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Elevator control panelboards

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Panelboards Overview

Choices to quickly change feeder breakers in electrical distribution equipment have evolved over the years. While using drawout switchgear with power air circuit breakers remains a highly reliable solution, requests for drawout molded case circuit breakers (MCCBs) have increased. And, customers need a wall-mounted panelboard solution with front-accessibility and front-connected equipment to meet space requirements and application needs.

Eaton's drawout MCCB Pow-R-Line® 4DX (PRL4DX) panelboard provides this solution.

This is the first design to offer two- and three-pole MCCBs in a mechanical drawout design. Breaker ratings from 20 A to 600 A use unique drawout cassettes. Breakers are inserted and removed via a mechanical removal system similar to other drawout designs associated with switchgear; however, these breakers are horizontally mounted in a traditional panelboard group-mounted manner.

Market and Segment Applications

While the drawout MCCB panelboard design may be substituted for nearly any traditional application with feeder MCCBs, it has been specifically designed to meet the needs of several industries, including:

- Electrical distribution systems where a changeout of circuit breakers is needed to upgrade equipment to a new process
- Data centers
- Industrial facilities to minimize downtime
- Institutions
- Laboratories
- Healthcare facilities
- Critical load applications

Standards and Certifications

- UL® 67 Listed for wall-mounted applications from 600 A to 1200 A
- National Electrical Code®

Available Ratings

The panelboards are rated at 240 Vac, 480 Vac and 600 Vac. Fault current is available up to 200 kAIC at 240 Vac, 100 kAIC at 480 Vac and 65 kAIC at 600 Vac. The short-circuit current rating of the panelboard is determined by the low short-circuit current rating of the lowest rated overcurrent device in the panelboard.

Boxes and trims are UL 50 Listed and labeled. Both the box and the trim are painted ANSI-61 light gray. Deadfront covers are also painted ANSI-61 light gray to match box and trim.

Drawout feeder MCCBs are available in two- and three-pole offerings from 20 A to 600 A. Main breakers above 600 A are fixed-mounted using a traditional bolt-on design. Main breakers 600 A and below are available with either the traditional fixed-mounted, bolt-on design or in a drawout cassette. For drawout mains or feeders above 600 A, please use Eaton's switchboard offering.

Panelboard Options

- Copper and silver-plated copper
- Copper lugs
- Density-rated bus
- Ground bars
- Customer-owned meters
- Service entrance equipment construction
- Surge protective devices
- Seismically qualified panelboards

General Construction Features

Eaton's assembled panelboards are designed for sequence phase connection of branch circuit devices. This allows complete flexibility of circuit arrangement (single-, two- or three-poles) to allow balance of the electrical load on each phase.

Sturdy, rigid chassis assembly ensures accurate alignment of interior with panel front; prevents flexing and minimizes possibility of loosening or damage to current carrying parts during and after installation.

Four point in-and-out adjustment of panel interior is provided to meet critical depth dimensions on flush installations. This compensates for possible misalignment of box at installation.

Main lugs are mechanical solderless type and approved for copper and aluminum conductors.

Enclosures

Boxes are code-gauge galvanized steel except for column type panelboards, which include a painted box finished in ANSI-61 light gray to match the trim. Standard panelboard cabinets are designed for indoor use. Alternate types are available for outdoor and special purpose applications.

All enclosures are furnished in accordance with UL standards and include wiring gutters with proper wire bending space. Special cabinets can be provided at an additional charge.

The 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).

EZ™ Trim

The EZ Box and EZTrim are provided standard for Pow-R-Line 1X and Pow-R-Line 2X lighting panelboards, as well as Pow-R-Line 3X and Pow-R-Line 3E mid-range panelboards.

EZ Trim Provides Standard Door-in-Door Construction With No Exposed Hardware or Sharp Ridges. No Tools are Required for Installation.

The trims for lighting and appliance branch circuit panelboards and small power distribution panelboards include a door with rounded corners and concealed hinges. A flush-type latch and lock assembly is included. All locks are keyed alike. These trims are available in both surface and flush mounted designs.

Fronts for power distribution panelboards use a unique breaker front cover design in which each device has a dedicated bolt-on steel cover. The individual covers form a single deadfront for the panelboard that is used in conjunction with two wiring gutter covers to complete the trim. A door is not finished as part of the standard offering on these panelboards but can be provided, for an additional charge, using a deeper than standard box.

Combination AFCI Circuit Breakers

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

Elevator Control Panelboards

Elevator control panelboards integrate electrical protection and controls for elevators and meet stringent code requirements in a single, cost-effective package.

Application Considerations and Definitions

Standards

All Eaton's panelboards are designed to meet the following applicable industry standards, except where noted:

1. Underwriters Laboratories
   a. Panelboards: UL 67
   b. Cabinets, boxes and trims: UL 50

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

2. National Electrical Code
3. NEMA Standards: PB 1
4. 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:

a. Service (voltage and frequency).
b. Interrupting capacity (fully or series rated).
c. Ampere rating of main.
d. Ampere ratings of branches.
e. Installation environment.
f. Codes and standards mandates.

Panelboard Short-Circuit Rating

The short-circuit rating of Eaton's assembled panelboards are test verified by, and listed with, Underwriters Laboratories. Generally, these ratings are that of the lowest interrupting rated device in the panel.

Certain exceptions to this rule exist where branch devices have been UL tested in combination with specific main devices having a higher interrupting rating. Where these defined main breaker and branch breaker combinations are used, the **series short-circuit rating** of the assembled panelboard will be the same as the series tested rating of the approved rated main breaker. Available main and branch breaker combinations are tabulated on **Page 22.5-11** through **Page 22.5-21**. All combinations shown are UL tested and listed.

These 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

Please refer to Molded Case Circuit Breakers Design Guides for detailed information on overcurrent protective device combinations for use on selectively coordinated systems.

Service Entrance Equipment

NEC Articles 230.F and G, and UL, require that:

a. Panels used as service entrance equipment must be located near the point where the supply conductors enter the building.
b. A panelboard having main lugs only shall have a maximum of six service disconnects to de-energize the entire panelboard from the supply conductors. Where more than six disconnects are required, a main service disconnect must be provided.
c. Must include connector for bonding and grounding neutral conductor.
d. A service-entrance-type UL label must be factory installed.
e. 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.

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, for connection to one feeder, must be furnished in more than one section (box), 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 that is not protected by a single main overcurrent device either in the panelboard or immediately upstream, i.e., service entrance panelboards with main lugs only using the six disconnect rule.

Sub-Feed Lugs (Figure 22.5-1)

Sub-feed lugs are one means of interconnecting multi-section panels. The sub-feed (second set of) lugs are mounted directly beside the main lugs. These are required in each section except the last panel in the lineup. The feeder cables are brought into the wiring gutter of the first section and connected to the main lugs. Another set of the same size cables are connected 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.

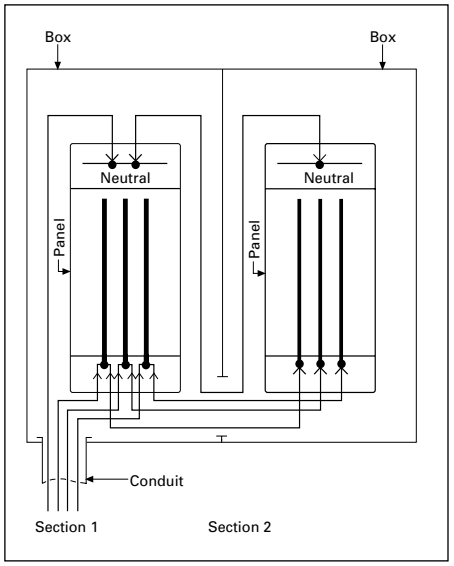

Figure 22.5-1. Sub-Feed Lugs

Through-Feed Lugs (Figure 22.5-2)

Through-feed lugs are another method to interconnect multi-section panelboards. The incoming feeder cables are connected to the 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. The interconnecting cables are connected to the through-feed lugs in Section 1 and are carried over to the main lugs in Section 2. The connection arrangement could be reversed, i.e., main lugs at top; through-feed lugs at bottom end of panel. Cross cables are not furnished by Eaton.

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

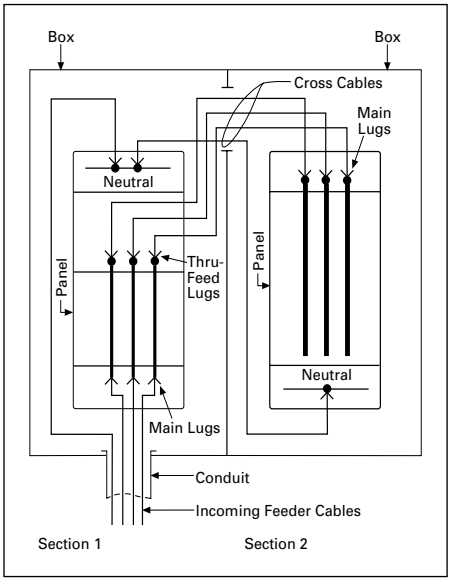

Figure 22.5-2. Through-Feed Lugs

Multiple Section Panelboard—Flush Mounted

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

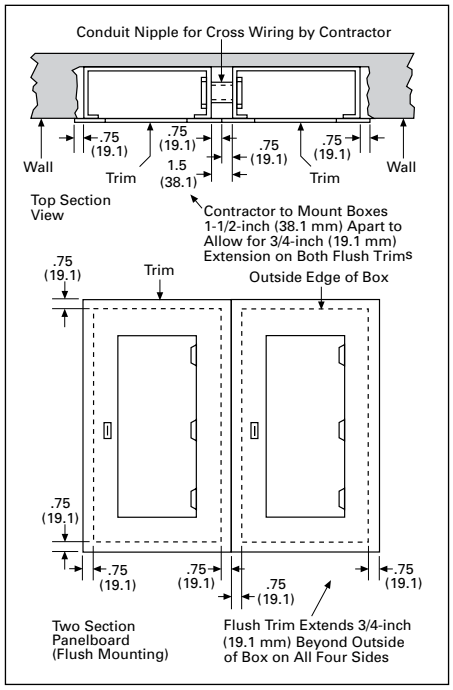

Figure 22.5-3. Multiple Section Panelboard—Flush Mounted—Dimensions in Inches (mm)

Branch Circuit Loading for Lighting Panels

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

a. Lighting circuits: NEC Article 210, 215, 220 and 240.
b. Distribution circuits, actual or continuous loads: NEC Article 384.16.
c. Motor circuits: NEC Article 430.
d. Diversity factor.
e. Provision for future loading.

Overcurrent Protection

National Electrical Code 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 the National Electrical Code Article 408 for specifics.

Ground Fault Protection

Ground fault protection (GFP) may be added to most panelboards using Eaton's integral molded case circuit breaker GFP and included feeder devices on power panelboards and mains on all panelboards.

Arcflash Reduction Maintenance System™

Eaton's Arcflash Reduction Maintenance System is available on many molded case circuit breakers from 70 A to air power circuit breakers at 5000 A. Recognized by the 2011 National Electrical Code and the National Electrical Safety Code (NFPA 70E), the Arcflash Reduction Maintenance System allows breakers to trip quickly thus significantly reducing the available arc flash potential.

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 the overcurrent protective devices.

UL test procedures are based, in part, on 80% loading of panelboard branch circuit devices. Article 408 of the NEC 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 such factors as ambient temperature, duty cycle, frequency or altitude.

Exception: There is one exception to this rule in both UL and NEC. It applies to assemblies and overcurrent devices that have been approved for continuous duty at 100% of its rating. This exception is covered in NEC 210.20 (a). Also see Molded Case Circuit Breakers Design Guides for additional information.

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:

a. Excessive vibration or shock.
b. Frequencies above 60 cycles.
c. Altitudes above 6600 ft (2012 m).
d. Damp environment (possible fungus growth).
e. 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. However, 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, Eaton recommends a harmonic survey be conducted of the distribution system, be it new or existing.

Surge Protective Devices (SPD)

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

Electrical loads and microprocessor-based equipment are highly susceptible to both high and low energy transients. High energy transients include lightning induced surges and power company switching. These high energy transients can destroy components instantly.

More frequently the electrical system experiences low energy transients and high frequency noise.

The effects of continual low energy transients and high frequency noise can cause erratic equipment performance or sudden failure of electronic circuit board components.

Eaton can provide protective and diagnostic systems integral to panelboards. The SPD is integrated into the panelboards using a “zero lead length” direct bus bar connection. Integral disconnect is used on all Pow-R-Line 4 panels.

Eaton SPDs May be Integrated into Most Panelboards

The SPD protects sensitive electronic equipment from the damaging effects of high and low energy transients.

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

Compact Panelboard Meter

Most Eaton panelboards can integrate a compact meter for reading the panelboard power and energy usage. Eaton’s Power Xpert Meter 350 has ANSI 12.20 0.5% accuracy, a bright backlit LCD display, real energy pulse output, phase loss alarm and optional RS-485 communication capability.

Product Overview

Elevator Control Panelboard

General Description

Panelboard Ratings

Ratings

- 240 Vac and 600 Vac
- Three-phase, three-wire and three-phase, four-wire
  - ❑ 200 kA short-circuit current ratings

Main Lugs Only

- 800 A maximum

Branch Devices

- 30–200 A, 240 Vac and 600 Vac fused switch to feed the elevator

Elevator Controls Standard Features

- Factory wired from switch to controls
- 200 kA rms short-circuit current rating
- 120 Vac shunt trip
- Ground termination
- Branch fusible switch
- Class J fuse clips on switch (fuses not included)
- 100 VA Control Power Transformer (CPT) with 120 Vac secondary
- CPT primary and secondary fusing
- Selection of primary CPT voltages
- Fire safety interface relay with user-selected coil voltage
- Fire alarm voltage monitoring relay
- Keyed test switch
- "ON" pilot light; user selects color

Note: Fuses are not sold with panelboard products and can be purchased through authorized Bussmann distributors.

Standards

- The Elevator Control Panelboard meets and is listed to the following standards:
  - ❑ UL 67 listed panelboard
  - ❑ UL 50 listed enclosure
  - ❑ UL 98 listed fusible elevator control fusible switches

Options

- Integrated Surge Protective Device (SPD) 100–400 kA
- Specialized control to meet local codes

Application Description

The Elevator Control Panelboard is designed to replace multiple components provided in elevator control rooms, thus consolidating and standardizing this area. With the ability to control up to four elevators in a common shaft, the Elevator Control Panelboard offers the needed controls in a space-saving design while allowing access by the various trades involved with the installation.

Not only does the Elevator Control Panelboard provide electrical feeds, it also contains necessary components for the control of the elevator and the fire alarm system.

Codes

The Elevator Control Panelboard is designed to meet the following codes:

- NFPA 70 (National Electrical Code)
- NFPA 72 (National Fire Alarm Code)
- ANSI/ASME A17.1 (Safety Code for Elevators and Escalators)
- NFPA 13 (Installation of Sprinkler Systems)

Selective Coordination

Eaton's Elevator Control Panelboard has superior selective coordination properties. When paired with the appropriate upstream fusing, the elevator control panelboard can selectively coordinate with higher fault current levels. All fuses must be of the same manufacturer. Consult the specific fuse manufacturer's data for selective coordination values.

Surge Protective Device (SPD)

Surge Protective Devices (SPD) may be integrated into all Elevator Control Panelboards. Because most installation calls for SPDs, integrating an Eaton SPD ensures proper installation and significantly limits destructive let-through beyond all size-mounted solutions.

Table 22.5-1. Elevator Feeder Devices

Ampere Rating	Fuse Class	Short-Circuit Current Rating (kAIC Symmetrical)	
		240 Vac	600 Vac
30 60	Class J Class J	200 200	200 200
100 200	Class J Class J	200 200	200 200

Table 22.5-2. Box Sizing and Selection—Dimensions in Inches (mm)

Ampere Rating	Number of Elevators	Dimensions			
		Without SPD		With SPD	
		Width	Height	Width	Height
400 400 400	2 3 4	40.00 (1016.0) 40.00 (1016.0) 40.00 (1016.0)	57.00 (1447.8) 57.00 (1447.8) 57.00 (1447.8)	40.00 (1016.0) 40.00 (1016.0) 40.00 (1016.0)	73.00 (1854.2) 73.00 (1854.2) 73.00 (1854.2)
600 600 600	2 3 4	40.00 (1016.0) 40.00 (1016.0) 40.00 (1016.0)	57.00 (1447.8) 57.00 (1447.8) 57.00 (1447.8)	40.00 (1016.0) 40.00 (1016.0) 40.00 (1016.0)	73.00 (1854.2) 73.00 (1854.2) 73.00 (1854.2)
800 800	3 4	40.00 (1016.0) 40.00 (1016.0)	73.00 (1854.2) 73.00 (1854.2)	40.00 (1016.0) 40.00 (1016.0)	73.00 (1854.2) 73.00 (1854.2)

Note: Dimensions reflect NEMA Type 1 enclosures. All boxes are 11.31 inches (287.3 mm) deep.

Terminal Wire Ranges

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 22.5-3. Standard Main Lug Terminals

Panel Type	Wire Size Ranges for Ampere Capacity						
	100 A	225 A	250 A	400 A	600 A	800 A	1200 A
Elevator control	—	—	#4–500 kcmil	(2) #4/0–500 kcmil	(2) #4/0–500 kcmil	(3) #4/0–500 kcmil	—

Note: Optional 750 kcmil mechanical screw-type terminals are available upon request. Panelboard dimensions may be affected. Refer to Eaton.

Table 22.5-4. Fusible Switch Terminals

Ampere Rating	Wire Size Ranges
30 60 100	#14–1/0 #14–1/0 #14–1/0
200	#4–300 kcmil
400	250–750 kcmil or (2) 3/0–250 kcmil
600	(2) #4–600 kcmil or (4) 3/0–250 kcmil
800	(3) 250–750 kcmil or (6) 3/0–250 kcmil
1200	(4) 250–750 kcmil or (8) 3/0–250 kcmil

Metering Devices

Power Xpert Meter 1000

Power Xpert Meter 2000

IQ 130/140/150

The Power Xpert 1000 Meter

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) is a revenue grade power and energy meter that delivers a cost-effective solution for energy and sub-metering applications. This three-phase meter provides high accuracy and advanced features in the standard 4-inch form factor and can be expanded with multiple modular I/O options.

Key features include:

- ANSI C12.20 and IEC 62053-22 utility billing accuracy will help meet stringent customer specifications
- Available in 5 A and 333 mV CT type inputs, allowing 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.

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

IQ 130/140/150

Providing the first line of defense against costly power problems, Eaton's IQ 100 electronic power meters can perform the work of an entire wall of legacy metering equipment using today's technology.

- 24-bit AD converters that sample at more than 400 samples per cycle
- Meet ANSI C12.20 standards for accuracy of 0.5 percent
- Confidently used for primary revenue metering and submetering applications
- Direct-reading metered values such as watts, watt demand, watthours, voltage amperes (VA), VA-hours, vars, varhours and power factor
- Also available in Eaton's enclosed meter product

IQ 250/260

The IQ 250 and IQ 260 electronic meters provide capabilities you wouldn't normally expect in an affordable, ultra-compact meter—such as fast sampling rate and accurate metering for a full range of power attributes. Built-in slots allow for future upgrades.

- Comprehensive metering
- High-end accuracy
- Self-test capability to validate accuracy
- Large, easy-to-read display
- Local or remote configuration
- Industry-standard communication protocols
- Mix-and-match input/output options
- Integration with Eaton's Power Xpert Architecture
- Field-upgradeable

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

Monitoring Equipment and Surge Protective Devices

Power Xpert Multi-Point Meter

Power Xpert Gateway

Integrated Surge Protective Devices

Power Xpert Multi-Point Meter

Eaton Power Xpert Multi-Point meter (PXMP) helps facility managers track and accurately allocate energy usage among tenants or departments in office buildings, shopping malls, industrial sites, universities and campuses, and apartment and condominium complexes. Power Xpert Multi-Point Meters monitor, quantify and help benchmark energy usage.

Key features include:

- Meets rigid ANSI C12.20 and IEC 62053-22 accuracy specifications for revenue meters
- Quick connect terminals for current sensors, Modbus communication and bus voltages
- Monitors power and energy for up to 60 current sensors; scalable from 6 to 60 circuits
- 256 MB of standard memory for up to two years of 15-minute interval data
- Extensive LEDs for verification of sensor connections, communication status and equipment status
- Automatically detects rating of each current sensor; current sensors are self-protecting in the event of an open circuit condition under load for added safety and reliability

For more information, visit www.eaton.com/meters.

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.

For detailed information, please 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.

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 22.5-4**), or it may be mounted remote (**Figure 22.5-5**) 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.

From the tables on **Page 22.5-13** through **Page 22.5-21**, specific combinations of main devices (upstream) and branch devices (downstream), series connected and electrically adjacent in the system, may be selected to qualify the assembled panelboard for the short-circuit ratings shown. Series ratings apply **only** to those Eaton breakers listed and published. **Do not use "Classified" breakers.**

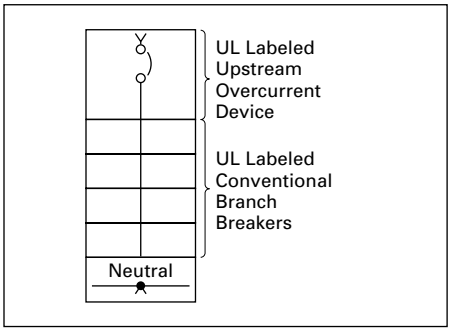

Figure 22.5-4. Main Device

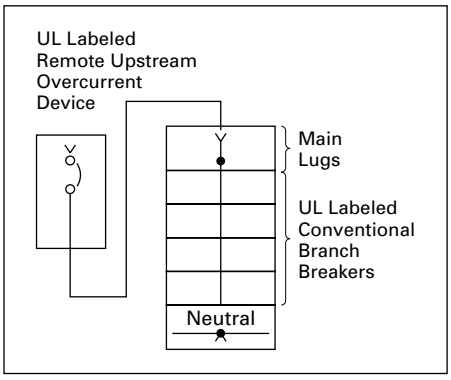

Figure 22.5-5. Mounted Remote

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 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—Where 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 overcurrent 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. See the tables on **Page 22.5-19** through **Page 22.5-21** 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.

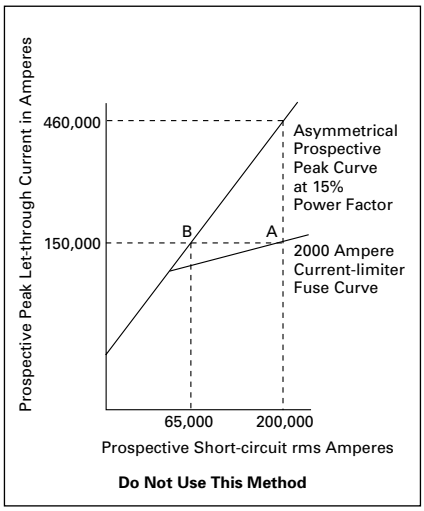

Figure 22.5-6. Old Up-Over-Down Chart

Applying Series Ratings

The following is provided to use the series rating tables on the following pages.

Step 1. Determine the available system voltage and fault current.

Step 2. Select the appropriate table using the system voltage.

Step 3. Use the appropriate "Series Equipment Rating" column equal to, or greater than, the available fault current, to determine the allowable combinations of main (upstream) and branch (downstream) overcurrent devices. Main devices are shown in bold/shaded areas. Respective branch breakers are shown directly below their associated main device. If a rating is not initially found in a column, first look to the columns to the right for higher "Series Equipment Ratings" within the same table. If still not found, use ratings from table of a higher system voltage (higher numbered tables).

Example 1:

240 V, three-phase, three-wire, AC system with available fault current of 37,438 A. Main (upstream) device is a three-pole, 150 A, PDG2xG breaker. The branch (downstream) breakers are two- and three-pole, 20, 30 and 60 A, 240 V, BAB breakers.

1. Go to the 240 V table (**Table 22.5-6**).
2. Look down under the 42 kA column. This rating is not shown.
3. Look to the columns to the right. This rating is shown under the 65 kA column, and therefore is valid.

Example 2:

480Y/277 V, three-phase, four-wire, AC system with available fault current of 62,097 A. Main (upstream) device is a three-pole, 250 A breaker. The branch (downstream) breakers are two- and three-pole, 60, 70 and 100 A FDB breakers.

1. Go to the 480Y/277 V table (**Table 22.5-9**).
2. Look down under the 65 kA column. This rating is not shown.
3. Look to the columns to the right. This rating is still not shown.
4. Look at the table with the next higher system voltage (480 V, **Table 22.5-10**).
5. This rating is shown under the 65 kA column, and therefore is valid.

Example 3:

208Y/120 V, three-phase, four-wire, AC system with available fault current of 56,438 A. Main (upstream) device is a three-pole, 225 A, PDD2xG breaker. The branch (downstream) breakers are single-pole, 20 A BAB (120/240 V), and two- and three-pole, 70 A BAB (240 V).

1. Go to the 240 V table (**Table 22.5-6**).
2. Look under the 65 kA column. This rating is shown under the 65 kA column, and therefore is valid for the two- and three-pole (240 V) breakers.
3. Look at the 120/240 V table (**Table 22.5-5**) for the single-pole (120/240 V) rating.
4. Look under the 65 kA column. This rating is shown under the 65 kA column, and therefore is valid for the single-pole (120/240 V) breakers.

Other Applications of Series Ratings

Series ratings can also 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 B 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 and listed in triple rating **Table 22.5-18**.

Main devices shown centered at top in shaded area, respective branch devices shown directly below.

Table 22.5-5. 120/240 Vac—Breaker/Breaker Series Ratings
Main devices are shown centered at top, in shaded area. Respective branch devices shown directly below.

Main Breaker Maximum Amperes	Series Equipment Rating—kA Symmetrical											
	18	22	42	65			100			200		
100	**PDG2xF** BAB HQP QBGF QBGFT QBCAF	**QBHW QPHW** BAB HQP QBGF QPGF QBAG QBGFT QPGFT		**GB, GHB** BAB HQP QBGF QPGF QBAG QBHW QPHW QBHW QPHW QBGFT QPGFT QBCAF			**FB-P** BAB HQP QBGF QPGF QBAG QBHW QPHW PDG2xF PDG2xG QBGFT QPGFT			**FCL** BA HQP QBGF QPGF QBAG QBHW QPHW GB, GHB GHQ PDG2xF PDG2xG PDG2xM QBGFT QPGFT QBCAF	
125				**BRX** BAB (15–70 A) BAB (90–100 A) HQP (15–70 A) HQP (90–100 A)			**EGH** GHQ, GHB					
150	BAB HQP QBGF QBAG QBGFT QBCAF			**PDG3xG*** BAB HQP QBHW QPHW			BAB HQP GHB PDG2xF PDG2xG (15–150 A) QBHW QPHW					
200							**LA-P** BAB HQP QBHW QPHW PDG2xF PDG2xG					

Table 22.5-5. 120/240 Vac—Breaker/Breaker Series Ratings (Continued)
Main devices are shown centered at top, in shaded area. Respective branch devices shown directly below.

Main Breaker Maximum Amperes	Series Equipment Rating—kA Symmetrical										
	18	22	42	65			100			200	
225		**PDD2xF**		**PDD2xG, PDG2xG**	**FDE**		**PDD2xM**		**PDG2xP**		**PDG2xP**
		BAB HQP QBGF QPGF QBHGF QPHGF QBHW QPHW QBAG QBGFT QPGFT QBHGFT QPHGFT	BAB HQP QBGF QPGF QBHGF QPHGF QBHW QPHW QBAG QBGFT QPGFT QBHGFT QPHGFT QBCAF	BAB HQP QBGF QPGF QBAG QBHW QBHGF QBGFT QPGFT QBHGFT QBCAF	QBGF QPGF QBAG QBHGF QBGFT QPGFT QBHGFT QBCAF QPHGF QPHGFT	BAB HQP QBHW QPHW	BAB ① HQP ① QBGF QPGF QBAG QBGFT QPGFT QBCAF	BAB HQP QBGF QBAG QBHW QPHW QBHGF GB, GHB GHQ, GHQRSP PDG2xF, EGS PGD2xG QBGFT QPGFT QBCAF	BAB HQP QBHW QPHW BAB HQP QBGF QBAG QBHW QPHW QBHGF GHB, PDG2xF PDG2xG (15–150 A) QBGFT EGS PDG3xG* (15–150 A) QBCAF QBHGFT QPGF QPGFT QPHGF QPHGFT		GB, GHB GHQ PDG2xF PDG2xG PDG2xM EGS EGH
250				**JD**							
				BAB (15–70 A) HQP (15–70 A) QBHW QPHW PDG2xF	BAB HQP QBHW QPHW	QBGF QPGF QBAG QBGFT QPGFT QBCAF	GB, GHB PDG2xF PDG2xG EGS	BAB HQP QBHW QPHW		GB, GHB PDG2xF PDG2xG PDG2xM EGS EGH	
400		**PDD3xGy**	**PDG3xG* PDF3xG**	**PDG3xM* PDF3xM**	**PDD3xGy PDF3xG**	**KDPDG3xP**	**PDG3xM* PDF3xM**	**PDG3xP***		**PDG3xP**	**LCL**
		BAB HQP QBGF QPGF QBAG QBGFT QPGFT	BAB (15–70 A) HQP (15–70 A) QBHW QPHW	BAB (15–70 A) HQP (15–70 A) QBHW QPHW	PDG2xF	BAB (15–70 A) HQP (15–70 A)	GB, GHB PDG2xF PDG2xG EGS ②	QBHW QPHW		GB, GHB PDG2xF PDG2xG PDG2xM EGS EGH	BAB HQP QBGF QPGF QBAF QBAG QBHW QPHW GB, GHB PDG2xF PDG2xG PDG2xM QBGFT QPGFT QBCAF
600							PDG2xF				
800							**PDG4xM** PDG2xF				
1200							PDG5xM PDG5xM-C PDG2xF PDD2xF PDD2xG				

① Single-pole version is restricted to 15–70 A.
② Not valid with PDF3xM.

Series Rated Combinations

Table 22.5-6. 240 Vac—Breaker/Breaker—Series Ratings

For single- and two-pole 120/240V rated breakers (BA, BAB, HQP, QBHW, QPHW), see **Table 22.5-5**.
Main devices are shown centered at top, in shaded area. Respective branch devices shown directly below.

Main Breaker Maximum Amperes	Series Equipment Rating—kA Symmetrical								
	18	22	42	65		100			200
100	**PDG2xF** BAB_H HQP_H	**QBHW_H** **QPHW_H** BAB_H HQP_H		**GB, GHB** BAB_H HQP_H QBHW_H QPHW_H		**FB-P** BAB_H HQP_H PDG2xF PDG2xG			**FCL** BAB_H HQP_H QBHW_H QPHW_H GB, GHB PDG2xF PDG2xG PDG3xG* PDG2xM*
125						**EGH** GHB			
150	**FDB** BAB_H HQP_H								
200						**LA-P** BAB_H HQP_H QBHW_H QPHW_H PDG2xF PDG2xG JDB			
225		**PDD2xF** HQP_H BAB_H QBHW QPHW	HQP_H BAB_H QBHW QPHW **CHH** BAB_H	**PDD2xG** BAB_H HQP_H QBHW_H	**PDG2xG, PDG3xG*** BAB_H HQP_H QBHW_H QPHW_H PDG2xF ①	**PDD2xM, EDC** BAB_H HQP_H	**PDG2xM** BAB_H HQP_H QBHW_H QPHW_H GB, GHB PDG2xF PDG2xG PDG3xG*	**PDG2xP** BAB_H HQP_H QBHW_H QPHW_H	**PDG2xP** GB, GHB PDG2xF PDG2xG PDG3xG* PDG2xM
250				**JDB** BAB_H (15–70A) HQP_H (15–70 A) QBHW_H QPHW_H PDG2xF	BAB_H (15–70 A) HQP_H (15–70 A) QBHW_H QPHW_H	GB, GHB PDG2xF PDG2xG PDD2xG JDB EGS	BAB_H HQP_H QBHW_H QPHW_H		GB, GHB PDG2xF PDG2xG PDG3xG* PDG2xM, PDD2xF PDD2xG PDD2xM JDB EGS, EGH

① Valid on two- and three-pole breaker only. Not valid for single-pole.

Table 22.5-7. 240 Vac—Breaker/Breaker—Series Ratings
For single- and two-pole 120/240 V rated breakers (BA, BAB, HQP, QBHW, QPHW), see **Table 22.5-5**.
Main devices are shown centered at top, in shaded area. Respective branch devices shown directly below.

Main Breaker Maximum Amperes	Series Equipment Rating—kA Symmetrical				
	65	**100**		**200**	
400	**PDD3xGy, PDG3xG* PDF3xG** BAB_H HQP_H QBHW_H QPHW_H PDG2xF	**PDG3xM*, PDF3xM** QBHW_H ① QPHW_H ① GB, GHB PDG2xF PDG3xG*, PDG2xG PDD2xF, PDD2xG JDB PDD3xGy, PDG3xG* EGS ②	**PDG3xP*** QBHW_H QPHW_H	**PDG3xP** GB, GHB PDG2xF PDG2xG, PDG3xG* PDG2xM, PDD2xF PDD2xG, PDD2xM JDB PDG3xG* PDD3xGy PDG3xM*	**LCL** BAB_H HQP_H QBHW_H QPHW_H GB, GHB PDG2xF PDG2xG, PDG2xM PDD2xF, PDD2xG PDG3xG* PDD2xM, JDB PDD3xGy, PDG3xG* PDG3xM
500		**NB-P** JDB PDG3xG*, PDD3xGy PDF3xG			
600		**HLDB** GB ①, GHB ① PDG2xG, PDD2xF PDD2xG, PDG2xF JDB PDG3xG*, PDD3xGy, PDF3xG, LDB		PDD2xF, PDD2xG PDD2xM	
800		**NB-P** PDG3xG*, PDD3xGy	**PDG4xM** PDG2xF PDG2xG		
1200		**PDG5xM** PDD2xF, PDD2xG PDG2xF			**PDG5xP** PDD2xF, PDD2xG PDD2xM
2500		PDD2xF, PDD2xG			PDD2xF, PDD2xG PDD2xM

① Valid on two- and three-pole breakers only. Not valid for single-pole.
② Not valid with PDF3xM.

Main devices shown in shaded area, respective branch devices shown directly below.

Table 22.5-8. 277 Vac—Breaker/Breaker Series Ratings
Main devices are shown centered at top, in shaded area. Respective branch devices shown directly below.
All ratings in this table apply to single-pole branch breakers only. For two- and three-pole branch breakers, see other tables.

Main Breaker Maximum Amperes	Series Equipment Rating—kA Symmetrical						
	22	**25**	**35**	**65**	**100**		**150**
100							**FCL** GHB GHQ, GHQRSP PDG2xF PDG2xG PDG2xM
125			**EGS** GHQ, GHB	**EGH** GHQ, GHB			
225			**PDG2xG, PDG3xG*** GHB GHQ GHQRSP ① GHBGFEP ①	**PDG2xM** GHB GHQRSP ② GHBGFEP ② GHQ PDG2xF PDG2xG	**PDG2xP** GHB PDG2xF PDG2xG PDG2xM		
250	**JD, JDB** GHB		**JD, JDB** GHB (15–50 A) GHBGFEP ③	**HJD** GHB (15–50 A) PDG2xF PDG2xG GHBGFEP	**LCL** PDG2xP	**JDC** GHB PDG2xF PDG2xG PDG2xM	
400	**PDG3xG*** **PDF3xG** GHB	**PDG3xM*** **PDF3xM** GHB	**PDG3xG*** **PDF3xG** GHB PDG2xF PDG2xG GHQ ④	**PDG3xM*, PDF3xM** GHB PDG2xF PDG2xG GHQ ⑤	**PDG3xP*** GHB PDG2xF PDG2xG PDG2xM		**LCL** GHB PDG2xF PDG2xG PDG2xM

① Not valid with PDG3xG*.
② Not valid with HFDE.
③ Not valid with JDB.
④ Not valid with PDF3xG.
⑤ Not valid with PDF3xM.

Table 22.5-9. 480Y/277 Vac—Breaker/Breaker Series Ratings
Main devices are shown centered at top, in shaded area. Respective branch devices shown directly below.
All ratings in this table apply to two- and three-pole branch breakers only. For single-pole branch breakers, see **Table 22.5-8**.

Main Breaker Maximum Amperes	Series Equipment Rating—kA Symmetrical					
	22	**25**	**35**	**65**	**100**	**150**
100						**FCL** GHB, GHQRSP
125			**EGS** GHB	**EGH** GHB		
225			**PDG2xG, PDG3xG*** GHB, GHQRSP ⑥	**PDG2xM** GHB, GHQRSP ⑦	**PDG2xP** GHB	
250	**JDB** GHB		**JDB** GHB (15–50 A)	GHB (15–50 A)	GHB	
400	**PDG3xG*** **PDF3xG** GHB	**PDG3xM*, PDF3xM** GHB	**PDG3xG*** **PDF3xG** GHB (15–50 A)	**PDG3xM*, PDF3xM** GHB (15–50 A)	**PDG3xP*** GHB (15–50 A)	**LCL** GHB

⑥ Not valid with PDG3xG*.
⑦ Not valid with HFDE.

Main devices shown in shaded area, respective branch devices shown directly below.

Table 22.5-10. 480 Vac—Breaker/Breaker Series Ratings
Main devices are shown centered at top, in shaded area. Respective branch devices shown directly below.
All ratings in this table apply to two- and three-pole branch breakers only. Not valid for single-pole branch breakers.

Main Breaker Maximum Amperes	Series Equipment Rating—kA Symmetrical					
	25	**35**	**65**	**100**		**150**
100				**FB-P** PDG2xF PDG2xG PDG2xM		**FCL** PDG2xF PDG2xG, PDG3xG* PDG2xM
200				**LA-P** PDG2xF PDG2xG PDG2xM JDB		
225		**PDG2xG, PDG3xM,** PDG2xF	**PDG2xM*** PDG2xF PDG2xG, PDG3xG EGS ①	**PDG2xP** PDG2xF, EGS, EGH PDG2xG, PDG3xG* PDG2xM		
250	**JDB** PDG2xF		PDG2xF PDG2xG PDG3xG* JDB EGS	PDG2xF, EGS, EGH PDG2xG, PDG3xG* PDG2xM JDB		**LCL** PDG3xG*
400		**PDG3xG*** PDG2xF	**PDG3xM*** PDG2xF PDG2xG, PDG3xG* JDB PDG3xG* EGS	**PDG3xP*** PDG2xF, EGS, EGH PDG2xG, PDG3xG* PDG2xM JDB PDG3xG* PDG3xM*	**LA-P** JDB PDG3xG* PDG3xM*	**LCL** PDG2xF PDG2xG, PDG3xG* PDG2xM PDG2xP JDB PDG3xG* PDG3xM*
500				**NB-P** JDB PDG3xG* PDG3xM*		
600		**LDB** **CLD** JDB	**HLDB** PDG2xG, PDG3xG* JDB PDG3xG* LDB			

① Not valid with HFDE.

Table 22.5-11. 600 Vac—Breaker/Breaker Series Ratings
Main fuse class shown centered at top, in shaded area. Respective branch devices shown directly below.
All ratings in this table apply to two- and three-pole branch breakers only. Not valid for single-pole branch breakers.

Main Breaker Maximum Amperes	Series Equipment Rating—kA Symmetrical					
	18	**25**	**35**	**42**	**50**	**100**
225	**PDG2xG**	**PDG2xM**	**PDG2xP**			
		PDG2xG	PDG2xG, PDG3xG* PDG2xM			
250	**JDB**					**LCL**
		PDG2xG JDB	PDG2xG PDG2xM JDB			PDG3xG*
400		**PDG3xG***	**PDG3xM*, PDF3xM**	**PDG3xP***	**PDG3xP***	**LCL**
		PDF3xG	PDG2xG, PDG3xG* PDG2xM JDB	PDG2xG, PDG3xG* PDG2xM	JDB PDG3xG* PDG3xM*	PDG2xG, PDG3xG* PDG2xM PDG2xP JDB PDG3xG* PDG3xM* PDG3xP*
		PDG2xG JDB				
600		**LDB**	**HLDB**			
		CLD	PDG3xG* LDB			
		PDG2xG JDB				

Table 22.5-12. 120/240 Vac—Fuse/Breaker Series Ratings
Main fuse class shown centered at top, in shaded area. Respective branch devices shown directly below.

Main Fuse Maximum Amperes	Series Equipment Rating—kA Symmetrical					
	100			**200**		
100						**R**
						BAB HQP QBHW QPHW GB GHB
200			**R**	**J**	**T**	
			GB GHB	BAB HQP QBHW QPHW	BAB HQP QBHW QPHW	
400	**J**	**T**		**J**	**T**	
	BAB HQP QBHW QPHW	BAB HQP QBHW QPHW		GB GHB	GB GHB	

Main devices shown in shaded area, respective branch devices shown directly below.

Table 22.5-13. 240 Vac—Fuse/Breaker Series Ratings
For single- and two-pole 120/240 V rated breakers (BA, BAB, HQP, QBHW, QPHW), see **Table 22.5-12**.
Main fuse class shown centered at top, in shaded area. Respective branch devices shown directly below.

Main Fuse Maximum Amperes	Series Equipment Rating—kA Symmetrical					
	100			200		
100						**R** BAB_H HQP_H QBHW_H QPHW_H GB GHB
200			**R** GB GHB	**J** BAB_H HQP_H QBHW_H QPHW_H	**T** BAB_H HQP_H QBHW_H QPHW_H	**R** GB ① GHB ①
400	**J** BAB_H HQP_H QBHW_H QPHW_H	**T** BAB_H HQP_H QBHW_H QPHW_H		**J** GB GHB	**T** GB GHB	
600			**L** PDG2xF PDG2xG, PDG3xG* PDD2xG JDB PDD3xGy, PDG3xG*			

① Valid on two- and three-pole breakers only. See **Table 22.5-12** for single-pole.

Table 22.5-14. 277 Vac Fuse/Breaker Series Ratings
Main fuse class are shown centered at top, in shaded area. Respective branch devices shown directly below. All ratings in this table apply to single-pole branch breakers only. For two- and three-pole branch breakers, consult other tables.

Main Fuse Maximum Amperes	Series Equipment Rating—kA Symmetrical						
	65		100			200	
100			**J** GHQ GHQRSP	**T** GHQ GHQRSP		**R** GHB	
200	**J** GHQ GHQRSP	**T** GHQ GHQRSP	**J** PDG2xF PDG2xG PDG2xM	**T** PDG2xF PDG2xG PDG2xM	**R** GHB		
400						**J** GHB	**T** GHB

Table 22.5-15. 480Y/277 Vac—Fuse/Breaker Series Ratings
Main fuse class shown centered at top, in shaded area. Respective branch devices shown directly below. All ratings in this table apply to two- and three-pole branch breakers only. For single-pole branch breakers, see **Table 22.5-14**.

Main Fuse Maximum Amperes	Series Equipment Rating—kA Symmetrical						
	65		100		200		
100							**R** GHB
200				**R** GHB			
400					**J** GHB	**T** GHB	
600			**J** PDG2xF PDG2xG PDG2xM PDG2xP	**T** GHB PDG2xF PDG3xG* PDG2xG PDG3xG* PDG2xM PDG2xP			

Table 22.5-16. 480 Vac—Fuse/Breaker Series Ratings
Main fuse class shown centered at top, in shaded area. Respective branch devices shown directly below. All ratings in this table apply to two- and three-pole branch breakers only. Not valid for single-pole branch breakers.

Main Fuse Maximum Amperes	Series Equipment Rating—kA Symmetrical					
	100			200		
100			**R** PDG2xF			
200	**J** PDG2xF PDG2xG PDG2xM PDG2xP	**T** PDG2xF PDG2xG PDG2xM PDG2xP				

Table 22.5-17. 600 Vac—Fuse/Breaker Series Ratings
Main fuse class shown centered at top, in shaded area. Respective branch devices shown directly below. All ratings in this table apply to two- and three-pole branch breakers only. Not valid for single-pole branch breakers.

Main Fuse Maximum Amperes	Series Equipment Rating—kA Symmetrical					
	100			200		
100			**R** PDG2xG PDG3xG* PDG2xM PDG2xP			
200	**J** PDG2xG PDG3xG* PDG2xM PDG2xP	**T** PDG2xM PDG2xP	**R** PDG3xG* PDG2xM			
400	**J**	**T**	**R** PDG3xG* PDG3xM* PDG3xP*			
600				**J** PDG3xG PDG3xM PDG3xP	**T** PDG3xG* PDG3xM* PDG3xP*	

Table 22.5-18. Triple Series Ratings

Main Fuse Class and Maximum Amperes	Tenant Main Type	Branch Type	System Voltage	Short-Circuit Series Rating (kA, Sym.)
L-6000	PDD3xGy, PDG3xGBGB	K, GDHB, PDG2xF ①	240	100
L-6000	PDD3xGy, PDG3xGGB	K, GDHBB	120/240	100
L-6000	PDD3xGy PDG3xPG	FD ①, FDB	240	100
L-6000	PDD3xGy PDG3xG*		240	100
L-6000	JDB	GB, GHB	240	100
L-6000	JDB	GB, GHB	120/240	100
L-6000	PDG2xG	GB, GHB	240	100
L-6000	PDG2xG	GB, GHB	120/240	100
L-6000	PDG2xG	BAB_H, HQP_H QBHW_H, QPHW_H	240	100
L-6000	PDG2xG	BA, BAB HQP (15–70 A)	120/240	100
L-6000	PDG2xF	BAB_H, HQP_H	240	100
L-6000	PDG2xF	BA, BAB, HQP	120/240	100

① Valid on two- and three-pole breakers only. Not valid for single-pole.

Panelboard Selection Guide

Table 22.5-19. Product Types

					
Type PRL1X	**Fusible Lighting Panelboard PRL1XF**	**Type PRL1X-LX Column Type**	**Type PRL2X**	**Fusible Lighting Panelboard PRL2XF**	**Type PRL2X-LX Column Type**
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	240 and 480Y/277 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 lugs only 400 A maximum	Main lugs only 225 A maximum
Main circuit breaker 600 A maximum		Main circuit breaker 225 A maximum	Main circuit breaker 600 A maximum		Main circuit breaker 225 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	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

Table 22.5-19. Product Types (Continued)

			
Retrofit Panelboard PRL-1RX and PRL-2RX	**Type PRL3X**	**Type PRL3E**	**Type PRL4X**
Bolt-on or plug-on circuit breakers 240 or 480Y/277 Vac	Bolt-on circuit breakers 240, 480 or 600 Vac; 250 Vdc maximum	Bolt-on circuit breakers 240 Vac maximum	Circuit breakers or fusible switches; 240, 480 or 600 Vac; 600 Vdc maximum
Main lugs only 225 A maximum	Main lugs only 800 A maximum	Main lugs only 600 A maximum	Main lugs only 1200 A maximum
			Main circuit breaker 1200 A maximum
Main circuit breaker 225 A maximum	Main circuit breaker 600 A maximum	Main circuit breaker 600 A maximum	Main fusible switch 1200 A maximum
			Branch circuit breakers 1200 A maximum, Single-, two- and three-pole
Branch circuit breakers 100 A maximum Single-, two- and three-pole	Branch circuit breakers 225 A maximum Single-, two- and three-pole	Branch circuit breakers 125 A maximum Single-, two- and three-pole	Branch fusible switches 1200 A maximum, Single-, two- and three-pole

Table 22.5-19. Product Types (Continued)

		
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 22.5-20. Panelboard Selection Guide

Panelboard Type	Page Reference	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	**22.1-1**	Breaker	240	—	600	600	15–100	10–22	22–200
Pow-R-Line 2X ①	**22.2-1**	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	**22.3-1**	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	**22.3-5**	Breaker	480	250	600	600	15–125	35–65	35–100
Pow-R-Line 4X ①	**22.4-1**	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	**22.4-8**	Fusible switch	240 600	250	1200 1200	1200 1200	30–1200 30–1200	100–200 100–200	— —
Pow-R-Line 4DX	**22.4-11**	Breaker	240 480	— —	1200 1200	1200 1200	20–600 Drawout 15–1200 Fixed	100 65	— —
Pow-R-Line 1XF	**22.6-5**	Fusible switch	240	—	400	400	15–30	200	200
Pow-R-Line 2XF	**22.6-7**	Fusible switch	480Y/277	—	400	400	15–30	200	200
Pow-R-Line 1X-LX	**22.5-1**	Breaker	240	—	225	225	15-30	10–22	18–200
Pow-R-Line 2X-LX	**22.5-4**	Breaker	480Y/277	125/250	225	225	15–30	14	25–150
Pow-R-Line 1RX	**22.6-1**	Breaker	240	—	225	225	15–100	10–22	22–100
Pow-R-Line 2RX	**22.6-3**	Breaker	480Y/277	—	225	225	15–100	14	22–150
Elevator control panelboard ①	**22.6-11**	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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