

PMDX-411

SmartBOB-USB with DB-25 Connector

For use with Mach4

Quick Start Guide



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This document applies to units built on artwork revision PCB-522B.

This is a rough draft and users are cautioned that there may be errors in this document!! If you discover errors in this document, please report them to us.

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1.0 Overview

The PMDX-411 is a USB interfaced motion control pulse engine housed inside a DB-25 connector shell. It can be used as a signal source for many breakout boards including the PMDX-126 or for connecting to controller/driver boxes such as the PMDX-340 or the GeckoDrive G540. It is also possible to use the signals directly with stepper drivers and home/limit switches if you build a suitable cable to mate with the DB-25 male connector on the PMDX-411.

In addition to this document, please also see our web forum for additional support and for announcements of new versions of the PMDX-SmartBOB Mach4 plug-in.

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

1.1 Updates to This Manual and Application Notes

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

<http://www.pmdx.com/PMDX-411>

1.2 Before plugging the PMDX-411 into your computer

Download and run the SmartBOB-USB plug-in installer as directed in section 5.0 of this manual. This will prevent other "helpful" software from trying to identify the USB device and installing an incorrect driver.

1.3 Powering the PMDX-411

The PMDX-411 is powered directly from the USB port. No additional power source is needed, nor is it possible to connect an external power source to the PMDX-411.

2.0 Jumpers

There are no jumpers inside the PMDX-411. All configuration is handled in the Mach4 plug-in software.

3.0 LEDs

There are two LEDs visible on the outside of the PMDX-411 housing, one red and one green. 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

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

4.0 Connectors

4.1 USB cable

There is a 16 inch long cable with a USB type A plug extending from the rear of the shell of the PMDX-411. This cable is not intended to be detached from the PMDX-411, but is replaceable if damaged. There is no bulky connector where this cable enters the rear of the PMDX-411 to prevent the cable from being routed away from the PMDX-411 at an angle. This also avoids having an easily damaged mini-USB connector at this vulnerable location.

This cable provides communications with the host computer and power from the host. The PMDX-411 is a USB 2.0 device. The SmartBOB-USB plug-in installer will install a Windows device driver to service the USB device as well as installing the plug-in itself.

USB extension cables can be used with the PMDX-411. We recommend that the total cable length not exceed 15 feet. The quality of the cable does matter, specifically the conductor size for the power leads. Light duty cables often have 28 AWG wires for the +5 volts and ground. While this may be OK for mice and keyboards we recommend a cable with 24 AWG wires for power. Our PMDX-USB-AtoA cable uses 24 AWG wires for power.

4.2 DB-25 Male connector

The machine interface connector is a male DB-25 connector that mimics the male DB-25 used for parallel printer ports on an IBM_PC style computer. This connector is intended to plug directly onto the female DB-25 connector frequently found on breakout boards, machine controllers, and stepper driver boxes. If the target system is equipped with a male DB-25 connector, a female-to-female gender changer such as the PMDX-DB25GenderAdaptFF can be used between the PMDX-411 and the target system.

4.3 Signal Naming Versus Pin Numbering Conventions

While Mach4 allows interfaces and the plug-ins that support them to name pins in any manner desired, we used the parallel printer port naming conventions for the PMDX-411. This was done because people are familiar with this scheme, and because our DB-25 male connector on the PMDX-411 is the same style of connector normally used for parallel ports.

4.4 Signals available on the DB-25 connector

The signals on the male DB-25 connector have the same layout and direction as those of a parallel printer port. The signals are buffered 5 volt logic signals.

The step and direction signals have sufficient drive current to directly connect to opto-isolator inputs of stepper and servo motor drivers.

There are two possible plans for assigning step/direction signals to the “data port” on pins 2 through 9. The step/direction signals cannot be randomly assigned.

- Step on pins 2, 4, 6, 8, and Direction on pins 3, 5, 7, 9
- Step on pins 3, 5, 7, 9, and Direction on pins 2, 4, 6, 8

The input signals are compatible with 3.3 and 5 volt logic signals. They also have pull-up resistors to allow operation with simple switches connected from the input signal to ground.

The DB-25 input signals available are:

- GND is available on pins 18 through 24 and is the ground reference for all of the inputs.
- Pin 10 – typically assigned as the emergency stop input. This is by convention and a different signal can be assigned as emergency stop if required and the Pin 10 equivalent can be used as a standard input signal. The PMDX-411 plug-in can be used to configure which pin is the emergency stop and the PMDX-411 will act accordingly.
- Pin 11 is a general purpose input signal
- Pin 12 is a general purpose input signal
- Pin 13 is a general purpose input signal
- Pin 15 is a general purpose input signal

The output signals are 5 volt logic signals that can source or sink up to 24 milliAmperes of current.

The DB-25 output signals available are:

- GND is the ground reference for the outputs.
- Pin 1 is a general purpose output signal
- Pin 14 is a general purpose output signal
- Pin 16 is a general purpose output signal
- Pin 17 is a general purpose output signal

5.0 Configuring the Mach4 plug-in for the PMDX-411

5.1 Initial Mach4 Configuration

WARNING: DO NOT PLUG THE PMDX-411 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-411 as some other type of USB device and installing an incorrect driver.*

- (1) Make sure the PMDX-411 is **unplugged** from the PC's USB port.
- (2) Download and run the SmartBOB-USB plug-in installer program.

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 files in the folders at "C:\Mach4Hobby\PlugIns" and "C:\Mach4Hobby\PlugIns\PMDX-SmartBOB-USB"(currently only the release notes and uninstall files are stored in this sub-directory).

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

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

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

Firmware in the PMDX-411 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.

- (3) After installing the PMDX-SmartBOB-USB plug-in as described above, create a new profile by using the Mach4Loader icon on the desktop to copy the PMDX sample profile into a new profile with the name of your choice. This is suggested so that reinstalling the PMDX plug-in will not overwrite your updated profile.
- (4) For this example we will call the new profile "PMDXMill". If you choose a different name, substitute your name where ever you see "PMDXMill" mentioned. Refer to the *Mach4 Configuration Guide* (available at <http://www.machsupport.com/help-learning/product-manuals/>) for further instructions on how to copy or create a new profile, and how to create shortcuts to launch the profile of your choice. **Do not open this new profile yet.** Exit the Mach4 Loader after copying the profile.
- (5) Plug the PMDX-411 into a USB port on your computer. Wait a few seconds (up to 30 if this is the first time the device has been connected). You may see a few pop-up messages from

Windows about installing a new device. Wait for the "your new device is ready to use" message in the lower right corner of your screen.

NOTE: If you have not run the setup program from step (2) which installs the Windows communications port driver for the PMDX-SmartBOB-USB this step will fail, or sometimes your system may automatically install a competing driver that will not work with the PMDX-SmartBOB-USB.

- (6) Start Mach4 again using the new PMDXMill profile. If you see a "cannot find device" warning, exit Mach4 and then unplug the PMDX-411 from the USB port. Wait 30 seconds, then plug the PMDX-411 back into the USB port. Wait another 30 seconds and then start Mach4 again. If you still get this warning, contact PMDX support.

NOTE: You *MAY* see the PMDX-SmartBOB-USB Firmware Update dialog displayed. If so, that means that the plug-in requires different firmware than what is currently in the device. The version numbers are displayed in the dialog box. Click on "Download" to download the required firmware to the device. When the download is done, click on the "Exit" button to close the dialog box.

5.2 Configuring the PMDX-411 Inputs and Outputs

- (1) If Mach4 Hobby is not still running from the steps in the previous section, start Mach4Hobby using the new PMDXMill profile that you created in the previous section.
- (2) SmartBOB-USB Plug-In Configuration – Go to the “Configure->Plugins” menu and then click on the “Configure” button next to the PMDX-SmartBOB-USB plug-in. This displays the SmartBOB-USB plug-in configuration dialog. There are several tabs:
 - The “Device Info” tab shows the Mach4 build number, plug-in version and device firmware version numbers. You will need these numbers if you contact us for support.
 - The “Motor Config” tab allows you to change the motor settings that are not available in the normal Mach4 configuration screens.
 - The “Feature Config” tab has settings for charge pump and the spindle speed PWM output.
 - The “Performance Settings” tab control how the plug-in and the PMDX-411 device communicate. These settings should normally not need to be changed.
 - The “Debug” tab should only be used under direction from PMDX support. Changing these settings may have a significant negative impact on the performance of the system.
- (3) **STEP and DIRECTION PINS** - The PMDX-411 supports up to 4 motors. The motor connections have fixed pin assignments on the PMDX-411 as follows:

Motor0	pins 2 & 3
Motor1	pins 4 & 5
Motor2	pins 6 & 7
Motor3	pins 8 & 9

Which pin is step and which is direction is controlled via the plug-in configuration screen. Go to the "Configure->Plugins" menu and then click on the "Configure" button next to the PMDX-SmartBOB-USB plug-in, then click on the “Motor Config” tab The step and direction options are:

- Step on pins 2, 4, 6, 8, and Direction on pins 3, 5, 7, 9
- Step on pins 3, 5, 7, 9, and Direction on pins 2, 4, 6, 8

Select the option that matches your breakout board or your desired motor driver wiring. These are the only options that will be offered for step and direction pinouts. Boards which do not accept step and direction signals using one of these two pinout assignments will require a special cable to present the signals on the required pins.

The "Motor Config" tab also has settings for step pulse width and step and direction polarity. Usually these can be left in their default states unless you need step rates above 50 KHz, in which case you need to change the step pulse width to 5us (for 100 KHz maximum step rate).

Click "OK" and then close the "Configure Plugins" dialog box by clicking "OK".

- (4) **MOTOR PARAMETERS** - Configure the motor parameters, axis mapping, homing parameters, input signal and output signals as shown in the "Mach4 Configuration Guide" in Section 4, "Machine Settings" (available at <http://www.machsupport.com/help-learning/product-manuals/>). When assigning input or output signals, click in the "Device" column to display the device selection list and select "SmartBOBUSB". Then in the "Input Name" or "Output Name" column, select the parallel port pin that you want to assign to that signal. For input signals, you can assign multiple signal names to a single input pin. For output signals, you can only assign one output name to any output pin. The signal name lists are long. Be sure to scroll all the way to the end of the list to see all the possible signals.
- (5) **E-Stop INPUT** - When you are using the PMDX-411 stand alone, you should normally assign the E-Stop signal to "Pin 10" with a red "X" in the "Active Low" column. If you are using a ribbon cable to connect to another breakout board, you may assign the E-Stop signal to whatever pin your breakout board uses for that purpose. For PMDX breakout boards, this is still pin 10.
- (6) **Charge Pump Output** - When using a PMDX-411 stand alone you do NOT need to assign a "Charge Pump" signal to any output pin. If you are also connecting an external device to the PMDX-411 and that device requires a charge pump signal, you may assign a charge pump output signal pin. The PMDX-411 will automatically enable and disable its outputs, including the "Charge Pump", based on the state of the Mach4 "Enable" button, the status of the USB communications connection, and the E-Stop input. A "charge pump" signal is not needed or used by the PMDX-411 itself because the USB communications with the Mach4 plug-in (or lack of communications) tell the PMDX-411 when to enable or disable its outputs.

If your breakout board or device (such as a PMDX-126, PMDX-340, or Geckodrive G540) requires a "charge pump" signal on one of its pins, then assign "Charge Pump #1" to that output pin. On the PMDX-411, the charge pump signal may be assigned to any of the four general purpose output pins ("Pin 1", "Pin 14", "Pin 16" or "Pin 17"). PMDX products that use a charge pump signal expect it on pin 17. The Geckodrive G540 expects the charge pump on pin 16.

Charge Pump Frequency: The charge pump output frequency defaults to a 12.5 KHz square wave, which works with the Geckodrive G540 as well as all PMDX breakout boards. If you need a different frequency, go to the plug-in configuration dialog and click on the "Feature Config" tab.

Geckodrive G540 Note: If you are using the G540, then check the "Charge Pump On Always" box in the "Charge Pump" section of the "Feature Config" tab of the plug-in configuration dialog.

6.0 Known Limitations

See the PMDX-SmartBOB plug-in documentation for a list of known limitations. This can be downloaded from our web site here:

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