

# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

Catalog  
0612CT0101 R07/14  
**2014**  
Class 0612



**CONTENTS**

<b>Description</b> .....	<b>Page</b>
General Information .....	7
Electronic Trip Systems .....	22
PowerPact M-Frame Molded Case Circuit Breakers .....	38
PowerPact P-Frame Molded Case Circuit Breakers .....	41
PowerPact R-Frame Circuit Breakers .....	52
Compact NS630b–NS1600 Circuit Breakers .....	61
Compact NS1600b–NS3200 Circuit Breaker .....	66
Accessories .....	69
P-Frame Cradles and Cradle Accessories .....	91
Dimensional Drawings .....	97
Trip Curves .....	135
Catalog Numbers .....	149



by Schneider Electric

**PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers**



# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

<b>SECTION 1: GENERAL INFORMATION .....</b>	<b>7</b>
Introduction .....	7
Features and Benefits .....	7
Specifications .....	8
Codes and Standards .....	8
Circuit Breaker Ratings .....	9
Enclosure Sizes .....	11
Operating Conditions .....	11
Trip System .....	12
Motor Circuit Protectors .....	13
Automatic Molded Case Switches .....	13
Internal Operating Mechanism .....	14
Push-to-Trip Button .....	14
Circuit Breaker Mounting and Connections .....	14
Catalog Numbering System .....	16
Testing Requirements .....	20
<b>SECTION 2: ELECTRONIC TRIP SYSTEMS .....</b>	<b>22</b>
Type ET Electronic Trip System .....	22
Micrologic™ Electronic Trip Systems .....	23
Protection Settings.....	27
Ammeter Measurements.....	27
Communication Network.....	27
Protection Settings.....	29
Maintenance Record.....	29
Load Shedding and Reconnection Parameters .....	29
Indication Option Via Programmable Contacts.....	30
Real-Time Metering .....	32
Demand Metering .....	32
Metering.....	33
Waveform Capture.....	33
Customized Alarm Programming.....	34
Event Logs.....	34
Additional Characteristics for Type P and H Trip Units.....	34
Long-Time Trip Functions.....	35
Short-Time Trip Functions .....	35
Instantaneous Trip Function .....	35
Ground-Fault Trip Functions.....	36
<b>SECTION 3: POWERPACT M-FRAME MOLDED CASE CIRCUIT BREAKERS .....</b>	<b>38</b>
Performance .....	38
Interrupting Ratings .....	39
Termination Information .....	39
Accessories .....	39
Control Wiring .....	40
<b>SECTION 4: POWERPACT P-FRAME MOLDED CASE CIRCUIT BREAKERS .....</b>	<b>41</b>
Performance .....	41
Catalog Numbers .....	42
Continuous Current Rating .....	46
Interrupting Ratings .....	46
Automatic Molded Case Switches .....	47
Motor Circuit Protectors .....	48
Electrically-Operated Circuit Breakers .....	49

# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

Termination Information .....	49
Control Wiring .....	49
<b>SECTION 5: POWERPACT R-FRAME CIRCUIT BREAKERS .....</b>	<b>52</b>
Performance .....	52
Catalog Numbers .....	53
Interrupting Ratings .....	58
Automatic Molded Case Switches .....	58
Termination Information .....	59
Continuous Current Rating .....	59
Control Wiring .....	59
<b>SECTION 6: COMPACT NS630B–NS1600 CIRCUIT BREAKERS .....</b>	<b>61</b>
Performance .....	61
Catalog Numbers .....	63
Interrupting Ratings .....	65
Electrically-Operated Circuit Breakers .....	65
Automatic Molded Case Switches .....	65
Termination Information .....	65
Accessories .....	65
Control Wiring .....	65
<b>SECTION 7: COMPACT NS1600B–NS3200 CIRCUIT BREAKER .....</b>	<b>66</b>
Performance .....	66
Catalog Numbers .....	67
Interrupting Ratings .....	67
Automatic Molded Case Switches .....	67
Termination Information .....	68
Accessories .....	68
Control Wiring .....	68
<b>SECTION 8: ACCESSORIES .....</b>	<b>69</b>
Accessories .....	69
Electrical Accessories .....	71
Auxiliary Switch (OF).....	73
Alarm Switch (SD).....	73
Overcurrent Trip Switch (SDE).....	73
Micrologic™ Trip Unit Accessories .....	76
Display Options .....	82
Test Equipment .....	84
Circuit Breaker Terminations .....	85
External Accessories .....	88
Locking Accessories .....	89
Sub-Feed Lugs .....	90
<b>SECTION 9: P-FRAME CRADLES AND CRADLE ACCESSORIES .....</b>	<b>91</b>
Circuit Breaker and Cradle Design .....	91
Cradle Accessories .....	92
Cradle Locking and Interlocking .....	94
Open Door Racking Interlock .....	94
Miscellaneous Accessories .....	94
Wiring Diagrams .....	95

# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

<b>SECTION 10: DIMENSIONAL DRAWINGS .....</b>	<b>97</b>
Dimensions for M-Frame Circuit Breakers .....	97
Dimensions for P-Frame and NS630b–NS1600 Circuit Breakers .....	100
Dimensions for R-Frame and NS1600b–NS3200 Circuit Breakers .....	124
<b>SECTION 11: TRIP CURVES .....</b>	<b>135</b>
<b>SECTION 12: CATALOG NUMBERS .....</b>	<b>149</b>

**PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers**



## Section 1—General Information

### Introduction

PowerPact™ M-frame, P-frame and R-frame and Compact™ NS630b–NS3200 electronic trip molded case circuit breakers are designed to protect electrical systems from damage caused by overloads, short circuits, and ground faults. All circuit breakers are designed to open and close a circuit by nonautomatic means and to open the circuit automatically on a predetermined overcurrent. Electronic trip molded case circuit breakers use an electronic trip system to signal the circuit breaker to open automatically.

The PowerPact M-frame (800 A frame size), P-frame (1200 A frame size) and R-frame (3000 A frame size) circuit breakers are dual rated to UL489 and IEC 60947-2. The Compact NS630b–NS1600 (1600 A frame size) and NS1600b–NS3200 (3200 A frame) circuit breakers are rated to IEC 60947-2 only.

M-frame molded case circuit breakers are equipped with a basic ET1.0 electronic trip system, which has a fixed long-time (overload) setting and an adjustable instantaneous (short-circuit) trip setting. P-frame, R-frame and NS630b–NS3200 molded case circuit breakers are available with either a basic ET 1.0I electronic trip system or with a more advanced Micrologic™ trip system. Electronic trip motor circuit protectors (trip system ET 1.0M), which trip on short circuit only, and automatic molded case switches, which trip at a predetermined self-protection level only, are also available for special applications. All of these circuit breakers are available labeled as Square D™ or Schneider Electric™ (formerly Merlin Gerin™, Federal Pioneer™, or Federal Pacific™).

For information on other Square D brand PowerPact molded case circuit breakers, see the Class 611 catalog PowerPact H-, J-, and L-Frame Circuit Breakers.

### Features and Benefits

M-frame, P-frame, R-frame and NS630b–NS3200 electronic trip circuit breakers:

- Provide overload and short-circuit protection
- Are true RMS sensing devices
- Provide means to manually disconnect power to the circuit
- Provide enhanced coordination by their adjustability
- Provide high interrupting ratings and withstand ratings

Circuit breakers with Micrologic trip units can also:

- Provide integral equipment ground-fault protection or alarm
- Provide communications
- Provide power monitoring
- Provide protective relaying functions
- Provide zone-selective interlocking (ZSI), which can reduce damage in the event of a fault

# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

## Section 1—General Information

### Specifications

Electronic trip molded case circuit breakers have a molded case made of a glass-reinforced insulating material (thermal set composite resin) that provides high dielectric strength. These circuit breakers:

- Are available in either dual-rated Underwriters Laboratory® (UL®) / International Electrotechnical Commission® (IEC®) or IEC-only constructions
- Are also Canadian Standard Association® (CSA®) and Association of the Electrical Sector® (ANCE®) certified (dual-rated UL/IEC circuit breakers only)
- Are manufactured in unit-mount, I-Line™ and drawout (P-frame and NS630b–NS1600) constructions
- Are available with either type ET or Micrologic electronic tripping systems
- Provide optional power monitoring, communications, protective relaying, integral ground-fault protection for equipment and zone-selective interlocking functions
- Share common tripping of all poles
- Can be mounted and operated in any position
- Are equipped with an externally-accessible test port for use with hand-held and full-function test sets
- Are available in motor circuit protector and automatic molded case switch constructions
- Can be reverse connected, without restrictive LINE and LOAD markings
- Meet the requirements of National Electrical Code® (NEC®) Sections 240.6 by providing a means to seal the rating plug and trip unit adjustments

### Codes and Standards

M-, P- and R-frame, and NS630b–NS3200 electronic trip circuit breakers and switches are manufactured and tested in accordance with the following standards:

**Table 1: Standards**

M-Frame, P-Frame and R-Frame Circuit Breakers	P- and R-Frame Switches	NS630b–NS3200 Circuit Breakers	NS630b–NS3200 Switches
UL 489 <sup>1</sup> IEC Standard 60947-2 CSA C22.2 No 5 Federal Specification W-C-375B/GEN NEMA AB1 NMX J-266 UTE, VDE, BS, CEI, UNE, CCC	UL 489 <sup>2</sup> IEC Standard 60947-3 CSA C22.2 No 5 Federal Specification W-C-375B/GEN NEMA AB1 NMX J-266 UTE, VDE, BS, CEI, UNE	IEC Standard 60947-2 Federal Specification W-C-375B/GEN NEMA AB1 UTE, VDE, BS, CEI, UNE	IEC Standard 60947-3 Federal Specification W-C-375B/GEN NEMA AB1 UTE, VDE, BS, CEI, UNE

<sup>1</sup> PowerPact M-frame circuit breaker is in UL File E10027.  
 PowerPact P-frame circuit breaker is in UL File E63335.  
 PowerPact R-frame circuit breaker is in UL File E10027.

<sup>2</sup> PowerPact P-frame switch is in UL File E103740.  
 PowerPact R-frame switch is in UL File E33117.

Circuit breakers should be applied according to guidelines detailed in the NEC and other local wiring codes.



## Circuit Breaker Ratings

### Interrupting Rating

The interrupting rating is the highest current at rated voltage the circuit breaker is designed to safely interrupt under standard test conditions. Circuit breakers must be selected with interrupting ratings equal to or greater than the available short-circuit current at the point where the circuit breaker is applied to the system (unless it is a branch device in a series rated combination). Interrupting ratings are shown on the front of the circuit breaker. For grounded B phase interrupting ratings, see Data Bulletin 2700DB0202.

**Table 2: UL/IEC Circuit Breaker Interrupting Ratings**

Circuit Breaker <sup>1</sup>	UL/CSA Rating (60 Hz)				IEC 60947-2 Rating (50/60 Hz)			
	3 Phase			Grounded B Phase (1Ø-3Ø)	240 Vac		380/415 Vac	
	240 Vac	480 Vac	600 Vac		240 Vac 2P	Icu	Ics	Icu
MG	65 kA	35 kA	18 kA	65 kA	50 kA	25 kA	35 kA	20 kA
MJ	100 kA	65 kA	25 kA	65 kA	65 kA	35 kA	50 kA	25 kA
PG	65 kA	35 kA	18 kA	65 kA	50 kA	25 kA	35 kA	20 kA
PJ	100 kA	65 kA	25 kA	65 kA	65 kA	35 kA	50 kA	25 kA
PK	65 kA	50 kA	50 kA	65 kA	50 kA	25 kA	50 kA	25 kA
PL	125 kA	100 kA	25 kA	65 kA	125 kA	65 kA	85 kA	45 kA
RG	65 kA	35 kA	18 kA	35 kA	50 kA	25 kA	35 kA	20 kA
RJ	100 kA	65 kA	25 kA	100 kA	65 kA	35 kA	50 kA	25 kA
RK	65 kA	65 kA	65 kA	65 kA	85 kA	65 kA	70 kA	55 kA
RL	125 kA	100 kA	50 kA	125 kA	125 kA	65 kA	85 kA	45 kA

<sup>1</sup> The K interrupting rating is recommended for applications having high inrush and/or non-linear loads such as large motors, transformers, motors with soft starts, etc.

**Table 3: IEC Only Circuit Breaker Interrupting Ratings (50/60 Hz)**

Circuit Breaker	Interrupting Rating	220/240 Vac		380/415 Vac		440 Vac		500/525 Vac		660/690 Vac	
		Icu	Ics	Icu	Ics	Icu	Ics	Icu	Ics	Icu	Ics
<b>Electrically Operated</b>											
NS630b–NS1600	N Interrupting Rating	50 kA	37 kA	50 kA	37 kA	50 kA	37 kA	40 kA	30 kA	30 kA	22 kA
NS630b–NS1600	H Interrupting Rating	70 kA	35 kA	70 kA	35 kA	65 kA	32 kA	50 kA	25 kA	42 kA	21 kA
NS630b–NS1000	L Interrupting Rating	150 kA	150 kA	150 kA	150 kA	130 kA	130 kA	100 kA	100 kA	—	—
<b>Manually Operated</b>											
NS630b–NS1600	N Interrupting Rating	85 kA	50 kA	50 kA	50 kA	50 kA	50 kA	40 kA	40 kA	30 kA	30 kA
NS630b–NS1600	H Interrupting Rating	85 kA	52 kA	70 kA	52 kA	65 kA	48 kA	50 kA	37 kA	42 kA	31 kA
NS630b–NS1000	L Interrupting Rating	150 kA	150 kA	150 kA	150 kA	130 kA	130 kA	100 kA	100 kA	—	—
NS630b–NS800	R Interrupting Rating	200 kA	200 kA	200 kA	200 kA	200 kA	200 kA	100 kA	100 kA	75 kA	75 kA
NS1600b–NS3200	N Interrupting Rating	85 kA	65 kA	70 kA	52 kA	65 kA	65 kA	65 kA	65 kA	65 kA	65 kA
NS1600b–NS3200	H Interrupting Rating	125 kA	94 kA	85 kA	64 kA	85 kA	64 kA	—	—	—	—

# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

## Section 1—General Information

### Application Ratings

The voltage rating is the highest voltage for the electrical system on which the circuit breaker can be applied. The frequency rating indicates the system frequency for which the circuit breaker is intended. The withstand rating is used to improve system coordination by maximizing the current level at which the circuit breaker trips with no intentional delay. The withstand rating is the level of RMS symmetrical current that a circuit breaker can carry in a closed position for a stated period of time.

**Table 4: Voltage, Frequency and Withstand Ratings**

Circuit Breaker	Voltage Rating	Frequency Rating	Withstand Rating at 480 Vac <sup>1</sup>
MG, MJ	600 Vac	60 Hz (UL), 50/60 Hz (IEC)	10 kA (0.5 sec)
PG, PK	600 Vac	60 Hz (UL), 50/60 Hz (IEC)	25 kA (0.5 sec)
PJ	600 Vac	60 Hz (UL), 50/60 Hz (IEC)	10 kA (0.5 sec)
PL	480 Vac	60 Hz (UL), 50/60 Hz (IEC)	10 kA (0.5 sec)
R-frame (RG, RJ, RK, RL)	600 Vac	60 Hz (UL), 50/60 Hz (IEC)	32 kA (3 sec)
NS630b–NS1600 N Interrupting Rating	690 Vac	50/60 Hz (IEC)	19.2 kA (1 sec)
NS630b–NS1600 H Interrupting Rating	690 Vac	50/60 Hz (IEC)	19.2 kA (1 sec)
NS630b–NS1000 L Interrupting Rating	690 Vac	50/60 Hz (IEC)	N/A
NS630b–NS1000 R Interrupting Rating	690 Vac	50/60 Hz (IEC)	N/A
NS1600b–NS3200 N Interrupting Rating	690 Vac	50/60 Hz (IEC)	32 kA (3 sec)
NS1600b–NS3200 H Interrupting Rating	440 Vac	50/60 Hz (IEC)	32 kA (3 sec)

<sup>1</sup> A system coordination study should be done for optimum circuit breaker coordination.

### Ampere Rating (Continuous Current Rating)

The ampere rating (or continuous current rating) ( $I_r$ ) is the maximum current that a circuit breaker can carry. The sensor size ( $I_n$ ) is the maximum ampere rating for a specific circuit breaker and is based on the size of the sensor plug inside the circuit breaker. This value is printed below the trip unit on the sensor plug. See Sensor Plugs (page 78) for more information.

**NOTE:** The maximum ampere rating a circuit breaker family can carry is called the frame size. Sensor size is less than or equal to frame size.

The ampere rating of a type ET electronic trip circuit breaker is equal to the current sensor size ( $I_n$ ).

The ampere rating of a Micrologic™ electronic trip circuit breaker is determined by the mathematical equation:

$$\text{Ampere Rating} = \text{Sensor Size} \times \text{Rating Plug Setting} \quad (I_r = I_n \times \text{Rating Plug Setting})$$

The rating plug varies the circuit breaker ampere rating as a function of its sensor size. Rating plugs have nine dial settings; the multiplier values corresponding with each setting are printed on the rating plug. The maximum setting range is 0.4–1.0 x  $I_n$ .

# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

## Section 1—General Information

### Enclosure Sizes

All type ET electronic trip UL/IEC M-frame, P-frame and R-frame circuit breakers are available as standard rated circuit breakers. Micrologic electronic trip UL/IEC circuit breakers are also available in 100% rated constructions. Because the additional heat generated when applying circuit breakers at 100% of continuous current rating, the use of specially designed enclosures and 194° F (90°C) rated wire sized per the 167° F (75°C) NEC chart is required.

Circuit breakers with 100% rating can also be used in applications requiring only 80% continuous loading.

**Table 5: Minimum Enclosure Sizes for Fixed-Mounted Circuit Breakers**

Circuit Breaker Rating	Enclosure Dimensions (h x w x d) in./ (mm)		Ventilation Area			
	3P Circuit Breaker	4P Circuit Breaker	Top		Bottom	
M-Frame, ≤ 800 A, Standard Rated	51.9 x 20.25 x 7.75 (1318.3 x 514.4 x 196.9)	51.9 x 23.01 x 7.75 (1318.3 x 584.4 x 196.9)	—	—	—	—
P-Frame, ≤ 800 A, 100% Rated P-Frame, ≤ 1200 A, Standard Rated	51.9 x 20.25 x 7.75 (1318.3 x 514.4 x 196.9)	51.9 x 23.01 x 7.75 (1318.3 x 584.4 x 196.9)	—	—	—	—
P-Frame, ≤ 1200 A, 100% Rated	62.25 x 23 x 14.75 (1581.2 x 584.2 x 374.7)	62.25 x 25.76 x 14.75 (1581.2 x 654.2 x 374.7)	16.5 in.	10,645 mm	16.5 in.	10,645 mm
R-Frame, Standard Rated <sup>1</sup>	30 x 21 x 7 (762 x 533 x 178)	30 x 25.5 x 7 (762 x 648 x 178)	—	—	—	—
R-Frame, 100% Rated <sup>1</sup>	30 x 21 x 7 (762 x 533 x 178)	30 x 25.5 x 7 (762 x 648 x 178)	40.25 in.	26,000 mm	40.25 in.	26,000 mm

<sup>1</sup> RLTB or RL3TB kits may extend beyond end of enclosure when using minimum enclosure size.

### Operating Conditions

#### Temperature

To meet the requirements of the UL489 Standard, molded case circuit breakers are designed, built and calibrated for use on 50/60 Hz ac systems in a 40°C (104°F) ambient environment. Electronic trip circuit breakers, however, are designed to react only to the magnitude of the current flowing through the circuit breaker and are inherently ambient insensitive. Both UL/IEC and IEC-only circuit breakers may be operated at temperatures between -25°C and +70°C (-13°F and 158°F). For temperatures other than 40°C (104°F), the circuit breakers must be re-rated as shown.

**Table 6: Temperature Derating Values per ANSI C37.20.1**

Maximum Ambient Temperature											
°F	140	122	<b>104</b>	86	77	68	50	32	14	-4	-22
°C	60	50	<b>40</b>	30	25	20	10	0	-10	-20	-30
<b>Current</b>	0.83	0.92	<b>1.00</b>	1.07	1.11	1.14	1.21	1.27	1.33	1.39	1.44

#### Altitude

Circuit breakers are suitable for use at altitudes up to 13,100 ft. (4000 m). For altitudes higher than 6560 ft. (2000 m), circuit breakers must be derated as shown.

**Table 7: Altitude Derating Values Per ANSI C37.20.1 Table 10**

Altitude	≤ 6,600 ft. (≤ 2,000 m)	8,500 ft. (2,600 m)	13,000 ft. (3,900 m)
<b>Voltage</b>	1.00	0.95	0.80
<b>Current</b>	1.00	0.99	0.96

# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

## Section 1—General Information

### Extreme Atmospheric Conditions

PowerPact circuit breakers have successfully passed the tests defined below for extreme atmospheric conditions.

Dry cold and dry heat:

- IEC 68-2-1—Dry cold at -67°F (-55°C)
- IEC 68-2-2—Dry heat at 185°F (+85°C)

Damp heat (tropicalization)

- IEC 68-2-30—Damp heat (temperature 131°F (55°C) and relative humidity of 95%, condensing)
- IEC 68-2-52 level 2—Salt mist

The materials used in the PowerPact circuit breakers will not support the growth of fungus and mold.

### Vibration

PowerPact circuit breakers meet IEC 60068-2-6 Standards for vibration.

- 2 to 13.2 Hz and amplitude 0.039 in. (1 mm)
- 13.2 to 100 Hz constant acceleration

### Storage Temperature

Circuit breakers with trip units without LCD displays may be stored in the original packaging at temperatures between -58°F (-50°C) and 185°F (85°C). For circuit breakers with trip units with LCD displays, this range is -40°F (-40°C) to 185°F (85°C).

### Trip System

The trip system causes the circuit breaker to open automatically under overload, short-circuit or equipment ground-fault conditions. Electronic trip circuit breakers give the customer more versatility to achieve coordination with features such as adjustable instantaneous pickup and high withstand ratings.

The type ET and the Micrologic trip systems consist of current sensors, a microprocessor-based trip unit, and a tripping coil. The tripping coil is a flux transfer solenoid that requires no external power source. All type ET and Micrologic protective functions are completely fault powered.

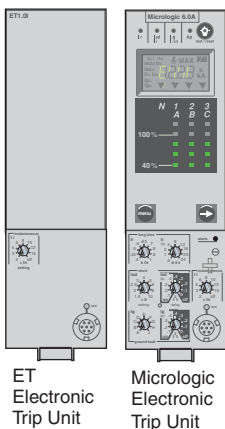
#### Micrologic Trip System

Features found in Micrologic™ electronic trip circuit breakers, such as universally interchangeable rating plugs, adjustable long-time pickups and 100% ratings also provide capacity for future growth.

The integral equipment ground-fault sensing capabilities available with Micrologic trip systems mean that there are fewer parts and pieces to purchase, mount and wire. These capabilities include integral ground-fault protection for equipment, which causes the circuit breaker to trip when a ground fault is detected, as well as integral ground-fault alarm, which does not trip the circuit breaker but sends an alarm when a ground fault is detected.

Certain Micrologic trip systems also offer the customer true power management system solutions through communication. These trip units can communicate with other circuit breakers in the system and also with a power monitoring system. Communication is by Modbus® and does not require proprietary software.

Communication between trip units allows zone-selective interlocking (ZSI) between circuit breakers at different levels in the system. ZSI reduces fault stress by allowing the upstream circuit breaker closest to the fault to ignore its preset delay time and trip without any intentional delay on a short circuit or ground fault. For more information on ZSI, see data bulletin *Reducing Fault Stress with Zone-Selective Interlocking*.



# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

## Section 1—General Information

Communication with a power monitoring system through a communications network allows a ground fault to be reported without interrupting power to the system. It also allows the power monitoring system to remotely report power usage, current flow, and trip history.

### Instantaneous OFF Feature

Micrologic™ 5.0 and 6.0 Standard, A, P and H electronic trip units provide the unique ability to turn the instantaneous tripping function OFF. Turning off the instantaneous trip function increases the current level at which the circuit breaker will trip with no intentional delay to the level of the short-time withstand rating. This current level is typically much higher than any of the pickup levels provided by the adjustable instantaneous feature. Therefore, using the instantaneous OFF feature improves coordination by allowing the user to take advantage of the circuit breaker withstand rating.

### Motor Circuit Protectors

An instantaneous trip version of the electronic trip circuit breaker is also available for motor circuit protection. These motor circuit protectors comply with NEC requirements for providing short-circuit protection when installed as part of a Listed combination controller having motor overload protection.

Electronic trip motor circuit protectors are similar in construction to type ET electronic trip circuit breakers. They are designed as disconnect devices for use in combination with motor starters. These motor circuit protectors provide short-circuit protection only and have an adjustable amperage pickup so they can be set to open instantaneously at current values slightly above the motor starting inrush current. This setting coordinates the pickup time-current response of the motor circuit protector with the overload relay of the motor starter to give the best possible protection.

Current interrupting ratings for these UL Recognized components are established in combination with motor starters and properly-sized overload relays and contactors.

### Automatic Molded Case Switches

P-frame, R-frame and NS630b–NS3200 circuit breakers are also available in automatic molded case switch construction. Automatic switches are similar in construction to electronic trip circuit breakers, except that the switches open instantaneously at a factory-set non-adjustable trip point calibrated to protect only the molded case switch itself. Because of their molded case construction, they are more compact than conventional disconnect switches and accept electrical accessories for added flexibility.

Molded case switches are intended for use as disconnect devices only. UL489 requires molded case switches to be protected by a circuit breaker or fuse of equivalent rating. Molded case switches are labeled with their appropriate withstand ratings. The withstand rating of a switch is defined as the maximum current at rated voltage that the molded case switch will withstand without damage when protected by a circuit breaker with an equal continuous current rating.

**Table 8: P- and R-Frame Withstand Ratings<sup>1</sup>**

Voltage	Withstand Rating					
	P-Frame Circuit Breakers			R-Frame Circuit Breakers		
	J	K	L	J	K	L
240 Vac	100 kA	65 kA	125 kA	—	65 kA	125 kA
480 Vac	65 kA	50 kA	100 kA	—	50 kA	100 kA
600 Vac	25 kA	50 kA	25 kA	—	50 kA	50 kA

<sup>1</sup> The withstand rating is the fault current at rated voltage that the molded case switch will withstand without damage when protected by a circuit breaker with an equal continuous current rating.

## Internal Operating Mechanism

### Manually-Operated Circuit Breakers

M-frame, P-frame, R-frame and NS630b–NS3200 manually-operated circuit breakers have a single operating handle that acts directly through the operating mechanism against the contact blades. Multi-pole circuit breakers have a common trip bar for positive action of all poles on manual and automatic operation. These circuit breakers have a trip-free mechanism that allows them to trip even though the operating handle may be restricted (by a handle operating mechanism or padlock attachment) in the I/ON position. If not restricted, the operating handle moves to a position between I/ON and O/OFF when the circuit breaker is tripped.

The face of the manually-operated circuit breaker is marked with standard ON/OFF and international I/O markings to indicate handle position. In addition, the O/OFF portion of the circuit breaker handle is color coded green.

### Electrically-Operated Circuit Breakers

P-frame and NS630b–NS1600 circuit breakers are also available with a two-step stored-energy mechanism which can be charged manually or using a motor. The closing time is less than five cycles. Closing and opening operations can be initiated by remote control or by push buttons on the front cover. An O-C-O (open-close-open) cycle is possible without recharging. Electrically-operated circuit breakers include a motor, shunt trip, and shunt close of the same voltage plus an overcurrent trip switch (SDE).

The face of electrically-operated circuit breakers is also marked ON/OFF and I/O, and equipped with a position indicator to show contact position.

### Push-to-Trip Button

The push-to-trip button located on the face of each manually-operated circuit breaker is a standard feature on these circuit breakers. This allows the user to manually trip the circuit breaker without risking exposure to live parts. During normal on-off operation, the handle opens and closes the circuit breaker contact but does not exercise the tripping mechanism.

Use the push-to-trip button to:

- Exercise the circuit breaker mechanism
- Check the auxiliary and alarm switch circuits

## Circuit Breaker Mounting and Connections

**Table 9: Circuit Breaker Mounting and Connections**

Circuit Breaker	Unit-Mount Construction		I-Line™ Construction	Drawout Construction
	Cable Connection	Bus Connection		
M-Frame	X	X	X	—
P-Frame	X	X	X	X
R-Frame	X <sup>1</sup>	X	X <sup>2</sup>	—
NS630b–NS1250	X	X	—	X
NS1600–NS3200	—	X	—	—

<sup>1</sup> Must use RLTB or RL3TB terminal pad kit.

<sup>2</sup> Through 1200 A, 100% rated only.

### Unit-Mount Circuit Breakers

Unit-mount M-frame, P-frame, R-frame and NS630b–NS3200 circuit breakers are individually-mounted using supplied mounting screws. The four mounting screws are inserted through mounting holes molded into the circuit breaker case and threaded into the circuit breaker mounting enclosure. To properly support the circuit breaker, all four mounting screws must be used.

Unit-mount M-frame, P-frame and NS630b–NS1250 circuit breakers can be ordered with mechanical line and load side lugs. The standard lugs can be removed for the installation of compression-type lugs or bus connections. All lugs are UL Listed for their proper application and marked for use with aluminum and copper (Al/Cu) or copper only (Cu) conductors. Lugs suitable for copper and aluminum conductors are made of tin-plated aluminum. Lugs suitable for use with copper conductors only are made of copper.

See individual frame sections for frame-specific connection information.



M-Frame Unit-Mount



P-Frame Unit-Mount



Electrically Operated  
P-Frame Unit-Mount



R-Frame Unit-Mount

### I-Line™ Circuit Breakers

M-frame circuit breakers through 800 A and P-frame and R-frame circuit breakers through 1200 A are available in I-Line construction for easy installation and removal in I-Line panelboards and switchboards. I-Line circuit breakers use “blow-on” type line side connectors. In case of a short circuit, increased magnetic flux causes the plug-on connectors of the circuit breaker to tighten their grasp on the panelboard or switchboard bus bars. The I-Line connectors and circuit breaker mounting bracket are integral parts of I-Line circuit breakers and cannot be removed or replaced. I-Line circuit breakers come with mechanical load side lugs.



M-Frame I-Line



P-Frame I-Line



R-Frame I-Line

### Drawout Circuit Breakers

P-frame manually-operated circuit breakers and switches are also available in drawout construction. The drawout assembly mechanism allows the circuit breaker to be racked in four positions (connected, test, disconnect or withdrawn).

P-frame cradles are ordered separately and are available with factory and field-installed accessories. See Section 9—P-Frame Cradles and Cradle Accessories for details.



P-Frame Drawout

# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

## Section 1—General Information

### Catalog Numbering System

The M-frame, P-frame, R-frame and NS630b–NS3200 circuit breakers and cradles follow a “smart” catalog numbering system. The following tables are intended as a tool to decipher existing catalog numbers. **They are not intended for use in building catalog numbers, as some combinations may not be available.** To build a catalog number, please see the *Digest*, the *Product Selector* or contact the local field office.

### M-Frame, P-Frame and R-Frame Circuit Breaker Catalog Numbers

**NOTE:** Not all options are available on all frames.

**Table 10: Catalog Number for M-, P- and R-Frame (UL/IEC Dual-Rated) Circuit Breakers**

Field Position	Field Description	Options	Description
1	Brand Name	(blank)	Square D
		N	Schneider Electric (Formerly Merlin Gerin brand)
2	Circuit Breaker Frame	M	800 A Max.
		P	1200 A Max.
		R	3000 A Max.
3	Interrupting Rating	G	35 kA @ 480 Vac
		J	65 kA @ 480 Vac
		K	P-Frame: 50 kA @ 600 Vac R-Frame: 65 kA @ 600 Vac
		L	100 kA @ 480 Vac
4	Connection	F	No Lugs
		L	Lugs on Both Ends
		M	Lugs on I/ON End
		P	Lugs on O/OFF End
		A	I-Line
		D	Drawout (Not Available on M and R Frames)
5	Poles	2	2P
		3	3P
		4	4P
6	Voltage Rating	4	480 V
		6	600 V
7–9	Ampere Rating	###	Circuit Breaker Rating (120 = 1200 A)
		000	Automatic Switch Value
10	Standard or 100% Rated	(none)	Standard Rated
		C	100% rated

*Continued on next page*



**PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers**  
**Section 1—General Information**

**Table 10: Catalog Number for M-, P- and R-Frame (UL/IEC Dual-Rated) Circuit Breakers**

Field Position	Field Description	Options	Description
11–14	Circuit Breaker Trip System	(none)	ET1.0 (M-Frame)
		(none)	ET1.0I (P-Frame, R-Frame)
		U31	Micrologic™ 3.0 Trip Unit
		U33	Micrologic 5.0 Trip Unit
		U41	Micrologic 3.0A Trip Unit
		U43	Micrologic 5.0A Trip Unit
		U44	Micrologic 6.0A Trip Unit
		U63	Micrologic 5.0P Trip Unit
		U64	Micrologic 6.0P Trip Unit
		U73	Micrologic 5.0H Trip Unit
		U74	Micrologic 6.0H Trip Unit
	Automatic Switch Trip System <sup>1</sup>	S60	600 A <sup>2</sup>
		S80	800 A <sup>2</sup>
		S10	1000 A <sup>2</sup>
		S12	1200 A
		S16	1600 A
		S20	2000 A
		S25	2500 A
		S30	3000 A
	Motor Circuit Protector Trip System	M68	1200–10000 A <sup>2</sup>
M69		1500–10000 A <sup>2</sup>	
M70		1800–10000 A <sup>2</sup>	
15	Rating Plug	A–H	See Table 75
16-17	Modbus® Communication	E1	Modbus BCM
18	I-Line™ Phasing	See <i>Digest, Product Selector</i>	

For Factory-Installed Accessories, See *Product Selector*

<sup>1</sup> For more information on P-frame switches, see page 47. For more information on R-frame switches, see page 58.

<sup>2</sup> Not available on R-frame.

**PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers**  
**Section 1—General Information**

**NS630b–NS3200 Circuit Breaker Catalog Numbers**

**Table 11: Catalog Number for NS630b–NS3200 (IEC-Rated) Circuit Breakers**

Field Position	Field Description	Options	Description
1	Brand Name	(Blank)	Square D
		N	Schneider Electric
2	Circuit Breaker Frame	R	3200 A Max.
		P	1600 A Max.
3	Interrupting Rating	N	Standard Interrupting Rating
		H	High Interrupting Rating
		L	Current Limiting
		R <sup>1</sup>	200 kA Interrupting
4	Connection	F	No lugs
		L	Lugs on Both Ends
		M	Lugs on I/ON End
		P	Lugs on O/OFF End
		D	Drawout
5	Certification	S	Rear Connected
		E	IEC
6	Poles	3	3P
		4	4P
7	Voltage Rating	4	440 Vac
		6	690 Vac
8–10	Ampere Rating	###	Circuit Breaker Rating (120 = 1200 A)
		000	Automatic Switch Value
11–14	Circuit Breaker Trip System	U32	Micrologic™ 2.0 Trip Unit
		U33	Micrologic 5.0 Trip Unit
		U42	Micrologic 2.0A Trip Unit
		U43	Micrologic 5.0A Trip Unit
		U44	Micrologic 6.0A Trip Unit
		U63	Micrologic 5.0P Trip Unit
		U64	Micrologic 6.0P Trip Unit
		U73	Micrologic 5.0H Trip Unit
	U74	Micrologic 6.0H Trip Unit	
	Automatic Switch Trip System	S63	630 A
S80		800 A	
S10		1000 A	
S12		1250 A	
S16		1600 A	
S20		2000 A	
Non-Automatic Switch Trip System	S25	2500 A	
	S32	3200 A	
	Z63	630 A	
	Z80	800 A	
15	Rating Plug	Z10	1000 A
		Z12	1250 A
		Z16	1600 A
		R–T	See Table 74
16–17	Modbus® Communications	E1	Modbus BCM

For Accessories, See *Product Selector*

<sup>1</sup> R interruption only valid with rear-connected (S) termination.

# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

## Section 1—General Information

### Cradle Catalog Numbers

P-frame and NS630b–NS1600 manually-operated circuit breakers and switches are available in drawout construction (factory installed only). The circuit breakers may be ordered using the circuit breaker catalog numbering systems described above. The cradles must be ordered separately.

**Table 12: Cradle Catalog Number**

Field Position	Field Description	Options	Description
1	Cradle	C	Cradle
2	Frame Size	S	P-Frame 3P
		D	P-Frame 4P
3	Brand/Certification	L	Square D Brand UL/IEC Dual-Rated
		G	Schneider Electric IEC Rated Only
4	Circuit Breaker Interruption Rating	E	P-Frame "G", "J", "K", or "L" Interrupting Rating
5	Cradle Connections Top Terminals	V	Rear-Connected T Vertical (RCTV)
		H	Rear-Connected T horizontal (RCTH)
		E	Front-Connected Flat (FCF)
6	Cradle Connections Bottom Terminals	V	Rear-Connected T Vertical (RCTV)
		H	Rear-Connected T Horizontal (RCTH)
		E	Front-Connected Flat (FCF)
7	Shutters and Associated Options	9	None (Standard for P-Frame Circuit Breakers)
		3	Shutters with Padlocking Provision
8	Circuit Breaker Mismatch and Cradle Interlock	A	See <i>Product Selector</i>
9	Metering CT	X	Not Applicable on P-Frame Cradle
10	Cradle Secondary Disconnects Wiring	X	See <i>Product Selector</i>
11–18	Miscellaneous Cradle Options	X	See <i>Product Selector</i>

## Testing Requirements

### UL, NEMA, CSA, and NMX requirements

The UL, NEMA, CSA and NMX labels on a circuit breaker indicate that the circuit breaker meets the requirements of UL Standard 489, NEMA Standard AB-1, CSA Standard C22.2 No. 5 and NMX standard J266. The labels also mean that the production procedure is monitored by UL, CSA and ANCE inspectors to ensure continued compliance to these standards. These requirements include the following tests:

- *200% Overload Calibration*—each pole of the circuit breaker must trip within a specified time limit when carrying 200% of its continuous current rating.
- *135% Overload Calibration*—with all poles connected in series, the circuit breaker must trip within a specified time limit while carrying 135% of its continuous current rating.
- *Overload*—the circuit breaker must make and break 600% of its continuous current rating at rated voltage. Circuit breaker frame sizes 125–1600 A must perform 50 operations at 600%. Circuit breaker frame sizes 2000–2500 A must perform 25 operations at 600%.
- *Temperature Rise*—while carrying 100% of rated current and mounted in open air, temperature rise on a wiring terminal must be within specified limits. For 100% rating, the circuit breaker is mounted in an enclosure.
- *Endurance*—UL489 requires that the circuit breaker must complete, at minimum, the following number of operations:

**Table 13: Endurance Operations**

Frame Size	Operations	
	With Current <sup>1</sup>	Without Current
1200–2500	500	2000

<sup>1</sup> UL requires the circuit breaker to operate 10% of the “with current” operations with a shunt trip.

- *Calibration*—both the 200% and 135% overload calibration tests are repeated after endurance testing.
- *Short Circuit*—the circuit breaker shall be subjected to test currents based on voltage rating and frame size, with the type and number of operations based on the number of poles, frame rating and voltage rating. Example: a 3P, 600 Vac, 2500 A frame circuit breaker is subjected to one 20 kA single-phase closing of the circuit on the circuit breaker per pole and one 30 kA three-phase closing of the circuit on the circuit breaker for a total of seven short circuit tests.
- *Trip Out*—the 200% thermal calibration test is repeated following the short-circuit tests.
- *Dielectric*—the circuit breaker must withstand, for one minute, twice its rated voltage plus 1000 V:
  - Between line and load terminals with the circuit breaker in the open, tripped and OFF positions.
  - Between terminals of opposite polarity with the circuit breaker closed.
  - Between live parts and the overall enclosure with the circuit breaker both open and closed.

No conditioning of the circuit breaker can take place during or between tests. There can be no failure of functional parts at the conclusion of the sequences.

After qualifying a set of circuit breakers to the standard tests, a manufacturer can have additional circuit breaker samples tested on higher than standard available fault currents. The following performance requirements apply:

- *200% Overload Calibration*—each pole of the circuit breaker must trip within a specified time limit when carrying 200% of its continuous current rating.
- *Short-circuit Test*—with the load side terminals connected by 10-inch lengths of specified cable (or a shorting bar), the circuit breaker is exposed to a short-circuit current for a set time interval. After safe interruption, the circuit breaker is reset and closed again on the short circuit.
- *250% Overload Calibration*—each pole of the circuit breaker must trip within a specified time limit when carrying 250% of its continuous current rating.

# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

## Section 1—General Information

- *Dielectric Withstand*—the circuit breaker is subjected to twice the voltage rating at which the interrupting test was conducted, but not less than 900 V.
  - Between line and load terminals with the circuit breaker in the tripped and in the OFF positions.
  - Between terminals of opposite polarity with the circuit breaker closed.
  - Between live parts and the overall enclosure with the circuit breaker both open and closed.

When the sample circuit breakers pass these tests, circuit breakers of the same construction can be marked or labeled with the current interrupting rating for the higher fault currents.

### IEC Requirements

The IEC markings on a circuit breaker indicates that the circuit breaker meets the requirements of IEC Standard 60947-2 for circuit breakers and 60947-3 for automatic switches. These requirements include the following tests:

**Table 14: IEC Test Sequence**

Sequence	Category of Devices	Tests
General Performance Characteristics (Sequence 1)	All Circuit Breakers	<ul style="list-style-type: none"> <li>• Tripping Limits and Characteristics</li> <li>• Dielectric Properties</li> <li>• Mechanical and Electrical Endurance</li> <li>• Overload</li> <li>• Dielectric Voltage Withstand</li> <li>• Temperature Rise</li> <li>• 145% Calibration (3 Poles in Series or 3-Phase Test)</li> </ul>
Rated Service Short-circuit Breaking Capacity (Ics) (Sequence 2)	All Circuit Breakers	<ul style="list-style-type: none"> <li>• Rated service short circuit breaking capacity (O-t-CO-t-CO)</li> <li>• Electrical Endurance (5% of with Current Operations of Sequence 1)</li> <li>• Dielectric Voltage Withstand</li> <li>• Temperature Rise</li> <li>• 145% Calibration (3 poles in series or 3-phase test)</li> </ul>
Rated Ultimate Short-circuit Breaking Capacity (Icu) (Sequence 3)	Circuit Breakers of Utilization Category A Circuit Breakers of Utilization Category B	<ul style="list-style-type: none"> <li>• 200% Calibration (Each Pole Separately)</li> <li>• Rated Ultimate Short Circuit Breaking Capacity (O-t-CO)</li> <li>• Dielectric Voltage Withstand</li> <li>• 250% Calibration (Each Pole Separately)</li> </ul>
Rated Short-time Withstand Current (Icw) (Sequence 4)	Circuit Breakers of Utilization Category B	<ul style="list-style-type: none"> <li>• 200% Calibration (Each Pole Separately)</li> <li>• Rated Short-Time Withstand Current</li> <li>• Temperature Rise</li> <li>• Short-Circuit Breaking Capacity at Maximum Short-Time Withstand Current (O-t-CO)</li> <li>• Dielectric Voltage Withstand</li> <li>• 200% Calibration (Each Pole Separately)</li> </ul>
Combined Sequence	Circuit Breakers of Utilization Category B: When Icw = Ics Replaces Sequences 2 and 4 When Icw = Ics = Icu Replaces Sequences 2, 3 and 4	<ul style="list-style-type: none"> <li>• 200% Calibration (Each Pole Separately)</li> <li>• Rated Short-Time Withstand Current Icw</li> <li>• Rated Service Short-Circuit Breaking Capacity at Ics (O-CO-CO) at Maximum Relay Temp.</li> <li>• 145% Calibration (3 Poles in Series or 3-Phase Test)</li> <li>• Dielectric Voltage Withstand</li> <li>• Temperature Rise</li> <li>• 200% Calibration (Each Pole Separately)</li> </ul>
Individual Pole Short-Circuit Test Sequence (Annex H)	Circuit Breakers for Use in IT Systems	<ul style="list-style-type: none"> <li>• Individual Pole Short-Circuit Breaking Capacity</li> <li>• Dielectric Voltage Withstand</li> <li>• 250% Calibration (Each Pole Separately)</li> </ul>

## Section 2—Electronic Trip Systems

M-frame circuit breakers are available with the type ET 1.0 electronic trip system. P-frame and R-frame circuit breakers are available with either the ET1.0I basic electronic trip system or the Micrologic™ electronic trip system. The NS630b–NS3200 circuit breakers are available with the Micrologic electronic trip system. The sensing system responds to the flow of current through the circuit breaker.

### Thermal Imaging

The thermal imaging function protects the cables or bus bars from overheating in case of low amplitude repetitive faults. Such overheating can be due to repetitive motor startings, fluctuating load, intermittent ground faults, or subsequent closing after a fault. Traditional electronic protection does not protect against repetitive faults because the duration of each overload above the pickup setting is too short to achieve effective tripping. Nevertheless, each overload involves a temperature rise in the installation, the cumulative effect of which could lead to overheating of the system.

The thermal imaging function remembers and integrates the thermal heating caused by each pickup setting overrun. Before tripping, the integrated heating value will reduce the associated time delay and, therefore, the reaction of the trip unit will be closer to the real heating of the power network system. After tripping, the function will also reduce the time delay when closing the circuit breaker on an overload.

### True RMS Current Sensing

The sensing system responds to the flow of current through the circuit breaker. The trip unit samples the current waveform to provide true RMS protection through the fifteenth harmonic. This true RMS sensing gives accurate values for the magnitude of a non-sinusoidal waveform. Therefore, the heating effects of harmonically distorted waveforms are accurately evaluated.

The Micrologic H trip unit provides additional sampling of the waveforms to measure and provide waveform capture of harmonic distortion to the thirty-first harmonic.

### Type ET Electronic Trip System

Type ET trip units are available with M-frame, P-frame and R-frame UL/IEC circuit breakers. Circuit breakers with type ET trip units have a fixed ampere rating. The trip units are not field-interchangeable and will not accept any communications or other trip unit accessories. The trip system uses a set of current transformers (called CTs or sensors) to sense current, a trip unit to evaluate the current, and a tripping solenoid to trip the circuit breaker.

#### ET1.0 (M-Frame only)

The ET1.0 trip system is available on M-frame circuit breakers and is equipped with fixed long-time and adjustable instantaneous tripping functions only. The long-time pickup is fixed at  $1.0 \times I_n$ , while the instantaneous pickup is adjustable (dial settings from  $2-10 \times I_n$ ) with no intentional time delay.

#### ET1.0I (P-Frame and R-Frame only)

The ET1.0I trip system is available on both P-frame and R-frame circuit breakers and is equipped with fixed long-time and adjustable instantaneous tripping functions only. The long-time pickup is fixed at  $1.0 \times I_n$ , while the instantaneous pickup is adjustable (dial settings from  $1.5-12 \times I_n$ ) with no intentional time delay.

#### ET1.0M (P-Frame only)

The ET1.0M trip system is only available on P-frame motor circuit protectors and provides protection for short circuit conditions only. The trip unit has a single adjustment for instantaneous pickup that, if

# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

## Section 2—Electronic Trip Systems

exceeded, will trip the circuit breaker with no intentional delay. Instantaneous trip dial settings are 2–16 x I<sub>n</sub> for 600 A circuit breakers and 1.5–12 x I<sub>n</sub> for 800–1200 A circuit breakers.

### Micrologic™ Electronic Trip Systems

The P-frame, R-frame and NS630b–NS3200 electronic trip circuit breakers can be equipped with the optional Micrologic trip systems listed below:

**Table 15: Micrologic Trip Systems**

Model	(LS0) Long-time + Short-time + Zero delay (IEC Rated Only)	(LI) Long-time + Instantaneous Protection (UL Listed, IEC Rated)	(LSI) Long-time + Short-time + Instantaneous Protection (UL Listed, IEC Rated)	(LSIG) Long-time + Short-time + Instantaneous Protection + Equipment Ground-fault Protection (UL Listed, IEC Rated)
Micrologic Basic Trip Unit	2.0	3.0	5.0	—
Micrologic A Trip Unit	2.0A	3.0A	5.0A	6.0A
Micrologic P Trip Unit	—	—	5.0P	6.0P
Micrologic H Trip Unit	—	—	5.0H	6.0H

Trip units are designed to protect power circuits and loads. Micrologic trip systems use a set of current transformers (called CTs or sensors) to sense current, a trip unit to evaluate the current, and a tripping solenoid to trip the circuit breaker. Adjustable rotary switches on the trip unit allow the user to set the proper overcurrent or equipment ground-fault current protection required in the electrical system. If current exceeds a set value for longer than its set time delay, the trip system opens the circuit breaker. Alarms may be programmed for remote indications. Measurements of current, voltage, frequency, power, and power quality optimize continuity of service and energy management.

Integration of protection functions in the Application Specific Integrated Circuit (ASIC) electronic component used in all Micrologic trip units guarantees a high degree of reliability and immunity to conducted or radiated disturbances. On Micrologic P and H trip units, advanced functions are managed by an independent microprocessor.

Circuit breakers are shipped with the trip unit long-time pickup switch set at 1.0 and all other trip unit adjustments set at their lowest settings. Actual settings required for a specific application must be determined by a qualified consultant or plant engineer. A coordination study is recommended to provide coordination between all circuit breakers in the distribution system.

**Table 16: Micrologic™ Trip Unit Features**

Feature	Micrologic Trip Unit (X = Standard Feature O = Available Option)										
	Standard			Ammeter				Power		Harmonics	
	2.0	3.0	5.0	2.0A	3.0A	5.0A	6.0A	5.0P	6.0P	5.0H	6.0H
Field-Installable	X	X	X	X	X	X	X	X	X	X	X
LI		X			X						
LS0	X			X							
LSI			X			X		X		X	
LSIG/Ground-Fault Trip <sup>1</sup>							X		X		X
Ground-Fault Alarm/No Trip <sup>1, 2</sup>								X		X	
Ground-Fault Alarm and Trip <sup>1, 2</sup>									X		X
Adjustable Rating Plugs	X	X	X	X	X	X	X	X	X	X	X
True RMS Sensing	X	X	X	X	X	X	X	X	X	X	X
UL Listed		X	X		X	X	X	X	X	X	X
Thermal Imaging	X	X	X	X	X	X	X	X	X	X	X
Phase-Loading Bar Graph				X	X	X	X	X	X	X	X

# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

## Section 2—Electronic Trip Systems

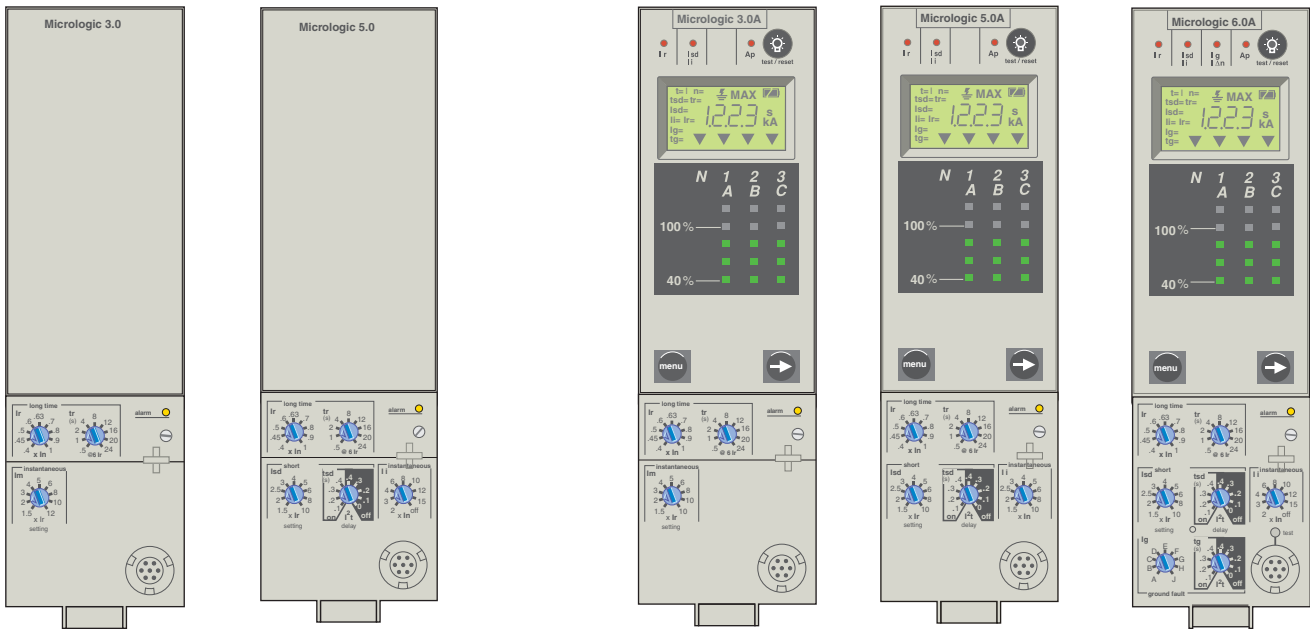
**Table 16: Micrologic™ Trip Unit Features (continued)**

Feature	Micrologic Trip Unit (X = Standard Feature O = Available Option)										
	Standard			Ammeter				Power		Harmonics	
	2.0	3.0	5.0	2.0A	3.0A	5.0A	6.0A	5.0P	6.0P	5.0H	6.0H
LED for Long-Time Pick-Up	X	X	X	X	X	X	X	X	X	X	X
LED for Trip Indication				X	X	X	X	X	X	X	X
Digital Ammeter				X	X	X	X	X	X	X	X
Zone-Selective Interlocking <sup>3</sup>				X		X	X	X	X	X	X
Communications				O	O	O	O	X	X	X	X
LCD Dot Matrix Display								X	X	X	X
Advanced User Interface								X	X	X	X
Protective Relay Functions								X	X	X	X
Neutral Protection <sup>1</sup>								X	X	X	X
Contact Wear Indication								X	X	X	X
Incremental Fine Tuning of Settings								X	X	X	X
Selectable Long-Time Delay Bands								X	X	X	X
Power Measurement								X	X	X	X
Power Quality Measurements										X	X
Waveform Capture										X	X

<sup>1</sup> 3Ø, 4W circuits require either a neutral current transformer or a 4-pole breaker.

<sup>2</sup> Requires M6C Programmable Contact Module.

<sup>3</sup> Not available for 2.0A trip units as upstream devices.



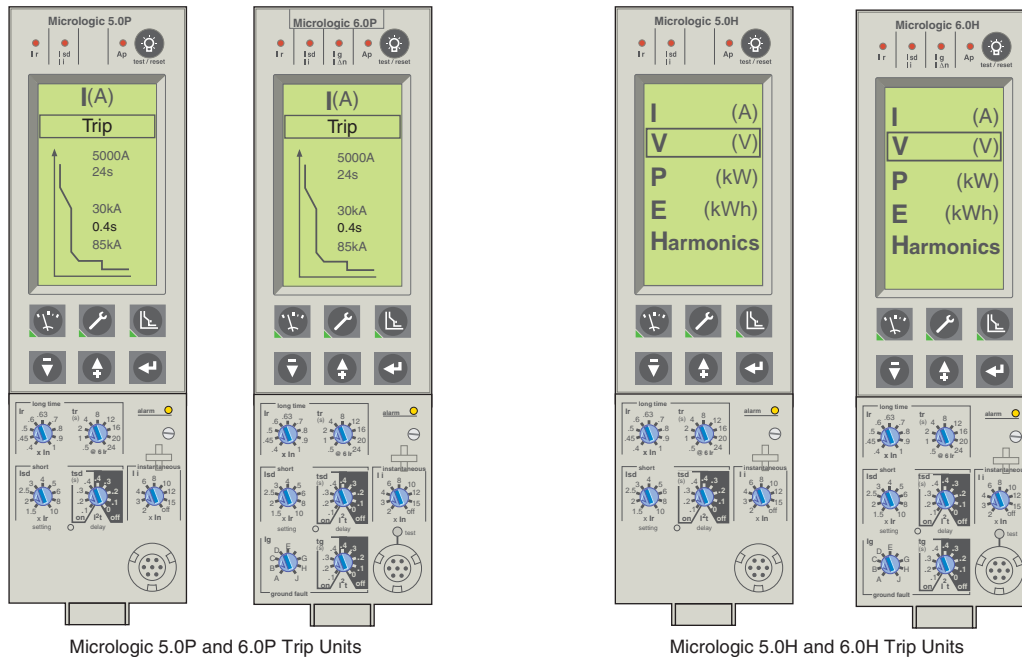
Micrologic 3.0 and 5.0 Basic Trip Units

Micrologic 3.0A, 5.0A and 6.0A Trip Units



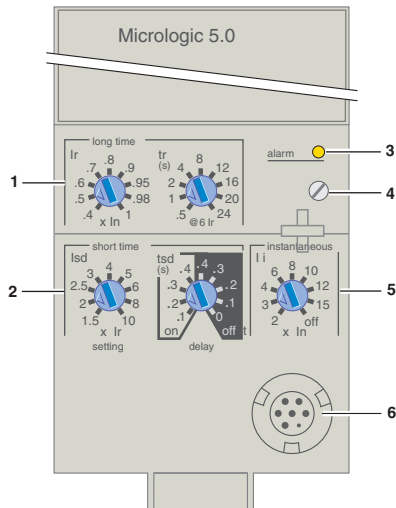
# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

## Section 2—Electronic Trip Systems



Micrologic 5.0P and 6.0P Trip Units

Micrologic 5.0H and 6.0H Trip Units



- 1—Long-time current setting and tripping delay
- 2—Short-time pickup and tripping delay
- 3—Overload signal (LED)
- 4—Long-time rating plug screw
- 5—Instantaneous pickup
- 6—Test connector

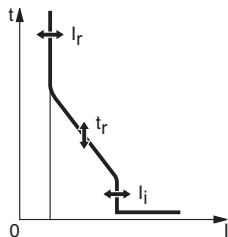
### Micrologic™ 2.0, 3.0 and 5.0 Basic Trip Units

The Micrologic 2.0, 3.0, and 5.0 basic trip units protect power circuits.

#### Protection Settings

Protection thresholds and delays are set using the rotary switches. A full-range of long-time settings are available via field-installable adjustable rating plugs.

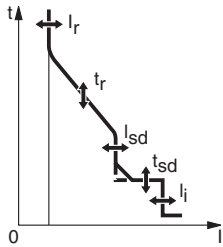
- Overload protection
  - True RMS long-time protection
  - Thermal imaging: Active thermal imaging before and after tripping
- Short-circuit protection
  - Short-time RMS
  - Selection of  $I^2t$  type (ON or OFF) for short-time delay
- Instantaneous protection
- Neutral protection on four-pole circuit breakers



**Table 17: Micrologic 2.0 and 3.0 Basic Trip Unit Settings**

	Current setting (A)		2.0:	0.40	0.50	0.60	0.70	0.80	0.90	0.95	0.98	1.00
	Tripping between 1.05 and 1.20 x $I_r$	$I_r = I_n \times \dots$	3.0:	0.40	0.45	0.50	0.60	0.63	0.70	0.80	0.90	1.00
			Other ranges are available by changing rating plug									
Long-time Protection	Maximum Time Delay (s)	$t_r$ at 1.5 x $I_r$		12.5	25	50	100	200	300	400	500	600
	Accuracy: 0 to -20%	$t_r$ at 6 x $I_r$		0.5	1	2	4	8	12	16	20	24
		$t_r$ at 7.2 x $I_r$		0.34	0.69	1.38	2.7	5.5	8.3	11	13.8	16.6
	Thermal Imaging		20 minutes before or after tripping									
Short-time Protection	Current Setting (A)	$I_{sd} = I_r \times \dots$	2.0:	1.5	2	2.5	3	4	5	6	8	10
	Accuracy: $\pm 10\%$ No delay											
Instantaneous Protection	Current Setting (A)	$I_i = I_n \times \dots$	3.0:	1.5	2	3	4	5	6	8	10	12
	Accuracy: $\pm 10\%$											

**PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers**  
**Section 2—Electronic Trip Systems**



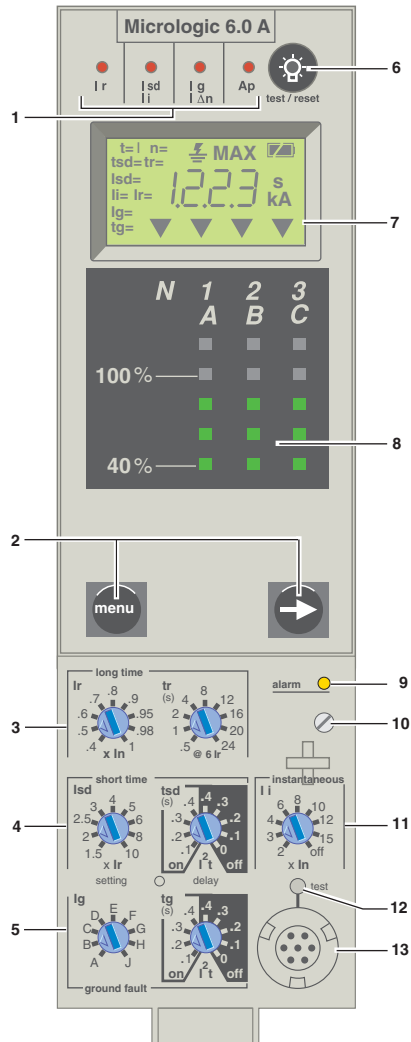
**Table 18: Micrologic 5.0 Basic Trip Unit Settings**

Long-time Protection	Current Setting (A) Tripping Between 1.05 and 1.20 x I <sub>r</sub>	I <sub>r</sub> = I <sub>n</sub> x ...	IEC:	0.40	0.50	0.60	0.70	0.80	0.90	0.95	0.98	1.00	
			UL:	0.40	0.45	0.50	0.60	0.63	0.70	0.80	0.90	1.00	
			Other Ranges are Available by Changing Rating Plug										
	Maximum Time Delay (s) Accuracy: 0 to -20%	t <sub>r</sub> at 1.5 x I <sub>r</sub> t <sub>r</sub> at 6 x I <sub>r</sub> t <sub>r</sub> at 7.2 x I <sub>r</sub>		12.5	25	50	100	200	300	400	500	600	
Thermal Imaging			20 Minutes Before or After Tripping										
Short-time Protection	Current Setting (A) Accuracy: ±10%	I <sub>sd</sub> = I <sub>r</sub> x ...		1.5	2	2.5	3	4	5	6	8	10	
	Settings		I <sup>2</sup> t OFF	0	0.1	0.2	0.3	0.4					
			I <sup>2</sup> t ON		0.1	0.2	0.3	0.4					
	Maximum Time Delay (s) at 10 x I <sub>r</sub>	t <sub>sd</sub>	Min. Trip Time (ms)	20	80	140	230	350					
			Max. Trip Time (ms)	80	140	200	320	500					
Instantaneous Protection	Current Setting (A) Accuracy: ±10%	I <sub>i</sub> = I <sub>n</sub> x ...		2	3	4	6	8	10	12	15	off	

# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

## Section 2—Electronic Trip Systems

### Micrologic™ 2.0A, 3.0A, 5.0A and 6.0A Trip Units with Ammeter



- 1—Indication of tripping cause
- 2—Navigation buttons
- 3—Long-time current setting and tripping delay
- 4—Short-time pickup and tripping delay
- 5—Ground-fault pickup and tripping delay
- 6—Test lamp and reset
- 7—Digital display
- 8—Three-phase bar graph and ammeter
- 9—Overload signal (LED)
- 10—Long-time rating plug screw
- 11—Instantaneous pickup
- 12—Electronic push-to-trip
- 13—Test connector

Micrologic A trip units protect power circuits and provide current measurements, overload protection, and short-circuit protection. In addition, the 6.0A trip units also provide ground-fault protection for equipment.

#### Protection Settings

Protection thresholds and delays are set using the rotary switches. The selected values are momentarily displayed in amperes and in seconds. A full-range of long-time settings are available via the field-installable rating plug.

- Overload protection (true RMS long-time protection).
- Thermal imaging (active thermal imaging before and after tripping).
- Short-circuit protection.
  - Short-time RMS.
  - $I^2t$  ON or OFF for short-time delay.
- Instantaneous protection.
- Ground-fault protection for equipment.
  - Residual ground-fault protection for equipment.
  - Source ground-return ground-fault protection for equipment.
  - Modified differential ground-fault protection (MDGF) for equipment.
- Neutral protection on four-pole circuit breakers.
- ZSI: Zone-selective interlocking (a ZSI terminal block may be used to interconnect a number of trip units to provide total discrimination for short-time and equipment ground-fault protection, without delay for tripping). Not available for 3.0A trip units or for 2.0A trip units installed as upstream device.

#### Ammeter Measurements

Micrologic A trip units measure the true RMS value of currents. They provide continuous current measurement from 0.2 to 20 x  $I_n$  with an accuracy of 1.5% (including sensors). No auxiliary source is needed where  $I > 0.2 \times I_n$ . The optional external power supply (24 Vdc) makes it possible to display currents where  $I < 0.2 \times I_n$  and to store values of the interrupted current.

A digital LCD screen continuously displays the most heavily loaded phase ( $I_{max}$ ) or displays the  $I_A$ ,  $I_B$ ,  $I_C$ ,  $I_g$ , and (on 4P circuit breakers only)  $I_N$  stored current and setting values by successively pressing the navigation button.

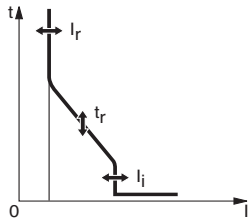
#### Communication Network

In conjunction with an optional communication network, the trip unit transmits the following parameters:

- Setting values
- All ammeter measurements
- Tripping causes.

# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

## Section 2—Electronic Trip Systems

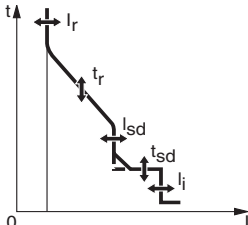


**Table 19: Micrologic 2.0A and 3.0A Trip Unit Settings**

Long-time Protection	Current Setting (A)		2.0A: 0.40 0.50 0.60 0.70 0.80 0.90 0.95 0.98 1.00
	Tripping Between 1.05 and 1.20 x Ir	$I_r = I_n \times \dots$	3.0A: 0.40 0.45 0.50 0.60 0.63 0.70 0.80 0.90 1.00
			Other Ranges are Available by Changing Rating Plug
	Maximum Time Delay (s)	$t_r$ at 1.5 x Ir	12.5 25 50 100 200 300 400 500 600
Short-time Protection	Current Setting (A) Accuracy: ±10%, No delay	$I_{sd} = I_r \times \dots$	2.0A: 1.5 2 2.5 3 4 5 6 8 10
			3.0A: 1.5 2 3 4 5 6 8 10 12
Instantaneous Protection	Current Setting (A) Accuracy: ±10%	$I_i = I_n \times \dots$	3.0A: 1.5 2 3 4 5 6 8 10 12

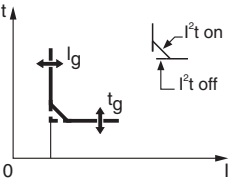
**Table 20: Micrologic 5.0A and 6.0A Trip Unit Settings**

Long-time Protection	Current Setting (A)		IEC: 0.40 0.50 0.60 0.70 0.80 0.90 0.95 0.98 1.00	
	Tripping Between 1.05 and 1.20 x Ir	$I_r = I_n \times \dots$	UL: 0.40 0.45 0.50 0.60 0.63 0.70 0.80 0.90 1.00	
			Other ranges are available by changing rating plug	
	Maximum Time Delay (s)	$t_r$ at 1.5 x Ir	12.5 25 50 100 200 300 400 500 600	
Short-time Protection	Current Setting (A) Accuracy: ±10%	$I_{sd} = I_r \times \dots$	1.5 2 2.5 3 4 5 6 8 10	
			Settings	$I^2t$ OFF 0 0.1 0.2 0.3 0.4
			$I^2t$ ON 0.1 0.2 0.3 0.4	
Instantaneous Protection	Current Setting (A) Accuracy: ±10%	$I_i = I_n \times \dots$	2 3 4 6 8 10 12 15 off	



**Table 21: Micrologic 6.0A Trip Unit Ground-Fault Settings**

Ground-fault Pickup (A) Accuracy: ±10%	$I_g = I_n \times \dots$	A B C D E F G H J
	$I_n \leq 400$ A	0.3 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
	$400 < I_n \leq 1200$ A	0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Maximum Time Delay (s) at $1 \times I_g$	Settings	$I^2t$ OFF 0 0.1 0.2 0.3 0.4
		$I^2t$ ON 0.1 0.2 0.3 0.4
	$t_g$	Minimum Trip Time (ms) 20 80 140 230 350
		Maximum Trip Time (ms) 80 140 200 320 500



### External Power Supplies for Micrologic Trip Units

Current-based protection functions require no auxiliary power source.

**Table 22: Micrologic A Use of External 24 Vdc Power Supply**

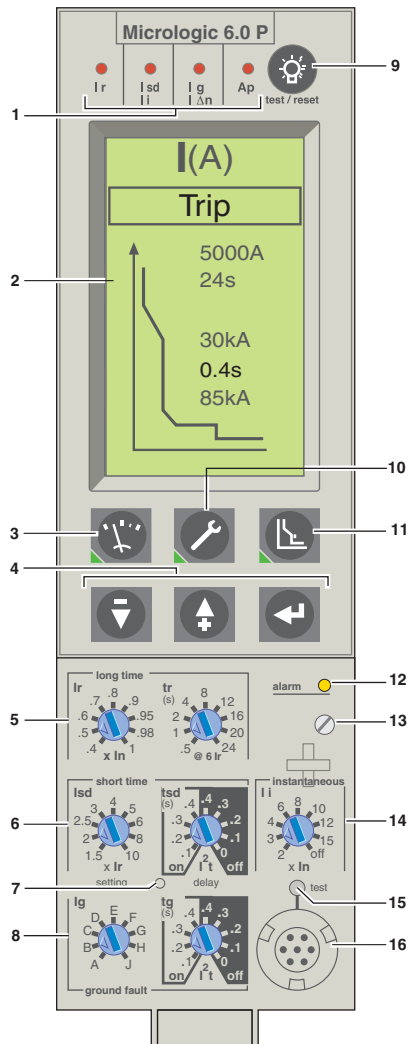
Function	Without 24 Vdc Power Supply at F1 and F2	With 24 Vdc Power Supply at F1 and F2
Fault Protection for LSIG Functions	Yes	Yes
LED Trip Indication	Yes	Yes
Ammeter and bar graph displays	Yes	Yes
Trip setting and Max. Current Readings Can Be Accessed on the Display by Using Navigation Buttons	Yes, If Current Flow on One Phase is Equal To or Greater Than:	Yes
Ground-Fault Push-to-Trip Button Works for Testing Ground Fault <sup>1</sup>	Sensor Plug Value (In) Minimum Ground-fault Pickup	
	100–250 A 30% of sensor rating	
Modbus® Communications (Optional)	400–1200 A 20% of sensor rating	Yes, with separate 24 Vdc power supply for the circuit breaker communication module
	1600–6300 A 500 A	
Back-lit Display	No	Yes

<sup>1</sup> Ground fault Push-to-trip button will also be functional if hand-held test kit or full-function test kit is powering the trip unit.

# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

## Section 2—Electronic Trip Systems

### Micrologic™ 5.0P and 6.0P Trip Units with Power Metering



- 1—Indication of tripping cause
- 2—High resolution screen
- 3—Measurement display
- 4—Navigation buttons
- 5—Long-time current setting and tripping delay
- 6—Short-time pickup and tripping delay
- 7—Hole for settings lockout pin
- 8—Ground-fault pickup and tripping delay
- 9—Test lamp and indication reset
- 10—Maintenance indicators
- 11—Protection settings
- 12—Overload signal (LED)
- 13—Long-time rating plug screw
- 14—Instantaneous pickup
- 15—Electronic push-to-trip
- 16—Test connector

Micrologic P trip units provide power metering and extended protection in addition to the adjustable protection functions of the Micrologic A trip unit.

#### Protection Settings

The adjustable protection functions of the 5.0P and 6.0P trip units are identical to those of Micrologic A trip unit (overloads, short circuits, equipment ground-fault protection; see page 27). These units also feature:

- Fine adjustment
 

Within the range below the rotary switch setting, fine adjustments of pickups/delays in steps of 1 A/s (except for short-time and ground-fault) are possible on the keypad or remotely by the communication network.
- Inverse definite minimum time lag (IDMTL) setting.
 

Coordination with fuse-type or medium-voltage protection systems is optimized by adjusting the long-time delay curve around  $6 \times I_r$  axis. This setting ensures better coordination with certain loads.
- Neutral protection
 

On three-pole circuit breakers, neutral protection may be set using the keypad or remotely using the communication network to one of four positions: OFF,  $1/2N$  ( $1/2 \times I_n$ ),  $1N$  ( $1 \times I_n$ ), or  $1.6N$  ( $2 \times I_n$ ).

**NOTE:** Neutral protection is disabled if long-time curve is set to one of the IDMTL protection settings.

#### Configuring Alarms and Other Protection Functions

When the cover is closed, the keypad may no longer be used to change the protection settings, but it still provides access to the displays for measurements, histories, indicators, etc. Depending on the thresholds and time delays set, the Micrologic P trip unit monitors current, voltage, power, frequency, and phase sequence. Each threshold overrun may be signalled remotely via the communication network.

Each threshold overrun may be combined with tripping (protection) or an indication carried out by an optional M6C programmable contact (alarm), or both (protection and alarm).

#### Maintenance Record

The maintenance record can be consulted using the full-function test kit or remotely via the communication network. It can be used as an aid in troubleshooting and to assist scheduling for device maintenance operations.

Recorded indications include:

- Highest current measured
- Operation counter (cumulative total and total since last reset)
- Number of test kit connections
- Number of trips in operating mode

#### Load Shedding and Reconnection Parameters

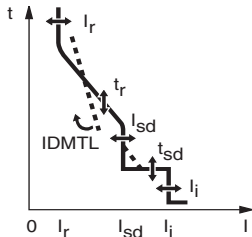
Load shedding and reconnection parameters can be set according to the power or the current flowing through the circuit breaker. Load shedding is carried out by a remote computer via the communication network or by an M6C programmable contact.

# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

## Section 2—Electronic Trip Systems

### Indication Option Via Programmable Contacts

The M6C programmable contact may be used to signal threshold overruns or status changes. It can be programmed using the keypad on the Micrologic P trip unit or remotely using the communication network. The contact is required to obtain data from the protective relay functions on Type P and Type H trip units.

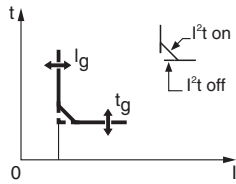


**Table 23: Micrologic 5.0P and 6.0P Trip Unit Settings**

Protection Type	Setting	Formula	Current Setting (A)									
			0.40	0.50	0.60	0.70	0.80	0.90	0.95	0.98	1.00	
Long-Time (RMS) Protection	Current Setting (A)	$I_r = I_n \times \dots$	IEC									
	Tripping Between 1.05 and 1.20 x $I_r$	$I_r = I_n \times \dots$	UL									
	Maximum Time Delay (s)	$t_r$ at 1.5 x $I_r$	12.5	25	50	100	200	300	400	500	600	
	Accuracy: 0 to -20%	$t_r$ at 6 x $I_r$	0.5	1	2	4	8	12	16	20	24	
Short-Time (RMS) Protection	Current Setting (A)	$I_{sd} = I_r \times \dots$	Accuracy: ±10%									
	Maximum Time Delay (s)	$t_{sd}$	Settings									
	Accuracy: ±10%	$t_{sd}$	Accuracy: ±10%									
Instantaneous Protection	Current Setting (A)	$I_i = I_N \times \dots$	Accuracy: ±10%									
	Accuracy: ±10%	$I_i = I_N \times \dots$	2	3	4	6	8	10	12	15	off	

**Table 24: Micrologic 6.0P Trip Unit Ground-Fault Settings**

Setting	Formula	Ground-Fault Pickup (A)									
		A	B	C	D	E	F	G	H	J	
Ground-Fault Pickup (A)	$I_g = I_n \times \dots$	Accuracy: ±10%									
	$I_n \leq 400$ A	0.3	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	
	$400$ A < $I_n \leq 1200$ A	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	
Maximum Time Delay (s) at 1 x $I_g$	Settings	$I^2t$ OFF									
	Settings	$I^2t$ ON									
	Min. Trip Time (ms)	20	80	140	230	350					
	Max. Trip Time (ms)	80	140	200	320	500					



**Table 25: Micrologic 5.0P and 6.0P Trip Unit Settings for Protection Functions**

Function	Setting	Threshold	Time Delay
Current	Current Imbalance	0.05 to 0.6 x $I_{max}$	1 to 40 s
	Maximum Current	$I_{max}$ : $I_A, I_B, I_C, I_N, I_g$	15 to 1500 s
	Voltage Imbalance	0.02 to 0.3 x $V_n$	1 to 40 s
Voltage	Minimum Voltage	$V_{min}$	100 to 725 V (Phase Total)
	Maximum Voltage	$V_{max}$	100 to 1200 V (Between Phases)
Power	Maximum Power	$P_{max}$	5 to 500 kW
	Reverse Power	$P_r$	0.02 to 0.2 x $P_n$
Frequency	Minimum Frequency	$F_{min}$	45 to 65 Hz
	Maximum Frequency	$F_{max}$	45 to 540 Hz
Phase	Sequence	$\Delta \emptyset$	$\emptyset A-\emptyset B-\emptyset C$ or $\emptyset A-\emptyset C-\emptyset B$

**Table 26: Micrologic 5.0P and 6.0P Trip Unit Settings for Current and Power Load-Shedding**

Function	Setting	Pickup		Drop-out	
		Threshold	Time Delay	Threshold	Time Delay
Current	I	0.5 to 1.0 x $I_r$ Per Phase	20% to 80% x $t_r$	0.3 to 1.0 x $I_r$ per phase	10 to 600 s
Power	P	200 kW to 10 MW	10 to 3600 s	100 kW to 10 MW	10 to 3600 s

Micrologic P trip units are designed to be used with an external 24 Vdc power supply. Current-based protection functions require no auxiliary power source.

# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

## Section 2—Electronic Trip Systems

**Table 27: Micrologic P Use of External 24 Vdc Power Supply**

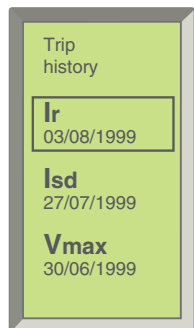
Function	Without 24 Vdc Power Supply at F1 and F2	With 24 Vdc Power Supply at F1 and F2
Fault Protection for LSIG Functions	Yes	Yes
LED Trip Indication	Yes	Yes
LCD Display and Backlight are Functional	Yes <sup>1</sup>	Yes
Ground-Fault Push-to-Trip Button Works for Testing Ground Fault <sup>2</sup>	Yes <sup>1</sup>	Yes
Metering, Monitoring, and History Logs are Functional	Yes <sup>1</sup>	Yes
Communications Between Trip Unit and M2C and M6C Programmable Contact Modules	No	Yes
Operation of M6C Programmable Contact Module	No	Yes, with separate 24 Vdc power supply for the module
Modbus® Communications	No	Yes, with separate 24 Vdc power supply for the circuit breaker communication module

<sup>1</sup> If circuit breaker has 100 Vac or more between two phases or phase to neutral and is bottom fed or closed in a top fed application.

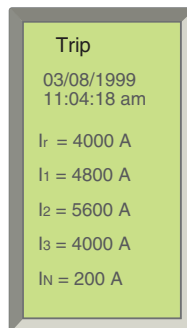
<sup>2</sup> Ground-fault push-to-trip button will also be functional if hand-held test kit or full-function test kit is powering the trip unit.

### Tripping and Alarm Histories

The last ten trips and ten alarms are recorded in two separate history files that can be displayed on the screen (sample displays are shown).



Trip History



Alarm History

The following information is contained in these files:

#### Trip History

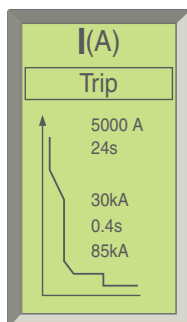
- Type of fault
- Date and time of fault
- Interrupted current

#### Alarm History

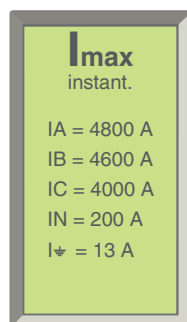
- Type of alarm
- Date and time of alarm
- Values measured at time of alarm

### Metering

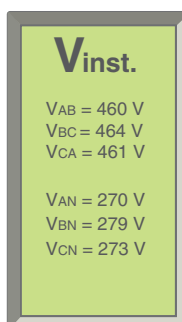
The Micrologic P trip unit calculates in real time the electrical values V, A, W, VAR, VA, Wh, VARh, VAh, Hz, power factor and crest factor. It also calculates demand current and power over an adjustable time period.



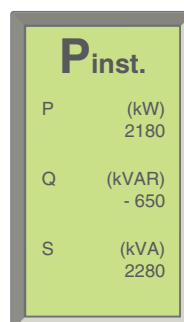
Current Metering



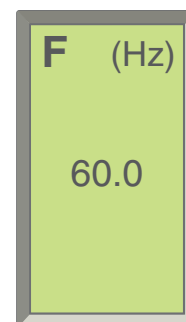
Maximum Current



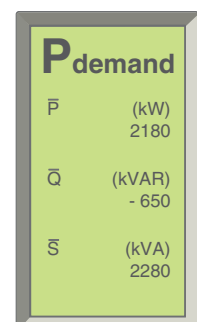
Voltage Metering



Power Metering



Frequency



Power Demand

# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

## Section 2—Electronic Trip Systems

### Real-Time Metering

The value displayed on the screen is refreshed every second. Minimum and maximum measurement values are stored in memory.

**Table 28: Real-Time Metering**

Type of Measurement		Unit of Measurement	Measurement Source
Current	$I_{RMS}$	A	$\varnothing A, \varnothing B, \varnothing C$ or N
	$I_{AVERAGE}$	A	$(\varnothing A + \varnothing B + \varnothing C) / 3$
	$I_{PEAK}/\sqrt{2}$	A	$\varnothing A, \varnothing B, \varnothing C$ or N
Voltage	$V_{RMS}$	V	$(\varnothing A-\varnothing B), (\varnothing B-\varnothing C)$ and $(\varnothing C-\varnothing A)$
	$V_{RMS}$	V	$(\varnothing A-N), (\varnothing B-N)$ and $(\varnothing C-N)$
	$\Delta V_{IMBALANCE}$	%	$V_{RMS}$
Power	P, Q and S	W, VAR, VA	Total
	EP, EQ and ES	Wh, VARh, VAh	Total
	Power factor		Total
Frequency	F	Hz	50/60

### Demand Metering

The demand is calculated over a fixed or sliding time window that can be programmed from five to sixty minutes. Depending on the contract signed with the power supplier, specific programming makes it possible to avoid or minimize the cost of overrunning the subscribed power. Maximum demand values are systematically stored and time stamped.

**Table 29: Demand Metering**

Type of Measurement		Unit of Measurement	Measurement Source
Current	$I_{DEMAND}$	A	$\varnothing A, \varnothing B, \varnothing C$ or N
Power	P, Q and $S_{DEMAND}$	W, VAR, VA	Total

### Communication Network

The communication network may be used to:

- Remotely read parameters for the protection functions.
- Transmit all the measurements and calculated values.
- Signal the causes of tripping and alarms.
- Consult the history files and the maintenance indicator record.

In addition, an event log of the last 100 events and a maintenance record, which is stored in the trip unit memory but not available locally, may be accessed via the communication network.

This Modbus® communication system is compatible with the Powerlogic™ System Manager™ software (SMS).

### Event Log

The event log may be accessed by a remote computer via the communication network. All events are time stamped and include:

- Trips
- Beginning and end of alarms
- Modifications to settings and parameters
- Loss of time
- Test kit connections
- Counter resets
- System faults (thermal self-protection, major fault and minor fault alarms)



Micrologic™ 5.0H and 6.0H Trip Units with Harmonic Metering



In addition to the P functions, the Micrologic H trip units offer:

- In-depth analysis of power quality including calculation of harmonics and the fundamentals
- Diagnostics aid and event analysis through waveform capture
- Customized alarm programming to analyze and track down a disturbance on the ac power system
- Systematic time stamping of all events and creation of logs

Metering

The Micrologic H trip unit offers all the measurements carried out by the Micrologic P trip unit, with the addition of phase-by-phase measurements of power and energy as well as calculation of:

- Current and voltage total harmonic distortion (THD, thd)
- Current, voltage and power fundamentals (50/60 Hz)
- Harmonic components (amplitude and phase) up to the 31st current and voltage harmonic
- Real-time metering: The value displayed on the screen is refreshed every second. The table below shows what is measured in real-time metering

Table 30: Measurements

Type of Measurement	Unit of Measurement	Measurement Source
Current	$I_{RMS}$	A ØA, ØB, ØC or N
	$I_{AVERAGE}$	A (ØA + ØB + ØC) / 3
	$I_{PEAK/\sqrt{2}}$	A ØA, ØB, ØC or N
	$\Delta I_{IMBALANCE}$	% ØA, ØB, ØC or N
Voltage	$V_{RMS}$	V (ØA–ØB), (ØB–ØC) and (ØC–ØA)
	$V_{RMS}$	V (ØA–N), (ØB–N) and (ØC–N)
	$\Delta V_{IMBALANCE}$	% $V_{RMS}$
Power	P, Q and S	W, VAR, VA Total
	EP, EQ and ES Power factor	Wh, VARh, VAh Total
Frequency	F	Hz ØA, ØB, or ØC
Power Quality Indicators	Fundamentals	50/60 Hz component V, I, P, Q, and S
	THD	% V/I
	V and I harmonics	Amplitude to phase 1, 2, 3, 4...50

- Demand Metering: Similar to the Micrologic P trip unit, demand values are calculated over a fixed or sliding time window that can be set from five to sixty minutes.

Table 31: Demand Metering

Type of Measurement	Unit of Measurement	Measurement Source
Current	$I_{DEMAND}$	A ØA, ØB, ØC or N
Power	P, Q and $S_{DEMAND}$	W, VAR, VA Total

Waveform Capture

The Micrologic H trip units can capture and store current and voltage waveforms using digital sampling techniques similar to those used in oscilloscopes. Using the information available in the captured waveform, it is possible to determine the level of harmonics as well as the direction and amplitude of the flow of harmonic power.

The Micrologic™ H trip unit can record manually via the keypad the following waveforms:

- Currents  $I_A$ ,  $I_B$ ,  $I_C$  and  $I_N$
- Phase-to-phase voltages  $V_{AB}$ ,  $V_{BC}$ , and  $V_{CA}$

# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

## Section 2—Electronic Trip Systems

Waveforms may be displayed on the graphic screen of the control unit or communicated over a networked system. The recording takes place over one cycle with a measurement range of 1 to 1.5  $I_n$  for current and 0 to 690 volts for voltage. Resolution is 64 points per cycle.

### Customized Alarm Programming

The instantaneous value of each measurement can be compared to user-set high and low thresholds. Overrun of a threshold generates an alarm. Programmable action can be linked to each alarm, including circuit breaker opening, activation of an M6C contact, recording of measurements in a log, etc.

### Event Logs

Each event is recorded with:

- The date, time, and name of the event
- The event characteristics

Micrologic H trip units are designed to be used with an external 24 Vdc power supply. Current-based protection functions require no auxiliary power source.

**Table 32: Micrologic H Use of External 24 Vdc Power Supply**

Function	Without 24 Vdc Power Supply at F1 and F2	With 24 Vdc Power Supply at F1 and F2
Fault Protection for LSIG Functions	Yes	Yes
LED Trip Indication	Yes	Yes
LCD Display and Backlight are Functional	Yes <sup>1</sup>	Yes
Ground-Fault Push-to-Trip Button Works for Testing Ground Fault <sup>2</sup>	Yes <sup>1</sup>	Yes
Metering, Monitoring, and History Logs are Functional	Yes <sup>1</sup>	Yes
Communications Between Trip Unit and M2C and M6C Programmable Contact Modules	No	Yes
Operation of M6C Programmable Contact Module	No	Yes, with Separate 24 Vdc Power Supply for the Module
Modbus™ Communications	No	Yes, with Separate 24 Vdc Power Supply for the Circuit Breaker Communication Module

<sup>1</sup> If circuit breaker has 100 Vac or more between two phases or phase to neutral and is bottom fed or closed in a top fed application.

<sup>2</sup> Ground-fault push-to-trip button will also be functional if hand-held test kit or full-function test kit is powering the trip unit.

### Additional Characteristics for Type P and H Trip Units

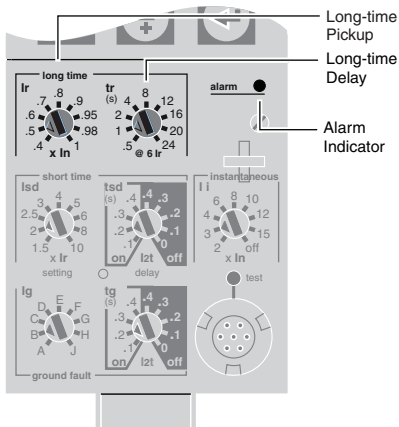
- Setting the display language: System messages can be displayed in six different languages (English - US, English - UK, French, German, Spanish, and Italian). The desired language is selected via the keypad.
- Protection functions: All current-based protection functions require no auxiliary source. Voltage-based protection functions are connected to ac power via a voltage measurement input built into the circuit breaker on the bottom side. (Optional external voltage measurement is available as a factory-installed option.)
- Accuracy of measurements (including sensors):
  - Voltage (V) 1%
  - Current (A) 1.5% (higher accuracy [1%] may be achieved with special calibration on the current transformer [CT characterization option])
  - Frequency (Hz) 0.1 Hz
  - Power (W) and energy (Wh) 2.5%
  - The Micrologic H trip unit uses a dedicated metering data chain separate from the protection data chain so that a greater number of data samples can be used for metering. This increases the number of samples taken per time period, which in turn gives the H trip unit a higher degree of metering accuracy.

# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

## Section 2—Electronic Trip Systems

- Stored information: The fine setting adjustments, the last 100 events and the maintenance record remain in the trip unit memory even when power is lost.
- Reset: An individual reset, via the keypad or remotely, will reset alarms, minimum and maximum data, peak values, counters and indicators.

### Micrologic™ Trip Unit Functions



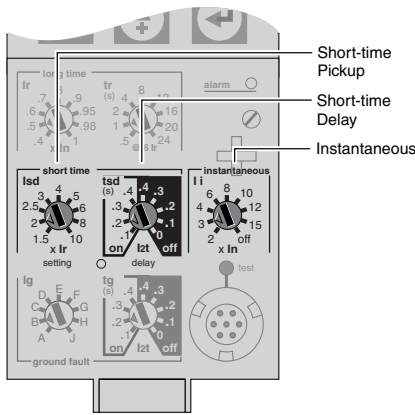
Long-time Trip Functions

#### Long-Time Trip Functions

The *long-time pickup* switch sets the maximum current level the circuit breaker will carry continuously. The maximum current level ( $I_r$ ) is the long-time pickup setting multiplied by the sensor plug amperage ( $I_n$ ). If the current exceeds this value for longer than the long-time delay time, the circuit breaker will trip.

The *long-time delay* switch sets the length of time that the circuit breaker will carry a sustained overload before tripping. Delay bands are labeled in seconds of overcurrent at six times the ampere rating. For maximum coordination, there are eight delay bands. Long-time delay is an “inverse time” characteristic in that the delay time decreases as the current increases.

The trip unit includes an *alarm indicator* that will be lit continuously when the current is above 100% of the pickup setting.



Short-time Trip Functions

#### Short-Time Trip Functions

The *short-time pickup* switch sets the short-circuit current level at which the circuit breaker will trip after the set short-time delay. The short-time current ( $I_{sd}$ ) equals the short-time pickup setting multiplied by the long-time pickup ( $I_r$ ).

The *short-time delay* switch sets the length of time the circuit breaker will carry a short circuit within the short-time pickup range. The delay (based on 10 times the ampere rating  $I_r$ ) can be adjusted to four positions of  $I^2t$  ramp operation ( $I^2t$  ON) or five positions of fixed time delays ( $I^2t$  OFF).  $I^2t$  ON delay is an “inverse time” characteristic in that the delay time decreases as the current increases. Short-time delay for the 2.0 trip unit is fixed at a delay band of 20 to 80 ms.

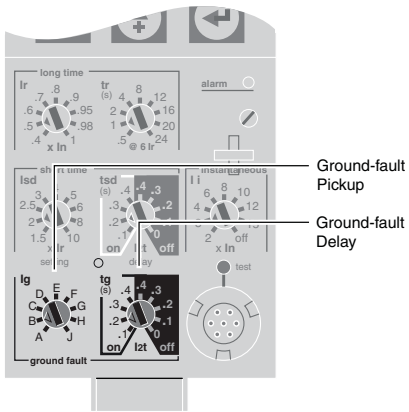
#### Instantaneous Trip Function

The *instantaneous pickup* switch sets the short-circuit current level at which the circuit breaker will trip with no intentional time delay. The instantaneous current ( $I_i$ ) is equal to the instantaneous pickup setting multiplied by the sensor plug amperage ( $I_n$ ).

The instantaneous function will override the short-time function if the instantaneous pickup is adjusted at the same or lower setting than the short-time pickup. In trip units with both adjustable short-time and instantaneous trip functions, the adjustable instantaneous trip can be disabled by setting Instantaneous pickup to OFF.

# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

## Section 2—Electronic Trip Systems



### Ground-Fault Trip Functions

The *ground-fault pickup* switch sets the current level at which the circuit breaker will trip after the set ground-fault delay. Ground-fault pickup values ( $I_g$ ) are based on circuit breaker sensor plug ( $I_n$ ) only, not on the rating plug multiplier ( $I_r$ ). Changing the rating plug multiplier has no effect on ground-fault pickup values.

The *ground-fault delay* switch sets the length of time the circuit breaker will carry ground-fault current which exceeds the ground-fault pickup level before tripping. The delay, based on the sensor plug amperage ( $I_n$ ), can be adjusted to four positions of  $I^2t$  ramp operation ( $I^2t$  ON) or five positions of fixed time delays ( $I^2t$  OFF).  $I^2t$  ON delay is an “inverse time” characteristic in that the delay time decreases as the current increases.

### Communication Network

P-frame, R-frame and NS630b–NS3200 circuit breakers and Micrologic™ trip unit information is available via a Modbus® communication network to Powerlogic™ System Manager™ software (SMS) or third party applications for reporting and recording.

Types of Information via Modbus communication network includes:

- Circuit breaker identification and status
- Remote control of circuit breaker operation
- View and set protection function parameters
- Real-time readings
- Trip indication
- Alarm reporting
- Historical files and maintenance records

The Modbus circuit breaker communication feature, standard on the Micrologic P and H trip units and available for the Micrologic A trip unit, is made up of:

- A Modbus Circuit Breaker Communication Module (BCM) installed on the circuit breaker and supplied with a kit for optional connection to the XF shunt close and MX shunt trip
- An optional Modbus Cradle Communication Module (CCM) installed adjacent to the circuit breaker cradle. A set of cradle position switches is required for status of circuit breaker position (connected, test, or disconnected). (Drawout circuit breaker only.)

### Modbus Circuit Breaker Communication Module (BCM)

The Modbus Circuit Breaker Communication Module (BCM) is installed in the circuit breaker and requires a separate, isolated 24 Vdc power source. The BCM is optically coupled to the Micrologic trip unit to ensure a high level of isolation between the trip unit and the communication network. The Modbus BCM provides circuit breaker status via dedicated OF (open or closed) and SDE (fault tripped) switches and provides the capability of remotely controlling the circuit breaker. It also maintains an event log of circuit breaker status containing the number of times the circuit breaker has experienced each status position with the date and time of the last transition. This information and the remote control capability are available to a Modbus supervisor system via a Modbus communication network.

### Modbus Cradle Communication Module (CCM)

The optional Modbus Cradle Communication Module (CCM) (drawout circuit breakers only) is installed adjacent to the circuit breaker cradle and is the gateway between the Modbus network and the Modbus BCM. The Modbus CCM provides circuit breaker cradle status including connected position (CE), disconnected position (CD) and cradle test position (CT). The CCM monitors the position of the

# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

## Section 2—Electronic Trip Systems

Modbus BCM and trip unit when it detects a circuit breaker being racked from the disconnected to the test position. This capability allows a circuit breaker to be replaced without the need to manually configure the communication parameters in the Modbus BCM. The CCM maintains an event log of the date and time of the last circuit breaker transition. In order to aid system communication troubleshooting, the CCM has visual indication of the module's operating status by means of two LEDs.

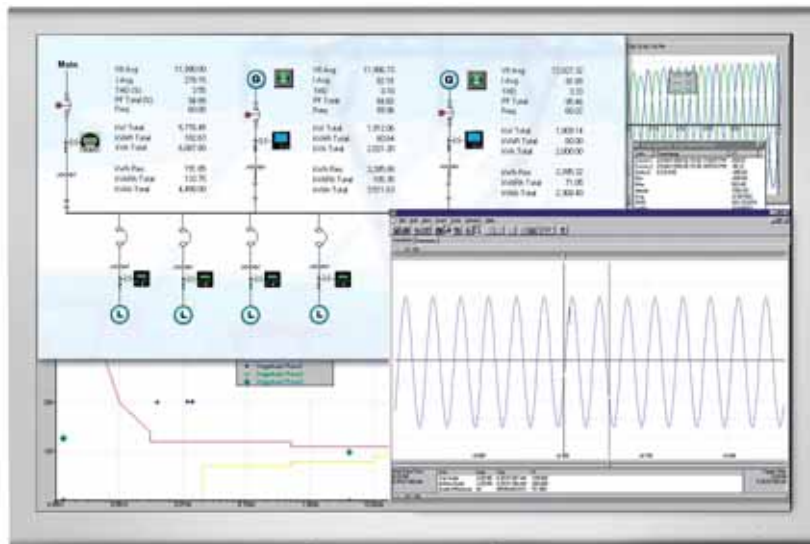
### PowerLogic™ System Manager Software (SMS)

System Manager Software (SMS), used for power systems and energy management, provides the human-machine interface (HMI) for electrical system information on a PC. SMS displays circuit breaker and trip unit information in several formats including:

- Graphical screens including real-time readings, circuit breaker status and remote control of circuit breaker operation
- Tables displaying real-time readings, maintenance information and date and time of last operation
- Waveform captures including harmonic content
- Tabular displays of event logs and data logs
- Alarm annunciation and recording

### Electrical Installation Supervision using ION-Enterprise Software

- PowerLogic™ ION-Enterprise software is ideally suited to the supervision needs of small system applications, monitoring up to 32 devices.
- Installed on a PC under Windows, it represents a cost-effective and easy-to-implement power-monitoring solution that offers:
  - automatic detection of compatible devices
  - real-time monitoring of data including power requirements
  - a report generator with a number of pre-defined reports that can be exported to Excel
  - cost allocation
  - time-stamped data-logging possibilities
  - Modbus serial and Modbus TCP/IP compatible communication.



## Section 3—PowerPact M-Frame Molded Case Circuit Breakers

### Performance

PowerPact M-frame molded case circuit breakers provide improved performance and a compact solution for applications up to 800 A. They complement the existing PowerPact P- and R-frame circuit breakers, and replace the traditional MA/MH circuit breakers with a smaller footprint and competitive cost.

- Available in 300, 350, 400, 450, 500, 600, 700, and 800 A ratings.
- Available in 2- and 3-pole unit-mount and I-Line versions

**Table 33: Termination Options**

Frame	Termination Letter	Termination Option
	F	No Lugs
M-Frame	L	Lugs both ends
	M	Lugs ON end Terminal Nut Kit Off end
	P	Lugs OFF end Terminal Nut Kit On end

For factory-installed termination, place termination letter in the third block of the circuit breaker catalog number.

**M, G, L, 3, 6, 4, 0, 0** or **D, G, L, 3, 6, 4, 0, 0, E, 2, 0**

└─ Termination Letter ─┘



M-Frame Unit-Mount



M-Frame I-Line

- Built-in electronic trip unit type ET 1.0 provides better accuracy than standard thermal-magnetic trip units. The ET 1.0 trip unit cannot be field replaced, nor does it allow adjustment of the trip point setting. (It is considered an electronic equivalent of a thermal-magnetic circuit breaker.)
- Fixed long-time and adjustable instantaneous protection (2 to 10 times nominal ampere rating) is standard.
- Same dimensions, common mounting, bussing, cabling and door cut-out as PowerPact P-frame circuit breakers.
- Approximately 15% smaller installed volume than the MA/MH circuit breakers.
- A full range of electrical accessories are available:
  - Shunt trip (various AC and DC voltages are available)
  - Undervoltage trip (various AC and DC voltages are available)
  - Time delayed undervoltage trip (various AC and DC voltages are available)
  - Auxiliary switches (up to 3A/3B); low-level switches are also available (voltage and amperage)
  - Alarm switch (1A/1B); low-level switches are also available (voltage and amperage)
  - Overcurrent trip switch (SDE)
- A full range of mechanical accessories are available:
  - Standard mechanical lugs (aluminum or copper)
  - Crimp (compression) lugs (aluminum or copper)
  - Power distribution lugs (aluminum only)
  - Bus connector kit
  - Inter-phase barriers
  - Door escutcheons (for toggle or accessory cover)
  - Padlocking device (removable or fixed version), complies with OSHA requirements
  - Key-lock device (Kirk® or Schneider Electric™ keylocks)

# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

## Section 3—PowerPact M-Frame Molded Case Circuit Breakers

### Catalog Numbers

**Table 34: UL/IEC Rated, Unit-Mount, Manually-Operated, Standard-Rated Electronic Trip Circuit Breakers with Non-Interchangeable 1.0 Electronic Trip (Fixed Long-Time and Adjustable Instantaneous Trip Settings)**

Type	Poles	Current Rating							
		300 A	350 A	400 A	450 A	500 A	600 A	700 A	800 A
MG	2	MGL26300	MGL26350	MGL26400	MGL26450	MGL26500	MGL26600	MGL26700	MGL26800
MJ	2	MJL26300	MJL26350	MJL26400	MJL26450	MJL26500	MJL26600	MJL26700	MJL26800
MG	3	MGL36300	MGL36350	MGL36400	MGL36450	MGL36500	MGL36600	MGL36700	MGL36800
MJ	3	MJL36300	MJL36350	MJL36400	MJL36450	MJL36500	MJL36600	MJL36700	MJL36800

**Table 35: UL/IEC Rated, I-Line™, Manually-Operated, Standard-Rated Electronic Trip Circuit Breakers with Non-Interchangeable 1.0 Electronic Trip (Fixed Long-Time and Adjustable Instantaneous Trip Settings)**

Type	Poles	Current Rating							
		300 A	350 A	400 A	450 A	500 A	600 A	700 A	800 A
MG <sup>1</sup>	2	MGA263002	MGA263502	MGA264002	MGA264502	MGA265002	MGA266002	MGA267002	MGA268002
MJ <sup>1</sup>	2	MJA263002	MJA263502	MJA264002	MJA264502	MJA265002	MJA266002	MJA267002	MJA268002
MG <sup>2</sup>	3	MGA36300	MGA36350	MGA36400	MGA36450	MGA36500	MGA36600	MGA36700	MGA36800
MJ <sup>2</sup>	3	MJA36300	MJA36350	MJA36400	MJA36450	MJA36500	MJA36600	MJA36700	MJA36800

<sup>1</sup> Suffix 2 is for AC phasing (standard offer), or use 5 for CA phasing (option).

<sup>2</sup> No suffix is for ABC phasing (standard offer), or use 6 for CBA phasing (option).

### Interrupting Ratings

**Table 36: Interrupting Ratings**

Mounting	Circuit Breaker	Interrupting Ratings						
		UL/CSA/NMX			IEC 60947-2			
		240 Vac	480 Vac	600 Vac	240 Vac		380/415 Vac	
					Icu	Ics	Icu	Ics
Individually-Mounted	MG	65 kA	35 kA	18 kA	50 kA	25 kA	35 kA	20 kA
	MJ	100 kA	65 kA	25 kA	65 kA	35 kA	50 kA	25 kA
I-Line	MG	65 kA	35 kA	18 kA	50 kA	25 kA	35 kA	20 kA
	MJ	100 kA	65 kA	25 kA	65 kA	35 kA	50 kA	25 kA



M-Frame Unit-Mount



M-Frame I-Line

### Termination Information

Unit-mount circuit breakers have mechanical lugs standard on both ends. I-Line circuit breakers have lugs standard on the O/OFF end. These lugs accept aluminum or copper wire. See Table 88 on page 86 for more lug options.

### Accessories

Accessories are available either factory- or field-installed. They can be installed in accessory compartments behind the circuit breaker accessory cover. See Table 62 on page 70 for available accessories.

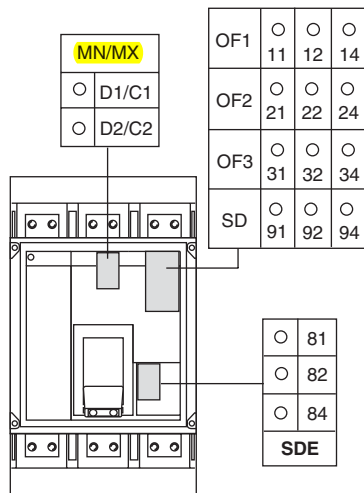
## Control Wiring

Control wiring is connected to terminals located under the circuit breaker accessory cover.

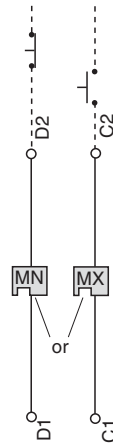
**NOTE:** All diagrams show circuit breaker in open position

**Figure 1: Accessory Control Wiring Diagrams**

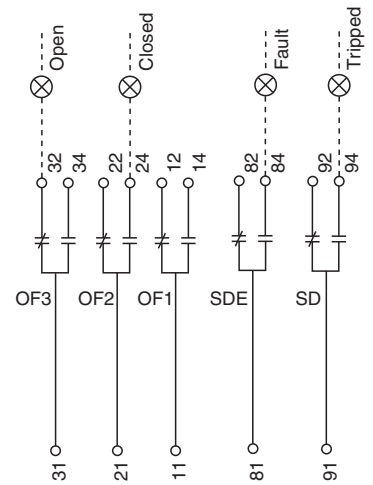
Function	Connector	Description
Auxiliary Contacts	OF	Open/Closed Circuit Breaker Position Contacts
	SD	Bell Alarm
Remote Operation	MN	Undervoltage Trip Device
	MX	Shunt Trip



### Remote Operation



### Alarm Contacts





## Section 4—PowerPact P-Frame Molded Case Circuit Breakers

### Performance

Providing unparalleled performance and control, the P-frame circuit breakers features the exclusive Micrologic™ electronic trip units, which allow for a range of sophisticated applications for metering and monitoring. In addition, trip units can be interchanged in the field to allow for maximum flexibility.

The compact size and small footprint of the P-frame circuit breaker permits high density installations in I-Line™ panelboards and switchboards. These circuit breakers are available in 100% rated construction for all unit-mount circuit breakers and up to 800 A in I-Line circuit breakers to meet a broad range of commercial and industrial application needs.

- Both standard (80%) and 100% rated construction circuit breakers are available in 1200 A with a sensor size range of 250–1200 A.
- Interrupting ratings (AIR):

Voltage	G	J	K	L
240 Vac	65 kA	100 kA	65 kA	125 kA
480 Vac	35 kA	65 kA	50 kA	100 kA
600 Vac	18 kA	25 kA	50 kA	25 kA

- The P-frame circuit breakers with K interrupting rating are recommended for applications having high inrush and/or non-linear loads such as large motors, transformers, motors with soft starts, etc.
- Compact circuit breaker size allows for small footprint installations using I-Line panelboards and switchboards. Nine inch width provides increased density installation.
- Most field-installable accessories are common to all frame sizes for easier stocking and installation
- Selection of four interchangeable Micrologic trip units available, with Powerlogic™ power metering and monitoring capabilities available in advanced trip units.
- Field-installable sensor plugs (after January 2007). See Table 74 on page 78.
- Compatible with Powerlogic systems and high amperage power circuit breakers.
- Built-in Modbus® protocol provides an open communications platform and eliminates the need to purchase additional, proprietary network solutions.
- Connection options include bus, cable or I-Line for installation flexibility.
- Additional options are available for 5-cycle closing, stored energy mechanisms and drawout-mounting.



P-Frame Unit-Mount



P-Frame I-Line



P-Frame Drawout

**PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers**  
**Section 4—PowerPact P-Frame Molded Case Circuit Breakers**

**Catalog Numbers**

**Table 37: UL/IEC Rated, Unit-Mount<sup>1</sup>, Manually-Operated, Standard-Rated Electronic Trip Circuit Breakers with Basic Electronic Trip and Micrologic™ Electronic Trip Unit**

Trip Unit		Circuit Breaker Catalog Number <sup>2</sup>					
		Current Rating (Sensor Rating)					
	Type	250 A <sup>3</sup>	400 A	600 A	800 A	1000 A	1200 A
Basic Electronic Trip Unit (Not Interchangeable)	ET1.0I	—	—	PGL36060	PGL36080	PGL36100	PGL36120
	2P <sup>4</sup> , 3P	—	—	PJL36060	PJL36080	PJL36100	PJL36120
	Fixed	—	—	PKL36060	PKL36080	PKL36100	PKL36120
	Long-time	—	—	PLL34060	PLL34080	PLL34100	PLL34120
Micrologic Interchangeable Standard Trip Unit	3.0 (LI) 3P, 4P <sup>5</sup> (G & K only)	PGL36025U31A	PGL36040U31A	PGL36060U31A	PGL36080U31A	PGL36100U31A	PGL36120U31A
		PJL36025U31A	PJL36040U31A	PJL36060U31A	PJL36080U31A	PJL36100U31A	PJL36120U31A
		PKL36025U31A	PKL36040U31A	PKL36060U31A	PKL36080U31A	PKL36100U31A	PKL36120U31A
		PLL34025U31A	PLL34040U31A	PLL34060U31A	PLL34080U31A	PLL34100U31A	PLL34120U31A
	5.0 (LSI) 3P 4P <sup>5</sup> (G & K only)	PGL36025U33A	PGL36040U33A	PGL36060U33A	PGL36080U33A	PGL36100U33A	PGL36120U33A
		PJL36025U33A	PJL36040U33A	PJL36060U33A	PJL36080U33A	PJL36100U33A	PJL36120U33A
		PKL36025U33A	PKL36040U33A	PKL36060U33A	PKL36080U33A	PKL36100U33A	PKL36120U33A
		PLL34025U33A	PLL34040U33A	PLL34060U33A	PLL34080U33A	PLL34100U33A	PLL34120U33A
Micrologic Interchangeable Ammeter Trip Unit <sup>6</sup>	3.0A (LI) 3P 4P <sup>5</sup> (G & K only)	PGL36025U41A	PGL36040U41A	PGL36060U41A	PGL36080U41A	PGL36100U41A	PGL36120U41A
		PJL36025U41A	PJL36040U41A	PJL36060U41A	PJL36080U41A	PJL36100U41A	PJL36120U41A
		PKL36025U41A	PKL36040U41A	PKL36060U41A	PKL36080U41A	PKL36100U41A	PKL36120U41A
		PLL34025U41A	PLL34040U41A	PLL34060U41A	PLL34080U41A	PLL34100U41A	PLL34120U41A
	5.0A (LSI) 3P 4P <sup>5</sup> (G & K only)	PGL36025U43A	PGL36040U43A	PGL36060U43A	PGL36080U43A	PGL36100U43A	PGL36120U43A
		PJL36025U43A	PJL36040U43A	PJL36060U43A	PJL36080U43A	PJL36100U43A	PJL36120U43A
		PKL36025U43A	PKL36040U43A	PKL36060U43A	PKL36080U43A	PKL36100U43A	PKL36120U43A
		PLL34025U43A	PLL34040U43A	PLL34060U43A	PLL34080U43A	PLL34100U43A	PLL34120U43A
	6.0A (LSIG) 3P 4P <sup>5</sup> (G & K only)	PGL36025U44A	PGL36040U44A	PGL36060U44A	PGL36080U44A	PGL36100U44A	PGL36120U44A
		PJL36025U44A	PJL36040U44A	PJL36060U44A	PJL36080U44A	PJL36100U44A	PJL36120U44A
		PKL36025U44A	PKL36040U44A	PKL36060U44A	PKL36080U44A	PKL36100U44A	PKL36120U44A
		PLL34025U44A	PLL34040U44A	PLL34060U44A	PLL34080U44A	PLL34100U44A	PLL34120U44A
Micrologic Interchangeable Power Trip Unit with Modbus <sup>®</sup> Communications	5.0P (LSI) 3P 4P <sup>5</sup> (G & K only)	PGL36025U63AE1	PGL36040U63AE1	PGL36060U63AE1	PGL36080U63AE1	PGL36100U63AE1	PGL36120U63AE1
		PJL36025U63AE1	PJL36040U63AE1	PJL36060U63AE1	PJL36080U63AE1	PJL36100U63AE1	PJL36120U63AE1
		PKL36025U63AE1	PKL36040U63AE1	PKL36060U63AE1	PKL36080U63AE1	PKL36100U63AE1	PKL36120U63AE1
		PLL34025U63AE1	PLL34040U63AE1	PLL34060U63AE1	PLL34080U63AE1	PLL34100U63AE1	PLL34120U63AE1
	6.0P (LSIG) 3P 4P <sup>5</sup> (G & K only)	PGL36025U64AE1	PGL36040U64AE1	PGL36060U64AE1	PGL36080U64AE1	PGL36100U64AE1	PGL36120U64AE1
		PJL36025U64AE1	PJL36040U64AE1	PJL36060U64AE1	PJL36080U64AE1	PJL36100U64AE1	PJL36120U64AE1
		PKL36025U64AE1	PKL36040U64AE1	PKL36060U64AE1	PKL36080U64AE1	PKL36100U64AE1	PKL36120U64AE1
		PLL34025U64AE1	PLL34040U64AE1	PLL34060U64AE1	PLL34080U64AE1	PLL34100U64AE1	PLL34120U64AE1
Micrologic Interchangeable Harmonic Trip Unit with Modbus Communications	5.0H (LSI) 3P 4P <sup>5</sup> (G & K only)	PGL36025U73AE1	PGL36040U73AE1	PGL36060U73AE1	PGL36080U73AE1	PGL36100U73AE1	PGL36120U73AE1
		PJL36025U73AE1	PJL36040U73AE1	PJL36060U73AE1	PJL36080U73AE1	PJL36100U73AE1	PJL36120U73AE1
		PKL36025U73AE1	PKL36040U73AE1	PKL36060U73AE1	PKL36080U73AE1	PKL36100U73AE1	PKL36120U73AE1
		PLL34025U73AE1	PLL34040U73AE1	PLL34060U73AE1	PLL34080U73AE1	PLL34100U73AE1	PLL34120U73AE1
	6.0H (LSIG) 3P 4P <sup>5</sup> (G & K only)	PGL36025U74AE1	PGL36040U74AE1	PGL36060U74AE1	PGL36080U74AE1	PGL36100U74AE1	PGL36120U74AE1
		PJL36025U74AE1	PJL36040U74AE1	PJL36060U74AE1	PJL36080U74AE1	PJL36100U74AE1	PJL36120U74AE1
		PKL36025U74AE1	PKL36040U74AE1	PKL36060U74AE1	PKL36080U74AE1	PKL36100U74AE1	PKL36120U74AE1
		PLL34025U74AE1	PLL34040U74AE1	PLL34060U74AE1	PLL34080U74AE1	PLL34100U74AE1	PLL34120U74AE1

1 Catalog numbers are for circuit breakers with lugs on line and load ends. Consult the *Product Selector* for catalog numbers for circuit breakers with alternate terminations.  
2 The L interrupting rating at 600 Vac is 25 kA.  
3 250 A is not available as a 4 pole circuit breaker.  
4 For 2P, replace the leading 3 in the catalog number following the prefix with a 2 (PGL36025 becomes PGL<sub>2</sub>6025.)  
5 For 4P (available in G and K interrupting levels only), replace the leading 3 in the catalog number following the prefix with a 4 (PGL36040U31A becomes PGL<sub>4</sub>6040U31A).  
6 Add E1 suffix for Modbus communications.

**PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers**  
**Section 4—PowerPact P-Frame Molded Case Circuit Breakers**

**Table 38: UL/IEC Rated, Unit-Mount<sup>1</sup>, Manually-Operated, 100%-Rated Electronic Trip Circuit Breakers with Micrologic™ Electronic Trip Units**

Trip Unit, Interchangeable 3P, 4P	Circuit Breaker Catalog Number <sup>2</sup>					
	Current Rating (Sensor Rating)					
Type	250 A <sup>3</sup>	400 A	600 A	800 A	1000 A	1200 A
<b>Micrologic Interchangeable Standard Trip Unit</b>						
3.0 (LI) 3P 4P <sup>4</sup> (G & K only)	PGL36025CU31A	PGL36040CU31A	PGL36060CU31A	PGL36080CU31A	PGL36100CU31A	PGL36120CU31A
	PJL36025CU31A	PJL36040CU31A	PJL36060CU31A	PJL36080CU31A	PJL36100CU31A	PJL36120CU31A
	PKL36025CU31A	PKL36040CU31A	PKL36060CU31A	PKL36080CU31A	PKL36100CU31A	PKL36120CU31A
	PLL34025CU31A	PLL34040CU31A	PLL34060CU31A	PLL34080CU31A	PLL34100CU31A	PLL34120CU31A
5.0 (LSI) 3P 4P <sup>4</sup> (G & K only)	PGL36025CU33A	PGL36040CU33A	PGL36060CU33A	PGL36080CU33A	PGL36100CU33A	PGL36120CU33A
	PJL36025CU33A	PJL36040CU33A	PJL36060CU33A	PJL36080CU33A	PJL36100CU33A	PJL36120CU33A
	PKL36025CU33A	PKL36040CU33A	PKL36060CU33A	PKL36080CU33A	PKL36100CU33A	PKL36120CU33A
	PLL34025CU33A	PLL34040CU33A	PLL34060CU33A	PLL34080CU33A	PLL34100CU33A	PLL34120CU33A
<b>Micrologic Interchangeable Ammeter Trip Unit<sup>5</sup></b>						
3.0A (LI) 3P 4P <sup>4</sup> (G & K only)	PGL36025CU41A	PGL36040CU41A	PGL36060CU41A	PGL36080CU41A	PGL36100CU41A	PGL36120CU41A
	PJL36025CU41A	PJL36040CU41A	PJL36060CU41A	PJL36080CU41A	PJL36100CU41A	PJL36120CU41A
	PKL36025CU41A	PKL36040CU41A	PKL36060CU41A	PKL36080CU41A	PKL36100CU41A	PKL36120CU41A
	PLL34025CU41A	PLL34040CU41A	PLL34060CU41A	PLL34080CU41A	PLL34100CU41A	PLL34120CU41A
5.0A (LSI) 3P 4P <sup>4</sup> (G & K only)	PGL36025CU43A	PGL36040CU43A	PGL36060CU43A	PGL36080CU43A	PGL36100CU43A	PGL36120CU43A
	PJL36025CU43A	PJL36040CU43A	PJL36060CU43A	PJL36080CU43A	PJL36100CU43A	PJL36120CU43A
	PKL36025CU43A	PKL36040CU43A	PKL36060CU43A	PKL36080CU43A	PKL36100CU43A	PKL36120CU43A
	PLL34025CU43A	PLL34040CU43A	PLL34060CU43A	PLL34080CU43A	PLL34100CU43A	PLL34120CU43A
6.0A (LSIG) 3P 4P <sup>4</sup> (G & K only)	PGL36025CU44A	PGL36040CU44A	PGL36060CU44A	PGL36080CU44A	PGL36100CU44A	PGL36120CU44A
	PJL36025CU44A	PJL36040CU44A	PJL36060CU44A	PJL36080CU44A	PJL36100CU44A	PJL36120CU44A
	PKL36025CU44A	PKL36040CU44A	PKL36060CU44A	PKL36080CU44A	PKL36100CU44A	PKL36120CU44A
	PLL34025CU44A	PLL34040CU44A	PLL34060CU44A	PLL34080CU44A	PLL34100CU44A	PLL34120CU44A
<b>Micrologic Interchangeable Power Trip Unit with Modbus® Communications</b>						
5.0P (LSI) 3P 4P <sup>4</sup> (G & K only)	PGL36025CU63AE1	PGL36040CU63AE1	PGL36060CU63AE1	PGL36080CU63AE1	PGL36100CU63AE1	PGL36120CU63AE1
	PJL36025CU63AE1	PJL36040CU63AE1	PJL36060CU63AE1	PJL36080CU63AE1	PJL36100CU63AE1	PJL36120CU63AE1
	PKL36025CU63AE1	PKL36040CU63AE1	PKL36060CU63AE1	PKL36080CU63AE1	PKL36100CU63AE1	PKL36120CU63AE1
	PLL34025CU63AE1	PLL34040CU63AE1	PLL34060CU63AE1	PLL34080CU63AE1	PLL34100CU63AE1	PLL34120CU63AE1
6.0P (LSIG) 3P 4P <sup>4</sup> (G & K only)	PGL36025CU64AE1	PGL36040CU64AE1	PGL36060CU64AE1	PGL36080CU64AE1	PGL36100CU64AE1	PGL36120CU64AE1
	PJL36025CU64AE1	PJL36040CU64AE1	PJL36060CU64AE1	PJL36080CU64AE1	PJL36100CU64AE1	PJL36120CU64AE1
	PKL36025CU64AE1	PKL36040CU64AE1	PKL36060CU64AE1	PKL36080CU64AE1	PKL36100CU64AE1	PKL36120CU64AE1
	PLL34025CU64AE1	PLL34040CU64AE1	PLL34060CU64AE1	PLL34080CU64AE1	PLL34100CU64AE1	PLL34120CU64AE1
<b>Micrologic Interchangeable Harmonic Trip Unit with Modbus Communications</b>						
5.0H (LSI) 3P 4P <sup>4</sup> (G & K only)	PGL36025CU73AE1	PGL36040CU73AE1	PGL36060CU73AE1	PGL36080CU73AE1	PGL36100CU73AE1	PGL36120CU73AE1
	PJL36025CU73AE1	PJL36040CU73AE1	PJL36060CU73AE1	PJL36080CU73AE1	PJL36100CU73AE1	PJL36120CU73AE1
	PKL36025CU73AE1	PKL36040CU73AE1	PKL36060CU73AE1	PKL36080CU73AE1	PKL36100CU73AE1	PKL36120CU73AE1
	PLL34025CU73AE1	PLL34040CU73AE1	PLL34060CU73AE1	PLL34080CU73AE1	PLL34100CU73AE1	PLL34120CU73AE1
6.0H (LSIG) 3P 4P <sup>4</sup> (G & K only)	PGL36025CU74AE1	PGL36040CU74AE1	PGL36060CU74AE1	PGL36080CU74AE1	PGL36100CU74AE1	PGL36120CU74AE1
	PJL36025CU74AE1	PJL36040CU74AE1	PJL36060CU74AE1	PJL36080CU74AE1	PJL36100CU74AE1	PJL36120CU74AE1
	PKL36025CU74AE1	PKL36040CU74AE1	PKL36060CU74AE1	PKL36080CU74AE1	PKL36100CU74AE1	PKL36120CU74AE1
	PLL34025CU74AE1	PLL34040CU74AE1	PLL34060CU74AE1	PLL34080CU74AE1	PLL34100CU74AE1	PLL34120CU74AE1

<sup>1</sup> Catalog numbers are for circuit breakers with lugs on line and load ends. Consult the product selector for catalog numbers for circuit breakers with alternate terminations.  
<sup>2</sup> The L interrupting rating at 600 Vac is 25 kA.  
<sup>3</sup> 250 A is not available as a 4 pole circuit breaker.  
<sup>4</sup> For 4P (available in G and K interrupting levels only), replace the leading 3 in the catalog number following the prefix with a 4 (PGL36040CU31A becomes PGL46040CU31A).  
<sup>5</sup> Add E1 suffix for Modbus communications.

# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

## Section 4—PowerPact P-Frame Molded Case Circuit Breakers

**Table 39: UL/IEC Rated, I-Line, Manually-Operated, Standard-Rated Electronic Trip Circuit Breakers with Basic Electronic Trip and Micrologic™ Electronic Trip Units**

Trip Unit		Circuit Breaker Catalog Number <sup>1</sup>					
		Current Rating (Sensor Rating)					
	Type <sup>2</sup>	250 A	400 A	600 A	800 A	1000 A	1200 A
Basic Electronic Trip Unit Not Interchangeable	ET1.0I	—	—	PGA36060	PGA36080	PGA36100	PGA36120
	2P <sup>3</sup> , 3P	—	—	PJA36060	PJA36080	PJA36100	PJA36120
	Fixed	—	—	PKA36060	PKA36080	PKA36100	PKA36120
	Long-time	—	—	PLA34060	PLA34080	PLA34100	PLA34120
Micrologic Interchangeable Standard Trip Unit	3.0 (LI) 3P	PGA36025U31A	PGA36040U31A	PGA36060U31A	PGA36080U31A	PGA36100U31A	PGA36120U31A
		PJA36025U31A	PJA36040U31A	PJA36060U31A	PJA36080U31A	PJA36100U31A	PJA36120U31A
		PKA36025U31A	PKA36040U31A	PKA36060U31A	PKA36080U31A	PKA36100U31A	PKA36120U31A
		PLA34025U31A	PLA34040U31A	PLA34060U31A	PLA34080U31A	PLA34100U31A	PLA34120U31A
	5.0 (LSI) 3P	PGA36025U33A	PGA36040U33A	PGA36060U33A	PGA36080U33A	PGA36100U33A	PGA36120U33A
		PJA36025U33A	PJA36040U33A	PJA36060U33A	PJA36080U33A	PJA36100U33A	PJA36120U33A
		PKA36025U33A	PKA36040U33A	PKA36060U33A	PKA36080U33A	PKA36100U33A	PKA36120U33A
		PLA34025U33A	PLA34040U33A	PLA34060U33A	PLA34080U33A	PLA34100U33A	PLA34120U33A
Micrologic Interchangeable Ammeter Trip Unit <sup>4</sup>	3.0A (LI) 3P	PGA36025U41A	PGA36040U41A	PGA36060U41A	PGA36080U41A	PGA36100U41A	PGA36120U41A
		PJA36025U41A	PJA36040U41A	PJA36060U41A	PJA36080U41A	PJA36100U41A	PJA36120U41A
		PKA36025U41A	PKA36040U41A	PKA36060U41A	PKA36080U41A	PKA36100U41A	PKA36120U41A
		PLA34025U41A	PLA34040U41A	PLA34060U41A	PLA34080U41A	PLA34100U41A	PLA34120U41A
	5.0A (LSI) 3P	PGA36025U43A	PGA36040U43A	PGA36060U43A	PGA36080U43A	PGA36100U43A	PGA36120U43A
		PJA36025U43A	PJA36040U43A	PJA36060U43A	PJA36080U43A	PJA36100U43A	PJA36120U43A
		PKA36025U43A	PKA36040U43A	PKA36060U43A	PKA36080U43A	PKA36100U43A	PKA36120U43A
		PLA34025U43A	PLA34040U43A	PLA34060U43A	PLA34080U43A	PLA34100U43A	PLA34120U43A
6.0A (LSIG) 3P	PGA36025U44A	PGA36040U44A	PGA36060U44A	PGA36080U44A	PGA36100U44A	PGA36120U44A	
	PJA36025U44A	PJA36040U44A	PJA36060U44A	PJA36080U44A	PJA36100U44A	PJA36120U44A	
	PKA36025U44A	PKA36040U44A	PKA36060U44A	PKA36080U44A	PKA36100U44A	PKA36120U44A	
	PLA34025U44A	PLA34040U44A	PLA34060U44A	PLA34080U44A	PLA34100U44A	PLA34120U44A	
Micrologic Interchangeable Power Trip Unit with Modbus <sup>®</sup> Communications	5.0P (LSI) 3P	PGA36025U63AE1	PGA36040U63AE1	PGA36060U63AE1	PGA36080U63AE1	PGA36100U63AE1	PGA36120U63AE1
		PJA36025U63AE1	PJA36040U63AE1	PJA36060U63AE1	PJA36080U63AE1	PJA36100U63AE1	PJA36120U63AE1
		PKA36025U63AE1	PKA36040U63AE1	PKA36060U63AE1	PKA36080U63AE1	PKA36100U63AE1	PKA36120U63AE1
		PLA34025U63AE1	PLA34040U63AE1	PLA34060U63AE1	PLA34080U63AE1	PLA34100U63AE1	PLA34120U63AE1
	6.0P (LSIG) 3P	PGA36025U64AE1	PGA36040U64AE1	PGA36060U64AE1	PGA36080U64AE1	PGA36100U64AE1	PGA36120U64AE1
		PJA36025U64AE1	PJA36040U64AE1	PJA36060U64AE1	PJA36080U64AE1	PJA36100U64AE1	PJA36120U64AE1
		PKA36025U64AE1	PKA36040U64AE1	PKA36060U64AE1	PKA36080U64AE1	PKA36100U64AE1	PKA36120U64AE1
		PLA34025U64AE1	PLA34040U64AE1	PLA34060U64AE1	PLA34080U64AE1	PLA34100U64AE1	PLA34120U64AE1
Micrologic Interchangeable Harmonic Trip Unit with Modbus Communications	5.0H (LSI) 3P	PGA36025U73AE1	PGA36040U73AE1	PGA36060U73AE1	PGA36080U73AE1	PGA36100U73AE1	PGA36120U73AE1
		PJA36025U73AE1	PJA36040U73AE1	PJA36060U73AE1	PJA36080U73AE1	PJA36100U73AE1	PJA36120U73AE1
		PKA36025U73AE1	PKA36040U73AE1	PKA36060U73AE1	PKA36080U73AE1	PKA36100U73AE1	PKA36120U73AE1
		PLA34025U73AE1	PLA34040U73AE1	PLA34060U73AE1	PLA34080U73AE1	PLA34100U73AE1	PLA34120U73AE1
	6.0H (LSIG) 3P	PGA36025U74AE1	PGA36040U74AE1	PGA36060U74AE1	PGA36080U74AE1	PGA36100U74AE1	PGA36120U74AE1
		PJA36025U74AE1	PJA36040U74AE1	PJA36060U74AE1	PJA36080U74AE1	PJA36100U74AE1	PJA36120U74AE1
		PKA36025U74AE1	PKA36040U74AE1	PKA36060U74AE1	PKA36080U74AE1	PKA36100U74AE1	PKA36120U74AE1
		PLA34025U74AE1	PLA34040U74AE1	PLA34060U74AE1	PLA34080U74AE1	PLA34100U74AE1	PLA34120U74AE1

<sup>1</sup> The L interrupting rating at 600 Vac is 25 kA.

<sup>2</sup> For 3P, no suffix is for ABC phasing (standard offer), or use 6 for CBA phasing (option).

<sup>3</sup> For 2P, replace the leading 3 in the catalog number following the prefix with a 2 (PGA36025 becomes PGA<sub>2</sub>6025). Add the suffix 2 for AC phasing (standard offer), or use 5 for CA phasing (option).

<sup>4</sup> Add E1 suffix for Modbus communications.

# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

## Section 4—PowerPact P-Frame Molded Case Circuit Breakers

**Table 40: UL/IEC Rated, I-Line, Manually-Operated, 100%-Rated Electronic Trip Circuit Breakers with Micrologic™ Electronic Trip Units**

Trip Unit, Interchangeable		Circuit Breaker <sup>1</sup>			
		Current Rating (Sensor Rating)			
	Type <sup>2</sup>	250 A	400 A	600 A	800 A
Micrologic Interchangeable Standard Trip Unit	3.0 (LI) 3P	PGA36025CU31A	PGA36040CU31A	PGA36060CU31A	PGA36080CU31A
		PJA36025CU31A	PJA36040CU31A	PJA36060CU31A	PJA36080CU31A
		PKA36025CU31A	PKA36040CU31A	PKA36060CU31A	PKA36080CU31A
		PLA34025CU31A	PLA34040CU31A	PLA34060CU31A	PLA34080CU31A
	5.0 (LSI) 3P	PGA36025CU33A	PGA36040CU33A	PGA36060CU33A	PGA36080CU33A
		PJA36025CU33A	PJA36040CU33A	PJA36060CU33A	PJA36080CU33A
		PKA36025CU33A	PKA36040CU33A	PKA36060CU33A	PKA36080CU33A
		PLA34025CU33A	PLA34040CU33A	PLA34060CU33A	PLA34080CU33A
Micrologic Interchangeable Ammeter Trip Unit <sup>3</sup>	3.0A (LI) 3P	PGA36025CU41A	PGA36040CU41A	PGA36060CU41A	PGA36080CU41A
		PJA36025CU41A	PJA36040CU41A	PJA36060CU41A	PJA36080CU41A
		PKA36025CU41A	PKA36040CU41A	PKA36060CU41A	PKA36080CU41A
		PLA34025CU41A	PLA34040CU41A	PLA34060CU41A	PLA34080CU41A
	5.0A (LSI) 3P	PGA36025CU43A	PGA36040CU43A	PGA36060CU43A	PGA36080CU43A
		PJA36025CU43A	PJA36040CU43A	PJA36060CU43A	PJA36080CU43A
		PKA36025CU43A	PKA36040CU43A	PKA36060CU43A	PKA36080CU43A
		PLA34025CU43A	PLA34040CU43A	PLA34060CU43A	PLA34080CU43A
	6.0A (LSIG) 3P	PGA36025CU44A	PGA36040CU44A	PGA36060CU44A	PGA36080CU44A
		PJA36025CU44A	PJA36040CU44A	PJA36060CU44A	PJA36080CU44A
		PKA36025CU44A	PKA36040CU44A	PKA36060CU44A	PKA36080CU44A
		PLA34025CU44A	PLA34040CU44A	PLA34060CU44A	PLA34080CU44A
Micrologic Interchangeable Power Trip Unit with Modbus® Communications	5.0P (LSI) 3P	PGA36025CU63AE1	PGA36040CU63AE1	PGA36060CU63AE1	PGA36080CU63AE1
		PJA36025CU63AE1	PJA36040CU63AE1	PJA36060CU63AE1	PJA36080CU63AE1
		PKA36025CU63AE1	PKA36040CU63AE1	PKA36060CU63AE1	PKA36080CU63AE1
		PLA34025CU63AE1	PLA34040CU63AE1	PLA34060CU63AE1	PLA34080CU63AE1
	6.0P (LSIG) 3P	PGA36025CU64AE1	PGA36040CU64AE1	PGA36060CU64AE1	PGA36080CU64AE1
		PJA36025CU64AE1	PJA36040CU64AE1	PJA36060CU64AE1	PJA36080CU64AE1
		PKA36025CU64AE1	PKA36040CU64AE1	PKA36060CU64AE1	PKA36080CU64AE1
		PLA34025CU64AE1	PLA34040CU64AE1	PLA34060CU64AE1	PLA34080CU64AE1
Micrologic Interchangeable Harmonic Trip Unit with Modbus Communications	5.0H (LSI) 3P	PGA36025CU73AE1	PGA36040CU73AE1	PGA36060CU73AE1	PGA36080CU73AE1
		PJA36025CU73AE1	PJA36040CU73AE1	PJA36060CU73AE1	PJA36080CU73AE1
		PKA36025CU73AE1	PKA36040CU73AE1	PKA36060CU73AE1	PKA36080CU73AE1
		PLA34025CU73AE1	PLA34040CU73AE1	PLA34060CU73AE1	PLA34080CU73AE1
	6.0H (LSIG) 3P	PGA36025CU74AE1	PGA36040CU74AE1	PGA36060CU74AE1	PGA36080CU74AE1
		PJA36025CU74AE1	PJA36040CU74AE1	PJA36060CU74AE1	PJA36080CU74AE1
		PKA36025CU74AE1	PKA36040CU74AE1	PKA36060CU74AE1	PKA36080CU74AE1
		PLA34025CU74AE1	PLA34040CU74AE1	PLA34060CU74AE1	PLA34080CU74AE1

- <sup>1</sup> The L interrupting rating at 600 Vac is 25 kA.
- <sup>2</sup> No suffix is for ABC phasing (standard offer), or use 6 for CBA phasing (option).
- <sup>3</sup> Add E1 suffix for Modbus communications.

**Table 41: P-Frame Termination Options**

F = No Lugs (Includes terminal nut kit on both ends)  
 L = Lugs both ends  
 M = Lugs I/ON end, terminal nut kit O/OFF end  
 P = Lugs O/OFF end, terminal nut kit I/ON end  
 D = Drawout  
 A = I-Line

For factory-installed termination, place termination letter in the third block of the circuit breaker catalog number.

**P, G, L, 3, 6, 0, 4, 0, U, 4, 1, A**  
 └ Termination Letter

**Table 42: P-Frame Interrupting Ratings**

Voltage	P-Frame Interrupting Rating			
	G	J	K	L
240 Vac	65 kA	100 kA	65 kA	125 kA
480 Vac	35 kA	65 kA	50 kA	100 kA
600 Vac	18 kA	25 kA	50 kA	25 kA

**PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers**  
**Section 4—PowerPact P-Frame Molded Case Circuit Breakers**

**Continuous Current Rating**

All circuit breakers marked as 100% rated can be continuously loaded to 100% of their rating.

Because of additional heat generated when applying circuit breakers at 100% of continuous current rating, the use of specially-designed enclosures and 90°C (194°F) wire is required. The 90°C (194°F) wire must be sized according to the ampacity of the 75°C (167°F) wire column in the NEC. Minimum enclosure size and ventilation specifications are indicated on the circuit breaker and in its instruction bulletin and in Table 5 on page 11.

Circuit breakers with 100% rating can also be used in applications requiring only 80% continuous loading.

**Interrupting Ratings**

**Table 43: Interrupting Ratings**

Mounting	Circuit Breaker	Ampere Rating (A)		Interrupting Ratings						
		Basic Electronic Trip Units	Micrologic™ Trip Units	UL/CSA/NMX			IEC 60947-2			
				240 Vac	480 Vac	600 Vac	240 Vac		380/415 Vac	
							Icu	Ics	Icu	Ics
Individually-Mounted	PG	600, 800, 1000, 1200	250, 400, 600, 800, 1000, 1200	65 kA	35 kA	18 kA	50 kA	25 kA	35 kA	20 kA
	PJ			100 kA	65 kA	25 kA	65 kA	35 kA	50 kA	25 kA
	PK			65 kA	50 kA	50 kA <sup>1</sup>	50 kA	25 kA	50 kA	25 kA
	PL			125 kA	100 kA	25 kA <sup>1</sup>	125 kA	65 kA	85 kA	45 kA
I-Line™	PG	600, 800, 1000, 1200	250, 400, 600, 800, 1000, 1200	65 kA	35 kA	18 kA	50 kA	25 kA	35 kA	20 kA
	PJ			100 kA	65 kA	25 kA	65 kA	35 kA	50 kA	25 kA
	PK			65 kA	50 kA	50 kA <sup>1</sup>	50 kA	25 kA	50 kA	25 kA
	PL			125 kA	100 kA	25 kA <sup>1</sup>	125 kA	65 kA	85 kA	45 kA

<sup>1</sup> Non-standard AIR.

**PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers**  
**Section 4—PowerPact P-Frame Molded Case Circuit Breakers**

**Automatic Molded Case Switches<sup>1</sup>**

Automatic molded case switches are available in individually-mounted and I-Line constructions from 600–1200 A. Automatic switches are similar in construction to electronic trip circuit breakers except that long-time tripping is not present. The switches open instantaneously at a non-adjustable magnetic trip point calibrated to protect only the molded case switch itself. They must be used in conjunction with a circuit breaker or fuse of equivalent rating.

**Table 44: Automatic Switch Information**

Circuit Breaker	Ampere Rating	Voltage Rating	Catalog Number	Withstand Rating			Trip Point (±10%)
				240 Vac	480 Vac	600 Vac	
PJ 2P <sup>1</sup> , 3P	600	600 Vac	PJL36000S60	100 kA	65 kA	25 kA	10 kA
	800	600 Vac	PJL36000S80	100 kA	65 kA	25 kA	10 kA
	1000	600 Vac	PJL36000S10	100 kA	65 kA	25 kA	10 kA
	1200	600 Vac	PJL36000S12	100 kA	65 kA	25 kA	10 kA
PK 2P, 3P, 4P <sup>2</sup>	600	600 Vac	PKL36000S60	65 kA	50 kA	50 kA	24 kA
	800	600 Vac	PKL36000S80	65 kA	50 kA	50 kA	24 kA
	1000	600 Vac	PKL36000S10	65 kA	50 kA	50 kA	24 kA
	1200	600 Vac	PKL36000S12	65 kA	50 kA	50 kA	24 kA
PL 2P, 3P	600	480 Vac	PLL34000S60	125 kA	100 kA	—	10 kA
	800	480 Vac	PLL34000S80	125 kA	100 kA	—	10 kA
	1000	480 Vac	PLL34000S10	125 kA	100 kA	—	10 kA
	1200	480 Vac	PLL34000S12	125 kA	100 kA	—	10 kA

<sup>1</sup> For 2P, replace the leading 3 in the catalog number following the prefix with a 2 (PJL36000S60 becomes PJL26000S60). Add the suffix 2 for AC phasing (standard offer), or use 5 for CA phasing (option).

<sup>2</sup> For 4P, replace the leading 3 in the catalog number following the prefix with a 4 (PKL36000S60 becomes PKL46000S60).

<sup>1</sup> Catalog numbers for automatic switches are designated by "000" in positions 7–9 (ampere rating) and S60, S80, S10, or S12 in positions 11–14 (trip system). See Table 10.

**Motor Circuit Protectors<sup>2</sup>**

Motor circuit protectors are similar in construction to thermal-magnetic circuit breakers, but have only instantaneous trip functions provided by the ET1.0M trip unit. These motor circuit protectors comply with NEC requirements for providing short-circuit protection when installed as part of a listed combination controller having motor overload protection. Interrupting ratings are determined by testing the motor circuit protector in combination with a contactor and overload relay.

Motor circuit protectors are available in PJ and PL individually-mounted and I-Line™ construction. According to the NEC, the instantaneous trip of the motor circuit protector may be set to a maximum of 8 to 17 times motor Full Load Amps (FLA), but a setting as close as possible to inrush current (without nuisance tripping) results in the best protection. The instantaneous trip pickup level is adjustable within the ranges shown below.

**Table 45: Motor Circuit Protector Trip Range**

Ampere Rating	Adjustable Trip Range	Catalog Number	
		J-Interrupting—600 Vac	L-Interrupting—480 Vac
600 A	1200–10,000 A	PJL36060M68	PLL34060M68
800 A	1200–10,000 A	PJL36080M68	PLL34080M68
1000 A	1500–10,000 A	PJL36100M69	PLL34100M69
1200 A	1800–10,000 A	PJL36120M70	PLL34120M70

**NOTE:** Continuous currents larger than the ampere rating can damage the motor circuit protector.

Select motor circuit protectors as follows:

1. Determine motor horsepower (hp) rating from the motor nameplate. The selection table is suitable for motors with locked-rotor indicating code letters per NEC Table 430-7 (b) as follows:

Horsepower	Motor Code Letters
30–150	A–G
150 or More	A–F

For other motors contact the field office.

2. Select a motor circuit protector with an ampere rating recommended for the hp and voltage involved.
3. Select an adjustable trip setting of at least 800% but not to exceed 1300% (1700% for high-efficiency motors) of the motor full load amperes (FLA).
4. The NEC 1300% maximum setting (1700% for high-efficiency motors) may be inadequate for motor circuit protectors to withstand current surges typical of the magnetization current of auto-transformer type reduced voltage starters or open transition wye-delta starters during transfer from “start” to “run,” constant hp multi-speed motors and motors labeled “high efficiency”.
5. Part-winding motors, per NEC 430-3, should have two motor circuit protectors selected from the above at not more than one-half the allowable trip setting for the horsepower rating. The two circuit protectors should operate simultaneously as a disconnecting means per NEC 430-103.

<sup>2</sup> Catalog numbers for motor circuit protectors are designated by M68, M69, or M70 in positions 11–14 (trip system). See Table 10.



## Electrically-Operated Circuit Breakers

Electrically-operated P-frame circuit breakers are available in I-Line™ and unit-mount construction up to 1200 A and are denoted in the catalog number by an “M\_” suffix. These come equipped with a two-step stored energy mechanism and come standard with a motor assembly. These are available factory-installed only.

Motor assemblies provide on and off control from remote locations. The assemblies contain a spring-charging motor (MCH), a shunt trip (MX) and a shunt close (XF) and are available in standard or communicating versions. An SDE overcurrent trip switch is also included for trip indication. When remote indication of the circuit breaker status is required, use of a circuit breaker with an OF auxiliary switch for on-off indication. See Table 70 on page 75 for details.

**Table 46: Motors Assembly Voltage Ratings (Vn)**

Voltage Type	Voltage Ratings (Vn)
Vac 50/60 Hz	48, 100–130, 220–240, 380–415
Vdc	24–30, 48–60, 110–130, 200–250

## Termination Information

Unit-mount circuit breakers and switches have mechanical lugs standard on both ends. I-Line circuit breakers have lugs standard on the O/OFF end. These lugs accept aluminum or copper wire. Manually-operated P-frame circuit breakers are also available in drawout construction. See Table 88 on page 86 for more lug options.

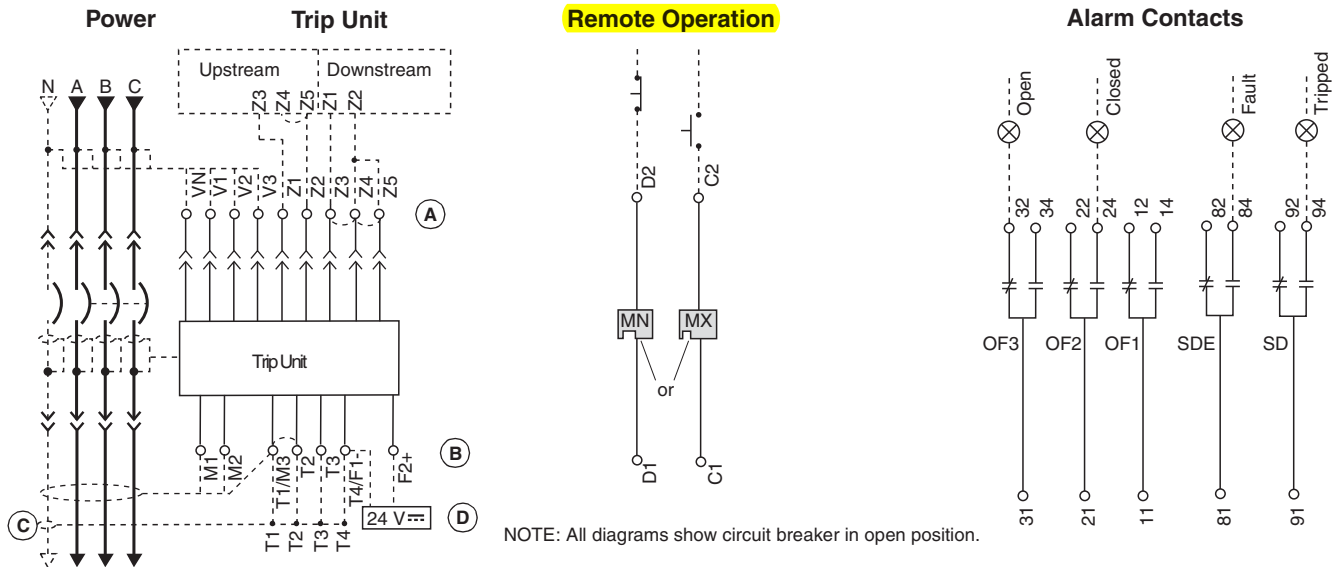
## Control Wiring

Control wiring for unit-mount and I-Line construction is connected to terminals located under the circuit breaker accessory cover. Control wiring for drawout construction is connected to terminals located on the cradle.

# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

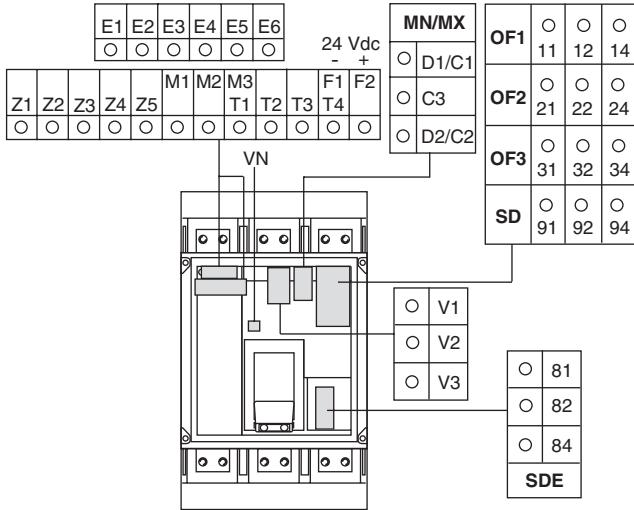
## Section 4—PowerPact P-Frame Molded Case Circuit Breakers

**Figure 2: Accessory Control Wiring Diagrams for Manually-Operated Circuit Breakers**



NOTE: All diagrams show circuit breaker in open position.

- A—Do not remove factory-installed jumpers between Z3, Z4 and Z5 unless ZSI is connected.
- B—Do not remove factory-installed jumper between T1 and T2 unless neutral CT is connected. Do not install jumper between T3 and T4.
- C—For proper wiring of neutral CT, refer to Instruction Bulletin 48041-082-01 shipped with it.
- D—24 Vdc power supply for trip unit must be separate and isolated from 24 Vdc power supply for communication modules.



Connector	Recommended Wire Size
V1, V2, V3, Vn	22–16 AWG (0.3–1.5 mm <sup>2</sup> )
E1–E2	22 AWG (0.3 mm <sup>2</sup> ) MIN shielded pair cable or twisted pair copper wires
T	22 AWG (0.3 mm <sup>2</sup> ) stranded shielded cable
M	Refer to MDGF instructions
E3–E6, Q1, Q2, Q3	22 AWG (0.3 mm <sup>2</sup> ) shielded twisted pairs with drain (Belden 8723 or equal) <sup>3</sup>
OF, SD, SDE	18–16 AWG (0.8–1.5 mm <sup>2</sup> )
MN, MX	18–14 AWG (0.8–2.5 mm <sup>2</sup> )
F	Size per aux 24 Vdc power supply
Z1–Z5	22–18 AWG (0.3–0.8 mm <sup>2</sup> )

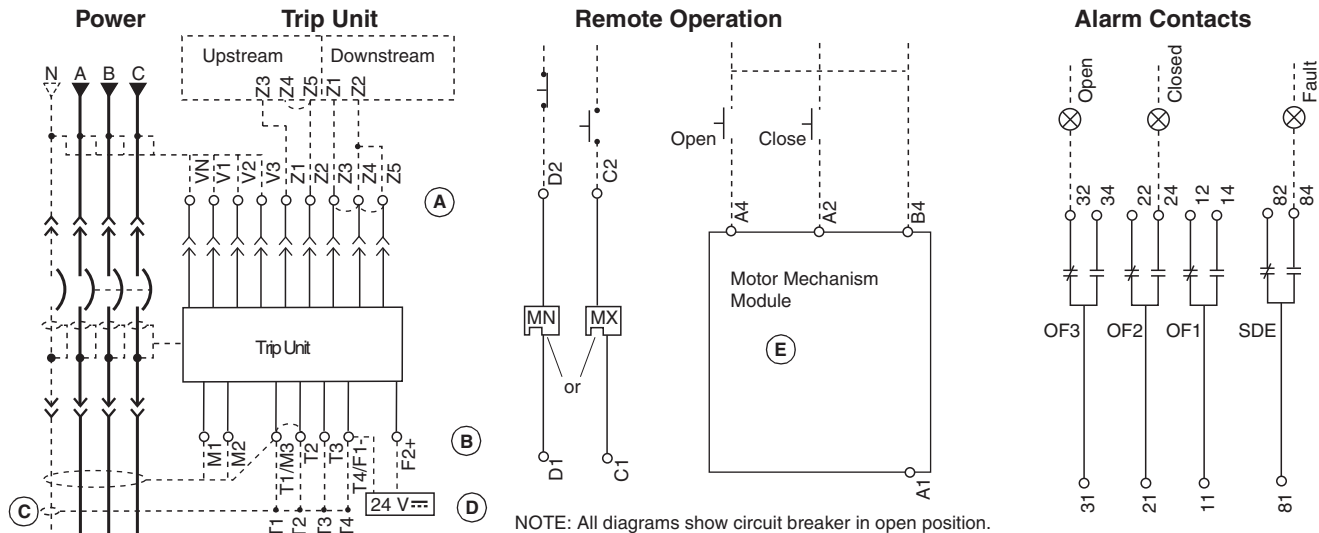
Trip Unit Type				Connector	Description
Basic	A	P	H		
—	•	•	•	Com: E1-E6	Circuit breaker communication module E1 = +24 Vdc E2 = Common E3 = Out - E4 = Out + E5 = In - E6 = In +
—	•	•	•	Z	Zone-selective interlocking (ZSI) Z1 = ZSI OUT signal Z2 = ZSI OUT Z3 = ZSI IN signal Z4 = ZSI IN short-time delay Z5 = ZSI IN ground fault
—	•	•	•	T	External neutral sensor
—	•	•	•	F	24 Vdc external power supply
—	—	•	•	Vn <sup>1</sup>	External neutral voltage takeoff
—	—	•	•	V1, V2, V3	External phase voltage takeoff
—	—	•	•	M6C <sup>2</sup> : Q1, Q2, Q3	6 programmable contacts 24 Vdc external power supply required
Function		Connector		Description	
Auxiliary Contacts		OF		Open/Closed circuit breaker or switch position contacts	
		SD		Bell alarm	
		SDE		Electrical fault alarm contact	
Remote Operation		MN		Undervoltage trip device	
		MX		Shunt trip	

<sup>1</sup> Neutral voltage supplied with flying leads.  
<sup>2</sup> Optional M6C programmable contacts are supplied with flying leads.

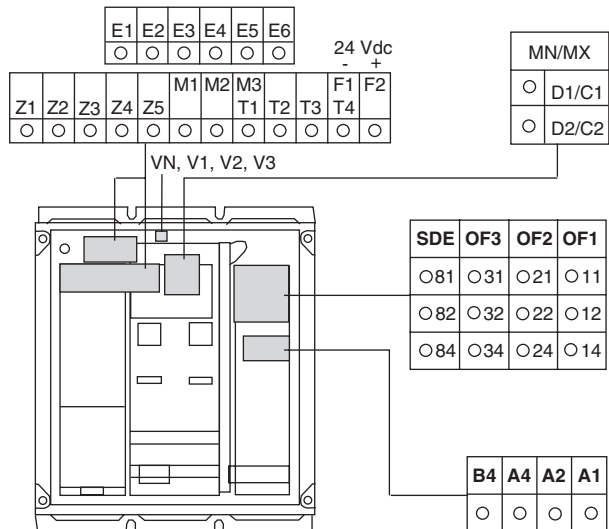
# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

## Section 4—PowerPact P-Frame Molded Case Circuit Breakers

**Figure 3: Accessory Control Wiring Diagrams for Electrically-operated Circuit Breakers**



- A—Do not remove factory-installed jumpers between Z3, Z4 and Z5 unless ZSI is connected.
- B—Do not remove factory-installed jumper between T1 and T2 unless neutral CT is connected. Do not install jumper between T3 and T4.
- C—For proper wiring of neutral CT, refer to Instruction Bulletin 48041-082-01 shipped with it.
- D—24 Vdc power supply for trip unit must be separate and isolated from 24 Vdc power supply for communication modules.
- E—Motor mechanism includes opening and closing coils.



Connector	Recommended Wire Size
E1–E2	22 AWG (0.3 mm <sup>2</sup> ) MIN shielded pair cable or twisted pair copper wires
V1, V2, V3, Vn	22–16 AWG (0.3–1.5 mm <sup>2</sup> )
T	22 AWG (0.3 mm <sup>2</sup> ) stranded shielded cable
E3–E6, Q1, Q2, Q3	22 AWG (0.3 mm <sup>2</sup> ) shielded twisted pairs with drain (Belden 8723 or equal) <sup>3</sup>
M	Refer to MDGF instructions
OF, SD, SDE	18–16 AWG (0.8–1.5 mm <sup>2</sup> )
MN, MX	18–14 AWG (0.8–2.5 mm <sup>2</sup> )
F	Size per aux 24 Vdc power supply
Z1–Z5	22–18 AWG (0.3–0.8 mm <sup>2</sup> )

Trip Unit Type				Connector	Description
Basic	A	P	H		
–	•	•	•	Com: E1-E6	Circuit breaker communication module E1 = +24 Vdc E2 = Common E3 = Out - E4 = Out + E5 = In - E6 = In +
–	•	•	•	Z	Zone-selective interlocking (ZSI) Z1 = ZSI OUT signal Z2 = ZSI OUT Z3 = ZSI IN signal Z4 = ZSI IN short-time delay Z5 = ZSI IN ground fault
–	•	•	•	T	External neutral sensor
–	•	•	•	F	24 Vdc external power supply
–	–	•	•	Vn <sup>1</sup>	External voltage takeoff
–	–	•	•	V1, V2, V3 <sup>1</sup>	External phase voltage takeoff
–	–	•	•	M6C <sup>1</sup> : Q1, Q2, Q3	6 programmable contacts 24 Vdc external power supply required
Function		Connector		Description	
Auxiliary Contacts		OF		Open/Closed circuit breaker or switch position contacts	
		SDE		Electrical fault alarm contact	
Remote Operation		MN		Undervoltage trip device	
		MX		Shunt trip	
Motor Mech Module		A4		Electrical opening	
		A2		Electrical closing	
		B4, A1		Power supply for control devices and gear motor	

<sup>1</sup> Optional M6C and external voltage takeoff are supplied with flying leads.

## Section 5—PowerPact R-Frame Circuit Breakers

### Performance

Providing unparalleled performance and control, the R-frame circuit breakers features the exclusive Micrologic™ electronic trip units, which allow for a range of sophisticated applications for metering and monitoring. In addition, trip units can be interchanged in the field to allow for maximum flexibility.

The compact size and smaller footprint of the R-frame circuit breaker permits higher density installations using I-Line™ panelboards and switchboards. These circuit breakers are available in 100% rated construction up to 3000 A to meet a broad range of commercial and industrial application needs.



R-Frame Unit-Mount



R-Frame I-Line

- Both standard and 100% rated construction circuit breakers are available in 3000 A with a sensor size range of 600–3000 A.
- Interrupting ratings (AIR):

Voltage	G	J	K	L
240 Vac	65 kA	100 kA	65 kA	125 kA
480 Vac	35 kA	65 kA	65 kA	100 kA
600 Vac	18 kA	25 kA	65 kA	50 kA

- The K interrupting rating is recommended for applications having high inrush and/or non-linear loads such as large motors, transformers, motors with soft starts, etc.
- Compact circuit breaker size allows for smaller footprint installations using I-Line panelboards and switchboards. Fifteen-inch width provides increased density installation.
- Most field-installable accessories are common to all frame sizes for easier stocking and installation
- Selection of four interchangeable Micrologic trip units available, with Powerlogic™ power metering and monitoring capabilities available in advanced trip units.
- Compatible with Powerlogic systems and high amperage power circuit breakers.
- Built-in Modbus® protocol provides an open communications platform and eliminates the need to purchase additional, proprietary network solutions.
- Connection options include bus, cable or I-Line for installation flexibility.

PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers  
Section 5—PowerPact R-Frame Circuit Breakers

Catalog Numbers

Table 47: UL/IEC Rated, Unit-Mount, Manually-Operated, Standard-Rated Electronic Trip Circuit Breakers with Basic Electronic Trip and Micrologic™ Electronic Trip Units—600A to 1200A

Trip Unit Type	Circuit Breaker Catalog Number			
	Current Rating (Sensor Rating)			
	600 A	800 A	1000 A	1200 A
<b>Basic Electronic Trip Unit Not interchangeable</b>				
ET1.0I 2P <sup>1</sup> , 3P Fixed Long-time	RGF36060	RGF36080	RGF36100	RGF36120
	RJF36060	RJF36080	RJF36100	RJF36120
	RKF36060	RKF36080	RKF36100	RKF36120
	RLF36060	RLF36080	RLF36100	RLF36120
<b>Micrologic Interchangeable Standard Trip Unit</b>				
3.0 (LI) 3P, 4P <sup>2</sup>	RGF36060U31A	RGF36080U31A	RGF36100U31A	RGF36120U31A
	RJF36060U31A	RJF36080U31A	RJF36100U31A	RJF36120U31A
	RKF36060U31A	RKF36080U31A	RKF36100U31A	RKF36120U31A
	RLF36060U31A	RLF36080U31A	RLF36100U31A	RLF36120U31A
5.0 (LSI) 3P, 4P <sup>2</sup>	RGF36060U33A	RGF36080U33A	RGF36100U33A	RGF36120U33A
	RJF36060U33A	RJF36080U33A	RJF36100U33A	RJF36120U33A
	RKF36060U33A	RKF36080U33A	RKF36100U33A	RKF36120U33A
	RLF36060U33A	RLF36080U33A	RLF36100U33A	RLF36120U33A
<b>Micrologic Interchangeable Ammeter Trip Unit<sup>3</sup></b>				
3.0A (LI) 3P, 4P <sup>2</sup>	RGF36060U41A	RGF36080U41A	RGF36100U41A	RGF36120U41A
	RJF36060U41A	RJF36080U41A	RJF36100U41A	RJF36120U41A
	RKF36060U41A	RKF36080U41A	RKF36100U41A	RKF36120U41A
	RLF36060U41A	RLF36080U41A	RLF36100U41A	RLF36120U41A
5.0A (LSI) 3P, 4P <sup>2</sup>	RGF36060U43A	RGF36080U43A	RGF36100U43A	RGF36120U43A
	RJF36060U43A	RJF36080U43A	RJF36100U43A	RJF36120U43A
	RKF36060U43A	RKF36080U43A	RKF36100U43A	RKF36120U43A
	RLF36060U43A	RLF36080U43A	RLF36100U43A	RLF36120U43A
6.0A (LSIG) 3P, 4P <sup>2</sup>	RGF36060U44A	RGF36080U44A	RGF36100U44A	RGF36120U44A
	RJF36060U44A	RJF36080U44A	RJF36100U44A	RJF36120U44A
	RKF36060U44A	RKF36080U44A	RKF36100U44A	RKF36120U44A
	RLF36060U44A	RLF36080U44A	RLF36100U44A	RLF36120U44A
<b>Micrologic Interchangeable Power Trip Unit with Modbus® Communications</b>				
5.0P (LSI) 3P, 4P <sup>2</sup>	RGF36060U63AE1	RGF36080U63AE1	RGF36100U63AE1	RGF36120U63AE1
	RJF36060U63AE1	RJF36080U63AE1	RJF36100U63AE1	RJF36120U63AE1
	RKF36060U63AE1	RKF36080U63AE1	RKF36100U63AE1	RKF36120U63AE1
	RLF36060U63AE1	RLF36080U63AE1	RLF36100U63AE1	RLF36120U63AE1
6.0P (LSIG) 3P, 4P <sup>2</sup>	RGF36060U64AE1	RGF36080U64AE1	RGF36100U64AE1	RGF36120U64AE1
	RJF36060U64AE1	RJF36080U64AE1	RJF36100U64AE1	RJF36120U64AE1
	RKF36060U64AE1	RKF36080U64AE1	RKF36100U64AE1	RKF36120U64AE1
	RLF36060U64AE1	RLF36080U64AE1	RLF36100U64AE1	RLF36120U64AE1
<b>Micrologic Interchangeable Harmonic Trip Unit with Modbus Communications</b>				
5.0H (LSI) 3P, 4P <sup>2</sup>	RGF36060U73AE1	RGF36080U73AE1	RGF36100U73AE1	RGF36120U73AE1
	RJF36060U73AE1	RJF36080U73AE1	RJF36100U73AE1	RJF36120U73AE1
	RKF36060U73AE1	RKF36080U73AE1	RKF36100U73AE1	RKF36120U73AE1
	RLF36060U73AE1	RLF36080U73AE1	RLF36100U73AE1	RLF36120U73AE1
6.0H (LSIG) 3P, 4P <sup>2</sup>	RGF36060U74AE1	RGF36080U74AE1	RGF36100U74AE1	RGF36120U74AE1
	RJF36060U74AE1	RJF36080U74AE1	RJF36100U74AE1	RJF36120U74AE1
	RKF36060U74AE1	RKF36080U74AE1	RKF36100U74AE1	RKF36120U74AE1
	RLF36060U74AE1	RLF36080U74AE1	RLF36100U74AE1	RLF36120U74AE1

<sup>1</sup> For 2P, replace the leading 3 in the catalog number following the prefix with a 2 (RGF36060 becomes RGF<sub>2</sub>6060.)

<sup>2</sup> For 4P, replace the leading 3 in the catalog number following the prefix with a 4 (RPF36060U31A becomes RGF<sub>4</sub>6060U31A).

<sup>3</sup> Add E1 suffix for Modbus communications.

**PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers**  
**Section 5—PowerPact R-Frame Circuit Breakers**

**Table 48: UL/IEC Rated, Unit-Mount, Manually-Operated, Standard-Rated Electronic Trip Circuit Breakers with Basic Electronic Trip and Micrologic™ Electronic Trip Units—1600A to 3000A**

Trip Unit Type	Circuit Breaker Catalog Number			
	Current Rating (Sensor Rating)			
	1600 A	2000 A	2500 A	3000 A
<b>Basic Electronic Trip Unit Not interchangeable</b>				
ET1.0I 2P <sup>1</sup> , 3P Fixed Long-time	RGF36160	RGF36200	RGF36250	—
	RJF36160	RJF36200	RJF36250	—
	RKF36160	RKF36200	RKF36250	—
	RLF36160	RLF36200	RLF36250	—
<b>Micrologic Interchangeable Standard Trip Unit</b>				
3.0 (LI) 3P, 4P <sup>2</sup>	RGF36160U31A	RGF36200U31A	RGF36250U31A	RGF36300U31A
	RJF36160U31A	RJF36200U31A	RJF36250U31A	RJF36300U31A
	RKF36160U31A	RKF36200U31A	RKF36250U31A	RKF36300U31A
	RLF36160U31A	RLF36200U31A	RLF36250U31A	RLF36300U31A
5.0 (LSI) 3P, 4P <sup>2</sup>	RGF36160U33A	RGF36200U33A	RGF36250U33A	RGF36300U33A
	RJF36160U33A	RJF36200U33A	RJF36250U33A	RJF36300U33A
	RKF36160U33A	RKF36200U33A	RKF36250U33A	RKF36300U33A
	RLF36160U33A	RLF36200U33A	RLF36250U33A	RLF36300U33A
<b>Micrologic Interchangeable Ammeter Trip Unit<sup>3</sup></b>				
3.0A (LI) 3P, 4P <sup>2</sup>	RGF36160U41A	RGF36200U41A	RGF36250U41A	RGF36300U41A
	RJF36160U41A	RJF36200U41A	RJF36250U41A	RJF36300U41A
	RKF36160U41A	RKF36200U41A	RKF36250U41A	RKF36300U41A
	RLF36160U41A	RLF36200U41A	RLF36250U41A	RLF36300U41A
5.0A (LSI) 3P, 4P <sup>2</sup>	RGF36160U43A	RGF36200U43A	RGF36250U43A	RGF36300U43A
	RJF36160U43A	RJF36200U43A	RJF36250U43A	RJF36300U43A
	RKF36160U43A	RKF36200U43A	RKF36250U43A	RKF36300U43A
	RLF36160U43A	RLF36200U43A	RLF36250U43A	RLF36300U43A
6.0A (LSIG) 3P, 4P <sup>2</sup>	RGF36160U44A	RGF36200U44A	RGF36250U44A	RGF36300U44A
	RJF36160U44A	RJF36200U44A	RJF36250U44A	RJF36300U44A
	RKF36160U44A	RKF36200U44A	RKF36250U44A	RKF36300U44A
	RLF36160U44A	RLF36200U44A	RLF36250U44A	RLF36300U44A
<b>Micrologic Interchangeable Power Trip Unit with Modbus® Communications</b>				
5.0P (LSI) 3P, 4P <sup>2</sup>	RGF36160U63AE1	RGF36200U63AE1	RGF36250U63AE1	RGF36300U63AE1
	RJF36160U63AE1	RJF36200U63AE1	RJF36250U63AE1	RJF36300U63AE1
	RKF36160U63AE1	RKF36200U63AE1	RKF36250U63AE1	RKF36300U63AE1
	RLF36160U63AE1	RLF36200U63AE1	RLF36250U63AE1	RLF36300U63AE1
6.0P (LSIG) 3P, 4P <sup>2</sup>	RGF36160U64AE1	RGF36200U64AE1	RGF36250U64AE1	RGF36300U64AE1
	RJF36160U64AE1	RJF36200U64AE1	RJF36250U64AE1	RJF36300U64AE1
	RKF36160U64AE1	RKF36200U64AE1	RKF36250U64AE1	RKF36300U64AE1
	RLF36160U64AE1	RLF36200U64AE1	RLF36250U64AE1	RLF36300U64AE1
<b>Micrologic Interchangeable Harmonic Trip Unit with Modbus Communications</b>				
5.0H (LSI) 3P, 4P <sup>2</sup>	RGF36160U73AE1	RGF36200U73AE1	RGF36250U73AE1	RGF36300U73AE1
	RJF36160U73AE1	RJF363200U73AE1	RJF36250U73AE1	RJF36300U73AE1
	RKF36160U73AE1	RKF363200U73AE1	RKF36250U73AE1	RKF36300U73AE1
	RLF36160U73AE1	RLF36200U73AE1	RLF36250U73AE1	RLF36300U73AE1
6.0H (LSIG) 3P, 4P <sup>2</sup>	RGF36160U74AE1	RGF36200U74AE1	RGF36250U74AE1	RGF36300U74AE1
	RJF36160U74AE1	RJF36200U74AE1	RJF36250U74AE1	RJF36300U74AE1
	RKF36160U74AE1	RKF36200U74AE1	RKF36250U74AE1	RKF36300U74AE1
	RLF36160U74AE1	RLF36200U74AE1	RLF36250U74AE1	RLF36300U74AE1

<sup>1</sup> For 2P, replace the leading 3 in the catalog number following the prefix with a 2 (RGF36060 becomes RGF<sub>2</sub>6060).

<sup>2</sup> For 4P, replace the leading 3 in the catalog number following the prefix with a 4 (RPF36060U31A becomes RGF<sub>4</sub>6060U31A).

<sup>3</sup> Add E1 suffix for Modbus communications.

**PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers**  
**Section 5—PowerPact R-Frame Circuit Breakers**

**Table 49: UL/IEC Rated, Unit-Mount, Manually-Operated, 100%-Rated Electronic Trip Circuit Breakers with Micrologic™ Electronic Trip Units—600 A to 1200 A**

Trip Unit Type	Circuit Breaker Catalog Number <sup>1</sup>			
	Current Rating (Sensor Rating)			
	600 A	800 A	1000 A	1200 A
<b>Micrologic Standard Trip Unit Interchangeable, 3P, 4P</b>				
3.0 (LI)	RGF36060CU31A	RGF36080CU31A	RGF36100CU31A	RGF36120CU31A
	RJF36060CU31A	RJF36080CU31A	RJF36100CU31A	RJF36120CU31A
	RKF36060CU31A	RKF36080CU31A	RKF36100CU31A	RKF36120CU31A
	RLF36060CU31A	RLF36080CU31A	RLF36100CU31A	RLF36120CU31A
5.0 (LSI)	RGF36060CU33A	RGF36080CU33A	RGF36100CU33A	RGF36120CU33A
	RJF36060CU33A	RJF36080CU33A	RJF36100CU33A	RJF36120CU33A
	RKF36060CU33A	RKF36080CU33A	RKF36100CU33A	RKF36120CU33A
	RLF36060CU33A	RLF36080CU33A	RLF36100CU33A	RLF36120CU33A
<b>Micrologic Ammeter Trip Unit<sup>2</sup> Interchangeable, 3P, 4P</b>				
3.0A (LI)	RGF36060CU41A	RGF36080CU41A	RGF36100CU41A	RGF36120CU41A
	RJF36060CU41A	RJF36080CU41A	RJF36100CU41A	RJF36120CU41A
	RKF36060CU41A	RKF36080CU41A	RKF36100CU41A	RKF36120CU41A
	RLF36060CU41A	RLF36080CU41A	RLF36100CU41A	RLF36120CU41A
5.0A (LSI)	RGF36060CU43A	RGF36080CU43A	RGF36100CU43A	RGF36120CU43A
	RJF36060CU43A	RJF36080CU43A	RJF36100CU43A	RJF36120CU43A
	RKF36060CU43A	RKF36080CU43A	RKF36100CU43A	RKF36120CU43A
	RLF36060CU43A	RLF36080CU43A	RLF36100CU43A	RLF36120CU43A
6.0A (LSIG)	RGF36060CU44A	RGF36080CU44A	RGF36100CU44A	RGF36120CU44A
	RJF36060CU44A	RJF36080CU44A	RJF36100CU44A	RJF36120CU44A
	RKF36060CU44A	RKF36080CU44A	RKF36100CU44A	RKF36120CU44A
	RLF36060CU44A	RLF36080CU44A	RLF36100CU44A	RLF36120CU44A
<b>Micrologic Power Trip Unit with Modbus® Communications Interchangeable, 3P, 4P</b>				
5.0P (LSI)	RGF36060CU63AE1	RGF36080CU63AE1	RGF36100CU63AE1	RGF36120CU63AE1
	RJF36060CU63AE1	RJF36080CU63AE1	RJF36100CU63AE1	RJF36120CU63AE1
	RKF36060CU63AE1	RKF36080CU63AE1	RKF36100CU63AE1	RKF36120CU63AE1
	RLF36060CU63AE1	RLF36080CU63AE1	RLF36100CU63AE1	RLF36120CU63AE1
6.0P (LSIG)	RGF36060CU64AE1	RGF36080CU64AE1	RGF36100CU64AE1	RGF36120CU64AE1
	RJF36060CU64AE1	RJF36080CU64AE1	RJF36100CU64AE1	RJF36120CU64AE1
	RKF36060CU64AE1	RKF36080CU64AE1	RKF36100CU64AE1	RKF36120CU64AE1
	RLF36060CU64AE1	RLF36080CU64AE1	RLF36100CU64AE1	RLF36120CU64AE1
<b>Micrologic Harmonic Trip Unit with Modbus Communications Interchangeable, 3P, 4P</b>				
5.0H (LSI)	RGF36060CU73AE1	RGF36080CU73AE1	RGF36100CU73AE1	RGF36120CU73AE1
	RJF36060CU73AE1	RJF36080CU73AE1	RJF36100CU73AE1	RJF36120CU73AE1
	RKF36060CU73AE1	RKF36080CU73AE1	RKF36100CU73AE1	RKF36120CU73AE1
	RLF36060CU73AE1	RLF36080CU73AE1	RLF36100CU73AE1	RLF36120CU73AE1
6.0H (LSIG)	RGF36060CU74AE1	RGF36080CU74AE1	RGF36100CU74AE1	RGF36120CU74AE1
	RJF36060CU74AE1	RJF36080CU74AE1	RJF36100CU74AE1	RJF36120CU74AE1
	RKF36060CU74AE1	RKF36080CU74AE1	RKF36100CU74AE1	RKF36120CU74AE1
	RLF36060CU74AE1	RLF36080CU74AE1	RLF36100CU74AE1	RLF36120CU74AE1

<sup>1</sup> For 4P, replace the leading 3 in the catalog number following the prefix with a 4 (RPF36060CU31A becomes RGF<sub>4</sub>6060CU31A).

<sup>2</sup> Add E1 suffix for Modbus communications.

**PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers**  
**Section 5—PowerPact R-Frame Circuit Breakers**

**Table 50: UL/IEC Rated, Unit-Mount, Manually-Operated, 100%-Rated Electronic Trip Circuit Breakers with Micrologic™ Electronic Trip Units—1600 A to 3000 A**

Trip Unit Type	Circuit Breaker Catalog Number <sup>1</sup>			
	Current Rating (Sensor Rating)			
	1600 A	2000 A	2500 A	3000 A
<b>Micrologic Standard Trip Unit Interchangeable, 3P, 4P</b>				
3.0 (L)	RGF36160CU31A	RGF36200CU31A	RGF36250CU31A	RGF36300CU31A
	RJF36160CU31A	RJF36200CU31A	RJF36250CU31A	RJF36300CU31A
	RKF36160CU31A	RKF36200CU31A	RKF36250CU31A	RKF36300CU31A
	RLF36160CU31A	RLF36200CU31A	RLF36250CU31A	RLF36300CU31A
5.0 (LSI)	RGF36160CU33A	RGF36200CU33A	RGF36250CU33A	RGF36300CU33A
	RJF36160CU33A	RJF36200CU33A	RJF36250CU33A	RJF36300CU33A
	RKF36160CU33A	RKF36200CU33A	RKF36250CU33A	RKF36300CU33A
	RLF36160CU33A	RLF36200CU33A	RLF36250CU33A	RLF36300CU33A
<b>Micrologic Ammeter Trip Unit<sup>2</sup> Interchangeable, 3P, 4P</b>				
3.0A (L)	RGF36160CU41A	RGF36200CU41A	RGF36250CU41A	RGF36300CU41A
	RJF36160CU41A	RJF36200CU41A	RJF36250CU41A	RJF36300CU41A
	RKF36160CU41A	RKF36200CU41A	RKF36250CU41A	RKF36300CU41A
	RLF36160CU41A	RLF36200CU41A	RLF36250CU41A	RLF36300CU41A
5.0A (LSI)	RGF36160CU43A	RGF36200CU43A	RGF36250CU43A	RGF36300CU43A
	RJF36160CU43A	RJF36200CU43A	RJF36250CU43A	RJF36300CU43A
	RKF36160CU43A	RKF36200CU43A	RKF36250CU43A	RKF36300CU43A
	RLF36160CU43A	RLF36200CU43A	RLF36250CU43A	RLF36300CU43A
6.0A (LSIG)	RGF36160CU44A	RGF36200CU44A	RGF36250CU44A	RGF36300CU44A
	RJF36160CU44A	RJF36200CU44A	RJF36250CU44A	RJF36300CU44A
	RKF36160CU44A	RKF36200CU44A	RKF36250CU44A	RKF36300CU44A
	RLF36160CU44A	RLF36200CU44A	RLF36250CU44A	RLF36300CU44A
<b>Micrologic Power Trip Unit with Modbus® Communications Interchangeable, 3P, 4P</b>				
5.0P (LSI)	RGF36160CU63AE1	RGF36200CU63AE1	RGF36250CU63AE1	RGF36300CU63AE1
	RJF36160CU63AE1	RJF36200CU63AE1	RJF36250CU63AE1	RJF36300CU63AE1
	RKF36160CU63AE1	RKF36200CU63AE1	RKF36250CU63AE1	RKF36300CU63AE1
	RLF36160CU63AE1	RLF36200CU63AE1	RLF36250CU63AE1	RLF36300CU63AE1
6.0P (LSIG)	RGF36160CU64AE1	RGF36200CU64AE1	RGF36250CU64AE1	RGF36300CU64AE1
	RJF36160CU64AE1	RJF36200CU64AE1	RJF36250CU64AE1	RJF36300CU64AE1
	RKF36160CU64AE1	RKF36200CU64AE1	RKF36250CU64AE1	RKF36300CU64AE1
	RLF36160CU64AE1	RLF36200CU64AE1	RLF36250CU64AE1	RLF36300CU64AE1
<b>Micrologic Harmonic Trip Unit with Modbus Communications Interchangeable, 3P, 4P</b>				
5.0H (LSI)	RGF36160CU73AE1	RGF36200CU73AE1	RGF36250CU73AE1	RGF36300CU73AE1
	RJF36160CU73AE1	RJF36200CU73AE1	RJF36250CU73AE1	RJF36300CU73AE1
	RKF36160CU73AE1	RKF36200CU73AE1	RKF36250CU73AE1	RKF36300CU73AE1
	RLF36160CU73AE1	RLF36200CU73AE1	RLF36250CU73AE1	RLF36300CU73AE1
6.0H (LSIG)	RGF36160CU74AE1	RGF36200CU74AE1	RGF36250CU74AE1	RGF36300CU74AE1
	RJF36160CU74AE1	RJF36200CU74AE1	RJF36250CU74AE1	RJF36300CU74AE1
	RKF36160CU74AE1	RKF36200CU74AE1	RKF36250CU74AE1	RKF36300CU74AE1
	RLF36160CU74AE1	RLF36200CU74AE1	RLF36250CU74AE1	RLF36300CU74AE1

<sup>1</sup> For 4P, replace the leading 3 in the catalog number following the prefix with a 4 (RPF36060CU31A becomes RGF46060CU31A).  
<sup>2</sup> Add E1 suffix for Modbus communications.



**PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers**  
**Section 5—PowerPact R-Frame Circuit Breakers**

**Table 51: UL/IEC Rated, I-Line, Manually-Operated, 100%-Rated Electronic Trip Circuit Breakers with Micrologic™ Electronic Trip Units**

Trip Unit, Interchangeable		Circuit Breaker Catalog Number	
		Current Rating	
	Type	1000 A	1200 A
Micrologic Standard Trip Unit	3.0 (LI)	RGA36100CU31A	RGA36120CU31A
		RJA36100CU31A	RJA36120CU31A
		RKA36100CU31A	RKA36120CU31A
		RLA36100CU31A	RLA36120CU31A
	5.0 (LSI)	RGA36100CU33A	RGA36120CU33A
		RJA36100CU33A	RJA36120CU33A
		RKA36100CU33A	RKA36120CU33A
		RLA36100CU33A	RLA36120CU33A
Micrologic Ammeter Trip Unit <sup>1</sup>	3.0A (LI)	RGA36100CU41A	RGA36120CU41A
		RJA36100CU41A	RJA36120CU41A
		RKA36100CU41A	RKA36120CU41A
		RLA36100CU41A	RLA36120CU41A
	5.0A (LSI)	RGA36100CU43A	RGA36120CU43A
		RJA36100CU43A	RJA36120CU43A
		RKA36100CU43A	RKA36120CU43A
		RLA36100CU43A	RLA36120CU43A
	6.0A (LSIG)	RGA36100CU44A	RGA36120CU44A
		RJA36100CU44A	RJA36120CU44A
		RKA36100CU44A	RKA36120CU44A
		RLA36100CU44A	RLA36120CU44A
Micrologic Power Trip Unit with Modbus® Communications	5.0P (LSI)	RGA36100CU63AE1	RGA36120CU63AE1
		RJA36100CU63AE1	RJA36120CU63AE1
		RKA36100CU63AE1	RKA36120CU63AE1
		RLA36100CU63AE1	RLA36120CU63AE1
	6.0P (LSIG)	RGA36100CU64AE1	RGA36120CU64AE1
		RJA36100CU64AE1	RJA36120CU64AE1
		RKA36100CU64AE1	RKA36120CU64AE1
		RLA36100CU64AE1	RLA36120CU64AE1
Micrologic Harmonic Trip Unit with Modbus Communications	5.0H (LSI)	RGA36100CU73AE1	RGA36120CU73AE1
		RJA36100CU73AE1	RJA36120CU73AE1
		RKA36100CU73AE1	RKA36120CU73AE1
		RLA36100CU73AE1	RLA36120CU73AE1
	6.0H (LSIG)	RGA36100CU74AE1	RGA36120CU74AE1
		RJA36100CU74AE1	RJA36120CU74AE1
		RKA36100CU74AE1	RKA36120CU74AE1
		RLA36100CU74AE1	RLA36120CU74AE1

<sup>1</sup> Add E1 suffix for Modbus communications.

**PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers**  
**Section 5—PowerPact R-Frame Circuit Breakers**

**Interrupting Ratings**

**Table 52: Interrupting Ratings**

Mounting	Circuit Breaker	Ampere Rating (A)		Interrupting Ratings						
		Basic Electronic Trip Units	Micrologic™ Trip Units	UL/CSA/NMX			IEC 60947-2			
				240 Vac	480 Vac	600 Vac	240 Vac		380/415 Vac	
							Icu	Ics	Icu	Ics
Individually-Mounted	RG	1200, 1600, 2000, 2500	600, 800, 1000, 1200, 1600, 2000, 2500, 3000	65 kA	35 kA	18 kA	50 kA	25 kA	35 kA	20 kA
	RJ			100 kA	65 kA	25 kA	65 kA	35 kA	50 kA	25 kA
	RK			65 kA	65 kA	65 kA	85 kA	65 kA	70 kA	55 kA
	RL			125 kA	100 kA	50 kA	125 kA	65 kA	85 kA	45 kA
I-Line™	RG	NA	1000, 1200	65 kA	35 kA	18 kA	50 kA	25 kA	35 kA	20 kA
	RJ			100 kA	65 kA	25 kA	65 kA	35 kA	50 kA	25 kA
	RK			65 kA	65 kA	65 kA	85 kA	65 kA	70 kA	55 kA
	RL			125 kA	100 kA	50 kA	125 kA	65 kA	85 kA	45 kA

**Automatic Molded Case Switches**

Automatic molded case switches are available in unit-mount construction from 1200–3000 A. Automatic switches are similar in construction to electronic trip circuit breakers except that long-time protection is not present. The switches open instantaneously at a non-adjustable magnetic trip point calibrated to protect only the molded case switch itself. They must be used in conjunction with a circuit breaker or fuse of equivalent rating.

**NOTE:** Catalog numbers for automatic switches are designated by “000” in positions 7–9 (ampere rating) and S12, S16, S20, S25, or S30 in positions 11–14 (trip system). See Table 10.

**Table 53: Automatic Switch Information**

Circuit Breaker	Ampere Rating	Catalog Number <sup>1</sup>	Withstand Rating			Trip Point (±10%)
			240 Vac	480 Vac	600 Vac	
RK 2P <sup>1</sup> , 3P	1200	RKF36000S12	65 kA	65 kA	65 kA	57 kA
	1600	RKF36000S16	65 kA	65 kA	65 kA	57 kA
	2000	RKF36000S20	65 kA	65 kA	65 kA	57 kA
	2500	RKF36000S25	65 kA	65 kA	65 kA	57 kA
	3000	RKF36000S30	65 kA	65 kA	65 kA	57 kA
RL 2P, 3P	1200	RLF36000S12	125 kA	100 kA	50 kA	48 kA
	1600	RLF36000S16	125 kA	100 kA	50 kA	48 kA
	2000	RLF36000S20	125 kA	100 kA	50 kA	48 kA
	2500	RLF36000S25	125 kA	100 kA	50 kA	48 kA
	3000	RLF36000S30	125 kA	100 kA	50 kA	48 kA

<sup>1</sup> For 2P, replace the leading 3 in the catalog number following the prefix with a 2 (RKP36000S12 becomes RKP26000S12).

## Termination Information

I-Line™ circuit breakers have lugs standard on the O/OFF end. Unit-mount circuit breakers and switches are equipped for direct bus connection. For certain circuit breaker ratings and to connect cable to R-frame circuit breakers, an RLTB terminal pad kit may be required. Refer to Section 10—Dimensional Drawings for terminal pad kit dimensions.

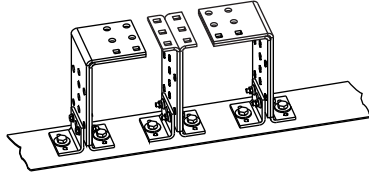


Table 54: RLTB Terminal Pad Kit

Table 55: Terminal Pad Kits for R-Frame Circuit Breakers

R-Frame Circuit Breaker	Terminal Pad Kit	Lugs per Phase	Field-Installable Kits	
	Usage		3P (One End Only)	4P (One End Only)
3000 A, 100% Rated	Required for Cable or Bus	9	RL3TB <sup>1</sup>	RL3TB4
3000 A, Standard (80% Rated)	Required for Cable or Bus	8	RLTB <sup>1</sup>	RLTB4
2500 A, 100% Rated	Required for Cable or Bus	8	RLTB <sup>1</sup>	RLTB4
2500 A, Standard (80% Rated)	Required for Cable, Optional for Bus	8	RLTB	RLTB4
All Other R-Frame Circuit Breakers	Required for Cable, Optional for Bus	8	RLTB	RLTB4

<sup>1</sup> Supplied as standard with the R-frame circuit breaker.

For cable connection to RLTB, use AL2500RK lug. See page 86.

## Continuous Current Rating

All circuit breakers marked as 100% rated can be continuously loaded to 100% of their rating. 100%-rated circuit breakers are available in unit-mount construction up to 3000 A and in I-Line construction up to 1200 A.

Because of the additional heat generated when applying circuit breakers at 100% of continuous current rating, the use of specially-designed enclosures and 90°C (194°F) wire is required. The 90°C (194°F) wire must be sized according to the ampacity of the 75°C (167°F) wire column in the NEC. Minimum enclosure size and ventilation specifications are indicated on a label on the circuit breaker, in the circuit breaker instruction bulletin and in Table 5 on page 11.

Circuit breakers with 100% rating can also be used in applications requiring only 80% continuous loading.

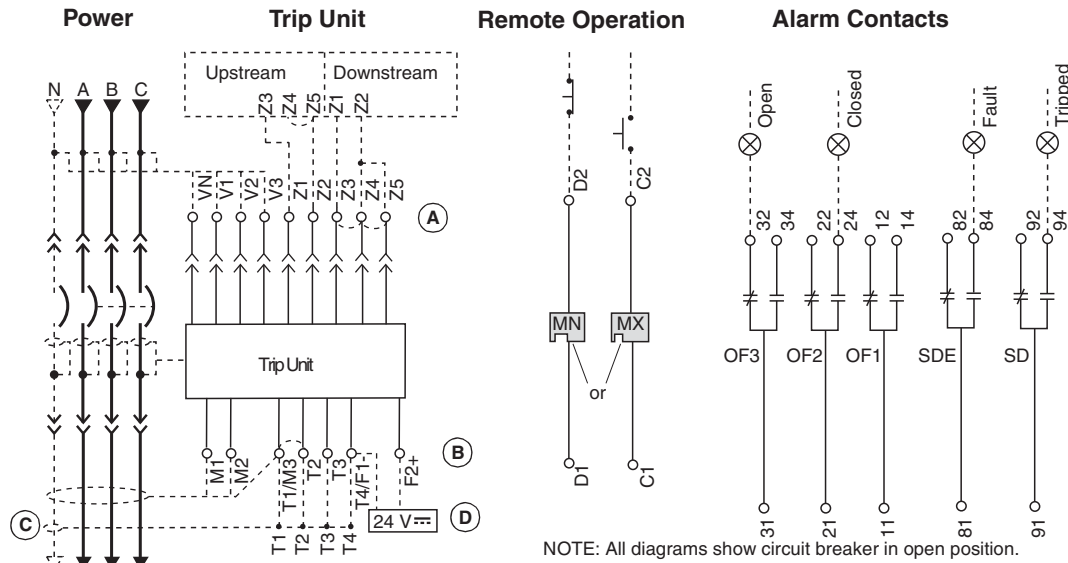
## Control Wiring

Control wiring is connected to terminals located under the circuit breaker accessory cover.

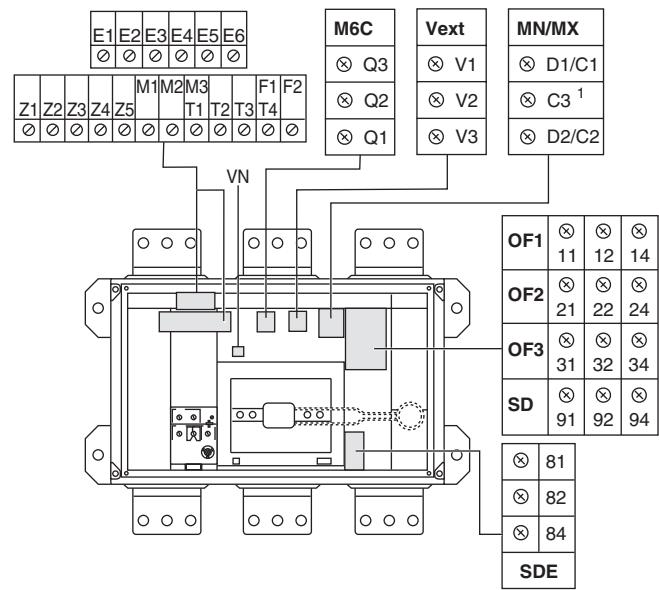
# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

## Section 5—PowerPact R-Frame Circuit Breakers

**Figure 4: Accessory Control Wiring Diagrams**



- A—Do not remove factory-installed jumpers between Z3, Z4 and Z5 unless ZSI is connected.
- B—Do not remove factory-installed jumper between T1 and T2 unless neutral CT is connected. Do not install jumper between T3 and T4.
- C—For proper wiring of neutral CT, refer to Instruction Bulletin 48041-082-01 shipped with it.
- D—24 Vdc power supply for trip unit must be separate and isolated from 24 Vdc power supply for communication modules.



Connector	Recommended Wire Size
V1, V2, V3, Vn	22–16 AWG (0.3–1.5 mm <sup>2</sup> )
E1–E2	22 AWG (0.3 mm <sup>2</sup> ) MIN shielded pair cable or twisted pair copper wires
T	22 AWG (0.3 mm <sup>2</sup> ) stranded shielded cable
M	Refer to MDGF instructions
Z1–Z5	22–18 AWG (0.3–0.8 mm <sup>2</sup> )
OF, SD, SDE	18–16 AWG (0.8–1.5 mm <sup>2</sup> )
MN, MX	18–14 AWG (0.8–2.5 mm <sup>2</sup> )
F	Size per aux 24 Vdc power supply
E3–E6, Q1, Q2, Q3	22 AWG (0.3 mm <sup>2</sup> ) shielded twisted pairs with drain (Belden 8723 or equal) <sup>3</sup>

<sup>1</sup> C3 terminal is not used.  
<sup>2</sup> Neutral voltage takeoff supplied as flying lead.

Trip Unit Type	Basic			Connector	Description
	A	P	H		
—	•	•	•	Com: E1–E6	Circuit breaker communication module E1 = +24 Vdc E2 = Common E3 = Out - E4 = Out + E5 = In - E6 = In +
—	•	•	•	Z	Zone-selective interlocking Z1 = ZSI OUT signal Z2 = ZSI OUT Z3 = ZSI IN signal Z4 = ZSI IN short-time delay Z5 = ZSI IN ground fault
—	•	•	•	T	External neutral sensor
—	•	•	•	M	Modified differential ground fault (MDGF)
—	•	•	•	F	24 Vdc external power supply
—	—	•	•	Vn <sup>2</sup>	External neutral voltage takeoff
—	—	•	•	M6C: Q1, Q2, Q3	6 programmable contacts 24 Vdc external power supply required
—	—	•	•	V1, V2, V3	External phase voltage takeoff

Function	Connector	Description
Auxiliary Contacts	OF	Open/Closed circuit breaker or switch position contacts
	SD	Bell alarm
	SDE	Electrical fault alarm contact
Remote Operation	MN	Undervoltage trip device
	MX	Shunt trip

## Section 6—Compact NS630b–NS1600 Circuit Breakers

### Performance

The Compact NS630b–NS1600 circuit breakers feature the exclusive Micrologic™ electronic trip units, which allow for a range of sophisticated applications for metering and monitoring. In addition, trip units can be interchanged in the field to allow for maximum flexibility.

The compact size and small footprint of the NS circuit breakers permit higher density installations. These circuit breakers are available in ratings up to 1600 A to meet a broad range of commercial and industrial application needs.

- Circuit breakers are available in 1600 A construction with a sensor size range of 250–1600 A.
- Interrupting ratings (AIR):



Compact NS630b–NS1600

Circuit Breaker	Interrupting Rating	220/240 Vac		380/415 Vac		440 Vac		500/525 Vac		660/690 Vac	
		Icu	Ics	Icu	Ics	Icu	Ics	Icu	Ics	Icu	Ics
<b>Electrically Operated</b>											
NS630b–NS1600	N	50 kA	37 kA	50 kA	37 kA	50 kA	37 kA	40 kA	30 kA	30 kA	22 kA
NS630b–NS1600	H	70 kA	35 kA	70 kA	35 kA	65 kA	32 kA	50 kA	25 kA	42 kA	21 kA
NS630b–NS1000	L	150 kA	150 kA	150 kA	150 kA	130 kA	130 kA	100 kA	100 kA	—	—
<b>Manually Operated</b>											
NS630b–NS1600	N	85 kA	50 kA	50 kA	50 kA	50 kA	50 kA	40 kA	40 kA	30 kA	30 kA
NS630b–NS1600	H	85 kA	52 kA	70 kA	52 kA	65 kA	48 kA	50 kA	37 kA	42 kA	31 kA
NS630b–NS1000	L	150 kA	150 kA	150 kA	150 kA	130 kA	130 kA	100 kA	100 kA	—	—
NS630b–NS800	R	200 kA	200 kA	200 kA	200 kA	200 kA	200 kA	100 kA	100 kA	75 kA	75 kA

- Compact circuit breaker size allows for smaller footprint installations. Nine inch width provides increased density installation.
- Most field-installable accessories are common to all frame sizes for easier stocking and installation
- Selection of four interchangeable Micrologic trip units available, with Powerlogic™ power metering and monitoring capabilities available in advanced trip units.
- Compatible with Powerlogic systems and high amperage power circuit breakers.
- Built-in Modbus® protocol provides an open communications platform and eliminates the need to purchase additional, proprietary network solutions.
- Connection options include bus or cable for installation flexibility.
- Additional options are available for five-cycle closing, stored energy mechanisms and drawout-mounting.

# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

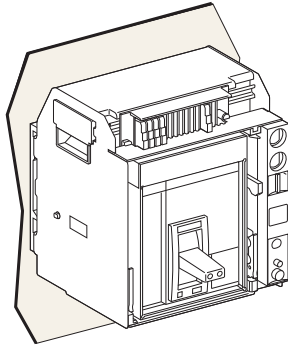
## Section 6—Compact NS630b–NS1600 Circuit Breakers

### Drawout Configuration

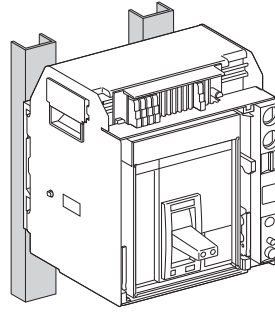
The drawout configuration makes it possible to:

- extract and/or rapidly replace the circuit breaker without having to touch connectors
- allow for the addition of circuits at a later date

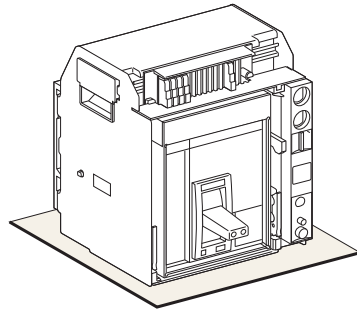
Compact NS630b to NS1600 circuit breakers should be installed vertically only.



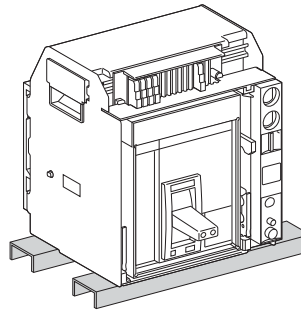
Mounting on a backplate.



Rear mounting on rails.



Device on mounting plate.



Device on rails.

**PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers  
Section 6—Compact NS630b–NS1600 Circuit Breakers**

**Catalog Numbers**

**Table 56: IEC-Rated, Unit-Mount, Manually-Operated, 3P Electronic Trip Circuit Breakers with Micrologic™ Electronic Trip Units<sup>1</sup>**

Trip Unit		Circuit Breaker					
		Current Rating					
		630 A	800 A	1000 A	1250 A	1600 A	
Micrologic Standard Trip Unit	2.0 (LSO)	NPNLE36063U32R	NPNLE36080U32R	NPNLE36100U32R	NPNLE36125U32R	NPNFE36160U32R	
		NPHLE36063U32R	NPHLE36080U32R	NPHLE36100U32R	NPHLE36125U32R	NPHFE36160U32R	
		NPLLE34063U32R	NPLLE34080U32R	NPLLE34100U32R	—	—	
		NPRLE34063U32R	NPRLE34080U32R	—	—	—	
	5.0 (LSI)	NPNLE36063U33R	NPNLE36080U33R	NPNLE36100U33R	NPNLE36125U33R	NPNFE36160U33R	
		NPHLE36063U33R	NPHLE36080U33R	NPHLE36100U33R	NPHLE36125U33RN	NPHFE36160U33R	
		NPLLE34063U33R	NPLLE34080U33R	NPLLE34100U33R	—	—	
		NPRLE34063U33R	NPRLE34080U33R	—	—	—	
	Micrologic Ammeter Trip Unit <sup>2</sup>	2.0A (LSO)	NPNLE36063U42R	NPNLE36080U42R	NPNLE36100U42R	NPNLE36125U42R	NPNFE36160U42R
			NPHLE36063U42R	NPHLE36080U42R	NPHLE36100U42R	NPHLE36125U42R	NPHFE36160U42R
			NPLLE34063U42R	NPLLE34080U42R	NPLLE34100U42R	—	—
			NPRLE34063U42R	NPRLE34080U42R	—	—	—
5.0A (LSI)		NPNLE36063U43R	NPNLE36080U43R	NPNLE36100U43R	NPNLE36125U43R	NPNFE36160U43R	
		NPHLE36063U43R	NPHLE36080U43R	NPHLE36100U43R	NPHLE36125U43R	NPHFE36160U43R	
		NPLLE34063U43R	NPLLE34080U43R	NPLLE34100U43R	—	—	
		NPRLE34063U43R	NPRLE34080U43R	—	—	—	
6.0A (LSIG)		NPNLE36063U44R	NPNLE36080U44R	NPNLE36100U44R	NPNLE36125U44R	NPNFE36160U44R	
		NPHLE36063U44R	NPHLE36080U44R	NPHLE36100U44R	NPHLE36125U44R	NPHFE36160U44R	
		NPLLE34063U44R	NPLLE34080U44R	NPLLE34100U44R	—	—	
		NPRLE34063U44R	NPRLE34080U44R	—	—	—	
Micrologic Power Trip Unit with Modbus® Communications	5.0P (LSI)	NPNLE36063U63RE1	NPNLE36080U63RE1	NPNLE36100U63RE1	NPNLE36125U63RE1	NPNFE36160U63RE1	
		NPHLE36063U63RE1	NPHLE36080U63RE1	NPHLE36100U63RE1	NPHLE36125U63RE1	NPHFE36160U63RE1	
		NPLLE34063U63RE1	NPLLE34080U63RE1	NPLLE34100U63RE1	—	—	
		NPRLE34063U63RE1	NPRLE34080U63RE1	—	—	—	
	6.0P (LSIG)	NPNLE36063U64RE1	NPNLE36080U64RE1	NPNLE36100U64RE1	NPNLE36125U64RE1	NPNFE36160U64RE1	
		NPHLE36063U64RE1	NPHLE36080U64RE1	NPHLE36100U64RE1	NPHLE36125U64RE1	NPHFE36160U64RE1	
		NPLLE34063U64RE1	NPLLE34080U64RE1	NPLLE34100U64RE1	—	—	
		NPRLE34063U64RE1	NPRLE34080U64RE1	—	—	—	
Micrologic Harmonic Trip Unit with Modbus Communications	5.0H (LSI)	NPNLE36063U73RE1	NPNLE36080U73RE1	NPNLE36100U73RE1	NPNLE36125U73RE1	NPNFE36160U73RE1	
		NPHLE36063U73RE1	NPHLE36080U73RE1	NPHLE36100U73RE1	NPHLE36125U73RE1	NPHFE36160U73RE1	
		NPLLE34063U73RE1	NPLLE34080U73RE1	NPLLE34100U73RE1	—	—	
		NPRLE34063U73RE1	NPRLE34080U73RE1	—	—	—	
	6.0H (LSIG)	NPNLE36063U74RE1	NPNLE36080U74RE1	NPNLE36100U74RE1	NPNLE36125U74RE1	NPNFE36160U74RE1	
		NPHLE36063U74RE1	NPHLE36080U74RE1	NPHLE36100U74RE1	NPHLE36125U74RE1	NPHFE36160U74RE1	
		NPLLE34063U74RE1	NPLLE34080U74RE1	NPLLE34100U74RE1	—	—	
		NPRLE34063U74RE1	NPRLE34080U74RE1	—	—	—	

<sup>1</sup> For 4P, replace the 3 in the catalog number following the prefix with a 4 (NPNLE35053U43R becomes NPNLE46063U43R).

<sup>2</sup> Add E1 suffix for Modbus communications.

# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

## Section 6—Compact NS630b–NS1600 Circuit Breakers

**Table 57: Compact Non-Automatic Switch**

Compact Switch-Catalog Number <sup>1</sup>			NPNLE36063U32R	NPNLE36080U32R	NPNLE36100U32R	NPNLE36125U32R	NPNLE36160U32R
Number of Poles			3, 4	3, 4	3, 4	3, 4	3, 4
Control	Manual	Toggle	X	X	X	X	X
		Direct or extended rotary handle	X	X	X	X	X
	Electric		X	X	X	X	X
Connections	Fixed	Front connection	X	X	X	X	X
		Rear connection	X	X	X	X	X
	Drawout (on cradle)	Front connection	X	X	X	X	X
		Rear connection	X	X	X	X	X
Electrical Characteristics as per IEC 60947-3							
Conventional thermal current (A)	$I_{th}$	60°C	630	800	1000	1250	1600
Rated insulation voltage (V)	$U_i$		800	800	800	800	800
Rated impulse withstand voltage (V)	$U_{imp}$		8	8	8	8	8
Rated operation voltage (V)	$U_e$	AC 50/60 Hz	690	690	690	690	690
		220/240 V	630	800	1000	1250	1600
		380/415V					
		440/480 V <sup>2</sup>					
		500/525 V					
660/690 V							
Short-circuit making capacity	$I_{cm}$	(kA peak)	52	52	52	52	52
Short-time withstand current	$I_{cw}$	(A rms) 0.5s 20s	19.2 4	19.2 4	19.2 4	19.2 4	19.2 4
Suitability for isolation			X	X	X	X	X
Durability (C-O cycles)	Mechanical		1000	1000	1000	1000	1000
	Electrical	AC	2000	2000	2000	2000	1000
Positive contact indication			X	X	X	X	X
Pollution degree			3	3	3	3	3
Protections							
Add-on earth-leakage protection	Combination with Vigirex relay		X				
Additional indication and control auxiliaries							
Indication contacts			X				
Voltage releases	MX shunt release		X				
	MN undervoltage release		X				
Remote communication by bus							
Device status indication (communicating auxiliary contacts)			X				
Device remote operation (communicating motor operator)			X				
Installation							
Accessories	Terminal extensions and spreaders		X				
	Terminal shields and interphase barriers		X				
	Escutcheons		X				
Dimensions (mm) W x H x D	Fixed	3P	327 x 210 x 147				
		4P	327 x 280 x 147				
Weight (kg)	Fixed	3P	14				
		4P	18				

<sup>1</sup> Installation standards require upstream protection.

<sup>2</sup> Suitable for 480 V NEMA.



## Interrupting Ratings

See page 61.

## Electrically-Operated Circuit Breakers

Electrically-operated NS630b–NS1600 circuit breakers are available in unit-mount construction up to 1600 A and are denoted in the catalog number by an “M\_” suffix. These come equipped with a two-step stored energy mechanism and come standard with a motor assembly.

Motor assemblies provide on and off control from remote locations. The assemblies contain a spring-charging motor (MCH), a shunt trip (MX) and a shunt close (XF) and are available in standard or communicating versions. An SDE overcurrent trip switch is also included for trip indication. When remote indication of the circuit breaker status is required, use of a circuit breaker with an OF auxiliary switch (for on-off indication).

**Table 58: Motor Assembly Voltage Ratings (Vn)**

Voltage Type	Voltage Ratings (Vn)
Vac 50/60 Hz	48, 100–130, 220–240, 380–415
Vdc	24–30, 48–60, 100–130, 200–250

For catalog numbers, see Table 70 on page 75.

## Automatic Molded Case Switches

Automatic molded case switches are available in unit-mount constructions from 630–1600 A. Automatic switches are similar in construction to electronic trip circuit breakers except that long-time protection is not present. The switches open instantaneously at a non-adjustable magnetic trip point calibrated to protect only the molded case switch itself. They must be used in conjunction with a circuit breaker or fuse of equivalent rating.

## Termination Information

Unit-mount circuit breakers and switches have mechanical lugs standard on both ends. These lugs accept aluminum or copper wire. Manually operated circuit breakers are also available in drawout construction.

Other terminations are available as accessories for non-standard applications. See Table 88 on page 86 for more lug options.

## Accessories

Accessories are available either factory-installed or field-installable. They can be installed in accessory compartments behind the circuit breaker accessory cover. See Table 62 on page 70 for available accessories.

## Control Wiring

Control wiring is connected to terminals located under the circuit breaker accessory cover.

### Accessory Control Wiring Diagrams for Manually-Operated Circuit Breakers

See Figure 2 on page 50. (Same as PowerPact P-frame circuit breaker.)

### Accessory Control Wiring Diagrams for Electrically-Operated Circuit Breakers

See Figure 3 on page 51. (Same as PowerPact P-frame circuit breaker.)

## Section 7—Compact NS1600b–NS3200 Circuit Breaker

### Performance

The Compact NS1600b–NS3200 circuit breakers feature the exclusive Micrologic™ electronic trip units, which allow for a range of sophisticated applications for metering and monitoring. In addition, trip units can be interchanged in the field to allow for maximum flexibility.

The compact size and smaller footprint of the NS circuit breaker permits higher density installations. These circuit breakers are available in up to 3200 A construction to meet a broad range of commercial and industrial application needs.

- Circuit breakers are available in 3200 A construction with a sensor size range of 600–3200 A.
- Interrupting ratings (AIR):

Interrupting Rating	220/240 Vac		380/415 Vac		440 Vac		500/525 Vac		660/690 Vac	
	Icu	Ics	Icu	Ics	Icu	Ics	Icu	Ics	Icu	Ics
N	85 kA	65 kA	70 kA	52 kA	65 kA	65 kA	65 kA	65 kA	65 kA	65 kA
H	125 kA	94 kA	85 kA	64 kA	85 kA	64 kA	—	—	—	—

- The N interrupting rating is recommended for applications having high inrush and/or non-linear loads such as large motors, transformers, motors with soft starts, etc.
- Compact circuit breaker size allows for smaller footprint installations. Fifteen-inch width provides increased density installation.
- Most field-installable accessories are common to all frame sizes for easier stocking and installation
- Selection of four interchangeable Micrologic trip units available, with Powerlogic™ power metering and monitoring capabilities available in advanced trip units.
- Compatible with Powerlogic systems and high amperage power circuit breakers.
- Built-in Modbus® protocol provides an open communications platform and eliminates the need to purchase additional, proprietary network solutions.
- Connection options include bus or cable for installation flexibility.



Compact NS1600b–NS3200

# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

## Section 7—Compact NS1600b–NS3200 Circuit Breaker

### Catalog Numbers

**Table 59: IEC-Rated, Unit-Mount, Manually-Operated, 3P Electronic Trip Circuit Breakers with Micrologic™ Electronic Trip Units**

Trip Unit		Circuit Breaker			
		Current Rating <sup>1</sup>			
		1600 A	2000 A	2500 A	3200 A
Micrologic Standard Trip Unit	2.0 (LS0)	NRNFE36160U32R	NRNFE36200U32R	NRNFE36250U32R	NRNFE36320U32R
		NRHFE36160U32R	NRHFE36200U32R	NRHFE36250U32R	NRHFE36320U32R
	5.0 (LSI)	NRNFE36160U33R	NRNFE36200U33R	NRNFE36250U33R	NRNFE36320U33R
		NRHFE36160U33R	NRHFE36200U33R	NRHFE36250U33R	NRHFE36320U33R
Micrologic Ammeter Trip Unit <sup>2</sup>	2.0A (LS0)	NRNFE36160U42R	NRNFE36200U42R	NRNFE36250U42R	NRNFE36320U42R
		NRHFE36160U42R	NRHFE36200U42R	NRHFE36250U42R	NRHFE36320U42R
	5.0A (LSI)	NRNFE36160U43R	NRNFE36200U43R	NRNFE36250U43R	NRNFE36320U43R
		NRHFE36160U43R	NRHFE36200U43R	NRHFE36250U43R	NRHFE36320U43R
	6.0A (LSIG)	NRNFE36160U44R	NRNFE36200U44R	NRNFE36250U44R	NRNFE36320U44R
		NRHFE36160U44R	NRHFE36200U44R	NRHFE36250U44R	NRHFE36320U44R
Micrologic Power Trip Unit with Modbus® Communications	5.0P (LSI)	NRNFE36160U63RE1	NRNFE36200U63RE1	NRNFE36250U63RE1	NRNFE36320U63RE1
		NRHFE36160U63RE1	NRHFE36200U63RE1	NRHFE36250U63RE1	NRHFE36320U63RE1
	6.0P (LSIG)	NRNFE36160U64RE1	NRNFE36200U64RE1	NRNFE36250U64RE1	NRNFE36320U64RE1
		NRHFE36160U64RE1	NRHFE36200U64RE1	NRHFE36250U64RE1	NRHFE36320U64RE1

<sup>1</sup> For 4P, replace the leading 3 in the catalog number following the prefix with a 4 (NRHFE~~3~~6200U74RE1 becomes NRHFE~~3~~6200U74RE1).

<sup>2</sup> Add E1 suffix for Modbus Communications.

### Interrupting Ratings

See page 66.

### Automatic Molded Case Switches

Automatic molded case switches are available in unit-mount constructions from 1600–3200 A. Automatic switches are similar in construction to electronic trip circuit breakers except that long-time protection is not present. The switches open instantaneously at a non-adjustable magnetic trip point calibrated to protect only the molded case switch itself. They must be used in conjunction with a circuit breaker or fuse of equivalent rating.

**Table 60: Automatic Switch Information**

Ampere Rating	Icw	Trip Point
1600	32 kA	57 kA
2000	32 kA	57 kA
2500	32 kA	57 kA
3200	32 kA	57 kA

# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

## Section 7—Compact NS1600b–NS3200 Circuit Breaker

### Termination Information

NS1600b–NS3200 circuit breakers and switches are equipped for bus connection only. For certain amperages, an RLTBE terminal pad kit may be required. (Same kit as the PowerPact R-frame circuit breaker.) Refer to Section 10—Dimensional Drawings for terminal pad kit dimensions.

**Table 61: Terminal Pad Kits for Compact NS1600b–NS3200 Circuit Breakers**

Circuit Breaker	Terminal Pad Kit (One End Only)		
	Usage	3P Kit	4P Kit
3200 A	Required	Provided	Provided
All Other Circuit Breakers	Optional	RLTBE	RLTBE4

### Accessories

Accessories are available either factory-installed or field-installable. They can be installed in accessory compartments behind the circuit breaker accessory cover. (Same accessories as the R-frame circuit breaker.)

### Control Wiring

Control wiring is connected to terminals located under the circuit breaker accessory cover.

### Accessory Control Wiring Diagrams

Refer to Wiring Diagrams on page 60. (Same as the R-frame circuit breaker.)

## Section 8—Accessories

### Accessories

M-frame, P-frame, R-frame and NS630b–NS3200 circuit breakers can be used with a variety of internal and external accessories to increase application versatility and meet the demands of modern electrical distribution systems.

Circuit breaker internal accessories are available either factory installed or field installable. They can be installed in accessory compartments behind the circuit breaker accessory cover.

### Factory-Installed Accessories

Factory-installed accessories are internally mounted by the factory. Accessories only available factory installed cannot be removed or repaired in the field. Order factory-installed accessories by adding the correct two-letter suffix to the standard circuit breaker catalog number. To build a catalog number, refer to the product selector or contact a field office.

### Field-Installable Accessories

Field-installable accessories can be installed or replaced in the field without affecting the circuit breaker ratings. Field-installable accessories are shipped separately from the circuit breakers. Install and wire field-installable accessories according to the instructions supplied with the circuit breaker and particular accessory. Order field-installable accessories by the catalog number found in the *Schneider Electric Digest*.

# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

## Section 8—Accessories

**Table 62: Field/Factory-Installed Accessories**

Accessory	M-Frame Manually-Operated Circuit Breakers		P-Frame and NS630b–NS1600				R-Frame and NS1600b–NS3200 Circuit Breakers		Page No.
	Field Installable	Factory Installed	Manually-Operated Circuit Breakers		Electrically- Operated Circuit Breakers		Field Installable	Factory Installed	
			Field Installable	Factory Installed	Field Installable	Factory Installed			
Shunt Trip (MX)	Y	Y	Y	Y	Y	Y	Y	Y	71
Undervoltage Trip (MN)	Y	Y	Y	Y	Y	Y	Y	Y	72
Adjustable Time Delay Module for Undervoltage Trip	Y	N	Y	N	Y	N	Y	N	73
Auxiliary Switch (OF)	Y	Y	Y	Y	Y	Y	Y	Y	73
Alarm Switch (SD)	Y	Y	Y	Y	N/A	N/A	Y	Y	73
Overcurrent Trip Switch (SDE)	N	N	Y	Y	Y	Y	Y	Y	73
Spring-Charging Motor	N/A	NA	N/A	N/A	Y	Y	N/A	N/A	75
Trip Unit Replacement Covers	N	N	Y	N	Y	N	Y	N	76
Neutral Current Transformer	N	N/A	Y	N	Y	N	Y	N	77
Ground-Fault Interface Module	N	N/A	Y	Y	Y	Y	Y	Y	77
External Sensor for SGR or MDGF Protection	N	N/A	Y	Y	Y	Y	Y	Y	77
Sensor Plugs	N	N	Y	Y	Y	Y	Y	Y	78
Rating Plugs	N	N	Y	Y	Y	Y	Y	Y	78
M2C and M6C Programmable Contacts	N/A	N/A	Y	Y	Y	Y	Y	Y	79
Circuit Breaker Communication Module	N/A	N/A	Y	Y	Y	Y	Y	Y	79
Restraint Interface Module	N/A	N/A	Y	N	Y	N	Y	N	81
External Power Supply Module	N	N/A	Y	Y	Y	Y	Y	Y	81
External Battery Backup Module	N	N/A	Y	Y	Y	Y	Y	Y	81
Hand-Held Test Kit	N	N/A	Y	Y	Y	Y	Y	Y	84
Full-Function Test Kit	Y	N/A	Y	Y	Y	Y	Y	Y	84
Mechanical Lug	Y	Y	Y	Y	Y	Y	Y	Y	85
Compression Lug	Y	Y	Y	Y	Y	Y	Y	Y	85
Terminal Pad	Y	Y	Y	Y	Y	Y	Y	Y	85
I-Line Jaws	Y	Y	Y	Y	Y	Y	Y	Y	85
Power Distribution Connectors	Y	Y	Y	Y	Y	Y	Y	Y	86
Control Wire Terminations	Y	Y	Y	Y	Y	Y	Y	Y	86
Phase Barriers	Y	N	Y	N	Y	N	Y	N	88
Electric Joint Compound	Y	Y	Y	Y	Y	Y	Y	Y	88
Door-Mounted Operating Mechanism	Y	Y	Y	Y	Y	Y	N/A	N/A	88
Rotary Handle	N/A	N/A	N	Y	N/A	N/A	N/A	N/A	89
Replacement Handles	Y	Y	Y	Y	Y	Y	Y	Y	89
Long Handle Extension	Y	Y	Y	Y	N/A	N/A	N/A	N/A	89
Accessory Cover Door Escutcheons	Y	N	Y	N	Y	N	Y	N	89
Padlock Attachment	Y	Y	Y	Y	Y	Y	Y	Y	89
Keylock	N	Y	N	Y	N	Y	N	Y	89
Keylock Provision	N	Y	N	Y	N	Y	N	Y	89
Sub-Feed Lugs	Y	Y	Y	Y	Y	Y	Y	Y	90

Y = Yes  
 N = No  
 N/A = Not Available

## Electrical Accessories

### Maximum Wire Length

Maximum Wire Length—The inrush currents for these devices are approximately 200 VA. When low supply voltages (12, 24 or 48 V) are used, the maximum allowable wire length is dependent on the voltage and the wire size.

**Table 63: Maximum Wire Length<sup>1</sup>**

Device	Percent of Source Voltage	Source Voltage					
		12 Vdc		24 Vdc		48 Vdc	
Wire Size		14 AWG (2.08 mm <sup>2</sup> )	16 AWG (1.31 mm <sup>2</sup> )	14 AWG (2.08 mm <sup>2</sup> )	16 AWG (1.31 mm <sup>2</sup> )	14 AWG (2.08 mm <sup>2</sup> )	16 AWG (1.31 mm <sup>2</sup> )
UVR (MN)	100%	—	—	159 ft (48.5 m)	100 ft (30.5 m)	765 ft (233.2 m)	472 ft (143.9 m)
	85%	—	—	44 ft (13.4 m)	29 ft (8.8 m)	205 ft (62.5 m)	129 ft (39.3 m)
Shunt Trip (MX) and Shunt Close (XF)	100%	57 ft (17.4 m)	34 ft (10.4 m)	314 ft (95.7 m)	200 ft (61.0 m)	1503 ft (457.8 m)	944 ft (287.7 m)
	85%	27 ft (8.2 m)	17 ft (5.2 m)	205 ft (62.5 m)	126 ft (38.4 m)	957 ft (291.7 m)	601 ft (183.2 m)

<sup>1</sup> The length shown in the table is for each of the two supply wires.

### Shunt Trip (MX1) and Shunt Close (XF)



Shunt Trip (MX1) and Shunt Close (XF)

**Shunt Trip (MX1):** When energized, the shunt trip instantaneously opens the circuit breaker. The shunt trip may be energized continuously or intermittently.

**Shunt Close (XF):** Remotely closes the circuit breaker if the spring mechanism is charged. The shunt close may be energized continuously or intermittently. This accessory is for electrically-operated P-frame circuit breaker only.

Communication versions of the MX1 and XF are available for direct connection via the circuit breaker communication module (BCM).

**Table 64: Shunt Trip and Shunt Close Characteristics**

Characteristics		MX1	XF	Min	Max
Voltage Ratings (V <sub>n</sub> )	Vac 50/60 Hz	24 Vac		17 Vac	26 Vac
		48 Vac		34 Vac	52 Vac
		120 Vac		60 Vac	132 Vac
		240 Vac		168 Vac	264 Vac
		277 Vac		194 Vac	304 Vac
		380 Vac		266 Vac	418 Vac
	Vdc	480 Vac		336 Vac	528 Vac
		12 Vdc		8 Vdc	13 Vdc
		24 Vdc		17 Vdc	26 Vdc
		48 Vdc		34 Vdc	52 Vdc
		125 Vdc	88 Vdc	137 Vdc	
		250 Vdc	175 Vdc	275 Vdc	
Operating Threshold		0.7 to 1.1 V <sub>n</sub>	0.85 to 1.1 V <sub>n</sub>		
Power Consumption (VA or W)	Steady-State/Inrush	4.5/200			
Circuit Breaker Response Time at V <sub>n</sub> <sup>1</sup>		50 ms ±10	70 ms ±10 (NW ≤ 4000 A)		
			80 ms ±10 (NW > 4000 A)		
			55 ms (NT)		

<sup>1</sup> Shunt trip (MX1) and shunt close (XF) circuits must be energized for minimum of 200 ms.

**PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers**  
**Section 8—Accessories**

**Undervoltage Trip (MN)**



Undervoltage Trip (MN)

This function opens the circuit breaker via an electrical order.

It is made up of:

- Instantaneous trip
- Fixed undervoltage trip (time delayed) or,
- Adjustable undervoltage trip (time delayed)

As shown in the wiring diagram for the remote tripping function below, the delay unit (installed outside the circuit breaker) may be disabled by an emergency off button to obtain non-delayed opening of the circuit breaker.

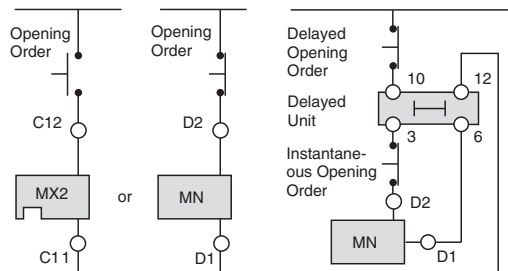
The undervoltage trip (MN) instantaneously opens the circuit breaker when its supply voltage drops to a value between 35% and 70% of its rated voltage.

If the undervoltage trip is not energized, it is impossible to close the circuit breaker, either manually or electrically. An attempt to close the circuit breaker produces no movement of the main contacts. Closing is allowed when the supply voltage of the undervoltage trip reaches 85% of rated voltage.

**Table 65: Undervoltage Trip Characteristics**

Characteristics	MN		
Voltage Ratings ( $V_n$ )	Vac 50/60 Hz	24 Vac	
		48 Vac	
		120 Vac	
		240 Vac	
		277 Vac	
		380 Vac	
		480 Vac	
		Vdc	12 Vdc
			24 Vdc
			48 Vdc
	125 Vdc		
	Power Consumption (VA or W)	Constant/Inrush	4.5/200
		Operating Threshold	Opening
	Closing		0.35 $V_n$
Circuit Breaker Response Time at $V_n$		90 ms $\pm$ 5	

**Figure 5: Wire Diagram for the Remote Tripping Function**





### Time-Delay Module for Undervoltage Trip

To eliminate circuit breaker nuisance tripping during temporary voltage dips (micro-breaks), operation of the undervoltage trip (MN) can be delayed by adding an external time-delay module to the undervoltage trip circuit. Available as adjustable and non-adjustable module.



**Table 66: Time-Delay Module Characteristics**

Characteristics				Factory-Installed Cat. No. Suffix	Field-Installable Cat. No.
Voltage Ratings of Time-delay Module	Adjustable	Vac 50/60 Hz / Vdc	48-60	—	S33680
			100-130	—	S33681
			200-250	—	S33682
			380-480	—	S33683
	Non-Adjustable	Vac 50/60 Hz / Vdc	100-130	—	S33684
			200-250	—	S33685
Operating Threshold		Opening	0.35 to 0.7 V <sub>n</sub>		
		Closing	0.85 V <sub>n</sub>		
Power Consumption			4.5 VA/W (holding), 200 VA/W (inrush)		
Time-Delay Settings	Adjustable		0.5, 0.9, 1.5, and 3.0 s		
	Non-Adjustable		0.25 s		

### Indication Contacts

Changeover contacts are used to provide remote circuit breaker status information and can be used for indications, electrical locking, relaying, etc. All the auxiliary contacts are also available in “low-level” versions capable of switching very low loads (for the control of PLCs or electronic circuits).

#### Auxiliary Switch (OF):

- remotely indicates the position of the main circuit breaker contacts.
- can be used to operate indicator lights, relays or other accessories.
- circuit breaker can accommodate up to three 1A/1B auxiliary switches.

#### Alarm Switch (SD)

- indicates that the circuit breaker has tripped due to:
  - an overload
  - a short circuit
  - an earth-leakage fault
  - operation of a voltage release
  - operation of the “push-to-trip” button
- Returns to de-energized state when the circuit breaker is reset.

#### Overcurrent Trip Switch (SDE)

- indicates that the circuit breaker has tripped due to:
  - an overload
  - a short circuit
  - an earth-leakage fault
- Returns to de-energized state when the circuit breaker is reset.

# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

## Section 8—Accessories

**Table 67: Electrical Characteristics of the OF/SD/SDE Auxiliary Contacts**

Contacts		Standard		Low Level <sup>1</sup>	
Rated thermal current (A)		6		5	
Minimum load		100 mA at 24 V		1 mA at 24 V	
Operational current (A)	Voltage	AC	DC	AC	DC
	24 V	6	6	5	5
	48 V	6	2.5	5	2.5
	110 V	6	0.6	5	0.6
	220/240 V	6	—	5	—
	250 V	—	0.3	5	0.3
	380/440 V	6	—	5	—
	480 V	6	—	5	—
660/690 V	6	—	—	—	

<sup>1</sup> SDE is not available in low level for electrically-operated P-frame circuit breakers.

**NOTE:** If the maximum voltage and current is exceeded, the low-level functions of the switch will be lost but the switch will continue to function as a standard switch.

**Table 68: Catalog Numbers**

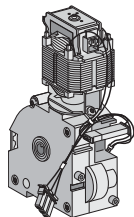
Description	Standard Min Load = 10 mA with 24 V		Low Level Min Load = 1 mA with 24 V	
	Factory-Installed Cat. No. Suffix	Field-Installable Cat. No.	Factory-Installed Cat. No. Suffix	Field-Installable Cat. No.
1 Auxiliary Switch (OF) 1a1b	AA	S29450	AE	S29452
2 Auxiliary Switch (OF) 1a1b	AB	2x S29450	AF	2x S29452
3 Auxiliary Switch (OF) 1a1b	AC	3x S29450	AG	3x S29452
Alarm Switch (SD) 1a1b	BC	S29450	BH	S29452
Overcurrent Trip Switch (SDE) 1a1b	BD	S29450	BJ <sup>1</sup>	S29452
Alarm Switch/Overcurrent Trip Switch (SD/SDE) 2a2b	BE	2x S29450	BK <sup>1</sup>	2x S29452

<sup>1</sup> Not available on an electrically-operated P-frame circuit breaker.

**Spring-Charging Motors (MCH) for P-Frame Circuit Breakers**

The spring-charging motor automatically charges the spring mechanism for closing the circuit breaker and also recharges the spring mechanism when the circuit breaker is in the ON position. Instantaneous reclosing of the circuit breaker is thus possible following circuit breaker opening. The spring-mechanism charging handle is used only as a backup if auxiliary power is absent.

The spring-charging motor is equipped as standard with a limit switch contact (CH) that signals the charged position of the mechanism (springs charged).



**Table 69: Spring-Charging Motor Characteristics**

Characteristics		MCH
Voltage Ratings ( $V_n$ )	Vac 50/60 Hz	48-60, 100-130, 200-250, 240-277, 380-415, 400-440, 480
	Vdc	24-30, 48-60, 100-125, 200-250
Operating Threshold		0.85 to 1.1 $V_n$
Power Consumption		180 VA
Motor Overcurrent		2–3 x $I_n$ for 0.1 s
Charging Time		4 s maximum on NW, 3 s maximum on NT
Duty Cycle		3 cycles per minute maximum
Endurance		10,000 cycles for NW < 4000 A 5000 cycles for NW ≥ 4000 A
CH Contact		10 A at 240 V

**Table 70: Spring-Charging Motors for Electrically-Operated P-Frame Circuit Breakers**

Description	Rated Voltage (+10%/-15%)		Factory Installed Cat. No. Suffix	Field- Replacement Spring Charging Motor Cat. No.	Replacement Coils	
					Factory Installed Cat. No. Suffix	Opening/Closing Coil Cat. No.
Standard Motor for Electrically-Operated Circuit Breakers	Vac	48	ML	S47391	SL	S33660
		100-130	MA	S47395	SA	S33661
		220-240	MC	S47396	SC	S33662
		380-415	MF	S47398	SH	S33664
	Vdc	24-30	MO	S47390	SK	S33659
		48-60	MV	S47391	SL	S33660
		110/130	MR	S47392	SA	S33661
		200/250	MS	S47393	SC	S33662
Communicating Motor Mechanism for Electrically-Operated Circuit Breakers	Vac	48	NL	S47391	EL	S33034
		100-130	NA	S47395	EA	S33035
		220-240	NC	S47396	EC	S33036
		380-415	NF	S47398	EH	S33038
	Vdc	24-30	NO	S47390	EK	S33033
		48-60	NV	S47391	EL	S33034
		110-130	NR	S47392	EA	S33035
		200-250	NS	S47393	EC	S33036

### Micrologic™ Trip Unit Accessories

Circuit breakers are shipped with trip unit installed, but can have the trip units replaced in the field. Actual trip units and settings required for specific applications must be determined by a qualified consultant or plant engineer. A coordination study is recommended to provide coordination between all circuit breakers in the distribution system.

**Table 71: Field-Installable Micrologic Trip Unit**

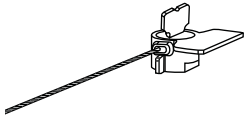
Model	Protection	Additional Features	Field-Installable Cat. No. <sup>1</sup>
2.0 (IEC only)	LSO	None	<b>S132R</b>
3.0 (UL/ANSI only)	LI		<b>S131A</b>
5.0	LSI		<b>S133A</b>
2.0A (IEC only)	LSO	Ammeter	<b>S142R</b>
3.0A (UL/ANSI only)	LI		<b>S141A</b>
5.0A	LSI		<b>S143A</b>
6.0A	LSIG		<b>S144A</b>
5.0P	LSI	Metering, Advanced Protection	<b>S163A</b> <sup>2</sup>
6.0P	LSIG		<b>S164A</b> <sup>2</sup>
5.0H	LSI	Metering, Advanced Protection & Harmonic Analysis	<b>S173A</b> <sup>2</sup>
6.0H	LSIG		<b>S174A</b> <sup>2</sup>

<sup>1</sup> The standard rating plug supplied with a trip unit is the "A" rating plug. To specify an alternative adjustable rating plug, please add the letter designation to the end of the catalog number. Please refer to Digest for a complete listing of adjustable settings available with each plug. (Example: S143B would specify a "B" rating plug instead of the standard "A" plug.) Use suffix "N" if no rating plug is required.

When replacing a Basic trip unit with Type A (Ammeter), P (Power metering) or H (Harmonic analysis) trip unit, order the 12-pin connector kit S33101 for the PowerPact P-frame drawout circuit breakers or kit S33100 for PowerPact P-frame unit-mount and R-frame circuit breakers.

<sup>2</sup> Requires Circuit Breaker Communications Module.

### Lead-Free Trip Unit Sealing Kit



The MICROTUSEAL lead-free trip unit seal was designed as a RoHS-compliant replacement for lead seals. It may be used to seal Micrologic trip units and other devices. It is manufactured as a stainless steel cable and polycarbonate locking mechanism which shows evidence of tampering. The seal is individually numbered for control purposes.

Order kit number **MICROTUSEAL**.

### Replacement Covers

**Table 72: Replacement Covers**

Device	Cat. No.
Micrologic A Trip Unit Cover, clear	<b>S33592</b>
Micrologic P/H Trip Unit Cover, opaque gray	<b>S47067</b>



### Neutral Current Transformer (CT)

Current transformers are available for applications requiring ground-fault protection on three-phase, four-wire systems or for neutral protection and metering. Neutral current transformers are not required on non-ground-fault circuit breakers, or on three-phase, three-wire systems. The rating of the external neutral current transformer must be compatible with the rating of the circuit breaker.

**Table 73: Neutral Current Transformer Catalog Numbers**

Circuit Breaker	Sensor	Cat. No.
P-Frame	250	<b>S33575</b>
	400–1600	<b>S33576</b>
R-Frame	250	<b>S48916</b>
	400–1600	<b>S34036</b>
	2000	<b>S48896</b>
	2500	<b>S48182</b>
All	All	<b>NCTWIRING<sup>1</sup></b>
12-pin Trip Unit Connector		<b>S33100</b>

<sup>1</sup> Included with NCT.

**NOTE:** These neutral current transformers cannot be used for SGR (Source Ground-Return) or MDGF (Modified Differential Ground Fault) applications.

### Ground-Fault Interface Module



The ground-fault interface module (P-frame, R-frame and NS630b–NS3200 circuit breakers only) is used to sum the current flow in three-phase, four-wire systems and multiple-sourced systems, using one or more specially-designed external current sensors to measure current flow. The ground-fault interface module is commonly used in two applications:

- For a ground-source return ground-fault sensing (SGR) system
- For a modified differential ground-fault (MDGF) system

More complex systems are possible, for information about these, contact a field sales representative.

Order kit number **S48891**.

### External Sensor for SGR or MDGF Protections

For use on 400 A sensor or higher.

In SGR applications, an external sensor is installed around the connection of the transformer neutral point to ground. Its secondary is connected to the Micrologic™ 6.0A, 6.0P or 6.0H trip units.

In MDGF applications, a sensor is installed on each phase and neutral conductor. The sensors for each circuit breaker are connected to an interface module. These, in turn, connect to the Micrologic 6.0A, 6.0P or 6.0H trip units.

Order kit number **S33579**.



# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

## Section 8—Accessories



### Sensor Plugs

Sensor plugs are used to set the current rating ( $I_n$ ) of the PowerPact P- and R-frame circuit breakers.

Beginning in January 2007 (date code 07011), the sensor plugs are field-replaceable, down to 50% of the original rating. Mechanical keying in the circuit breaker prevents changing a rating plug to a higher rating than the original factory-installed sensor plug.

**Table 74: Sensor Plugs**

Circuit Breaker	Original Circuit Breaker Amperage	Sensor Plug Range	Sensor Plug Catalog No.
UL P-Frame	250 A	250 A	S47052
	400 A	400 A	S47053
	600 A	600 A	S48823
	800 A	600–800 A	S33092
	1000 A	600–1000 A	S33093
	1200 A	600–1200 A	S48824
IEC P-Frame	630 A	630 A	S33091
	800 A	600–800 A	S33092
	1000 A	600–1000 A	S33093
	1250 A	600–1250 A	S33094
	1600 A	600–1600 A	S33095
UL R-Frame	600 A	600 A	S48823
	800 A	600–800 A	S33092
	1000 A	600–1000 A	S33093
	1200 A	600–1200 A	S48824
	1600 A	800–1600 A	S33095
	2000 A	1000–2000 A	S33982
	2500 A	1200–2500 A	S33983
	3000 A	1200–3000 A	S48825
IEC R-Frame	1600 A	1600 A	S33095
	2000 A	1600–2000 A	S33982
	2500 A	1600–2500 A	S33983
	3200 A	1600–3200 A	S33984

### Rating Plugs

Interchangeable rating plugs are available to limit the long-time threshold setting range for greater versatility.



**Table 75: Rating Plug Settings**

Rating Plug		Switch Settings $I_r = I_n \times \dots$										Cat. No.
For P-Frame and R-Frame Circuit Breakers	Type A	0.4	0.45	0.5	0.6	0.63	0.7	0.8	0.9	1		S48818
	Type B	0.4	0.44	0.5	0.56	0.63	0.75	0.88	0.95	1		S48819
	Type C	0.42	0.50	0.53	0.58	0.67	0.75	0.83	0.95	1		S48820
	Type D	0.4	0.48	0.64	0.7	0.8	0.9	0.93	0.95	1		S48836
	Type E	0.6	0.7	0.75	0.8	0.85	0.9	0.93	0.95	1		S48837
	Type F	0.84	0.86	0.88	0.9	0.92	0.94	0.96	0.98	1		S48838
	Type G	0.66	0.68	0.7	0.72	0.74	0.76	0.78	0.8	0.82		S48839
	Type H	0.48	0.5	0.52	0.54	0.56	0.58	0.6	0.62	0.64		S48840
For NS630b–NS3200 Circuit Breakers	Type R <sup>1</sup>	0.4	0.5	0.6	0.7	0.8	0.9	0.95	0.98	1		S33542
	Type S	0.4	0.45	0.5	0.55	0.6	0.65	0.7	0.75	0.8		S33543
	Type T	0.8	0.82	0.85	0.88	0.9	0.92	0.95	0.98	1		S33544
	Type P (Off Plug)	No Long-Time Protection.										S33545

**Modbus® Circuit Breaker Communication Module (BCM)**



The circuit breaker communication module is independent of the trip unit. Installed on the circuit breaker, behind the trip unit, it receives and transmits information on the communication network. An optical link is used for communication with the Micrologic™ A, P, and H trip units. Power requirements are 30 mA, 24 Vdc.

**NOTE:** The power supply for the circuit breaker communication module must be separate and isolated from the power supply for the trip unit.

The following may be connected to this module:

- A set of dedicated switches which read the status of the circuit breaker.
- A set of “actuators” (MX shunt trip or motor mechanism) to control the circuit breaker.

**Table 76: Circuit Breaker Communication Module Characteristics**

Circuit Breaker Identification	ID Code, Address Size, Rating, Performance Type of Trip Unit Type of Long-Time Rating Plug				
	Status Indication				
Status Indication		On/Off Indication Fault Trip			
Controls		Opening/Closing			
<b>Circuit Breaker and Trip Unit</b>					
		<b>A</b>	<b>P</b>	<b>H</b>	
Settings	Reading of Settings on Rotary Switches	X	X	X	
	Fine Settings in the Range Imposed by the Rotary Switches		X	X	
	Setting of Protection and Alarms		X	X	
	Customized Alarm Programming			X	
Operating and Maintenance Aids	Reading of Protection and Alarms	Standard	X	X	
		Set	X	X	
		Customized		X	
	Reading of Measurements	Current	X	X	X
		Voltages, Frequency, Power, etc.		X	X
		Power Quality: Fundamentals and Harmonics			X
	Waveform Capture			X	
	Histories	History of Trips and Alarms <sup>1</sup>		X	X
		Log of Trips and Alarms			X
	Indicators	Contact Wear, Counters, Etc.		X	X
Maintenance Record				X	

<sup>1</sup> Up to 10 trips and 10 alarms.

**Table 77: Trip Unit Field-Installable Accessories**

Description	Factory-Installed Cat. No. Suffix	Field-Installable Kit Cat. No.						
		P-Frame				R-Frame		
		Unit Mount	I-Line™	Motor Operated	Drawout	With Rotary Handle	Unit Mount	I-Line
Circuit Breaker Communication Module (BCM) (Modbus)	E1	S64205		S64207	S64206	S64205		
Two Programmable Contacts Module (M2C)	V	S64273						
Six Programmable Contacts Module (M6C)	W	S64204			S64202	S64204	S64201	
External Voltage Sensing (EVS)	YV	S64203		S64210	S64209	S64210	S64208	
Trip Unit Battery for Trip Indicator Lights	—	S33593						
12-pin Trip Unit Connector for P- and R-Frame Circuit Breakers	—	S33100						

# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

## Section 8—Accessories

### M2C and M6C Programmable Contacts



The M2C and M6C contacts are used with the Micrologic™ P and H control units, and indicate the type of fault and instantaneous or delayed threshold overruns (i.e: trip unit protection pickup, current/voltage unbalance, under/over voltage, reverse power, phase rotation, under/over frequency, and load shedding). The M2C has two programmable contacts while the M6C has six. They require an external 24 Vdc power supply (100 mA consumption).

**NOTE:** The M2C and M6C may use the same 24 V power supply as the trip unit. The M2C, M6C and trip unit power supply must be separate and isolated from the power supply used for the BCM/CCM.

M6C contacts are programmed via the control unit using a keypad or via a supervisory station with the COM communication option. They may be programmed:

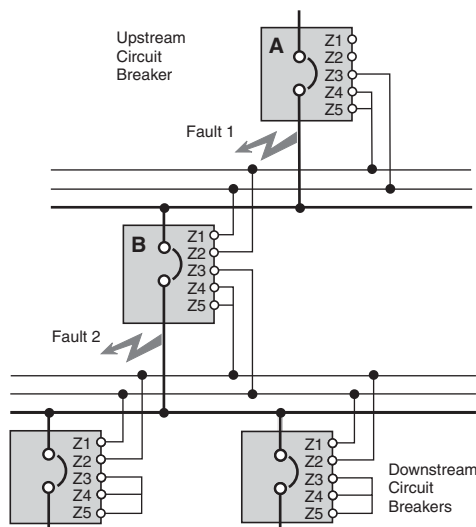
- With instantaneous return to the initial state
- Without return to the initial state
- With return to the initial state following a delay

**Table 78: Characteristics for M2C and M6C Programmable Contacts**

Minimum Load		100 mA/24 V
Breaking Capacity at a Power Factor (p.f.) of 0.7	240 Vac	5 A
	380 Vac	3 A
	24 Vdc	1.8 A
	48 Vdc	1.5 A
	125 Vdc	0.4 A
	250 Vdc	0.15 A

### Zone-Selective Interlocking (ZSI)

**Table 79:**



ZSI is used to reduce the stress on electrical distribution equipment during fault conditions by reducing the time it takes to clear the fault, while maintaining system coordination between overcurrent protective devices.

During a short-circuit or ground-fault condition on a ZSI system, the device directly ahead of the fault sends a signal upstream via control wiring to restrain upstream circuit breakers from tripping and then trips with no intentional time delay to clear the fault. Upstream devices which receive a restraint signal obey their short-time and/or ground-fault delay settings to maintain coordination in other areas of the system. Upstream devices that do not receive a restraint signal trip with no intentional time delay.

- Fault 1—The upstream circuit breaker (A) will clear the fault with no intentional delay, regardless of its time-delay setting.
- Fault 2—Circuit breaker (B) will inform upstream circuit breaker (A) that it is clearing the fault. This will prevent circuit breaker (A) from tripping instantaneously. Circuit breaker (A) will trip at the end of its time delay setting if the fault is not cleared during this time.

ZSI requires trip settings be coordinated so a downstream circuit breaker will trip before an upstream circuit breaker under overload, short-circuit or ground-fault conditions. Effective coordination requires a system coordination study. See data bulletin 0100DB0501, *Short Circuit Coordination for Low-Voltage Circuit Breakers*.



**Restraint Interface Module (RIM)**



The restraint interface module (RIM) is used to allow zone-selective interlocking communications between circuit breakers with old Micrologic™, Merlin Gerin™, or Federal Pioneer™ trip units and GC series ground-fault relays. For 120 Vac/24 Vdc systems, use catalog number S48890. For 240 Vac/24 Vdc systems, use catalog number S48895.

Downstream circuit breakers with Micrologic 2.0A, 5.0A, 5.0P, 5.0H, 6.0A, 6.0P, and 6.0H trip units can restrain up to fifteen upstream circuit breakers with Micrologic 5.0A, 5.0P, 5.0H, 6.0A, 6.0P, and 6.0H trip units without requiring a restraint interface module. If the number of upstream circuit breakers exceeds fifteen, then a RIM is required.

**Table 80: RIM Requirements<sup>1</sup>**

Upstream Device (Receives input from RIM)	Micrologic trip unit <sup>2</sup>	Micrologic Series B trip unit	Square D GC-100 relay	Square D GC-200 relay	Merlin Gerin STR58 trip units	Federal Pioneer USRC and USRCM trip units
Micrologic Trip Unit <sup>2</sup>	15	R	R	15	15	R
Square D Micrologic Series B Trip Units	R	26	R	R	R	15
Square D GC-100 Relay	R	R	7	R	R	R
Square D GC-200 Relay	15	R	R	15	15	R
Merlin Gerin STR58 Trip Units	15	R	R	15	15	R
Merlin Gerin STR53 Trip Units	15	R	R	15	15	R
Federal Pioneer USRC and USRCM Trip Units	R	15	R	R	R	15
Square D Add-on Ground Fault Module for Equipment Protection	R	5	R	R	R	R

<sup>1</sup> R = RIM is required.  
Number denotes maximum number of upstream circuit breakers that can be restrained without requiring a RIM.

<sup>2</sup> Includes 2.0A (as a downstream trip unit only), 5.0A, 5.0P, 5.0H, 6.0A, 6.0P, and 6.0H trip units.

**External Power Supply Module**

When used with the Micrologic™ A, P, and H trip units, a power supply module makes it possible to:

- Display currents less than 20% of sensor ( $I_n$ ).
- Maintain display of tripping causes after opening of the circuit breaker.
- Store the value of the interrupted current (P and H trip units only).
- The modules are not UL Listed.

**Table 81: External Power Supply Module**

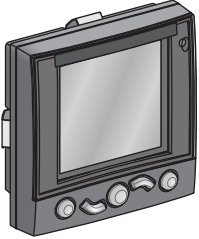
Power Supply Input (+10%, -15%)	Output Voltage	Output Power	Cat. No.
24–30 Vdc Input	24 Vdc	5 VA/5 W (Ripple < 5%)	685823
48/60 Vdc Input			685824
125 Vdc Input			685825
110–130 Vac Input			685826
200–240 Vac Input			685827
380–415 Vac Input			685829

**External Battery Backup Module**

The external battery backup module (Catalog No. 685831) provides up to twelve hours of backup power for the power supply module.

## Display Options

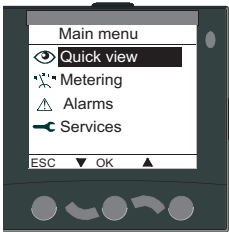
### Front Display Module Functions (FDM121) (Micrologic A / P / H Trip Units Only)



The front display module (FDM121) can be integrated in the PowerPact P- and R-frame circuit breaker system. It uses the sensors and processing capacity of the Micrologic trip unit to display measurements, demand, power quality and maximum/minimum values along with alarms, histories, and maintenance indicators.

It is easy to use and requires no special software or settings and is immediately operational when connected to the PowerPact P- and R-frame circuit breakers by a simple cable.

The FDM121 is a large display, but requires very little depth. The anti-glare graphic display screen is backlit for easy reading even under poor ambient lighting and at sharp angles.



FDM121 Display



Surface Mount Accessory

**Table 82: Characteristics**

Screen	Size	96 x 96 x 30 mm
	Installation	Requires 10 mm behind the door (or 20 mm when the 24 Vdc power supply connector is used).
	Backlighting	White
	Viewing Angle	Vertical ±60°, horizontal ±30°
	Resolution	High: excellent reading of graphic symbols.
Alarm LED	Flashing orange	Alarm pick-up
	Steady orange after operator reset	Alarm condition persists.
Operating temperature	14°F to 131°F (-10 °C to +55 °C).	
Certifications	UL, CSA, CE	
24 Vdc power supply	Tolerances 24 V -20% +10% (19.2 V to 26.4 V)	When the FDM121 is connected to the communication network, the 24 Vdc is supplied by the communication network wiring.
Power Requirements	40 mA, 24 Vdc	
Mounting	Standard door cut-out 92 x 92 mm. Attached using clips.	To avoid a cut-out in the door, a surface-mount accessory is available for surface mounting by drilling two 22 mm diameter holes.
Degree of protection	NEMA12 / IP54 in front.	NEMA12 / IP54 is maintained after mounting by using the supplied gasket during installation.

### Mounting

The FDM121 is easily installed in equipment.

- Standard door cut-out 3.62 x 3.62 in. (92 x 92 mm).
- Attached using clips.

To avoid a cut-out in the door, an accessory is available for surface mounting by drilling only two 0.87 in. (22 mm) diameter holes.

The FDM121 degree of protection is NEMA12 / IP54 in front. NEMA12 / IP54 is maintained after mounting by using the supplied gasket during installation.

### Electrical Connection

The FDM121 is equipped with:

- a 24 Vdc terminal block:
  - plug-in type with 2 wire inputs per point for easy daisy-chaining
  - power supply range of 24 V -20% (19.2 V) to 24 V +10% (26.4 V)
- two RJ45 jacks.

When the second connector is not used, it must be fitted with a line terminator TRV00880.

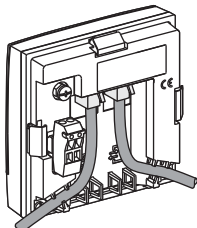
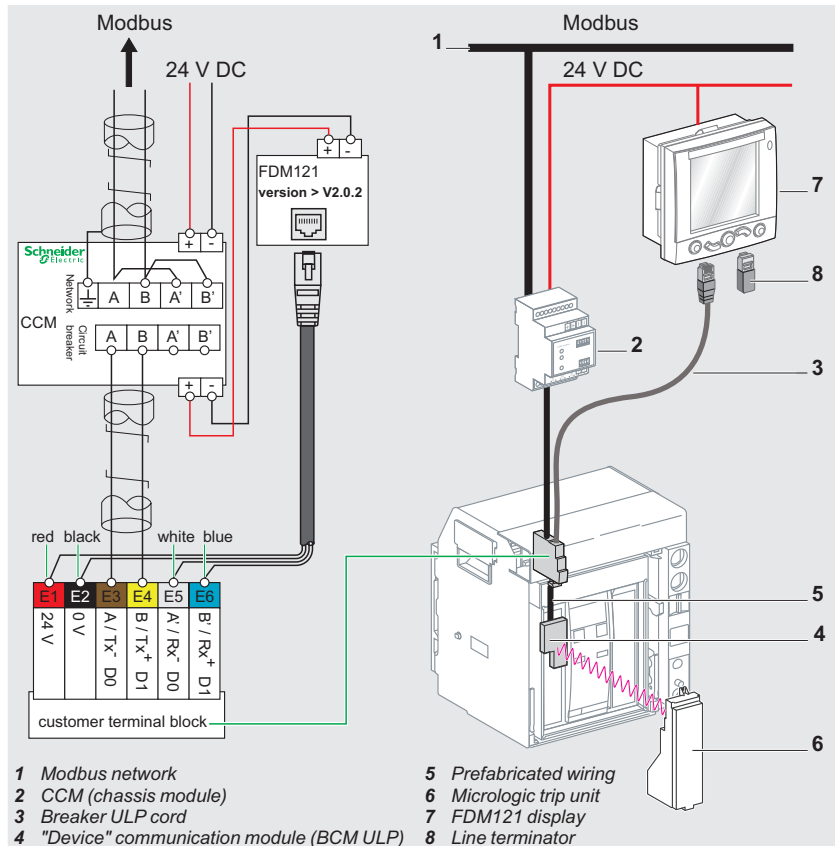


Figure 6: Communication Components and FDM121 Connections



### Navigation

Five buttons are used for intuitive and fast navigation.

The "Context" button may be used to select the type of display (digital [text], bargraph, analog).

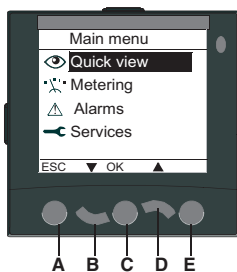
The user can select the display language (Chinese, English, French, German, Italian, Portuguese, Spanish, etc.) Other languages can be downloaded.

### Screens

Main menu

When powered up, the FDM121 screen automatically displays the ON/OFF status of the device.

When not in use, the screen is not backlit. Backlighting can be activated by pressing one of the buttons. It goes off after 3 minutes.



Quick view	Provides access to five screens that display a summary of essential operating information (I, U, f, P, E, THD, circuit breaker On / Off).
Metering	Used to display the measurement data (I, U-V, f, P, Q, S, E, THD, PF) with the corresponding min/max values.
Alarms	Displays active alarms and the alarm history
Services	Provides access to the operation counters, energy and maximum reset function, maintenance indicators, identification of modules connected to the internal bus and FDM121 internal settings (language, contrast, etc.)

## Catalog Numbers

**Table 83: Front Display Module Catalog Numbers**

Description	Catalog No.
FDM121	STRV00121
FDM121 Mounting Accessory	TRV00128

## Test Equipment

### Hand-Held Test Kit

The hand held test kit may be used to:

- Verify trip unit operation, the mechanical operation of the circuit breaker, and the electrical continuity of the connection between the tripping coil and the trip unit.
- Supply control power to the trip unit for settings via the keypad when the circuit breaker is open (Micrologic P and H trip units).
- Inhibit thermal imaging for primary injection test (for Micrologic types A, P or H).
- Inhibit ground fault for primary injection test (for Micrologic types A, P or H).
- Self-restrain Zone-Selective Interlocking (ZSI) (for Micrologic types A, P or H).



**Table 84: Hand-held Test Kit Catalog Numbers**

Device	Cat. No.
Hand-held Test Kit	S33594
Seven-pin Test Cable (for Connection Between Test Kit and Trip Unit) <sup>1</sup>	S48907
Two-pin Test Cable (for Connection Between Test Kit and Trip Unit)	S48908

<sup>1</sup> Included in the test kit. Kit for replacement only.

### Full-Function Test Kit

The full-function test kit consists of a signal-injection box which can be used alone or with a supporting personal computer (PC). The optional test kit software is compatible with Windows® 95, 98 and Windows NT® operating systems.

The test kit **without** a supporting PC may be used to check:

- The mechanical operation of the circuit breaker
- The electrical continuity of the connection between the tripping coil and the trip unit
- Trip unit operation — for example:
  - Display of settings
  - Operating tests on the electronic component
  - Automatic and manual tests on protection functions (trip curve verification)
  - Tests on the Zone-Selective Interlocking (ZSI) function
  - Inhibition of the ground-fault protection for equipment
  - Inhibition of the thermal imaging
- Save test data into test kit

The test kit **with** a supporting PC may be used to:

- Print test data
- Compare the real tripping curve with the curves available on the PC



**Table 85: Full-Function Test Kit Catalog Numbers**

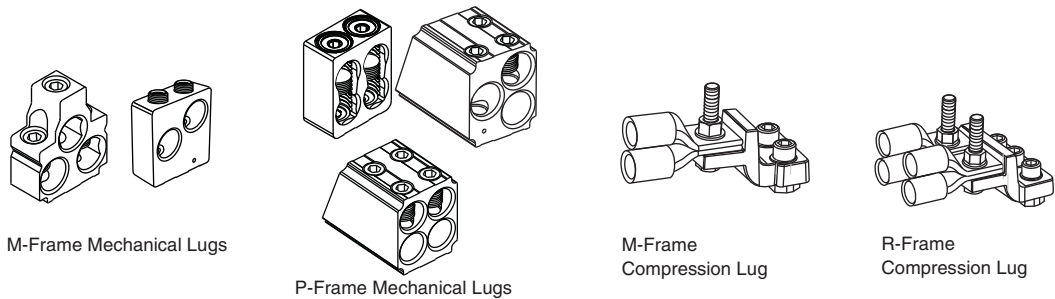
Device	Cat. No.
Full-function Test Kit	S33595
Seven-pin Test Cable (for Connection Between Test Kit and Trip Unit) <sup>1</sup>	S48907
230 Vac Filtered Power Cord <sup>1</sup>	S48856
120 Vac Filtered Power Cord <sup>1</sup>	S48855

<sup>1</sup> Included in the test kit. Kit for replacement only.

## Circuit Breaker Terminations

### Mechanical, Compression, and Distribution Lugs

The M-frame, P-frame and NS630b–NS1250 circuit breakers have mechanical lugs standard on both ends of the unit-mounted circuit breakers. The M-frame and P-frame I-Line™ circuit breakers have mechanical lugs standard on the O/OFF end only. These lugs are suitable for use with copper or aluminum wire. Rear connectors, compression lugs and distribution lugs are available for special applications.



P-frame and NS630b–NS1600 circuit breakers are also available in drawout construction. See Section 8 for drawout cradle details.

The R-frame and NS1600b–NS3200 circuit breakers have terminal pads only (no lugs) for bus connections on both ends. Terminal pads are required for the use of lugs on R-frame circuit breakers, lugs are not available for NS1600b–NS3200 circuit breakers. See the section on R-frame and NS1600b–NS3200 circuit breakers for information on terminal pad requirements. R-frame I-Line circuit breakers have mechanical lugs standard on the O/OFF end only (AL1200R53K).

Copper mechanical lugs are available for use with copper wire only. These lugs can be factory installed by adding an LC suffix to the circuit breaker catalog number for standard copper lugs and LD suffix for high-amp copper lugs (M-frame, P-frame and NS630b–NS1250 ≤ 800 A circuit breakers only). See the Digest or product selector or contact the field office for more information.

### I-Line™ Jaw Configurations

Standard 3P I-Line circuit breakers are supplied with an ABC phase jaw connection. In applications where the jaw configuration must be reversed, specify a CBA jaw configuration by adding the digit 6 to the phasing position of the circuit breaker catalog number.

I-Line 2P circuit breakers are available in AC or CA phasing. Add the digit of the desired phasing to the phasing position of the circuit breaker catalog number.

**Table 86: I-Line Phase Options**

Phase Option Number	Phase Connections
1	AB
2	AC
3	BA
4	BC
5	CA
6	CB

# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

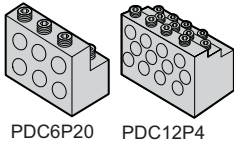
## Section 8—Accessories

**Table 86: I-Line Phase Options**

Phase Option Number	Phase Connections
Standard 6	ABC CBA

### Power Distribution Connectors

Power distribution connectors (PDCs) are available for M-frame, P-frame and NS630b–NS1250 unit-mount circuit breakers as field-installable kits. They can be used for multiple load wire connections on one circuit breaker. Each is UL Listed for copper wire only. Power distribution connectors are for use on the O/OFF end of the circuit breaker only, and the O/OFF end must be connected to the load. PDCs are for use in UL508 applications only.



### Control Wire Terminations

Mechanical lug kits are available with provisions for control wire terminations. The control wire is crimped to a standard ring-type wire crimp terminal (not included) and secured to the lug using the #6-32 screw included in the kit. These lugs are UL and CSA Recognized as a circuit breaker component.

These lugs are available factory installed or as field-installable kits. For factory-installed control wire terminations, add the suffix from the table below in the lug option field of the catalog number.

**Table 87: Control Wire Termination**

Termination Code	Control Wire Location	Control Wire Suffix
L	Both ends	LW
M	ON end only	LU
P	OFF end only	LV

**Table 88: Lug Kits**

Lug Type	Catalog Number	Used On	Circuit Breaker Type	Lugs Per Kit <sup>1</sup>	Max. Amp. Rating	Conductors/Lug	
						No.	Range
Aluminum Mechanical Lug <sup>2</sup>	AL800M23K	M-Frame, P-Frame ≤ 800 A, NS630b–NS800	Unit-Mount, I-Line	3, 4	800	3	3/0 AWG–500 kcmil (95–250 mm <sup>2</sup> )
	AL800P6K	M-Frame, P-Frame ≤ 800 A <sup>3</sup> , NS630b–NS800	Unit-Mount, I-Line	3, 4	800	2	3/0 AWG–600 kcmil (95–300 mm <sup>2</sup> )
	AL800P7K	M-Frame, P-Frame ≤ 800 A <sup>3</sup> , NS630b–NS800	Unit-Mount, I-Line	3	770	2	3/0 AWG–750 kcmil (95–400 mm <sup>2</sup> ); Compact AL 750 kcmil (400 mm <sup>2</sup> ) only
	AL1200P24K	M-Frame, P-Frame > 800 A, optional for ≤ 800 A, NS630b–NS1200	Unit-mount, I-Line	1	1200	4	3/0 AWG–500 kcmil (95–250 mm <sup>2</sup> )
	AL1200P25K	P-Frame > 800 A, optional for ≤ 800 A, NS630b–NS1200	Unit-Mount	3, 4	1200	4	3/0 AWG–500 kcmil (95–250 mm <sup>2</sup> )
	AL1200R53K	R-Frame, NS1600b–NS3200	I-Line	1	1200	4	3/0 AWG–600 kcmil (95–300 mm <sup>2</sup> )
	AL1200P6KU	P-Frame > 800 A, optional for ≤ 800 A, NS630b–NS1200	Unit-Mount	3	1200	3	350-600 kcmil (185-300 mm <sup>2</sup> )
	AL1200P7KU	P-Frame ≤ 800 A <sup>3</sup> , NS630b–NS800	Unit-Mount	3	1155	3	3/0 AWG–750 kcmil (95–400 mm <sup>2</sup> ); Compact AL 750 kcmil only
	AL2500RK	R-Frame, NS1600b–NS3200	Unit-Mount	2	2500	1	1/0 AWG–750 kcmil (50–400 mm <sup>2</sup> )

*Continued on next page*

# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

## Section 8—Accessories

**Table 88: Lug Kits (continued)**

Lug Type	Catalog Number	Used On	Circuit Breaker Type	Lugs Per Kit <sup>1</sup>	Max. Amp. Rating	Conductors/Lug	
						No.	Range
Copper Mechanical Lugs <sup>4</sup>	CU800M23K	M-Frame, P-Frame ≤ 800 A, NS630b–NS800	Unit-Mount, I-Line	3, 4	800	3	3/0 AWG–500 kcmil (95–250 mm <sup>2</sup> )
	CU1200P24K	M-Frame, P-Frame > 800 A, optional for ≤ 800 A, NS630b–NS1200	Unit-Mount, I-Line	1	1200	4	3/0 AWG–500 kcmil (95–250 mm <sup>2</sup> )
	CU1200P25K	P-Frame > 800 A, optional for ≤ 800 A, NS630b–NS1200	Unit-Mount	3, 4	800	4	3/0 AWG–500 kcmil (95–250 mm <sup>2</sup> )
	CU1200R53K	R-Frame, NS1600b–NS3200	I-Line	1	1200	4	3/0 AWG–600 kcmil (95–300 mm <sup>2</sup> )
	CU250P1K	M-Frame, P-Frame ≤ 800 A, NS630b–NS800	PJ	3	150 A	1	1–1/0 AWG (50 mm <sup>2</sup> )
Aluminum Compression Lugs	YA250P3	M-Frame, P-Frame, NS630b–NS1200	Unit-Mount, I-Line	1	250	1	2/0 AWG–300 kcmil (70–150 mm <sup>2</sup> )
	YA400P3	M-Frame, P-Frame, NS630b–NS1200	Unit-Mount, I-Line	2	400	1	2/0 AWG–300 kcmil (70–150 mm <sup>2</sup> )
	YA1200R3	R-Frame, NS1600b–NS3200	I-Line	4	1200	1	2/0 AWG–300 kcmil (70–150 mm <sup>2</sup> )
	YA300P5	M-Frame, P-Frame, NS630b–NS1200	Unit-Mount, I-Line	1	300	1	4/0 AWG–500 kcmil (95–240 mm <sup>2</sup> )
	YA600P5	M-Frame, P-Frame, NS630b–NS1200	Unit-Mount, I-Line	2	600	1	4/0 AWG–500 kcmil (95–240 mm <sup>2</sup> )
	YA1200R5	R-Frame, NS1600b–NS3200	I-Line	4	1200	1	4/0 AWG–500 kcmil (95–240 mm <sup>2</sup> )
	YA400P7	M-Frame, P-Frame, NS630b–NS1200	Unit-Mount, I-Line	1	400	1	500–750 kcmil (240–400 mm <sup>2</sup> )
	YA800P7	M-Frame, P-Frame, NS630b–NS1200	Unit-Mount, I-Line	2	800	1	500–750 kcmil (240–400 mm <sup>2</sup> )
	YA1200R7	R-Frame, NS1600b–NS3200	I-Line	4	1200	1	500–750 kcmil (240–400 mm <sup>2</sup> )
YA2500R7	R-Frame, NS1600b–NS3200	Unit-Mount	2	2500	1	500–750 kcmil (240–400 mm <sup>2</sup> )	
Copper Compression Lugs <sup>4</sup>	CYA400P5	M-Frame, P-Frame, NS630b–NS1200	Unit-Mount, I-Line	1	400	1	4/0 AWG–500 kcmil (95–240 mm <sup>2</sup> )
	CYA600P5	M-Frame, P-Frame, NS630b–NS1200	Unit-Mount, I-Line	2	600	1	4/0 AWG–500 kcmil (95–240 mm <sup>2</sup> )
	CYA1200R5	R-Frame, NS1600b–NS3200	I-Line	4	1200	1	4/0 AWG–500 kcmil (95–240 mm <sup>2</sup> )
	CYA800R7	M-Frame, P-Frame, NS630b–NS1200	I-Line	2	800	1	500–750 kcmil (240–400 mm <sup>2</sup> )
	CYA1200R7	R-Frame, NS1600b–NS3200	I-Line	4	1200	1	500–750 kcmil (240–400 mm <sup>2</sup> )
Power Distribution Connectors (Copper Only)	PDC12P4	M-Frame, P-Frame, NS630b–NS1200	Unit-Mount, I-Line	3	400	12	10–4 AWG (6–25 mm <sup>2</sup> )
	PDC12P44	M-Frame, P-Frame, NS630b–NS1200	Unit-Mount, I-Line	4	400	12	10–4 AWG (6–25 mm <sup>2</sup> )
	PDC6P20	M-Frame, P-Frame, NS630b–NS1200	Unit-Mount, I-Line	3	600	6	12–2/0 AWG (25–70 mm <sup>2</sup> )
	PDC6P204	M-Frame, P-Frame, NS630b–NS1200	Unit-Mount, I-Line	4	600	6	12–2/0 AWG (25–70 mm <sup>2</sup> )

<sup>1</sup> For 4P circuit breakers, add “4” to kit catalog number (AL800M23K4 instead of AL800M23K).

<sup>2</sup> For version with tapped hole for control wire add a T before the K to the kit catalog number (AL800M23TK instead of AL800M23K).

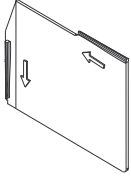
<sup>3</sup> Does not fit onto I/ON end of unit-mount P-frame circuit breakers.

<sup>4</sup> Not available with tapped hole for control wire.

**External Accessories**

**Phase Barriers**

Phase barriers are available for M-frame, P-frame and NS630b–NS1600 unit-mount circuit breakers with bus connections or with lugs ≤ 800 A. Phase barriers are also available for R-frame and NS1600b–NS3200 unit-mount circuit breakers.



**Table 89: Phase Barriers**

Used With	Cat. No.	Qty Per Kit
M-Frame and P-Frame	<b>S33646</b>	3
R-Frame	<b>S33998</b>	

**Electric Joint Compound**

I-Line circuit breakers, I-Line busway plug-on units and I-Line panelboards and switchboards are supplied with factory-applied joint compound on the plug-on connectors. The compound is especially formulated for I-Line connections and contributes to the overall performance of the connection.

If the joint compound is removed, it must be reapplied. A two-ounce container of the compound (Cat. No. PJC7201) is available.

**Door-Mounted Operating Mechanisms**

Door-mounted operating mechanisms are available for M- and P-frame circuit breakers. The Type L door-mounted variable-depth operating mechanism feature heavy-duty, all-metal constructions. They can be padlocked in the OFF position when the enclosure door is open. Handle assemblies can be locked OFF with up to three padlocks, which also locks the door closed. Complete kits include a handle assembly, operating mechanism, and shaft assembly, and are rated for NEMA Type 1, 3R and 12 enclosures. A door drilling template is supplied for ease of installation.



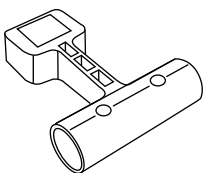
**Table 90: Door-Mounted Operating Mechanisms**

Description	Description	Handle Assembly <sup>1</sup>	Shaft Mounting Depth	Cat. No.
Circuit Breaker Mechanism	Type L	Painted, 8 inch	7.2–11.625 in. (182–295 mm)	<b>LW1</b>
		Painted, 8 inch	7.2–22.25 in. (182–565 mm)	<b>LW4</b>
Handle Assembly <sup>2</sup>	Type 3, 4	Painted, 8 inch	7.2–11.625 in. (182–295 mm)	<b>LHP48</b>
	Type 3, 4, 4X	Chrome Plated, 8 inch		<b>LCP48</b>
Replacement Parts	Handle Assembly	Painted, 8 inch	—	<b>LHP8</b>
	Operating Mechanism	—	—	<b>LW7</b>
	Standard Shaft	—	7.2–11.625 in. (182–295 mm)	<b>LS8</b>
	Long Shaft	—	7.2–22.25 in. (182–565 mm)	<b>LS10</b>

<sup>1</sup> Painted handles are painted flat black, with the base ring silver.  
<sup>2</sup> Due to gasketing, NEMA 3 and 4 handle assemblies are NOT trip indicating.

**Handle Extension**

Handle extensions are available for M- and P-frame circuit breakers. Order catalog number 33195.





### Rotary Operating Handles

P-frame and NS630b–NS1600 circuit breakers are available with standard black directly-mounted (IP-40) or door-mounted / telescopic door-mounted (IP-55) rotary handles. The rotary handles are factory-installed and available with two early-break or two early-make contacts.

**Table 91: Rotary Operated Handles**

Device	Switches	Factory-Installed Cat. No. Suffix
Direct Mounted, Standard Black Handle	—	<b>RD10</b>
	Two Early-Break and Two Early-Make Switches	<b>RD16</b>
Door Mounted, Standard Black Handle	—	<b>RE10</b>
	Two Early-Break and Two Early-Make Switches	<b>RE16</b>
Rotary Handle Replacement Kit	—	<b>S33875</b>

### Replacement Handles

Replacement handle assemblies are available for R-frame and NS1600b–NS3200 circuit breakers. Replacement toggle handle extensions, including an optional longer handle extension, are available for M-frame, P-frame, and NS630b–NS1600 circuit breakers.

**Table 92: Replacement Handles for M-, P-, and R-Frame Circuit Breakers**

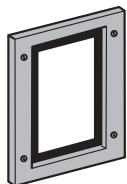
Description	Frame	Field-Installed Cat. No.
Standard	R-Frame	<b>S33997</b>
Standard Short	M-, P-Frame	<b>S46998</b>
Long	M-, P-Frame	<b>S46996</b>

### Door Escutcheons

Accessory cover door escutcheons are available for all M-frame, P-frame, R-frame and NS630b–NS3200 circuit breakers. Toggle door escutcheons are also available for fixed-mounted, P-frame, manually-operated circuit breakers.

**Table 93: Door Escutcheons for M-, P-, and R-Frame Circuit Breakers**

Description	Frame	Field-Installed Cat. No.
Accessory Cover	M-, P-Frame	<b>S33718</b>
	R-Frame	<b>S33929</b>
Toggle Handle	M-, P-Frame	<b>S33717</b>
Drawout	P-Frame	<b>S33857</b>



### Locking Accessories

Field-installable handle padlock attachments are available for manually-operated circuit breakers. These attachments will accommodate three padlocks with a shackle diameter of 3/16–5/16 in. (5–8 mm) and will lock the circuit breaker in the O/OFF position only.

A handle padlock attachment is also available for locking manually-operated circuit breakers in either the I/ON or O/OFF position. This attachment will accommodate three padlocks with a shackle diameter of 3/16–5/16 in. (5–8 mm) and is available as factory or field installation.

Kirk® key interlock brackets are also available for locking circuit breakers in the O/OFF position only. Not available for drawout P-frame or NS630b–NS1600.

Circuit breakers with rotary handles come standard with provision for padlocking the handle in the O/OFF position only. Key locks are also available for locking the circuit breaker in the I/ON or O/OFF positions.

A keylock or padlock provision for padlocking the circuit breaker in the O/OFF position is optional on electrically-operated P-frame and NS-630b–NS1600 circuit breakers.

# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

## Section 8—Accessories

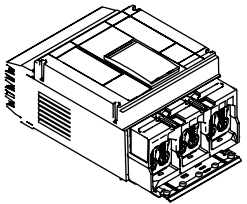
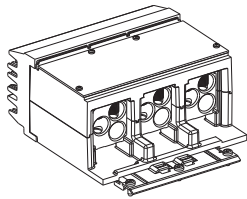
**Table 94: Locks and Interlocking**

Device	Description	M- and P-Frame		R-Frame	
		Factory-Installed Cat. No. Suffix	Field-Installed Cat. No.	Factory-Installed Cat. No. Suffix	Field-Installed Cat. No.
Handle Padlocking Device	Removable (Lock Off or On)	—	—	—	—
	Removable (Lock Off Only)	—	S44936	—	S33996
	Fixed (Lock Off or On)	YP	S32631	YP	S32631
	Fixed (Lock Off Only)	YQ	MPRPAF	YQ	MPRPAF
Interlocking (Not UL listed)	Mechanical for Circuit Breakers with Rotary Handles	—	S33890 <sup>1</sup>	—	—
Key Locking	Provision Only, Vertical Mount, 1 key interlock including padlock provision, open position only	Kirk	JE <sup>1</sup>	—	JE <sup>1</sup>
	Provision Only, Vertical Mount, 1 or 2 Locks	Kirk	JA	—	—
	Provision Only, Horizontal Mount	Kirk	JK	—	JK
	1 Lock, M- and P-Frame	Ronis	JB	—	JB
	1 or 2 Locks, R-Frame	Profalux	JD	—	JD
	Provision and 1 Lock, Vertical Mount	Kirk	JG	—	—
	Provision and 1 Lock, Horizontal Mount	Kirk	JL	—	JL
		Ronis	JC	—	JC
		Profalux	JF	—	JF
Provision and 2 Locks Keyed Alike, Vertical Mount	Kirk	JN	—	—	
Provision and 2 Locks Keyed Alike, Horizontal Mount	Kirk	—	—	JN	
Provision and 2 Locks Keyed Differently, Vertical Mount	Kirk	JP	—	—	
Provision and 2 Locks Keyed Differently, Horizontal Mount	Kirk	—	—	JP	

<sup>1</sup> Not available on M-frame, motor-operated P-frame, or I-Line circuit breakers.

## Sub-Feed Lugs

Sub-feed lug kits are UL Listed for use on Listed equipment. They have plug-on jaw construction and plug on to the I-Line™ bus stack in the same manner as branch circuit breakers. Lugs on these devices accommodate the same wire sizes as the equivalent ampere rated circuit breakers.

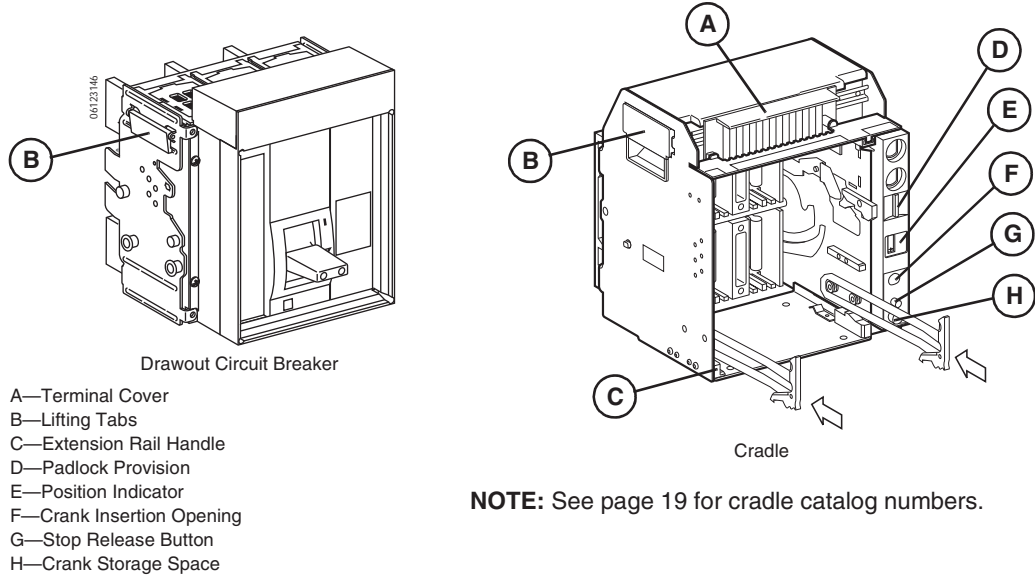


**Table 95: I-Line Sub-Feed Lug Kit Terminations**

Plug-On Lug Kit Cat. No.	Poles	Mounting Height	Ampere Rating	Lug		
				Catalog No.	Wire Size	Conductors Per Lug
SL800M5	3		800 A	—	3/0 AWG–500 kcmil (95–240 mm <sup>2</sup> )	3
SL1200P5	3		1200 A	—	3/0 AWG–500 kcmil (95–240 mm <sup>2</sup> )	4
SL1200P6	3		1200 A	—	350–600 kcmil (185–300 mm <sup>2</sup> )	3
SL1200P7	3		1200 A	—	3/0 AWG–750 kcmil (95–400 mm <sup>2</sup> )	2
S33931	3	9 in.	1200 A	AL1200P24K	3/0 AWG–500 kcmil (95–240 mm <sup>2</sup> )	4
S33930	3	15 in.	1200 A	AL1200R53K	3/0 AWG–600 kcmil (95–300 mm <sup>2</sup> )	4

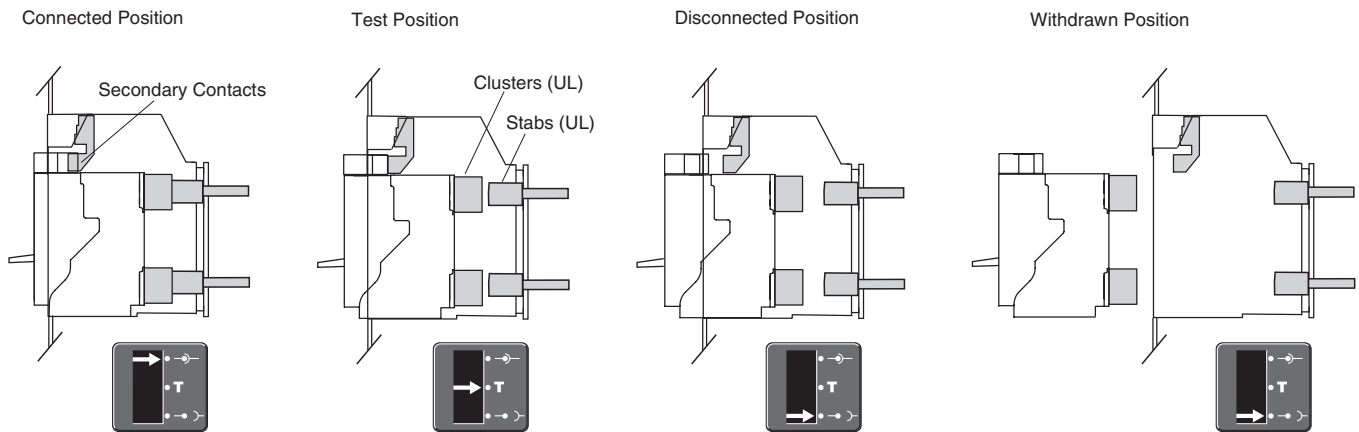
## Section 9—P-Frame Cradles and Cradle Accessories

### Circuit Breaker and Cradle Design



### Drawout Mechanism

The drawout assembly mechanism allows the circuit breaker to be racked in four positions (connected, test, disconnected, or withdrawn), as shown in the figure below.



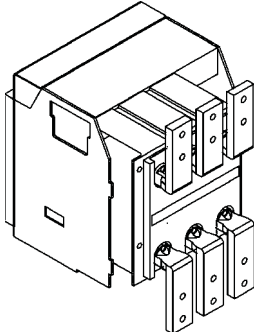
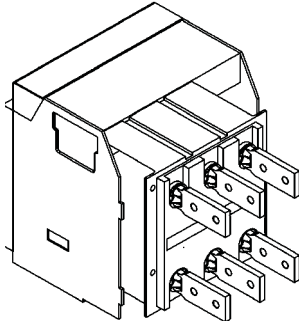
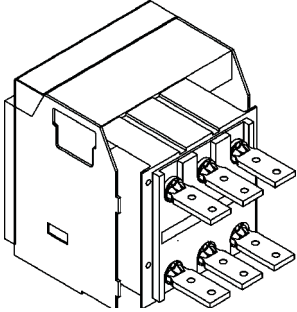
**NOTE:** For UL/CSA Listed devices, the clusters are mounted on the circuit breaker and the stabs are on the cradle. For IEC devices, the clusters are mounted on the cradle and the stabs are mounted on the circuit breaker.

# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

## Section 9—P-Frame Cradles and Cradle Accessories

### Connectors

Table 96: Available Connectors

Front-Connected Flat (FCF)	Rear-Connected “T” Vertical (RCTV)	Rear-Connected “T” Horizontal (RCTH)
		

### Cradle Accessories

#### Cradle Position Switches

Three optional cradle position switches are available for the cradle:

- Cradle position switches (CE) to indicate the connected position.
- Cradle position switches (CD) to indicate the disconnected position. This position is indicated when the required clearance for isolation of the power and auxiliary circuits is reached.
- Cradle position switches (CT) to indicate the test position. In this position, the power circuits are disconnected and the auxiliary circuits are connected.

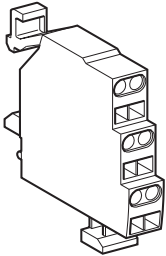


Table 97: Cradle Position Switches

Switch Type		CE	CD	CT	Cat. No.		CE	CD	CT	Cat. No.
Maximum Push-In Switches		3	2	1			3	2	1	
Breaking Capacity at a Power Factor (pf) of 0.3	Standard: 10 mA/24 V Min. Load				S33170	Low-Level: 1 mA/4 V Min. Load <sup>1</sup>				S33171
	240 Vac	8 A				24-48 Vac	5 A			
	380 Vac	8 A				240 Vac	5 A			
	480 Vac	8 A				380 Vac	5 A			
	600-690 Vac	6 A				24-48 Vdc	2.5 A			
	24-48 Vdc	2.5 A				125 Vdc	0.8 A			
	125 Vdc	0.8 A				250 Vdc	0.3 A			
250 Vdc	0.3 A									

<sup>1</sup> If the maximum voltage and current is exceeded, the low-level function of the switch will be lost but the switch will continue to function as a standard switch with standard switch specifications.

# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

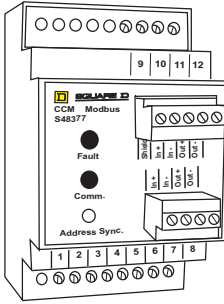
## Section 9—P-Frame Cradles and Cradle Accessories

### Modbus® Cradle Communication Module (CCM)

The Cradle Communication Module (catalog number S33852) makes it possible to address the cradle and to maintain the address when the circuit breaker or the BCM is replaced. Cradle position switches connected to the module determine and communicate the position of the circuit breaker in the cradle. Power requirements: 30 mA, 24 Vdc.

**NOTE:** The power supply for the circuit breaker communication module must be separate and isolated from the power supply for the trip unit.

**Table 98: Cradle Communication Module Characteristics**



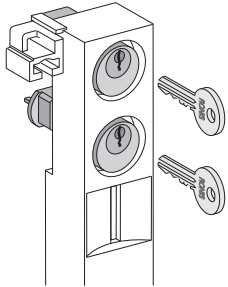
<b>Circuit Breaker Identification</b>	ID Code, Address			
	Size, Rating, Performance			
	Type of Trip Unit			
	Type of Long-Time Rating Plug			
<b>Status Indication</b>	On/Off Indication			
	Connected/Disconnected/Test Position Fault Trip			
<b>Controls</b>	Opening/Closing			
		<b>Trip Unit</b>		
	Settings	<b>A</b>	<b>P</b>	<b>H</b>
	Reading of Settings on Rotary Switches	X	X	X
	Fine Settings in the Range Imposed by the Rotary Switches		X	X
	Setting of Protection and Alarms		X	X
<b>Operating and Maintenance Aids</b>	Customized Alarm Programming			X
	Reading of Protection and Alarms	Standard		X
		Set		X
		Customized		X
	Reading of Measurements	Current	X	X
		Voltages, frequency, power, etc. Power quality: Fundamentals and harmonics		X
	Waveform Capture			X
	Histories	History of trips and alarms <sup>1</sup>		X
Log of trips and alarms			X	
Indicators	Contact wear, counters, etc.		X	
	Maintenance record		X	

<sup>1</sup> Up to ten trips and ten alarms.

## **Cradle Locking and Interlocking**

### **Disconnected Position Locking**

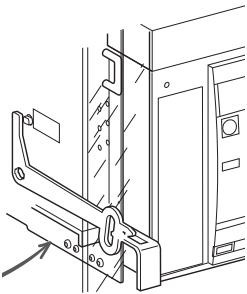
The circuit breaker can be locked in the disconnected position by key interlock (optional, catalog number **s33772**) or padlock (standard). The key interlock is on the cradle and accessible with the door locked.



- Kirk key interlocks are available for UL/CSA circuit breakers. Key is captive when circuit breaker is closed.
- Locking in all positions (disconnected, test, and connected) is possible. Factory standard setting is locking in disconnected position.

### **Door Interlock**

The door interlock (catalog number **S33786**) prevents the compartment door from being opened when the circuit breaker is in the connected or test position. If the circuit breaker is put into the connected position with the door open, the door can be closed without disconnecting the circuit breaker. For greater protection, this interlock can be used in conjunction with the open door racking interlock.



### **Open Door Racking Interlock**

The racking interlock (catalog number **s33788**) prevents racking in the circuit breaker when the door is open. (Insertion of the circuit breaker racking crank is not possible when the compartment door is open.)

### **Cradle Rejection Kits**

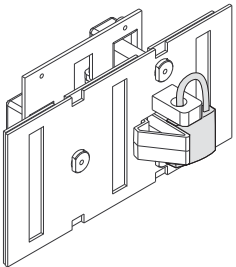
The cradle rejection feature (optional, catalog number **s33767**) ensures that only the properly designated circuit breaker or switch is matched with the selected cradle assembly.

## **Miscellaneous Accessories**

### **Shutter and Shutter Lock**

The shutters automatically block access to the main disconnects when the circuit breaker is in the disconnected, test, or fully withdrawn position. The shutter lock is used to prevent connection of the circuit breaker or to lock the shutters in the closed position.

The optional shutter assembly (catalog number **s48933**) consists of shutter and padlock provision.



### **Door Escutcheon (CDP)**

The door escutcheon (catalog number **s33857**) provides a frame and seal for the circuit breaker.

### **Transparent Cover for Door Escutcheon (CCP) (P-Frame Only)**

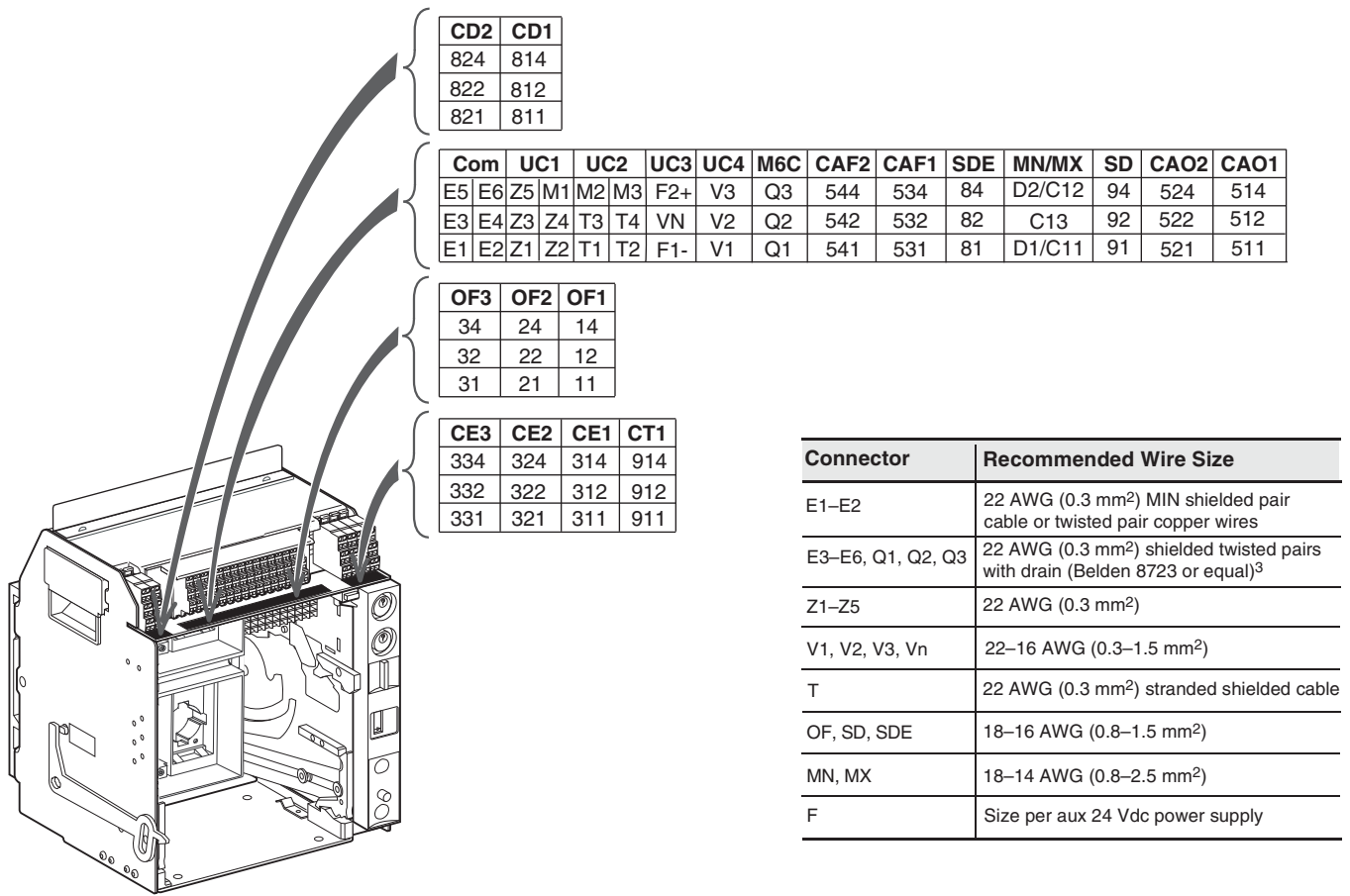
The door escutcheon cover (catalog number **s33859**) is hinge-mounted and is designed to be installed on the door escutcheon for the P-frame drawout circuit breaker.

# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

## Section 9—P-Frame Cradles and Cradle Accessories

### Wiring Diagrams

Figure 7: Terminal Layout for Push-In Connector Installation



Function	Connector	Description
Auxiliary Contacts	OF	Open/Closed circuit breaker or switch position contacts
Rotary Handle Contacts	CAO	Early break contact
	CAF	Early make contact
Cradle Contacts	CD	Disconnected position contacts
	CE	Connected position contacts
	CT	Test position contacts
Remote Operation	SDE	Electrical fault alarm contact
	SD	Alarm contact
	MN	Undervoltage trip device
	MX <sup>1</sup>	Shunt trip

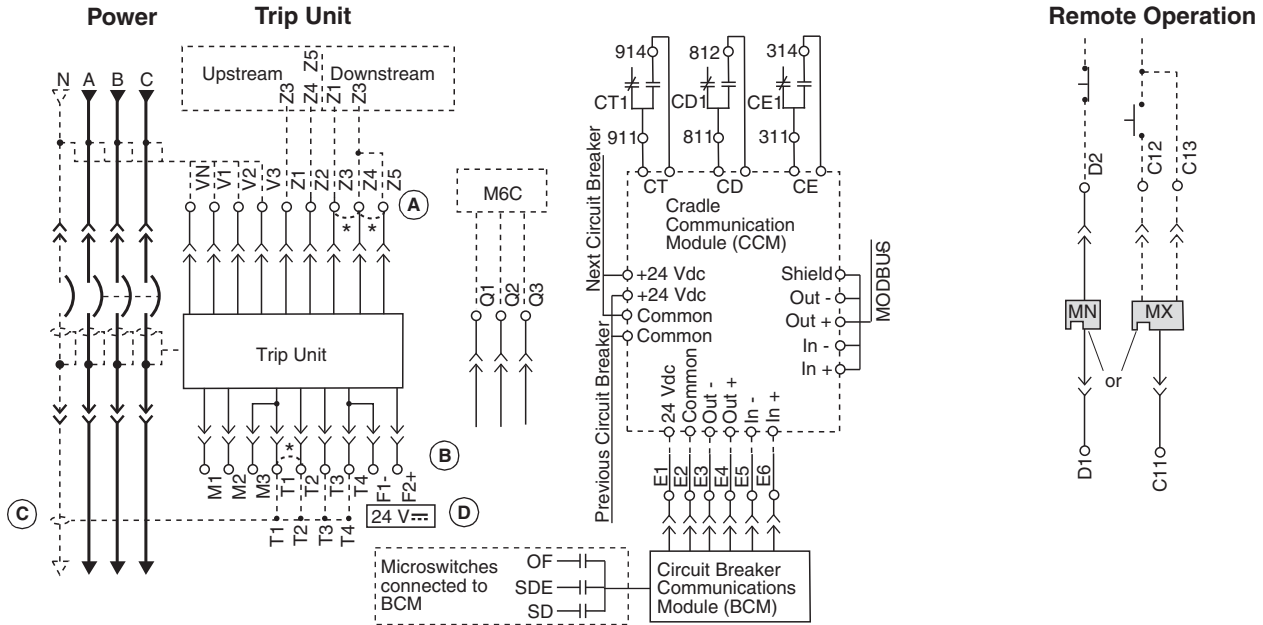
<sup>1</sup> When networked MXF coils are used, terminal C3 must be connected to line even if the communication module is not installed.

Trip Unit Type				Connector	Description
Basic	A	P	H		
—	X	X	X	Com: E1-E6	Communication
—	X	X	X	UC1: Z	Zone-selective Interlocking Z1 = ZSI OUT signal Z2 = ZSI OUT Z3 = ZSI IN signal Z4 = ZSI IN short time Z5 = ZSI IN ground fault
—	X	X	X	UC1: M1	Modified differential ground fault (MDGF)
—	X	X	X	UC2: T	External neutral
—	X	X	X	UC2: M	Modified differential ground fault (MDGF)
—	X	X	X	UC3: F	24 Vdc external power supply (F1 -, F2 +)
—	—	X	X	UC3: Vn	External neutral plug
—	—	X	X	UC4	External phase voltage sensing
—	—	X	X	M6C	Six programmable contacts

# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

## Section 9—P-Frame Cradles and Cradle Accessories

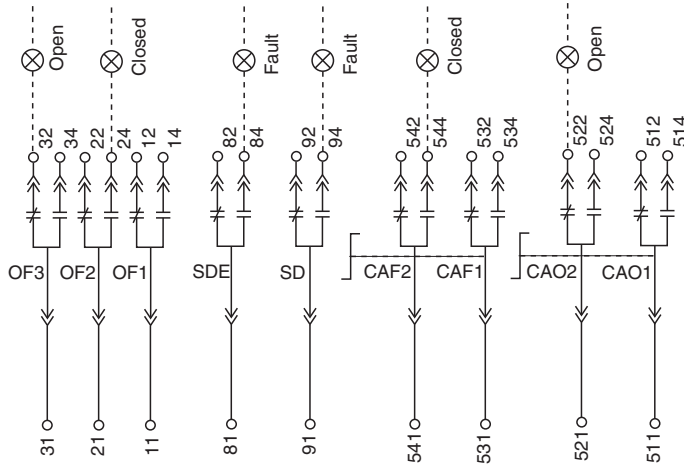
Figure 8: Wiring Diagrams for Auxiliary Connections



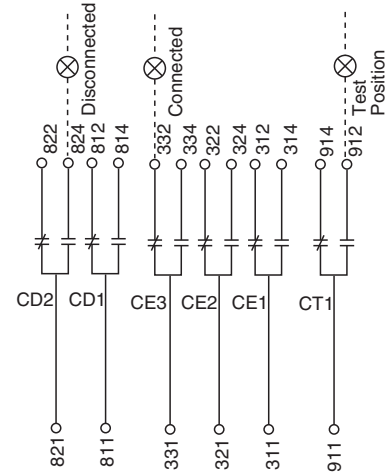
NOTE: All diagrams show circuit breaker in tripped position.

- A—Do not remove factory-installed jumpers between Z3, Z4 and Z5 unless ZSI is connected.
- B—Do not remove factory-installed jumper between T1 and T2 unless neutral CT is connected. Do not install jumper between T3 and T4.
- C—For proper wiring of neutral CT, refer to Instruction Bulletin 48041-082-01 shipped with it.
- D—24 Vdc power supply for trip unit must be separate and isolated from 24 Vdc power supply for communication modules.
- E—For proper wiring of the FDM, refer to user guide 5100512864A-02.

### Auxiliary Contacts



### Cell Switches

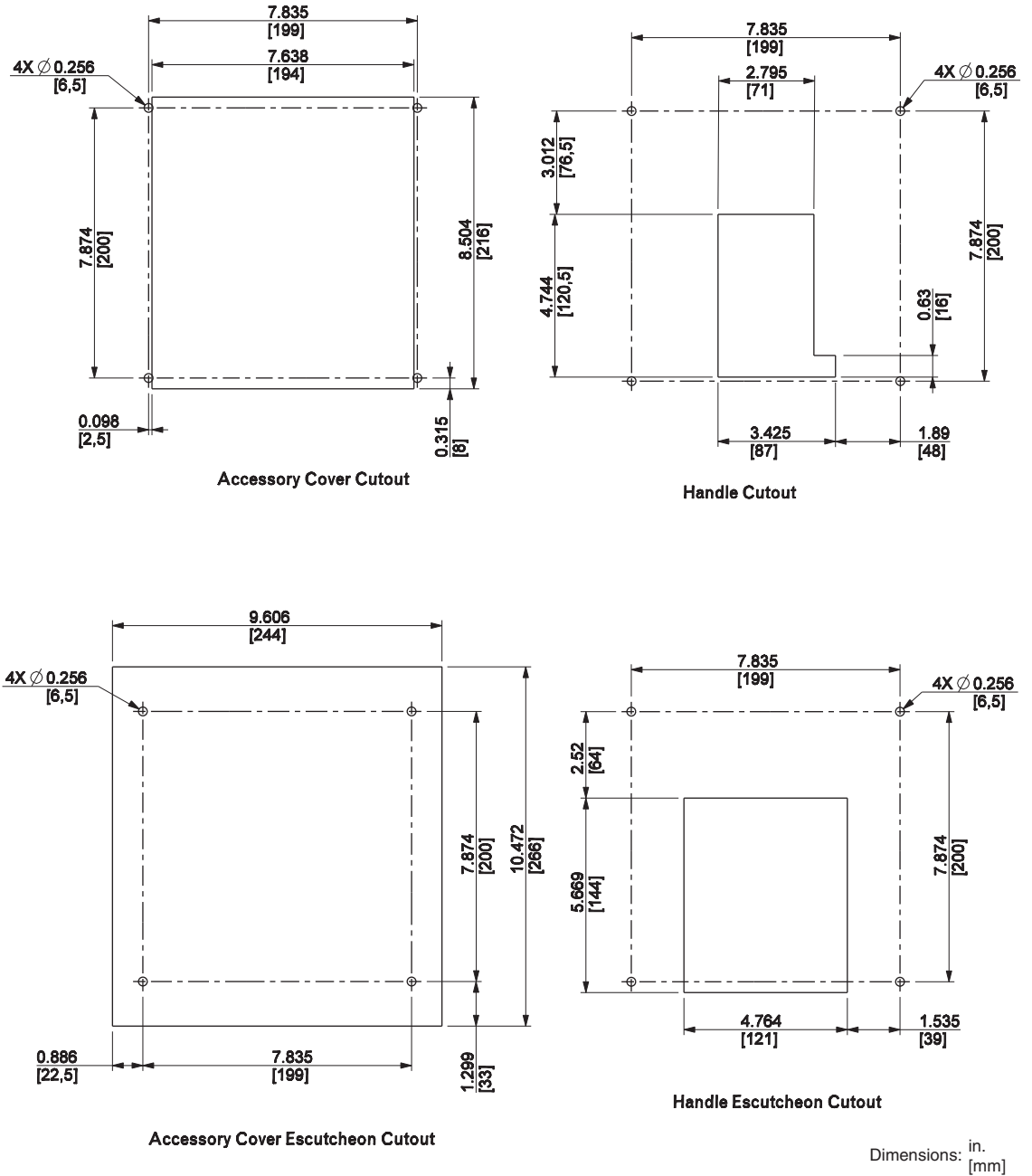




## Section 10—Dimensional Drawings

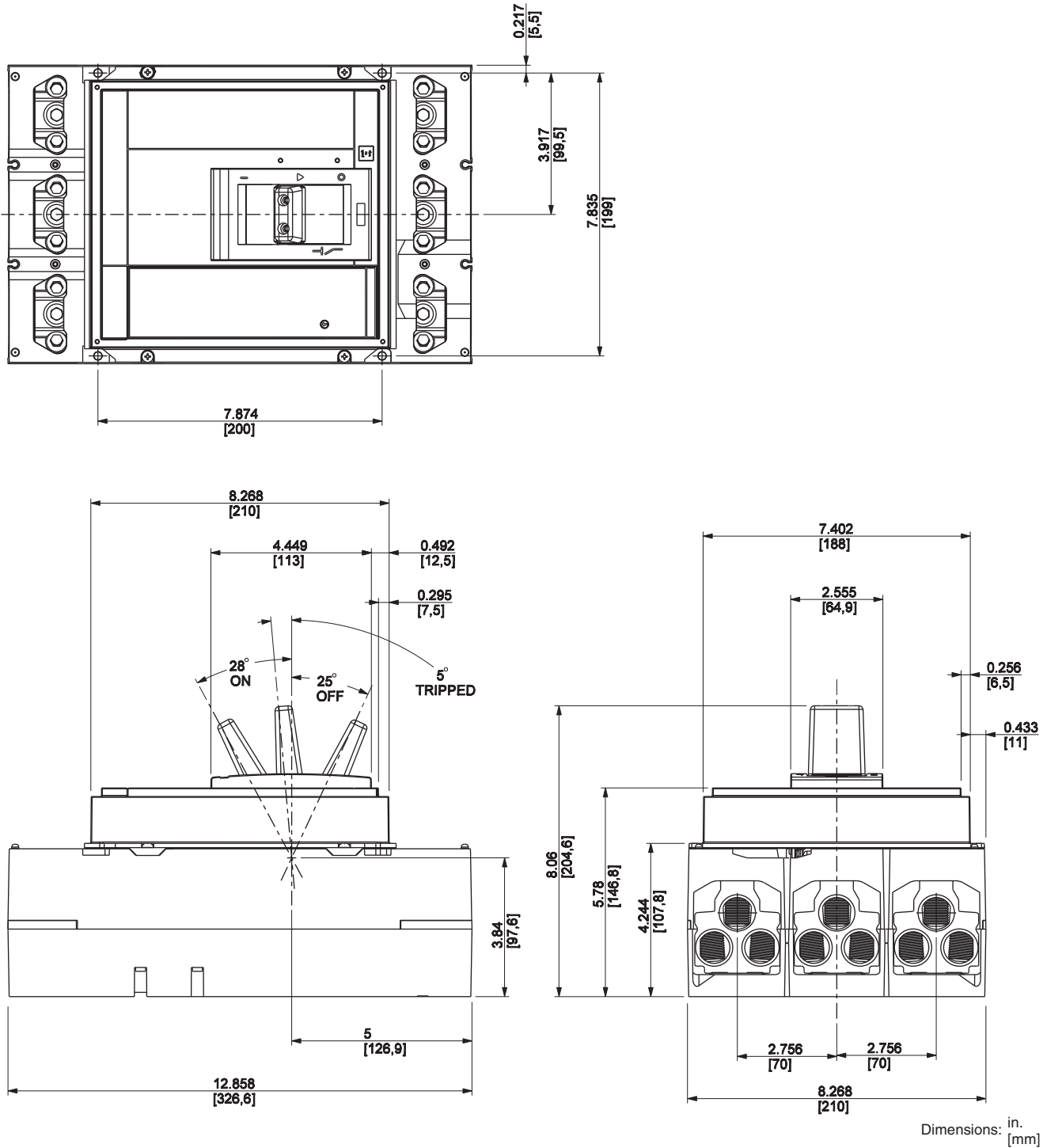
### Dimensions for M-Frame Circuit Breakers

Figure 9: M-Frame Individually-Mounted Circuit Breaker Enclosure Mounting Holes and Door Cutouts



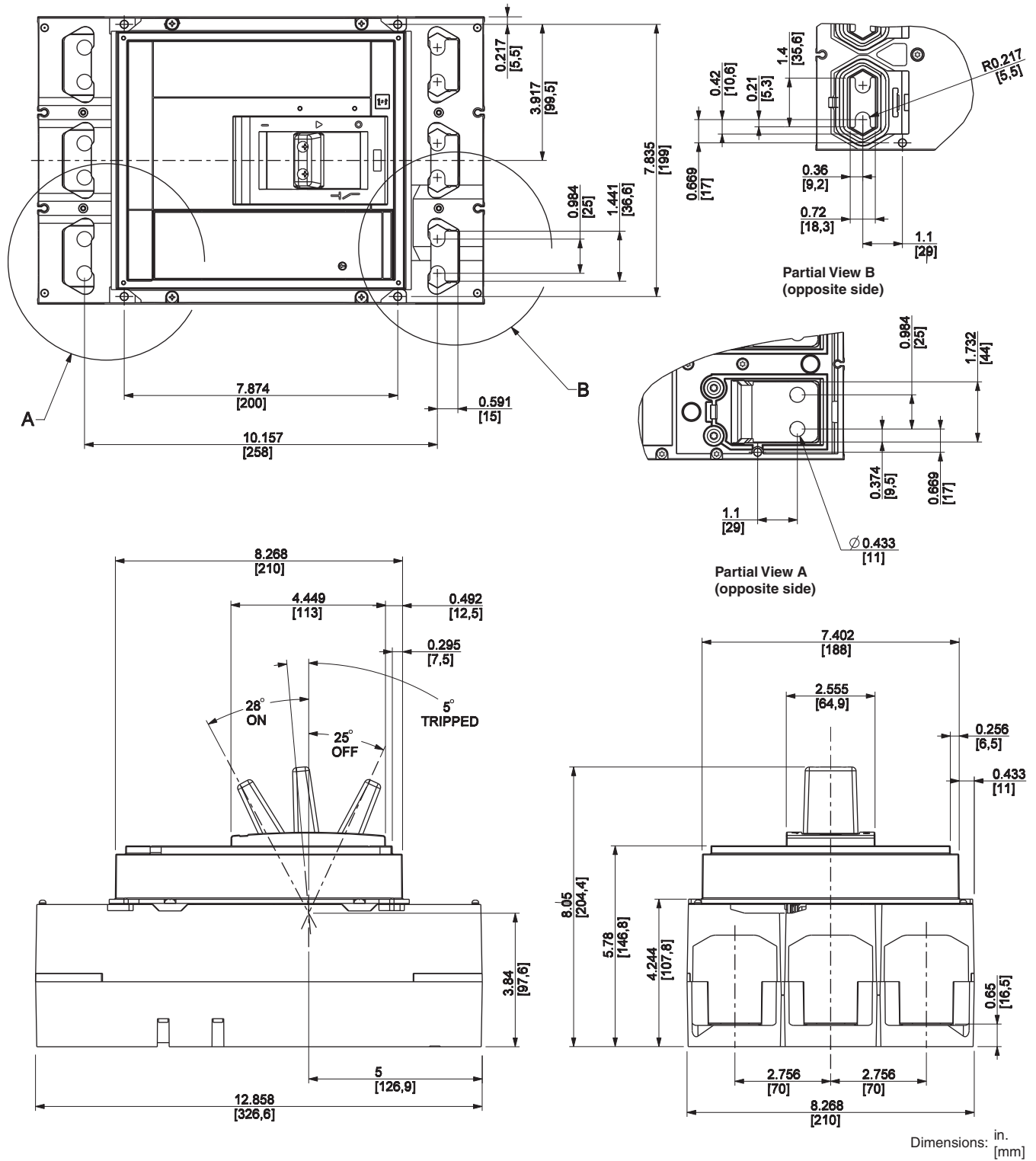
**PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers**  
**Section 10—Dimensional Drawings**

**Figure 10: M-Frame Individually-Mounted 3P 800 A Circuit Breaker with Lugs on Both Ends**



PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers  
Section 10—Dimensional Drawings

Figure 11: M-Frame Individually-Mounted 3P 800 A Circuit Breaker without Lugs



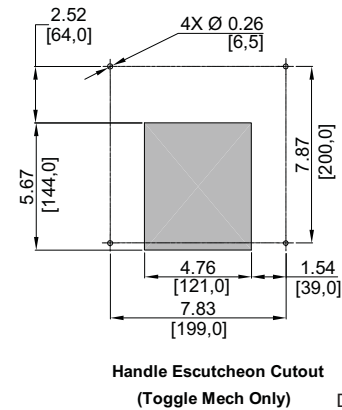
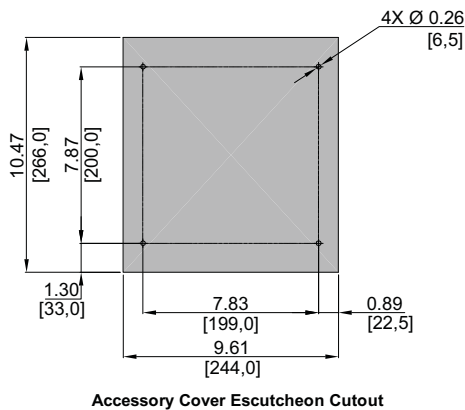
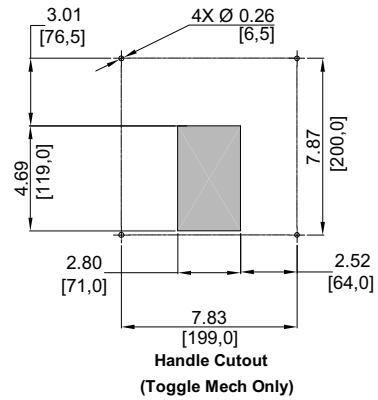
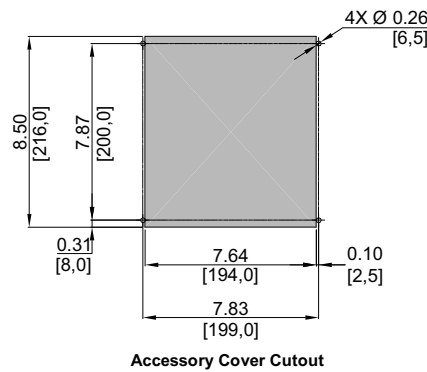
**PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers**  
**Section 10—Dimensional Drawings**

**Dimensions for P-Frame and NS630b–NS1600 Circuit Breakers**

**Table 99: Enclosure Dimensions**

Circuit Breaker Rating	Circuit Breaker Enclosure Dimensions (H x W x D)		Ventilation Area			
	in.	mm	Top		Bottom	
≤ 800 A, 100% rated	51.9 x 20.25 x 7.75	1318.3 x 514.4 x 196.9	–	–	–	–
≤ 1200 A, standard rated	51.9 x 20.25 x 7.75	1318.3 x 514.4 x 196.9	–	–	–	–
> 800 A, 100% rated	62.25 x 23 x 14.75	1581.2 x 584.2 x 374.7	16.5 in. <sup>2</sup>	10,645 mm <sup>2</sup>	16.5 in. <sup>2</sup>	10,645 mm <sup>2</sup>

**Figure 12: P-Frame and NS630b–NS1600 Individually-Mounted Circuit Breaker Enclosure Mounting Holes and Door Cutouts**

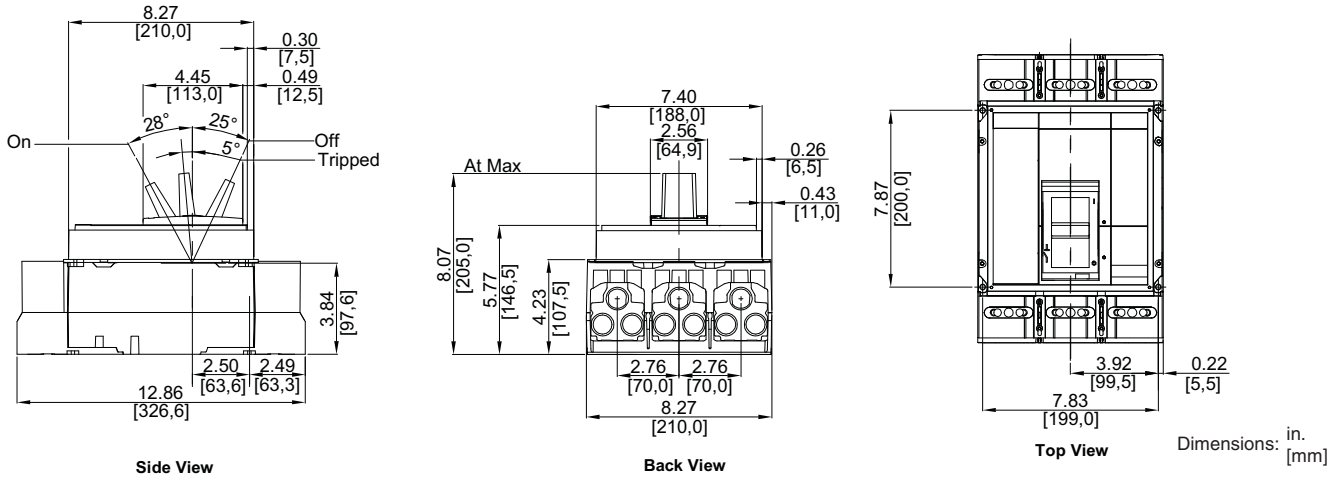


Dimensions: in. [mm]

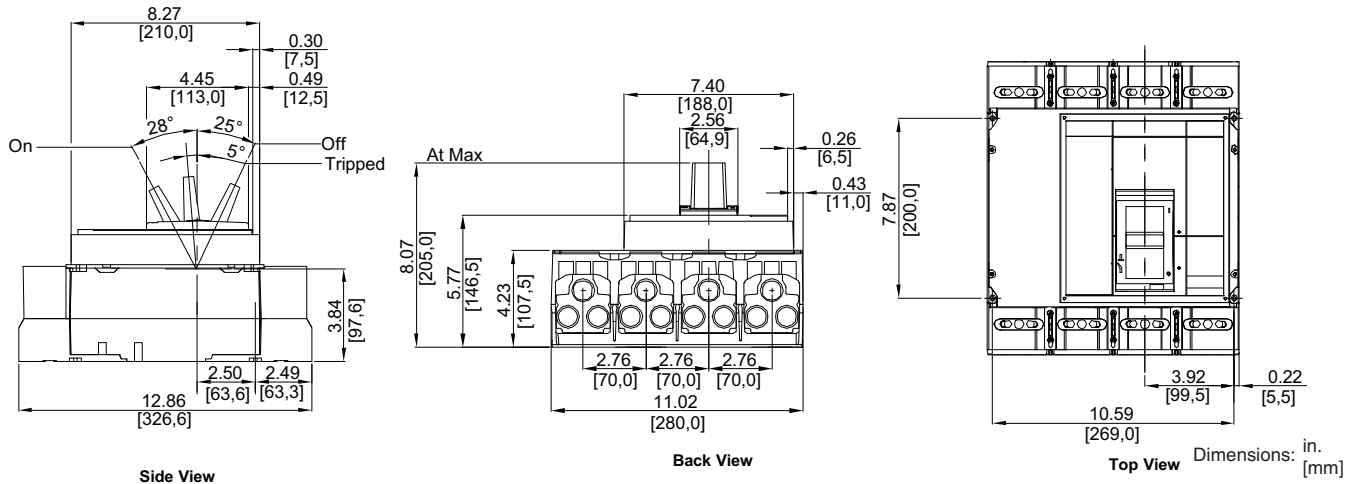
# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

## Section 10—Dimensional Drawings

**Figure 13: P-Frame and NS630b–NS1600 Individually-Mounted 3P Circuit Breaker ≤ 800 A with Lugs on Both Ends**

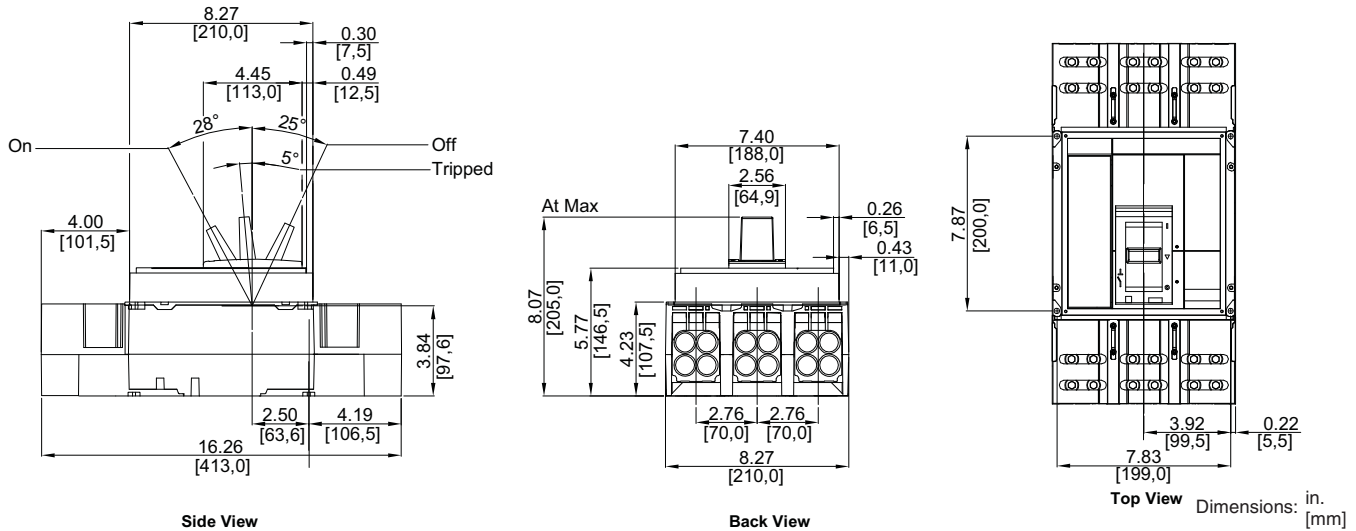


**Figure 14: P-Frame and NS630b–NS1600 Individually-Mounted 4P Circuit Breaker ≤ 800 A with Lugs on Both Ends**

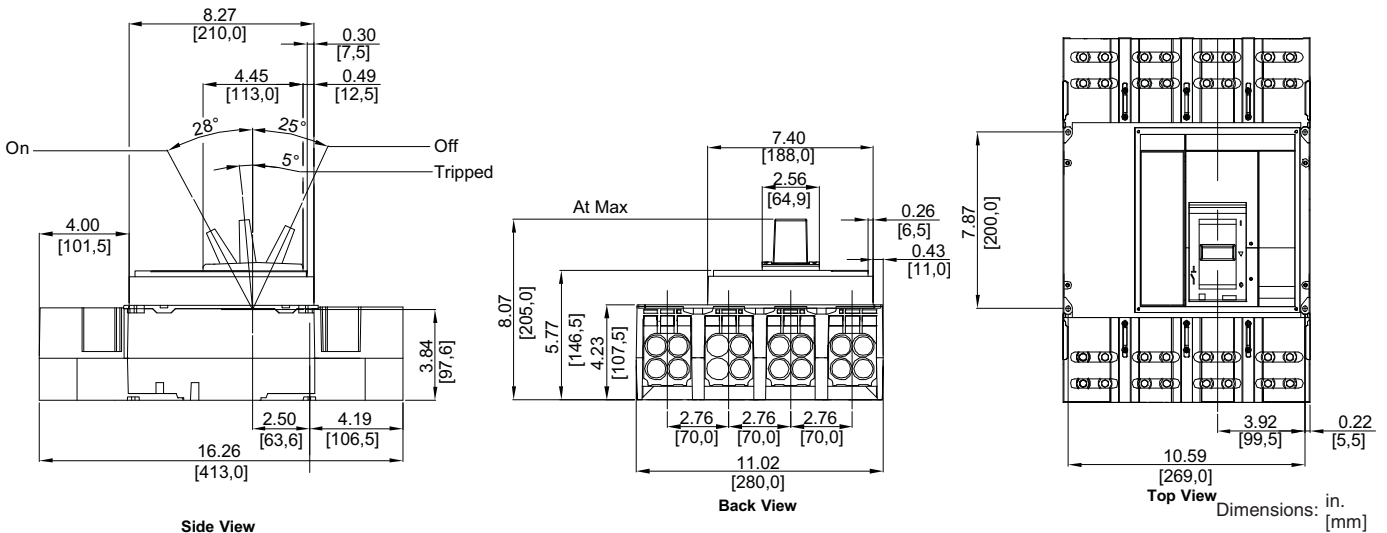


**PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers**  
**Section 10—Dimensional Drawings**

**Figure 15: P-Frame and NS630b–NS1600 Individually-Mounted 3P Circuit Breaker > 800 A with Lugs on Both Ends**

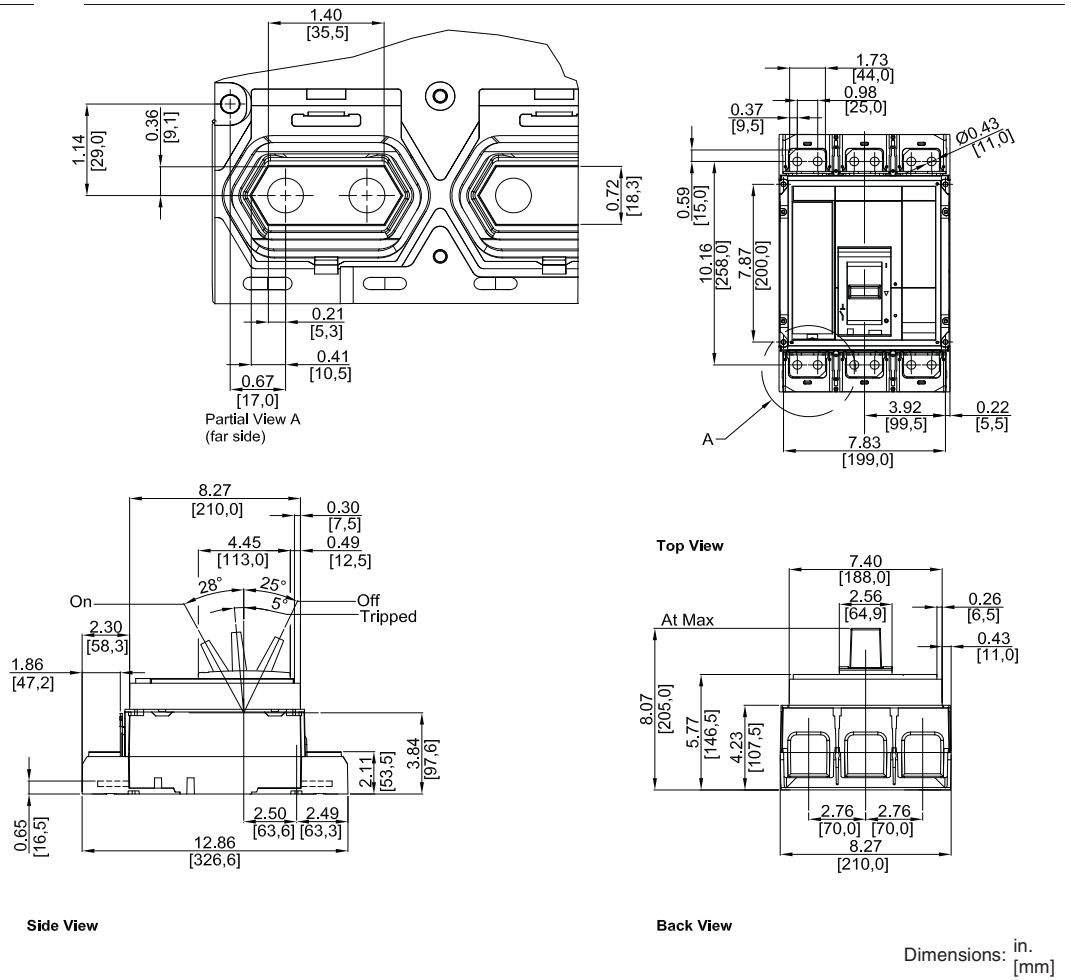


**Figure 16: P-Frame and NS630b–NS1600 Individually-Mounted 4P Circuit Breaker > 800 A with Lugs on Both Ends**



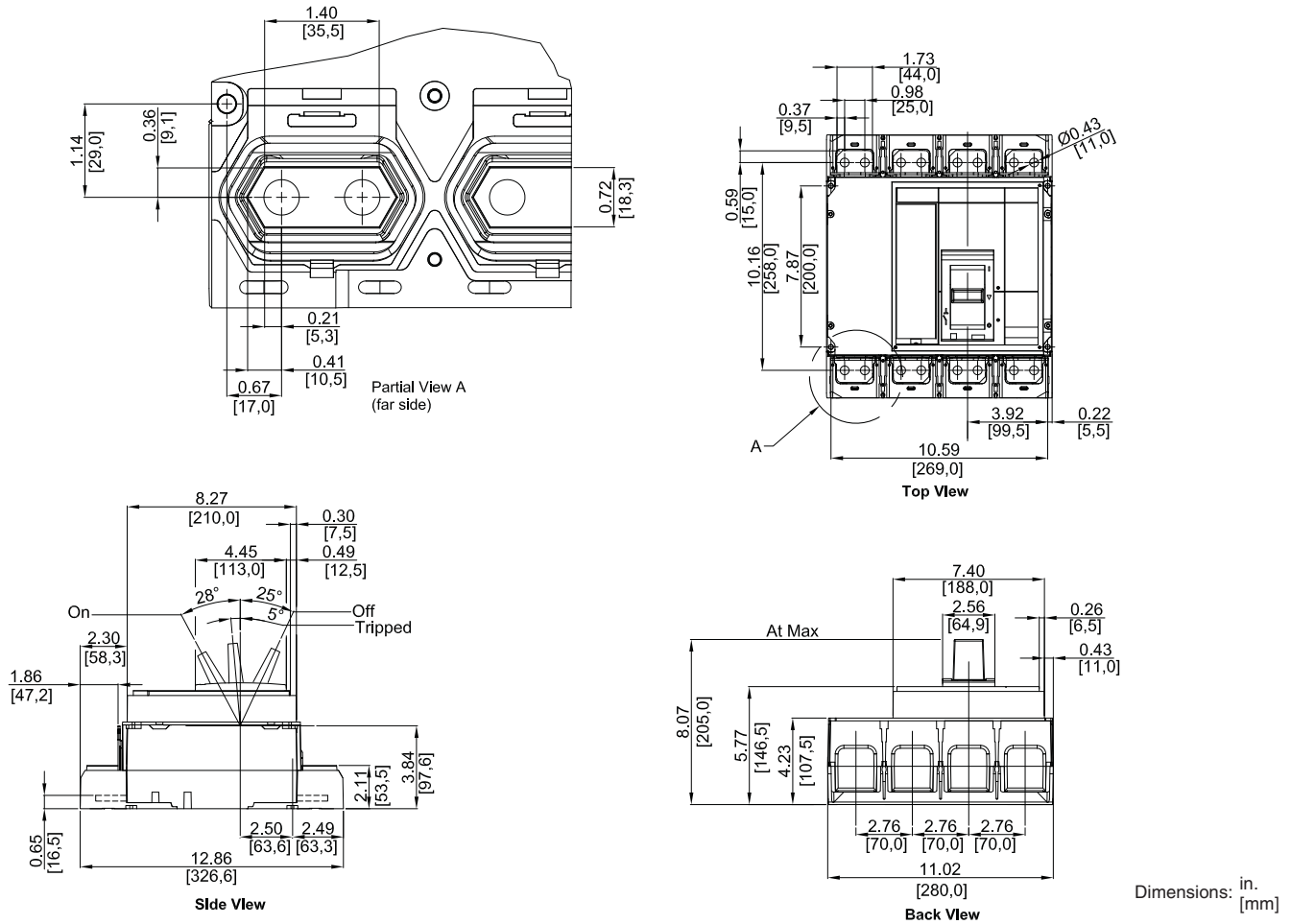
# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers Section 10—Dimensional Drawings

Figure 17: P-Frame and NS630b–NS1600 Individually-Mounted 3P Circuit Breaker without Lugs



**PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers**  
**Section 10—Dimensional Drawings**

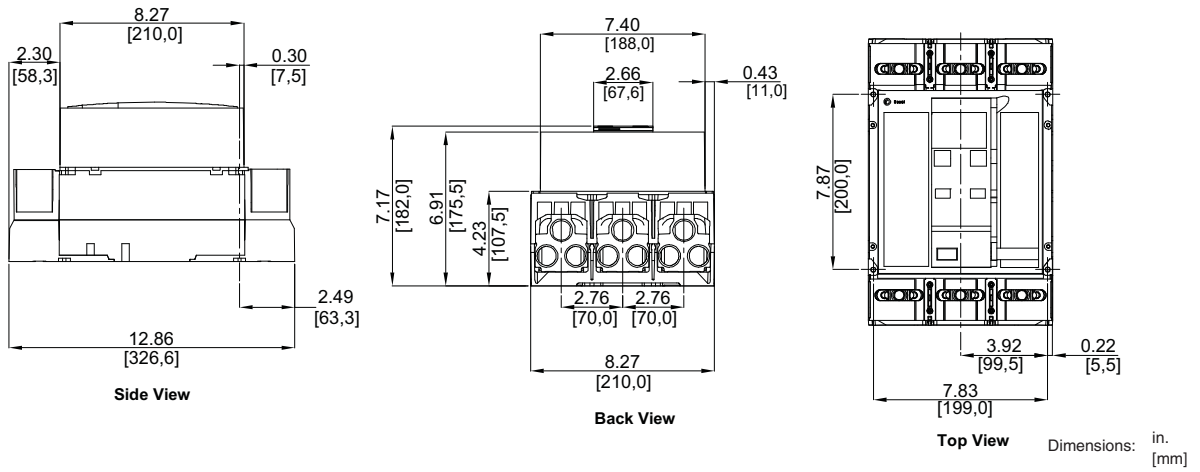
**Figure 18: P-Frame and NS630b–NS1600 Individually-Mounted 4P Circuit Breaker without Lugs**



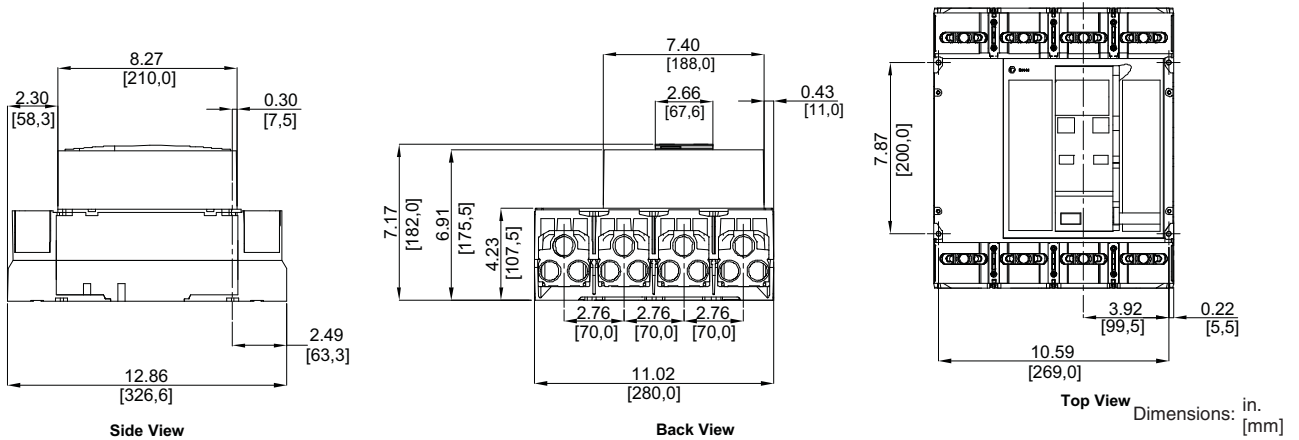


**PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers**  
**Section 10—Dimensional Drawings**

**Figure 19: P-Frame and NS630b–NS1600 Individually-Mounted Electrically-Operated 3P Circuit Breaker ≤ 800 A with Lugs on Both Ends**

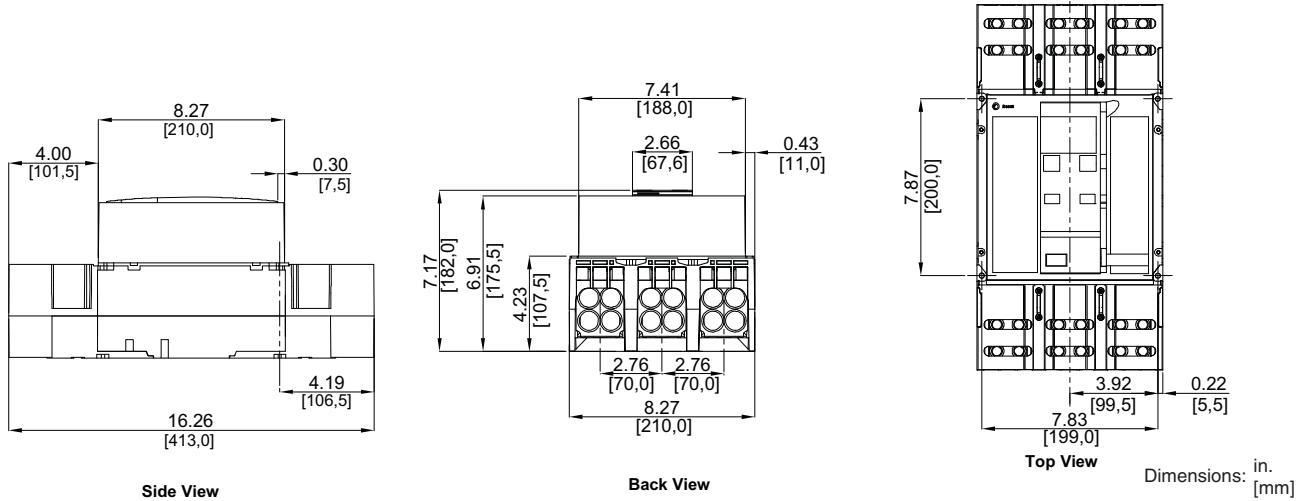


**Figure 20: P-Frame and NS630b–NS1600 Individually-Mounted Electrically-Operated 4P Circuit Breaker ≤ 800 A with Lugs on Both Ends**

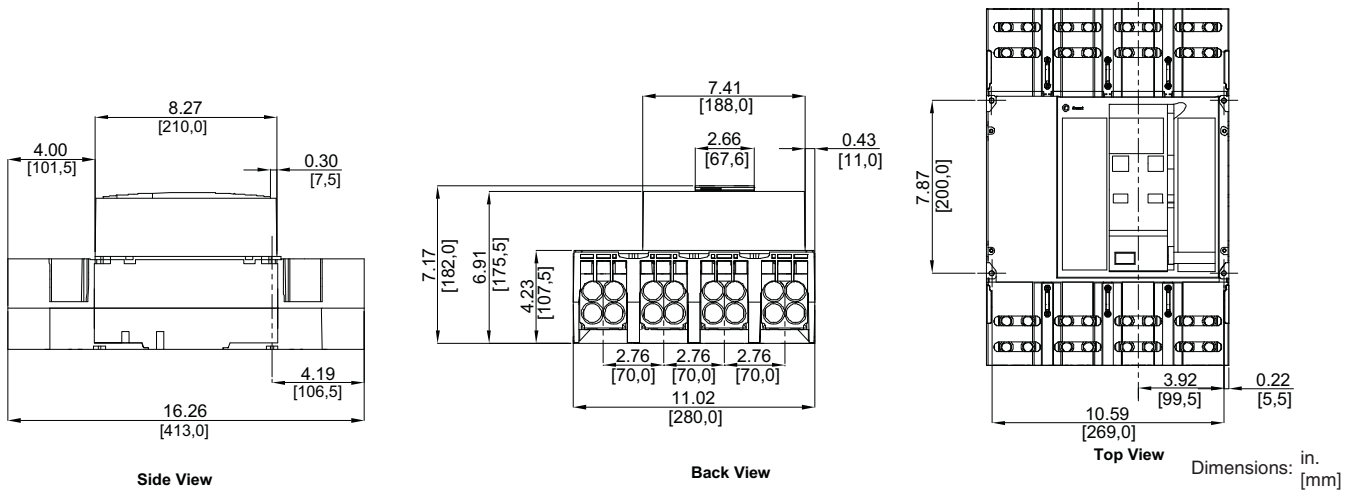


**PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers**  
**Section 10—Dimensional Drawings**

**Figure 21: P-Frame and NS630b–NS1600 Individually-Mounted Electrically-Operated 3P Circuit Breaker > 800 A with Lugs on Both Ends**

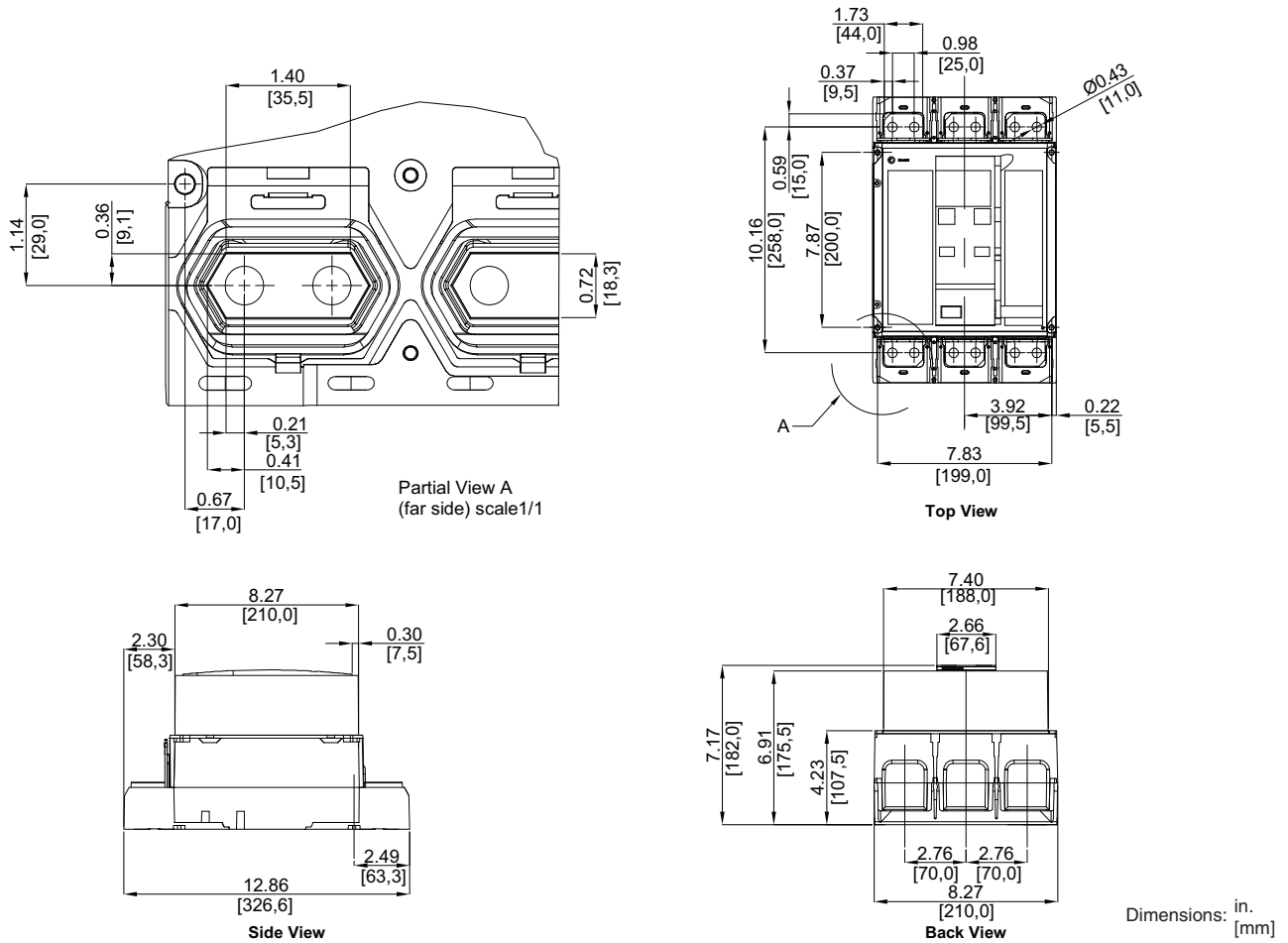


**Figure 22: P-Frame and NS630b–NS1600 Individually-Mounted Electrically-Operated 4P Circuit Breaker > 800 A with Lugs on Both Ends**



# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers Section 10—Dimensional Drawings

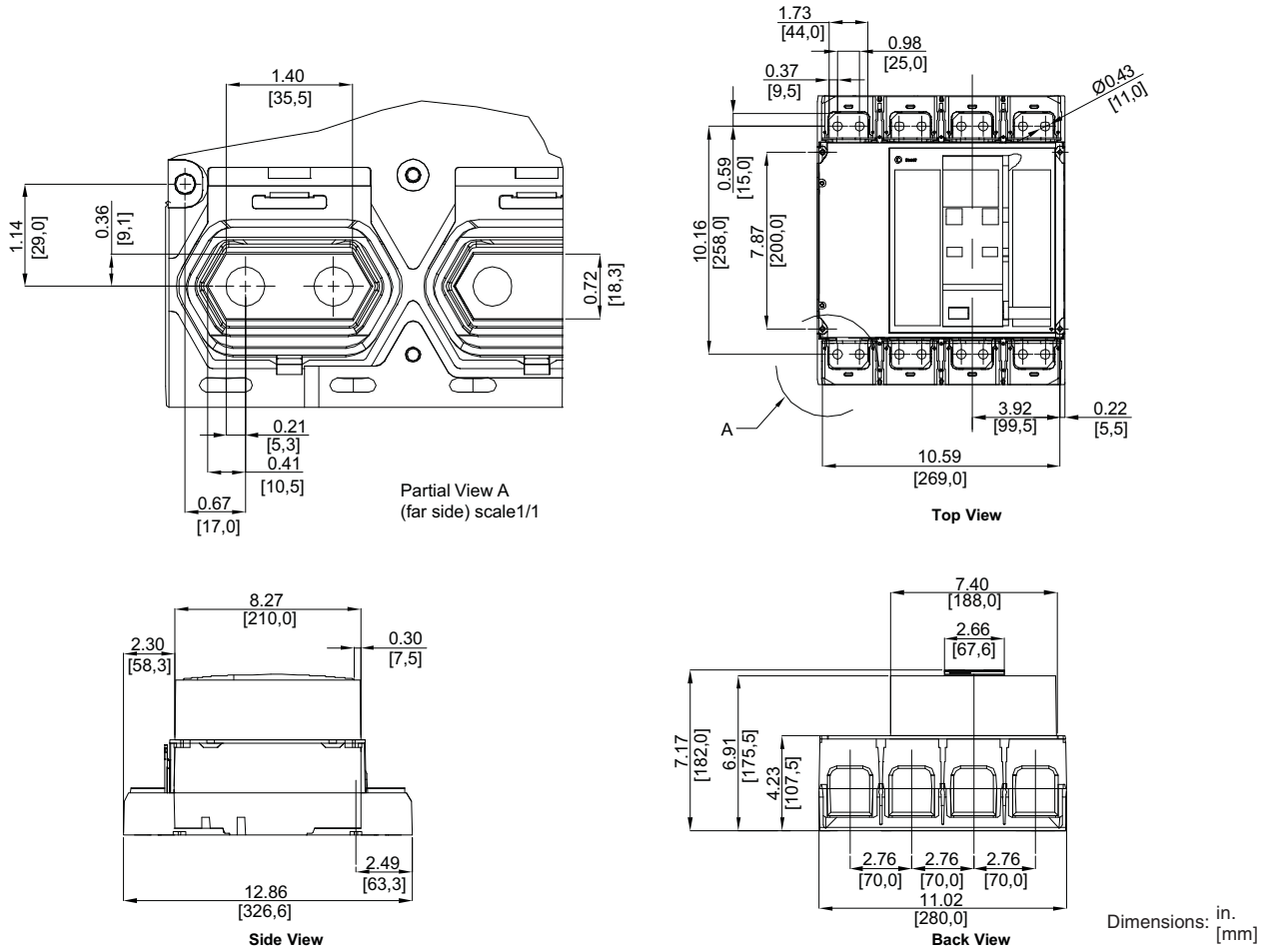
**Figure 23: P-Frame and NS630b–NS1600 Individually-Mounted Electrically-Operated 3P Circuit Breaker without Lugs**



# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

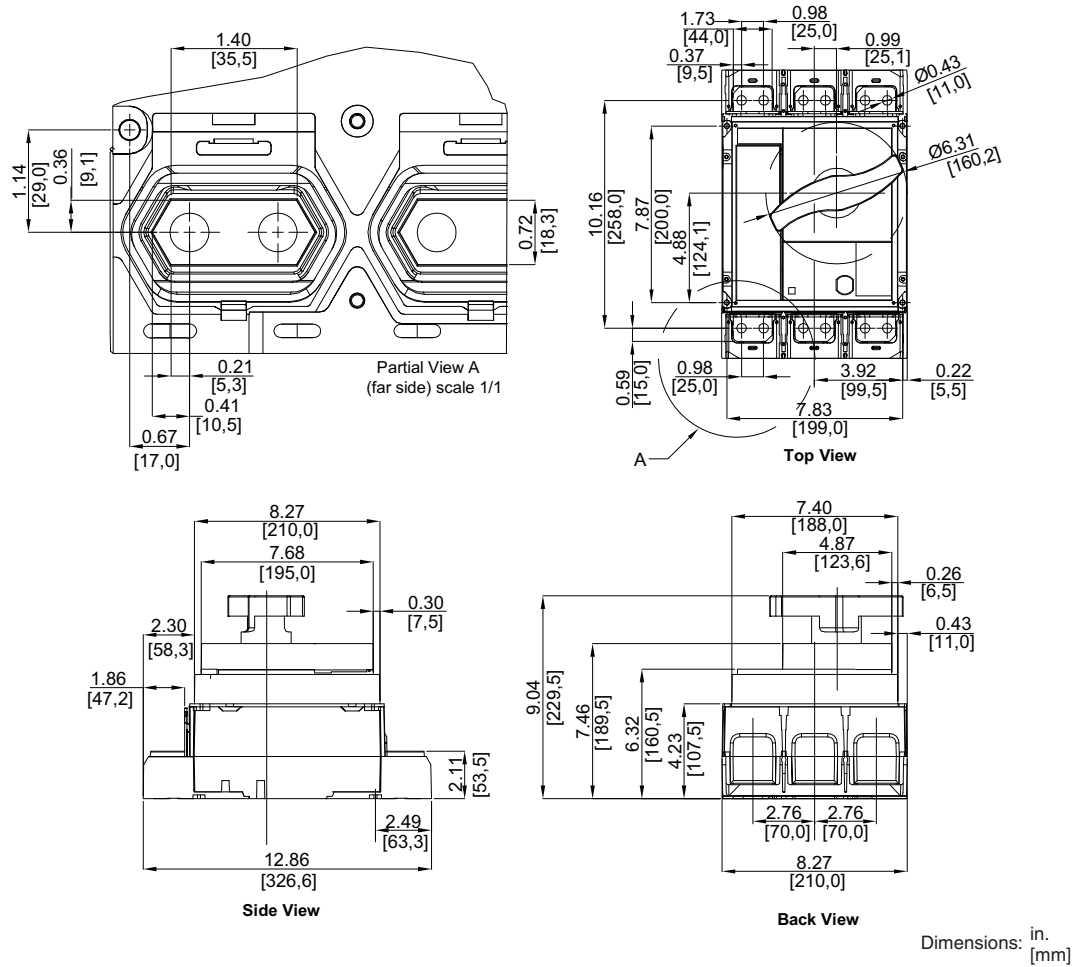
## Section 10—Dimensional Drawings

**Figure 24: P-Frame and NS630b–NS1600 Individually-Mounted Electrically-Operated 4P Circuit Breaker without Lugs**



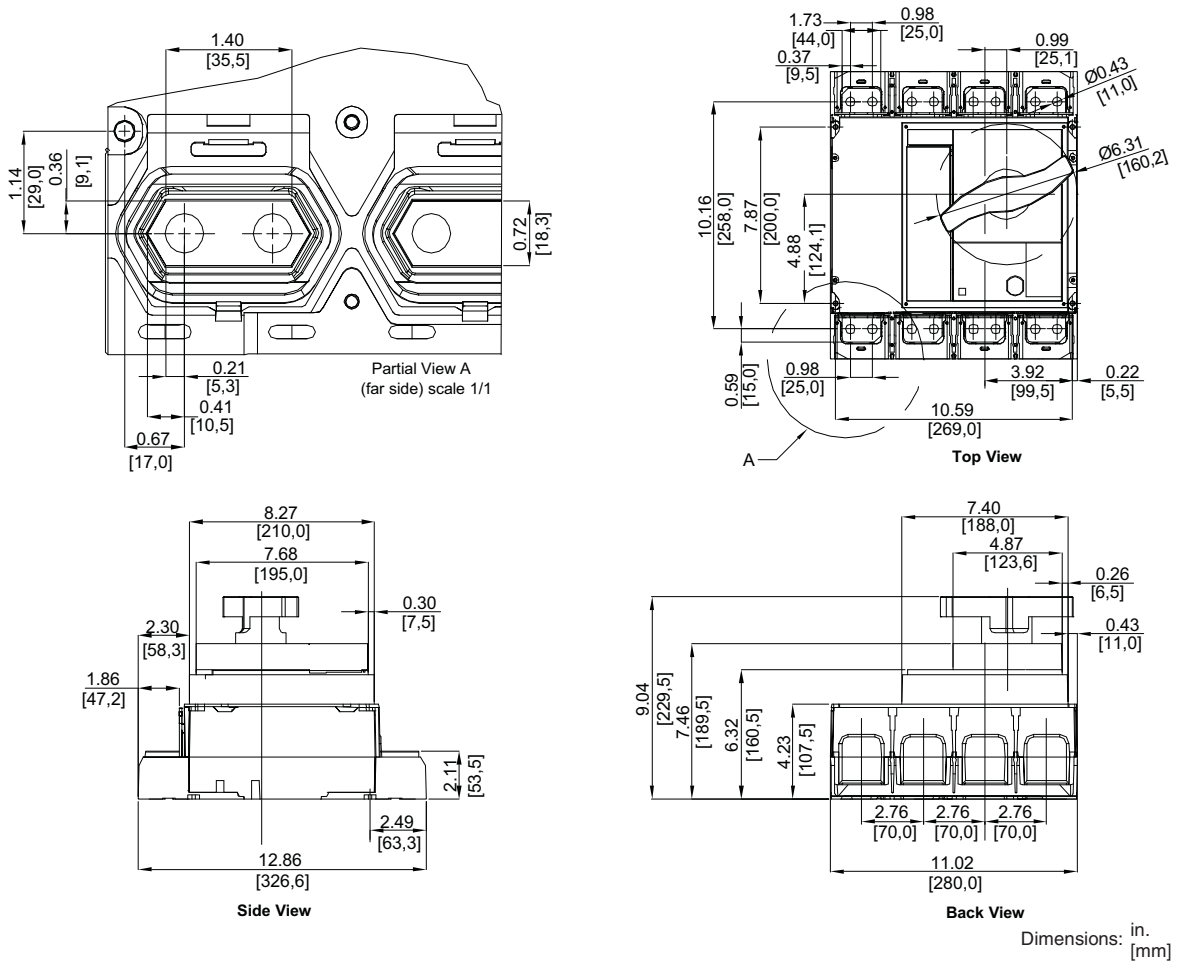
# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers Section 10—Dimensional Drawings

**Figure 25: P-Frame and NS630b–NS1600 Individually-Mounted 3P Circuit Breaker with Rotary Handle**

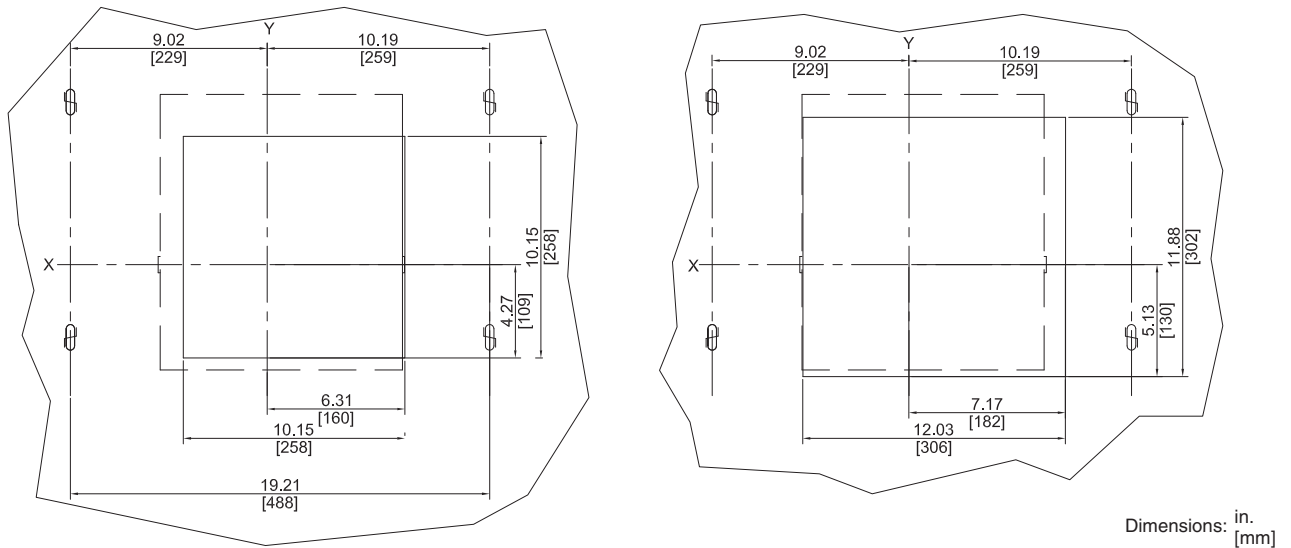


**PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers**  
**Section 10—Dimensional Drawings**

**Figure 26: P-Frame and NS630b–NS1600 Individually-Mounted 4P Circuit Breaker with Rotary Handle**

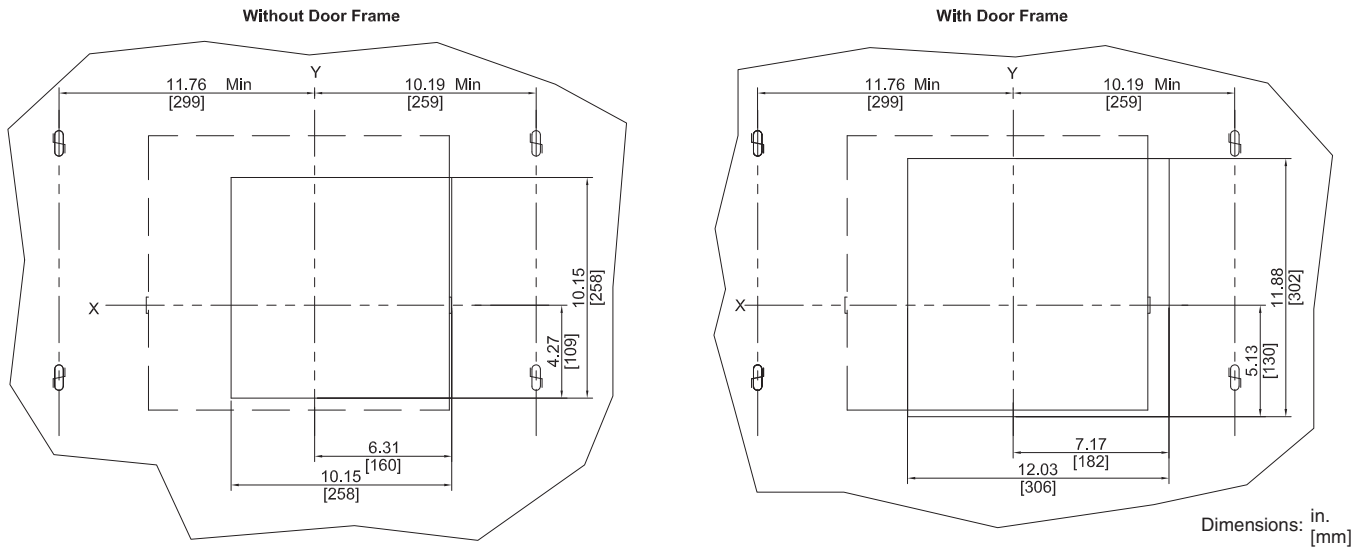


**Figure 27: P-Frame and NS630b–NS1600 3P Drawout Circuit Breaker Door Cutout**

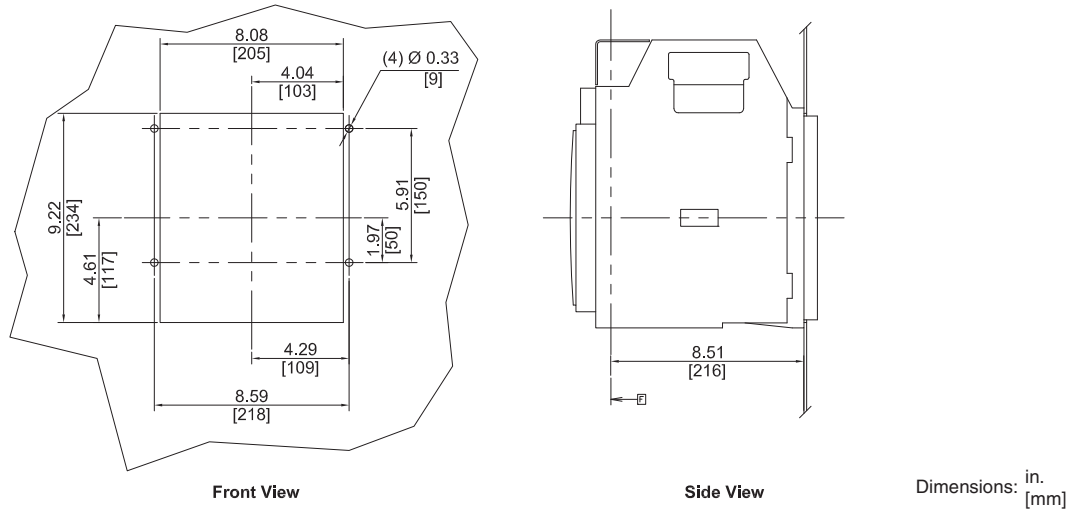


# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers Section 10—Dimensional Drawings

**Figure 28: P-Frame and NS630b–NS1600 4P Drawout Circuit Breaker Door Cutout**

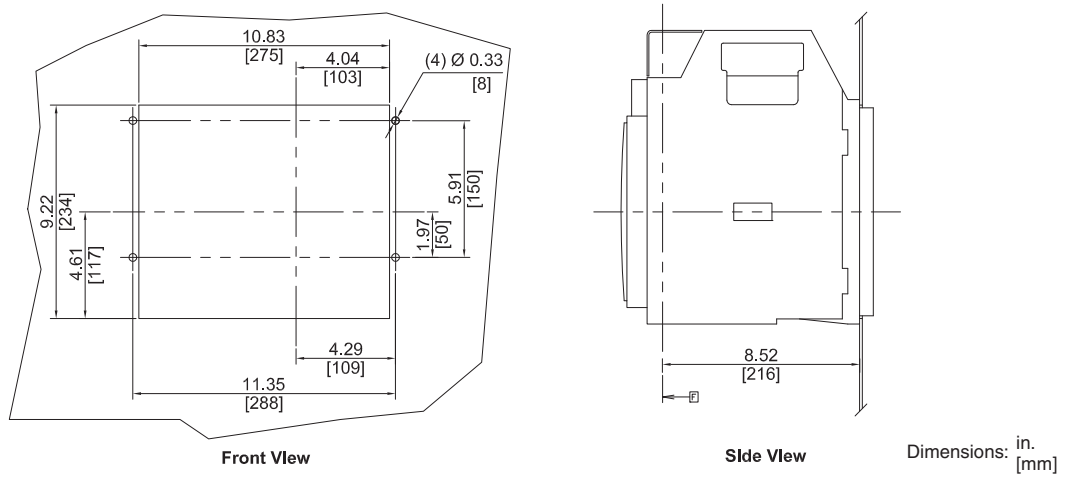


**Figure 29: P-Frame and NS630b–NS1600 3P Drawout Circuit Breaker Rear Cutout**

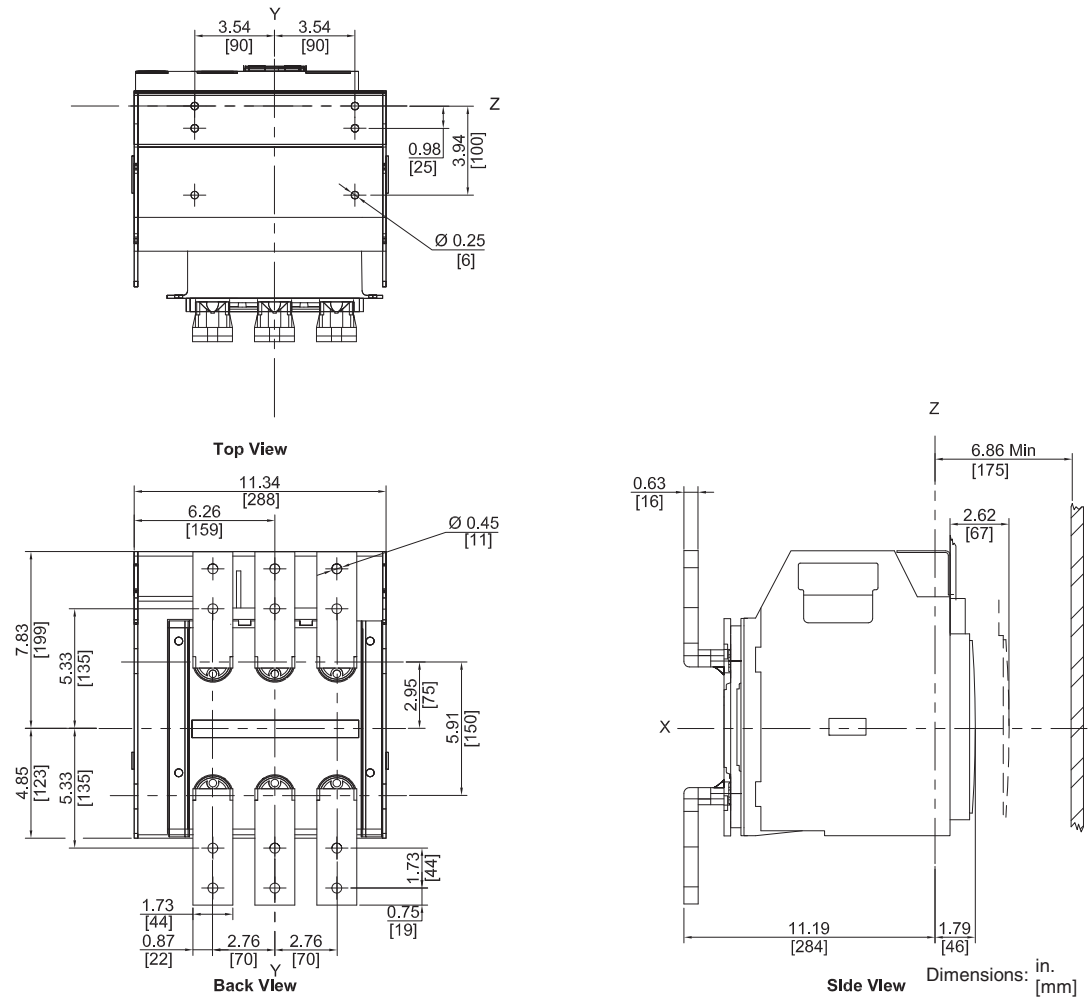


**PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers**  
**Section 10—Dimensional Drawings**

**Figure 30: P-Frame and NS630b–NS1600 4P Drawout Circuit Breaker Rear Cutout**



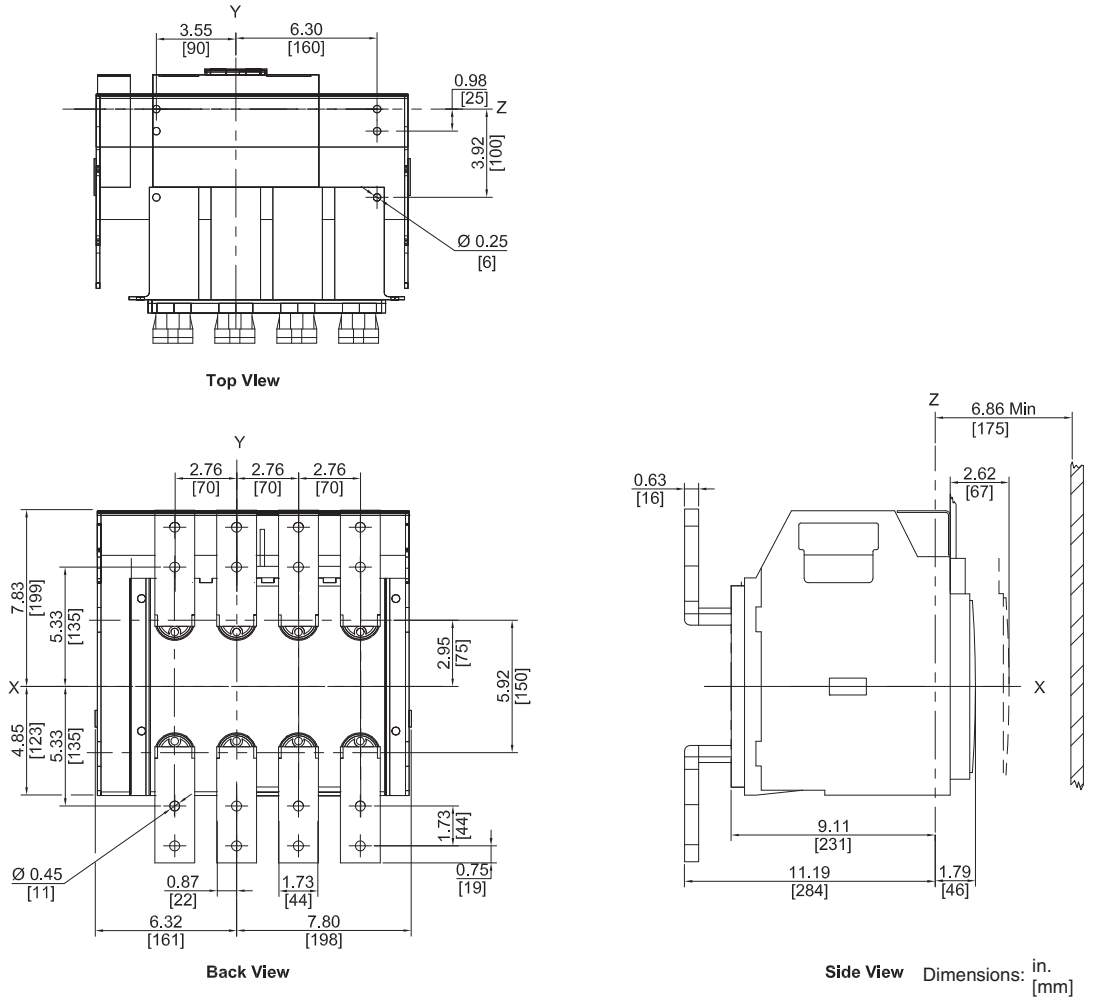
**Figure 31: P-Frame Drawout 3P Circuit Breaker ≤ 1200 A with Front-Connected Flat (FCF) Connectors**





PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers  
Section 10—Dimensional Drawings

Figure 32: P-Frame Drawout 4P Circuit Breaker ≤ 1200 A with Front-Connected Flat (FCF) Connectors

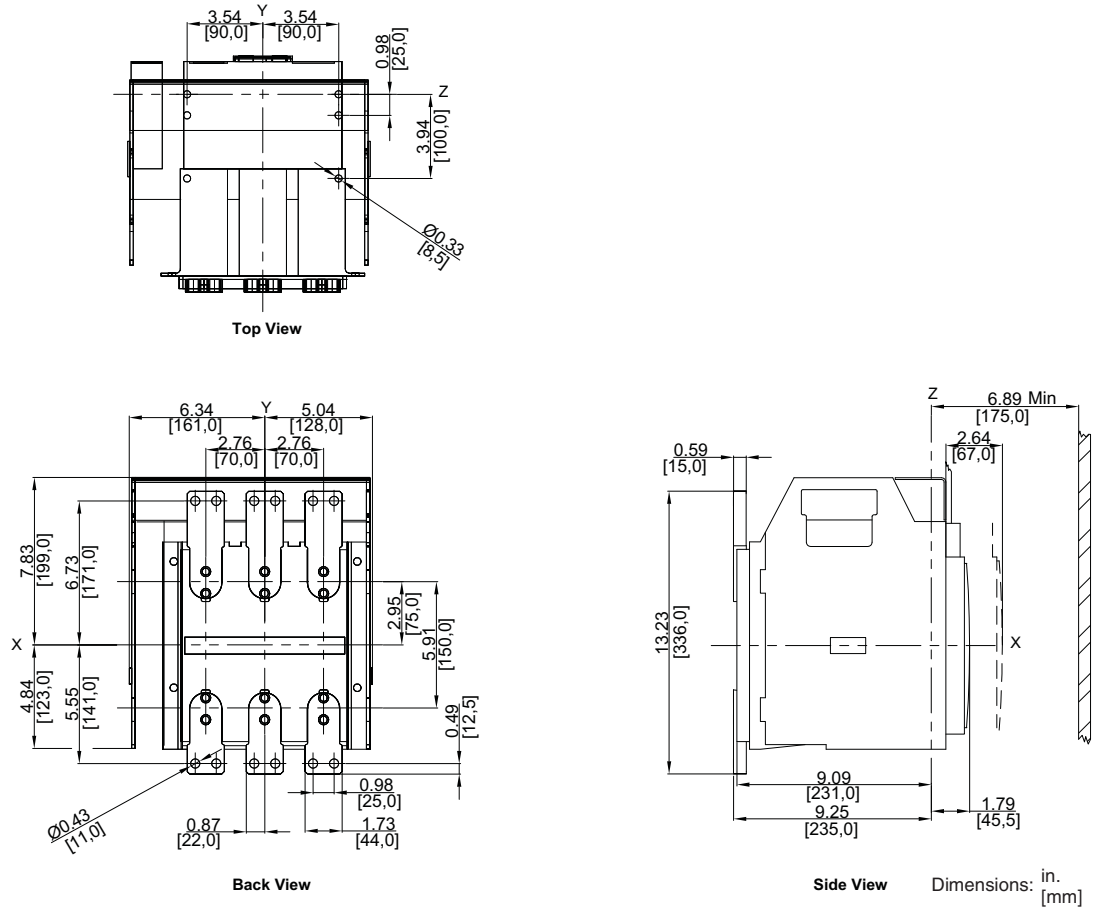


Side View Dimensions: in. [mm]

# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

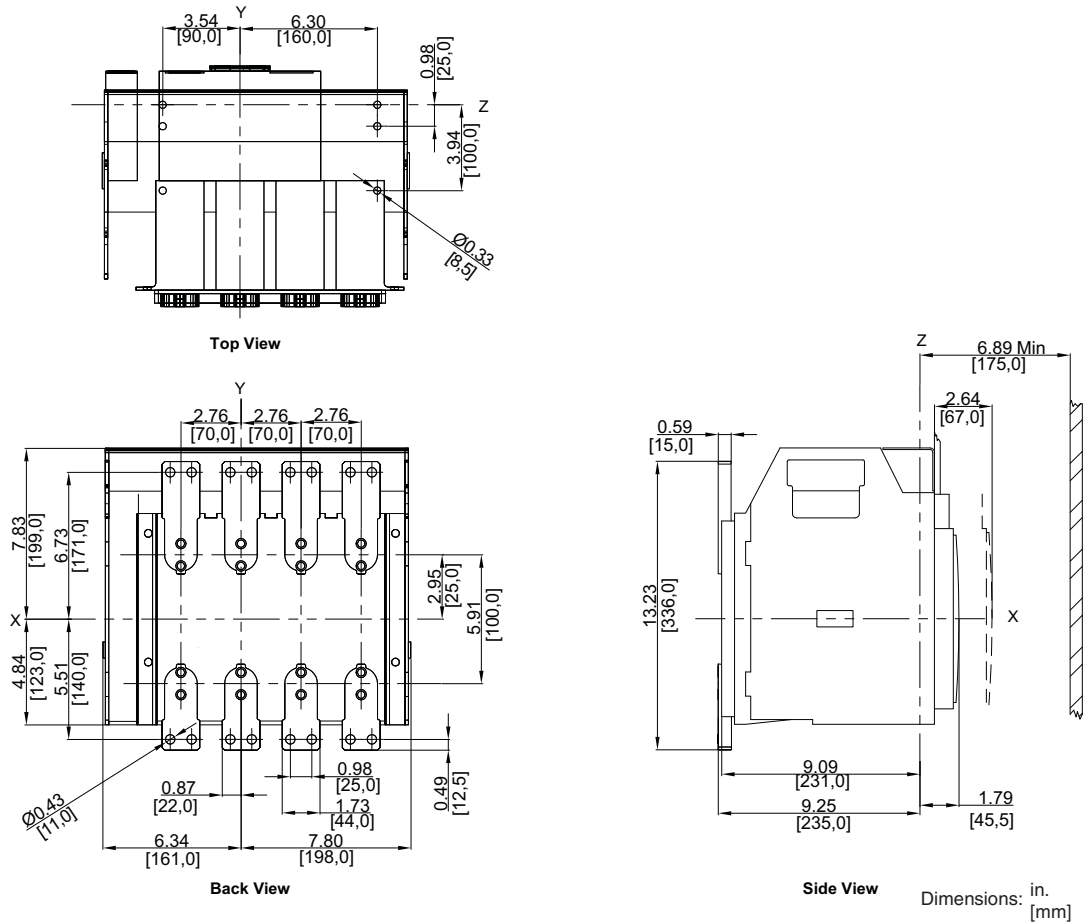
## Section 10—Dimensional Drawings

Figure 33: NS630b–NS1600 Drawout 3P Circuit Breaker ≤ 1600 A with Front-Connected Flat (FCF) Connectors



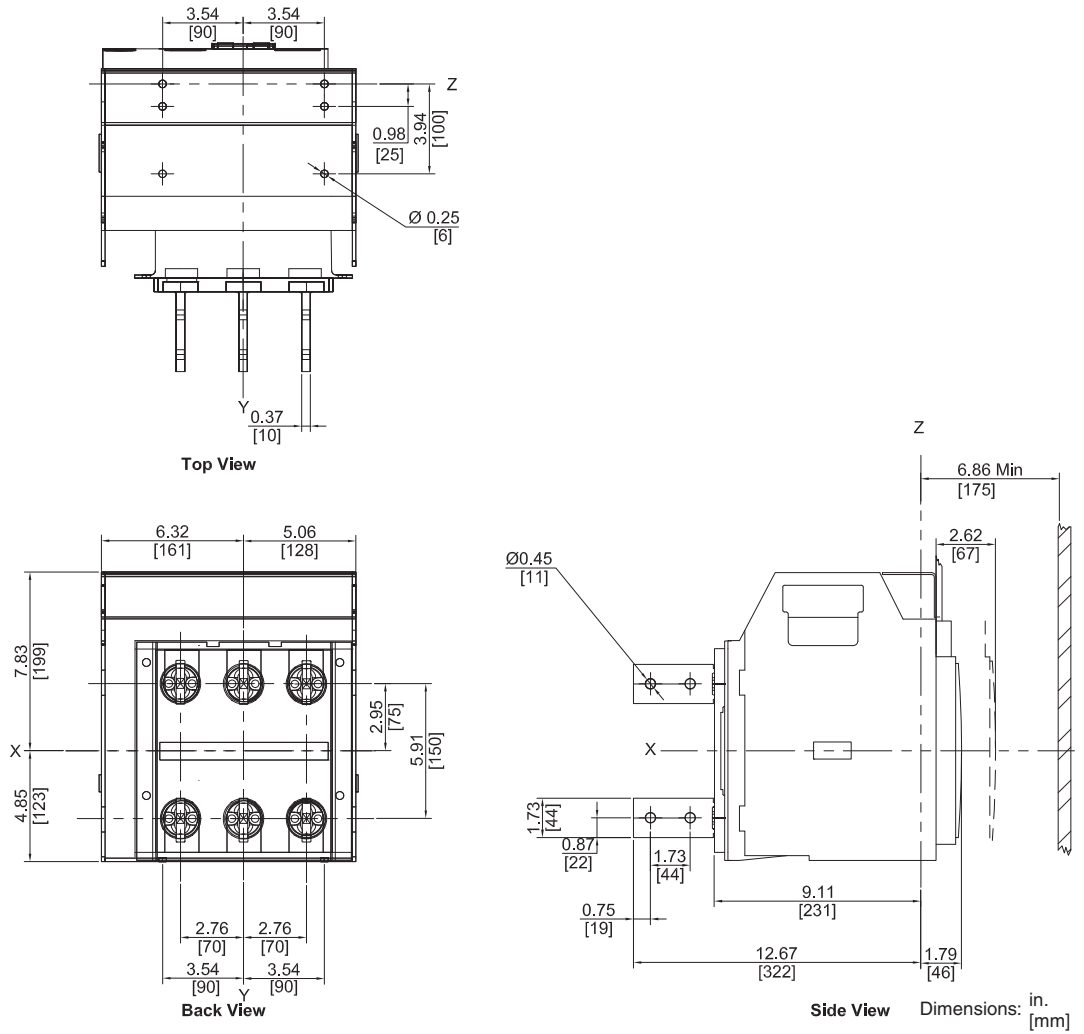
# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers Section 10—Dimensional Drawings

**Figure 34: NS630b–NS1600 Drawout 4P Circuit Breaker ≤ 1600 A with Front-Connected Flat (FCF) Connectors**



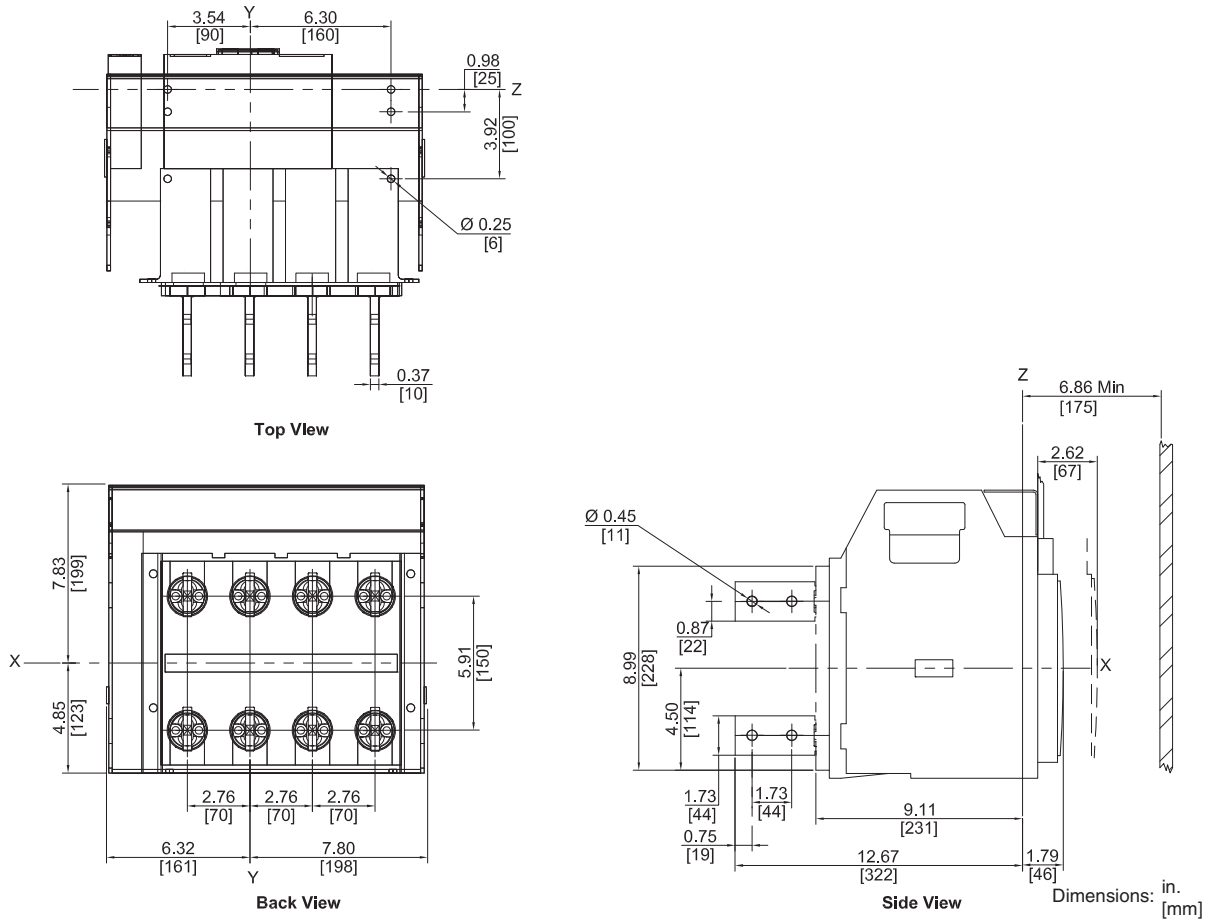
**PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers**  
**Section 10—Dimensional Drawings**

**Figure 35: P-Frame Drawout 3P Circuit Breaker ≤ 1200 A with Rear-Connected “T” Vertical (RCTV) Connectors**



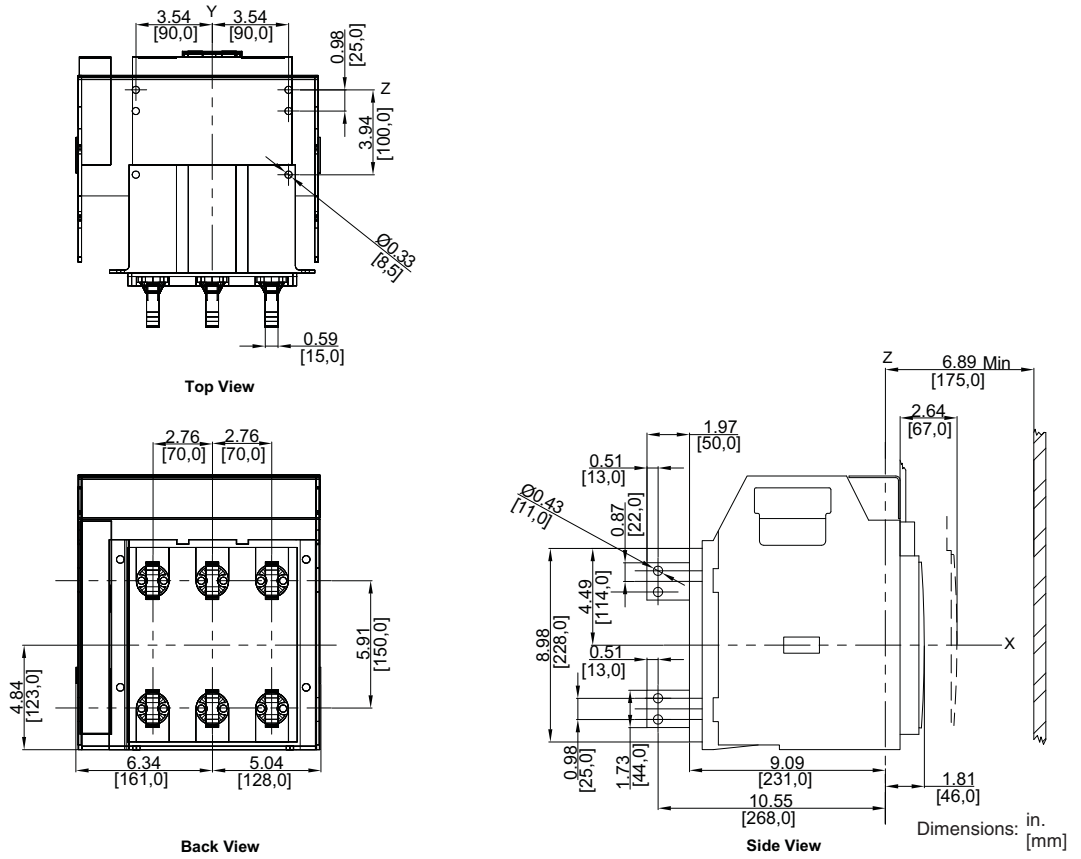
PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers  
 Section 10—Dimensional Drawings

Figure 36: P-Frame Drawout 4P Circuit Breaker ≤ 1200 A with Rear-Connected “T” Vertical (RCTV) Connectors



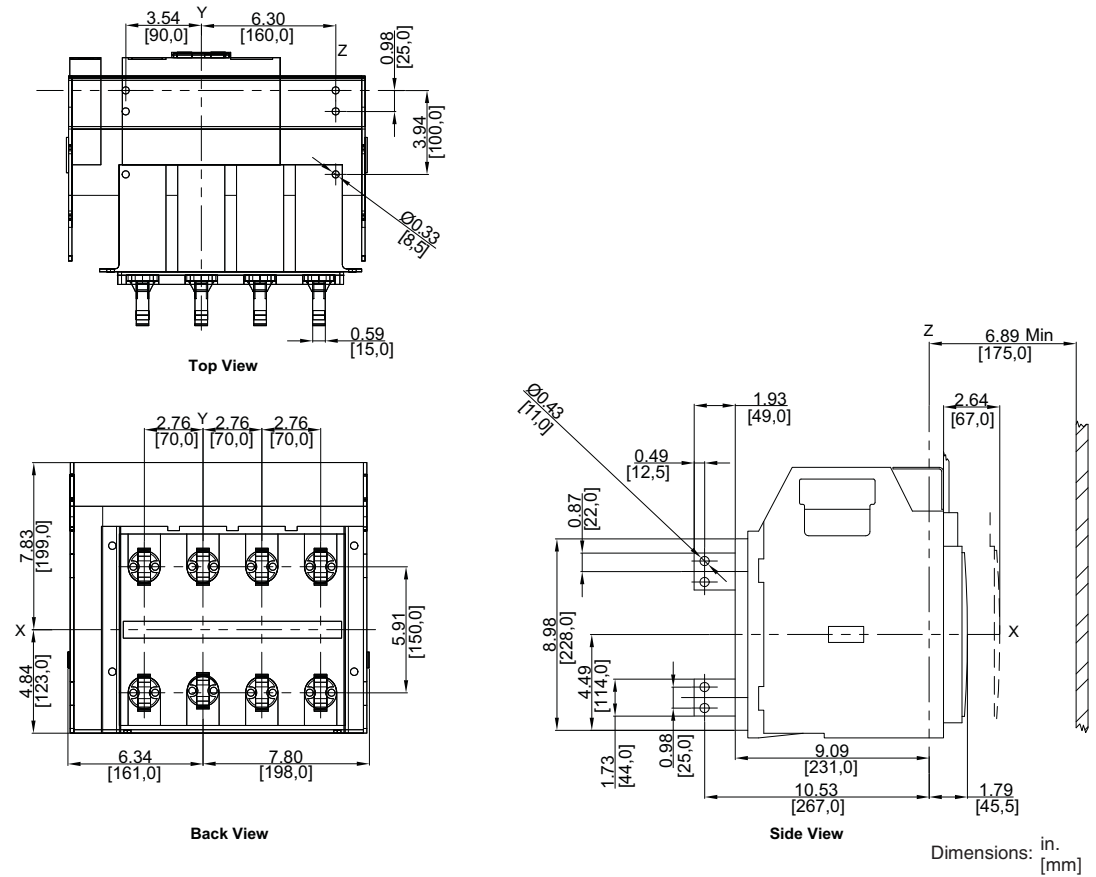
**PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers**  
**Section 10—Dimensional Drawings**

**Figure 37: NS630b–NS1600 Drawout 3P Circuit Breaker ≤ 1600 A with Rear-Connected “T” Vertical (RCTV) Connectors**



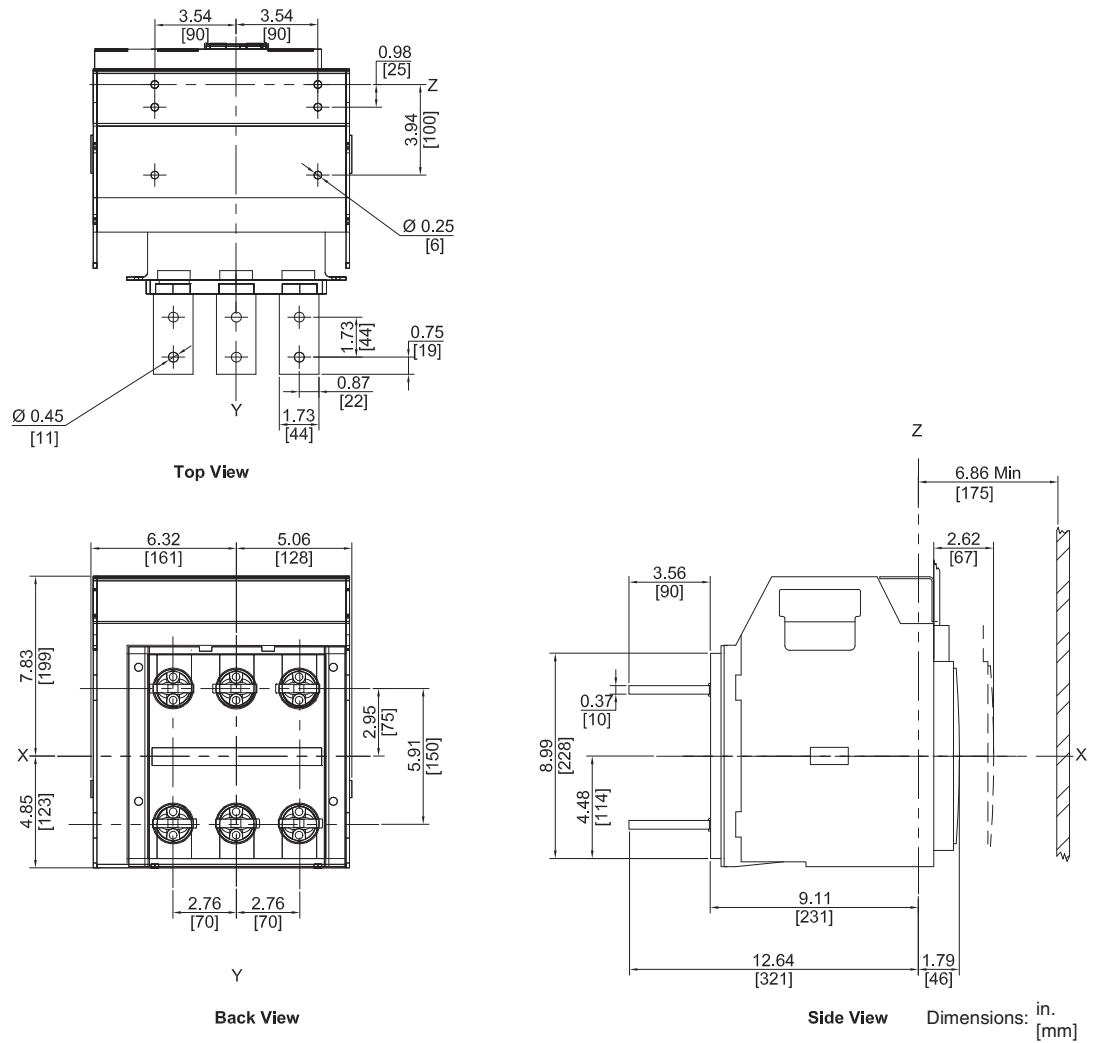
PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers  
Section 10—Dimensional Drawings

Figure 38: NS630b–NS1600 Drawout 4P Circuit Breaker ≤ 1600 A with Rear-Connected “T” Vertical (RCTV) Connectors



**PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers**  
**Section 10—Dimensional Drawings**

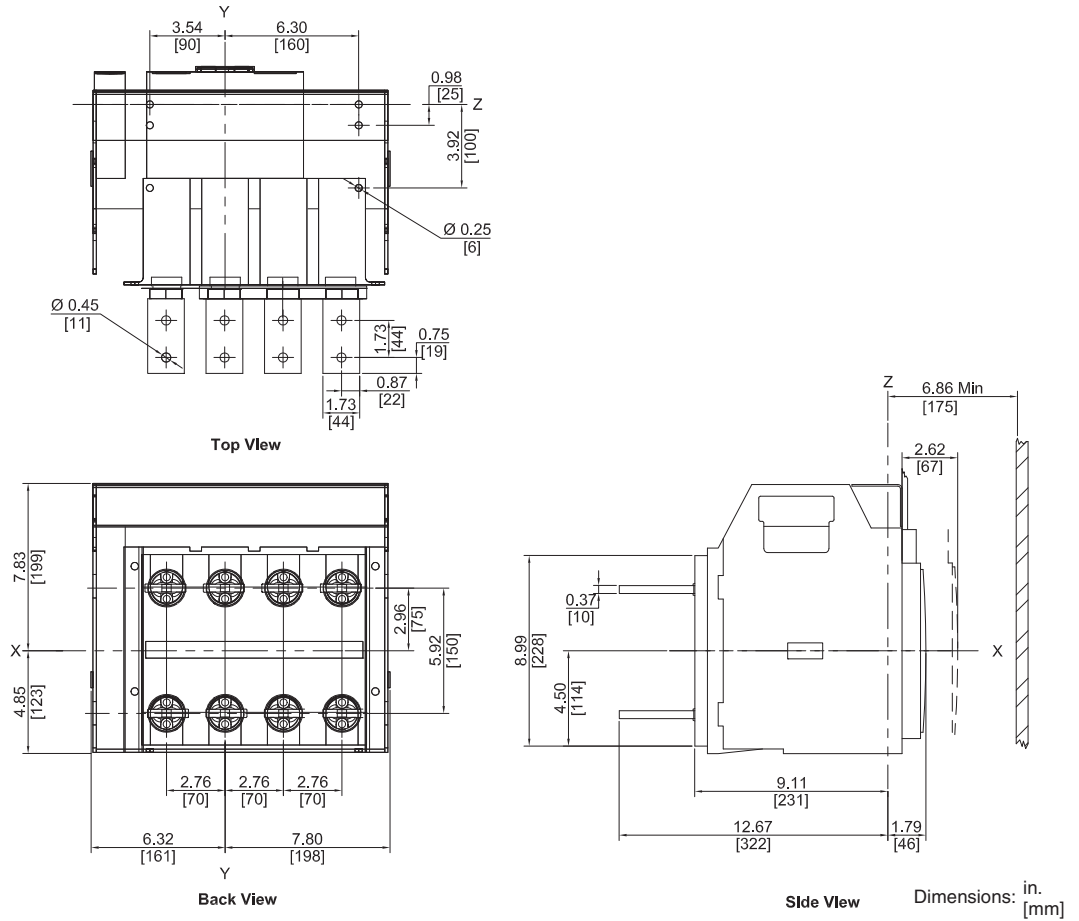
**Figure 39: P-Frame Drawout 3P Circuit Breaker ≤ 1200 A with Rear-Connected “T” Horizontal (RCTH) Connectors**





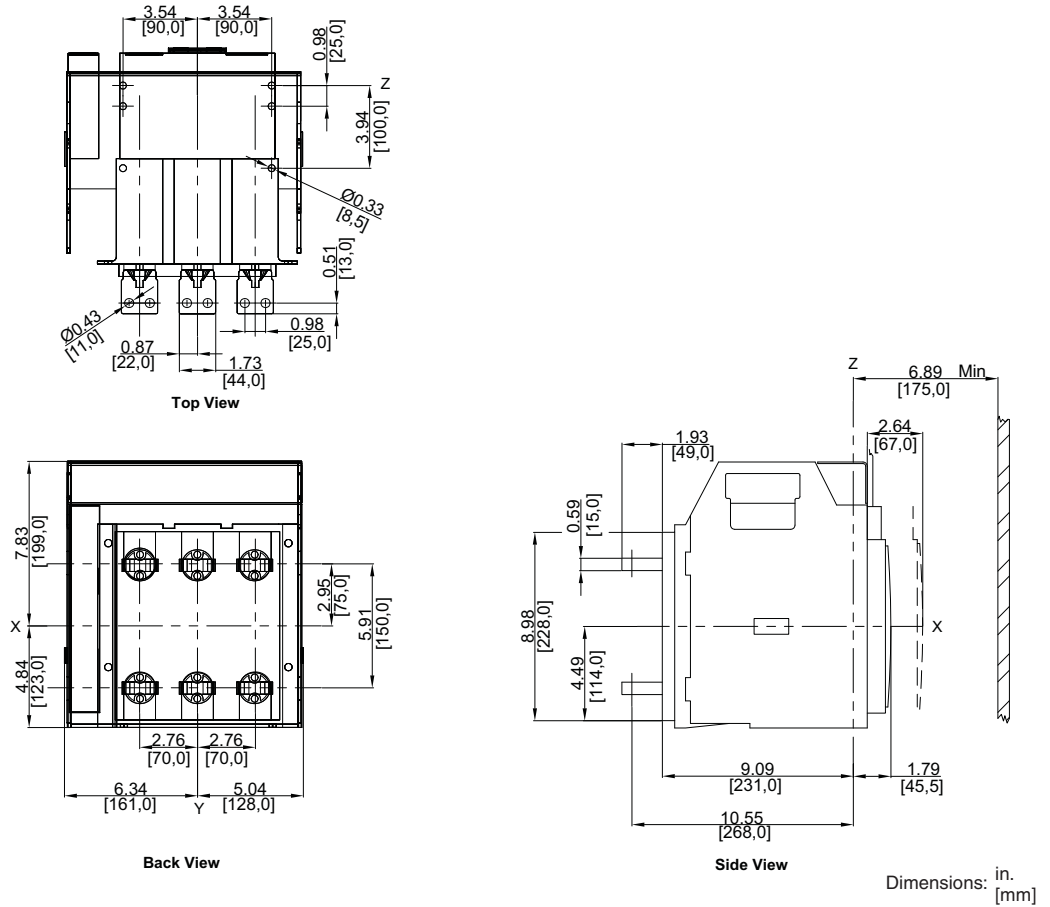
PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers  
 Section 10—Dimensional Drawings

Figure 40: P-Frame Drawout 4P Circuit Breaker ≤ 1200 A with Rear-Connected “T” Horizontal (RCH) Connectors



**PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers**  
**Section 10—Dimensional Drawings**

**Figure 41: NS630b–NS1600 Drawout 3P Circuit Breaker ≤ 1600 A with Rear-Connected “T” Horizontal (RCTH) Connectors**



PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers  
Section 10—Dimensional Drawings

Figure 42: NS630b–NS1600 Drawout 4P Circuit Breaker ≤ 1600 A with Rear-Connected “T” Horizontal (RCH) Connectors

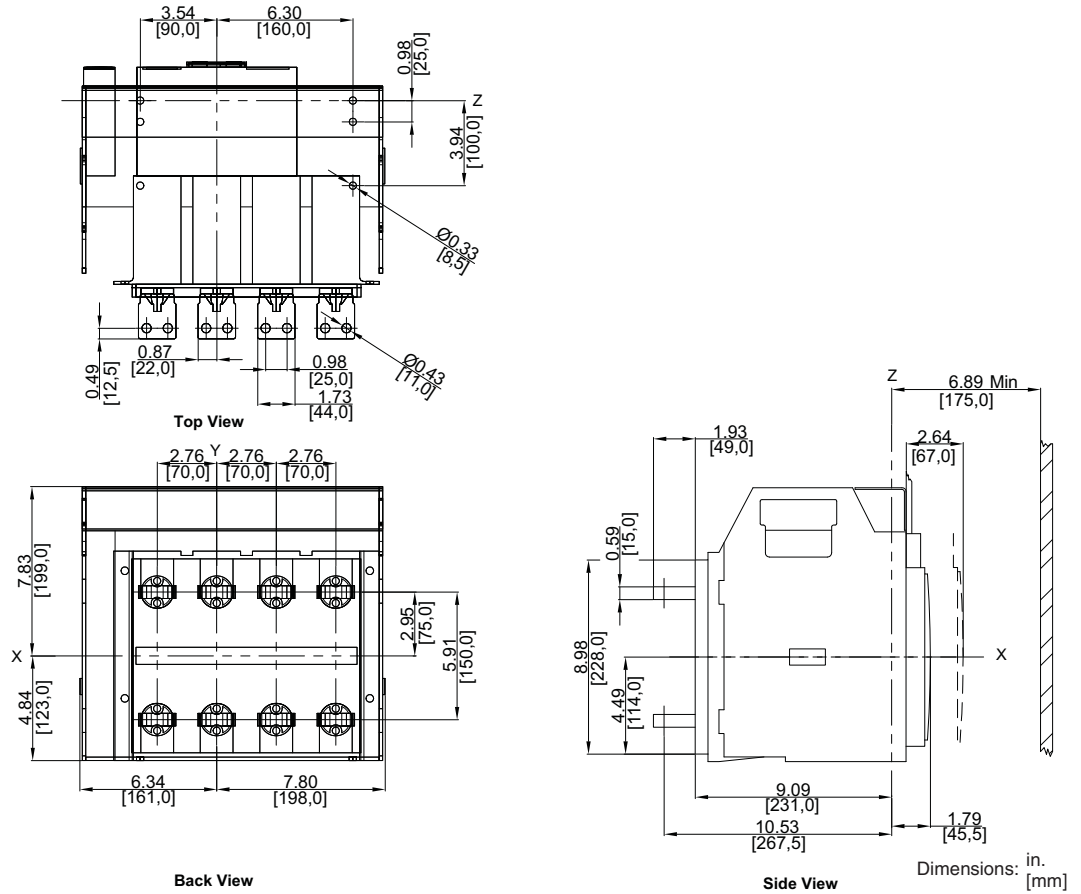
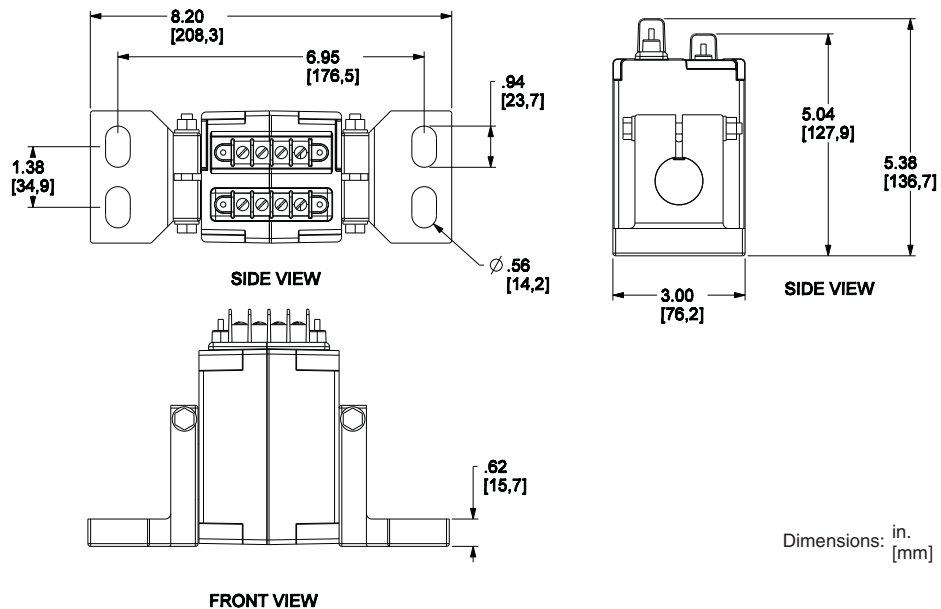


Figure 43: P-Frame and NS630b–NS1600 100–1600 A External Neutral Current Transformers



**PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers**  
**Section 10—Dimensional Drawings**

**Dimensions for R-Frame and NS1600b–NS3200 Circuit Breakers**

**Figure 44: R-Frame Individually-Mounted UL Listed 3P Circuit Breaker**

**Minimum Enclosure Size**

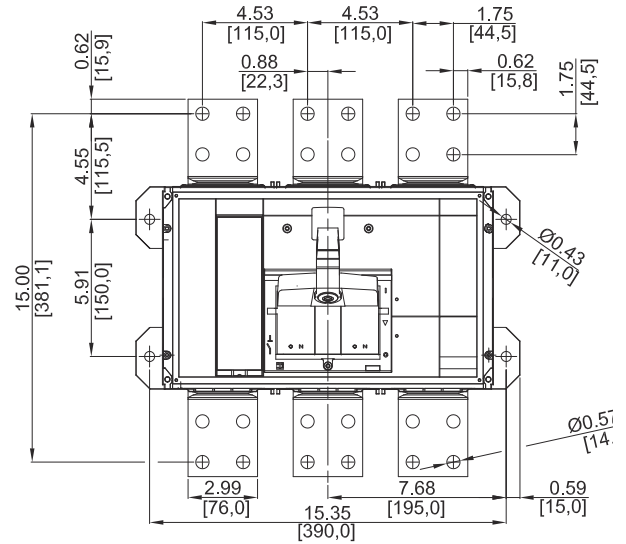
30 x 21 x 7  
 (762 x 533 x 178)

**Minimum Ventilation**

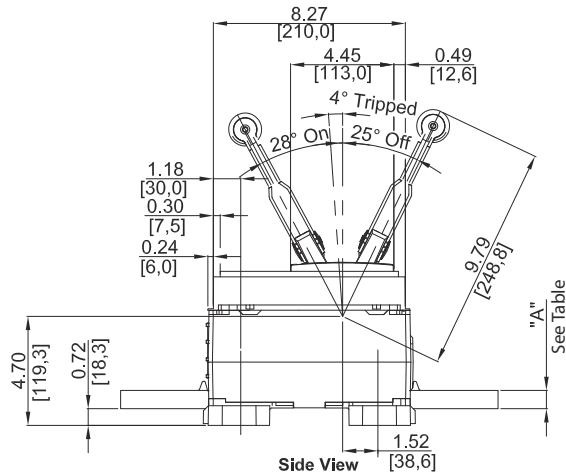
**(100% Rated Circuit Breakers Only):**

40.25 in.² (250 cm²) on top and bottom of enclosure

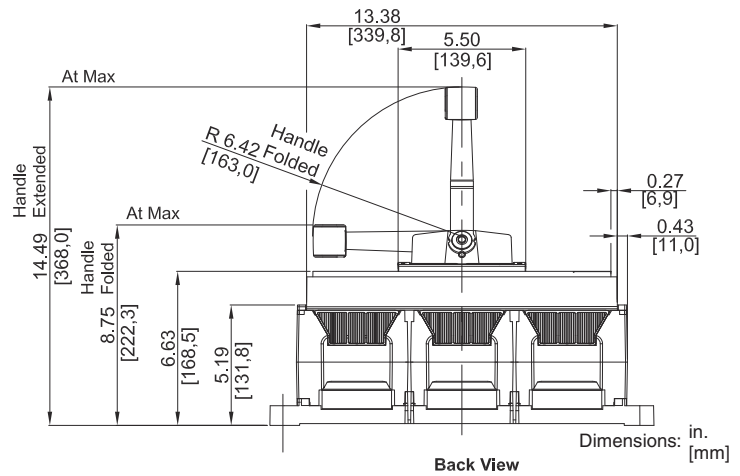
Circuit Breaker	"A"
1600 A	0.50 in. [12.8 mm]
2000 A	0.63 in. [16 mm]
2500 A	0.79 in. [20 mm]
3000 A	0.79 in. [20 mm]



**Top View**



**Side View**



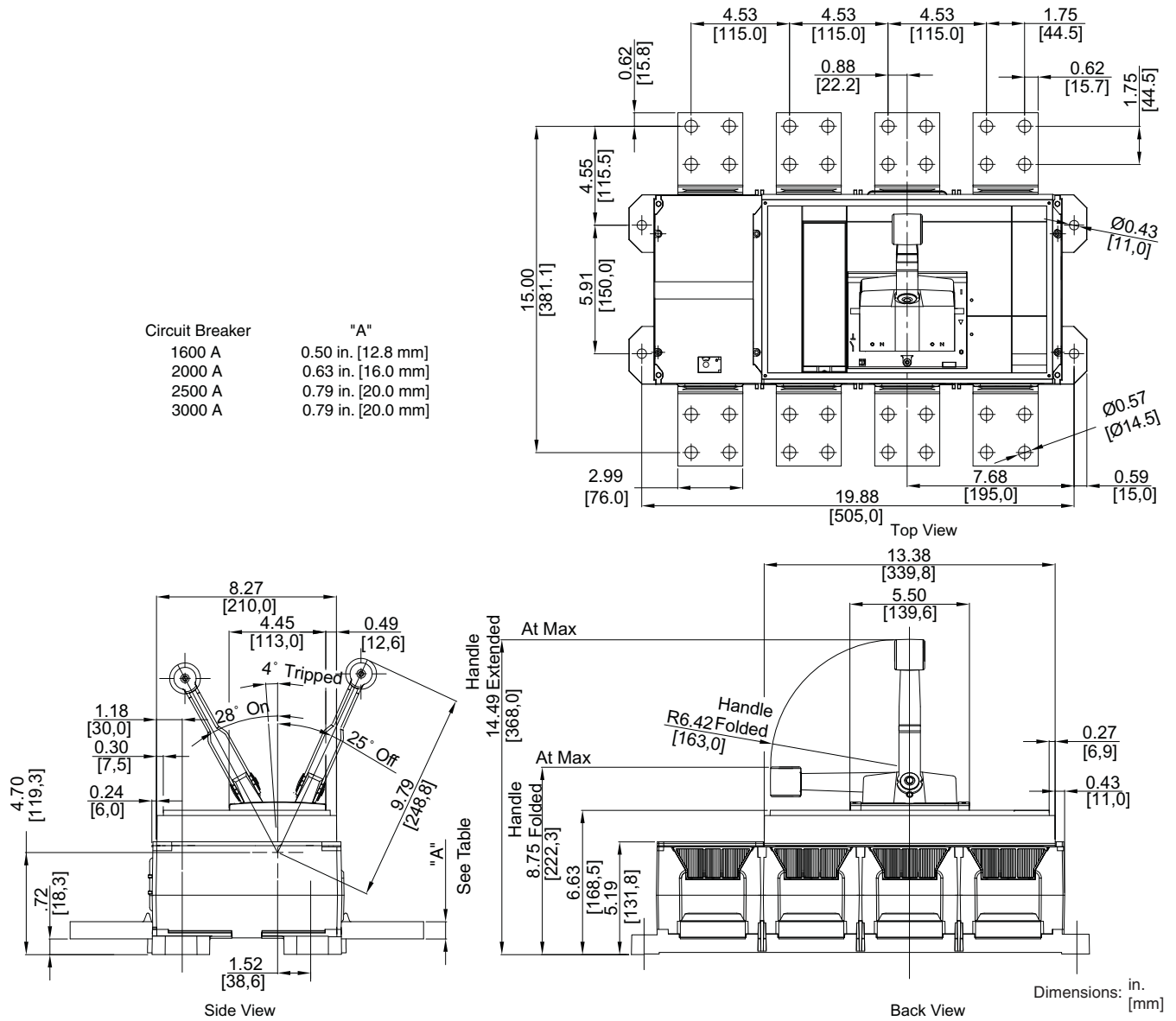
**Back View**

Dimensions: in. [mm]

# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

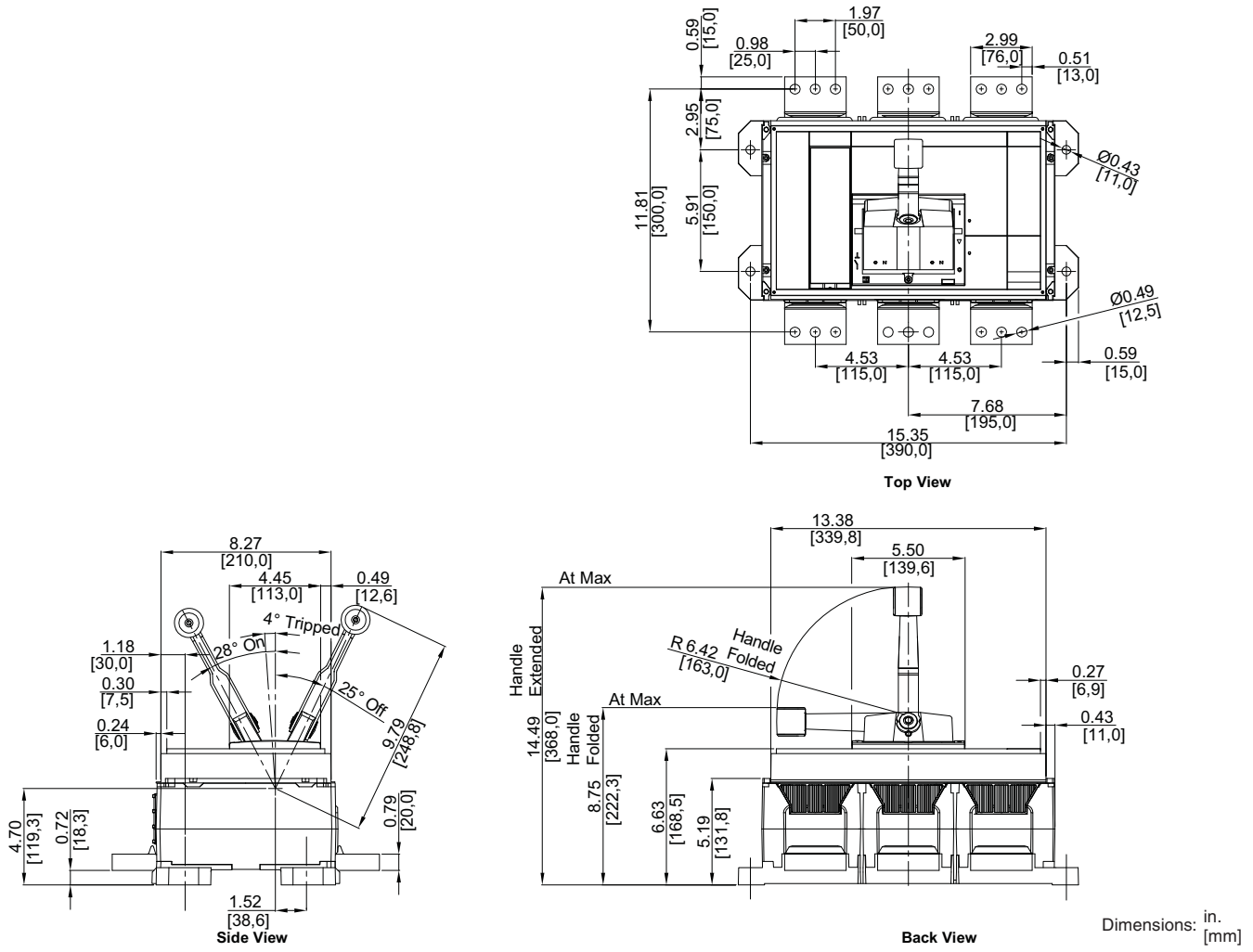
## Section 10—Dimensional Drawings

Figure 45: R-Frame Individually-Mounted UL Listed 4P Circuit Breaker



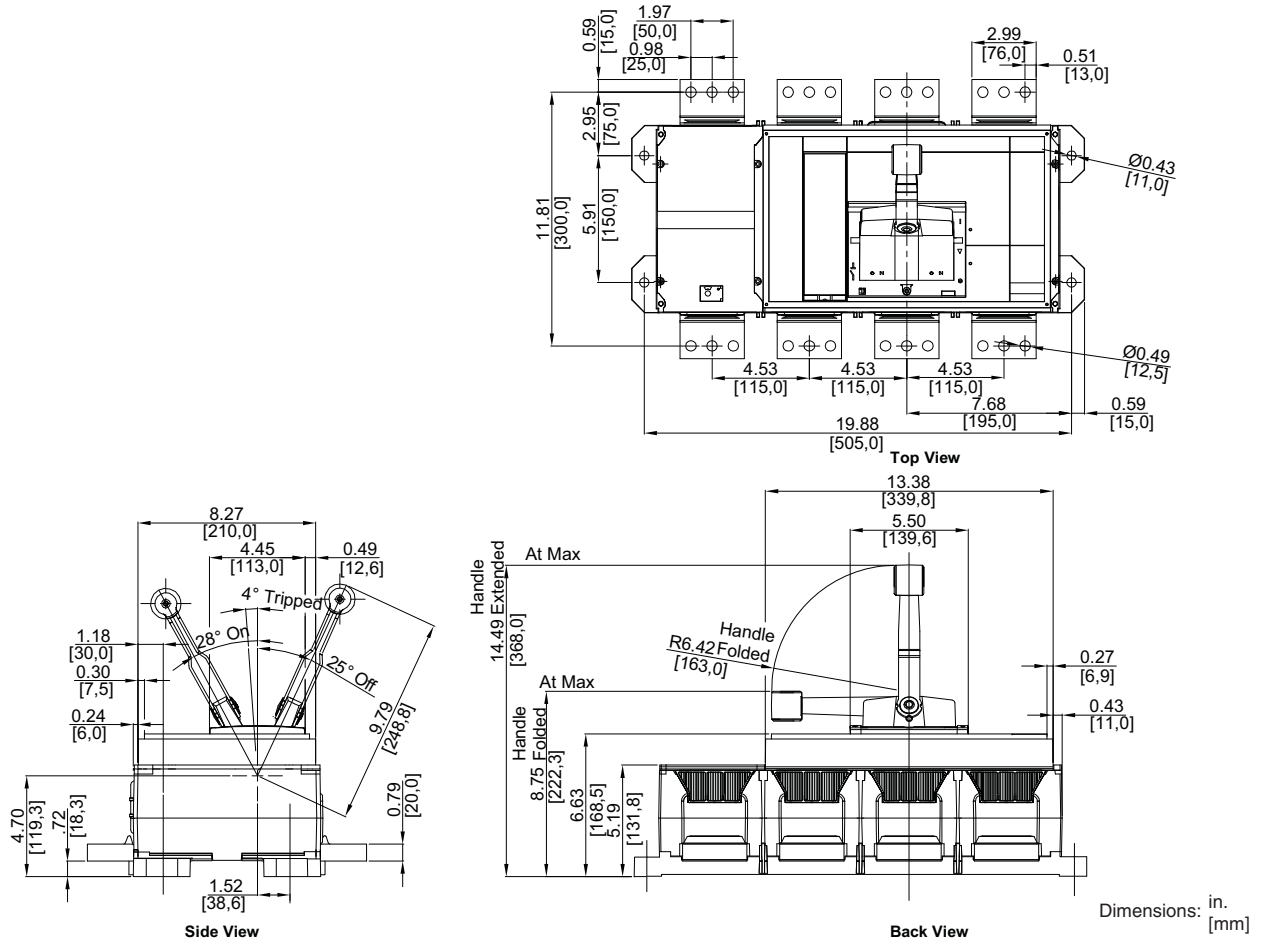
**PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers**  
**Section 10—Dimensional Drawings**

**Figure 46: NS1600b–NS3200 Individually-Mounted IEC Rated, 3P Circuit Breaker**



# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers Section 10—Dimensional Drawings

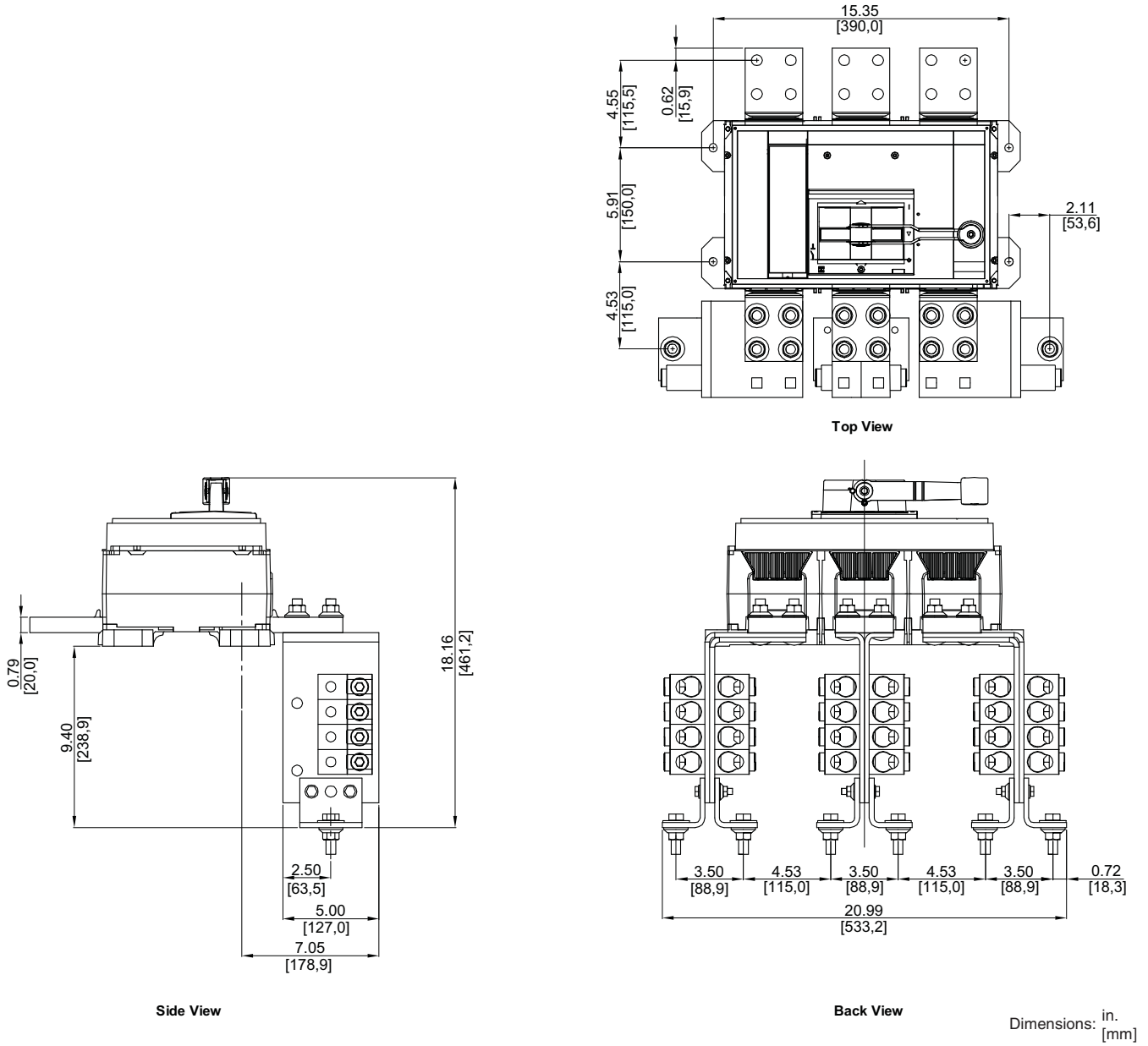
Figure 47: NS1600b–NS3200 Individually-Mounted IEC Rated 4P Circuit Breaker



# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

## Section 10—Dimensional Drawings

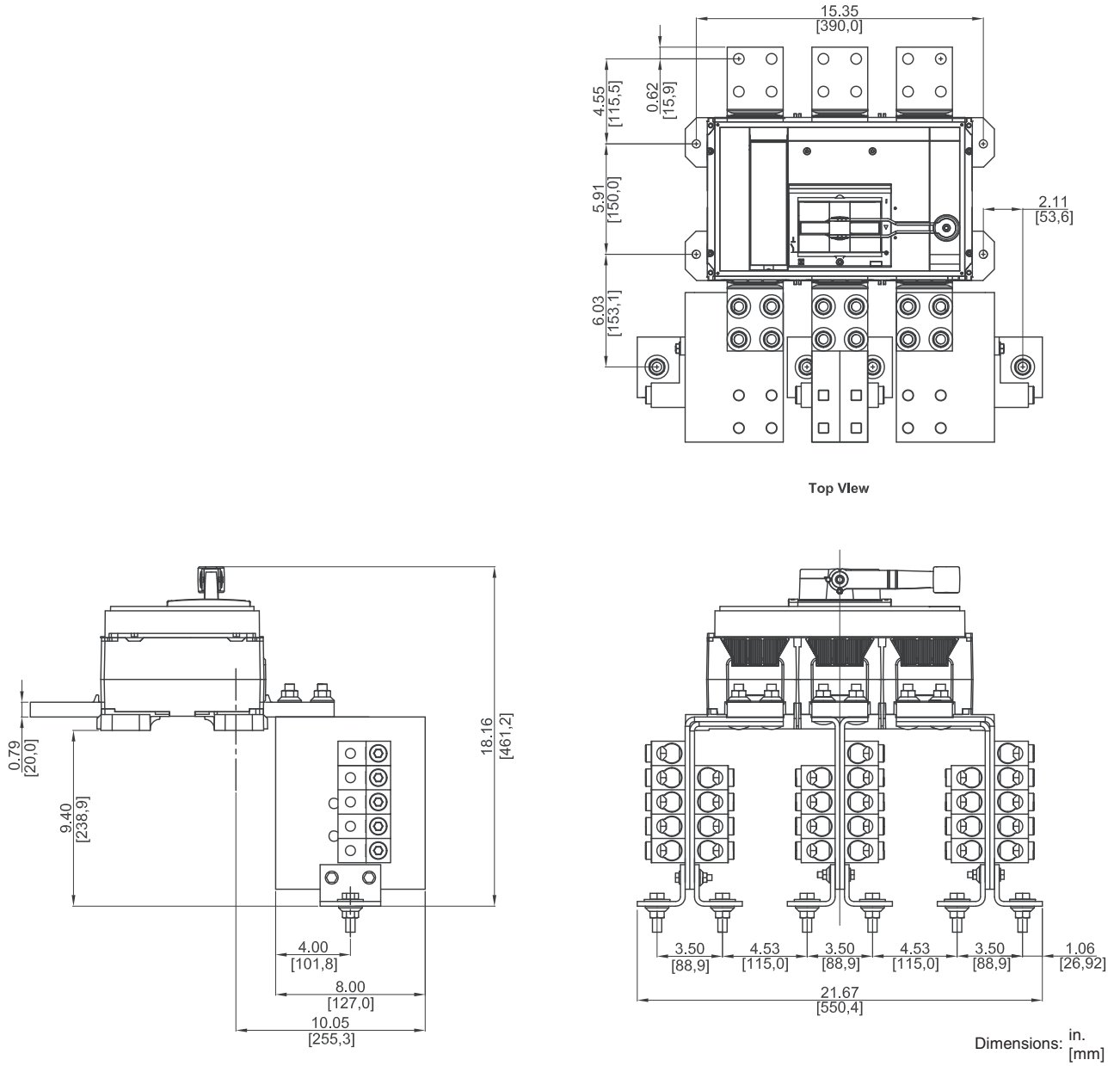
Figure 48: R-Frame RLTB 3P Terminal Pad (UL)





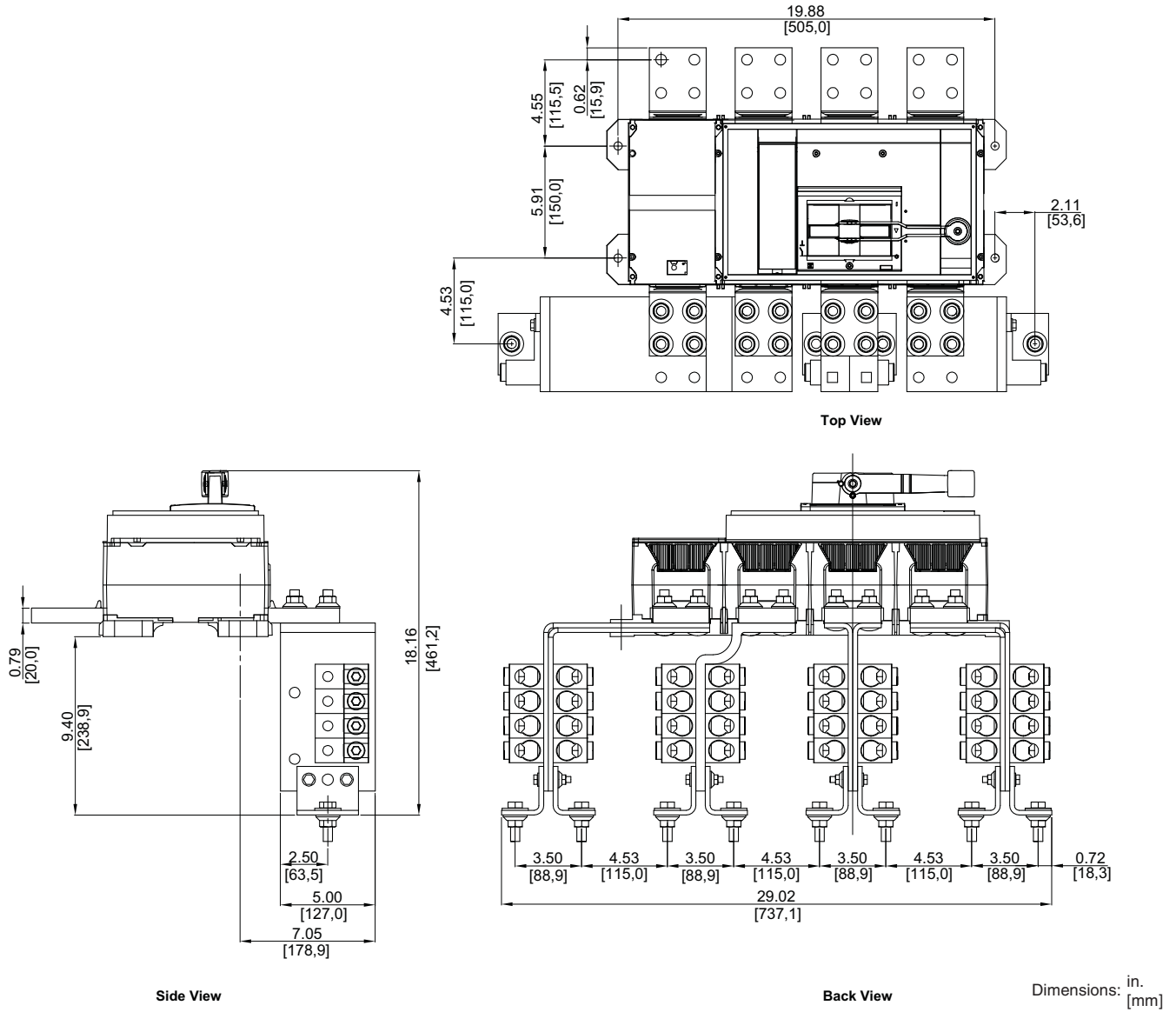
PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers  
 Section 10—Dimensional Drawings

Figure 49: R-Frame RL3TB 3P Terminal Pad (UL)



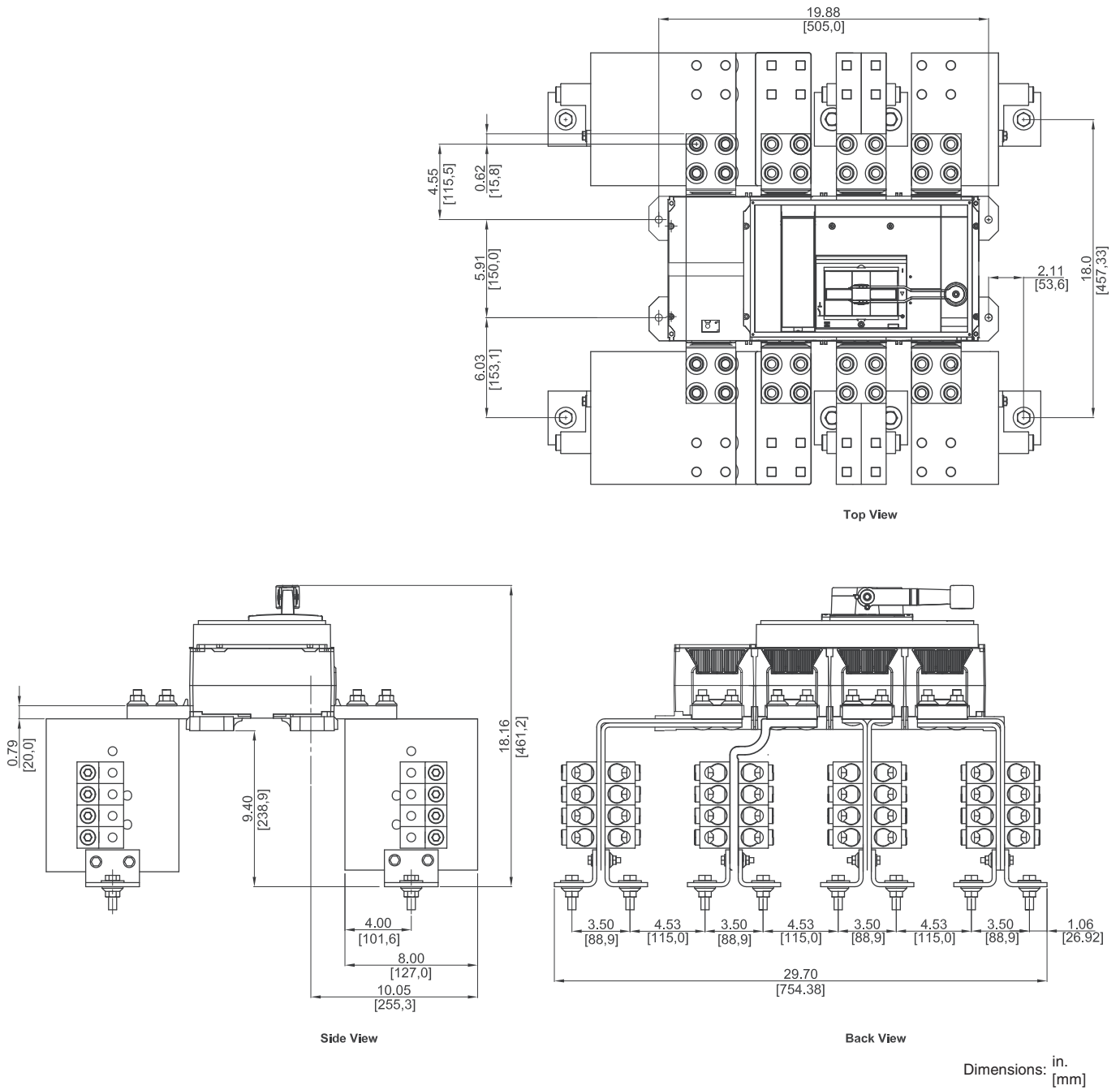
**PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers**  
**Section 10—Dimensional Drawings**

**Figure 50: R-Frame RLTB 4P Terminal Pad (UL)**



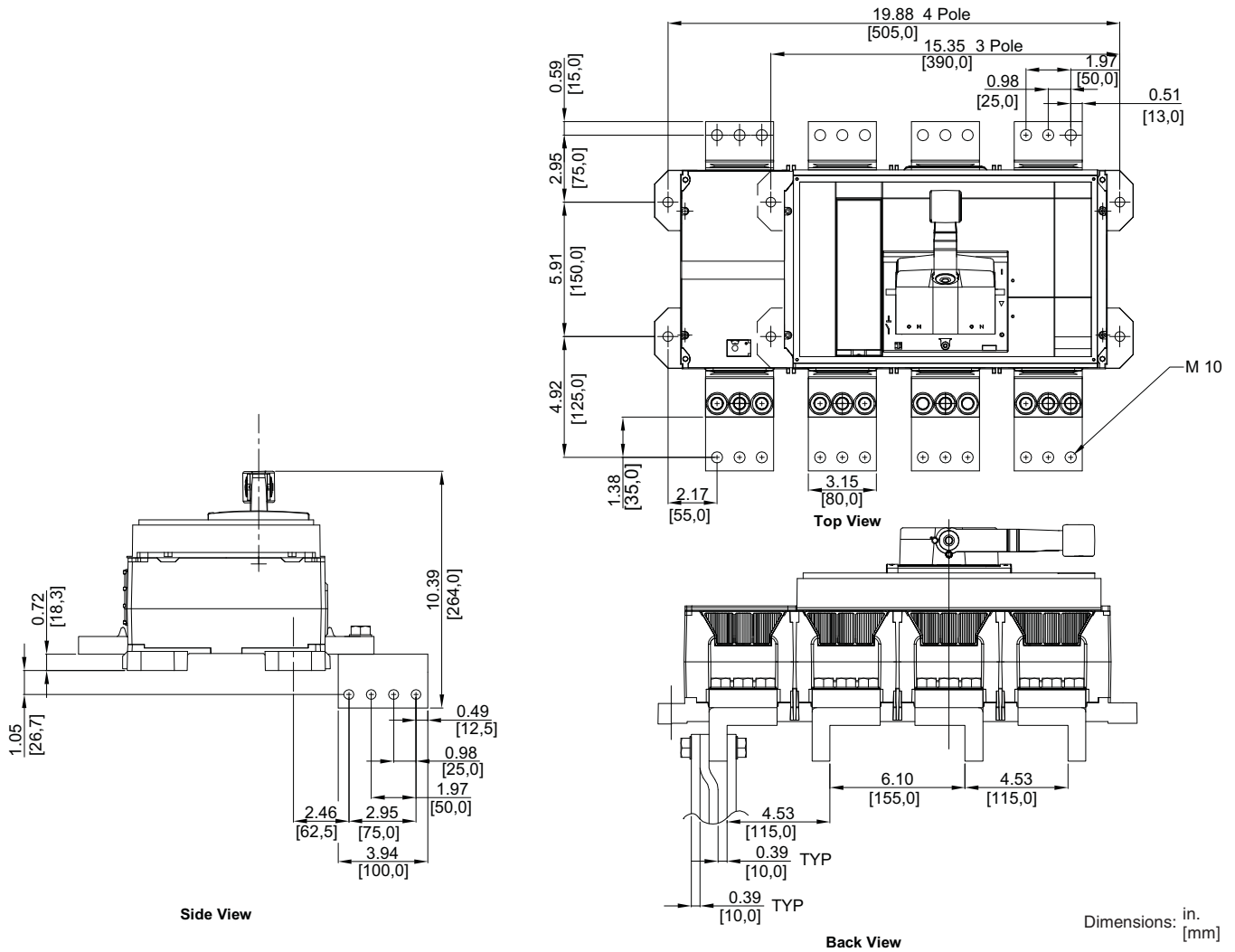
# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers Section 10—Dimensional Drawings

Figure 51: R-Frame RL3TB 4P Terminal Pad (UL)



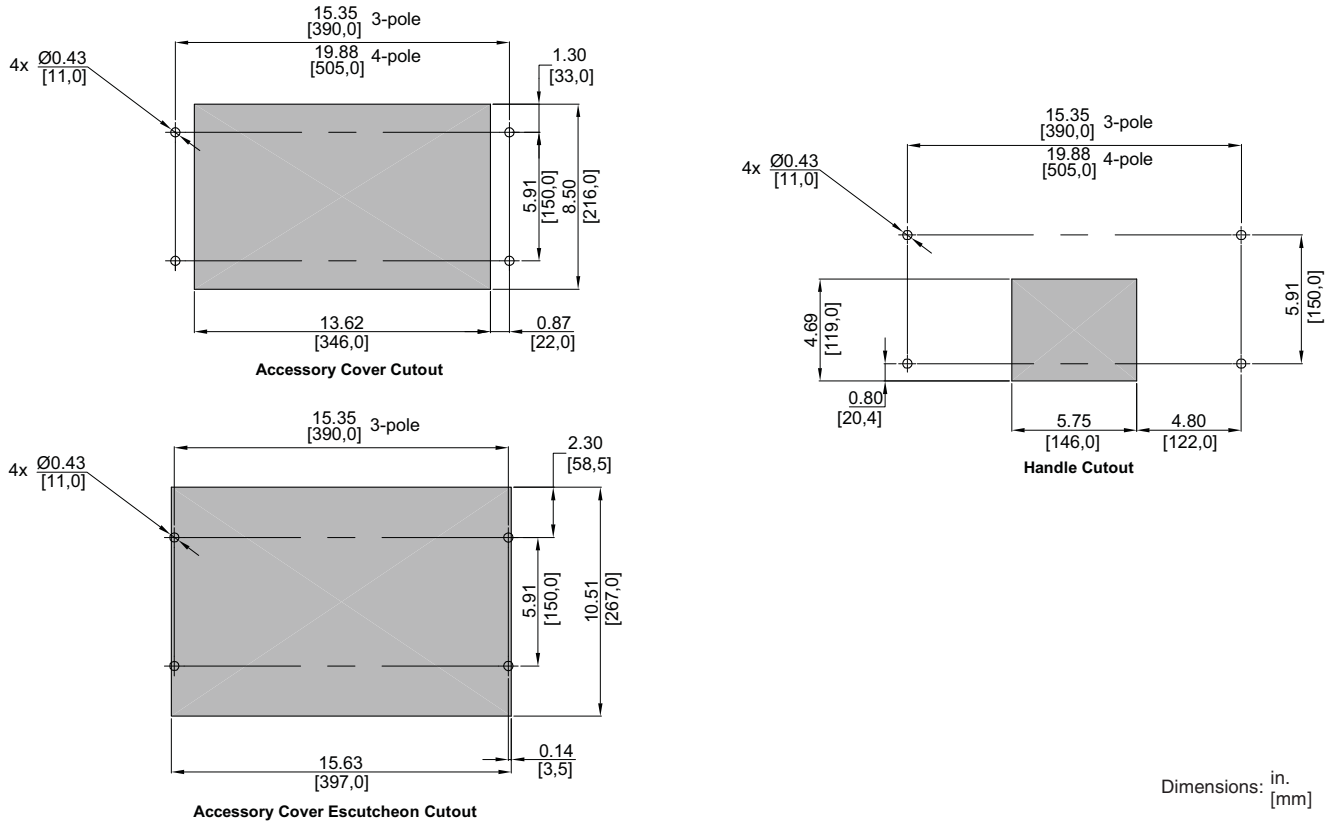
**PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers**  
**Section 10—Dimensional Drawings**

**Figure 52: NS1600b–NS3200 RLTBE Terminal Pad (IEC)**

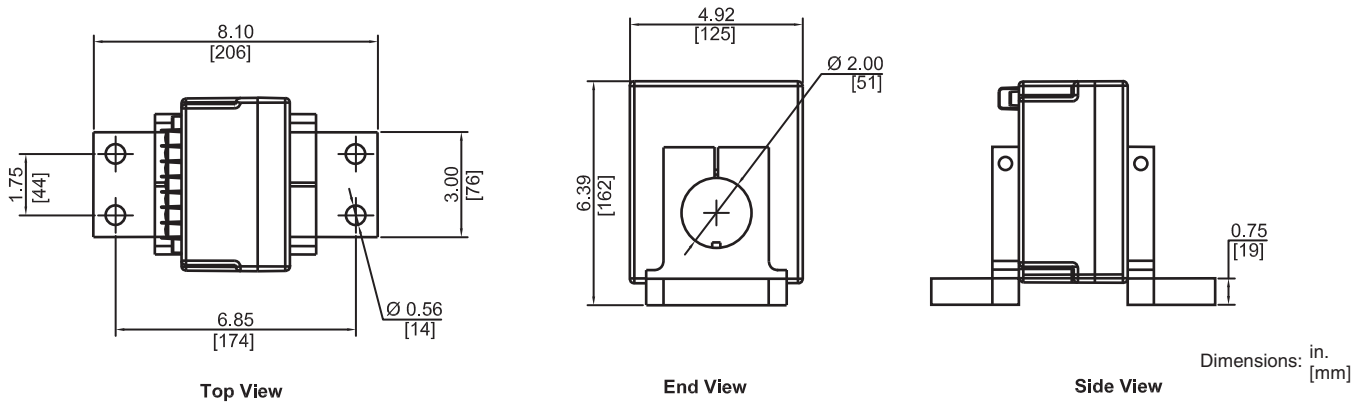


# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers Section 10—Dimensional Drawings

**Figure 53: R-Frame and NS1600b–NS3200 Enclosure Mounting Holes and Door Cutouts**

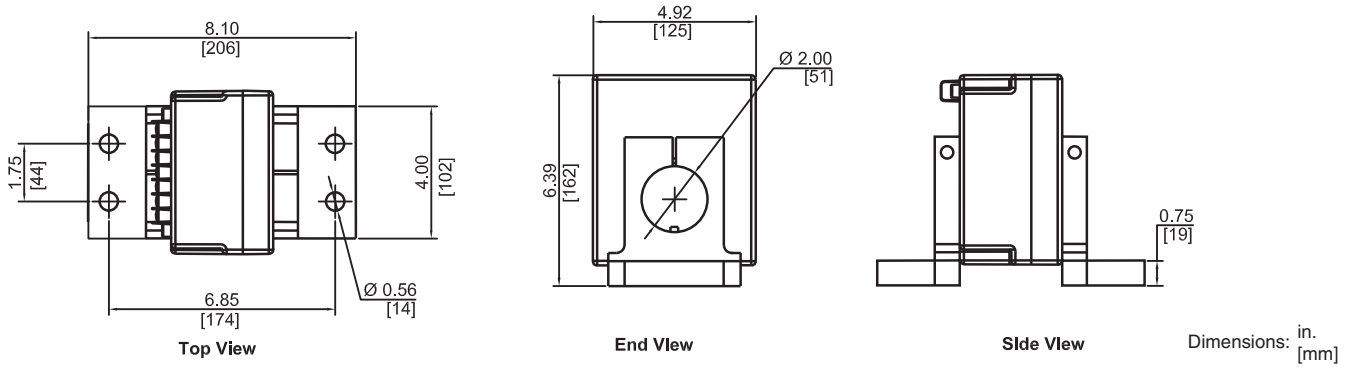


**Figure 54: R-Frame and NS1600b–NS3200 100–1600 A External Neutral Current Transformers**

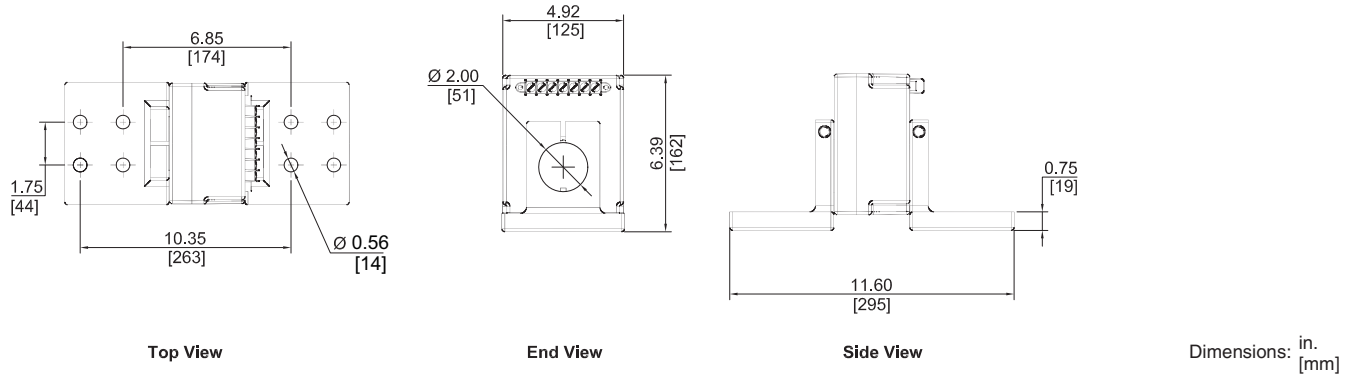


**PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers**  
**Section 10—Dimensional Drawings**

**Figure 55: R-Frame and NS1600b–NS3200 2000 A External Neutral Current Transformers**

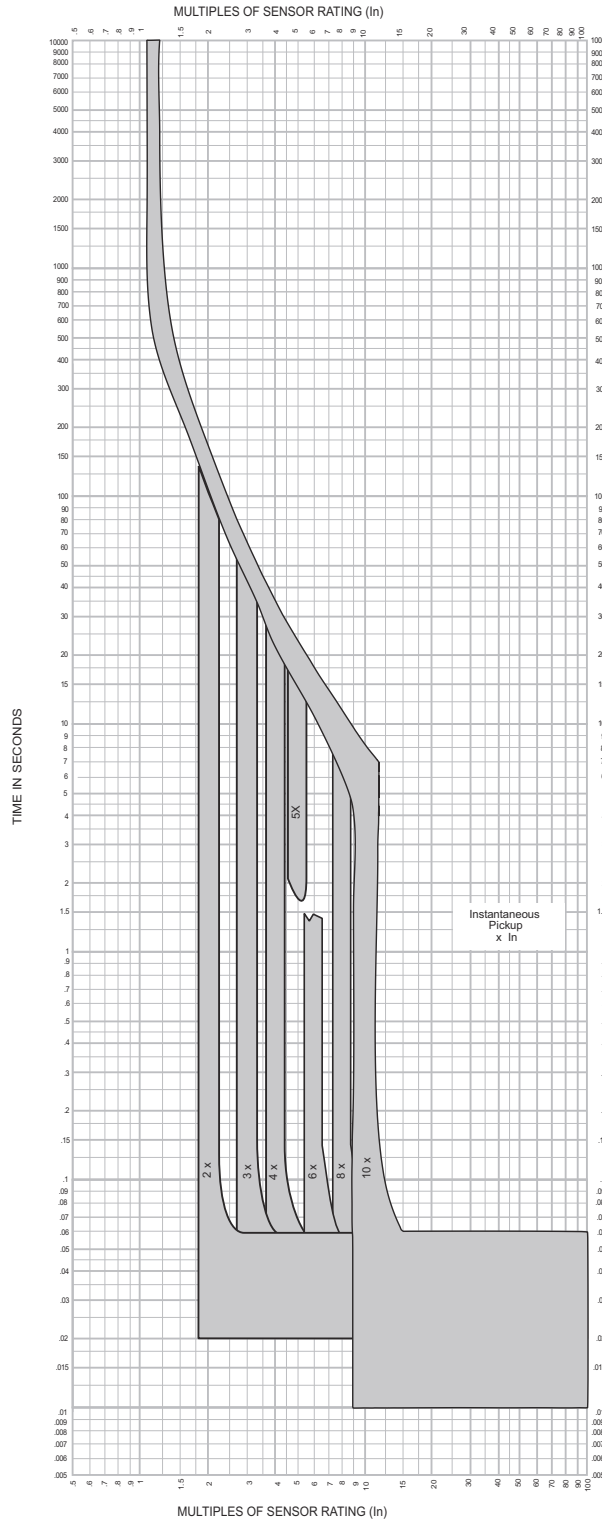


**Figure 56: R-Frame and NS1600b–NS3200 2500–3200 A External Neutral Current Transformers**



## Section 11—Trip Curves

Basic Electronic Trip Unit ET 1.0I, M-Frame 800 A Characteristic Trip Curve



### ELECTRONIC TRIP 1.0

CHARACTERISTIC TRIP CURVE NO. 613-14

Long-Time Pickup and Delay  
Instantaneous Pickup and Delay  
2x – 10x

The time-current curve information is to be used for application and coordination purposes only.

Curves apply from -30°C to +60°C ambient temperature.

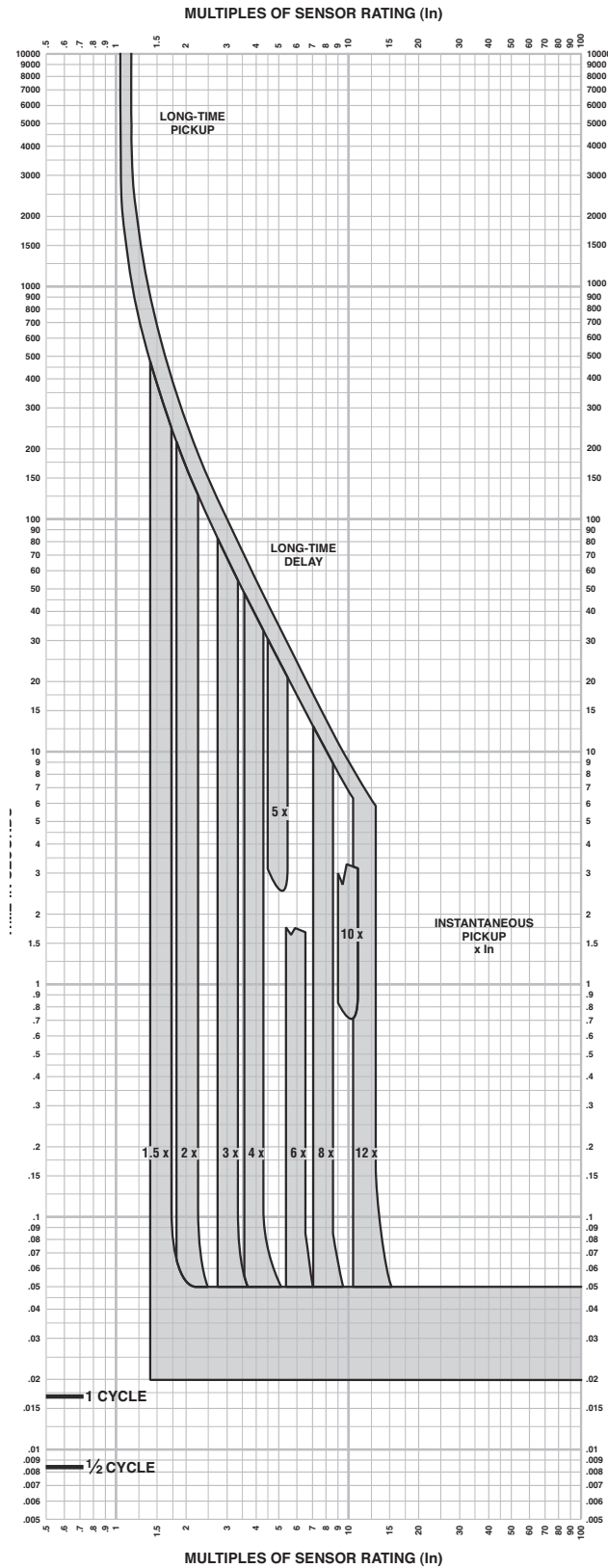
#### Notes:

1. There is a memory effect that can act to shorten the long-time delay. The memory effect comes into play if a current above the long-time delay pickup value exists for a time and then is cleared by the tripping of a downstream device or the circuit breaker itself. A subsequent overload will cause the circuit breaker to trip in a shorter time than normal. The amount of time delay reduction is inverse to the amount of time that has elapsed since the previous overload. Approximately 20 minutes is required between overloads to completely reset memory.
2. Total clearing times shown include the response times of the trip unit, the circuit breaker opening, and the extinction of the current.

# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

## Section 11—Trip Curves

Basic Electronic Trip Unit 1.0I P- and R-Frame Characteristic Trip Curve



### ELECTRONIC TRIP 1.0I CHARACTERISTIC TRIP CURVE NO. 613-12

Long-time Pickup and Fixed Delay  
Instantaneous Pickup  
1.5x-12x

The time-current curve information is to be used for application and coordination purposes only.

Curves apply from -30°C to +60°C ambient temperature.

Instantaneous override values are given on 613-10.

**Notes:**

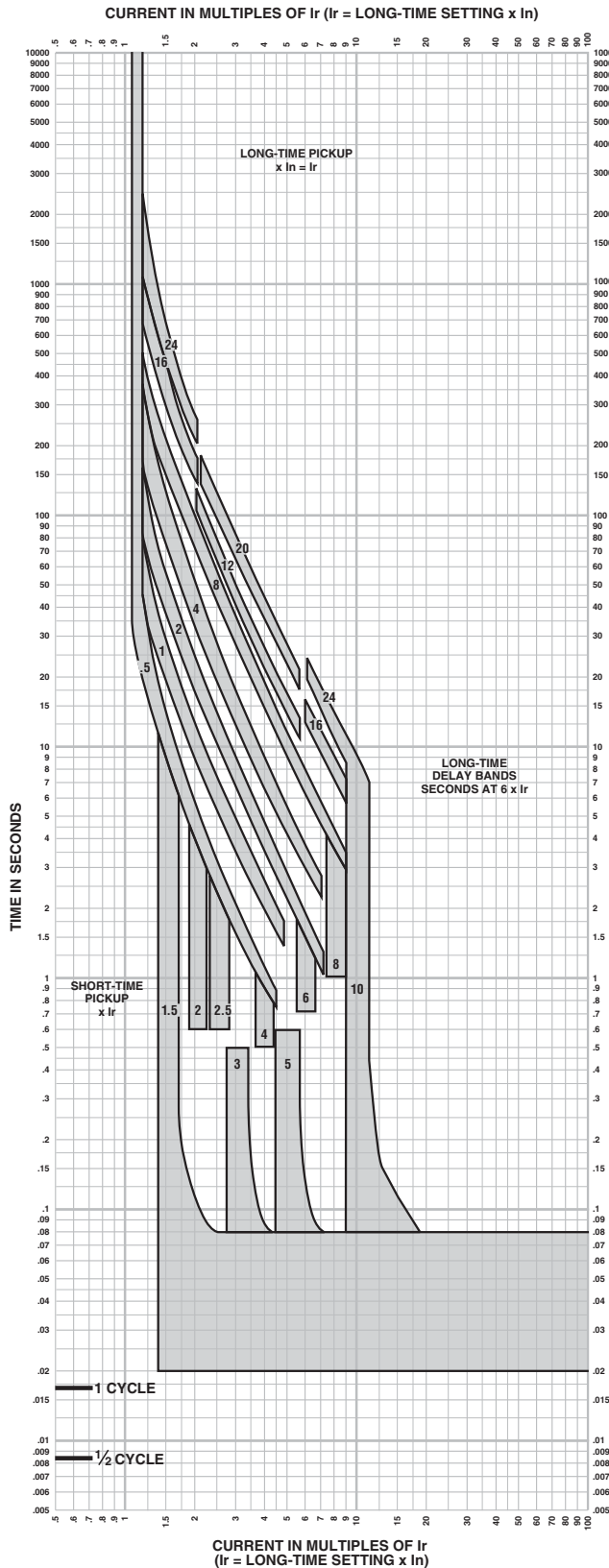
1. There is a thermal-imaging effect that can act to shorten the long-time delay. The thermal-imaging effect comes into play if a current above the long-time delay pickup value exists for a time and then is cleared by the tripping of a downstream device or the circuit breaker itself. A subsequent overload will cause the circuit breaker to trip in a shorter time than normal. The amount of time delay reduction is inverse to the amount of time that has elapsed since the previous overload. Approximately 20 minutes is required between overloads to completely reset thermal-imaging.
2. Total clearing times shown include the response times of the trip unit, the circuit breaker opening, and the extinction of the current.



# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

## Section 11—Trip Curves

Micrologic 2.0A NS630b–NS3200 Trip Unit Characteristic Trip Curve



### Micrologic 2.0A Trip Unit

Long-Time Pickup and Delay  
Short-Time Pickup with No Delay

Characteristic Trip Curve No. 613-9

The time-current curve information is to be used for application and coordination purposes only.

Curves apply from -30°C to +60°C (-22°F to +140°F) ambient temperature.

#### Notes:

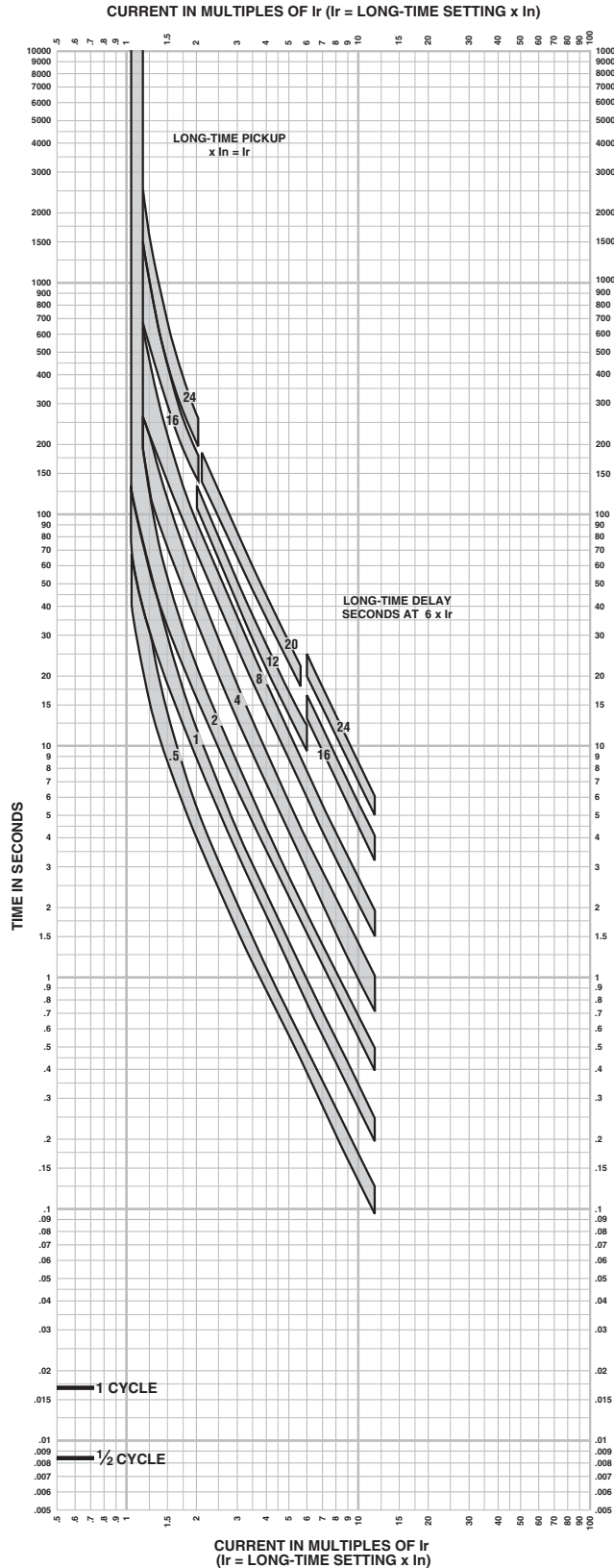
1. There is a thermal-imaging effect that can act to shorten the long-time delay. The thermal-imaging effect comes into play if a current above the long-time delay pickup value exists for a time and then is cleared by the tripping of a downstream device or the circuit breaker itself. A subsequent overload will cause the circuit breaker to trip in a shorter time than normal. The amount of time delay reduction is inverse to the amount of time that has elapsed since the previous overload. Approximately twenty minutes is required between overloads to completely reset thermal-imaging.
2. The end of the curve is determined by the short-time setting.
3. Total clearing times shown include the response times of the trip unit, the circuit breaker opening, and the extinction of current.
4. Overload indicator illuminates at 100%.

Curve No. 0613TC0009  
Drawing No. B48095-613-09

# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

## Section 11—Trip Curves

### Micrologic 3.0A P-Frame and R-Frame Trip Unit Characteristic Trip Curve



### Micrologic 3.0A Trip Unit

#### Long-Time Pickup and Delay

#### Characteristic Trip Curve No. 613-6

The time-current curve information is to be used for application and coordination purposes only.

Curves apply from -30°C to +60°C (-22°F to +140°F) ambient temperature.

#### Notes:

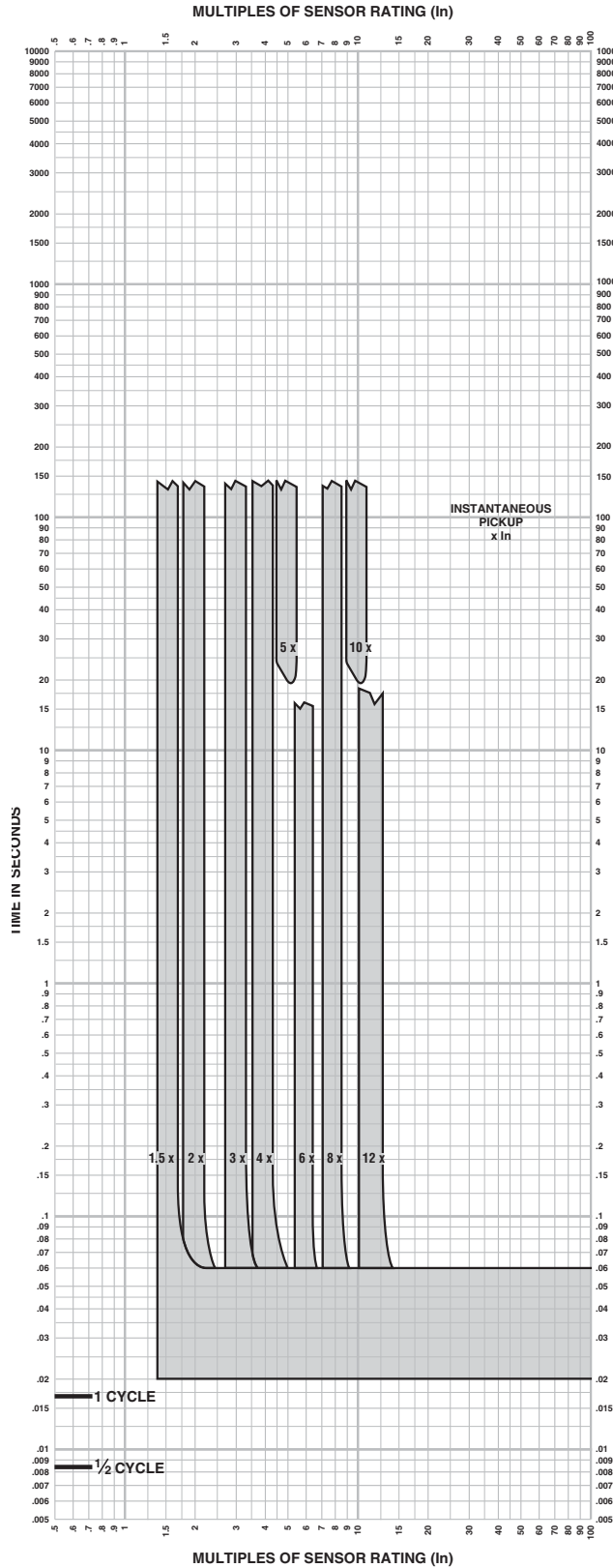
1. There is a thermal-imaging effect that can act to shorten the long-time delay. The thermal-imaging effect comes into play if a current above the long-time delay pickup value exists for a time and then is cleared by the tripping of a downstream device or the circuit breaker itself. A subsequent overload will cause the circuit breaker to trip in a shorter time than normal. The amount of time delay reduction is inverse to the amount of time that has elapsed since the previous overload. Approximately twenty minutes is required between overloads to completely reset thermal-imaging.
2. The end of the curve is determined by the instantaneous setting of the circuit breaker.
3. Total clearing times shown include the response times of the trip unit, the circuit breaker opening, and the extinction of current.
4. See trip curve 613-8 on page 139 for instantaneous pickup trip curve.

Curve No. 0613TC0006  
Drawing No. B48095-613-06

# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

## Section 11—Trip Curves

### Micrologic 3.0A P-Frame and R-Frame Trip Unit Characteristic Trip Curve



### Micrologic 3.0A Trip Unit

**Instantaneous Pickup, 1.5X to 12X**  
**Characteristic Trip Curve No. 613-8**

**The time-current curve information is to be used for application and coordination purposes only.**

**Curves apply from -30°C to +60°C (-22°F to +140°F) ambient temperature.**

#### Notes:

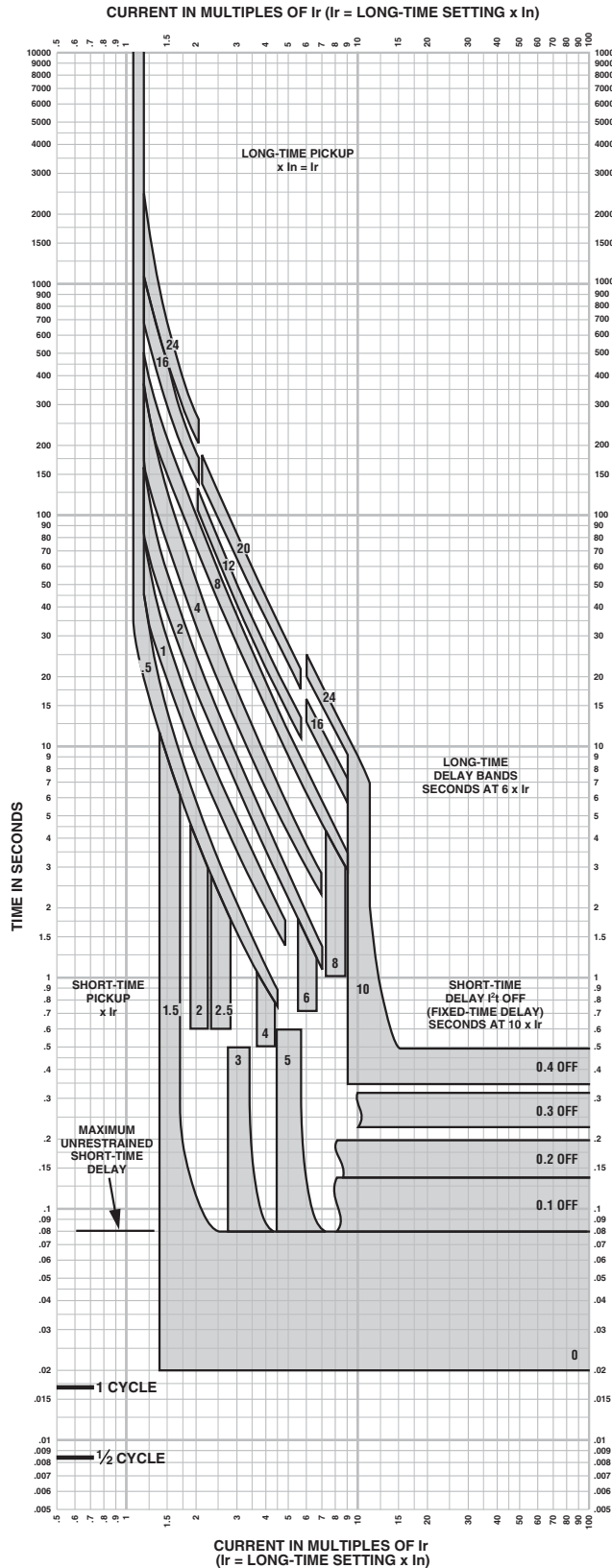
1. The end of the curve is determined by the interrupting rating of the circuit breaker.
2. Total clearing times shown include the response times of the trip unit, the circuit breaker opening, and the extinction of current.
3. The instantaneous region of the trip curve shows maximum total clearing times. Actual clearing times in this region can vary depending on the circuit breaker mechanism design and other factors. The actual clearing time can be considerably faster than indicated. Contact your local sales office for additional information.
4. See trip curve 613-6 on page 138 for long-time pickup and delay trip curves.

Curve No. 0613TC0008  
 Drawing No. B48095-613-08

# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

## Section 11—Trip Curves

### Micrologic 5.0/6.0 P-Frame, R-Frame and NS630b–NS3200 A/P/H Trip Unit Characteristic Trip Curve



### Micrologic 5.0/6.0 A/P/H Trip Units

Long-Time Pickup and Delay  
Short-Time Pickup and  $I^2t$  OFF  
Delay

### Characteristic Trip Curve No. 613-4

The time-current curve information is to be used for application and coordination purposes only.

Curves apply from  $-30^\circ\text{C}$  to  $+60^\circ\text{C}$  ( $-22^\circ\text{F}$  to  $+140^\circ\text{F}$ ) ambient temperature.

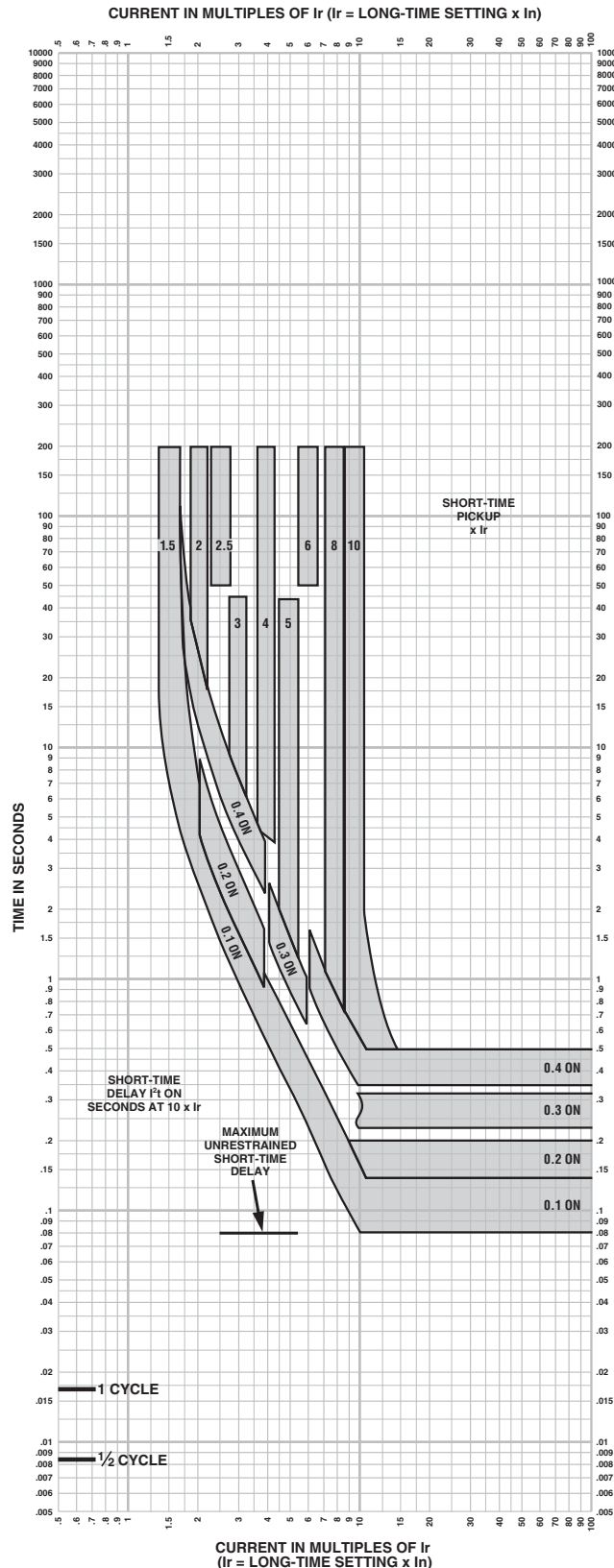
### Notes:

1. There is a thermal-imaging effect that can act to shorten the long-time delay. The thermal-imaging effect comes into play if a current above the long-time delay pickup value exists for a time and then is cleared by the tripping of a downstream device or the circuit breaker itself. A subsequent overload will cause the circuit breaker to trip in a shorter time than normal. The amount of time delay reduction is inverse to the amount of time that has elapsed since the previous overload. Approximately twenty minutes is required between overloads to completely reset thermal-imaging.
2. The end of the curve is determined by the interrupting rating of the circuit breaker.
3. With zone-selective interlocking ON, short-time delay utilized, and no restraining signal, the maximum unrestrained short-time delay time band applies regardless of the setting.
4. Total clearing times shown include the response times of the trip unit, the circuit breaker opening, and the extinction of the current.
5. For a withstand circuit breaker, instantaneous can be turned OFF. See trip curve 613-7 on page 142 for instantaneous trip curve. See table on page 146 for instantaneous override values.
6. Overload indicator illuminates at 100%.

Curve No. 0613TC0004  
Drawing No. B48095-613-04

# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers Section 11—Trip Curves

## Micrologic 5.0/6.0 P-Frame, R-Frame and NS630b–NS3200 A/P/H Trip Units Characteristic Trip Curve



### Micrologic 5.0/6.0 A/P/H Trip Units Short-Time Pickup and $I^2t$ ON Delay Characteristic Trip Curve No. 613-5

The time-current curve information is to be used for application and coordination purposes only.

Curves apply from  $-30^\circ\text{C}$  to  $+60^\circ\text{C}$  ( $-22^\circ\text{F}$  to  $+140^\circ\text{F}$ ) ambient temperature.

#### Notes:

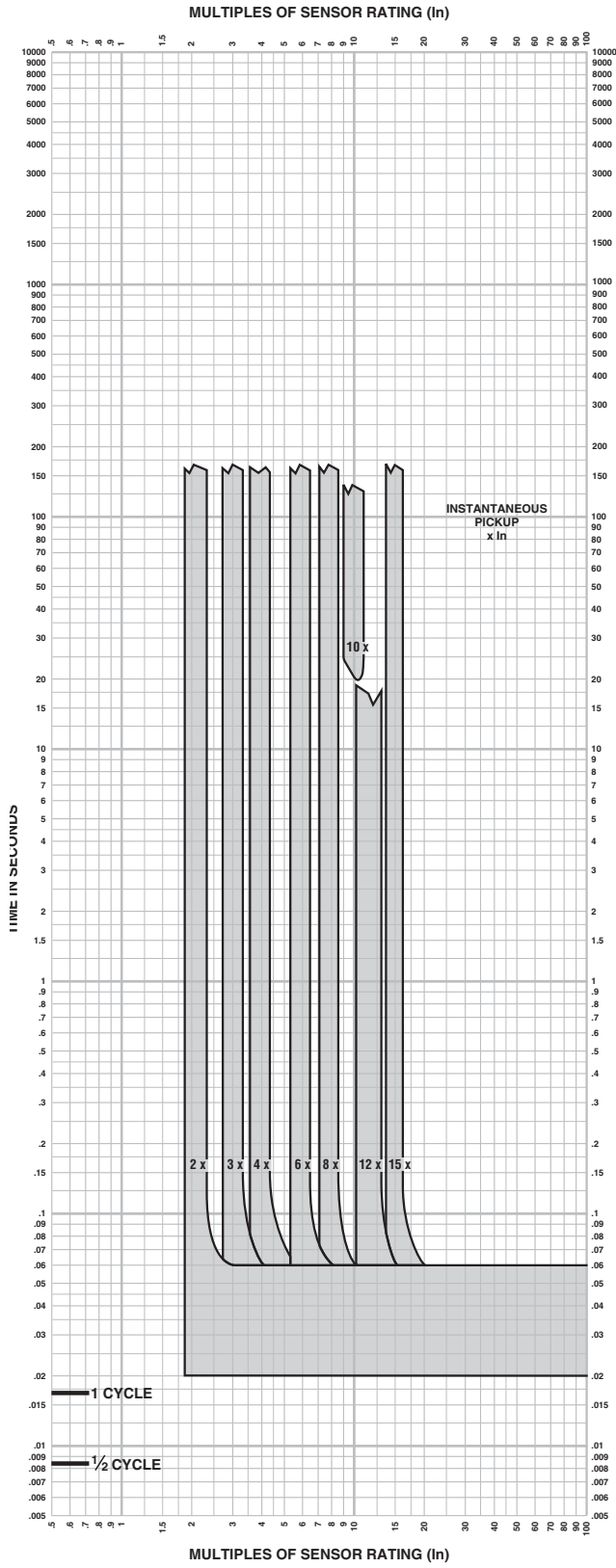
1. There is a thermal-imaging effect that can act to shorten the long-time delay. The thermal-imaging effect comes into play if a current above the long-time delay pickup value exists for a time and then is cleared by the tripping of a downstream device or the circuit breaker itself. A subsequent overload will cause the circuit breaker to trip in a shorter time than normal. The amount of time delay reduction is inverse to the amount of time that has elapsed since the previous overload. Approximately twenty minutes is required between overloads to completely reset thermal-imaging.
2. The end of the curve is determined by the interrupting rating of the circuit breaker.
3. With zone-selective interlocking ON, short-time delay utilized, and no restraining signal, the maximum unrestrained short-time delay time band applies regardless of the setting.
4. Total clearing times shown include the response times of the trip unit, the circuit breaker opening, and the extinction of current.
5. For withstand circuit breaker, instantaneous can be turned OFF. See trip curve 613-7 on page 142 for instantaneous trip curve. See table on page 146 for instantaneous override values.
6. See Trip Curve 613-4 on page 140 for long-time pickup and delay trip curve.

Curve No. 0613TC0005  
Drawing No. B48095-613-05

# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

## Section 11—Trip Curves

### Micrologic 5.0/6.0 P-Frame, R-Frame and NS630b–NS3200 A/P/H Trip Units Characteristic Trip Curve



#### Micrologic 5.0/6.0 Trip Units

**Instantaneous Pickup, 2X to 15X and OFF**

**Characteristic Trip Curve No. 613-7**

**The time-current curve information is to be used for application and coordination purposes only.**

**Curves apply from -30°C to +60°C (-22°F to +140°F) ambient temperature.**

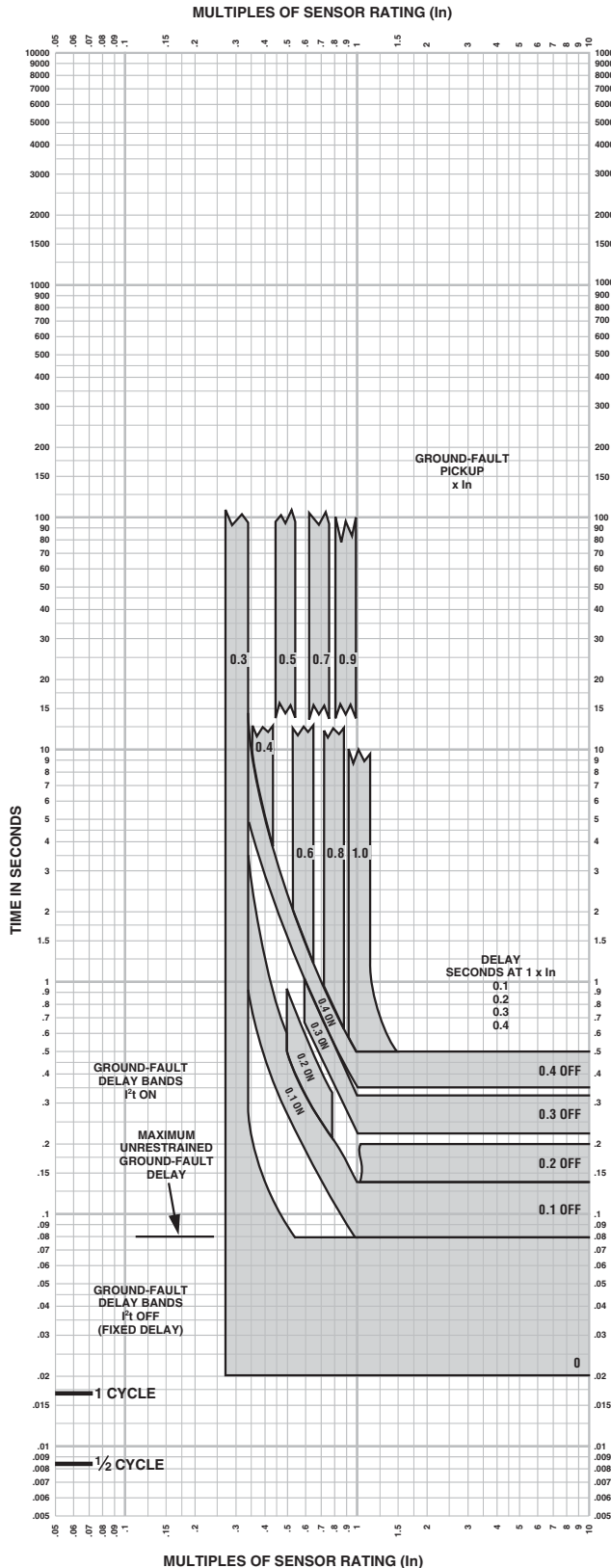
#### Notes:

1. The end of the curve is determined by the interrupting rating of the circuit breaker.
2. Total clearing times shown include the response times of the trip unit, the circuit breaker opening, and the extinction of current.
3. The instantaneous region of the trip curve shows maximum total clearing times. Actual clearing times in this region can vary depending on the circuit breaker mechanism design and other factors. The actual clearing time can be considerably faster than indicated. Contact your local sales office for additional information.
4. For a withstand circuit breaker, instantaneous can be turned OFF. See trip curve 613-7 on page 142 for the instantaneous trip curve. See table on page 146 for the instantaneous override values.
5. See trip curve 613-4 on page 140 and trip curve 613-5 on page 141 for long-time pickup, long-time delay, short-time pickup and short-time delay trip curves.

Curve No. 0613TC0007  
Drawing No. B48095-613-07

# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers Section 11—Trip Curves

## Micrologic 6.0 P-Frame, R-Frame and NS630b–NS3200 A/P/H Trip Units with Adjustable Ground-fault Pickup and Delay Characteristic Trip Curve



Micrologic 6.0 A/P/H Trip Units  
with Adjustable Ground-Fault Pickup  
and Delay

Ground Fault  $I^2t$  OFF and ON

$I_n \leq 400$  A

Characteristic Trip Curve No. 613-1

The time-current curve information  
is to be used for application and  
coordination purposes only.

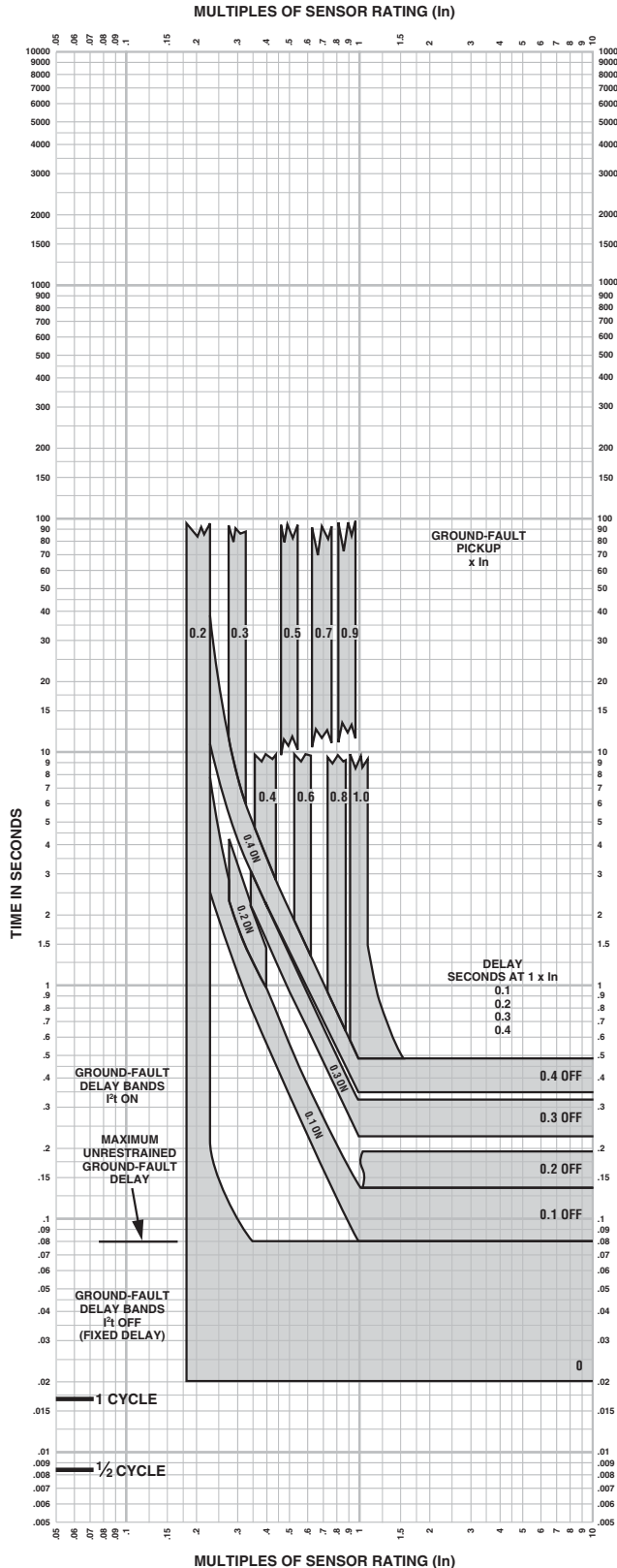
Curves apply from  $-30^\circ\text{C}$  to  $+60^\circ\text{C}$   
( $-22^\circ\text{F}$  to  $+140^\circ\text{F}$ ) ambient  
temperature.

Curve No. 0613TC0001  
Drawing No. B48095-613-01

# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

## Section 11—Trip Curves

### Micrologic 6.0 P-Frame, R-Frame and NS630b–NS3200 A/P/H Trip Units with Adjustable Ground-fault Pickup and Delay Characteristic Trip Curve



Micrologic 6.0 A/P/H Trip Units with Adjustable Ground-Fault Pickup and Delay

Ground Fault I<sup>2</sup>t OFF and ON

400 A < I<sub>n</sub> ≤ 1200 A

Characteristic Trip Curve No. 613-2

The time-current curve information is to be used for application and coordination purposes only.

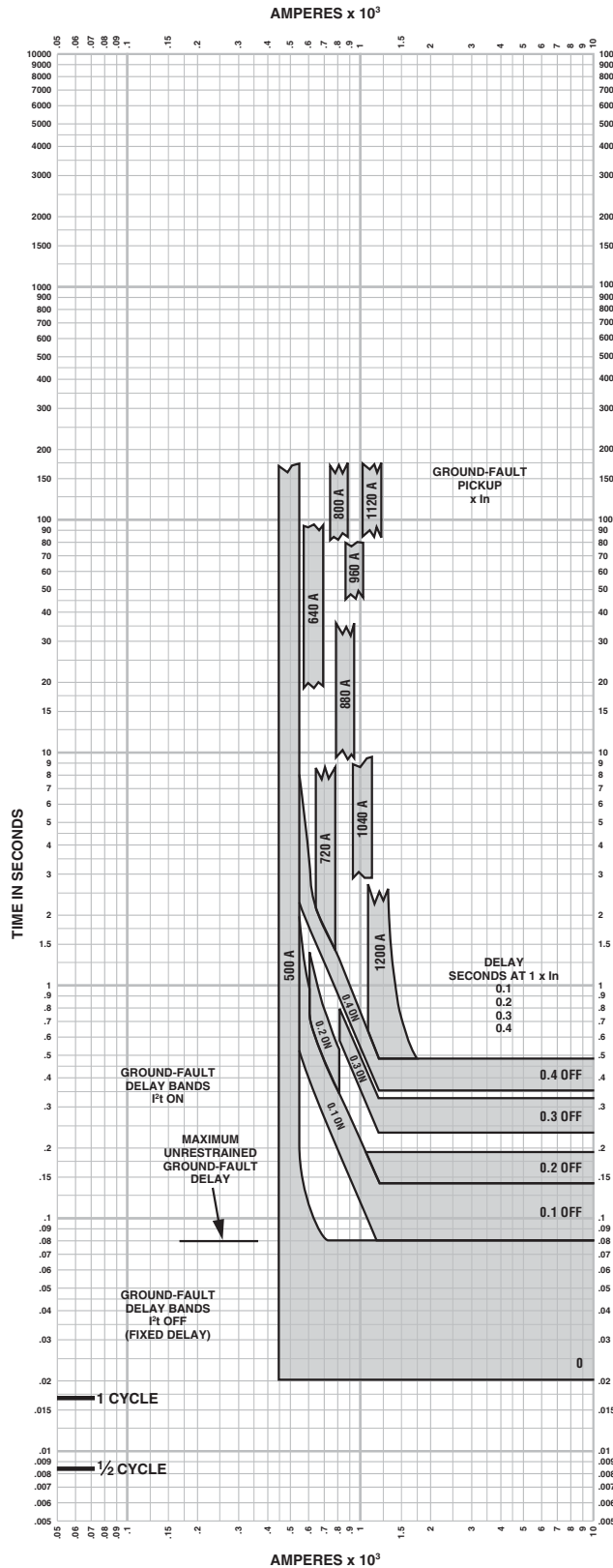
Curves apply from -30°C to +60°C (-22°F to +140°F) ambient temperature.

Curve No. 0613TC0002  
Drawing No. B48095-613-02



# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers Section 11—Trip Curves

## Micrologic 6.0 P-Frame, R-Frame and NS630b–NS3200 A/P/H Trip Units with Adjustable Ground-fault Pickup and Delay Characteristic Trip Curve



Micrologic 6.0 A/P/H Trip Units  
with Adjustable Ground-Fault Pickup  
and Delay

Ground Fault I<sup>2</sup>t OFF and ON

I<sub>n</sub> > 1200 A

Characteristic Trip Curve No. 613-3

The time-current curve information is  
to be used for application and  
coordination purposes only.

Curves apply from -30°C to +60°C  
(-22°F to +140°F) ambient  
temperature.

Curve No. 0613TC0003  
Drawing No. B48095-613-03

**PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers**  
**Section 11—Trip Curves**

**Table 100: Instantaneous Override Values Characteristic Trip Curve**

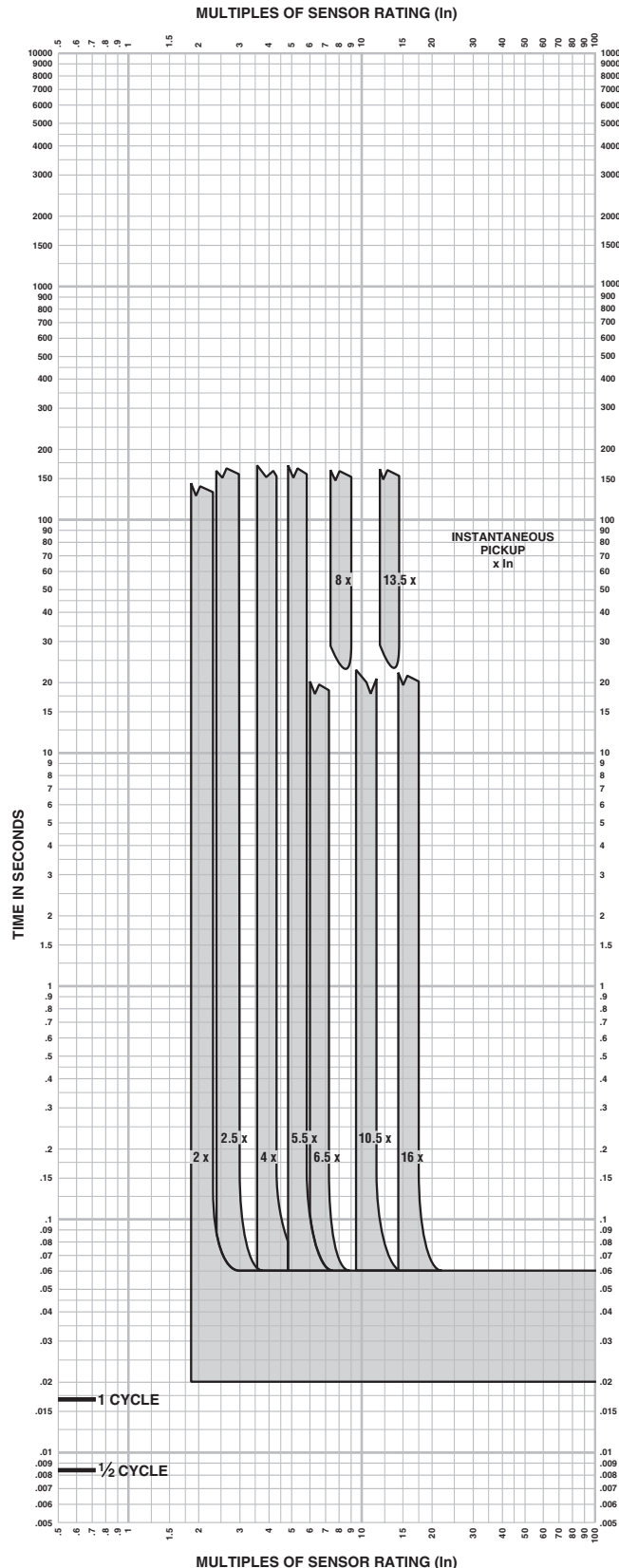
UL/IEC Circuit Breaker	Instantaneous Override <sup>1</sup> (kA RMS)	UL/IEC Circuit Breaker	Instantaneous Override <sup>1</sup> (kA RMS)
RG 600	57 ± 10%	MG300	12 ± 15%
RG 800	57 ± 10%	MG350	12 ± 15%
RG 1000	57 ± 10%	MG400	12 ± 15%
RG 1200	57 ± 10%	MG450	12 ± 15%
RG 1600	57 ± 10%	MG500	12 ± 15%
RG 2000	57 ± 10%	MG600	12 ± 15%
RG 2500	57 ± 10%	MG700	12 ± 15%
RJ 600	48 ± 15%	MG800	12 ± 15%
RJ 800	48 ± 15%	MJ300	12 ± 15%
RJ 1000	48 ± 15%	MJ350	12 ± 15%
RJ 1200	48 ± 15%	MJ400	12 ± 15%
RJ 1600	48 ± 15%	MJ450	12 ± 15%
RJ 2000	48 ± 15%	MJ500	12 ± 15%
RJ 2500	48 ± 15%	MJ600	12 ± 15%
RK 600	57 ± 15%	MJ700	12 ± 15%
RK 800	57 ± 15%	MJ800	12 ± 15%
RK 1000	57 ± 15%	<b>IEC Circuit Breaker</b>	<b>Instantaneous Override<sup>1</sup> (kA RMS)</b>
RK 1200	57 ± 15%		
RK 1600	57 ± 15%		
RK 2000	57 ± 15%		
RK 2500	57 ± 15%		
RL 600	48 ± 15%		
RL 800	48 ± 15%		
RL 1000	48 ± 15%		
RL 1200	48 ± 15%		
RL 1600	48 ± 15%		
RL 2000	48 ± 15%		
RL 2500	48 ± 15%		
PG 250	24 ± 10%	NS 630b H	24 ± 10%
PG 400	24 ± 10%	NS 800 H	24 ± 10%
PG 600	24 ± 10%	NS 1000 H	24 ± 10%
PG 800	24 ± 10%	NS 1250 H	24 ± 10%
PG 1000	24 ± 10%	NS 1600 H	24 ± 10%
PG 1200	24 ± 10%	NS 1600b H	48 ± 15%
PJ 250	7 ± 10%	NS 2000 H	48 ± 15%
PJ 400	10 ± 10%	NS 2500 H	48 ± 15%
PJ 600	10 ± 10%	NS 3200 H	48 ± 15%
PJ 800	10 ± 10%	NS 630b L	24 ± 10%
PJ 1000	10 ± 10%	NS 800 L	24 ± 10%
PJ 1200	10 ± 10%	NS 1000 L	24 ± 10%
PK 250	24 ± 10%	NS 630b N	24 ± 10%
PK 400	24 ± 10%	NS 800 N	24 ± 10%
PK 600	24 ± 10%	NS 1000 N	24 ± 10%
PK 800	24 ± 10%	NS 1250 N	24 ± 10%
PK 1000	24 ± 10%	NS 1600 N	24 ± 10%
PK 1200	24 ± 10%	NS 1600b N	57 ± 10%
PL 250	7 ± 10%	NS 2000 N	57 ± 10%
PL 400	10 ± 10%	NS 2500 N	57 ± 10%
PL 600	10 ± 10%	NS 3200 N	57 ± 10%
PL 800	10 ± 10%		
PL 1000	10 ± 10%		
PL 1200	10 ± 10%		

<sup>1</sup> Faults at or above instantaneous override value will be cleared at 25 msec or less.

# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

## Section 11—Trip Curves

### Basic Electronic Trip Unit 1.0M, P-Frame 600 A MDP Characteristic Trip Curve



### Basic Electronic Trip Unit 1.0M, 600 A

Instantaneous Pickup, 2X to 16X

Characteristic Trip Curve No. 613-13

The time-current curve information is to be used for application and coordination purposes only.

Curves apply from -30°C to +60°C (-22°F to +140°F) ambient temperature.

Instantaneous override values are given on page 146.

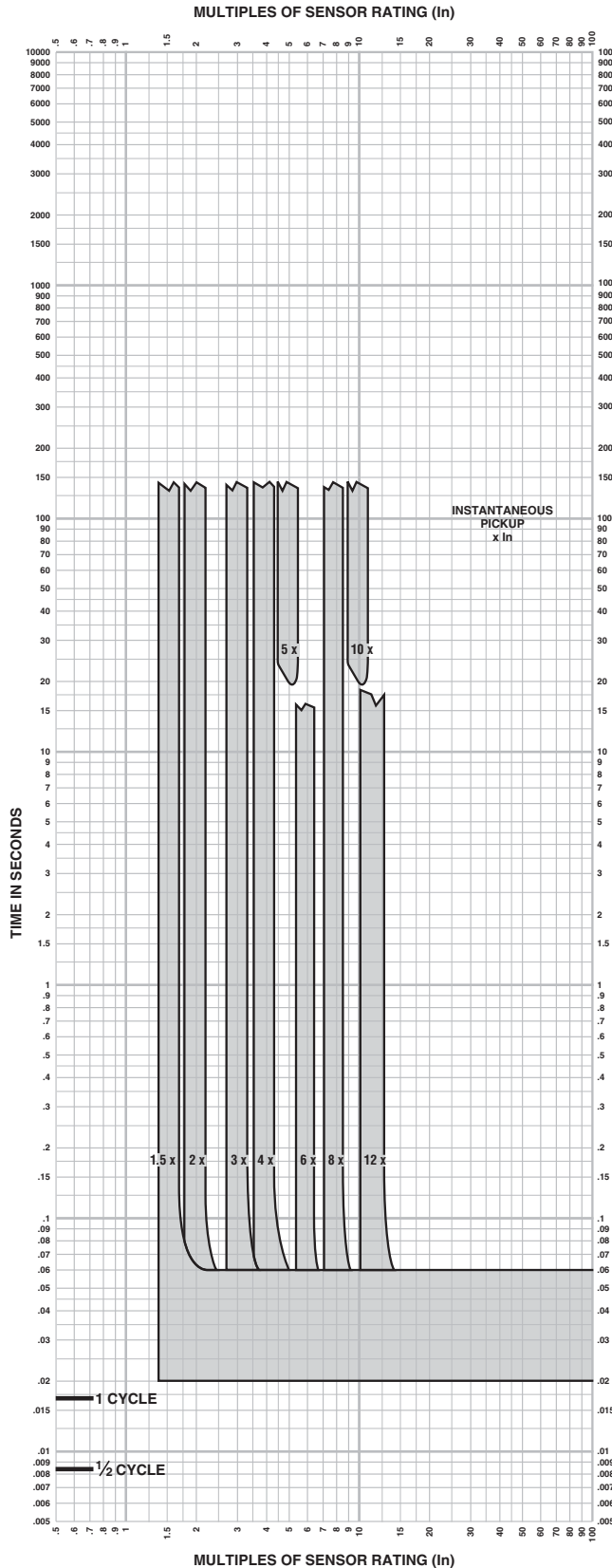
#### Notes:

1. The end of the curve is determined by the interrupting rating of the circuit breaker.
2. Total clearing times shown include the response times of the trip unit, the circuit breaker opening, and the extinction of current.
3. The instantaneous region of the trip curve shows maximum total clearing times. Actual clearing times in this region can vary depending on the circuit breaker mechanism design and other factors. The actual clearing time can be considerably faster than indicated. Contact your local sales office for additional information.

# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

## Section 11—Trip Curves

### Basic Electronic Trip Unit 1.0M P-Frame 800–1200A MCP Characteristic Trip Curve



### Basic Electronic Trip Unit 1.0M

Instantaneous Pickup, 1.5X to 12X

Characteristic Trip Curve No. 613-11

The time-current curve information is to be used for application and coordination purposes only.

Curves apply from -30°C to +60°C (-22°F to +140°F) ambient temperature.

Instantaneous override values are given on page 146.

#### Notes:

1. The end of the curve is determined by the interrupting rating of the circuit breaker.
2. Total clearing times shown include the response times of the trip unit, the circuit breaker opening, and the extinction of current.
3. The instantaneous region of the trip curve shows maximum total clearing times. Actual clearing times in this region can vary depending on the circuit breaker mechanism design and other factors. The actual clearing time can be considerably faster than indicated. Contact your local sales office for additional information.

Section 12—Catalog Numbers

685823	81	MJA267002	39	NPLLE34063U33R	63	NPRLE34063U43R	63	PDC6P204	87
685824	81	MJA268002	39	NPLLE34063U42R	63	NPRLE34063U44R	63	PGA36025CU31A	45
685825	81	MJA36300	39	NPLLE34063U43R	63	NPRLE34063U63RE1	63	PGA36025CU33A	45
685826	81	MJA36350	39	NPLLE34063U44R	63	NPRLE34063U64RE1	63	PGA36025CU41A	45
685827	81	MJA36400	39	NPLLE34063U63RE1	63	NPRLE34063U73RE1	63	PGA36025CU43A	45
685829	81	MJA36450	39	NPLLE34063U64RE1	63	NPRLE34063U74RE1	63	PGA36025CU44A	45
AL1200P24K	86	MJA36500	39	NPLLE34063U73RE1	63	NPRLE34080U32R	63	PGA36025CU63AE1	45
AL1200P24K	90	MJA36600	39	NPLLE34063U74RE1	63	NPRLE34080U33R	63	PGA36025CU64AE1	45
AL1200P25K	86	MJA36700	39	NPLLE34080U32R	63	NPRLE34080U42R	63	PGA36025CU73AE1	45
AL1200P6KU	86	MJA36800	39	NPLLE34080U33R	63	NPRLE34080U43R	63	PGA36025CU74AE1	45
AL1200P7KU	86	MJL26300	39	NPLLE34080U42R	63	NPRLE34080U44R	63	PGA36025CU31A	44
AL1200R53K	86	MJL26350	39	NPLLE34080U43R	63	NPRLE34080U63RE1	63	PGA36025U33A	44
AL1200R53K	90	MJL26400	39	NPLLE34080U44R	63	NPRLE34080U64RE1	63	PGA36025U41A	44
AL2500RK	86	MJL26450	39	NPLLE34080U63RE1	63	NPRLE34080U73RE1	63	PGA36025U43A	44
AL800M23K	86	MJL26500	39	NPLLE34080U64RE1	63	NPRLE34080U74RE1	63	PGA36025U44A	44
AL800P6K	86	MJL26600	39	NPLLE34080U73RE1	63	NRHFE36160U32R	67	PGA36025U63AE1	44
AL800P7K	86	MJL26700	39	NPLLE34080U74RE1	63	NRHFE36160U33R	67	PGA36025U64AE1	44
CU1200P24K	87	MJL26800	39	NPLLE34100U32R	63	NRHFE36160U42R	67	PGA36025U73AE1	44
CU1200P25K	87	MJL36300	39	NPLLE34100U33R	63	NRHFE36160U43R	67	PGA36025U74AE1	44
CU1200R53K	87	MJL36350	39	NPLLE34100U42R	63	NRHFE36160U44R	67	PGA36040CU31A	45
CU250P1K	87	MJL36400	39	NPLLE34100U43R	63	NRHFE36160U63RE1	67	PGA36040CU33A	45
CU800M23K	87	MJL36450	39	NPLLE34100U44R	63	NRHFE36160U64RE1	67	PGA36040CU41A	45
CYA1200R5	87	MJL36500	39	NPLLE34100U63RE1	63	NRHFE36200U32R	67	PGA36040CU43A	45
CYA1200R7	87	MJL36600	39	NPLLE34100U64RE1	63	NRHFE36200U33R	67	PGA36040CU44A	45
CYA400P5	87	MJL36700	39	NPLLE34100U73RE1	63	NRHFE36200U42R	67	PGA36040CU63AE1	45
CYA600P5	87	MJL36800	39	NPLLE34100U74RE1	63	NRHFE36200U43R	67	PGA36040CU64AE1	45
CYA800R7	87	MPRPAF	90	NPNFE36160U32R	63	NRHFE36200U44R	67	PGA36040CU73AE1	45
LCP48	88	NPRPAF	90	NPNFE36160U33R	63	NRHFE36200U63RE1	67	PGA36040CU74AE1	45
LHP48	88	NCTWIRING	77	NPNFE36160U42R	63	NRHFE36200U64RE1	67	PGA36040U31A	44
LHP8	88	NPHFE36160U32R	63	NPNFE36160U43R	63	NRHFE36250U32R	67	PGA36040U33A	44
LS10	88	NPHFE36160U33R	63	NPNFE36160U44R	63	NRHFE36250U33R	67	PGA36040U41A	44
LS8	88	NPHFE36160U42R	63	NPNFE36160U63RE1	63	NRHFE36250U42R	67	PGA36040U43A	44
LW1	88	NPHFE36160U43R	63	NPNFE36160U64RE1	63	NRHFE36250U43R	67	PGA36040U44A	44
LW4	88	NPHFE36160U44R	63	NPNFE36160U73RE1	63	NRHFE36250U63RE1	67	PGA36040U63AE1	44
LW7	88	NPHFE36160U63RE1	63	NPNFE36160U74RE1	63	NRHFE36250U64RE1	67	PGA36040U64AE1	44
MGA263002	39	NPHFE36160U64RE1	63	NPNLE36063U32R	63	NRHFE36320U32R	67	PGA36040U73AE1	44
MGA263502	39	NPHFE36160U73RE1	63	NPNLE36063U33R	63	NRHFE36320U33R	67	PGA36040U74AE1	44
MGA264002	39	NPHFE36160U74RE1	63	NPNLE36063U42R	63	NRHFE36320U42R	67	PGA36060	44
MGA264502	39	NPHLE36063U32R	63	NPNLE36063U43R	63	NRHFE36320U43R	67	PGA36060CU31A	45
MGA265002	39	NPHLE36063U33R	63	NPNLE36063U44R	63	NRHFE36320U44R	67	PGA36060CU33A	45
MGA266002	39	NPHLE36063U42R	63	NPNLE36063U63RE1	63	NRHFE36320U63RE1	67	PGA36060CU41A	45
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MGA36300	39	NPHLE36063U63RE1	63	NPNLE36063U74RE1	63	NRNFE36160U32R	67	PGA36060CU63AE1	45
MGA36350	39	NPHLE36063U64RE1	63	NPNLE36080U32R	63	NRNFE36160U33R	67	PGA36060CU64AE1	45
MGA36400	39	NPHLE36063U73RE1	63	NPNLE36080U33R	63	NRNFE36160U42R	67	PGA36060CU73AE1	45
MGA36450	39	NPHLE36063U74RE1	63	NPNLE36080U42R	63	NRNFE36160U43R	67	PGA36060CU74AE1	45
MGA36500	39	NPHLE36080U32R	63	NPNLE36080U43R	63	NRNFE36160U44R	67	PGA36060U31A	44
MGA36600	39	NPHLE36080U33R	63	NPNLE36080U44R	63	NRNFE36160U63RE1	67	PGA36060U33A	44
MGA36700	39	NPHLE36080U42R	63	NPNLE36080U63RE1	63	NRNFE36160U64RE1	67	PGA36060U41A	44
MGA36800	39	NPHLE36080U43R	63	NPNLE36080U64RE1	63	NRNFE36200U32R	67	PGA36060U43A	44
MGL26300	39	NPHLE36080U44R	63	NPNLE36080U73RE1	63	NRNFE36200U33R	67	PGA36060U44A	44
MGL26350	39	NPHLE36080U63RE1	63	NPNLE36080U74RE1	63	NRNFE36200U42R	67	PGA36060U63AE1	44
MGL26400	39	NPHLE36080U64RE1	63	NPNLE36100U32R	63	NRNFE36200U43R	67	PGA36060U64AE1	44
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MGL26600	39	NPHLE36100U32R	63	NPNLE36100U43R	63	NRNFE36200U64RE1	67	PGA36080	44
MGL26700	39	NPHLE36100U33R	63	NPNLE36100U44R	63	NRNFE36250U32R	67	PGA36080CU31A	45
MGL26800	39	NPHLE36100U42R	63	NPNLE36100U63RE1	63	NRNFE36250U33R	67	PGA36080CU33A	45
MGL36300	39	NPHLE36100U43R	63	NPNLE36100U64RE1	63	NRNFE36250U42R	67	PGA36080CU41A	45
MGL36350	39	NPHLE36100U44R	63	NPNLE36100U73RE1	63	NRNFE36250U43R	67	PGA36080CU43A	45
MGL36400	39	NPHLE36100U63RE1	63	NPNLE36100U74RE1	63	NRNFE36250U44R	67	PGA36080CU44A	45
MGL36450	39	NPHLE36100U64RE1	63	NPNLE36125U32R	63	NRNFE36250U63RE1	67	PGA36080CU63AE1	45
MGL36500	39	NPHLE36100U73RE1	63	NPNLE36125U33R	63	NRNFE36250U64RE1	67	PGA36080CU64AE1	45
MGL36600	39	NPHLE36100U74RE1	63	NPNLE36125U42R	63	NRNFE36320U32R	67	PGA36080CU73AE1	45
MGL36700	39	NPHLE36125U32R	63	NPNLE36125U43R	63	NRNFE36320U33R	67	PGA36080CU74AE1	45
MGL36800	39	NPHLE36125U42R	63	NPNLE36125U44R	63	NRNFE36320U42R	67	PGA36080U31A	44
MICROTUSEAL	76	NPHLE36125U43R	63	NPNLE36125U63RE1	63	NRNFE36320U43R	67	PGA36080U33A	44
MJA263002	39	NPHLE36125U44R	63	NPNLE36125U64RE1	63	NRNFE36320U44R	67	PGA36080U41A	44
MJA263502	39	NPHLE36125U63RE1	63	NPNLE36125U73RE1	63	NRNFE36320U63RE1	67	PGA36080U43A	44
MJA264002	39	NPHLE36125U64RE1	63	NPNLE36125U74RE1	63	NRNFE36320U64RE1	67	PGA36080U44A	44
MJA264502	39	NPHLE36125U73RE1	63	NPRLE34063U32R	63	PDC12P4	87	PGA36080U63AE1	44
MJA265002	39	NPHLE36125U74RE1	63	NPRLE34063U33R	63	PDC12P44	87	PGA36080U64AE1	44
MJA266002	39	NPLLE34063U32R	63	NPRLE34063U42R	63	PDC6P20	87	PGA36080U73AE1	44

# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers Catalog Numbers

PGA36080U74AE1 .....	44	PGL36080CU43A .....	43	PJA36040CU74AE1 .....	45	PJL36025CU74AE1 .....	43	PJL36100U33A .....	42
PGA36100 .....	44	PGL36080CU44A .....	43	PJA36040U31A .....	44	PJL36025U31A .....	42	PJL36100U41A .....	42
PGA36100U31A .....	44	PGL36080CU63AE1 .....	43	PJA36040U33A .....	44	PJL36025U33A .....	42	PJL36100U43A .....	42
PGA36100U33A .....	44	PGL36080CU64AE1 .....	43	PJA36040U41A .....	44	PJL36025U41A .....	42	PJL36100U44A .....	42
PGA36100U41A .....	44	PGL36080CU73AE1 .....	43	PJA36040U43A .....	44	PJL36025U43A .....	42	PJL36100U63AE1 .....	42
PGA36100U43A .....	44	PGL36080CU74AE1 .....	43	PJA36040U44A .....	44	PJL36025U44A .....	42	PJL36100U64AE1 .....	42
PGA36100U44A .....	44	PGL36080U31A .....	42	PJA36040U63AE1 .....	44	PJL36025U63AE1 .....	42	PJL36100U73AE1 .....	42
PGA36100U63AE1 .....	44	PGL36080U33A .....	42	PJA36040U64AE1 .....	44	PJL36025U64AE1 .....	42	PJL36100U74AE1 .....	42
PGA36100U64AE1 .....	44	PGL36080U41A .....	42	PJA36040U73AE1 .....	44	PJL36025U73AE1 .....	42	PJL36120 .....	42
PGA36100U73AE1 .....	44	PGL36080U43A .....	42	PJA36040U74AE1 .....	44	PJL36025U74AE1 .....	42	PJL36120CU31A .....	43
PGA36100U74AE1 .....	44	PGL36080U44A .....	42	PJA36060 .....	44	PJL36040CU31A .....	43	PJL36120CU33A .....	43
PGA36120 .....	44	PGL36080U63AE1 .....	42	PJA36060CU31A .....	45	PJL36040CU33A .....	43	PJL36120CU41A .....	43
PGA36120U31A .....	44	PGL36080U64AE1 .....	42	PJA36060CU33A .....	45	PJL36040CU41A .....	43	PJL36120CU43A .....	43
PGA36120U33A .....	44	PGL36080U73AE1 .....	42	PJA36060CU41A .....	45	PJL36040CU43A .....	43	PJL36120CU44A .....	43
PGA36120U41A .....	44	PGL36080U74AE1 .....	42	PJA36060CU43A .....	45	PJL36040CU44A .....	43	PJL36120CU63AE1 .....	43
PGA36120U43A .....	44	PGL36100 .....	42	PJA36060CU44A .....	45	PJL36040CU63AE1 .....	43	PJL36120CU64AE1 .....	43
PGA36120U44A .....	44	PGL36100CU31A .....	43	PJA36060CU63AE1 .....	45	PJL36040CU64AE1 .....	43	PJL36120CU73AE1 .....	43
PGA36120U63AE1 .....	44	PGL36100CU33A .....	43	PJA36060CU64AE1 .....	45	PJL36040CU73AE1 .....	43	PJL36120CU74AE1 .....	43
PGA36120U64AE1 .....	44	PGL36100CU41A .....	43	PJA36060CU73AE1 .....	45	PJL36040CU74AE1 .....	43	PJL36120M70 .....	48
PGA36120U73AE1 .....	44	PGL36100CU43A .....	43	PJA36060CU74AE1 .....	45	PJL36040U31A .....	42	PJL36120U31A .....	42
PGA36120U74AE1 .....	44	PGL36100CU44A .....	43	PJA36060U31A .....	44	PJL36040U33A .....	42	PJL36120U33A .....	42
PGA3620U33A .....	44	PGL36100CU63AE1 .....	43	PJA36060U33A .....	44	PJL36040U41A .....	42	PJL36120U41A .....	42
PGA3620U41A .....	44	PGL36100CU64AE1 .....	43	PJA36060U41A .....	44	PJL36040U43A .....	42	PJL36120U43A .....	42
PGA3620U43A .....	44	PGL36100CU73AE1 .....	43	PJA36060U43A .....	44	PJL36040U44A .....	42	PJL36120U44A .....	42
PGA3620U44A .....	44	PGL36100CU74AE1 .....	43	PJA36060U63AE1 .....	44	PJL36040U63AE1 .....	42	PJL36120U63AE1 .....	42
PGA3620U63AE1 .....	44	PGL36100U31A .....	42	PJA36060U64AE1 .....	44	PJL36040U64AE1 .....	42	PJL36120U64AE1 .....	42
PGA3620U64AE1 .....	44	PGL36100U33A .....	42	PJA36060U64AE1 .....	44	PJL36040U73AE1 .....	42	PJL36120U73AE1 .....	42
PGA3620U73AE1 .....	44	PGL36100U41A .....	42	PJA36060U73AE1 .....	44	PJL36040U74AE1 .....	42	PJL36120U74AE1 .....	42
PGA3620U74AE1 .....	44	PGL36100U43A .....	42	PJA36060U74AE1 .....	44	PJL36060 .....	42	PKA36025CU31A .....	45
PGA3625CU31A .....	43	PGL36100CU31A .....	43	PJA36080 .....	44	PJL36060CU31A .....	43	PKA36025CU33A .....	45
PGA3625CU33A .....	43	PGL36100CU33A .....	43	PJA36080CU31A .....	45	PJL36060CU33A .....	43	PKA36025CU41A .....	45
PGA3625CU41A .....	43	PGL36100CU64AE1 .....	43	PJA36080CU33A .....	45	PJL36060CU41A .....	43	PKA36025CU43A .....	45
PGA3625CU43A .....	43	PGL36100CU73AE1 .....	43	PJA36080CU41A .....	45	PJL36060CU43A .....	43	PKA36025CU44A .....	45
PGA3625CU44A .....	43	PGL36100CU74AE1 .....	43	PJA36080CU43A .....	45	PJL36060CU44A .....	43	PKA36025CU63AE1 .....	45
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**PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers**  
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PKL36040U44A .....	42	PLA36120U74AE1 .....	42	PLA34100U44A .....	44	PLL34080CU63AE1 .....	43	RGF36060CU43A .....	55
PKL36040U63AE1 .....	42	PLA34025CU31A .....	45	PLA34100U63AE1 .....	44	PLL34080CU64AE1 .....	43	RGF36060CU44A .....	55
PKL36040U64AE1 .....	42	PLA34025CU33A .....	45	PLA34100U64AE1 .....	44				

# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

## Catalog Numbers

RGF36060CU63AE1	55	RGF36160U31A	54	RJA36120CU64AE1	57	RJF36160CU31A	56	RKA36100CU64AE1	57
RGF36060CU64AE1	55	RGF36160U33A	54	RJA36120CU73AE1	57	RJF36160CU33A	56	RKA36100CU73AE1	57
RGF36060CU73AE1	55	RGF36160U41A	54	RJA36120CU74AE1	57	RJF36160CU41A	56	RKA36100CU74AE1	57
RGF36060CU74AE1	55	RGF36160U43A	54	RJF36060	53	RJF36160CU43A	56	RKA36120CU31A	57
RGF36060U31A	53	RGF36160U44A	54	RJF36060CU31A	55	RJF36160CU44A	56	RKA36120CU33A	57
RGF36060U33A	53	RGF36160U63AE1	54	RJF36060CU33A	55	RJF36160CU63AE1	56	RKA36120CU41A	57
RGF36060U41A	53	RGF36160U64AE1	54	RJF36060CU41A	55	RJF36160CU64AE1	56	RKA36120CU43A	57
RGF36060U43A	53	RGF36160U73AE1	54	RJF36060CU43A	55	RJF36160CU73AE1	56	RKA36120CU44A	57
RGF36060U44A	53	RGF36160U74AE1	54	RJF36060CU44A	55	RJF36160CU74AE1	56	RKA36120CU63AE1	57
RGF36060U63AE1	53	RGF36200	54	RJF36060CU63AE1	55	RJF36160U31A	54	RKA36120CU64AE1	57
RGF36060U64AE1	53	RGF36200CU31A	56	RJF36060CU64AE1	55	RJF36160U33A	54	RKA36120CU73AE1	57
RGF36060U73AE1	53	RGF36200CU33A	56	RJF36060CU73AE1	55	RJF36160U41A	54	RKA36120CU74AE1	57
RGF36060U74AE1	53	RGF36200CU41A	56	RJF36060CU74AE1	55	RJF36160U43A	54	RKF36000S12	58
RGF36080	53	RGF36200CU43A	56	RJF36060U31A	53	RJF36160U44A	54	RKF36000S16	58
RGF36080CU31A	55	RGF36200CU44A	56	RJF36060U33A	53	RJF36160U63AE1	54	RKF36000S20	58
RGF36080CU33A	55	RGF36200CU63AE1	56	RJF36060U41A	53	RJF36160U64AE1	54	RKF36000S25	58
RGF36080CU41A	55	RGF36200CU64AE1	56	RJF36060U43A	53	RJF36160U73AE1	54	RKF36000S30	58
RGF36080CU43A	55	RGF36200CU73AE1	56	RJF36060U44A	53	RJF36160U74AE1	54	RKF36060	53
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RGF36080U31A	53	RGF36200U44A	54	RJF36080CU31A	55	RJF36200CU44A	56	RKF36060CU63AE1	55
RGF36080U33A	53	RGF36200U63AE1	54	RJF36080CU33A	55	RJF36200CU63AE1	56	RKF36060CU64AE1	55
RGF36080U41A	53	RGF36200U64AE1	54	RJF36080CU41A	55	RJF36200CU64AE1	56	RKF36060CU73AE1	55
RGF36080U43A	53	RGF36200U73AE1	54	RJF36080CU43A	55	RJF36200CU73AE1	56	RKF36060CU74AE1	55
RGF36080U44A	53	RGF36200U74AE1	54	RJF36080CU44A	55	RJF36200U74AE1	56	RKF36060U31A	53
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RGF36080U64AE1	53	RGF36250CU31A	56	RJF36080CU64AE1	55	RJF36200U33A	54	RKF36060U41A	53
RGF36080U73AE1	53	RGF36250CU33A	56	RJF36080CU73AE1	55	RJF36200U41A	54	RKF36060U43A	53
RGF36080U74AE1	53	RGF36250CU41A	56	RJF36080CU74AE1	55	RJF36200U43A	54	RKF36060U44A	53
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RGF36100CU41A	55	RGF36250CU64AE1	56	RJF36080U43A	53	RJF36200U74AE1	54	RKF36060U74AE1	53
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RGF36100CU44A	55	RGF36250CU74AE1	56	RJF36080U63AE1	53	RJF36250CU31A	56	RKF36080CU31A	55
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RGF36100CU74AE1	55	RGF36250U43A	54	RJF36100	53	RJF36250CU44A	56	RKF36080CU44A	55
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RGF36100U33A	53	RGF36250U63AE1	54	RJF36100CU33A	55	RJF36250CU64AE1	56	RKF36080CU64AE1	55
RGF36100U41A	53	RGF36250U64AE1	54	RJF36100CU41A	55	RJF36250CU73AE1	56	RKF36080CU73AE1	55
RGF36100U43A	53	RGF36250U73AE1	54	RJF36100CU43A	55	RJF36250CU74AE1	56	RKF36080CU74AE1	55
RGF36100U44A	53	RGF36250U74AE1	54	RJF36100CU44A	55	RJF36250U31A	54	RKF36080U31A	53
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RGF36100U73AE1	53	RGF36300CU41A	56	RJF36100CU73AE1	55	RJF36250U43A	54	RKF36080U43A	53
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RGF36120CU74AE1	55	RGF36300U44A	54	RJF36120	53	RJF36300CU63AE1	56	RKF36100CU44A	55
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RGF36120U33A	53	RGF36300U64AE1	54	RJF36120CU33A	55	RJF36300CU73AE1	56	RKF36100CU64AE1	55
RGF36120U41A	53	RGF36300U73AE1	54	RJF36120CU41A	55	RJF36300CU74AE1	56	RKF36100CU73AE1	55
RGF36120U43A	53	RGF36300U74AE1	54	RJF36120CU43A	55	RJF36300U31A	54	RKF36100CU74AE1	55
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RGF36120U64AE1	53	RJA36100CU41A	57	RJF36120CU64AE1	55	RJF36300U43A	54	RKF36100U41A	53
RGF36120U73AE1	53	RJA36100CU43A	57	RJF36120CU73AE1	55	RJF36300U44A	54	RKF36100U43A	53
RGF36120U74AE1	53	RJA36100CU44A	57	RJF36120CU74AE1	55	RJF36300U63AE1	54	RKF36100U44A	53
RGF36160	54	RJA36100CU63AE1	57	RJF36120U31A	53	RJF36300U64AE1	54	RKF36100U63AE1	53
RGF36160CU31A	56	RJA36100CU64AE1	57	RJF36120U33A	53	RJF36300U73AE1	54	RKF36100U64AE1	53
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RGF36160CU43A	56	RJA36120CU31A	57	RJF36120U44A	53	RKA36100CU31A	57	RKF36120	53
RGF36160CU44A	56	RJA36120CU33A	57	RJF36120U63AE1	53	RKA36100CU33A	57	RKF36120CU31A	55
RGF36160CU63AE1	56	RJA36120CU41A	57	RJF36120U64AE1	53	RKA36100CU41A	57	RKF36120CU33A	55
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RGF36160CU73AE1	56	RJA36120CU44A	57	RJF36120U74AE1	53	RKA36100CU44A	57	RKF36120CU43A	55
RGF36160CU74AE1	56	RJA36120CU63AE1	57	RJF36160	54	RKA36100CU63AE1	57	RKF36120CU44A	55



# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

## Catalog Numbers

RKF36120CU63AE1 .....	55	RKF36300U41A .....	54	RLF36100CU74AE1 .....	55	RLF36250U41A .....	54	S33170 .....	92
RKF36120CU64AE1 .....	55	RKF36300U43A .....	54	RLF36100U31A .....	53	RLF36250U43A .....	54	S33171 .....	92
RKF36120CU73AE1 .....	55	RKF36300U44A .....	54	RLF36100U33A .....	53	RLF36250U44A .....	54	S33542 .....	78
RKF36120CU74AE1 .....	55	RKF36300U63AE1 .....	54	RLF36100U41A .....	53	RLF36250U63AE1 .....	54	S33543 .....	78
RKF36120U31A .....	53	RKF36300U64AE1 .....	54	RLF36100U43A .....	53	RLF36250U64AE1 .....	54	S33544 .....	78
RKF36120U33A .....	53	RKF36300U73AE1 .....	54	RLF36100U44A .....	53	RLF36250U73AE1 .....	54	S33545 .....	78
RKF36120U41A .....	53	RKF36300U74AE1 .....	54	RLF36100U63AE1 .....	53	RLF36250U74AE1 .....	54	S33575 .....	77
RKF36120U43A .....	53	RKF363200U73AE1 .....	54	RLF36100U64AE1 .....	53	RLF36300CU31A .....	56	S33576 .....	77
RKF36120U44A .....	53	RL3TB .....	59	RLF36100U73AE1 .....	53	RLF36300CU33A .....	56	S33579 .....	77
RKF36120U63AE1 .....	53	RL3TB4 .....	59	RLF36100U74AE1 .....	53	RLF36300CU41A .....	56	S33592 .....	76
RKF36120U64AE1 .....	53	RLA36100CU31A .....	57	RLF36120 .....	53	RLF36300CU43A .....	56	S33593 .....	79
RKF36120U73AE1 .....	53	RLA36100CU33A .....	57	RLF36120CU31A .....	55	RLF36300CU44A .....	56	S33594 .....	84
RKF36120U74AE1 .....	53	RLA36100CU41A .....	57	RLF36120CU33A .....	55	RLF36300CU63AE1 .....	56	S33595 .....	85
RKF36160 .....	54	RLA36100CU43A .....	57	RLF36120CU41A .....	55	RLF36300CU64AE1 .....	56	S33646 .....	88
RKF36160CU31A .....	56	RLA36100CU44A .....	57	RLF36120CU43A .....	55	RLF36300CU73AE1 .....	56	S33659 .....	75
RKF36160CU33A .....	56	RLA36100CU63AE1 .....	57	RLF36120CU44A .....	55	RLF36300CU74AE1 .....	56	S33660 .....	75
RKF36160CU41A .....	56	RLA36100CU64AE1 .....	57	RLF36120CU63AE1 .....	55	RLF36300U31A .....	54	S33660 .....	75
RKF36160CU43A .....	56	RLA36100CU73AE1 .....	57	RLF36120CU64AE1 .....	55	RLF36300U33A .....	54	S33661 .....	75
RKF36160CU44A .....	56	RLA36100CU74AE1 .....	57	RLF36120CU73AE1 .....	55	RLF36300U41A .....	54	S33661 .....	75
RKF36160CU63AE1 .....	56	RLA36120CU31A .....	57	RLF36120CU74AE1 .....	55	RLF36300U43A .....	54	S33662 .....	75
RKF36160CU64AE1 .....	56	RLA36120CU33A .....	57	RLF36120U31A .....	53	RLF36300U44A .....	54	S33662 .....	75
RKF36160CU73AE1 .....	56	RLA36120CU41A .....	57	RLF36120U33A .....	53	RLF36300U63AE1 .....	54	S33664 .....	75
RKF36160CU74AE1 .....	56	RLA36120CU43A .....	57	RLF36120U41A .....	53	RLF36300U73AE1 .....	54	S33680 .....	73
RKF36160U31A .....	54	RLA36120CU44A .....	57	RLF36120U43A .....	53	RLF36300U74AE1 .....	54	S33681 .....	73
RKF36160U33A .....	54	RLA36120CU63AE1 .....	57	RLF36120U44A .....	53	RLTB .....	59	S33682 .....	73
RKF36160U41A .....	54	RLA36120CU64AE1 .....	57	RLF36120U63AE1 .....	53	RLTB .....	59	S33683 .....	73
RKF36160U43A .....	54	RLA36120CU73AE1 .....	57	RLF36120U64AE1 .....	53	RLTB <sup>1</sup> .....	59	S33684 .....	73
RKF36160U44A .....	54	RLA36120CU74AE1 .....	57	RLF36120U73AE1 .....	53	RLTB <sup>1</sup> .....	59	S33685 .....	73
RKF36160U63AE1 .....	54	RLF36000S12 .....	58	RLF36120U74AE1 .....	53	RLTB4 .....	59	S33717 .....	89
RKF36160U64AE1 .....	54	RLF36000S16 .....	58	RLF36160 .....	54	RLTB4 .....	59	S33718 .....	89
RKF36160U73AE1 .....	54	RLF36000S20 .....	58	RLF36160CU31A .....	56	RLTB4 .....	59	S33767 .....	94
RKF36160U74AE1 .....	54	RLF36000S25 .....	58	RLF36160CU33A .....	56	RLTB4 .....	59	S33772 .....	94
RKF36200 .....	54	RLF36000S30 .....	58	RLF36160CU41A .....	56	RLTBE .....	68	S33788 .....	94
RKF36200CU31A .....	56	RLF36060 .....	53	RLF36160CU43A .....	56	RLTBE4 .....	68	S33857 .....	89
RKF36200CU33A .....	56	RLF36060CU31A .....	55	RLF36160CU44A .....	56	S131A .....	76	S33857 .....	94
RKF36200CU41A .....	56	RLF36060CU33A .....	55	RLF36160CU63AE1 .....	56	S132R .....	76	S33859 .....	94
RKF36200CU43A .....	56	RLF36060CU41A .....	55	RLF36160CU64AE1 .....	56	S133A .....	76	S33875 .....	89
RKF36200CU44A .....	56	RLF36060CU43A .....	55	RLF36160CU73AE1 .....	56	S141A .....	76	S33890 .....	90
RKF36200CU63AE1 .....	56	RLF36060CU44A .....	55	RLF36160CU74AE1 .....	56	S142R .....	76	S33929 .....	89
RKF36200CU64AE1 .....	56	RLF36060CU63AE1 .....	55	RLF36160U31A .....	54	S143A .....	76	S33982 .....	78
RKF36200CU73AE1 .....	56	RLF36060CU64AE1 .....	55	RLF36160U33A .....	54	S144A .....	76	S33982 .....	78
RKF36200CU74AE1 .....	56	RLF36060CU73AE1 .....	55	RLF36160U41A .....	54	S163A .....	76	S33983 .....	78
RKF36200U31A .....	54	RLF36060CU74AE1 .....	55	RLF36160U43A .....	54	S164A .....	76	S33983 .....	78
RKF36200U33A .....	54	RLF36060U31A .....	53	RLF36160U44A .....	54	S173A .....	76	S33984 .....	78
RKF36200U41A .....	54	RLF36060U33A .....	53	RLF36160U63AE1 .....	54	S174A .....	76	S33996 .....	90
RKF36200U43A .....	54	RLF36060U41A .....	53	RLF36160U64AE1 .....	54	S29450 .....	74	S33997 .....	89
RKF36200U44A .....	54	RLF36060U43A .....	53	RLF36160U73AE1 .....	54	S29450 .....	74	S33998 .....	88
RKF36200U63AE1 .....	54	RLF36060U44A .....	53	RLF36160U74AE1 .....	54	S29450 .....	74	S34036 .....	77
RKF36200U64AE1 .....	54	RLF36060U63AE1 .....	53	RLF36200 .....	54	S29450 .....	74	S44936 .....	90
RKF36200U74AE1 .....	54	RLF36060U64AE1 .....	53	RLF36200CU31A .....	56	S29450 .....	74	S46996 .....	89
RKF36250 .....	54	RLF36060U73AE1 .....	53	RLF36200CU33A .....	56	S29450 .....	74	S46998 .....	89
RKF36250CU31A .....	56	RLF36060U74AE1 .....	53	RLF36200CU41A .....	56	S29452 .....	74	S47052 .....	78
RKF36250CU33A .....	56	RLF36080 .....	53	RLF36200CU43A .....	56	S29452 .....	74	S47053 .....	78
RKF36250CU41A .....	56	RLF36080CU31A .....	55	RLF36200CU44A .....	56	S29452 .....	74	S47067 .....	76
RKF36250CU43A .....	56	RLF36080CU33A .....	55	RLF36200CU63AE1 .....	56	S29452 .....	74	S47390 .....	75
RKF36250CU44A .....	56	RLF36080CU41A .....	55	RLF36200CU64AE1 .....	56	S29452 .....	74	S47390 .....	75
RKF36250CU63AE1 .....	56	RLF36080CU43A .....	55	RLF36200CU73AE1 .....	56	S29452 .....	74	S47391 .....	75
RKF36250CU64AE1 .....	56	RLF36080CU44A .....	55	RLF36200CU74AE1 .....	56	S32631 .....	90	S47391 .....	75
RKF36250CU73AE1 .....	56	RLF36080CU63AE1 .....	55	RLF36200U31A .....	54	S32631 .....	90	S47391 .....	75
RKF36250CU74AE1 .....	56	RLF36080CU64AE1 .....	55	RLF36200U33A .....	54	S33033 .....	75	S47391 .....	75
RKF36250U31A .....	54	RLF36080CU73AE1 .....	55	RLF36200U41A .....	54	S33034 .....	75	S47392 .....	75
RKF36250U33A .....	54	RLF36080CU74AE1 .....	55	RLF36200U43A .....	54	S33034 .....	75	S47392 .....	75
RKF36250U41A .....	54	RLF36080U31A .....	53	RLF36200U44A .....	54	S33035 .....	75	S47393 .....	75
RKF36250U43A .....	54	RLF36080U33A .....	53	RLF36200U63AE1 .....	54	S33035 .....	75	S47393 .....	75
RKF36250U44A .....	54	RLF36080U41A .....	53	RLF36200U64AE1 .....	54	S33036 .....	75	S47395 .....	75
RKF36250U63AE1 .....	54	RLF36080U43A .....	53	RLF36200U64AE1 .....	54	S33036 .....	75	S47395 .....	75
RKF36250U64AE1 .....	54	RLF36080U44A .....	53	RLF36200U73AE1 .....	54	S33038 .....	75	S47396 .....	75
RKF36250U73AE1 .....	54	RLF36080U63AE1 .....	53	RLF36200U74AE1 .....	54	S33091 .....	78	S47396 .....	75
RKF36250U74AE1 .....	54	RLF36080U64AE1 .....	53	RLF36250 .....	54	S33092 .....	78	S47398 .....	75
RKF36300CU31A .....	56	RLF36080U73AE1 .....	53	RLF36250CU31A .....	56	S33092 .....	78	S47398 .....	75
RKF36300CU33A .....	56	RLF36080U74AE1 .....	53	RLF36250CU33A .....	56	S33092 .....	78	S48182 .....	77
RKF36300CU41A .....	56	RLF36100 .....	53	RLF36250CU41A .....	56	S33093 .....	78	S48818 .....	78
RKF36300CU43A .....	56	RLF36100CU31A .....	55	RLF36250CU43A .....	56	S33093 .....	78	S48819 .....	78
RKF36300CU44A .....	56	RLF36100CU33A .....	55	RLF36250CU44A .....	56	S33093 .....	78	S48820 .....	78
RKF36300CU63AE1 .....	56	RLF36100CU41A .....	55	RLF36250CU63AE1 .....	56	S33094 .....	78	S48823 .....	78
RKF36300CU64AE1 .....	56	RLF36100CU43A .....	55	RLF36250CU64AE1 .....	56	S33095 .....	78	S48823 .....	78
RKF36300CU73AE1 .....	56	RLF36100CU44A .....	55	RLF36250CU73AE1 .....	56	S33095 .....	78	S48824 .....	78
RKF36300CU74AE1 .....	56	RLF36100CU63AE1 .....	55	RLF36250CU74AE1 .....	56	S33095 .....	78	S48824 .....	78
RKF36300U31A .....	54	RLF36100CU64AE1 .....	55	RLF36300U31A .....	54	S33100 .....	77	S48825 .....	78
RKF36300U33A .....	54	RLF36100CU73AE1 .....	55	RLF36250U33A .....	54	S33100 .....	79	S48836 .....	78

# PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers Catalog Numbers

S48837 ..... 78  
 S48838 ..... 78  
 S48839 ..... 78  
 S48840 ..... 78  
 S48855 ..... 85  
 S48856 ..... 85  
 S48891 ..... 77  
 S48896 ..... 77  
 S48907 ..... 84  
 S48907 ..... 85  
 S48908 ..... 84  
 S48916 ..... 77  
 S48933 ..... 94  
 S64201 ..... 79  
 S64202 ..... 79  
 S64203 ..... 79  
 S64204 ..... 79  
 S64204 ..... 79  
 S64205 ..... 79  
 S64205 ..... 79  
 S64206 ..... 79  
 S64207 ..... 79  
 S64208 ..... 79  
 S64209 ..... 79  
 S64210 ..... 79  
 S64210 ..... 79  
 S64273 ..... 79  
 STRV00121 ..... 84  
 TRV00128 ..... 84  
 YA1200R3 ..... 87  
 YA1200R5 ..... 87  
 YA1200R7 ..... 87  
 YA2500R7 ..... 87  
 YA250P3 ..... 87  
 YA300P5 ..... 87  
 YA400P3 ..... 87  
 YA400P7 ..... 87  
 YA600P5 ..... 87  
 YA800P7 ..... 87



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0612CT0101 R07/14 Replaces 0612CT0101 R06/14