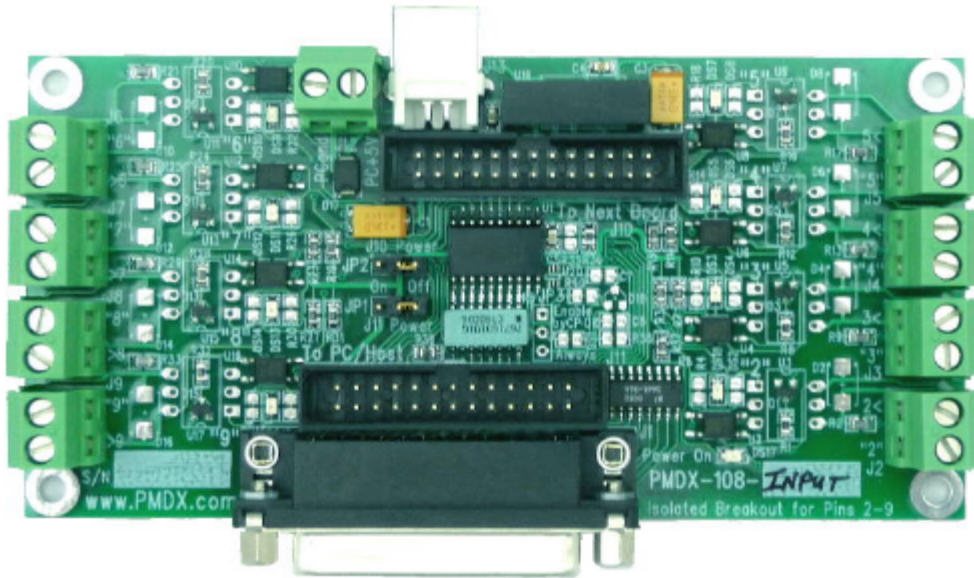


PMDX-108-Input

8-Channel Isolated Input Board for PC parallel port pins 2-9



User's Manual

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Table of Contents

1.0	Overview	3
1.1	Ordering Information (part numbers)	3
1.2	Important Safety Information	3
1.3	Warranty Summary.....	3
1.4	Trademarks	4
1.5	Features.....	4
1.6	Updates to this Manual	4
2.0	Installation and Operation	5
2.1	Choose a power source	5
2.2	Connect to PC/Host.....	5
2.3	Configure PC/Host Software for inputs	5
2.4	Test Input Signals.....	5
2.5	Connect Sensors and Switches.....	5
3.0	Input Signal Connections	5
4.0	Power Supply	8
4.1	Power On LED (DS17)	9
4.2	Power Feed-Through Mode.....	9
5.0	Jumpers	10
6.0	Connectors	11
6.1	PC/Host Parallel Port (J1 and J11)	11
6.2	Input Signal Connectors (J2 through J9)	12
6.3	"Next Board" Parallel Port (J10)	12
6.4	Power Connector (J12)	13
6.5	USB Connector (J13).....	13
7.0	Grounding and Isolation Issues	13
8.0	Mechanical Specifications	14
9.0	Electrical and Environmental Specifications	14
	Appendix A – Warranty	15

1.0 Overview

This document describes the configuration and operation of the PMDX-108-Input 8-Channel Isolated Input Board. The PMDX-108-Input provides isolation for eight inputs from external equipment (including industrial machinery) and the "data bits" (pins 2 through 9) of a PC parallel port or compatible interface (i.e. SmoothStepper or other device). This serves to isolate the PC interface from the external power and equipment. This document pertains to the following versions of the PMDX-108-Input:

Circuit Board Revision: PCB-477B or PCB-477C (marked on the bottom of the board)

1.1 Ordering Information (part numbers)

Please note that there are two variants of the PMDX-108 family: the PMDX-108-Input which is covered in this manual, and the PMDX-108-Output which is covered in its own, separate manual.

1.2 Important Safety Information

The PMDX-108-Input 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-108-Input is not guaranteed to be fail-safe. The system into which the PMDX-108-Input is installed should provide fail-safe protection and emergency stop capability.

The PMDX-108-Input 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-108-Input 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.

1.3 Warranty Summary

The PMDX-108-Input 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.

<p>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.</p>

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.**

1.4 Trademarks

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

<u>Product Names</u>	<u>Company</u>
Mach3	ArtSoft (http://www.machsupport.com)
SmoothStepper	Warp9 Tech Design, Inc. (http://www.warp9td.com/)
PMDX-125, PMDX-170, PMDX-171	PMDX/Practical Micro Design, Inc. (http://www.pmdx.com)

1.5 Features

The PMDX-108-Input has the following features:

PC Parallel Port:

- Optically isolated inputs for the 8 data bits on pins 2 through 9 of a parallel port
- Can be used with a parallel port or with the Warp9 SmoothStepper
- 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-125 to supplement PMDX-125's second port

Inputs (Equipment Connectors):

- On-board inverter generates isolated power for inputs
- Inputs use individual two pin terminal strips
- Inputs share a common ground on one terminal of each two pin strip
- Inputs are opto-isolated from parallel port
- Inputs directly accept electro-mechanical switches connected between input and ground

- Inputs directly accept NPN (open collector) outputs from proximity sensors
- Inputs directly accept 24 volt DC signals from PLCs (programmable logic controllers)
- Inputs directly accept 5 volt logic signals
- Response time is less than 20 μ s
- On-board LED's for each input signal status

Pass-Through Connector:

- 26-pin ribbon cable header connects to PMDX-125 for other parallel port signals.

Power Supply:

- Requires a single 5 volts DC power source for operation
- Power can be supplied via a two pin terminal strip
- Optional alternate source of power can be pin 26 of either ribbon connector
- SmoothStepper and PMDX-125 support feeding power using ribbon connector
- Another alternate power source can be any USB port (not signals, power only)
- On-board LED's for power status

1.6 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-108-Input page (follow the links from the main page). Also check on the "Support" web page for application notes related to the PMDX-108-Input.

2.0 Installation and Operation

2.1 Choose a power source

The PMDX-108-Input requires a regulated +5V DC power supply that can provide at least 125 mA. See section 4.0 for more information on power supplies. Apply power to the PMDX-108-Input 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
- Check the jumper settings (see section 4.0)
- Also see the note in section 4.1.

2.2 Connect to PC/Host

Connect the PMDX-108-Input to your PC's parallel port or to your host controlled (for example, A SmoothStepper), using either the 25-pin "D" connector labeled "J1" or the 26-pin ribbon cable connector labeled "J11".

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. Likewise, the default configuration for a SmoothStepper is that pins 2 through 9 on the 2nd port are outputs from the SmoothStepper. You must configure your controller and/or 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-108-Input 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.

2.4 Test Input Signals

DO NOT CONNECT YOUR SWITCHES AND SENSORS YET.

In this step you will use a short piece of wire or a jumper clip to test the PMDX-108-Input's inputs, the connection to your controller and your CNC software configuration.

For each pair of input terminals on the PMDX-108-Input, short the two terminals together. For example, for pin 2 on the parallel port, short the screw terminals on J2 together (they are labeled "2" and "2<"). Verify that your CNC software recognizes the signal and reports it as "low" or "zero". Now remove the wire and verify that your CNC software reports the signal as "high" or "one".

Repeat this step for each input signal that you plan to use.

2.5 Connect Sensors and Switches

Connect your sensors and switches to the PMDX-108-Input as shown in section 3.0.

3.0 Input Signal Connections

This section shows how to connect various types of switches and sensors to the PMDX-108-Input board. The PMDX-108-Input provides eight (8) optically isolated general-purpose input signals. These are connected to pins 2 through 9 on the PC/Host parallel port. Internal circuitry on the PMDX-108-Input pulls these inputs high when there is nothing connected to the input terminal (or when a switch circuit is open).

The PMDX-108-Input's inputs can be driven by any of the following:

- Mechanical switches, in either "normally open" or "normally closed" configurations
- Open-collector transistor outputs
- NPN-style sensors such as the PMDX-170 Optical Interrupter and the PMDX-171 Hall Effect Sensor, and many other commercially available sensors
- +5V logic signals
- +24V PLC signals

These devices can act as limit switches, home indicators or other status information. Mechanical switches can be wired directly between the two pins on each input connector. Note that the examples below show the signals connected to a particular pins input connector, but the inputs may be connected to any of the input connectors in a similar manner. The sensor, switch or input circuit must be capable of sinking 6 mA when pulling or driving the input signal to ground.

There is an LED next to each input terminal that lights when the input is connected to the "<" terminal or driven to a logic "low" level.

WARNING – The PMDX-108-Input's inputs are optically isolated from the PC/Host-side ground. The terminals on J2 through J9 marked "<" are isolated returned signals and NOT ground pins, though all "<" terminals are tied together. Connecting any "<" terminal on connectors J2 through J9 to the "PCgnd" terminal on the power connector will defeat this isolation.

Normally Closed Switches

The left-hand drawing in Figure 1 shows an example of "normally closed" mechanical switches. The switches are wired in series so that the "normal" case is ground (logic low) going into pin 2 of the PC's parallel port. When one or more of the switches open, a "pull-up" circuit in the PMDX-108-Input provides a logic high into pin 1 on the PC's parallel port. Any number of "normally closed" mechanical switches may be connected in series to a single input terminal on the PMDX-108-Input.

Normally Open Switches

The right-hand drawing in Figure 1 shows an example of "normally open" mechanical switches. The switches are wired in parallel so that the "normal" case is that the "pull-up" circuit in the PMDX-108-Input provides a logic high going into pin 2 of the PC's parallel port. When one or more of the switches close, a logic low appears on pin 2 on the PC's parallel port. Any number of "normally open" switches may be paralleled onto a single input terminal on the PMDX-108-Input.

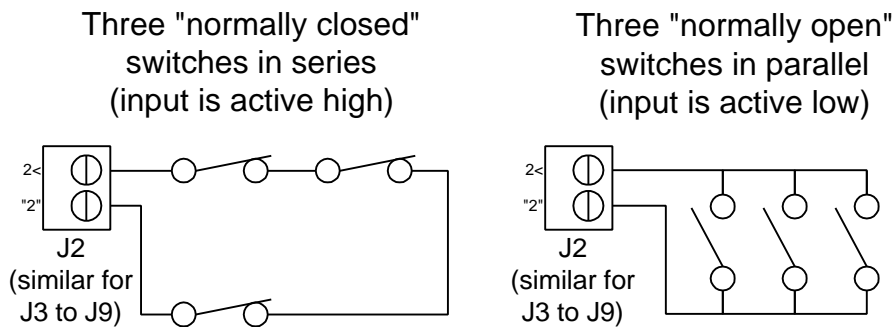


Figure 1 - Sample Mechanical Switch Input Connections

NPN-Style Sensors, Optical Interrupter or Hall Effect Sensor

Figure 2 shows an example using the PMDX-170 slotted optical sensor and/or the PMDX-171 hall effect sensor. The sensor's output signal is connected to the PMDX-108-Input input pin. This example uses an isolated power supply to power the sensors to preserve the isolation provided by the PMDX-108-Input.

NOTE – In some cases it may be possible to get the isolated power from another PMDX card that has self-powered isolated inputs, for example the J11 or J12 connectors of a PMDX-125.

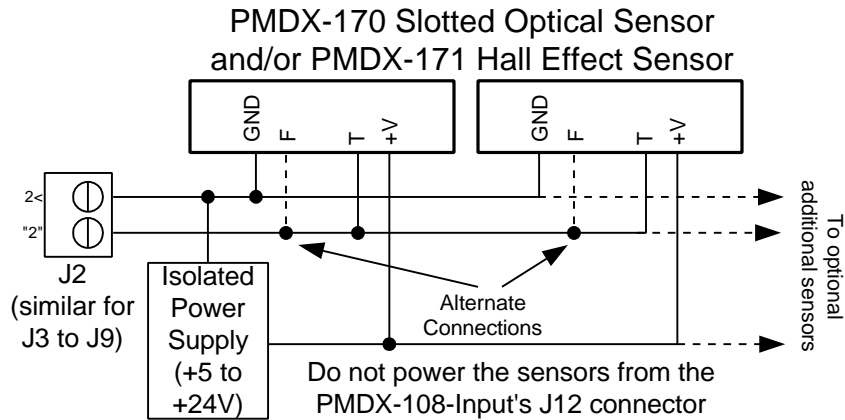
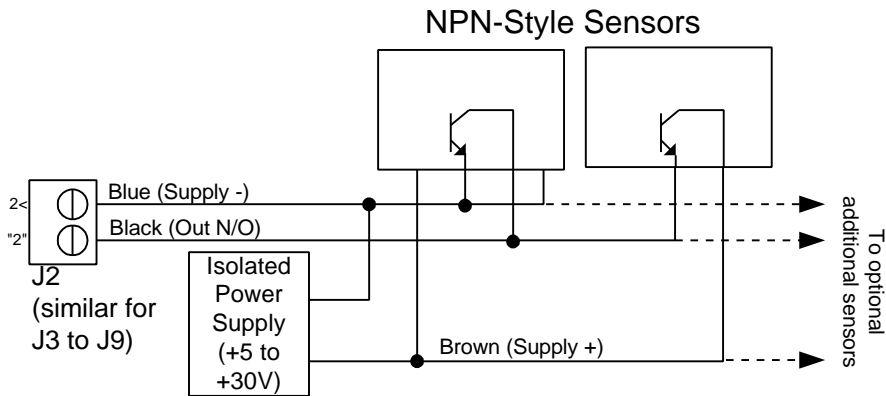


Figure 2 - Sample PMDX-170/PMDX-171 Input Connections

Figure 3 shows an example using NPN-style sensors. This example uses an isolated power supply to power the sensors to preserve the isolation provided by the PMDX-108-Input (see note above).



Shows the typical 3-wire color code and power for sensors that require a +10 to +30V supply.

Verify your sensor's color code!

Figure 3 - Sample NPN-Style Sensor Input Connections

4.0 Power Supply

The PMDX-108-Input requires a regulated +5V power supply. The board can be powered from any one of these sources:

- External power supply via screw terminal connector J12 (see section 6.4 and Figure 4 below).
- USB connector J13 (see section 6.5 and Figure 4 below). **Do not configure the PMDX-108-Input to provide power to any other boards when the PMDX-108-Input is powered from its USB connector.**
- From PC/Host on ribbon cable connector J11 pin 26 (see section 6.1 and Figure 4 below). This will not work when connected to a regular PC parallel port. This can only be used then the PMDX-108-Input is connected to a controller like the SmoothStepper that can provide +5V on pin 26 of the ribbon cable. **Do not power the PMDX-108-Input from the SmoothStepper when the SmoothStepper is powered from its USB connector.**
- From "Next Board" on ribbon cable connector J10 pin 26 (see section 6.3 and Figure 4 below). This configuration is usually used when the PMDX-108-Input is connected between a PC/Host controller and a PMDX-125. It allows the PMDX-108-Input to be powered from the PMDX-125 or similar breakout board.

WARNING – Do not connect more than one power source to the PMDX-108-Input. Doing so may damage the PMDX-108-Input and your power supply.

Figure 4 below shows the jumper settings for various power sources.

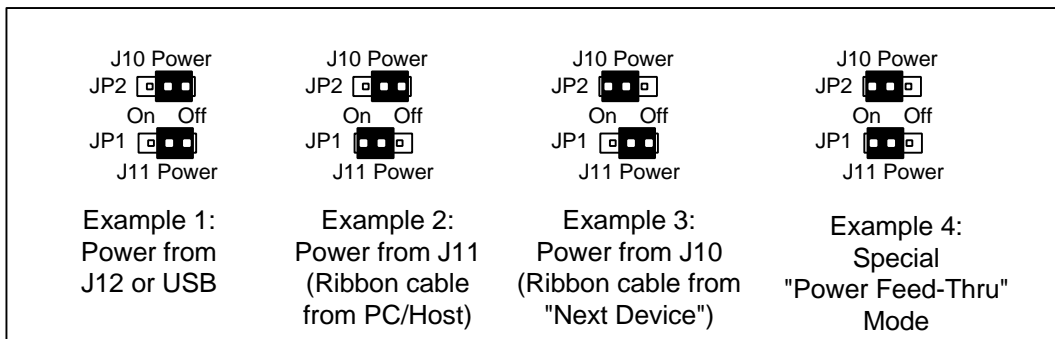


Figure 4 - PMDX-108-Input Power Supply Jumper Settings

Example 1 These jumper settings are used when the PMDX-108-Input is powered via the 2-pin screw terminal (J12) or from the USB connector **AND** the PMDX-108-Input is not providing power to any other device via the 26-pin ribbon cables.

Example 2 These jumper settings are used in two cases:

- When the PMDX-108-Input is powered from the 26-pin ribbon cable connected to J11 (i.e. from the PC/Host controller such as a SmoothStepper).
- When the PMDX-108-Input is powered from the 2-pin screw terminal (J12) (as in example 1) **AND** PMDX-108-Input is providing power to the host controller (i.e. SmoothStepper) via the 26-pin ribbon cable on J11

WARNING – The PMDX-108-Input cannot provide power any other device when it is powered from its USB connector.

- Example 3 These jumper settings are used in two cases:
- When the PMDX-108-Input is powered from the 26-pin ribbon cable connected to J10 (i.e. from the "Next Board" such as a PMDX-125).
 - When the PMDX-108-Input is powered from the 2-pin screw terminal (J12) (as in example 1) **AND** the PMDX-108-Input is providing power to the "Next Board" via the 26-pin ribbon cable on J10.

WARNING – The PMDX-125 cannot be powered from the PMDX-108-Input. Do not use these jumper settings if you have power connected to the screw terminals or USB connector and the PMDX-108-Input is connected to a PMDX-125. Doing so may damage the PMDX-108-Input, the PMDX-125 and/or your power supply.

WARNING – The PMDX-108-Input cannot provide power any other device when it is powered from its USB connector.

- Example 4 These jumper settings are for the "power feed-through" mode when the PMDX-108-Input is connected between a SmoothStepper and a PMDX-125. In this case, the PMDX-125 can provide power to **both** the PMDX-108-Input and the SmoothStepper. See section 4.2 for complete connection and jumper setting information.

4.1 Power On LED (DS17)

The PMDX-108-Input provides an LED (DS17, labeled "Power On") that indicates the presence of the +5V supply.

NOTE – When no power is applied to the PMDX-108-Input, and the PMDX-108-Input 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.***

4.2 Power Feed-Through Mode

Power feed-through mode allows the PMDX-108-Input to be powered from the "Next Card" connector and to pass the +5V power through to the host controller. In the example given below, the PMDX-125 is configured to provide +5V power on both of its 26-pin ribbon cable connectors. This +5V is then used to power the PMDX-108-Input, and passed through the PMDX-108-Input to provide power to the SmoothStepper.

WARNING – When powering the PMDX-108-Input and SmoothStepper from a PMDX-125, make sure to not exceed the total current that the PMDX-125 can supply (including any sensors that are powered by the PMDX-125).

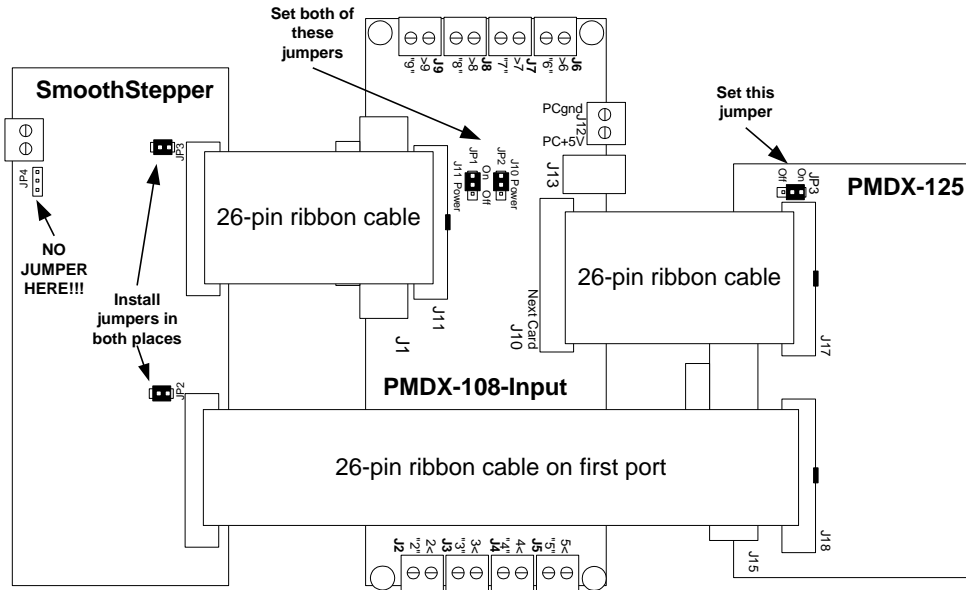


Figure 5 - PMDX-108-Input with PMDX-125 and SmoothStepper with power from PMDX-125 through PMDX-108-Input to SmoothStepper

5.0 Jumpers

The PMDX-108-Input contains three jumpers, as shown below.

- JP1 Power to/from J10 (see section 4.0)
- JP2 Power to/from J11 (see section 4.0)
- JP3 Not installed

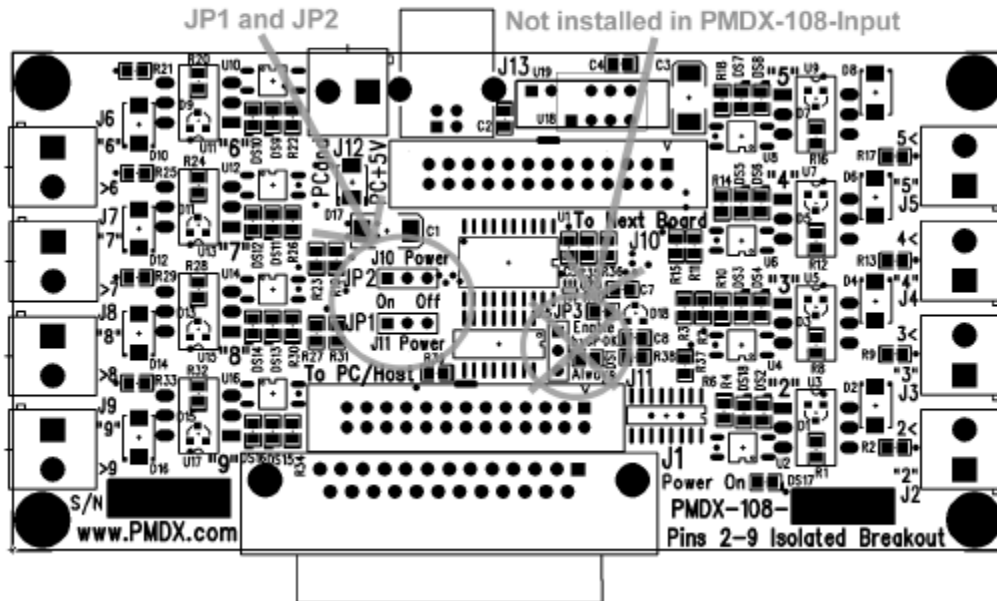


Figure 6 - PMDX-108-Input Jumper Locations

6.0 Connectors

The PMDX-108-Input 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 through J9	2-pin screw terminals for input signals on parallel port pins 2 through 9 (i.e. J2 is for parallel port pin 2, J3 for pin 3, etc.)
J10	26-pin ribbon cable for parallel port pass-through to another device.
J11	26-pin ribbon cable alternate to J1 from PC parallel port or host controller
J12	2-pin screw terminal for power supply input.
J13	USB connector for alternate power supply input

Table 1 - Summary of PMDX-108-Input Connectors

6.1 PC/Host Parallel Port (J1 and J11)

The PMDX-108-Input 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).

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-108-Input
1	Passed through to J10 ("Next Board")
2	output to PC/Host from J2
3	output to PC/Host from J3
4	output to PC/Host from J4
5	output to PC/Host from J5
6	output to PC/Host from J6
7	output to PC/Host from J7
8	output to PC/Host from J8
9	output to PC/Host from J9
10	Passed through to J10 ("Next Board")
11	Passed through to J10 ("Next Board")
12	Passed through to J10 ("Next Board")
13	Passed through to J10 ("Next Board")
14	Passed through to J10 ("Next Board")
15	Passed through to J10 ("Next Board")
16	Passed through to J10 ("Next Board")
17	Passed through to J10 ("Next Board")
18 – 25	Ground signals, connected to PMDX-108-Input ground and to J10 ("Next Board")
26	Not present on the PC parallel port, but is present on the 26-pin ribbon cable connector (J11). This pin can be used to provide +5V power into or out of the PMDX-108-Input. See section 4.0 for more information.

Table 2- 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 Input Signal Connectors (J2 through J9)

The table below shows the labels for connector J2, which corresponds to the PC parallel port pin 2. The labels on the other connectors would be in a similar format (i.e. for J3 the labels will be "3" and "3<").

Pin	Example Label	Description
1	"2"	Isolated input
2	2<	Isolated return (this signal is common to all eight connectors)

Table 3 – Input Signal Connectors (J2 through J9)

6.3 "Next Board" Parallel Port (J10)

The PMDX-108-Input 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 the PMDX-108-Input does not use.

Equivalent PC Parallel Port Pin Numbers	Function on PMDX-108-Input
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 from J1/J11 (PC/Host)
11	Passed through from J1/J11 (PC/Host)
12	Passed through from J1/J11 (PC/Host)
13	Passed through from J1/J11 (PC/Host)
14	Passed through from J1/J11 (PC/Host)
15	Passed through from 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-108-Input ground and to J1 and J11 (PC/Host).
26	Not present on a PC parallel port, but is present on this 26-pin ribbon cable connector. This pin can be used to provide +5V power into or out of the PMDX-108-Input. See section 4.0 for more information.

Table 4- "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.

6.4 Power Connector (J12)

This connector can be used to connect a regulated +5V power supply to the PMDX-108-Input board.

WARNING: *When using J12, make sure that nothing is plugged in to the USB connector (J13).*

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 AND the "Next Board" parallel port connector.

Table 5 – Power Supply Connector Pin-Out (J12)

6.5 USB Connector (J13)

The USB connector can be used to provide +5V to power the PMDX-108-Input board. It is not used for USB communication, only for power.

WARNING: *When using the USB connector to power the PMDX-108-Input, make sure that nothing is connected to the power supply connector J12.*

7.0 Grounding and Isolation Issues

WARNING – *Do not connect the PC ground to the equipment ground. Doing so will bypass the isolation provided by the PMDX-108-Input.*

WARNING – *If you have sensors connected to the PMDX-108-Input, do not power the sensors from the same power supply used for the PMDX-108-Input. And do not power the sensors from a power supply sharing the same ground as the PMDX-108-Input's power supply. Doing so will bypass the isolation provided by the PMDX-108-Input.*

8.0 Mechanical Specifications

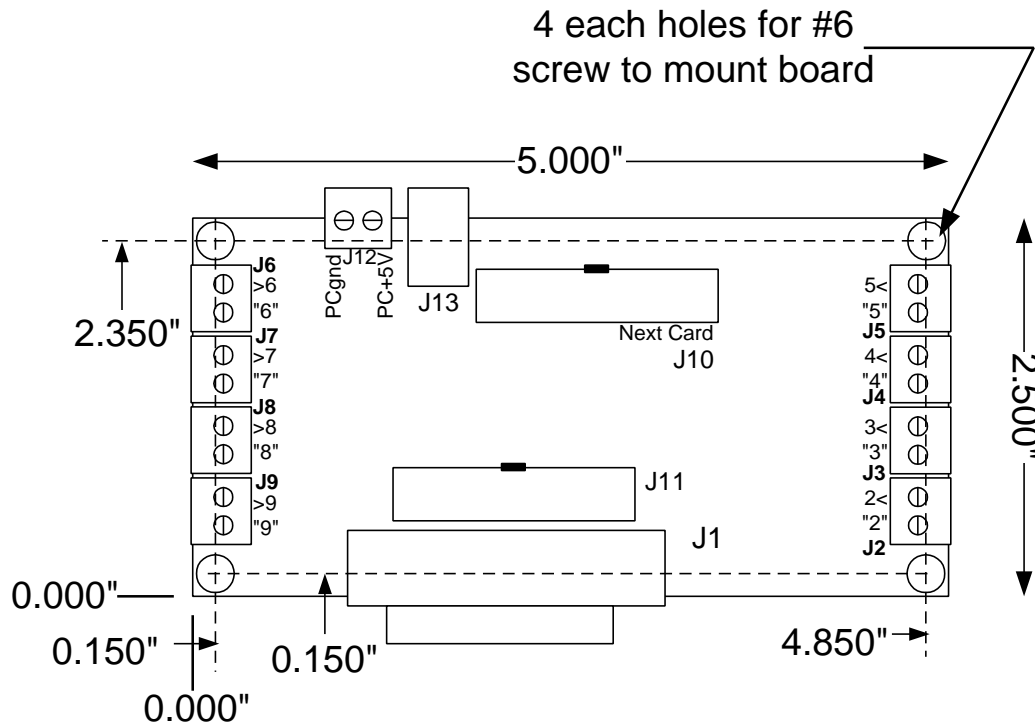


Figure 7 - PMDX-108-Input Dimensions and Mounting Holes

WARNING: The PMDX-108-Input should be protected from liquids, dirt, or chips (especially metal chips which can cause shorts) coming in contact with the board.

9.0 Electrical and Environmental Specifications

Power Supply:

+5V DC, regulated, 125 mA maximum From any power supply input:
 J12, J13 (USB connector for power only),
 J10 pin 26 or J11 pin 26

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 J2 through J9):

Inputs: Low must be able to sink 6 mA at less than 0.8V
 High must be open circuit or greater than 3.0 volts (and no greater than 25VDC)
 Response time is 20 μ s

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

Appendix A – Warranty

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.