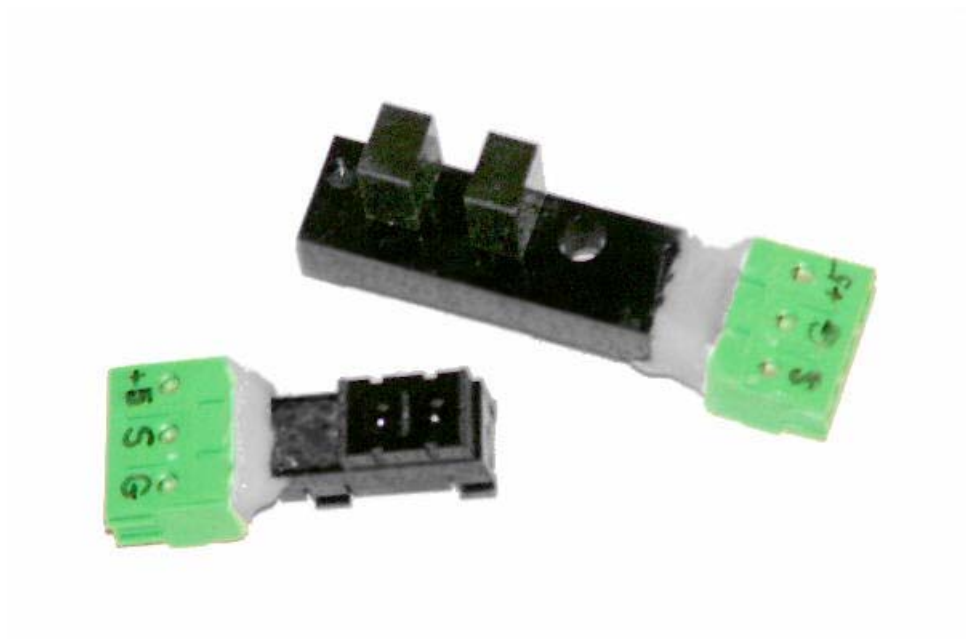


PMDX Optical Sensors



User's Manual

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PMDX
7432 Alban Station Blvd., A105
Springfield, VA 22150-2321 USA

Web: <http://www.pmdx.com>
Phone: +1 (703) 912-4991
FAX: +1 (703) 912-5849

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1.0 Overview

This document describes the configuration and operation of the PMDX Optical Sensors. The PMDX Optical Sensors are useful for mill or lathe spindle speed sensing and for lathe threading index position pickup. This document pertains to the following versions of the PMDX Optical Sensors:

PMDX Sensor Part Numbers: PMDX-Sensor-S (slotted)
PMDX-Sensor-R (reflective)

1.1 Important Safety Information

The PMDX Optical Sensors are 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 these parts are integrated into the purchaser's system and cannot be responsible for guaranteeing the safety of your system.

The PMDX Optical Sensors are *not* intended for limit or home switch applications because they have no protection against debris, coolants or cutting oils.

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

Automated machine tools, into which the PMDX Optical Sensors 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 Optical Sensors are 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.

If you have an item requiring service, please see the support page on the PMDX web site (<http://www.pmdx.com>) for return instructions.

The purchaser must pay shipping to return the unit to PMDX. We 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.

1.3 Features

The PMDX Optical Sensors has the following features:

- Built-in signal conditioning circuitry
- Infrared emitter and detector with optical filters to block visible ambient light
- Reflective sensor uses modulation to further reduce interference from ambient light
- Slotted sensor has an open-collector output allowing connection to +5, +12 or +24 volt systems with an external pull-up resistor
- Reflective sensor has totem-pole (i.e. CMOS) outputs for use with +5V systems only.
- Output signal is conditioned to provide reliable indication of status, i.e. no linear region, the output is an ON or OFF logic signal only
- Direct connection to PMDX-120, PMDX-121, PMDX-122, PMDX-131 and most other breakout boards.
- Powered from +5 volts at less than 30 milli-amperes
- Screw clamp terminal connector

1.4 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 Optical Sensors page (follow the links from the main page).

2.0 Installation and Operation

These sensors are useful for mill or lathe spindle speed sensing and for lathe threading index position pickup. While you may be able to use these sensors for limit or home switches they are *not* recommended for these applications because they have no protection against debris, coolants, or cutting oils.

Note that all PMDX breakout boards have the necessary pull-up resistor on board and have +5V power available to power the sensor so no external components are needed.

<i>Pin Label</i>	<i>Description</i>
+5	+5V DC power supply
S	Signal out
G	Ground (power supply return)

Table 1 –Connector Pin-Out

<i>Sensor Type</i>		<i>Output Signal</i>
<i>Reflective</i>	<i>Slotted</i>	
Reflection	Open	pulled to GND (logic low)
No reflection	Obstructed	floats (open-collector) or driven high. See sections 2.2 and 2.3 for details.

Table 2 – Output Signal Polarity

2.1 General Operating Constraints

In order to achieve the maximum pulse rates given in the electrical specifications (section 4.0), the interrupter or non-reflective portion must be between 25% and 75% of the overall duty cycle. For operation below these maximum pulse rates, smaller interrupter widths can be used. The exact width required for the interrupter or non-reflective portion depends on many factors, including the interface electronics and control software. For example, a large-value pull-up resistor will slow the response time of the sensor. Also, the time it takes the control software to read the output of the sensor will limit the maximum pulse rate. The bottom line is that, in general, you should experiment with your setup to determine the maximum operational limits.

2.2 Slotted Sensor

Two types of interrupters can be used with the slotted optical sensor: a "flag" style, or a "solid with an opening" style. The "flag" style uses a small flag or tooth-shape protrusion to interrupt the LED/Sensor path at the reference position. The "solid" style uses a solid interrupter that has an opening of some kind at the reference position. When using a solid interrupter with an opening at the reference point, the opening must extend a minimum of 3mm above and 3mm below the center line of the LED/Sensor path (see Figure 1 on page 6). Therefore, if you are using a round hole, the hole must be 6mm diameter or greater.

Warning:	The actual size of the interrupter opening depends on the speed of the interrupter material and how short a pulse the PC can detect. The faster the device is moving (and/or the slower the PC), the larger the hole needs to be in order for the PC (or other hardware) to recognize the output pulse from the sensor. You may have to experiment to determine the exact size opening that your application requires.
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2.2.1 Slotted Sensor Output Signal

The slotted sensor has an open-collector output. When the slot is "open", the output is pulled to ground. When the slot is obstructed, the output floats. To obtain a valid logic level, the output must have a resistor installed between the output signal and a power supply voltage. Usually this is a resistor whose value is between 1.0K ohms and 10K ohms, connected to a +5V power supply. See section 4.0 for information on the maximum voltage that may be attached to the output signal.

2.3 Reflective Sensor

The reflective sensor uses IR modulation to further reduce interference from ambient light.

Note:	The reflective sensor is very sensitive to its own signal. The ideal focal plane is 3/8" to 3/4". It is difficult to make objects closer than 1/4" be non-reflective enough to not be detected.
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Warning:	The actual size of the reflective strip (or non-reflective strip) depends on the speed of the material, the distance from the sensor to the material, and how short a pulse the PC can detect. The faster the device is moving (and/or the slower the PC), the larger the strip needs to be in order for the PC (or other hardware) to recognize the output pulse from the sensor. You may have to experiment to determine the exact size strip that your application requires.
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2.3.1 Reflective Sensor Output Signal

The reflective sensor has a totem-pole (CMOS-style) output. When the sensor sees the reflected signal the output is pulled to ground. When the sensor sees no reflection the output is driven close to +5 volts. See section 4.0 for information on the output signal voltages.

Warning:	The reflective sensor has a totem-pole (i.e. CMOS) style output, and must only be connected to +5V systems.
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3.0 Mechanical Specifications

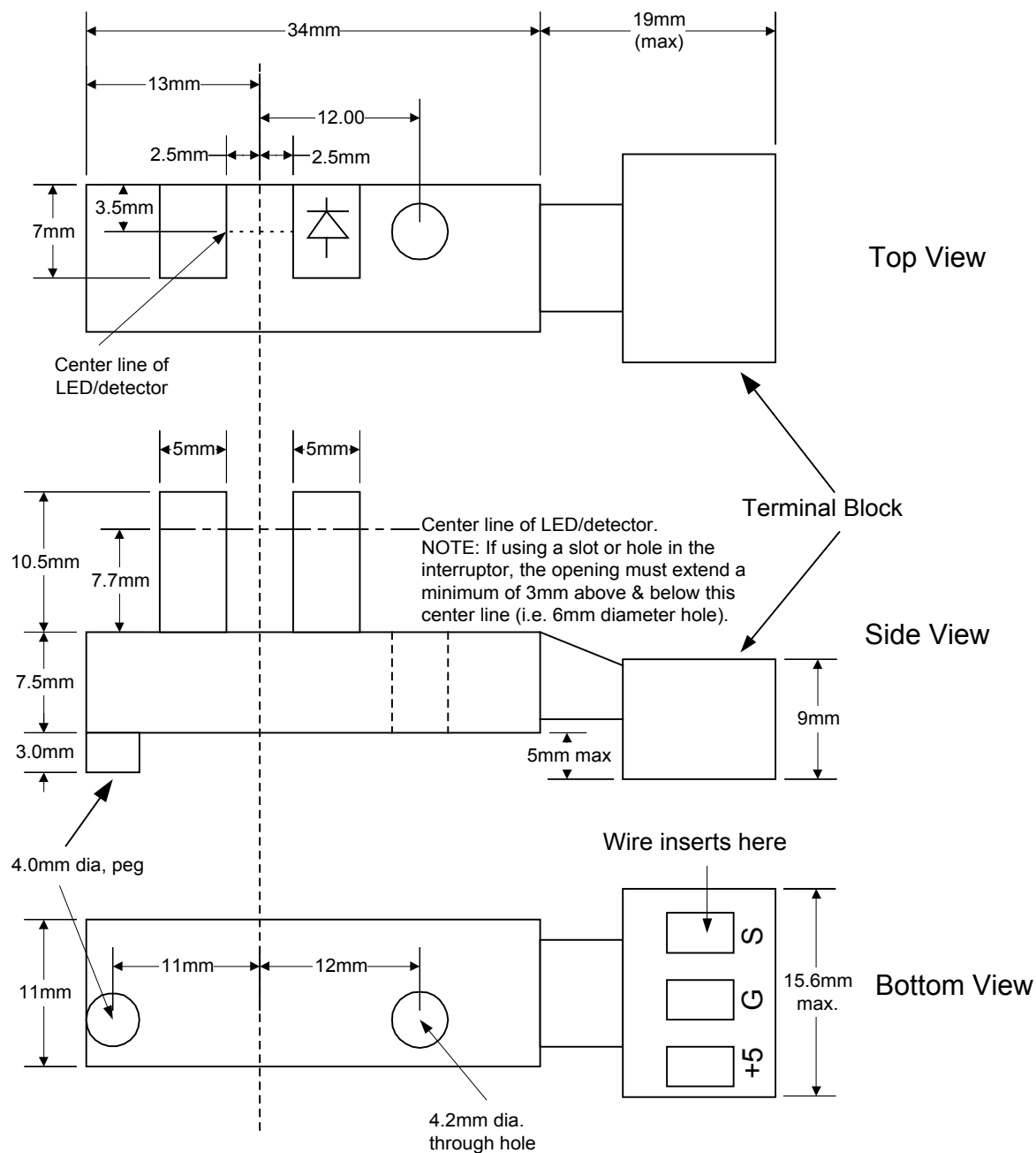


Figure 1 - PMDX-Sensor-S Dimensions

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

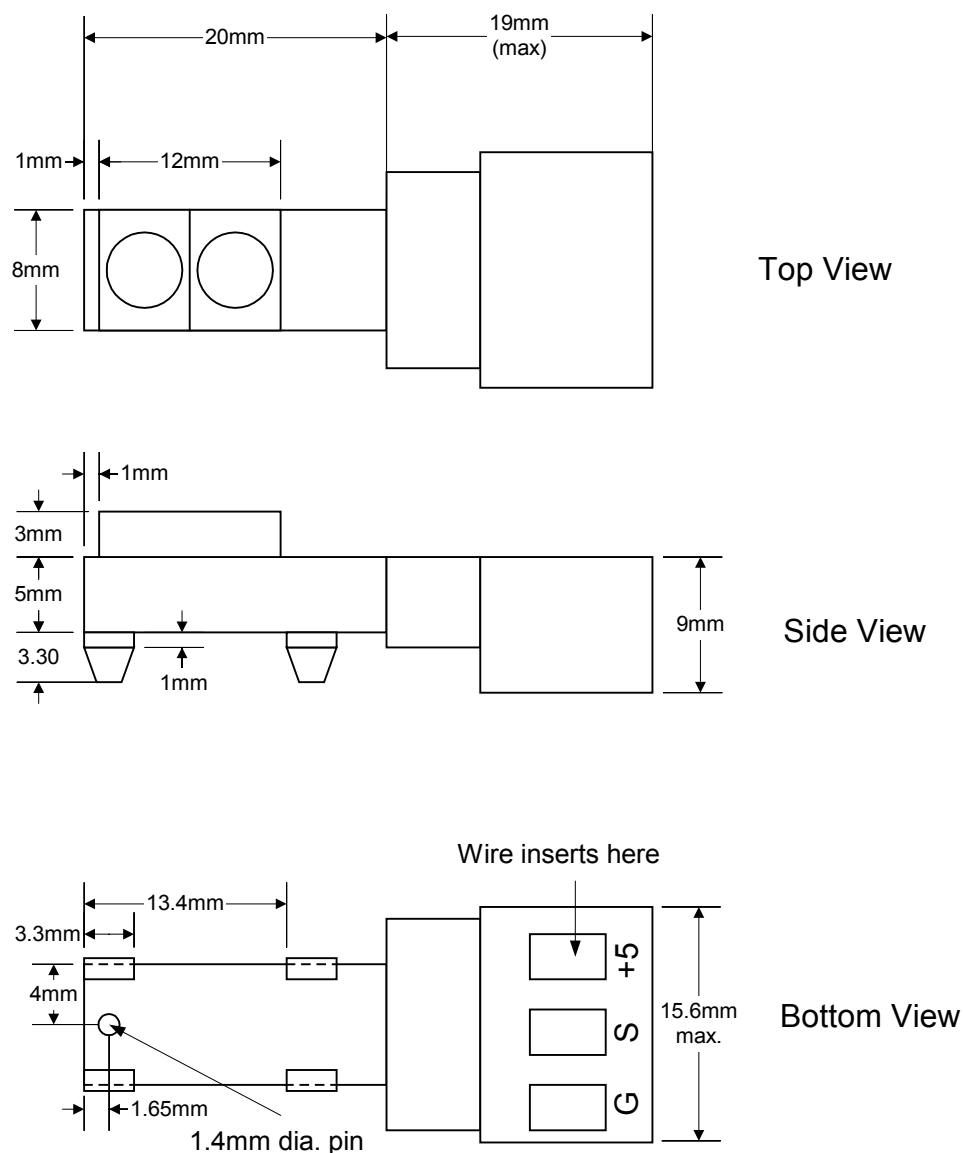


Figure 2 - PMDX-Sensor-R Dimensions

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

4.0 Electrical and Environmental Specifications

Power Supply: +5V VDC input, 30 mA maximum

Output: PMDX-Sensor-S: Open-collector output
Max. output "low": 0.3V sinking up to 4mA
Max. output "high": pull-up resistor to 24V maximum

PMDX-Sensor-R: Totem-pole (CMOS) output
Max. output "low": 0.3V sinking up to 4mA
Min. output "high": 4.7V sourcing up to 4mA

Pulse Rate: Reflective Sensor: in excess of 400 Hz (24,000 RPM)
Slotted Sensor: in excess 2000 Hz (120,000 RPM)

NOTE: See also section 2.1 for more information. RPM is based on single pulse per revolution of the spindle.

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.