

Mach3 Controller Best Practices

Product: Mach3-Configured Controller (PN 34917)

Purpose: The purpose of this document is to provide best-practice instructions for Mach3-configured controller, which can experience motion errors during program execution.

Background: Motion error issues are often intermittent, infrequent, and may appear random. This makes them difficult to repeat and troubleshoot. This list of controller best-practices is compiled by Tormach from internal engineering testing, customer feedback, and correspondence with ArtSoft (the authors of Mach3 software). This list is applicable to any Mach3-controlled CNC tool.

While this list should not be considered definitive, following the best practices outlined below should help minimize the chances of incurring a motion error during the execution of programs.

Software and System Corruption Issues

1. Reboot controller once a day to force both Mach3 and Windows to restart.
2. Do not use anti-virus or malware-detection software as these programs may generate motion errors.
3. Scan flash drive for viruses on desktop computer before transferring files to machine controller. Although Windows Embedded Standard operating systems are designed for industrial use, Windows operating systems including XP, Vista, Windows 7, and Windows 8 can still carry viruses.
4. Do not load unnecessary software onto the machine controller — the controller should be dedicated to control of your CNC equipment only. Even common software, such as Adobe Reader and QuickTime has been shown to create problems.
5. Be aware that any software may have associated programs or processes running in the background. Those programs can generate intermittent signal interruptions that can result in motion errors.
6. Mach3 configurations can become corrupt. Keep your Mach3 software disc and Mach3 license CD in a safe location for later use in reloading Mach3. Both discs are needed to do a complete reinstall of Mach3.
7. The Windows Embedded Standard operating system can become corrupt. Use the Tormach controller restore disc to do a complete restoration of the hard disk, including all operating system files and software. Be aware that this is a complete restoration to *pre-shipped* status. Any G-code files, software updates, configurations, tool tables, or other information will be lost.

USB Devices and Hardware Conflict Issues

1. Be careful when installing untested USB devices. Understand that any device plugged into the controller may trigger the automated activation of device drivers or background software which may disrupt operation. This includes things as simple as keyboards or certain types of flash drives.
2. Do not use wireless devices with a Windows Embedded Standard operating system.
3. Do not interface via a USB-based parallel port; a true parallel-printer port is required.

4. When using a flash drive to transfer G-code files, transfer the file to the controller hard drive and unplug the flash drive. When plugged into a USB port, some flash drives run disruptive programs in the background.
5. Avoid passive and powered USB hubs as they can generate electrical noise.
6. Do not network controllers as are not intended to be connected to the Internet (as they do not have anti-virus software installed). In addition, Tormach controllers are shipped with the network Ethernet disabled.
7. When using Windows Embedded Standard operating systems, noisy electrical supply lines to your controller can cause any number of USB-related issues. Most commonly this results in lock up of USB-devices like a keyboard or mouse. Please contact Tormach Technical Support for more in-depth documentation on this subject.

Multi-tasking / Resource Management Issues

1. Never run any software other than Mach3 while machining.
2. Turn off the tool path display while running long programs (250,000 lines or more), or code using 4th axis motion. Mach3 may prioritize display updates over tool-path control, resulting in position problems.
3. Do not minimize/maximize screens. Mach3 may prioritize display updates over tool-path control, resulting in position problems.
4. Do not switch between Mach screen sets while code is active (either running or paused).
5. Do not rotate or zoom the tool path display. Tool path updates are computationally intensive and take significant time away from the controller. This is particularly true when there is an isometric display as opposed to flat XY view; rotations are the most difficult.
6. Do not update tool path display.
7. While running G-code, do not open Windows File Explorer or other programs such as Notepad.

G-code / Syntax Issues

1. Review tool-change call outs, especially when using G-code created with a generic Fanuc CAM post processor. Review your machine's operator manual on how Mach3 prefers to see tool-change call outs. Mach3 will ignore tool-length offsets if this syntax is not followed.
2. Avoid unnecessary code usage such as turning on a canned cycle (G81) immediately followed by turning off the same mode (G80). Verbose and pointless codes are often inserted by poorly-planned CAM posts and have been associated with motion errors in Mach3.

Additional Technical Information:

1. Mach3 does not require a controller with a powerful processor, but it does need the controller's full attention. Because Mach is a real-time, motion-control program, it relies on the controller to supply a consistent pulse stream of control signals (used by the stepper drivers and motors) to create motion. If, during machine motion the controller spends time (measured in milliseconds, or even microseconds) processing information unrelated to Mach3 core functions, control signals will be inconsistent. Poor-quality signals from the controller may result in problems ranging from minor loss of position to major axis stalls and crashes.
2. For a detailed technical discussion of the relationship between Mach3 and the controller it is running on, please read the Tormach Machine Controller White Paper (http://www.tormach.com/engineering_tmc.html).