

## [ APPLICATION NOTE #182 ]

# Modular PDU Slot Locks

By Dan Rohr, Richard Thrasher, Peter Champagne, and Abby Collins

## PROJECT AT A GLANCE

### Project Type

Continuous improvement of Schneider Electric Modular Power Distribution Units

### Location

Worldwide

### Applications

Small, medium, large data centers

### Equipment Installed

Modular PDU, Modular RPP, Modular RDP, UPS with embedded Modular PDU



## CUSTOMER BENEFITS

- Improved safety

### Abstract

This application note explains the purpose of Schneider Electric Modular PDU slot locks and Schneider Electric service policy for electrical work. It also describes the importance of understanding site-specific arc flash risk when interacting with electrical equipment.

The Modular Power Distribution product family includes Modular Power Distribution Units (Modular PDUs), Modular Remote Power Panels (Modular RPPs), Modular Rack Distribution Panels (Modular RDPs), and modular power distribution solutions embedded in or designed exclusively for Symmetra PX UPSs.

Throughout this application note, the term “Modular PDU” shall refer to any power distribution solution that uses Power Distribution Modules to deliver power. The term “PDM” shall refer to Power Distribution Modules.

## Modular PDU Slot Locks

The Modular PDU Slot Locks impede the installation or removal of Power Distribution Modules and provide a physical reminder to read and follow all safety information and installation and removal procedures defined in the Installation manual. The safety and installation procedures are intended to reduce the risk of arc flash.

The slot locks are installed in the Modular PDU in the factory. Each slot lock covers two PDM positions to discourage neglect. A slot lock key is included with the product and facilitates removal of the lock. The slot lock removal procedure is described in detail in the PDU's Installation manual.

After Power Distribution Modules are installed, the slot locks must be installed. They snap into place over the Power Distribution Module hinges and obstruct removal of the Power Distribution Modules.

Figure 1: Slot locks installed near the Power Distribution Module hinges to block insertion or removal of PDMs



Although arc flash events are infrequent, the severity of an injury or equipment damage as a result of an arc flash can be high depending on the available fault energy. Because of the perception of low risk, operators may be tempted to ignore the results of site-specific arc flash risk/short circuit fault analysis. The Modular PDU slot lock is intended to remind operators of the importance of taking safety precautions to limit the risk of arc flash.

North America only: When the Modular PDU, Power Distribution Modules, and Slot Locks are used in compliance with the procedures defined in the installation manual, the product and process follow the intent of NFPA 70E.

## Arc Flash and the Modular PDU

Arc flash is caused when a phase of the electrical system makes an unintended connection to ground or another phase. It results in an arc flash that can harm or kill personnel and can damage or destroy equipment.

“An arc flash hazard may exist when energized electrical conductors or circuit parts are exposed or when they are within equipment in a guarded or enclosed condition, provided a person is interacting with the equipment in such a manner that could cause an electric arc. Under normal operating conditions, enclosed energized equipment that has been properly installed and maintained is not likely to pose an arc flash hazard.” (National Fire Protection Association, 2011, p.9)

Removing a Power Distribution Module while the PDM breaker is in the “on” position, while the Modular PDU is receiving power, is one example of an abnormal condition which could cause arc flash.

## Standards intended to reduce exposure to major electrical hazards

Schneider Electric strives to protect the safety of employees and customers worldwide. The Schneider Electric *Global Safety Directive on Electrical Safety (GSD 007)* requires all employees to follow arc flash hazard reduction strategies. For example, the Global Safety Directive includes requirements that an Electrical Hazard Analysis must be performed for every electrical task; the hazards of shock and arc flash must be eliminated by locking out the load (in this case,

the Modular PDU); and all tools, equipment, and Personal Protective Equipment (PPE) must be appropriate for the voltage and arc flash hazard levels that may be encountered during the work (Global Safety Directive, p. 1).

North America:

The National Fire Protection Association (NFPA) 70E Standard for Electrical Safety in the Workplace “defines requirements for safe work practices to protect personnel by reducing exposure to major electrical hazards” (“NFPA 70E: Standard For Electrical Safety In The Workplace® Document Information,” 2012). Ultimately, NFPA 70E compliance is the responsibility of the site.

Worldwide:

The International Electrotechnical Commission directive IEC 60364-4-41, “Low Voltage Electrical Installations - Protection for safety - Protection against electric shock”, defines requirements for electrical work practices. Ultimately, compliance with IEC directives is the responsibility of the site.

### Understanding the risk of arc flash at your site

To lower the risk of arc flash in the workplace environment, it is important to understand the electrical hazards that are unique to your data center. Arc flash hazard analysis explains the level of arc flash risk for the Modular PDU based on electrical conditions specific to your site. It determines three key pieces of information:

- Incident energy analysis: The incident energy of an arc flash for a specific set of conditions. Incident energy is “the amount of energy impressed on a surface, a certain distance from the source, generated during an electrical arc event.” (National Fire Protection Association, 2011, p. 11-12)
- Arc flash boundary: The area around the potential arc source within which a person could receive a second degree burn if an arc flash occurred. ((National Fire Protection Association, 2011, p.10)
- Personal protective equipment (PPE) requirement: The level of personal protective equipment that must be worn within the arc flash boundary

With this information, the worker can clearly understand the importance of following the best safety practices prescribed by Schneider Electric, as well as local and national codes, when performing maintenance and service procedures on the Modular PDU.

### Modular PDU features that lower the risk of electrical hazard

Although Schneider Electric cannot eliminate the risk of arc flash, many features are designed into the Modular PDU to reduce the risk and severity of electrical hazard:

- Each PDM slot must be covered by a filler plate.
- The PDU has a locked door which restricts access to potential sources of electrical hazard.
- Two options are available for removing or replacing a Power Distribution Module:
  - Turn off all power supplying the equipment and perform appropriate lockout/tagout procedures before installing or removing the Power Distribution Module.
  - OR
  - If a Symmetra PX UPS is providing power to the Modular PDU, place the UPS into battery operation (to reduce fault current) before removing the Power Distribution Module. To place the UPS into battery operation, see the UPS Operation Manual.
- The PDM and PDU are designed to prevent accidental installation of a 208V PDM into a 400V PDU and vice versa:
  - The 208V PDM connector and backplane outlet are designed with a different shape than the 400V PDM connector and backplane outlet. The shape of the PDM connector and the backplane outlet must match in order to successfully install the PDM.
  - The backplane outlet and the rear cover of the PDM must be the same color. This is a visual indicator that the PDU and PDM voltages are compatible.
- All PDMs are pre-assembled and tested in the factory; the PDM design integrates the breaker, drop cord (“whip”), and connector together as a whole, and testing confirms the PDM is correctly wired.
- Transformer-based Modular PDUs are equipped with a current-limiting input breaker.
- PDM circuit breakers must be open during installation or removal of the PDM.

## What if powering down my equipment is infeasible due to equipment design or introduces additional hazards?

Schneider Electric has carefully reviewed wording in product hazard messages to alert users to potential hazards, how to avoid those hazards, and the consequences of not following hazard messages. Workplace safety standards such as NFPA 70E and CSA Z462 are clear that the proper method to work on or near electrical equipment is in a de-energized state.

However, it is recognized that the standards identify exceptions where powering down the equipment is infeasible due to equipment design or actually introduces additional hazards. While elimination of all risk is not possible, in those situations where it can be demonstrated that energized work is necessary, certain tasks, including the installation or removal of Power Modules into the Modular PDU may be performed on an energized Modular PDU only after the user has demonstrated that the application meets the required exceptions in local regulations, NFPA 70E, CSA Z462 or other standards as appropriate and employs the work practices and personal protective equipment prescribed in the standard.

### Summary

Schneider Electric is dedicated to enabling customer safety and compliance with applicable local and national electrical codes. In North America, NFPA 70E and CSA Z462 have restricted electrical work practices with the goal of reducing the risk of arc flash. In the rest of the world, IEC 60364-4-41 defines requirements for electrical work practices.

This application note defines important steps toward reducing arc flash hazards in the workplace. For example, slot locks installed in the Modular PDU impede the installation or removal of Power Distribution Modules and provide a physical reminder to read and follow all safety information and installation and removal procedures defined in the Installation manual. The safety and installation procedures are intended to reduce the risk of arc flash.

Schneider Electric also recommends arc flash hazard analysis of the PDU(s) at your site. This analysis provides understanding of site-specific arc flash risk when interacting with electrical equipment. Because arc flash risk is based on electrical conditions specific to your site, reduction of arc flash hazard is the responsibility of the site.

### The future of arc flash research

Schneider Electric is a proud sponsor of the jointly run IEEE and NFPA Arc Flash Research Project:  
<http://standards.ieee.org/about/arcflash/sponsors.html>

## Additional resources

North America: Square D Arc Flash Analysis

[http://www.plantservices.com/knowledge\\_centers/square\\_d/](http://www.plantservices.com/knowledge_centers/square_d/)

<http://www.schneider-electric.us/sites/us/en/customers/consulting-engineer/consulting-engineer.page>

<http://products.schneider-electric.us/products-services/services/electrical-distribution-services/arc-flash-safety/>

Schneider Electric Arc Flash White Papers:

<http://www.schneider-electric.us/sites/us/en/customers/consulting-engineer/white-papers-case-studies.page>

## References

National Fire Protection Association. (2011). *NFPA 70E Standard for Electrical Safety In the Workplace* (2012 edition). Quincy, MA.

(2012). "NFPA 70E: Standard For Electrical Safety In The Workplace® Document Information". Retrieved from <http://www.nfpa.org/codes-and-standards/document-information-pages?mode=code&code=70E>.

Schneider Electric SA. (2012). *Global Safety Directive: Electrical Safety* (GSD 007). Widdowson, R.