

Newfangled Standard For Setting Tool Offsets In Mach4 Lathe

This document has been drafted to discuss the supported, standard practice and procedure for setting tool offsets in Mach4Lathe.

During this tutorial, offsets for the 4 tools pictured below will be set using the “ Tool Offset” setter button.

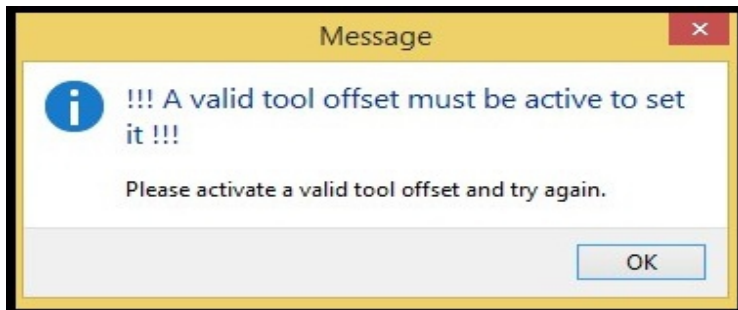


From left to right, the tools depicted will be T1, T2, T3, and T4.

The concept of successful “tool offsets” in Mach4Lathe will be based on three major factors:

- 1. A reliable homing method for the X axis. (should be done with a limit switch to ensure reliability.)**
- 2. The use of a “Master Tool” in tool slot 1. (all other tools will reference Tool 1 in the Z axis)**
- 3. Establishing a fixture offset prior to setting the tool offset. This is the point the tools will be compared to one another and in relationship to the Z axis, and then offsets will be set.**

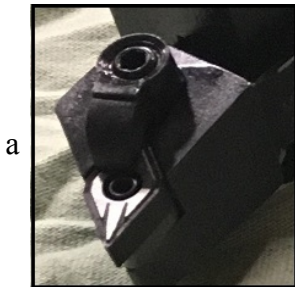
Once a user has a lathe under power, homing/referencing should be the first action taken before moving forward. Referencing X upon any start up will validate any previously set offsets or new offsets to be entered. Home in X should be machine coordinate X Zero.



Because the Z tool offsets used in Mach4Lathe are simply a relationship between themselves, a fixture offset, and the master tool, referencing/homing the Z is not critical. If the machine has a limit or home switch wired for the Z axis, homing the Z upon start up will not interfere with setting offsets. However, if homing the Z is a habit continue to do it and proceed

with this tutorial.

Once the homing process is complete it is now safe to begin setting tool offsets. The term “ Master Tool” will be used numerous times in this document. The master tool is Tool 1 and will ALWAYS have 0 for its Z tool length offset value. All other tools will obtain a Z offset based on the master. Any tool can be used as a master but it is highly recommended that Tool 1 is used. Tool 1 is used in this document.



Tool 1 is an outside diameter turning tool with an indexable insert. It is also a tool that is mostly used for finishing operations and is not subject to the tool wear that roughing operations produce. This ensures reliable offsets and stable tool.

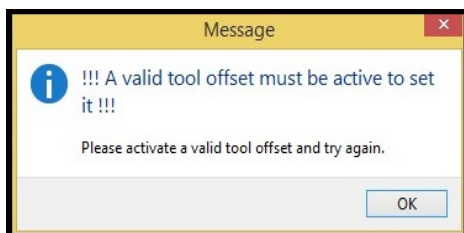
For instance, if a drill is used for Tool 1 and it had to be sharpened, previously set tool offsets would no longer be accurate.

Setting the “Master Tool”

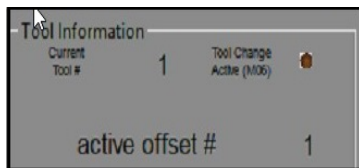
Once a decision has been made for a master tool, it should be loaded into the lathe's tool holder. To set offsets for a specific tool, it should be called with a tool change and should have its offsets active.



In the MDI Tab, call a tool change for Tool 1 ; T0101. Then hit Cycle Start. Follow the prompts to complete the tool change. The DROs on the screen should change and reflect Tool 1's offsets. The DRO values may not make sense, as they are a reflection of the Machine Coordinates.



If the previous step is missed and a tool offset is not active, Mach4 will remind users to do so with this message box. If this shows up, the previous step (calling a tool and its offset) must be repeated.



Once the tool change is complete, a quick look at the tool information box will confirm this.

Current tool is 1 and the active offset is also 1.

The master tool can now be set.

Knowing that there are three more tools that need to be set, a piece of stock was loaded in the lathe chuck so a reference diameter could be established, as well as a fixture offset for Z.

Tip Dir	Tip Rad	Direction	Des
0	0.0000		
0	0.0000		

Before setting offsets, look at the tools to be set up and the way they will be used during operations. At this time Tool Direction should be set. In the tool table, 7 columns to the right, there is one labeled “Direction”.

Tip Rad	Direction	Description
0.0000	Primary	

If this field for the tool is empty, the direction should be changed to either Primary or Secondary.

****There are two choices here that are discussed in a different document: “Primary” and “Secondary” tool direction****

95% of tools will be “Primary Direction” tools.

Mach4 Tool Direction Document



Tool 1 is loaded in the tool holder and has been used to turn a 1.0" diameter. When the cut is complete, X should not be moved. Move the tool off the part with the Z axis while the spindle is still turning.

A reminder: this diameter will be used to set the remaining tools as well.

Now that the diameter has been turned and measured, enter the turned diameter in the X DRO above the "SET X OFFSET" button and then hit enter to set the value in the DRO.

After the 1.0" value is set in the X DRO, click the "SET X OFFSET" button under the X DRO in the "Tool Offset Setters" box.



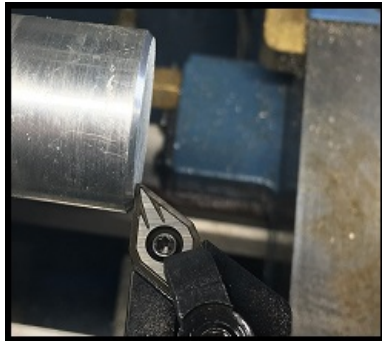
With Tool 1 and the offsets active, this will set the X offset to 1.0. The "CURRENT X" DRO at the top of the screen should reflect this change and read 1.0.



This has now set the X offset, or diameter, for Tool 1.

ALL X OFFSETS SHOULD BE SET USING THIS METHOD. THE OFFSETS SET WITH THE SET X BUTTON WILL BE PLACED IN THE TOOL TABLE BY DEFAULT. DO NOT SET VALUES FOR X USING THE FIXTURE OFFSET {G54}. THIS WILL CORRUPT ANY VALUES THERE AFTER USING THE SET X BUTTON OR AFTER HOMING, CAUSING A MACHINE CRASH.

Since Tool 1 is the “Master Tool” (as discussed earlier), it will not have a tool offset for Z. Next, set a fixture (G54) offset for Z. This will establish a reference surface on the part in the Z axis to set tools 2-4. Z tool length offsets can be set later.



Tool 1 has been touched off the face of the work piece and is in position to set the fixture, or G54, offset.

By clicking on the “Zero Fixture Z” button next to the Current Z DRO, the fixture offset has been set with the Master Tool.



The Current Z DRO should display zero. In this case, this is just a reference surface for setting Tools 2-4. If Tools 1-4 had been set previously., their respective offset values would have been logged and stored

in the tool table.

This will become the method for setting a Z Fixture offset for any part set up. The values for tool offset X and Z are stored in the tool table.

Fixture Offsets						
	X	Y	Z	A	B	C
Work Shift	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Head Shift	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
G54	0.0000	0.0000	0.5637	0.0000	0.0000	0.0000

A glance at the “Current Z DRO” states that G54, or Z fixture offset, is zero. Opening the Fixture Offsets Table, you see that the Z

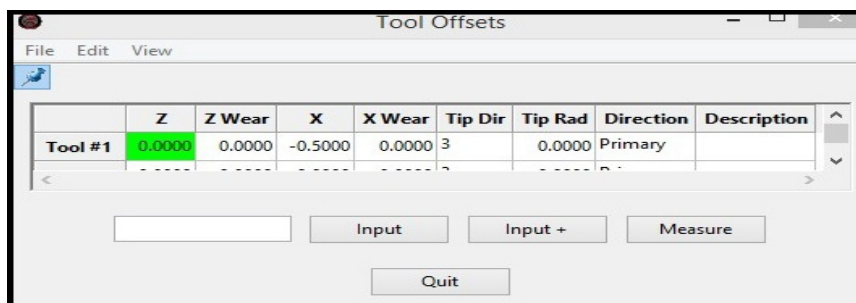
fixture offset for G54 has been set to .5637? Why?



If the “Machine Pos Toggle” button is pressed, the Z DRO should now display .5637. This is the relationship between the Master Tool, Fixture Offset, and machine coordinates.

This verifies that the fixture offset (G54) that was set is valid and accurate.

Currently, the Master Tool's X offset has been set. A fixture offset (G54) has been established also maintaining zero for the Master Tool's Z tool length offset.



A quick look at the Tool Table will verify this.

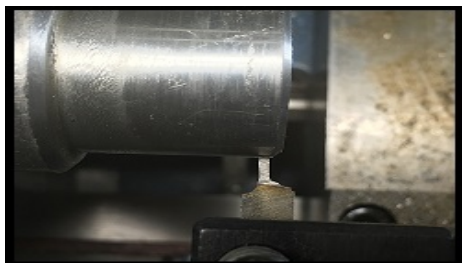
Move Tool 1 to a safe distance away from the part to load Tool2 in the holder.

Tool 2

In the MDI Tab, call a tool change for Tool 2 ; T0202.
Then hit Cycle Start Follow the prompts to complete the tool change.



Tool 2 has been called and its offsets are active.



The offset in X should be set on the turned 1.0” diameter in the lathe (this value should still be in the SET X OFFSET DRO).
With Tool 2 on the 1.0” diameter,

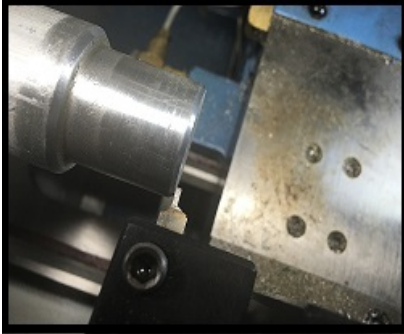


Click the “SET X OFFSET” Button.
The X, or diameter, offset change should take place.

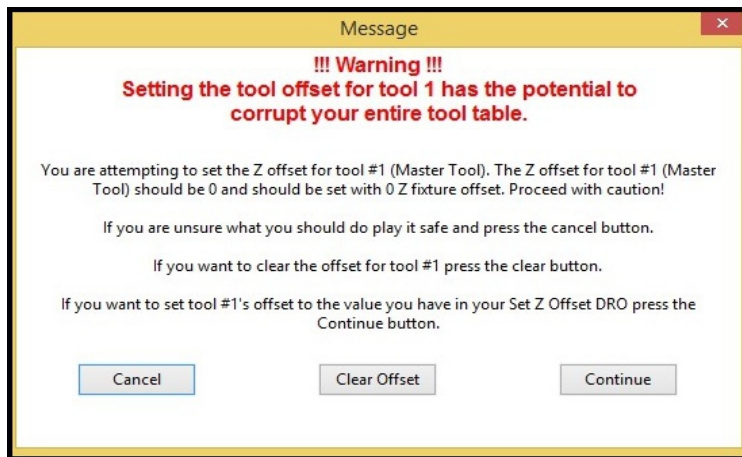


The 1.0" value should be present in the Current X DRO.

Tool2 should now be moved into position to set the Z tool offset .



When setting the Master Tool, the "SET OFFSET Z" button was not used. A fixture offset was set, leaving zero for a value in the Tool 1's Z offset.



If "SET Z OFFSET" is clicked, while setting the fixture offset for Tool 1, the Master Tool, Mach4 will ask to continue with this action. The Z Offset for this tool should be zero.

Setting Z for any tool after the Master Tool, will use the "SET Z OFFSET" rather than the "ZERO FIXTURE Z". Why? The Master Tool does not (and should not) have a length associated with it. It has, however, been used to establish a reference point for the

fixture, or (G54). Using the "SET Z OFFSET" button for tools after 1 will set their Z offsets in relationship to the Master Tool's length of zero. Therefore, once these values are established, the math will be done by Mach4 as a comparison between the called tool Z offset that will show up in the "Current Z DRO", the Master Tool's offset, and the Fixture Z offset (G54). Once set, this will happen every time the tool is called.



With Tool 2 in place to set its Z Length offset, the "Current Z DRO" has a value of -.653 (in this example). This is the actual difference in length between Tool 2 and

the Master Tool.

To set Tool 2's Z offset (or the current fixture offset) to zero , click on the “SET Z OFFSET” button. Normally, the value in the “SET Z OFFSET DRO” should be left at zero. There are a few instances where the user would have to enter a value in this DRO.

If the tool being set can be set from the “common surface”, then there is no need for a value in the DRO. If the tool being set physically cannot be set from the “common surface”, then the value of the difference from the surface the user can use and the “common surface” should be entered in the DRO.

Example: if a tool has geometry that requires the user to use a .500 gauge block between it, and the “common surface”, then the .500 gauge block thickness should be entered into the “SET Z OFFSET” DRO. The math done in this case will take into consideration the .500 value and will set the tool's Z offset to the actual “common surface.” There are many other situations like this which will be discussed in advanced Lathe tool documents and/or videos.



Once “SET Z OFFSET” is clicked, the “Current Z DRO” now has a value of zero. This has set Tool 2's Z length offset to be zero at the fixture offset zero (G54).

Also a quick look at the tool table will show -.653 has been set for Tool 2 in the Z. This is the difference as seen before in the “Current Z DRO.” When Tool 2 is called, Mach4 will now use this value from the tool table in the calculations to keep Tool 2's Z at fixture Z zero (or G54). The new value is highlighted in green.

Tool Offsets								
File Edit View								
	Z	Z Wear	X	X Wear	Tip Dir	Tip Rad	Direction	Description
Tool #2	-0.6530	0.0000	-0.0317	0.0000	3	0.0000	Primary	

The Master Tool, a fixture offset, and Tool2's offset have now been set. The next two tools will mimic

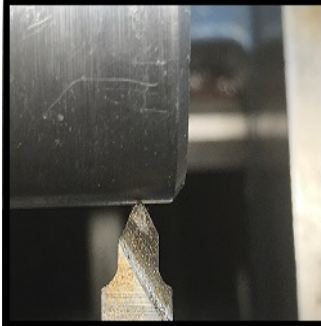
the process of Tool 2's offset set up.

TOOL 3



In the MDI Tab, call a tool change for Tool 3 ; T0303. Then hit Cycle Start. Follow the prompts to complete the tool change.

Jog Tool 3 to the 1.0" turned diameter.



Set the X DRO to 1.0".



Click the "SET X OFFSET" button. X for Tool 3 is set and should reflect in the current X DRO.

Jog Tool 3 into position to set the Z tool offset.



Current Z DRO displays the difference in Z as compared to the Master Tool.



Click on the “SET Z OFFSET” button.



The “Current Z DRO” should reflect this change.

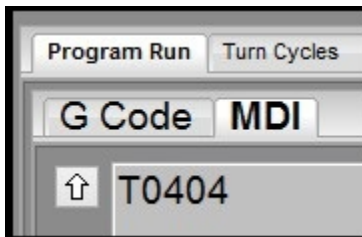
A quick look at the Tool Table shows Tool 3's Z offset is now set to -.2523.

 A screenshot of a CNC control interface window titled "Tool Offsets". It contains a table with tool offsets for Tool #3.

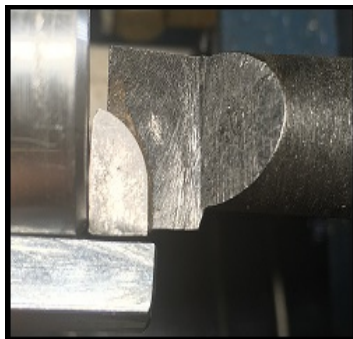
	Z	Z Wear	X	X Wear	Tip Dir	Tip Rad	Direction	Description
Tool #3	-0.2523	0.0000	-0.0317	0.0000	0	0.0000	Primary	

Tool 3's offsets are now set.

TOOL 4



In the MDI Tab, call a tool change for Tool 4 ; T0404. Then hit Cycle Start. Follow the prompts to complete the tool change.



Jog Tool 4 to the 1.0” turned diameter.



Be sure the SET X DRO is set to 1.0" then click the "SET X OFFSET" button.



X for Tool 4 is set, and should reflect in the "Current X DRO."

-----**This is an ID cutting tool-----**
The gauge block depicted is used to align the cutting tip with the 1.0" diameter.



Jog Tool 4 into position to set the Z tool offset.



"Current Z DRO" displays the difference in Z as compared to the Master Tool.

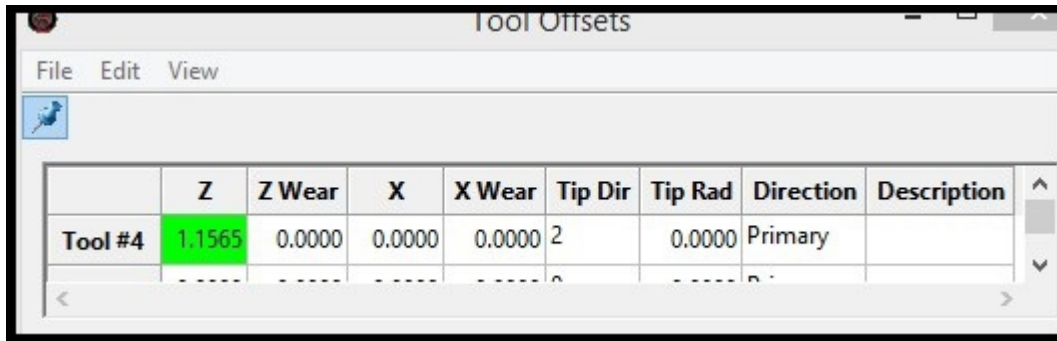


Click on the "SET Z OFFSET" button.



The "Current Z DRO" should reflect this change.

A quick look at the Tool Table. 1.1565 has been set to Tool 4's Z offset table.



Tool #	Z	Z Wear	X	X Wear	Tip Dir	Tip Rad	Direction	Description
Tool #4	1.1565	0.0000	0.0000	0.0000	2	0.0000	Primary	

Tool 4's offsets are now set.

Tools 1-4, as well as a fixture offset, have been set. These tools' offsets are now written and stored in the tool table. They will not change unless they are changed by the user. Practicing this Master Tool method will allow users to easily have multiple tools set up in their tool table regardless of how many of them can be mounted on a machine at one time.

This method also allows for very quick transfer from part to part, even if the parts are not similar.

The setting of a Z Fixture Zero with the master tool will set all preset tools for any job with one click.

This document's procedures for setting fixture and tool offsets in Mach4Lathe are the practiced and supported methods of Newfangled Solutions.

****Click on the link below to view to associated video****

MACH SUPPORT CHANNEL