Low-voltage power distribution and control systems > Panelboards >

Retrofit panelboards Pow-R-Line 1RX and 2RX

Contents

Powering Business Worldwide

More about this product
Eaton.com/panelboards

Complete library of design guides
Eaton.com/designguides

Lighting and Distribution Panelboards Overview

- Designed for sequence phase connection of branch circuit devices
- Enables single-, two- or three-pole arrangements for a balanced electrical load on each phase
- Sturdy, rigid chassis assembly ensures accurate alignment of interior with panel front
- Assembly also prevents flexing and minimizes loosening or damage to current-carrying parts
- Four-point in-and-out adjustment of panel interior meets critical depth dimensions on flush installations
- Main lugs are approved for copper or aluminum conductors

Available Ratings

- Rated at 240 Vac, 480 Vac and 600 Vac
- Fault current available up to 200 kAIC at 240 Vac, 100 kAIC at 480 Vac and 65 kAIC at 600 Vac

Panelboard Options

- Aluminum, copper, silver-plated copper or tin-plated copper bus
- Aluminum or copper lugs
- Density-rated bus
- Ground bars
- Customer-owned meters
- Service entrance equipment construction
- Surge protective devices
- Seismically qualified panelboards

From left to right: Pow-R-Line 1X, Pow-R-Line 2X, Pow-R-Line 4X and Pow-R-Line 3X panelboards

Enclosures

- Boxes are code-gauge galvanized steel, available unfinished or painted ANSI-61 light gray
- Standard panelboard cabinets are designed for indoor use
- Alternate types are available for special-purpose applications
- All enclosures meet UL® standards and include wiring gutters with proper wire bending space
- Box dimensions shown are inside dimensions—for outside dimensions, add 0.25 inch (6.4 mm)
- Standard panelboard boxes are supplied without knockouts (blank endwalls)

The Three-Piece Trim for Larger Power Distribution Panelboards Provides for Easy Handling and Installation

Fronts

- Made of code-gauge steel with a high-durability ANSI-61 light gray finish
- Branch circuit and small power distribution panelboards include a door and concealed hinges
- Flush-type latch and lock assembly included
- All locks are keyed alike
- Trims available in both surface- and flush-mounted designs

Power Distribution Panelboard Fronts Only

- Utilize a breaker front cover design providing each device with a dedicated bolt-on steel cover
- Individual covers form a single deadfront used with two wiring gutter covers to complete the trim
- A door is not finished but can be provided for an additional charge using a deeper-than-standard box

EZ Box™ and EZ Trim™

Provided standard for:

- Pow-R-Line 1X and Pow-R-Line 2X lighting panelboards
- Pow-R-Line 3X, Pow-R-Line 3E and Pow-R-Line 3XF mid-range panelboards

EZ Box and EZ Trim

Features

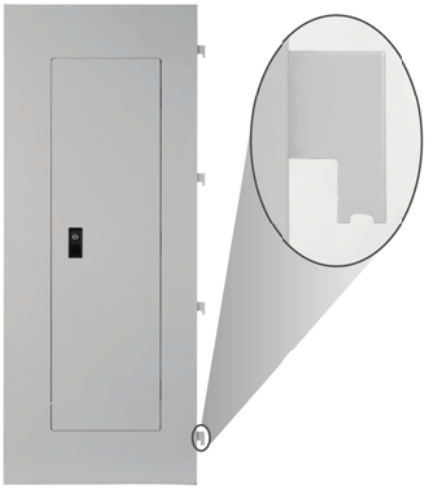
- Virtually eliminates sharp edges
- Trim installs quickly
- Door-in-door is standard
- Ability to adjust flush box to wall irregularities
- Trim installs without the need for tools
- No exposed hardware (because there is none)

EZ Box

- Flanges are bent and painted, and without sharp edges
- All steel panelboard chassis parts are painted to reduce injuries during handling and installation
- Each flange adjusts outward up to 0.75 inch (19.1 mm), enabling installer to flush the box with a wall after wall material is installed
- Flanges also provide means for attaching EZ Trim

EZ Trim

- Design installs in seconds
- Standard trim includes door-in-door construction and no exposed hardware
- No tools required for installation
- Includes hangers attached on the right side
- Bottom trim hanger with notch in base inserts into the bottom right side box flange opening, resting the notch on the flange



Standalone Trim and Bottom Flange Hanger with Notch

Standards and Certifications

When used with Eaton's panelboard chassis, EZ Box and EZ Trim meet the following applicable industry standards:

- UL 50 Listed
- NEMA® Standard PB1
- Federal specifications
- National Electrical Code® (NEC®)

UL Listed

Application Considerations and Definitions

Standards

All Eaton panelboards meet the following applicable industry standards, except where noted:

- UL
  - Panelboards: UL 67
  - Cabinets, boxes and trims: UL 50

Note: Only panelboards containing UL Listed devices can be UL labeled.

- NEC
- NEMA PB 1
- Federal Specification W-P-115c
  - Circuit breaker—Type I Class 1
  - Fusible switch—Type II Class 1

Panelboard Selection Factors

In selecting a panelboard, the following factors must be considered:

- Service (voltage and frequency)
- Interrupting capacity (fully or series rated)
- Ampere rating of main
- Ampere ratings of branches
- Installation environment
- Codes and standards mandates

Panelboard Short-Circuit Rating

- Eaton's assembled panelboards are test verified by, and listed with, UL
- Ratings are generally that of the lowest interrupting rated device in the panel
- Where branch devices have been UL tested in combination with specific main devices having a higher interrupting rating, the series short-circuit rating of the assembled panelboard will be the same as the series tested rating of the approved rated main breaker
- Series ratings apply to panels having main devices, or main-lug-only panelboards fed remotely by the device listed in the series ratings chart as the main, for which UL Listed tests were conducted

Selective Coordination

Refer to Molded Case Circuit Breakers Design Guides for information on overcurrent protective device combinations used in selectively coordinated systems.

Service Entrance Equipment

Service Entrance Equipment NEC Articles 230.62 and 230.71, and UL, require that:

- Panelboards used as service entrance equipment must be located near the point where the supply conductors enter the building
- A single service disconnect within the panelboard
- Must include service disconnect barrier, connector for bonding and grounding neutral conductor
- A service-entrance-type UL label must be factory installed
- Ground fault protection of equipment shall be provided for solidly grounded wye electrical services of more than 150 V to ground, but not exceeding 600 V phase-to-phase for each service disconnecting means rated 1000 A or more
- Service entrance panels must be identified as such on the order entry to the manufacturing location

Table 22.6-1. Service Entrance Main Breaker Kits

Description	Circuit Breaker Frame	Catalog Number
Service entrance barrier for PD5	PD5	**PRLSEBPD5**
Service entrance barrier for PD4	PD4	**PRLSEBPD4**
Service entrance barrier for PD3	PD3	**PRLSEBPD3**
Service entrance barrier for PD2	PD2	**PRLSEBPD2**
Service entrance barrier for GHB	GHB	**PRLSEBGHB**
Service entrance barrier for BAB	BAB	**PRLSEBBAB**

Column Type Panelboards

The same general code restrictions apply as for standard-width panels except where trough extensions are used.

Multi-Section Panelboards

- When more than 42 overcurrent protective devices are required, two or more separate enclosures may be required
- Separate fronts for each box are standard

Interconnecting Multi-Section Panelboards

- When a panelboard must be furnished in more than one section (box) for connection to one feeder, each section must be furnished with main bus and terminals of the same rating unless a main overcurrent device is provided in each section
- Sub-feed or through-feed provisions must also be added to provide connection capability to the second section

Note: Sub-feed or through-feed lugs cannot be used on any panelboard not protected by a single main overcurrent device either in the panelboard or immediately upstream, i.e., service entrance panelboards with main-lug-only using the six disconnect rule.

Sub-Feed Lugs (Figure 22.6-1)

- Sub-feed (second set of) lugs interconnect multi-section panels
- Mounted directly beside the main lugs
- Required in each section except the last panel in the lineup
- Feeder cables are brought into the wiring gutter of the first section and connected to the main lugs
- Another set of same-size cables connect to the sub-feed lugs (Section 1) and are carried over to the main lugs of the adjacent panel
- Cross connection cables are not furnished by Eaton
- Sub-feed lugs are only available on main-lug-only panels

Note: Sub-feed lugs may not be used on main-lug-only (six disconnect rule) service entrance panels.

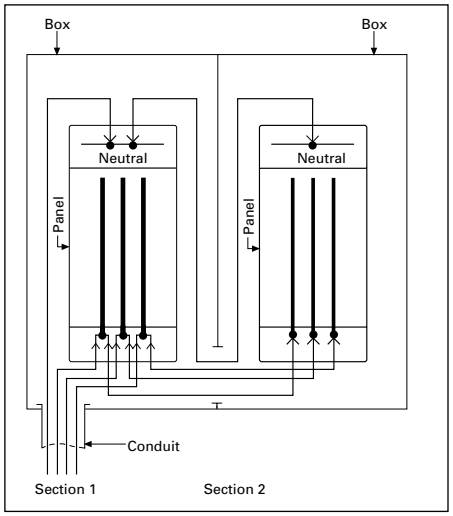


Figure 22.6-1. Sub-Feed Lugs

Through-Feed Lugs (Figure 22.6-2)

- Another method to interconnect multi-section panelboards
- Incoming feeder cables connect to main lugs or main breaker at the bottom of panel (Section 1)
- Another set of lugs (through-feed) are located at the opposite end of the main bus
- Interconnecting cables connect to the through-feed lugs in Section 1 and are carried over to the main lugs in Section 2
- Connection arrangement is reversible, with main lugs at top and through-feed lugs at bottom of end of panel
- Cross connection cables are not furnished by Eaton

Note: Through-feed lugs may not be used on main-lug-only (six disconnect rule) service entrance panels.

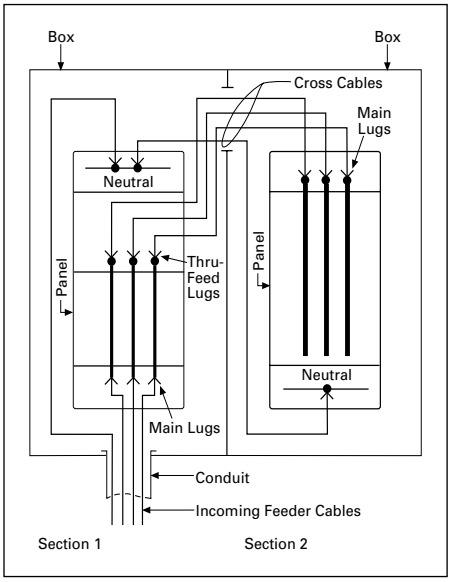


Figure 22.6-2. Through-Feed Lugs

Multiple Section Panelboard—Flush Mounted

Shown below is the standard method for flush mounting multiple section lighting and distribution panelboards using standard flush trims.

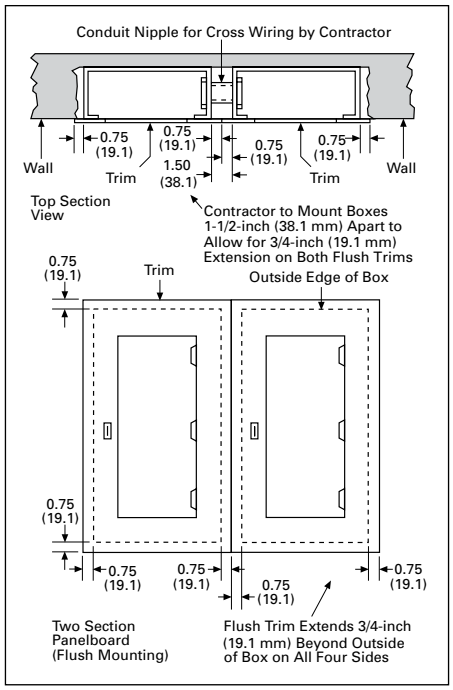


Figure 22.6-3. Multiple Section Panelboard—Flush Mounted—Dimensions in Inches (mm)

Branch Circuit Loading for Lighting Panels

The size of mains and branches should be selected based on the following:

- Lighting circuits: NEC Article 210, 215, 220 and 240
- Distribution circuits, actual or continuous loads: NEC Article 384.16
- Motor circuits: NEC Article 430
- Diversity factor
- Provision for future loading

Overcurrent Protection

- NEC Article 408 states a panelboard shall be protected by an overcurrent protective device having a rating not greater than that of the panelboard
- The overcurrent protective device shall be located within, or at any point on the supply side of, the panelboard
- Exceptions to Article 408 selectively apply—refer to it for specifics

Ground Fault Protection

May be added to most panelboards using Eaton's integral molded case circuit breaker and included feeder devices on:

- Power panelboards
- Mains on all panelboards

Arcflash Reduction Maintenance System™

- Available on many molded case circuit breakers from 70 A to air power circuit breakers at 5000 A
- Enables breakers to trip quickly, significantly reducing the available arc flash potential
- Recognized by the 2011 NEC and the National Electrical Safety Code® (NFPA 70E®)

Combination AFCI Circuit Breakers

- Eaton's 125 Vac AFCI single- and two-pole, 15 A and 20 A bolt-on breakers in panelboards meet NEC Article 210.12
- See the NEC for definitions and details

Retrofit Panelboards

- Pow-R-Line 1RX and Pow-R-Line 2RX Retrofit Panelboards are the only panelboards in the market listed for use in retrofit applications in other manufacturers' existing back boxes

Ambient Temperatures

The primary function of an overcurrent device is to protect the conductor and its insulation against overheating. In selecting the size of the devices and conductors, consideration should be given to the ambient temperature surrounding the conductors within and external to the panelboard. Cumulative heating within the panelboard may cause premature operation of overcurrent protective devices.

- UL test procedures are based, in part, on 80% loading of panelboard branch circuit devices
- NEC Article 408 limits the loading of overcurrent devices in panelboards to 80% of rating where in normal operation, the load will continue for three hours or more
- Further derating may be required, depending on ambient temperature, duty cycle, frequency or altitude
- An exception applies to assemblies and overcurrent devices approved for continuous duty at 100% of their rating and is covered in NEC 210.20 (a)—for additional information, see Molded Case Circuit Breakers Design Guides

Special Conditions

Standard panelboards, assembled with standard components, are adequate for most applications. However, special consideration should be given to those required for application under special conditions, such as:

- Excessive vibration or shock
- Frequencies above 60 cycles
- Altitudes above 6600 feet (2012 m)
- Damp environment (possible fungus growth)
- Compliance with federal, state and municipal electrical codes and standards

Seismic Qualification

Refer to Power Distribution Systems Design Guides for information on seismic qualification for this and other Eaton products.

Harmonic Currents

- Standard panelboard neutrals are rated for 100% of the panelboard current
- Because harmonic currents can cause overheated neutrals, an option is provided for neutrals to be rated at 200% (1200 A maximum neutral for 600 A main bus) of the panelboard phase current
- Panelboards with the 200% rated neutral are UL Listed as suitable for use with nonlinear loads
- Prior to specifying the 200% rated neutral, a harmonic survey of the distribution system is recommended

Surge Protective Devices (SPD)

The quality of power feeding sensitive electronic loads is critical to the reliable operation of any modern facility. The most frequent causes of microprocessor-based equipment downtime and damage are voltage transients and electrical noise.

- High-energy transients include lightning-induced surges and power company switching that can destroy components instantly
- Continual low-energy transients and high-frequency noise, which are more frequent, can cause erratic equipment performance or sudden failure of electronic circuit board components

Eaton's SPD provides protective and diagnostic systems that are integral to panelboards:

- Safeguards sensitive electronic equipment from the damaging effects of high- and low-energy transients
- Integrates into the panelboards using a "zero lead length" direct busbar connection
- Uses integral disconnect on all panelboards

For complete product description and available ratings, refer to Surge Protection (SPD) & Power Conditioning Products Design Guides.

Eaton SPDs May be Integrated into Most Panelboards

Compact Panelboard Meter

Most Eaton panelboards can integrate a meter for reading the panelboard power and energy usage. Our Power Xpert™ Meter 350 offers:

- ANSI 12.20 0.5% accuracy
- A bright backlit LCD display
- Real energy pulse output
- Phase loss alarm
- Optional RS-485 communication capability

Pow-R-Line 1RX Retrofit Panelboard

Pow-R-Line 1RX

General Description

Panelboard Ratings

Voltage
- 240 Vac maximum

Main Lugs
- 100–225 A

Main Breakers
- 100–225 A

Branch Breakers
- 15–100 A (bolt-on chassis)

Short-Circuit Current Ratings (Symmetrical)
- 240 Vac: 10 kA and 22 kA fully rated
- 240 Vac: 22–200 kA series rated

Service
- Three-phase, four-wire 208Y/120 V and 240/120 V delta
- Single-phase, three-wire 120/240 V
- Single-phase, two-wire 120 V
- Three-phase, three-wire 208 and 240 V

Suitable for service entrance applications when specified.

Mains

For available mains, refer to **Table 22.6-2**.

Main breakers, 100 A, Types BAB and QBH are horizontally mounted, same as branch breakers. All other main breakers are vertically mounted.

Branch Circuits

For available branch devices, refer to **Table 22.6-3**.

Eaton offers a factory-assembled panelboard interior and trim designed to bolt directly into an existing enclosure.

Custom-built panelboard interiors and trims can be provided to retrofit most any manufacturer's existing panelboard enclosure.

The panelboards are listed and are marked with both the Underwriters Laboratories (UL) and Canadian Standards Association (CSA®) labels.

Why Retrofit?

- Upgrade protective device interrupting ratings
- Replacing old, obsolete circuit breakers with new
- Providing additional circuits for load growth
- Accommodating system change and additions
- Adding ground fault circuit interrupters

Immediate Benefits

- Installation time is dramatically reduced
- Disruption of existing power service is minimal
- Less cleanup and wall repair because there is no need to cut and break concrete or finished wall surface

Main Lugs Only

The short-circuit rating of the MLO assembled panelboard will be fully rated based upon the lowest rated branch device, or may be series rated with an approved upstream device.

Main lugs only ampere ratings: 100 and 225.

Main Circuit Breakers

The short-circuit rating shown is that of the main breaker only. The short-circuit rating of the assembled panelboard is the rating of the lowest fully rated main or branch device, or the rating of an approved series rated combination.

Table 22.6-2. Main Circuit Breakers

Breaker Frame Amperes	Breaker Type	Interrupting Rating (kA Symmetrical) at 240 V
100	BAB	10
100	QBHW	22
100	PDG2xF	18
225	PDG2xG, PDG3xG	65
225	PDG2xM	100
225	PDG2xP	200
225	PDD2xF	22
225	PDD2xG	65
225	PDD2xM	100
225	PDD2xM	200

Series Rated Combinations

The panelboards are listed and are marked with both the Underwriters Laboratories (UL) and Canadian Standards Association (CSA) labels.

Table 22.6-3. Branch Circuit Breakers

Breaker Type	Ampere Rating	Number of Poles	Interrupting Rating (kA Symmetrical)		
			120 V	120/240 V	240 V
BAB	15–70	1	10	—	—
BAB	15–100	2	—	10	—
BAB	15–100	2, 3	—	—	10
BAB-D ①	15–60	1, 2	10	10	—
BAB-C ②	15–30	1, 2	10	10	—
BABRP ③	15–30	1, 2	10	10	—
BABRSP ③	15–30	1, 2	10	10	—
QBGF, QBGFEP	15–50 ④	1, 2	10	10	—
QBCAF ⑤	15–20	1	10	10	—
QBHW	15–70	1	22	—	—
QBHW	15–100	2	—	22	—
QBHW-H	15–100	2, 3	—	—	22
QBHGF, QBGFEP	15–30	1, 2	22	22	—
QBHCAF ⑤	15–20	1	22	22	—

① HID (High Intensity Discharge) rated breaker.
② Switching neutral breaker. Single-pole device requires two-pole space, two-pole device requires three-pole space.
③ Solenoid operated breaker.
④ 50 A is two-pole only.
⑤ Arc fault breaker.

Pow-R-Line 2RX Retrofit Panelboard

Pow-R-Line 2RX

General Description

Panelboard Ratings

Voltage

- 240 Vac
- 480Y/277 Vac maximum

Main Lugs

- 100–225 A

Main Breakers

- 100–225 A

Branch Breakers

- 15–100 A (bolt-on chassis)

Short-Circuit Current Ratings (Symmetrical)

- 240 Vac: 10 kA and 22 kA fully rated
- 240 Vac: 22–200 kA series rated

Service

- Three-phase, four-wire 480Y/277 Vac
- Three-phase, four-wire 208Y/120 Vac and 240/120 Vac delta
- Single-phase, three-wire 120/240 Vac
- Single-phase, two-wire 120 Vac
- Three-phase, three-wire 208 and 240 Vac

Suitable for service entrance applications when specified.

Mains

For available mains, refer to **Table 22.6-4**.

Main breakers, 100 A, Type GHB is horizontally mounted, same as branch breakers. All other main breakers are vertically mounted.

Branch Circuits

For available branch devices, refer to **Table 22.6-5**.

Eaton offers a factory-assembled panelboard interior and trim designed to bolt directly into an existing enclosure.

Custom-built panelboard interiors and trims can be provided to retrofit most any manufacturer's existing panelboard enclosure.

The panelboards are listed and are marked with both the Underwriters Laboratories (UL) and Canadian Standards Association (CSA) labels.

Why Retrofit?

- Upgrade protective device interrupting ratings
- Replacing old, obsolete circuit breakers with new
- Providing additional circuits for load growth
- Accommodating system change and additions
- Adding ground fault circuit interrupters

Immediate Benefits

- Installation time is dramatically reduced
- Disruption of existing power service is minimal
- Less cleanup and wall repair because there is no need to cut and break concrete or finished wall surface

Main Lugs Only

The short-circuit rating of the MLO assembled panelboard will be fully rated based upon the lowest rated branch device, or may be series rated with an approved upstream device.

Main lugs only ampere ratings: 100 and 225.

Main Circuit Breakers

The short-circuit rating shown is that of the main breaker only. The short-circuit rating of the assembled panelboard is the rating of the lowest fully rated main or branch device, or the rating of an approved series rated combination.

Table 22.6-4. Main Circuit Breakers

Breaker Frame Amperes	Breaker Type	Interrupting Rating (kA Symmetrical)	
		240 Vac	480Y/277 Vac
100	GHB	65	14
225 225	PDG2xM PDG2xP	100 200	65 100

Series Rated Combinations

The panelboards are listed and are marked with both the Underwriters Laboratories (UL) and Canadian Standards Association (CSA) labels.

Table 22.6-5. Branch Circuit Breakers

Breaker Type	Ampere Rating	Number of Poles	Interrupting Rating (kA Symmetrical)			
			120 Vac	240 Vac	277 Vac	480Y/277 Vac
GHQ GHB GHB	15–30 15–100 15–100	1, 2 1 2, 3	65 65 —	— — 65	14 14 —	— — 14
GHB-HID ① GHBGFEP ② HGHB	15–20 15–60 15–30	1 1 1	65 65 65	— — —	14 14 25	— — —

① HID (High Intensity Discharge) rated breaker.
② GHB breaker with 30 ma equipment ground fault protection.

Circuit Breaker Technical Data

Table 22.6-6. Electrical Characteristics of Circuit Breakers

Circuit Breaker Ratings				UL Listed Interrupting Ratings (kA rms Symmetrical)						
Type	Ampere Rating	Number of Poles	Volts AC	AC Rating, Volts					DC Rating, Volts ①	
				120/240	240	277	480	600	125	250
BAB	15–70 15–100	1 2	120 120/240	10 10	— —	— —	— —	— —	— —	— —
BAB-H	15–100	2, 3	240	—	10	—	—	—	—	—
BABRP, BABRSP	15–30 15–30	1 2	120 120/240	10 10	— —	— —	— —	— —	— —	— —
QBGF, QPGFEP QBGFEP	15–50 15–50	1 2	120 120/240	10 10	— —	— —	— —	— —	— —	— —
QBHW	15–70 15–100	1 2	120 120/240	22 22	— —	— —	— —	— —	— —	— —
QBHW-H	15–100	2, 3	240	—	22	—	—	—	—	—
QBHGF QBHGFEP	15–30 15–30	1 2	120 120/240	22 22	— —	— —	— —	— —	— —	— —
QBHAF	15–20	1	120	22	—	—	—	—	—	—
GHB	15–100 ② 15–100	1 2, 3	277 480Y/277	65 —	— 65	14 —	— 14 ③	— —	14 —	— 14
GHQ	15–30	1, 2	277	65	—	14	—	—	—	—
HGHB	15–30	1	277	65	—	25	—	—	—	—
GHBGFEP	15–60	1	277	—	—	14	—	—	—	—
PDG2xF	15–100 15–100	1 2, 3	277 480	— —	— 18	14 —	— 14	— —	10 —	— 10
PDG2xG, PDG3xG	15–150 15–225	1 2, 3	277 600	— —	— 65	35 —	— 35	— 18	10 —	— 10
PDD2xF PDD2xG	100–225 100–225	2, 3 2, 3	240 240	— —	22 65	— —	— —	— —	10 10	— —

① DC ratings apply to substantially non-inductive circuits.
② DC rated single-pole, 15–70 A only.
③ Rating 480Y/277 Vac maximum.
④ Available with integral ground fault protection.
⑤ 100k based on NEMA test procedure.

Terminal Wire Ranges, Pressure-Type Al/Cu Terminals Except as Noted

Where copper-aluminum terminals are supplied on designated panelboard types, best results are obtained if a suitable joint compound is applied when aluminum conductors are used.

Table 22.6-7. Standard Main Lug Terminals

Panel Type	Wire Size Ranges for Ampere Capacity	
	100 A	225 A
Pow-R-Line 1X, 1XF, 1RX	#12–1/0	#6–300 kcmil
Pow-R-Line 2X, 2XF, 2RX	#12–1/0	#6–300 kcmil

Table 22.6-8. Standard Main Breaker and Branch Breaker Terminals

Breaker Type	Ampere Rating	Wire Size Ranges
BAB, QBHW, BABRSP	15–70	#14–#4
PDD2xF, PDD2xG PDD2xM, PDD2xM ①	100–225	#4–4/0 or #6–300 kcmil
PDG2xF, PDG2xG PDG2xM, PDG2xP ①, HFDDC ①	15–100 125–225	#14–1/0 #4–4/0
GHB, HGHB, GHQ, GHQRSP	15–50 25–100	#14–1/0 #10–1/0

① Suitable for DC applications only.

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 three models: PXR 10, PXR 20 and PXR 25.

Standards and Certifications

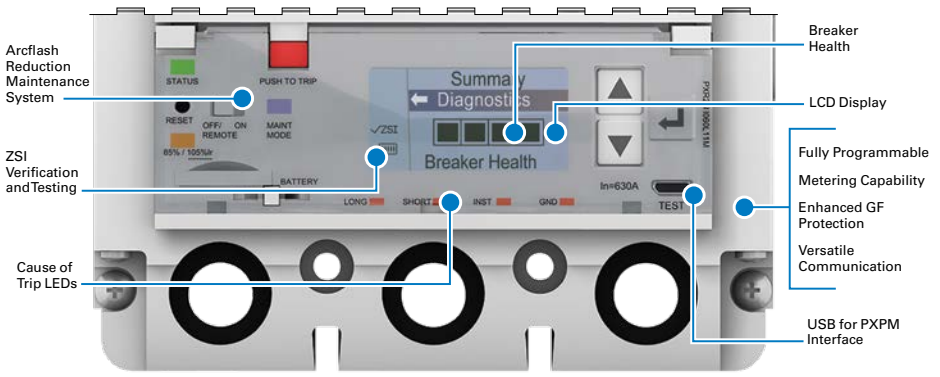
The PXR trip units are listed by Underwriters Laboratories (UL) and Canadian Standards Association (CSA) for use in Power Defense™ Frame 2, 3, 4, 5 and 6 molded case circuit breakers. All PXR units have also passed the IEC 60947-2 test program that includes EMC testing. All trip units meet the low-voltage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

Features

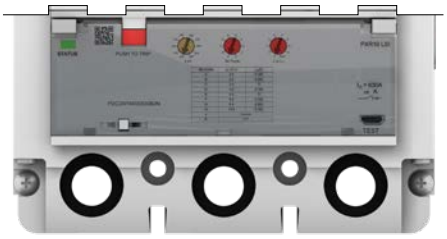
The PXR electronic trip units provide an enhanced and easy-to-use interface that enables end users and maintenance engineers to more easily change set points, test and configure circuit breakers, and review energy and power information. The Power Xpert Protection Manager (PXPM) software also provides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

Advanced features include:

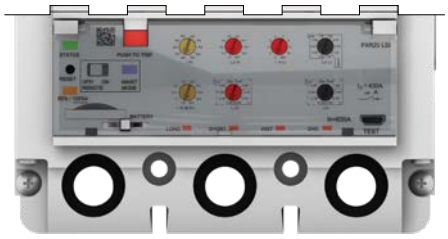
- Industry-first breaker health algorithms provide real-time monitoring and communication of breaker condition
- Cause of trip LED indication and trip event data storage
- Zone selective interlocking (ZSI) verification and testing indication
- Adjustable Arcflash Reduction Maintenance System settings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



PXR 25 Trip Unit



PXR 10



PXR 20

Table 22.6-9. PXR Features

Features	PXR 10	PXR 20	PXR 25
Protection types	LSI	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™ Available PD3, PD4, PD5, PD6 to meet NEC 240.87 requirements		○	○
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%
Voltage metering accuracy			0.5%
Power and energy metering accuracy			1.0%

Legend:
● Standard
○ Optional
▲ Available through USB port (PXPM)

Metering and Surge Protective Devices

Power Xpert Meter 350

Integrated Surge Protective Devices

Power Xpert Meter 350

The Power Xpert Meter 350 (PXM350) is a revenue grade energy meter that delivers a cost-effective solution for energy and submetering applications. This DIN rail mounted, three-phase energy meter provides high accuracy in a small form factor. The user-friendly LCD display is ideal for building energy management, energy monitoring and metering systems.

Meter features include:

- Data collection and management for energy and multi-parameters measurement
- Demand measurement and forecasting of current, active power, reactive power and apparent power
- System event logging with configurable parameter alarms
- LCD display with backlight support
- Electronic and physical sealing to prevent tampering

For more information on other available power meters, visit www.eaton.com/meters.

Integrated Surge Protective Devices

Eaton integrates our industry-leading surge protective devices (SPD) in to switchboards. Lead length is kept to a minimum to maximize SPD performance. SPD units are available with ratings up through 400k, and are UL listed and labeled to UL 1449 3rd Edition.

All switchboards with integrated SPD units are connected to a lineside overcurrent protective device for disconnecting means. When applied on the lineside of a service entrance main, the disconnecting means does not count as a service disconnect per National Electrical Code Article 230.71[A].

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

Table 22.6-10. Side-by-Side Comparison of the SPD Series' Available Feature Packages

Feature package comparison	Basic	Standard	Standard with Surge Counter	Power Xpert SPD
Surge protection using thermally protected MOV technology	■	■	■	■
Dual-colored protection status indicators for each phase	■	■	■	■
Dual-colored protection status indicators for the neutral-ground protection mode ①	■	■	■	
Tri-colored protection status indicators for each phase and the neutral-ground protection mode ①				■
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			■	■
Percentage protection remaining status				■
RJ45 Ethernet port for LAN connection, Modbus TCP/IP or BACnet/IP				■
UI webpage and programmable settings				■
Time-and-date stamped surge log and surge categorization				■

① Neutral-ground protection mode available in applicable voltage configurations only.

PRL1RX Layout Guide

Technical Data and Specifications

Bussing

100–225 A: Tin-plated aluminum is standard, copper is available as an option.

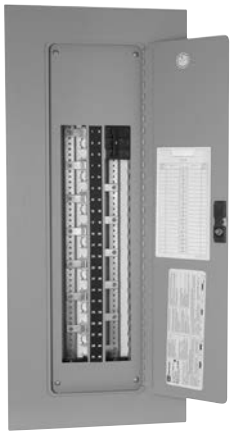
Boxes

Fits existing box depths from 4.50 (114.3 mm) to 6.00 inches (152.4 mm) deep.

Optional mounting brackets are available if existing enclosure exceeds 6.00 inches (152.4 mm) deep.

Boxes shallower than standard may require special collar adapters.

Trims



Pow-R-Line 1RX

The trim and door is designed to attach directly to the panelboard deadfront assembly so that there is no external trim-fastening hardware required.

The interior backpan or optional mounting plates are fastened directly to the back of the existing enclosure using the hardware provided.

Neutral and Ground Bus

- Integrally mounted Neutral assembly
- Ground bar and bonding conductor included
- Neutral and Ground convertible from left-right
- Insulated/Isolated ground bus is available as an option
- Aluminum is standard, copper is available as an option

Application Guidelines

The following dimensions and data are necessary for production of a panelboard to fit an existing box:

Existing Flush-Mounted Box

- Height dimension H
- Width dimension W
- Depth dimension D
- Flange width dimension F
- If box is not flush with plaster line, dimension E

Existing Surface-Mounted Box

- Height dimension H
- Width dimension W
- Depth dimension D
- Flange width dimension may be F or FF as appropriate:
  - ❑ Flange width dimension F
  - ❑ Flange width dimension FF

Stud Locations

In most applications, the existing mounting hardware in the enclosure may be removed, but in some areas, the backpan may need to be attached using a minimum of one existing mounting stud to meet local code requirements for grounding. Confirm with your local electrical code authority having jurisdiction.

Stud location dimensions:
A _____, B _____ and C _____.

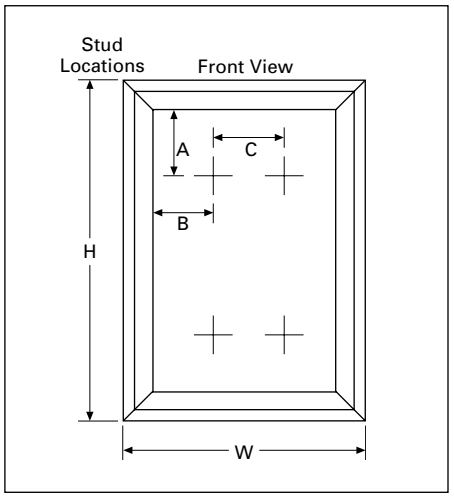


Figure 22.6-4. Existing Interior Mounting Studs

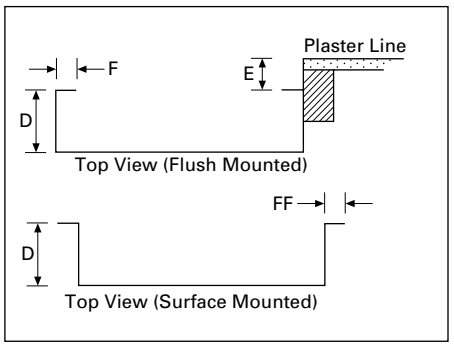


Figure 22.6-5. Existing Box Top View

Table 22.6-11. Minimum Enclosure Sizing

Ampere Rating	Number of Circuits	Main Device Type	Minimum Enclosure Dimensions Inches (mm)		
			Height	Width	Depth
Main Lug Only					
100	18 30 42	MLO	21.00 (533.4) 27.00 (685.8) 34.00 (863.6)	14.25 (362.0) 14.25 (362.0) 14.25 (362.0)	4.50 (114.3) 4.50 (114.3) 4.50 (114.3)
225	18 30 42	MLO	21.00 (533.4) 27.00 (685.8) 34.00 (863.6)	14.25 (362.0) 14.25 (362.0) 14.25 (362.0)	4.50 (114.3) 4.50 (114.3) 4.50 (114.3)
Main Breaker					
100	18 30 42	BAB, QBHW	21.00 (533.4) 27.00 (685.8) 34.00 (863.6)	14.25 (362.0) 14.25 (362.0) 14.25 (362.0)	4.50 (114.3) 4.50 (114.3) 4.50 (114.3)
	18 30 42	PDG2xF, PDD2xG, PDD2xM PDG2xG, PDG2xM PDD2xF, PDD2xM	30.00 (762.0) 36.00 (914.4) 42.00 (1066.8)	14.25 (362.0) 14.25 (362.0) 14.25 (362.0)	4.50 (114.3) 4.50 (114.3) 4.50 (114.3)
225	18 30 42	PDD2xG, PDD2xM, PDD2xF PDD2xM, PDG2xG, PDG2xM, PDG2xP	30.00 (762.0) 36.00 (914.4) 42.00 (1066.8)	14.25 (362.0) 14.25 (362.0) 14.25 (362.0)	4.50 (114.3) 4.50 (114.3) 4.50 (114.3)

PRL2RX Layout Guide

Technical Data and Specifications

Bussing

100–225 A: Tin-plated aluminum is standard, copper is available as an option.

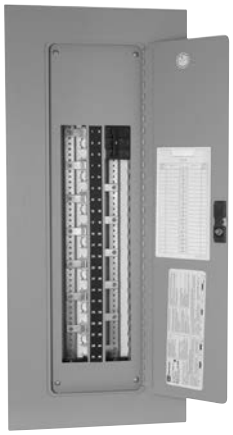
Boxes

Fits existing box depths from 4.50 (114.3 mm) to 6.00 inches (152.4 mm) deep.

Optional mounting brackets are available if existing enclosure exceeds 6.00 inches (152.4 mm) deep.

Boxes shallower than standard may require special collar adapters.

Trims



Pow-R-Line 2RX

The trim and door is designed to attach directly to the panelboard deadfront assembly so that there is no external trim-fastening hardware required.

The interior backpan or optional mounting plates are fastened directly to the back of the existing enclosure using the hardware provided.

Neutral and Ground Bus

- Integrally mounted Neutral assembly
- Ground bar and bonding conductor included
- Neutral and Ground convertible from left-right
- Insulated/Isolated ground bus is available as an option
- Aluminum is standard, copper is available as an option

Application Guidelines

The following dimensions and data are necessary for production of a panelboard to fit an existing box:

Existing Flush-Mounted Box

- Height dimension H
- Width dimension W
- Depth dimension D
- Flange width dimension F
- If box is not flush with plaster line, dimension E

Existing Surface-Mounted Box

- Height dimension H
- Width dimension W
- Depth dimension D
- Flange width dimension may be F or FF as appropriate:
  - ❑ Flange width dimension F
  - ❑ Flange width dimension FF

Stud Locations

In most applications, the existing mounting hardware in the enclosure may be removed, but in some areas, the backpan may need to be attached using a minimum of one existing mounting stud to meet local code requirements for grounding. Confirm with your local electrical code authority having jurisdiction.

Stud location dimensions:
A _____, B _____ and C _____.

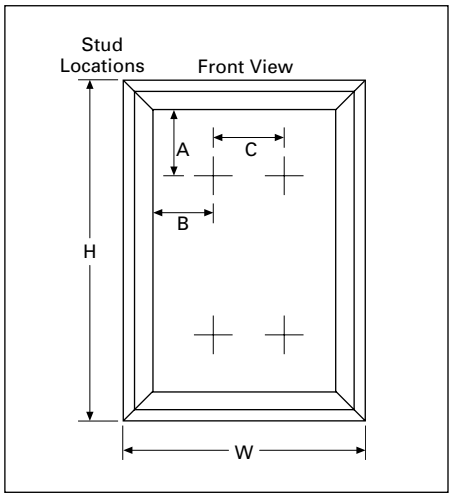


Figure 22.6-6. Existing Interior Mounting Studs

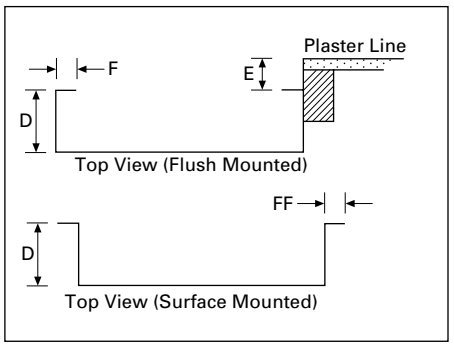


Figure 22.6-7. Existing Box Top View

Table 22.6-12. Minimum Enclosure Sizing

Ampere Rating	Number of Circuits	Main Device Type	Minimum Enclosure Dimensions Inches (mm)		
			Height	Width	Depth
Main Lug Only					
100	18 30 42	MLO	21.00 (533.4) 27.00 (685.8) 34.00 (863.6)	14.25 (362.0) 14.25 (362.0) 14.25 (362.0)	4.50 (114.3) 4.50 (114.3) 4.50 (114.3)
225	18 30 42	MLO	21.00 (533.4) 27.00 (685.8) 34.00 (863.6)	14.25 (362.0) 14.25 (362.0) 14.25 (362.0)	4.50 (114.3) 4.50 (114.3) 4.50 (114.3)
Main Breaker					
100	18 30 42	GHB	21.00 (533.4) 27.00 (685.8) 34.00 (863.6)	14.25 (362.0) 14.25 (362.0) 14.25 (362.0)	4.50 (114.3) 4.50 (114.3) 4.50 (114.3)
	18 30 42	PDG2xG, PDG2xM, PDG2xP	30.00 (762.0) 36.00 (914.4) 42.00 (1066.8)	14.25 (362.0) 14.25 (362.0) 14.25 (362.0)	4.50 (114.3) 4.50 (114.3) 4.50 (114.3)
225	18 30 42	PDG2xG, PDG2xM	30.00 (762.0) 36.00 (914.4) 42.00 (1066.8)	14.25 (362.0) 14.25 (362.0) 14.25 (362.0)	4.50 (114.3) 4.50 (114.3) 4.50 (114.3)

Series Rated Combinations

UL permits panelboards to be labeled with a short-circuit rating of up to 200,000 A symmetrical where UL listed combinations of main and branch circuits are used.

These combinations consist of main breakers or fusible devices connected ahead of, and in series with approved conventional devices.

Two arrangements are acceptable and comply with UL standards for panelboards. The main circuit breaker may be installed in the panel as a main device (**Figure 22.6-8**), or it may be mounted remote (**Figure 22.6-9**) from the panel. In either case, the approved main and branch combinations must be followed. These arrangements are acceptable and are UL listed having been tested in accordance with UL standards.

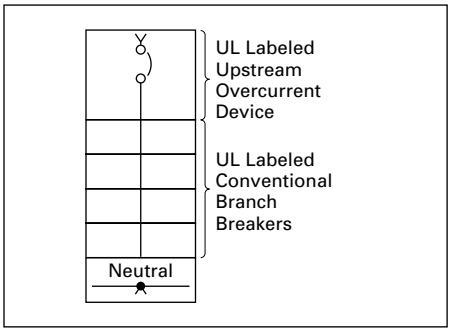


Figure 22.6-8. Main Device

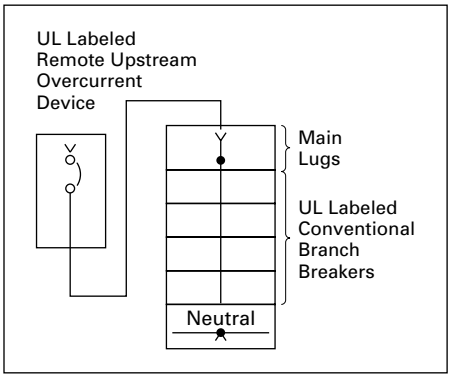


Figure 22.6-9. Mounted Remote

Industry standards and the NEC require protection of the entire electrical distribution system from damage due to short-circuit faults. Article 230.205 of the NEC states that service entrance equipment shall be suitable for the short-circuit current available at its supply terminals. The entire distribution system is required to meet this standard. Series rated systems have become an effective method of meeting these requirements.

There are three protection systems used to protect low voltage power distribution equipment. They are:

- Fully rated protection
- Fully rated, selectively coordinated protection
- Series rated protection

Fully Rated Protection—All overcurrent devices are rated for the full prospective short-circuit current at their line side terminals throughout the system.

Selectively Coordinated Protection—A fully rated system where the over-current device closest to the fault will open first, thus isolating the faulty circuit.

Series Rated Protection—A short-circuit interrupting rating assigned to a combination of two or more over-current protective devices that are connected in series and in which the rating of the downstream device(s) in the combination is less than the series rating.

Series ratings are also known in the industry as integrated ratings, series combination ratings and series connected ratings.

UL Issues

In a series rated system, all of the overcurrent devices in series in the protective scheme must have been tested and listed by Underwriters Laboratories for series combination use in the system.

All Eaton's series ratings are in full compliance with all applicable requirements of the latest editions of UL 489, 891 and 67.

The UL Recognized Component Directory (the Yellow Book) contains breaker manufacturers' series connected listings. These are intended ONLY as a guideline for use by others who are responsible for their own testing, labeling and listing. Therefore, the UL Recognized Component Directory cannot be used to interpret series connected ratings in assembled equipment. The assembled equipment must also be UL tested for series ratings.

Code Issues

The fault current contribution of motors connected between series rated breakers must be considered. Article 240.86 in the NEC states that for series ratings, the sum of the motor full-load currents cannot exceed 1% of the interrupting rating of the lower rated circuit breaker. The actual fault current contribution from induction motors is about four times their full-load current (impedance value of 25%). For example, if the downstream branch circuit breakers used in a series rated combination have an interrupting rating of 14,000 A rms symmetrical for a 480 V system, the maximum allowable motor contribution to that panel from the branch circuit breakers is 140 A (1%). For typical induction motors, this is equivalent to a total horsepower at 480 V of approximately 115 horsepower.

Requirements of the NEC (NFPA 70) for series ratings may be met by equipment marked with ratings adequate for the available fault current at the point of application in the electrical system. Eaton panelboards and switchboards are marked consistent with NEC Article 240.83.

Additionally, Article 110.22 requires field marking on equipment where series ratings are used. This label is supplied standard with all Eaton panelboards and switchboards.

NEC Required Caution Label

Note: The NEC requires the installer to properly apply and complete this label. Label(s) must be placed on all equipment where series ratings are used.

Fuse Application Considerations

Fuses can be used instead of circuit breakers in fully rated, selectively coordinated and series connected protection systems.

Visit Eaton website at https://www.eaton.com/us/en-us/products/low-voltage-power-distribution-control-systems/series-rating.html or download Eaton Information Manual 1C96944H02 for fuse breaker data applied to series connected designs.

Don't apply fuses using the up-over-down method, which has been recommended by some fuse manufacturers for sizing a current-limiting fuse that protects a downstream molded case circuit breaker with a specified rms symmetrical interrupting rating. The method can lead to erroneous and unsafe conclusions, and should not be used.

Example: Assume a specific type of current-limiting fuse rated 2000 A. Then using the figure below:

1. Draw a vertical line from the prospective short-circuit current of 200 kA to intersect the typical peak let-through curve at "A."
2. Draw a horizontal line left from Point "A" to intersect the "prospective peak" curve at "B."
3. Drop a vertical line from "B" to intersect the horizontal axis and read the recommended rating, 65 kA rms, concluding that a circuit breaker with a 65 kA interrupting capacity will be protected by a specified 2000 A current-limiting fuse.

This conclusion is wrong when the downstream service has a blow-open contact assembly, as does a molded case circuit breaker or similar device.

The reason: The up-over-down method ignores dynamic impedance (the inherent current-limiting of the downstream molded case circuit breaker). Such impedance is developed directly by the forces of the let-through current created when the contacts are blown open.

For proper application of current-limiting fuses, always refer to recommendations by the manufacturer of the circuit breaker, which are based on actual test data.

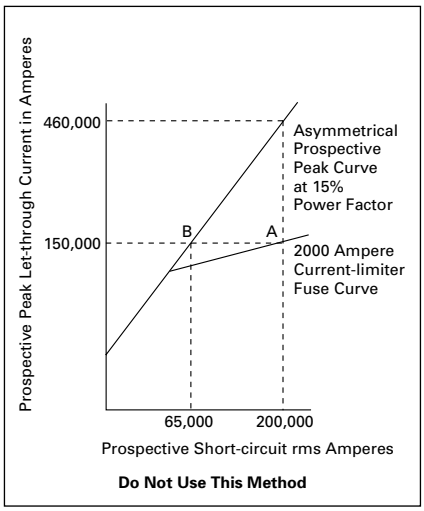


Figure 22.6-10. Old Up-Over-Down Chart

Applications of Series Ratings

Series ratings can be applied under the following guidelines:

Any FULLY RATED breaker can be applied upstream, downstream or in the middle of any of the series ratings stated in the tables.

Any series rating stated in the tables may have additional branch breakers of the EXACT SAME TYPE further downstream in that rating.

COMBINING SERIES RATINGS is allowed under certain conditions. Main and branch series ratings may be combined if:

- Breakers A, B and C are in series respectively from main to branch
- Breakers A and B series rate together
- Breakers A and C series rate at the same interrupting rating level (or higher)
- It is allowable to use A, B and C together at the A-B series rating

It is improper to combine series ratings under the following condition:

- Breakers A, B and C are in series respectively from main to branch
- Breakers A and B series rate together
- Breakers A and C series rate at the same interrupting rating level (or higher)
- It is NOT allowable to use A, B and C together at the A-B or B-C series rating

However, combining multiple overcurrent devices as in this example, can be accomplished if all devices in the series combination have been tested together.

For more information on available series ratings combinations, please see Information Manual 1C96944H02.

Panelboard Selection Guide

Table 22.6-13. Product Types

			
Type PRL1X	**Fusible Lighting Panelboard PRL1XF**	**Type PRL1X-LX Column Type**	**Type PRL2X**
Bolt-on or plug-on circuit breakers 240 Vac maximum	240 Vac maximum	Bolt-on circuit breakers 240 Vac maximum	Bolt-on or plug-on circuit breakers 240 or 480Y/277 Vac 125/250 Vdc maximum
Main lugs only 600 A maximum	Main lugs only 400 A maximum	Main lugs only 225 A maximum	Main lugs only 600 A maximum
Main circuit breaker 600 A maximum		Main circuit breaker 225 A maximum	Main circuit breaker 600 A maximum
Branch circuit breakers 100 A maximum Single, two- and three-pole	Branch overcurrent protective devices 30 A maximum Single-, two- and three-pole utilizing Class CC fuses	Branch circuit breakers 100 A maximum Single-, two- and three-pole	Branch circuit breakers 100 A maximum Single-, two- and three-pole

		
Fusible Lighting Panelboard PRL2XF	**Type PRL2X-LX Column Type**	**Retrofit Panelboard PRL-1RX and PRL-2RX**
240 and 480Y/277 Vac maximum	Bolt-on or plug-on circuit breakers 240 or 480Y/277 Vac 125/250 Vdc maximum	Bolt-on or plug-on circuit breakers 240 or 480Y/277 Vac
Main lugs only 400 A maximum	Main lugs only 225 A maximum	Main lugs only 225 A maximum
	Main circuit breaker 225 A maximum	Main circuit breaker 225 A maximum
Branch overcurrent protective devices 30 A maximum Single-, two- and three-pole utilizing Class CC fuses	Branch circuit breakers 100 A maximum Single-, two- and three-pole	Branch circuit breakers 100 A maximum Single-, two- and three-pole

Table 22.6-13. Product Types (Continued)

			
Type PRL3E	**Type PRL3X**	**Type PRL3XF**	**Type PRL4X / PRL4F**
Bolt-on circuit breakers 240 Vac maximum	Bolt-on circuit breakers 240, 480 or 600 Vac; 250 Vdc maximum	Bolt-on fusible switches 600 Vac; 125 Vdc maximum	Circuit breakers or fusible switches; 240, 480 or 600 Vac; 600 Vdc maximum
Main lugs only 600 A maximum	Main lugs only 800 A maximum	Main lugs only 400 A maximum	Main lugs only 1200 A maximum
			Main circuit breaker 1200 A maximum
Main circuit breaker 600 A maximum	Main circuit breaker 600 A maximum	Main fusible or non-fusible switch 400 A maximum	Main fusible switch 1200 A maximum
			Branch circuit breakers 1200 A maximum, Single-, two- and three-pole
Branch circuit breakers 125 A maximum Single-, two- and three-pole	Branch circuit breakers 225 A maximum Single-, two- and three-pole	Branch Bussmann Compact Circuit Protector Base with CUBEFuse 100 A maximum Single-, two- and three-pole	Branch fusible switches 1200 A maximum, Single-, two- and three-pole

		
Pow-R-Command	**Multipoint Metering Distribution Panelboard**	**Elevator Control Panelboard**
Bolt-on or plug-on circuit breakers 240 or 480Y/277 Vac	Bolt-on circuit breakers 600 Vac or 600 Vdc maximum	Bolt-on fusible switches 600 Vac maximum
Main lugs only 400 A maximum	Type PRL4X panelboard specially formatted to provide a compact and flexible multipoint metering solution for 250–1200 A applications	Controls for up to four elevators in a single panelboard
Main circuit breaker 400 A maximum		Main lugs only 800 A maximum
Branch circuit breakers 225 A maximum Single-, two- and three-pole		Branch overcurrent devices 15–200 A fusible switches with Class J fuse clips maximum
Single- and two-pole remote operated circuit breakers		
Integral load switching and dimming controls		Designed to meet specific sections various codes impacting elevators

Table 22.6-14. Panelboard Selection Guide

Panelboard Type	Device Type	Maximum Voltage Rating		Maximum Main Rating, Amperes		Branch Circuits Ampere Range	Short-Circuit Current Ratings rms Symmetrical Amperes, AC	
		AC	DC	Main Lugs Only	Main Device		Fully Rated (kA)	Series Rated (kA)
Pow-R-Line 1X ①	Breaker	240	—	600	600	15–100	10–22	22–200
Pow-R-Line 2X ①	Breaker	240 480Y/277	250	600 400 ②	600 400 ②	15–100 15–100	65 14	65–200 22–150
Pow-R-Line 3X ①	Breaker	240 480 600	250	800 800 800	600 600 600	15–225 15–225 15–225	10–200 14–100 14–35	22–200 22–150 —
Pow-R-Line 3E ①	Breaker	480	250	600	600	15–125	35–65	35–100
Pow-R-Line 4X ①	Breaker	240 480 600	600	1200 1200 1200	1200 1200 1200	15–1200 15–1200 15–1200	10–200 14–200 14–200	22–200 22–150 —
Pow-R-Line 4F ①	Fusible switch	240 600	250	1200 1200	1200 1200	30–1200 30–1200	100–200 100–200	— —
Pow-R-Line 4DX	Breaker	240 480	— —	1200 1200	1200 1200	20–600 Drawout 15–1200 Fixed	100 65	— —
Pow-R-Line 1XF	Fusible switch	240	—	400	400	15–30	200	200
Pow-R-Line 2XF	Fusible switch	480Y/277	—	400	400	15–30	200	200
Pow-R-Line 3XF	Fusible switch	600	125	400	400	15–100	200	200
Pow-R-Line 1X-LX	Breaker	240	—	225	225	15-30	10–22	18–200
Pow-R-Line 2X-LX	Breaker	480Y/277	125/250	225	225	15–30	14	25–150
Pow-R-Line 1RX	Breaker	240	—	225	225	15–100	10–22	22–100
Pow-R-Line 2RX	Breaker	480Y/277	—	225	225	15–100	14	22–150
Elevator control panelboard ①	Fusible	480	—	800	800	15–200	10–200	14–100

① Available with surge protective device (SPD) and metering.
② Amperage rating for DC voltage.

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