TB145 (Rev1) - Hand Tuning a Router

Overview

Hand tuning is not usually necessary with Centroid controls. However for some applications like routers you can often hand tune for more speed, and a little less accuracy. If you are not familiar with the effects that the different PID settings have, then you can read about them in Tech Bulletins 44 and 45. Note: If you are not familiar with the PID variables then you should NEVER change any of the settings. Damage to machine and or people can occur from incorrect values.

Tuning Process:

1. Start by setting the router table **Deadstart** to **5.0** and the **Delta V Max** to **15**.
2. Run an **Autotune** on the machine to get a good idea of what the machine is capable of. If **Autotune** gives you strange results at this stage, then please refer to the section below on machine setup.
3. Once the machine has been autotuned we will begin the process of determining the Max Rate the machine can be set to and still maintain position. Test that the machine can traverse at the Max Rate as set by Autotune. To do this either write a program for it or use **MDI** to issue a **G0** command for each axis in turn.
4. If the machine is able to move at the **Max Rate** as set by **Autotune** without any position errors, then you may begin to raise the **Max Rate** for each axis slowly.
4-1. Each time you raise the **Max Rate**, the software will prompt you to change the **Accel** time.
4-2. When you change the **Accel**, you must then change the **Ka** proportionately. For instance if you double the **Accel** time, you must half the **Ka**. For instance, if the **Ka** was set to 50, and the **Accel** to 0.1, if you needed to change the Accel to 0.2 then you would half the **Ka** o 25.
5. If an Axis has position errors, you have exceeded the **Max Rate** possible for that axis, and you need to back off a little and try again.
6. Once you have found the maximum rate that the machine will work at, reduce to 0.9 of this value. This is to allow for any mechanical changes on the machine from one day to the next. You must readjust the **Accel** and **Ka** accordingly.

For an example of PID settings before and after hand tuning, please see the tables below.

Example PID Settings After Running Autotune

Axis	Kg	Kv1	Ka	Accel	(Max Vel.)
X	0	4	44	0.130	600
Y	1	4	22	0.130	600
Z	3	3	30	0.130	600

Example PID Settings After Hand Tuning

Axis	Kg	Kv1	Ka	Accel	(Max Vel.)
X	0	4	22	0.260	1200
Y	1	4	11	0.260	1200
Z	3	3	15	0.260	1200

Machine Setup

It is important to remember that you cannot expect to hand tune, and then run the router at higher speeds if the machine is not setup correctly mechanically in the first place. The following should be done to ensure correct setup.

1. First thing you should do is run a **Drag Plot** on the machine to machine to ensure it is in alignment and that it has no tight spots. If you are not familiar with running a Drag Plot, please refer to Tech Bulletin 47.
2. The Turns Ratio on the machine should not be less than 1.5 Turns per Inch. If it is you will need to raise it above 1.5 Turns per Inch. Typically most routers run between 1.5 and 2 Turns per Inch.
3. It is important that the **Autotune Move Distance**, as governed by parameters 95 through 98, is set correctly for the machine setup.

The move distance depends on the **Turns Ratio** that is set on each axis. Please refer to the table below for approximate settings.

Turns Ratio	Autotune Move Distance
5.0 Turns per Inch	2.0 Inches
4.0 Turns per Inch	2.5 Inches
3.0 Turns per Inch	3.5 Inches
2.0 Turns per Inch	5.0 Inches
1.0 Turns per Inch	10.0 Inches

Document History

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