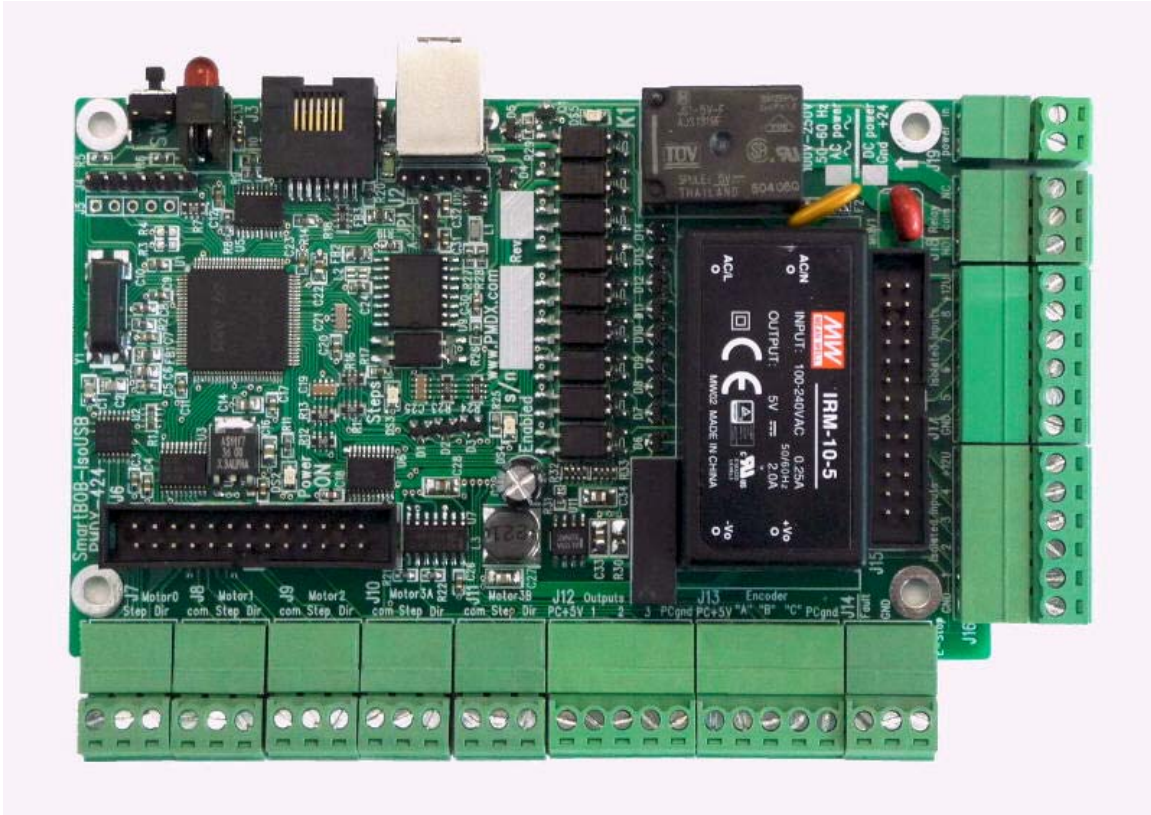# PMDX-424
SmartBOB-IsoUSB
For use with Mach4

Quick Start Guide

Document Revision: 0.6
Date: 8 April 2016
Circuit Board Revisions: PCB-525A and PCB-525B

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1.0   Overview

The **PMDX-424** is a motion control pulse engine with an integrated breakout board for connecting CNC machines to the Mach4 family of software using a USB port. In addition to this document, please also see our web forum for additional support and for announcements or new versions of the PMDX-SmartBOB Mach4 plug-in.

> **SmartBOB Software Updates, Support and Questions**
>
> Please visit our web forums for additional support and for announcements of new versions of the PMDX-SmartBOB Mach4 plug-in (new features, bug fixes, etc.). Our forums are also our preferred method of contact for support questions. The web address for our forums is:
>
> > http://www.pmdx.com/PMDX-Forums/
>
> You can create an account on the forums and request notification emails whenever we post a message on the "Announcements" forum.
>
> You may also contact us via email or phone. While we monitor the Mach Support forums (http://www.machsupport.com/forum/), those forums are not our primary focus. Sometimes it may take us a while to see and/or respond to questions posted there. For a quicker response, please use the PMDX forums.

> **WARNING:**   **_DO NOT PLUG THE PMDX-424 INTO YOUR PC'S USB PORT UNTIL INSTRUCTED TO IN THE STEPS BELOW! See section 2.3 for more information._** _This will help avoid other "helpful" software from trying to identify the PMDX-424 as some other type of USB device and installing an incorrect driver._
>
> **_If you are installing an update to the PMDX-424 plug-in,_** _then make sure the PMDX-424 is UNPLUGGED from the USB port before running the installer._

1.1   Features

(1)   Electrically isolated USB connection prevents ground loops and reduces noise sensitivity.

(2)   Screw terminals are pluggable terminal strips with 0.150" pitch for ease of wiring and repair.

(3)   Provides real time control for smooth step pulse signals up to 100 KHz on 4 axes (5 motors).

(4)   The on board power supply can be operated from universal AC mains input of 100 to 240 VAC. An alternate version accepts 12 to 36 volts DC. The PMDX-424 powers the PMDX-407 Spindle Control and can provide 12 volt DC power for NPN proximity sensors and 5 volts DC power for accessories such as an encoder or the PMDX-104 relay board.

(5)   Provides opto-isolated Emergency Stop and Fault inputs.

(6)   There are 8 opto-isolated input signals each having a pull-up resistor to +5 volts to allow use with simple mechanical switches or NPN proximity switches.

(7)   There are 3 extra non-isolated high speed input signals. These inputs will also function as inputs for an encoder that supports phase signals up to 1 MHz using a hardware quadrature decoder plus an index. This will allow lathe CSS and threading support in the future.

(8)   The relay output provides both N/O and N/C contacts rated for 6 amps and 240 VAC.

(9) There are three 5 volt logic level outputs that can provide up to 24 mA of drive current. These signals can be used to drive solid state relays or the PMDX-104 relay board.

(10) All outputs are turned off in the event of loss of communication from the host, or if the Emergency Stop or Fault inputs are activated, or Mach4 is set to "Disabled".

(11) A proprietary RJ-45 connector is provided to connect a PMDX-179 remote status panel.

(12) An on board "Enabled" LED is provided to indicate that the unit is ready to run the machine.

(13) An on board LED for "Steps" is provided to indicate that motion is in process.

(14) The board can be mounted against a panel with holes to allow access to the USB jack, remote panel RJ-45, pushbutton, and status LEDs.

(15) The PMDX-424 is a compact 3.0" by 5.0" board that fits in tight spaces.

(16) A low cost companion PMDX-407 spindle speed control interface is available.

1.2   Updates to This Manual and Application Notes

Please see the PMDX web site for updates to this manual:

http://www.pmdx.com/PMDX-424

2.0   Quick Start

2.1   Install Mach4 Hobby

(1) Download the latest Mach4Hobby installer and save it. You can download it from here:
http://www.machsupport.com/software/downloads-updates/
or PMDX maintains an archive of Mach4 releases here:
http://www.pmdx.com/Downloads_Mach4/Mach4_Hobby_Releases/
Run the installer by double-clicking on the file.

(2) Check on the 'I agree" box to accept the license terms and then click on "Next"

(3) We recommend that you install Mach4Hobby into the default "C:\Mach4Hobby" directory, so click on "Install" to accept the default directory and install Mach4Hobby. If you wish to install Mach4Hobby into a different directory either type the directory name into the "Destination Folder" box, or click on the "Browse" button to search for the directory, then click on "Install".

> **NOTE:** Some people have had issues installing and running Mach4Hobby from Windows accounts that do not have "Administrator" privileges. If you have problems with Mach4Hobby and your account does not have administrator privileges, un-install Mach4Hobby then try running the installer by right-clicking on the file and selecting "Run as…", then select the Administrator account from the following dialog.

2.2   Get Your Mach4Hobby License

If you purchased your Mach4Hobby license from PMDX, then you should receive an email with a coupon code and instructions on how to get your license file from the MachSupport web site. A description of the steps are also given here:

http://www.pmdx.com/Mach4-license

If you purchased your license from someone else, contact them for instructions on obtaining your license file.

2.3 Install the PMDX-SmartBOB-USB Plug-in

> *WARNING:* *DO NOT PLUG THE PMDX-424 INTO YOUR PC'S USB PORT UNTIL INSTRUCTED TO IN THE STEPS BELOW!* *This will help avoid other "helpful" software from trying to identify the PMDX-424 as some other type of USB device and installing an incorrect driver.*
>
> *If you are installing an update to the PMDX-424 plug-in,* *then make sure the PMDX-424 is UNPLUGGED from the USB port before running the installer.*

The most current version of the PMDX installer can be found here:

http://www.pmdx.com/PMDX-SmartBOB-USB-Plug-In

Unplug the PMDX-424 (and any other SmartBOB device) and close Mach4 if you have it running. Then download and run the SmartBOB-USB plug-in installer program. If any SmartBOB device is plugged into the PC, or if Mach4 is running, the installer will prompt you to un-plug the devices and close Mach4 before installing the plug-in.

> **NOTE:** We highly recommend installing the PMDX sample Mach4 profiles during the plug-in installation process. These profiles already have the PMDX-SmartBOB-USB plug-in enabled and have the PMDX-SmartBOB-USB device selected at the motion controller.

The plug-in installer will install the needed files in the Mach4 folder of your choice. It will default to "C:\Mach4Hobby". In this case, the installer will install the plug-in and signature files in "C:\Mach4Hobby\PlugIns" and assorted other files in "C:\Mach4Hobby\PlugIns\PMDX-SmartBOB-USB" (such as the release notes, the license terms, and the un-install files).

You can run a new version of the Setup installer without removing any existing version from your computer.

Firmware in the PMDX-424 is non-volatile and you will only be asked to download firmware if an update is needed to match the plug-in that is in use or if the firmware has become corrupted.

2.4 Powering the PMDX-424

The PMDX-424 requires external power connected to J19. It does NOT power the board from the USB connection. There are two versions of the PMDX-424: the standard version powered by 100 to 240 VAC, 50 or 60 Hz, and an alternate version powered by 12 to 36 (typically 24) volts DC.

With the standard version, connect the AC "hot" and "neutral" to the two screw terminals on J19. There is no polarity, either wire may be connected to either terminal.
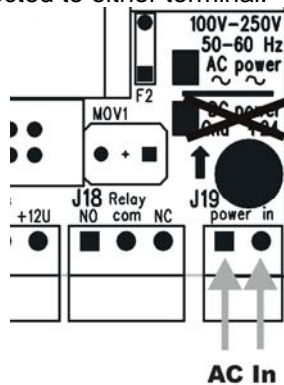
With the alternate DC powered version, connect the positive wire (+12V to +36V) wire to J19 pin 1 and the ground (GND) to J19 pin 2 (closest to the corner of the circuit board).
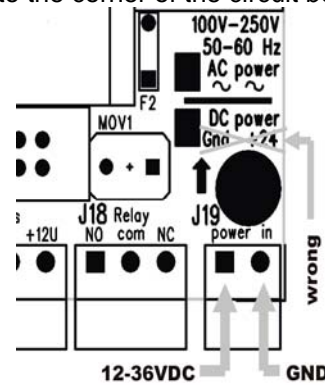
Figure 1 AC Power Connections   **Figure 2 – DC Power Connections**

2.5   E-Stop Input

We recommend that you leave the shorting clip in the E-Stop input until you have the rest of the PMDX-424 working. Then connect your E-Stop circuit if you have one. See section 4.10 for more information on the E-Stop and Fault inputs.

2.6   Initial Power-On

With the USB still unconnected, apply power to the PMDX-424. You should see almost all of the LEDs turn on for about 1 second and then turn off (the relay LED will not turn on as part of the power-on LED test). Then the "Power" LED should be on, the red LED should be on and the green LED underneath the red LED should be flashing one short flash every 2 seconds. If you do not see this, double-check your power connection and then contact PMDX support.

2.7   Connecting the USB Port

> *WARNING: You <u>MUST</u> install the PMDX SmartBOB Plug-as described in section 2.3 <u>BEFORE</u> connecting the PMDX-424 to the PC's USB Port.*

With the PMDX-424 still powered on, plug a USB cable into the PMDX-424 and into your PC. You may see a couple of messages in the lower right corner of your PC monitor telling you that Windows has found a new device and (hopefully) that it is ready to use. If you have previously used any SmartBOB-USB device on this PC, you may not see those messages. The red LED should still be on and the green LED should still be flashing one short flash every two seconds.

2.8   Start Mach4

> **NOTE:**   If this is the first time you have plugged the PMDX-424 into the PC's USB port, wait at least 30 seconds before trying to start Mach4. It can take some computers and some version of Windows this long to finish identifying the device and running the appropriate drivers. If you have plugged the PMDX-424 into the PC before, we still recommend waiting 10 to 15 seconds after plugging in the USB cable before starting Mach4.

Start Mach4 by clicking on the "Mach4 Hobby Loader" icon on your desktop. When the "Select a Profile" dialog appears, **make a copy of the PMDX sample profile**. Making a copy of the sample profile will guarantee that future PMDX-SmartBOB-USB plug-in installs will not overwrite your profile. To make a copy of the sample profile:

(1) Click once on the "PMDX-Sample" profile

(2) Then click on the "Copy Profile" button.

(3) Enter a name for the new profile. Our examples below use the name "PMDXMill", but call it something meaningful to you. You can leave the "Screen Set" line empty. Then click on "OK" to create the new profile.

(4) You be taken back to the "Select a Profile" window, with the new profile name highlighted/selected. Click on "OK" to start Mach4 with that profile.

You should see the red LED turn off (presuming that the E-Stop input is connected to GND), and the green LED should now be flashing on for one second and off for one second.

If this is the first time you've run Mach4 with the SmartBOB device since you have installed/updated the plug-in, you may see the "PMDX-SmartBOB-USB Firmware Update" window appear. If so, that means that the plug-in needs to load a new (or different) version of firmware into the PMDX-424. Click on the "Download" button to update the firmware. When done you may need to exit Mach4 and re-start it. The plug-in will tell you if you need to do this.

If you see pop-up messages saying that the plug-in could not find the SmartBOB device, see the FAQ section in the PMDX support forums here:

> http://www.pmdx.com/PMDX-Forums/

and click on the "SmartBOB-USB controllers and dedicated accessories" category. Or you can contact PMDX support for help.

2.9   Initial Plug-in and Device Configuration

Once Mach4 is running and the plug-in is communicating with the PMDX-424, review the plug-in specific configuration items to see if you need to change any of them. To open the plug-in configuration dialog, go to the Mach4 "Configure" menu and select "Plug-ins...". Then click on the "Configure" button on the "PMDX-SmartBOB-USB" line.

2.9.1   Motors

The PMDX-424 supports up to 4 axes with up to 5 motors, referred to as Moto0, Motor1, Motor2, Motor3A and Motor3B.. The assignment of axes to motors is done in Mach4 and any axis can be assigned to any motor or motors. While the plug-in and PMDX-424 know that Motor3 **may** actually be 2 motors driving a tandem axis, Mach4 will see them as a single motor named "Motor3".

2.9.2   Motor3 – Optional Tandem Motors

Motor3 may be used as a single motor, or as tandem motors on a slaved axis (i.e. gantry). To use as a single motor, wire the step/dir/com connections from J10 (Motor3A) to your motor driver and leave the connections on J11 unconnected. To use two motors for a slaved axis, connect one motor to J10 and the "slave" motor to J11.

The Motor3A and Motor3B outputs are derived from the same motor ("Motor3" in Mach4) and cannot be used independently. They are intended for use as the two ends of a gantry drive with two motors. Hardware on the PMDX-424 forces the "Motor3B" direction signal to be the opposite of the "Motor3A" direction, since this is the normal configuration for a gantry configuration. If you

require both motors to move in the same direction, it is possible to reverse one of the motors by swapping the wires on one phase going from the motor driver to the stepper motor.

2.9.3 Step, Direction and Common Signals

The Step, Direction, and Common terminals are labeled on each motor connector (presuming that the "Normal" step/direction pin-out has been selected, see the table below). The Common can be configured to be +5 volts or ground as required by your motor drivers. All motors must use the same common selection. It is not configurable on a motor-by-motor basis.

2.9.4 SmartBOB Plug-In Configuration

To display the SmartBOB plug-in configuration dialog, go to the Mach4 "Configure" menu and select "Plugins...", then click on the "PMDX SmartBOBUSB" item. In older versions of Mach4 (versions 4.2.0.2872 and earlier), selecting "Plugins..." will bring up the plug-ins dialog and you then need to click on the "Configure" button on the "PMDX SmartBOBUSB" line.

There are several tabs in the plug-in configuration dialog:

Tab Name	Description
Device Info	This tab shows the current Mach4, plug-in and device firmware versions, and has buttons to update the firmware and display the real-time input/output signal status window.
Motor Config	This tab allows you to change the following: • <u>Step and direction pin-out</u> – we recommend leaving this set to "Normal" unless you are using a PMDX-133 or PMDX-134 with the PMDX-424. The "Normal" setting will map the step and direction signals so that they match the silkscreen labels on the PMDX-424 connectors J7 through J11. • <u>Step and Direction Common</u> – The "COM" terminal on connectors J7 through J11 is programmable to be either ground or +5V. This setting depends on the motor drivers and wiring configuration that you are using. • <u>Step Pulse Width</u> • <u>Step Pulse Polarity</u> • <u>Dir Polarity</u>
Feature Config	As of plug-in version 0.36.171, there are no features on this tab that apply to the PMDX-424. That may change in future plug-in versions. **NOTE:** The PMDX-424 does not support a "Charge Pump" feature. It does not need one internally and is not designed to connect to any other board that does require one.
Spindle Config	The PMDX-424 can generate a PWM signal for controlling spindle speed. This signal can appear on some (but not all) of the PMDX-424 output signals. If you have a spindle speed controller such as the PMDX-407, configure the PWM output signal and other parameters here.
Performance Settings	Only change settings here if instructed to by PMDX support. If in doubt restore the default settings by clicking on the "Set to Default" buttons.
Debug	Only change settings here if instructed to by PMDX support. If in doubt restore the default settings by clicking on the "Restore Default Settings" button.

Table 1- SmartBOB Plug-In Configuration Dialog Tabs

2.10 Initial Mach4 Configuration

Now go through the standard Mach4 configuration dialog to configure you motor-to-axis mapping, homing, input signals and output signals. Go to the Mach4 "Configure" menu and select "Mach...". to view the general Mach4 configuration dialog. Please refer to the Mach4

documentation for more information on the configuration fields. The "Mach4 CNC Controller config.pdf" is available in the "Docs" directory in your Mach4 installation directory (for example, C:\Mach4Hobby\Docs).

In general, you will need to configure the following items

(1) **MOTOR TUNING PARAMETERS** – The "Motors" tab is where you enter the motor tuning parameters, including "steps per unit" (i.e. steps per inch, or steps per mm), maximum acceleration and maximum velocity.

(2) **AXIS MAPPING –** The "Axis Mapping" tab is where you map motors to Mach4 axes. Note that if you are using the PMDX-424's hardware slave motor feature on motors 3A and 3B, in Mach4 you will only map "Motor3" to the desired axis. If you wish to use Mach4's slave motor feature to drive two (or more) motors on a tandem axis, then assign the motors as master and slave as you normally would.

(3) **HOMING AND SOFT LIMITS** – This tab is where you configure the homing parameters and soft limits (if used).
   WARNING: Be aware when entering soft limit information that the soft limit "Max" setting is listed first, and the "Min" setting is listed second. This is not necessarily intuitive and entering the min value in the "Max" column and vice versa will **NOT** generate any error or warning messages from Mach4 but may cause erratic behavior, including having the axis jog in the opposite direction from what is commanded.

(4) **INPUT SIGNALS** – This tab is where you map the PMDX-424's input signals to various Mach4 input functions. Note that even though the PMDX-424 input signals are named "Input1" to "Input8" (and "EStop"), you do not have to assign them to the Mach4 input functions "Input #1", etc. You may assign them to any input function that you need. The Mach4 input signals named "Input #1", etc., are typically only used with Lua scripts.

   NOTE: You should map the Mach4 "E-Stop" input function to the PMDX-424's "EStop" input, with a red "X" in the "Active Low" column because the E-Stop is active high. Even if you don't map the PMDX-424's "EStop" input, the PMDX-424 will disable all outputs when the E-Stop input is active.

(5) **OUTPUT SIGNALS** – This tab is where you map the PMDX-424's output signals to various Mach4 output functions.
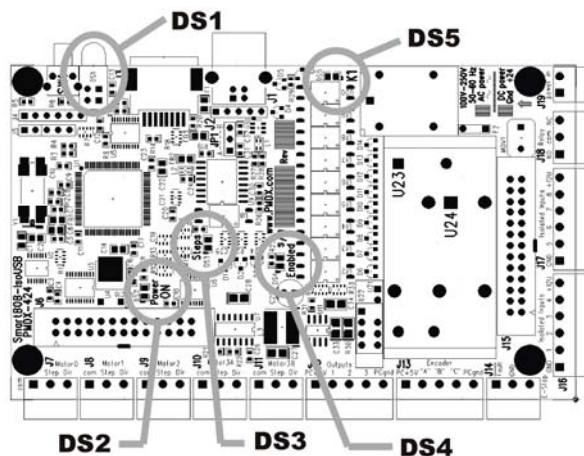
3.0 LEDs

Figure 3 – PMDX-424 LED Locations

3.1   External LEDs (DS1)

These are the combined red and green LED stack at the edge of the board. They indicate the status of the communications and control process. These are software defined LEDs and specifics of their meaning is documented in the plug-in description. Currently they are:

Red   - glows when the bootloader is running, when no communications from Mach4 and the SmartBOB plug-in, or E-Stop is active. Flashes to indicate several error conditions including corrupted firmware.

Green   - flashes quickly while the board is waiting for, or while downloading firmware
- flashes slowly (approximately 1 per second) while running normally
- Other flash codes are likely to be added in future firmware releases

3.2   Power On (DS2)

Located beside the J6 ribbon header. Glows when power is applied to the board. Note that the USB cable does not supply power to the PMDX-424, J19 must be used for board power.

3.3   Steps (DS3)

Located midway between J10 on the left edge of the board and the USB jack on the right edge of the board. This LED will flicker while step pulses are being generated for motion.

3.4   Outputs Enabled (DS4)

Located to the left of the serial number block. The "Outputs Enabled" indicator glows when the outputs are enabled. It will be activated when the USB communications are normal, there is no E-Stop condition and the Mach4 is in the "Enabled" state.

3.5   K1 Relay (DS5)

Located just above the relay. Glows when the relay is activated (the "NO" terminal is connected to the "COM" terminal).

4.0   Connectors

4.1   Signal Naming Versus Pin Numbering Conventions

Mach4 allows interfaces, and the plug-ins that support them, to name pins in any manner desired. For our simpler SmartBOBs we used the parallel printer port naming conventions. This was done because people are familiar with this scheme and these boards were intended as essentially replacements for a parallel port. The PMDX-424 has more signals available and they are no longer named or formatted to emulate a parallel port.

Signals on the PMDX-424 are named according to their intended function. When configuring the Mach4 software these names will appear in the drop down signal selection box instead of pin numbers.

4.2   USB Jack (J1)

J1 is a normal USB type B jack for communications with the host computer. It is used only for communications. ***The board is not powered from the USB port.***

4.3 Remote USB Jack (J2)

J2 allows attachment of a cable to provide a remote USB Jack located on your control enclosure. J2's pin-out matches the PMDX USB-Header-to-B-Panel cable (http://pmdx.com/USB-HDRtoB-Panel).

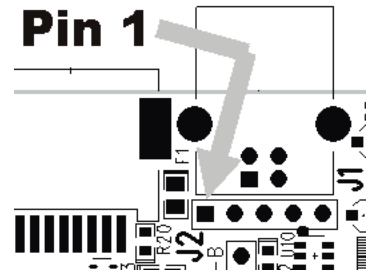| Pin #	Signal
1	USB Shield
2	Ground
3	D+
4	D-
5	USB +5V

Figure 4 - Remote USB Jack (J2) Pin-Out

4.4 Remote Status Panel (J3)

J3 is an RJ-45 connector that provides connection to a PMDX-179 status via a CAT5 cable. The signals on J2 are PMDX proprietary and are NOT Ethernet compatible.

> *WARNING: DO NOT connect Ethernet devices to connector J3!*

4.5 Factory test only (J4 and J5)

These terminal strips are for factory use only and are not populated.

4.6 Step and Direction outputs for motherboards (J6)

This is a 26 pin ribbon header for connection of PMDX-133 and PMDX-134 stepper driver motherboards. Future PMDX motor drivers may also use this connector.

4.7 Motor 0, 1, 2, 3A, and 3B (J7, J8, J9, J10, and J11)

These 3 position screw terminal blocks allow for connecting stepper motor drivers. Each block provides Step, Direction, and a Common for one driver. The SmartBOB plug-in can configure the "Common" to be either ground or +5V. All motors must use the same common selection. See sections 2.9.3 and 2.9.4 for more information.

Assignment of motors to axes is done in the main Mach4 configuration dialog and the motor names on the connector blocks have no predetermined connection to any axis. On gantry style machines, it is typical to assign Motor3 to whichever axis has the gantry. This is usually the "X" or "Y" axis.

The motor 3A and 3B are outputs for two motors on the same axis, and are intended for gantry systems with a motor on each side. The two sides can be controlled independently while homing, but otherwise run in lock step. The 3B direction is inverted from the 3A direction to accommodate the usual situation with rack and pinion motors facing opposite directions.

4.8 Output Signals (J12)

The signals on J12 are general purpose output signals. They are buffered 5 volt logic signals and can directly drive solid-state relays. These signals cannot be assigned as step and direction signals. Some of these signals can be used for PWM speed control. Power to operate solid-state relays (SSRs) or a PMDX-104 relay board can also be supplied through this connector. The ground on this connector is also connected to the "Lgnd" on J13.

> **NOTE:** Early production boards may be labeled "PC+5V" and "PCgnd" instead of "L+5V" and "Lgnd". The "L" stands for "logic", which is the power system running the internal processor, as opposed to isolated power on J16 and J17.

4.9   Encoder/non-isolated Input Signals (J13)

This connector provides three logic level input signals primarily intended for use with encoders, but they can be used as additional general purpose non-isolated input signals. These are 5 volt logic level signals. Pull-up resistors allow use with switches connecting to ground. These inputs are protected from voltages of up to 7 volts DC. These signals have less filtering because they are intended to be usable as high speed encoder inputs when the plugin supports this feature.

- L+5V ("logic +5V") is the non-isolated 5 volt DC power for encoders or other light loads

- "A" is a general purpose input (future encoder A channel input)

- "B" is a general purpose input (future encoder B channel input)

- "C" is a general purpose input (future encoder Index channel input)

- Lgnd ("logic ground") is the ground reference for the input signals and L+5V supply on J13. This ground is connected to the "Lgnd" on J12.

> **NOTE:**   Early production boards may be labeled "PC+5V" and "PCgnd" instead of "L+5V" and "Lgnd". The "L" stands for "logic", which is the power system running the internal processor, as opposed to isolated power on J16 and J17.

4.10   E-Stop and Fault opto-isolated inputs (J14)

The PMDX-424 always responds to the E-Stop and Fault inputs on J14, regardless of any E-Stop configuration settings in Mach4. For normal operation the E-Stop input must be connected to the GND terminal on J14, and the Fault input must be left unconnected, floating or driven to +5V (with respect to the GND terminal on J14). To indicate an E-Stop (or Fault), disconnect the E-Stop input from the GND terminal, and/or connect or drive the Fault input to the GND terminal on J14 (it can be driven to GND by a logic output or open-collector/open-drain output). When the PMDX-424 detects an active E-Stop or Fault input it will halt any motion and disable all of the outputs.

The PMDX-424 ships with shorting clip installed in J14 that connects the E-Stop input to GND. The Fault input is left un-connected. This is the "not EStop" state and will allow the PMDX-424 to enable its outputs once Mach4 is running and enabled.

4.11   Ribbon header for alternate input connections (J15)

This header provides for future motherboards to allow easier connection of sensors. The signals are the same as those in section 4.12 below.

4.12   General purpose opto-isolated inputs (J16 and J17)

J16 and J17 provide 8 isolated inputs. These inputs can be activated by a switch connection to ground, can be driven by the output of an NPN sensor, or can be driven by a 5 volt logic signal. The use of PNP sensors will require the use of a PMDX-105 or a similar circuit to convert the signals to pull to ground instead of 24 volts. These inputs are protected against voltages up to 50 volts DC. An isolated, un-regulated 12 volts DC is provided to power proximity sensors.

4.13   Mechanical SPDT Relay output (J18)

The relay output is rated for a maximum of 6 amperes at up to 240 volts AC or 5 amperes at 24 volts DC. There is arc suppression provided between the normally open and common contacts of the relay to enhance the lifetime of the contacts when switching an inductive load.

- The N/O terminal is the normally open contact of the relay. This terminal is connected to the common terminal when the relay IS activated.
- Relay Com is the common terminal of the SPST contacts.
- The NC terminal is the normally closed contact of the relay. This terminal is connected to the common terminal when the relay is NOT activated.

This relay may also be used to add Fwd/Rev control when using a PMDX-407 spindle control.

4.14   Power Input (J19)

Power input to the board. The PMDX-424 is offered in two versions. One version accepts 100 to 240 VAC and the other accepts 12 to 36 (nominally 24) volts DC. The type of power is marked on the board near J19. Also see the diagrams in section 2.4.

5.0   Known Limitations

See the PMDX-SmartBOB plug-in documentation for a list of known limitations. This can be viewed from the copy of the release notes installed with the plug-in. You can find it here (presuming that you installed Mach4 in the default "C:\Mach4Hobby" directory):

> C:\Mach4Hobby\Plugins\PMDX-SmartBOB-USB\ReleaseNotes.html

You can also view the release notes for various plug-in versions on our web site here:

> http://www.pmdx.com/PMDX-SmartBOB-USB-Plug-In

6.0   Mechanical Dimensions

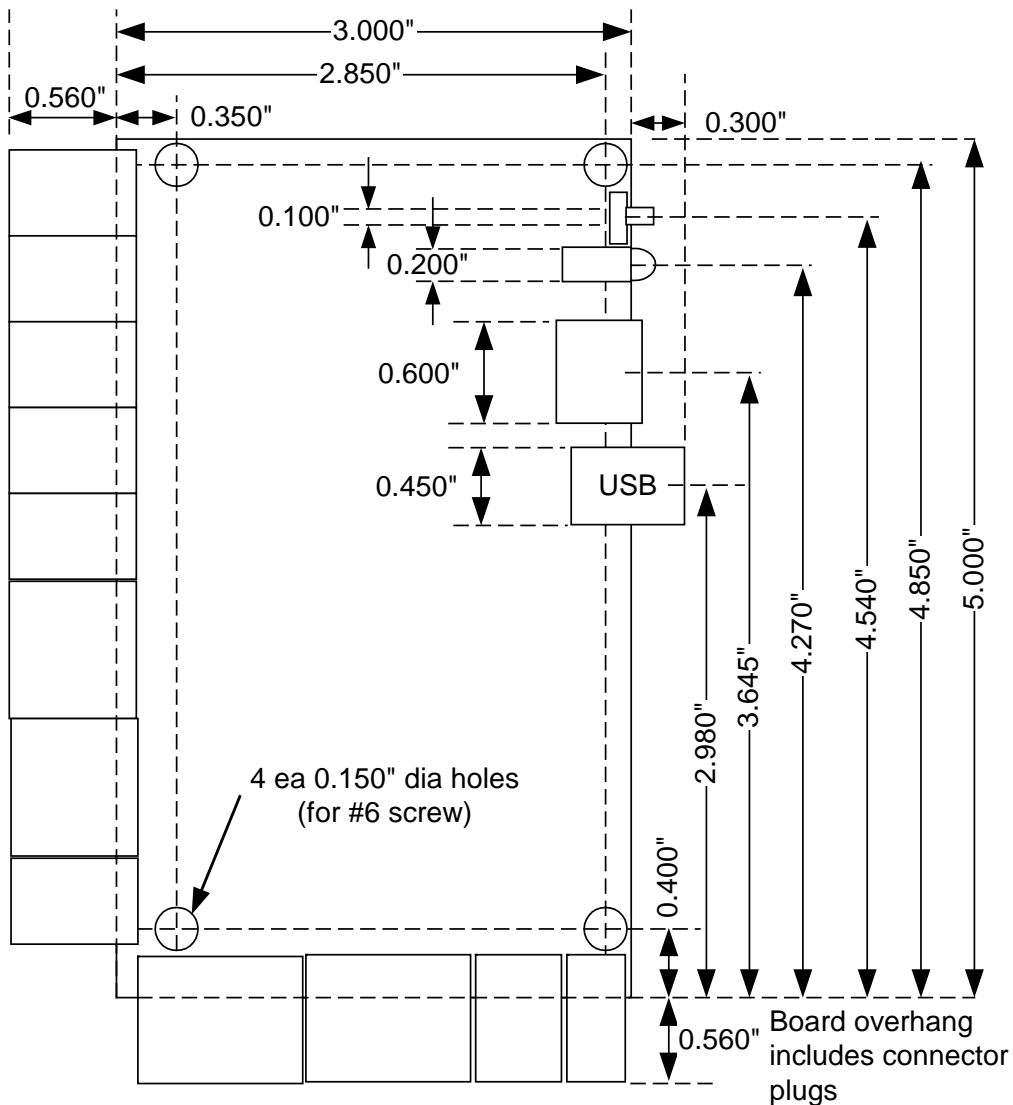Board Height: Maximum 0.850" above the PCB and 0.100" below the PCB (including connectors). PCB thickness is 0.62".

Figure 5 – PMDX-424 Mechanical Dimensions