

### MACH3

Mach3 software controls the axis / moving parts of the machine which have motion. Motion is composed of other parameters such as time and velocity. So acceleration is just one required value the software must know in order to control the motion. The description of a machines axis motion is defined to Mach in Motor Tuning and Setup. Figure 1 below shows a Trapezoidal motion profile which is used in Mach. (Note: There are other motion profiles but the information here is restricted to the movement profile found in Mach).

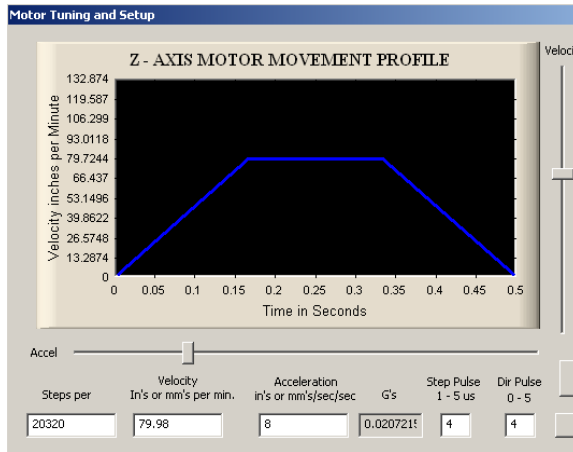


FIGURE 1 – MOVEMENT PROFILE

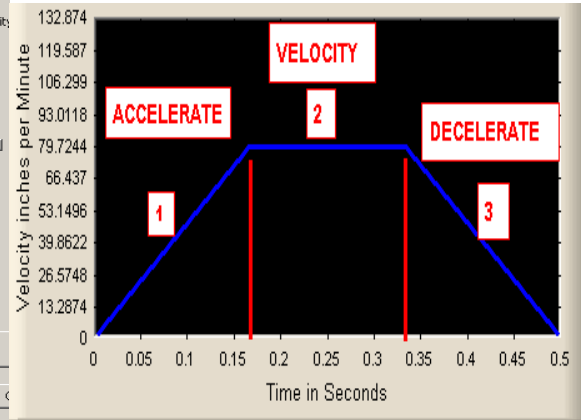


FIGURE 2

The motion shown in Figure 2 is composed of three parts and related to time. The axis will accelerate at a constant change rate until it reaches a velocity, then the axis will maintain that velocity, and then decelerate.

Figure 3 shows acceleration from a lower constant velocity to a higher constant velocity. (The figure is provided for understanding and is not part of motor tuning)

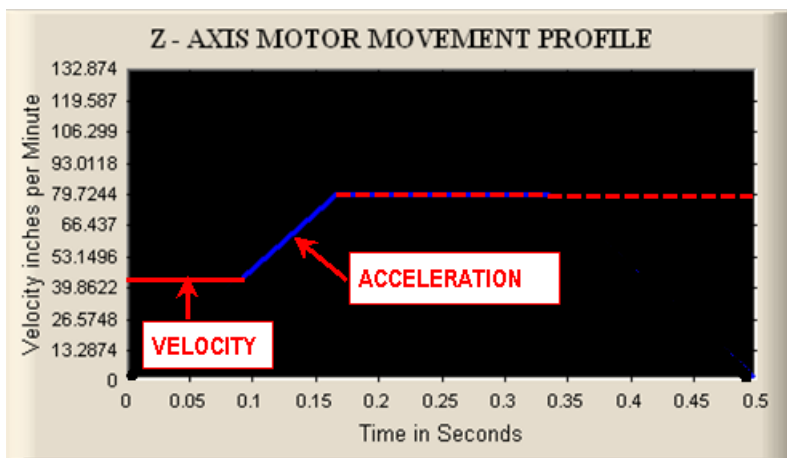


FIGURE 3

## KERNEL SPEED

The graph shown in Figure 2 was based on a Kernel Speed of 25000 Hz. The selected Kernel Speed defines how many pulses you want the computer to output when using Mach3 and is defined as shown in Figure 3. The Driver Test, when run, will confirm that the selected Kernel Speed can be used in harmony with Windows since Mach is sharing time with the operating system. Changing the Kernel Speed will change the graph in Figure 2 increasing or decreasing the max allowable velocity the software will use. There is no advantage to using a higher Kernel speed than necessary.

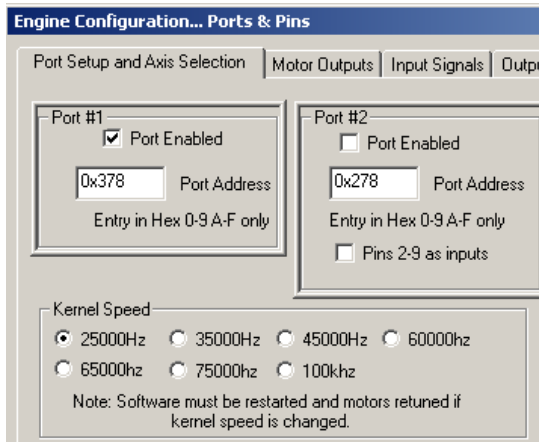


FIGURE 3

The computer output ( number of available pulse instructions to the drive ) can restrict the velocity, the steps per unit input is calculated and is composed of the axis components, the drive may be limited to how many pulses it can send to the motors, how fast something can accelerate to a velocity is dependant on the axis systems ability to provide adequate torque at some rate to address the systems inertia. All this is interrelated, so keep in mind the above comments and hopefully what was noted before is taking on some meaning, namely.

*In practical applications one defines an acceleration desired and finds what is required to achieve it ...or ... accepts the value based on some other parameters.*

Figure 4A & 4B shows the affect of changing the Kernel Speed ( KS) and the result for the same given acceleration, velocity and steps per unit value.

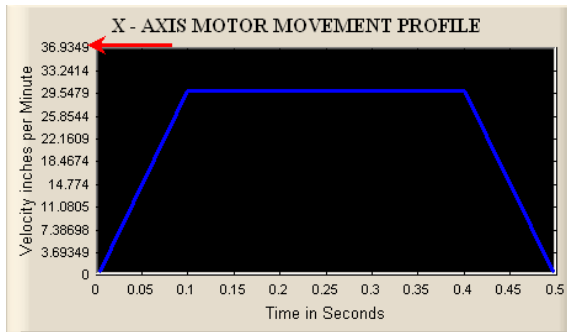


FIGURE 4A KS=25000

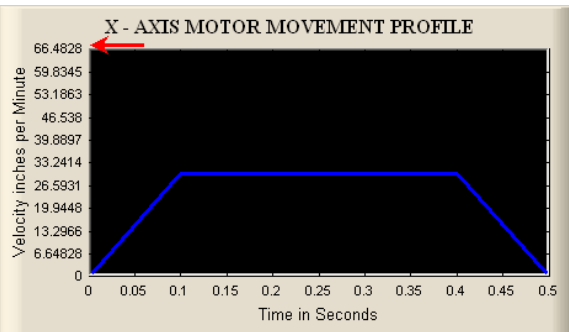


FIGURE 4B KS=45000

The velocity which is shown in terms of IPM ( inches per min) was almost doubled. That does not mean your machine has the capability to achieve the higher velocity that the software is using. IPM terms are used in CNC and one can convert to inches per minute, feet per second, miles per hour, etc if they can't relate to IPM.