



## INSTRUCTIONS

# POLARIZATION CELL REPLACEMENT (PCR)



## INTRODUCTION

The Polarization Cell Replacement (PCR) is a solid-state DC isolated/AC grounding (i.e., coupling) device designed for use in conjunction with cathodically protected equipment located in Class I, Zone 2, Group IIC or in Class I, Division 2 hazardous (classified) locations or in ordinary (non-hazardous) locations. The PCR is suitable for: (1) AC voltage mitigation, (2) over-voltage protection of isolated joints and similar structures and equipment, (3) DC isolated and AC grounding of cathodically protected structures and electrical equipment in cathodically protected structures.

The PCR can be used in a variety of different applications, each of which requires specific installation guidelines. These installation instructions cover the following common applications.

- DC isolated/AC grounding of cathodically protected structures containing electrical equipment.
- DC isolated of an electric power utility grounding system from a users grounding system.
- Over-voltage protection of isolated joints.
- AC voltage mitigation.

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.

Technical information for most applications is available on the Dairyland website.

## 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

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

## READ ENTIRE DOCUMENT BEFORE INSTALLING

### 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 isolated gloves, a shorting cable approximately 3 ft (0.91 m) long with isolated 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 isolated clamps, Model# BCL-1/0 for all decoupler ratings.) 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.

#### Mounting

Mount the PCR so that the total length of conductor to the connection points will be as short as possible if the PCR is going to be used to provide over-voltage protection from lightning. All conductors have inductance which will cause a significant voltage per unit of conductor length when subject to lightning impulse current. To minimize the voltage developed between the connection points, install the PCR as close as practical to the required connection points and cut the conductor to the shortest possible length during installation.



For most isolated joint applications the PCR can, and should, be installed with about 6 inches ( $\approx 150$  mm) of lead. Conductors can develop 1-3 kV/ft. (approx. 3-10 kV/meter) of length due to lightning; hence, the reason, 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.

## Mounting Accessories

Numerous mounting accessories are available from Dairyland to aid in the proper installation of the PCR. Full details and complete installation instructions are available on Dairyland.com.

## Environmental Exposure

The standard PCR enclosure is rated NEMA 4X and is suitable for outdoor non-submersible applications. PCRs having the optional NEMA 6P enclosure rating may be submersed in non-freezing conditions up to 6.5 ft. (2 m) depth for occasional prolonged periods, though not continuously.

The unit must be installed in environments with ambient temperatures of  $-49^{\circ}\text{F}$  to  $+149^{\circ}\text{F}$  ( $-45^{\circ}\text{C}$  to  $+65^{\circ}\text{C}$ ).

## 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.com

## Polarity

If the PCR purchased has asymmetrical blocking characteristics and it is being connected between a cathodically protected structure and ground, connect the negative terminal of the PCR to the cathodically protected structure and the positive terminal to ground.

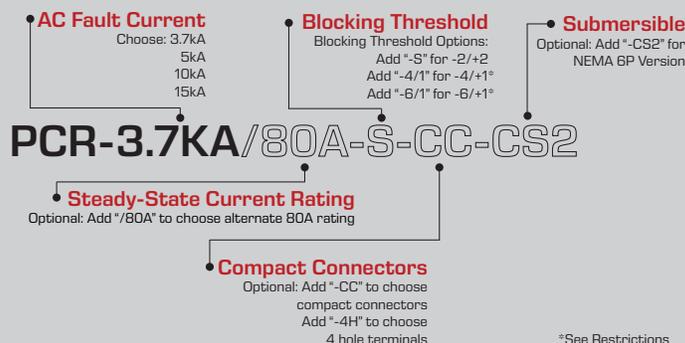
If being connected between two different cathodically protected systems, attach the negative terminal to the more negative structure and the positive terminal to the less negative structure. A label on the PCR cover shows the polarity of each conductor. If a symmetrical version of the PCR was furnished, the polarity marks are not relevant since the unit has identical voltage blocking with either polarity.

## Field Testing

Before installation, the following measurements are suggested to confirm that the steady-state conditions imposed on the PCR will be within its ratings.

1. Measure the open-circuit DC voltage between the PCR connection points with a multimeter. The open-circuit DC voltage measured should be within the DC blocking voltage rating of the model selected (i.e., normally  $-3.0$  V/ $+1.0$  V or  $+/-2.0$  V, unless a custom version has been ordered).

## Model Number Chart



## Certifications

The PCR 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 1 & 2, Groups 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 20 $\mu$ s)
  - Enclosure Rating: NEMA 4X (NEMA 6P Optional)
  - Temperature Range:  $-45^{\circ}\text{C}$  to  $+65^{\circ}\text{C}$  ( $-49^{\circ}\text{F}$  to  $+149^{\circ}\text{F}$ )

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 20 $\mu$ s)
- Temperature Range:  $-45^{\circ}\text{C}$  to  $+65^{\circ}\text{C}$
- Enclosure Rating: IP66



2. Measure the steady-state short-circuit AC-RMS current between the PCR connection points with a clamp-on ammeter. The short-circuit AC-RMS steady-state current measured should be less than the steady-state AC current rating of the PCR model ordered.
3. After installation, the DC voltage across the PCR terminals can be measured to confirm that the expected value of cathodic protection voltage exists, assuming the cathodic protection system is ON. (The voltage measured with a voltmeter will be less than the actual cathodic protection voltage because it is not being measured with respect to a reference cell.)
4. After installation, the steady-state AC current through the PCR conductors can again be measured. The current measured should be comparable to the value measured prior to installation since the AC impedance of the PCR is negligible (i.e., about 10 milliohms at 60 Hz).
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 isolated, 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, and if needed perform the following additional tests.
6. The definitive 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 very 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.

**CUSTOMERSERVICE@DAIRYLAND.COM**

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Stoughton, WI 53589, USA

## GENERAL COMMENTS

The PCR does not require routine maintenance, but if the cathodic protection voltage level near the PCR is below the normal or expected value, it is suggested that the unit be field tested following procedures available from Dairyland.

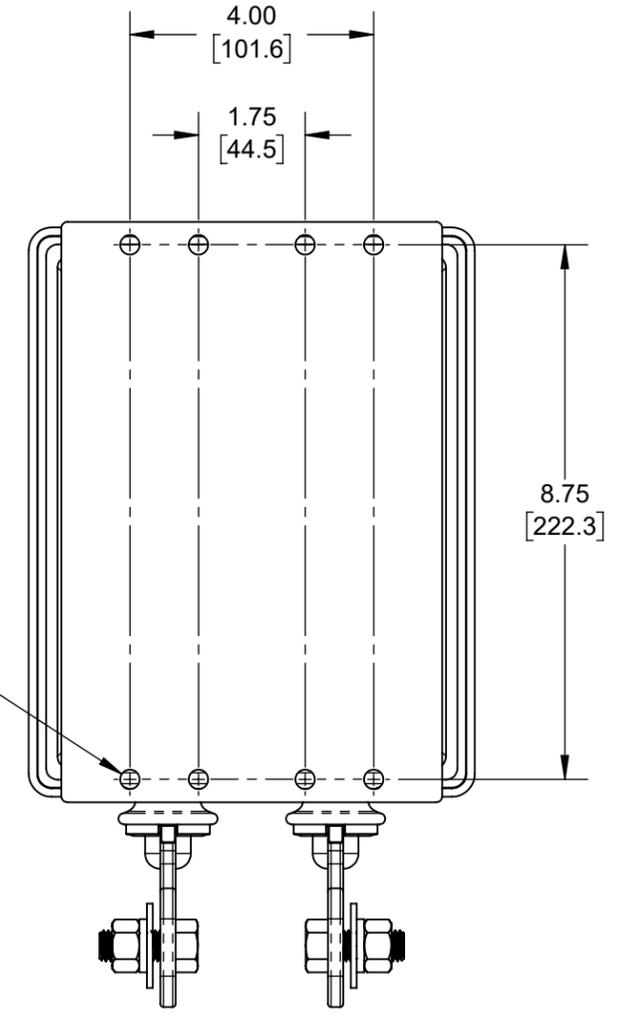
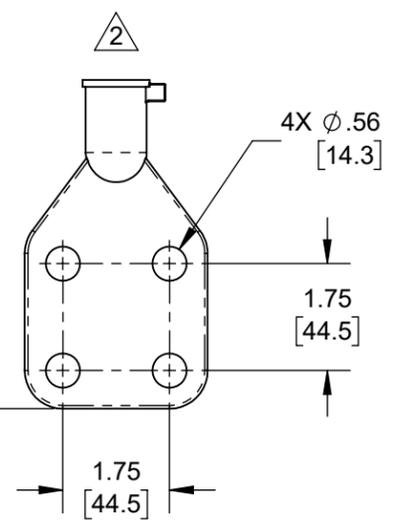
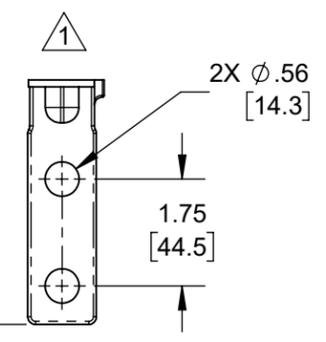
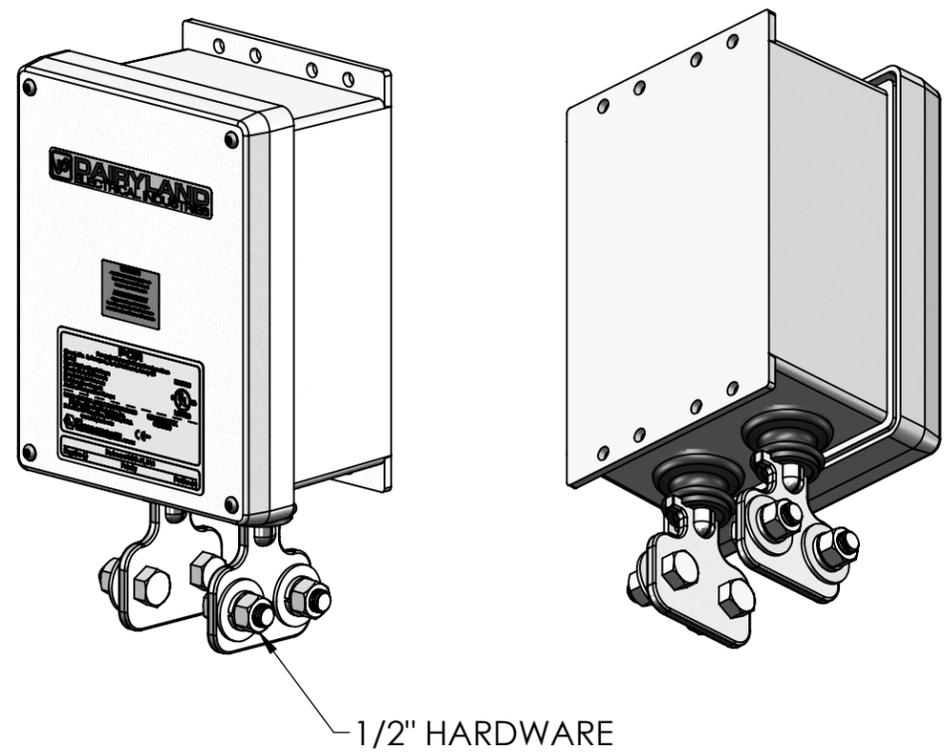
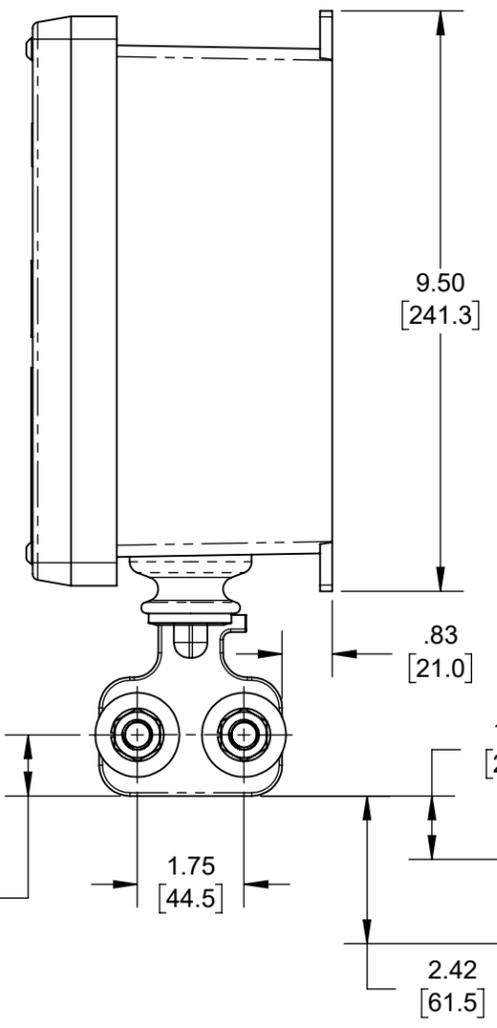
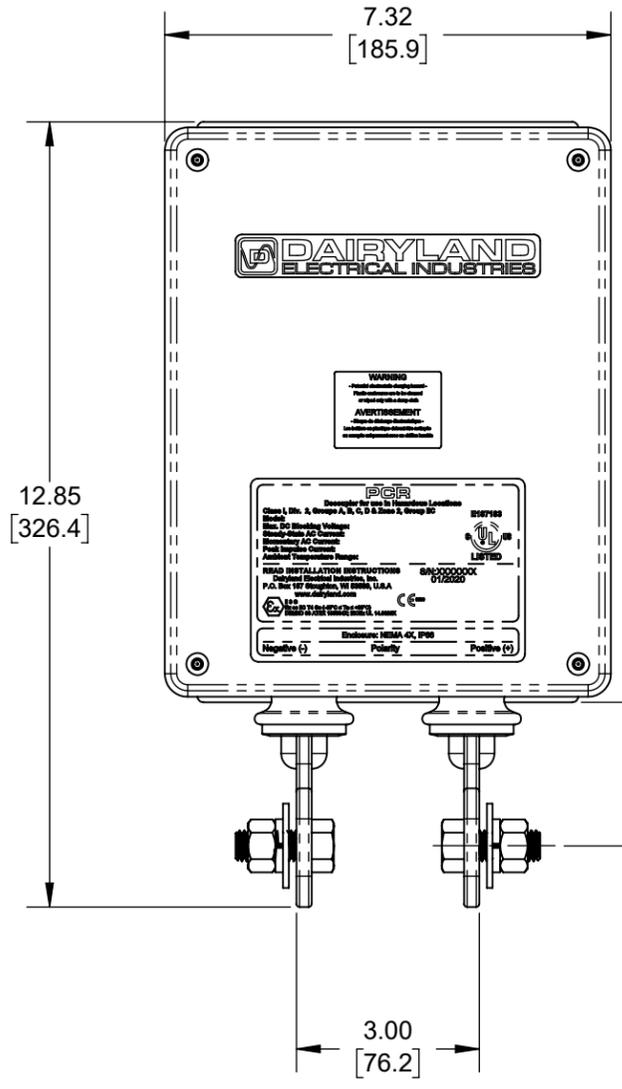
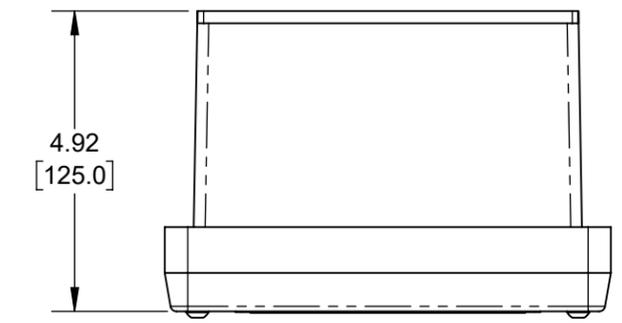
The PCR cover should not be removed as this can affect the NEMA 4 or IP66 rain tight rating.

There is no routine maintenance that can be done in the field. If a problem is suspected, contact Dairyland for trouble-shooting assistance.

The PCR 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 lightning current beyond rating.

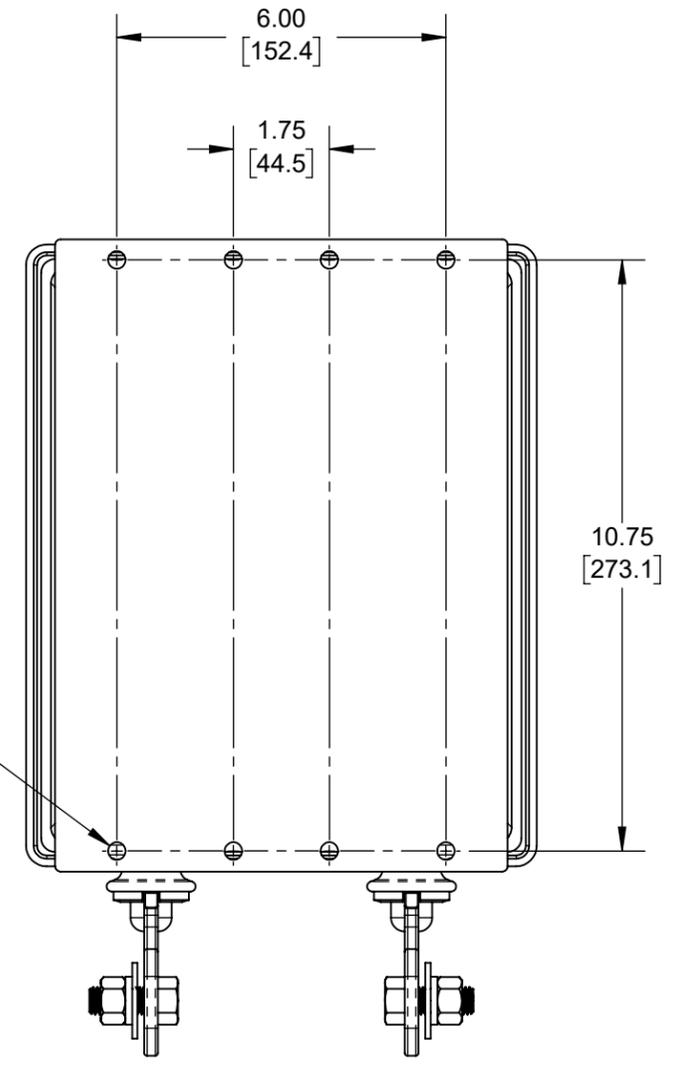
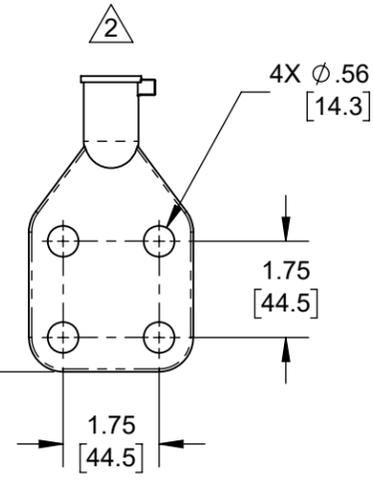
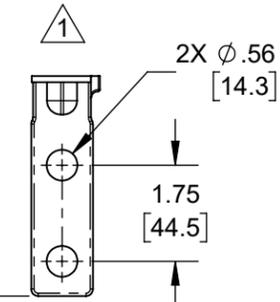
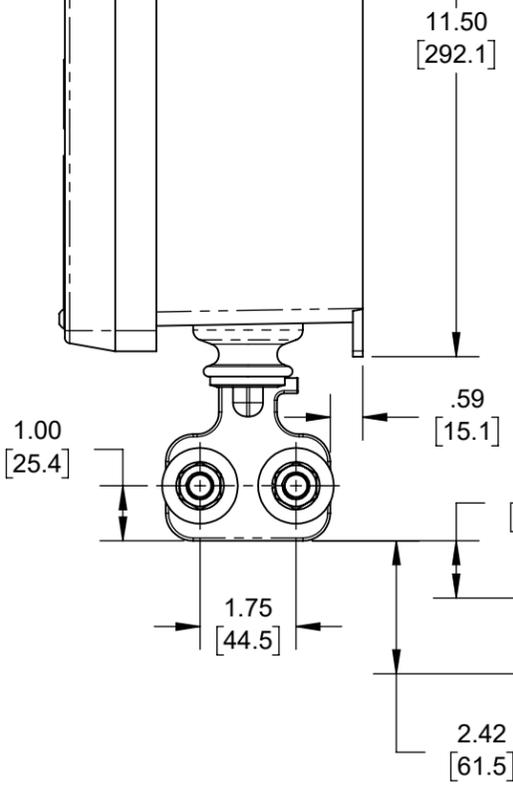
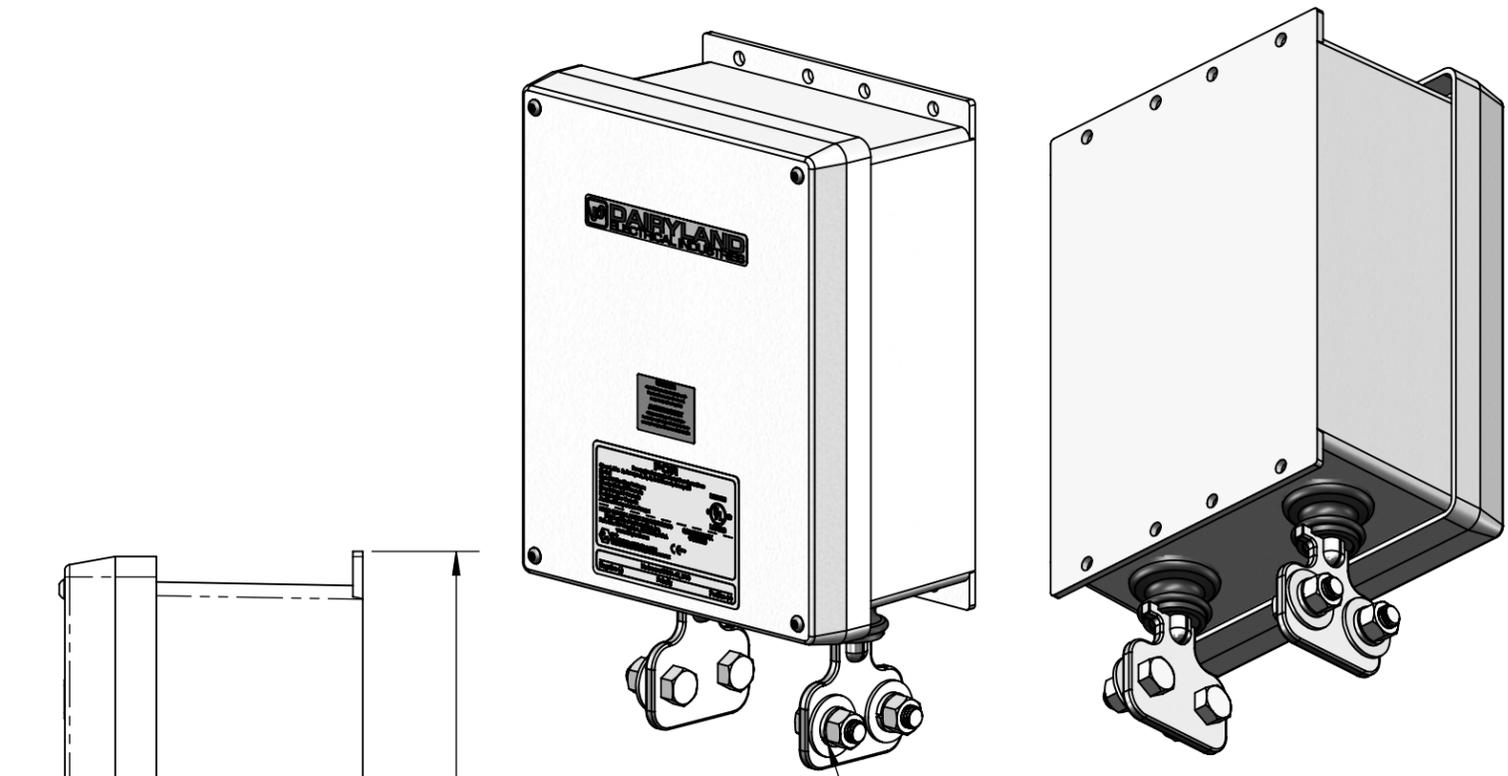
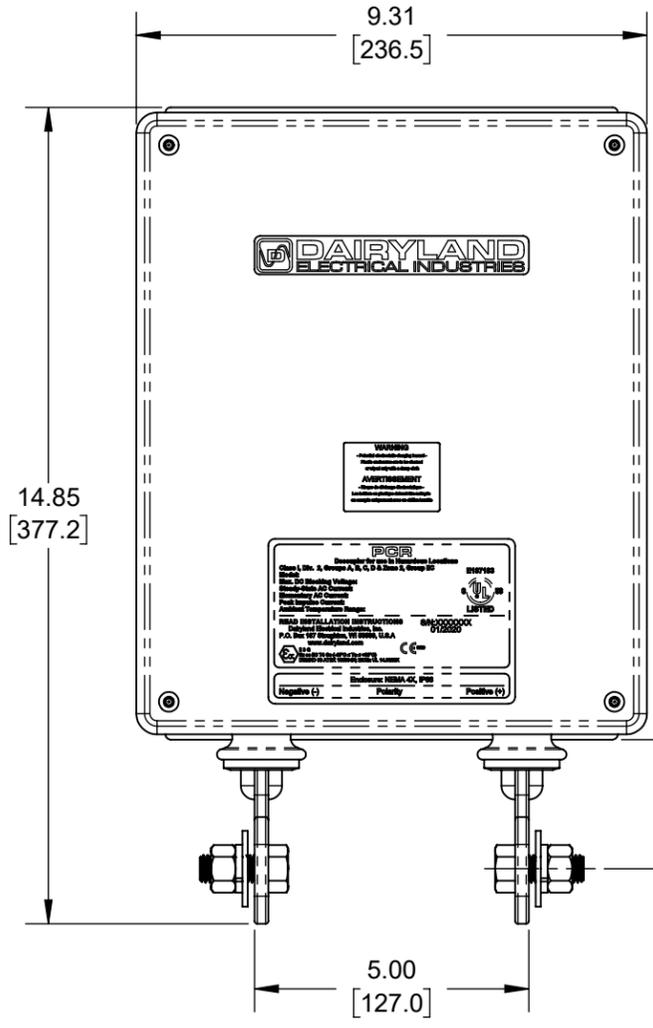
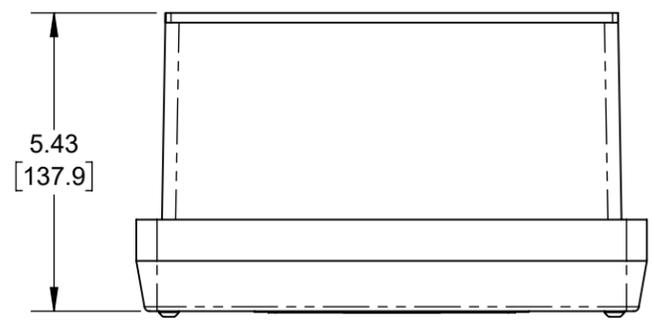
## ATEX AND IECX COMMENTS

- The device shall be placed into service in accordance with the ratings and limitations stated in the installation and operating instructions.
- No ongoing maintenance is required, as the device is designed to be maintenance-free, and is of solid-state construction with no moving, wearing, or serviceable parts.
- During installation the device should be handled and mounted in a location so that direct impact is minimized.
- Regular testing of the device is not required. Users who desire to verify the operating condition of the device should refer to the section entitled "Field Testing." Observe all safety precautions described, in addition to industry or company safety practices.
- **WARNING:** Potential electrostatic charging hazard – Plastic enclosures are to be cleaned or wiped only with a damp cloth.
- 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 gases, vapors, mists, air or dust mixtures are unlikely to occur, or are likely to occur only infrequently and for short periods. Such locations correspond to Zone 2 classification according to ATEX Directive 2014/34/EU.
- This equipment complies with the standards listed per certificate numbers DEMKO 03 ATEX 135584X and IECEx UL 14.0020X and UL21UKEX2248X.
- **CE** **Ex** II 3 G Ex ec IIC T4 Gc



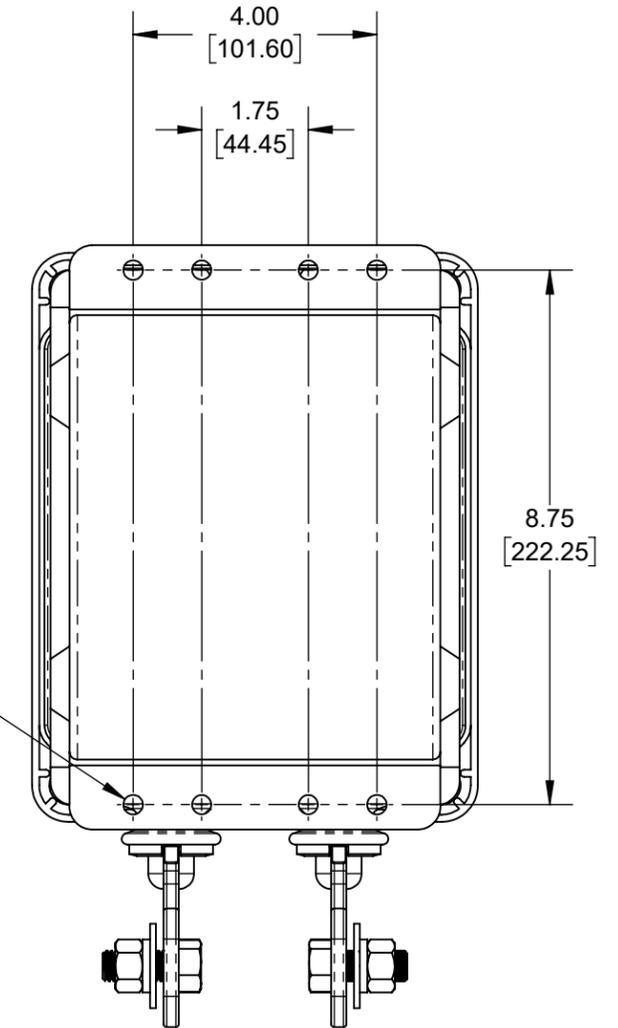
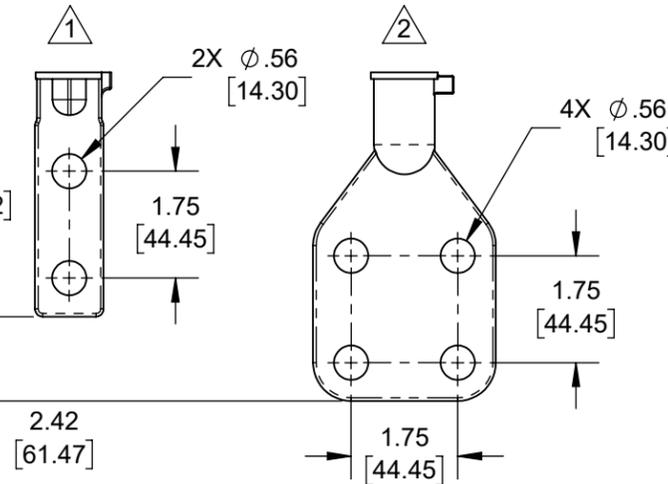
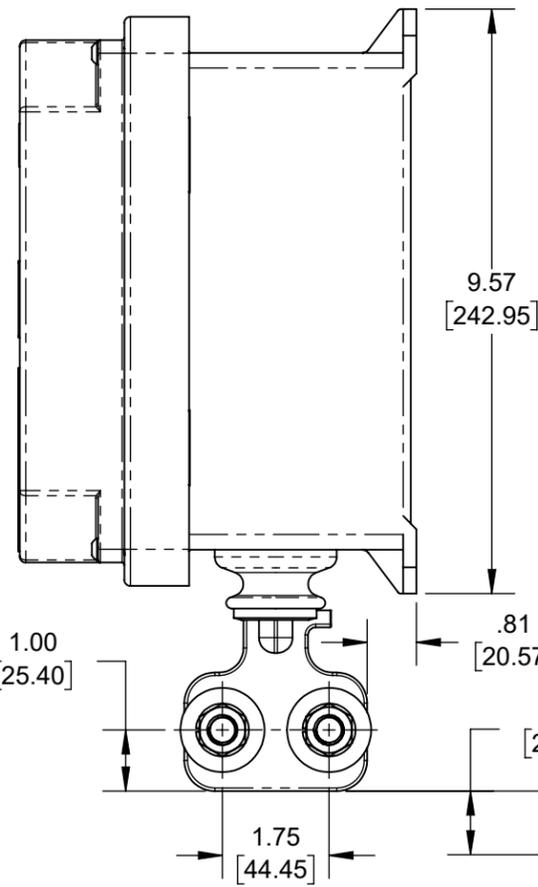
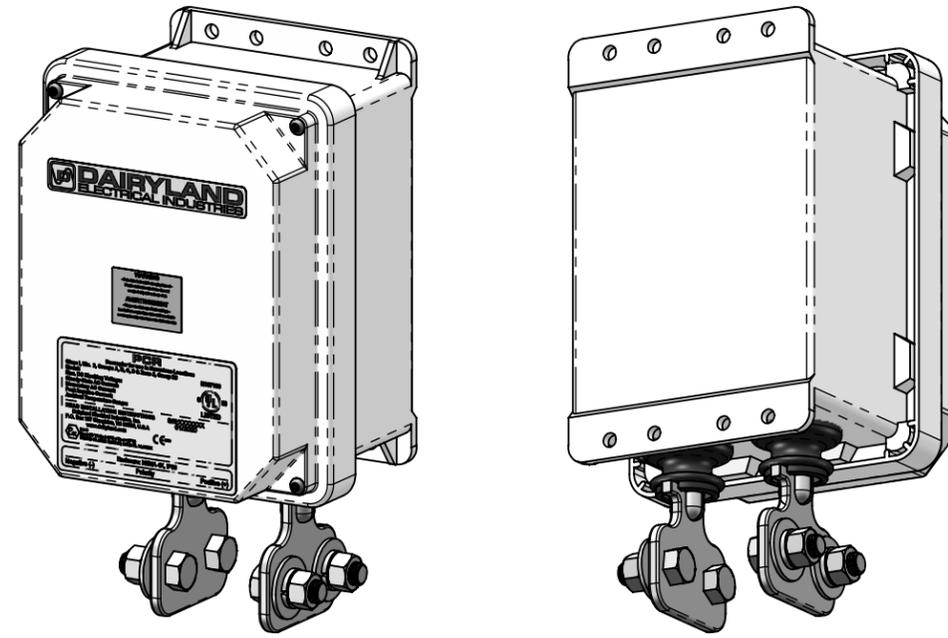
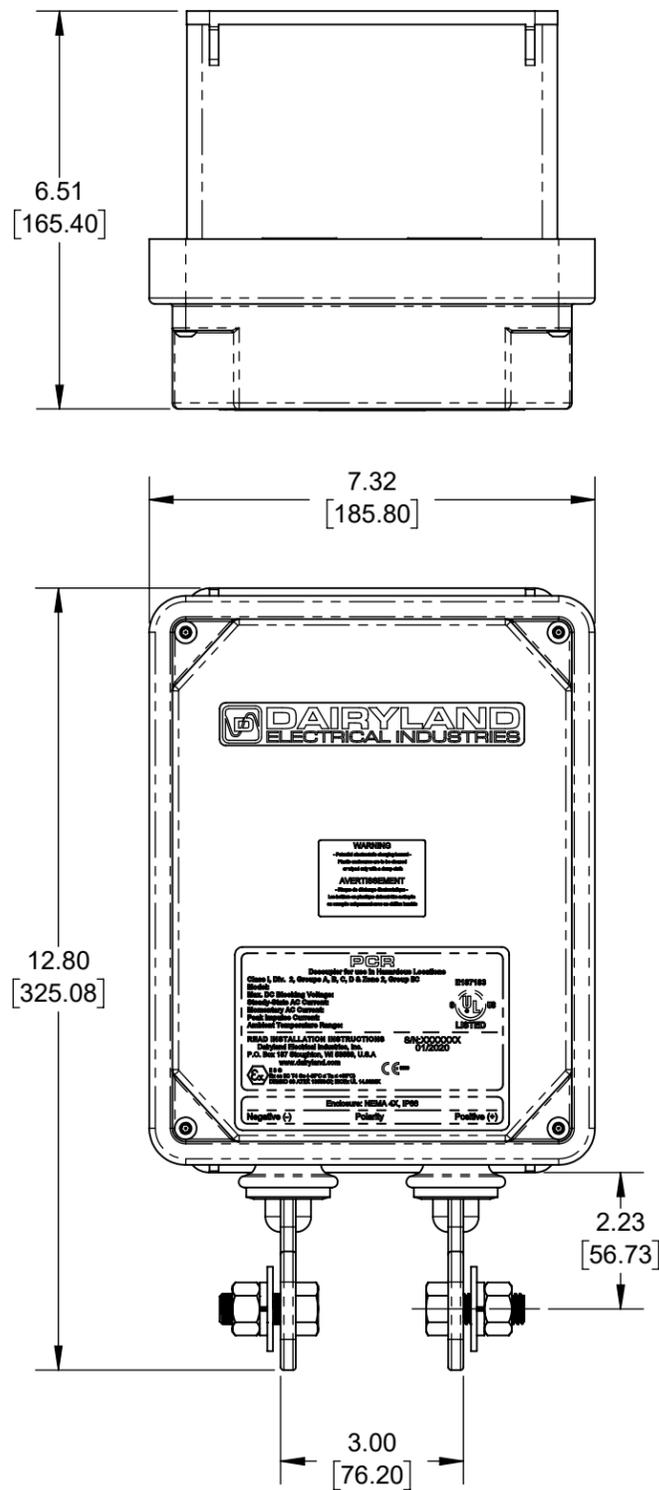
- NOTES:
- ① ALTERNATE TERMINAL: SPECIFIED BY ADDING "-CC" TO ANY PCR MODEL NUMBER
  - ② ALTERNATE TERMINAL: SPECIFIED BY ADDING "-H" TO ANY PCR MODEL NUMBER

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UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. COMPUTER-GENERATED DRAWING DO NOT EDIT MANUALLY.	FINISH:  <b>NA</b>	DWG APPROVAL: <b>RJH</b>	DATE APPROVAL: <b>07/22/2021</b>	
<b>.XXX = ±.005"</b> <b>.XX = ±.01"</b> <b>.X = ±.03"</b> <b>ANGLES = ±1°</b>		TITLE: <b>PCR 3.5KA THRU 10KA OUTLINE DRAWING</b>		
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NOTES:  
 1 ALTERNATE TERMINAL: SPECIFIED BY ADDING "-CC" TO ANY PCR MODEL NUMBER  
 2 ALTERNATE TERMINAL: SPECIFIED BY ADDING "-4H" TO ANY PCR MODEL NUMBER

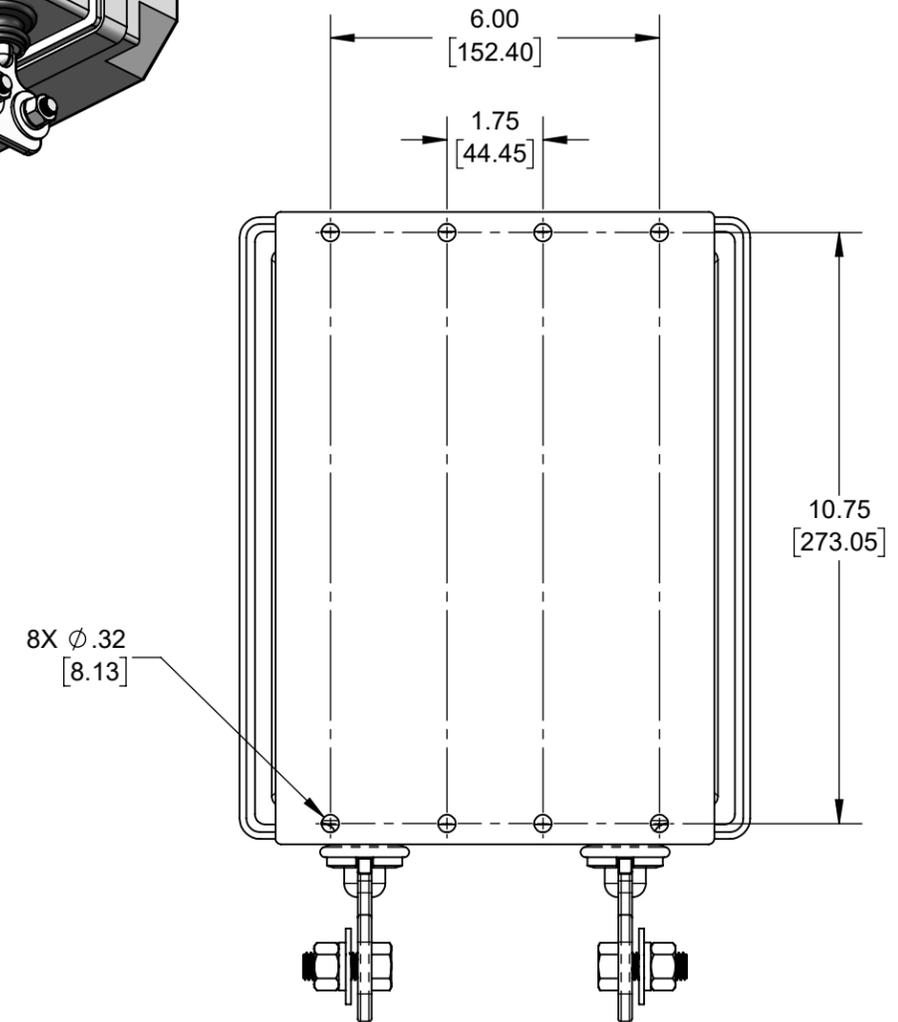
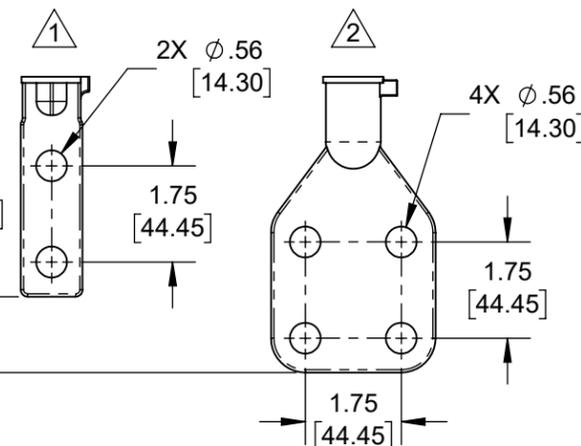
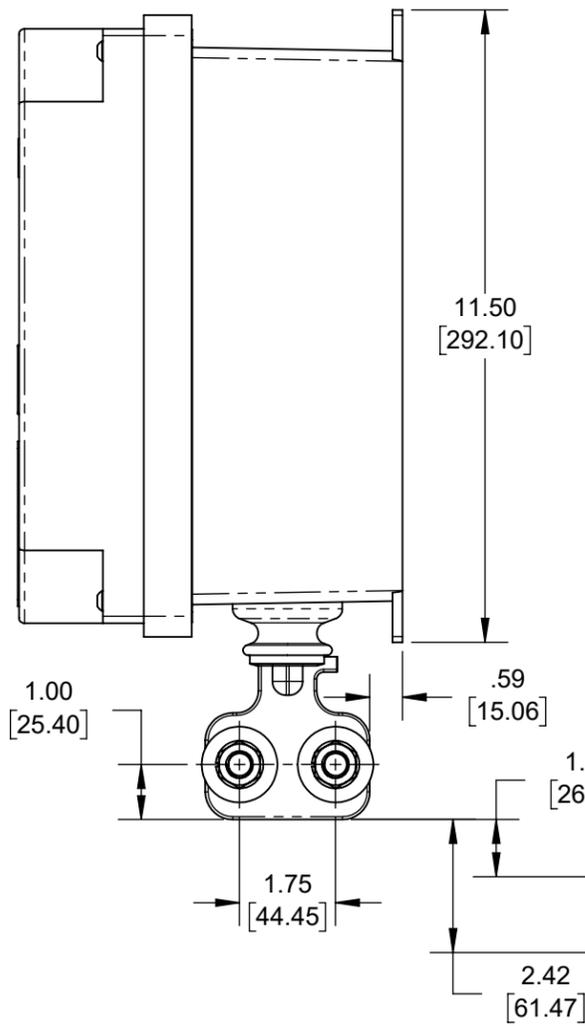
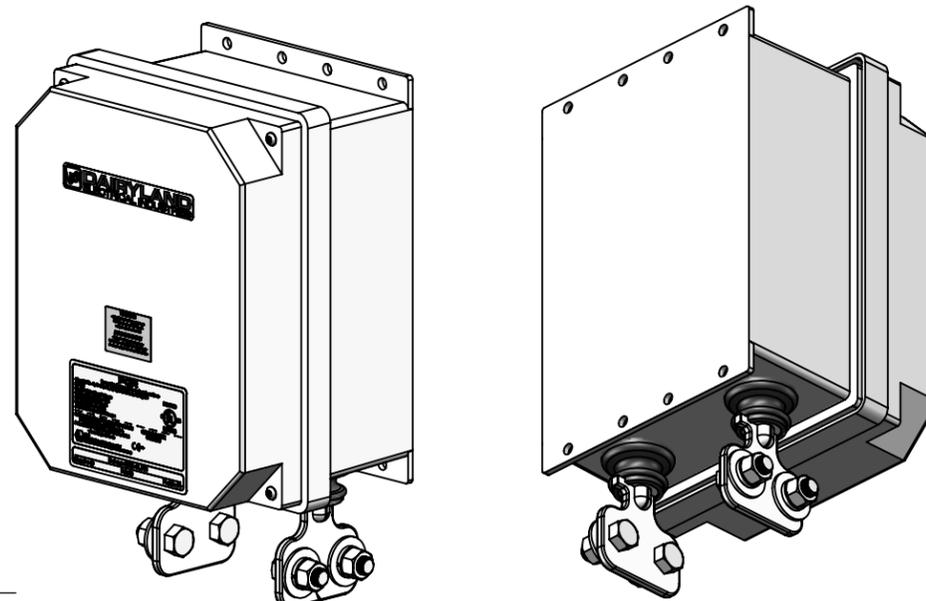
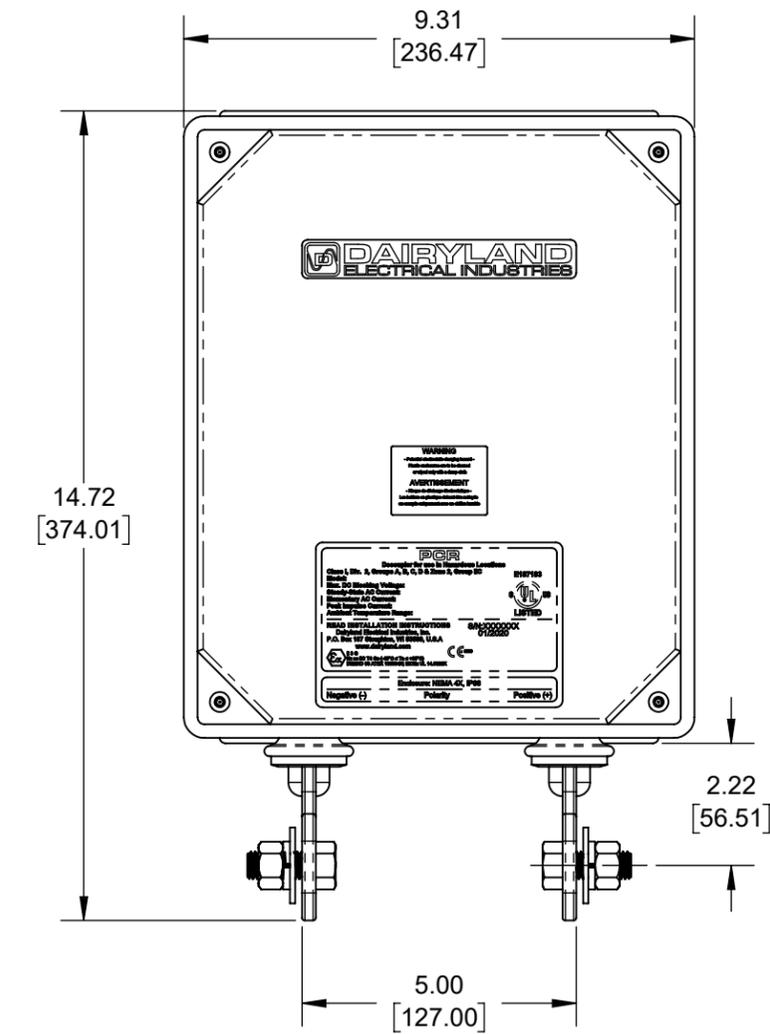
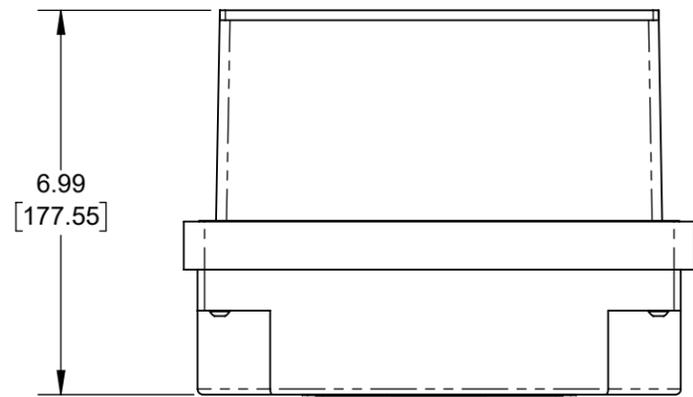
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NOTES:

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- ② ALTERNATE TERMINAL: SPECIFIED BY ADDING "-4H" TO ANY PCR MODEL NUMBER

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NOTES:

- ① ALTERNATE TERMINAL: SPECIFIED BY ADDING "-CC" TO ANY PCR MODEL NUMBER
- ② ALTERNATE TERMINAL: SPECIFIED BY ADDING "-4H" TO ANY PCR MODEL NUMBER

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