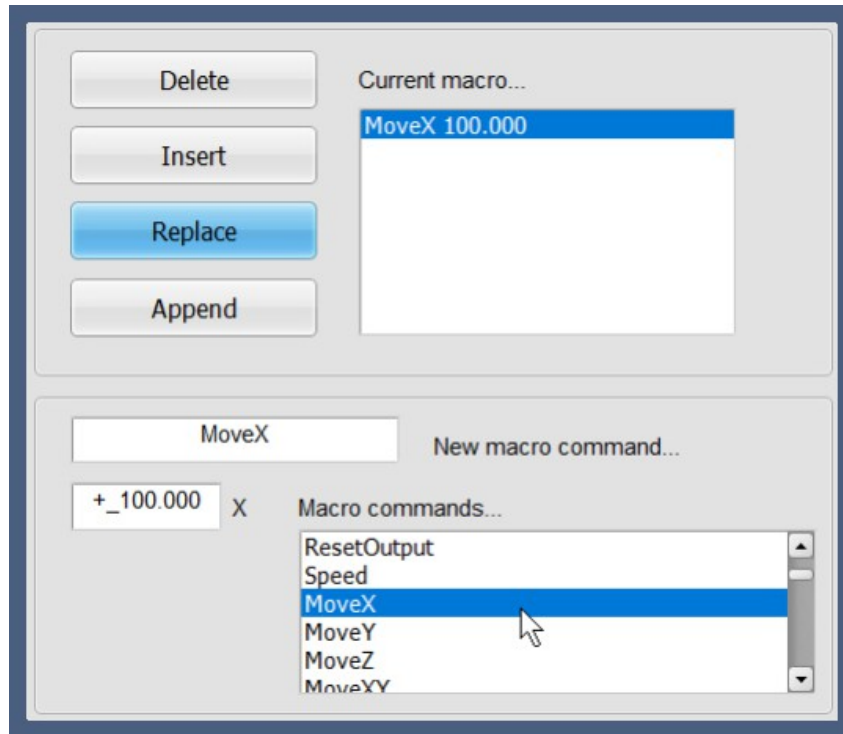

The new sequence is programmed or displayed in the upper part under **Current macro**.

The individual functions or macro commands can be selected further below. After the selection, it is possible to set further parameters for the selected command.

For example, to insert a macro command that moves the X axis by +100, the following settings should be made:

To do this, first select the macro command and then set the parameter for the move to be executed. With a click on **Insert** or **Append** this command is now taken over into the current macro list.
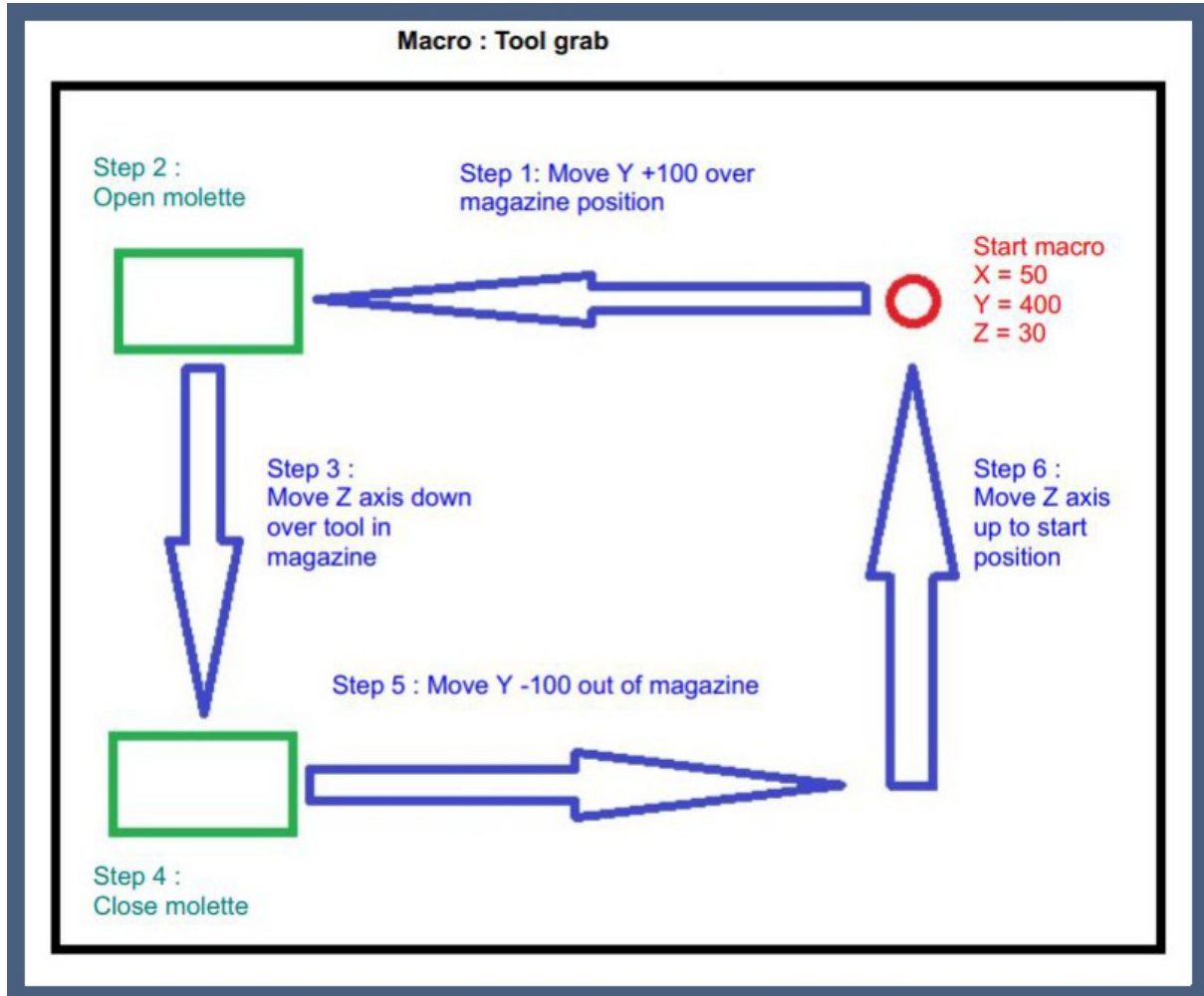
In order to use macros to program the picking up (grab) and putting down (release) of the tools, it is necessary to create a sequence of several macro commands.

For an overview of the travel paths and additional signals, it is useful to make a simple sketch.

In our example, a linear tool magazine is to be used (tool shelf). The tool is to be inserted into the clamping holder of the magazine via the Y-axis.

The necessary travel paths for picking up (grab) a tool are as follows:

```
                    Macro : Tool grab

  Step 2 :                  Step 1: Move Y +100 over
  Open molette              magazine position

                                                      Start macro
                                                      X = 50
                                                      Y = 400
                                                      Z = 30

            Step 3 :                        Step 6 :
            Move Z axis down                Move Z axis
            over tool in                    up to start
            magazine                        position

            Step 5 : Move Y -100 out of magazine

  Step 4 :
  Close molette
```

Step 1:   Moving from the start position specified in the ATC parameters to position over tool holder

Step 2:   Open the molette and switch on taper cleaning

Step 3:   Move the spindle down over the tool holder

Step 4:   Close the mollette and switch off the taper cleaning

Step 5:   Moving out of the tool magazine with Y axis

Step 6:   Raise Z-axis to original start position

In order to be able to program this sequence using macros you must implement the individual steps accordingly.

The complete sequence should then look similar to this one:
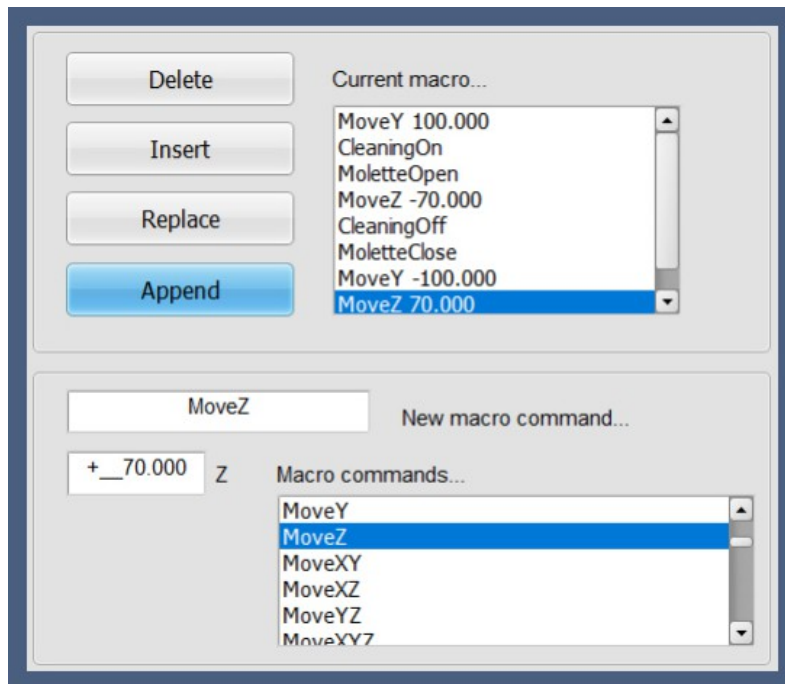
Note:

The signals for the molette (collet chuck) and the magazine blow-out (taper cleaning) are available in the signal wizard and must be assigned the pin numbers of the interface that are electrically wired. The output signals Q248 and Q245 are relevant for molette and taper cleaning.
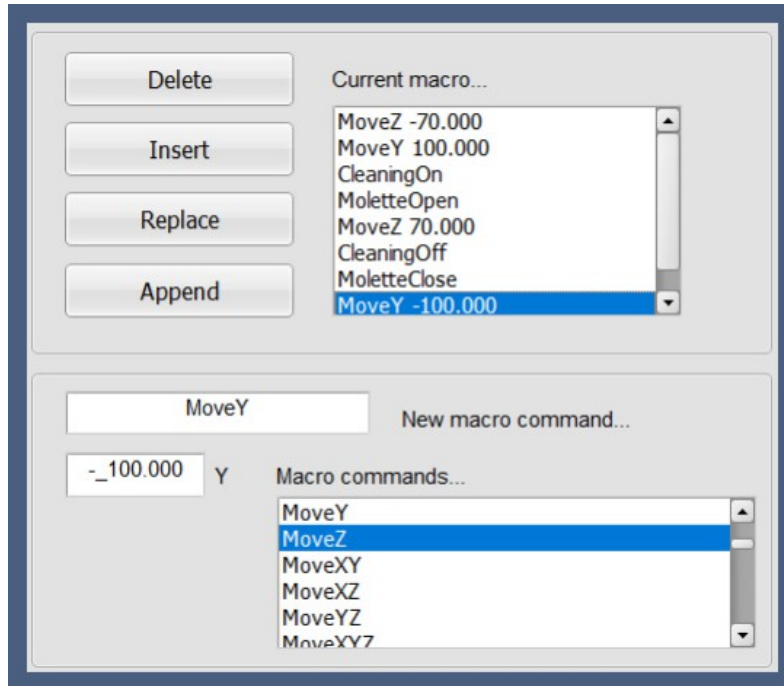
The sequence for releasing the tool is now programmed in the same way. The movement sequence for placing the tool down looks something like this:
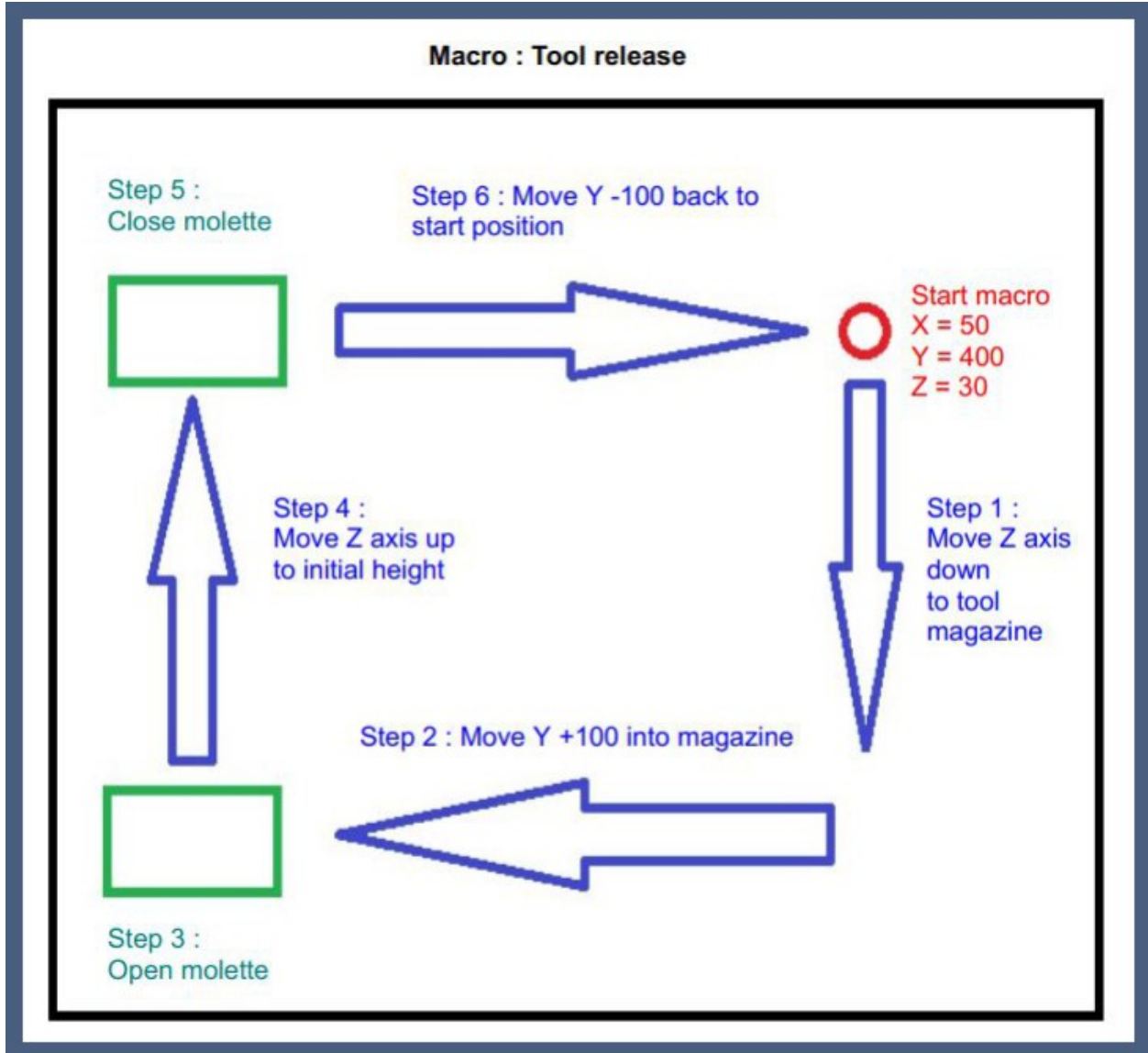
For our example, the release macro looks as follows:

In principle the steps are exactly the same as in the procedure for grabbing the tool but has inverted sequence and the molette must be opened first.
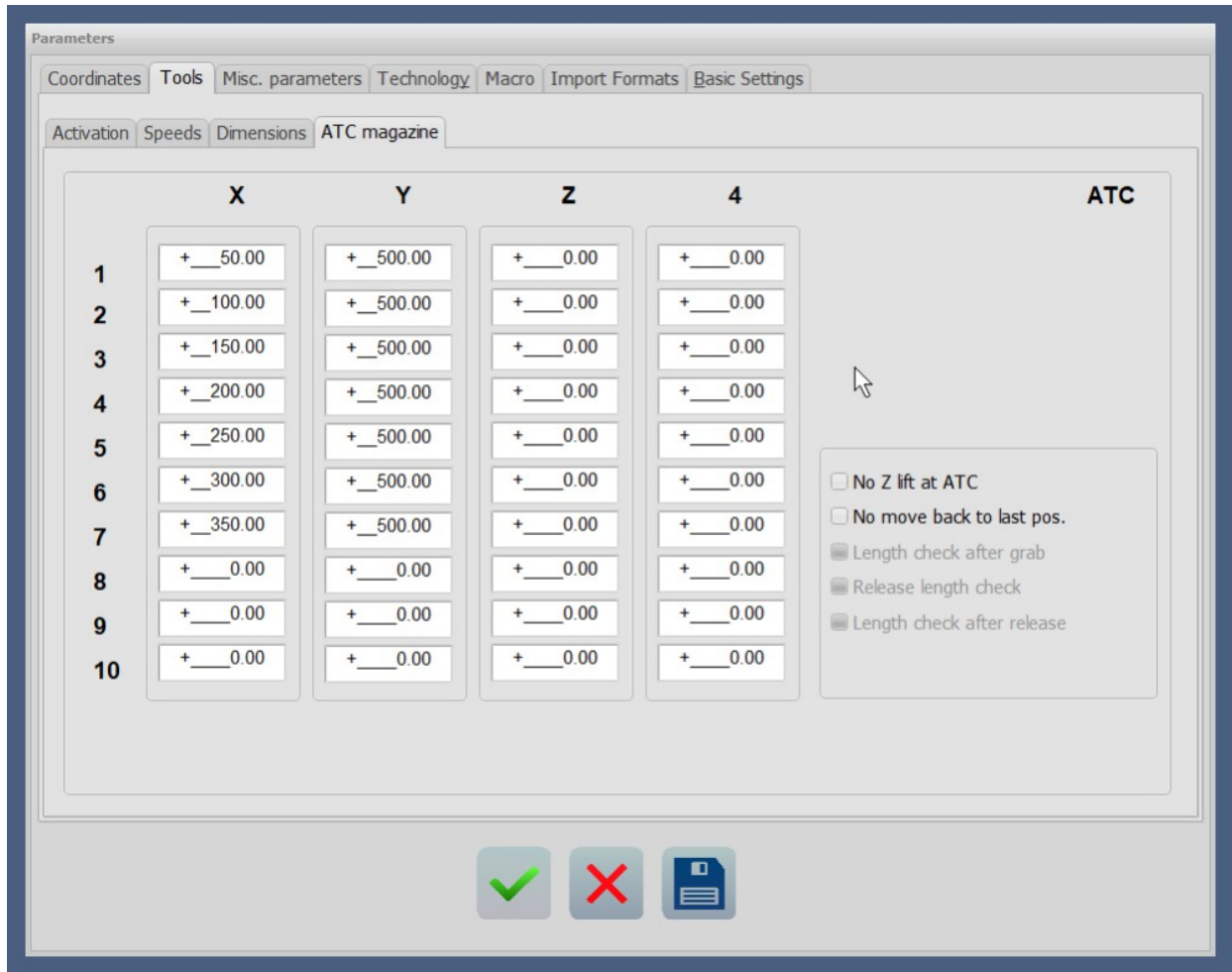
If you want to control your tool changer by means of the **4th axis**, the procedure with the macros is the same, only a path for the 4th axis is defined for the magazine positions, e.g. to extend a drawer or to rotate a turret magazine.

In this case the tool table contains a fourth column under **Parameter-Tools-ATC** in which the positions of the 4th axis can be entered.

	X	Y	Z	4	ATC
1	+___50.00	+__500.00	+____0.00	+____0.00	
2	+__100.00	+__500.00	+____0.00	+____0.00	
3	+__150.00	+__500.00	+____0.00	+____0.00	
4	+__200.00	+__500.00	+____0.00	+____0.00	
5	+__250.00	+__500.00	+____0.00	+____0.00	
6	+__300.00	+__500.00	+____0.00	+____0.00	☐ No Z lift at ATC
7	+__350.00	+__500.00	+____0.00	+____0.00	☐ No move back to last pos.
8	+____0.00	+____0.00	+____0.00	+____0.00	☐ Length check after grab
9	+____0.00	+____0.00	+____0.00	+____0.00	☐ Release length check
10	+____0.00	+____0.00	+____0.00	+____0.00	☐ Length check after release

If movements of the 4th axis are necessary for release and grab tools, there are also macro commands for this and the 4th axis can be moved in the same way as the three axes XYZ.

Move4   New macro command...

+__12.500 4   Macro commands...
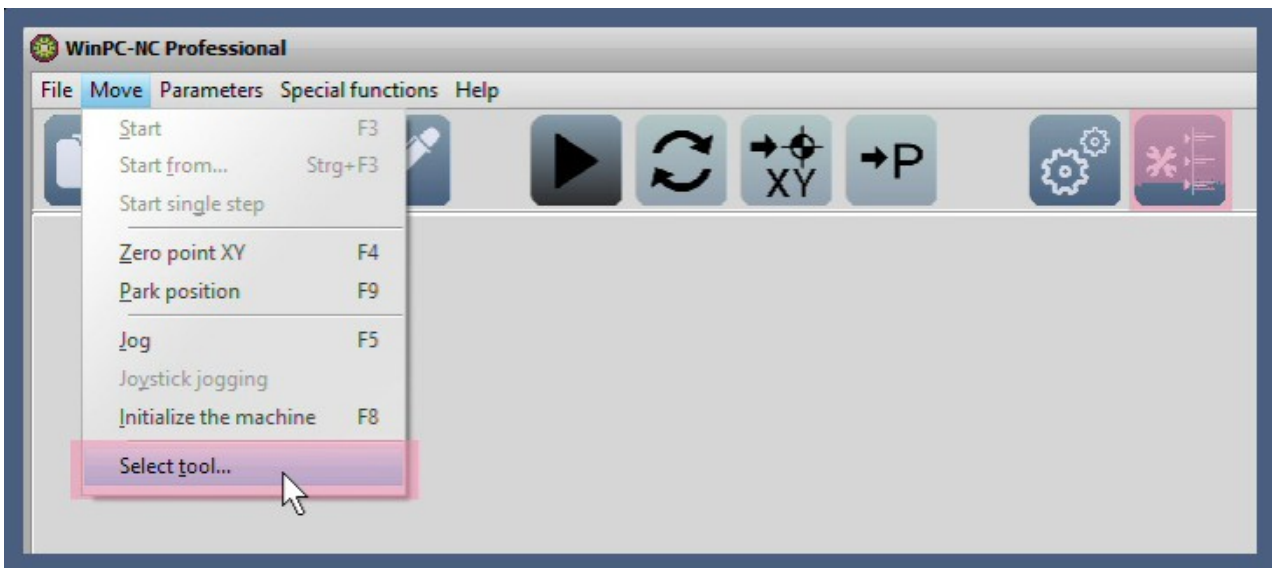
MoveXZ
MoveYZ
MoveXYZ
Move4
MoveAbsX
MoveAbsY
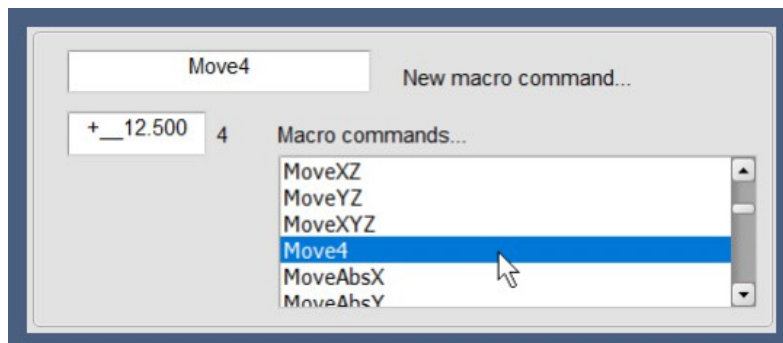
Step 4: Test the new settings

If the configuration of the tool changer has been carried out, the new settings can now be tested. To do this, carry out a reference run in the first step and bring your machine into a ready-to-run state.

Now open the **Select tool** menu:

A new dialog window opens with which you can control the tool changer manually:
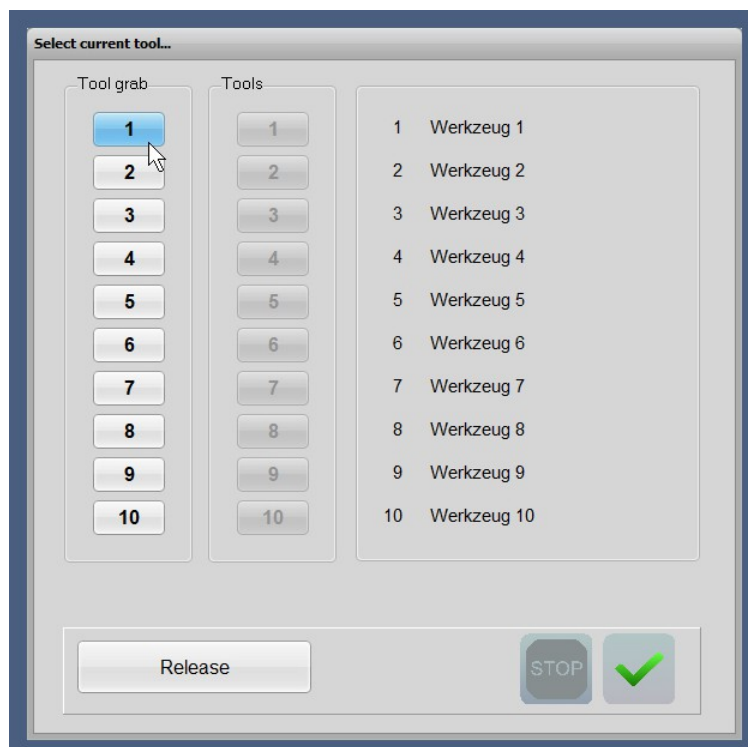
If you click on the corresponding **tool number** in the **Grab** column, your machine carries out the automatic tool change with this tool.

First *WinPC-NC* reaches the defined magazine position and then executes all macro commands in the defined sequence. If all paths and times and sequences are defined correctly at the end the desired tool should be inserted in the molette and ready for further use.

To stop the process, you can abort the tool change and sequence at any time with **Stop**.

By clicking on **Release** the machine puts the tool down and stops in front of the magazine without a tool.

Manual opening of the molette is possible with a click on the **molette button** in the lower menu bar.

Note:

Always test the new configuration carefully to prevent damage to your machine.

You can abort the tool change at any time by clicking Stop. If an unexpected malfunction occurs, you can also press the emergency stop button to cancel the process and all axis movements.

Note:

For the first tests, it is advisable to strongly limit the traversing speed during the tool change.

For this purpose, it is possible to select a safe and slow speed as the first step in the macro.