

# *PMDX-137*

## *Power Prep Module*



## *User's Manual*

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## 1.0 Overview

This document describes the configuration and operation of the PMDX-137 Power Prep Module. This document pertains to the following versions of the PMDX-137:

Circuit Board Revision: PCB-493A (marked on the bottom of the board)

### 1.1 Ordering Information (part numbers)

The PMDX-137 can be built to support various output voltage and current requirements, as designated by the full part numbers:

<u>Part Number</u>	<u>Output Capacity</u>
PMDX-137-8020	80 VDC, up to 20 Amperes
PMDX-137-5020	50 VDC, up to 20 Amperes

For lower voltage applications, the PMDX-137-5020 is preferred over the PMDX-137-8020 because the PMDX-137-5020 offers greater filter capacitance.

The appearance and number of filter capacitors can vary between the different PMDX-137 models, as well as among boards of the same model due to different vendors of filter caps.

### 1.2 Important Safety Information

The PMDX-137 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-137 is not guaranteed to be fail-safe. The system into which the PMDX-137 is installed should provide fail-safe protection and emergency stop capability.

The PMDX-137 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 adequate 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-137 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-137 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 Repairs" page on our web site (<http://www.pmdx.com>) for full details of our repair and shipping policies.*

## 1.4 Features

The PMDX-137 is electrically and functionally equivalent to the older PMDX-135, and can be used in place of a PMDX-135 as long as the different mechanical form factor can be accommodated (the PMDX-137 is shorter and wider than the PMDX-135).

The PMDX-137 has the following features:

Designed for True 20 Amp Performance:

- Multiple filter capacitors to reduce heating caused by high ripple current
- Heatsink on bridge rectifier
- Extra large copper areas on PCB in high-current areas.

AC Input Power:

- 18 to 56 volts AC for the PMDX-137-8020
- 18 to 36 volts AC for the PMDX-137-5020

DC Output Power:

- 24 to 80 volts DC for the PMDX-137-8020
- 24 to 50 volts DC for the PMDX-137-5020
- Both versions support up to 20 Amperes

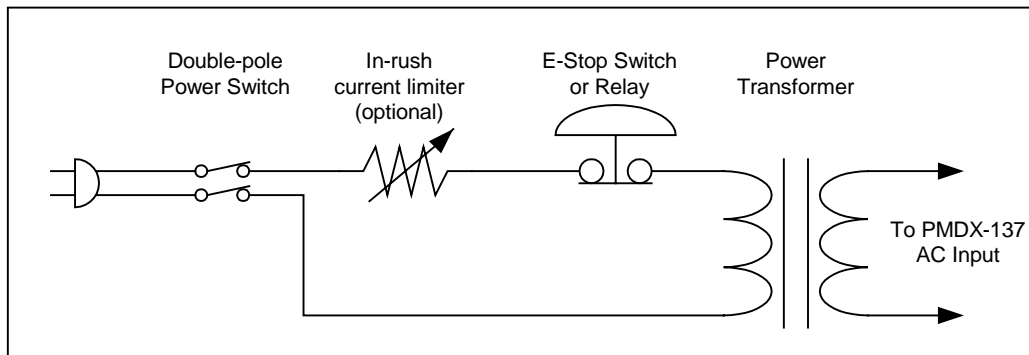
Dump Circuit:

- Electronic "back EMF" dump circuit to shunt excess power returned by motors to help prevent over-voltage on the DC output.
- Rapid discharge circuit to remove charge from filter capacitors within 5 seconds or removal of input power.

## 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-137 page (follow the links from the main page).

## 2.0 Sample Input Wiring Diagram



*Figure 1 – Sample input wiring diagram*

**WARNING:** The AC input must be transformer-isolated from the mains input. Auto-transformers and variable (Variac) transformers DO NOT provide suitable isolation.

### 3.0 Connectors

The following sections describe the pin-out and functionality of each of the PMDX-137 connectors. 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).

<i>Connector</i>	<i>Description</i>
J1	AC Power Input
J2, J3, J4	DC Power Output
J5	Optional External Dump Resistor

*Table 1 - Summary of PMDX-137 Connectors*

#### 3.1 AC Power Input Connector (J1)

Connector J1 provides alternate connections for the input AC power.

<i>Pin</i>	<i>Label</i>	<i>Description</i>
1	none	AC input
2	none	AC input

*Table 2 -AC Power Input Connector Pin-Out (J1)*

**WARNING:** *The AC input must be transformer-isolated from the mains input. Auto-transformers and variable (Variac) transformers DO NOT provide suitable isolation.*

#### 3.2 DC Power Output Connector (J2, J3 and J4)

Connectors J2, J3, and J4 provide the unregulated DC output power. J3 provides the main connections for large-gauge wiring. J2 and J4 provide additional terminals for connecting power to auxiliary devices. **Note that both terminals of J2 are connected to the "POS" output, and both terminals of J4 are connected to the "NEG" output.**

<i>Pin</i>	<i>Label</i>	<i>Description</i>
J3 pin 1	POS	Positive DC output (also connected to BOTH pins of J2)
J3 pin 2	NEG	Negative DC output (also connected to BOTH pins of J4)

*Table 3 - DC Output Power Connector Pin-Out (J3)*

#### 3.3 External Dump Resistor Connector (J5)

Connector J5 allows you to connect an external "dump" resistor. See section 5.0 for details.

### 4.0 LED Indicators

The PMDX-137 provides two LED indicators.

DS1, labeled "Power ON", indicates the presence of DC voltage on the output connector.

DS2, labeled "DUMP", indicates that the circuit is "dumping" excessive charge from the filter capacitors.

## 5.0 Dump Circuit

The dump circuit works by placing a heavy resistor load on the DC output whenever the output rises above the internally-generated voltage. This helps prevent damage to motor drivers when the back EMF from decelerating motors causes current to flow back into the power supply and thereby trying to raise the output voltage. When the PMDX-137 senses this voltage surge, the resistive load is applied to help absorb the excess voltage. The "DUMP" LED indicates when this is occurring.

The dump circuit's on board resistors are intended for short bursts of operation such as servo systems where you do not have all axes decelerating at the same time, or for stepper motor systems. If you have a servo system that will return significant energy to the PMDX-137 due to motor deceleration, you should attach an external dump resistor to connector J5. The resistance and power rating of this resistor will depend on your motors and system design. If you need assistance selecting a dump resistor, please contact PMDX by email with details of your system.

The dump circuit also acts to rapidly discharge the main filter capacitors when the input power is removed.

## 6.0 Voltage and Transformer Selection

There are several factors to consider when choosing input and output voltages for the PMDX-137, as described in the following sections.

### 6.1 Selecting AC Input and DC Output Voltages

The PMDX-137's output voltage is specified by the following equation:

$$\text{DC output voltage} = [ (\text{AC input voltage}) * 1.414 ] - 1.5 \text{ volts}$$

For example, 48 volts AC input yields 66.37 volts DC on the output.

Input voltage should be selected to allow some safety margin in the output voltage. Some transformer output voltages may be several percent higher than specified by the manufacturer when lightly loaded. This property is sometimes specified as "percent regulation" by the transformer manufactures. Toroid transformers typically have better regulation than conventional transformers. Additionally, the AC mains voltages can often be 10% higher than nominal. Therefore, use the following equation to calculate the worst-case output voltage:

$$[ (\text{high line}) * (\text{regulation factor}) * (\text{nominal voltage} * 1.414) ] - 1.5\text{V}$$

In this case, our 48 volt transformer could yield a worst-case output voltage of:

$$[ (110\%) * (108\%) * (48 * 1.414) ] - 1.5 \text{ which equals } 79.13 \text{ volts DC}$$

For this reason, if you intend to power Geckodrive products near their rated input voltage (80V DC), PMDX recommends that the supply be limited to transformers that will not cause greater than 80V DC output when all factors are worst case.

### 6.2 Selecting Transformer Current Rating

Transformers are most often rated in RMS output current. The input of a bridge rectifier/capacitor filter power supply is *not* an RMS load. Indeed, it has a much worse load factor. Conservative design recommendations for transformer manufactures may specify that the transformer be RMS rated for as much as 1.8 times the DC output current of the bridge rectifier/capacitor filter power supply.

One exception to this may be transformers that are specified for "rectifier duty".

## 7.0 Mechanical Specifications

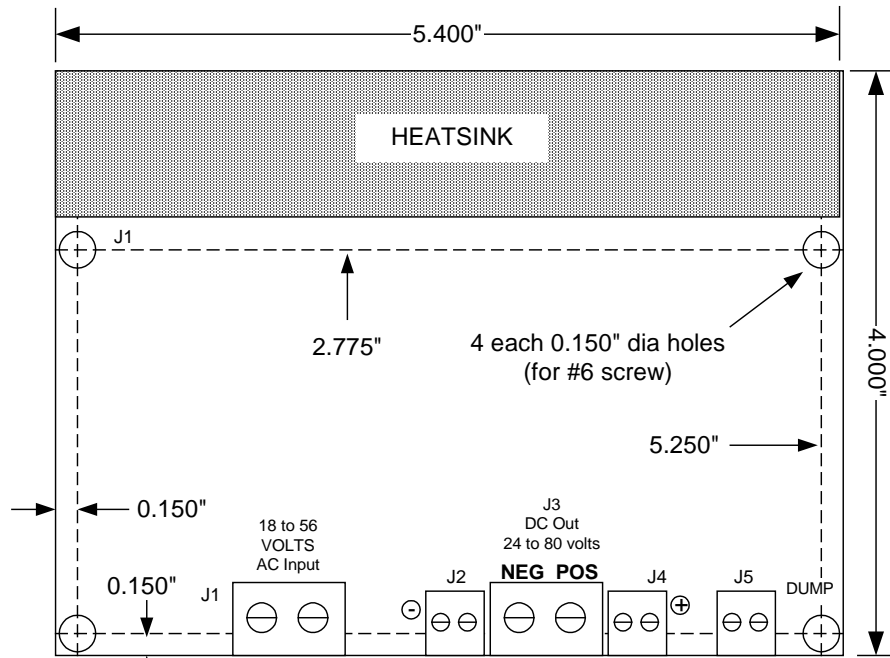


Figure 2 - PMDX-137 Dimensions and Mounting Holes

The maximum clearance height above the PMDX-137 circuit board is 2.175 inches, and beneath the circuit board is 0.125 inches.

**WARNING:** *The PMDX-137 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:**

Power In: PMDX-137-8020 – 18 to 56 volts AC  
 PMDX-137-5020 – 18 to 36 volts AC  
 (note that the exact input voltage depends on your desired DC output voltage)

Power Out: PMDX-137-8020 – 24 to 80 volts DC, unregulated with a minimum of 23,500  $\mu$ F filter\*\*  
 PMDX-137-5020 – 24 to 50 volts DC, unregulated with a minimum of 48,000  $\mu$ F filter\*\*  
 (note that the exact output voltage depends on AC input voltage)  
 \*\* filter capacitance is built-in to the PMDX-137

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

**WARNING:** *Forced-air cooling is required for operation in ambient temperatures above 40° C, and is recommended for operation above 30° C or when drawing near full load.*

## **Appendix A – Warranty**

### ***Statement***

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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***

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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.