Many Mach 3 users are very confused about the CV settings and how they affect machine motion. Maybe I can shed some needed light on the topic :)

General Logic Configuration (Config -> General Config...)

-Motion Mode (Constant Velocity OR Exact Stop)

Constant Velocity "CV" – This mode attempts to maintain a constant velocity during ALL angular or arc moves while obeying the acceleration parameter. This is not possible during some moves...such as single axis moves that change direction (i.e. Motion must stop at some point during these moves). On moves where constant velocity can be maintained, the corners will be rounded depending on how high the acceleration is set combined with the *CV Distance Tolerance* (see below) . Higher accelerations and smaller *CV Distance Tolerance* values will result in tighter corners and lower following errors. Note, this is NOT the same as servo following error and has nothing to do with PID control. Servo/Stepper following errors will be slightly WORSE than the CV induced following error depending on how "tight" the servo loop is. Stepper motors will lag as well (+- 1 full step), and will lose steps if pushed too far (VERY BAD).

Exact Stop – This mode accelerates and decelerates to each "point" in the gcode. Mach-3 only sees one move at a time and usually machines run somewhat rough and very slowly in this mode. Exact stop should only be used where a machine must not round any corners (inside or outside). However, remember that most CAM software will output many tiny G01 moves to form arcs. In exact stop mode this type of movement will leave very bad surface finishes and can be hard on tooling and machine components.

-General Configuration (LookaHead_____ Lines)

Only applicable in CV mode. This determines how far "down the road" Mach-3's motion planner is looking. Setting this to a low number is like driving your car while being very nearsighted. A high setting is like 20/20 vision and using binoculars when necessary to see far down the road. This allows the software to better able to adapt to sudden changes in the motion path. It is recommended to keep this at around 200 for most cases. The maximum value is 1000, and setting this high may cause problems depending on the speed of your computer.

-CV Control (Plasma Mode, CV Dist Tolerance_____ Units.., G100 Adaptive NurbsCV, Stop CV on angles > _____ Degrees

Plasma Mode - Plasma mode will do anti dive stuff and also tries not to round the corners in some circumstances… For the most part this setting should not be used unless you are

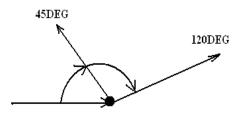using a machine with very bad accel and poor step resolution.

CV Dist Tolerance_____Units.. - This value affects the amount of rounding at the corners. Setting this very high will allow the machine to run as fast as possible. Setting it to a low value will result in less rounding of corners as the machine will follow closer to the geometry while trading off some speed. This is the distance from the end of the line that it is cutting to where the arc starts rounding… So it is the distance from the intersection of the CV arc to "true" end of the move (if it was done with Exact stop)

G100 Adaptive NurbsCV – This is old and needs to be taken out… this is from when the G100 was doing DDA's and is now obsolete

Stop CV on angles > _____Degrees – This is a really nice setting that automatically switches the machine from CV to Exact Stop mode depending on the approaching angle of the next line of code.   Setting to 90 degrees is usually a good compromise because most Gcode that has a 90 degree (or smaller) turn is usually indicative of where the user wants a nice sharp corner. However, some CAM software can output some REALLY bad code which represents an arc or angular move as a giant sequence of small 90 degree stair steps such as....

G01 X0 Y0
X0.01
Y0.01
X0.02
Y0.02

This code will run TERRIBLY with any setting at 90 deg or above. Sometimes it is VERY hard to tell if your code has this problem by just looking at the display window. This issue has had me banging my head against the wall, so if nothing you try will get your machine flying around the curves, you may want to look at your code. Also, it may be necessary to zoom way in on the Mach-3 toolpath display to see this sort of problem.

Shuttle Wheel Setting (Shuttle Accel.____ Seconds)

Determines how much time is allowed for the backlash takeup movement to take place. For my servo systems I set this to a VERY small value (0.00001). This will prevent the backlash motion from affecting the smoothness of the machine because the step pulses are sent out as fast as possible (to the limit of the kernal speed). A large number may be required in stepper systems to prevent lost steps. I also find it very helpful to set the backlash distance to some HUGE visible number (10mm), then it is easy to see how the

different backlash settings affect machine motion.

Backlash Values (Config -> Backlash)

Backlash Distance in units – This is the amount of slop/compliance/takeup/lost motion in your motion axis. For friction free machines (linear guides, etc.), the machine may slide back and forth across the backlash distance at will (during accelerations, heavy cuts, vibration). So it is really best to remove as much of the lost motion as possible before applying backlash compensation in software. For high friction machines (boxways/dovetails) or slow machines, this is not as much of an issue.

Backlash Speed % of Max – This is needed because backlash compensation is not constrained properly by the acceleration parameter. In a stepper system this will result in lost steps if set to 100%, while in servo systems 100% is just fine :)

Main Screen (Settings Alt6)

CV Distance – See above

CV Feedrate – This will CV a move BUT at the federate that you ask for. For example if you have a CVfeedrate set at 50UPM and your move is programmed at 20 the next axis velocity will accelerate to 20 at the same time the first axis decelerates down to 20. as a result the CV move will look just like a move done at 20UPM. The problem with this is that at high speed you will feel a massive amount of jerk in the system ☹.

It should be obvious that CV settings can have drastic effects on machine performance. While first starting out, it is best to turn CV on, and turn off all the other settings until you are very comfortable with the interactions that can take place. Servo systems are very forgiving in respect to CV settings and will not lose position no matter what. Steppers however can lose steps at the blink of an eye if a setting is not exactly right. For stepper users, keep things as conservative as possible and realize that pushing the envelope may result in lost steps and lost hair!

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