



INSTRUCTIONS

PCR X



## INTRODUCTION

*Read entire document before installing*

As part of the Polarization Cell Replacement (PCR) family of products, the PCRX provides similar protection and mitigation characteristics as the PCR with the added benefit of enabling quick and accurate “instant off” readings during interrupted surveys. The PCRX is a solid-state DC isolation/AC grounding (i.e., decoupling) device designed for use in conjunction with cathodically protected equipment located in Class I, Division 2 hazardous (classified) locations or in ordinary (unclassified) locations. The PCRX has been evaluated against requirements for effective ground-fault current path and isolation of objectionable DC ground currents and is suitable for: (1) AC voltage mitigation, (2) over-voltage protection of isolation joints and similar structures and equipment, and (3) DC isolation and AC grounding of cathodically protected structures and electrical equipment in cathodically protected structures.

The PCRX can be used in a variety of different applications, each of which requires specific installation guidelines, available on the Dairyland website. Those installation instructions cover the following common applications.

- DC isolation/AC grounding of cathodically protected structures containing electrical equipment.
- Over-voltage protection of isolation joints.
- AC voltage mitigation by providing an AC current path.

Some applications listed may not apply in some countries due to different codes and practices. If your application is not covered by these installation instructions, contact Dairyland.

General and specific technical information for most applications is available on the Dairyland website.

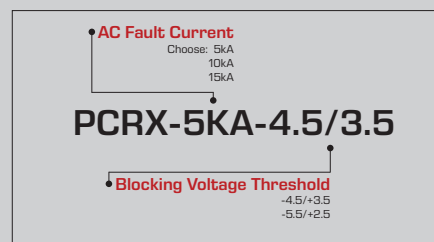
## INSTALLATION GUIDELINES

These general instructions apply to all applications.

### Worker Safety

For worker safety during installation or removal, it is recommended that the user obtain certain equipment; namely a pair of electrically insulated gloves, a shorting cable approximately 3 ft (0.91 m) long with insulated clamps on each end, and a multi-meter to measure AC voltage. (Of these items, Dairyland offers a suitable 3 ft long 1/0AWG shorting cable with insulated clamps, Model# BCL-1/0 for decouplers rated up to 15kA). The following installation procedure assumes that these items are available. It is suggested that a grounding jumper be used as a safety precaution in the event the lead to the structure rises to an unsafe potential when it is disconnected during the installation or removal process or if an electrical disturbance occurs while the decoupler is being installed. Be sure to remove the grounding jumper after the decoupler is completely installed. If the structure voltage is not at a safe touch potential (i.e., >15VAC to ground per NACE SP0177), then insulating gloves should be used.

## MODEL NUMBER CHART



**Blocking Threshold Voltage:** -5.5Vdc/+2.5Vdc and -4.5Vdc/+3.5Vdc standard.

**Momentary AC Fault Current:** 5kA, 10kA, and 15kA (rms, 30 cycles 50/60Hz)

**Steady-State AC Current Rating:** 45A rms 50/60Hz max continuous

**Peak Impulse Current Rating:** 100kA, 8x20µs waveform.

Note: This peak impulse current rating is a simulation of lightning.

### Certifications

The PCRX has been tested by Nationally Recognized Testing Laboratories (NRTLs) for compliance to independent standards in its operation, ratings, and construction. This includes compliance to standards for:

Class I, Div. 2, Groups A, B, C, D and Zone 2, Group IIC.

Class & Division System: UL (United States) and C-UL (Canada)

- Effective Ground Fault Current Path per:
  - NFPA 70 (US National Electric Code – NEC): Article 250.4(A)(5)
  - CSA C22.1 (Canadian Electric Code, Part I): 10-100 & 10-500
- Isolation of Objectionable DC Ground Currents per:
  - NFPA 70: Article 250.6(E)
  - CSA C22.1: 10-100 & 10-500
- Hazardous Location Use:
  - Class 1, Division 2, Groups A, B, C, D by UL & C-UL per:
    - UL 121201, 9th Ed. and CSA C22.2 No.213-17
- Safety Requirements for Electrical Equipment per:
  - UL 61010-1, 3rd Ed. & CSA C22.2 No. 61010-1
  - Overvoltage Protection from Impulse (Lightning) Current: 100kA (8 x 20µs)
  - Enclosure Rating: NEMA 4X
  - Temperature Range: -40°C to +50°C (-40°F to +122°F)
  - Max Altitude: 2000 meters
  - Ambient Pressure of 80 kPa (0.8 bar) to 110 kPa (1.1 bar)
  - Relative Humidity: 0-100% noncondensing
  - Outdoor use
  - Pollution Degree 2

Zone System: ATEX / IECEx / UKEx (Europe / International / UK). ATEX per directive 2014/34/EU (Equipment for use in Potentially Explosive Atmospheres):

- Zone 2, Group IIC, Increased Safety “ec”
- EN IEC 60079-0: 2018
- EN IEC 60079-7: 2015+A1:2018
- IEC 60079-0: 2017
- IEC 60079-7: 2017
- Overvoltage Protection from Impulse (Lightning) Current: 100kA (8 x 20µs)
- Temperature Range: -40°C to +50°C
- Enclosure Rating: IP66



## **! WARNING**

During installation, the voltage on the structure may rise to an unsafe level (i.e., due to induced AC, AC fault or lightning on the structure). Sparking and current flow may occur when connecting or disconnecting decouplers or over-voltage protectors. Assure that this does not occur in hazardous locations where gases or vapors may be present. All necessary safety precautions must be taken by the user to avoid unsafe worker conditions, including arcing, in accordance with applicable industry and/or company-required practices. Dairyland provides suggested procedures for installing and operating this equipment (See the section on Worker Safety). But the user must be responsible for and approve the procedures to be used by its workers when installing the equipment because Dairyland cannot be familiar with each user's safety guidelines.

## **! WARNING**

Explosion Hazard - Substitution of any component may impair suitability for Class I, Division 2.

## **! WARNING**

A PCRX should never be installed in parallel with another PCRX or with a standard decoupler in order to achieve a rating above a singular PCRX's ratings at a designated installation location. Device failure may occur, particularly if the units are exposed to steady-state current above 45A AC-rms.

## **NOTICE**

The stainless steel enclosure is internally bonded to the positive terminal. Ensure that the PCRX enclosure is mounted in a manner that provides isolation between it and the cathodically protected structure.

### **Mounting**

Mount the PCRX so that the total length of conductor to the connection points will be as short as possible if the PCRX is going to be used to provide protection against peak impulse current/waveforms comparable to lightning. All conductors have inductance which will cause a significant voltage per unit of conductor length when subject to lightning surge current. To minimize the voltage developed between the connection points, install the PCRX as close as practical to the required connection points and cut the conductor to the shortest possible length during installation. For most isolation joint applications the PCRX can, and should, be installed with about 6 inches ( $\approx 150$  mm) of conductor. Conductors can develop 1-3 kV/ft. (approx. 3-10 kV/meter) of length due to lightning; hence the reason why conductors should be kept as short as possible in lightning applications. Conductor length is not critical for limiting voltage due to 50 Hz or 60 Hz current. Note: Because of the internal bond between the enclosure and positive terminal, mount the PCRX on a structure not in contact with the cathodically protected structure.

The PCRX is made to mount on a flat surface (e.g., a wood post, unistrut, or panel) with up to 5/16" bolts furnished by the user. Pedestal mounting is also an option. Due to the mass of the PCRX, it is always recommended that the unit be mounted to a sturdy structure. If the application is protection of an isolated flange, this may require a support post or other similar structure, as well as applicable connection accessories available from Dairyland such as AP or MTL kits. This must be done keeping in mind the conductor length considerations noted above. For additional information on accessories suitable for the PCRX, see Dairyland Accessories.

### **Environmental Exposure**

The PCRX enclosure is rated NEMA 4X and IP66, making it suitable for outdoor non-submersible applications. The unit must be installed in environments with ambient temperatures of  $-40^{\circ}\text{F}$  to  $+122^{\circ}\text{F}$  ( $-40^{\circ}\text{C}$  to  $+50^{\circ}\text{C}$ ).

### **Specific Installation Guidance**

The Dairyland website contains detailed information on the installation methods specific to a given application. For wiring diagrams and/or application guidance, see Dairyland Applications.

### **Polarity**

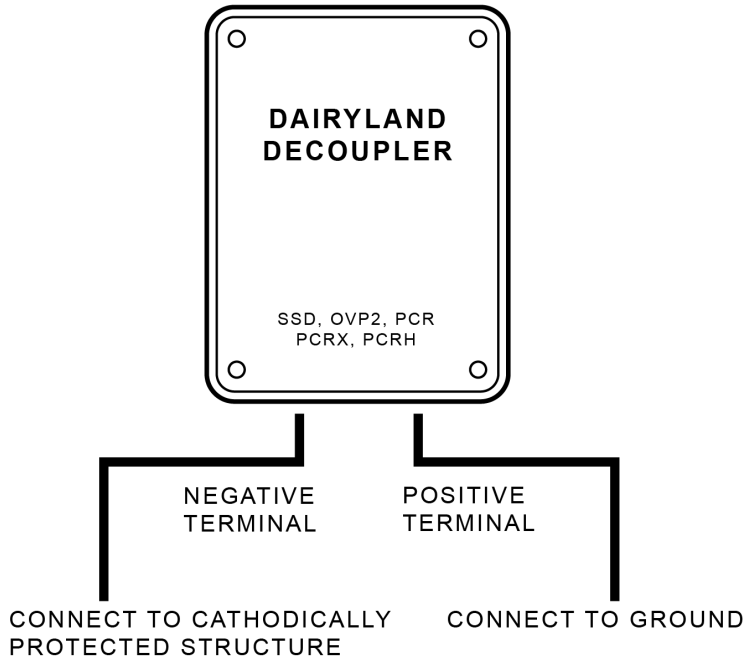
For a visual diagram, see the "Polarity Wiring Diagram" on the next page. All PCRX models have asymmetrical blocking characteristics. Therefore, when being connected between a cathodically protected structure and ground, connect the negative terminal of the PCRX to the cathodically protected structure and the positive terminal to ground.

If being connected between two different cathodically protected systems, attach the negative terminal to the more negative structure and the positive terminal to the less negative structure, keeping in mind that the positive terminal is bonded internally to the metallic enclosure. Consider if the PCRX enclosure mounting could affect the cathodic protection system. A label on the PCRX cover shows the polarity of each conductor.

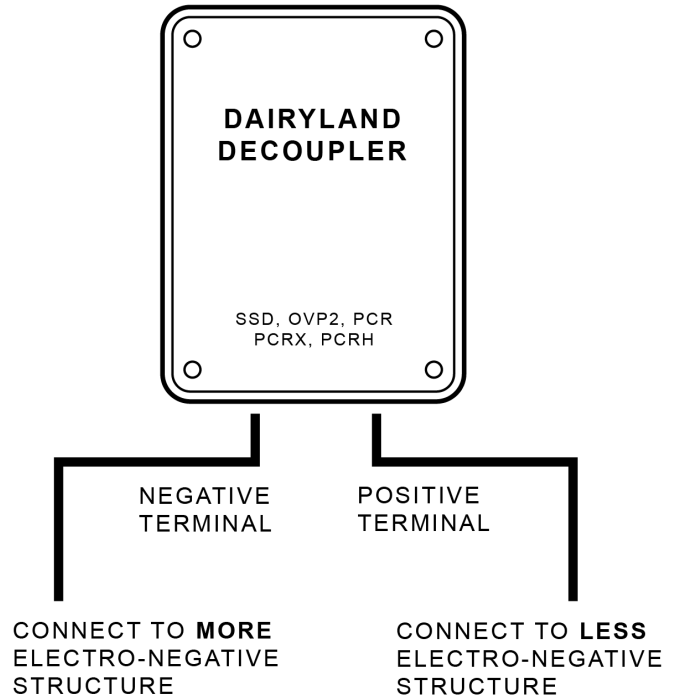


## POLARITY WIRING DIAGRAM

FOR CONNECTIONS BETWEEN A CATHODICALLY PROTECTED STRUCTURE AND GROUND



FOR CONNECTIONS BETWEEN TWO DIFFERENT CATHODICALLY PROTECTED STRUCTURES





## Field Testing

1. Before installation, it is recommended that steady-state AC current is measured to ensure the application is within the rating of the PCRX. With a clamp-on ammeter, measure the steady-state AC-RMS current flowing between the PCRX connection points, utilizing a suitable bonding jumper or the system wiring. The AC-RMS steady-state AC current must be less than 45Amps AC-RMS.
2. Because the stainless steel enclosure is internally bonded to the positive terminal, ensure the PCRX is physically mounted to a structure that provides isolation between it and the cathodically protected structure.
3. Install the PCRX appropriate for the given application. Connect the negative terminal to the more negative structure and the positive terminal to the grounded or more positive structure, taking care to note any bonding and safety requirements from above. Remove any bonding jumper when done.
4. After installation, the DC voltage across the PCRX terminals can be measured to confirm that the PCRX has been applied within its operating voltage limits. The allowable DC voltage across the terminals depends on the level of steady-state AC. A clamp-on ammeter can again be used to confirm the AC-RMS steady-state current through the PCRX. See the table below for guidance. A more in-depth discussion of operating voltage parameters can be found in PCRX Technical Literature at Dairyland.com.

AC Current Through PCRX (Amps ACrms)	Blocking Threshold -4.5V/+3.5V	Blocking Threshold -5.5V/+2.5V
	DC Operating Voltage Range Across Terminals	
< 0.6	-1.7V / +0.7V	-2.7V / -0.3V
0.7	-3.7V / +2.7V	-4.7V / +1.7V
1	-3.9V / +2.9V	-4.9V / +1.9V
2	-4.1V / +3.1V	-5.1V / +2.1V
5	-4.1V / +3.1V	-5.1V / +2.1V
15	-3.8V / +2.8V	-4.8V / +1.8V
25	-3.5V / +2.5V	-4.5V / +1.5V
35	-3.1V / +2.1V	-4.1V / +1.1V
45	-2.8V / +1.8V	-3.8V / +0.8V

5. To verify correct device operation while in service, measure the pipe to soil voltage using a reference cell. An acceptable CP reading will indirectly indicate correct operation with DC isolation, as device conduction would bond the CP system to ground (or to the other

connected structure) and affect the CP reading. While an indirect test, it has proven to be a good indicator of operation. An unacceptable reading may be due to other factors besides the Dairyland device, such as an external system short, and if needed perform the following additional tests.

6. A more thorough test is one performed with the device out of circuit. If the device is in service, disconnect the CP structure attachment conductor (typically at the negative terminal) so that the product is isolated, but first addressing any safety issues such as adding a current-rated bonding jumper between the two connection points, wearing insulating gloves, etc. Note that if the Dairyland device is performing mitigation of induced AC voltage, disconnecting the device will leave the structure as an open circuit, and the induced voltage on the pipeline may rise to high levels. Therefore, take appropriate safety measures before proceeding. Next, momentarily short the device terminals to remove any residual charge that may be on the internal capacitor. Connect a multi-meter, set to the lowest Ohms scale, across the terminals. If the product is functional, the resistance will start at zero ohms and then slowly increase as the capacitor in the decoupler begins to charge from the multi-meter. The test may be discontinued at this point, as charging the capacitor can take up to 10 minutes, and it is only necessary to observe this general response briefly. If the product is failed, the reading will remain fixed and at a very low resistance value, typically a fraction of one Ohm

If any measurements do not produce the expected results, contact Dairyland.

## GENERAL COMMENTS

The PCRX does not require routine maintenance, but if the cathodic protection voltage level near the PCRX is below the normal or expected value, it is suggested that the unit be field tested using the above procedures.

Clean the outer enclosure surface with damp cloth if needed.



The PCRX cover should not be removed as this can affect the NEMA 4X rating.

There is no routine maintenance that can be done in the field. If a problem is suspected, contact Dairyland for trouble-shooting assistance. If repairs are necessary, the unit is to be returned to Dairyland for diagnosis and repair after requesting a Return Material Authorization (RMA).

The PCRX is designed to fail as a short-circuit to assure safety grounding at all times if the unit fails due to excessive AC fault current or peak impulse current/waveform beyond rating.



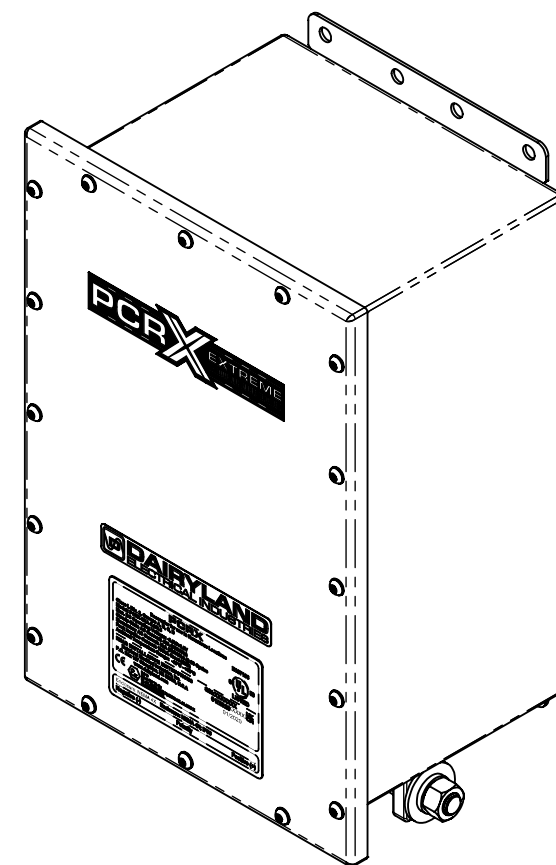
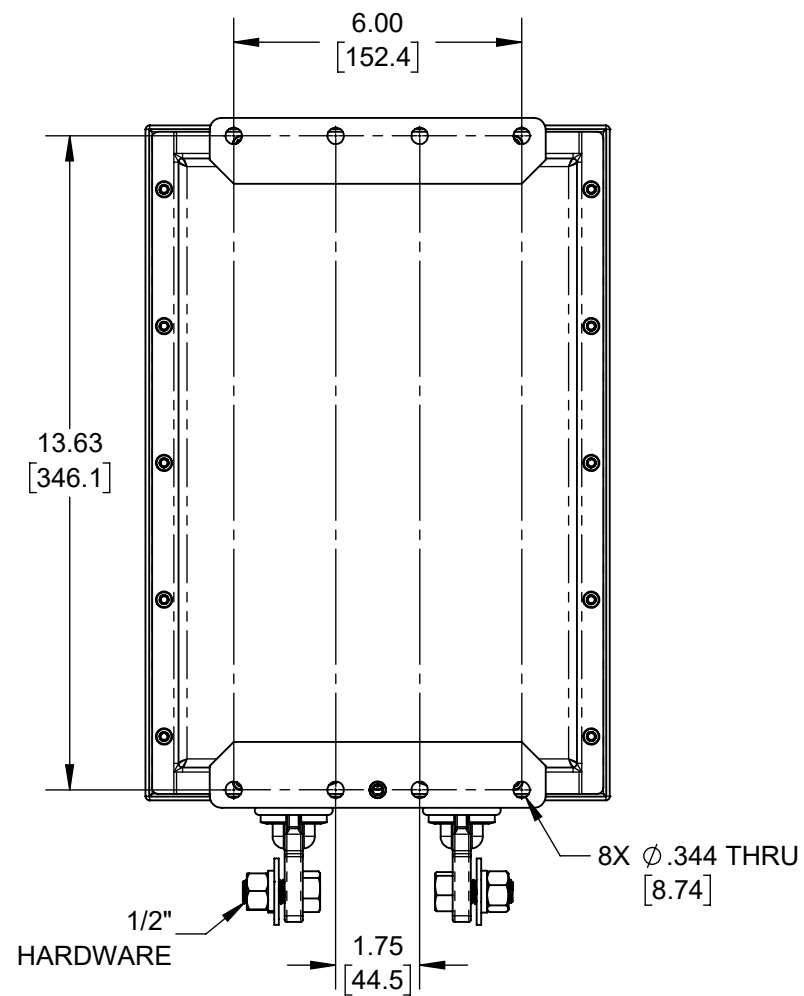
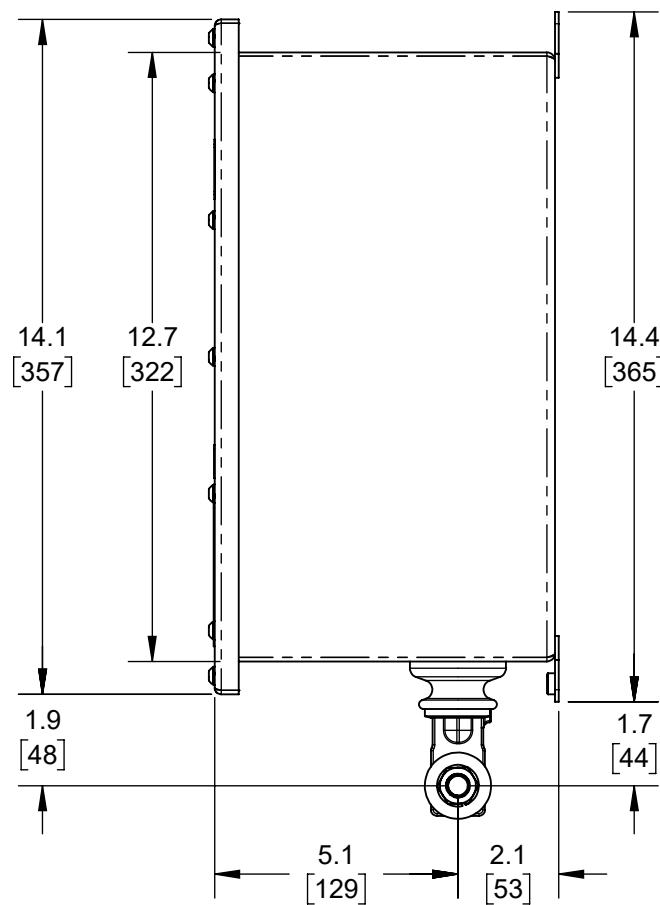
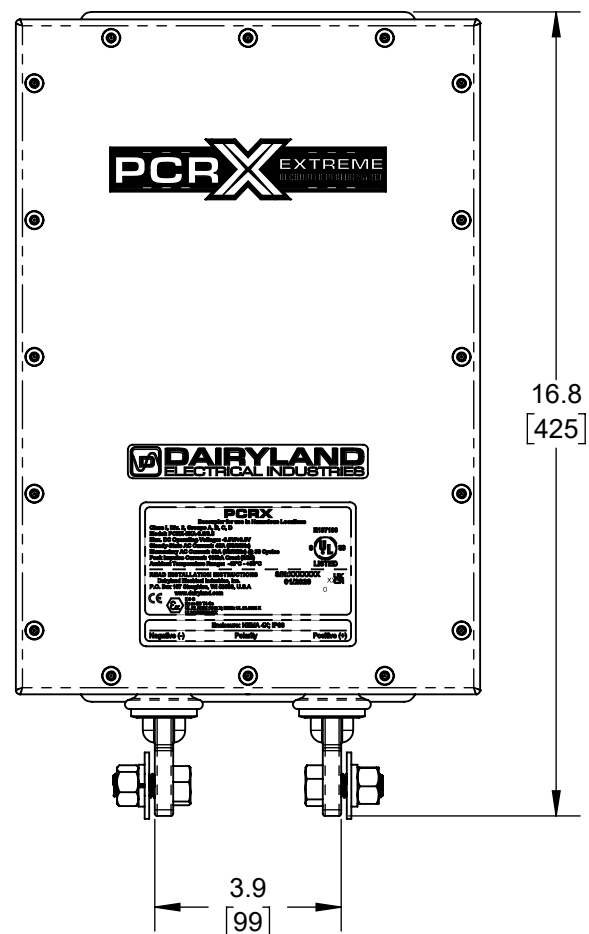
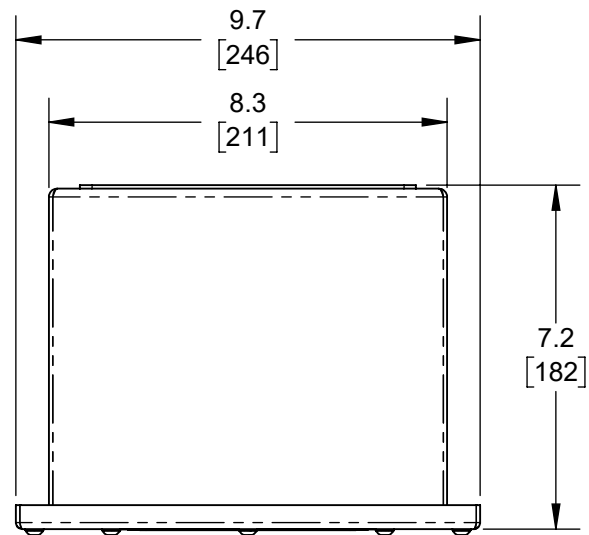
## PCR X ATEX AND IEC EX COMMENTS:

- During installation the device should be handled and mounted in a location so that direct impact is minimized.
- Products marked CE, EX II 3 G are Equipment Group II, Equipment Category 3, and comply with the Essential Health and Safety Requirements relating to the design and construction of such equipment given in Annex II to the Directive 2014/34/EU.
- This equipment is intended for use in area in which explosive atmospheres caused by gasses, vapors, mists, air or dust mixtures are unlikely to occur, or are likely to occur only infrequently and for short periods. Such location correspond to Zone 2 classification according to ATEX Directive 2014/34/EU.
- This equipment complies with the standards listed per certificate numbers UL 21 ATEX 2542X and IECEx UL 21.0033X and UL21UKEX2247X.
- Connections to the PCR X should be made only when the area is non-hazardous.
-   II 3 G Ex ec IIC T4 Gc

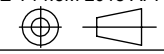

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ISOMETRIC VIEW

ASME Y14.5M 2018 APPLIES  UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. COMPUTER-GENERATED DRAWING DO NOT EDIT MANUALLY.	MATERIAL:	DRAWN:	DATE DRAWN:	 <b>DAIRYLAND ELECTRICAL INDUSTRIES, INC.</b> P.O. BOX 187 STOUGHTON, WI 53589 608-877-9900 DAIRYLAND.COM
	FINISH:	NA	DWG APPROVAL:	
.XXX = ±.005" .XX = ±.01" .X = ±.03" ANGLES = ±1°	NA	TITLE:	<b>PCRX ASSEMBLY OUTLINE DRAWING</b>	
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