

KEEPING YOUR TOOL LIBRARIES SYNCHRONIZED

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Figures by Author

If you do CNC machining, you have at least two tool libraries (or rather, two copies of the same library): one in your CAM program and one in the CNC machine. For me, CAM is Fusion 360 and the CNC machine is a Tormach 770M. I also sometimes use G-Wizard for feeds and speeds, so I have another copy there.

All of my libraries have a mechanism for import and export, so I've decided to use that to keep them synchronized. Of course, none of them use the same format so it's not trivial to copy them back and forth. I use Microsoft Excel with macros written in Visual Basic for Applications (VBA) to translate the formats and provide a smooth workflow. I've shared my Tool Library Manager on GitHub and thought *Digital Machinist* readers might find it useful.

One of the key features of Tool Library Manager is that individual library formats are defined by a rule table; there is no macro code specific to an individual library. Because of this, I was recently able to add another library format in minutes. And when Fusion 360 changed their format to add two lines at the top with version information, it took only seconds to change a rule table entry to adapt. If you have a different program or device that can import/export its library in a format compatible with Excel, you should be able to easily create a new entry in the rule table to cover it.

Let's talk a bit about what constitutes compatibility with Excel. The most common import/export format is Comma Separated Values, or CSV. Excel treats CSV as a native format; just clicking on a CSV file will start Excel and load the file. Fusion 360 happens to use a variation called Tab Separated Values (TSV), which requires a little interaction from the user when manually loaded. Excel can save back CSV files, but it can't save files in TSV format.

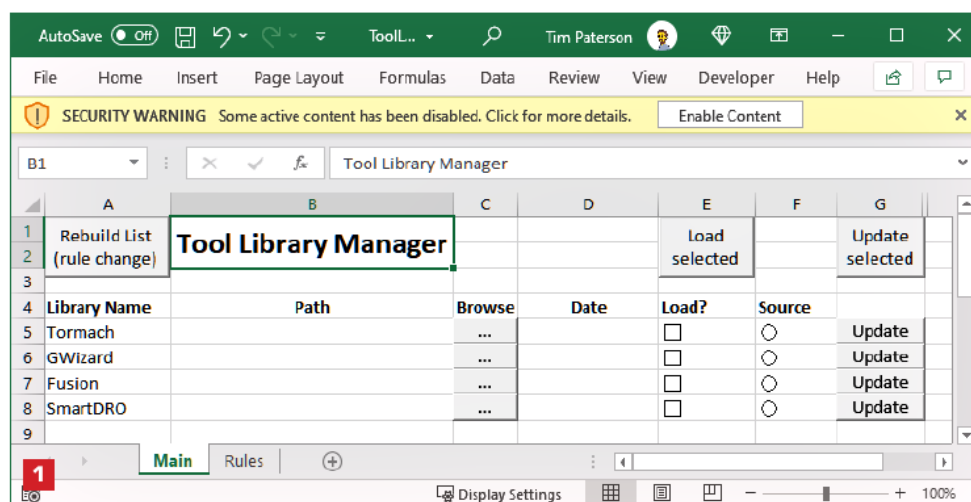
This format limitation happens to work fine for me. I consider Fusion 360 to be my "master" library, since CAM time is where a new tool is introduced. All the other libraries derive from it, and I have no need to import back into Fusion 360. The fact that I couldn't if I wanted to – because it uses TSV format – isn't an obstacle.

USING THE MANAGER

You will find a Git repository for the project at <https://github.com/TimPaterson/CNC-Tool-Library-Manager>. If you're into Git, you can go ahead and clone the repository if you like. But if you just want to use Tool Library Manager, go to the right side of the GitHub page and find "Releases." Click on "Latest," then click on "ToolLibrary.xlsm" to download the Excel workbook.

Like any downloaded file loaded by Microsoft Office, Excel will put the workbook in "Protected View," requiring you to click "Enable Editing." This will move you on to the next level of security, shown in **Figure 1**. You need to click "Enable Content" to allow the VBA macros to run.

But the first step in using Tool Library Manager doesn't involve



The main screen of Tool Library Manager.

Excel at all. Start by exporting the library from each of your programs or devices. The things I use – Fusion 360, G-Wizard, and Tormach Path Pilot – all have the ability to export their tool libraries to CSV or TSV files. Even though Fusion 360 is the “master” for me, the latest copy of each of the others is needed to preserve fields I don’t want to change, such as the tool length. Export is needed even for a new device that doesn’t have anything in its library yet, because a sample is required with column headings for all the tool parameters.

The next step brings us back to the Main sheet of the Excel workbook. Let’s assume for the moment that the list of libraries is correct for you. Click on each row in the “Browse” column to locate that row’s exported tool library. This doesn’t load the library, it just sets the path name in the Path cell. By saving the path in the workbook, this step can be skipped next time.

Check the boxes in the “Load?” column for each exported library you want to load. Then, the button above the column, “Load selected,” can be clicked and things start happening. A new worksheet is created for each library, adding a tab at the bottom with the library name. If there was already a worksheet for a library (as there usually would be after the first time), it is simply discarded. You can click any of the tabs to see the corresponding tool library, which has been sorted by tool number. **Figure 2** shows the four additional tabs for the four libraries I have.

The “Date” column displays the timestamp of the exported file. This is helpful to make sure you remember to actually export all the libraries (speaking from experience). If that column doesn’t have today’s date, you aren’t using a fresh export.

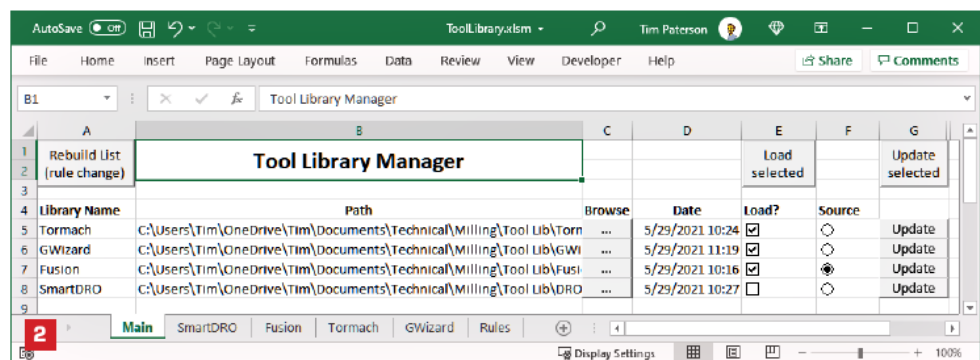
Now comes the big moment. Just choose one tool library in the “Source” column, and you’re ready to merge it into the other libraries. You can do them individually or click “Update selected” to do all that are checked in the “Load?” column (skipping the source). The updated libraries automatically overwrite the original exported library files.

The final step, of course, is to import those libraries back into your CNC machine and any other programs you use.

open when the macros are run. Close any other workbooks before clicking the “Load selected” button.

THE RULE LIST

Figure 3 shows the rules table you’ll see by selecting the “Rules” tab at the bottom of the workbook. In the top row, there are the names of all the different tool libraries. There can be any number of columns; the first blank cell in the top row ends the list of names. The library name is used in the table on the Main sheet and as the



After loading tool libraries, each library has its own sheet with a tab at the bottom.

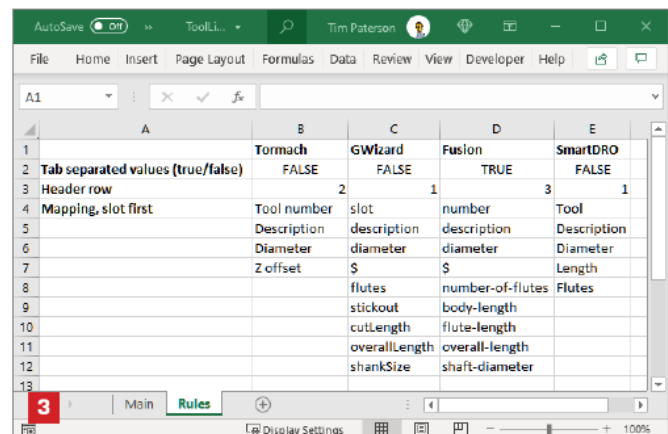
Tool Library Manager was designed to have a very simple workflow. It can’t improve on the steps needed to export and import libraries from each program or device. But that aside, here’s typically all you do:

1. Open the spreadsheet.
2. Click “Load selected” (file paths and “Load?” checkboxes should already be set).
3. Check the “Date” column to make sure you exported everything.
4. Click “Update selected” (“Source” should already be set).
5. Close and save the spreadsheet.

Note: Tool Library Manager should be the only Excel workbook

name of the tabs along the bottom.

The second row must be “TRUE” if the library was exported as a TSV file, and “FALSE” for a CSV file. The third row gives the row number that has the column headers. For example, the exported Fusion 360 library has two lines with version information, and the column headers start on Line 3.



The table of rules for loading and updating tool libraries.

Tool number	Description	Z offset	Diameter
1	3D Tester	4.557	0
2	1/32" carbide TiCN 2 flute end m	2.56	0.03125
3	1/16" carbide TiCN 2 flute end m	2.573	0.0625
4	1/8" carbide TiCN 3 flute end mil	2.877	0.125
5	3/4 HSS TiN 4-flute end mill	4.6915	0.75
6	7/16 x 2 HSS TiN 4-flute end mill	4.308	0.4375
7	1/2" carbide TiCN 4 flute end mil	3.583	0.5

4 A Tormach tool library loaded into its own Excel workbook.

The fourth row has the name each library uses for the tool number. Every row after that is the name of corresponding columns where a value should be copied from the master library to the other libraries. (Remember, the master library is chosen on the Main sheet using the “Source” column; you can change it anytime.)

Let’s look at these in detail. Rows 5 and 6 are pretty simple – all libraries have a description and a tool diameter that should track with the master. But in row 7 there’s a “\$” instead of a name for two of the libraries. This is a placeholder that causes the row to be ignored for those libraries. This is important for this particular row, because the Tormach “Z offset” and SmartDRO “Length” tell how much to adjust the Z-axis when changing tools. Fusion 360 doesn’t know this value, as it’s measured in the shop just before the CNC cycle is started. While Fusion 360 is normally the master, it can’t be allowed to change this.

On the other hand, the tool lengths I measure when I’m using my Tormach will also apply when I use the SmartDRO on my manual mill. And if I measure a tool while manually milling, I will want to copy the length back to the Tormach. So there are occasions where I might make Tormach my master and update SmartDRO, and

vice versa. (If I didn’t have two devices that both used tool length, this entire row could be deleted.)

When a column for a library hits a blank cell, that’s considered the end of its list. (That’s why the “\$” placeholder was needed instead of leaving the cell blank.) You can see Fusion 360 and G-Wizard continue to share parameters that are

of no interest to the machines. Things like stickout and shank size can come into play in G-Wizard, for example, when calculating tool deflection. Fusion 360 asks for this info when I enter a new tool, so I go ahead and put it in. But I could also leave it out of the table and just keep it private to G-Wizard.

MAKING YOUR OWN RULES

If you are using a different device or program from the ones I use, there’s a good chance you can make your own rules for it. The basic requirements are:

- It can export to an Excel-compatible file format (as previously discussed).
- The file has a row of column names (not necessarily the first row).
- The rows after the column name row are the tool values.

To get started on your own rules, export a tool library and load it into its own Excel workbook. You can adjust the column widths to make things more readable. **Figure 4** shows a portion of the exported library from my Tormach.

With the device tool library side-by-side with the rule table, it should be easy to fill in a new column (or change an existing one). Choose a name, and whether or not it was exported as a TSV file. Looking at the tool library,

which row has the column headers? You can see for the Tormach, there is an introductory row and then the column headers in row 2.

Next, get the column name used for the tool number. This is in a fixed place because it’s used to match up the rows from each of the libraries.

Then, pick out additional column names and line them up with corresponding names from other libraries. Some names may not be self-explanatory, and it might help to look at the values in the column to see what it means. For example, I found “flute-length” in Fusion 360 was equivalent to “cutLength” in G-Wizard.

You can delete entire columns for libraries you don’t use. Just make sure you don’t leave a blank column; subsequent columns should be moved over.

When you make any changes in the top (name) row of the rules – whether editing a name or adding/deleting entire columns – you must update the table of libraries on the Main sheet. Just click the “Rebuild List” button and it will build a new table with current library names. But if you have fewer libraries than before, it will not clear the extra rows. You can simply delete (or clear) the rows manually.

I hope there are readers out there who will find this tool useful. I had to learn a lot about Excel and VBA to make this happen, but learning is always fun. I was surprised how rusty I was at VBA, considering I have two “Ship-It” awards from Microsoft for writing the VBA execution engine (okay, back in the ’90s). If you have questions or problems with it, the GitHub project includes Discussions and Issues sections where you can make comments and ask questions.