Power Xpert Solar 250 kW Inverter

Power Xpert Solar 1500/1650 kW Inverter

600 Vdc Per Pole and 1000 Vdc Disconnect

Pow-R-Line C Group-Mounted Distribution Switchboard

2.1 Power Xpert Solar 250 kW Inverter

Power Xpert Solar 250 kW Inverter

Contents

Power Xpert Solar 250 kW Inverter

Product Description

The Eaton Power Xpert Solar 250 kW Inverter incorporates Eaton's programmable logic controllers (PLCs), advanced variable frequency drives and protective relays. Every critical component inside the Power Xpert Solar 250 kW Inverter is proven to be reliable based on the known life cycles of high volume industrial and electrical control equipment.

Engineered for ease-of-installation, operation, and maintenance, the Power Xpert Solar 250 kW Inverter contains the intelligence to automate the commissioning, operation, and shut down procedures with minimal physical action. These robust utility-interactive three-phase inverters are based on Eaton's mature motor-drive assembly featuring Eaton's Active Front End© (AFE) control technology.

The Power Xpert Solar 250 kW inverter is designed specifically for 480 Vac three-phase utility (grid) applications and 600 Vdc (open circuit) PV systems. It is an excellent choice for either indoor or outdoor installations from a company known for its state-of-the-art electrical products and industry support.

- CEC 96% efficiency
- >99% MPPT efficiency—3rd Party verified
- Earliest startup—latest shutdown with DC excitation and zero load grid sync
- Minimized offline nuisance events with superior fault tolerance of a utility grade electric protection relay

Features and Benefits

Dual-Stage 250 kW inverter with hysteresis, 2 x 125 kW design, provides optimum efficiency in lower irradiance conditions. Offers less stressful power-stage operation for improved inverter longevity. Seamless dual-inverter operation.

Grid Sensor based vector control ensures precise synchronism and fast response to grid dynamics, ensuring a stable operation and an improved solar energy harvesting.

Advanced Proportional Integral Derivative (PID) control enables precise synchronization to the grid, finer current and power limits. Improved temperature limits, better reactive power or power factor control.

DC excitation algorithm and system control Smart PV energy utilization over wasteful utility-based methods of energizing the transformer. Faster morning "wake-up" and power export. Faster mid-day re-connect improves energy harvesting during utility anomalies and outages, minimal-stress "zero-crossing" grid connection process, less part-count for improved solar-system reliability.

Large DC bus capacitors smart, extremely low ripple-current on the PV array makes for a better, trouble-free solar-module operation. Reduced stress on solar modules and wiring control algorithm ensures lower stress on isolation transformer over adverse environmental conditions.

Inverter re-combiner box with DC circuit breaker option available:

- Optional inverter re-combiner box with DC breakers to meet NEC® 2011 requirements for safe DC disconnect, eliminating the need for external DC disconnects
- DC breaker option eliminates the need to replace DC fuses, allowing cost and time savings (lowering O&M costs)
- Current sensing of each DC input is available for array zone monitoring; DC input current is reported to inverter controller, which makes it available via Modbus®

- DC breakers can be individually turned off, allowing isolation of a defective sub-array while allowing other sub-arrays to operate. This feature enhances de-bugging procedures and maximizes fault-tolerance
- DC breakers are available on different configurations and ampacity (90A DC, 100A DC, 125A DC, 150A DC, 175A DC, 200A DC and 225A DC)

Inverter grounding bus on DC and AC sides allows installation as per NEC 690.47 (C) (1), (2), or (3), should the facility POCC have a bonded equipment-ground to the facility's grounding electrode system.

Maximum power point: Fast (mSec based) response time with variable step-size control reacts to sudden changes, improved current response for low-irradiance periods, sudden-onset shading and grid outages, superior solar-energy harvesting

Isolation-transformer-based solar inverter which operates with all photovoltaic modules (technologies), negative and positive grounded PV systems.

Eaton Logic Controller (ELC) watch-dog system that ensures greater system integration and information response for display and stored performance data. It Isolates controls from external interference (anti-hacking)

Rich standard features and options list

- Full-load DC switch disconnect and AC breaker, lockout/tagout compatible
- Lockable display and controls door with window sealed against the elements
- Configurable utility connection
  - Three-wire delta (A/B/C), no neutral required
  - Four-wire wye (A/B/C/N), N-sensing only
  - 100 kA surge protection
  - 200 kAIC AC breaker
  - Large DC and AC conductor gland plates on bottom and immediate sides
  - Color, menu-driven display
  - Indicator lights (LEDs) and selection switch
  - Remote, field-duplicable up-fits
    - Remote indicators (LEDs)
    - Remote OFF (shutdown)
  - AC view-window for visible blade disconnect
  - Infrared inspection ports for DC and AC cabinets
  - CEC approved 2% PBI power meter
  - Internal heater for humidity and cold temperature control
  - Multiple DC input (combiner) with fuse and breaker options
  - SunSpec Alliance compatible monitoring (gateway)

Two-cabinet design Inverter and isolation transformer that enables integration into electrical rooms, provides better package for roof-top installations, is easier to receive, lift, transport and secure, design category(s) seismic complaint, terminated transformer cables included.

Easy maintenance by Eaton's Electrical Services & Systems (EESS)

- No ladder required to service cooling-system air filters; ground-level access
- Three-door design ensures wide opening for limited-access locations
- Country and worldwide local services

Commissioning support through country and worldwide local services.

Remote monitoring interface support via Modbus/TCP with an RJ 45 plug, and a terminal block supplying additional I/O and a 120 Vac power supply for compatibility with third party monitoring applications.

Advanced anti-islanding function, which prevents the operation of the inverter in the event of a utility outage.

AC overcurrent protection and safety inverter is equipped with a 200 kAIC AC breaker that is operable from the outside of the unit via lockout/tagout–capable handle.

No need for AC fuse replacements, minimizing O&M costs.

Inverter doors are fitted with mechanical interlocks that will safely shut down the inverter if doors are opened.

Human Machine Interface (HMI): A color touch screen LCD display that represents the status screens during normal operation and additional screens with password protection for access to configuration, troubleshooting, and service.

Standards and Certifications

- UL® 1741 2nd Edition January 2010
- IEEE® 1547
- NFPA 70, National Electrical Code® (NEC)
- CEC Listed (California Energy Commission)
- Seismic qualified to IBC/CBC

Catalog Number Selection

The catalog number is what determines the exact product feature set. The base configuration and subsequent catalog number of the Power Xpert Solar 250 kW Inverter is **SOX23111B1092M0011**.

Power Xpert Solar 250 kW inverter

SOX 2 3 1 1 1 B 1 0 9 2 M 0 0 1 1

Part String
SOX = Power Xpert Solar Inverter

Power Range
2 = 250 kW

Reserved
3 = None

Utility Connection Configuration
1 = Delta
2 = Wye

AC Output Voltage
1 = 480 Vac

Ground Scheme
1 = Negative ground
2 = Positive ground

Reserved
B = None

Viewing Windows
1 = None
2 = DC section
3 = AC section
4 = AC and DC section

Recombiner OCPD—Fusing
0 = No OCPD
2 = 4 x 300A
3 = 8 x 150A
4 = 6 x 225A
5 = 6 x 200A
6 = 8 x 175A
7 = 8 x 125A
9 = Breaker option

Recombiner OCPD—DC Breaker
1 = 16 x 90A
2 = 14 x 100A
3 = 12 x 125A
4 = 8 x 150A
5 = 8 x 175A
6 = 7 x 200A
7 = 6 x 225A
9 = Fuse option

Recombiner OCPD—DC Breaker with Shunt Trip and Current Sensors
0 = OCPD circuit breaker without shunt trip and current sensors
1 = OCPD circuit breaker with shunt trip and current sensors
2 = Not applicable (fuse option)

Inverter Communication
M = Modbus/TCP protocol (Ethernet-based)

Revenue-Grade Meter
0 = No meter
1 = Revenue-grade meter included

Reserved
0 = No options

IR Inspection Port
1 = None
6 = AC and DC cabinets

Destination Market—Language
1 = USA/English

Product Selection

Overcurrent Protection Device—Fusing Option

Recombiner OCPD—Fusing	Utility Connection Configuration	Ground Scheme	Viewing Windows	Revenue Grade Meter	Catalog Number ①
No OCPD	Delta	Negative ground	None	Not included	**SOX23111B1092M0011**
4 x 300A fuse	Delta	Positive ground	None	Not included	**SOX23112B1292M0011**
6 x 225A fuse	Delta	Negative ground	DC section	Not included	**SOX23111B2492M0011**
6 x 200A fuse	Wye	Positive ground	DC section	Not included	**SOX23212B2592M0011**
8 x 175A fuse	Wye	Negative ground	AC section	Not included	**SOX23211B3692M0011**
8 x 150A fuse	Wye	Positive ground	AC section	Not included	**SOX23212B3392M0011**
8 x 125A fuse	Wye	Negative ground	AC and DC section	Not included	**SOX23211B4792M0011**

Overcurrent Protection Device—DC Breaker Option, without Shunt Trip and Current

Recombiner OCPD—DC Breaker	Utility Connection Configuration	Ground Scheme	Viewing Windows	Revenue Grade Meter	Catalog Number ①
16 x 90A	Delta	Negative ground	AC and DC section	Not included	**SOX23111B4910M0011**
14 x 100A	Delta	Positive ground	None	Not included	**SOX23112B1920M0011**
12 x 125A	Delta	Negative ground	None	Not included	**SOX23111B1930M0011**
8 x 150A	Wye	Positive ground	DC section	Not included	**SOX23212B2940M0011**
8 x 175A	Wye	Negative ground	DC section	Not included	**SOX23211B2950M0011**
7 x 200A	Wye	Positive ground	AC section	Not included	**SOX23212B3960M0011**
6 x 225A	Wye	Negative ground	AC section	Not included	**SOX23211B3970M0011**

Overcurrent Protection Device—DC Breaker Option, with Shunt Trip and Current

Recombiner OCPD—DC Breaker	Utility Connection Configuration	Ground Scheme	Viewing Windows	Revenue Grade Meter	Catalog Number ①
16 x 90A	Delta	Positive ground	AC and DC Section	Not included	**SOX23112B4911M0011**
14 x 100A	Delta	Negative ground	AC and DC Section	Not included	**SOX23111B4921M0011**
12 x 125A	Delta	Positive ground	None	Not included	**SOX23112B1931M0011**
8 x 150A	Wye	Negative ground	None	Not included	**SOX23211B1941M0011**
8 x 175A	Wye	Positive ground	DC Section	Not included	**SOX23212B2951M0011**
7 x 200A	Wye	Negative ground	DC Section	Not included	**SOX23211B2961M0011**
6 x 225A	Wye	Positive ground	AC Section	Not included	**SOX23212B3971M0011**

Note

① Catalog numbers are not limited to the examples shown. More combinations may be obtained from catalog numbering system, see **Page V15-T2-4**.

2.1 Power Xpert Solar 250 kW Inverter

Technical Data and Specifications

2

AC Output Specifications—Factory Default

Description	Specification
Maximum continuous output power	250 kW
Weighted efficiency (CEC)	96%
Maximum continuous output current	312A
Maximum fault current output	365A for 8ms
Maximum branch overcurrent protection	400A ①
Nominal operating voltage	Three-phase 480 Vac
Operating voltage range	423–528 Vac
Nominal operating frequency	60 Hz
Operating frequency range	57.0–60.5 Hz
Tare loss	70W
Total harmonic distortion	< 3% THD
Power factor	> 0.99
Utility connection	Delta three-wire (A,B,C); wye four-wire (A,B,C,N) ②

DC Input Specifications

Description	Specification
DC maximum input voltage	600 Vdc
DC maximum power point tracking range (MPPT)	300–500 Vdc
DC operating range	300–600 Vdc
DC input start	400 Vdc ③
DC operating current nominal	860A
Maximum DC ISC input	1340A
Factory configured PV array grounding	Positive/negative

Mechanical Specifications

Description	Specification
Operating temperature range without power fold back	–20° to 50°C
Storage temperature range	–30° to 70°C
Enclosure rating	UL Type 3R
Enclosure(s) construction	Polyester powder coated cold rolled steel
Relative humidity	0 to 95% noncondensing
Inverter weight	4000 lbs (1814 kg)
Transformer weight	2850 lbs (1293 kg)
Inverter envelope dimensions in inches (mm) H x W x D	94.00 x 93.00 x 46.00 (2387.6 x 2362.2 x 1168.4)
Transformer dimensions in inches (mm) H x W x D	64.00 x 50.00 x 40.00 (1625.6 x 1270.0 x 1016.0)
Inverter and transformer mounting	Pad mount—not free standing
Isolation transformer—external	Delta/wye
Cooling	Air convection
Max altitude (before potential derating)	3300 ft (1000m)
Air flow/inverter	1700 cfm ③
Seismic rating successfully evaluated	Seismic qualified to IBC/CBC

Certifications

Description
UL 1741 2nd Ed Jan 2010, IEEE 1547

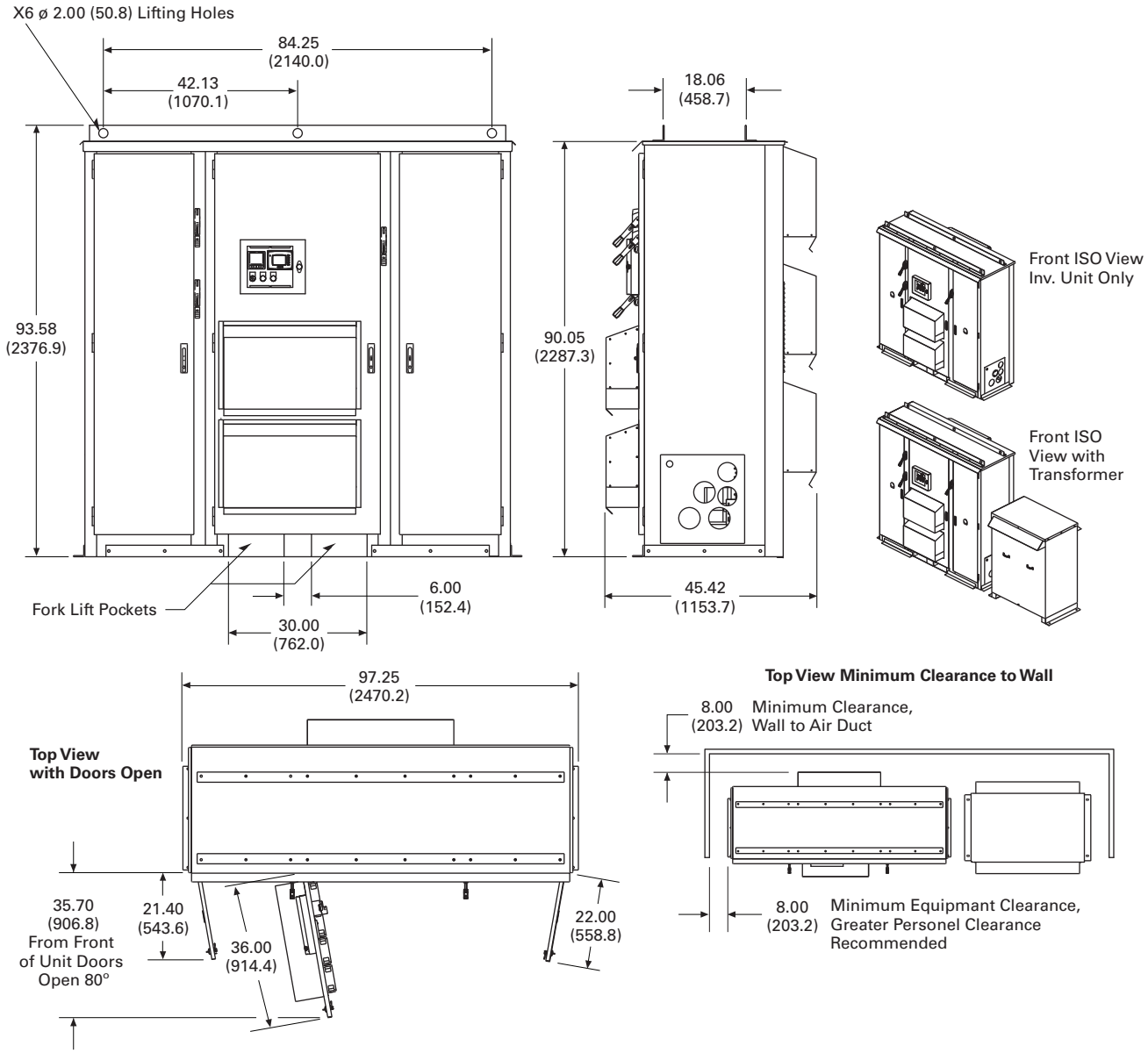
Notes

① 400A AC breaker.
② Factory default is delta three-wire.
③ Factory default is 400 Vdc.

Dimensions

Approximate Dimensions in inches (mm)

Power Xpert Solar 250 kW Inverter Dimensions and Connection Diagrams



2.2 Power Xpert Solar 1500/1670 kW Inverter

Power Xpert Solar 1500/1670 kW Inverter

Contents

Power Xpert Solar 1500/1670 kW Inverter

Product Description

The Power Xpert® Solar MW scale inverter is a rugged, robust and reliable solar inverter designed with Eaton engineering's 100-year tradition of safety and reliability. Designed for utility applications the Power Xpert Solar 1500/1670 is the world's largest PV inverter and sets the new standard in reliability and performance.

The inverter is outdoor-rated, and no extra shelter (canopy) or environmental protection is needed in order for the equipment to sustain operation in harsh environments (rain, dust, snow and sun). This makes the Power Xpert Solar inverter not only an economical and cost-effective solution but capable of rapid deployment and installation.

Availability is optimized by a complete fault tolerant design. This inverter is composed by three blocks of 500 kW (555 kW), which can be individually isolated in the unlikely event of a fault, allowing the inverter to operate at partial power until field service arrives on site. This provides for higher reliability and availability than using multiple smaller inverters.

The Power Xpert Solar inverter provides the most cost-effective solution in the market for the following reasons:

- Fully outdoor rated enclosure—no extra shelter or environmental protection needed
- Inverter includes:
  - Recombiner box with fuses
  - Load brake rated DC disconnect switches
  - AC circuit breaker for AC disconnection
  - AC and DC surge suppression
  - True MW design—one inverter is needed for 1.5 MW/1.67 MW station providing the lowest cost of installation and operation:
    - Fewer cement pads, less excavation and less cement
    - Reduced field labor for cabling and wiring due to fewer units needed
    - Direct-coupling, throat connection with step-up transformer
- Fault tolerance design—inverter is able to run at partial power (1/3, 2/3 of full power)
- High reliability due to conservatively rated components, film capacitors and liquid cooling
- No active power de-rating for up to ±0.91 power factor support
- SCADA communication via Modbus® TCP

Features and Benefits

- True MW scale inverter allows for maximum cost savings on installation of inverter and transformer. It also enables a skidless solution as there is only one inverter and a simple pad-mount transformer to be installed
- Inverter can be configured as a 1.5 MW or 1.67 MW for maximum output power optimization. Depending on the MPPT range for the array, the inverter output power can be set to 1.5 MW or 1.67 MW
- Power factor support at rated power. The inverter will supply full rate power (1.5 MW or 1.67 MW), and still provide support for up to a ±0.91 power factor range. This provides cost optimization especially on projects with a power factor support requirement
- Maximum flexibility on grid support. Power Xpert Solar grid and frequency ride through settings are flexible and can be changed to meet local utility or special grid requirements
- Maximum DC/AC ratio (array I_{sc}): Maximum array short-circuit current (I_{sc}) cannot be higher than 4480 ADC. As long as this limit is maintained, the inverter warranty will not be voided
- The inverter voltage and frequency disturbance characteristics are set and controlled by a widely accepted protection relay SEL-751A. This device is well known by utilities and enables one extra protection layer for safe inverter shutdown under abnormal grid conditions
- Direct-coupling throat connection between the inverter and transformer enables cost savings on cables, conduits and pad installation. The throat connection has been implemented using Eaton's vast experience on low voltage switchgear with connection to a step-up transformer
- DC grounding configuration is available as positive and negative schemes
- A recombiner box with maximum flexibility is available. The standard configurations for number of DC inputs, DC fuse current and cable size are shown in the Catalog Number Selection graphic on **Page V15-T2-10**. The DC fuse ratings available are 160 A, 200 A, 250 A, 315 A, 350 A, 355 A and 400 A
- Array Zone monitoring is possible with the option of current sensing on each DC input. This option allows current monitoring of the ungrounded DC polarity inputs. Each DC input current measurement is stored on the internal inverter controller and available to a plant monitoring device via Modbus TCP
- Fiber optics communication connection is available for large plants, where inverter stations are placed at a far distance from the plant central controller or monitoring device
- Optional auxiliary I/O ports provide an effective way of cost-savings when external devices need to be monitored, such as step-up transformer measurements (liquid temperature, pressure and level). The standard offering is 6 digital inputs and 1 analog input. Other options are available, please consult factory
- A revenue grade meter in the low voltage side of the step-up transformer is also present as an option. Please consult an Eaton representative for further information

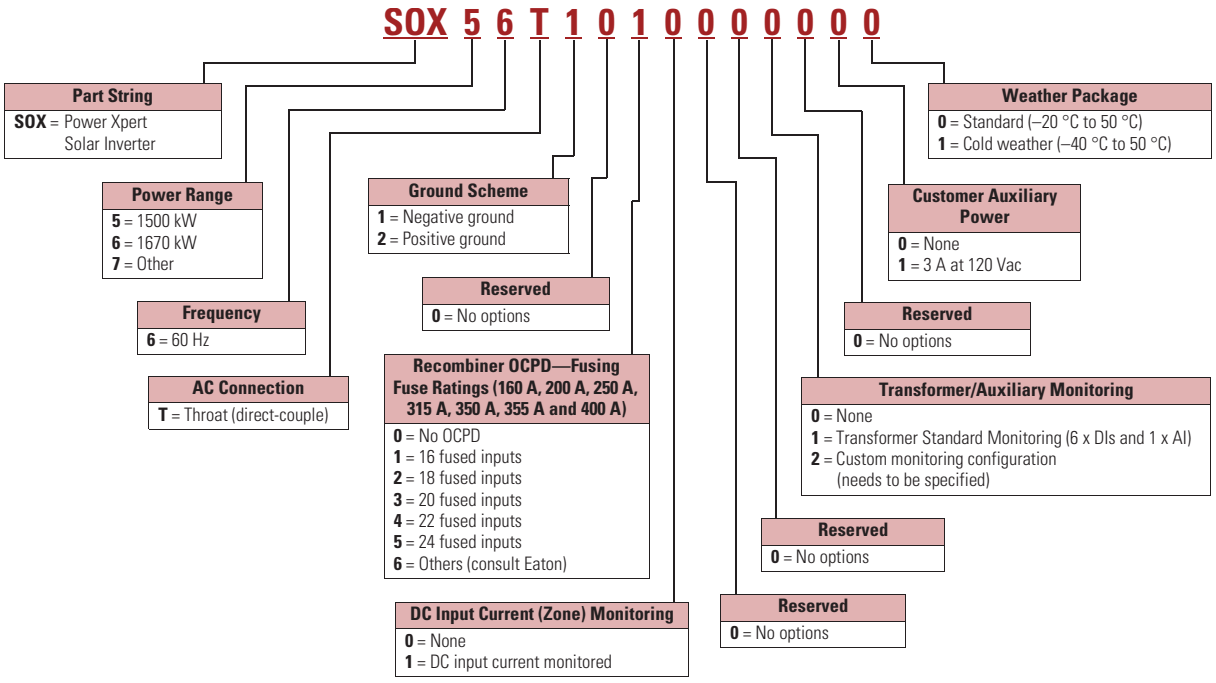
Standards and Certifications

- The 1500 kW and 1670 kW inverters are certified by Intertek per UL® 1741

Catalog Number Selection

The catalog number system is what determines the product configuration. The base configuration and subsequent catalog number of the Power Xpert Solar 1500/1670 kW Inverter is **SOX66T1010000000**.

Power Xpert Solar 1500/1670 kW Inverter



Technical Data and Specifications

Power Xpert Solar

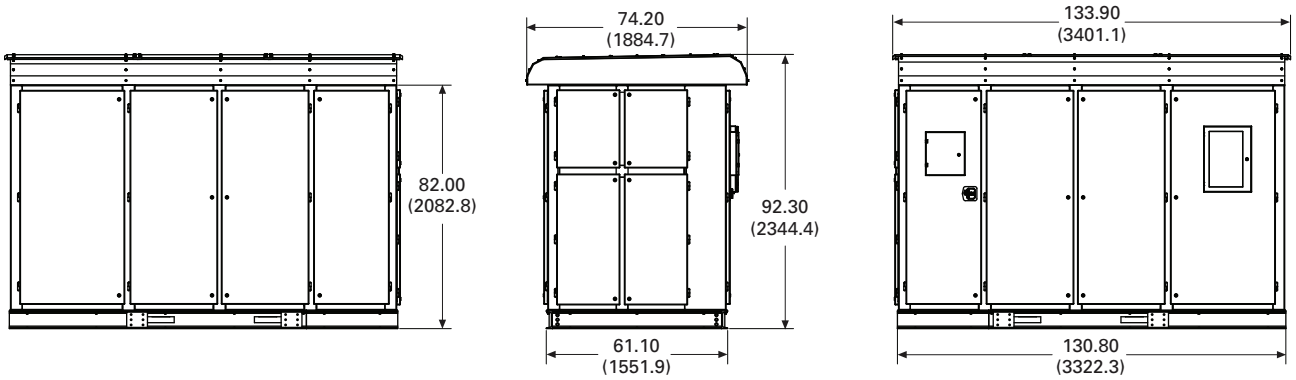
Description	1500 kW	1670 kW
AC Output		
Nominal apparent power AC at 50 °C	1650 kVA	1831 kVA
Rated output power AC at 50 °C	1500 kW	1666 kW
Nominal output current	2707 A	2707 A
Maximum continuous output current at 50 °C	3000 A	3000 A
Nominal operating voltage	320 Vac	357 Vac
Operating voltage range (withstand)	+/–10%	+/–10%
Nominal operating frequency	60 Hz	60 Hz
Operating frequency range	57–63 Hz	57–63 Hz
Total harmonic distortion at rated power	Per IEEE 1547	Per IEEE 1547
Power factor at rated power	± 0.91 adjustable power factor (zero to unity)	± 0.91 adjustable power factor (zero to unity)
AC configuration	Delta three-wire or wye ungrounded	Delta three-wire or wye ungrounded
DC Input		
Number of DC inputs	Customer specified fuse arrangement (16–24 input pairs)	Customer specified fuse arrangement (16–24 input pairs)
Maximum input voltage open circuit, V_{OC}	1000 Vdc	1000 Vdc
MPPT DC voltage range for full power production	500–1000 Vdc	550–1000 Vdc
MPPT DC voltage range for CEC weighted efficiency	500–800 Vdc	550–800 Vdc
Nominal DC operating current DC	3100 ADC	3100 ADC
PV array grounding	Negative and positive (optional)	Negative and positive (optional)
DC monitoring	Optional current sensors on each DC input	Optional current sensors on each DC input
Maximum array Isc connected to inverter	4480 ADC	4480 ADC
Efficiency and Losses		
CEC weighted efficiency	98%	98.5%
Maximum inverter efficiency	98.6%	98.7%
Nighttime power consumption	333 W	335 W
Protection		
AC disconnect	AC circuit breaker with LOTO	AC circuit breaker with LOTO
AC surge suppression	Yes, monitored by inverter SCADA	Yes, monitored by inverter SCADA
DC disconnect	Load brake switch disconnect	Load brake switch disconnect
DC surge suppression	Yes, monitored by inverter SCADA	Yes, monitored by inverter SCADA
Ground fault monitoring	Yes, monitored by inverter SCADA	Yes, monitored by inverter SCADA
Insulation monitoring	Optional	Optional
Communications and Controls		
Communications with plant central controller	Modbus (TCP) copper and fiber connection available	Modbus (TCP) copper and fiber connection available
Power metering	Optional power metering device in LV side of step-up transformer	Optional power metering device in LV side of step-up transformer
HMI	Yes	Yes

Power Xpert Solar, continued

Description	1500 kW	1670 kW
Mechanical		
Operating temperature range full power	–20 °C to 50 °C	–20 °C to 50 °C
Optional extended temperature range (cold weather package)	–40 °C to 50 °C	–40 °C to 50 °C
Storage temperature range	–30 °C to 70 °C	–30 °C to 70 °C
Enclosure protection	Outdoor rated NEMA® 4 for controls equipment NEMA 3R for magnetics and switchgear	Outdoor rated NEMA 4 for controls equipment NEMA 3R for magnetics and switchgear
Enclosure painting	Powder-coated cold-rolled steel with corrosion-resistant hardware and fittings	Powder-coated cold-rolled steel with corrosion-resistant hardware and fittings
Relative humidity	0 to 100% condensing	0 to 100% condensing
Inverter mounting	Pad or skid mount	Pad or skid mount
Cooling	Independent, self-contained, closed-loop liquid cooling and air forced convection	Independent, self-contained, closed-loop liquid cooling and air forced convection
Maximum operating altitude	3300 ft (higher altitudes possible with derating)	3300 ft (higher altitudes possible with derating)
Inverter dimensions in inches (H x W x D) ①	96 x 131 x 62	96 x 131 x 62
Design Features		
Grid management features (optional)	LVRT	LVRT
	HVRT	HVRT
	ZVRT	ZVRT
	FRT	FRT
	Ramp control	Ramp control
	Frequency droop	Frequency droop
	Grid management features adjustable to meet FERC, WECC and ERCOT requirements	Grid management features adjustable to meet FERC, WECC and ERCOT requirements

Dimensions

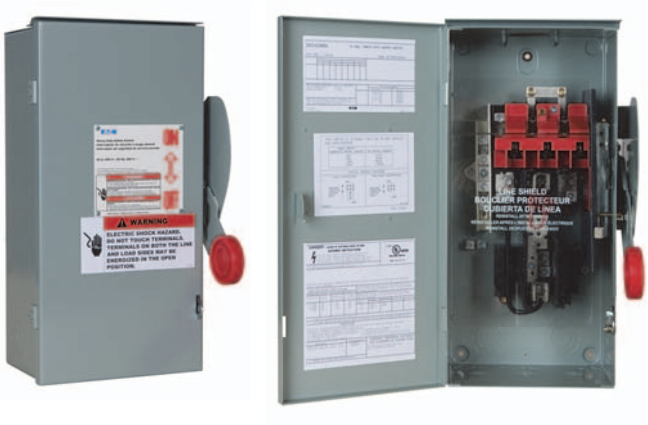
Approximate Dimensions in Inches (mm)



Note

① Preliminary.

600 Vdc Single-Pole Disconnect



Contents

600 Vdc Single-Pole Disconnects

Product Description

Eaton's offering of PV switches have multiple poles factory-wired, and they are approved for NEC Article 690 applications right from the box. Other manufacturers require the contractor to add jumpers to a two- or three-pole switch, add a neutral, and add labels to meet this requirement. For fusible switches, the Eaton PV single-pole switch requires only one fuse per switch—saving the customer at least one fuse on each switch.

Application Description

When photovoltaic panels convert the sun's energy into electricity, the power generated is direct current (DC). Typically, the systems are designed with DC system voltages in the 400–600V range. This is much higher voltage than typically found in building systems. The higher voltage, when combined with the lack of a current sine wave with zero crossings, creates a number of challenges in wiring, particularly when switching circuits on and off.

DC circuits consist of two wires—a positive and a negative. In most PV systems, one of these wires is grounded (like a neutral in an AC system). Which of the two wires is grounded is specified by the solar panel manufacturer. The more common application is a negative ground, and the location of this bond is usually found at the inverter. Per the National Electrical Code (NEC) Section 690.5(A), only the current-carrying ungrounded conductor should be switched. Thus, in a negative-grounded system, only the positive wire is switched.

Unlike AC systems that possess a current sine wave with zero crossings, the interruption of higher voltage DC circuits requires an increased air gap to safely and quickly interrupt and break the arc. Within this family of switches, the increased gap is accomplished by wiring multiple poles of a single switch in series for safe arc interruption. The UL 98 listing of these products does not permit multiple circuits to be switched by one switch.

600 Vdc Single-Pole Disconnects

Features

Standard Features

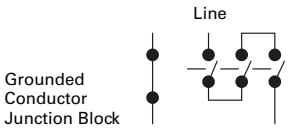
- All switches are single-pole and suitable for switching one circuit
- Clear polycarbonate deadfront to guard against accidental contact with live parts
- NEC 690.17–compliant labeling warning that the switch terminals may be energized in the open position
- NEC 690.14.(C) 2 required "PV System Disconnect" label included
- Isolated ground terminals (neutral) for grounded conductors
- Ground lug for equipment grounding conductor
- NEMA 3R, 12 and 4X stainless enclosures
- Fusible and non-fusible configurations—Class R fuse clips standard
- Fuse clips are located on the center pole to ensure that both fuse clips are de-energized—meets NEC Article 690.16, which requires isolation of the fuse from all potential supply sources
- Available for Flex Center modifications (windows, pilot lights, 316 grade stainless, and so on)

Standards and Certifications

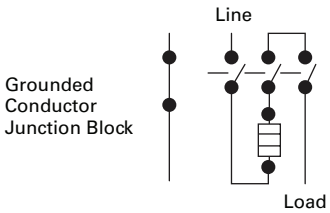
- UL 98 listed
- Marked as suitable for NEC 690 PV applications up to 600 Vdc
- OSHPD Special Seismic Certification Preapproval (OSP)

Wiring Diagrams

Non-Fusible 600 Vdc

Wiring Diagram	Ampere Rating	NEMA 3R	NEMA 12	NEMA 4X	Lug Capacity Main and Neutral (Isolated Ground) ①	Ground Lug
Non-Fused Construction	30	DH161URKN	DH161UDKN	DH161UWKN	#2–#14 Cu/Al	#4–#14 Cu/Al
	60	DH162URKN	DH162UDKN	DH162UWKN	#2–#14 Cu/Al	#4–#14 Cu/Al
	100	DH163URKN	DH163UDKN	DH163UWKN	1/0–#14 Cu/Al	#4–#14 Cu/Al
	200	DH164URKN	DH164UDKN	DH164UWKN	300 kcmil—#6 Cu/Al ②	#2–#14 Cu/Al
	400	DH165URKN	DH165UDKN	DH165UWKN	(1) 750 kcmil—1/0 or (2) 300 kcmil—1/0 Cu/Al	250 kcmil—#6 Cu/Al
	600	DH166URKN	DH166UDKN	DH166UWKN	(1) 750 kcmil—1/0 and (1) 600 kcmil—#2 Cu/Al	250 kcmil—#6 Cu/Al

Fusible 600 Vdc (Class R Fuse Clips—One Fuse Required Per Switch)

Wiring Diagram	Ampere Rating	NEMA 3R	NEMA 12	NEMA 4X	Lug Capacity Main and Neutral (Isolated Ground) ①	Ground Lug
Fused Construction	30	DH161NRK	DH161NDK	DH161NWK	#2–#14 Cu/Al	#4–#14 Cu/Al
	60	DH162NRK	DH162NDK	DH162NWK	#2–#14 Cu/Al	#4–#14 Cu/Al
	100	DH163NRK	DH163NDK	DH163NWK	1/0–#14 Cu/Al	#4–#14 Cu/Al
	200	DH164NRK	DH164NDK	DH164NWK	300 kcmil—#6 Cu/Al ②	#2–#14 Cu/Al
	400	DH165NRK	DH165NDK	DH165NWK	(1) 750 kcmil—1/0 or (2) 300 kcmil—1/0 Cu/Al	250 kcmil—#6 Cu/Al
	600	DH166NRK	DH166NDK	DH166NWK	(1) 750 kcmil—1/0 and (1) 600 kcmil—#2 Cu/Al	250 kcmil—#6 Cu/Al

Notes

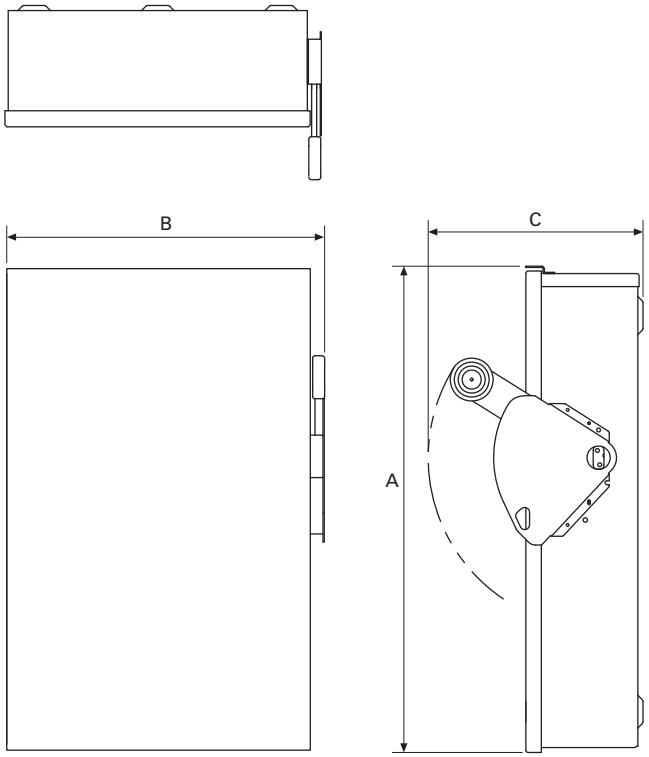
① UL 98 limits the conductor current sizing to 75°C. 90°C wire may be terminated per Article 110.14(C); however, the maximum current capacity is limited to NEC Table 310.16, 75°C column.

② N3R has 250 kcmil–#6 Cu/Al max lug capacity. NEMA12 and 4X have 300 kcmil–#6 Cu/Al.

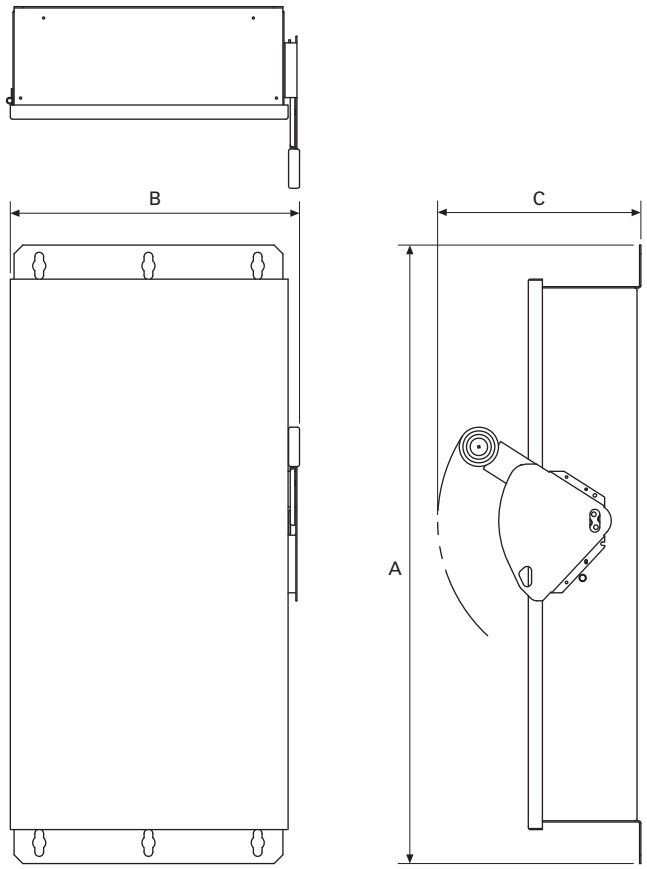
Dimensions

Approximate Dimensions in Inches (mm)

Type 3R Solar Switch



Type 12-3R and 4X Solar Switch



Type 3R Solar Switch

Ampere Rating	A	B	C	Main Lug Capacity ①	Ground Lug Capacity
30	16.35 (415.3)	8.87 (225.3)	9.89 (251.2)	#2 AWG–#14 AWG Cu/Al	#4 AWG–#14 AWG Cu/Al
60	16.35 (415.3)	8.87 (225.3)	9.89 (251.2)	#2 AWG–#14 AWG Cu/Al	#4 AWG–#14 AWG Cu/Al
100	22.15 (562.6)	11.84 (300.7)	9.89 (251.2)	1/0 AWG–#14 AWG Cu/Al	#4 AWG–#14 AWG Cu/Al
200	28.27 (718.1)	16.66 (423.2)	11.26 (286.0)	250 kcmil–#6 AWG Cu/Al	#2 AWG–#14 AWG Cu/Al
400	45.00 (1143.0)	24.12 (612.6)	12.39 (314.7)	(1) 750 kcmil—1/0 or (2) 300 kcmil—1/0 Cu/Al	250 kcmil—#6 AWG Cu/Al
600	52.50 (1333.5)	25.12 (638.0)	14.07 (357.4)	(1) 750 kcmil—1/0 and (1) 600 kcmil—#2 AWG Cu/Al	250 kcmil—#6 AWG Cu/Al

Type 12-3R and 4X Solar Switch

Ampere Rating	A	B	C	Main Lug Capacity ①	Ground Lug Capacity
30 Non-fusible	14.14 (359.2)	8.76 (222.5)	10.22 (259.6)	#2 AWG–#14 AWG Cu/Al	#4 AWG–#14 AWG Cu/Al
30 Fusible	19.08 (484.6)	8.76 (222.5)	10.22 (259.6)	#2 AWG–#14 AWG Cu/Al	#4 AWG–#14 AWG Cu/Al
60 Non-fusible	14.14 (359.2)	8.76 (222.5)	10.22 (259.6)	#2 AWG–#14 AWG Cu/Al	#4 AWG–#14 AWG Cu/Al
60 Fusible	19.08 (484.6)	8.76 (222.5)	10.22 (259.6)	#2 AWG–#14 AWG Cu/Al	#4 AWG–#14 AWG Cu/Al
100	24.95 (633.7)	11.79 (299.5)	10.22 (259.6)	1/0 AWG–#14 AWG Cu/Al	#4 AWG–#14 AWG Cu/Al
200	35.38 (898.7)	16.95 (430.5)	11.63 (295.4)	300 kcmil–#6 AWG Cu/Al	#2 AWG–#14 AWG Cu/Al
400	57.47 (1459.7)	24.12 (612.6)	12.43 (315.7)	(1) 750 kcmil—1/0 or (2) 300 kcmil—1/0 Cu/Al	250 kcmil—#6 AWG Cu/Al
600	63.00 (1600.2)	26.34 (669.0)	14.25 (362.0)	(1) 750 kcmil—1/0 and (1) 600 kcmil—#2 AWG Cu/Al	250 kcmil—#6 AWG Cu/Al

Note

① UL 98 limits the conductor current sizing to 75°C. 90°C wire may be terminated per Article 110.14(C); however, the maximum current capacity is limited to NEC Table 310.16, 75°C column.

600 Vdc Per Pole and 1000 Vdc Disconnect

Contents

600 Vdc Per Pole and 1000 Vdc Disconnects

Product Description

The latest addition to Eaton's solar disconnect family of products is the UL Listed 600 Vdc per pole, bi-directional disconnect. Listed to the UL 98B standard, this design has the capacity to switch multiple circuits of up to 600 Vdc each. Also included in the line are 1000 Vdc disconnects, designed for use in large scale projects where the higher voltage helps drive improved efficiencies.

The use of renewable energy sources is on the rise. Photovoltaic (PV) systems are among the fastest growing of the new green technologies, and they are being installed on a variety of building types and landscapes throughout North America. This results in a growing need for products to meet the requirements of these systems. Eaton's lineup of 600 Vdc per pole and 1000 Vdc switches are tested and listed to the rigorous UL 98B standard, in line with NEC 690 Code requirements for PV installations.

Application Description

Switching devices primarily designed for DC service require design features to increase the total arcing voltage. This can be achieved by designing larger single air gaps and multiple gaps in series, or by using magnetic fields to force arc movement. In this safety switch design, Eaton uses magnetic fields, created with the use of permanent magnets, to stretch the arc. These products are not polarity sensitive, so they can be used on either negative or positive grounded systems, and they provide protection regardless of whether the current flow is in the "normal" direction or is reversed (possible due to miswiring or under a fault condition).

Note: Photos shown above—
Left: 60A, 3 circuit, 600 Vdc per pole, NEMA 3R.
Right: 200A, 4 circuit, 600 Vdc per pole, NEMA 4, w/ isolated grounded return terminals.

Grounded PV systems

A large number of PV systems in North America to date are grounded systems. These systems will be either positive grounded or negative grounded. In a positive grounded system, the disconnect will switch (break) the negative (–) conductor only. Conversely, in a negative grounded system, the disconnect will switch (break) the positive (+) conductor only. It is important that the disconnect applied within a grounded PV system be properly rated for that specific system. Eaton's lineup of switches (600 Vdc and 1000 Vdc) are designed and UL Listed for use in both positive and negative grounded applications—one switch can be used on either system.

Ungrounded PV systems

Somewhat less common today are ungrounded (floating) PV systems. These use transformerless inverters and, relative to the disconnects within the system, both the positive (+) and the negative (–) conductors are switched. Eaton is proud to also offer a series of disconnects (600 Vdc and 1000 Vdc) for ungrounded systems.

Safety

The incorporation of the modified heavy duty safety switch mechanism provides a visible means of disconnect when the switch handle is in the OFF position. Blade disengagement from the stationary contact can be seen when viewing the switch base.

Features

Standard Features

- UL Listed to the UL 98B standard
- Marked as suitable for NEC 690 PV applications per UL 1741 requirements
- Suitable for use on positive and negative grounded systems, not polarity sensitive
- Bi-directional functionality; will break high-energy DC arc regardless of direction of current flow
- Ampacity range—30, 60, 100, 200 and 400A
- Clear polycarbonate deadfront shield
- Equipment ground
- NEMA 3R, 4 and 4X stainless steel enclosures
- Flex Center modification available, such as viewing windows, pilot lights and more

600 Vdc Specific Features

- First UL Listed 600 Vdc per pole, bi-directional solution in the market
- 2-, 3-, 4- and 6-circuit configurations for grounded systems
- 1-, 2- and 3-circuit configurations for ungrounded systems
- Fusible and non-fusible
- Grounded configurations include isolated return terminals. Exceptions include 6-circuit 30, 60, 100A, and 4-circuit 400A
- Suitable for use on a circuit capable of delivering up to 10,000A, 600 Vdc

1000 Vdc Specific Features

- 1-, 2- and 3-circuit configurations for both grounded and ungrounded systems
- Fusible and non-fusible
- Factory-installed jumpers
- Grounded configurations include isolated return terminals. Exceptions include 2-circuit 400A
- Suitable for use on a circuit capable of delivering up to 10,000A, 1000 Vdc

Standards and Certifications

Listed to the UL 98B standard in-line with NEC 690 Code requirements for PV installations.

Catalog Number Selection

DC Disconnects

DCG 3 06 1 U R M _

Class and Type
- **DCG** = DC disconnect/ grounded system
- **DCU** = DC disconnect/ ungrounded system

Number of Circuits ①
- **1** = 1 circuit
- **2** = 2 circuits
- **3** = 3 circuits
- **4** = 4 circuits
- **6** = 6 circuit

Maximum System Voltage
- **06** = 600 Vdc
- **10** = 1000 Vdc

Ampacity
- **1** = 30A
- **2** = 60A
- **3** = 100A
- **4** = 200A
- **5** = 400A

Protection
- **F** = Fusible
- **U** = Non-fusible

NEMA Enclosure Rating
- **R** = NEMA 3R
- **P** = NEMA 4 (painted steel)
- **W** = NEMA 4X, stainless 304
- **X** = NEMA 4X, stainless 316

Switch Series
- **M** = DC photovoltaic applications

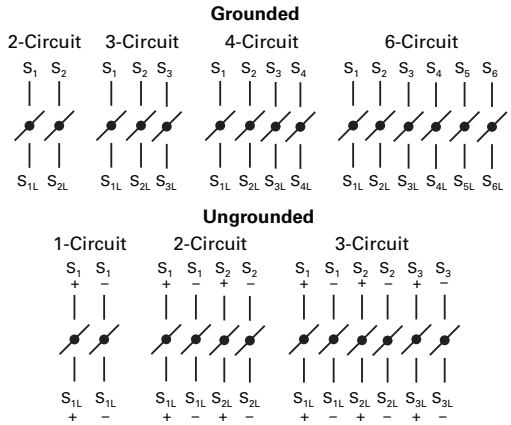
Accessories/Options
- **Blank** = No accessories
- **2** = 1NO/1NC auxiliary contact
- **3** = 2NO/2NC auxiliary contact
- **W** = Viewing window
- **J** = Factory-converted Class J fuse provisions

Note

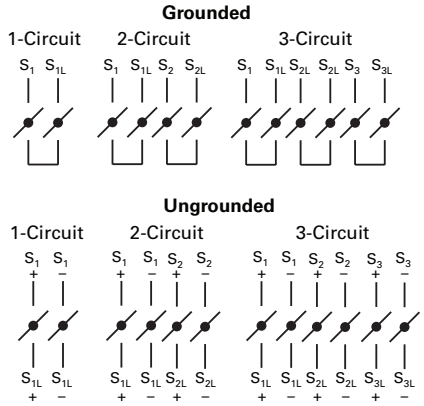
① Not all configurations for ampere rating and number of circuits are available. All circuit configurations can be found in the product dimension tables.

Wiring Diagrams

600 Vdc/Pole Wiring Diagrams (30–400A)



1000 Vdc/Pole Wiring Diagrams (30–400A)



Note: Majority of grounded configurations have isolated return terminals. Due to enclosure size limitations, 600 Vdc exceptions include 6-circuit 30, 60, 100A; 4-circuit 400A; 1000 Vdc exceptions include 2-circuit 400A.

DC Disconnect Lug Capacity

Maximum Vdc System Voltage	Ampere Rating	Lug Capacity ①②③ Main Input	Main Output	Solid Return (for Grounded Conductor) Input	Solid Return (for Grounded Conductor) Output	Equipment Ground Input	Equipment Ground Output
600	30	#2–#14 AWG	#2–#14 AWG	1/0–#14 AWG	1/0–#14 AWG	#4–#14 AWG	#4–#14 AWG
	60	#2–#14 AWG	#2–#14 AWG	1/0–#14 AWG	1/0–#14 AWG	#4–#14 AWG	#4–#14 AWG
	100	1/0–#14 AWG	1/0–#14 AWG	1/0–#14 AWG	1/0–#14 AWG	#4–#14 AWG	#4–#14 AWG
	200	300 kcmil–#6	300 kcmil–#6	300 kcmil–#6	300 kcmil–#6	#4–#14 AWG	1/0–#14
	400	(1) 750 kcmil–1/0 and (1) 600 kcmil–#2	(1) 750 kcmil–1/0 and (1) 600 kcmil–#2	(2) 750 kcmil–1/0	(2) 750 kcmil–1/0	#4–#14 AWG	250 kcmil–#6
1000	30	#2–#14 AWG	#2–#14 AWG	#2–#14 AWG	#2–#14 AWG	#4–#14 AWG	#4–#14 AWG
	60	#2–#14 AWG	#2–#14 AWG	#2–#14 AWG	#2–#14 AWG	#4–#14 AWG	#4–#14 AWG
	100	1/0–#14 AWG	1/0–#14 AWG	1/0–#14 AWG	1/0–#14 AWG	#4–#14 AWG	#4–#14 AWG
	200	300 kcmil–#6	300 kcmil–#6	300 kcmil–#6	300 kcmil–#6	#4–#14 AWG	1/0–#14
	400	(1) 750 kcmil–1/0 and (1) 600 kcmil–#2	(1) 750 kcmil–1/0 and (1) 600 kcmil–#2	(2) 750 kcmil–1/0	(2) 750 kcmil–1/0	#4–#14 AWG	250 kcmil–#6

600 Vdc Non-Fusible and Fusible

	Grounded Systems Number of Circuits					Ungrounded Systems Number of Circuits		
Amperes	1	2	3	4	6	1	2	3
30	●		●		◆	◆		◆
60	●		●		◆	◆		◆
100	●		●		◆	◆		◆
200	●	●	●	●	●	◆	◆	◆
400	●	●	●	■		◆	◆	
600	●							

1000 Vdc Non-Fusible and Fusible

	Grounded Systems Number of Circuits			Ungrounded Systems Number of Circuits		
Amperes	1	2	3	1	2	3
30	●	◆		◆	◆	
60	●	◆		◆	◆	
100	●	◆		◆	◆	
200	●	●	●	◆	◆	◆
400	●	■		◆	◆	

Legend

- ● Indicates grounded conductor terminal included with isolated lugs for each circuit.
- ◆ Indicates no grounded conductor terminal included.
- ■ Indicates only non-fusible version includes grounded conductor terminal with isolated lug for each circuit.

Notes

① All lug capacities shown are for standard lugs. For options, including compression type, consult factory.

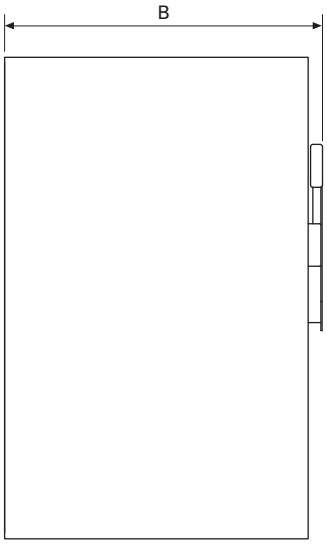
② All lugs are Cu/Al rated.

③ UL 98/98B limits the conductor current sizing to 75°C. 90°C wire may be terminated per Article 110.14(C); however, the maximum current capacity is limited to NEC Table 310.16, 75°C column.

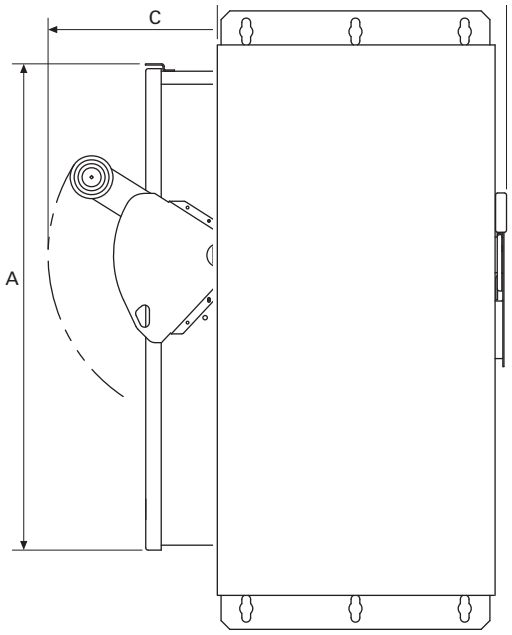
Dimensions

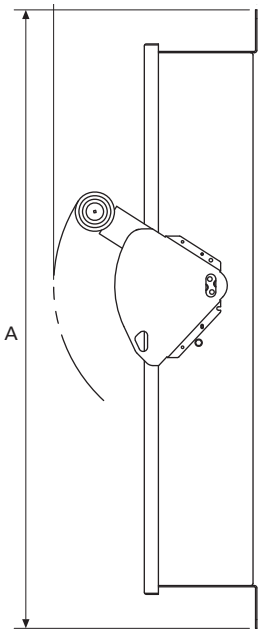
Approximate Dimensions in Inches (mm)

NEMA Type 3R



NEMA Type 4, 4X Stainless





600 Vdc Non-Fusible and Fusible

Ampere Rating	Number of Circuits	NEMA Type 3R ① A	B	C	D	NEMA Types 4, 4X Stainless ① A	B	C	D
Grounded									
30, 60	3	16.27 (413.3)	8.87 (225.3)	9.89 (251.2)	5.25 (133.4)	19.08 (484.6)	8.76 (222.5)	10.22 (259.6)	5.50 (139.7)
30, 60	6	19.08 (484.6)	12.88 (327.2)	10.22 (259.6)	5.50 (139.7)	19.08 (484.6)	12.88 (327.2)	10.22 (259.6)	5.50 (139.7)
100	3	21.99 (558.5)	11.84 (300.7)	9.89 (251.2)	5.25 (133.4)	24.95 (633.7)	11.79 (299.5)	10.22 (259.6)	5.50 (139.7)
100	6	24.95 (633.7)	16.13 (409.7)	10.22 (259.6)	5.50 (139.7)	24.95 (633.7)	16.13 (409.7)	10.22 (259.6)	5.50 (139.7)
200	2	35.38 (898.7)	16.54 (420.1)	11.63 (295.4)	6.44 (163.6)	35.38 (898.7)	16.54 (420.1)	11.63 (295.4)	6.44 (163.6)
200	3	35.38 (898.7)	16.54 (420.1)	11.63 (295.4)	6.44 (163.6)	35.38 (898.7)	16.54 (420.1)	11.63 (295.4)	6.44 (163.6)
200	4	35.38 (898.7)	24.46 (621.3)	11.63 (295.4)	6.44 (163.6)	35.38 (898.7)	24.46 (621.3)	11.63 (295.4)	6.44 (163.6)
200	6	39.18 (995.2)	30.18 (766.6)	11.63 (295.4)	6.44 (163.6)	39.18 (995.2)	30.18 (766.6)	11.63 (295.4)	6.44 (163.6)
400 ②	2	57.47 (1459.7)	24.12 (612.6)	12.43 (315.7)	7.19 (182.6)	57.47 (1459.7)	24.12 (612.6)	12.43 (315.7)	7.19 (182.6)
400 ②	3	57.47 (1459.7)	24.12 (612.6)	12.43 (315.7)	7.19 (182.6)	57.47 (1459.7)	24.12 (612.6)	12.43 (315.7)	7.19 (182.6)
400 ②	4	57.47 (1459.7)	24.12 (612.6)	12.43 (315.7)	7.19 (182.6)	57.47 (1459.7)	24.12 (612.6)	12.43 (315.7)	7.19 (182.6)
Ungrounded									
30, 60	1	16.27 (413.3)	8.87 (225.3)	9.89 (251.2)	5.25 (133.4)	19.08 (484.6)	8.76 (222.5)	10.22 (259.6)	5.50 (139.7)
30, 60	3	19.08 (484.6)	12.88 (327.2)	10.22 (259.6)	5.50 (139.7)	19.08 (484.6)	12.88 (327.2)	10.22 (259.6)	5.50 (139.7)
100	1	21.99 (558.5)	11.84 (300.7)	9.89 (251.2)	5.25 (133.4)	24.95 (633.7)	11.79 (299.5)	10.22 (259.6)	5.50 (139.7)
100	3	24.95 (633.7)	16.13 (409.7)	10.22 (259.6)	5.50 (139.7)	24.95 (633.7)	16.13 (409.7)	10.22 (259.6)	5.50 (139.7)
200	1	35.38 (898.7)	16.54 (420.1)	11.63 (295.4)	6.44 (163.6)	35.38 (898.7)	16.54 (420.1)	11.63 (295.4)	6.44 (163.6)
200	2	35.38 (898.7)	16.54 (420.1)	11.63 (295.4)	6.44 (163.6)	35.38 (898.7)	16.54 (420.1)	11.63 (295.4)	6.44 (163.6)
200	3	35.38 (898.7)	24.46 (621.3)	11.63 (295.4)	6.44 (163.6)	35.38 (898.7)	24.46 (621.3)	11.63 (295.4)	6.44 (163.6)
400 ②	1	57.47 (1459.7)	24.12 (612.6)	12.43 (315.7)	7.19 (182.6)	57.47 (1459.7)	24.12 (612.6)	12.43 (315.7)	7.19 (182.6)
400 ②	2	57.47 (1459.7)	24.12 (612.6)	12.43 (315.7)	7.19 (182.6)	57.47 (1459.7)	24.12 (612.6)	12.43 (315.7)	7.19 (182.6)

Notes

① NEMA Type 4 and 4X stainless steel enclosures are suitable for mounting in either vertical or horizontal positions. NEMA Type 3R enclosures must be mounted vertically.

② For smaller NEMA 3R enclosure, consult factory.

Approximate Dimensions in Inches (mm)

1000 Vdc Non-Fusible (Fusible Available at 200A and 400A)

Ampere Rating	Number of Circuits	NEMA Type 3R ① A	B	C	D	NEMA Types 4, 4X Stainless ① A	B	C	D
Grounded									
30, 60	1	16.27 (413.3)	8.87 (225.3)	9.89 (251.2)	5.25 (133.4)	14.14 (359.2)	8.76 (222.5)	10.22 (259.6)	5.50 (139.7)
30, 60	2	19.08 (484.6)	12.88 (327.2)	10.22 (259.6)	5.50 (139.7)	19.08 (484.6)	12.88 (327.2)	10.22 (259.6)	5.50 (139.7)
100	1	21.99 (558.5)	11.84 (300.7)	9.89 (251.2)	5.25 (133.4)	24.95 (633.7)	11.79 (299.5)	10.22 (259.6)	5.50 (139.7)
100	2	24.95 (633.7)	16.13 (409.7)	10.22 (259.6)	5.50 (139.7)	24.95 (633.7)	16.13 (409.7)	10.22 (259.6)	5.50 (139.7)
200	1	35.38 (898.7)	16.95 (430.5)	11.63 (295.4)	6.44 (163.6)	35.38 (898.7)	16.95 (430.5)	11.63 (295.4)	6.44 (163.6)
200	2	35.38 (898.7)	24.57 (624.1)	11.63 (295.4)	6.44 (163.6)	35.38 (898.7)	24.57 (624.1)	11.63 (295.4)	6.44 (163.6)
200	3	35.38 (898.7)	24.57 (624.1)	11.63 (295.4)	6.44 (163.6)	35.38 (898.7)	24.57 (624.1)	11.63 (295.4)	6.44 (163.6)
400 ②	1	57.47 (1459.7)	24.12 (612.6)	12.43 (315.7)	7.19 (182.6)	57.47 (1459.7)	24.12 (612.6)	12.43 (315.7)	7.19 (182.6)
400 ②	2	57.47 (1459.7)	24.12 (612.6)	12.43 (315.7)	7.19 (182.6)	57.47 (1459.7)	24.12 (612.6)	12.43 (315.7)	7.19 (182.6)
Ungrounded									
30, 60	1	16.27 (413.3)	8.87 (225.3)	9.89 (251.2)	5.25 (133.4)	14.14 (359.2)	8.76 (222.5)	10.22 (259.6)	5.50 (139.7)
30, 60	2	19.08 (484.6)	12.88 (327.2)	10.22 (259.6)	5.50 (139.7)	19.08 (484.6)	12.88 (327.2)	10.22 (259.6)	5.50 (139.7)
100	1	21.99 (558.5)	11.84 (300.7)	9.89 (251.2)	5.25 (133.4)	24.95 (633.7)	11.79 (299.5)	10.22 (259.6)	5.50 (139.7)
100	2	24.95 (633.7)	16.13 (409.7)	10.22 (259.6)	5.50 (139.7)	24.95 (633.7)	16.13 (409.7)	10.22 (259.6)	5.50 (139.7)
200	1	35.38 (898.7)	16.54 (420.1)	11.63 (295.4)	6.44 (163.6)	35.38 (898.7)	16.54 (420.1)	11.63 (295.4)	6.44 (163.6)
200	2	35.38 (898.7)	16.54 (420.1)	11.63 (295.4)	6.44 (163.6)	35.38 (898.7)	16.54 (420.1)	11.63 (295.4)	6.44 (163.6)
200	3	35.38 (898.7)	24.46 (621.3)	11.63 (295.4)	6.44 (163.6)	35.38 (898.7)	24.46 (621.3)	11.63 (295.4)	6.44 (163.6)
400 ②	1	57.47 (1459.7)	24.12 (612.6)	12.43 (315.7)	7.19 (182.6)	57.47 (1459.7)	24.12 (612.6)	12.43 (315.7)	7.19 (182.6)
400 ②	2	57.47 (1459.7)	24.12 (612.6)	12.43 (315.7)	7.19 (182.6)	57.47 (1459.7)	24.12 (612.6)	12.43 (315.7)	7.19 (182.6)

Notes

① NEMA Type 4 and 4X stainless steel enclosures are suitable for mounting in either vertical or horizontal positions. NEMA Type 3R enclosures must be mounted vertically.

② For smaller NEMA 3R enclosure, consult factory.

Pow-R-Line C Group-Mounted Distribution Switchboard

Contents

Pow-R-Line C Distribution Switchboards

Product Description

Eaton's Pow-R-Line C distribution switchboards combine a space-saving design with modular construction and increased system ratings to provide economical and dependable electrical system distribution and protection.

Application Description

Whether providing access for solar systems to main distribution systems or combining outputs of multiple inverters, Eaton's Pow-R-Line C switchboards are available for customization for many applications, including backfeed scenarios.

Refer to Eaton's *Consulting Application Guide.*

Features, Benefits and Functions

Pow-R-Line C designates a family of distribution switchboards, incorporating design concepts that fit the ever-increasing need for applications on high short-circuit systems, while retaining maximum safety and convenience throughout the line.

- 6000A maximum main bus rating
- 600 Vac and below
- 600 Vdc and below
- Front or rear accessible
- Type 1 or Type 3R enclosures
- ANSI-61 gray powder coat paint finish
- Microprocessor-based metering and monitoring devices
- Utility metering provisions
- Surge protective devices (SPD)
- Ground fault protection on mains and distribution devices
- Busway and transformer connections
- Complete protective device accessory capability
- 65 kAIC bus bracing standard; optional 100 or 200 kAIC
- Standard tin-plated aluminum bus; optional copper- or silver-plated copper bus
  - Standard bus ampacities based on UL heat test ratings. Optional density rated bus systems are also available

Main and Individually Mounted Devices

- Magnum® SB insulated case circuit breakers, 800–5000A, fixed or drawout
- Magnum DS power circuit breakers, 800–5000A, fixed or drawout
- Molded case circuit breakers, 400–2500A, fixed mounted
- Bolted pressure switches, 800–5000A
- FDPW fusible switches, 400–1200A

Group-Mounted Distribution Devices

- Molded case circuit breakers, 15–1200A
- FDPW fusible switches, 30–1200A

Front Accessible

Front-accessible switchboards align at the rear, enabling them to be placed against a wall (Pow-R-Line C front accessible). If the main section is deeper than others, due to physical size of the main device, the necessary off-set in line-up will occur in front, and the main section will be accessible from the side as well as from the front. Standard front accessible switchboards will align at the front and rear.

Rear Accessible

Rear-accessible switchboards align at the front and the rear. Bus maintenance and cable entry and exit require rear access.

Standard Switchboard Height

Standard Pow-R-Line C switchboard height is 90 inches (2286.0 mm).

Group Mounting

Group-mounted circuit protective devices are an assembly of units mounted on a panelboard type base (panelboard construction). Units may be molded case breakers, or FDPW fusible switches. Circuit protective devices are accessible from the front.

A main molded case breaker or main FDPW fusible switch, within the sizes listed for panelboard design, can be included in the panel-mounted assembly in lieu of a separate, individually mounted unit.

Space Only for Future Devices Group-Mounted Construction

Where space only for future circuit protective devices is required, the proper space and a blank filler plate will be supplied. Connections and mounting hardware are not included.

Provision for Future Devices

Where provisions for future circuit protective devices are required, space for the device, corresponding vertical bus, device connectors and the necessary mounting hardware will be supplied.

Busbar System

Standard bus in the switchboards is tin-plated aluminum. Silver-plated copper and tin-plated copper are also available.

Main bus and sub-main buses meet UL and NEMA standards for temperature rise on all Pow-R-Line C switchboards. Special bus densities are available.

Overcurrent Devices

To properly select and size overcurrent devices for use in a switchboard, the allowable temperature rise must be taken into account as to its effect on the tripping characteristics of the devices in question.

Accordingly, Article 220 of the NEC requires overcurrent devices to be rated not less than 125% of the continuous load they are protecting. To comply with this, an 80% derating factor must be used with all overcurrent devices such as molded case breakers and FDPW fusible switches unless they are tested and marked as 100% rated devices.

Short-Circuit Rating

Standard bus and connectors on all switchboards are rated for use on systems capable of producing up to 65,000A rms symmetrical short-circuit current at the incoming terminals.

Increased bus short-circuit ratings equal to that of connected switchboard devices, up to 200,000A rms symmetrical, are available in most Pow-R-Line C switchboards when approved main devices are installed. Contact Eaton for more information. UL labeled switchboard sections are marked with their applicable short-circuit rating.

Provision for Busway Entrance and Exit

Busway connections to switchboard sections include cutout and drilling in the top of the switchboard with riser connections from the switchboard device or bus, up to the point where the bus duct enters the switchboard. No connections are furnished external to the switchboard.

Note: In all transactions involving busway attached to switchboards, it is essential that information regarding orientation of the busway with respect to the front of the switchboard be supplied to the coordinating assembly plant.

On Pow-R-Line C switchboards, solid busbar is used to connect the bus duct to the individually mounted main device, main or sub-main switchboard bus, or vertical main bus of panel mounted circuit protective device panels. Busway fed by group-mounted branch devices are cable connected.

Aluminum riser connections are standard. Copper- or silver-plated copper is available as a modification.

Transitions

Transition structures are required for connecting switchboards to the secondary of power center transformer (dry or liquid filled), motor control centers, and for other special switchboard configurations such as "L" or "U" shaped lineups. In some applications, an extra structure complete with connections is required; in others, where switchboard depth and space permit, only the connection conductors are required. Refer to factory for these applications.

Standards and Certifications

- Meets NEMA Standard PB-2 and UL 891
- Seismically qualified

Product Selection

For complete application and pricing information, contact your local Eaton sales office.

Technical Data and Specifications

Service

- 120/240V, single-phase, three-wire
- 240/120V, 208Y/120V, 415Y/240V, 480Y/277V or 600Y/347V three-phase, four-wire
- 600 Vdc

Main Bus Rating

- 400–5000A

Service Section

- Main circuit breaker, 400–5000A
- Main fusible switch, 400–5000A
- Main lugs only, 400–6000A

Metering Sections

- Tenant main disconnects and meter sockets (200A maximum self-contained metered circuits)
- Hot sequence metering circuits
- Cold sequence metering circuits (WCMS only)
- Optional rear barriered wireways or load side pull sections for cable exit requirements
- Sections for metered circuits larger than 200A available with 400A continuous rated self-contained sockets or with CT compartment and transformer rated socket in combination with disconnect

Integrated Facility Switchboard

Contents

An Eaton Green Solution

Integrated Facility Switchboard

Product Description

Eaton's Integrated Facility Switchboards use the modular Pow-R-Line C group-mounted switchboard design to integrate traditionally separate electrical distribution and control equipment into a single space-saving factory assembled and connected package.

The service entrance equipment can be integrated with multiple lighting and appliance branch panelboards into a compact front-accessible group-mounted switchboard. Where multiple panelboards are used in the same electrical room as a conventional distribution switchboard or power panelboards, the integrated design will significantly reduce equipment space requirements, as well as reduce installation time and cost.

Other associated equipment can also be integrated into the assembly, including dry-type distribution transformers, time clock space, lighting control, electronic controls, surge protective devices, metering and energy monitoring devices. Depending upon the application, other user-defined equipment such as a subsystem control package may also be incorporated.

Application Description

Eaton's Integrated Facility Switchboards are designed to meet specific needs for:

- Solar/alternative energy integration projects
- Retail chain stores
- Commercial offices
- High rise buildings
- Correctional facilities
- Agricultural facilities
- Industrial facilities
- Hospitals/health care facilities
- Educational facilities

Whether the application is a multi-site prototype or single application, integrated switchboards offer time and space-saving features.

For complete application description, refer to Eaton's *Consulting Application Guide*.

Features, Benefits and Functions

Front Accessible

Integrated Facility Switchboards are front accessible and align at the rear, enabling them to be placed against a wall. Most switchboards align at the front and the rear. If the main section is deeper than others, due to physical size of the main device, the necessary off-set in line-up will occur in front, and the main section will be accessible from the side as well as from the front.

Standard Switchboard Height

Switchboard height is 90 inches (2286.0 mm).

A limited offering of 78-inch (1981.2 mm) high equipment is available. Consult the factory for specific applications.

Switchboard Shipping Splits

The sections can be shipped as specified by the customer to meet specific requirements.

For retrofit applications, single-piece switchboard structures can be shipped to facilitate movement through limited access doorways, etc.

Factory Interconnections

Most sub-panels are fed from the main distribution panel feeder circuit breakers using copper cable sized per the NEC and UL.

Space Savings

The space-saving switchboard installation provides additional usable floor space. For example:

- Retail stores—floor space for sales
- Offices—additional storage, cubicle
- Health care—additional work area
- Retrofits—ability to fit existing rooms

Site Construction Savings

Timely installation of the electrical system typically is a key element on the critical path for any project.

Along with the time to install the equipment, other expenses include the time to handle all of the loose pieces of equipment arriving on a job site and ensuring it reaches the proper trades person. With Eaton's Integrated Facility Switchboards, one piece of equipment is typically shipped to a job site virtually eliminating these issues.

The equipment may also be used for temporary power on job sites, further reducing construction expenses and times.

Standards and Certifications

- Meets NEMA Standard PB-2 and UL 891
- Panelboards mounted inside the sections meet NEMA PB-1 and UL 67
- Other equipment is UL listed as applicable and appropriate

UL Listed

Product Selection

For complete application and pricing information, contact your local Eaton sales office.

Additional Information

For information on reverse feed breaker applications, please see **Consulting Application Guide—Molded-Case Circuit Breakers & Enclosures**, CA08104001E, Tab 27.

Solar Panelboards

Contents

Product Selection Guide

Product Types

Type PRL1a

Bolt-On or Plug-On Circuit Breakers
240 Vac Maximum

Main lugs only
400A maximum

Main Circuit breaker
400A maximum

Branch circuit breakers
100A maximum,
Single-, two- and three-pole

Type PRL2a

Bolt-On Circuit Breakers
240 or 480Y/277 Vac; 125/250 Vdc Maximum

Main lugs only
400A maximum

Main circuit breaker
400A maximum

Branch circuit breakers
100A maximum,
Single-, two- and three-pole

Type PRL3a

Bolt-On Circuit Breakers
240, 480 or 600 Vac; 250 Vdc Maximum

Main lugs only
800A maximum

Main circuit breaker
600A maximum

Branch circuit breakers
225A maximum,
Single-, two- and three-pole

Type PRL4

Circuit Breakers or Fusible Switches
240, 480 or 600 Vac; 600 Vdc Maximum

Main lugs only
1200A maximum

Main circuit breaker
1200A maximum

Main fusible switch
1200A maximum

Branch circuit breakers
1200A maximum,
Single-, two- and three-pole

Branch fusible switches
1200A maximum,
two- and three-pole

Type PRL1a Panelboard

Contents

Product Description

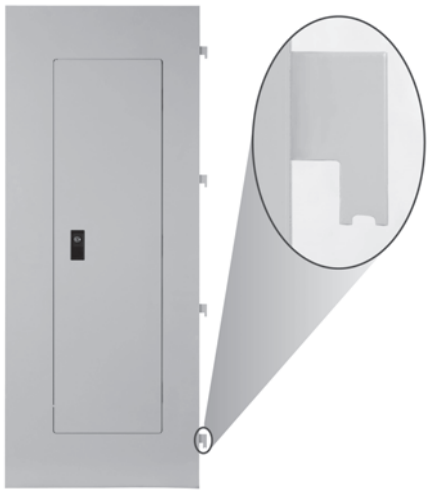
Eaton's EZ Box™ and EZ Trim™ represents the first significant change in panelboard box and trim designs in more than a half-century. The EZ Box and EZ Trim have been designed for faster, more secure and safer installations. The new EZ Box and EZ Trim are provided standard for Eaton's Pow-R-Line 1a and Pow-R-Line 2a lighting panelboards, as well as the Pow-R-Line 3a and Pow-R-Line 3E mid-range panelboard.

Flange Detail

Features

- Virtually eliminates sharp edges
- Trim installs in seconds rather than minutes
- 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)

The EZ Box flanges are bent and painted, which virtually eliminates the sharp edges associated with traditional boxes. Additionally, all steel panelboard chassis parts are painted. This significantly reduces potential injury for material handlers and installers. Each flange is adjustable outward up to 3/4-inch (19.1 mm). This feature allows the installer to adjust flush box applications to be level and flat with the finished wall after the wall material is installed to help correct wall irregularities. The new box flange also provides the means for attaching the EZ Trim.



Standalone Trim and Bottom Flange Hanger with Notch

Corner Flange Detail

Fast Installation

The EZ Trim incorporates a groundbreaking design that installs in seconds, rather than minutes. The standard trim features include door-in-door construction; no exposed hardware and no tools are required for installation.

Each EZ Trim includes hangers attached on the right side. The bottom trim hanger has a notch in its base. To install, the bottom hanger is inserted into the bottom right side box flange opening, resting the notch on the flange.

Trim Hanger Inserted Into Box Flange

The balance of the hangers are aligned with the other flange openings and pushed in. When all hangers are in the box flange, the trim is lifted up slightly to clear the notch on the bottom hanger, and the trim in self-supported on the EZ Box.

The installation is completed by swinging the trim to the closed position, then lifting and pushing slightly to the right. The trim will drop into place totally secured. The multi-point catches on the left side of the trim will lock into the left side box flange openings.

To prevent the trim from being removed by non-authorized persons, a unique sliding means automatically latches in place when the trim door is closed. Along with a new lock, the EZ Trim offers a high degree of door security.

Standards and Certifications

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

- UL 50 listed
- NEMA Standard PB1
- Federal specifications
- National Electrical Code

UL Listed

Trim Hanging on Surface Mounted Box

Product Selection

Boxes and Trims Only—Type 1

Types PRL1a, PRL2a and PRL3a (400A Maximum)

Box Dimensions—Inches (mm)	Height	YS Box Catalog Number	LT Trim Catalog Number	EZ Box ① Catalog Number	EZ Trim ① Catalog Number
20.00 W x 5.75 D (508.0 W x 146.1 D)	36.00 (914.4)	**YS2036**	**LT2036S or F**	**EZB2036R**	**EZT2036S or F**
	42.00 (1066.8)	**YS2042**	**LT2042S or F**	**EZB2042R**	**EZT2042S or F**
	48.00 (1219.2)	**YS2048**	**LT2048S or F**	**EZB2048R**	**EZT2048S or F**
	60.00 (1524.0)	**YS2060**	**LT2060S or F**	**EZB2060R**	**EZT2060S or F**
	72.00 (1828.8)	**YS2072**	**LT2072S or F**	**EZB2072R**	**EZT2072S or F**
	90.00 (2286.0)	**YS2090**	**LT2090S or F**	**EZB2090R**	**EZT2090S or F**

Type PRL3a (600A)

Box Dimensions—Inches (mm)	Height	YS Box Catalog Number	LT Trim Catalog Number	EZ Box ① Catalog Number	EZ Trim ① Catalog Number
20.00 W x 5.75 D (508.0 W x 146.1 D)	36.00 (914.4)	**YS2036**	**LTV2036S or F**	**EZB2036R**	**EZTV2036S or F**
	48.00 (1219.2)	**YS2048**	**LTV2048S or F**	**EZB2048R**	**EZTV2048S or F**
	60.00 (1524.0)	**YS2060**	**LTV2060S or F**	**EZB2060R**	**EZTV2060S or F**
	72.00 (1828.8)	**YS2072**	**LTV2072S or F**	**EZB2072R**	**EZTV2072S or F**
	90.00 (2286.0)	**YS2090**	**LTV2090S or F**	**EZB2090R**	**EZTV2090S or F**

Type PRL3a (800A)

Box Dimensions—Inches (mm)	Height	YS Box Catalog Number	LT Trim Catalog Number
28.00 W x 5.75 D	36.00 (914.4)	**YS2836**	**LTV2836S or F**
	48.00 (1219.2)	**YS2848**	**LTV2848S or F**
	60.00 (1524.0)	**YS2860**	**LTV2860S or F**
	72.00 (1828.8)	**YS2872**	**LTV2872S or F**
	90.00 (2286.0)	**YS2890**	**LTV2890S or F**

Note

① EZ Box must be used with EZ Trim.

Pow-R-Line C Panelboards

Contents

Product Description

Distribution Panelboards

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-pole) 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 or aluminum conductors.

Enclosures

Boxes are code-gauge galvanized steel, 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 indoor and special purpose applications.

All enclosures are furnished in accordance with Underwriters Laboratories 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 1/4-inch (6.4 mm).

Standard panelboard boxes are supplied without knockouts (blank endwalls).

Fronts

Fronts (trims) for all panelboards are made of code-gauge steel and have a high durability ANSI-61 light gray finish applied by a baked-on polyester powder coating paint system.

The fronts 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.

EZ Trim Features Standard Door-in-Door with No Exposed Hardware or Sharp Edges (no Tools are Required for Installation)

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

Fronts for power distribution panelboards utilize 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.

Application Description

Whether providing access for solar systems to inverter inputs or combining outputs from multiple inverters, Eaton's Pow-R-Line C panelboards are available for customization for any application, including backfeed scenarios.

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
- Environment

Panelboard Short-Circuit Rating

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

Service Entrance Equipment

The National Electrical Code (NEC) requires that:

- A panel used as service entrance equipment must be located near the point where the supply conductors enter the building
- 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
- A disconnectable electrical bond must be provided between the neutral and ground
- A service entrance type UL label must be factory installed
- Ground fault protection of equipment shall be provided for each service disconnect rated 1000A or more if the electrical service is a solidly grounded wye system of more than 150V to ground, but not exceeding 600V phase-to-phase

Note: Service entrance panels must be identified as such on the order.

Panelboard Standards

In 2008, both the National Electrical Code (Article 408) and UL 67 were updated to remove the mandated 42-circuit limitation. Eaton offers panelboards with more than 42 circuits for those jurisdictions that have adopted the 2008 NEC or later.

For jurisdictions that have not adopted the 2008 or later version of the National Electrical Code, the 42-circuit limitation for Lighting and Appliance Branch Panelboards remains in place. Check with your local code officials to determine specific jurisdiction status.

Panelboard Installation

NEC requires that the operating handle of the topmost mounted device be no more than 6 feet 7 inches (2006.6 mm) above the finished floor and should be installed per NEC and manufacturer's instructions.

Additional boxes and fronts are required when the components required for one panelboard exceed the standard box dimensions.

Multi-Section Panelboards

When two or more separate enclosures are required, separate fronts for each box are standard. A common front can be furnished at additional charge.

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 included (and priced) to provide connection capability to the second section.

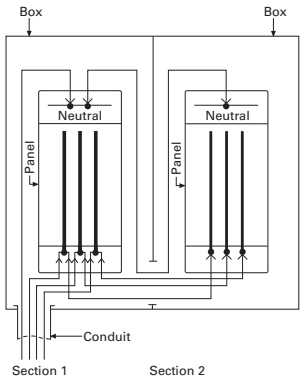
Note: Sub-feed or through-feed lugs cannot be used on any panelboard that is not protected by a single main overcurrent device either in the panelboard or immediately upstream, i.e., service entrance panelboards with main lugs only using the six disconnect rule.

Sub-Feed Lugs

Sub-feed lugs (see figure below) 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.

Sub-Feed Lugs

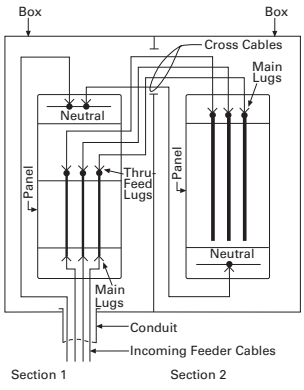


Through-Feed Lugs

Through-feed lugs (see figure below) 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.

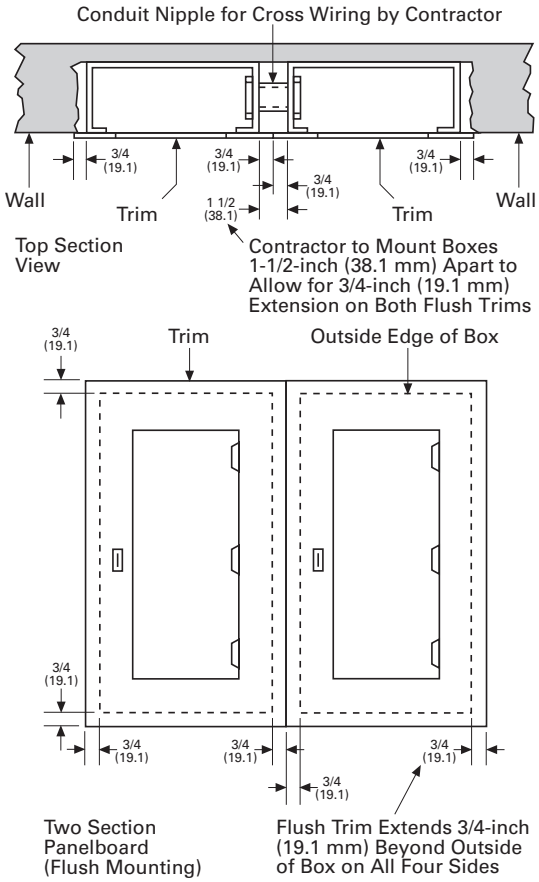
Through-Feed Lugs



Multiple Section Panelboard—Flush Mounted

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

Multiple Section Panelboard Flush Mounted—Dimensions in Inches (mm)



Overcurrent Protection

The following requirements will be found in the NEC:

Each lighting and appliance branch circuit panelboard shall be individually protected on the supply side by not more than two main circuit breakers or two sets of fuses having a combined rating not greater than that on the panelboard.

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.

Underwriters Laboratories test procedures are based, in part, on 80% loading of panelboard branch circuit devices. 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 listed for continuous duty at 100% of its rating.

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 (2011.7m)
- Damp environment (possible fungus growth)
- Compliance with federal, state and municipal electrical codes and standards

Seismic Considerations

The Uniform Building Code® and the International Building Code, as well as local and state building codes, place an emphasis on seismic building design requirements. Electrical distribution systems are treated as attachments to the building and therefore, fall into this category.

All Eaton panelboards are seismic qualified at the highest possible level, and have been tested in accordance with ANSI C37.81. This standard quantifies actual earthquake conditions, as well as equipment seismic capability.

Harmonic Currents

Standard panelboard neutrals are rated for 100% of the panelboard current. However, since harmonic currents can cause overheated neutrals, an option is provided for neutrals to be rated at 200% (1200A maximum neutral for 600A main bus) of the panelboard phase current.

Panelboards with the 200% rated neutral are UL listed as suitable for use with non-linear 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

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 surge protective device (SPD) is integrated into the panelboards using a "zero lead length" direct busbar connection.

Pow-R-Line 4

The SPD protects sensitive electronic equipment from the damaging effects of high and low energy transients, as well as high frequency noise.

Standards and Certifications

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

- Underwriters Laboratories:
  - Panelboards: UL 67
  - Cabinets and Boxes: UL 50

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

- National Electrical Code
- NEMA Standards: PB 1
- Federal Specification W-P-115c:
  - Circuit Breakers—Type I Class I
  - Fusible Switch—Type II Class I

UL Listed

Technical Data and Specifications

Panelboard Selection Guide

Panelboard Type	Device Type	Maximum Voltage Rating AC	Maximum Voltage Rating DC	Maximum Main Rating (Amperes) MLO	Maximum Main Rating (Amperes) Main Device	Branch Circuits Ampere Range	Sub-Feed Breaker Maximum Amperes	AC Interrupting Capacity rms Symmetrical Amperes (kA) Fully Rated	AC Interrupting Capacity rms Symmetrical Amperes (kA) Series Rated
PRL1a	Breaker	240	—	400	400	15–100	400	10–22	22–100
PRL2a	Breaker	240	250	400	400	15–100	400	65	65–200
	Breaker	480Y/277	250	400	400	15–100	400	14	22–150
PRL2R	Breaker	240	—	225	225	15–100	—	10–22	22–200
	Breaker	480Y/277	—	225	225	15–100	—	14	22–100
PRL3a	Breaker	240	250	800	600	15–225	600	10–200	22–200
	Breaker	480	250	800	600	15–225	600	14–100	22–150
	Breaker	600	250	800	600	15–225	600	14–35	—
PRL4B	Breaker	240	600	1200	1200	15–1200	—	10–200	22–200
	Breaker	480	600	1200	1200	15–1200	—	14–200	22–150
	Breaker	600	600	1200	1200	15–1200	—	14–200	—
PRL4F	Fusible	240	250	1200	1200	30–1200	—	100–200	—
	Fusible	600	250	1200	1200	30–1200	—	100–200	—

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

Note: All terminal sizes are based on wire ampacities corresponding to those shown in NEC Table 310.16 under the 75°C insulation columns (75°C wire). The use of smaller size, (in circular mills), regardless of insulation temperature rating, is not permitted.

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.

Check Eaton's standard terminal sizes versus customer requirements. In particular, 400 and 800A breakers often require nonstandard lugs.

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

Standard Main Lug Terminals

Panel Type	Wire Size Ranges for Ampere Capacity 100A	225A	250A	400A	600A	800A	1200A
PRL1a	#12–1/0	#6–300 kcmil	—	(2) #4–500 kcmil	—	—	—
PRL2a	#12–1/0	#6–300 kcmil	—	(2) #4–500 kcmil	—	—	—
PRL3a	#12–1/0	—	#6–350 kcmil	(2) #4–500 kcmil	(2) #4–500 kcmil	(3) #4–500 kcmil	—
PRL4	—	—	#4–500 kcmil	(2) #4–500 kcmil	(2) #4–500 kcmil	(3) #4–500 kcmil	(4) #4–500 kcmil

Standard Circuit Breaker Terminals

Breaker Type	Ampere Rating	Wire Range
BAB, QBHW, BABRSP, HQP, QPHW	15–70	#14–#4
	90–100	#8–1/0
EDB, EDS, ED, EDH, EDC	100–225	#4–4/0 or #6–300 kcmil
EGB, EGE, EGS, EGH	15–50	#14–3/0 AL/CU
	60–125	#6–3/0 AL/CU
EHD, FDB, FD, HFD, FDC, HFDDC ①	15–100	#14–1/0
	125–225	#4–4/0
FCL	15–100	#14–1/0
GHB, HGHB, GHQ, GHQRSP	15–20	#14–#10
	25–100	#10–1/0
EGB, EGS, EGH	15–50	#14–1/0
	60–125	#6–2/0
JD, HJD, JDC, HJDDC ①	70–250	#4–350 kcmil
DK	250–350	250–500 kcmil
	400	(2) 3/0–250 kcmil or (1) 3/0–500 kcmil
KD, HKD, KDC, HKDDC, ① CKD, CHKD	225	(1) #3–350 kcmil
	350	(2) 3/0–250 kcmil or
	400	(2) 3/0–250 kcmil or (1) 3/0–500 kcmil
LHH	150–400	#2–500 kcmil
	150–400	(2) #2–500 kcmil
	150–400	(1) 500–750 kcmil
LGE, LGH, LGC, LGU, LHH ②	250–400	(1) #2–500 kcmil
	500–600	(2) #2–500 kcmil
LD, HLD, LDC, HLDDC ① CLD, CHLD	300–500	(2) 250–350 kcmil
	600	(2) 400–500 kcmil
MDL, HMDL, HMDLDC ① CMDL, CHMDL	400–600	(2) #1–500 kcmil
	700–800	(3) 3/0–400 kcmil
ND, HND, CND, CHND, NDC, CNDC	800–1000	(3) 3/0–400 kcmil
	1200	(4) 4/0–500 kcmil
LCL	125–225	(1) #6–350 kcmil
	250–400	(1) #4–250 kcmil and (1) 3/0–600 kcmil
FB-P	15–100	#14–1/0
LA-P	70–225	#6–350 kcmil
	250–400	(1) #4–250 kcmil and (1) 3/0–600 kcmil
NB-P, NBDC ①	300–700	(2) #1–500 kcmil
	800	(3) 3/0–400 kcmil

FDPW Switch Terminals

Ampere Rating	Wire Range
30	#14–1/0
60	#14–1/0
100	#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

Notes

① Suitable for DC applications only.

② LHH is 400A maximum.

Selection Guide

Molded Case Circuit Breaker Ratings

Note: Circuit breakers equal or exceed Federal Specification W-C-375b requirements for the particular class associated with each circuit breaker type.

Breaker Type	Continuous Ampere Rating	Number of Poles	Maximum Voltage AC	UL Listed Interrupting Ratings—kA Symmetrical Amperes AC Rating Volts 120/240	240	277	480	600	DC Rating Volts ① 125	250
BAB ②③, HQP ②③	15–70	1	120	10	—	—	—	—	—	—
	15–100	2	120/240	10	—	—	—	—	—	—
	15–100	2, 3	240	—	10	—	—	—	—	—
BABRP, BABRSP ②	15–30	1	120	10	—	—	—	—	—	—
	15–30	2	120/240	10	—	—	—	—	—	—
QBGF, QBGFEP, QPGF, QPGFEP, QBAF, QBAG	15–40	1	120	10	—	—	—	—	—	—
	15–50	2	120/240	10	—	—	—	—	—	—
	15–20	1	120	10	—	—	—	—	—	—
	15–20	2	120/240	10	—	—	—	—	—	—
QBHW ②③, QPHW ②③	15–70	1	120	22	—	—	—	—	—	—
	15–100	2	120/240	22	—	—	—	—	—	—
	15–100	2, 3	240	—	22	—	—	—	—	—
QBHGF, QBHGFEP, QPHGF, QPHGFEP	15–30	1	120	22	—	—	—	—	—	—
	15–30	2	120/240	22	—	—	—	—	—	—
GQ, GHQ ②, GHQRSP, GHB ②③	15–20	1	277	65	—	14	—	—	—	—
	15–100 ④	1	277	65	—	14	—	—	14	—
	15–100 ④	2, 3	480Y/277	—	65	—	14	—	—	14
HGHB ②, GHBGFEP	15–30	1	277	65	—	25	—	—	—	—
	15–60	1	277	—	—	14	—	—	—	—
GHBS	15–30	1	277	65	—	14	—	—	—	—
	15–30	2	480Y/277	—	65	—	14	—	—	—
EHD ②③	15–100	1	277	—	—	14	—	—	10	—
	15–100	2, 3	480	—	18	—	14	—	—	10
EGB	15–125	1	277	35	35	18	—	—	10	—
	15–125	2, 3	480	—	35	—	18	—	—	10
EGS	15–125	1	277	100	—	35	—	—	35	—
	15–125	2, 3	480	—	100	—	35	—	—	35
EGH	15–125	1	277	200	—	65	—	—	42	—
	15–125	2, 3	480	—	200	—	65	—	—	42
FDB ⑤, FD ②③	15–150	2, 3	600	—	18	—	14	14	—	10
	15–150	1	277	—	—	35	—	—	10	—
	15–225	2, 3	600	—	65	—	35	18	—	10
HFD ②③	15–150	1	277	—	—	65	—	—	10	—
	15–225	2, 3	600	—	100	—	65	25	—	22

Notes

① DC ratings apply to substantially non-inductive circuits.
② 15 and 20A single-pole switching duty rated for fluorescent applications.
③ Single-, two- and three-pole HACR rated.
④ DC rated single-pole, 15–70A only.
⑤ Two- and three-pole HACR rated.

Selection Guide, continued

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Molded Case Circuit Breaker Ratings, continued

Note: Circuit breakers equal or exceed Federal Specification W-C-375b requirements for the particular class associated with each circuit breaker type.

Breaker Type	Continuous Ampere Rating	Number of Poles	Volts AC	UL Listed Interrupting Ratings—kA Symmetrical Amperes AC Rating Volts 120/240	240	277	480	600	DC Rating Volts ① 125	250
FDC ②	15–225	2, 3	600	—	200	—	100	35	—	22
FCL	15–100	2, 3	480	—	200	—	150	—	—	—
EDB ②	100–225	2, 3	240	—	22	—	—	—	10	—
EDS ②	100–225	2, 3	240	—	42	—	—	—	10	—
ED ②	100–225	2, 3	240	—	65	—	—	—	10	—
EDH ②	100–225	2, 3	240	—	100	—	—	—	10	—
EDC ②	100–225	2, 3	240	—	200	—	—	—	10	—
EGB ②	15–125	1, 2, 3	240	—	25	—	18	—	—	—
EGE ②	15–125	1, 2, 3	240	—	—	—	—	18	—	—
EGS ②	15–125	1, 2, 3	240	—	85	—	35	22	—	—
EGH ②	15–125	1, 2, 3	240	—	100	—	65	25	—	—
JD ②	70–250	2, 3	600	—	65	—	35	18	—	10
HJD ②	70–250	2, 3	600	—	100	—	65	25	—	22
JDC ②	70–250	2, 3	600	—	200	—	100	35	—	22
DK	250–400	2, 3	240	—	65	—	—	—	—	10
KD, CKD ③	100–400	2, 3	600	—	65	—	35	25	—	10 ④
HKD, CHKD ③	100–400	2, 3	600	—	100	—	65	35	—	22 ④
LHH ⑤	150–400	2, 3	480	—	100	—	65	35	—	42
KDC	100–400	2, 3	600	—	200	—	100	65	—	22 ④
LCL ⑤	125–400	2, 3	600	—	200	—	200	100	—	—
LGE	250–600	3	600	—	65	—	35	18	—	22
LGC ⑤	250–600	2, 3	600	—	200	—	100	50	—	42
LGU ⑤	250–600	2, 3	600	—	200	—	150	65	—	50
LD ⑤, CLD ③⑤	300–600	2, 3	600	—	65	—	35	25	—	22 ④
LGH	250–600	3	600	—	100	—	65	35	—	22
HLD ⑤, CHLD ③⑤	300–600	2, 3	600	—	100	—	65	35	—	25 ④
LDC ⑤, CLDC ③⑤	300–600	2, 3	600	—	200	—	100	50	—	25 ④
MDL ⑤, CMDL ③⑤	400–800	2, 3	600	—	65	—	50	25	—	22 ④
HMDL ⑤, CHMDL ③⑤	400–800	2, 3	600	—	100	—	65	35	—	25 ④
ND ⑤, CND ③⑤	600–1200	2, 3	600	—	65	—	50	25	—	—
HND ⑤, CHND ③⑤	600–1200	2, 3	600	—	100	—	65	35	—	—
NDC ⑤, CNDC ③⑤	600–1200	2, 3	600	—	200	—	100	65	—	—
Integrally Fused, Current Limiting Circuit Breakers										
FB-P	15–100	2, 3	600	—	200	—	200	200	—	⑥
LA-P	70–400	2, 3	600	—	200	—	200	200	—	⑥
NB-P	300–800	2, 3	600	—	200	—	200	200	—	⑥

Notes

① DC ratings apply to substantially non-inductive circuits.
② Two- and three-pole HACR rated.
③ 100% rated circuit breaker.
④ DC rating not available with electronic trip.
⑤ Available with integral ground fault protection.
⑥ 100k based on NEMA test procedure.

Type PRL1a

Contents

Type PRL1a

Product Description

- 240 Vac maximum
- Three-phase four-wire, three-phase three-wire, single-phase three-wire, single-phase two-wire
- 400A maximum mains
- 100A maximum branch breakers
- Bolt-on or plug-on branch breakers
- Each branch connector is capable of up to a total of 140A maximum by breaker ampere rating
- Factory assembled
- Refer to **Page V15-T2-29** for additional information

Application Description

- Lighting branch panelboard
- Fully rated or series rated
- Interrupting ratings up to 200 kA symmetrical
- Suitable for use as Service Entrance Equipment, when specified on the order
- See **Pages V15-T2-29** through **V15-T2-36** for additional information

Standards and Certifications

- UL 67, UL 50
- Federal Specification W-P-115c
- Refer to **Page V15-T2-29** for additional information

UL Listed

Product Selection

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Type PRL1a

PRL1a

Ampere Rating	Interrupting Rating (kA Sym.) 240 Vac	Breaker Type
Main Lug Only		
100	—	—
225	—	—
400	—	—
Main Breaker		
100	10	BAB
100	18	EHD
100	22	QBHW
100	22	EDB
100	42	EDS
100	65	ED
100	65	FD, FDE
100	100	EDH
100	100	HFD, HFDE
225	22	EDB
225	42	EDS
225	65	ED
225	100	EDH
250	65	JD
250	100	HJD
250	200	JDC
400	65	DK
400	65	KD
400	100	HKD
400	100	LHH
400	200	KDC

PRL1a Branch Circuit Breakers

Bolt-on = BAB, QBHW, QBGF, QBHGF, QBGFEP, QBHGFEP, QBAF, QBAG, QBHAF, QBHAG
Plug-on = HQP, QPHW, QPGF, QPHGF, QPGFEP, QPHGFEP

Ampere Rating	Interrupting Rating (kA Sym.) 240 Vac ①	Breaker Type
15–60	10	BAB, HQP
70	10	BAB, HQP
80–100	10	BAB, HQP
15–50 ②	10	QBGF, QPGF ③
15–50 ②	10	QBGFEP, QPGFEP ④
15–20	10	QBCAF ⑤
15–60	10	BAB-D, HQP-D ⑥
15–30	10	BAB-C, HQP-B ⑦
15–30	10	BABRP ⑧
15–30	10	BABRSP ⑧
15–60	22	QBHW, QPHW
70	22	QBHW, QPHW
80–100	22	QBHW, QPHW
15–30	22	QBHGF, QPHGF ③
15–30	22	QBHGFEP, QPHGFEP ④
15–20	22	QBHCAF ⑤
Provision	—	—

Notes

① Single-pole breakers are rated 120 Vac maximum.
② 50A devices are available as two-pole only.
③ GFCI for 5 mA personnel protection.
④ GFP for 30 mA equipment protection.
⑤ Arc fault circuit breaker.
⑥ HID (High Intensity Discharge) rated breaker.
⑦ Switching Neutral Breaker. single-pole device requires two-pole space, two-pole device requires three-pole space.
⑧ Solenoid operated breaker.

Box Sizing and Selection

Approximate Dimensions in Inches (mm)

Assembled Circuit Breaker Panelboards and Lighting Controls

Box size and box and trim catalog numbers for all standard panelboard types are found on **Page V15-T2-40**.

Instructions

1. Using description of the required panelboard, select the rating and type of main required.
2. Count the total number of branch circuit poles, including provisions, required in the panelboard. Do not count main breaker poles. Convert two- or three-pole branch breaker to single-poles, i.e., three-pole breaker, count as three poles. Determine sub-feed breaker or through-feed lug requirements.
3. Select the main ampere rating section from table on **Page V15-T2-40**.
4. Select panelboard type from first column, main breaker frame, if applicable, from second column, and sub-feed breaker frame, if applicable, from the third column.
5. From Step #2, determine the number of branch circuits in Column 4.
6. Read box size, box and trim catalog numbers across columns to the right. Specify surface or flush mounting on the order.

Cabinets

Fronts are code-gauge steel, ANSI-61 light gray painted finish.

Boxes are code-gauge galvanized steel without knockouts. Standard depth is 5-3/4 inches (146.1 mm). Standard width is 20 inches (508.0 mm). An optional 28-inch (711.2 mm) wide box is available.

Top and Bottom Gutters

5-1/2 inches (139.7 mm) minimum.

Approximate Dimensions in Inches (mm)

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PRL1a Panelboard Sizing

Panelboard Types	Main Breaker Types and Mounting Position (H) = Horizontal (V) = Vertical	Sub-Feed Breaker Types and Mounting Position (H) = Horizontal (V) = Vertical	Maximum No. of Branch Circuits Including Provisions	Box Dimensions ① Height	Width	Depth	YS Box Catalog Number	LT Trim Catalog Number	EZ Box Catalog Number	EZ Trim Catalog Number
100A										
Main breaker	BAB, QBHW (H)	—	15	36.00 (914.4)	20.00 (508.0)	5.75 (146.1)	**YS2036**	**LT2036S or F**	**EZB2036R**	**EZT2036S or F**
		—	27	48.00 (1219.2)	20.00 (508.0)	5.75 (146.1)	**YS2048**	**LT2048S or F**	**EZB2048R**	**EZT2048S or F**
		—	39	48.00 (1219.2)	20.00 (508.0)	5.75 (146.1)	**YS2048**	**LT2048S or F**	**EZB2048R**	**EZT2048S or F**
		—	42	60.00 (1524.0)	20.00 (508.0)	5.75 (146.1)	**YS2060**	**LT2060S or F**	**EZB2060R**	**EZT2060S or F**
Main lugs or main breaker	EHD FD, HFD (V)	—	18	36.00 (914.4)	20.00 (508.0)	5.75 (146.1)	**YS2036**	**LT2036S or F**	**EZB2036R**	**EZT2036S or F**
		—	30	48.00 (1219.2)	20.00 (508.0)	5.75 (146.1)	**YS2048**	**LT2048S or F**	**EZB2048R**	**EZT2048S or F**
		—	42	48.00 (1219.2)	20.00 (508.0)	5.75 (146.1)	**YS2048**	**LT2048S or F**	**EZB2048R**	**EZT2048S or F**
Main lugs or main breaker with 100A through-feed lugs or sub-feed breaker	EHD FD HFD (V)	EHD FD HFD (V)	18	48.00 (1219.2)	20.00 (508.0)	5.75 (146.1)	**YS2048**	**LT2048S or F**	**EZB2048R**	**EZT2048S or F**
			30	48.00 (1219.2)	20.00 (508.0)	5.75 (146.1)	**YS2048**	**LT2048S or F**	**EZB2048R**	**EZT2048S or F**
			42	60.00 (1524.0)	20.00 (508.0)	5.75 (146.1)	**YS2060**	**LT2060S or F**	**EZB2060R**	**EZT2060S or F**
225A										
Main lugs or main breaker	EDB, EDS, ED, EDH, FD, HFD (V)	—	18	36.00 (914.4)	20.00 (508.0)	5.75 (146.1)	**YS2036**	**LT2036S or F**	**EZB2036R**	**EZT2036S or F**
		—	30	48.00 (1219.2)	20.00 (508.0)	5.75 (146.1)	**YS2048**	**LT2048S or F**	**EZB2048R**	**EZT2048S or F**
		—	42	48.00 (1219.2)	20.00 (508.0)	5.75 (146.1)	**YS2048**	**LT2048S or F**	**EZB2048R**	**EZT2048S or F**
Main lugs or main breaker with 225A throughfeed lugs or sub-feed breaker	FD, HFD, EDS, ED, EDH (V)	FD, HFD, EDS, ED, EDH (V)	18	48.00 (1219.2)	20.00 (508.0)	5.75 (146.1)	**YS2048**	**LT2048S or F**	**EZB2048R**	**EZT2048S or F**
			30	60.00 (1524.0)	20.00 (508.0)	5.75 (146.1)	**YS2060**	**LT2060S or F**	**EZB2060R**	**EZT2060S or F**
			42	60.00 (1524.0)	20.00 (508.0)	5.75 (146.1)	**YS2060**	**LT2060S or F**	**EZB2060R**	**EZT2060S or F**
400A										
Main breaker	DK, KD, HKD, KDC, LHH (V)	—	18	48.00 (1219.2)	20.00 (508.0)	5.75 (146.1)	**YS2048**	**LT2048S or F**	**EZB2048R**	**EZT2048S or F**
		—	30	60.00 (1524.0)	20.00 (508.0)	5.75 (146.1)	**YS2060**	**LT2060S or F**	**EZB2060R**	**EZT2060S or F**
		—	42	60.00 (1524.0)	20.00 (508.0)	5.75 (146.1)	**YS2060**	**LT2060S or F**	**EZB2060R**	**EZT2060S or F**
Main lugs or main breaker with 225A through-feed lugs or sub-feed breaker	DK, KD, HKD, KDC, LHH (V)	FD, HFD, EDS, ED, EDH (V)	18	60.00 (1524.0)	20.00 (508.0)	5.75 (146.1)	**YS2060**	**LT2060S or F**	**EZB2060R**	**EZT2060S or F**
			30	60.00 (1524.0)	20.00 (508.0)	5.75 (146.1)	**YS2060**	**LT2060S or F**	**EZB2060R**	**EZT2060S or F**
			42	72.00 (1828.8)	20.00 (508.0)	5.75 (146.1)	**YS2072**	**LT2072S or F**	**EZB2072R**	**EZT2072S or F**
Main breaker with 400A through-feed lugs or sub-feed breaker	DK, KD, HKD, KDC, LHH (V)	DK, KD, HKD, KDC (V)	18	72.00 (1828.8)	20.00 (508.0)	5.75 (146.1)	**YS2072**	**LT2072S or F**	**EZB2072R**	**EZT2072S or F**
			30	72.00 (1828.8)	20.00 (508.0)	5.75 (146.1)	**YS2072**	**LT2072S or F**	**EZB2072R**	**EZT2072S or F**
			42	90.00 (2286.0)	20.00 (508.0)	5.75 (146.1)	**YS2090**	**LT2090S or F**	**EZB2090R**	**EZT2090S or F**

Note

① Smaller panelboard box sizes are available if required. Contact Eaton for application information.

Type PRL2a

Contents

Type PRL2a

Product Description

- 480Y/277 Vac maximum (125 Vdc)
- Three-phase four-wire, three-phase three-wire, single-phase three-wire, single-phase two-wire
- 400A maximum mains
- 100A maximum branch breakers
- Bolt-on branch breakers
- Each branch connector is capable of up to a total of 140A maximum by breaker ampere rating
- Factory assembled
- Refer to **Page V15-T2-20** for additional information

Application Description

- Lighting branch panelboard
- Fully rated or series rated
- Interrupting ratings up to 200 kA symmetrical
- Suitable for use as Service Entrance Equipment, when specified on the order
- See **Pages V15-T2-20** through **V15-T2-36** for additional information

Standards and Certifications

- UL 67, UL 50
- Federal Specification W-P-115c
- Refer to **Page V15-T2-20** for additional information

UL Listed

Product Selection

Type PRL2a

PRL2a

Ampere Rating	Interrupting Rating (kA Symmetrical) 240 Vac	480Y/277 Vac	125/250 Vdc	Breaker Type
Main Lug Only				
100	—	—	—	—
225	—	—	—	—
400	—	—	—	—
Main Breaker				
100	65	14	14	GHB
100	18	14	10	EHD
100	65	35	10	FD, FDE
100	100	65	22	HFD, HFDE
100	200	100	22	FDC
225	65	—	—	ED
225	65	35	10	FD, FDE
225	100	65	22	HFD, HFDE
225	200	100	22	FDC
250	65	35	10	JD
250	100	65	22	HJD
250	200	100	22	JDC
400	65	35	10	KD
400	100	65	22	HKD
400	100	65	—	LHH
400	200	100	22	KDC

PRL2a Branch Circuit Breakers

Ampere Rating	Interrupting Rating (kA Symmetrical) 240 Vac ①	480Y/277 Vac	125/250 Vdc	Breaker Type
15–20	65	14	—	GHQ ②
15–20	65	14	14	GHB ②
25–60	65	14	14	GHB ②
70–100	65	14	14	GHB ②
15–30	65	25	—	HGHB ②
15–20	65	14	—	GHQRSP ③
15–30	65	14	—	GHBS ②③
15–60	—	14	—	GHBGFEP ②④
15–20	—	14	—	GHBHID ②⑤
Provision	—	—	—	—

Notes

① Interrupting ratings in this column are applicable to 120 Vac for single-pole breakers.
② Must be used on 480Y/277V grounded wye systems only.
③ Remote controllable breaker.
④ GFP for 30 mA equipment protection. Requires two-pole spaces. 277 Vac only.
⑤ HID (High Intensity Discharge) rated breaker.

Box Sizing and Selection

Approximate Dimensions in Inches (mm)

Assembled Circuit Breaker Panelboards and Lighting Controls

Box size and box and trim catalog numbers for all standard panelboard types are found on **Page V15-T2-44**.

Instructions

1. Using description of the required panelboard, select the rating and type of main required.
2. Count the total number of branch circuit poles, including provisions, required in the panelboard. Do not count main breaker poles. Convert two- or three-pole branch breaker to single-poles, i.e., three-pole breaker, count as three poles. Determine sub-feed breaker or through-feed lug requirements.
3. Select the main ampere rating section from table on **Page V15-T2-44**.
4. Select panelboard type from first column, main breaker frame, if applicable, from second column, and sub-feed breaker frame, if applicable, from the third column.
5. From Step #2, determine the number of branch circuits in Column 4.
6. Read box size, box and trim catalog numbers across columns to the right. Specify surface or flush mounting on the order.

Cabinets

Fronts are code-gauge steel, ANSI-61 light gray painted finish.

Boxes are code-gauge galvanized steel without knockouts. Standard depth is 5-3/4 inches (146.1 mm). Standard width is 20 inches (508.0 mm). An optional 28-inch (711.2 mm) wide box is available.

Top and Bottom Gutters

5-1/2 inches (139.7 mm) minimum.

Approximate Dimensions in Inches (mm)

PRL2a Panelboard Sizing

Panelboard Types	Main Breaker Types and Mounting Position (H) = Horizontal (V) = Vertical	Sub-Feed Breaker Types and Mounting Position (H) = Horizontal (V) = Vertical	Maximum No. of Branch Circuits Including Provisions	Box Dimensions ① Height	Width	Depth	YS Box Catalog Number	LT Trim Catalog Number	EZ Box Catalog Number	EZ Trim Catalog Number
100A										
Main breaker	BAB, QBHW (H)	—	15	36.00 (914.4)	20.00 (508.0)	5.75 (146.1)	**YS2036**	**LT2036S or F**	**EZB2036R**	**EZT2036S or F**
		—	27	48.00 (1219.2)	20.00 (508.0)	5.75 (146.1)	**YS2048**	**LT2048S or F**	**EZB2048R**	**EZT2048S or F**
		—	39	48.00 (1219.2)	20.00 (508.0)	5.75 (146.1)	**YS2048**	**LT2048S or F**	**EZB2048R**	**EZT2048S or F**
		—	42	60.00 (1524.0)	20.00 (508.0)	5.75 (146.1)	**YS2060**	**LT2060S or F**	**EZB2060R**	**EZT2060S or F**
Main lugs or main breaker	EHD FD, HFD, FDE HFDE (V)	—	18	36.00 (914.4)	20.00 (508.0)	5.75 (146.1)	**YS2036**	**LT2036S or F**	**EZB2036R**	**EZT2036S or F**
		—	30	48.00 (1219.2)	20.00 (508.0)	5.75 (146.1)	**YS2048**	**LT2048S or F**	**EZB2048R**	**EZT2048S or F**
		—	42	48.00 (1219.2)	20.00 (508.0)	5.75 (146.1)	**YS2048**	**LT2048S or F**	**EZB2048R**	**EZT2048S or F**
Main lugs or main breaker with 100A through-feed lugs or sub-feed breaker	EHD FD, FDE HFD, HFDE (V)	EHD FD HFD (V)	18	48.00 (1219.2)	20.00 (508.0)	5.75 (146.1)	**YS2048**	**LT2048S or F**	**EZB2048R**	**EZT2048S or F**
			30	48.00 (1219.2)	20.00 (508.0)	5.75 (146.1)	**YS2048**	**LT2048S or F**	**EZB2048R**	**EZT2048S or F**
			42	60.00 (1524.0)	20.00 (508.0)	5.75 (146.1)	**YS2060**	**LT2060S or F**	**EZB2060R**	**EZT2060S or F**
225A										
Main lugs or main breaker	EDB, EDS, ED, EDH, FD, HFD FDE, HFDE (V)	—	18	36.00 (914.4)	20.00 (508.0)	5.75 (146.1)	**YS2036**	**LT2036S or F**	**EZB2036R**	**EZT2036S or F**
		—	30	48.00 (1219.2)	20.00 (508.0)	5.75 (146.1)	**YS2048**	**LT2048S or F**	**EZB2048R**	**EZT2048S or F**
		—	42	48.00 (1219.2)	20.00 (508.0)	5.75 (146.1)	**YS2048**	**LT2048S or F**	**EZB2048R**	**EZT2048S or F**
	JD, HJD JDC (V)	—	18	60.00 (1524.0)	20.00 (508.0)	5.75 (146.1)	**YS2060**	**LT2060S or F**	**EZB2060R**	**EZT2060S or F**
		—	30	60.00 (1524.0)	20.00 (508.0)	5.75 (146.1)	**YS2060**	**LT2060S or F**	**EZB2060R**	**EZT2060S or F**
		—	42	72.00 (1828.8)	20.00 (508.0)	5.75 (146.1)	**YS2072**	**LT2072S or F**	**EZB2072R**	**EZT2072S or F**
Main lugs or main breaker with 225A through-feed lugs or sub-feed breaker	EHD, FD, HFD, EDB, EDS, ED, EDH FDE, HFDE (V)	EHD, FD, HFD, EDB, EDS, ED, EDH (V)	18	48.00 (1219.2)	20.00 (508.0)	5.75 (146.1)	**YS2048**	**LT2048S or F**	**EZB2048R**	**EZT2048S or F**
			30	48.00 (1219.2)	20.00 (508.0)	5.75 (146.1)	**YS2048**	**LT2048S or F**	**EZB2048R**	**EZT2048S or F**
			42	60.00 (1524.0)	20.00 (508.0)	5.75 (146.1)	**YS2060**	**LT2060S or F**	**EZB2060R**	**EZT2060S or F**
	JD, HJD JDC (V)	EHD, FD, HFD, EDB, EDS, ED, EDH (V)	18	60.00 (1524.0)	20.00 (508.0)	5.75 (146.1)	**YS2060**	**LT2060S or F**	**EZB2060R**	**EZT2060S or F**
			30	72.00 (1828.8)	20.00 (508.0)	5.75 (146.1)	**YS2072**	**LT2072S or F**	**EZB2072R**	**EZT2072S or F**
			42	72.00 (1828.8)	20.00 (508.0)	5.75 (146.1)	**YS2072**	**LT2072S or F**	**EZB2072R**	**EZT2072S or F**
400A										
Main lugs or main breaker	DK, KD, HKD, KDC, LHH (V)	—	18	60.00 (1524.0)	20.00 (508.0)	5.75 (146.1)	**YS2060**	**LT2060S or F**	**EZB2060R**	**EZT2060S or F**
		—	30	60.00 (1524.0)	20.00 (508.0)	5.75 (146.1)	**YS2060**	**LT2060S or F**	**EZB2060R**	**EZT2060S or F**
		—	42	72.00 (1828.8)	20.00 (508.0)	5.75 (146.1)	**YS2072**	**LT2072S or F**	**EZB2072R**	**EZT2072S or F**
Main lugs or main breaker with 225A through-feed lugs or sub-feed breaker	DK, KD, HKD, KDC, LHH (V)	EHD, FD, HFD, EDB, EDS, ED, EDH (V)	18	60.00 (1524.0)	20.00 (508.0)	5.75 (146.1)	**YS2060**	**LT2060S or F**	**EZB2060R**	**EZT2060S or F**
			30	72.00 (1828.8)	20.00 (508.0)	5.75 (146.1)	**YS2072**	**LT2072S or F**	**EZB2072R**	**EZT2072S or F**
			42	72.00 (1828.8)	20.00 (508.0)	5.75 (146.1)	**YS2072**	**LT2072S or F**	**EZB2072R**	**EZT2072S or F**
Main lugs or main breaker with 400A through-feed lugs or sub-feed breaker	DK, KD, HKD, KDC, LHH (V)	JD, HJD, JDC, DK, KD, HKD, KDC (V)	18	72.00 (1828.8)	20.00 (508.0)	5.75 (146.1)	**YS2072**	**LT2072S or F**	**EZB2072R**	**EZT2072S or F**
			30	90.00 (2286.0)	20.00 (508.0)	5.75 (146.1)	**YS2090**	**LT2090S or F**	**EZB2090R**	**EZT2090S or F**
			42	90.00 (2286.0)	20.00 (508.0)	5.75 (146.1)	**YS2090**	**LT2090S or F**	**EZB2090R**	**EZT2090S or F**

Note

① Smaller panelboard box sizes are available if required. Contact Eaton for application information.

Type PRL3a

Contents

Type PRL3a

Product Description

- 600 Vac maximum (250 Vdc)
- Three-phase four-wire, three-phase three-wire, single-phase three-wire, single-phase two-wire
- 800A maximum main lugs
- 600A maximum main breaker
- 225A maximum branch breakers
- Bolt-on branch breakers
- Factory assembled
- Refer to **Page V15-T2-29** for additional information

Application Description

- Lighting panelboard or power distribution panelboard
- Fully rated or series rated
- Interrupting ratings up to 200 kA symmetrical
- Suitable for use as Service Entrance Equipment, when specified on the order
- See **Pages V15-T2-29** through **V15-T2-36** for additional information

Standards and Certifications

- UL 67, UL 50
- Federal Specification W-P-115c
- Refer to **Page V15-T2-29** for additional information

UL Listed

Product Selection

2

Type PRL3a

PRL3a

Ampere Rating	Interrupting Rating (kA Symmetrical) 240 Vac	480 Vac	600 Vac	250 Vdc	Breaker Type
Main Lug Only					
100	—	—	—	—	—
250	—	—	—	—	—
400	—	—	—	—	—
600	—	—	—	—	—
800 ①	—	—	—	—	—
Main Breaker					
100	18	14	—	10	EHD
100	18	14	14	10	FDB
100	22	—	—	—	EDB
100	42	—	—	—	EDS
100	65	—	—	—	ED
100	100	—	—	—	EDH
100	65	35	18	10	FD, FDE
100	100	65	25	22	HFD, HFDE
100	200	100	35	22	FDC
100	200	150	—	—	FCL
100	200	200	200	100 ②	FB-P ③
225	22	—	—	—	EDB
225	42	—	—	—	EDS
225	65	—	—	—	ED
225	100	—	—		EDH
225	200	—	—	—	EDC
225	65	35	18	10	FD, FDE
225	100	65	25	22	HFD, HFDE
225	200	100	35	22	FDC
250	65	35	18	10	JD
250	100	65	25	22	HJD
250	200	100	35	22	JDC
400	65	—	—	10	DK
400	65	35	25	10	KD
400	100	65	35	22	HKD
400	100	65	—	—	LHH
400	200	100	65	22	KDC
400	65	—	—	—	LCL ④
400	200	200	200	100 ②	LA-P ③④
600	65	35	18	22	LGE
600	100	65	35	22	LGH
600	200	100	50	42	LGC
600	65	35	25	22	LD
600	100	65	35	25	HLD
600	200	100	50	25	LDC
600	65	35	25	22	CLD ⑤
600	100	65	35	25	CHLD ⑤
600	200	100	50	25	CLDC ⑤

Notes

① 800A MLO requires 28-inch (711.2 mm) wide box.
② 100,000 based on NEMA test procedure.
③ Top feed only.
④ Requires 6.50-inch (165.1 mm) deep box. Not available in Type 3R, 12, 4 and 4X enclosures.
⑤ 100% rated circuit breaker. Requires copper bus. Not available in Type 12, 4 and 4X enclosures.

PRL3a Branch Circuit Breakers

Ampere Rating	Interrupting Rating (kA Symmetrical) 240 Vac	480 Vac	600 Vac	250 Vdc	Breaker Type
15–60	10 ②③	—	—	—	BAB
15–60	10	—	—	—	BAB-H
70	10 ②③	—	—	—	BAB
70	10	—	—	—	BAB-H
80–100	10 ②③	—	—	—	BAB
80–100	10	—	—	—	BAB-H
15–50 ①	10 ②③	—	—	—	QBGF
15–50 ①	10	—	—	—	QBGFEP
15–20	10 ②③	—	—	—	QBCAF ④
15–60	10 ②③	—	—	—	BAB-D ⑤
15–30	10 ②③	—	—	—	BAB-C ⑥
15–30	10 ②	—	—	—	BABRP ⑦
15–30	10 ②	—	—	—	BABRSP ⑦
15–60	22 ②③	—	—	—	QBHW
15–60	22	—	—	—	QBHW-H
70	22 ②③	—	—	—	QBHW
70	22	—	—	—	QBHW-H
80–100	22 ②③	—	—	—	QBHW
80–100	22	—	—	—	QBHW-H
15–30	22	—	—	—	QBHGF
15–30	22	—	—	—	QBHGFEP
15–20	22 ②③	—	—	—	QBHCAF ④
15–20	65	14 ⑧⑨	—	—	GHQ
15–20	65	14 ⑧⑨	—	14	GHB

PRL3a Branch Circuit Breakers, continued

Ampere Rating	Interrupting Rating (kA Symmetrical) 240 Vac	480 Vac	600 Vac	250 Vdc	Breaker Type
25–60	65	14 ⑧⑨	—	14	GHB
70–100	65	14 ⑧⑨	—	14	GHB
15–30	65	25 ⑧⑨	—	—	HGHB
15–20	65	14 ⑧⑨	—	14	GHQRSP ⑦
15–30	65	14 ⑧⑨	—	14	GHBS ⑦
15–60	—	14 ⑧⑨	—	—	GHBGFEP
15–20	—	14 ⑧⑨	—	—	GHBHID ⑤
15–60	18 ⑩	14 ⑧	—	10	EHD
70–100	18 ⑩	14 ⑧	—	10	EHD
15–60	18	V14	14	10	FDB
70–100	18	14	14	10	FDB
110–150	18	14	14	10	FDB
15–60	65 ⑩	35 ⑧	18	10	FD, FDE
70–100	65 ⑩	35 ⑧	18	10	FD, FDE
110–225	65 ⑩	35	18	10	FD ⑪, FDE
15–60	100 ⑩	65 ⑧	25	22	HFD, HFDE
70–100	100 ⑩	65 ⑧	25	22	HFD, HFDE
110–225	100 ⑩	65	25	22	HFD ⑪, HFDE
15–60	200	100	35	22	FDC
70–100	200	100	35	22	FDC
110–225	200	100	35	22	FDC ⑪
100–225	22	—	—	—	EDB ⑪
100–225	42	—	—	—	EDS ⑪
100–225	65	—	—	—	ED ⑪
100–225	100	—	—	—	EDH ⑪
100–225	200	—	—	—	EDC ⑪

Notes

① 50A devices are available as two-pole only.
② Single-pole breaker rated 120 Vac.
③ Two-pole breaker rated 120/240 Vac.
④ Arc fault circuit breaker.
⑤ HID (High Intensity Discharge) rated breaker.
⑥ Switching Neutral Breaker. single-pole device requires two-pole space, two-pole device requires three-pole space.
⑦ Solenoid operated breaker.
⑧ Single-pole breaker rated 277 Vac.
⑨ For use on 480Y/277V systems only.
⑩ AIC rating for two- and three-pole breakers only.
⑪ Maximum of six breakers per panel, 175–225A.

Box Sizing and Selection

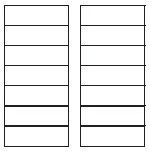
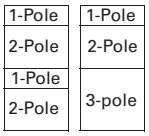
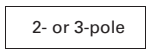
Approximate Dimensions in Inches (mm)

2

Panel Layout Instructions

1. Select:
   a. Required mains (lugs or breaker).
   b. Neutral where required.
   c. Branch circuits as required.
2. Layout panel as shown below, using appropriate "X" dimensions.
3. Using total X units (panel height) find box height in inches (mm) and box catalog number from table below. (When total X units come out to an uneven number, use next highest number; i.e., if total X comes out 25X, use 31X.)

Layout—PRL3a

		Poles	
		6 - 3X 12 - 5X 18 - 8X 24 - 10X 30 - 13X 36 - 15X 42 - 18X	BAB, QBHW, QBCAF, BABRP, BABRSP, QBHCAF GHQ, GHB, HGHB ①
		1X 2X 3X	EDB, EDS, ED, EDH, EDC, EHD, FDB, FD, FDE, HFD, FDC, HFDE 150A max. per branch breaker (300A max. per connector)
		2X 2-Pole 3X three-pole	EDB, EDS, ED, EDH, EDC FD, HFD, FDC, ② FDE, HFDE
Neutral Section		5X 8X 11X	100–250A 400–800A 800A with through-feed lug
Main Lug Section		2X 5X 8X 14X	100A 250A 400–600A 800A
Main Breaker Section	Horizontal Mounting	2X 2-Pole 3X three-pole	EHD, FDB, FD, HFD, FDC, FDE, HFDE EDB, EDS, ED, EDH, EDC ③
	Vertical Mounting	7X 9X 14X 15X 17X 18X 21X	EHD, FDB, FD, FDE, HFD, FDC, HFDE, EDB, EDS, ED, EDH, EDC ④ FCL, FB-P ⑤ JD, HJD, JDC DK, KD, HKD, KDC, LHH LD, HLD, LDC, CLD, CHLD, CLDC LGE, LGH, LGC LCL, LA-P ⑤⑥

Notes

① GHB, HGHB and GHQ breakers cannot be mixed on same connector as BAB, QBHW, BABRP and BABRSP.
② Maximum of six breakers per panel.
③ Horizontal mounted 15–150A main breakers EHD, FDB, FD, FDE, HFD, HFDE and FDC, will be furnished as branch breaker construction. Branch breakers single-, two- or three-pole as required, may be located opposite these main breakers.
④ If optional terminal kit 3TA225FDK is required, use 10X.
⑤ FB-P and LA-P top mounting only.
⑥ LCL or LA-P main breaker requires 6-1/2-inch (165.1 mm) deep box.

Layout Example

1. Description of Panel
   Type PRL3a three-phase, four-wire, 120/208 Vac flush mounting. Panel to have short-circuit rating of 22,000 symmetrical amperes. Main breaker 400A, three-pole, bottom mounting. Branch circuits bolt-on as follows:
   12–200A single-pole QBHW
   1–200A three-pole ED
   1–225A three-pole ED
2. Layout Information from **Layout—PRL3a** table (left):
   a. 400A Neutral. . . . . .= 8X
   b. 12-poles of QBHW . . . . . .= 5X
   c. Two three-pole ED breakers . . = 6X
   d. Main breaker, 400A,
   Three-pole DK. . . . . .= 15X
   Total Height. . . . . .= 34X
3. From **Box Tabulation—PRL3a** table (below):
   a. 34X Height (use 40X box)
   b. Box Height 72 inches (1828.8 mm)
   c. Box Catalog Number. . . . . **YS2072** or **EZB2072R**

Box Tabulation—PRL3a

"X" Units	Box Height	YS Box Catalog Number	LT Trim Catalog Number	EZ Box Catalog Number	EZ Trim Catalog Number
100–400A					
14X	36.00 (914.4)	**YS2036**	**LT2036S or F**	**EZB2036R**	**EZT2036S or F**
23X	48.00 (1219.2)	**YS2048**	**LT2048S or F**	**EZB2048R**	**EZT2048S or F**
31X	60.00 (1524.0)	**YS2060**	**LT2060S or F**	**EZB2060R**	**EZT2060S or F**
40X	72.00 (1524.0)	**YS2072**	**LT2072S or F**	**EZB2072R**	**EZT2072S or F**
53X	90.00 (2286.0)	**YS2090**	**LT2090S or F**	**EZB2090R**	**EZT2090S or F**
600A					
23X	48.00 (1219.2)	**YS2048**	**LTV2048S or F**	**EZB2048R**	**EZTV2048S or F**
31X	60.00 (1524.0)	**YS2060**	**LTV2060S or F**	**EZB2060R**	**EZTV2060S or F**
40X	72.00 (1524.0)	**YS2072**	**LTV2072S or F**	**EZB2072R**	**EZTV2072S or F**
53X	90.00 (2286.0)	**YS2090**	**LTV2090S or F**	**EZB2090R**	**EZTV2090S or F**
800A					
23X	48.00 (1219.2)	**YS2848**	**LTV2848S or F**	—	—
31X	60.00 (1524.0)	**YS2860**	**LTV2860S or F**	—	—
40X	72.00 (1524.0)	**YS2872**	**LTV2872S or F**	—	—
53X	90.00 (2286.0)	**YS2890**	**LTV2890S or F**	—	—

Cabinets

Fronts are code-gauge steel, ANSI-61 light gray painted finish.

Boxes are code-gauge galvanized steel without knockouts. Standard depth is 5-3/4 inches (146.1 mm).

Standard widths are:
20-inch (508.0 mm)
100–600A.
28-inch (711.2 mm)
800A.

Standard Depth

5-3/4 inches (146.1 mm).

Top and Bottom Gutters

5-1/2 inches (139.7 mm) minimum.

Side Gutters

4 inches (101.6 mm) minimum.

Type PRL4

Type PRL4B Circuit Breaker and Type PRL4F Fusible Panelboards

Contents

Type PRL4

Product Description

- 600 Vac maximum (600 Vdc)
- Three-phase, four-wire, three-phase three-wire, single-phase three-wire, single-phase two-wire
- PRL4B circuit breaker panelboard
- PRL4F fusible switch panelboard
- 1200A maximum mains
- 1200A maximum branch devices
- Bolt-on branch devices
- Factory assembled
- Refer to **Page V15-T2-29** for additional information

Application Description

- Power distribution panelboard
- Fully rated or series rated
- Interrupting ratings up to 200 kA symmetrical
- Suitable for use as Service Entrance Equipment, when specified on the order
- See **Pages V15-T2-29** through **V15-T2-36** for additional information

Standards and Certifications

- UL 67, UL 50
- Federal Specification
- W-P-115c
- Refer to **Page V15-T2-29** for additional information

UL Listed

Product Selection

2

Type PRL4

PRL4 Main Lugs and Main Breakers

Ampere Rating	Interrupting Rating (kA Symmetrical) 240 Vac	480 Vac	600 Vac	250 Vdc	600 Vdc	Breaker Type
Main Lug Only						
250	—	—	—	—	—	—
400	—	—	—	—	—	—
600	—	—	—	—	—	—
800	—	—	—	—	—	—
1200	—	—	—	—	—	—
Main Breaker ①						
250	65	35	18	10	—	JD
250	100	65	25	22	—	HJD
250	—	—	—	42	35	HJDDC ②
250	200	100	35	22	—	JDC
250	200	200	—	—	—	LCL
400	65	—	—	10	—	DK
400	65	35	25	10	—	KD
400	65	35	25	—	—	CKD ③④
400	100	65	35	22	—	HKD
400	—	—	—	42	35	HKDDC ②
400	100	65	35	42	—	LHH
400	100	65	35	—	—	CHKD ③④
400	200	100	65	22	—	KDC
400	200	200	—	—	—	LCL
400	200	200	200	—	—	LA-P
600	65	35	18	22	—	LGE ①
600	100	65	35	22	—	LGH ①
600	200	100	50	42	—	LGC
600	200	150	65	50	—	LGU
600	65	35	25	22	—	LD
600	65	35	25	—	—	CLD ③
600	100	65	35	25	—	HLD
600	—	—	—	42	35	HLDDC ②
600	100	65	35	—	—	CHLD ③
600	200	100	50	25	—	LDC
600	200	100	50	—	—	CLDC ③
800	65	50	25	22	—	MDL
800	100	65	35	25	—	HMDL
800	—	—	—	42	35	HMDLDC ②
800	65	50	25	—	—	CMDL ③
800	100	65	35	—	—	CHMDL ③
800	200	200	200	—	—	NB-P
800	65	50	25	—	—	ND
800	100	65	35	—	—	HND
800	200	100	65	—	—	NDC
800	65	50	25	—	—	CND ③⑤
800	100	65	35	—	—	CHND ③⑤
800	200	100	65	—	—	CNDC ③⑤
1200	65	50	25	—	—	ND
1200	100	65	35	—	—	HND
1200	200	100	65	—	—	NDC
1200	65	50	25	—	—	CND ③⑤
1200	100	65	35	—	—	CHND ③⑤
1200	200	100	65	—	—	CNDC ③⑤
1200	—	—	—	42	50	NBDC ②

PRL4 Main Fusible Switches

Ampere Rating	Interrupting Rating (kA Symmetrical) 240 Vac	480 Vac	Device Type
Main Fusible Switch 240 Vac, 250 Vdc ⑥⑦⑧			
200	See **Page V15-T2-39**		FDPB
400			FDPW
600 ⑨			FDPW
800 ⑨			FDPW
1200 ⑨			FDPW
Main Fusible Switch 600 Vac ⑥⑦			
200	See **Page V15-T2-39**		FDPB
400			FDPW
600 ⑨			FDPW
800 ⑨			FDPW
1200 ⑨			FDPW

Notes

① For ground fault protection on main devices, see **Modification 14** on **Page V15-T2-63** or **Modification 15** on **Page V15-T2-63**

② For use on DC systems only.

③ 100% rated breaker. Requires copper bus. Not available in Type 12, 4 and 4X enclosures.

④ Breaker only available in three-pole frame.

⑤ Requires 44-inch (1117.6 mm) wide box.

⑥ For ground fault protection on main devices, see **Modification 15** on **Page V15-T2-63**.

⑦ Fuses not included. **Specify required fuse clips on all switches.**

⑧ Class J Fuse provisions are applicable only to 600V units. When required, use dimensions of 600V units for all voltages 600 and below.

⑨ No DC rating on 600, 800 and 1200A switches

PRL4 Branch Devices

Ampere Rating	Interrupting Rating (kA Symmetrical) 240 Vac	480 Vac	600 Vac	250 Vdc	600 Vdc	Breaker Type
15–60	10 ②③	—	—	—	—	BAB
15–60	10	—	—	—	—	BAB-H
70–100	10 ②③	—	—	—	—	BAB
70–100	10	—	—	—	—	BAB-H
15–50 ①	10 ②③	—	—	—	—	QBGF
15–20	10 ②③	—	—	—	—	QBCAF ④
15–60	22 ②③	—	—	—	—	QBHW
15–60	22	—	—	—	—	QBHW-H
70–100	22 ②③	—	—	—	—	QBHW
70–100	22	—	—	—	—	QBHW-H
15–30	22 ②③	—	—	—	—	QBHGF
15–20	22 ②③	—	—	—	—	QBHCAF ④
15–20	65 ②	14 ⑤	—	—	—	GHQ ⑦
15–60	65 ②	14 ⑤	—	14	—	GHB ⑦
70–100	65 ②	14 ⑤	—	14	—	GHB ⑦
15–30	65 ②	25 ⑤	—	—	—	HGHB ⑦
15–60	18 ⑧	14 ⑤	—	10	—	EHD
70–100	18 ⑧	14 ⑤	—	10	—	EHD
15–60	18	14	14	10	—	FDB
70–100	18	14	14	10	—	FDB
110–150	18	14	14	10	—	FDB
15–60	65 ⑧	35 ⑤	18	10	—	FD, FDE
70–100	65 ⑧	35 ⑤	18	10	—	FD, FDE
110–225	65 ⑧	35	18	10	—	FD, FDE
15–60	100 ⑧	65 ⑤	25	22	—	HFD, HFDE
70–100	100 ⑧	65 ⑤	25	22	—	HFD, HFDE
110–225	100 ⑧	65	25	22	—	HFD, HFDE
15–60	200	100	35	22	—	FDC
70–100	200	100	35	22	—	FDC
110–225	200	100	35	22	—	FDC
15–100	200	150	—	—	—	FCL
15–150	—	—	—	42	35	HFDDC ⑥
100–225	22	—	—	—	—	EDB
100–225	42	—	—	—	—	EDS
100–225	65	—	—	—	—	ED
100–225	100	—	—	—	—	EDH
100–225	200	—	—	—	—	EDC
70–225	65	35	18	10	—	JD
250	65	35	18	10	—	JD
70–225	100	65	25	22	—	HJD

PRL4 Branch Devices, continued

Ampere Rating	Interrupting Rating (kA Symmetrical) 240 Vac	480 Vac	600 Vac	250 Vdc	600 Vdc	Breaker Type
250	100	65	25	22	—	HJD
70–250	—	—	—	42	35	HJDDC ⑥
70–225	200	100	35	22	—	JDC
250	200	100	35	22	—	JDC
125–250	200	200	—	—	—	LCL
250–400	65	—	—	10	—	DK
100–400	65	35	25	10	—	KD
100–400	65	35	25	—	—	CKD ⑨⑩⑪
100–400	100	65	35	22	—	HKD
100–400	—	—	—	42	35	HKDDC ⑥
100–400	100	65	35	—	—	CHKD ⑨⑩⑪
125–400	100	65	35	42	—	LHH
100–400	200	100	65	22	—	KDC
200–400	200	200	—	—	—	LCL
250–600	65	35	18	22	—	LGE
300–600	65	35	25	22	—	LD
300–600	65	35	25	—	—	CLD ⑨
250–600	100	65	35	22	—	LGH
300–600	100	65	35	25	—	HLD
300–600	—	—	—	42	35	HLDDC ⑥
300–600	100	65	35	—	—	CHLD ①
250–600	200	100	35	42	—	LGC
300–600	200	100	50	25	—	LDC
300–600	200	100	50	25	—	CLDC ①
250–600	200	150	65	50	—	LGU
400–800	65	50	25	22	—	MDL
400–800	100	65	35	25	—	HMDL
300–800	—	—	—	42	35	HMDLDC ⑥
400–800	65	50	25	—	—	CMDL ①
400–800	100	65	35	—	—	CHMDL ①
400–800	65	50	25	—	—	ND
400–800	100	65	35	—	—	HND
400–800	200	100	65	—	—	NDC
400–800	65	50	25	—	—	CND ①②
400–800	100	65	35	—	—	CHND ①②
400–800	200	100	65	—	—	CNDC ①②
600–1200	65	50	25	—	—	ND
600–1200	100	65	35	—	—	HND
600–1200	200	100	65	—	—	NDC
600–1200	65	50	25	—	—	CND ①②
600–1200	100	65	35	—	—	CHND ①②
600–1200	200	100	65	—	—	CNDC ①②
700–1200	—	—	—	42	50	NBDC ⑥

Notes

① 50A devices are available as two-pole only.
② Single-pole breakers rated 120 Vac.
③ Two-pole breakers rated 120/240 Vac.
④ Arc fault circuit breaker.
⑤ Single-pole breakers rated 277 Vac.
⑥ For use on DC systems only.
⑦ At 480V, must be used on 480Y/277V grounded wye systems only.
⑧ AIC rating for two- and three-pole breakers only.
⑨ 100% rated breaker. Requires copper bus. Not available in Type 12, 4 and 4X enclosures.
⑩ Breaker only available in three-pole frame.
⑪ Available in single branch mounting only.

PRL4 Branch Devices, continued

Ampere Rating	Interrupting Rating (kA Symmetrical) 240 Vac	480 Vac	600 Vac	250 Vdc	Breaker Type
Integrally Fused, Current Limiting Circuit Breaker					
15–100	200	200	200	①	FB-P
125–225	200	200	200	①	LA-P
250–400	200	200	200	①	LA-P
400–600	200	200	200	①	NB-P
700–800	200	200	200	①	NB-P
Fusible Switches 240 Vac, 250 Vdc ②					
30/30 ③	See table at the right				FDPW-Twin
60/60 ③					FDPW-Twin
100/100 ③					FDPW-Twin
200/200					FDPB-Twin
100					FDPW-Single
200					FDPB-Single
400	See table at the right				FDPW-Single
600 ④					FDPW-Single
800 ④					FDPW-Single
1200 ④					FDPW-Single
Fusible Switches 600 Vac ②					
30/30 ③	See table at the right				FDPW-Twin
60/60 ③					FDPW-Twin
100/100 ③					FDPW-Twin
200/200 ⑤					FDPB-Twin
100					FDPW-Single
200					FDPB-Single
400	See table at the right				FDPW-Single
600 ④					FDPW-Single
800 ④					FDPW-Single
1200 ④					FDPW-Single

FDPW and FDPB Switch Ratings, 240 or 600 Vac

Ampere Rating	Fuse Class Used	Short-Circuit Ratings (kA Symmetrical)
30–100	R, J ⑤	200
200 Single	R, J ⑤	200
200 Twin	R ⑥, J ⑤, T	200
400, 600 ⑦	R ⑦, J ⑤, T	200
800, 1200 ⑦	L	200

Notes

① 100 kAIC based on NEMA test procedure.

② Fuses not included. **Specify required fuse clips on all switches. (T fuse clips not available for 200/200 twin switches.)**

③ When branches of a twin unit are of different ampere ratings, as a 30–60 twin unit, price and layout as a 60–60 twin unit; when a 60–100 twin unit, price and layout as a 100–100 twin unit.

④ No DC rating on 600, 800 and 1200A switches.

⑤ Class J fuse provisions are applicable to 600V units. When required, use price and dimensions of 600V units for all voltages 600V and below.

⑥ Twin 200A switches are not available with Class R fuse clips at 600V.

⑦ When shunt trip is required, 400–600A switches used with Class R fuses are rated 100 kAIC.

Box Sizing and Selection—PRL4B

Approximate Dimensions in Inches (mm)

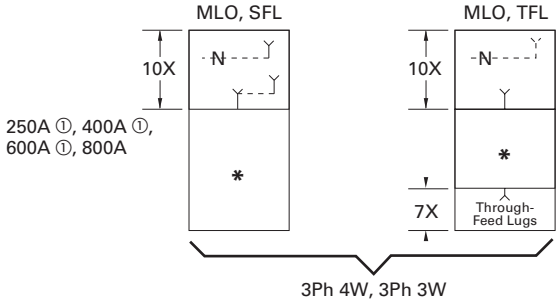
Main Lug Only (MLO), Main Breaker, Neutral, Through-Feed Lug (TFL) and Sub-Feed Lug (SFL) "X" Space Requirements. (For other configurations not shown, refer to Eaton.)

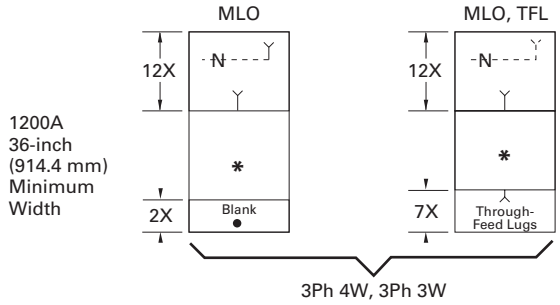
* = Space available for branch devices. For device sizing, see **Page V15-T2-55**.

● = Blank means no bus under cover, to meet NEC cable bending space.

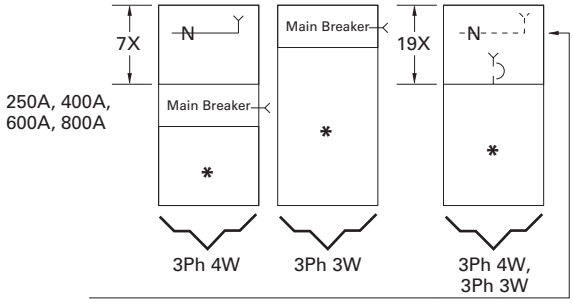
PRL4B Layout

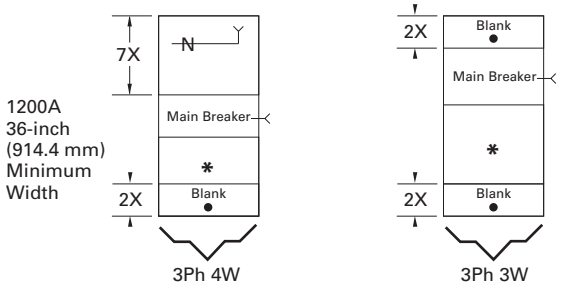
Standard Main Lug, Through-Feed and Sub-Feed Lugs ① (500 kcmil Maximum)



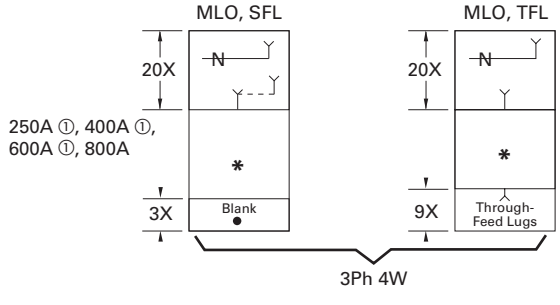


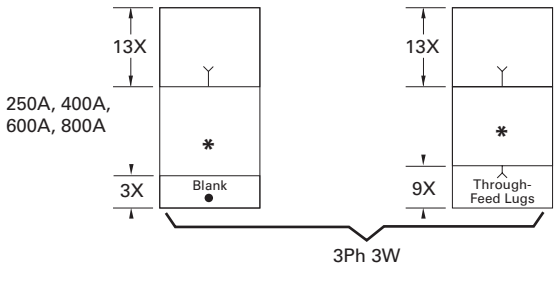
Main Breaker with Neutral (when required) (500 kcmil Maximum)

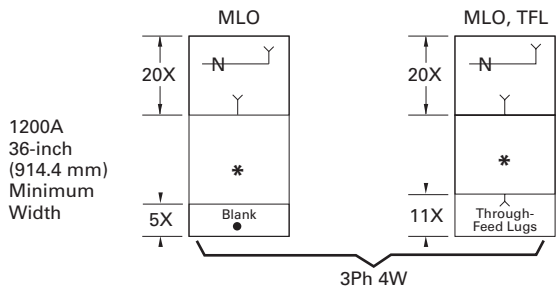


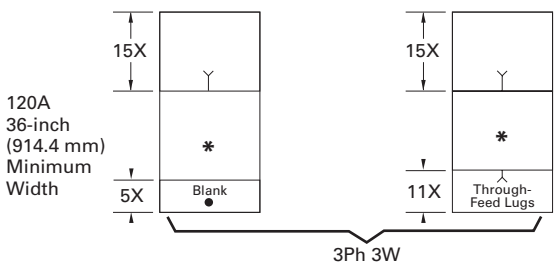


Optional Main Lugs, Through-Feed and Sub-Feed Lugs ① (750 kcmil Maximum)









Note

① Sub-feed lugs are available 250–600A. For 600A, use 1200A "A" space.

Approximate Dimensions in Inches (mm)

Panel Layout and Dimensions

To determine the dimensions of a given panelboard enclosure, make a layout sketch by fitting together the main, branch and lug modules according to the appropriate tables in the layout guide. Assign "X" units to each module as shown and obtain a total "X" number.

The height of the enclosure is related to the total "X" units in the layout as shown in table on right. Three standard box heights are available to accommodate any and all layout arrangements. "X" unit totals that do not exactly match those in table on right must be rounded off to the next highest standard (26X, 38X, 50X).

If a calculated "X" total for a panel exceeds 50X, the panel must be split into two or more separate sections with "X" space for through-feed lugs figured in for all but one section. If a neutral is required, a separate neutral bar and appropriate "X" space must be included in each section.

Layout Example

- 1–PRL4B panelboard, 480Y/277 volt, three-phase four-wire 65 kA, 800A, main lug, consisting of:
  - 12–20A/single-pole HFD
  - 2–250A/three-pole HJD
  - 1–400A/three-pole HKD

Reference PRL4B Layout Example

1. From layout guide, total "X" height of panel = 26X, (which is a design standard and no rounding off is necessary).
2. From table on right, enclosure height for 26X panel = 57 inches (1447.8 mm).
3. Width = 24 inches (609.6 mm)—directly from layout guide.
4. Enclosure depth = 11.31 inches (287.0 mm)—standard for all PRL4 panelboards.

PRL4B Layout Example

20A/1P	20A/1P	1X
20A/1P	20A/1P	1X
20A/1P	20A/1P	1X
20A/1P	20A/1P	1X
20A/1P	20A/1P	1X
20A/1P	20A/1P	1X
250A/3P		3X
250A/3P		3X
400A/3P		4X
Main Lugs 800A Neutral		10X

Total = 26X

Box Dimensions—PRL4B

"X" Units	Catalog Number	Height	Width	Depth ①
26X	**BX2457**	57.00 (1447.8)	24.00 (609.6)	11.31 (287.0)
38X	**BX2473**	73.50 (1866.9)	24.00 (609.6)	11.31 (287.0)
50X	**BX2490**	90.00 (2286.0)	24.00 (609.6)	11.31 (287.0)
38X	**BX3673**	73.50 (1866.9)	36.00 (914.4)	11.31 (287.0)
50X	**BX3690**	90.00 (2286.0)	36.00 (914.4)	11.31 (287.0)
38X	**BX4473**	73.50 (1866.9)	44.00 (1117.6)	11.31 (287.0)
50X	**BX4490**	90.00 (2286.0)	44.00 (1117.6)	11.31 (287.0)

Top and Bottom Gutters

10.63-inch (269.9 mm) minimum.

Side Gutters—Minimum

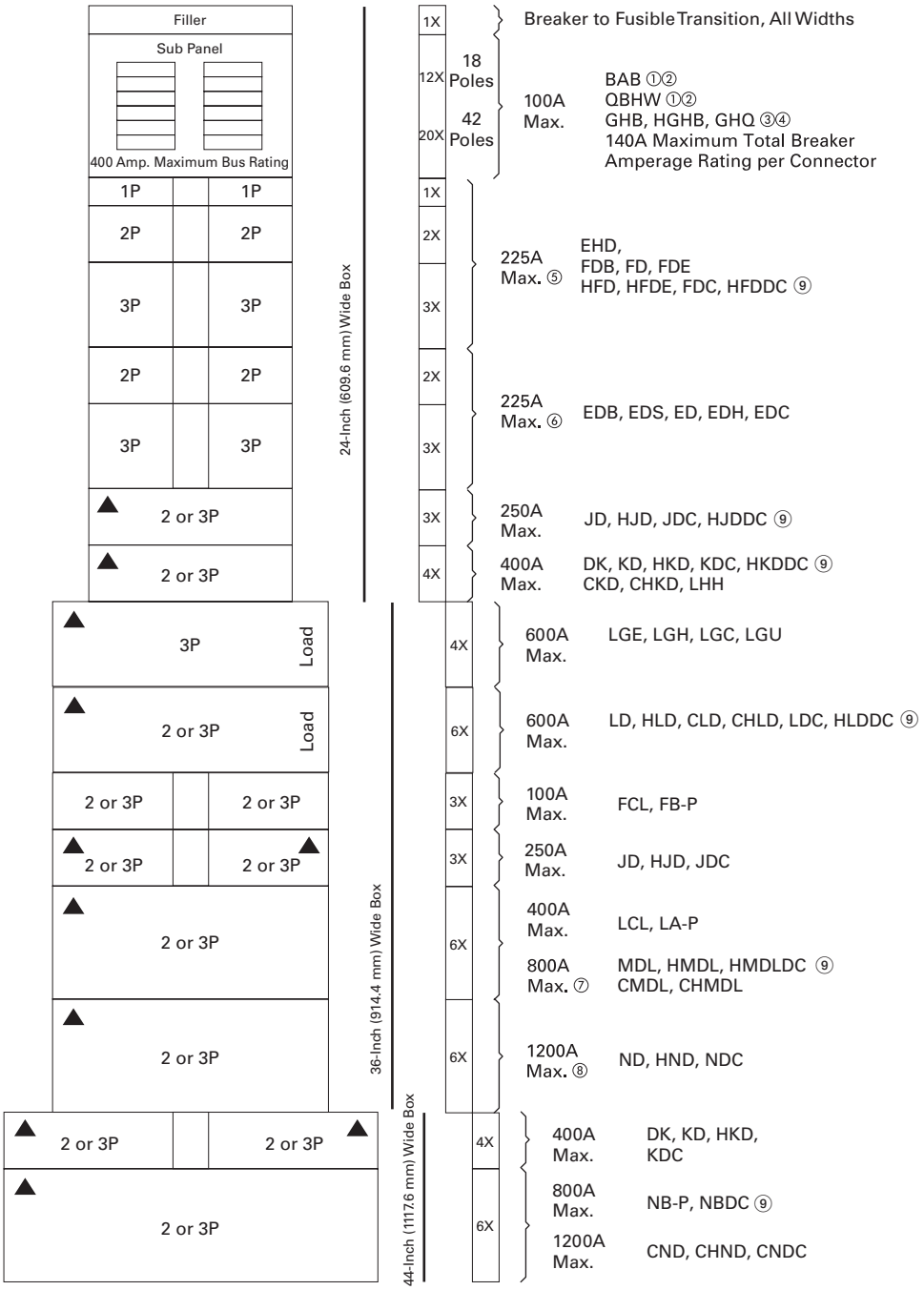
24.00-inch (609.6 mm) wide box—5.00-inch (127.0 mm).
36.00-inch (914.4 mm) wide box—6.00-inch (152.4 mm).
44.00-inch (1117.6 mm) wide box—8.00-inch (203.2 mm).

Notes

① Box depth is 10.40 inches (264.2 mm), cover adds 0.90 inches (22.9 mm) to depth.

800A maximum bus size in 24.00-inch (609.6 mm) wide box. Flush trims not available on PRL4B panels.

Layout for Branch and Horizontally Mounted Main Devices Layout—PRL4B



Notes

① BAB and QBHW breakers with shunt trips require one additional pole space, i.e., single-pole is two-pole size, two-pole is three-pole size, and three-pole is four-pole size.
② If panel contains only BAB or QBHW branch breakers, use a PRL1a panelboard.
③ GHB, HGHB or GHQ breakers cannot be mixed on same subchassis as BAB, QBHW.
④ If panel contains only GHB, HGHB or GHQ branch breakers, use a PRL2a panelboard.
⑤ When only one single-pole breaker of the group is required on either side of chassis, the single-pole breaker space required changes from 1X to 2X.
⑥ Minimum 36-inch (914.4 mm) wide box is required if optional #6–300 kcmil lug is required.
⑦ MDL main breaker in 24-inch (609.6 mm) wide box, refer to **Page V15-T2-53**.
⑧ Optional 750 kcmil terminal requires 44-inch (1117.6 mm) wide box.
⑨ For use on DC systems only.

See **Page V15-T2-53** for MLO or Neutral and Vertically Mounted Mains space requirements.

Box Sizing and Selection—PRL4F

Approximate Dimensions in Inches (mm)

2

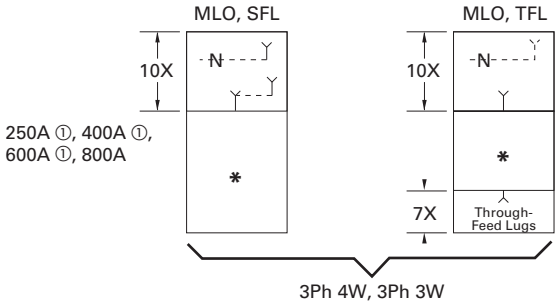
Main Lug (MLO), Main Switch, Neutral, Through-Feed (TFL) and Sub-Feed Lug (SFL) "X" Space Requirements. (For other configurations not shown, refer to Eaton.)

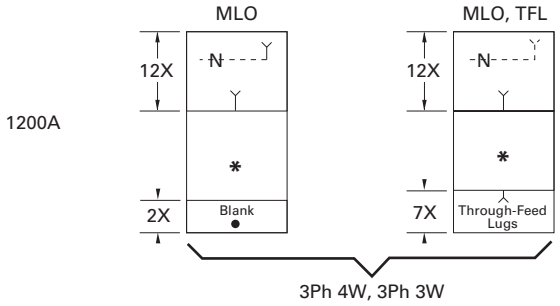
* = Space available for branch devices. For device sizing, see **Page V15-T2-58**.

● = Blank means no bus under cover, to meet NEC cable bending space.

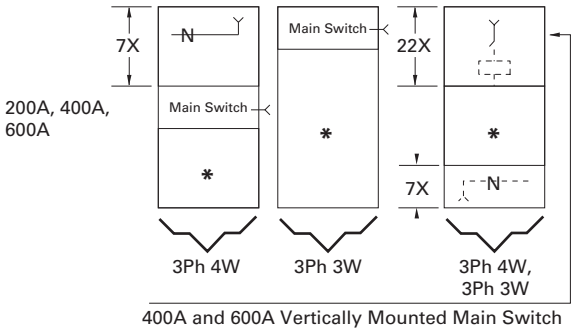
PRL4F Layout

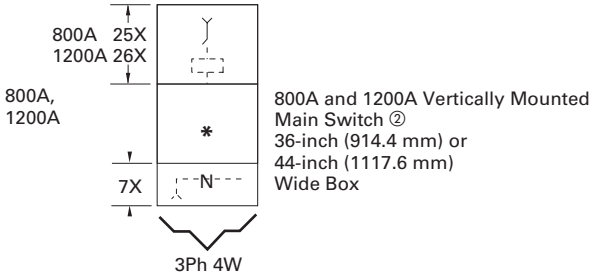
Standard Main Lug, Through-Feed and Sub-Feed Lugs ① (500 kcmil Maximum)



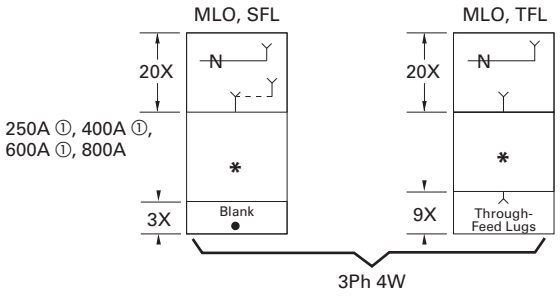


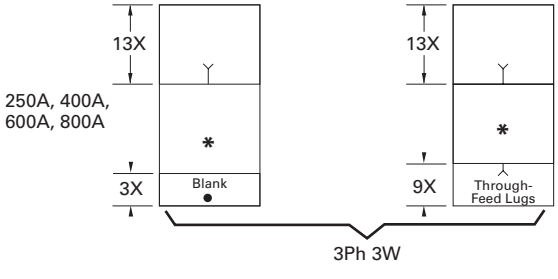
Main Switch with Neutral (when required) (500 kcmil Maximum)

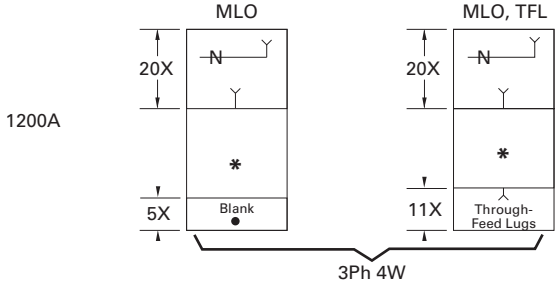


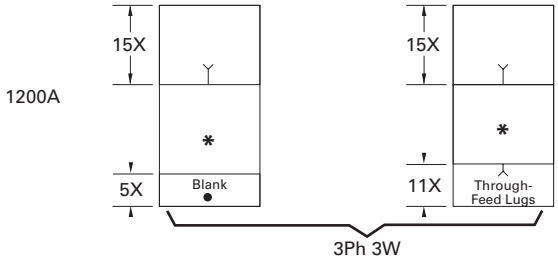


Optional Main Lugs, Through-Feed and Sub-Feed Lugs ① (750 kcmil Maximum)









Notes

① Sub-feed lugs are available 250–600A. For 600A, use 1200A "A" space.

② 800A and 1200A mains available only in vertical mounting.

Approximate Dimensions in Inches (mm)

Panel Layout and Dimensions

To determine the dimensions of a given panelboard enclosure, make a layout sketch by fitting together the main, branch and lug modules according to the appropriate tables in the layout guide. Assign "X" units to each module as shown and obtain a total "X" number.

The height of the enclosure is related to the total "X" units in the layout as shown in table on right. Three standard box heights are available to accommodate any and all layout arrangements. "X" unit totals that do not exactly match those in table on right must be rounded off to the next higher standard (38X, 50X).

If a calculated "X" total for a panel exceeds 50X, the panel must be split into two or more separate sections with "X" space for through-feed lugs figured in for all but one section. If a neutral is required, a separate neutral bar and appropriate "X" space must be included in each section.

Layout Example

- PRL4F, three-phase four-wire, 208Y/120 volt complete with 400A main switch and the following branches:
  - One 200A/three-pole
  - Two 100A/three-pole
  - Two 30A/three-pole

Panel to have short-circuit rating of 100 kA symmetrical.

Reference PRL4F Layout Example

1. From layout guide, total "X" height of panel = 43X.
2. Rounded off to next higher standard = 50X.
3. From table on right, enclosure height for 50X panel = 90 inches (2286.0 mm).
4. Width = 36 inches (914.4 mm).
5. Enclosure depth is standard for all PRL4 panelboards = 11.31 inches (287.0 mm).

Type PRL4F Layout Example

400A Neutral		7X
30A/3P	30A/3P	4X
100A/3P	100A/3P	4X
200A/3P		6X
400A three-pole Main Switch (Vertical Mounted)		22X
	Total =	43X

Box Dimensions—PRL4F

"X" Units	Catalog Number	Height	Width	Depth ①
38X	**BX3673**	73.50 (1866.9)	36.00 (914.4)	11.31 (287.0)
50X	**BX3690**	90.00 (2286.0)	36.00 (914.4)	11.31 (287.0)
38X	**BX4473**	73.50 (1866.9)	44.00 (1117.6)	11.31 (287.0)
50X	**BX4490**	90.00 (2286.0)	44.00 (1117.6)	11.31 (287.0)

Top and Bottom Gutters

10.63 inches (269.9 mm) minimum.

Side Gutters—Minimum

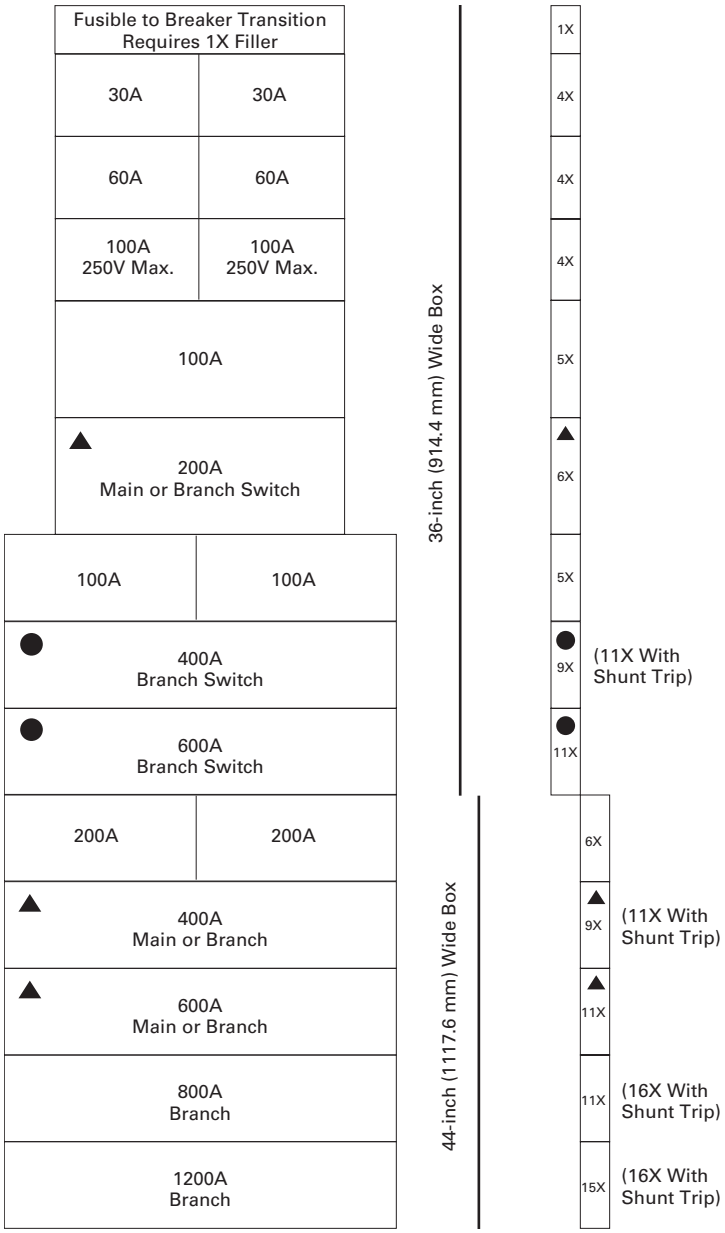
- 36-inch (914.4 mm) wide box:
  - 8-inch (203.2 mm)—200A maximum
  - 6-inch (152.4 mm)—400–1200A maximum
- 44-inch (1117.6 mm) wide box:
  - 10-inch (254.0 mm)—200A maximum
  - 8-inch (203.2 mm)—400–1200A

Notes

① Box depth is 10.40-inch (264.2 mm), cover adds 0.90-inch (22.8 mm) to depth.

Flush trims not available on PRL4F panels.

Layout for Branch and Horizontally Mounted Main Device—PRL4F



▲ Fusible switch may be used as horizontally main.

● 400 and 600A horizontally mounted feeder switches in 36-inch (914.4 mm) or 44-inch (1117.6 mm) wide box. 400 and 600A horizontally mounted main switches only in 44-inch (1117.6 mm) wide box. For vertically mounted main, see **Page V15-T2-56** for sizing.

Note: See **Page V15-T2-56** for MLO or Neutral and Vertically Mounted Main space requirements.

Panelboards and Lighting Controls

Contents

Description

Types PRL1a, 2a, 3a, 4

Modifications Selection Guide

Modifications—Alphabetical Index

Modification	Item	Available on Panelboard Types PRL1a	PRL2a	PRL3a	PRL4B	PRL4F
Ambient compensating breakers	1	No	No	Yes	Yes	—
Bus density	2	Yes	Yes	Yes	Yes	Yes
Cabinets—special: Types 2, 3R, 4, 4X, 12	3	Yes	Yes	Yes	Yes	Yes
Complete assembly	4	Yes	Yes	Yes	Yes	Yes
Compression type lugs, mains only	5	Yes	Yes	Yes	Yes	Yes
Concealed trim clamps (LT trim)	6	Yes	Yes	Yes	No	No
Conduit covers	7	Yes	Yes	Yes	Yes	Yes
Copper lugs	8	Yes	Yes	Yes	Yes	Yes
Copper main bus	9, 9a, 9b	Yes	Yes	Yes	Yes	Yes
Directory frame—metal	10	Yes	Yes	Yes	Yes	Yes
Doors, special	11	Yes	Yes	Yes	Yes	Yes
Fungus-proof	12	Yes	Yes	Yes	Yes	Yes
Ground bar	13	Yes	Yes	Yes	Yes	Yes
Electronic trip units	14	No	No	No	Yes	—
Ground fault protection (zero sequence)	15	No	No	No	Yes	Yes
Handle lockoff device	16	Yes	Yes	Yes	Yes	Std.
Hinges, special (LT trim)	17	Yes	Yes	Yes	Yes	Yes
Increased dimensions	18	Yes	Yes	Yes	No	No
Increased panel bus rating	19	Yes	Yes	Yes	No	No
Interiors to fit existing boxes	20	Yes	Yes	Yes	Yes	Yes
Locks, special (LT trim)	21	Yes	Yes	Yes	Yes	Yes
Molded case switches	22	Yes	Yes	Yes	Yes	No
Nameplates engraved	23	Yes	Yes	Yes	Yes	Yes

Modifications—Alphabetical Index, continued

Modification	Item	Available on Panelboard Types PRL1a	PRL2a	PRL3a	PRL4B	PRL4F
Neutral rated 200%	24	Yes	Yes	Yes	Yes	Yes
Painting and special coating	25	Yes	Yes	Yes	Yes	Yes
Permanent circuit numbers	26	Yes	Yes	Yes	Yes	Yes
Remote control switches (ASCO 920)	27	No	No	Yes	No	No
Service entrance	28	Yes	Yes	Yes	Yes	Yes
Shunt trips	29	Yes	Yes	Yes	Yes	Yes
Split bus or meter loop	30	No	No	Yes	No	No
Metering devices	31	No	No	No	Yes	Yes
Sub-metering, IQ Energy Sentinel	32	No	No	No	Yes	No
Sub-feed breakers	33	Yes	Yes	Yes	No	No
Sub-feed lugs	34	Yes	Yes	Yes	Yes	Yes
Tamperproof screws (LT trim)	35	Yes	Yes	Yes	Yes	Yes
Through-feed lugs	36	Yes	Yes	Yes	Yes	Yes
Time clock space only	37	Yes	Yes	Yes	—	—
Touchup paint	38	Yes	Yes	Yes	Yes	Yes
Surge protective device (SPD)	39	Yes	Yes	Yes	Ye	Yes
Terminals, copper only for breakers	40	Yes	Yes	Yes	Yes	—

1. Ambient Compensating Breakers

For ambient compensating breakers (where available) in lieu of standard breakers, add 10 percent to panelboard branch breaker and to main breaker list prices, if required. (Not UL listed.)

2. Bus Density

Main bus ampere rating is determined by UL listed temperature test. For 750A per square inch aluminum or 1000A per square inch copper, make price addition as follows:

Modification 2

Panel Type	Maximum Amperes
Aluminum—750A per Square Inch	
PRL1a, 2a	100
	225
	400
PRL3a	250
	400
PRL4	400
	800
Copper—1000A per Square Inch	
PRL1a, 2a	100
	225
	400
PRL3a	250
	600
PRL4	400
	1200

3. Special Cabinet (Box) Construction

Modification 3

Modification
Type 1 Enclosure
28-inch (711.2 mm) wide in place of standard 20-inch (508.0 mm) wide PRL1a, PRL2a, PRL3a
Type 2 Enclosure
(Drip-proof with gasketed trim) PRL1a, PRL2a, PRL3a 20-inch (508.0 mm) wide
Type 3R Enclosure
PRL1a, PRL2a 20-inch (508.0 mm) wide
PRL1a, PRL2a 28-inch (711.2 mm) wide
PRL3a ① 20-inch (508 mm) wide (600A maximum)
PRL3a ① 28-inch (711.2 mm) wide (600A maximum)
PRL4 24-inch (609.6 mm) or 36-inch (914.4) wide only
Type 12 Enclosure
PRL1a, PRL2a 20-inch (508.0 mm) wide
PRL1a, PRL2a 28-inch (711.2 mm) wide
PRL3a ① 20-inch (508 mm) wide (600A maximum)
PRL3a ① 28-inch (711.2 mm) wide (600A maximum)
PRL4 24-inch (609.6 mm) or 36-inch (914.4) wide only Must also add bus density price from Modification 2 for PRL4
Type 4 Enclosure or Type 4X Stainless Steel Enclosure
Refer to Eaton

4. Complete Assembly

Complete assembly of panelboard box, interior and trim prior to shipment when required.

5. Compression Main Lugs—Al/Cu Burndy Range Taking

For other terminal types and box sizes, refer to Eaton.

Modification 5—Compression Lug Data

Main Amperes	Wire Range by Panel Type PRL1a and PRL2a	PRL3a	PRL4
100	(1) #1–1/0 or (1) 2/0–300 kcmil	—	—
125	—	(1) #4–2/0 or (1) 2/0–300 kcmil	—
225	(1) 2/0–300 kcmil or (1) 4/0–500 kcmil	—	—
250	—	(1) 2/0–350 kcmil or (1) 4/0–500 kcmil	(2) 500–750 kcmil
400	(2) 4/0–300 kcmil or (2) 500–750 kcmil	(2) 4/0–300 kcmil or (2) 500–750 kcmil	(2) 500–750 kcmil
600	—	(2) 2/0–500 kcmil or (2) 500–750 kcmil	(2) 500–750 kcmil
800	—	—	(3) 500–750 kcmil
1200	—	—	(4) #2–600 kcmil or (4) 500–750 kcmil

Modification 5—Box Height Additions

Main Amperes	PRL1a, PRL2a	PRL3a without Neutral	PRL3a with Neutral
100	0	0X	0X
225	0	—	—
250	—	2X	5X
400	0	0X	0X
600	—	0X	0X

Maximum size for PRL1a and PRL2a panels:
1–750 kcmil per phase, or 2–500 kcmil per phase.
For PRL4 panels, see layout pages.

6. Concealed Trim Clamps—LT Trim

Modification 6

Description
Add per panel PRL1a, PRL2a, PRL3a

7. Conduit Covers

Fabricated sheet metal to cover open conduits above and/or below standard Type 1 box.

Modification 7

Cover Type
Conduit Enclosing Shield (open back) PRL1a, PRL2a, PRL3a, PRL4—Refer to Eaton
Conduit Enclosure (solid back) PRL1a, PRL2a, PRL3a, PRL4—Refer to Eaton

Note

① At 600A, PRL3a requires the addition of density rated copper bus for Type 3R or 12 enclosure.

8. Copper Lugs

Optional copper mechanical main lugs only. (Includes main incoming neutral lug.)

Modification 8

Main Amperes	Wire Range and Number of Lugs Per Phase
100	(1) #14–1/0
225	(1) #6–250 kcmil
250	(1) #6–250 kcmil
400	(2) #1/0–600 kcmil
600	(2) #1/0–600 kcmil
800	(2) #1/0–600 kcmil
1200	(3) #1/0–600 kcmil

Modification 8—Box Height Additions

Main Amperes	PRL1a, PRL2a	PRL3a without Neutral	PRL3a with Neutral	PRL4
100	0	0X	0X	—
225	0	—	—	—
250	—	0X	0X	0X
400	0	0X	0X	0X
600	—	1X	1X	0X
800	—	—	—	0X
1200	—	—	—	0X

9. Copper Main Bus

Modification 9

Available in PRL1a, PRL2a, PRL3a and PRL4

9a. Silver-Plated Copper Main Bus

Modification 9a

Available in PRL1a, PRL2a, PRL3a and PRL4

9b. Tin-Plated Copper Main Bus (PRL1a, 2a, 3a, Only)

Modification 9b

Panel Type
PRL1a, PRL2a, PRL3a

10. Directory Frame—Metal

Modification 10

Frame Type
Metal frame, plastic cover

11. Trim and Door Modifications—Special Fronts and Doors

Modification 11

Description
Door-in-door, one door over interior and one which exposes gutter. (LT Trim) (PRL1a, PRL2a, PRL3a only)
Common trim for two section panels with boxes bolted together. (LT Trim) (PRL1a, PRL2a, PRL3a only)
Standard flush lock with quarter turn fasteners at top and bottom of trim door (LT Trim) (standard on doors 48-inch (1219.2 mm) high and over). (PRL1a, PRL2a, PRL3a only)
To provide a trim with a lockable door for PRL4 panels (door-in-door is standard with this adder). Includes National lock with standard keying. ①
Add per panel

12. Fungus Proofing

For fungus proofing external portions of circuit breakers and all non-metallic parts, add 10 percent of total panelboard list price. For fungus proofing fusible switches and all non-metallic parts, add 20 percent of total panelboard list price.

13. Ground Bar

Modification 13

	Description	Bar Type
Panel Type		
PRL1a PRL2a PRL3a PRL4	Aluminum terminal bar for aluminum or copper cable	Standard, insulated/isolated ②
	Copper terminal bar for copper cable only	Standard, insulated/isolated ②
Column Type		
In Pull Box In Gutter	Aluminum terminal bar for aluminum or copper cable	Standard, insulated/isolated ②
	Copper terminal bar for copper cable only	Standard, insulated/isolated ②

Notes

① Extra depth box is required. Box will be 12.82-inch (325.6 mm) deep.

② For PRL1a, 2a, 3a and Column Type panelboards. The insulated/isolated ground bar includes a standard ground bar.

14. Electronic Trip Units

Modification 14—Applies to Digitrip 310 and 310+ Trip Units

Description
K-, L- and M-Frame Circuit Breaker (three-pole only)
Digitrip RMS310 LS
Digitrip RMS310 LSI
Digitrip RMS310 LSG ①
Digitrip RMS310 LSIG ①
N-Frame circuit breaker
Digitrip RMS310 LS
Digitrip RMS310 LSI
Digitrip RMS310 LSG ①
Digitrip RMS310 LSIG ①
Digiview Ammeter for 310+ Trip Unit

15. Zero Sequence Ground Fault Protection

For main devices only (circuit breakers or FDPW switch) in PRL4 assembled panels. Available in 250–1200A panels.

Price includes current monitors, ground bar, static sensor, shunt trip, necessary space, mounting and connecting in panelboards. Price does not include circuit breaker or FDPW switch.

Zero sequence ground fault is available with the following family of main devices:

Modification 15

Main Device
JD, KD, LD, MDL, ND, LCL, LA-P, NB-P FDPW switches (400–1200A)

16. Circuit Breaker Handle Lockoff Devices

Modification 16

Breaker Types
Non-Padlockable
BAB, QBHW, GHB, EHD, FDB, FD, ED, EDH, EDC, HQP, QPHW
JD, KD, MDL, ND
Padlockable
EHD, FDB, FD, HFD, FDC, ED, EDH, EDC, GHB, BAB, QBHW, HQP, QPHW, EGB, EGS, EGH
JD, KD, LD, MDL, ND, FDE, HFDE

17. Special Hinges—LT Trim

Piano hinges in lieu of standard hinges.

18. Increased Dimensions (PRL1a, PRL2a and PRL3a Only) Type 1 Enclosure Only

Modification 18

Description
Increased End Gutters
4 inch (101.6 mm) Top or Bottom
7 inch (177.8 mm) Top or Bottom
12 inch (304.8 mm) Top or Bottom
Increased Side Gutters
4 inch (101.6 mm) Left or Right
7 inch (177.8 mm) Left or Right
12 inch (304.8 mm) Left or Right

19. Increased Panel Main Bus Rating (Three-Phase Four-Wire, Single-Phase Three-Wire)

Modification 19

Main Bus Ampere Rating	Panel Type
100–225/250	PRL1a, PRL2a, PRL3a
225–400	
600 (PRL3a)	
250–400	PRL4
400–600	
600–800	
800–1200	

20. Interior and Fronts to Fit Existing Boxes

Refer to Eaton.

21. Special Locks

Modification 21

Description
LT Type Trim
Yale 511S with rosette
Yale 4651S (LL803 Key)
Master keying—above locks or standard lock—per panelboard
Corbin 15767 (Cat. #60 Key) PRL1a, PRL2a, PRL3a
Tee handle and 3-point catch PRL1a, PRL2a, PRL3a
COMPX metal lock with standard keying PRL1a, PRL2a, PRL3a
COMPX metal lock with GE75 keyway PRL1a, PRL2a, PRL3a, PRL4
EZ Type Trim
Standard Lock, Keyed GE75
Standard Lock, Keyed to Corbin TEU-1
Standard Lock, Keyed to Corbin Cat 60
Standard Lock, Keyed to Corbin WEM1

Notes

① Main breaker only.

PRL4 with door includes National lock with standard keying. See **Modification 11**.

22. Molded Case Switches (Three-Pole, Two-Pole)

Modification 22

Not UL Listed

Breaker Frame	Maximum Volts	Maximum Amperes
EHD	480	100
FD	600	225
JD	600	250
DK	240	400
KD	600	400
LD	600	600
MDL	600	800
ND	600	1200

23. Nameplates, Engraved

Modification 23

Type
Mastic back and installed by purchaser, per nameplate
Fixed to panel trim with two screws or rivets, per nameplate PRL1a, PRL2a, PRL3a only

24. Neutral Rated 200%

Modification 24

Main Bus Rating	Neutral Rating
100	225
225	450
250	500
400	800
600	1200

Modification 24—Box Height Additions

Main Bus Rating	Neutral Rating	PRL1a, PRL2a	PRL3a	PRL4
100	225	0	0X	—
225	450	0	—	—
250	500	—	3X	0X
400	800	0	3X	0X
600	1200	—	3X	0X

Note: Dimensions based on mechanical lugs. For compression or copper lugs, refer to Eaton.

For 800 and 1200A PRL4 with 200% neutral, refer to Eaton.

25. Painting and Special Coatings

Standard boxes are code-gauge galvanized sheet steel. Standard trims are code-gauge sheet steel with a rust inhibiting phosphatized coating and finished with ANSI-61.

Modification 25

Description
Painted boxes (ANSI-61)
Painted trims or boxes (other than ANSI-61)

26. Permanent Circuit Numbers

Modification 26

Description
To provide permanently attached Micarta ×circuit numbers.

27. Remote Control Switches—ASCO 920 (Three-Pole, Two-Pole)

Electrically operated, mechanically held remote control switch directly mounted to panelboard bus for total or split bus switching applications.

(For split bus applications, make price addition from **Modification 30**.)

480 Vac maximum short-circuit rating of panelboard is 22 kAIC maximum.

Includes complete installation in the panelboard with a screw cover over the switch compartment.

Pushbuttons or other control devices are not included. For control circuit modifications, refer to Eaton.

Modification 27—Remote Control Switches (PRL3a Only)

Switch Rating Amperes
30, 60, 75, 100, 150, 200, 225

Modification 27—Remote Control Switch Modifications

Description
Two-wire control relay
Three-wire control relay
Control power transformer
To provide hinged cover in place of standard screw cover

28. Service Entrance

To provide a Service Entrance Label as detailed under the "Service Entrance Equipment" in application considerations. Only panelboards meeting these requirements can be labeled as such. The requirement for a Service Entrance Label must be noted on order entry. Includes neutral disconnect link and Service Entrance Equipment Label. (Ground bar not included—see **Modification 13**.)

Modification 28

Panel Type
PRL1a, PRL2a, PRL3a, PRL4

29. Shunt Trip for Main or Branch Circuit Breaker and FDPW Switches

For tripping device from a remote point. Voltage and frequency must be specified. Wiring to terminal blocks is not included. Standard leads extend 18-inches (457.2 mm) out of device.

Factory-installed 120, 240 or 480 Vac shunt trips are available with UL listing as shown in table below. Underwriters Laboratories listing is not available for shunt trip mounted on molded case switches.

Modification 29

Device
BAB, QBHW Requires one additional pole space, i.e., single-pole is two-pole size, two-pole is three-pole size and three-pole is four-pole size.
GHB (three-pole only)
All other circuit breakers
FDPW switch (400–1200A)

30. Split Bus or Meter Loop (250A Max., 3Ph 4W, 3Ph 3W, 1Ph 3W, 1Ph 2W)

Panel type PRL3a only. For enclosure size, refer to Eaton.

Modification 30

Main Bus Amperes
100–250

31. Metering Devices (PRL4 Only)

IQ digital metering for incoming service. Devices are installed in chassis mounted compartment with hinged door. Standard CTs (1200A maximum) are included with devices. Requires copper bus at 1200A.

Modification 31

Device	Box Height Addition
IQ 130 with CTs and display	13X
IQ 130 with CTs, no display	13X
IQ 140 with CTs and display	13X
IQ 140 with CTs, no display	13X
IQ 150 with CTs and display	13X
IQ 150 with CTs, no display	13X
IQ 210 with CTs	13X
IQ 220 with CTs	13X
IQ 230 with CTs	13X
IQ 230M with CTs	13X
IQ 250 with CTs and display	13X
IQ 250 with CTs, no display	13X
IQ 260 with CTs and display	13X
IQ 260 with CTs, no display	13X
PXM 2250 with CTs and display	13X
PXM 2250 with CTs, no display	13X
PXM 2260 with CTs and display	13X
PXM 2260 with CTs, no display	13X
PXM 2270 with CTs and display	13X
PXM 2270 with CTs, no display	13X

32. Sub-Metering IQ Multi-Point Submeter II (PRL4 Only)

Microprocessor-based breaker-mounted device to monitor power and energy (kW, kWH, kW demand). Device mounts on the load side of three-pole F-, J- and K-Frame feeder breakers. Units are shipped with the interior for field installation. Minimum box width of 36 inches (914.4 mm) is required.

Modification 32

IQ Energy Sentinel
F-Frame three-pole (150A maximum)
J-Frame three-pole
K-Frame three-pole

33. Sub-Feed Breakers

Modification 33—Panel Types PRL1a, PRL2a, PRL3a One Breaker Per Panel

Maximum Amperes	Number of Poles	Breaker Type	Interrupting Rating (kA Symmetrical) 240V	480V	Box Height Addition PRL3a
100	2	EHD	18	14	NA
150	2	FDB	18	14	NA
225	2	FD	65	35	NA
225	2	HFD	100	65	NA
225	2	FDC	200	100	NA
225	2	EDB	22	—	NA
225	2	EDS	42	—	NA
225	2	ED	65	—	NA
225	2	EDH	100	—	NA
225	2	JD	65	35	14X
225	2	HJD	100	65	14X
225	2	JDC	200	100	14X
250	2	JD	65	35	14X
250	2	HJD	100	65	14X
250	2	JDC	200	100	14X
400	2	DK	65	—	15X
400	2	KD	65	35	15X
400	2	HKD	100	65	15X
400	2	KDC	200	100	15X
100	3	EHD	18	14	NA
150	3	FDB	18	14	NA
225	3	FD	65	35	NA
225	3	HFD	100	65	NA
225	3	FDC	200	100	NA
225	3	EDB	22	—	NA
225	3	EDS	42	—	NA
225	3	ED	65	—	NA
225	3	EDH	100	—	NA
225	3	JD	65	35	14X
225	3	HJD	100	65	14X
225	3	JDC	200	100	14X
250	3	JD	65	35	14X
250	3	HJD	100	65	14X
250	3	JDC	200	100	14X
400	3	DK	65	—	15X
400	3	KD	65	35	15X
400	3	HKD	100	65	15X
400	3	KDC	200	100	15X

Note: 225A maximum on Column Type panels. Sub-feed breaker not available on PRL3a panel with subchassis.

Modification 33—Panel Type PRL3a Only. Two Breakers Per Panel—Twin Mounted

Maximum Amperes	Number of Poles	Breaker Type	Interrupting Rating (kA Symmetrical) 240 Volts	480 Volts	Box Height Addition PRL3a
225	2	JD	65	35	20X
225	2	HJD	100	65	20X
225	2	JDC	200	100	20X
250	2	JD	65	35	20X
250	2	HJD	100	65	20X
250	2	JDC	200	100	20X
225	3	JD	65	35	20X
225	3	HJD	100	65	20X
225	3	JDC	200	100	20X
250	3	JD	65	35	20X
250	3	HJD	100	65	20X
250	3	JDC	200	100	20X

34. Sub-Feed Lugs (3Ph 4W, 3Ph 3W, 1Ph 3W, 1Ph 2W)

Note: Not available on service entrance panels with main lugs only (six disconnect rule).

Mechanical Al/Cu lugs. Compression or copper lugs requires additional price adder from **Modification 5—Compression Lug Data** or **Modification 8** as appropriate.

Available on main lug panels only.

Modification 34

Main Amperes	Box Height Addition
Panel Types PRL1a, PRL2a	
100–225	0X
Panel Type PRL3a	
100–250	1X
Panel Type PRL4 ①	
250–400	0X
600	4X

35. Tamperproof Screws—LT Trim

Modification 35

Description
Tamperproof screws for trims, in lieu of standard screws.

36. Through-Feed Lugs (3Ph 4W, 3Ph 3W, 1Ph 3W, 1Ph 2W)

Note: 225 amperes maximum on Column Type panels. Not available on service entrance panels with main lugs only (six disconnect rule).

Mechanical Al/Cu lugs. Compression or copper lugs requires additional price adder from **Modification 5—Compression Lug Data** or **Modification 8** as appropriate.

Not available on panels with sub-feed breaker.

Modification 36

Main Amperes	Box Height Addition
Panel Types PRL1a, PRL2a	
100	②
225	②
400	②
Panel Type PRL3a	
100	2X
250	5X
400	8X
600	8X
800	14X
Panel Type PRL4 ②	
250	7X
400	7X
600	7X
800	7X
1200	5X

37. Time Clock Space Only

Includes box, trim, door and mounting pan.

Modification 37

Enclosure Type
Type 1
PRL1a, PRL2a, PRL3a (24-inch (609.6 mm) space)
PRL1a, PRL2a, PRL3a (36-inch (914.4mm) space)
Type 3R
PRL1a, PRL2a, PRL3a (24-inch (609.6 mm) space)

38. Touchup Paint

Modification 38

Description
12 oz. spray can. ANSI-61 light gray indoor
Case Lot of 12—12 oz. spray cans. ANSI-61 light gray indoor single style

Notes

① Refer to PRL4 layout.

② Refer to panelboard sizing charts.

39. Surge Protective Device (SPD)

Type PRL1a, PRL2a and PRL 3a and Panelboards

Package includes SPD unit connected to the panelboard bus.

Available for all enclosure types.

Sizing:
PRL1a, PRL2a: Add 7 inches (177.8 mm) to the standard box height.

PRL3a: Add 4X for 100–200 kA SPD units.

Type PRL4 and Elevator Control Panelboards

Package includes SPD unit and integral circuit breaker disconnect (30A) connected to the panel bus.

Available for all enclosure types.

The SPD unit and integral circuit breaker disconnect will require 7X of chassis space. (Only available in 36-inches (914.4 mm) or 44-inches (1117.6 mm) wide enclosure.)

Modification 39

Description	kA/Phase								
Surge Current Rating	**50**	**80**	**100**	**120**	**160**	**200**	**250**	**300**	**400**
SPD Package Options									
Basic LEDs monitor L-N, L-G, L-L and N-G									
PRL1a, PRL2a, PRL3a	■	■	■	■	■	■	—	—	—
PRL4, Elevator Control Panelboard	■	■	■	■	■	■	■	■	■
Standard Feature Package LEDs monitor L-N, L-G, L-L and N-G EMI/RFI filtering Audible alarm with disable switch Form C relay contact									
PRL1a, PRL2a, PRL3a	■	■	■	■	■	■	—	—	—
PRL4, Elevator Control Panelboard	■	■	■	■	■	■	■	■	■
Standard Package LEDs monitor L-N, L-G, L-L and N-G EMI/RFI filtering Audible alarm with disable switch Form C relay contact Six digit LCD display Counts surges in all modes Non-volatile memory (no battery backup) Reset button designed to prevent accidental resets									
PRL1a, PRL2a, PRL3a	■	■	■	■	■	■	—	—	—
PRL4, Elevator Control Panelboard	■	■	■	■	■	■	■	■	■

40. Copper Wire Only Terminals for Molded Case Circuit Breakers

(To replace standard Al/Cu terminals.)

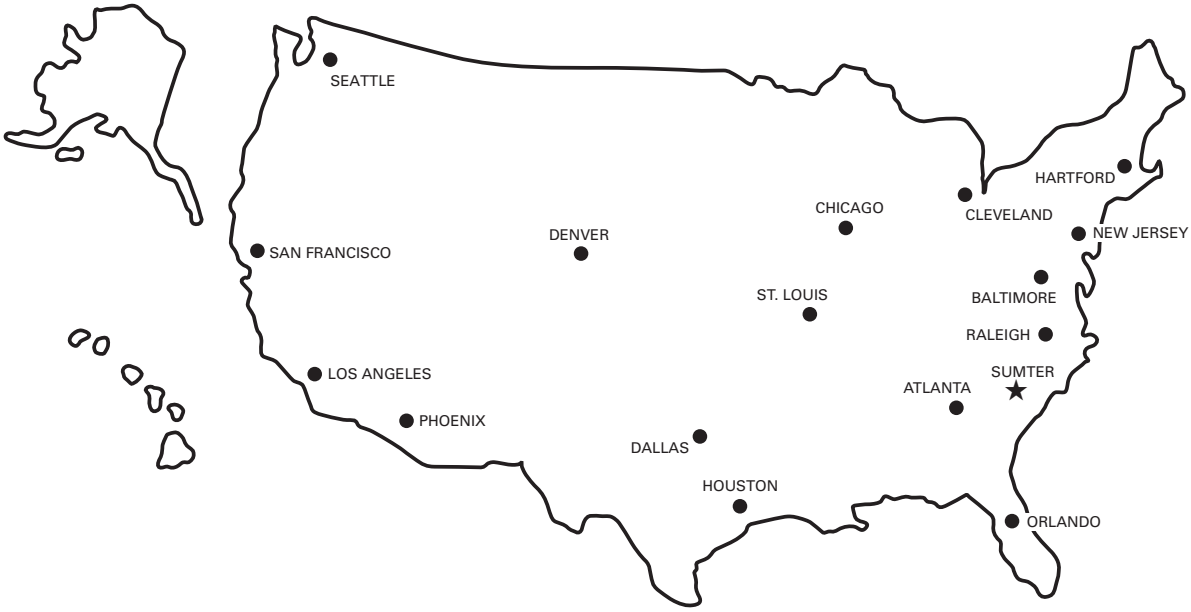
Modification 40

Breaker Frame	Maximum Breaker Ampere Rating	Terminal Material	Wire Range
F	225	Copper	#4–4/0
J	250	Stainless Steel	#4–350
K	225	Copper	(1) #3–350
	350	Copper	(1) 250–500
	400	Copper	(2) 3/0–250
L	600	Copper	(2) 250–500
M	600	Copper	(2) #2/0–500
	800	Copper	(3) #3/0–300
N	700	Copper	(2) #2/0–500
	1000	Copper	(3) #3/0–500
	1200	Copper	(4) #3/0–400

Note

① Requires 15A branch breaker for cable connection—three-pole (three-phase) or two-pole (single-phase). (Add breaker separately, not included in price.)

Manufacturing Plant Locations



Main Plant

Sumter
845 Corporate Circle
P.O. Box 2258
Sumter, SC 29150
(803) 481-3131

Satellite Plants

Atlanta
7000 Highlands Parkway SE
Suite 102
Smyrna, GA 30082
Fax (770) 433-1863
Phone (678) 309-4260

Baltimore
7451 Coca Cola Drive
Suite C
Hanover, MD 21076
Fax (410) 796-7755
Phone (410) 796-7777

Chicago
220 Windy Point Drive
Glendale Heights, IL 60139
Fax (630) 260-6303
Phone (630) 860-3569

Cleveland
12875 Corporate Drive
Suite E
Parma, OH 44130
Fax (216) 433-0545
Phone (216) 433-0616

Dallas
631 Westport Parkway
Suite 100
Grapevine, TX 76051
Fax (817) 251-6249
Phone (817) 251-6797

Denver
2450 Airport Road
Suite C
Aurora, CO 80011
Fax (303) 366-9993
Phone (303) 366-2080

Hartford
40A International Drive
Windsor, CT 06095
Fax (860) 298-1305
Phone (860) 298-1306

Houston
10810 West Little York
Suite 100
Houston, TX 77041
Fax (713) 688-3764
Phone (713) 688-8430

Los Angeles
Electrical Sector—Satellite
11120 Philadelphia Street
Mira Loma, CA 91752
Fax (951) 685-3775
Phone (951) 685-5788

New Jersey
96 Stemmers Lane
Westampton, NJ 08060
Fax (609) 835-4777
Phone (609) 835-4230

Orlando
9436 Southridge Park Court
Suite 100
Orlando, FL 32819
Fax (407) 841-9135
Phone (407) 264-9301

Phoenix
921 South Park Lane
Tempe, AZ 85281
Fax (480) 449-4223
Phone (480) 449-4222

Raleigh
2933 S. Miami Boulevard
Suite 111
Durham, NC 27703
Fax (919) 572-9751
Phone (919) 544-7074

St. Louis
56 Soccer Park Road
Fenton, MO 63026
Fax (636) 717-3590
Phone (636) 717-3500

San Francisco
20923 Cabot Boulevard
Hayward, CA 94545
Fax (510) 784-8980
Phone (510) 784-8981

Seattle
1604 15th Street SW
Suite 114
Auburn, WA 98001
Fax (253) 833-5058
Phone (253) 833-5021

Satellites

A unique concept of facilities close to customer locations, assuring fast delivery of standard- and custom-assembled equipment *when it's needed*.

Located at strategic locations throughout the United States, these facilities manufacture and deliver standard or custom-assembled panelboards, switchboards and enclosed circuit breakers…when and where you need them. And, when you have an emergency, they can have your equipment ready in hours.

Highly trained and experienced personnel will manage your order and ensure that you receive on-time delivery of high quality equipment that meets your specifications.

Special Configurations

The unique capabilities of these plants and people can provide solutions for special products to meet special needs.

Typical examples include special dimensions, retrofit equipment and panelboard interiors to fit existing boxes.

Speedy Delivery

- Panelboards: from one to five days.
- Switchboards: between five and 10 days.
- Assembled Enclosed Circuit Breakers: from one to 10 days.

Save Time and Money

No matter your location, you will save time and money when ordering from a satellite. For more information, contact your Eaton representative or authorized distributor.

Additional Information

For information on reverse feed breaker applications, please see **Consulting Application Guide—Molded-Case Circuit Breakers & Enclosures**, CA08104001E, Tab 27.

2.6 Solar Services

Product Group Overview

Contents

Product Group Overview

Eaton has created several key support groups, for the direct purpose of providing the highest quality service available today in the renewable energy market segment. These valued-added support capabilities allow us to provide a level of service above all other manufacturers and regional independent organizations. Below is a description of the groups involved in completing any successful solar photovoltaic turnkey project from design through construction. Equipment startup and system commissioning and even long-term maintenance requirements are part of Eaton's strengths.

Features

- Feasibility studies
- AC interconnection analysis
- DC and photovoltaic system engineering
- Turnkey construction
- Utility interconnection substations
- Equipment manufacturer
- Equipment and system commissioning
- Monitoring services
- Long term maintenance

Contents

Solar Renewable Analysis and Consultation

Product Overview

Eaton's team can provide a cost-effective review with recommendations that maximizes solar renewable energy production. Eaton's approach investigates all or some of the following:

- Analysis of solar production potential by applying various methods of fixed, tilt and tracking systems
- Analysis of electrical interconnect feasibility and power usage
- Analysis of term-term maintenance and monitoring options and associated costs
- Development of Life-Cycle-Cost-Analysis (LCCA) for potential solar sites
- Initial analysis via use of Google-Earth photographs if feasible
- If required, specific site visits to further investigate the above
- If required, site visual audit of electrical equipment operating conditions
- Establishing a "Solar Production Index" when evaluating multiple sites
- Identify any potential issues with equipment life expectancy and warranty fulfillment obligations

Our analysis starts with the following premises that have been communicated to us by developers:

- Need to maximize solar energy production with expected 20-year solar variations
- Estimated construction costs identified and technical opinion of project completion from a technical and construction standpoint
- Preliminary review of any potential civil or structural issues involving potential solar sites
- Best practice recommendations for long-term monitoring to ensure maximum uptime and energy production to match the financial model
- Need for experienced analysis of hardware supplied, life expectancy and potential issues with warranty fulfillment obligations
- Recommendations for ongoing maintenance, operations and failure response

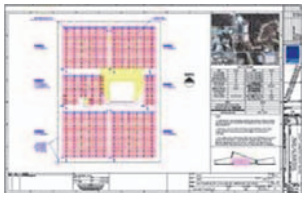
Product Description

Eaton's Electrical Services & Systems Group has extensive experience in electrical power distribution systems design, installation, start-up, commissioning, maintenance, trouble-shooting, life-extension and ongoing monitoring of operating parameters as well as failure indicators. We have added expertise and direct experience in the area of solar renewable energy projects, therefore providing developers and investors a non-biased technical review of potential solar sites.

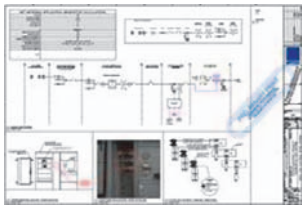
Terms and Conditions

Eaton can provide the above services in accordance with Eaton Standard Terms and Conditions or other mutually acceptable terms at either a fixed price or a time-and-material basis. If you have any questions or requests, please contact your local Eaton Engineering Services & Systems office today.

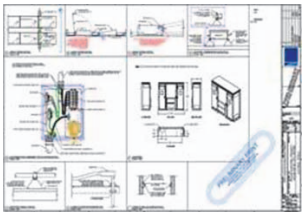
Roof and Wind Analysis



Electrical Design



Construction Details



2.6 Solar Services

Solar Design

Contents

Solar Design

Product Overview

Interconnection Analysis Services

Power system analysis services offer a focused and systematic approach to enhance performance and design, validate equipment selection, and simulate response to abnormal conditions. Typical analysis services performed during design of new renewable generation sites include:

- Short-Circuit Analysis—Calculation of the available short-circuit currents at equipment locations throughout the power system. Evaluation of equipment ratings ensures equipment can withstand, and, where applicable, interrupt an electrical fault. Results are critical for proper system design, including specification and selection of equipment
- Protective Device Coordination—Determination of necessary characteristics, ratings, and settings for electrical protective devices
- Arc Flash Analysis—Calculation of arc flash hazards associated with energized work at locations throughout the power system in accordance with NFPA 70E, IEEE1584, National Electric Safety Code, and Z462 requirements
- Load Flow Analysis—Analysis of the system's capacity to supply electrical energy from the renewable energy source to the utility or customer under steady-state conditions, determination of appropriate continuous ratings for electrical equipment, and optimal placement and characteristics of reactive power compensation equipment
- Harmonic Analysis—Evaluation of harmonic currents on the electrical system introduced by the renewable energy source and application of harmonic mitigation equipment and design techniques
- Transient Stability Analysis—Evaluation of dynamic behavior of the renewable source and system voltages during transient conditions such as system faults or start-up
- Switching Transient Analysis—Analysis of system behavior during switching conditions to identify possible damaging voltage transients. Results are used to design and specify mitigation equipment such as snubbers

Electrical Design Services

Eaton's electrical design services can extend from the point of utility connect to the equipment. Design services are integrated with analysis services, resulting in a complete engineered solution. The level of design detail can be customized from minimal design consultation and advice to a complete design package with specifications and drawings.

Typical design services include:

- Distribution System Design—Design and specification of the electrical distribution system from the point of interconnection to generation equipment
- Substation Design—Complete substation design service is available, including ground grid analysis and design, substation layout, equipment specification, protection, and control
- Protection and Control—Design of advanced electrical protection and control including transmission line protection, system automation, advanced metering and smart grid capabilities

DC Engineering Services

One-line diagram of the power system is critical to support the system evaluation and analysis. The one-line diagram shows the identification and ratings of electrical equipment such as: transformers, cables, circuit breakers, protective relays, fuses, switches, current transformers, potential transformers, surge arresters, and so on. ANSI device numbers identify protective relay types. The one-line diagram is typically provided with each type of power system study. Electrical one-line diagram, showing DC and AC portions of the system, to include the following:

- Solar module manufacturer, type and catalog number; number of module strings, number of modules per string (DC)
- Make, model, DC kW rating of solar panels
- Make, model, AC kW rating of inverter(s)
- Make, model, voltage, and current interrupt rating of all AC and DC disconnect switches
- Make and model of all lightning arrestors and surge suppression equipment
- Make and model of combiner boxes and fuses
- Make, model and rating of all circuit breakers and electrical panels
- Make and model of the utility meter
- Size, insulation rating, and temperature rating of system wiring and nominal voltage present on each line
- Complete electrical circuit back to customer's utility connection. All customer electrical panels related to the PV system shall be shown. Such panels shall be labeled with the make, model, bus rating and customer designation. The main circuit breaker shall also be labeled with the make and rating (if applicable)
- Proper compliance with all authorities having jurisdiction
- Step up transformer, MV switchgear, and point of utility connection

Typical DC connection drawing, showing the following:

- Typical termination for a solar module string
- Typical panel to panel termination
- Typical combiner box termination
- Develop cable routing and interconnection details
- Step up transformer, MV switchgear, point of utility connection equipment
- Grounding plan

Equipment layout drawing(s), showing locations for the following:

- Solar modules
- Combiner boxes
- Disconnect switches
- Inverters
- Conduit routing
- Existing panel, switchboard, or switchgear connection
- Step up transformer, MV switchgear, point of utility connection arrangement

Cable and conduit schedule, to show:

- Cable/conduit ID
- From/To destinations
- Voltages, AC or DC
- Cable and conduit sizing
- Number of conductors/ sets per phase
- Insulation type

Power Systems Engineering is an integral part of Eaton's electrical service capabilities. The combined Eaton Electrical Services & Systems team can provide a full scope of design and construction management services to support your project needs:

- Engineering and design
- Multi-vendor equipment supply
- Turnkey projects and construction management
- Installation services
- Power quality and load measurements
- Power quality investigation
- Energy management studies
- Renewable energy applications

Electrical Design Submittals

Eaton can prepare an equipment specification by using an approved single line diagram(s); knowledge of physical environment restrictions; the application of the electrical equipment; the equipment manufacturer's standards and options; the latest manufacturing industry standards; and a thorough knowledge of the latest local and national codes and regulations for installation of the equipment.

Eaton can develop equipment layout or arrangement plans that will identify the location of the equipment based upon the customer's physical restrictions. Once the equipment location has been determined, foundation designs, equipment grounding, and raceway routing designs will be developed and issued for approval.

Eaton can provide the following minimum design elements for the design deliverables:

- Title sheet
- Existing site plan
- PV array layout
- Electrical one-line diagram sheet
- Equipment location plan
- Equipment specifications
- 100% design drawings and other information as needed to enable accurate procurement and installation required to construct the project

2.6 Solar Services

Solar Design

Product Description

Eaton's Power System Engineering team is your ally to provide analysis and design for connecting renewable and alternative energy generation to the utility grid. Our experience and North American coverage make Eaton the choice to analyze and design the electrical distribution system and substation for wind and solar farm projects.

Our power system engineers bring extensive skills and expertise to power system analysis and design. Active participation in technical societies such as IEEE and collaboration with a variety of utilities and industries ensures that our engineers are knowledgeable about today's cutting edge engineering techniques.

Contents

Turnkey Services

Product Overview

Services for Solar Photovoltaic Power

Pre-installation services

- Solar site assessments including technical and financial analysis
- Solar system design including shading and annual kWh output analysis
- Photovoltaic panel selection
- Electrical balance of system design
- Monitoring system design (meters and software)
- Building connection and substation design

Installation services

- Solar photovoltaic panel installation
- Electrical balance of system installation
- Building infrastructure connection
- Utility grid interconnection up to 345 kV substations, synchronizing and controls
- Solar system commissioning and performance verification

PV System Commissioning

- Eaton can provide start up and commissioning services for the solar array, DC equipment, inverters and all AC equipment up to the point of connection
- Eaton can supply all test equipment and labor to properly test the PV system
- Eaton can complete the required field verification of the solar system components from the PV panels to the electrical AC grid connection. Acceptance will involve several steps starting at factory testing through final site system performance evaluations, with ongoing reporting and evaluation
- Eaton can supply complete close out documentation including final test reports, O&M manuals, training and as built drawings

Post-installation services

- Remote performance monitoring (metering and data collection)
- Ongoing energy production monitoring and rebate certifications
- Site power quality, load shedding and future expansion analysis
- Maintenance
- Operations training for site personnel
- Safety training
- Access to around-the-clock customer support

Other services

- Arc flash hazard analysis and solutions
- Power reliability studies
- LEED certification audits
- Building energy audits

Equipment Solutions for Solar Photovoltaic Power

DC switching and protection

- DC solar disconnect switches
- DC solar integrated disconnect combiner switch
- DC string level and array level monitoring

Inverters

- Solar inverters
- String Inverters, commercial inverters, utility class inverters

AC switching and protection

- AC solar switchboards and panelboards
- AC solar load centers
- AC disconnect switches
- AC circuit breakers
- Low voltage and medium voltage AC switchgear
- Low voltage and medium voltage transformers

Packaging

- Integrated Solar System (ISS)
- Integrated Power Assembly (IPA)

Monitoring and metering

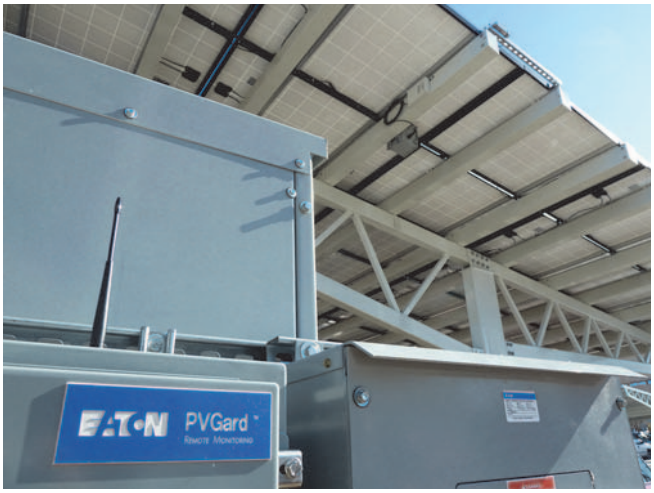
- Metering solutions compatible with Eaton and other manufacturers' equipment
- Customized metering solutions
- Web-enabled data collection and monitoring
- Cellular and satellite communications

2.6 Solar Services

Turnkey Services

Product Description

Eaton's turnkey project capabilities can help you build your solar business without adding staff or assets. With decades of experience in managing electrical power, we know what it takes to design and install a power system that generates clean, reliable power.



Contents

Solar Monitoring

Product Overview

PVGard® is a web-based solar monitoring system that can transmit via hard wire land lines or wireless communications from field acquired measurement parameters. Data parameters monitored and displayed can include but not be limited to the following measurements and displays:

Photovoltaic power output performance measurement transducers

- AC current and voltage
- DC current and voltage
- Kilowatt-hour meter

Meteorological data measurements

- Ambient air temperature
- Relative humidity
- Barometric pressure
- Wind speed
- Wind direction
- Rainfall
- Global horizontal irradiance
- Solar cell temperature

Real time data at minimal of 15 minute intervals

- AC current, voltage and kilowatt hours
- Solar plane of array irradiance
- Ambient temperature and wind speed

Calculated parameters

- AC power output
- Sunlight conversion efficiency to AC and DC power
- Inverter DC to AC power conversion efficiency
- Avoided pollutant emissions of CO2, SOx, and NOx gases

Inverter monitored data

- Watt-hour
- AC and DC voltage and current
- AC frequency
- Cumulated watt-hours
- Inverter error codes
- Inverter conversion efficiency
- DC string level and re-combiner current monitoring

Inverter System Sensors—(Enhanced monitoring parameters)

- Internal equipment enclosure temperatures and humidity
- Internal dust/smoke alarm levels within enclosures
- Water intrusion detector (floor water)
- Breaker trip or operation
- Fan and heater circuit operation
- Load current of main circuit breakers
- Transformer monitoring and alarms
- Relay status/health and Inverter error codes alarming
- Safe-solar detection and protection
- Quarterly performance reports to be e-mailed to site personnel
- Alarm conditions will be e-mailed and text-message to site personnel/Eaton
- Alarm and operating conditions will be summarized in quarterly report
- Inverter health index

The monitoring and display software permits customization to incorporate descriptive text, schematic diagrams, and user-specific data.

PVGard also provides the capability to generate the following type of graphs:

- Average plots of irradiance
- Average plots of ambient temperature and module temperature
- Daily value or totals of energy production
- Peak daily power
- Peak daily module temperature
- Peak daily irradiance plot over a specific month
- Monthly values of energy production
- Incident solar irradiance
- Cumulated yearly voided emissions of CO2, SOx, and NOx gases

The displayed data can also incorporate a looping background of pictures from the site, graphic overlays of the solar power generation in watts and watt-hours for each inverter. Other display capabilities:

- Project location on globe coordinates with zoom-in and out capability
- Current weather conditions
- Power generation from the total system and/or the individual solar power arrays
- Historic power generation
- Solar power system environmental impact
- Educational power point presentation (optional)
- Installed solar power electrical system overview and single line diagram

The display system can be capable of being programmed periodically to show additional information related to scheduled maintenance.

Product Description

Eaton's PVGard Engineered Monitoring system is a web-based system that monitors and proactively manages PV array equipment, inverters, AC equipment and weather parameters. Eaton builds in custom algorithms to track multiple inputs in order to improve and maintain system performance. For example PVGard alerts users to underperforming panels and can schedule maintenance on inverters when expected production values are shown to be lower than optimal performance.