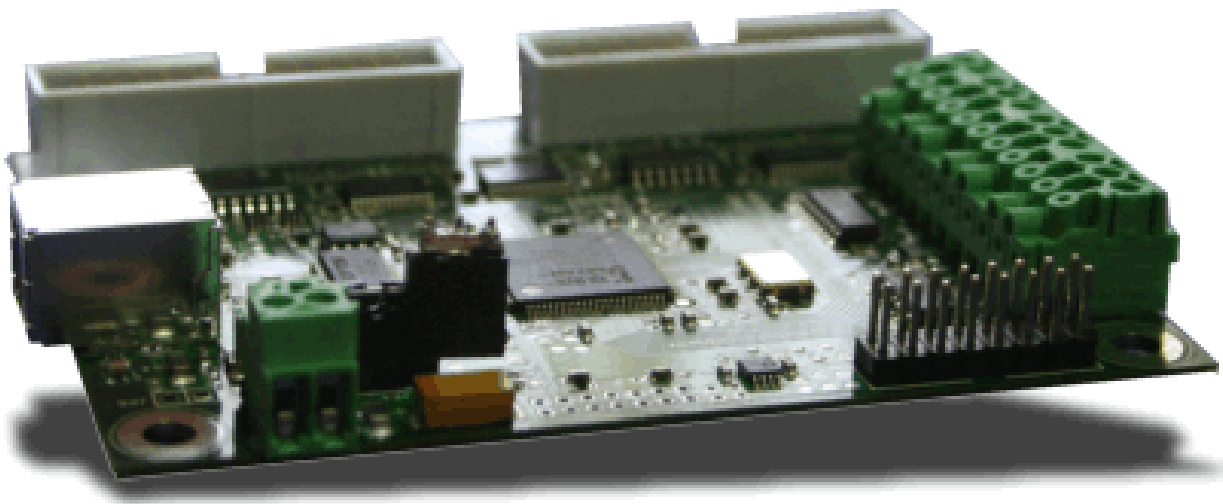

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Installing and Configuring the SmoothStepper V1.5

Jeffrey T. Birt



A quick guide to installing and updating the SmoothStepper

I have had several questions recently about how to configure the SmoothStepper and also how to update it when a new driver and/or plug-in is released. This guide is intended to aid those folks who are wanting to know a bit more about configuring the SmoothStepper for best performance and keep it update with the latest driver and plug-ins. Please do not try and run Mach until your installation or upgrade is complete.

This guide is not complete and is not intended to replace the SmoothStepper or mach user's manuals. Please download both of them as they contain valuable information.

What you need to get started doing a fresh installation

- Download the latest Mach 3 lock-down version here:
<http://machsupport.com/downloads.php>
- Download the latest SmoothStepper driver AND plug-in here:
<http://warp9td.com/downloads.htm>

We recommend using the latest Mach 3 lockdown version which can be downloaded at the link above. NOTE: you must use Mach 3 version 3.042.032 or later to be compatible with the latest SmoothStepper plug-in. Follow the standard installation instructions for Mach which can be found [here](#). When using the SmoothStepper you do not need to install Mach's parallel port driver. Be sure to reboot after the installation is complete.

To allow Mach 3 to recognize and use the SmoothStepper you will need to install the SmoothStepper driver and SmoothStepper Mach 3 plug-in. We suggest using the latest plug-in and driver versions. NOTE: you must use plug-in version v015ogx2.M3P and driver version 2.04.16 or newer with the latest versions of Mach. Unzip the files; I like to copy them into a new folder named 'SmoothStepper' on my desktop, please refer to Figure 1.

Next, plug a USB cable in between the SmoothStepper and PC. When prompted by the 'Found New Hardware' wizard choose the 'Have Disk' option and browse to the driver file you downloaded and select the '*.inf' file. After the driver has installed double click on the plug-in file and it will be installed into the Mach plug-in folder. Please note that after the plug-in installs it will erase the .m3p file. NOTE: For Windows 7, after the SmoothStepper is plugged in please stop Windows from trying to find and install the driver and follow the driver upgrade instructions given below.

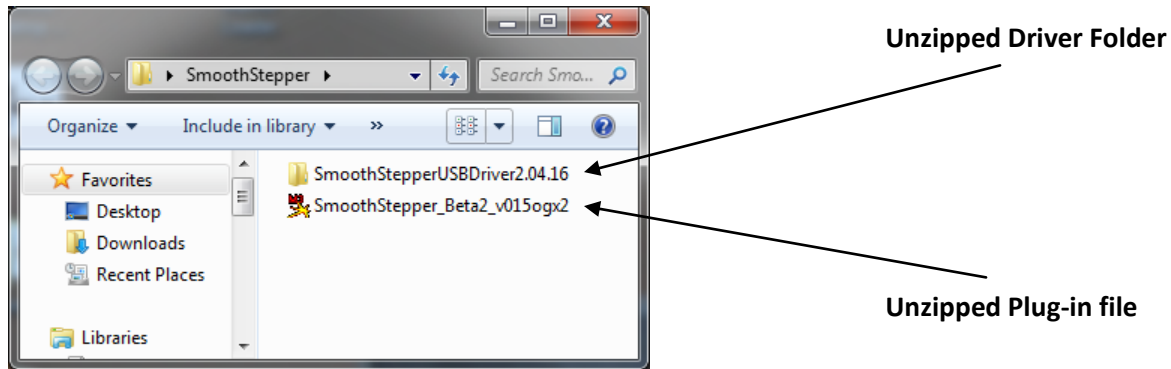


Figure 1

On Windows 7, you will be told that the driver cannot be found. To install the driver you will need to use Device Manager. The easiest way to launch Device Manager is to right click on 'My Computer' or 'Computer' (depending on your OS) and select 'Manage'. You can find 'My Computer' or 'Computer' either on your desktop, by clicking on the Start Menu icon or by pressing the Windows key. This will bring up the 'Computer Management' console from which you can select 'Device Manager'. See Figure 2 below.

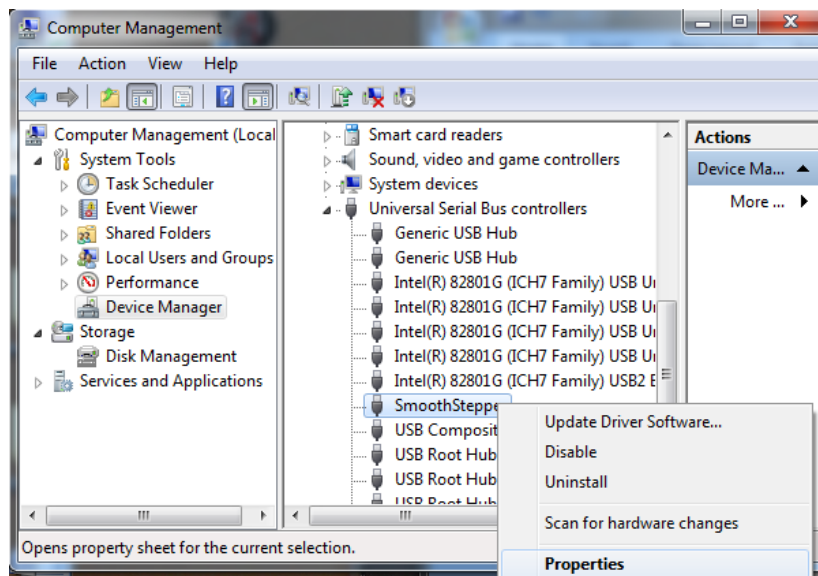


Figure 2

Expand the USB section in Device Manager and then right click on the 'SmoothStepper' entry and select 'Properties' as shown above. The 'SmoothStepper Properties' window will popup, from this window select the 'Driver tab and then the 'Update Driver' button as shown in Figure 3.

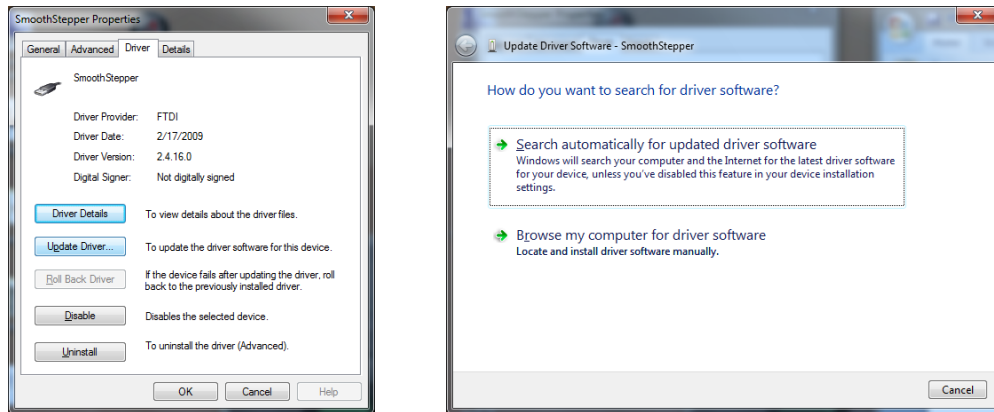


Figure 3

We want to choose the 'manual' option for updating the driver by selecting the 'Browse my computer...' option. Navigate to SmoothStepperUSBDriver2.08.24 folder and select the '*.inf' file and then Click OK. See Figure 4 below.

Finally, click the 'Next' button to install the updated driver. If you get a screen that says 'This driver cannot be verified...' go ahead and select OK to continue.

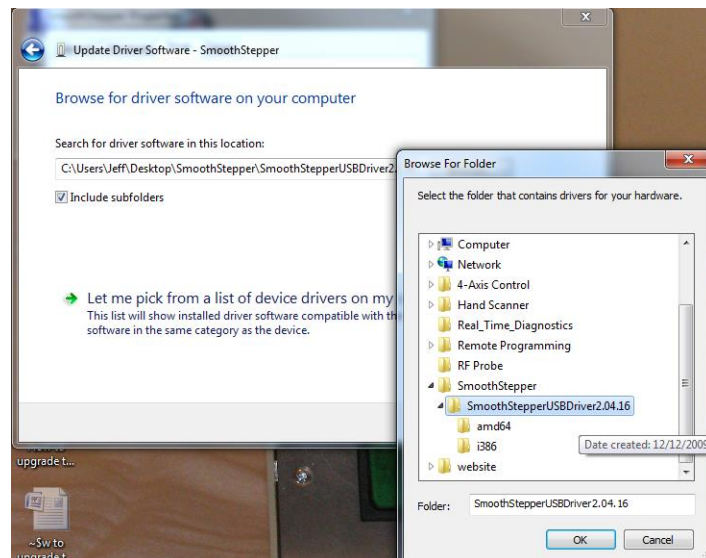


Figure 4

One other thing that needs done it to tell Window's that it cannot remove power from your USB ports. For Windows XP or Vista you do this by using 'Device Manager'. The easiest way to get to 'Device Manager' is to right click on 'My Computer' (or 'Computer' in Vista), and select 'Manage'. This will open the 'Computer Management' console. Select the 'Device Manager' from the list on the left hand side and then expand the 'Universal Serial Bus controllers' section. See Figure 5 below.

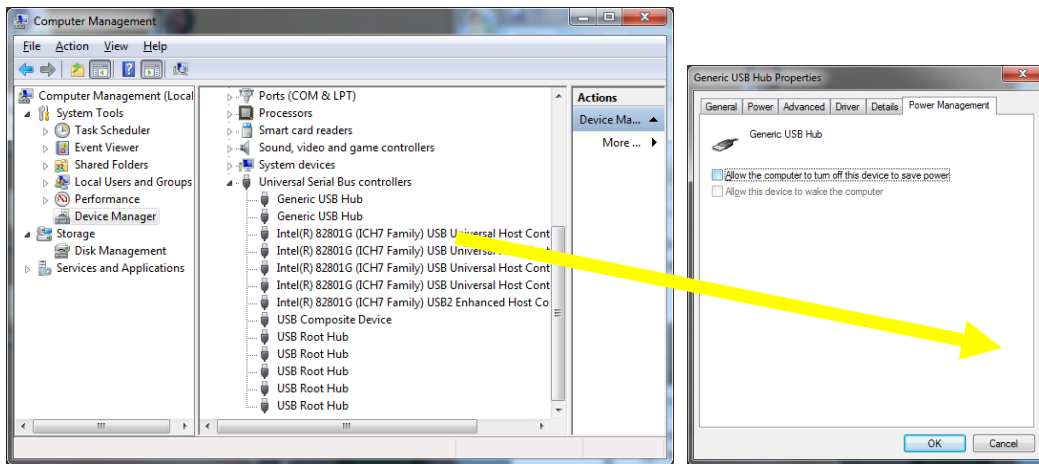


Figure 5

Right click on each entry in the list and select 'Properties' and look for a 'Power Management' tab. Click on the 'Power management' tab and unselect the 'Allow the computer to turn off this device to save power' box. This will keep your SmoothStepper powered up and all times and prevent problems.

On Windows 7 you do all of this through the power settings. Open up the Control Panel and type "Power Options" in the search bar as shown in Figure 6. Then select Change power savings settings.

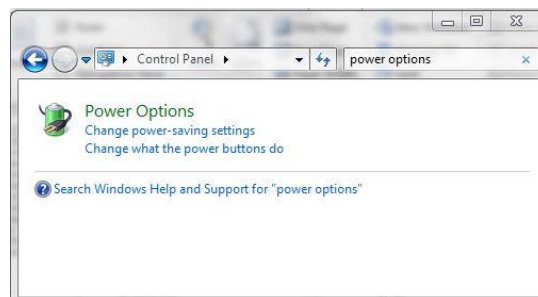


Figure 6

You will see the screen shown in Figure 7. Click 'Show additional plans' and select the High Performance plan then click on Change plan settings.

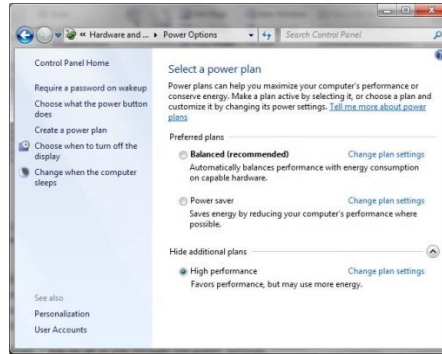


Figure 7

Go through the advanced options and make sure things are set as follows, then click 'Apply'.

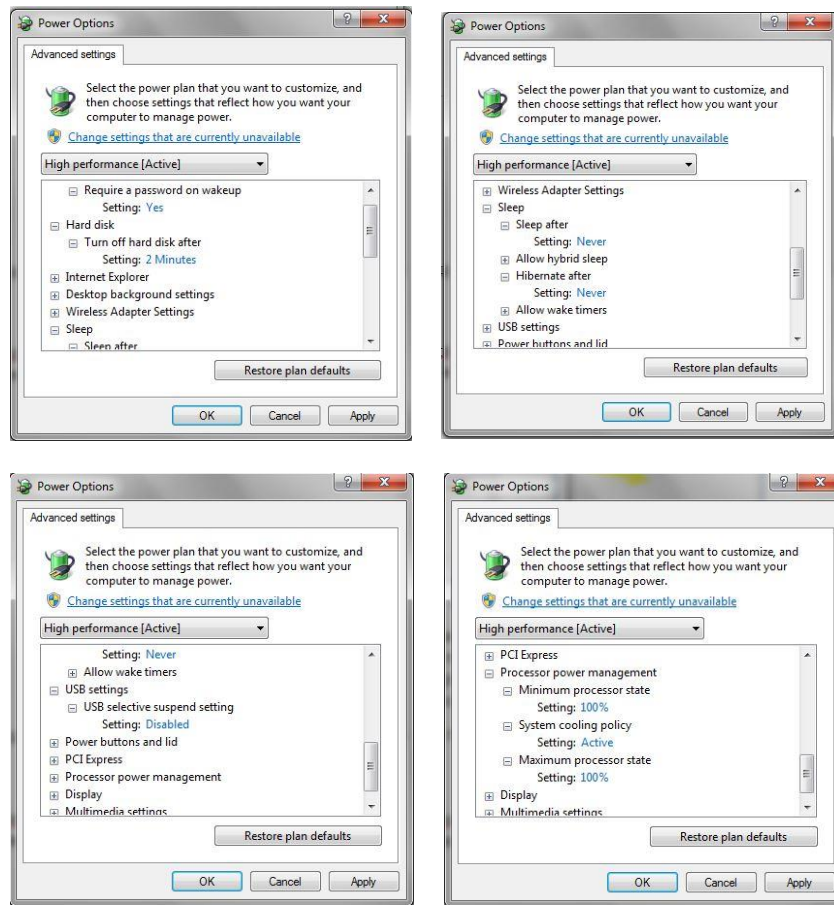


Figure 8



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To use the SmoothStepper with Mach 3 you need tell Mach to use it as the motion control device. Since Mach saves all your settings in 'Profiles' you need to create or modify a profile. If you are retrofitting an existing machine you can use Mach Loader to clone your existing profile. If you don't have an existing profile you can use Mach loader to create a new one.

Start Mach up with your new profile and then click on the 'Function Cfg's' menu and select 'Reset Dev Sel...'. Now shut down Mach and restart using your new profile. When Mach starts it will ask you to choose a motion control device, select the SmoothStepper.

The only other thing to watch out for is that the SS plug-in is likely to complain about the spindle step/direction signals not being set to a valid port in Ports and Pins (you can keep them disabled if you are not using a S/D spindle but they just have to have a valid port assigned.)

Updating the SmoothStepper Driver and Plug-in

- Download the latest Mach 3 lock-down version here:
<http://machsupport.com/downloads.php>
- Download the latest SmoothStepper driver AND plug-in here:
<http://warp9td.com/downloads.htm>

The first thing we'll want to do is make a copy of the Mach profiles you use and their macros. This is just a precaution in case they get overwritten when Mach is updated. To do this, go to: C:\Mach3\ and copy your profile which will be something like 'Mach3Mill.xml' and the entire 'Macros' folder to a safe place elsewhere on your computer.

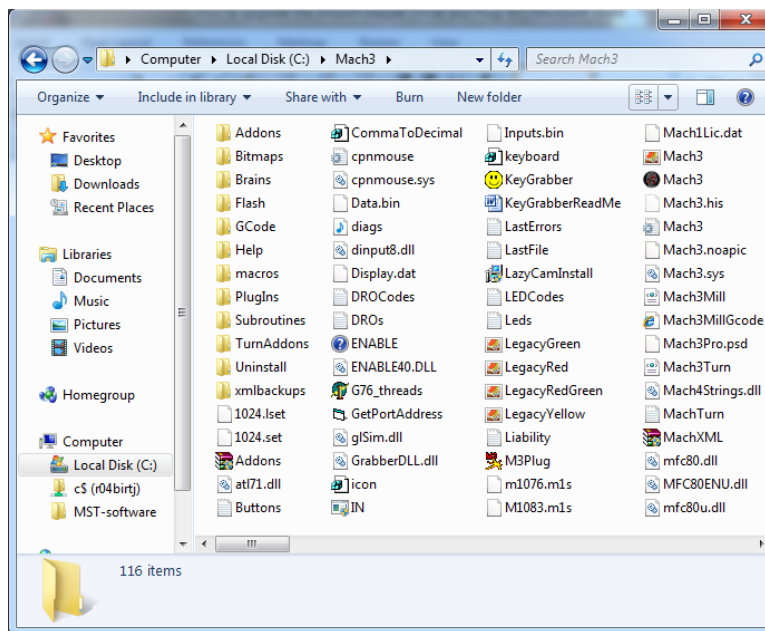


Figure 2

The next step is to remove the old SmoothStepper plug-in from Mach's plug-in folder: C:\Mach3\PlugIns, see the image below. You want to delete any file starting with SmoothStepper.

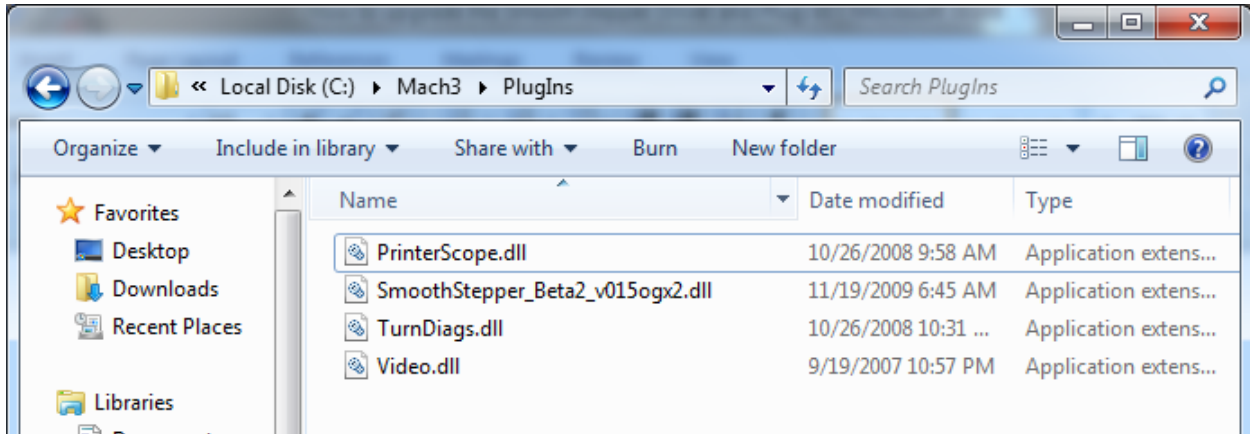


Figure 3

Now run the Mach3 installer that you just downloaded. You do not need to install or create any profiles when updating Mach. When you have Mach already installed, installing a newer version will update the older version by writing the new files over top of the old.

Now let's install the new SmoothStepper plug-in. Find the new plug-in file you downloaded, it should look something like Figure 3 below. Double click on it to install it. You will see a small pop-up window informing you that it was installed and the plug-in file you downloaded will disappear. It's a good idea to backup the plug-in file somewhere else and copy it to you desktop for installation.



Figure 4

With all of that done we can get the new driver installed. This is probably the trickiest part and depending on your OS the screens you see may look a bit different than the images shown here as I'm using Windows 7.

To update the driver you need to use Device Manager. The easiest way to launch Device Manager is to right click on 'My Computer' or 'Computer' (depending on your OS) and select 'Manager'. You can find 'My Computer' or 'Computer' either on your desktop, by clicking on the Start Menu icon or by pressing the Windows key. This will

bring up the 'Computer Management' console from which you can select 'Device Manager'. See Figure 4 below.

NOTE: You must have the SmoothStepper plugged in before launching Device Manger but DO NOT run Mach until the upgrade process is complete.

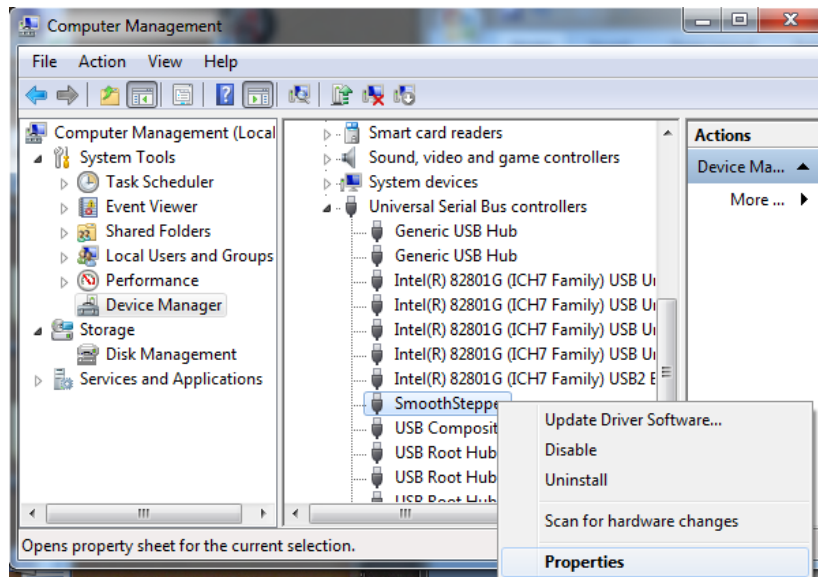


Figure 5

Expand the USB section in Device Manager and then right click on the 'SmoothStepper' entry and select 'Properties' as shown above. The 'SmoothStepper Properties' window will popup, from this window select the 'Driver' tab and then the 'Update Driver' button as shown in Figure 5.

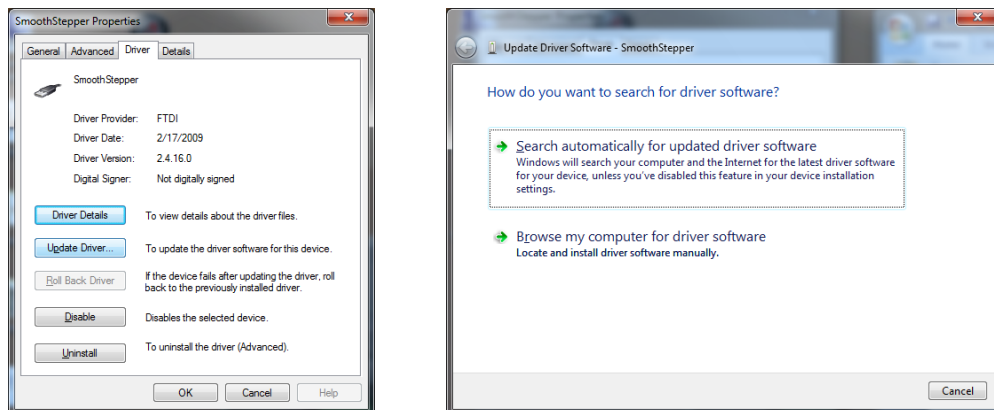


Figure 6

We want to choose the 'manual' option for updating the driver by selecting the 'Browse my computer...' option. Navigate to where you saved the driver file when you downloaded it, I saved mine to my desktop, and select that folder and then Click OK. See Figure 6 below.

Finally, click the 'Next' button to install the updated driver. If you get a screen that says 'This driver cannot be verified...' go ahead and select OK to continue.

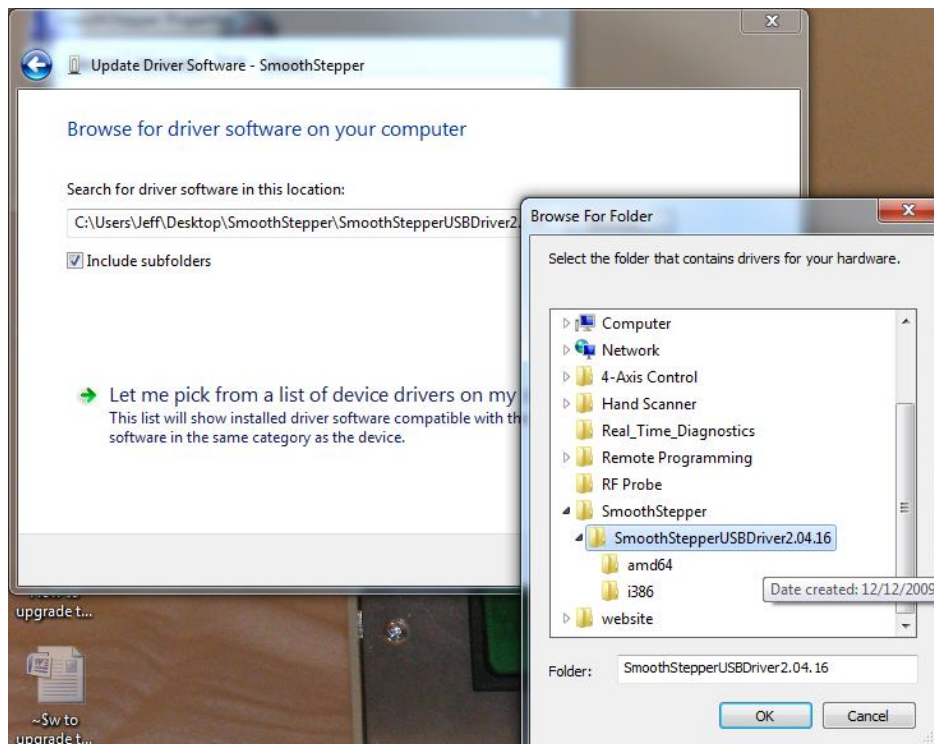


Figure 7

Well, I hope this short guide is helpful to all the SmoothStepper owners out there. If there are parts of this guide that are confusing just drop me a line at birt_j@soigeneris.com. Also, be sure to check out our website for all of your CNC needs: <http://www.soigeneris.com> .

Configuration Tips

The SmoothStepper or any other motion control device that works with Mach DOES NOT interpret or manipulate the G-code, Mach ALWAYS does that. Mach's planner interprets the G-Code and breaks every movement down into the itty-bitty movements that needs to take place between each clock cycle; by clock cycle I am referring to the 'kernel' rate on the parallel port drive and the 'Controller Frequency' and 'Max Step Frequency' in the SmoothStepper configuration. In the SmoothStepper you can think of the 'Max Step Frequency' as sort of a kernel frequency that you can assign per axis. Just like with the parallel port driver, the steps/unit and max velocity determine the frequency needed.

In either case let's say you are starting from 0,0,0 and have a 'G0 X0.1234'; Mach will break that distance down into the small bits that need to be moved to each clock cycle (accounting for acceleration, deceleration and velocity, steps/unit). If your using the LPT driver then this clock is the kernel frequency, for the SmoothStepper is a combination of the 'Controller Frequency' and 'Max Step Frequency', as mentioned above. In some case breaking down a movement into all of these little steps leads to very minute rounding errors in the axis DRO. Since Mach runs a sort of cumulative axis DRO this is not an actual error as if it could not break a move down into an even number for display purposes the next move will be calculated properly, so any single step will be taken up on the next move. A crude analogy would be typing '1/3' into a calculator. You'll get 0.33333333...which we would just say is '0.3333'.

If the SmoothStepper has its 'Max Step Frequency' set too high for an axis it will limit the output resolution for that axis. You can get an idea of what this frequency should be set to by knowing your steps/unit and max velocity.

Steps/Unit * Units/Min = Steps/Min

Steps/Min / 60 = Steps/Second (or Max Step Frequency)

This Steps/Second is the needed step frequency for that Axis, you should set the SmoothStepper's 'Max Step Frequency' to the lowest value that is equal to or greater than your Steps/Second. Once you get all your axis' 'Max Step Frequency' set, adjust the 'Controller Frequency' to the lowest value that proved Smooth movement, the note on the SmoothStepper configuration page says higher settings will limit resolution.

SmoothStepper Spindle Set Up

Go to Config->Ports&Pins->Motor Outputs tab

- Enable the spindle
- Assign port and pin values to match your system

Go to Config->Ports&Pins->Spindle setup tab

- Check the box that says 'Use Spindle Motor Output'
- If your spindle uses an Output to trigger a relay this needs to set up.
- The other settings do not apply to the SmoothStepper

Go to Config->Motor Tuning->Spindle Axis (press Save when done)

For a PWM spindle:

- Set "Steps Per" to 1000 (can adjust later for acceleration)
- Set "Velocity" to 60 (Effects some Mach calculations, no effect on SS)
- Set "Accel" to 1 (The accel is calculated as "Steps Per" * "Accel", so just adjust "Steps Per" to get the accel results that work well)

For Step & Direction:

- Set "Steps Per" to the maximum step frequency. This is the frequency that will produce the maximum speed of the spindle motor.
- Set "Velocity" to 60. This is a magic number that allows you to enter the max step frequency for "Steps Per".
- Set "Accel" to whatever value gives you the acceleration you want.

Go to Config -> Spindle Pulleys

- Select a pulley
- Choose min and max RPM, and a ratio so that spindle feedback calculates the correct RPM for display



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SmoothStepper Config (Under PlugIn Control)

For PWM:

- Check the box for PWM
- Select a base frequency for PWM (in Hz)

For Step & Direction:

- Check the box for Step & Direction
- Select a step pulse width. Make sure the frequency that was selected in Motor Tuning is not too fast for this pulse width. Otherwise the signal will never transition. For example, for a max step frequency of 25 kHz, the maximum pulse width is 40 microseconds. At 25 kHz, the waveform would be 100% duty cycle if the pulse width is 40 us.

Homing and Limits

Here is a screen shot of the new Homing Dialog.

Axis	Approach Speed (units/min)	Backoff Speed (units/min)	Index Port	Index Pin	Index Active Low	Final Position (units)	Slave Misalignment (units)	Max Master/Slave Separation (units)
X	10	1	2	10	<input type="checkbox"/>	0.1	0	0
Y	10	1	2	11	<input type="checkbox"/>	0.1	0.014	1
Z	5	1	2	13	<input type="checkbox"/>	0.1	0	0
A	0	0	2	12	<input type="checkbox"/>	0		
B	0	0	0	0	<input type="checkbox"/>	0		
C	0	0	0	0	<input type="checkbox"/>	0		

Enable This Config

Approach and Backoff speeds are in units/min (i.e. inches/minute or mm/minute). Absolute values are better than using a percentage, which is the way it is done with the Parallel Port. If you want to use a percentage, using a value of 0 for either of these options will make it revert to using Mach's reference speed percentage. For Slaved axes it is not necessary to enter an approach speed or Backoff speed since it will use the master's.

The Index Port and Pin are used if you have encoders with index pulses. This is by far the most accurate way to home. If these values are set to non-SmoothStepper Ports and/or pins, the plugin will ignore them and use the switches when backing off. Index Active Low changes the polarity of the signal.

Final Position is the position it should move to relative to Machine Zero. The plugin commands a G1 G53 move to this position. In the same move, it also adjusts the slave's destination by the Slave Misalignment amount. At the end of the move, the master and slave should be square and slaved again.

Max Master/Slave Separation is the maximum distance it will allow the master and slave to be separated by. On the approach to the switch, this is not enforced as precisely as I'd like. The separation is monitored in the plugin rather than the device. I actually haven't added this code yet, but I will soon. When it backs off of the switches, it backs off as a slaved pair. On the final gcode move, the max separation is strictly enforced.

