1.0   Terms of Use

PMDX-145 and PMDX-145 plug-in software for Mach control software Terms of Use

The PMDX-145 is intended for integration by the purchaser into industrial control systems. It is solely the purchaser's responsibility to assure that the system is configured in a manner consistent with applicable safety requirements. Practical Micro Design, Inc. does not control how this board and associated software is integrated into the purchaser's system and is not responsible for guaranteeing the safety of the system.

The PMDX-145 is not guaranteed to be fail-safe. The system into which the PMDX-145 is installed must provide fail-safe protection and emergency stop capability.

The PMDX-145 contains circuitry that may be connected to dangerous voltages. Care must be taken so that the user cannot come in contact with these voltages. An enclosure that allows for modest ventilation, but prevents intrusion by operator's hands and foreign objects, especially conductive byproducts of machining operations, should be utilized with this board. Interlock switches on power circuits should remove power when the enclosure is opened. Automated machine tools, into which the PMDX-145 may be integrated, can cause injury. Precautions should be taken to assure that operators are trained in their proper operation and safety procedures, and that they are protected from moving parts that may be under remote control and may move unexpectedly.

The PMDX-145 may not be used in life support or other critical safety applications.

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2.0   Overview

This document covers the installation and operation of the PMDX-145 Mach3 plug-in, version 2012.05.15.

The PMDX-145 Mach3 plug-in is a software module used to allow the PMDX-145 and any attached pendant or MPG to control some parts of Mach3. See section 2.2 for detailed descriptions of the plug-in's capabilities.

Terminology:

plug-in   Mach3 software module (also called a "DLL" in Microsoft Windows terminology). These reside in the "Plugins" subdirectory of the Mach3 install directory and have names ending in ".dll" (for example, "PMDX-145.dll" which is installed from PMDX-145.m3p, see section 3.0).

SmoothStepper   USB-based interface board for use with Mach3, produced by Warp9 Tech Design, Inc. (http://www.warp9td.com)

Conventions:
When talking about Mach3 menus and configuration screens, this document refers to then using "->" to separate sub-menu items.
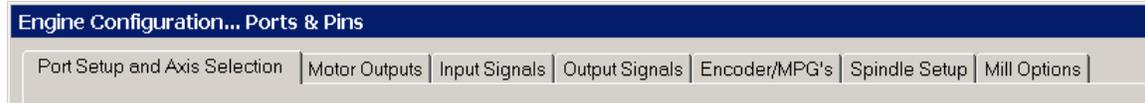
For example, when this document says:
>   *Go to the "Config->Ports and Pins" dialog*
it means to go to the "Config" menu and select the "Ports and Pins" item as show in the image to the right. This will open the dialog box that allows you to change the Mach3 hardware configuration.

In the Mach3 *Ports and Pins* dialog box, there are several tabs across the top:

Clicking on one of these tabs will display a different group of configuration information. This document refers to these like this:
>   *Go to the "Config->Ports and Pins" dialog, "Input Signals" tab*
That means to open the *Ports and Pins* dialog box, then click on the *Input Signals* tab along the top.

2.1   System Requirements

The PMDX-145 plug-in is designed to operate in the following environment:

- Mach3 version 3.043.022 or newer (go to the Mach3 "Help -> About Mach3" menu to see the version number). The PMDX-145 plug-in has not been tested against older versions of Mach3 and may or may not work. We cannot provide support for Mach3 versions earlier than this version. Furthermore, you should be running the "lock-down" version of Mach3 unless you absolutely must have one of the experimental features in the development version.

- PC with two parallel ports (this plug-in uses port #2 for the PMDX-145). The parallel ports may be a mixture of motherboard and PCI plug-in card ports.
  NOTE: USB-to-Parallel-Port adapters WILL NOT WORK. Nor does a SmoothStepper or other parallel port replacement device (though this may be addressed in a future release)

- PC operating system, processor speed and memory requirements are the same as for Mach3.

2.2   Plug-In and PMDX-145 Capabilities

The PMDX-145 and this plug-in allow a pendant or set of front panel controls to control various aspects of Mach3. The user can manually jog the various axis and change the jog step size.

Specifically, with a HEDSS-style pendant attached to the PMDX-145, the plug-in provides the following functionality: ***when the white "enable" button on the side of the pendant is pressed and when the pendant "axis select" switch is in any position other than "off"***:
- Automatically switch Mach3 into "MPG jog mode"
- Set the current MPG #1 jog axis according to the pendant "axis select" switch
- Set the MPG jog increment according to the pendant "Increment select" switch (see jog increment note below)
- Enable the MPG (manual pulse generator) on the pendant to jog the selected axis (presuming that Mach3 is not in EStop).
- The pendant's EStop switch will control the PMDX-145's EStop relay and Fault solid-state relay (actually this happens whether or not the white "enable" button is pressed).

Jog Increment Note:
The jog increment values depend on whether Mach3 is using inches or millimeters as the "default" or "native" units. You can determine (and change) this setting by going to the "Config->Select Native Units"

menu. Click on "OK" when you see the warning about metric of English Gcode and then you will see a dialog that allows you to choose the default units. **NOTE**: If you change this value, you **must** exit Mach3 and restart it for the change to take effect.

The increment values shown in the table below indicate the distance that Mach3 will move an axis for 1 click of the MPG when Mach3 is set to "Multi-Step" MPG Mode. When Mach3 is in any other MPG mode, Mach3 determines the relationship between MPG movement and axis motion. To determine which MPG mode Mach3 is in, press the TAB key to display the on-screen MPG graphic. The upper section is titled "MPG Mode" and there will be a green indicator next to the current mode.

Setting	Inc Value (inches)	Inc Value (mm)
x1	0.001	0.01
x10	0.010	0.10
x100	0.100	1.00

2.3   Caveats & Limitations

- **This version of the plug-in will not work with a SmoothStepper or other parallel port replacement device.** It requires a real, physical PC parallel port. This may be addressed in a future release.

- The plug-in supports axis select settings for up to 6 axis from the pendant (note that the HEDDS-style pendant shown in our examples has only 4 axis select switch positions).

- This plug-in **DOES NOT** support the two external switches on connector J5. This will be addressed in a future release.

- This plug-in will force the configuration of "MPG #1" in Mach3 as follows: (and shown in the figure):
  - MPG #1 enabled
  - Phase A from port 2 pin 8
  - Phase B from port 2 pin 7
  - Steps per unit set to 4.000

The plug-in will over-write any changes that you try to make to this configuration. This configuration matches the wiring in the HEDSS pendants that we have looked at. If your pendant causes jogging motion in the wrong direction, then you will need to re-wire the MPG in your pendant to swap the wires to the A and B phase terminals. Future versions of the plug-in may allow the user to change the pin assignments in the plug-in.
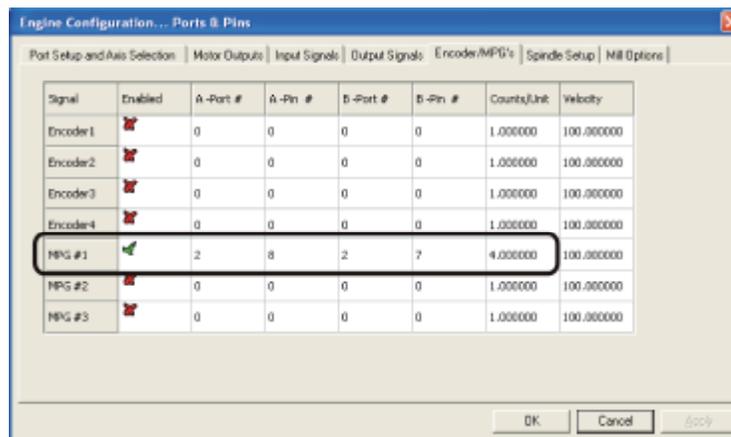
- The PMDX-145 plug-in assumes that the PMDX-145 breakout board is connected to parallel port #2 as defined in the "Port #2" section of the main Mach3 *Ports and Pins* dialog box. The plug-in will check to make sure that port #2 is enabled and that it is configured for "pins 2-9 as inputs". If not, the plug-in will display an error message and disable the plug-in.

3.0   Installing the Plug-In

Download the latest plug-in ZIP file from the PMDX web site (http://www.pmdx.com, then look for "Support" and then "Downloads" across the top of the screen). Extract the contents of the ZIP file to a temporary directory. Look for the file named "PMDX-145.m3p". An "m3p" file is the installation version of a Mach3 plug-in file (not to be confused with "mp3", which is an audio file). Double-click on the "PMDX-145.m3p" file. This will automatically copy the file into your Mach "Plugins" directory and rename it to PMDX-145.dll.

> *WARNING –*   *Installing a new version of the plug-in will overwrite any existing PMDX-145 plug-in already installed in the Mach3 "Plugins" directory and it will NOT issue any warning that it is overwriting a file.*

3.1   Determining the Plug-In Version

To see what version of the PMDX-145 plug-in is installed, display the PMDX-145 plug-in configuration dialog box as described in section 7.0. The version number is displayed in the blue title bar at the top of the dialog box.

4.0   Install a 2nd Parallel Port

The PMDX-145 plug-in requires that the PMDX-145 be connected to a 2nd PC parallel port. Usually this means buying a PCI Parallel Port add-in card, such as the PMDX-2PARPCI, and installing it in your PC. The directions on how to do this are beyond the scope of this manual. Please consult the documentation for the add-in card for installation instructions.
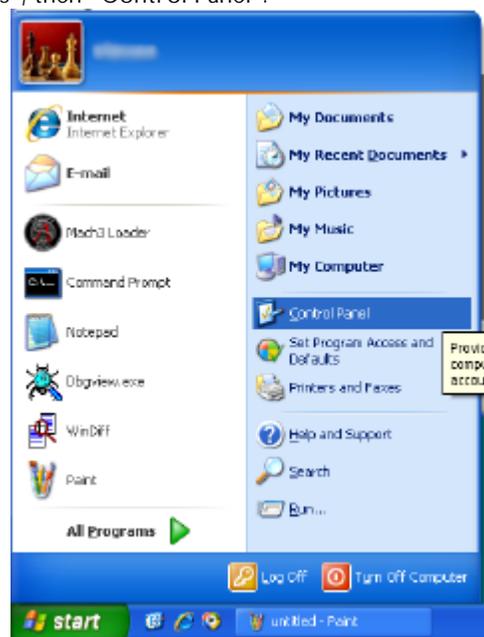
In order to configure Mach3 to use this new parallel port, you will need to know it's I/O base address. The instructions below are for Windows XP, but the process is similar in Windows 2000 and Vista.

(1)   Go to the Windows "Start" button, then select "Settings", then "Control Panel".
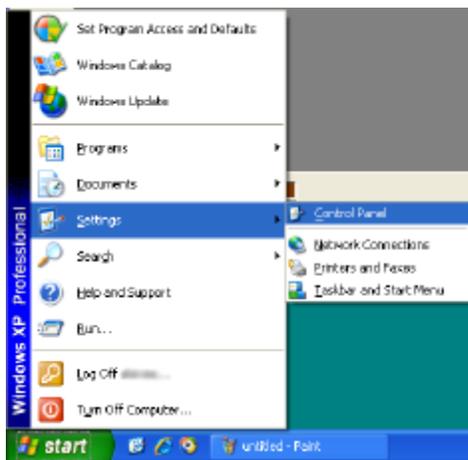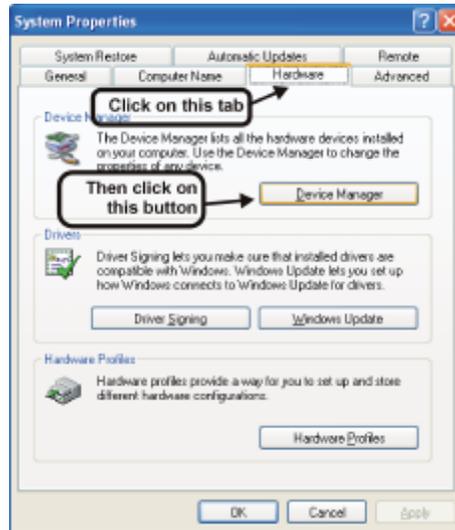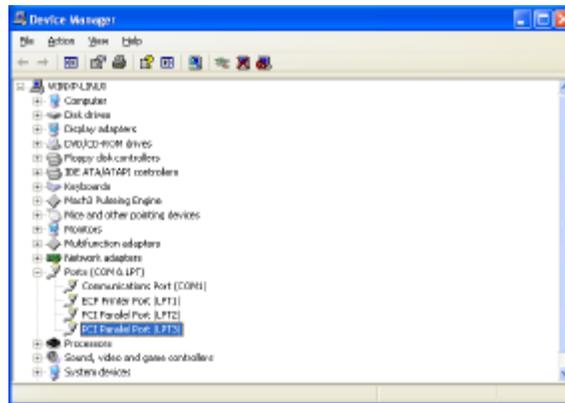

     Using the "Classic" start menu,   OR   Using the new XP-style start menu

(2)   In the Control Panel window, double-click on the "System" icon.

(3)   In the System Properties window, click on the "Hardware" tab, then click on the "Device manager" button.

(4)   In the "Device Manager" window, click on the plus sign next to "Ports (COM & LPT)" to expand that line.

(5)   You should see one or more lines that start with "PCI Parrallel Port". If you are using the PMDX-2PARPCI dual parallel port card, usually the higher numbered port (LPT3 in this example) is the port that is on the PCI card. The lower-numbered port (LPT2 in this example) is usually the port that requires a ribbon cable off of the PCI board. Double-click on the parallel port line (the one with LPT3 in this example) to open the "Properties" dialog box as shown below.

Click on the "Resources" tab so show the I/O port addresses used by this parallel port. Write down the first number in the first line ("1010" in this example). You will use this number to configure the second parallel port in Mach3.
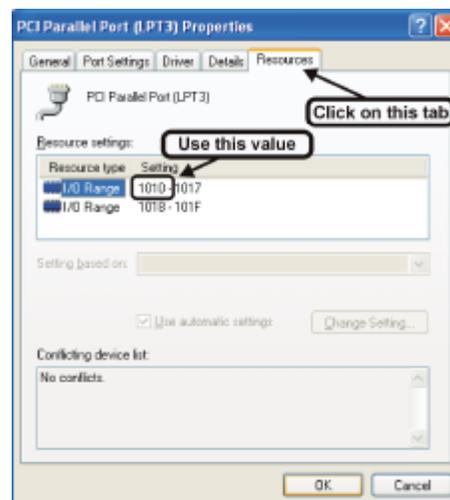
5.0   Configure Mach3

> **NOTE – Mach3 User Interface Quirks**
>
> Due to quirks in the Mach3 user interface, when you change settings in the *Ports and Pins* dialog, you should click on the "Apply" button first and then the "OK" button. If you don't click on "Apply" and instead just click on "OK", Mach3 may not store your changes. This is true for Mach3 versions at least through version 3.043.022.
>
> Also, if you double-click on a cell in the *Ports and Pins*, *Output Signals* or *Input Signals* tabs, the scroll bars may disappear from the dialog box and the names in the "Signal" may be overwritten. If you see this happen, press the "ESC" key or click on "Cancel" to abort the changes. Then re-display the *Ports and Pins* dialog box.

(1)   Start Mach3 and go to the "Config->Ports & Pins" dialog.

(2)   Configure "Port #2" by entering the port address that you recorded when installing the 2nd parallel port (see step (5) in section 4.0) **with the leading "0x"**. So in our example you would enter "0x1010". Check the "Port Enabled" box and the "Pins 2-9 as inputs" box. This is shown in the picture below.
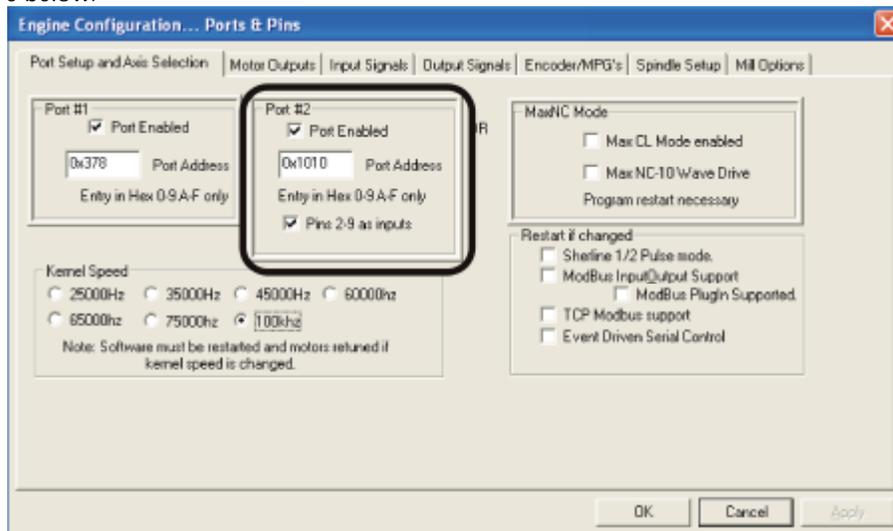
(3)   Now click on the "Apply" button (but not the "OK" button yet, we have more changes to make)

(4)   OPTIONAL: Click on the "Encoder/MPG" tab, then change the "MPG #1" settings as shown below. If you don't do this, the plug-in will do it for you and display a warning message (see "*Warning 100*" in section 9.1).
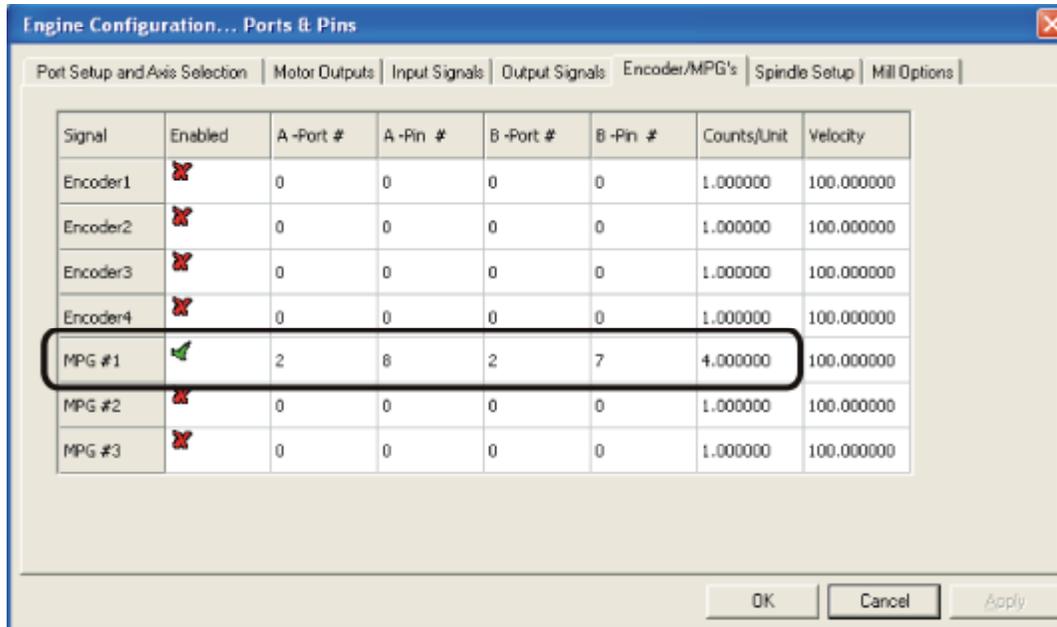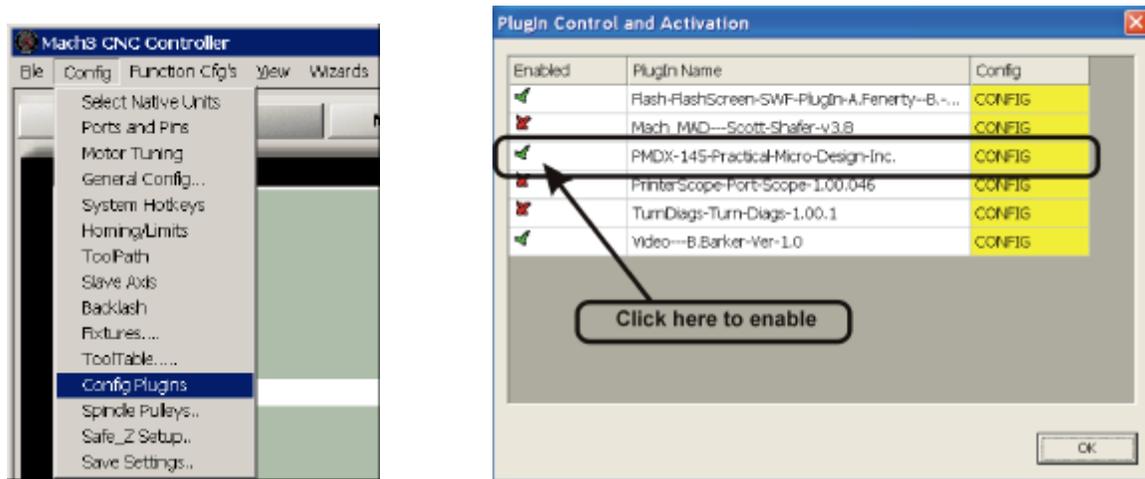
(5)   Now click on the "Apply" and then "OK" buttons.

6.0 Enable the Plug-In

Start Mach3. Open the *Config->Config Plugins* dialog box. You should see the PMDX-145 plug-in listed among the other available plug-ins. Click on the red "X" next to the PMDX-145 plug-in to change it to a green check mark. Then click on "OK".
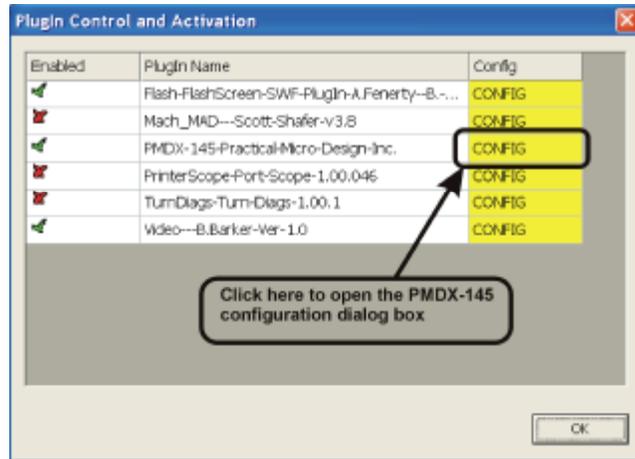
IMPORTANT: You must exit Mach3 and then re-start it before continuing.

    Note: The number of plug-ins and the order in which they are listed may be different on your PC

7.0 Configure the Plug-In

From within Mach3, open the *Config->Config Plugins* dialog box.

Click on the "CONFIG" box to the right of the PMDX-145 plug-in. This displays the PMDX-145 Configuration dialog box as shown below. For now, there are no configurable items in the plug-in. But this dialog box will show you the plug-in version number, which is displayed in the title bar at the top of the dialog box.

Click on OK to close the dialog box.

8.0   Verify Plug-In Operation

(1)   Exit Mach3

(2)   Power off the PMDX-145

(3)   Connect the HEDDS pendant to the PMDX-145

(4)   Power on the PMDX-145

(5)   Start Mach3

(6)   From the main Mach3 screen, press the TAB key to display the on-screen MPG as shown to the right:

(7)   On the HEDDS pendant, turn the axis select knob to the "X" setting (to control the X axis) and the increment select know to the "X1" setting.

(8) Press and hold the white "Enable" button on the side of the pendant. You should see the "Jog Mode" indicator change to "MPG", the "MPG Axis Alt A" line should have a green box next to "X" (indicating the "X" axis is being controlled), and the value to the right of the "Cycle Jog Step" should show "0.0010" if you are using inches, or "0.0100" if you are using mm.

(9) Release the "Enable" button on the pendant. The "Jog Mode" indicator should return to either "Cont" or "Step", and the green axis indicator next to "MPG Axis Alt A" should turn off.

(10) Press and hold the "Enable" button on the side of the pendant. Change the axis select know and Mach3 should show the "MPG Axis" indicators following the switch setting.

(11) With the pendant "Enable" button still pressed, change the increment select knob to "X10" and the value next to "Cycle Jog Step" should change to 0.0100 if using inches, or 0.1000 if using mm. Change the know to "X100" and the value should change to 0.1000 if using inches, or 1.000 if using mm. Release the "Enable" button.

(12) Set the axis select know to "X" and the increment select knob to "X1".

(13) Make sure that the Mach3 "RESET" button is not flashing (i.e. the Mach3 is not in EStop).

(14) Press and hold the pendant "Enable" button. Turn the MPG one click counter-clockwise. The Mach3 DRO for the X axis should decrement by 0.001. Turn the MPG one click clockwise and the DRO value should increment by 0.001.

(15) Release the pendant "Enable" button.

## 9.0 Plug-In Warning and Error Messages

9.1 Warning 100 – Forcing MPG Configuration
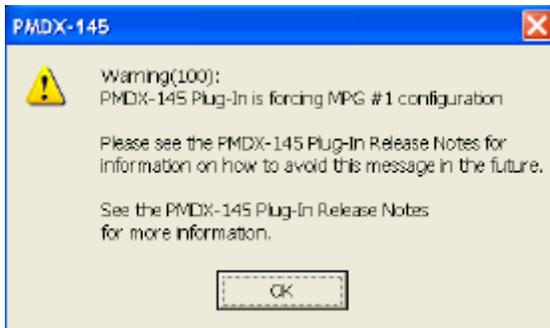
This warning can occur while starting Mach3 or after you close the Mach3 "Config->Ports and Pins" dialog box. The PMDX-145 requires a specific configuration for MPG #1 as shown in step (4) in section 5.0. If your Mach3 configuration file (also called the "XML file") does not contain the necessary configuration, the PMDX-145 plug-in will override the settings from the XML file. However, the changes only persist until you exit Mach3. The plug-in cannot change the settings in your configuration file.

Do the following to make these changes permanent:

(1) Go to the "Config->Ports and Pins" menu

(2) Click on the "Encoder/MPG's" tab

(3) Click on the green check mark in the "Enabled" column to change it to a red "X". Then click on the red "X" to change it back into a green check mark.
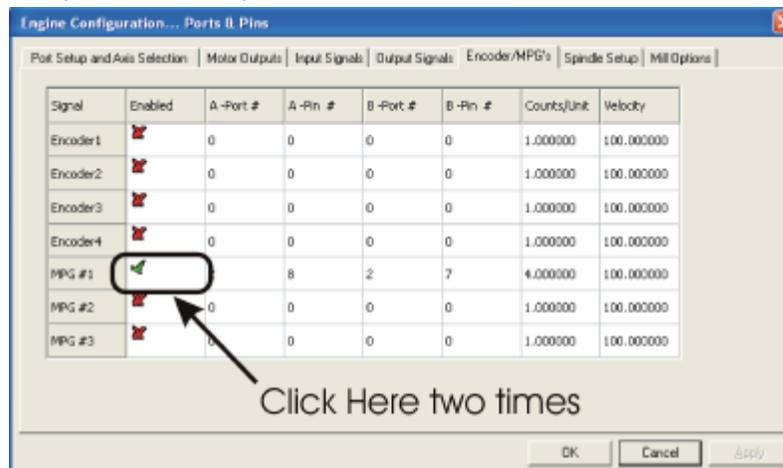
(4) Click on the "Apply" button, then the "OK" button.

This will save the updated MPG #1 settings in your configuration (XML) file and you should no longer see the warning message.

9.2 Warning 101 – Jogging is Disabled

Mach3 allows you to disable jogging so that someone accidentally touching the jog keys on the keyboard will not cause the machine to move. If you are using the default Mach3 mill screen set (see below), then you can see the jogging status and turn jogging on and off with the "Jog ON/OFF" button (in the "Tool Information" section). The button has a green outline when jogging is enabled.

If you press the enable button on the side of the pendant (to enable the pendant) when

Mach3 has jogging disabled, you will see this message warning you that Mach3 will ignore any jog commands from the pendant.

To re-enable jogging in Mach3, type CTRL-ALT-J (press the CONTROL key, ALT key and the "J" key at the same time). Or click on the "Jog ON/OFF" button.
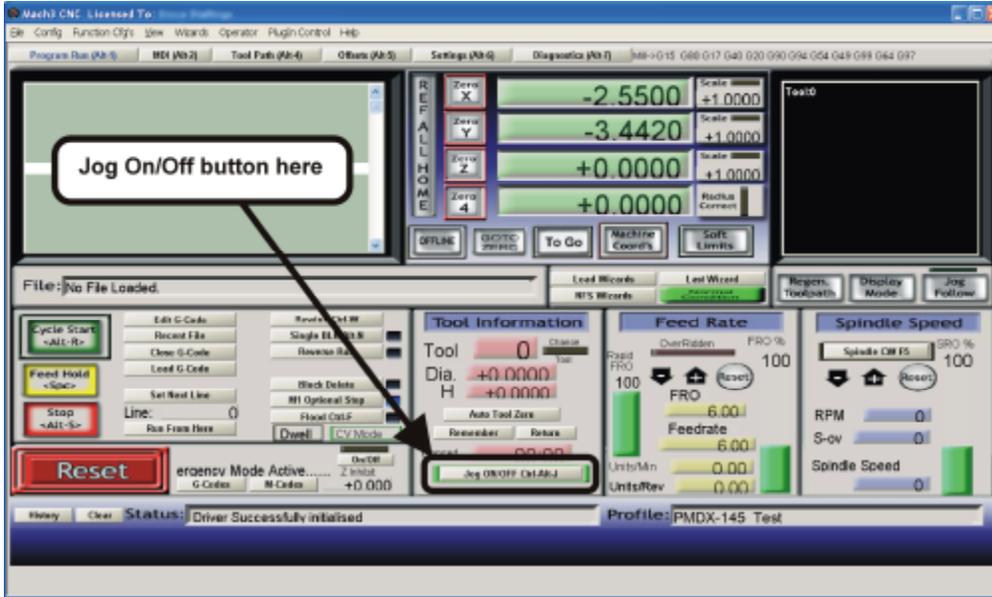

9.3   Error 200 – Could Not Connect to Mach3

The plug-in uses several methods to communicate with Mach3. Sometimes, on some PCs, Mach3 does not configure all of the registry entries that the plug-in needs. If you see this error, go to the PMDX web site under "Support" and then "Downloads". Look in the PMDX-145 section for the "Mach3 Registry Fix". Download the file and save it somewhere on your local hard disk.

> **NOTE:**   You must be logged into Windows using an account that has administrator privileges in order to install this registry patch.

Double-click on the "Mach3_Fix_COM_Interface.reg" file to load it into your registry. When Windows asks you if you want to add the information to the registry (see below), click on "Yes".
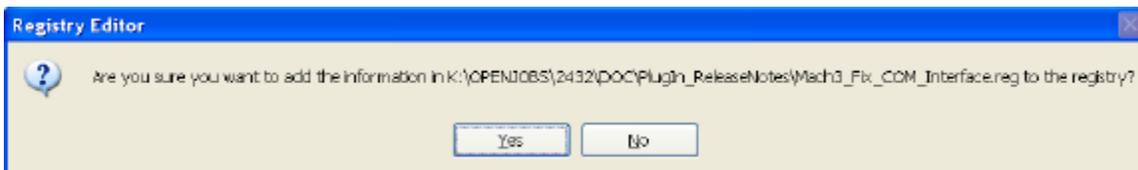

If you have trouble installing this registry patch, or if this does not fix your problem then contact PMDX support at pmdx-support@pmdx.com. Include your Windows version, Mach3 version and PMDX-145 plug-in version (see section 7.0).

### 9.4   Error 201 – Cannot Access Parallel Port

The plug-in was unable to read from parallel port #2. This error *should* never happen. Should you see this error, please contact PMDX support at pmdx-support@pmdx.com. Please include in your email the Mach3 version (see "Help->About") and PMDX-145 Plug-In version (see section 7.0) and a brief description of what your machine was doing when you got this error.

9.5   Error 202 – Port Not Configured Properly
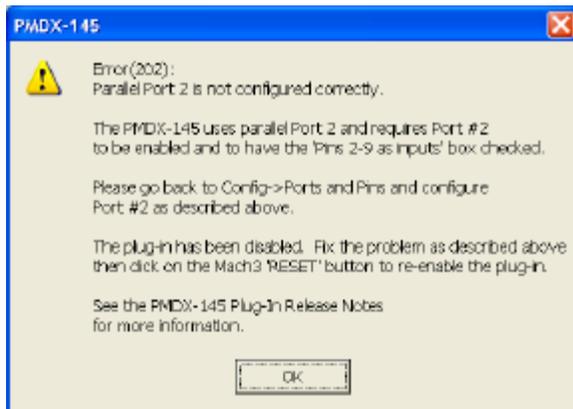
The plug-in detected that port 2 is either not enabled or is not set for "pins 2 to 9 as inputs". The plug-in **does not** attempt to validate the "port address" for port 2, as there are too many possible valid values for that. See section 5.0, *Configure Mach3*, for information on how to configure the parallel port.

9.6   Error 203 – Invalid Data (Board Unplugged)
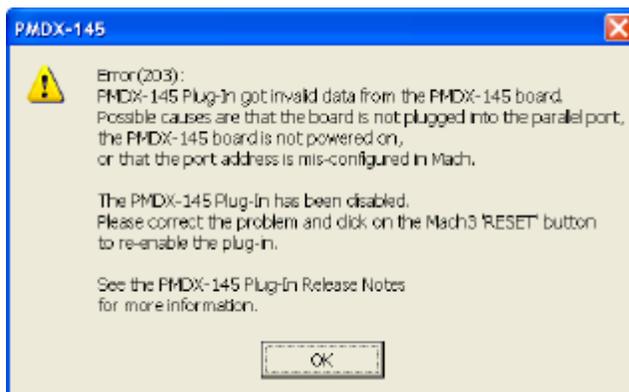
This error means that the plug-in got data from the parallel port that does not appear to be valid PMDX-145 data.

This could be due to several factors:
- Parallel port #2 is not configured properly (the "Port Address" is not correct)
- The PMDX-145 is not plugged into the proper parallel port
- The PMDX-145 is powered off
- Bad cable between the PMDX-145 and the parallel port

A quick way to verify that the PMDX-145 is connected to the proper parallel port and that the parallel port is configured correctly is to follow the steps in the "*Test Input Signals*" section of the PMDX-145 User's Manual.