Centroid CNC Tool Height Offset Methods: There are three main ways to setup and define tool lengths.

Method 1.) Measure Tool Lengths from the Z machine Home position.
Method 2.) Use a reference tool to measure tool lengths relative to the reference tool length.
Method 3.) Always re-measure every tool before use (don't use a reference tool or reference position, don't use tool offsets at all)

Which Method you choose hinges on:

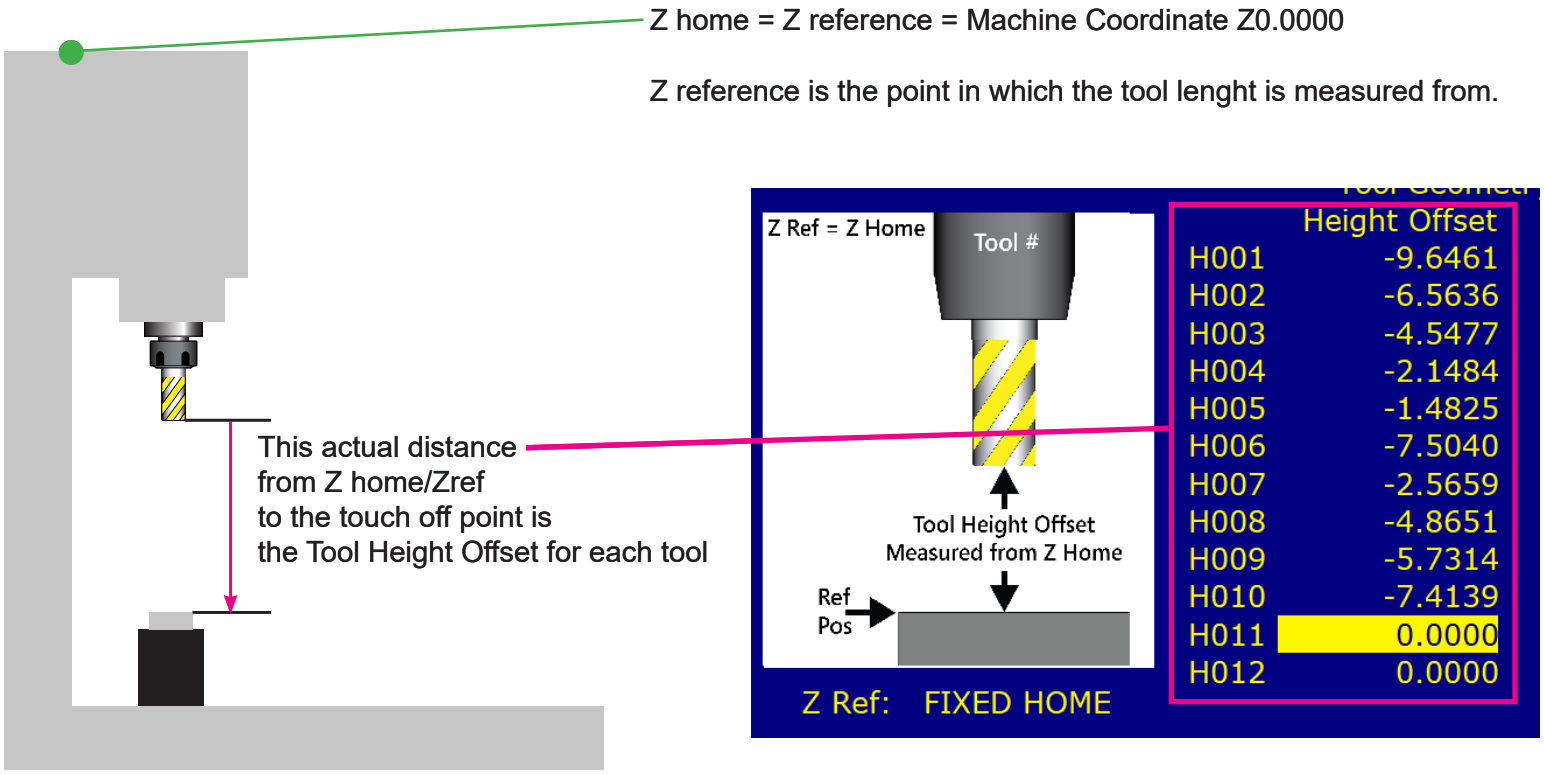
- If the machine has a reliable Z home position or not
- If you want to retain tool heights from day to day, maintain a tool library with many tool holders setup with commonly used tools or do you have one tool holder and you are constantly changing out bits and there for changing the lengths of those tool each time you take then in and out of the spindle/tool holder (think collet type spindles on inexpensive routers)

Once you have decide which Method you want to use. Then you can use a wide variety of work flows used to actually measure the tool lengths to suit your application or personal preference.

If the machine does have a reliable repeatable Z home position then I suggest Method 1. Method 2 will work on a machine tool that has a reliable machine home position as well. So, in the case of a machine with a reliable Z home position it is user preference which method to use.

If the machine DOES NOT have a reliable Z home position then Method 2 or 3 will be employed.

Machine has reliable Z home position. Method 1:



Method 1 example above in inches, note the tool height offsets are all negative values. These values are simply the distance the machine had to move in Z from Z home to the tool touch off for each tool. Set CNC12 parameter #3 = 6 to let CNC12 that you want to use this method and CNC12 will automatically set the Z referecnce position to equal Z home after the daily machine homing has been completed. Tool heights will automatically be retained day to day and only one tool is required to set a part Z zero position and all the tools setup in the tool library will automatically be set that same Z part zero. (no need to remeasure any tools unless they break or are changed, even then only that tool needs to be reset)

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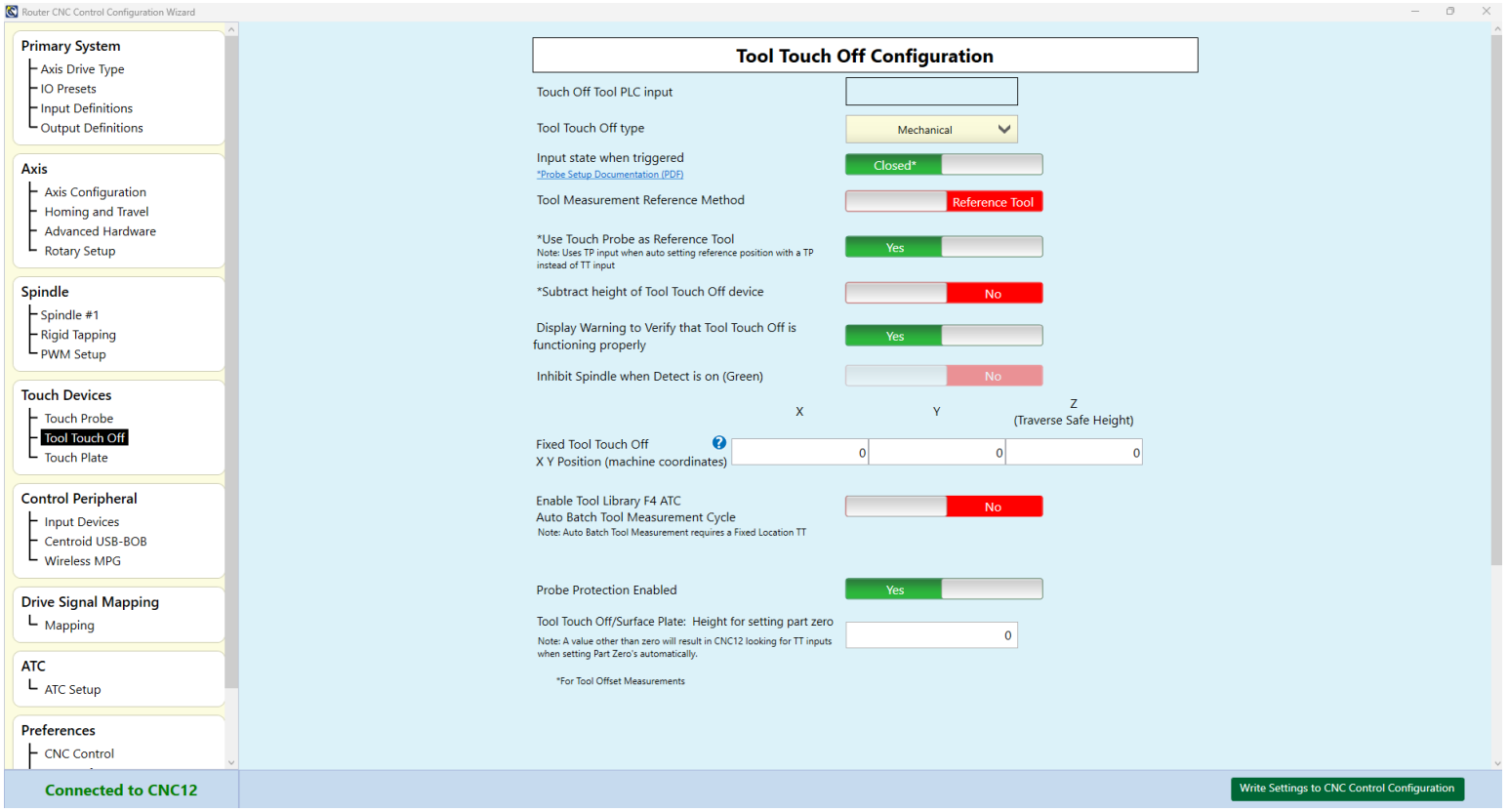
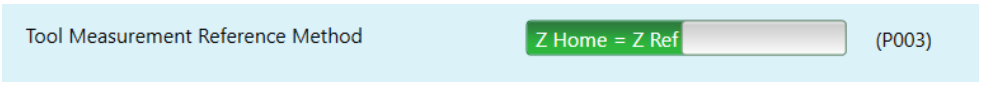
The Centroid CNC control configuration Wizard provides a choice on which method to use.

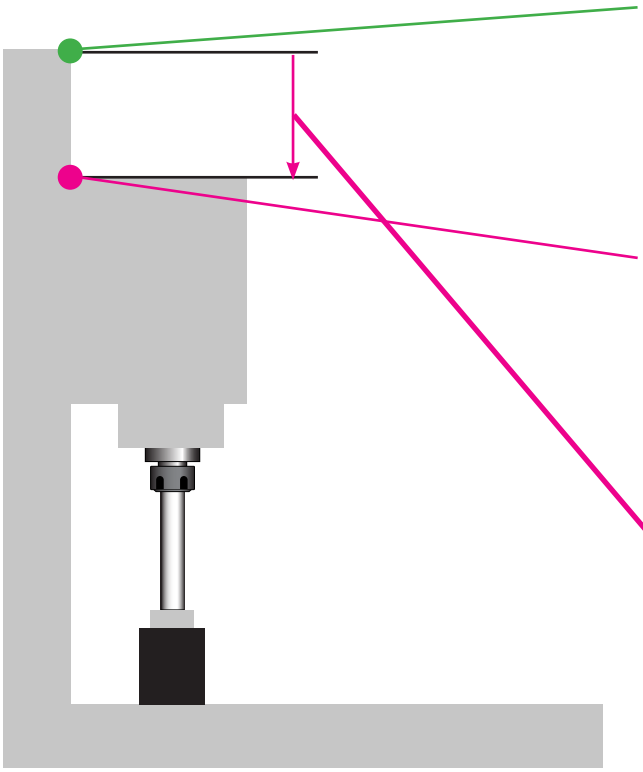




P3 = 6 = Method 1, Machine Home

P3 = 4 = Method 2, Reference Tool

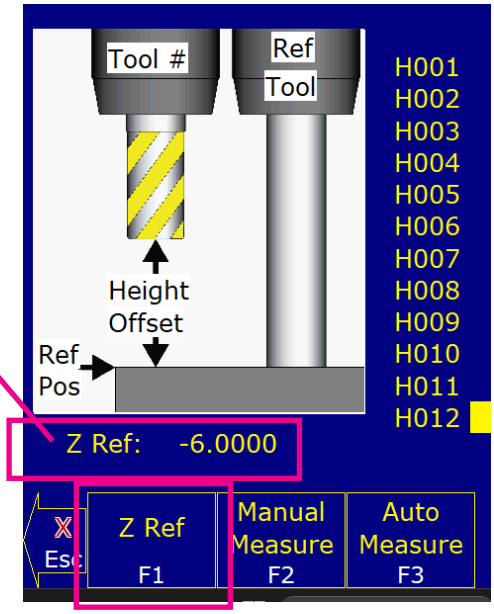
Method 2: Machine does not have a reliable Z home position. Use a refernce tool to set a reference position to measure tools against the lenght of the reference tool itself.



Z home = Machine Coordinate Z0.0000

Z reference = point in which tool heights will be measured from

Z reference is set each day by the user before measuring any tools

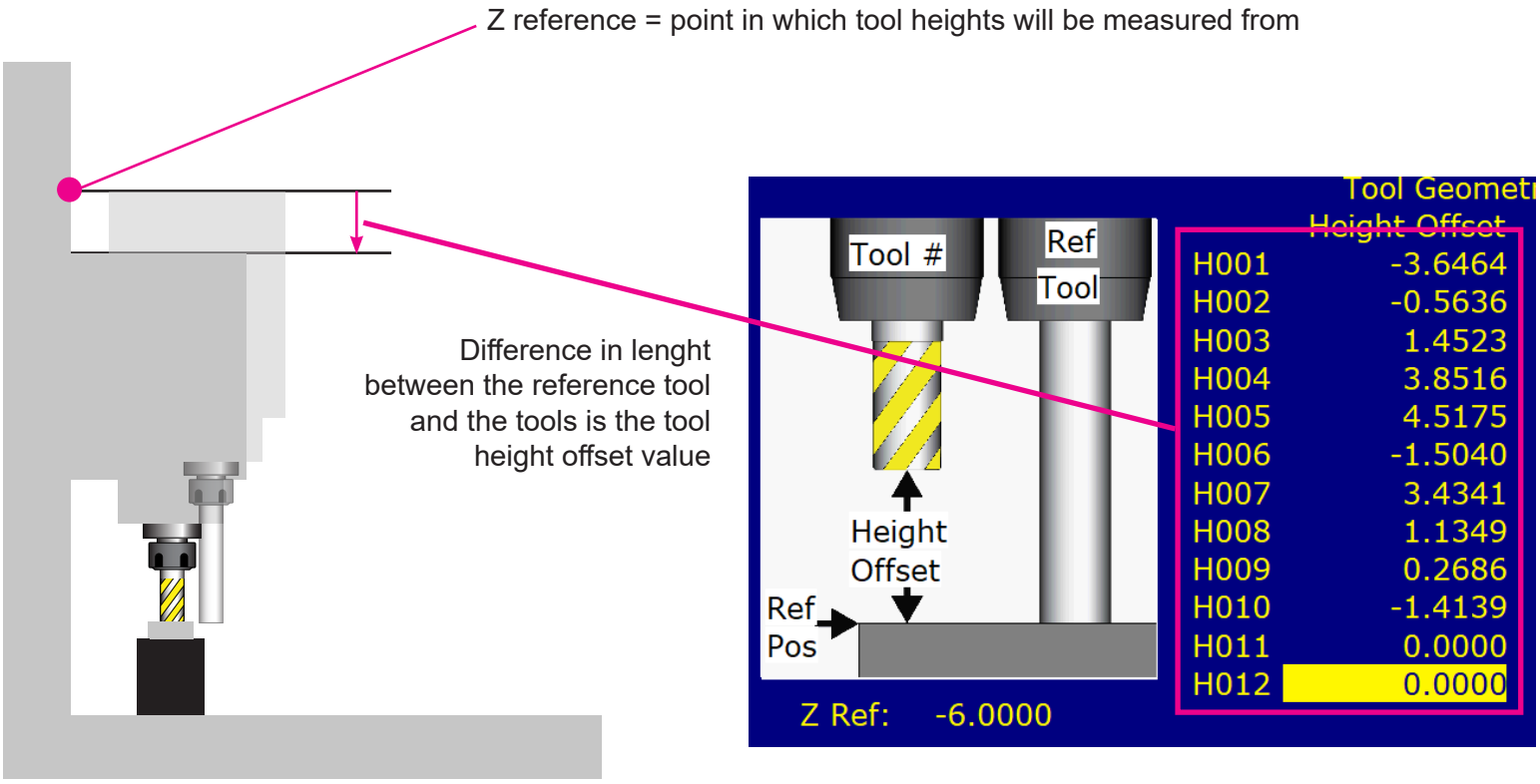


Set up a reference position with a referecne tool.
1.) Home the machine
2.) Touch refercne tool manually or automatically to the tool touch off point press F1 Z ref and follow the intstructions.

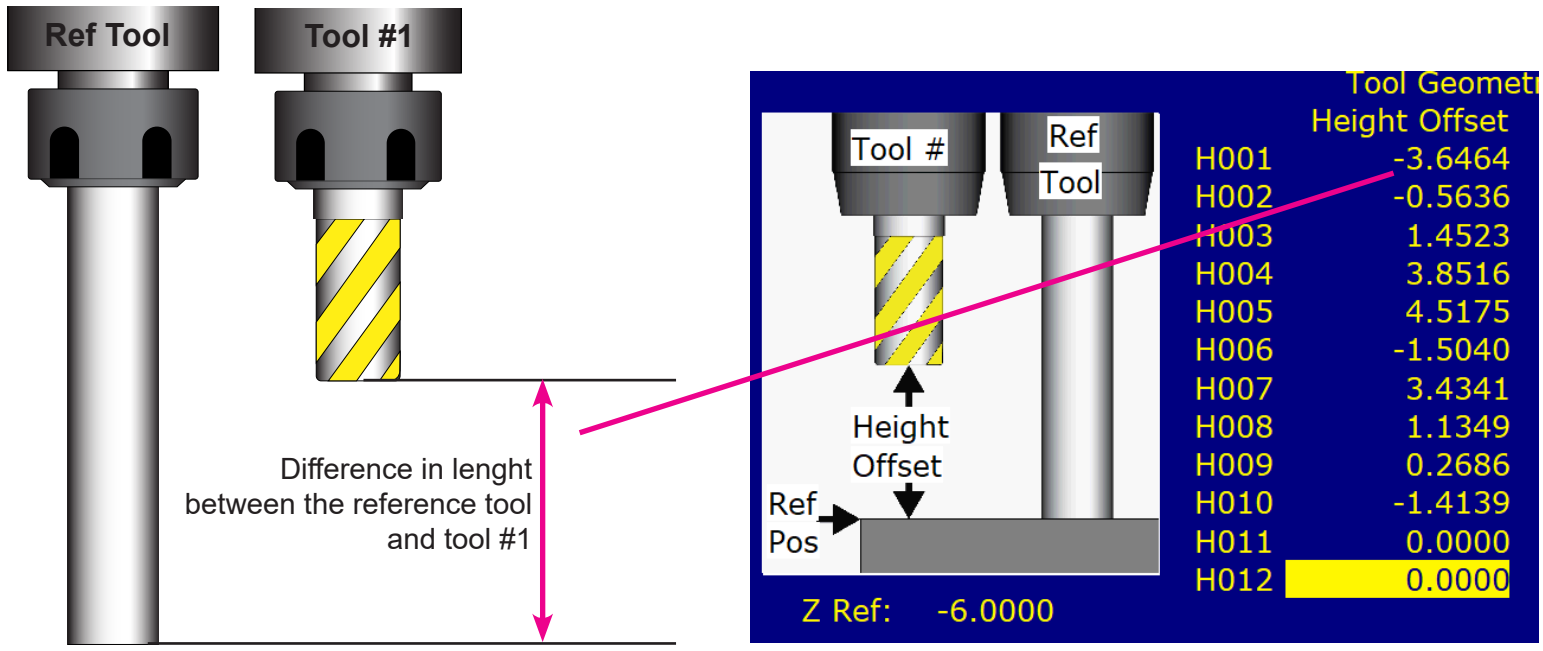
The Z reference point value is the distance CNC12 moved the Z axis from the Z Machine Home (machine coordinate z 0.000) to touch the reference tool to the tool touch off point.

If the machine does not have a reliable Z home position this Z reference point value will often CHANGE each time you set the Z reference position with the referecne tool But that is ok, since Method 2 uses a measured DIFFERENCE in lenght of the actual tools to a standard (the referecne tool) the position of the Z reference point itself is of little consequence as it is just a temporary point in which to COMPARE tool lenghts of actual tools to the reference tool itself.

The reference tool can be an actual tool number if you like. In our example Tool #12 is the reference tool. If you measure the Reference tool against itself the Height Offset value for the reference tool is 0.0000 since it is not longer or shorting than itself.



Method 2 example above in inches, note the tool height offsets can have positive or negative values. These values are simply the distance the machine had to move from Z reference to touch the tools to the same tool touch off point that the referece tool has used to set the reference position. These values are simply the difference in Lenght between the referecne tool and the actaul tool itself. Positive numbers means the tool is longer than the reference tool. Negative numbers means the tool is shorter than the referecne tool.
In this example these are the same tools used in the Method 1 example. Note the height offset values are different eventhough they are the same tools. The reference tool in this example is 6” long. Set CNC12 parameter #3 = 4 to let CNC12 that you want to use the reference tool Method 2.



Once you have determined which main method to employ each method support a wide variety of work flows to accommodate specific machine applications and personal preferences. For example, below is list of common tool height setup work flows, note this is a incomplete list and Centroid CNC12 is not limited to any of these work flows

1.) Method 1: Measure from Z home
    a.) with a fixed position TT, with a movable TT
    b.) with a 123 block manual touch
    c.) with an ATC auto touch with TT fixed or movable, or with a 123 block and manual touch
    d.) with a laser fork TT, with or without and ATC

2.) Use a reference tool to measure from
    a.) with a reference tool
    b.) with a probe as a reference tool
    c.) with a fixed position tt, with a movable TT
    d.) with an ATC auto touch with TT fixed or movable, or with a 123 block and manual touch
    e.) with a laser fork TT, with or without and ATC

3.) Always reset part Z zero with each tool that is about to be used before use (don't use a reference tool or reference position, don't use tool offsets at all)
    a.) do this manually
    b.) do this automatically with a custom M6 with a TT (fixed or floating) so for each tool change CNC12 will proper the operator to use a TT or 123 block or paper to touch off the tool within any G code job.

What ever main method you choose the variation are the exact same process just using different devices.

Pitfalls.
- Don't mix up setting part zeros with setting tool heights
- Don't mix up using a reference tool with measuring tool height from z home (don't try and use both methods at the same time)

CNC Router Tool Touch Off, Tool Height Offsets

Router Method 1: A Fixed TT Position for setting Tool Lenghts and using a Moveable Touch Plate for Setting Part XYZ zero positions a common router tool and part zero setup and work flow.

Method 1 Requirements:

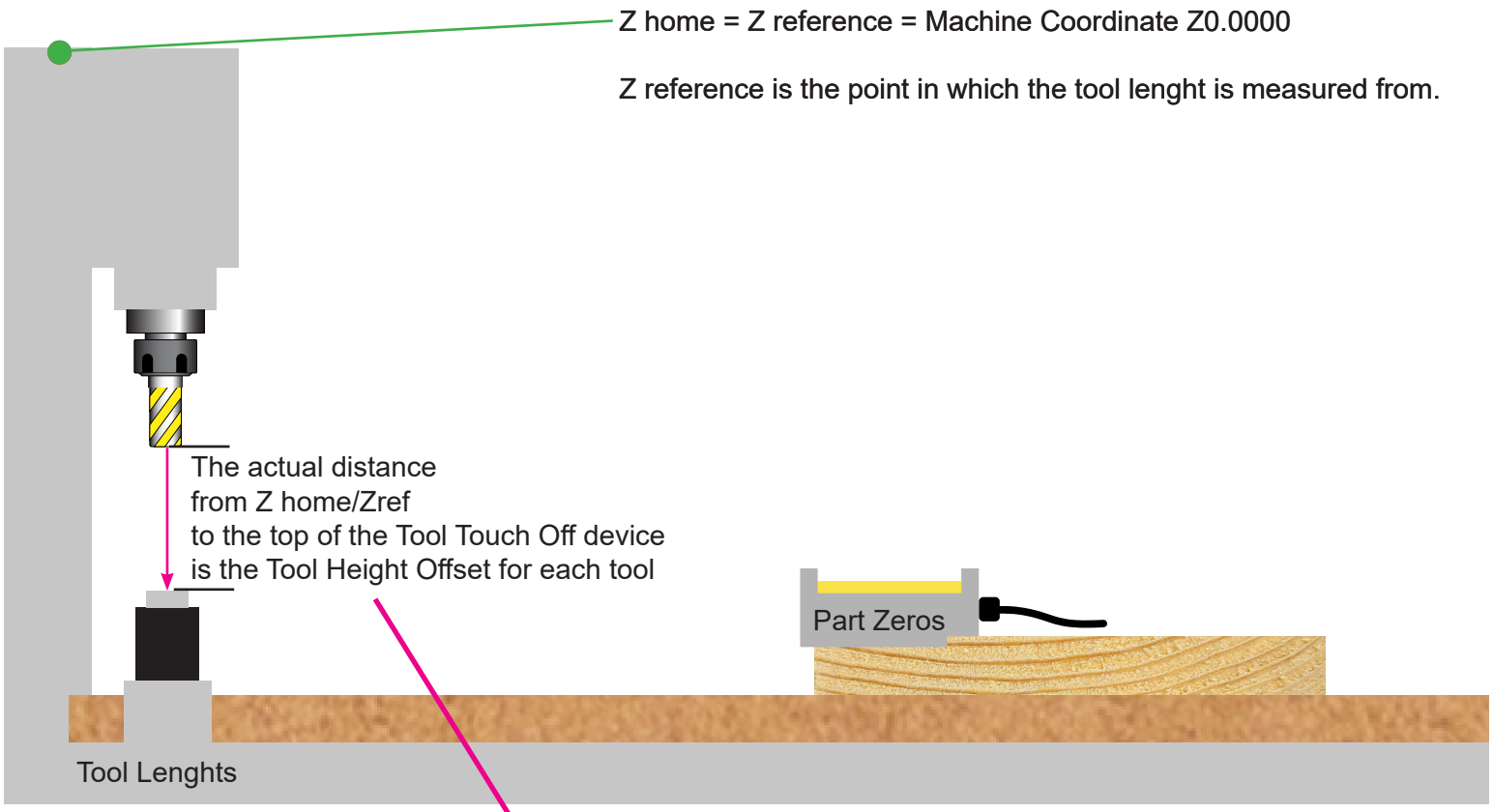
a.) A reliable repeatable Z Home Position. Typically this means Auto Homing is setup and working and uses switches that repeat to the desired accuracy and repeatability for the machine tool application. A reliable home position is most important since this method uses the Z home position to measure Tool Lenghts from.

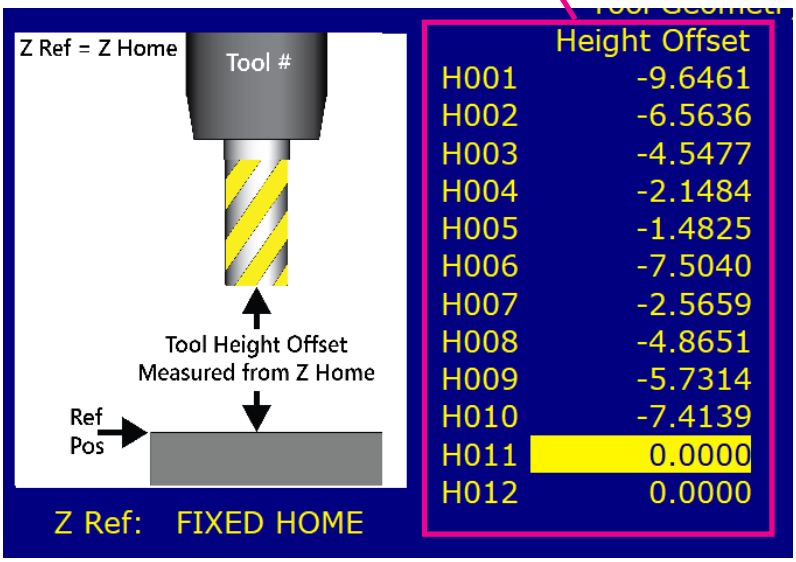
b.) A fixed mounted Tool Touch Off somewhere in the Machine Coordinate system envelope.

Advantages of Router Method 1.

a.) Daily setting of the Z reference position is elminated since Z reference is automatically set during the homing of Z

b.) Using a reference tool is unnessary





When using Method #1 the Tool Height Offset vaules will always be negative. They are negative since they are measured from machine coordinate Z zero (home) position which is at the top of the Z axis travel and therefore any move from Z home towards the TT is by definition negative.

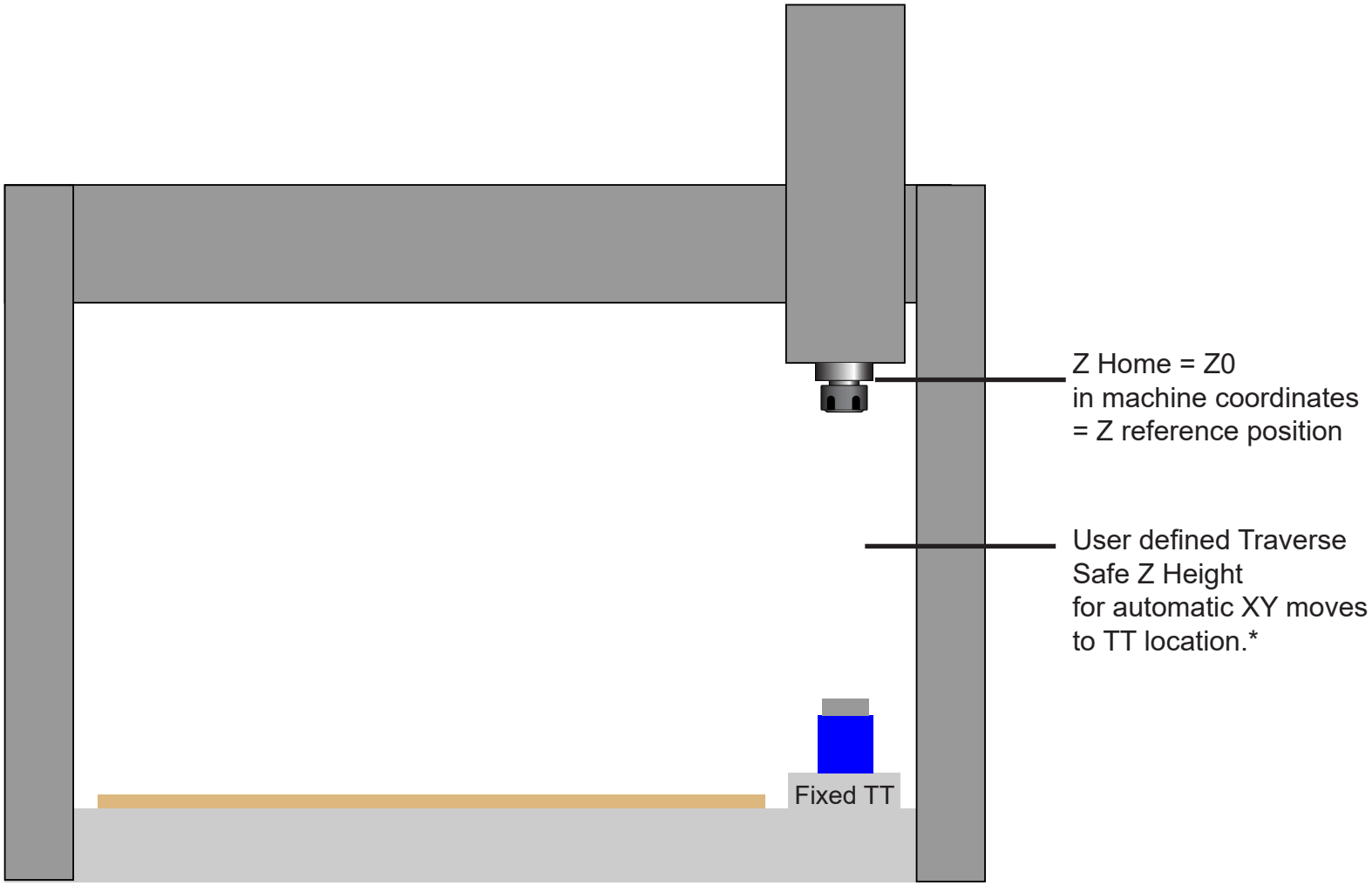
Definition of “Maintaining a Tool Library”: Typically means that the operator will maintain a set of commonly used tools in numbered dedicated tool holders. For instance Tool 1 is always a 1/2” diameter 2 flute tool which has its own tool holder. Tool 2 is always a 1/4” 2 flute tool and has its own dedicated tool holder (not switching out collets in the same tool holder!) etc. These tools are fixed in the tool holder and the lenght of the tool does not change until the bit is broken or worn out and replaced.

- When a bit is broken and replaced only that tool number needs to be remeasured using the TT. All the other measured tools are still valid.

- When maintining a tool library you can use any tool in the tool library to set a Part Z zero location and all the other tools in the Tool Library will automatically be set to that Zero position as well.

- Method 1 can be used with Maintaining a Tool Library OR *not!* If you choose to not maintain a tool library having a fixed TT still has its advantages and works. When *not* maintaining a tool library the operator simply measures each tool before use if it has changed lenght for instance when using same tool holder with different collets and different tools.

Fixed Position Router TT



* If you are unsure of what to set the Traverse Safe Z Height to, set it to Zero so any automatic XY traverse moves will travel the Z axis at the Z Home Position so it is less likey to crash a long tool into something.

A fixed position TT can be mounted anywhere within the machine coordinate system.
The XY position of the fixed TT is measured from the Home position (Machine Coordinates X0Y0).
In the example below, machine home is in the lower left and the TT is mounted to the right and back.
In this case the TT XY position numbers will both be positive for instance X50” Y92” from machine XY zero.