

MACHMOTION

Setting Up Your Tool Changer

Using Automation Direct PLCs

12/2/2011

Everything you need to know to setup a tool changer with your Automation Direct PLC.

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Getting the Software

The following files and software are needed for this tool changer to function properly:

- DirectSOFT 5
- Tool Changer Program
- M6Start, M250, and ModBus.cfg
- MachMotion.dll

DirectSOFT5

Begin by downloading DirectSOFT 5 from http://ftp.automationdirect.com/pub/DSP_53_SP.exe . You can also go to www.automationdirect.com and find the software yourself.

This is a free demo which limits your program to 100 rungs. Currently only 37 rungs are used in the PLC in the example tool changer program. If your tool changer is quite extensive, you may need to consider purchasing the software directly from Automation Direct.

When you open up the software, you will see the following window:

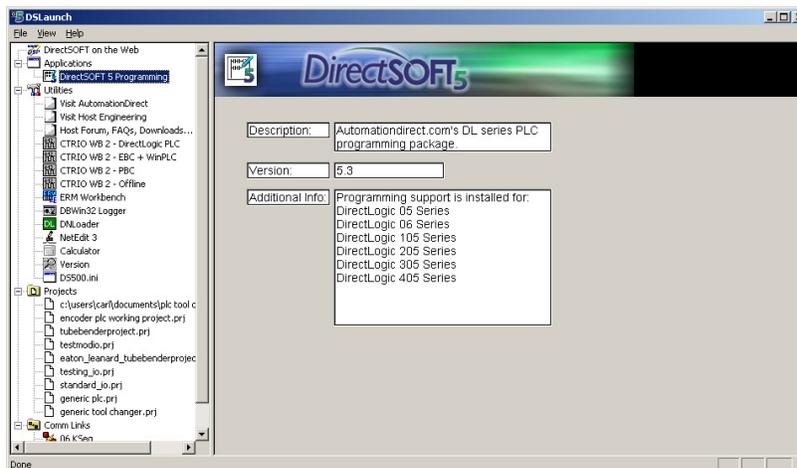


Figure 1 DirectSOFT5

Double click on **DirectSOFT 5 Programming** as shown above. It will ask you if you want to purchase it. If you will need more than 100 rungs, select the option to run the demo.

Tool Changer Program, M6Start, M250, ModBus.cfg, and MachMotion.dll

You can find most of these files on our website by downloading the zip file “PLC Programs & Macros” at <http://www.machmotion.com/support-overview/documentation.html>. Open the file for your PLC type (DL06 or DL205). Copy all the files in the macros folder to the following location:

C:\Mach3\macros\YourProfileName where “YourProfileName” is the profile you are using on your control. The folder called PLC Program contains the correct PLC program for your PLC.

Next download the latest MachMotion plugin (MachMotion.dll) here: <http://machmotion.com/support-overview/downloads.html>. Copy the plugin to the following location: **C:\Mach3\PlugIns**.

Setting up Mach3

To setup your tool changer, begin by configuring Mach3.

1. Start the **Mach3** software.
2. From the menu bar select **Config**, then press **General Config...**

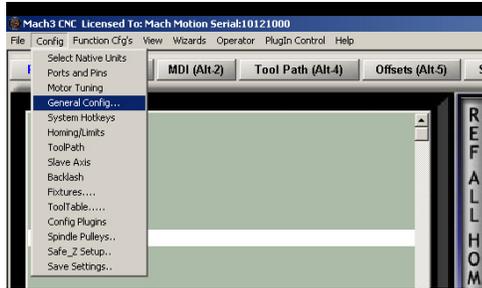


Figure 2 General Config

The following window will appear:

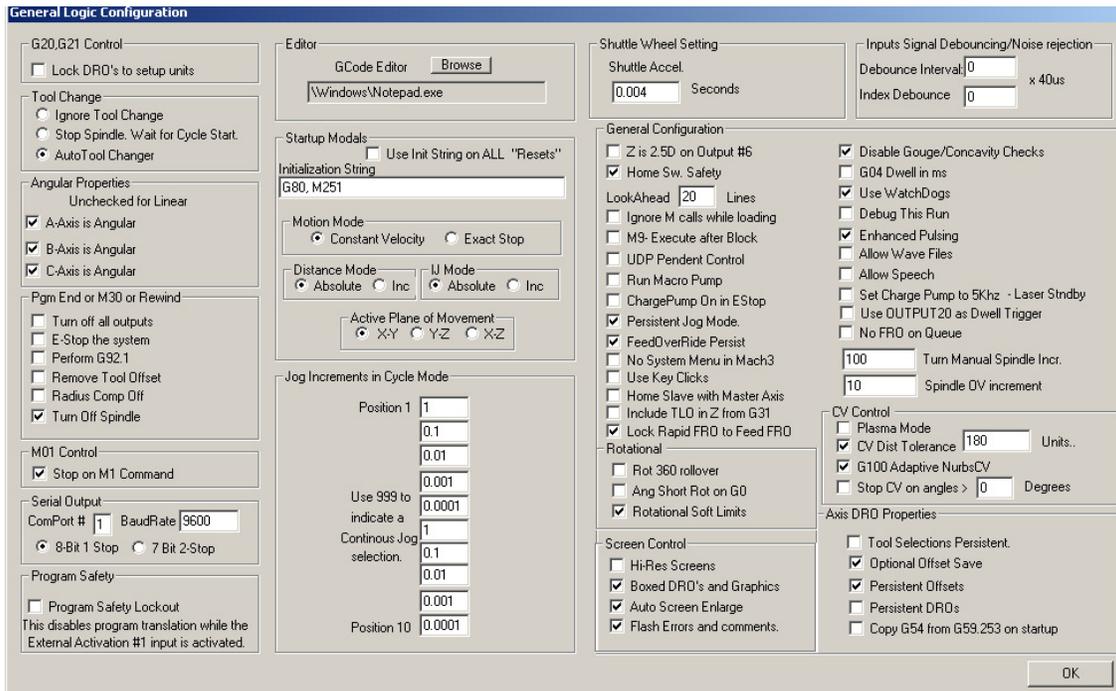


Figure 3 General Logic Configuration

3. Select **Auto Tool Changer** on the far left of the window.

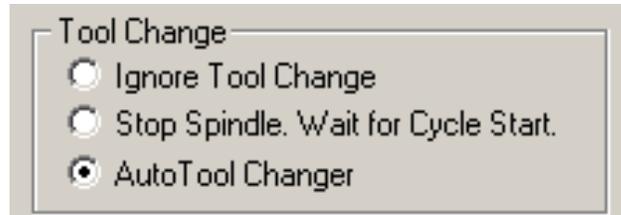


Figure 4 Auto Tool Changer

- In the **Initialization String** box, add “,M250” to the current text. This will run the initialization macro when the control turns on.

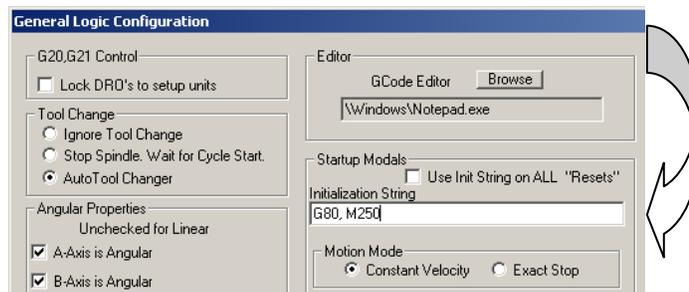


Figure 5 Initialization String

- Then press **OK** and the **General Logic Configuration** window will close.
- To enable the new MachMotion.dll, click on **Config**, then select **Config Plugins**.
- Enable the **MachMotion—MachMotion.com-Ver-X.XX** plugin by clicking on the red X under the Enabled column as shown below.

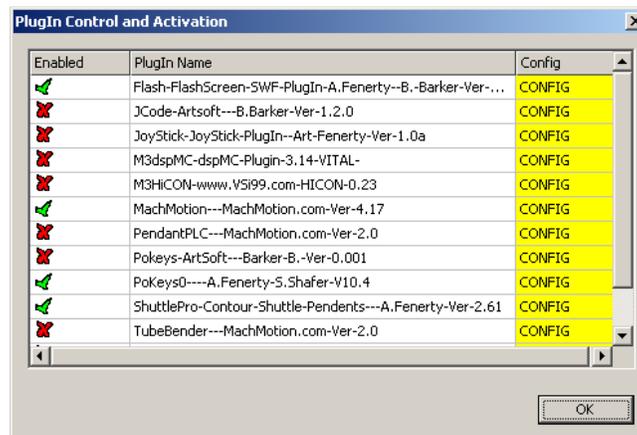


Figure 6 Enable Plugin

8. Restart the Mach3 software.
9. Open up **Config->Config Plugins** again.
10. Select the yellow **CONFIG** button for the **MachMotion—MachMotion.com-Ver-X.XX** plugin.
11. Next select the **System Configuration** button.
12. Select the check box **Modbus Enabled (Switch Panel, Pendant, or PLC)** as shown below.

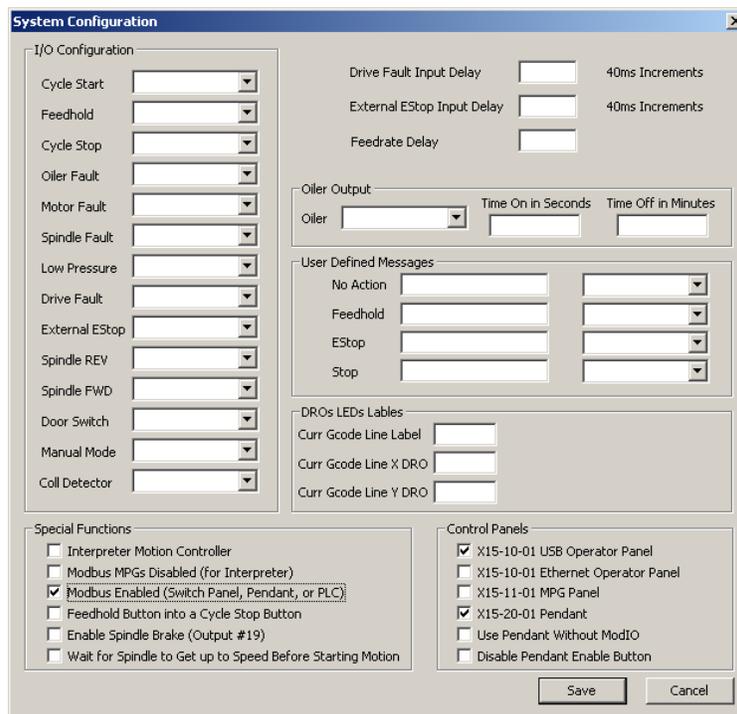


Figure 7 System Configuration

13. Next press **Save** and close out of all the open windows.

Mach3 is now configured to interface with your PLC.

Timeout Error

If the control tells the PLC to change tools and B1200.15 stays on for longer than 20 seconds, the control will give you the following timeout error: "Tool Change is not Complete."

To change this timeout value, select **Operator** and then **VB Script Editor**. Open **M6Start** which will be found in *C:\Mach3\Macros\YourProfileName*.

Setting up Your PLC

With Mach3 setup, it is time to configure your PLC.

1. Open the **Tool Changer** project in DirectSOFT 5. Click **File** on the menu bar and then select **Open Project**.

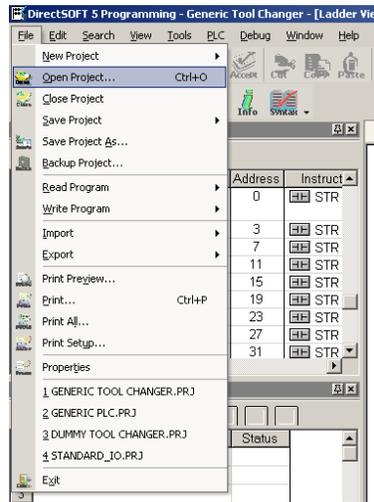


Figure 9 Open Project

You should see the following:

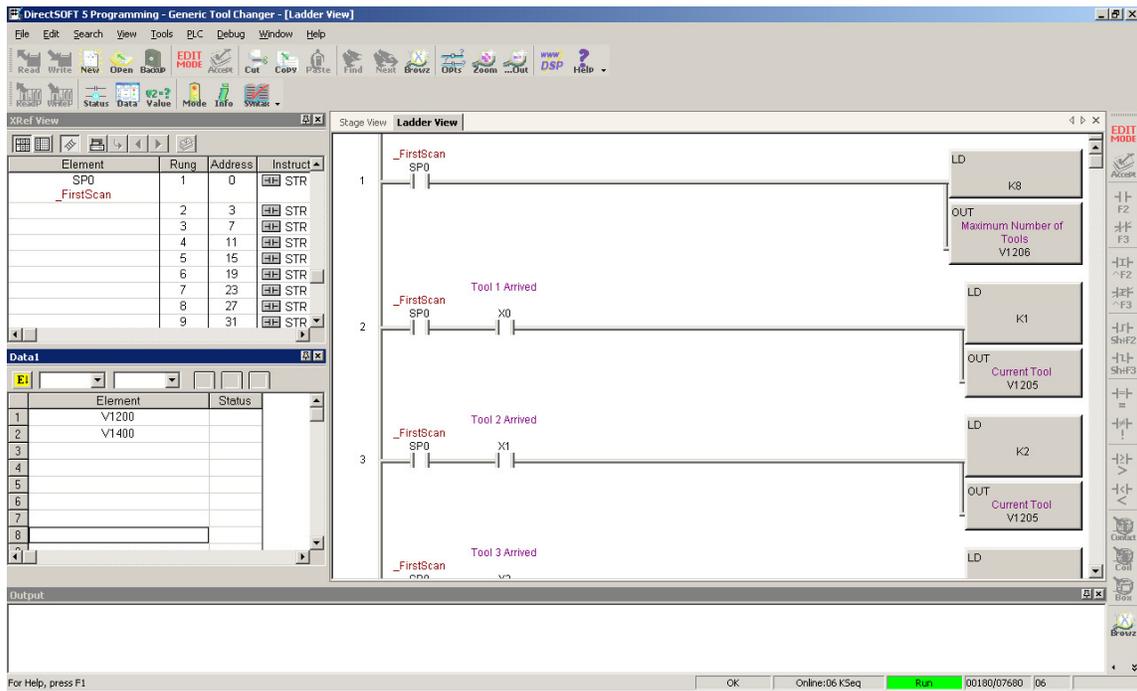


Figure 10 Tool Changer

- Enter in your maximum number of tools. Press the red button called **EDIT MODE** to be able to change the program.



Figure 11 Max Number of Tools

The above example only uses 8 tools.

- Add more initialization rungs for however many tools are needed. The tool changer initialization that tells your control what tool is currently loaded. Rungs 2-9 load the current tool position into register V1205. This value is used to reference your control with your tool changer when the control first turns on.



Figure 12 Find Current Tool

As shown above, depending on what input is active, the PLC knows what position the tool changer is in. Just copy the existing rungs to add another one. Notice that is routine is only run during the first scan. From then on, the only way to change the tool position is to receive an actual command from your control.

- Depending on how many tools are needed, copy the existing example of the of the tool changer start rungs.

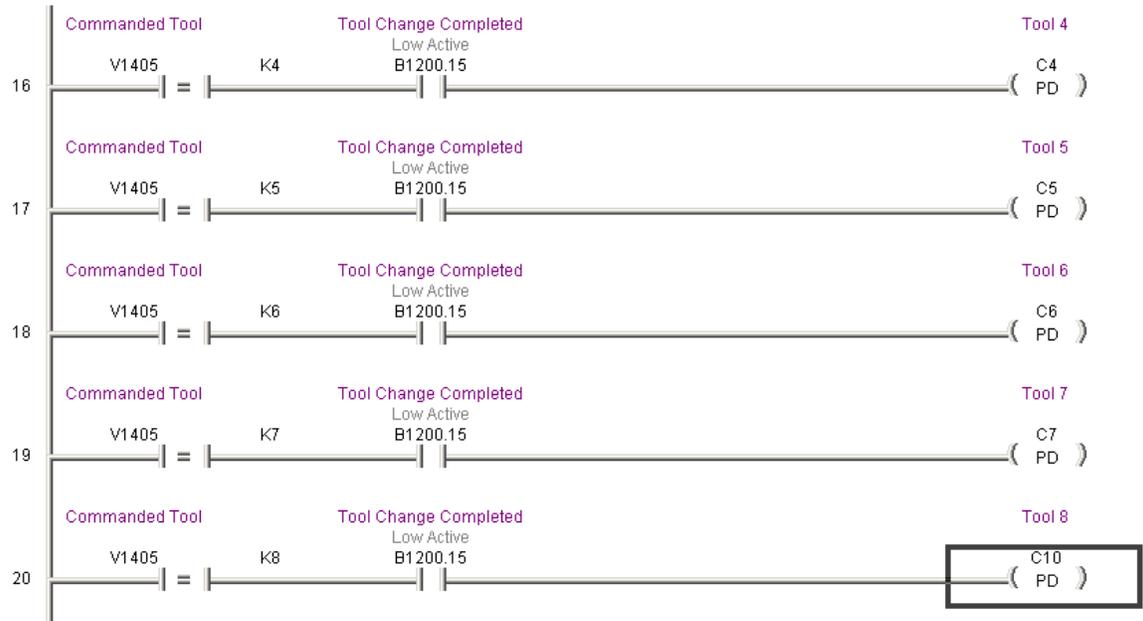


Figure 13 Start Rungs

The V memory location V1405 is the commanded tool from your control. When the M6Start macro is run in Mach3, it turns on B1400.15 for 500ms. That turns on B1200.15 which tells your control that the tool changer is currently changing the part. As long as the commanded tool and the current tool are different and the start command is received (B1400.15), the coil corresponding to the commanded tool will turn on for one cycle (PD). B1200.15 also starts the tool changer routine.

To add another tool, copy the rung for tool 8. Change the constant that V1405 is compared with and the coil that it turns on.

- Program your specific tool changer. Each tool has a specific coil that is turned on for one PLC scan. This coil starts your tool changer.

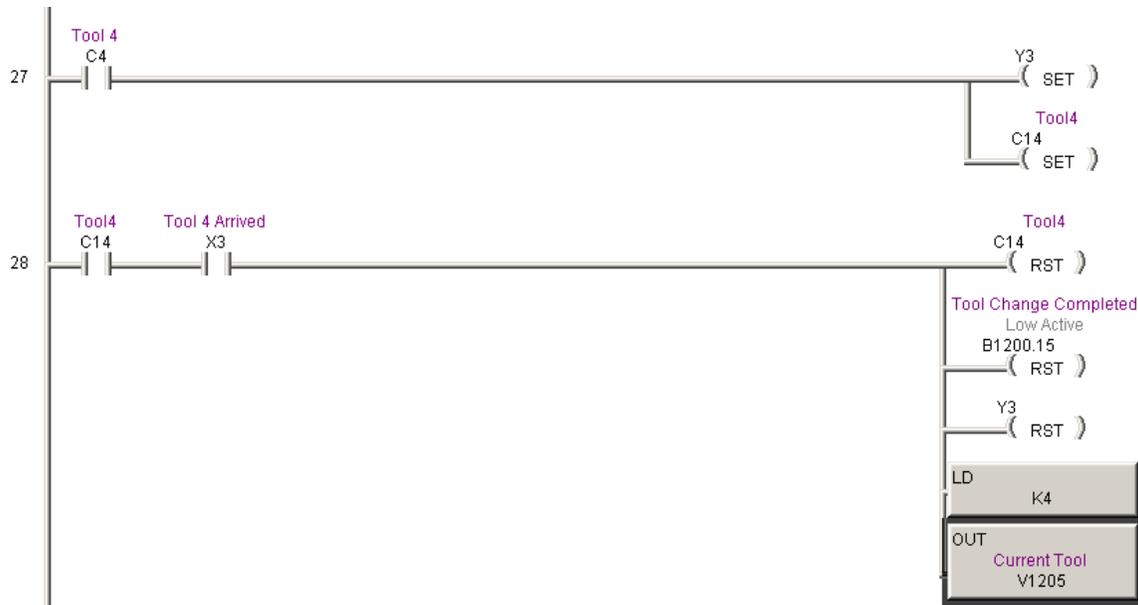


Figure 14 Tool Changer Routine

In the code above, C4 is only energized for one scan. In that time it turns on the output Y3 and C14. The PLC continues to scan the program until the input X3 is activated (Tool 4 Arrived). When that happens, C14, B1200.15, and Y3 are reset. When B1200.15 goes low, it tells the control that the tool change is complete. The new tool number is also loaded into the current tool memory (V1205). See the Appendix at the end of this document for a layout of all the V Memory used in the tool changer program.

In the example above, rungs 27 and 28 are where you will do most of your programming. Here you can add a stepper motor system which will rotate until the desired tool is reached. There is no limit to the number of ways you can program this tool changer. However, whatever you do, make sure not to forget these 4 vital steps:

- Tool Coil (C14 in the example above) must be reset.
- B1200.15 must be reset.
- Current tool must be loaded into V1205.

If the tool change is complete (B1200.15 is low) but the current tool does not equal the commanded tool, then Mach3 will give a pop up error stating, "Tool Change Failure." If the control tells the PLC to change tools and B1200.15 stays on for longer than 20 seconds, the control will give you the following timeout error: "Tool Change is not Complete." For more information see the section called Timeout Error above.

TIP: Study the manual for your specific PLC to learn how to program it. Automation Direct offers many very helpful examples in all of their manuals.

6. Add more tool change routine rungs if more tools are needed. After you have one rung programmed for your machine, it might be easiest just to copy it multiple times and then make the changes for each specific tool.



Figure 15 Adding More Routines

Underneath the 8th tool routine, you can add as many tools as you need.

WARNING

Your program will not run without an END statement.

Appendix

These tables show the allocation of V memory V1400-1406 and V1200-V1206.

PLC Inputs		PLC Outputs	
V Memory	Function	V Memory	Function
V1400	Status Register	V1200	Status Register
V1401	Reserved for I/O	V1201	Reserved for I/O
V1402	Reserved for I/O	V1202	Reserved for I/O
V1403	Reserved for I/O	V1203	Reserved for I/O
V1404	Reserved for I/O	V1204	Reserved for I/O
V1405	Commanded Tool	V1205	Current Position
V1406	Unused	V1206	Max Number of Tools

Below is the layout of each bit in the output status register V1200.

V1200 Status Register	Function	Active Low
Bit 0	Communication Check	
Bit 1	N.C.	
Bit 2	N.C.	
Bit 3	N.C.	
Bit 4	N.C.	
Bit 5	N.C.	
Bit 6	N.C.	
Bit 7	N.C.	
Bit 8	N.C.	
Bit 9	N.C.	
Bit 10	N.C.	
Bit 11	N.C.	
Bit 12	N.C.	
Bit 13	N.C.	
Bit 14	N.C.	
Bit 15	Finished Moving	Low

Below is the layout of each bit in the input status register V1400.

V1400 Status Register	Function	Active Low
Bit 0	Communication Check	
Bit 1	Emergency Stop	Low
Bit 2	N.C.	
Bit 3	N.C.	
Bit 4	N.C.	
Bit 5	N.C.	
Bit 6	N.C.	
Bit 7	N.C.	
Bit 8	N.C.	
Bit 9	N.C.	
Bit 10	N.C.	
Bit 11	N.C.	
Bit 12	N.C.	
Bit 13	N.C.	
Bit 14	N.C.	
Bit 15	Start Moving	High