# TB123 (Rev1) - Rigid Tapping Setup

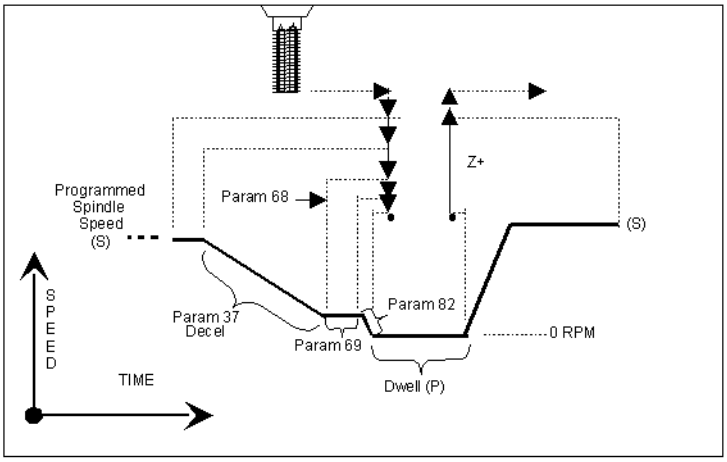
### Overview

This document describes the theory of rigid tapping parameters, to control accuracy of depth of cut and quality of threads, in various working materials.

There is no set specification on over-travel or under-travel associated with rigid tapping; therefore rigid tapping must be considered an "art" of machining. Centroid makes no warranty or guarantee regarding rigid tapping depth of over travel.

If rigid tapping results are not satisfactory, the user should consider purchasing an inexpensive and very forgiving floating tap attachment or using the very versatile thread milling technique, both are supported by Centroid.

### Graphic representation of parameter controls



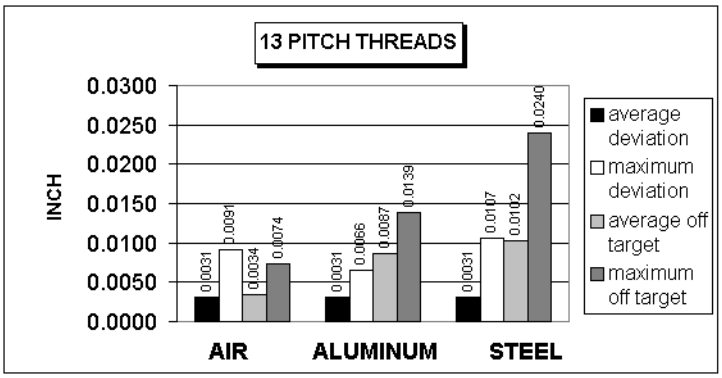
**Rigid Tapping Parameters**

| Parameter | Value | Function |
|---|---|---|
| 34 | 4,096 | Sets the counts per revolution (cpr) of the encoder. The encoders so far have been 1024 lines, providing 4096 cpr. If the encoder counts up when the spindle turns CW then the value should be positive. If the encouder counts up when the spindle turns CCW then the value should be negative. |
| 35 | 5 | Spindle encoder input (See chart below) |
| 36 | Bitwise value | Bit 0: 0-Disable rigid tapping, 1-Enable rigid tapping<br>Bit 1: 0-Wait for index pulse during rigid tapping, 2-Do not wait for index pulse<br>Bit 2: 0-Do not allow spindle override, 4-Allow spindle override.<br>***Example:*** A value of 3 will enable rigid tapping (bit 0 = 1) and during execution will not wait for the index pusle to start (bit 1 = 2) and the spindle override will not change the spindle speed<br>(bit 2 = 0). |
| 37 | 3.0 | Spindle deceleration time. This value is used for setting the spindle deceleration rate from the programmed spindle speed (S) down to the spindle speed of Parameter 68. Check the value of your inverter setting and enter it. (i.e. if the inverter is set to 3 seconds deceleration, enter 3). |
| 68 | 400 RPM | Minimum Rigid Tapping Spindle Speed (in RPM). This parameter hold the value that the spindle slows down to from the programmed spindle speed towards the end of the tapping cycle. The lower the value, the more accurately the Z axis will land on target, but at the expense of possibly stalling the motor which in turn will cause Z to stop short. If this value is too large, the off-target error increases. |
| 69 | 1.25 sec | Duration for Minimum Spindle Speed mode (in seconds). This is a buffer time value to allow the spindle time to decelerate to S=Parameter 68. If the number is too small, overshoot may occur. If too large, the user waits longer for hole to be tapped at the slow speed specified by Parameter 68. |
| 74 | 4 | Spindle M function to be run at the ***bottom*** of the hole for **G84** tapping.<br>Spindle M function to be run at the ***top*** of the hole to for **G74** counter tapping. |
| 84 | 3 | Spindle M function to be run at the ***bottom*** of the hole for **G74** tapping.<br>Spindle M function to be run at the ***top*** of the hole to for **G84** counter tapping. |
| 82 | 720<br>(2 revs) | Spindle Drift Adjustment (in degrees of rotation, i.e. 360 = 1 full rotation, 90 = 1/4 rotation). This value is the number of turns that the spindle makes to coast to a stop when it is shut off at the rpm specified by parameter 68. This value is proportional to the distance above the Z target at which the spindle motor must be shut off in order for Z to land on target. (Remember that Z is slaved to the spindle speed during rigid tapping.) |

### Spindle Encoder input Chart

| CPU7/CPU9 | | CPU10 | | | |
|---|---|---|---|---|---|
| Encoder Input | Parameter 35 | DC | | AC | |
| 3 | 2 | Encoder Input | P35 | Drive Type | P35 |
| 4 | 3 | | | | |
| 5 | 4 | 5 | 4 | SD3 | 6 |
| SD3 drive 6 | 5 | | | SD1 | 21 |

### Graphic representation of test results for precision




The above charts show test results of rigid tapping, utilizing version 7.14 software. The tool used in the testing was a 1/2-13 spiral fluted tap with TiN coating. Coolant used was water base soluble oil. Hole size was .4218. Tapping depth was .800. Also note that the parameters were adjusted to cut air, and not changed for aluminum or cold rolled steel for these tests. It can be seen, as the material changes, so does the off target values. This is due in part to the amount of torque required from the spindle to cut the various types of material. For testing purposes, the parameter settings for the above results were as follows.

Parameter 36 = 1, Parameter 37 = 3, Parameter 68 = 100, Parameter 69 = 1.25, Parameter 82 = 108

### Summary

Rigid tapping parameters will vary from machine to machine. Not all machines are built the same (i.e. Spindle hp, inverter type, rigidity, etc.), and tooling will play a roll in performance also. It was found through our testing, if we changed one physical parameter, (i.e. using a tapping oil instead of water base coolant), it improved the off target values by 1.5%. This is due to the fact that less friction is present when using special cutting oil, therefore requiring less hp by the spindle to drive the tap. In most cases, rigid tapping depths should be able to be held within +/- .008 inch or less by adjusting parameter 82 for specific cases.

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**Document History**

Rev1 Created on ***2001-07-03***