

Drawout molded-case breakers in panelboards and switchboards



Introduction

Traditional choices available in the marketplace for quickly changing feeder breakers in electrical distribution equipment have evolved over the years. While drawout switchgear with power air circuit breakers remains a highly reliable solution, many customers are requesting options with molded-case circuit breakers (MCCBs). The primary reason for requesting MCCB applications is to obtain front-accessible equipment in a compact design that reduces the footprint of the distribution equipment and saves valuable space within the facility.

Consultants and customers have requested UL® 67 Listed power panelboards and UL 891 Listed switchboards for this application. One of the problems is that customers have been relegated to a hybrid offering using drawout switchgear and plug-on MCCB offerings. While the hybrid system has had some success, it has not totally addressed the customer's need for drawout type of equipment.

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

Feeder devices above 600A through 1200A use a vertically mounted drawout MCCB design. Regardless of the drawout MCCB needed, all are front-accessible and front-connected. Specifics of the system are detailed in this document, Eaton catalog pages, and a product brochure.

Benefits

- Ease of maintenance
- Faster to remove and install
- Less downtime
- Space savings
- Safety

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Market and segment applications

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

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

Application and design assistance is available from Eaton. Eaton has Application Engineers in all districts who are ready to assist with your needs and to answer your questions. Contact your nearest Eaton sales office for more information.

Drawout MCCB panelboards

Pow-R-Line 4D drawout panelboards

The Eaton drawout Pow-R-Line® 4D (PRL4D) panelboard is UL 67 Listed for wall-mounted applications from 600A to 1200A. The panelboards are rated at 240 Vac, 480 Vac, and 600 Vac. Fault current is available up to 200 kAIC at 240 Vac and 100 kAIC at 480 Vac. The short-circuit current rating of the panelboard is determined by the low short-circuit current rating of the lowest rated device in the panelboard.

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

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

Panelboards are available with standard aluminum bus. Optional copper and silver-plated copper bus is available. Other options include copper lugs, density-rated bus, ground bars, customer-owned meters, service equipment construction, surge protective devices, and seismically qualified panelboards. For additional panelboard options, please consult the Eaton catalog.

Drawout MCCB switchboards

Pow-R-Line drawout switchboards

The Eaton Pow-R-Line drawout switchboard design is listed and labeled to the UL 891 standard. Switchboards are rated up to 5000A. Main breakers are available up to 5000A in both fixed-mounted and drawout configurations. Main breakers may be Magnum DS® power circuit breakers or Magnum SB insulated-case circuit breakers and are front-accessible. Fixed-mounted MCCB mains are also available up to 2500A.

The Eaton Pow-R-Line drawout switchboards are always custom-configured to your specifications. Examples of optional incoming configurations include alternative power source designs for automatic transfer switches, main-tie-main, double-ended mains, and custom transfer schemes. Utility and customer-owned metering is available. Customer metering options includes Web-enabled communicating systems.

Aluminum bus is standard. Optional copper and silver-plated copper is available. Other common options include surge protective devices, seismically qualified designs, density-rated bus, and more.

Drawout feeder MCCBs are available in two- and three-pole offerings from 20A to 600A in the high-density, group-mounted design.

Drawout feeders above 600A through 1200A integrate the molded-case NX drawout breaker. Drawout breakers above 1200A through 2000A use the Magnum SB insulated-case circuit breaker. All are front-accessible and front-connected.

Drawout MCCBs

Group-mounted—600A maximum

Group-mounted drawout MCCBs are available in Pow-R-Line 4D power panelboards and Pow-R-Line drawout switchboards. Group-mounted drawout MCCBs include Eaton JG and LG breaker families, and include standard thermal-magnetic trip units or optional Eaton 310+ electronic trip units.

The unique features of the drawout cassette enable Eaton to provide high-density, front-accessible, front-connected feeder overcurrent protective devices with up to 14 drawout breakers in a single switchboard distribution section.

Features of the drawout group-mounted MCCB design offer new options not available before in group-mounted distribution equipment.

The design uses a cassette that has two distinct parts. The cassette “base” is specially designed so that the lineside connections to the board’s vertical bus and the loadside connection to feeder conductors can be permanent. The “drawout” cassette allows the breaker and any breaker accessory connections to be removed.

Base cassette



Drawout Molded-Case Circuit Breaker Base Cassettes

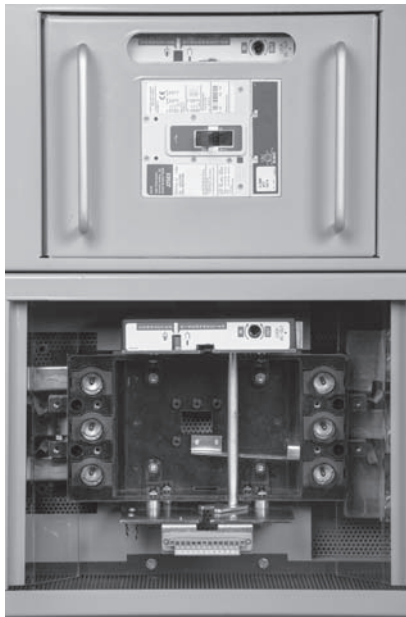
The base cassette is permanently mounted to the board’s chassis. The cassette base lineside connections use bus connectors and are factory-connected to the panelboard or switchboard vertical bus. The base cassette is permanently mounted to the board’s chassis and is designed to accept the drawout cassette that contains the breaker. The loadside feeder conductors are also part of the base cassette, allowing the loadside feeder conductors to remain with the base cassette when the breaker is removed. This enables the breaker to be removed from the group-mounted section without the need to remove the loadside conductors.

The base cassette contains a drawout racking mechanism, a Connected/Disconnected position indicator, and a pull-apart terminal block base (used when there are connections to breaker accessories). In addition, the base cassette houses the line and load connectors that accept the drawout MCCB cassette.

Note: Per industry practice, all power to the board section must be disconnected at its source before working on any electrical equipment.

Safety features include finger-safe connections to the drawout breaker cassette and a mechanism system that will not allow the breaker to be connected or removed while the breaker is in the energized, ON, position.

Drawout cassette



Drawout Molded-Case Circuit Breaker Installed

The drawout cassette contains the breaker and is group-mounted in a through-the-door design. The drawout cassette incorporates a viewing window and an external racking port. The viewing window allows personnel to visually inspect the status of the breaker and to see whether the breaker is connected to or disconnected from the bus. The window exposes the Connected/Disconnected position indicator on the base cassette. The external racking port allows access to the racking mechanism to draw out the breaker.

The drawout cassette includes a permanently mounted deadfront cover that is attached to the breaker assembly. The deadfront withdraws with the breaker assembly. Additionally, the drawout cassette contains handles attached to the deadfront to help easily remove the breaker.

When accessories are installed in the MCCB, the drawout cassette also contains a pigtail wiring harness. The harness is factory-wired. When the drawout breaker cassette is removed, the terminal block can be easily disconnected, enabling total removal of the drawout breaker cassette. External connections on the secondary side of the terminal block are provided by the installer.

The drawout cassette employs two breaker families. The JG family standard offering is an adjustable thermal-magnetic trip unit and offers two- and three-pole breakers ranging from 70A to 250A. Optional 310+ trip units offer ampere ranges from 20A to 250A. The JG family is available in either a single group-mounted design or a high-density, space-saving dual group-mounted design where two JG breakers occupy the same vertical space. This may require a wider enclosure.

The LG family also offers an adjustable thermal-magnetic trip unit as standard. Optional 310+ trip units provide ampere ranges from 100A to 600A. The LG family is available in a single-mount design only. See **Table 1** through **Table 4** for specific ratings.

Table 1. Standard Adjustable Thermal-Magnetic Trip Units

250A JG Frame	600A LG Frame
70A	250A
90A	300A
100A	350A
125A	400A
150A	500A
175A	600A
200A	—
225A	—
250A	—

Table 2. Optional 310+ Electronic Trip Units

250A JG Frame	600A LG Frame
20A	100A
25A	125A
30A	150A
40A	175A
45A	200A
50A	225A
70A	250A
80A	300A
90A	350A
100A	400A
110A	500A
125A	600A
150A	—
175A	—
200A	—
225A	—
250A	—

Table 3. Short-Circuit Current Ratings

Maximum Breaker Ampere Rating	Breaker Frame Designation (Type)	Short-Circuit Rating kA Symmetrical by AC Voltage		
		240 Vac	480 Vac	600 Vac
250A	JGS	85	35	18
	JGH	100	65	25
	JGC	200	100	35
600A	LGS	85	35	25
	LGH	100	65	35
	LGC	200	100	50

Table 4. Drawout Group-Mounted “X” Space Factors

This is the amount of space required for each of the drawout group-mounted breakers on the distribution chassis of the switchboard.

Breaker Family Type and Configuration	Group-Mounted Chassis “X” Space Required
JG family single mount	7X
JG family dual/twin mount	7X
LG family single mount	9X
LG family dual/twin mount	9X ①

① For use in switchboards only.

Drawout MCCB options

The following options are available on JG and LG family thermal-magnetic and electronic 310+ trip units. All optional accessories are factory-wired to the “drawout” cassette pull-apart terminal block.

Optional accessories**Table 5. Optional Accessories**

Accessory	Position (Only One Accessory per Position)	
	Left	Right
Alarm contact (Make/Break)		■
Auxiliary switch (1A/1B)		■
Auxiliary switch (2A/2B)		■
Auxiliary switch and alarm contact		■
Shunt trip (specify voltage)	■	
Undervoltage release mechanism	■	

Trip unit options**Table 6. Drawout MCCB Electronic Trip Unit Options**

Breaker Frame	Trip Unit Functionality
JGS, JGH, JGC, JGU	LS
	LSI
	LSG
	LSIG
LGS, LGH, LGC, LGU	LS
	LSI
	LSG
	LSIG
	ALSI
	ALSIG

The Eaton Arcflash Reduction Maintenance System™ provides reduced levels of incident arc-flash energy when put in the Maintenance mode. The Arcflash Reduction Maintenance System is available on the LG family of drawout MCCBs combining the Arcflash Reduction Maintenance System with the Digitrip™ 310+ electronic trip unit, allowing for the ability to place the trip unit in Maintenance mode to reduce potential arc-flash energy. This is done by a dedicated instantaneous sensing circuit with settings of 2.5 and 4.0 times the current rating of the trip unit. This dedicated analog sensing circuit delivers breaker clearing times that are faster than instantaneous by eliminating microprocessor processing latencies. This provides superior arc-flash reduction than simply the lower standard instantaneous pickup set point that others use.

When the Eaton Arcflash Reduction Maintenance System is enabled, the resulting reduced arc-flash energy allows for reduced PPE, which improves worker comfort and mobility. With the Arcflash Reduction Maintenance System set at 2.5X or 4.0X, it reduces incident energy levels to allow PPE Category 0 for currents of 2.5X or 4.0X the breaker ampere rating or greater. The initial setting of each Arcflash Reduction Maintenance System trip unit is determined by completing a power system analysis to assess available fault current at the circuit breaker. Based on that analysis, the Maintenance mode protection settings are defined, achieving a reduced level of arc-flash energy. The Maintenance mode is then activated by adjusting the trip unit's instantaneous setting to desired Maintenance mode levels that are determined by the power analysis.

For more information on breaker trip units and accessories, contact your local Eaton sales office or visit www.eaton.com.

Electronic trip units with zone selective interlocking (ZSI)

Unlike power air circuit breakers, MCCBs do not offer the ability to turn off the instantaneous trip settings. As a result, the coordination between one breaker and another could compromise selectivity (breaker closest to the fault opening first). ZSI is designed to mitigate selectivity issues with MCCBs.

Both the JG and LG families of MCCBs offer ZSI as an option.

ZSI provides increased system protection and can reduce arc-flash risk by allowing the breaker closest to the fault to trip without any preset time delays. This is achieved by selecting and setting the trip unit equipped with the ZSI option. The hardwired connection between the trip units sends a restraining signal upstream, allowing the breaker closest to the fault to act instantaneously. ZSI reduces stress on the distribution system and can reduce arc-flash risk by isolating faults without time delays.

Optional infrared (IR) viewing windows

IR windows are an available option on both the JG and LG families of single-mounted drawout MCCB cassettes. IR windows can be located to view the lineside and/or loadside connections. Select the IR Viewing Window option, manufacturer, and location at time of order.

Table 7. IR Viewing Windows

IR Window Manufacturer	Lineside Viewing Window	Loadside Viewing Window	Lineside and Loadside Viewing Window
Fluke (Hawk)	■	■	■
IRISS	■	■	■

Drawout NX MCCBs

Individually mounted 800A and 1200A

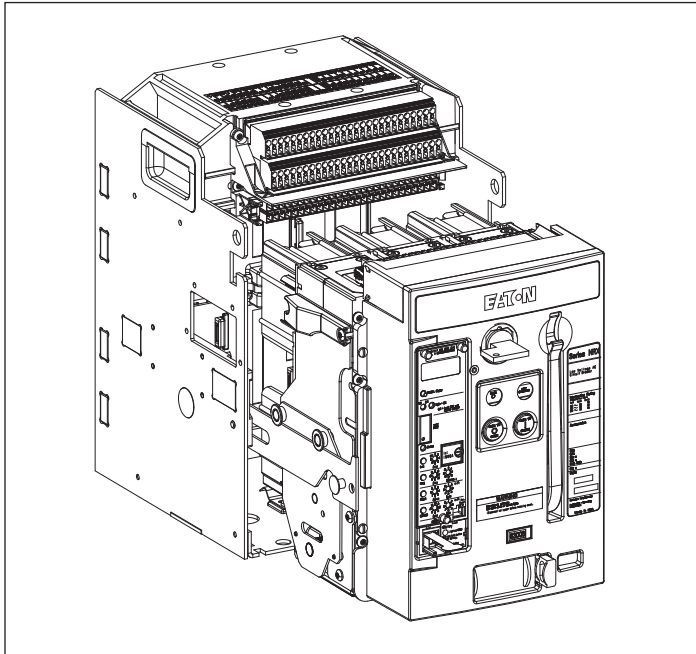


Figure 1. Typical NX Breaker with Drawout Cassette

For drawout applications above 600A, Eaton offers the NX breaker in our UL 891 Listed Pow-R-Line drawout switchboards. The NX is an insulated-case, UL 489 Listed circuit breaker. The breaker is 100% rated, and is offered as either a feeder or a main breaker. This front-accessible, front-connected breaker is available in an 800A and 1200A frame. Stored energy is standard.

The NX breaker has electronic trip units as standard and offers a wide range of breaker accessories.

NX breakers are individually mounted, front-accessible, and front-connected in traditional Pow-R-Line switchboard configurations. NX breakers are available in several configurations that include two NX front-accessible, front-connected breakers in a section; one NX breaker and half section group-mounted distribution chassis in a single switchboard section or one single NX breaker in its own section. The group-mounted chassis will accept either or both the JG and LG families of drawout MCCBs. See **Table 8** below.

Table 8. NX Feeder Mounting

Switchboard Section Top Half	Switchboard Section Bottom Half	Minimum Section Width in Inches
Configuration	Configuration	
Individually mounted NX	None	36
None	Individually mounted NX	36
Individually mounted NX	Individually mounted NX	45
Individually mounted NX	22X group-mounted chassis	45

Table 9. NX Short-Circuit Current Ratings

NX Insulated-Case Breakers	Breaker Ampere Rating	
	800A	1200A
Continuous Current Rating		
240 Vac	85	85
480 Vac	65	65
600 Vac	42	42

NX Trip Unit Rating Plugs

Trip Unit Rating Plug (Amperes)

800A

1000A

1200A

Drawout NX MCCB options

NX electronic trip unit

Table 10. NX Electronic Trip Unit Options

Trip Unit Functionality	Optional Arcflash Reduction Maintenance System
LSI	Yes
LSI with ZSI	Yes
LSIG	Yes
LSIG with ZSI	Yes
LSIA	Yes
LSIA with ZSI	Yes

L = Adjustable Long-Time Pickup

S = Adjustable Short-Time Pickup with Fixed Short-Time Delay

I = Adjustable Instantaneous Pickup

G = Adjustable Ground Fault Pickup

A = Adjustable Ground Fault Alarm Only (no trip)

NX accessories

Table 11. NX Accessories and Options

Accessory	Note
Shunt trip	Specify voltage
Undervoltage release	Specify voltage
Auxiliary switch	Specify 2 or 4 Form C
Motor operator	—
Trip indicator	—
Bell alarm	—
Shutters	—

Drawout MCCB metering options

A full line of Eaton customer metering is available. All options offered in Eaton's standard bolt-on switchboard product are also available with the Pow-R-Line drawout MCCB switchboard. Contact Eaton for details.

Drawout MCCB enclosure options

Indoor Type 1 enclosure is standard. Optional outdoor Type 3R switchboards are available.

Surge protective devices (SPDs)

Eaton SPDs are available. An MCCB is provided as a lineside disconnect for the SPD and is included in the price.

Table 12. SPD Surge Current Ratings and Options

Surge Protective Device Package Options	Surge Current Rating (kA)								
	50	80	100	120	160	200	250	300	400
Basic Package									
LED monitor, L-N, L-G, L-L, and N-G	■	■	■	■	■	■	■	■	■
Standard Package									
LED monitor, L-N, L-G, L-L, and N-G. EMI/RFI filtering. Audible alarm with disable switch. Form C relay contact.	■	■	■	■	■	■	■	■	■
Premium Package									
LED 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. Nonvolatile memory (no battery backup). Reset button designed to prevent accidental resets.	■	■	■	■	■	■	■	■	■

For additional information on Eaton drawout MCCB panelboards and switchboards, breakers, and options, please contact your nearest Eaton sales office or visit www.eaton.com.

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