PMDX-145

Pendant Adapter Board

User's Manual

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1.0 Overview

This document describes the configuration and operation of the PMDX-145 Pendant Adapter Board. The PMDX-145 provides an interface for a HEDSS-style pendant to the 8 data bits (pins 2 through 9) of a PC parallel port. Non-parallel port devices (i.e. SmoothStepper) are not yet supported.

1.1 Important Safety Information

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 is integrated into the purchaser's system and cannot be responsible for guaranteeing the safety of your system.

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

The PMDX-145 contains circuitry that may be connected to dangerous voltages. Care must be taken that 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.

This product may not be used in life support or other critical safety applications.

1.2 Warranty Summary

The PMDX-145 is warranted against failure due to defective parts or workmanship for 90 days from the date of sale. Refer to Appendix A for complete warranty details.

> *NOTE:* If you have an item requiring service, please see the "Warranty and Repairs" page on the PMDX web site (http://www.pmdx.com) for return instructions.

In general, the purchaser must pay shipping to send the unit to PMDX. For repairs covered under warranty and with return shipping to a USA address PMDX will ship the repaired unit back to you via ground transportation at our expense. Repairs are normally completed within 10 business days. See Appendix A for our complete warranty details. *Please see the "Warranty and Repair" page on our web site (http://www.pmdx.com) for full details of our repair and shipping policies.*

1.3 Trademarks

The following product names used in this manual are the trademark, trade name or registered mark of the respective companies:

Product Names	Company
Mach3	ArtSoft (http://www.machsupport.com)
SmoothStepper	Warp9 Tech Design, Inc. (http://www.warp9td.com/)
PMDX-126	PMDX/Practical Micro Design, Inc. (http://www.pmdx.com)

1.4   Features

The PMDX-145 has the following features:

PC Parallel Port:

- Provides pendant switch and MPG signals on the 8 "data bits" (pins 2 to 9) of the PC parallel port (operating in "input" mode)

- Can be used with a PC parallel port (on the motherboard or add-in card)

- Requires software that allows the data bits of the parallel port to be used as inputs

- Port connections can be made via a 26 pin ribbon cable, or using on-board DB-25 female

- Pass through connectors allow it to be connected between a host port and the PMDX-126 to supplement PMDX-126's second port

Pendant Interface:

- Phase A and B MPG signals

- Selector switches encoded to use fewer input signals

- Support for two additional push-buttons for custom pendants or modified HEDSS pendants.

- Supports external MPG inputs and switches for custom operator panels

Pass-Through Connector:

- 26-pin ribbon cable header connects to PMDX-126 for other parallel port signals.

Misc::

- Normally-closed relay contacts for E-Stop circuit (controlled by pendant E-Stop switch)

- Active low FAULT output for use with PMDX-126 boards.

- Power-on and E-Stop LEDs.

Power Supply:

- Requires a single +5 volts DC power source for operation

- Power can be supplied via a two pin terminal strip

- Alternate source of power from PMDX-126 via pin 26 of the ribbon

- On-board LED's for power status

1.5   Updates to this Manual

Check the PMDX web site for revisions or updates to this manual (http://www.pmdx.com). The latest revision of this manual is available on the PMDX-145 page (follow the links from the main page). Also check on the "Support" web page for application notes related to the PMDX-145.

2.0 Installation and Operation

2.1   Choose a power source

The PMDX-145 requires a regulated +5V DC power supply that can provide at least 50 mA plus the current required by the pendant or MPG (usually around 150 mA total). See section 0 for more information on power supplies. Apply power to the PMDX-145 and verify that the "Power On" LED turns on and is bright. If the LED remains off or glows dimly, check the following:

- Verify that the voltage on your power source is still +5V
- See the note in section 5.0 under "Power LED".

2.2   Connect to PC/Host

Connect the PMDX-145 to your PC's parallel port (usually a 2nd parallel port) using either the 25-pin "D" connector labeled "J1" or the 26-pin ribbon cable connector labeled "J11". Note that the PMDX-145 Mach3 plug-in does not currently support non-parallel port devices (i.e. SmoothStepper).

2.3   Configure PC/Host Software for inputs

The default configuration for PC parallel ports (and Mach3) is for pins 2 through 9 to be outputs from the PC. You must configure your CNC software to make these pins inputs to the PC or controller. The

steps necessary to do this vary depending on what hardware you have connected to the PMDX-145 and what CNC software you are using. Please refer to the documentation for your hardware and CNC software. Also check the "support" pages on the PMDX web site (http://www.pmdx.com) for application notes.

If you are using the PMDX-145 Mach3 Plug-In, it can detect if you have the proper parallel port 2 settings. Please refer to the plug-in documentation for more information.

2.4 Test Input Signals

> **DO NOT CONNECT YOUR PENDANT, MPG OR SWITCHES YET.**
>
> **DO NOT INSTALL THE PMDX-145 MACH3 PLUG-IN YET.**

In this step you will use a short piece of wire or a jumper clip to test two of the PMDX-145's inputs, the connection to your controller and your CNC software configuration. The examples here are specifically for Mach3 users. If you are using a different CNC program, please consult the documentation for that program to see how to monitor the parallel port pins directly.

In Mach3, go to the "Diagnostic" screen by either clicking on the "Diagnostics (Alt7)" tab, or type ALT-7 (press and hold the ALT key, then press the number 7 key above the keyboard, NOT the 7 key on the numeric keypad). On the diagnostics screen, find the section labeled "Port 1 Pins current State" just to the right of the center of the screen. In spite of its title, these green/black indicators will show both parallel port 1 and 2 input signals. A green (or light gray when this manual is printed in black & white) indicator means "1" or "logic high". A black indicator means "0" or "logic low".

> **NOTE:**   The images below were taken from Mach3 version 3.043.022. The layout may change in future Mach3 or Mach4 releases.

(1)   With no jumper wire connected, verify that your software reads parallel port pins 2 through 6 as all 'high" (or one) and pin 9 as "low" (or zero).

(2)   Connect the jumper wire onto screw terminal connector J5 from pin 2 (labeled "#2") to pin 3 (labeled "PCgnd"). Verify that your software sees parallel port pins 2 through 6 "high" (or one) and pin 9 "high" (or one).

(3)   Move one end of the jumper wire from J5 pin 2 to J5 pin 1 (labeled "#1"), so that the jumper wire is connected from J5 pin 3 (PCGnd) to J5 pin 1 (#1). Verify that your software sees parallel port pin 2 as "low" (or zero), parallel port pins 3 through 6 as "high" (or one) pin 9 as "high" (or one)..

(4)   Move the jumper wire from J5 to J6, from the terminals labeled "PCgnd" and "A". Verify that your software sees parallel port pin 7 as "low" (or zero) and pin 8 as "high" (or one).

(5)   Move one end of the jumper wire from the "A" terminal to the "B' terminal. Verify that your software sees parallel port pin 7 as "high" (or one) and pin 8 as "low" (or zero).
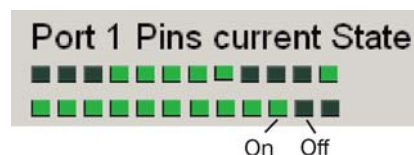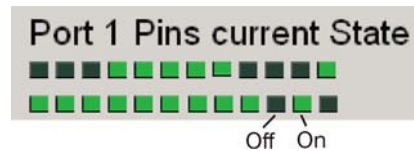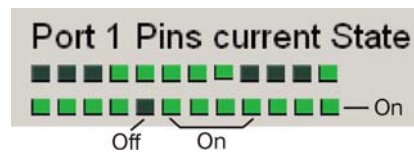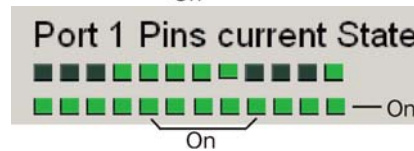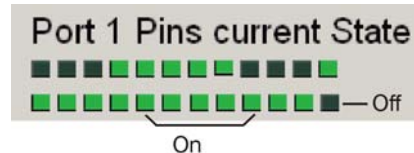
2.5   Connect Pendant and External Push-Buttons

Connect the HEDSS-style pendant to J2 or J12 depending on the cable you are using. If you have additional external push-buttons, connect them to J5 as shown in section 4.3.

To test these inputs, use the Mach3 "diagnostics" screen and verify the parallel port inputs are the same as shown in section 2.4 steps (2) and (3). Step (2) shows the inputs when button #2 is pressed, and step (3) shows the inputs when button #1 is pressed.

(1) Set the "Axis Sel" switch to the "X" axis, and the "Inc Sel" switch to the "x1" setting. Press and hold the "enable" button on the side of the pendant. Verify that your software reads parallel port pins 2 through 6 as all 'low" (or zero) and pin 9 as "high" (or one).

(2) Keep the "Axis Sel" switch in the "X" position and change the "Inc Sel" switch to the "x10" position. Press and hold the "enable" button on the side of the pendant. Verify that your software reads parallel port pins 2 through 4 as "low" (of zero), pin 5 as "high" (or one), pin 6 as "low" (or zero) and pin 9 as "high"(or one).

(3) Change the "Axis Sel" switch to the "4" position (i.e. 4th axis), and return the "Inc Sel" switch to the "x1" position. Press and hold the "enable" button on the side of the pendant. Verify that your software reads parallel port pins .2 and 3 as "high" (or one), pins 4 through 6 as "low" (or zero), and pin 9 as "high" (or one).
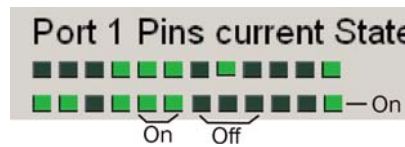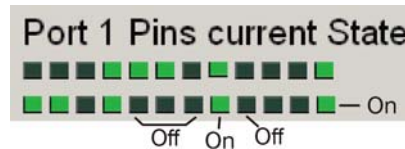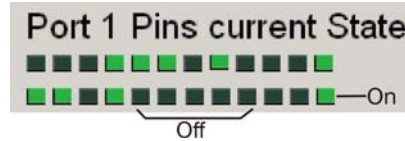
2.6   Install the PMDX-145 CNC Software Plug-In

If you are using Mach3 as your CNC software, now install the PMDX-145 Plug-In. The plug-in and release/installation notes may be downloaded from the PMDX web site (http://www.pmdx.com) under the "Support", "Software Downloads" page.

If you are using LinuxCNC (previously known as EMC2), please contact PMDX for help with configuring the HAL for the PMDX-145.

3.0 Decoding Pendant Switches

The PMDX-145 encodes the pendant switch settings so that they use fewer input bits on the parallel port. The table below shows the values of the parallel port 8-bit data bus.

Pin 6	Pin 5	Meaning
0	0	Speed x1
0	1	Speed x10
1	0	Speed x100
1	1	No switch active

Pin 4	Pin 3	Pin 2	Meaning
0	0	0	Axis Select #1 (X)
0	0	1	Axis Select #2 (Y)
0	1	0	Axis Select #3 (Z)
0	1	1	Axis Select #4 (A)
1	0	0	Axis Select #5 (B)
1	0	1	Axis Select #6 (C)
1	1	0	Ext. Push-Button #1
1	1	1	Ext. Push-Button #2

Table 1 – Pendant Switch Encoding (when Pin 9 is "1")

NOTE: The values shown in this table are valid ONLY when pin 9 reads as "1". When pin 9 reads as "0", the values of these other pins should be ignored. Pin 9 is the "pendant enable" signal and is asserted then the button on the side of the pendant is pressed.

4.0 External Connections

4.1 Fault Output

The PMDX-145 outputs a set of solid-state relay contacts as a Fault signal. These contacts are normally open and close when the pendant's E-Stop button is pressed. The Fault signal is designed to connect to the PMDX-126's Fault input to disable the PMDX-126's outputs when then pendant's E-Stop switch is pressed.

> *NOTE –* Unlike the E-Stop output, the Fault output is only valid when the PMDX-145 is powered on.

4.2 E-Stop Output

The PMDX-145 outputs a set of mechanical relay contacts as an E-Stop signal. These contacts are normally open (indicating an emergency stop condition), and close only when the PMDX-145 board has power and the pendant E-Stop switch is NOT pressed. The E-Stop relay contacts are designed to be part of the emergency stop circuitry that controls power to motors or other hazardous machine parts. The relay contacts are rated at 2 amperes at 30VDC or 0.5 amperes at 125VAC.

4.3 External Push-Button Connections

The PMDX-145 supports up to two additional push-buttons in addition to the selector switches on the HEDSS-style pendant. These additional push-buttons are optional, and if you are not using them you should not connect anything to the screw terminals on connector J5.

If you are using one or both of these additional buttons, connect them to the PMDX-145 as shown below.
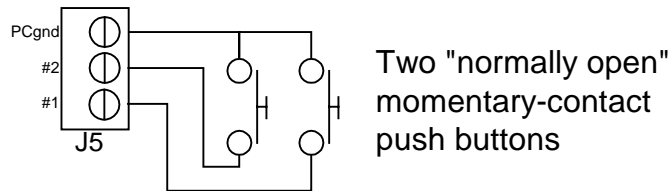
Figure 1 - Sample Mechanical Switch Input Connections

4.4 External MPG Connections

The PMDX-145 provides a screw-terminal connector (J6) as an alternate way to connect to an MPG. For example, if you are using the PMDX-145 with a "build-it-yourself" pendant by mounting your own MPG and switches on a panel, you could wire the MPG to connector J6 instead of trying to wire it into the DB25 connector J2.
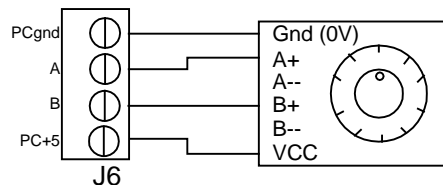
Figure 2 - Sample External MPG Connections

> *WARNING:* *Do not connect an external MPG and a HEDSS-style pendant to the PMDX-145 at the same time!*

4.5   Power Supply

The PMDX-145 requires a regulated +5V power supply. The board can be powered from any one of these sources:

- External power supply via screw terminal connector J13 (see section Figure 4 below).

- From "Next Board" on ribbon cable connector J10 pin 26 (see section 6.7). This configuration is usually used when the PMDX-145 is connected between a PC/Host controller and a PMDX-126. It allows the PMDX-145 to be powered from the PMDX-126 or similar breakout board.

> *WARNING –   Do not connect more than one power source to the PMDX-145. Doing so may damage the PMDX-145 and your power supply.*

4.5.1   Power Feed-Through Mode

Power feed-through mode allows the PMDX-145 to be powered from the "Next Card" connector. In the example given below, the PMDX-126 is configured to provide +5V power on both of its 26-pin ribbon cable connectors. This +5V is then used to power the PMDX-145 and the pendant.

> *WARNING –   When powering the PMDX-145 and pendant from a PMDX-126, make sure to not exceed the total current that the PMDX-126 can supply (including any sensors that are powered by the PMDX-126).*

Figure 3 - PMDX-145 with PMDX-126 and powered from PMDX-126

5.0 LEDs

Power On LED (DS1)

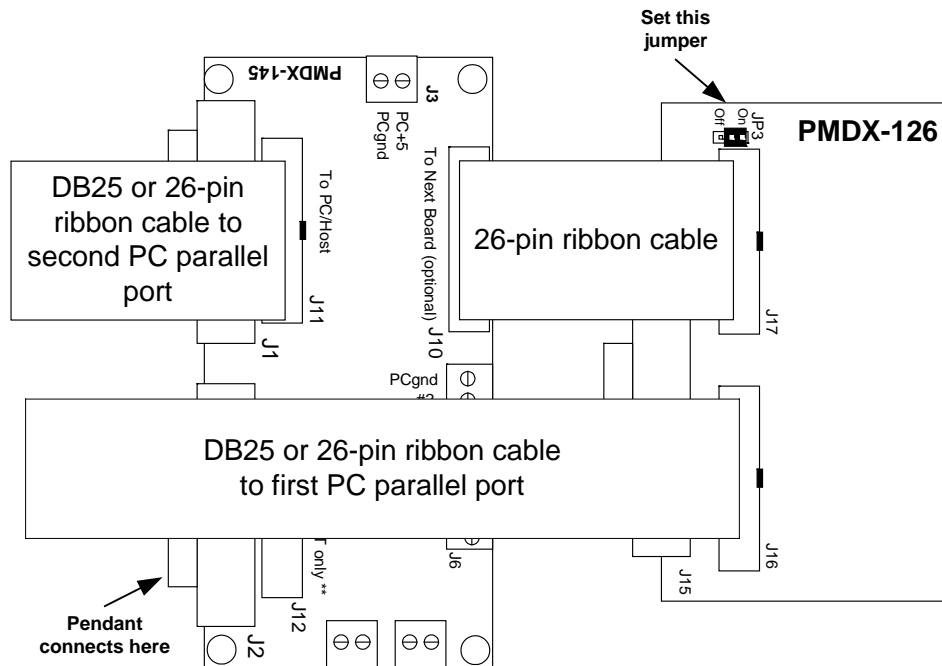The PMDX-145 provides an LED (DS1, labeled "Power On") that indicates the presence of the +5V supply.

> NOTE – When no power is applied to the PMDX-145, and the PMDX-145 is connected to the PC's parallel port, this LED may glow dimly. This is because the signals from the PC's parallel port can source a small amount of power when driven high. ***This does not mean that power is available to the rest of the board or that there is sufficient power for the board to function properly.***

E-Stop LED (DS2)

There is an LED next to the E-Stop connector (labeled DS2) that is lit when the E-Stop signal is active.

6.0 Connectors

The PMDX-145 contains the following connectors. The following sections describe the pin-out and functionality of each connector. For all connectors, pin "1" is the pin closest to the reference designator (i.e. J1 pin 1 is the pin closest to the "J1" text on the circuit board). In addition, all connectors have square pads on pin 1 (look on the bottom of the circuit board).

Connector	Description
J1	DB-25 style connector from PC parallel port or host controller
J2	DB-25 style connector to connect to pendant
J3	2-pin screw terminal connector for FAULT output (to PMDX-126)
J4	2-pin screw terminal connector for E-Stop relay contacts
J5	3-pin screw terminal connector for optional external push-button switches
J6	4-pin screw terminal connector for optional external MPG connections
J10	26-pin ribbon cable for parallel port pass-through to another device (PMDX-126 port 2, for example)
J11	26-pin ribbon cable alternate to J1 from PC parallel port or host controller
J12	26-pin ribbon cable alternate to J2 to connect to pendant
J13	2-pin screw terminal connector for +5V D|C power supply

Table 2 - Summary of PMDX-145 Connectors

6.1   PC/Host Parallel Port (J1 and J11)

The PMDX-145 provides both a 25-pin "D" connector and a 26-pin ribbon cable connector for connections to a PC or Host controller parallel port (note that only one connector should be used at a time).

> *NOTE –*   When using a DB-25 "male to male" cable to connect to the PC's printer port, make sure it has one-for-one straight-through pin connections. Cables intended as serial cables may not provide the correct connections.

PC Parallel Port Pin Numbers	*Function on PMDX-145*
1	Passed through to J10 ("Next Board")
2	Axis Select Bit 0
3	Axis Select Bit 1
4	Axis Select Bit 2
5	Speed Select Bit 0
6	Speed Select Bit 1
7	MPG Phase A signal
8	MPG Phase B signal
9	Data Valid signal (active low)
10	Passed through from J10 ("Next Board")
11	Passed through from J10 ("Next Board")
12	Passed through from J10 ("Next Board")
13	Passed through from J10 ("Next Board")
14	Passed through to J10 ("Next Board")
15	Passed through from J10 ("Next Board")
16	Passed through to J10 ("Next Board")
17	Passed through to J10 ("Next Board")
18 – 25	Ground signals, connected to PMDX-145 ground and to J10 ("Next Board")
26	Not present on the PC parallel port, no connection on the PMDX-145

Table 3- PC/Host Parallel Port Connectors (J1 and J11)

> *NOTE 1 –*   The PC Pin number column lists the pin numbers as they would appear on the PC's 25-pin "D" connector when using a standard printer cable.

6.2   Pendant Connectors (J2 and J12)

The PMDX-145 provides both a 25-pin "D" connector and a 26-pin ribbon cable connector for connections to a HEDSS-style pendant (note that only one connector should be used at a time). The pin-out of this connector matches the HEDSS-style pendant as shown below.

PC Parallel Port Pin Numbers	Function on PMDX-145
1	+5V from PMDX-145 to pendant
2	MPG ground (tied to ground on the PMDX-145)
3	MPG Phase A signal from pendant
4	MPG Phase B signal from pendant
5	LED+ to pendant
6	LED- to pendant (tied to ground on the PMDX-145)
7	Axis Select "X" (tied to ground when selected)
8	Axis Select "Y" (tied to ground when selected)
9	Axis Select "Z" (tied to ground when selected)
10	Axis Select "4" (tied to ground when selected)
11	Speed Select "x1" (tied to ground when selected)
12	Speed Select "x10" (tied to ground when selected)
13	Speed Select "x100" (tied to ground when selected)
14	Select Switch Common (tied to ground on the PMDX-145)
15	E-Stop Switch from pendant (open for "EStop" condition, connected to pin 16 for normal operation)
16	E-Stop Switch common (tied to ground on the PMDX-145)
17	Standby – no connected on the PMDX-145)
18	Axis Select "5" (tied to ground when selected)
19	Axis Select "6" (tied to ground when selected)
20	MPG Phase A Inverted (not connected on the PMDX-145)
21	MPG Phase B Inverted (not connected on the PMDX-145)
22-26	Not connected on the PMDX-145 (pin 26 only present on J12)

Table 4- HEDDS-Style Pendant Connectors (J2 and J12)

6.3   Fault Output Connector (J3)`

The table below shows the labels for connector J3.

Pin	Example Label	Description
1	~Fault	Fault output (connected to GND terminal when EStop is active)
2	GND	Isolated return for fault signal *Note - this signal is NOT tied to the PC ground*

Table 5 – Fault Output Connector (J3)

6.4   E-Stop Output Connector (J4)

The table below shows the labels for connector J4.

Pin	Example Label	Description
1	N/C	Normally closed relay terminal (connected to COM terminal when EStop is NOT active)
2	COM	Relay common terminal

Table 6 –E-Stop Output Connector (J4)

6.5   External Push-Button Connector (J5)

The table below shows the labels for connector J5.

Pin	Example Label	Description
1	#1	Push-button input for switch #1
2	#2	Push-button input for switch #2
3	PCgnd	PC ground (common reference for push-buttons)

Table 7 –External Push-Button Connector (J5)

6.6   External MPG Connector (J6)

The table below shows the labels for connector J6.

Pin	Example Label	Description
1	PC+5	PC-referenced +5V supply
2	B	MPG phase "B" signal
3	A	MPG phase "A" signal
4	PCgnd	PC ground (common reference for push-buttons)

Table 8 –External Push-Button Connector (J5)

6.7   "Next Board" Parallel Port (J10)

The PMDX-145 provides a 26-pin ribbon cable connector for connections to the "next board". The 'next board" would be another circuit board that can make use of the parallel port signals that thePMDX-145 does not use.

Equivalent PC Parallel Port Pin Numbers	Function on PMDX-145
1	Passed through from J1/J11 (PC/Host)
2	No connection
3	No connection
4	No connection
5	No connection
6	No connection
7	No connection
8	No connection
9	No connection
10	Passed through to J1/J11 (PC/Host)
11	Passed through to J1/J11 (PC/Host)
12	Passed through to J1/J11 (PC/Host)
13	Passed through to J1/J11 (PC/Host)
14	Passed through from J1/J11 (PC/Host)
15	Passed through to J1/J11 (PC/Host)
16	Passed through from J1/J11 (PC/Host)
17	Passed through from J1/J11 (PC/Host)
18 – 25	Ground signals, connected to PMDX-145 ground and to J1 and J11 (PC/Host).
26	This pin can be used to provide +5V power into the PMDX-145. See section 4.5.1 for more information.

Table 9- "Next Board" Parallel Port Connector (J10)

NOTE 1 –   The PC Pin number column lists the pin numbers as they would appear on the PC's 25-pin "D" connector when using a standard printer cable.

6.8   Power Connector (J13)

This connector can be used to connect a regulated +5V power supply to the PMDX-145 board.

WARNING: When using J13, make sure no power is provided via the "Next Board" connector (see section 6.7).

Pin	Example Label	Description
1	PC+5V	Regulated +5V supply
2	PCgnd	Ground (power supply return). This is common with the ground on the two PC/Host parallel port connectors, the pendant connectors *AND* the "Next Board" parallel port connector.

Table 10 – Power Supply Connector Pin-Out (J13)

7.0 Mechanical Specifications

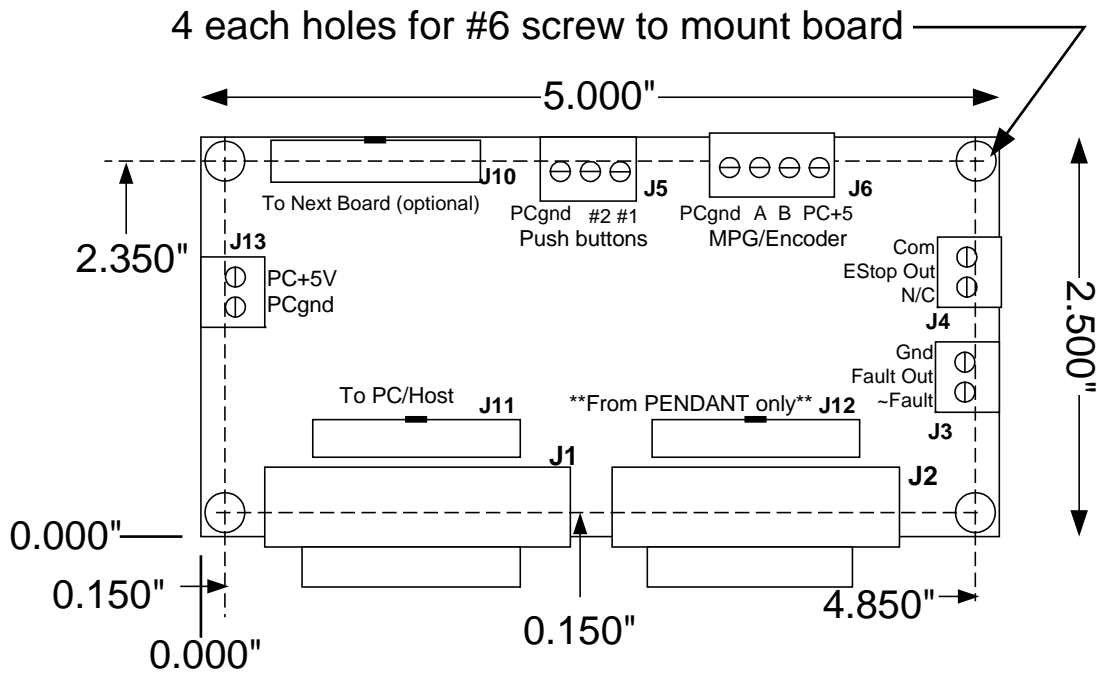4 each holes for #6 screw to mount board ⎯⎯⎯

Figure 4 - PMDX-145 Dimensions and Mounting Holes

> *WARNING: The PMDX-145 should be protected from liquids, dirt, or chips (especially metal chips which can cause shorts) coming in contact with the board.*

8.0 Electrical and Environmental Specifications

Power Supply:
+5V DC, regulated, *50* mA maximum for PMDX-145 only
+5V DC, regulated, 150 mA maximum for PMDX-145 and pendant
Note: Power may be supplied via either J13 or J10 pin 26 (from a PMDX-126, for example)

EStop Relay Contact Ratings (on J4):
2 amperes at 30VDC
0.5 amperes at 125VAC

Outputs to PC (via parallel port at J1 and J11):
Outputs: High: at least 3.8V driving a 6mA load
                   Low: at most 0.8V sinking 6mA

Inputs (at push-button inputs at J5 and MPG inputs at J6):
Inputs: Low must be able to sink 3 mA at less than 1.4V
                   High must be open circuit or greater than 3.2 volts (and no greater than 5VDC)

Environmental: Temperature: 0° to +55° C
                              Relative Humidity: 20% to 80% relative humidity, non-condensing

Appendix A – Warrant y

Statement

Practical Micro Design, Inc. (PMD) warrants that this hardware product is in good working condition, according to its specifications at the time of shipment, for a period of 90 days from the date it was shipped from PMD. Should the product, in PMD's opinion, malfunction within the warranty period, PMD will repair or replace the product without charge. Any replaced parts become the property of PMD. This warranty does not apply to the software component of a product or to a product which has been damaged due to accident, misuse, abuse, improper installation, usage not in accordance with product specifications and instructions, natural or personal disaster or unauthorized alterations, repairs or modifications.

Limitations

All warranties for this product, expressed or implied, are limited to 90 days from the date of purchase and no warranties, expressed or implied, will apply after that period.

All warranties for this product, expressed or implied, shall extend only to the original purchaser.

The liability of Practical Micro Design, Inc. in respect of any defective product will be limited to the repair or replacement of such product. Practical Micro Design, Inc. may use new or equivalent to new replacement parts.

Practical Micro Design, Inc. makes no other representations or warranties as to fitness for purpose, merchantability or otherwise in respect of the product. No other representations, warranties or conditions, shall be implied by statute or otherwise.

In no event shall Practical Micro Design, Inc. be responsible or liable for any damages arising
- (a) from the use of the product;
- (b) from the loss of use of the product;
- (c) from the loss of revenue or profit resulting from the use of the product; or
- (d) as a result of any event, circumstance, action or abuse beyond the control of Practical Micro Design, Inc.

whether such damages be direct, indirect, consequential, special or otherwise and whether such damages are incurred by the person to whom this warranty extends or a third party.