



Synergy Eaton Power Defense Switchboards

Manufactured by Spike Electric Controls using Eaton's Power Defense Circuit Breaker technology

About:

*The UL891 Compliant High quality Engineering Products

We, at Spike Electric Controls, introduce our Synergy Eaton Power Defense Switchboards range, which is an engineering marvel. We aim to bring you power products that are engineered for safety, reliability, and quality. We are committed to providing our clients with innovative solutions and meeting complex technical requirements with ease.

Our Synergy Eaton Power Defense Switchboards range is compliant with the specifications of the UL891 quality control standard, which is one of the most common and most widely trusted standards for switchboards. The UL standards are essentially a set of safety regulations that have been certified by OSHA (Occupational Safety and Health Administration) in the U.S. These standards have been approved by the U.S. federal government for the safety of workers.

The specifications of the UL891 quality control standard apply to the switchboards rated for 600V or less in accordance with the National Electric Code (NEC) and ANSI/NFPA 70. This standard also covers the switchboards which are used in circuits with available short circuit currents up to 2,000A or less.

Our Synergy switchboards are tested after being subject to a 2,000A fault current. This

certifies that our product can survive the extreme physical stress of such an event. This gives you an assurance that our Synergy Eaton Power Defense Switchboards range will hold up even in the most extreme circumstances.

The UL standards for switchboards focus on all aspects of safety w.r.t the switchboard systems. As per the requirements of the UL certification, our Synergy Eaton Power Defense Switchboards range is periodically sampled and tested to ensure compliance. So, there is a constant testing and thus, our task does not end with getting certified once only.

The badge of the UL certification conveys trust between the manufacturers, governing bodies, and consumers.

Installation and Maintenance:

Synergy Switchboards – Easy Installation and Maintenance

Our Synergy Eaton Power Defense Switchboards range is built to last and features design innovations that facilitate easy installation and maintenance. These switchboards are easily available to meet the needs of contractors, consultants and end-users.

The Synergy Eaton Power Defense Switchboards range adheres to the highest standards in terms of quality. We offer custom or standard switchboards that are easy to install, we are available 24/7 to assist any installation questions. Spike Electric will provide you with a sales engineers contact information before shipping that you can call directly for any questions 24/7.

Our Synergy Eaton Power Defense Switchboards range designs entail the most frequently requested ratings and options, with faster delivery.

Features for the Custom Option:

Synergy Eaton Power Defense Switchboards Features for the Custom option

- Circuit breaker and fusible switch mains and feeders
- NEMA Type 1, 12, 4, 4x or Type 3R available
- NEC 2017 Arc Energy Reduction available or also called arc-flash mitigation system available for main breaker
- 6000 Amp Max on Switch Boards
- 65 kAIC standard bus bracing. Optional 100 or 200 kAIC
- Voltages – up to 600 Vac or 250 Vdc

- Sequence utility metering – hot or cold
- Internally mounted surge protection devices
- Customer metering
- Main Tie Main
- Dual Generator Input
- Emergency Generator Input Parraell Switchboard
- Automatic Transfer Switch Intergraded into Switchboard
- Manuel Transfer Switch Intergraded into Switchboard
- Distribution Transformers Intergraded into Switchboard
- Mini Power Zone Intergraded into Switchboard
- Long-Time Delay · Short-Time Pickup · Short-Time Delay · Instantaneous Pickup · Ground Fault Pickup. available on all circuit breakers
- Custom Busway and transformer connections available
- PLC or relay based main automatic transfer schemes
- Microprocessor-based metering and monitoring equipment
- Utility metering provisions

Features for the Standard Option:

Synergy Eaton Power Defense Switchboards Features for the Standard option

- Voltages to 600 Vac or 250 Vdc
- NEMA enclosure types – indoor and outdoor
- Ratings - up to 6000 A, 100 kA SCCR
- Bussing options – aluminium or copper with tin plating or copper with silver plating option
- Internally mounted surge protection devices



Commercial Multi-Metering:

We offer an opportunity for providing revenue metering for multiple tenants in a cost-effective manner. Our aim is to reduce footprint requirements as well as installation time for projects that require top exit of load side cables. This proves to be an ideal option for shopping centers or for shopping malls.

Features of Commercial Multi-Metering:

- Commercial multi-metering is a hot sequence metering.
- It is available with Lever By-pass or Non-Lever-By-pass construction.
- Switchboard ratings – through 6000 A, 100 kA.
- Contains options to add future tenants and future sections.
- Factory installed devices are wired from the meter socket to disconnect.
- NEMA Type 1, 12, 4, 4x or Type 3R available.
- Alignment options include front and rear.
- Meter sections are available in three or six socket section configurations.
- 60-200 A without lever by-pass contains inbuilt meter sockets, 5 or 7 jaw, ring type, test block.
- 60-200 A lever by-pass contains inbuilt meter sockets, 7 jaw, ringless.
- 400-1200A have current transformer rated meter compartments.

Synergy Low Voltage Switchboards:

Synergy low voltage switchboards offer an economical way of distributing electricity. These switchboards are customized and may be used as a service entrance equipment or as distribution centers in commercial, institutional, and industrial applications. Synergy low voltage switchboards are enclosed and free-standing structures, which contain circuit breaker for services rated up to 6000A with a maximum voltage of 600 VAC.

In addition, there is an auxiliary section that facilitates cable or bus transition. It also provides additional space for connecting the service conductors to the line side of the main.

The Synergy low voltage switchboard frame mounts various components in the switchboard, which include transfer switches, special metering systems, and throwover systems.



Features of Synergy Low Voltage Switchboards:

- Switchboard ampacity to 400A to 6000A
- Voltage: Up to 600Vac, or 250Vdc
- Suitable for service entrance or distribution
- NEMA enclosures – Type 1, 12, 4, 4x or Type 3R
- Testing of short circuit rating of 3 cycles (.05 seconds); or immediate trip of tested OCPD; or braced to UL configuration standards
- Accessibility: front or rear
- Assembling in factory
- Sequence utility metering for hot or cold
- Customer metering
- Availability of protective device accessories
- Fully rated copper bus systems – 1000 A per sq in.
- Fully rated aluminium bus systems – 750 A per sq in.
- A large array of integrated components available – SPD, distribution transformers, automation, automatic transfer switches, etc.

Stainless Steel Switchboards & Stainless Steel Nema 4x Switchboards:

Out Door Stainless steel switchboards are common in highly corrosive environments that a painted steel enclosure may corrode over time. The longevity of the switch board is significantly increased when utilizing a stainless-steel switch board in those types of environments. When ordering a Nema 4x Switchboard there is a lot of room for error due to some companies not understanding the heat loss calculations that need to be done on a Nema 4X Rated switch board.

Nema 4x Switch Board should be rated for windblown dust and rain, splashing water, and hose directed water; undamaged by ice which forms on the enclosure. Circuit Breakers, switches, transfer switches and other devices generate a lot of heat. The heat needs to escape through a Nema 4x ventilated or AC cooled system or the enclosure needs to be sized properly in order to withstand the internal heat. Nema 4x Switchboards can have issues like nuisance tripping of circuit breakers, over heating of components, which in turn defeats the purpose of the 4x enclosure of increasing the longevity of the internal electrical components. Let Spike Electric Design and build your custom Nema 4x switch board. Our team of electrical engineers will ensure the heat calculations are done properly and working with their counterpart mechanical engineers will design the enclosure to fit the custom application.

Quick Ship Switchboards:

2-3 Week Lead Time

Synergy switchboards are quick ship switchboards which are suitable for use as service entrance equipment on ac systems.

Optional Seismic Compliance of Synergy Switchboards

Our Synergy Switchboards adhere to the requirements of the International Building Code (IBC), California Building Code (CBC), Office of Statewide Health Planning and Development (OSHPD), and ASCE/SEI 7 based on triaxial shake table testing; for equipment operation after a seismic activity.

A shake table testing was conducted by an independent test facility and compliance was verified to $I_p = 1.5$. The post test equipment functionality was verified as per the ASCE 7 requirements, which are a part of the seismic designated system.

Range – Benefits and Applications:

Our Synergy Eaton Power Defense Switchboards range provides various benefits, which include –

- custom or standard installation options
- quick installation time and mounting facility
- offer short lead times and an expedited delivery

Quality Management System ISO 9001 Manufacturing:

Learn more about our Quality Control Management system

The Synergy Eaton Power Defense Switchboards range has applications in various industries , which include –

- Manufacturing
- Water wastewater
- Commercial buildings

- Healthcare facilities
- Data Centres
- Textile
- Industrial buildings
- Commercial office buildings
- Pharmaceuticals
- Offshore Designs Available
- Oil & Gas

Contact Us for availing our products. We are happy to help and walk you through the installation process.

Catalog Number System

SWBE	4X	480V	SC	L	600	50	MB400	T	15-1200	ISOG
Catalog Prefix Synergy Eaton Switch Board					Bus Amps 400 600 800 1200 1600 2000 2500 3000 4000 5000 6000		Main Breaker 400A MB400 600A MB600 800A MB800 1200A MB1200 1600A MB1600 2000A MB2000 2500A MB25000 3000A MB3000 4000A MB4000 5000A MB5000 6000A MB6000 Main Lugs MLO__		Branch Breakers Poles 1 15-1200 2 15-1201 3 15-1202	
NEMA Rating Nema 1 1 Nema 3R 3 Nema 4 Painted 4 Nema 4x Stainless 4x								Power Entry Top Feed T Bottom Feed B		
Voltage 3-Phase 4-Wire 480 3-Phase 3-Wire 400V 3-Phase 3-Wire 600V										
			Bus Material Aluminum A Copper C Silver Plated Copper SC	Cable Incoming Left L Right R		Bus Rating 42ka 42 50kA 50 65kA 65 85kA 85 100kA 100 200kA 200				Enclosure Modifications & Accessories Isolated Ground ISOG Automatic Transfer Switch Section ATS Manual Transfer Switch Section MTS Cam Lok Panel for Generator Feed CL Main Tie Main MTM Dual Genrator Input DGI Mini Power Zone Section 45KVA Transformer & Lighting Panel MPZ Power Meter W/CT's PM Surge Protection Device must specify required kA 100kA-400Ka SPD____ LSIG LSIG ARMS AER Service Enterance Rated SER Utility Structure US



Power Defense

Circuit Breakers
PRODUCT GUIDE

EAT-N

BY **SP/KE**
ELECTRIC CONTROLS



A globally rated platform from Eaton

Power Defense™ molded case circuit breakers (MCCBs) and insulated case circuit breakers (ICCBs) are globally certified to meet your local requirements, empowering you to build and design systems that can be used anywhere in the world. Wherever Eaton does business, Power Defense circuit breakers are there, backed by Eaton's global support and fulfillment network, with the right resources in place to minimize your project lead-time and maximize your uptime. Integrating new products can be a challenge, which is why the Power Defense circuit breakers are available with online instructions, support and a product selector. These unique tools can help you engineer and deliver your projects quickly, ultimately helping to improve your bottom line.

The Power Defense circuit breakers feature the Power Xpert® Release (PXR) electronic trip units, offering premium protection and communication features allowing you to use fewer components and a simplified design while keeping your system connected, your equipment and employees protected, and your customers informed. The PXR trip unit family has models that will cover all of your needs, including fully programmable models that enable ultimate customization and flexibility, as well as value models that offer all of the benefits of electronic trip units, with simple setup and coordination.

PXR electronic trip units are equipped with the latest micro-processor technology including industry-first advanced algorithms that notify you when your power distribution circuit breaker needs to be maintained or replaced. They also have the embedded ability to accurately measure energy consumption with no additional meters or equipment, delivering critical data about your power distribution system and energy use in your facility.

Whether you're building production capacity or a legacy, the green factory of the future or the newest high rise on the next horizon, Power Defense circuit breakers will serve as guardian and protector as your ideas are realized in concrete and steel.

Power Defense circuit breakers—a globally rated platform from Eaton



Molded case circuit breaker



Insulated case circuit breaker



Eaton's Magnum low voltage power circuit breakers have set industry standards for decades for the global market. The broad and powerful circuit breaker offering provides comprehensive solutions to meet and/or exceed the unique and wide-ranging requirements of today's power distribution systems.

This innovative circuit breaker offering is designed for ultimate performance, custom configuration, and application flexibility. Magnum circuit breakers combine many years of successful circuit breaker protection experience with the latest technological advances in circuit breaker, trip unit, and communications performance.

Ever since introducing the first microprocessor-based trip unit, Eaton has advanced the technology with its versatile family of Digitrip RMS trip units designed exclusively for Magnum circuit breakers. Customers have the capability of providing an electrical distribution system with:

- Superior programmable protection/coordination
- Advanced warning capabilities
- System diagnostics/monitoring/communications

Eaton's Magnum family address the needs of a wide range of varying global application requirements. You will find product details, dimensional information, maintenance recommendations, and more when you take a closer look within this Magnum product guide.

Magnum consists of four product families. Each provides specific ratings, features and approvals to optimize performance in concert with the application:

- Magnum DS for ANSI rated switchgear applications
- Magnum SB for UL rated switchboard applications
- Magnum IEC for power distribution and switchboard applications
- Magnum DC switches for demanding UL or IEC rated DC applications

Magnum DS family

Magnum DS low voltage power circuit breakers are UL listed, designed, tested and certified to all applicable ANSI, NEMA, UL, CSA, IEC, EC and IEEE standards. Specifically, the circuit breakers meet or exceed the following:

- UL 1066
- ANSI C37.13
- ANSI C37.16
- ANSI C37.17
- ANSI C37.50
- IEC 60947-2 (ed.4)
- GB14048.2-2008
- CSA TIL No. D-34
"Interim certification requirements for low voltage power circuit breakers"

In addition, Magnum DS is suitable for use in: UL 1558 "Certified Magnum DS low voltage metal-enclosed switchgear", UL 891 "Standard for LV switchboards", UL CSA TIL No. D-34. Refer to Figure 1 for a visual reference and Table 1 for a quick ratings reference.

Product family characteristics:

- Up to 635 Vac operating voltage
- Up to 200 kA interruption ratings
- Up to 130 kA short time withstand ratings
- 200–5000A continuous current
- Three- and four-pole configurations
- Fixed and drawout

Magnum DS low voltage circuit breakers



Table 1. Magnum DS ANSI breaker family ratings (Class UL 1066)

Interruption rating (kA) @ 508 Vac	800 Amp Frame	1200 Amp Frame	1600 Amp Frame	2000 Amp Frame	2500 Amp Frame	3200 Amp Frame	4000 Amp Frame	5000 Amp ^③ Frame
200								
130								
100								
85								
65								
50								
42								

① Interruption rating shown based on breaker equipped with integral Digitrip RMS trip unit.

② Refer to Section 2 for a detailed ratings table.

③ 6000A is available in fan cooled switchgear. See www.eaton.com/lva

■ = Magnum DS standard frame

■ = Magnum DS narrow frame

■ = Magnum DS double narrow frame

■ = Magnum DS double standard frame

Magnum SB family

Magnum SB low voltage insulated case power circuit breakers are certified by UL 1066. The SB Family was designed for the performance and economic requirements of UL891 switchboard class applications overall. Refer to Figure 2 for a visual reference and Table 2 for a quick ratings reference.

Product family characteristics:

- Switchboard class
- Up to 635 Vac
- Three- and four-pole configurations
- Drawout and fixed mounted
- 200A to 5000A continuous current
- 50 kA to 150 kA interrupting ratings
- Short-time withstand up to 100 kA

Magnum SB insulated case circuit breakers



Table 2. Magnum SB insulated case breaker family ratings (Class UL 891)

Interruption rating (kA) @ 440 Vac Icu = Ics	800 Amp Frame	1200 Amp Frame	1600 Amp Frame	2000 Amp Frame	2500 Amp Frame	3000 Amp Frame	4000 Amp Frame	5000 Amp ^③ Frame
150	Standard	Standard	Standard	Standard	Double Standard	Double Standard	Double Standard	Double Standard
130	Standard	Standard	Standard	Standard	Standard	Standard	Double Standard	Double Standard
100	Standard	Standard	Standard	Standard	Standard	Standard	Double Standard	Double Standard
85	Standard	Standard	Standard	Standard	Standard	Standard	Double Standard	Double Standard
65	Standard	Standard	Standard	Standard	Standard	Standard	Standard	Standard
50	Standard	Standard	Standard	Standard	Standard	Standard	Standard	Standard

① Interruption rating shown based on breaker equipped with integral Digitrip RMS trip unit.

② Refer to Section 2 for a detailed ratings table.

③ 6000A is available in fan cooled switchgear. See www.eaton.com/lva

■ = Magnum SB standard frame

■ = Magnum SB narrow frame

■ = Magnum SB double narrow frame

■ = Magnum SB double standard frame

Universal family features

As mentioned, Magnum low voltage power circuit breakers consist of four product families. Although each family has its own unique performance and features, each Magnum breaker boasts a wide array of common design elements. These common design elements deliver proven performance with expanded capabilities, no matter which product family is applied. To fulfill the latest market needs with proven reliability and performance, Magnum is the clear choice for low voltage applications.

High performance interruption & withstand levels

Magnum provides large range withstand and interrupting ratings to maximize selectivity and system coordination.

- A range from 42kA up to 200 kA interrupting - application on power distribution systems with higher available fault currents.
- Up to 130 kA withstand (short-time) - total selectivity/selective coordination/discrimination between main, feeder, and branch circuit breakers.
- Current limiting performance - lower let-through currents for superior equipment protection.
- Optional Arc Flash Reduction Maintenance System (ARMSTM) - reduces arc flash hazards and improves operator and maintenance safety.
- Circuit breakers performance tested - meet or exceed all applicable ANSI, NEMA, UL, CSA, IEC, EC and IEEE standards. Specifically, the circuit breakers meet or exceed the following: UL 1066, ANSI C37.13, ANSI C37.16, ANSI C37.17, ANSI C37.50, IEC 60947-2, GB14048.2-2008, and CSA TIL No. D-34.

Continuous current ratings

- 800 to 5000A (UL1066), 800 to 6300A (IEC) - ensuring maximum uptime over expansive frame rating range.
- 100% rated – designed for continuous operation at 100% of current rating.
- Reverse feed capable - top or bottom feed for multiple source applications.

Sizes, dimensions, weights and configurations

Magnum circuit breakers are available in four physical frame sizes, all centered around a modular design approach. The versatile Magnum design concept maximizes enclosure density with the same basic height and depth, differing only in width.

Note: For detailed Magnum breaker outline drawings, please refer to Section 11: Magnum drawings and outlines

- Narrow frame (800 – 2000 Amps): Promoting the most compact modular enclosures.



- Standard frame (800 – 3200 Amps): Ideally suited for vertically stacked modular construction.



- Double narrow frame (4000 Amps): Decreased footprint when space is at a premium.



- Double standard frame (3200 – 5000A): Ideal for main and tie applications.



Increased ratings in less space provide the flexibility to design more robust electrical distribution systems, capable of handling larger available fault currents while providing better coordination with downstream devices.

Power Defense circuit breaker portfolio

Frame PD-1



Dimensions
3.00 W x 5.50 H x 2.99 D inches
(76.2 x 139.7 x 76.0 mm)

Current range
15–125 A

Maximum NEMA voltage
347 Y/600 Vac/250 Vdc

Maximum IEC voltage
415 Vac/250 Vdc

Certifications
UL/CSA/CE/CCC

Interrupting capacity at 480 Vac (kAIC)
18, 25, 35, 50, 65, 85, 100

100% UL rated options
Current limiting options

Trip unit options
T/M fixed fixed

- Through-cover accessories

Frame PD-2



Dimensions
4.13 W x 6.00 H x 3.38 D inches
(105.0 x 152.4 x 86.0 mm)

Current range
15–225 A

Maximum NEMA voltage
600 Vac/250 Vdc

Maximum IEC voltage
690 Vac/250 Vdc

Certifications
UL/CSA/CE/CCC

Interrupting capacity at 480 Vac (kAIC)
25, 35, 50, 65, 85, 100

100% UL rated options
Current limiting options

Trip unit options
T/M fixed fixed
PXR 10
PXR 20
PXR 20D
PXR 25

- Through-cover accessories
- Available with 2 PXR communication relays
- 1 Relay with Modbus RTU

Electronic protection
LSI, LSIG

Frame PD-3



Dimensions
8.25 W x 16.00 H x 4.09 D inches
(139.2 x 257.3 x 104.0 mm)

Current range
45–600 A

Maximum NEMA voltage
600 Vac/250 Vdc

Maximum IEC voltage
690 Vac/250 Vdc

Certifications
UL/CSA/CE/CCC

Interrupting capacity at 480 Vac (kAIC)
25, 35, 50, 65, 85, 100

100% UL rated options
Current limiting options

Trip unit options
T/M fixed adjustable
PXR 10
PXR 20
PXR 20D
PXR 25

- Through-cover accessories
- Available with 2 PXR communication relays
- Field-interchangeable trip units

Electronic protection
LSI, LSIG, ALSI, ALSIG

Frame PD-4



Dimensions
8.25 W x 16.00 H x 4.06 D inches
(209.6 x 406.4 x 103.1 mm)

Current range
300–800 A

Maximum NEMA voltage
600 Vac/250 Vdc

Maximum IEC voltage
690 Vac/250 Vdc

Certifications
UL/CSA/CE/CCC

Interrupting capacity at 480 Vac (kAIC)
35, 50, 65

100% UL rated options
Current limiting options

Trip unit options
T/M fixed adjustable
PXR 10
PXR 20
PXR 20D
PXR 25

- Through-cover accessories
- Available with 2 PXR communication relays
- Field-interchangeable trip units

Electronic protection
LSI, LSIG, ALSI, ALSIG

Frame PD-5



Dimensions
8.25 W x 16.00 H x 5.50 D inches
(209.6 x 406.4 x 139.7 mm)

Current range
320–1200 A (UL)
320–1600 A (IEC)

Maximum NEMA voltage
600 Vac/250 Vdc

Maximum IEC voltage
690 Vac/250 Vdc

Certifications
UL/CSA/CE/CCC

Interrupting capacity at 480 Vac (kAIC)
50, 65, 85, 100, 150

100% UL rated options
Current limiting options

Trip unit options
PXR 20
PXR 20D
PXR 25

- Field-interchangeable accessories
- Available with 3 PXR communication relays
- Field-interchangeable trip units

Electronic protection
LSI, LSIG, ALSI, ALSIG

Frame PD-6



Dimensions
15.50 W x 17.96 H x 9.00 D inches
(393.7 x 406.4 x 228.6 mm)

Current range
700–2500 A

Maximum NEMA voltage
600 Vac/250 Vdc

Maximum IEC voltage
690 Vac/250 Vdc

Certifications
UL/CSA/CE/CCC

Interrupting capacity at 480 Vac (kAIC)
65, 85, 100

100% UL rated options
Current limiting options

Trip unit options
PXR 20
PXR 20D
PXR 25

- Field-interchangeable accessories
- Available with 3 PXR communication relays
- Field-interchangeable trip units

Electronic protection
LSI, LSIG, ALSI, ALSIG

Frame PD-NF



Dimensions
10.00 W x 14.17 H x 7.86 D inches
(254.0 x 359.9 x 199.6 mm)
(with cassette)

Current range
200–1200 A (UL 489 option)
200–1600 A (IEC option)

Maximum NEMA voltage
600 Vac

Maximum IEC voltage
690 Vac

Certifications
UL/CSA or CE/CCC

Interrupting capacity at 480 Vac (kAIC)
42, 50, 65

100% UL rated

Trip unit options
PXR 20
PXR 25

Electronic protection
LSI, LSIG, ALSI, ALSIG

- Field-interchangeable accessories
- Available with 3 PXR communication relays
- Field-interchangeable trip units
- Stored energy mechanism
- Front connect or rear connect; fixed or drawout

Frame PD-RF



Dimensions
15.76 W x 17.96 H x 9.45 D inches
(400.3 x 456.2 x 240.0 mm)
(with cassette)

Current range
800–3000 A (UL 489 option)
800–4000 A (IEC option)

Maximum NEMA voltage
480 Vac

Maximum IEC voltage
690 Vac

Certifications
UL/CSA or CE/CCC

Interrupting capacity at 480 Vac (kAIC)
65, 85, 100

100% UL rated

Trip unit options
PXR 20
PXR 25

Electronic protection
LSI, LSIG, ALSI, ALSIG

- Field-interchangeable accessories
- Available with 3 PXR communication relays
- Field-interchangeable trip units
- Stored energy mechanism
- Rear connect; fixed or drawout

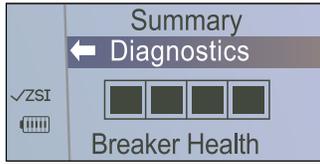
Power Defense

Circuit Breakers

ADVANCED TECHNOLOGY AND FEATURES



Breaker health



- Industry-first algorithm that provides real-time evaluation of breaker condition by tracking and analyzing diagnostic details including breaker operations, short-circuit fault levels, operational time, internal temperature and overloads
- Monitors and communicates breaker health status, enabling predictive maintenance to avoid costly, unscheduled downtime

Zone selective interlocking (ZSI)



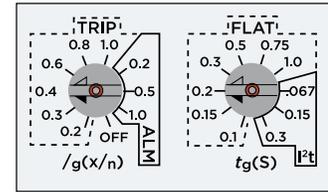
- Designed to reduce thermal and mechanical stress on distribution equipment and arc flash incident energy released during phase or ground faults by enabling the breaker closest to the fault to override customer-defined delay settings while communicating with upstream and downstream breakers
- PXR trip unit displays ZSI signal indication when system is engaged, communicating and check indication when input signal is detected, allowing network integrity testing and providing operational status

Arcflash Reduction Maintenance System™ (ARMS)



- Industry-leading solution to reduce arc flash energy released during maintenance operations using a separate circuit to provide faster than instantaneous clearing times
- Flexibility to enable system and provide visual indication by communications, remote switch and relay, or directly on the trip unit face
- Adjustable ARMS settings via LCD screen or PXPM software

Enhanced ground fault protection



- Expanded ground fault setting options improve coordination capabilities
- Combined functionality to trip and/or alarm, including a pre-alarm option via a programmable relay, provides maximum protection options and system uptime
- An OFF setting also provides flexibility in testing, troubleshooting and inventory management

Versatile communications options



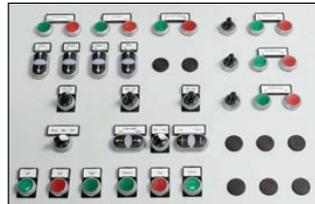
- Imbedded Modbus RTU
- Additional communications protocols, including Modbus TCP, webpage interface and PROFIBUS, available via Eaton's Communications Adapter Modules (CAM)
- CAM module relays that can be programmed for custom breaker and trip unit visibility

Cause of trip LEDs



- Cause of trip indication provides insights into a trip event, increasing worker safety and efficiency while troubleshooting
- PXR 20, 20D and 25 include LEDs on the face of the trip unit that will pulse ON/OFF until the unit is reset. An easily replaceable backup battery is included in the trip unit, but only used when no auxiliary power is connected
- All PXR 20s store additional trip event details in their memory that can be easily accessed via the USB port by the PXPM software

Programmable relays



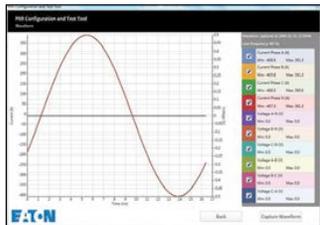
- Multiple programmable relays provide user customizable visibility into breaker and trip unit, such as status, trip events, alarms, and indication of ZSI, ARMS or breaker health

Power Xpert Protection Manager (PXPM) software



- PXR trip units equipped with micro-USB connection for secondary injection testing through your PC, saving you labor hours and the cost of expensive test kits
- Configure trip unit settings with direct-to-trip unit or offline setup, including duplication of settings between units
- Capture waveforms, monitor real-time power and energy readings, store up to 200 events, create printable test reports and customize display orientation

Metering capability



- Current and voltage metering accurate to 0.5% of reading; power and energy metering accurate to 1% of reading
- Voltage metering internal to trip unit with no need for external modules

LCD display with programmable settings



- Local availability to fully programmable settings, breaker diagnostics, visual customization, event records, injection testing and unit information

Power Defense

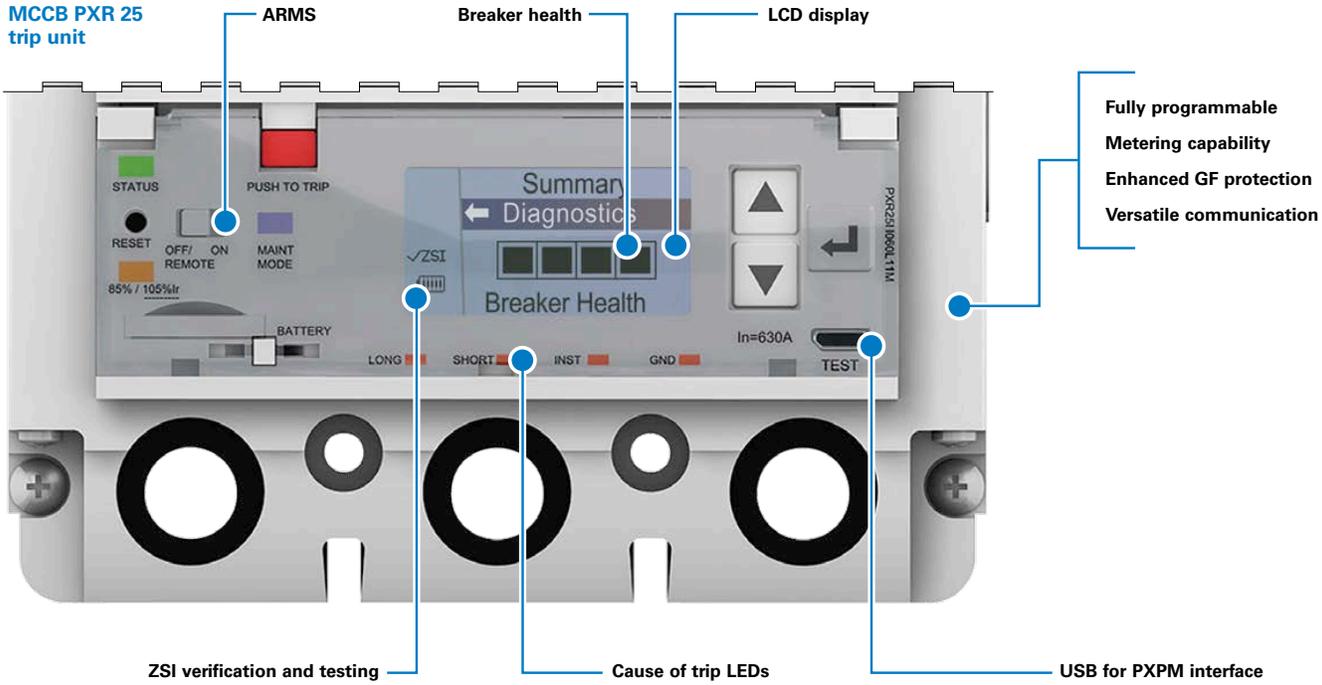
Circuit Breakers

POWER XPRT RELEASE (PXR) ELECTRONIC TRIP UNITS

EATON

BY **SPiKE**
ELECTRIC CONTROLS

MCCB PXR 25
trip unit

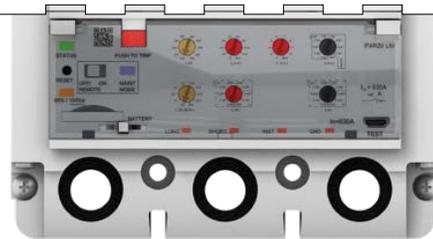


- Fully programmable
- Metering capability
- Enhanced GF protection
- Versatile communication

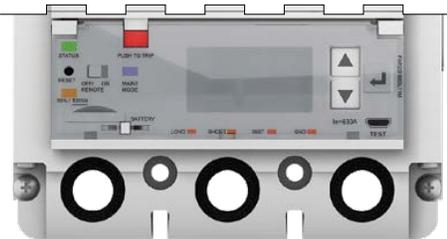
MCCB PXR 10



MCCB PXR 20



MCCB PXR 20D



MCCB PXR features

Features	PXR 10	PXR 20	PXR 20D	PXR 25
Protection types	LSI	LSI/LSIG	LSI/LSIG	LSI/LSIG
Status indication	●	●	●	●
USB secondary injection testing	●	●	●	●
Programmable by USB port (PXP)	●	●	●	●
Independent instantaneous adjustment	●	●	●	●
Adjustable L, S, I, G pickup and time	●	●	●	●
Cause of trip indication	▲	●	●	●
Load alarm indication with 2 levels	●	●	●	●
Programmable load alarm levels	●	●	●	●
Ground fault protection and alarm	○	○	○	○
Arcflash Reduction Maintenance System (ARMS) Available PD3, PD4, PD5, PD6	○	○	○	○
Zone selective interlocking (ZSI) with indication	○	○	○	○
Programmable relays	○	●	●	●
Modbus RTU communication	○	●	●	●
CAM module communication	○	○	○	○
Rotatable LCD display	○	●	●	●
Breaker health and diagnostic monitoring	○	▲	●	●
Current metering accuracy		2.0%	0.5%	0.5%
Voltage metering accuracy				0.5%
Power and energy metering accuracy				1.0%

● Standard

○ Optional

▲ Available through USB port (PXP)

Power Defense

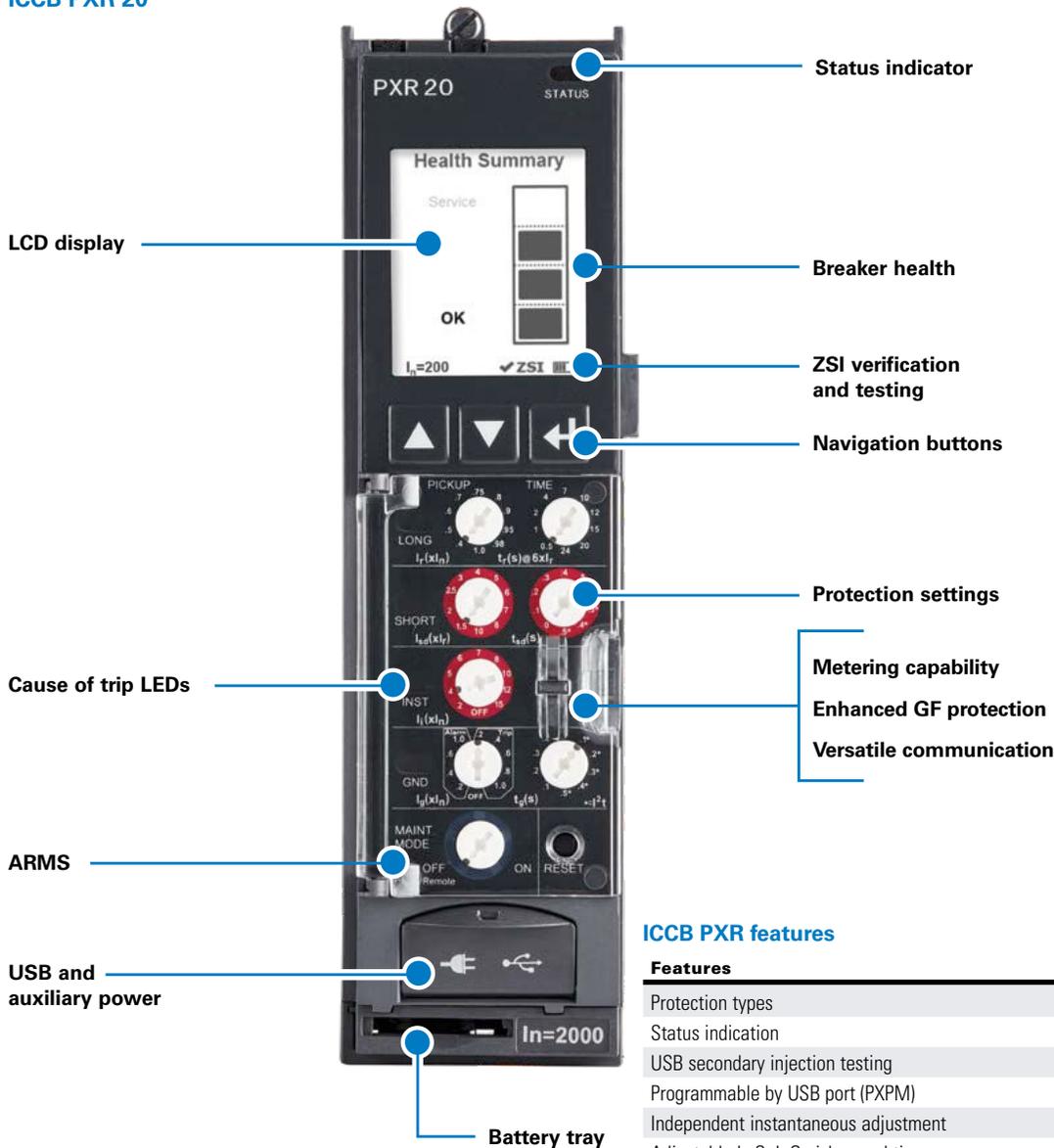
Circuit Breakers

POWER XPERT RELEASE (PXR) ELECTRONIC TRIP UNITS

EATON

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ELECTRIC CONTROLS

ICCB PXR 20



ICCB PXR features

Features	20 ICCB	25 ICCB
Protection types	LSI/LSIG	LSI/LSIG
Status indication	●	●
USB secondary injection testing	●	●
Programmable by USB port (PXPM)	●	●
Independent instantaneous adjustment	●	●
Adjustable L, S, I, G pickup and time	●	●
Cause of trip indication	●	●
Load alarm indication with 2 levels	●	●
Programmable load alarm levels	●	●
Ground fault protection and alarm	○	○
Arcflash Reduction Maintenance System (ARMS)	○	○
Available PD-NF, PD-RF	○	○
Zone selective interlocking (ZSI) with indication	●	●
Programmable relays	●	●
Modbus RTU communication	○	●
CAM module communication	●	○
Rotatable LCD display	●	●
Breaker health and diagnostic monitoring	●	●
Current metering accuracy	1.0%	1.0%
Voltage metering accuracy		1.0%
Power and energy metering accuracy		2.0%

- Standard
- Optional
- ▲ Available through USB port (PXPM)

What will you build? And how will you defend it?



Eaton's Power Defense breaker product selectors

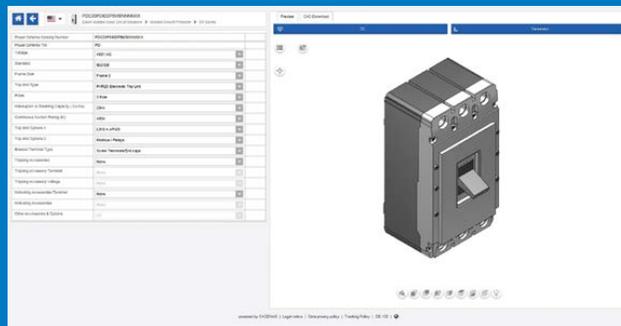
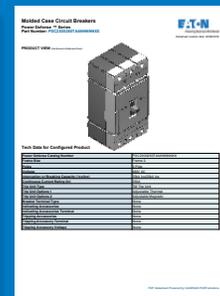
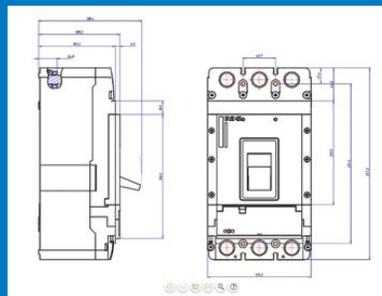
- Web interface to assist in breaker detail selection
- Adjusts for mobile access
- Downloadable 2D and 3D models in over 80 different formats
- Downloadable technical data sheets



MCCB selector



ICCB selector



Power Defense

Circuit Breakers

POWER XPERT RELEASE (PXR) ELECTRONIC TRIP UNITS

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**Our defense is
your best offense.**

When Power Defense circuit breakers safeguard your structure's power system, you are getting the latest protection technology, engineered for the future: Industry 4.0 features such as built-in communications, advanced energy metering and algorithms that notify you when your circuit breaker needs maintenance, as well as zone selective interlocking technology that clears faults quickly and locally, preventing propagation into your system. Arc flash reduction options help protect your people with the fastest tripping speed technology, not to mention Eaton's best-in-class support and service. You are freeing yourself and your customers from concerns and gaining the sort of assurance that allows your people to move and plan with confidence. That's why our defense is your best offense.

**Power
Defense**



A globally rated platform from Eaton.

Power Defense

Circuit Breakers

POW-R-LINE XD SWITCHBOARD DEVICES



Design Guide DG015003EN • Effective May 2020 • 21.3-7

Power Defense Molded Case Circuit Breakers



Power Defense Molded Case Circuit Breakers

Product Description

Eaton's globally accepted Power Defense molded case circuit breaker (MCCB) can:

- Connect to your network or the cloud with built-in communication capability
- Generate the data to help optimize your facility's performance
- Mitigate arc flash to keep your employees, customers and end users safe

The Power Defense MCCB portfolio is globally adaptive to your footprint no matter the application or project requirement. All frames have the availability of global certifications including IEC, CCC, UL and CSA®.

Eaton's best-in-class support enables you to order readily available product for on-time delivery, across the globe.

Modular Accessories

The Power Defense molded case circuit breakers feature new, modular accessories that are designed to make customization of the breaker for the unique requirements of the application easier than ever before. A common line of auxiliary switch and bell alarms allow for interchangeability between the different Power Defense breaker frames, enabling the final configuration of the breaker at the point of use and minimizing the amount of inventory required. Compact, modular shunt trips and undervoltage releases have been designed to be easily installed and removed as the project or application dictates.

Some of the most common accessories and their function are described below.

Internal Accessories

Auxiliary Switches—Provide circuit breaker primary contact status information. The auxiliary switch is used for remote indication and interlock system verification. These switches mount internal to the breaker in the right side accessory cavity.

Alarm Switches—Used for remote indication of automatic trip operation. The switch automatically resets when the circuit breaker is reset. These switches mount internal to the breaker in the right side accessory cavity.

Shunt Trip—Provides capability to trip the breaker by remote control. Shunt trips are designed to be applied at specific AC or DC voltages. These devices are installed internal to the breaker in the left side accessory cavity.

Undervoltage Release

(UVR)—Monitors a voltage, typically of a line voltage, and trips the circuit breaker when the voltage falls below 70% of the nominal voltage designated for the UVR. These devices are installed internal to the breaker in the left side accessory cavity.

External Accessories

Terminals—Multiple cable terminal options are available for each frame, providing alternatives to connect primary power and loads to the circuit breaker. Additionally, control wire terminals provide a means to tap off control power. Multi-wire terminals on the load side of the breaker can also be used to distribute the load from the circuit breaker to multiple devices without the use of separate distribution terminal blocks.

Terminal Shields—Provide protection against accidental contact with live terminations, as well as clearance between circuit breaker poles or adjacent circuit breakers, and are required for some terminal applications.

Interphase Barriers—Offer additional electrical clearance between circuit breaker poles for special termination applications.

Locking Devices—Offer the capability to lock the breaker handle in the OFF or ON position (trip-free operation allows the breaker to trip when locked in the ON position). Power Defense offers three primary types, including handle blocks, padlockable hasps, and provisions for Kirk trapped key locks (Kirk lock must be purchased separately).

Standards and Certifications

Power Defense circuit breakers meet applicable:

- UL 489
- CSA, C22.2 No. 5-02
- IEC 60947-2
- GB 14048.2-2008

Insulated Case Circuit Breakers

Magnum SB Low-Voltage Insulated Case Circuit Breakers



Magnum SB Insulated Case Circuit Breaker

Product Description

Magnum SB is a low-voltage insulated case circuit breaker family designed for the performance and economic requirements of UL 891 switchboards.

- Magnum SB insulated case circuit breakers have interruption ratings up to 100 kA at 480 Vac with continuous current ratings up to 5000 A
- Magnum SB insulated case circuit breakers have lighter-duty short-time withstand ratings and fixed internal instantaneous trips on most ratings, which is characteristic of UL 489 molded case breakers commonly used in UL 891 switchboards. This provides for greater economy and excellent coordination and selectivity for most commercial applications
- Fixed internal instantaneous trips will be phased in on all Magnum SB insulated case circuit breakers rated 3000 A and below to provide an extra safety factor by reducing the energy let-through to downstream circuits at the maximum instantaneous trip point and to facilitate feeder circuit breaker protection in UL 891 switchboards with 3-cycle bus bracing



Magnum SB in Pow-R-Line XD Assembly

Standards and Certifications

UL and ANSI Test Certifications

Magnum SB meets or exceeds the applicable ANSI, NEMA, UL and CSA standards, including:

- ANSI C37.13 (Low Voltage AC Power Circuit Breakers Used in Enclosures)
- ANSI C37.16 (Preferred Ratings, Related Requirements, and Application Recommendations for Low Voltage Power Circuit Breakers and AC Power Circuit Breakers)
- ANSI C37.17 (Trip Devices for AC and General Purpose DC Low Voltage Power Circuit Breakers)
- ANSI C37.50 (Test Procedures for Low Voltage AC Power Circuit Breakers Used in Enclosures)
- UL 489/1066 (Standard for Low Voltage AC and DC Power Circuit Breakers Used in Enclosures)
- NEMA SG3 (This standard adopts ANSI C37.16 in its entirety)

Comprehensive Enclosure Solutions

Magnum SB has proven performance in Eaton manufactured switchboards with the following test certifications:

- UL 891 (Certified Pow-R-Line Low Voltage Switchboards)

Approvals and Marks

UL listed: Magnum DS Breaker UL File E52096 and Cassette UL File E204565.

Digitrip RMS Trip Unit Family for Magnum Circuit Breakers

The Magnum family of Digitrip RMS trip units consists of four trip unit models, each providing increasing levels of features and options to enable the ultimate selection to match application requirements for protection, coordination, information, diagnostics and communication:

- **Digitrip RMS 520** enables the user as many as nine phase and ground current protection settings for maximum flexibility in trip curve shaping and multi-unit coordination, and adds ground current protection settings
- **Digitrip RMS 520M** adds phase, neutral and ground current metering with a four-character LCD display window
- **Digitrip RMS 520MC** adds communication of current values and breaker status (open, closed, tripped), and Arcflash Reduction Maintenance System for arc flash reduction
- **Digitrip RMS 1150+** provides programmability for more sophisticated distribution systems
 - Increased protection and coordination capabilities
 - Systems monitoring information including power factor, voltage, current, harmonic distortion values and waveform capture with a bright three-line (eight characters per line) LED display
 - Two programmable contacts for customer use
 - Time and date stamping of trip events for improved troubleshooting and diagnostics
 - Accuracy of 1% on current and voltage values and 2% on energy and power
 - Systems diagnostic information and breaker health menu
 - Communications
 - Arcflash Reduction Maintenance System for arc flash reduction

Power Defense

Circuit Breakers

POW-R-LINE XD SWITCHBOARD DEVICES



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Power Defense Insulated Case Circuit Breakers



Power Defense Insulated Case Circuit Breakers, NF and RF Frames

Product Description

The Power Defense ICCB NF frame provides the performance of a power circuit breaker—up to 1200 A and 65 kA interruption capacity at 480 Vac—in the compact size of a molded case breaker. It offers all the protection, features and flexibility you would expect in an air circuit breaker, in a compact footprint. The RF frame expands protection capabilities up to 3000 A with an interruption capacity of 100 kA at 480 Vac.

In today's commercial, facilities, data centers or manufacturing environments, space for new and retrofit equipment is a precious commodity. When building space is at a premium, or when system upgrading requires additional functionality, the compact size and broad capabilities of the Power Defense ICCB make it the right choice for the applications.

The Power Defense ICCB is available with a variety of connection options that give you the ability to efficiently lay out distribution equipment. It is important in switchboards that breakers are easily accessible for maintenance, inspection and operation. The cassette design allows you to inspect parts without removing the cassette from the switchboard cell. The design of the breaker and cassette enables full use of the breaker handle and cassette rails with a gloved hand, allowing electricians to remain in the appropriate PPE protective gear.

UL 489 breakers feature the innovative Power Xpert Release (PXR) trip units. PXR trip units are available with a wide variety of protection, metering and monitoring options including the Arcflash Reduction Maintenance System, 1% accurate current and voltage metering, and a variety of serial communication options.

Power Defense ICCB breakers with PXR trip units are UL 489 listed insulated case circuit breakers. They are tested to 20,000 and 10,000 mechanical operations for the NF and RF, respectively. This is significantly higher than industry standards ①, required for equivalent products on the market.

All Power Defense ICCB breakers are UL Listed to carry 100% of the nameplate amperage rating continuously in an enclosure. All this ensures long, reliable operation and reduces maintenance requirements.

Power Defense ICCB accessories can be quickly installed at the job site without any special tools. Each breaker comes standard with an accessory tray with the necessary accessories to simply plug and lock an accessory into the tray.

The breaker handle's ergonomic design also maximizes functionality and leverage. For a manually charged breaker, seven strokes completely charges the breaker quickly and easily, making it easier to cycle when needed during commissioning or scheduled maintenance.

- ① UL 489: For $I_n \leq 2500$ A, mechanical ops = 2500, for $I_n > 2500$, mechanical ops = 1500.
IEC60947-2: for $I_n \leq 2500$ A, mechanical ops = 3000, for $I_n > 2500$, mechanical ops = 2000.



Power Defense RF ICCB in Pow-R-Line XD Assembly

Power Defense

Circuit Breakers

POW-R-LINE XD SWITCHBOARD DEVICES



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Circuit Breaker Technical Data

Table 21.3-1. Molded Case Circuit Breakers

Circuit Breaker Type	Continuous Ampere Rating at 40 °C	No. of Poles	AC Voltage	Trip Type ①	UL Listed Interrupting Ratings rms Symmetrical Amperes				
					AC Ratings Volts				
					120	120/240	240	277	480
PDG2xF	15–100	1	277	N.I.T.	—	—	—	14	—
PDG2xF	15–100	2, 3	480	N.I.T.	—	—	18	—	14
PDG2xG	15–225	1	277	N.I.T.	—	—	—	35	—
PDG2xG	15–225	2, 3	600	N.I.T.	—	—	65	—	35
PDG2xG	15–225	4	600	N.I.T.	—	—	65	—	35
PDG2xM	5–225	1	277	N.I.T.	—	—	—	65	—
PDG2xM	15–225	2, 3	600	N.I.T.	—	—	100	—	65
PDG2xM	15–225	4	600	N.I.T.	—	—	100	—	65
JGS ②	70–250	2, 3	600	I.T.	—	—	65	—	35
JGH ②	70–250	2, 3	600	I.T.	—	—	100	—	65
JGC ②	70–250	2, 3	600	I.T.	—	—	100 ④	—	100
PDG3xGy	250–400	2, 3	240	N.I.T.	—	—	65	—	—
PDG3xG*	70–400	2, 3	600	I.T.	—	—	65	—	35
PDF3xG* ③	70–400	3	600	I.T.	—	—	65	—	35
PDG3xM*	70–400	2, 3	600	I.T.	—	—	100	—	65
PDF3xM ③	70–400	3	600	I.T.	—	—	100	—	65
LGS ②	250–600	2, 3	600	I.T.	—	—	65	—	65
LGH ②	250–600	2, 3	600	I.T.	—	—	100	—	65
LGC ②	250–600	2, 3	600	I.T.	—	—	100 ④	—	100
PDG3xG*	300–600	2, 3	600	I.T.	—	—	65	—	35
PDG3xM*	300–600	2, 3	600	I.T.	—	—	100	—	65
PDG3xP*	250–600	2, 3	600	I.T.	—	—	100 ④	—	100
PDG4xG	400–800	2, 3	600	N.I.T.	—	—	65	—	50
PDF4xG ③	400–800	3	600	N.I.T.	—	—	65	—	50
PDG4xM	400–800	2, 3	600	N.I.T.	—	—	100	—	65
PDF4xM ③	400–800	3	600	N.I.T.	—	—	100	—	65
NGH ②	600–1200	2, 3	600	N.I.T.	—	—	100	—	65
NGC ②	600–1200	2, 3	600	N.I.T.	—	—	100 ④	—	100
PDG5xM	600–1200	2, 3	600	N.I.T.	—	—	100	—	65
PDG5xP	600–1200	2, 3	600	N.I.T.	—	—	100 ④	—	100

① N.I.T. is non-interchangeable trip unit. I.T. is interchangeable trip unit.

② For use with drawout feeder device only.

③ 100% rated.

④ This breaker has a higher listed interrupting rating, but PRLXD is limited to 100 kAIC applications.

Power Defense

Circuit Breakers

POW-R-LINE XD SWITCHBOARD DEVICES

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Table 21.3-2. Magnum SB Insulated Case Circuit Breaker Interrupting Ratings ①

Circuit Breaker Type	Frame Amperes	Trip Unit Current Sensor and Rating Plug Ranges	Ratings rms Symmetrical Amperes (kAIC)		
			Interrupting Ratings		
			208/240 Vac	480 Vac	600 Vac
SBS-608	800	200–800	65	65	65
SBS-C08	800	200–800	100	100	85
SBS-612	1200	200–1200	65	65	65
SBS-C12	1200	200–1200	100	100	85
SBS-616	1600	200–1600	65	65	65
SBS-C16	1600	200–1600	100	100	85
SBS-620	2000	200–2000	65	65	65
SBS-C20	2000	200–2000	100	100	85
SBS-625	2500	200–2500	65	65	65
SBS-C25	2500	200–2500	100	100	85
SBS-630	3000	200–3000	65	65	65
SBS-C30	3000	200–3000	100	100	85
SBS-840	4000	2000–4000	65	65	65
SBS-C40	4000	2000–4000	100	100	85
SBS-850	5000	2500–5000	65	65	65
SBS-C50	5000	2500–5000	100	100	85

① Fixed internal instantaneous trip set at approximately $18 \times I_n$ symmetrical.

Table 21.3-3. Power Defense Insulated Case Circuit Breaker Interrupting Ratings

Circuit Breaker Type	Frame Amperes	Trip Unit Current Sensor Ranges	Ratings rms Symmetrical Amperes (kAIC)	
			Interrupting Ratings	
			208/240 Vac	480 Vac
PD-NF PXR 20/25	800	200–800	85	65
	1200	200–1200	85	65
PD-RF PXR 20/25	800	800	100	100
	1200	800–1200	100	100
	1600	800–1600	100	100
	2000	800–2000	100	100
	2500	800–2500	100	100
	3000	800–3000	100	100

Table 21.3-4. Standard Switchboard Terminals—Standard Main Breaker, Branch Breaker, Main Switch or Branch Switch Terminals

Breaker Type	Ampere Rating	Wire Size Ranges
PDD2xF, PDD2xG, PDD2xM, PDD2xP	100–225	(1) #4–4/0 or (1) #6–300 kcmil
PDG2xF, PDG2xG, PDG2xM, PDG2xP	15–100 125–225	(1) #14–1/0 kcmil (1) #4–4/0 or (1) #6–300 kcmil
JGS, JGH, JGC	70–250	(1) #4–350 kcmil
PDD3xGy	250–350 400	(1) 25–500 kcmil (2) 3/0–250 or (1) 3/0–500 kcmil
PDG3xG*, PDG3xM*, PDG3xP*, PDF3xG* ①, PDF3xM* ①	100–400 600	(1) 250–500 or (1) 500–750 kcmil (2) #2–500 kcmil
LGS, LGH, LGC	300–500 600	(1) 500–750 kcmil (2) #2–500 kcmil
PDG4xG, PDG4xM	300–800	(3) 3/0–400 or (2) 500–750 kcmil
PDF4xG ①, PDF4xM	800	(3) 3/0–400 or (2) 500–750 kcmil
PDG5xM, PDG5xP, PDG6xM, PDG6xP	800–1200	(4) 4/0–500 or (3) 500–750 kcmil
NGH, NGC	600–1000 1200	(4) 4/0–500 or (3) 500–750 kcmil
PD-NF	800 1200	(3) #1–500 or (3) 500–750 kcmil (4) #4–500 or (3) 3/0–750 kcmil
PD-RF	800 1200 1600 2000 2500 3000	(3) 500–750 or (3) #1–500 kcmil (4) #4–500 or (3) 3/0–750 kcmil (5) #4–500 or (5) 3/0–750 kcmil (6) #4–500 or (6) 3/0–750 kcmil (7) #4–500 or (7) 3/0–750 kcmil (8) #4–500 or (8) 3/0–750 kcmil

① 100% rated breaker.

Note: All terminal sizes are based on wire ampacities corresponding to those shown in NEC Table 310.16 under the 75 °C insulation columns (75 °C wire). The use of smaller size (in circular mills), regardless of insulation temperature rating is not permitted without voiding UL labels on devices and equipment.

Note: For other terminals available on some ratings of molded case circuit breakers refer to Molded Case Circuit Breakers & Enclosures Design Guide.

Cable Ranges for Standard Secondary Device Terminals

Wire and cable terminals supplied on switchboard mounted devices for making up incoming or outgoing cable connections are of the mechanical screw clamp pressure type. All standard terminals are suitable for use with either aluminum or copper cable except as noted in the table. Panel mounted devices use the standard terminal provided with that device.

Table 21.3-5. Standard Mechanical Incoming Terminal Ranges for Main Lugs Only and Main Devices Including Circuit Breakers and Fusible Devices

Ampere Rating	Cable Range
400–600 800 1200	(2) #4–500 or (2) 3/0–750 kcmil (3) #4–500 or (3) 3/0–750 kcmil (4) #4–500 or (4) 3/0–750 kcmil
1600 2000 2500	(5) #4–500 or (5) 3/0–750 kcmil (6) #4–500 or (6) 3/0–750 kcmil (7) #4–500 or (7) 3/0–750 kcmil
3000 4000 5000	(8) #4–500 or (8) 3/0–750 kcmil (11) #4–500 or (11) 3/0–750 kcmil (14) #4–500 or (13) 3/0–750 kcmil

Table 21.3-6. Range Taking Compression Main Terminals ②

Main Ampere Rating	Number of Conductors and Wire Range Per Phase	
	Aluminum Conductors	Copper Conductors
1200 1600 2000 2500	(4) 500–750 kcmil (5) 500–750 kcmil (6) 500–750 kcmil (7) 500–750 kcmil	(3) 500–750 kcmil (4) 500–750 kcmil (4) 500–750 kcmil (6) 500–750 kcmil
3000 4000 5000	(8) 500–750 kcmil (11) 500–750 kcmil (13) 500–750 kcmil	(7) 500–750 kcmil (9) 500–750 kcmil (11) 500–750 kcmil

② Compression terminations will take a range of conductors and include 500, 600, 700 and 750 kcmil.

Power Defense

Circuit Breakers

POW-R-LINE XD SWITCHBOARD DEVICES



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Power Xpert Release Trip Unit for Insulated Case Circuit Breakers



Power Xpert Release Trip Unit

Description

Eaton's Power Xpert Release (PXR) trip units are programmable communicating microprocessor-based low-voltage electronic trip unit systems for Eaton insulated case circuit breakers. PXR trip units are available in two models: PXR 20 and PXR 25.

The PXR electronic trip units provide an enhanced and easy-to-use interface that enables end users and maintenance engineers to more easily change set points, test and configure circuit breakers, and review energy and power information. Also, the Power Xpert Protection Manager software provides the capability of secondary injection tests and reports on-demand without the need of expensive test kits.

Standards and Certifications

The PXR trip units are listed by Underwriters Laboratories (UL) and Canadian Standards Association (CSA) for use in Power Defense NF and Power Defense RF circuit breakers. All PXR units have also passed the IEC 60947-2 test program that includes EMC testing. All trip units meet the low-voltage and EMC directives and carry the CE mark.

Features

Table 21.3-7. Power Xpert Features

Trip Unit	PXR 20	PXR 25
Diagnostics and Indication Features		
Trip Log	10 trip events 200 summary Additional storage available via CAM module	
Alarm log	10 alarm events—through COM	
Waveform capture	One waveform event captured in ETU	
Display	LCD dot matrix	
LEDs	ETU status Long trip Short trip	Instantaneous trip Ground trip ARMS status
Power for cause of trip LEDs	Control power or battery	
Battery Indication	Display (no PTT)	
Maintenance/wellness health and diagnostics	ETU temp. and max. Trip count Ops count / last date	Operating (run) time Health bar (algorithm)

PXR Metering, Communications and Other Features

Metering—current	Yes	Phase, Neutral, Ground, min., max., demand, peak
Metering—voltage	No	Yes L-L, L-N, avg. min., max., Frequency, min., max.
Metering—power	No	Yes kW, kVA, kvar Demand-kW, kVA, kvar Peak Demands
Metering—energy	No	Yes kWh-fwd, rev, net, tot kvarh-lead, lag, net, tot
Metering—PF apparent	No	Yes min., max.
Communications	Modbus RTU optional CAM modules optional	Modbus RTU native CAM modules optional
Testing method	PC via USB port Internal Secondary injection test circuit	
Relay outputs—alarms or trips	3	
QR code—support information	Yes	
Password—setting menu and test	Yes	
RoHS	Yes	

Protection Features

Ordering options	LSI, LSIG/A
Number of sensors	1 sensor—NF 1 sensor—RF
Sensor (rating) plug (I_n)	No plug Programmable I_n (21)
Slopes	I_t , I^2t , I^2t IEEE—MI, VI, EI
System frequency	50 / 60 Hz
Long delay pickup (I_l)	$0.4 - 1.0 \times (I_n)(10)$
Long delay time I^2T at $6 \times (I_l)$	$0.5 - 24 \text{ s } (10)$
Long delay thermal memory	Yes—Program disable
Short delay pickup	$1.5 - 10 \times (I_n)(10)$
Short delay time I^2t at $8 \times (I_l)$	0.1, 0.3, 0.4, 0.5 s
Short delay time flat	0.0, 0.1, 0.2, 0.3, 0.4, 0.5 s
Instantaneous pickup	$2 - 15 \times (I_n)(10)$
Ground (earth) fault pickup	Trip: $0.2 - 1.0 \times (I_n)(5)$ Alarm: $0.2 - 1.0 \times (I_n)(4)$ Off
Ground (earth) fault time I^2t at $0.625 \times (I_n)$	0.1, 0.2, 0.3, 0.4, 0.5 s
Ground (earth) fault time flat	0.1, 0.2, 0.3, 0.4, 0.5 s
ZSI, short delay and ground	Programmable Display indication
Neutral protection	Yes Off, 60, 100%
ARMS—arc flash—mode/settings	Optional—on or off/remote 5 settings ($\times I_n$)

Power Defense

Circuit Breakers

POW-R-LINE XD SWITCHBOARD DEVICES

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ELECTRIC CONTROLS

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Power Xpert Release Trip Unit for Molded Case Circuit Breakers

Description

Eaton's Power Xpert Release (PXR) trip units are programmable communicating microprocessor-based low-voltage electronic trip unit systems for Eaton molded case circuit breakers. PXR trip units are available in four models: PXR 10, PXR 20, PXR 20D and PXR 25.

Standards and Certifications

The PXR trip units are listed by Underwriters Laboratories (UL) and Canadian Standards Association (CSA) for use in Frame PD-2, PD-3, PD-4, PD-5 and PD-6 molded case circuit breakers. All PXR units have also passed the IEC 60947-2 test program that includes EMC testing. All trip units meet the low-voltage and EMC directives and carry the CE mark.

Features

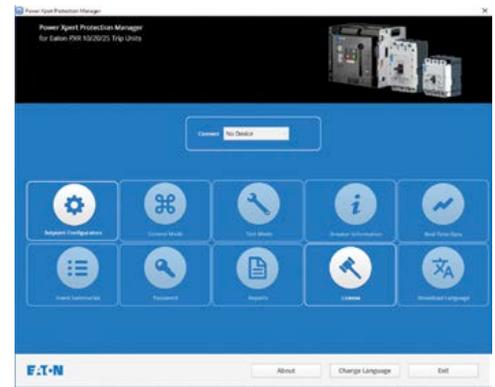
The PXR electronic trip units provide an enhanced and easy-to-use interface that enables end users and maintenance engineers to more easily change set points, test and configure circuit breakers, and review energy and power information. Also, the Power Xpert Protection Manager software provides the capability of secondary injection tests and reports on-demand without the need of expensive test kits.

Advanced features include:

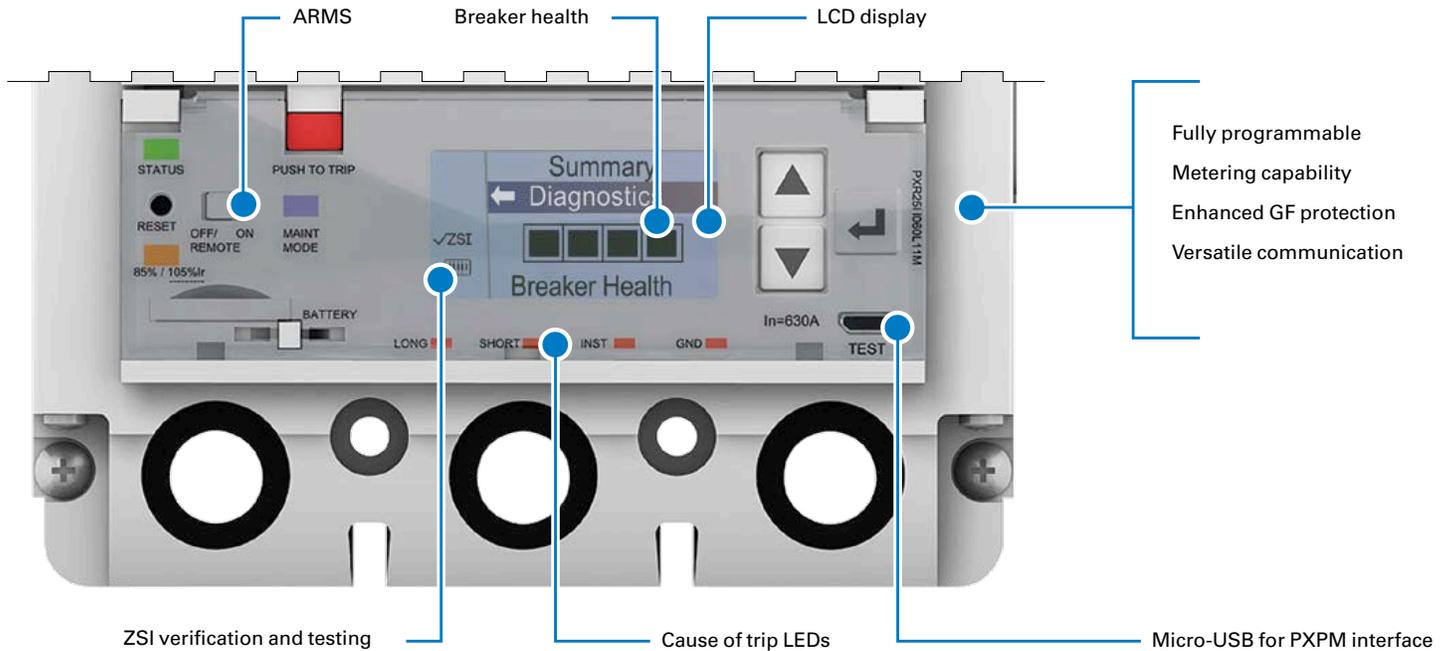
- Industry-first breaker health algorithms that provide real-time monitoring and communication of breaker condition
- Cause of trip LED indication and trip event data storage
- Zone selective interlocking (ZSI) verification and testing indication
- Adjustable Arcflash Reduction Maintenance System (ARMS) settings
- LCD display with programmable settings



Arcflash Reduction Maintenance System (ARMS)



Power Xpert Protection Manager (PXPM) Software



PXR 25 Trip Unit Features

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Table 21.3-8. Power Xpert Release (PXR) Features

Features	PXR 10	PXR 20	PXR 20D	PXR 25
Protection types	LSI	LSI/LSIG	LSI/LSIG	LSI/LSIG
Status indication	Standard	Standard	Standard	Standard
USB secondary injection testing	Standard	Standard	Standard	Standard
Programmable by USB port (PXPM)	Standard	Standard	Standard	Standard
Independent instantaneous adjustment	Standard	Standard	Standard	Standard
Adjustable L, S, I, G pickup and time		Standard	Standard	Standard
Cause of trip indication	Available through USB port (PXPM)	Standard	Standard	Standard
Load alarm indication with 2 levels		Standard	Standard	Standard
Programmable load alarm levels			Standard	Standard
Ground fault protection and alarm		Optional	Optional	Optional
Arcflash Reduction Maintenance System (ARMS) Available PD3, PD4, PD5, PD6		Optional	Optional	Optional
Zone selective interlocking (ZSI) with indication		Optional	Optional	Optional
Programmable relays		Optional	Standard	Optional
Modbus RTU communication		Optional	Standard	Optional
CAM module communication		Optional	Optional	Optional
Rotatable LCD display			Standard	Standard
Breaker health and diagnostic monitoring		Available through USB port (PXPM)	Standard	Standard
Voltage metering accurate to 0.5%				Standard
Power and energy metering accurate to 1%				Standard

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Metering Devices



Power Xpert Dashboard Lite



Power Xpert Meter 4000/6000/8000



Power Xpert Gateway

Power Xpert Dashboard Lite

The Power Xpert Dashboard Lite Processor (PXDBLP) generates the user interface for visualizing and interacting with Eaton trip units and meters in low-voltage panelboards and switchboards. Users can view the Power Xpert Dashboard screens locally through a 7-inch HMI mounted in the switchboard or remotely through a password-protected web interface.

Key features include:

- Communicates to Eaton's Modbus® RTU-enabled devices
- Upstream ModbusTCP and BACnet/IP support facilitates integration with third-party monitoring solutions
- 7-inch HMI web display
- Simple configuration—automatically discovers and imports connected devices
- Device view—displays meter and PXR trip unit information and logs all device data
- Energy load grouping (total, HVAC, interior lighting, etc.) allows for ASHRAE 90.1 energy code compliance
- Alarm and event timeline—event log, breaker trip information
- Optional apps—ARMS control, set point programming for Power Defense PXR 20/25 and Digitrip™ 1150 electronic trip units

Power Xpert Meter 4000/6000/8000

The Power Xpert Meter 4000/6000/8000 series is an internet-enabled (including a built-in web server) power quality and energy meter with comprehensive power and energy measurement, and integrated quality analysis.

These meters allow you to use a standard web browser to surf the meter and visualize a waveform and analyze trends.

Meter series benefits include:

- Accurate detection of fast transients
- Early warning of impending problems
- At-a-glance view of power quality
- Reduces power monitoring cost
- Supports continuous, non-disruptive monitoring
- Accessible via the ethernet
- Uses industry-standard communication protocols

Power Xpert Gateway

Eaton's Power Xpert Gateway (PXG) bridges the IT and facilities management worlds by bringing disparate panelboards, switchboards and other power equipment onto the network. The PXG takes the complexity out of connecting power equipment to the network. The web-enabled PXG is an out-of-the-box device that can support up to 96 devices, translate most industrial communication protocols, and offer user-selectable events and real-time trending. It also features e-mail notification of events, waveform capture and data/event logging—all with no special software. Adding basic meters or the utility's meter, the PXG assists in tracking energy usage. The PXG recognizes the interdependence of IT systems and power systems, and delivers what organizations need to bring these worlds together for seamless, end-to-end system reliability.

The PXG consolidates data available breakers, meters, motor controllers and protective relays, and presents the information in a variety of ways (a web browser being the most widely used method). The PXG is a stand-alone solution. As needs change and grow, the PXG can be integrated through Power Xpert Software into a broader solution that encompasses other intelligent hardware and can integrate with third-party network management systems (NMS) or building management systems (BMS) for system-wide monitoring and reporting of power and IT.

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Power Xpert Meter 1000



Power Xpert Meter 2000



Power Xpert Meter 3000

The Power Xpert 1000 Meters

The Power Xpert Meter 1000 series power and energy meters monitor the most critical aspects of an electrical distribution system. This premier metering instrument uses the latest in advanced technology to make it simple to use, powerful, scalable and highly flexible.

The Power Xpert Meter 1000 (PXM1000), 1100 (PXM1100), 1200 (PXM1200) and 1300 (PXM1300) deliver a cost-effective solution for energy and sub-metering applications. These three-phase meters provide high accuracy and advanced features in the standard 4-inch form factor and can be expanded with multiple modular I/O options.

Meter series benefits include:

- Utility billing accuracy that will help meet stringent customer specifications
- Ease of use in multiple applications
- Rogowski coils allow for ease of use in retrofit applications
- Multiple protocols including Modbus TCP and BACnet/IP and with available HTTP push, allowing data to be sent to the cloud to help meet energy code data storage requirements

The Power Xpert 2250 Meter

This meter provides all the core functions for monitoring power consumption and power quality, ethernet connectivity and onboard gateway card limits. This unit uses D/A technology to sample circuits at 400 samples per cycle for extremely accurate measurement of power factor and energy consumption. In addition, the meter has 256 MB for logging meter data.

The Power Xpert 2260 Meter

This meter adds the ability to monitor total harmonic distortion and the ability to set onboard meter limits. The meter also will illuminate LEDs on the faceplate, indicating that a limit has been exceeded and provides 512 MB for data logging.

The Power Xpert 2270 Meter

This meter adds the ability to monitor individual harmonics and visualize waveforms on your desktop using the embedded web server and raises the storage to 768 MB for data logging.

The Power Xpert 2280 Meter

This meter has all the capability of the PXM 2270 with the added capability to record waveforms at up to 64 samples per cycles. Also has the capability to configure the total, pre- and post-event cycles.

The Power Xpert 2290 Meter

This meter has all the capability of the PXM 2280 with the added capability to record waveforms at up to 512 samples per cycles.

Meter series benefits include:

- Fully understand your facility's power quality
- Detailed event information; pinpoint the root causes of problems—or prevent them from occurring
- Measure, trend and analyze power via information through onboard web and comma separated values (CSV) exporting capabilities
- Up to 768 MB of storage; typically 15 years of storage capability depending on the meter model and frequency of events
- Local or remote configuration

The Power Xpert 3000 Meter

The Power Xpert Meter 3000 (PXM3000) provides an extensive array of data, including power quality, energy and demand readings so you can manage energy utilization to help reduce peak demand charges and power factor penalties, and to identify excessive energy consumption.

Utilizing both a premier web interface with cloud storage and onboard data storage up to 4 GB, the PXM3000 allows you to keep your data at your fingertips to help reduce your overall energy usage and better manage your energy costs.

Key features include:

- Rich web interface
- Multiple protocols including Modbus RTU/TCP and BACnet/IP
- Onboard historical data charts
- Onboard waveform display
- Optional digital/analog inputs and outputs
- Storage of up to three custom data logs

For information on other available power meters, visit Eaton.com/meters

Metering Device Comparison

Table 21.3-9. Metering Device Comparison

Feature	PXM1000	PXM1100	PXM1200	PXM1300	PXM2250	PXM2260	PXM2270	PXM2280	PXM2290	PXM3000	PXM4000	PXM6000	PXM8000
Instrumentation													
Current, per phase	■	■	■	■	■	■	■	■	■	■	■	■	■
Current demand	■	■	■	■	■	■	■	■	■	■	■	■	■
Calculated neutral current	■	■	■	■	■	■	■	■	■	■	■	■	■
Voltage, per phase (L, L, L-N)	■	■	■	■	■	■	■	■	■	■	■	■	■
Min/Max Readings (I, V)	■	■	■	■	■	■	■	■	■	■	■	■	■
Min/Max Readings (I, V, PF, F, W, VAR, VA)	■	■	■	■	■	■	■	■	■	■	■	■	■
Frequency	■	■	■	■	■	■	■	■	■	■	■	■	■
Power													
Real, reactive and apparent power (W, VAR, VA)	■	■	■	■	■	■	■	■	■	■	■	■	■
Power factor, total	■	■	■	■	■	■	■	■	■	■	■	■	■
Real, reactive and apparent power demand	■	■	■	■	■	■	■	■	■	■	■	■	■
Demand Methods													
Block interval (sliding, fixed)	■	■	■	■	■	■	■	■	■	■			
Energy													
Real, reactive and apparent energy, total (Wh, VAR, Vah)	■	■	■	■	■	■	■	■	■	■	■	■	■
Harmonics													
Harmonic levels						40	40	40	40	63	127	127	127
Total Harmonic Distortion (THD)—voltage, current						■	■	■	■	■	■	■	■
Individual harmonics view	■	■	■	■			■	■	■	■	■	■	■
Total Demand Distortion (TDD)											■	■	■
Inter-harmonics												■	■

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Table 21.3-9. Metering Device Comparison (Continued)

Feature	PXM1000	PXM1100	PXM1200	PXM1300	PXM2250	PXM2260	PXM2270	PXM2280	PXM2290	PXM3000	PXM4000	PXM6000	PXM8000
Time of Use													
Energy/max. demand (TOU, 4 tariffs, 12 seasons, 14 schedules)			■							■			
DST—Two adjustable formats (M/D/H/M or M/W/First/H/M)			■							■			
TOU Metering Support (4)											■	■	■
Data Logging													
Storage		8 MB	8 MB	16 MB	256 MB	256 MB	768 MB	768 MB	768 MB	4 GB	2 GB	4 GB	8 GB
Historical Data Graphical View					■	■	■	■	■	■	■	■	■
Trend Logging					■	■	■	■	■	■	■	■	■
Custom Logs		■	■	■						■	■	■	■
Power Quality													
Waveform recording, samples/cycle				64				64	512	128	4096	4096	100,000
Number of cycles recorded at max. sampling				40				32	4	20			
Waveform view							■	■	■	■	■	■	■
Sags/dips, swell logging				■						■	■	■	■
%THD amperes and volts	■	■	■	■		■	■	■	■	■	■	■	■
Power Quality Index (dV/dT count, %TDDi, %THDv)											■	■	■
Communications													
RS-485, Modbus RTU/ASCII, KYZ output	■	■	■	■	■	■	■	■	■	■	■	■	■
DNP 3.0	■	■	■	■	■	■	■	■	■	■	■	■	■
Digital I/O													
Digital input	Optional												
Digital output	Optional												
Analog I/O													
Analog output	Optional												
Analog input	Optional	Optional	Optional	Optional						Optional			

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Table 21.3-9. Metering Device Comparison (Continued)

Feature	PXM1000	PXM1100	PXM1200	PXM1300	PXM2250	PXM2260	PXM2270	PXM2280	PXM2290	PXM3000	PXM4000	PXM6000	PXM8000
Ethernet													
HTTP, HTTPS (Web pages)	Optional	Optional	Optional	Optional	■	■	■	■	■	■	■	■	■
HTML (Standard web browser)											■	■	■
SMTP (Email)	Optional	Optional	Optional	Optional	■	■	■	■	■	■	■	■	■
NTP (Time Sync)	Optional	Optional	Optional	Optional	■	■	■	■	■	■	■	■	■
Modbus TCP/IP (RJ-45)	Optional	Optional	Optional	Optional	■	■	■	■	■	■	■	■	■
SNMP	Optional	Optional	Optional	Optional	■	■	■	■	■	■	■	■	■
BACnet/IP	Optional	Optional	Optional	Optional	■	■	■	■	■	■			
Phasor Diagram (Web View -Wye Connected)	Optional	Optional	Optional	Optional	■	■	■	■	■	■			
Revenue Accuracy													
ANSI C12.20 (0.5 or 0.2%)	0.20%	0.20%	0.20%	0.20%	0.20%	0.20%	0.20%	0.20%	0.20%	0.20%	0.20%	0.20%	0.20%

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Integrated Surge Protective Devices

Integrated SPDs

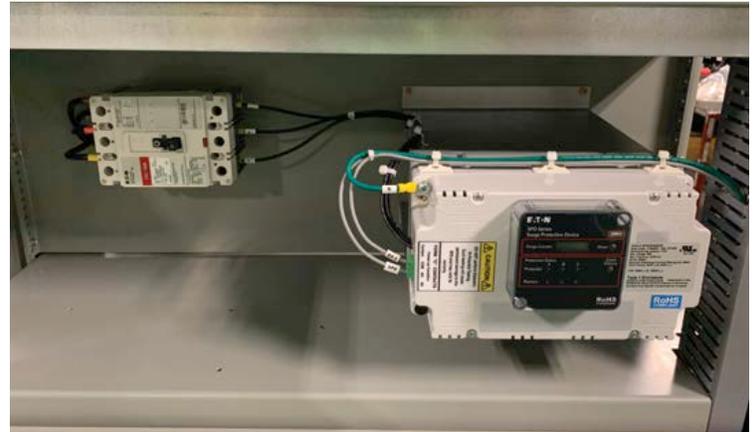
Eaton integrates our industry-leading SPD Series surge protective devices into panelboard and switchboard assemblies. Lead length is kept to a minimum to maximize SPD performance. Integrated SPD units are UL listed and labeled to UL 1449 3rd Edition.

Key features include:

- Thermally protected metal oxide varistor (MOV) technology
- 20 kA nominal discharge current (I_n) rating (maximum rating assigned by UL)
- 50 through 400 kA surge current capacity ratings
- Three feature package options (basic, standard, and standard with surge counter)
- 200 kA short-circuit current rating (SCCR)
- 10-year warranty

The breadth of the SPD Series' features, options and configurations ensures that the correct unit is available for all electrical applications, including service entrances, distribution switchboards, panelboards and point-of-use applications.

For complete SPD product description, application and ratings, visit www.eaton.com/spd.



Integrated Surge Protective Devices in Pow-R-Line XD Assembly

Table 21.3-10. Side-By-Side Comparison of the SPD Series' Available Feature Packages

Feature Package Comparison	Basic	Standard	Standard with Surge Counter
Surge protection using thermally protected MOV technology	■	■	
Dual-colored protection status indicators for each phase	■	■	
Dual-colored protection status indicators for the N-G protection mode	■	■	
Audible alarm with silence button		■	■
Form C relay contact		■	■
EMI/RFI filtering, providing up to 50 dB of noise attenuation from 10 kHz to 100 MHz		■	■
Surge counter with reset button			■