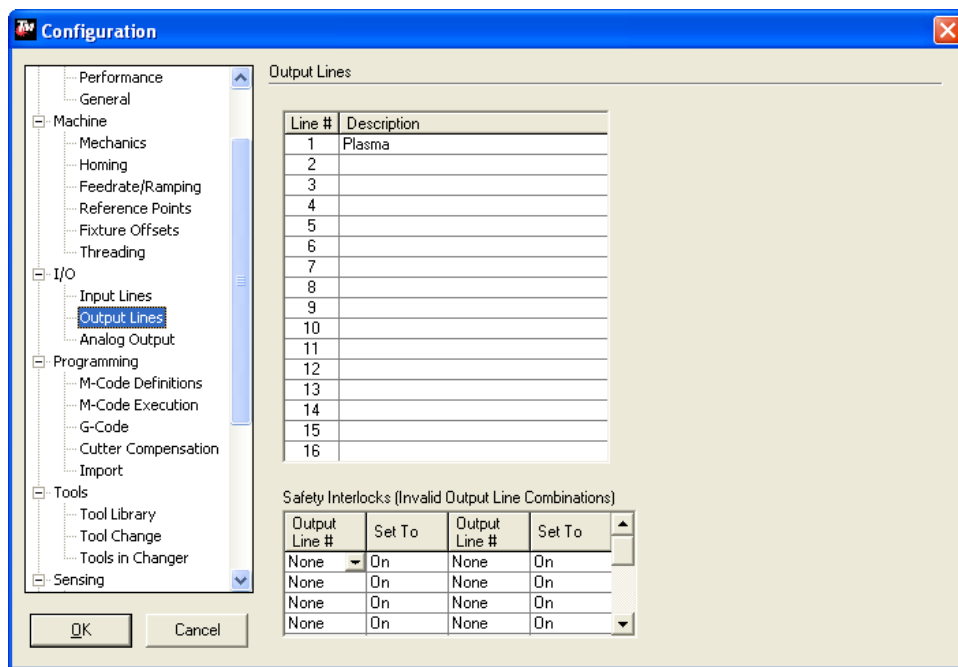


Multiple and Additional Tool Setup:

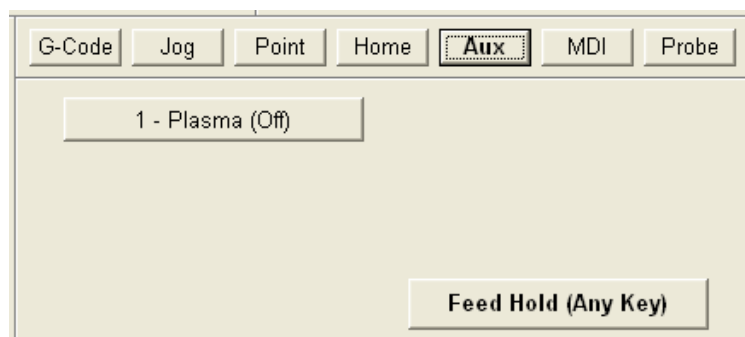
The Torchmate Driver software is designed to activate output lines to control a number of different tools. Discussed in this section will be the configurations for tools that Torchmate sells. This is not an exhaustive list of all the tools that can be attached and controlled from the table. In fact most any tool that can be activated by either a 110/220V outlet turning on and off, a 5V high/low signal, or an open/closed loop can be controlled by the Torchmate system. If a tool not listed here is to be set up please contact Torchmate Technical Support for assistance. This manual will discuss three tools; oxy fuel torches, routers, and plate markers.

Testing Output Lines:

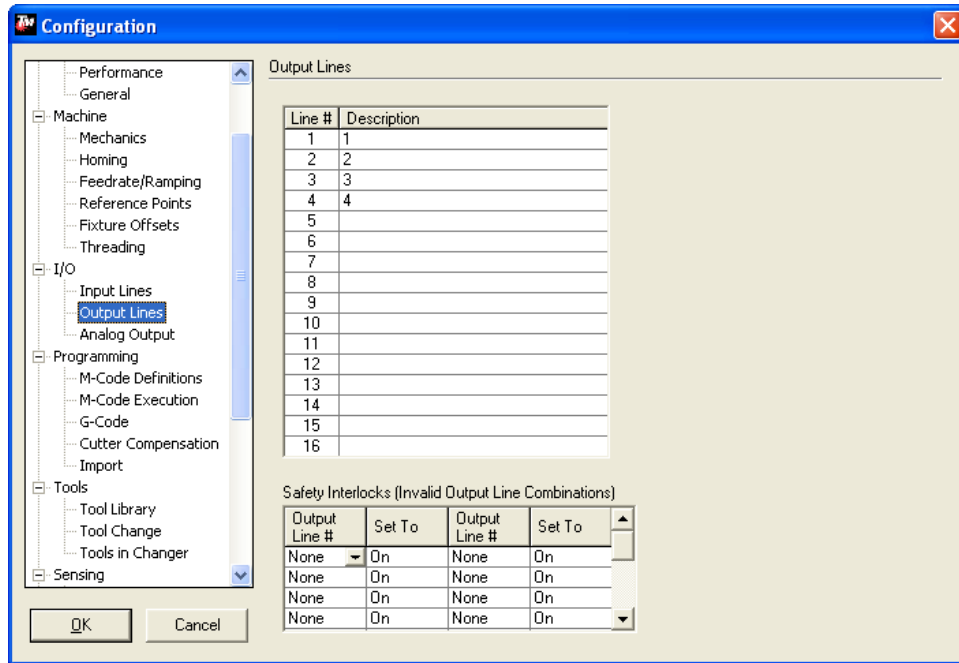
The first step in setting up multiple tools is to determine which output lines turn on which tool, the actual output line will vary depending on the number and type of interfaces wired into the CNC system. Go to 'Configuration' → 'I/O' → 'Output Lines', by default plasma will be listed in line one.



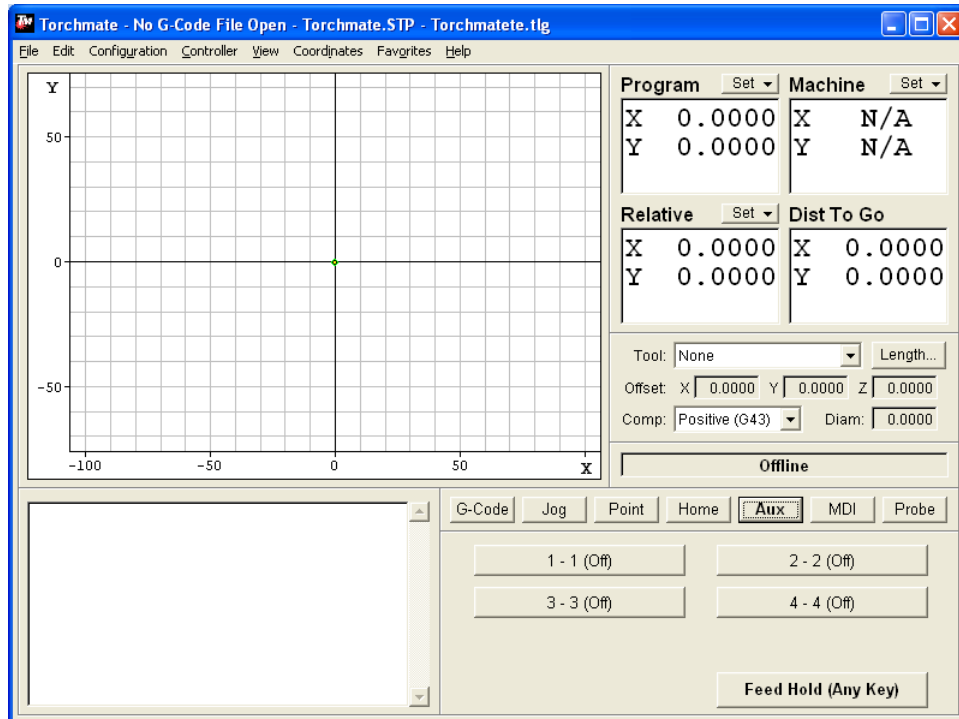
The tools listed here will appear in the 'AUX' tab on the main screen. This screen allows the output lines to be activated for testing.



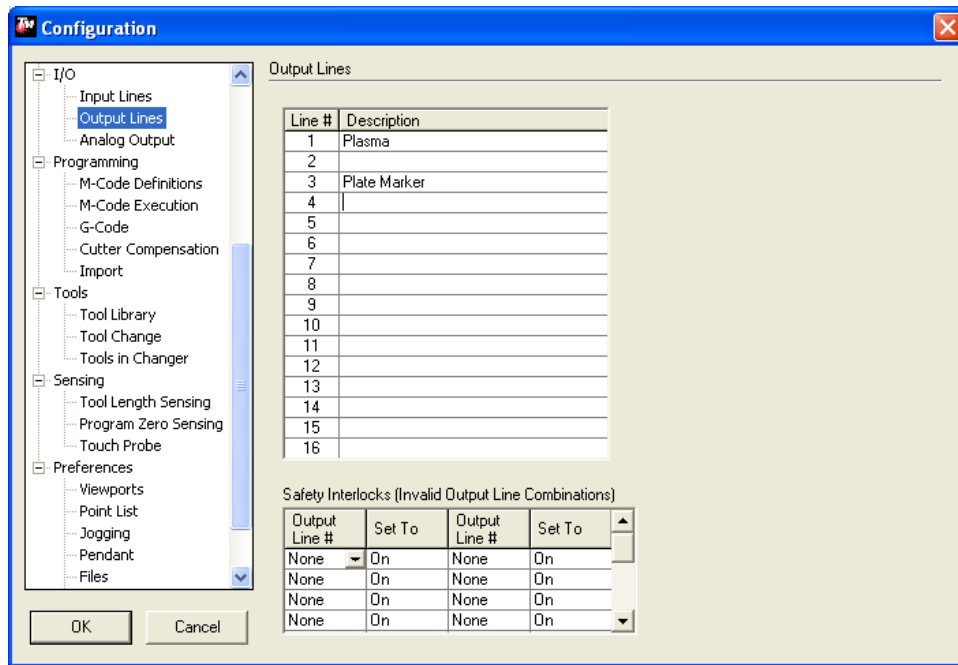
In order to enable other lines for testing a description must be entered in the 'Output Lines' menu. A simple description such as '1,2,3,4,...' allows the line to be identified in the 'AUX' menu.



Press 'OK' and access the 'AUX' tab output lines should now be listed by the descriptions given. For each interface connected enable two output lines, this will allow all possible outputs to be tested.



Try each line individually to determine which one activates which tool. Once this is established go back to the 'Output Lines' menu and change the description to reflect the test results.



Configuring Tools:

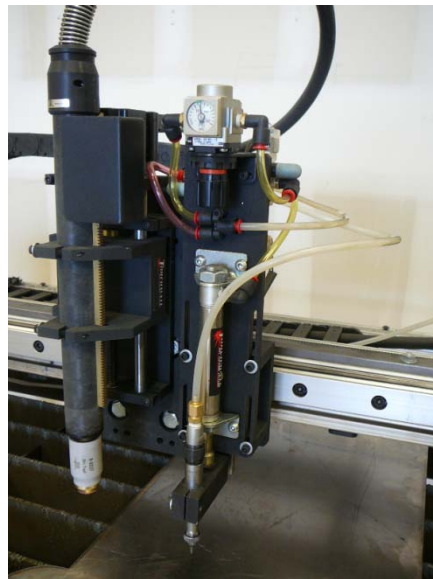
Multiple tools can be configured simultaneously and can then be selected via the 'Tool Drop Down Menu' on the main screen. All tools will need to have an 'M-code Definition' to turn them on and off; additionally a macro will be written to activate the proper tool when that tool is selected in the 'Tool Drop Down Menu'. A general understanding of how each tool operates can lead to a better understanding of how the macros will work.

Oxy Fuel Torch:



Torchmate oxy fuel systems use a three hose system to cut, generally oxygen and acetylene is used but not exclusively. In a three hose setup one hose is acetylene, one is the preheat oxygen, and the other is the cutting oxygen. The preheat oxygen and acetylene use manual adjustment knobs to adjust the flame, while the cutting oxygen is activated through a solenoid controlled by the software. There are two timing values that are used, the preheat time and the pierce time. Preheat time is a prescribed amount of time that the torch will sit at a pierce point to warm the metal, during this time only the preheat oxygen and acetylene will be flowing. The preheat time will vary significantly due to the thickness of the material being cut. The second timing factor is the pierce delay, this is the time from when then cutting oxygen fires until the motors begin to move this time is shorter than the preheat time and allows for a good pierce to be established prior to table motion. Oxy fuel torches can be used to cut thicker metals and while slower than plasma the resulting cut will result in little to no bevel.

Plate Marker:



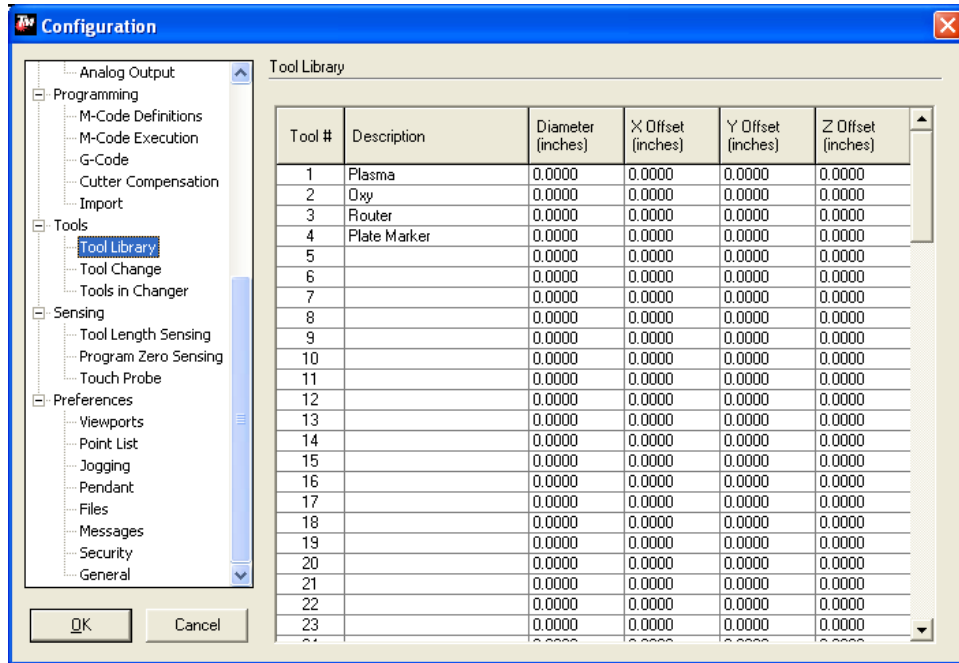
The Torchmate plate marking attachment uses a dual action pneumatic tip to punch metal at a rapid rate. This motion results in an etched-like design that can be used for part numbers, drill centers, or artistic designs. The force the plate marker strikes the material with as well as the frequency of oscillation can be set. By combining these two adjustments with various feed rates different effects can be achieved. The plate marker uses compressed air to run and a computer controlled solenoid to activate.

Router:

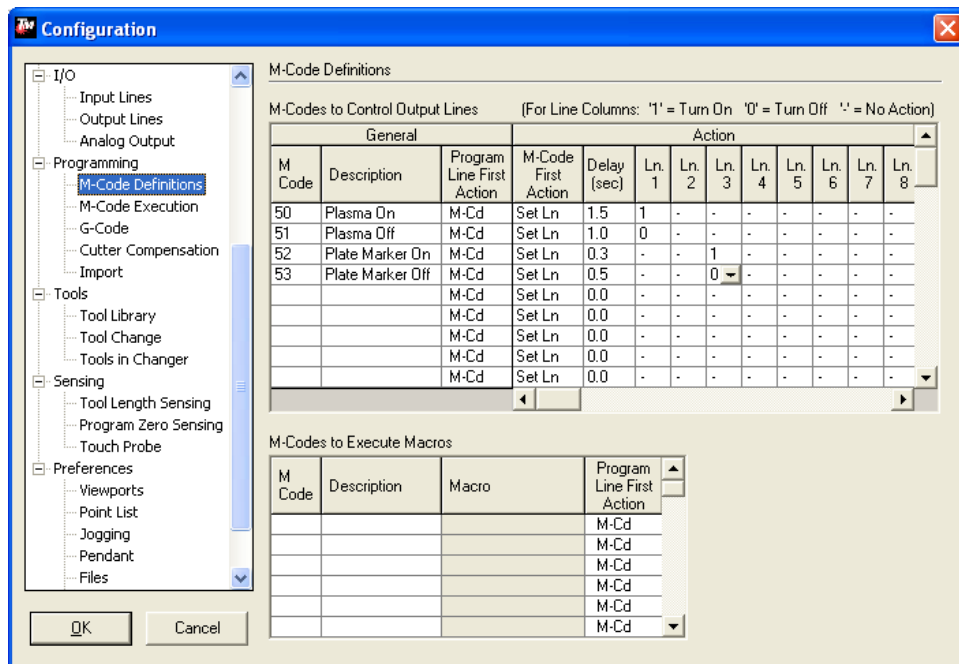
The Torchmate Z-axis utilizes a third axis to move a router, this allows for two and a half and three dimension cutting. Quality cuts with a router come from a combination of speed and the correct bit. Routing in the driver software utilizes three dimensional drawings or two dimensional drawings with plunge commands. Routers can cut foam, rubber, wood, acrylic, and many other materials.

Each tool used will need to be defined so that the driver software can reference it, go to 'Configuration' → 'Tools' → 'Tool Library'. This menu defines each tool, type in the tool name for the description; this

is the only setting that will be changed now. Note the tool number as this will be used in further configuration changes.



No matter what tool is used a macro will be created to control multiple tools. Begin by going to 'Configuration' → 'Programming' → 'M-code Definitions'. In this menu create an on and off M-code for any additional tools. These tools will also need 'Action' lines to be enabled; this line is based on which output line activates the tool as determined above, use a '1' for on and a '0' for off. Create as many tool macros as tools.

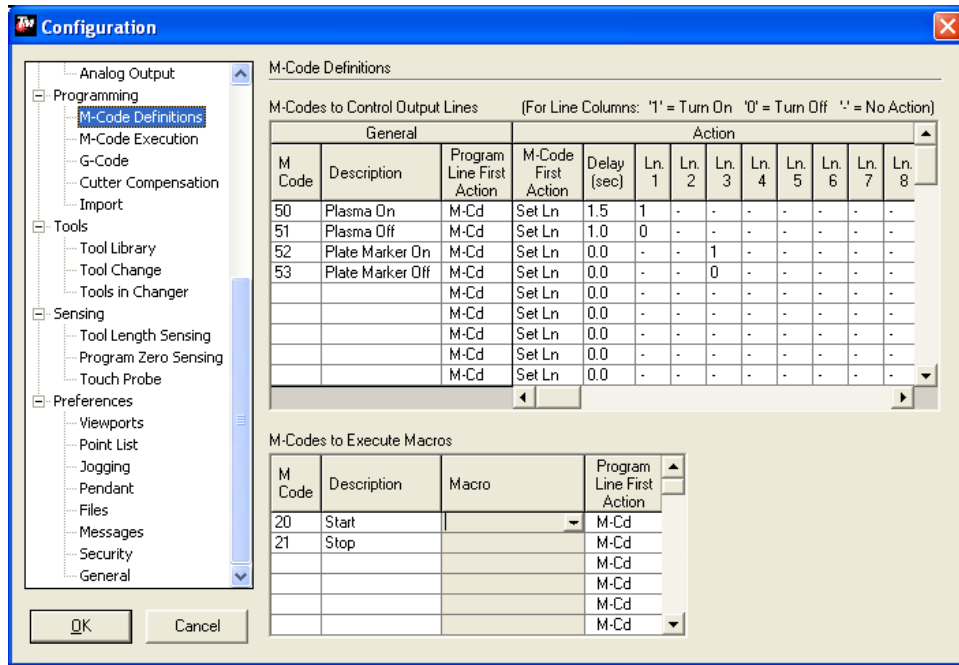


The delay setting for each tool will be slightly different.

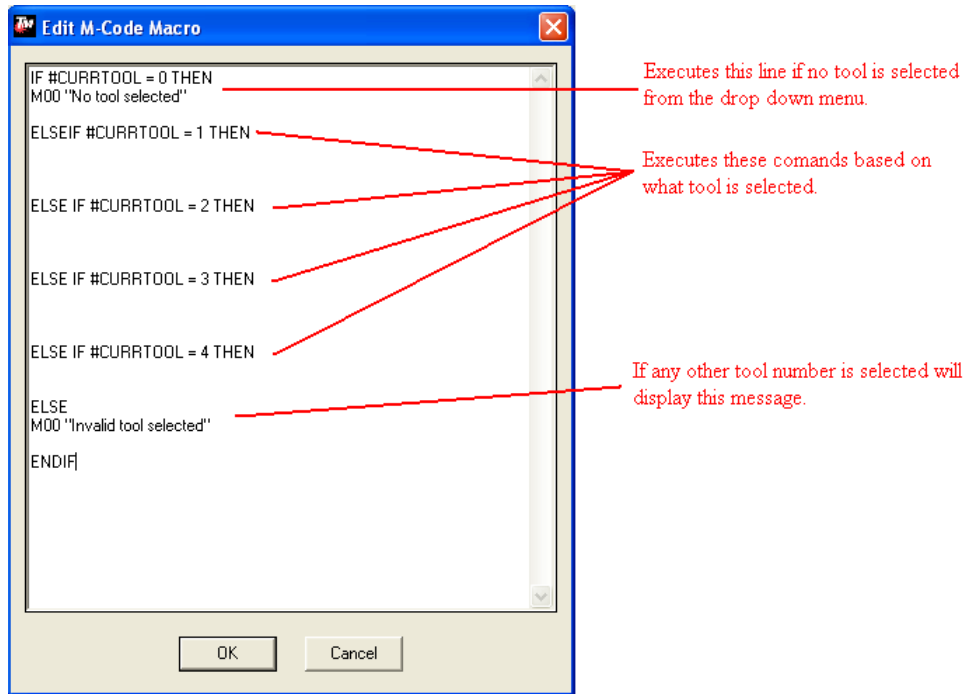
Tool	Tool On Delay	Tool Off Delay
Oxy Fuel	3+ sec. *	1.5 sec.
Plate Marker	0.5 sec.	0.5 sec.
Router	1.5 sec.	1.5 sec.

*The oxy fuel on delay is the pierce time setting; this will vary by thickness of material.

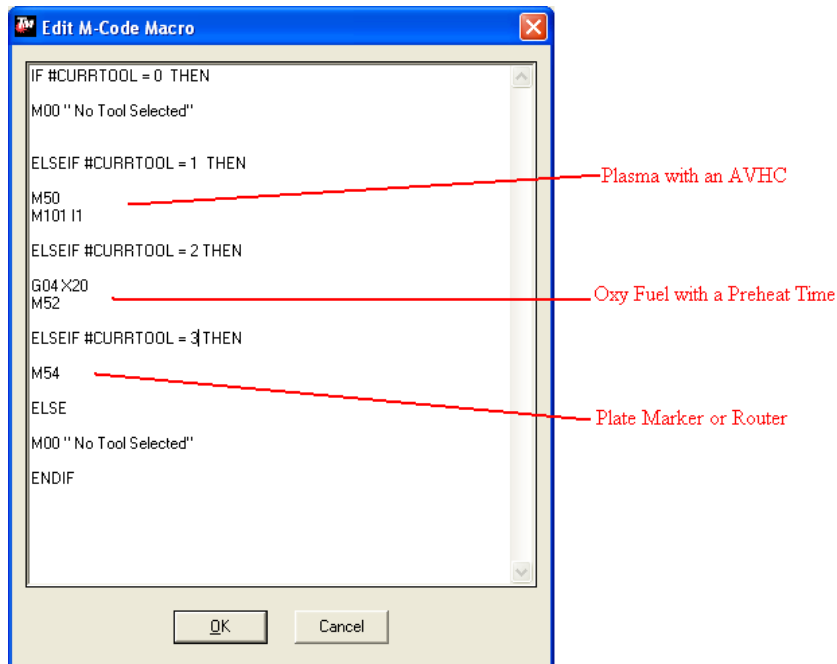
Two macros need to be created to utilize the tools drop down menu. The first will turn on which ever tool is selected and the second will turn off the selected tool. Begin by defining each macro and the description, use '20' and '21' named 'Start' and 'Stop' respectively.



Begin with the 'Start' macro, to edit this macro select the 'Macro' field and press the ▼ that appears, this will prompt an edit window. The 'Start' and 'Stop' macros will have the same basic form, the only difference being that certain commands will be different for each tool.

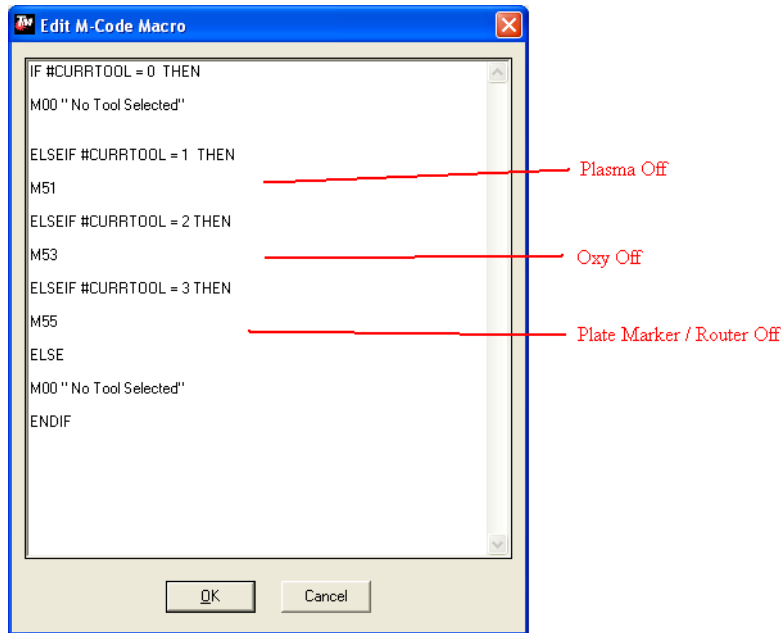


The commands listed after each tool command will vary. For plasma without an AVHC, plate marker, and router the command will just be the M-code used to turn the output line (M50, M52, ect.). For plasma with an AVHC and Oxy Fuel multiple commands will be executed. For example if M50 turns on plasma, M52 activates oxy fuel, and M54 activates a plate marker the macro will be written like this.

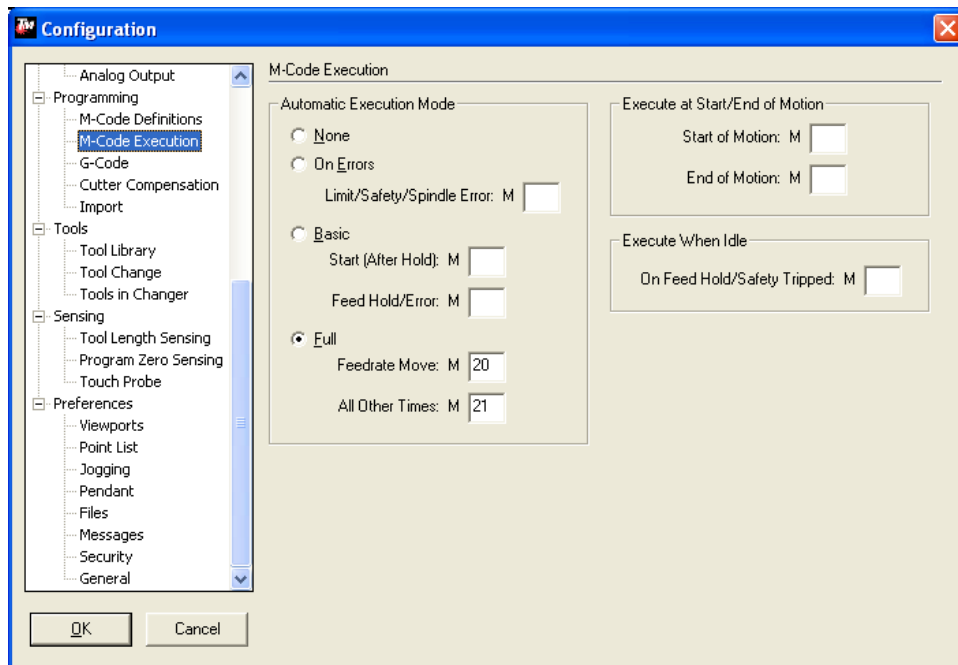


The order of the tools should match the order they are listed in the tool library previously defined.

Press 'OK' when the macro is finished, and proceed to the 'Stop' macro. The 'Stop' Macro will be written with a similar syntax as the 'Start' macro. For each tool the off commands will be written in, for the off commands no additional lines of code need to be written.



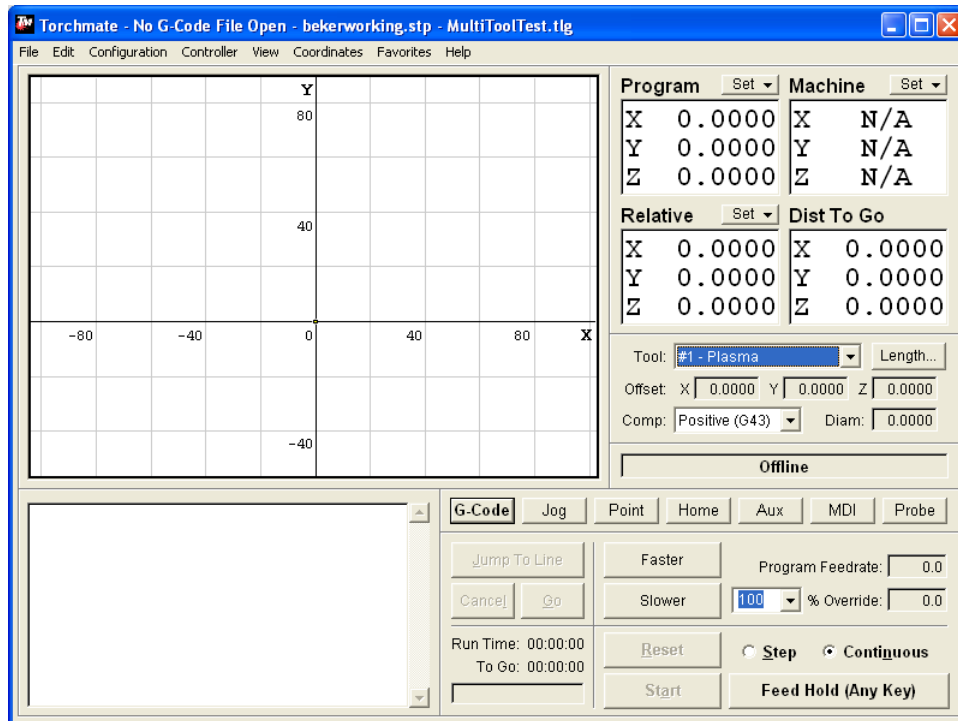
Press 'OK' once the 'Stop' macro is written. Go to 'Configuration' → 'Programming' → 'M-code Execution' Change the executed macros from 50 and 51 to 20 and 21 respectively, the software will now execute the multiple tool commands that were written previously.



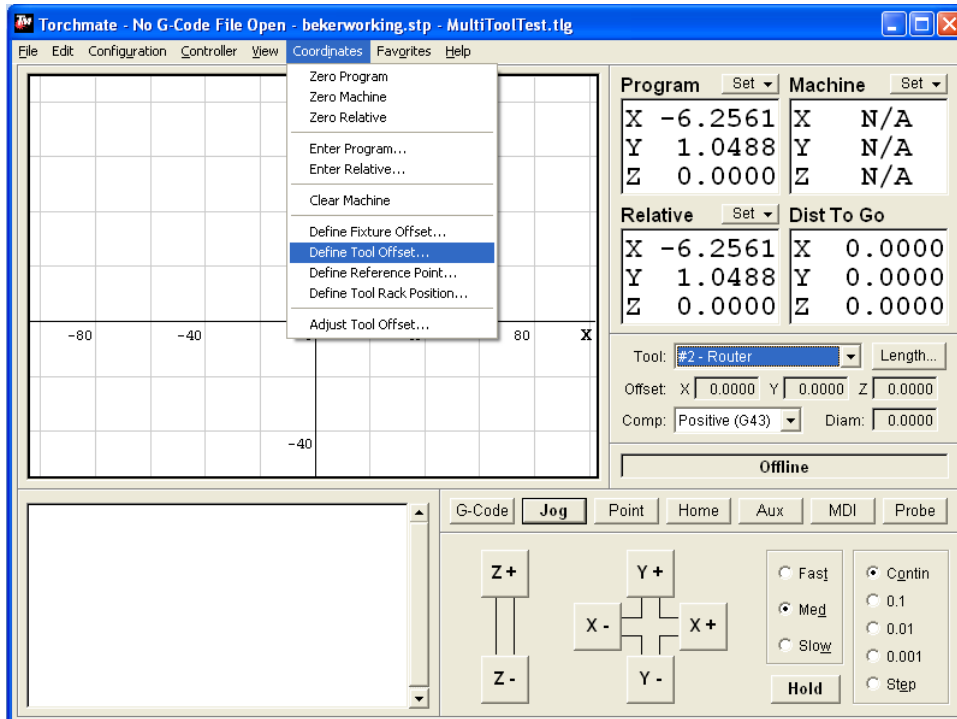
Defining Tool Offsets:

Tool offsets tell the computer the distance between each tool so that if a tool change is made the driver moves the new tool along the same path.

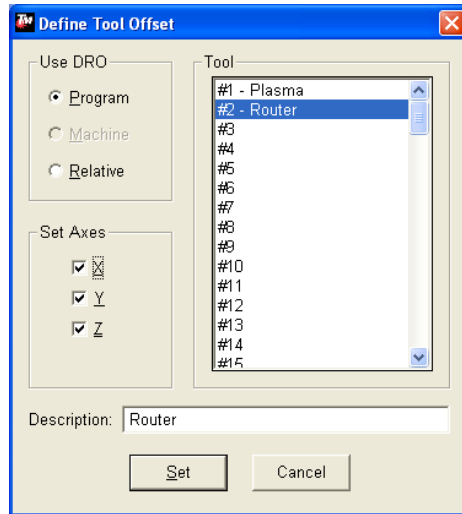
The first step is to go to the tool drop down menu and select the first tool. Jog the table physically to a location and mark the center of the tool selected. With the center marked go to the program coordinate box and set the zero.



Next jog the table so that the center of the second tool is at the marked point. From the tool pull down menu select the second tool. Go to 'Coordinates' → 'Define Tool Offset'.



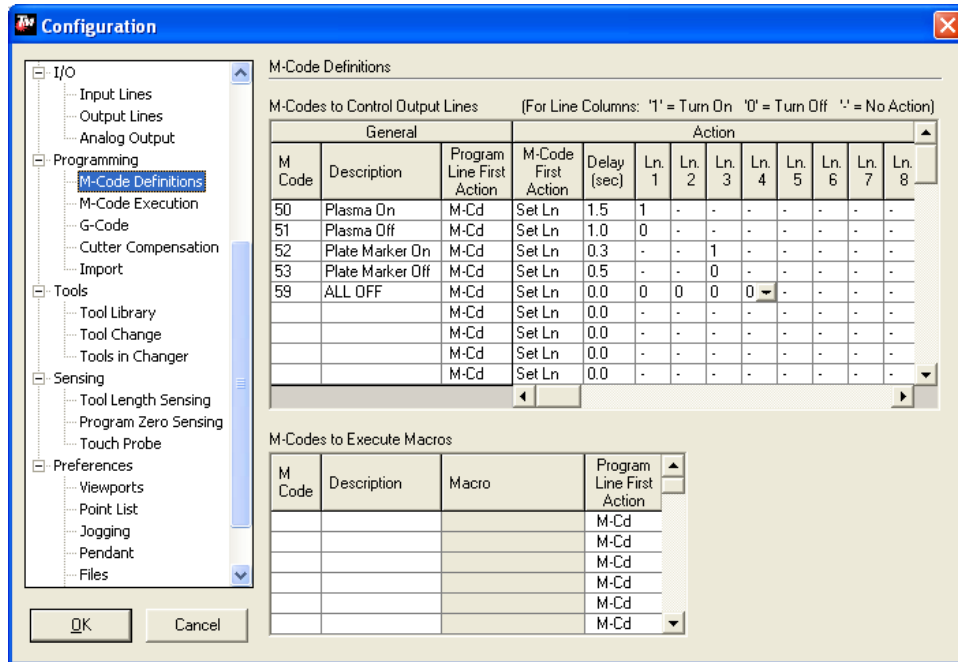
On this popup be sure to select all axes under 'Set Axes' and the second tool from the list, then select 'Set'. Repeat for any additional tools. The tool offsets are now configured, by selecting a tool from the pull down menu the program coordinates will change.



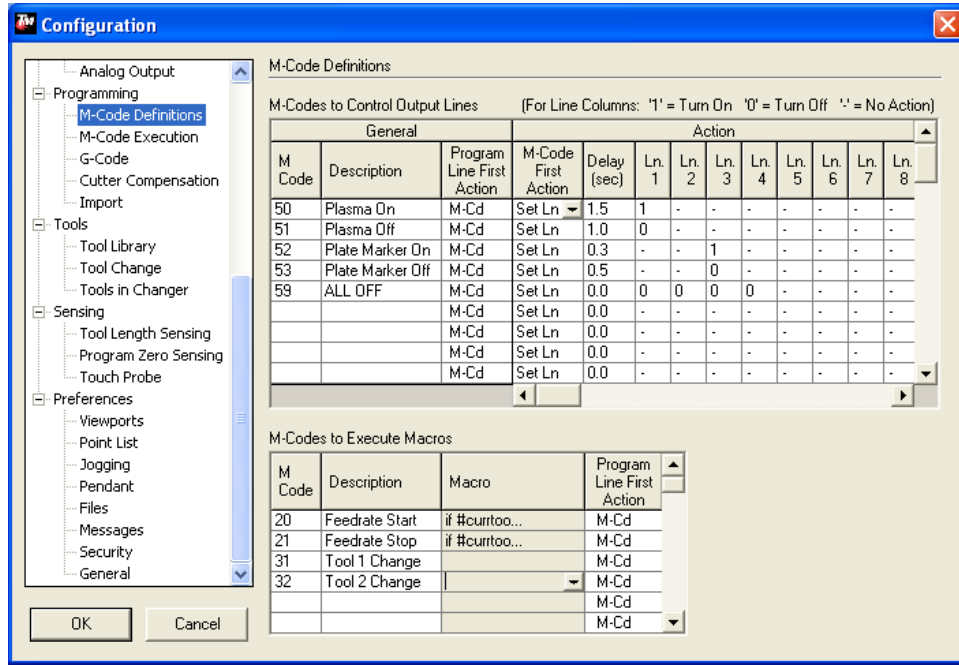
Using Multiple Tools in a Single Program:

Multiple tools can be used in the same program. This feature is quite a bit more advanced and a basic understanding of the driver software's operation is suggested before attempting to configure this type of set up. Following the steps above to configure multiple tools there will be a few additional changes to allow seamless tool changing. Ensure that the 'Configuring Tools' and 'Defining Tool Offsets' sections have been followed as this section will build on those setting changes.

Another M-Code macro will need to be added to turn all of the tools off. This line will set all action lines to '0' turning them off.



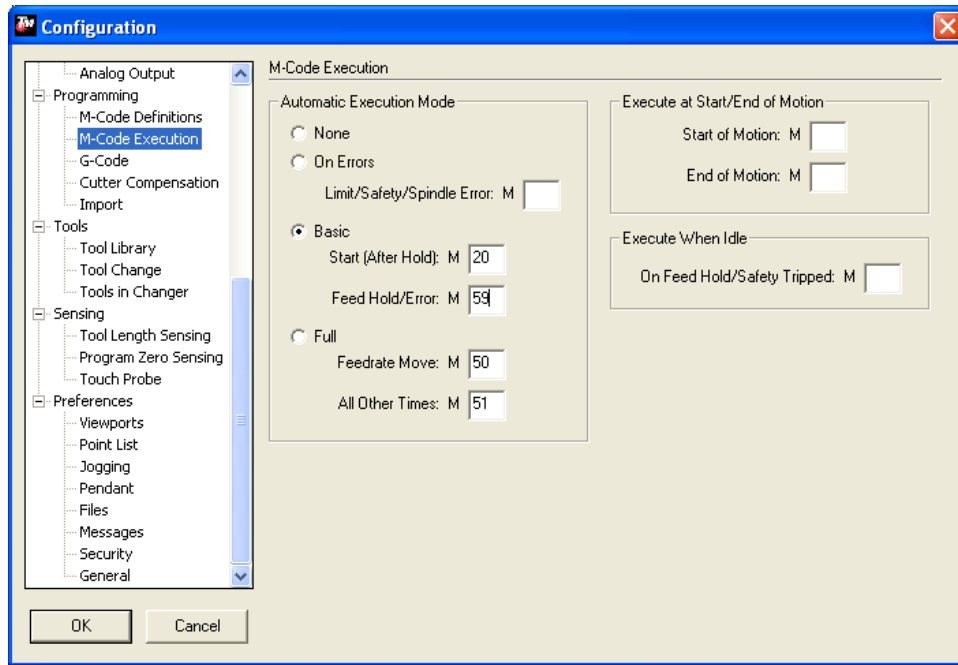
Additional macros now need to be created for tool changes. There will be one macro for each tool. To help keep track of them number the macros 31 for tool 1, 32 for tool 2, and so forth. Each macro will have a similar syntax.



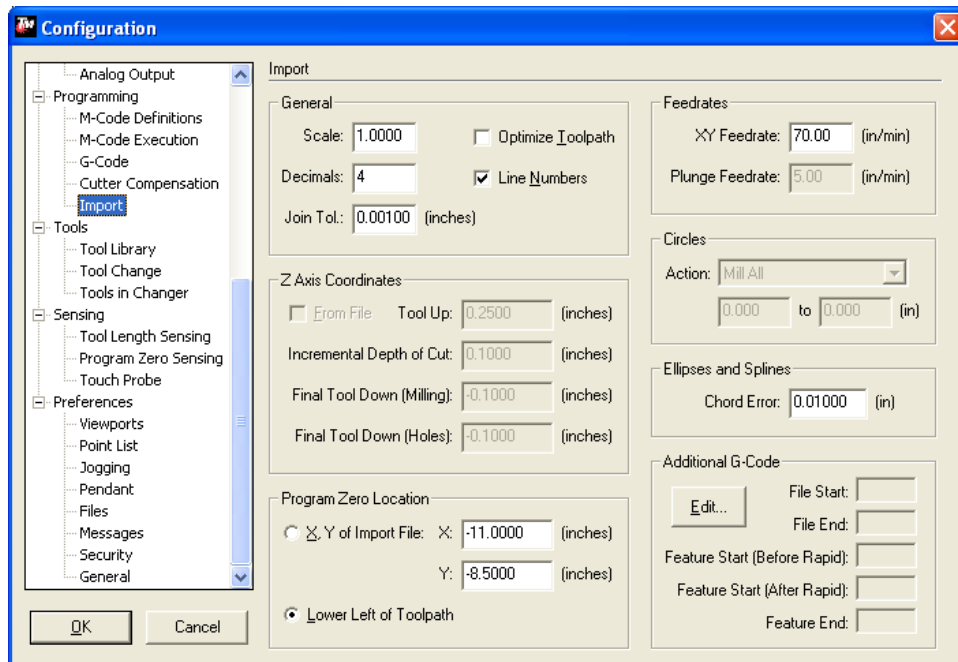
Each tool macro will be similar to the one below with T# and H# indicating what tool to change to.



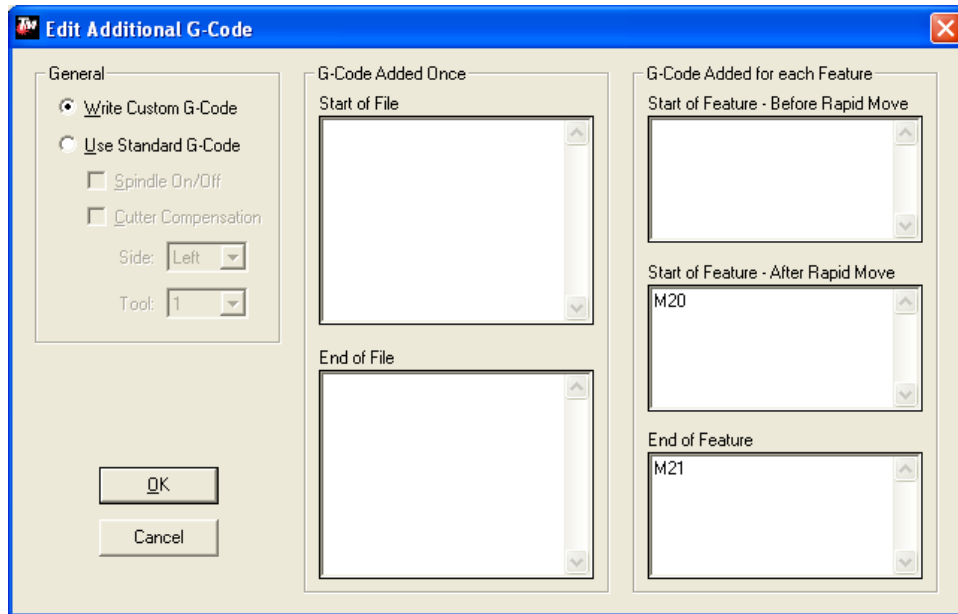
Once all the macros are made go to ‘Programming’ and ‘M-code Execution’ in here the ‘Automatic Execution Mode’ needs to be changed from ‘Full’ to ‘Basic’ and the ‘Start’ needs to be 20 and ‘Feed Hold’ needs to be whichever macro was made for the ‘ALL OFF’ command.



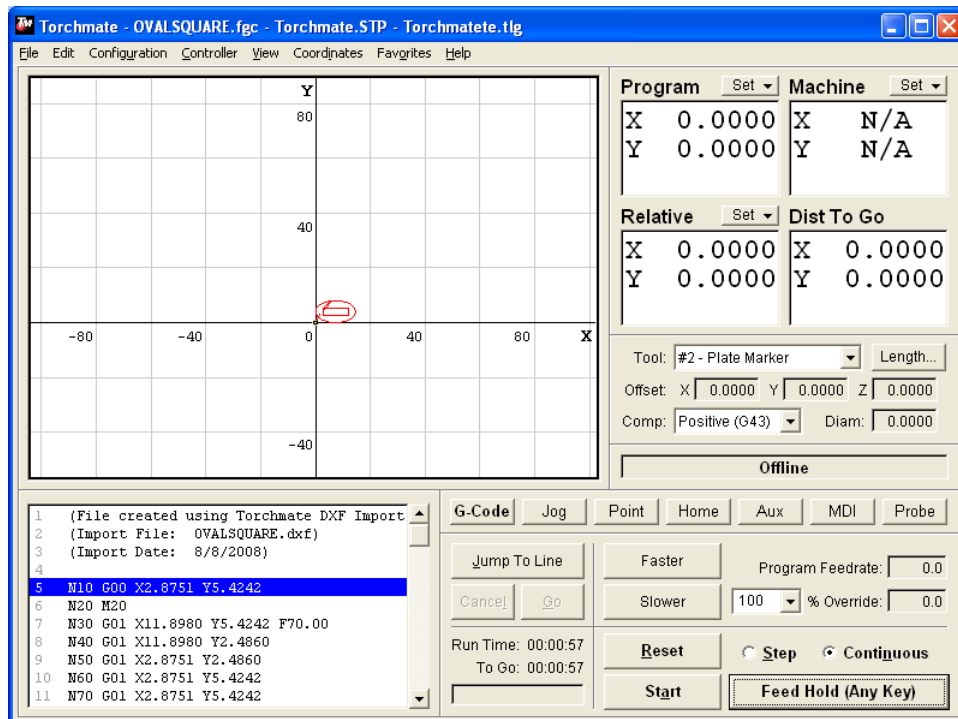
Since the mode has been changed from ‘Full’ to ‘Basic’ the import options will have to change to ensure that the tool on and off commands get inserted in the program. Go to ‘Configuration’ → ‘Programming’ → ‘Import’.



On the import screen there is a section labeled 'Additional G-Code' in this area select the 'Edit' button. This will bring up places where additional code can be entered. To ensure the tools run under 'Start of Feature - After Rapid Move' M20 needs to be added and under 'End of Feature' M21 should be inserted.



The software is now set up to use multiple tools in one program. When a file is imported in now the only editing that needs to be done is specifying when a tool change is to take place. Import a dxf file that contains toolpaths for multiple tools, for help creating these types of toolpaths see the Torchmate CAD guide on 'Multiple Tool Toolpaths'. Import this file as normal.



The driver automatically inserts the M codes to turn on and off the tools; the program needs to have the M codes inserted where it needs to make a tool change. To edit the program double click on the lower left window the one that lists all the code.

```

1 |(File created using Torchmate DXF Import)
2 |(Import File:  OVALSQARE.dxf)
3 |(Import Date:  8/8/2008)
4
5 N10 G00 X2.8751 Y5.4242
6 N20 M20
7 N30 G01 X11.8980 Y5.4242 F70.00
8 N40 G01 X11.8980 Y2.4860
9 N50 G01 X2.8751 Y2.4860
10 N60 G01 X2.8751 Y5.4242
11 N70 G01 X2.8751 Y5.4242
12 N80 M21
13 N90 G00 X5.6522 Y8.1939
14 N100 M20
15 N110 G01 X5.6827 Y7.9457
16 N120 G02 X6.4746 Y8.0184 I1.9771 J-17.1916
17 N130 G02 X7.2695 Y8.0424 I0.9199 J-17.2804
18 N140 G02 X7.8607 Y8.0265 I-0.6126 J-33.6428
19 N150 G02 X8.4499 Y7.9898 I-0.3991 J-11.1558
20 N160 G02 X9.0360 Y7.9185 I-1.0541 J-11.1130
21 N170 G02 X9.6202 Y7.8265 I-4.9435 J-33.2833
22 N180 G02 X10.1367 Y7.7133 I-5.6798 J-27.1547
23 N190 G02 X10.6475 Y7.5807 I-2.0536 J-8.9635
24 N200 G02 X11.1488 Y7.4158 I-2.6211 J-8.8143
25 N210 G02 X11.6445 Y7.2316 I-9.4192 J-26.0944
26 N220 G02 X12.1737 Y6.9884 I-3.9101 J-9.2080
27 N230 G02 X12.6825 Y6.7049 I-4.6132 J-8.8766
28 N240 G02 X13.0776 Y6.4403 I-3.8745 J-6.2130
29 N250 G02 X13.4482 Y6.1425 I-4.3980 J-5.8541
30 N260 G02 X13.7245 Y5.8759 I-3.5642 J-3.9693
  
```

Insert the M31, M32, ect. macros into the g-code where they are needed. In here the speed can also be changed if needed for different tools.

```

1 |(File created using Torchmate DXF Import)
2 |(Import File:  OVALSQARE.dxf)
3 |(Import Date:  8/8/2008)
4
5 M32
6 N10 G00 X2.8751 Y5.4242
7 N20 M20
8 N30 G01 X11.8980 Y5.4242 F50
9 N40 G01 X11.8980 Y2.4860
10 N50 G01 X2.8751 Y2.4860
11 N60 G01 X2.8751 Y5.4242
12 N70 G01 X2.8751 Y5.4242
13 N80 M21
14 M31
15 N90 G00 X5.6522 Y8.1939
16 N100 M20
17 N110 G01 X5.6827 Y7.9457 F80
18 N120 G02 X6.4746 Y8.0184 I1.9771 J-17.1916
19 N130 G02 X7.2695 Y8.0424 I0.9199 J-17.2804
20 N140 G02 X7.8607 Y8.0265 I-0.6126 J-33.6428
21 N150 G02 X8.4499 Y7.9898 I-0.3991 J-11.1558
22 N160 G02 X9.0360 Y7.9185 I-1.0541 J-11.1130
23 N170 G02 X9.6202 Y7.8265 I-4.9435 J-33.2833
24 N180 G02 X10.1367 Y7.7133 I-5.6798 J-27.1547
25 N190 G02 X10.6475 Y7.5807 I-2.0536 J-8.9635
  
```

M32 Tells the driver to select tool 2 and use this tool until told otherwise

The F value here is the speed it will use tool 2 at.

M31 switches to tool 1 this needs to be done after M21 and before any other commands.

The F value was added in to change speed for plasma.

The program will now run and change tools automatically. The last thing to change is up to personal preference. At every tool change the Torchmate driver software will pause the program and prompt a message that indicates the tool change. The program will then have to be started manually again. This setting can be disabled to allow for transitions to happen automatically with no message. To do this go to

'Configuration' → 'Tools' → 'Tool Change'. Change the tool change mode to silent to allow automatic switching.

