

# ROCK CREEK WRRF PRIMARY CLARIFIER No. 4 TREATMENT EXPANSION CLEAN WATER SERVICES

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APRIL 2024

## SECTION 16422 MOTOR STARTERS

### TABLE OF CONTENTS

RESPONSE TO SUBMITTAL COMMENTS

BILL OF MATERIALS

RECOMMENDED SPARES

DRAWINGS

CUT SHEETS

ENCLOSURE

SUBPANEL

DRIP SHIELD

MOUNTING FOOT KIT

GROUND BAR

CIRCUIT BREAKER

STARTER

CONTROL POWER TRANSFORMER

FUSES

PILOT DEVICES

RELAY

TERMINAL BLOCK

MOUNTING RAIL

WIRING DUCT



**OPTIMAL CONTROL SYSTEMS, INC.**

2324 Three Lakes Road SE

Albany, OR 97322

Phone: (541) 967-9323

Fax: (541) 967-9485

Project No. 0523-23SSE

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### RESPONSE TO SUBMITTAL COMMENTS

See Kurts comments. A&R.....Sorry or the delay on this one. It has been sitting waiting for responders that didn't need to respond which kept it out of my to do list.

*Acknowledged.*

Drawings 900LCP6201-01 & 02: Replace both ORT1 Checkout blocks with block that was sent to Hoyt Day on 11/15/2023. The two checkout blocks are inconsistent between the two drawings and both do not match block sent to Hoyt.

*Amended.*

Drawings 900LCP6201-01 & 02: Add descriptions in sheet title to show what is the purpose of this control panel and circuit drawing. The contract drawing, I303, shows the description.

*Amended.*

Drawings 900LCP6201-01 & 02: The project number in the border is wrong.

*Amended.*

The panel view on drawing 900LCP6201-1: Enlarge the view in order to read the terminal numbers.

*Amended.*

The panel view on drawing 900LCP6201-1: Add item numbers to reference bill of material parts.

*Amended.*

The panel view on drawing 900LCP6201-1: Wireways are positions so that cables will route over the grounding bar.

*Amended.*

The panel view on drawing 900LCP6201-1: How will the cables that will be routed out of the bottom of enclosure be supported to reduce strain?

*Additional wireway added to bottom of panel to help reduce strain; additional strain relief the responsibility of installer.*



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## SECTION 16422 MOTOR STARTERS

### RESPONSE TO SUBMITTAL COMMENTS CONT.

The panel view on drawing 900LCP6201-1: Need a wireduct on both sides of terminal strip?

*Amended.*

The front view panel view on 900LCP6201-1: Stretch the nameplate so that "480VAC POWER SOURCE: SWBD-10" is on a single line.

*Amended.*

Drawing 900LCP6201-02: Change wire/conductor designations from letters to numbers. Optimal shows wire labeled as G between 1A fuse and terminal 1.

*Amended.*

Avoid using letters on wiring diagrams (Ambiguous for L, N and G; 2 lines identified as N on drawing).

*Amended.*

Avoid renumbering electrically equivalent terminals (like 1-2-3). XFMR should show "100" VA size.

*Amended.*

See KR comments.

*Acknowledged.*



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Project No. 0523-23SSE

# Bill of Materials



**Project:** Rock Creek WRRF Primary Clarifier No. 4 Treatment Expansion  
**Specification Section(s):** Section 16422 – Motor Starters  
**Date:** April 2024

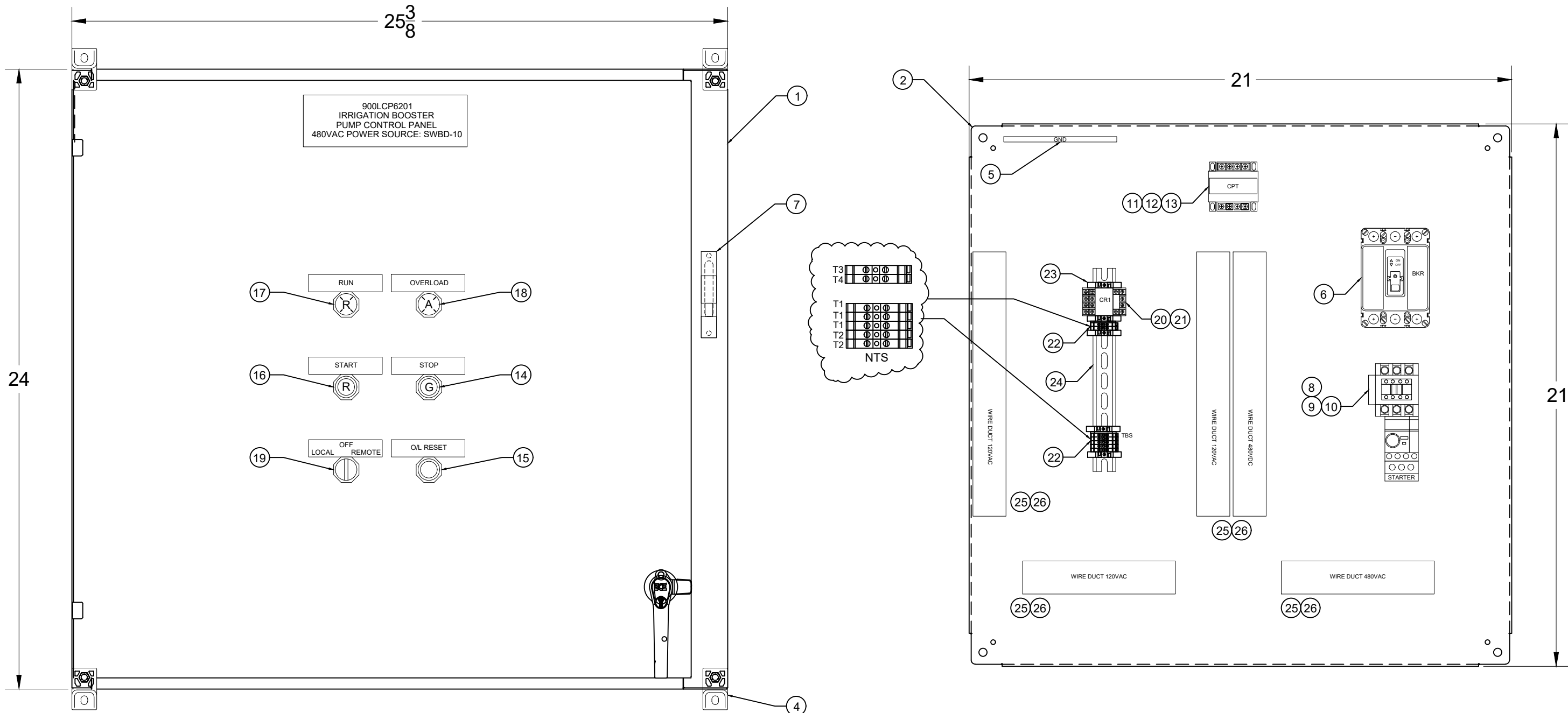
Item No.	Qty.	Tag(s)	Description	Manufacturer	Part Number	Serial Number
001	1	900LCP6201	S.S. XEL Enclosure, Type 316/316L, H 24" x W 25" x D 10"	Saginaw Control & Engineering	SCE-24XEL2510SS6LP	
002	1	900LCP6201	Subpanel, Bent	Saginaw Control & Engineering	SCE-24P24	
003	1	900LCP6201	Shield, S.S. Drip, Type 316/316L	Saginaw Control & Engineering	SCE-DS24SS6	
004	1	900LCP6201	Foot Kit, S.S. EL Mounting, Type 316/316L	Saginaw Control & Engineering	SCE-ELMFK4SS6-OS	
005	1	900LCP6201	Ground Bar, 14 Terminal	Eaton	GBKP1420	
006	1	900LCP6201	Circuit Breaker, F-Frame, 3-Pole, 35A, 65kAIC	Eaton	HFD3035L	
007	1	900LCP6201	Flex Shaft Handle Mechanism	Eaton	F1S03CX	
008	1	900LCP6201	Starter w/ C440 Electronic Overload Relay, Freedom Series, NEMA 1, 120VAC Coil	Eaton	AN19DN0A5E020	
009	1	900LCP6201	Transient Suppressor	Eaton	C320TS1	
010	1	900LCP6201	Remote Reset Module	Eaton	ZEB-XRR-120	
011	1	900LCP6201	Control Power Transformer, 240x480/120, 100VA	Eaton	C0100E2AFBQ	
012	2	900LCP6201	Time-Delay Fuse, KLDR Series, 1/2A	Littelfuse	KLDR.500	
013	1	900LCP6201	Time-Delay Fuse, FLM Series, 1A	Littelfuse	FLM001	
014	1	900LCP6201	Momentary Pushbutton, Flush, Green, NO	Eaton	10250T23G	
015	1	900LCP6201	Momentary Pushbutton, Flush, Black, NC	Eaton	10250T101-51	
016	1	900LCP6201	Momentary Pushbutton, Flush, Red, NC	Eaton	10250T102-51	
017	1	900LCP6201	Indicating Light, PressTest, LED, 120VAC, Red	Eaton	10250T297LRP2A	
018	1	900LCP6201	Indicating Light, PressTest, LED, 120VAC, Amber	Eaton	10250T297LAP2A	
019	1	900LCP6201	Selector Switch, 3-Position, Knob, Black	Eaton	10250T22KB	
020	1	900LCP6201	Relay w/ Indicator Light and Check Button, RR Series, 3PDT, 10A, 120VAC	Idec	RR3PA-ULCAC120V	
021	1	900LCP6201	Relay Socket, Fingersafe	Idec	SR3P-05C	
022	7	900LCP6201	Terminal Block	TE Connectivity	1SNA115116R0700	
023	5	900LCP6201	End Stop	TE Connectivity	1SNK900001R0000	
024	1	900LCP6201	Mounting Rail	TE Connectivity	1SNA173220R0500	
025	1	900LCP6201	Wiring Duct	Panduit	F2X3LG6	
026	1	900LCP6201	Wiring Duct Cover	Panduit	C2LG6	
027						
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# Recommended Spares



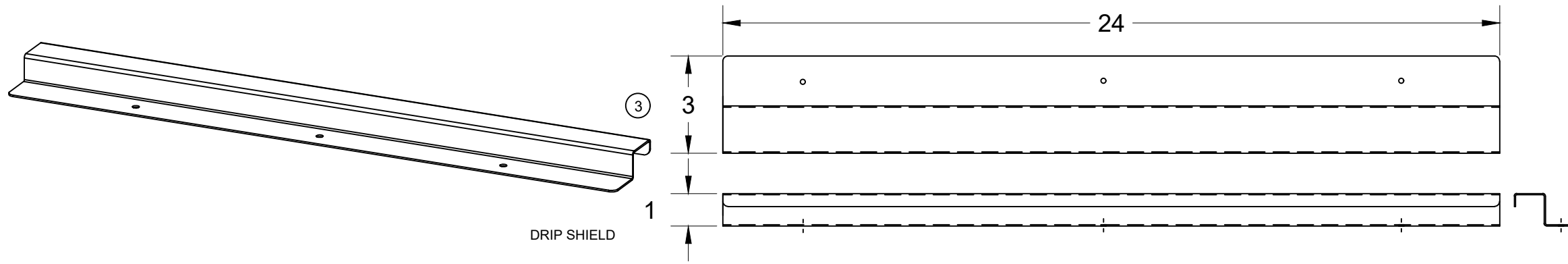
**Project:** Rock Creek WRRF Primary Clarifier No. 4 Treatment Expansion  
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**Date:** April 2024

Item No.	Qty.	Vendor	Description	Manufacturer	Part Number	Unit Price
001	1	Platt Electric Supply	Time-Delay Fuse, KLDR Series, 1/2A	Littelfuse	KLDR.500	\$43.75
002	1	Platt Electric Supply	Time-Delay Fuse, FLM Series, 1A	Littelfuse	FLM001	\$17.50
003						
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FRONT VIEW

PANEL VIEW



DRIP SHIELD

ORT1 CHECKOUT

INTEGRATOR: \_\_\_\_\_

ELECTRICAL: \_\_\_\_\_

OWNER: \_\_\_\_\_

DATE: \_\_\_\_\_

DRN: KCED	ORIG DATE: 2023.12.21
DSN: HAD	DWG #: RC900LCP6201
CHK: HAD	CAD FILE #: 0523-23SSE-LCP6201
APPD:	SCALE: AS NOTED

THIS BAR IS ONE INCH WHEN DRAWING IS FULL SCALE.

REV #	DATE	DRN	APPD	DESCRIPTION
C	2024.04.18	KCED	HAD	BoM
B	2024.03.12	KCED	HAD	SCALING
A	2024.12.21	KCED	HAD	ORIGINAL DRAFT



PROJ NAME: ROCK CREEK WRRF PRIMARY CLARIFIER NO. 4 TREATMENT EXPANSION

SHEET TITLE: INSTRUMENTATION IRRIGATION BOOSTER PUMP PANEL LAYOUT

SHEET: 1 OF 2  
PLOT DATE: 4/19/24  
PLC #: N/A  
CWS PROJ #: 7012

DWG #: RC900LCP6201

ENGR STAMP:



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SCE@SaginawControl.com

## SCE-24XEL2510SS6LP

### Product Specifications:

**Part Number:** SCE-24XEL2510SS6LP

**Description:** S.S. XEL Enclosure

**Height:** 24.00"

**Width:** 25.38"

**Depth:** 10.00"

**Price Code:** S5

**List Price:** \$1,657.78

**Catalog Page:** 292

**Est. Ship Weight:** 60.00 lbs



#### Construction

- \* 0.075 In. stainless steel Type 316/316L.
- \* Seams continuously welded and ground smooth.
- \* Flange trough collar around all sides of door opening.
- \* Pour in place oil & water resistant gasket
- \* Collar studs 3/8-16 provided for mounting optional panels.
- \* Holes provided in body for mounting disconnect operating handle and operating mechanism.
- \* Stainless steel concealed hinges.
- \* Doors are interchangeable and easily removed by pulling hinge pin.
- \* 3-point latching mechanism when door height is greater or equal to 40 inches, 2-point latching mechanism when door height is less than 40 inches.
- \* Latches are opened or closed with screwdriver (optional tamper-resistant inserts available).
- \* Mounting holes in back of enclosure.
- \* Mounting hardware, sealing washer and hole plug included.
- \* Ground studs on door and body.
- \* Black zinc die cast coinproof/padlocking handle.
- \* Removable print pocket.

#### Application

Designed to house electrical and electronic controls, instruments and components in areas which may be regularly hosed down or are in very wet conditions. Designed to house most standard type disconnects. Provides protection from dust, dirt, oil, and water. For outdoor application a drip shield and drain vent is recommended.

For details about the design, performance expectations, applications and design suggestions - See Design Considerations  
[www.saginawcontrol.com/instman/considerations.pdf](http://www.saginawcontrol.com/instman/considerations.pdf)

#### Finish

#4 brushed finish on all exterior surfaces. Optional sub-panels are powder coated white.

#### Industry Standards - (IS6)

- \* NEMA Type 3R, 4, 4X, 12 and Type 13
- \* UL Listed Type 3R, 4, 4X and 12
- \* CSA Type 4, 4X and 12
- \* IEC 60529
- \* IP 66

#### Notes

Disconnect switch (or circuit breaker) and operating mechanism are not furnished with this enclosure.

Special Instructions apply for IS3, IS4 and IS6 to maintain the environmental rating of Type 3R for these parts. Instructions are located on the enclosure door. Drip shield is required on IS3, drip shield is recommended on IS4 and IS6. Drain holes are required on all.

Provision for Lifting Lugs on enclosures when Height >48" and Depth >16". The Lifting Lug assembly will be included with the enclosure bolt pack.

#### Optional Accessories

- SCE-24P24 Subpanel, Bent
- SCE-24P24GALV Subpanel, Bent Galvanized
- SCE-BVK Breather Vent
- SCE-DF24EL24LP Panel, Dead Front (Wall Mount)
- SCE-DS24SS Shield, S.S. Drip
- SCE-ELMFK4SS6-OS Foot Kit, S.S. EL Mounting (4pc.)
- SCE-ELSP3 KIT, Swing-Out Panel (20 High & Up)
- SCE-RD24XEL2510SS6 Door, Replacement

#### Similar Part Numbers

- SCE-20XEL2108SS6LPS.S. XEL Enclosure
- SCE-24XEL2108SS6LPS.S. XEL Enclosure
- SCE-24XEL2508SS6LPS.S. XEL Enclosure
- SCE-30XEL2508SS6LPS.S. XEL Enclosure
- SCE-30XEL2510SS6LPS.S. XEL Enclosure
- SCE-36XEL2508SS6LPS.S. XEL Enclosure
- SCE-36XEL3110SS6LPS.S. XEL Enclosure
- SCE-36XEL3112SS6LPS.S. XEL Enclosure

#### Installation Information

- \* Cutler-Hammer Flange Mounted, Disconnects and Circuit Breakers
- \* Allen-Bradley Flange Mounted, Disconnects and Circuit Breakers
- \* Bussmann Flange Mounted, Disconnects and Circuit Breakers
- \* ABB Flange Mounted, Disconnects and Circuit Breakers
- \* GE Flange Mounted, Disconnects and Circuit Breakers
- \* Gould Flange Mounted, Disconnects and Circuit Breakers
- \* Moller Flange Mounted, Disconnects and Circuit Breakers
- \* Siemens Flange Mounted, Disconnects and Circuit Breakers
- \* Square D Flange Mounted, Disconnects and Circuit Breakers
- \* Mounting Foot Kit for Enviroline Enclosures
- \* Drip Shield Kit Assembly
- \* Swing Panel Assembly for Enviroline Enclosures
- \* Swing Panel ELSP3 for Encl. Height > 16
- \* Sealing Washer Specifications
- \* Dead Front Wall Mount With 3 Point Latching Hardware
- \* Mechanical Defeater ( 2018 Rev ) Video
- \* LS Electric Flange Mounted Disconnects
- \* Service Parts Wall Mount Disconnect Enclosures
- \* Enviroline Series Single Door Enclosures For Flange Mounted Disconnects



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## SCE-24P24

### Product Specifications:



**Part Number:** SCE-24P24  
**Description:** Subpanel, Bent  
**Height:** 21.00"  
**Width:** 21.00"  
**Depth:** 0.88"  
**Price Code:** P3  
**List Price:** \$59.18  
**Catalog Page:** 440  
**Est. Ship Weight:** 17.00 lbs

#### Finish

Powder Coated White.

#### Industry Standards - (IS17)

- ⚙ NEMA Not Applicable
- ⚙ UL Not Applicable
- ⚙ CSA N/A

#### Similar Part Numbers

SCE-10P10Subpanel, Flat  
SCE-12DLP12Subpanel, Flat  
SCE-12P10Subpanel, Flat  
SCE-12P12Subpanel, Flat  
SCE-12P12CSubpanel, Flat  
SCE-12P16CSubpanel, Flat  
SCE-12P20CSubpanel, Flat  
SCE-12P24Subpanel, Bent  
SCE-12P24CSubpanel, Flat  
SCE-14P12Subpanel, Flat

#### Installation Information

- ⚙ Sub-Plate Layout & Grounding for 3/8-16





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## SCE-DS24SS6

### Product Specifications:

**Part Number:** SCE-DS24SS6

**Description:** Shield, S.S. Drip

**Height:** 1.00"

**Width:** 24.00"

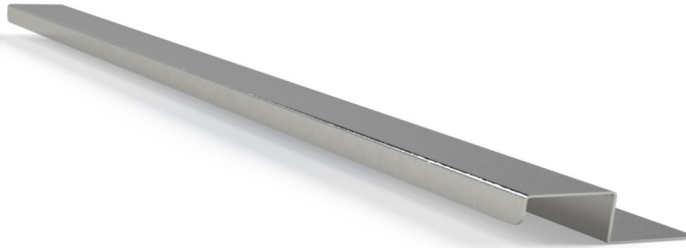
**Depth:** 3.00"

**Price Code:** P2

**List Price:** \$144.50

**Catalog Page:** 412

**Est. Ship Weight:** 1.55 lbs



#### Application

Protects door against dripping water and settling dust. Furnished with stainless steel screws and sealing washers. #4 Brushed Finish

#### Industry Standards - (IS17)

- \* NEMA Not Applicable
- \* UL Not Applicable
- \* CSA N/A

#### Similar Part Numbers

SCE-DS12SSShield, S.S. Drip  
SCE-DS12SS6Shield, S.S. Drip  
SCE-DS16SSShield, S.S. Drip  
SCE-DS16SS6Shield, S.S. Drip  
SCE-DS20SSShield, S.S. Drip  
SCE-DS20SS6Shield, S.S. Drip  
SCE-DS24SSShield, S.S. Drip  
SCE-DS30SSShield, S.S. Drip  
SCE-DS30SS6Shield, S.S. Drip  
SCE-DS36SSShield, S.S. Drip

#### Installation Information

- \* Drip Shield Kit Assembly



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## SCE-ELMFK4SS6-OS

### Product Specifications:



**Part Number:** SCE-ELMFK4SS6-OS

**Description:** Foot Kit, S.S. EL Mounting (4pc.)

**Height:** 3.00"

**Width:** 1.50"

**Depth:** 2.00"

**Price Code:** P2

**List Price:** \$61.76

**Catalog Page:** 435

**Est. Ship Weight:** 0.70 lbs

#### Application

SCE-ELMFK4SS6-OS: Made for use with all SCE Enviroline enclosures and two-door wall-mount enclosures. Made from heavy gauge stainless steel type 316 with 3/18-16 stainless steel stud to maintain type 3, 3R, 4, 4X and 12 rating of your enclosure. Available in kits of four.

SCE-HLPMFK: Made for use on HLP and SA LPPL Enclosure. Zinc Die Cast and Zinc Plated.

#### Industry Standards - (IS17)

- ⚙ NEMA Not Applicable
- ⚙ UL Not Applicable
- ⚙ CSA N/A

#### Similar Part Numbers

SCE-HLPMFK Mounting Foot Kit for HLP and SA LPPL Enc.

#### Installation Information

- ⚙ Mounting Foot Kit for Stainless Steel Enviroline Enclosures
- ⚙ Mounting Foot Kit for HLP and SA LPPL Enclosures

### GBKP14



### Plug-on Neutral Ground Bar Kits

Description (See Legend)	Length Inches (mm)	Ordering Quantity <sup>①</sup>	Catalog Number
●○○○○○●○○○○○	4.05	1	GBKP10 <sup>②</sup>
●○○○○○●○○○○○	5.05	1	GBKP1020 <sup>②</sup>
●○○○○○●○○○○○■	4.05	1	GBKP10P <sup>②③</sup>
●○○○○○●○○○○○	5.39	1	GBKP14 <sup>②</sup>
●○○○○○●○○○○○	6.39	1	GBKP1420 <sup>②</sup>
●○○○○○●○○○○○	5.39	1	GBKP14P <sup>②③</sup>
●○○○○○●○○○○○	7.72	1	GBKP21 <sup>②</sup>
●○○○○○●○○○○○	8.72	1	GBKP2120 <sup>②</sup>
●○○○○○●○○○○○	7.72	1	GBKP21P <sup>②③</sup>
●○○○○○●	2.39	1	GBKP5 <sup>②</sup>
●○○○○○■	3.39	1	GBKP520 <sup>②</sup>
●○○○○○●	2.39	1	GBKP5P <sup>②③</sup>

#### Ground Bar Legend

- = (3) #14–#10 Cu/Al or (1) #14–#4 Cu/Al
- = (1) #6–2/0 Cu/Al
- = Mounting hole

### GBK14



### Legacy Ground Bar Kits

Description (See Legend)	Length Inches (mm)	Ordering Quantity <sup>①</sup>	Catalog Number
●○○○○○●	2.54 (64.5)	1	GBK5 <sup>④</sup>
●○○○○○●■	3.59 (91.2)	1	GBK520 <sup>④</sup>
●○○○○○●○○○○○	4.29 (109.0)	1	GBK10 <sup>④</sup>
●○○○○○●○○○○○■	5.34 (135.6)	1	GBK1020 <sup>④</sup>
●○○○○○●○○○○○	5.69 (144.5)	1	GBK14 <sup>④</sup>
●○○○○○●○○○○○	6.74 (171.2)	1	GBK1420 <sup>④</sup>
●○○○○○●○○○○○■	8.14 (206.8)	1	GBK21 <sup>④</sup>
●○○○○○●○○○○○	9.19 (233.4)	1	GBK2120 <sup>④</sup>

#### Ground Bar Legend

- = (3) #14–#10 Cu/Al or (1) #14–#4 Cu/Al
- = (1) #6–2/0 Cu/Al
- = (1) 1/0–14 or (3) #10–12 Cu/Al
- ◐ = (1) #14–1/0 Cu/Al or (3) #14–#10 Cu/Al
- = Mounting hole

#### Notes

- ① Must be purchased in multiples of ordering quantities indicated.
- ② Distance between mounting holes is 2 inches (50.8 mm).
- ③ Individually packaged.
- ④ Distance between mounting holes is 1-3/4 inches (44.5 mm).

## Molded Case Circuit Breaker Product Family



## Product Overview

Eaton's molded case circuit breakers are designed to provide circuit protection for low-voltage distribution systems. They are described by NEMA as, "... a device for closing and interrupting a circuit between separable contacts under both normal and abnormal conditions," and furthermore as, "... a breaker assembled as an integral unit in a supporting and enclosing housing of insulating material." The National Electrical Code (NEC) describes them as, "A device designed to open and close a circuit by non-automatic means, and to open the circuit automatically on a predetermined overload of current, without injury to itself when properly applied within its rating."

So designed, Eaton circuit breakers protect conductors against overloads and conductors and connected apparatus, such as motors and motor starters, against short circuits.

In low-voltage distribution systems, there are many varied applications of molded case circuit breakers.

Eaton offers the most comprehensive family of molded case circuit breakers in the industry.

This section of circuit breakers includes:

- Thermal-magnetic trip breakers
- Electronic rms trip breakers
- Molded case switches
- Motor circuit protectors
- Current-limiting breakers
- Special application breakers

### Modified Breakers

Eaton breakers can be ordered with internal accessories installed. These modified breakers will be subject to an addition charge.

### Special Calibration

Special non-UL-listed calibrations are available for certain ambient temperatures other than 40 °C and for frequencies other than 50/60 Hz or DC. Reduced interrupting ratings will apply for 400 Hz applications.

## Contents

### Description

Description	Page
Standards and Certifications	V4-T2-262
Quick Reference	V4-T2-263
G-Frame (15–100 Amperes)	V4-T2-266
F-Frame (10–225 Amperes)	V4-T2-280
J-Frame (70–250 Amperes)	V4-T2-298
K-Frame (70–400 Amperes)	V4-T2-306
L-Frame (125–600 Amperes)	V4-T2-319
M-Frame (300–800 Amperes)	V4-T2-331
Motor Circuit Protectors (MCP)	V4-T2-342
Type ELC Current Limiter Attachment (Size 0–4)	V4-T2-353
Current-Limiting Circuit Breaker Module	V4-T2-354
Internal Accessories	V4-T2-357
External Accessories	V4-T2-390



### 50 °C Calibration

Add suffix **V** to catalog Number for complete breaker, listed above, when ordering listed ampere ratings for breakers to be used in 50 °C ambients. (No UL label.)

### Moisture-Fungus Treatment

All circuit breaker cases are molded from glass-polyester which does not support the growth of fungus. Any parts which are susceptible to the growth of fungus will require special treatment.

### Freeze-Tested Circuit Breakers

The circuit breakers may be ordered with freeze testing. This option uses special lubrication and mechanical operation is verified at –40 °C.

### Marine Applications

E- to R-Framed circuit breakers can be supplied to meet the following marine specifications:

- U.S. Coast Guard CFR 46; ABS—American Bureau of Shipping; IEEE 45; DNV; Lloyds; and ABS/NVR

These specifications generally require molded case circuit breakers to be supplied with 50 °C ambient, and plug-in adapter kits. When plug-in adapter kits are used, no terminals need be supplied (switchboard applications).

Circuit breakers can also be supplied to meet UL 489 Supplement SA (Marine use) and UL 489 Supplement SB (Naval Use).

UL 489 Supplement SA applies to vessels over 65 feet (19.8 m) in length. Requirements include 40 °C ambient calibration, special labeling, and no use of aluminum conductors or terminals. (No 50 °C.)

- Suffix H08

Or you can choose to add 50 °C ambient but then there is no "UL" mark.

- Suffix VH08

UL 489 Supplement SB requires partial 50 °C ambient calibration, vibration testing, special nameplating and no use of aluminum conductors or terminals. Eaton chooses to always fully calibrate to 50 °C ambient. ("Naval" labeled per UL, and UL now allows 50 °C label here.)

- Suffix VH09

### Certified Test Reports

Eaton breakers can be ordered with certified test reports at the time of order entry. Test report documents the thermal and magnetic or electronic tripping characteristics of the individual breaker. Breaker and test report must be ordered together. Add suffix 12 to breaker catalog number and enter separate line item on order for certified test report.

### Standards and Certifications

Molded case circuit breakers are designed to conform with the following standards:

- Underwriters Laboratories Inc., Standard UL 489, molded case circuit breakers and circuit breaker enclosures
- National Electrical Manufacturers Association (NEMA) Standards Publication No. AB1-1993, molded case circuit breakers
- Australian Standard AS 2184, molded case circuit breakers
- British Standards Institution Standard BS 4752: Part 1, switchgear and control gear Part 1: circuit breakers
- Canadian Standards Association (CSA) Standard C22.2 No. 5, service entrance and branch circuit breakers
- International Electrotechnical Commission Recommendations IEC 60947-2, circuit breakers
- Japanese T-Mark Standard molded case circuit breakers
- South African Bureau of Standards, Standard SABS 156, Standard Specification for molded case circuit breakers
- Swiss Electro-Technical Association Standard SEV 157-1, safety regulations for circuit breakers
- Union Technique de l'Electricite Standard NFC 63-120, low-voltage switchgear and control gear circuit breaker requirements
- Verband Deutscher Elektrotechniker (Association of German Electrical Engineers) Standard VDE 0660, low-voltage switchgear and control gear, circuit breakers

Conformance with these standards satisfies most local and international codes, assuming user acceptability and simplified application.

Molded case circuit breakers equal or exceed Federal Specification Classification W-C-375b requirements for the particular class associated with the circuit breaker frame being considered.

Open breakers do not have service entrance ratings. Service entrance rating is part of the enclosure.



Typical F-Frame Breaker  
F-Frame Breaker with Electronic Trip Unit



## Contents

### Description

	<i>Page</i>
Product Overview . . . . .	<b>V4-T2-261</b>
Standards and Certifications . . . . .	<b>V4-T2-262</b>
Quick Reference . . . . .	<b>V4-T2-263</b>
G-Frame (15–100 Amperes) . . . . .	<b>V4-T2-266</b>
F-Frame (10–225 Amperes)	
Catalog Number Selection . . . . .	<b>V4-T2-281</b>
Product Selection . . . . .	<b>V4-T2-283</b>
Accessories . . . . .	<b>V4-T2-294</b>
Technical Data and Specifications . . . . .	<b>V4-T2-295</b>
Dimensions and Weights . . . . .	<b>V4-T2-297</b>
J-Frame (70–250 Amperes) . . . . .	<b>V4-T2-298</b>
K-Frame (70–400 Amperes) . . . . .	<b>V4-T2-306</b>
L-Frame (125–600 Amperes) . . . . .	<b>V4-T2-319</b>
M-Frame (300–800 Amperes) . . . . .	<b>V4-T2-331</b>
Motor Circuit Protectors (MCP) . . . . .	<b>V4-T2-342</b>
Type ELC Current Limiter Attachment (Size 0–4) . . . . .	<b>V4-T2-353</b>
Current-Limiting Circuit Breaker Module . . . . .	<b>V4-T2-354</b>
Internal Accessories . . . . .	<b>V4-T2-357</b>
External Accessories . . . . .	<b>V4-T2-390</b>

## F-Frame (10–225 Amperes)

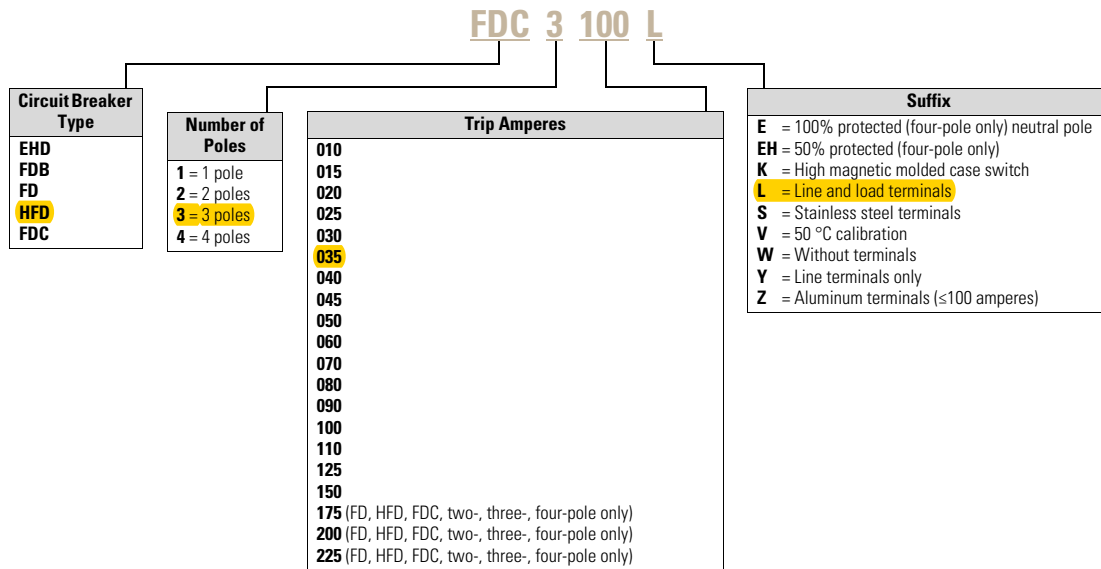
### Product Description

- All Eaton's F-Frame circuit breakers are HACR rated
- All circuit breakers 10 through 30 amperes are suitable for HID (high intensity discharge) use
- All F-Frame circuit breakers are suitable for reverse feed use

**Catalog Number Selection**

This information is presented only as an aid to understanding catalog numbers. It is not to be used to build catalog numbers for circuit breakers or trip units.

**FD-Frame Circuit Breakers with Thermal-Magnetic Trip Unit Technology**



# 2.4

## Molded Case Circuit Breakers

### Series C

#### Type HFD Thermal-Magnetic Circuit Breakers with Non-Interchangeable Trip Units (Includes Terminals on Load End Only)

2

Maximum Continuous Ampere Rating at 40 °C	277 Vac Maximum, 125 Vdc 65 kAIC at 277 Vac	600 Vac Maximum, 250 Vdc		
	Single-Pole Catalog Number	Two-Pole Catalog Number	Three-Pole	Four-Pole Catalog Number
15	HFD1015 ①	HFD2015	HFD3015	HFD4015
20	HFD1020 ①	HFD2020	HFD3020	HFD4020
25	HFD1025	HFD2025	HFD3025	HFD4025
30	HFD1030	HFD2030	HFD3030	HFD4030
35	HFD1035	HFD2035	HFD3035	HFD4035
40	HFD1040	HFD2040	HFD3040	HFD4040
45	HFD1045	HFD2045	HFD3045	HFD4045
50	HFD1050	HFD2050	HFD3050	HFD4050
60	HFD1060	HFD2060	HFD3060	HFD4060
70	HFD1070	HFD2070	HFD3070	HFD4070
80	HFD1080	HFD2080	HFD3080	HFD4080
90	HFD1090	HFD2090	HFD3090	HFD4090
100	HFD1100	HFD2100	HFD3100	HFD4100
110	HFD1110	HFD2110	HFD3110	HFD4110
125	HFD1125	HFD2125	HFD3125	HFD4125
150	HFD1150	HFD2150	HFD3150	HFD4150
175	—	HFD2175	HFD3175	HFD4175
200	—	HFD2200	HFD3200	HFD4200
225	—	HFD2225	HFD3225	HFD4225

**Note**

① UL listed for SWD applications, see NEC Article 240.83(d).



## Accessories Selection Guide and Ordering Information

2

### Line and Load Terminals

Line and load terminals provide wire connecting capabilities for specific ranges of continuous current ratings and wire types. Except as noted, terminals comply with Underwriters Laboratories Standards UL 486A and UL 486B. Unless otherwise specified, F-Frame circuit breakers are factory equipped with load terminals only.

### Ordering Information

F-Frame circuit breakers and molded case switches have load terminals only as standard equipment. When standard line-end terminals (same as standard load-end terminals) are required, add Suffix **L** to the circuit breaker catalog number. When non-standard or optional line and/or load terminals are required, order by style number. Specify if factory installation is required.

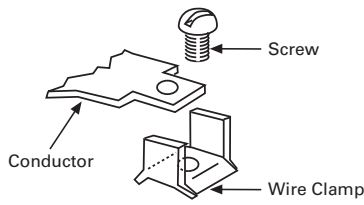
### Line and Load Terminals

Maximum Breaker Amperes	Terminal Body Material	Wire Type	AWG Wire Range	Metric Wire Range mm <sup>2</sup>	Package of Three Terminals Catalog Number
<b>Standard Pressure Type Terminals</b>					
20 (EHD)	Steel	Cu/Al	14–10	2.5–4	<b>3T20FB</b> ①
100	Steel	Cu/Al	14–1/0	2.5–50	<b>3T100FB</b>
225	Aluminum	Cu/Al	4–4/0	25–95	<b>3TA225FD</b>
<b>Optional Pressure Terminals</b>					
50	Aluminum	Cu/Al	14–4	2.5–25	<b>3TA50FB</b> ①
100	Aluminum	Cu/Al	14–1/0	2.5–50	<b>3TA100FD</b>
200	Stainless steel	Cu	4–4/0	25–95	<b>3T150FB</b>
225	Copper	Cu	4–4/0	25–95	<b>3T225FD</b>
225	Aluminum	Cu/Al	6–300 kcmil	16–150	<b>3TA225FDK3</b> ②
225	Aluminum	Cu/Al	6–300 kcmil	16–150	<b>3TA225FDK</b> ② ③

#### Notes

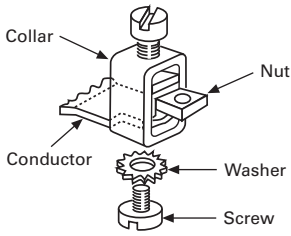
- ① Not for use with ED, EDH, EDC breakers.
- ② Includes terminal shield kit. Adds approximately 3 inches (76.2) to breaker height. Available for use on three-pole breaker only.
- ③ Replacement use only.

### Line and Load Terminals



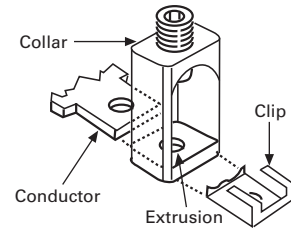
**3T20FB**

Assemble wire clamp to bottom of conductor as shown.



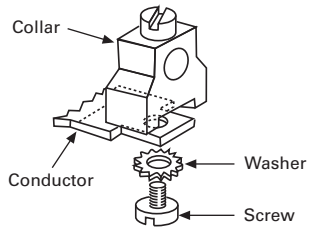
**3T100FB, 3T150FB**

Insert collar enclosing conductor as shown. Locate nut on top of conductor and tighten securely with screw and washer.  
**Caution:** Collar must surround conductor.



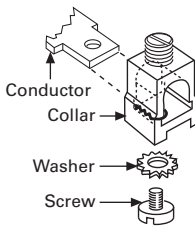
**3TA225FD**

Insert collar enclosing conductor and center on extrusion on collar. Install clip with legs on top of conductor and snap end around bottom of collar.



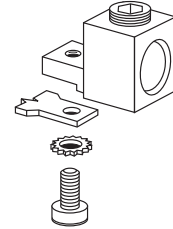
**3TA50FB**

Assemble collar on top of conductor as shown. Tighten securely with screw and washer.



**3TA100FD**

Collar slides onto conductor and is held in position by a screw and lockwasher.



**3TA225FDK3 (Up to 150 mm<sup>2</sup>)**

Assemble collar on top of conductor as shown. Tighten securely with screw and washer. Terminal shield must be used with this collar.  
**Note:** For 185 mm<sup>2</sup>, use 3TA225FDK1. Same illustration for 3TA225FDK

### Accessories

Different combinations of accessories can be supplied, depending on the types of accessories and the number of poles in the circuit breaker.

#### Allowable Accessory Combinations

##### FD Frame Accessories

Description	Reference Page	Single-Pole			Two-Pole			Three-Pole ①			Four-Pole			
		Center	Left	Right	Left	Right	Center	Left	Center	Right	Left	Center	Right	Neutral
<b>Internal Accessories (Only one internal accessory per pole)</b>														
Alarm lockout switch (make only)	V4-T2-359	■	—	—	—	—	—	—	—	—	—	—	—	—
Alarm lockout (Make/Break)	V4-T2-359	—	—	■	□	—	□	■	—	—	—	—	—	—
Alarm lockout (2Make/2Break)	V4-T2-359	—	—	■	□	—	□	■	—	—	—	—	—	—
Auxiliary switch (1A, 1B)	V4-T2-361	—	—	■	■	—	■	■	—	—	—	—	■	—
Auxiliary switch (2A, 2B)	V4-T2-361	—	—	■	■	—	■	■	—	—	—	—	■	—
Auxiliary switch and alarm switch combination	V4-T2-363	—	—	■	□	—	□	■	—	—	—	—	—	—
Shunt trip—standard	V4-T2-365	—	—	■	■	—	■	■	—	—	—	—	■	—
Shunt trip—low energy	V4-T2-369	—	—	■	■	—	■	■	—	—	—	—	—	—
Undervoltage release mechanism	V4-T2-371	—	—	■	■	—	■	■	—	—	—	—	—	—
<b>External Accessories</b>														
End cap kit	V4-T2-394	—	●	●	●	●	●	●	●	●	●	●	●	●
Keeper nut	V4-T2-394	●	●	●	●	●	●	●	●	●	●	●	●	●
Control wire terminal kit	V4-T2-395	●	●	●	●	●	●	●	●	●	●	●	●	●
Multewire connectors	V4-T2-396	●	●	●	●	●	●	●	●	●	●	●	●	●
Rear fed terminals	V4-T2-396	●	●	●	●	●	●	●	●	●	●	●	●	●
Base mounting hardware	V4-T2-396	●	●	●	●	●	●	●	●	●	●	●	●	●
Terminal shields	V4-T2-398	●	●	●	●	●	●	●	●	●	●	●	●	●
Terminal end covers	V4-T2-399	—	—	—	●	●	●	—	—	—	—	—	—	—
Interphase barriers	V4-T2-399	—	●	●	●	●	●	●	●	●	●	●	●	●
Non-padlockable handle block	V4-T2-400	■	■	—	—	■	—	—	■	—	—	—	—	—
Snap-on padlockable handle lock hasp	V4-T2-400	■	■	—	—	■	—	—	■	—	—	—	—	—
Padlockable handle lock hasp	V4-T2-401	—	—	■	□	—	□	□	—	□	—	□	—	—
Cylinder lock	V4-T2-401	—	—	—	■	—	—	—	—	—	—	—	—	—
Key interlock kit	V4-T2-402	—	—	■	□	—	□	□	—	□	—	□	—	—
Sliding bar interlock—requires two breakers	V4-T2-403	—	—	—	●	●	●	●	●	●	●	●	●	●
Walking beam interlock—requires two breakers	V4-T2-403	—	—	—	●	●	●	●	●	●	●	●	●	●
Electrical (solenoid and motor) operators	V4-T2-404	—	—	—	●	●	●	●	●	●	●	●	●	●
Plug-in adapters	V4-T2-405	—	●	●	●	●	●	●	●	●	●	●	●	●
Rear connecting studs	V4-T2-407	●	●	●	●	●	●	●	●	●	●	●	●	●
Panelboard connecting straps	V4-T2-408	●	●	●	●	●	●	●	●	●	●	●	●	●
Handle mechanisms	V4-T2-485	—	—	—	●	●	●	—	—	—	—	—	—	—
LFD current limiter	V4-T2-410	—	—	—	●	●	●	—	—	—	—	—	—	—
IQ Energy Sentinel	V4-T2-410	—	●	●	●	●	●	—	—	—	—	—	—	—
Cause of trip display	V4-T2-411	—	—	—	●	—	—	●	—	—	—	—	—	—
Remote mount cause of trip display	V4-T2-411	—	—	—	●	—	—	●	—	—	—	—	—	—
Cause of trip LED	V4-T2-411	—	—	—	●	—	—	●	—	—	—	—	—	—
<b>Modifications (Refer to Eaton)</b>														
Special calibration	—	●	●	●	●	●	●	●	●	●	●	●	●	●
Moisture fungus treatment	V4-T2-261	●	●	●	●	●	●	●	●	●	●	●	●	●
Freeze-tested circuit breakers	—	●	●	●	●	●	●	●	●	●	●	●	●	●
Marine/naval application	—	●	●	●	●	●	●	●	●	●	●	●	●	●

#### Legend

- Applicable in indicated pole position
- May be mounted on left or right pole—not both
- Accessory available/modification available

#### Note

① Internal accessories are listed with Underwriters Laboratories (UL) for factory installation. They are not listed with UL for field installation.

## Technical Data and Specifications

### UL 489 Interrupting Capacity Ratings

Circuit Breaker Type	Number of Poles	Interrupting Capacity (kA Symmetrical Amperes)					
		Volts AC (50/60 Hz)				Volts DC <sup>①</sup>	
		240	277	480	600	125	250 <sup>②③</sup>
EDB	2, 3	22	—	—	—	10	—
EDS	2, 3	42	—	—	—	10	—
ED	2, 3	65	—	—	—	10	—
EDH	2, 3	100	—	—	—	10	—
EDC	2, 3	200	—	—	—	10	—
EHD	1	—	4	—	—	10	—
	2, 3	18	—	14	—	—	10
FDB	2, 3, 4	18	—	14	14	—	10
FD	1	—	35	—	—	10	—
	2, 3, 4	65	—	35	18	—	10
FDE <sup>④</sup>	3	65	—	35	18	—	—
HFD	1	—	65	—	—	10	—
	2, 3, 4	100	—	65	25	—	22
HFDE <sup>④</sup>	3	100	—	65	25	—	—
FDC <sup>⑥</sup>	2, 3, 4	200	—	100	35	—	22
FDCE <sup>④⑤⑥</sup>	3	200	—	100	25	—	—

### IEC 157-1 (P1) Interrupting Capacity Ratings (P1)

Circuit Breaker Type	Number of Poles	Interrupting Capacity (kA Symmetrical Amperes)					
		Volts AC (50/60 Hz)				Volts DC <sup>①</sup>	
		220, 240	380, 415	440	500	125	250 <sup>②③</sup>
EDB	2, 3	22	—	—	—	10	—
EDS	2, 3	42	—	—	—	10	—
ED	2, 3	65	—	—	—	10	—
EDH	2, 3	100	—	—	—	10	—
EDC	2, 3	200	—	—	—	10	—
EHD	1	—	14	—	—	10	—
	2, 3	18	—	14	—	—	10
FDB	2, 3, 4	18	14	14	14	—	10
FD	1	35	—	—	—	10	—
	2, 3, 4	65	35	35	18	—	10
HFD	1	65	—	—	—	10	—
	2, 3, 4	100	65	65	25	—	22
FDC	2, 3, 4	200	100	100	35	—	22

### UL 489 Current-Limiting Data

Frame	Circuit	I <sub>p</sub> (kA)	I <sup>2</sup> T (10 <sup>6</sup> A <sup>2</sup> S)
FDC	240 V/200 kA	41.4	1.41
FDC	480 V/100 kA	38.9	2.50
FDC	600 V/35 kA	29.0	3.00

#### Notes

- ① DC ratings apply to substantially non-inductive circuits.
- ② Two-pole circuit breaker, or two poles of three-pole circuit breaker.
- ③ Time constant is 3 milliseconds minimum at 10 kA and 8 milliseconds minimum at 22 kA.
- ④ Electronics available on three-pole only, no DC rating for FDE, HFDE, FDCE.
- ⑤ Current limiting.
- ⑥ Check with Eaton for availability.
- ⑦ Neutral sensor required for four-wire systems if neutral protection is desired; sold separately.

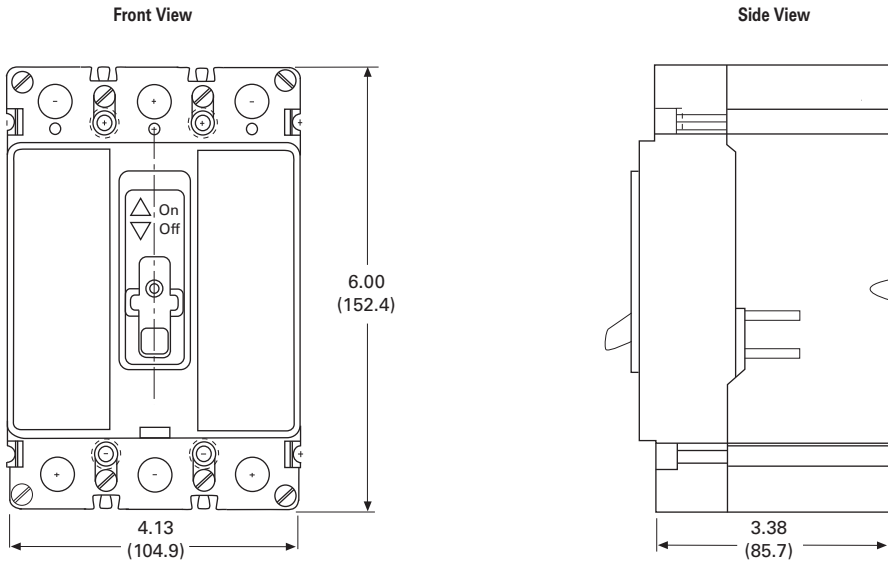
**Dimensions and Weights**

Approximate Dimensions in Inches (mm)

**FD Frame**

Number of Poles	Width	Height	Depth
1	1.38 (35.1)	6.00 (152.4)	3.38 (86.0)
2	2.75 (70.0)	6.00 (152.4)	3.38 (86.0)
3	4.13 (105.0)	6.00 (152.4)	3.38 (86.0)
4	5.50 (139.7)	6.00 (152.4)	3.38 (86.0)

**FD Frame, Three-Pole**



Approximate Shipping Weight Lb (kg)

**FD Frame**

Breaker Type	Number of Poles			
	1	2	3	4
ED, EDB, EDS, EDH, EDC	—	3 (1.4)	4.5 (2.0)	—
EHD, FDB, FD, HFD, FDC	2 (0.9)	3 (1.4)	4.5 (2.0)	6 (2.7)
FDE, HFDE, FDCE	—	—	4.5 (2.0)	—

## Handle Mechanisms



## Contents

<i>Description</i>	<i>Page</i>
Handle Mechanisms—Series G . . . . .	<b>V4-T2-473</b>
High-Performance Rotary Handle Mechanisms . . . . .	<b>V4-T2-474</b>
Universal Rotary . . . . .	<b>V4-T2-479</b>
Direct (Close-Coupled) Handle Mechanisms . . . . .	<b>V4-T2-481</b>
Flex Shaft. . . . .	<b>V4-T2-482</b>
Handle Mechanisms—Series C . . . . .	
High-Performance Rotary Handle Mechanisms . . . . .	<b>V4-T2-487</b>
Series C Rotary . . . . .	<b>V4-T2-491</b>
Direct (Close-Coupled) Handle Mechanisms . . . . .	<b>V4-T2-493</b>
Flex Shaft. . . . .	<b>V4-T2-494</b>
Handle Extension. . . . .	<b>V4-T2-497</b>

## Handle Mechanisms—Series C

## Product Overview

Handle mechanisms are used to operate molded case circuit breakers, molded case switches and motor circuit protectors. They are available in three basic configurations—Flange Mounted, Through-the-Door and Direct (Close-Coupled)—providing safe, dependable operation and ease of installation.

**Through-the-Door**

- High-Performance Rotary
- Series C Rotary

**Direct (Close-Coupled)**

- Universal Direct
- Euro IEC
- G Direct

**Flange Mounted**

- Flex Shaft
- C371

Handle mechanisms are used on enclosed circuit breakers, control panels and motor control centers in many different applications. Eaton has a handle mechanism for virtually any need.

**Through-the-Door Handle Mechanisms**

Eaton's through-the-door handle mechanisms mount on the front of an enclosure or cabinet door and externally operate the circuit breaker via a variable depth shaft or a linear operator (Type MC). Each rotary type handle mechanism includes a handle, base operating mechanism and shaft that can be cut to various lengths.

Series C Rotary and Universal Rotary handle mechanisms are for use with molded case circuit breakers (G, F, J, K, L, MDL), molded case switches and motor circuit protectors.

Type 4/4X handles are similar to standard handles except they include an internal neoprene gasket. Type 4/4X handle style number is 6648C22G03. Due to gasketing effect between the handle and the housing, the handle may not indicate a tripped position.

**Direct (Close-Coupled) Handle Mechanisms**

Direct (close-coupled) handle mechanisms mount directly to the circuit breaker. They are used in shallow enclosures where the standard variable depth Through-the-door type mechanism is not practical or cannot be used. They are typically for applications where high volume, standardized enclosures are being fabricated.

The Euro IEC Direct handle mechanism can be used on F- through R-Frames.

The G Direct is available with a black or the yellow handle, and with or without a shroud. It is suitable for use with NEMA 1 enclosures. It is for use only with the G-Frame (GD, GC, GHC, GMCP).

An escutcheon ring and interlock clip are provided as standard. The standard design includes a lock-off feature.

**Flange-Mounted Handle Mechanisms**

Flange-mounted handle mechanisms mount on the flange of an enclosure door. The Flex Shaft is an extra heavy-duty mechanism that includes a flexible shaft in various lengths, 3 feet (0.9m) through 10 feet (3m) for use with various size enclosures.

The Flex Shaft handle will accept up to three padlock shackles, each with a maximum diameter of 3/8-inch (9.5 mm). Can be used with NEMA 1, 3R and 12 fabricated enclosures. An optional handle is available for Flex Shaft that is suitable for use with NEMA 4 and 4X environments. Flex Shaft comes preset from the factory, requiring only minor field adjustments on installation, which takes about 10 minutes—a significant time savings compared to installation of other types of flange handle mechanisms. The Flex Shaft mechanism also takes up less interior enclosure space than competitive designs and the handle fits standard flange cutouts. Flex Shaft handle can be remotely mounted from breaker, where an operator can use it by “funneling” the cable through conduit.

The Type C371 circuit breaker operating mechanisms are designed for installation in control enclosures where main or branch circuit protective devices are required. All circuit breaker mechanisms are suitable for right-hand mounting.

Auxiliary contacts are not available for mounting on operating mechanisms. Where required, have them installed in circuit breaker.

**Handle Extension**

Handle extension is not included with J, K, L, M and N-Frame breakers. It must be purchased separately.

**Standards and Certifications**

Type C371 is UL Listed under File E62635.

Flex Shaft is UL Listed under File E64983 and meets CSA requirements.

Series C Rotary and Universal Rotary, are UL Listed and meet CSA requirements. Universal Rotary also meets IEC 60947-1 and IEC 60947-2 for international compliance. Rotary UL File Number is E64983.

The Universal Direct handle mechanism is UL 489 Listed, IEC 60947-1 and IEC 60947-2, and meets CSA requirements. The Euro IEC Direct handle mechanism is IEC-240-1. G Direct is UL Listed and meets CSA requirements.



#### Handle Mechanisms

2



### Flex Shaft

#### Product Description

##### **Flange-Mounted Handle Mechanisms**

Flange-mounted handle mechanisms mount on the flange of an enclosure door. The Flex Shaft is an extra heavy-duty mechanism that includes a flexible shaft in various lengths, 3 feet (0.9m) through 10 feet (3m) for use with various size enclosures.

The Flex Shaft handle will accept up to three padlock shackles, each with a maximum diameter of 3/8 inches (9.5 mm). It can be used with Type 12 fabricated enclosures. An optional handle is available for Flex Shaft that is suitable for use with Type 4 environments.

Flex Shaft comes preset from the factory, requiring only minor field adjustments on installation, which takes about 10 minutes—a significant time savings compared to installation of other types of flange handle mechanisms. The Flex Shaft mechanism also takes up less interior enclosure space than competitive designs, and the handle fits standard flange cutouts. Flex Shaft handle can be remotely mounted from breaker, where an operator can use it by “funneling” the cable through conduit.

### Contents

<b>Description</b>	<b>Page</b>
Handle Mechanisms—Series G . . . . .	<b>V4-T2-473</b>
High-Performance Rotary Handle Mechanisms . . . . .	<b>V4-T2-474</b>
Universal Rotary . . . . .	<b>V4-T2-479</b>
Direct (Close-Coupled) Handle Mechanisms . . . . .	<b>V4-T2-481</b>
Flex Shaft . . . . .	<b>V4-T2-482</b>
Handle Mechanisms—Series C	
High-Performance Rotary Handle Mechanisms . . . . .	<b>V4-T2-487</b>
Series C Rotary . . . . .	<b>V4-T2-491</b>
Direct (Close-Coupled) Handle Mechanisms . . . . .	<b>V4-T2-493</b>
Flex Shaft	
Product Selection	
Handle Extension . . . . .	<b>V4-T2-497</b>

#### Standards and Certifications

Flex Shaft is UL listed under File E64983 and meets CSA requirements.





## Product Selection

### Handle Mechanisms

#### Flex Shaft <sup>①②</sup>

Breaker Frame	Flexible Shaft Length in Feet (m)							
	3 (0.9)	4 (1.2)	5 (1.5)	6 (1.8)	7 (2.1)	8 (2.4)	9 (2.7)	10 (3.0)
	Catalog Number	Catalog Number	Catalog Number	Catalog Number	Catalog Number	Catalog Number	Catalog Number	Catalog Number
G <sup>①</sup>	F0S03C	F0S04C	F0S05C	F0S06C	—	—	—	—
F	F1S03C	F1S04C	F1S05C	F1S06C	F1S07C	F1S08C	F1S09C	F1S10C
F (dual)	F1S03CD	F1S04CD	F1S05CD	F1S06CD	F1S07CD	F1S08CD	F1S09CD	F1S10CD
J	F2S03C	F2S04C	F2S05C	F2S06C	F2S07C	F2S08C	F2S09C	F2S10C
K	F3S03C	F3S04C	F3S05C	F3S06C	F3S07C	F3S08C	F3S09C	F3S10C
L and MDL	—	F4S04C	F4S05C	F4S06C	—	—	—	F4S10C
N	—	F5S04C	F5S05C	F5S06C	—	—	—	F5S10C
R	—	F6S04	F6S05	F6S06	—	—	—	—
MD, MDS (old)	—	F7S04	F7S05	F7S06	—	—	—	F7S10C

#### High Performance Flex Shaft <sup>①②</sup>

Breaker Frame	Flexible Shaft Length in Feet (m)							
	3 (0.9)	4 (1.2)	5 (1.3)	6 (1.8)	7 (2.1)	8 (2.4)	9 (2.7)	10 (3.1)
	Catalog Number	Catalog Number	Catalog Number	Catalog Number	Catalog Number	Catalog Number	Catalog Number	Catalog Number
G	F0S03HP	F0S04HP	F0S05HP	F0S06HP	N/A	N/A	N/A	N/A
F	F1S03HP	F1S04HP	F1S05HP	F1S06HP	F1S07HP	F1S08HP	F1S09HP	F1S10HP
F (dual)	F1S03HPD	F1S04HPD	F1S05HPD	F1S06HPD	F1S07HPD	F1S08HPD	F1S09HPD	F1S10HPD
J	F2S03HP	F2S04HP	F2S05HP	F2S06HP	F2S07HP	F2S08HP	F2S09HP	F2S10HP
K	F3S03HP	F3S04HP	F3S05HP	F3S06HP	F3S07HP	F3S08HP	F3S09HP	F3S10HP
L and MDL	N/A	F4S04HP	F4S05HP	F4S06HP	N/A	N/A	N/A	F4S10HP
N	N/A	F5S04HP	F5S05HP	F5S06HP	N/A	N/A	N/A	F5S10HP
R	N/A	F6S04HP	F6S05HP	F6S06HP	N/A	N/A	N/A	N/A

### Flange-Mounted Handle Mechanisms

#### Type C371

Circuit Breaker or Motor Circuit Protector	Frame Size	Variable Depth Mounting Range Min./Max. <sup>②③</sup>	Operating Mechanism Only <sup>④</sup>	Operating Mechanism w/ 4-Inch Handle	
			Catalog Number	For NEMA 1–12 Enclosure Catalog Number	For NEMA 4/4X Enclosure Catalog Number
HMCP and Series C—EHD, FDB, FD, FDC, HFD, ED	150	6.50–16 (165.1–406.4)	C371E	C371E1	C371E2
HMCP and Series C—HJD, JD, JDB, JDC	250	6.50–16.63 (165.1–422.4)	C371F	C371F5	C371F6
HMCP and Series C—DK, HKD, KD, KDB	400	6.50–16.63 (165.1–422.4)	C371F	C371F5	C371F6
Series C—HLD, LD, LDC	600	8.50–22 (215.9–558.8)	C371G	C371G5	C371G6
Series C MD, MDS—(No MDL)	800	8.75–22 (222.3–558.8)	C371K	C371K5	C371K6
Series C—HND, ND, NDC	1200	9.75–22 (247.7–558.8)	C371K	C371K5	C371K6

#### Notes

- ① Suitable for GC/GD MCCB; not suitable for GMCP.
- ② For increased maximum allowable depth, see connecting rods on **Page V4-T2-496**.
- ③ Dimensions shown are from panel flange surface.
- ④ Does not include handle.

Type 4/4X handle mechanisms are available. Add Suffix X to complete catalog number. Add Suffix I to complete catalog number for IEC handle. Original narrow handle design (No C Suffix) is available. Remove C from catalog number.

When selecting the length of shaft, ensure minimum bending radius of 4 inches (101.6 mm) (5 inches, 12.7 mm for L-, N- and R-Frames) is maintained to operate properly. The standard method of shipment includes the mechanism preset at the factory; however, minor field adjustments may be required.

Dual breakers operator available on F-Frame only. Only the F, J and K can mount LH and RH all other RH only.

# 2.6

## Molded Case Circuit Breakers

### Handle Mechanisms

Approximate Dimensions in Inches (mm)

2

#### Handle Only

Circuit Breaker Frame Size (Amperes)	NEMA Enclosure Type	Operating Handle Length	Catalog Number
150	1/3R/3/12	4.00 (101.6)	<b>C371H1</b>
	4/4X	4.00 (101.6)	<b>C371H2</b>
	1/3R/3/12	6.00 (152.4)	<b>C371H3</b>
	4/4X	6.00 (152.4)	<b>C371H4</b>
250–1200	1/3R/3/12	4.00 (101.6)	<b>C371H5</b>
	4/4X	4.00 (101.6)	<b>C371H6</b>
	1/3R/3/12	6.00 (152.4)	<b>C371H7</b>
	4/4X	6.00 (152.4)	<b>C371H8</b>

#### Channel Support Kit (Rod Not Supplied)

For use to prevent bending of the operating handle mounting surface. This is especially useful when the operating handle is mounted on a channel in a multi-door enclosure.

Amperes	Catalog Number
600–1200	<b>C371CS6</b>

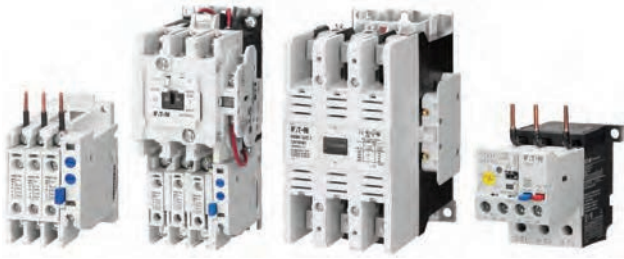
#### Connecting Rods <sup>①</sup>

Application	Catalog Number
Disconnect switches (30, 60, 100, 200 A sizes)	<b>C371CS1</b>
Circuit breakers (150, 250, 400 A sizes)	<b>C371CS1</b>
Circuit breakers (600, 800, 1200 A sizes)	<b>C371CS2</b>

#### Note

<sup>①</sup> Increase maximum allowable depth by 5 inches (127 mm).

Freedom Series



2

### Contents

<i>Description</i>	<i>Page</i>
Freedom Series	
Standards and Certifications . . . . .	<b>V5-T2-3</b>
Catalog Number Selection . . . . .	<b>V5-T2-3</b>
Contactors—Non-Reversing and Reversing . . . . .	<b>V5-T2-4</b>
Starters—Three-Phase Non-Reversing and Reversing, Full Voltage . . . . .	<b>V5-T2-10</b>
Starters—Single-Phase Non-Reversing, Full Voltage, Bi-Metallic Overload . . . . .	<b>V5-T2-15</b>
Accessories . . . . .	<b>V5-T2-21</b>
Renewal Parts . . . . .	<b>V5-T2-30</b>
Technical Data and Specifications . . . . .	<b>V5-T2-35</b>
Relays—Thermal Overload . . . . .	<b>V5-T2-39</b>
C440/ <i>XT</i> Electronic Overload Relay . . . . .	<b>V5-T2-48</b>

### Product Overview

Freedom Series starters and contactors feature a compact, space-saving design, using state-of-the-art technology and the latest in high strength, impact and temperature resistant insulating materials.

### Features, Benefits and Functions

#### Freedom NEMA

- Adjustable bimetallic ambient compensated overload relays with interchangeable heater packs—available in three basic sizes, covering applications up to 900 hp—reducing the number of different contactor/overload relay combinations that have to be stocked. Fixed heater overloads are optional
- Electronic overload relay (C440) available as a stand-alone unit and assembled with Freedom Contactor
- A full line of snap-on accessories— top and side mounted auxiliary contacts, solid-state and pneumatic timers, and so on
- Straight-through wiring— line lugs at top, load lugs at bottom
- Horizontal or vertical mounting on upright panel for application freedom
- Screw type power terminals have captive, backed-out self-lifting pressure plates with  $\pm$  screws—reduced wiring time
- Accessible terminals for easy wiring. Optional fingerproof shields available to prevent electrical shock
- Top located coil terminals convenient and readily accessible. 45 mm contactor magnet coils have three terminals, permitting either top or diagonal wiring—easy to replace European or U.S. style starters or contactors without changing wiring layout
- Designed to meet or exceed NEMA, UL, CSA, VDE, BS and other international standards and listings
- American engineering— built by Eaton, using the latest in statistical process control methods to produce high quality, reliable products
- Sized based on standard NEMA classifications
- Easy coil change and inspectable/replaceable contacts
- Available in open and NEMA Type 1, 3R, 4/4X and 12 enclosures

**Standards and Certifications**

- Standard: designed to meet or exceed UL, NEMA, IEC, CSA, VDE and BS
- UL listed: UL File #E1491, Guide #NLDX—Open and NEMA 1, 4, 12 Enclosed
- CSA Certified: CSA File #LR353, Class #321104 Open and NEMA 1 Enclosed



**ISO 9000 Certification**

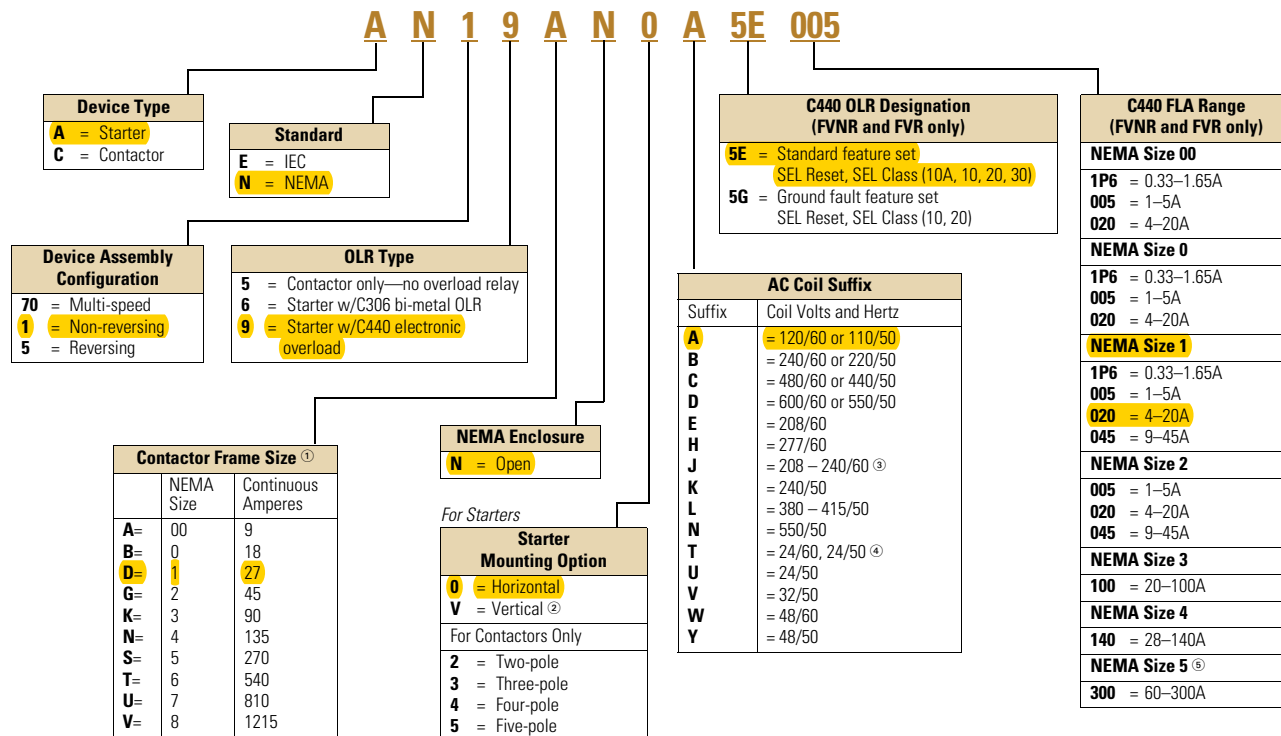
When you turn to Eaton’s products, you turn to quality. The International Standards Organization (ISO) has established a series of standards acknowledged by 91 industrialized nations to bring harmony to the international quest for quality. The ISO certification process covers 20 quality system elements in design, production and installation that must conform to achieve registration. This commitment to quality will result in increased product reliability and total customer satisfaction.

**Short Circuit Protection**

**Fuses and Inverse-Time Circuit Breakers** may be selected per Article 430, Part D of the National Electrical Code to protect motor branch circuits from fault conditions. If higher ratings or settings are required to start the motor, **do not** exceed the maximum as listed in Exception No. 2, Article 430-52.

**Catalog Number Selection**

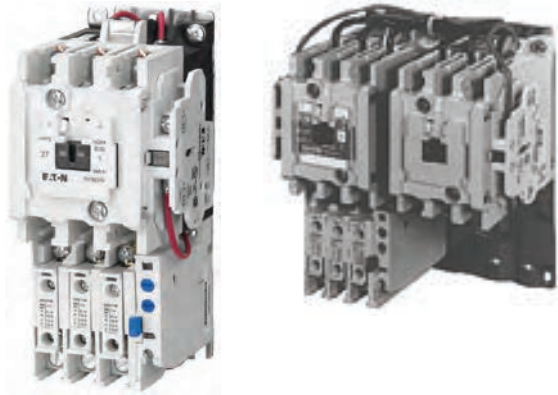
Freedom Series



**Notes**

- ① For contactor only orders, add **B** to end of catalog number if NEMA Size 00–2, 6.
- ② Only available on AN56 reversing starters.
- ③ NEMA Sizes 00 and 0 only.
- ④ NEMA Sizes 00 and 0 only. Sizes 1–8 are 24/60 only.
- ⑤ NEMA Size 5 requires the use of CTs with 1-5A OL relay.

Three-Phase Non-Reversing and Reversing, Full Voltage Starters



### Contents

<i>Description</i>	<i>Page</i>
Contactors—Non-Reversing and Reversing . . . . .	<b>V5-T2-4</b>
Starters—Three-Phase Non-Reversing and Reversing, Full Voltage	
Product Selection . . . . .	<b>V5-T2-11</b>
Kits and Accessories . . . . .	<b>V5-T2-13</b>
Renewal Parts Publication Numbers . . . . .	<b>V5-T2-13</b>
Technical Data and Specifications . . . . .	<b>V5-T2-13</b>
Wiring Diagrams . . . . .	<b>V5-T2-14</b>
Starters—Single-Phase Non-Reversing, Full Voltage, Bi-Metallic Overload . . . . .	<b>V5-T2-15</b>
Accessories . . . . .	<b>V5-T2-21</b>
Renewal Parts . . . . .	<b>V5-T2-30</b>
Technical Data and Specifications . . . . .	<b>V5-T2-35</b>
Relays—Thermal Overload . . . . .	<b>V5-T2-39</b>
C440/ <i>XT</i> Electronic Overload Relay . . . . .	<b>V5-T2-48</b>

### Starters—Three-Phase Non-Reversing and Reversing, Full Voltage

#### Product Description

##### Non-Reversing

Three-phase, full voltage magnetic starters are most commonly used to switch AC motor loads. Starters consist of a magnetically actuated switch (contactor) and an overload relay assembled together.

##### Reversing

Three-phase, full voltage magnetic starters are used primarily for reversing of three-phase squirrel cage motors. They consist of two contactors and a single overload relay assembled together. The contactors are mechanically and electrically interlocked to prevent line shorts and energization of both contactors simultaneously.

#### Features, Benefits and Functions

- Bimetallic ambient compensated overload relays—available in three basic sizes covering applications up to 900 hp—reducing number of different contactor/overload relay combinations that have to be stocked
- These overload relays feature:
  - Selectable manual or automatic reset operation
  - Interchangeable heater packs adjustable  $\pm 24\%$  to match motor FLA and calibrated for 1.0 and 1.15 service factors. Heater packs for smaller overload relay will mount in larger overload relay—useful in derating applications such as jogging
  - Load lugs built into relay base
  - Single-phase protection, Class 20 or Class 10 trip time
  - Overload trip indication
  - Electrically isolated NO-NC contacts (pull RESET button to test)
- The C440 is a self-powered, robust electronic overload designed for integrated use with Freedom NEMA contactors
  - Tiered feature set to provide coverage specific to your application
  - Broad 5: 1 FLA range for maximum flexibility
  - Coverage from 0.05–1500A to meet all your needs
- Long life twin break, silver cadmium oxide contacts—provide excellent conductivity and superior resistance to welding and arc erosion. Generously sized for low resistance and cool operation
- Designed to 3,000,000 electrical operations at maximum hp ratings up through 25 hp at 600V
- Steel mounting plate standard on all open type starters
- Wired for separate or common control

##### Non-Reversing

- Holding circuit contact(s) supplied as standard:
  - Sizes 00–3 have a NO auxiliary contact block mounted on right-hand side (on Size 00, contact occupies 4th power pole position—no increase in width)
  - Sizes 4–5 have a NO contact block mounted on left side
  - Sizes 6–7 have a 2NO/2NC contact block on top left
  - Size 8 has a NO/NC contact block on top left back and a NO on top right back

##### Reversing

- Each contactor (Size 00–8) supplied with one NO-NC side mounted contact block as standard. NC contacts are wired as electrical interlocks

**Product Selection**

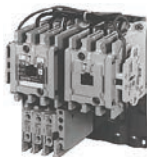
**When Ordering Supply**

- Catalog number
- Heater pack number (see selection table, **Pages V5-T2-41 to V5-T2-43**) or full load current

**Size 0  
Non-Reversing Starter**



**Size 1  
Reversing Starter**



**Type AN16/AN56 NEMA—Manual or Automatic Reset Overload Relay—Non-Reversing and Reversing <sup>①</sup>**

NEMA Size	Continuous Ampere Rating	Service-Limit Current Rating (Amperes) <sup>④</sup>	Maximum UL Horsepower <sup>②</sup>						Three-Pole Non-Reversing <sup>③</sup> Catalog Number	Three-Pole Reversing <sup>③</sup> Catalog Number	Vertical Reversing <sup>③</sup> Catalog Number
			Single-Phase		Three-Phase						
			115V	230V	208V	240V	480V	600V			
00	9	11	1/3	1	1-1/2	1-1/2	2	2	AN16AN0_C	AN56AN0_C	—
0	18	21	1	2	3	3	5	5	AN16BN0_C	AN56BN0_C	AN56BNV0_
1	27	32	2	3	7-1/2	7-1/2	10	10	AN16DN0_B	AN56DN0_B	AN56DNV0_
2	45	52	3	7-1/2	10	15	25	25	AN16GN0_B	AN56GN0_B	AN56GNV0_
3	90	104	—	—	25	30	50	50	AN16KN0_	AN56KN0_	AN56KNV0_
4	135	156	—	—	40	50	100	100	AN16NN0_	AN56NN0_	AN56NNV0_
5	270	311	—	—	75	100	200	200	AN16SN0_B	AN56SN0_B	—
6	540	621	—	—	150	200	400	400	AN16TN0_C	AN56TN0_C	—
7	810	932	—	—	200	300	600	600	AN16UN0_B	AN56UN0_B	—
8 <sup>⑤</sup>	1215	1400	—	—	400	450	900	900	AN16VN0_B	AN56VN0_B	—

**Magnet Coils—AC or DC**

Starter coils listed in this section also have a 50 Hz rating as shown in the adjacent table. Select required starter by catalog number and replace the magnet coil alpha designation

in the catalog number ( ) with the proper code suffix from the table.

For Sizes 00–2 and 5–8, the magnet coil alpha designation will be the next to last digit of the listed catalog number.

EXAMPLE: For a 380V, 50 Hz coil, change AN16BN0\_C to AN16BN0LC. For all other sizes, the magnet coil alpha designation will be the last digit of the listed catalog number.

For **DC Magnet Coils**, see Accessories, **Pages V5-T2-28 and V5-T2-29**.

**AC Suffix**

Coil Volts and Hertz	Code Suffix
120/60 or 110/50	<b>A</b>
240/60 or 220/50	<b>B</b>
480/60 or 440/50	<b>C</b>
600/60 or 550/50	<b>D</b>
208/60	<b>E</b>
277/60	<b>H</b>
208–240/60 <sup>⑥</sup>	<b>J</b>
240/50	<b>K</b>

Coil Volts and Hertz	Code Suffix
380–415/50	<b>L</b>
550/50	<b>N</b>
24/60, 24/50 <sup>⑦</sup>	<b>T</b>
24/50	<b>U</b>
32/50	<b>V</b>
48/60	<b>W</b>
48/50	<b>Y</b>
48/50	<b>Y</b>

**Notes**

<sup>①</sup> Starter catalog numbers do not include heater packs. Select one carton of three heater packs. Heater pack selection, **Pages V5-T2-41 to V5-T2-43**.

<sup>②</sup> Maximum horsepower rating of starters for 380V 50 Hz applications:

NEMA Size	00	0	1	2	3	4	5	6	7	8
Horsepower	1-1/2	5	10	25	50	75	150	300	600	900

<sup>③</sup> Underscore ( ) indicates coil suffix required, see AC Suffix table.

<sup>④</sup> The service-limit current ratings represent the maximum rms current, in amperes, which the controller shall be permitted to carry for protracted periods in normal service. At service-limit current ratings, temperature rises shall be permitted to exceed those obtained by testing the controller at its continuous current rating. The current rating of overload relays or trip current of other motor protective devices used shall not exceed the service-limit current rating of the controller.

<sup>⑤</sup> Common control. For separate 120V control, insert letter **D** in 7th position of listed catalog number. Example: AN56VND0CB.

<sup>⑥</sup> NEMA Sizes 00 and 0 only.

<sup>⑦</sup> NEMA Sizes 00 and 0 only. Sizes 1–8 are 24/60 only.

# 2.1

## NEMA Contactors and Starters

### Freedom Series

#### Two-Speed Selective Control

##### When Ordering Supply

- Catalog number plus magnet coil code suffix. Example: Size 0—AN700BN022B
- Heater pack number or full load current for each speed

For two-speed other than selective control:

- Catalog number plus magnet coil code suffix and option required. Example: AN700BN022B except compelling
- Heater pack number or full load current for each speed

**Note:** Two-speed starters are designed for starting and controlling both separate (two-winding) and reconnectable (one-winding) motors. Separate winding, WYE-WYE motors have a separate winding for each speed. Reconnectable, consequent pole motors use the same winding for both speeds. All standard starters are wired for selective control.

##### Two-Winding AN700DN022



#### Separate Winding ①

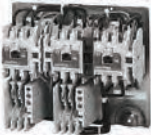
Maximum Horsepower—60/50 Hertz

Constant or Variable Torque

Constant or Variable Torque				Constant Horsepower				NEMA Size	Open Type Catalog Number
115V	200V	230V	460V/575V	115V	200V	230V	460/575V		
1-1/2	3	3	5	1	2	2	3	0	AN700BN022_
3	7-1/2	7-1/2	10	2	5	5	7-1/2	1	AN700DN022_
—	10	15	25	—	7-1/2	10	20	2	AN700GN022_
—	25	30	50	—	20	25	40	3	AN700KN022_
—	40	50	100	—	30	40	75	4	AN700NN022_
—	75	100	200	—	60	75	150	5	AN700SN022_

Prices of starters do not include heater packs. Select two packs (two overload relays, one for each speed). Heater pack selection, Pages V5-T2-41 to V5-T2-43.

##### One-Winding AN700BN0218



#### Reconnectable Winding ①

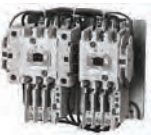
Maximum Horsepower—60/50 Hertz

Constant or Variable Torque

Constant or Variable Torque				Constant Horsepower				NEMA Size	Open Type Constant or Variable Torque Catalog Number	Constant Horsepower Catalog Number
115V	200V	230V	460V/575V	115V	200V	230V	460/575V			
1-1/2	3	3	5	1	2	2	3	0	AN700BN0218_	AN700BN0219_
3	7-1/2	7-1/2	10	2	5	5	7-1/2	1	AN700DN0218_	AN700DN0219_
—	10	15	25	—	7-1/2	10	20	2	AN700GN0218_	AN700GN0219_
—	25	30	50	—	20	25	40	3	AN700KN0218_	AN700KN0219_
—	40	50	100	—	30	40	75	4	AN700NN0218_	AN700NN0219_

Prices of starters do not include heater packs. Select two packs (two overload relays, one for each speed). Heater pack selection, Pages V5-T2-41 to V5-T2-43.

##### One-Winding AN700DN0218



#### Magnetic Coils—AC or DC

Coil Voltage and Hz	Code Suffix	Coil Voltage and Hz	Code Suffix	Coil Voltage and Hz	Code Suffix
120/60 or 110/50	A	277/60	H	24/60, 24/50 ②	T
240/60 or 220/50	B	208–240/60	J	24/50	U
480/60 or 440/50	C	240/50	K	32/50	V
600/60 or 550/50	D	380–415/50	L	48/60	W
208/60	E	550/50	N	48/50	Y

##### Notes

① If branch circuit protective device is 45A or greater, C320FBR1 fuse kit(s) may be required for circuit protection per NEC 530-072.

② NEMA Sizes 00 and 0 only. Sizes 1–5 are 24/60 only.

**Kits and Accessories**

- Auxiliary contacts, contactor mounted—**Pages V5-T2-25 to V5-T2-27**
- Transient suppressor, for magnet coil—**Page V5-T2-24**
- Timers—solid-state and pneumatic, mount on contactor—**Page V5-T2-22**

**Renewal Parts  
Publication Numbers**

- See **Page V5-T2-30**

**Technical Data and Specifications**

**Wire (75°C) Sizes—AWG or kcmil—NEMA Sizes 00–2—Open and Enclosed**

NEMA Size	Wire Size <sup>①</sup> Cu Only
<b>Power Terminals—Line</b>	
00	12–16 AWG stranded, 12–14 AWG solid
0	8–16 AWG stranded, 10–14 AWG solid
1	8–14 AWG stranded or solid
2	3–14 AWG (upper) and/or 6–14 AWG (lower) stranded or solid <sup>②</sup>
<b>Power Terminals—Load—Cu Only (stranded or solid)</b>	
00–0	14–6 AWG stranded or solid
1–2	14–2 AWG stranded or solid
<b>Control Terminals—Cu Only</b>	
12–16 AWG stranded, 12–14 AWG solid	

**Wire (75°C) Sizes—AWG or kcmil—NEMA Sizes 3–8—Open and Enclosed**

NEMA Size	Wire Size <sup>②</sup>
<b>Power Terminals—Line and Load</b>	
3	1/0–14 AWG Cu/Al
4	Open—3/0–8 AWG Cu; Enclosed—250 kcmil—6 AWG Cu/Al
5	750 kcmil—2 AWG; or (2) 250 kcmil—3/0 AWG Cu/Al
6	(2) 750 kcmil—3/0 AWG Cu/Al
7	(3) 750 kcmil—3/0 AWG Cu/Al
8	(4) 750 kcmil—1/0 AWG Cu/Al
<b>Control Terminals—Cu Only</b>	
12–16 AWG stranded, 12–14 AWG solid	

**Plugging and Jogging Service Horsepower Ratings <sup>③</sup>**

NEMA Size	200V	230V	460V	575V
00	—	1/2	1/2	1/2
0	1-1/2	1-1/2	2	2
1	3	3	5	5
2	7-1/2	10	15	15
3	15	20	30	30
4	25	30	60	60
5	60	75	150	150
6	125	150	300	300

**Notes**

- ① Minimum per NEC. Maximum wire size: Sizes 00 and 0 to 8 AWG and Sizes 1–2 to 2 AWG.
- ② Two compartment box lug.
- ③ Maximum horsepower where operation is interrupted more than 5 times per minute, or more than 10 times in a 10 minute period. NEMA Standard ICS2-1993 table 2-4-3.



# 2.1

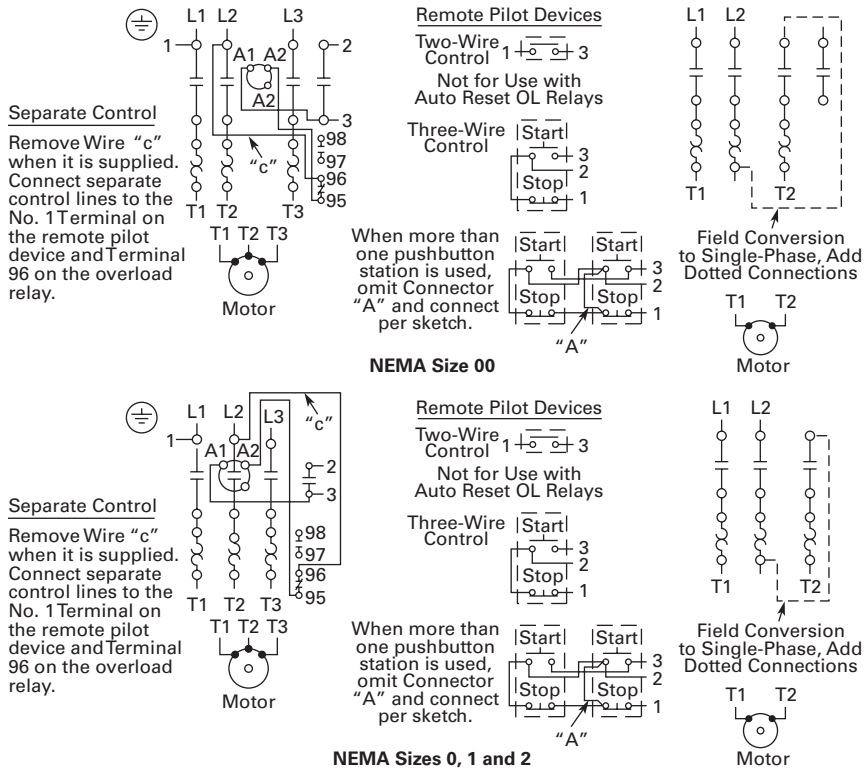
## NEMA Contactors and Starters

Freedom Series

### Wiring Diagrams

2

#### Three-Phase and Single-Phase Applications



Accessories

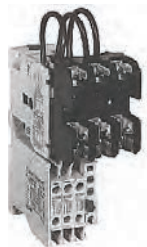
Three-Pole Top Mounted Fuse Block Kit

IEC Sizes A–K, NEMA Sizes 00–2

Field mount to Freedom Series starters and contactors. Designed to save space and

reduce installation costs. They provide short circuit protection for branch circuits.

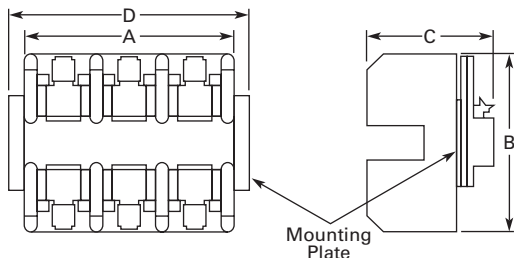
Mounted Fuse Block Kit



Fuse Block Kits

Fuse Type	Catalog Number
Class H—30A 250V	C350KH21
Class R—30A 250V	C350KR21
Class G—15A 300V	C350KG37
Class G—20A 300V	C350KG38
Class G—30A 300V	C350KG31
Class G—60A 300V	C350KG32
Class T—30A 300V	C350KT31
Class T—60A 300V	C350KT32
Class J—30A 600V	C350KJ61
Class J—60A 600V	C350KJ62
Type M—30A 600V ①	C350KM61
Class CC—30A 600V	C350KC63
Class T—30A 600V	C350KT61
Class T—60A 600V	C350KT62

Three-Pole Top Mounted Fuse Block Kit



Fuse Block Class	Amperes	Volts	Approximate Dimensions in Inches (mm)			
			Wide A	High B	Deep C	D
G	15, 20, 30	300	2.40 (61.0)	3.00 (76.2)	2.04 (51.8)	—
	60	300	2.62 (66.5)	4.25 (108.0)	2.08 (52.8)	—
H	30	250	3.00 (76.2)	3.10 (78.7)	2.23 (56.6)	3.62 (91.9)
J	30, 60	600	4.81 (122.2)	4.12 (104.6)	2.82 (71.6)	—
M, CC	30	600	2.40 (61.0)	3.00 (76.2)	2.04 (51.8)	—
R	30	250	3.00 (76.2)	3.10 (78.7)	2.23 (56.6)	3.62 (91.9)
T	30, 60	300	3.44 (87.4)	3.00 (76.2)	2.33 (59.2)	—
	30	600	3.75 (95.3)	3.31 (84.1)	2.26 (57.4)	—
	60	600	4.87 (123.7)	3.00 (76.2)	2.58 (65.5)	—

Mechanical Interlock and Reversing Kits

Mechanical interlocks and reversing kits are designed for field assembly of reversing contactors or starters from Freedom Series components. The reversing kits include a mechanical

interlock, stabilizer bar and a pre-cut, trimmed and formed wire set. Auxiliary contacts, if required, must be ordered separately. See Pages V5-T2-25 and V5-T2-26.

C321KM60B



Part No. 23-7165



Wire Set



Mechanical Interlock Only ②③

Application			
NEMA Size	IEC Size	Contactors Mounting	Catalog Number
00–2	A–K	Horizontal	C321KM60B
3	L–N	Horizontal	C321KM30
3 to 4	N to P	Horizontal	C321KM43
4	P–S	Horizontal	C321KM40
4 to 5	—	Horizontal	C321KM45
4 to 6	S to T/U	Horizontal	C321KM80
5	—	Horizontal	C321KM50
5 to 6	—	Horizontal	C321KM56
6	T and U	Horizontal	C321KM70
6 to 7	T/U to V–X	Horizontal	C321KM90
7	V, W and X	Horizontal	C321KM34
4 or 5 to 5	P–S to 5	Vertical	C321KM55
5 to 6	—	Vertical	C321KM65
6	T and U	Vertical	C321KM66
6 to 7	T/U to V–X	Vertical	C321KM67

Reversing Kits (Horizontal Contactor Mounting Only)

Application		
NEMA Size	IEC Size	Catalog Number
00	A–C	C321KM60K14B
0	D–F	C321KM60K13B
1	—	C321KM60K15B
2	G–K	C321KM60K16B
3	—	C321KM60K17 ④
—	L and M	C321KM60K21 ④
—	N	C321KM60K18 ④
4	—	C321KM60K19 ④
5	—	C321KM60K20 ④
—	P–S	C321KM60K44 ④

Notes

- ① Type M fuse block not approved for branch circuit protection.
- ② Without cross-wiring.
- ③ For use with latest series product.
- ④ Kit includes (2) NC auxiliary contacts.

# 2.1

## NEMA Contactors and Starters

### Freedom Series

2

#### Solid-State Timers

##### Solid-State ON DELAY Timer—Side Mounted on Freedom Series NEMA 00–2, IEC A–K and C25D, C25E and C25F Frame

This timer is designed to be **wired in series with the load** (typically a coil). When the START button is pushed (power applied to timer), the

ON DELAY timing function starts. At the completion of the set timing period, timer and series wired load will both be energized.

#### Solid-State Timer



#### Mounted Timer Product Selection

Timing Range	Catalog Number <sup>①②③</sup>
1–30 seconds	<b>C320TDN30_</b>
30–300 seconds	<b>C320TDN300_</b>

#### Shorting Bar Kits

These kits provide phase-to-phase power connections of contactors for field assembly. The kits include bus

connections and mounting hardware. The shorting bars connect all three phases of a single contactor.

#### Shorting Bar Kits

Description	Catalog Number
NEMA Size 3, IEC Sizes L–N	<b>C321SB18</b>
NEMA Size 4, IEC Sizes A–S	<b>C321SB19</b>
NEMA Size 6, IEC Sizes T and U	<b>C321SB22</b>

#### Pneumatic Timers—Top Mounted

Attachment mounts on top of any NEMA Size 00–2 or IEC Size A–K Freedom Series starter or contactor (top mounted auxiliary contacts cannot be installed on device when timer is used). Timer

unit has 1NO-1NC isolated timed contacts—circuits in each pole must be the same polarity. Units are convertible from OFF to ON DELAY or vice-versa.

#### Pneumatic Timers



#### Pneumatic Timers

Timing Range	Catalog Number
0.1 to 30 seconds	<b>C320TP1</b>
10 to 180 seconds	<b>C320TP2</b>

#### Maximum Ampere Ratings

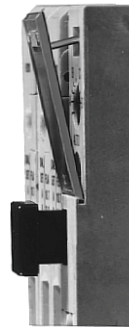
Description	Vac			
	120	240	480	600
Make	30	15	7.5	6
Break	3	1.5	0.75	0.6

#### Locking Cover for Overload Relay—C306 Only

Snap-on transparent or opaque plastic panel for covering access port to the overload relay trip setting

dial—helps prevent accidental or unauthorized changes to trip and reset setting.

#### Locking Cover for Overlay Relay



#### Locking Cover for Overlay Relay

Description	Min. Ordering Quantity (Std. Pkg.)	Catalog Number
Clear cover, no accessibility	50	<b>C320PC3</b>
Gray cover, no accessibility, with Auto only nib	50	<b>C320PC4</b>
Gray cover, no accessibility, with Manual only nib	50	<b>C320PC5</b>
Gray cover with FLA dial accessibility, A, B, C, D positions and Auto only nib	50	<b>C320PC6</b>
Gray cover with FLA dial accessibility, A, B, C, D positions and Manual only nib	50	<b>C320PC7</b>

#### Notes

- ① Add operating voltage suffix to catalog number.  
**A** = 120V, **B** = 240V, **E** = 208V
- ② Rated 0.5 ampere pilot duty—not to be used on larger contactors.
- ③ Terminal connections are quick connects only. Two per side.
- ④ 240V operating voltage not available for C320TDN3000\_.

**Identification Markers**

**IEC Sizes A–K, NEMA Sizes 00–2**

Designed to snap on the face of contactor for easy, personalized identification of individual devices. Includes holder and labels.

**Identification Markers**

Description	Catalog Number
Identification marker	C320DL2

**Control Circuit Fuse Block**

These panel mounted fuse holders, designed for control circuit protection or other similar low current requirements, have extractor type fuse caps. The Class CC rejection type fuses (KTK-R) used in these holders are intended for use with

equipment designated as being suitable for use on systems having high available fault currents. If branch circuit protective device is 45A or greater, C320FBR fuse kit may be required for control circuit protection per NEC 430-72.

**Control Circuit Fuse Block**

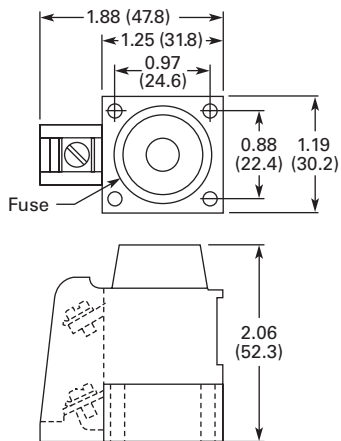


**Control Circuit Fuse Block**

Type	Max. Amperes	Catalog Number
Fuse holder only	15	C320FB ①
	30	C320FBR ②


**Dimensions**

Approximate Dimensions in Inches (mm)



**DIN Rail Mounting Channel—35 mm**

Designed for DIN rail mounting of IEC style contactors and starters.

DIN Rail	Description	Catalog Number
	1 meter length	MC382MA1

**Finger Protection Shields**

Snap-on shields for both contactors and starters provide IEC Type IP20 finger

protection. Prevents accidental contact with line/load terminals.

**Finger Protection Shields**

Application	Catalog Number
NEMA Size 00, IEC Sizes A–C	C320LS1
NEMA Size 0, IEC Sizes D–F	C320LS2
<b>NEMA Sizes 1–2, IEC Sizes G–K</b>	
Contactors	C320LS3
Reversing contactors	C320LS4
<b>NEMA Size 1</b>	
Starters	C320LS5
Reversing starters	C320LS6
<b>NEMA Size 2, IEC Sizes G–K</b>	
Starters	C320LS7
Reversing starters	C320LS8

**Adapter to DIN Rail Mount**

**NEMA 1–2 and IEC G–K Contactors**

Designed to allow DIN rail mounting of NEMA 1–2 and IEC G–K contactors. Includes all hardware required to

convert contactors from panel mounting to 35 mm DIN rail mounting.

**Adapter to DIN Rail Mount**

Catalog Number
C320DN65

**Notes**

- ① A fuse is not supplied, but holder will accept a Bussman Type KTK or KTK-R (13/32 in x 1-1/2 in) fuse, 600V maximum.
- ② Includes a 5A, 600V KTK-R fuse.

# 2.1

## NEMA Contactors and Starters

### Freedom Series

2

#### Transient Suppressor Kits

##### NEMA Sizes 00–2, IEC Sizes A–K

These kits limit high voltage transients produced in the control circuit when power is removed from the contactor or starter coil. There are three separate suppressors for use on 24–120V, 208–240V or 277–480V coils respectively.

These devices mount directly to the coil terminals of Freedom Series contactors or starters NEMA Sizes 00–2, IEC Sizes A–K and lighting contactors 10–60A. Reversing devices will require two.

##### C320TS2



##### NEMA Sizes 00–2, IEC Sizes A–K

Description	Coil Voltage ①	Catalog Number
Transient suppressor	24/120V	C320TS1
	208/240V	C320TS2
	277/480V	C320TS3

##### NEMA Sizes 3–5, IEC Sizes L–S

This device mounts on top of any side mounted auxiliary contact on Freedom Series NEMA Sizes 3–5, IEC Sizes L–S and lighting contactors 100–300A. It connects across coil terminals on any 120V contactor or starter magnet

coil (reversing starters or contactors require 2).

Limits high voltage transients produced in the circuit when power is removed from the coil.

##### C320AS1



##### NEMA Sizes 3–5, IEC Sizes L–S

Description	Coil Voltage	Catalog Number
Transient suppressor	120V	C320AS1

#### Add-On Power Pole Kit ②

##### NEMA Sizes 00–0, IEC Sizes A–F

This device mounts on the side of Freedom NEMA Size 00–0 and IEC Sizes A–F contactors. One unit can be mounted on each side and

carries UL, cUL and IEC ratings. The device is rated for resistive, inductive and lighting applications.

##### NEMA Sizes 00–0, IEC Sizes A–F

###### UL Ampere Rating

Inductive 600V	Resistive 600V	Horsepower Single-Phase		Locked Rotor 240V	Lighting Ballast Tungsten 480V	IEC 947 Ampere Rating		AC-5a AC-5b 480V	1NO Power Pole Catalog Number
		115V	230V			AC-1 600V	AC-3 600V		
15	20	1/2	2	96	20	20	12	18	C320PPD10

#### Notes

- ① Suppressor is compatible with coil voltages/ranges as shown, both 50 and 60 Hz.
- ② Power pole kits sold for replacement purposes only. For new applications, order the correct four-pole and five-pole contactor catalog numbers.

#### Adhesive Dust Cover

##### NEMA Sizes 00–2, IEC Sizes A–K

These adhesive stickers come 25 to a package and provide extra protection from contaminants when applied to the sides of Freedom NEMA Sizes 00–2 and IEC

Sizes A–K. Adhesive covers are easily applied to side opening where auxiliaries are not installed and provide extra protection from metal filings and other debris.

##### NEMA Sizes 00–2, IEC Sizes A–K

Description	Catalog Number
25 to a package	C320DSTCVR

## Auxiliary Contacts

### Contact Configuration Code

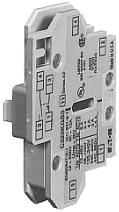

This two-digit code is found on the auxiliary contact to assist in identifying the specific contact configuration. The first digit indicates the quantity of NO contacts and the second indicates the quantity of NC contacts.

### NEMA Sizes 00–2—IEC Sizes A–K

The auxiliary contacts listed on this page are designed for installation on Freedom Series starters and contactors. Snap-on design facilitates quick, easy installation.

These bifurcated design contact blocks, featuring silver cadmium alloy contacts, are well suited for use in very low energy (logic level) circuits.

### NEMA Sizes 00–2—IEC Sizes A–K <sup>①</sup>

	Description	Contact Configuration Code <sup>②</sup>	Catalog Number
<b>Side Mounted</b> 	<b>Side Mounted</b>		
	1NO	10	C320KGS1
	1NC	01	C320KGS2
	1NO-1NC	11	C320KGS3
	2NO	20	C320KGS4
	2NC	02	C320KGS5
	1NO-1NCI	N/A	C320KGS6
	1NO (EC)-1NC (LO)	N/A	C320KGS7
	1NCI	N/A	C320KGS8
<b>Top Mounted</b> 	<b>Top Mounted</b>		
	1NO	10	C320KGT1
	1NC	01	C320KGT2
	1NO-1NC	11	C320KGT3
	2NO	20	C320KGT4
	2NC	02	C320KGT5
	1NO-1NCI	N/A	C320KGT6
	1NO (EC)-1NC (LO)	N/A	C320KGT7
	1NCI	N/A	C320KGT8
	3NO	30	C320KGT9
	2NO-1NC	21	C320KGT10
	1NO-2NC	12	C320KGT11
	3NC	03	C320KGT12
	4NO	40	C320KGT13
	3NO-1NC	31	C320KGT14
	2NO-2NC	22	C320KGT15
	1NO-3NC	13	C320KGT16
	4NC	04	C320KGT17
	3NO-1NCI	N/A	C320KGT18
	2NO-1NCI-1NC	N/A	C320KGT19
	2NO-1NO (EC)-1NC (LO)	N/A	C320KGT20
1NO-1NC-1NO (EC)-1NC (LO)	N/A	C320KGT21	

#### Notes

- ① NCI = Normally Closed early opening designed for use in reversing applications. EC = Early Closing. LO = Late Opening.
- ② For reference only—not part of catalog number.

# 2.1

## NEMA Contactors and Starters

Freedom Series

### NEMA Sizes 3–8—IEC Sizes L–Z

2

C320KGS42



#### Base Auxiliary Contacts— NEMA Sizes 3–5, IEC Sizes L–S

Circuit	Contact Configuration Code <sup>①</sup>	NEMA Size 3 IEC Sizes L–N Catalog Number	NEMA Sizes 4–5 IEC Sizes P–S Catalog Number
NO	10	C320KGS31	C320KGS41
NO-NC	11	C320KGS32	C320KGS42

C320KGS22



#### Auxiliary Contacts—NEMA Sizes 3–5, IEC Sizes L–S

Circuit	Contact Configuration Code <sup>①</sup>	Catalog Number
NO	10	C320KGS20
NC	01	C320KGS21
NO-NC <sup>②</sup>	11	C320KGS22

#### Sealed Logic Level

Circuit	Contact Configuration Code <sup>①</sup>	Catalog Number
NO	10	C320KGS20L
NC	01	C320KGS21L
NO-NC <sup>③</sup>	11	C320KGS22L

#### Auxiliary Contacts—NEMA Sizes 6–8, IEC Sizes T–Z

Circuit	Contact Configuration Code <sup>①</sup>	Size	Catalog Number
NO-NC	11	NEMA 8, IEC Z	C320KA5
2NO-2NC	22	NEMA 6–7	C320KA6
2NO-2NC	22	IEC T–X	C320KA8

### Auxiliary Contact Ratings (Amperes)

#### Ratings—NEMA A600

Current	AC Volts			
	120V	240V	480V	600V
Make	60	30	15	12
Break	6	3	1.5	1
Continuous	10	10	10	10

#### Ratings—NEMA P300

Continuous Thermal Rating: 5A

DC Volts	Make/Break Amperes
125	1.10
250	0.55

#### Ratings—Logic Level

##### Minimum Ratings for Logic Level and Hostile Atmosphere Application

Minimum Amperes	20 mA
Minimum Volts	24 Vac/Vdc

#### Ratings C320KGS20L, C320KGS21L, C320KGS22L

DC-12		AC-12	
$U_e$	$I_e$	$U_e$	$I_e$
80	0.1	250	0.1

#### Notes

<sup>①</sup> For reference only—not part of catalog number.

<sup>②</sup> NO-NC occupies two position—L2 and L3, or R2 and R3. See figure on **Page V5-T2-27**.

<sup>③</sup> Form C contacts.

## Auxiliary Contact Location

### NEMA Sizes 00–2, IEC Sizes A–K

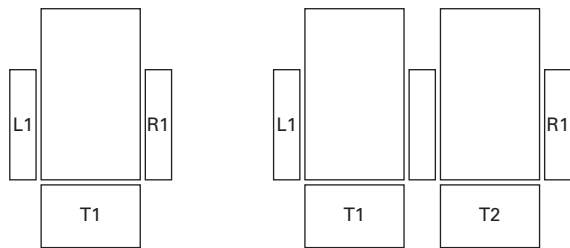
The sketches below illustrate the maximum number of auxiliary contacts that can be assembled to a contactor or starter and their locations.

assembled to a contactor or starter and their locations.

### Auxiliary Contacts

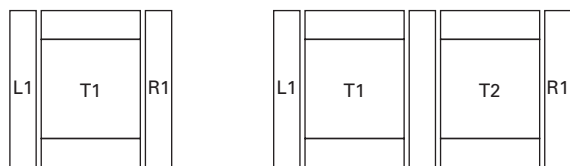
Size	Poles	Available Mounting Positions <sup>①②</sup>		Catalog Number
		Open Type	Enclosed	
A–K	3	T1, L1	L1	<b>AE16</b>
00	3	T1, L1, R1	L1	<b>AN16</b>
0–2	3	T1, L1	L1	
A–K	3	L1, R1	L1, R1	<b>AE56</b>
00–2	3	T1, T2	—	<b>AN56</b>
A–C	2–4	T1, L1, R1	L1, R1	<b>CE15</b>
D–K	3	T1, L1	L1	
G–J	4	T1, R1	—	
G–J	5	T1	—	
00	2–4	T1, L1, R1	L1	<b>CN15</b>
0–2	2–3	T1, L1	L1	
1, 2	4	T1, L1	—	
1, 2	5	T1, L1	—	
10A	2–4	T1, L1, R1	L1	<b>CN35</b>
20–60A	2–3	T1, L1	L1	
60A	4	T1, L1	—	
60A	5	T1, L1	—	
A–K	3	L1, R1	L1, R1	<b>CE55</b>
00–2	3	T1, T2	—	<b>CN55</b>

### Auxiliary Contact Location



Top View

Top View



Front View

Front View

**Non-Reversing Contactors and Starters**

**Reversing Contactors and Starters**

### NEMA Sizes 3–8, IEC Sizes L–Z

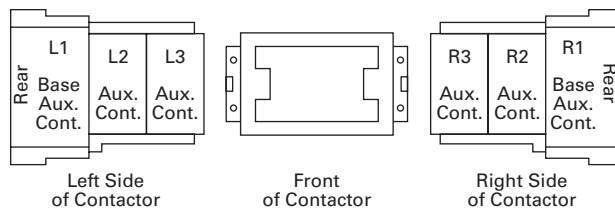
The sketches below illustrate the maximum number of auxiliary contacts that can be assembled to a contactor and their locations.

**Note:** A base auxiliary contact must be added in position R1 before additional auxiliary contacts can be mounted on NEMA Size 3 and IEC Sizes L–N, or in L1 on NEMA Sizes 4–5 and IEC Sizes P–S.

### Mounting Positions

Size	Available Mounting Positions <sup>①</sup>
NEMA Size 3, IEC Sizes L–N	R2, R3, L1, L2, L3
NEMA Sizes 4–5, IEC Sizes P–S	L2, L3, R1, R2, R3
NEMA Sizes 6–7, IEC Sizes T–X	R1
NEMA Size 8, IEC Size Z	L2, R2

### Auxiliary Contact Location

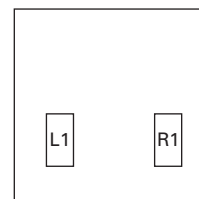


Left Side of Contactor

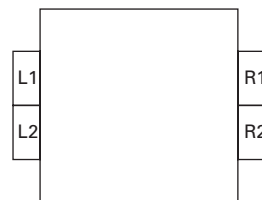
Front of Contactor

Right Side of Contactor

**NEMA Sizes 3–5  
IEC Sizes L–S**



**NEMA Sizes 6–7  
IEC Sizes T, U, V, W and X**



**NEMA Size 8  
IEC Size Z**

### Notes

- ① Available positions on contactors or starters other than what is factory installed.
- ② When a pneumatic timer is mounted on contactor, only side mounted auxiliary contact positions are available. The solid-state timer, when added, takes up side mounted auxiliary contact position.



### DC Magnet Coils

#### When Ordering Specify

#### Conversion Kit for Field Assembly

- Catalog number

#### Factory Installed DC Coil

- For factory installed DC magnet coil on AC contactors or non-combination starters (open type only), substitute the code suffix from the table on this page for the magnet coil identifier in the device catalog number. EXAMPLE: For Size 0 AC contactor with a 24 Vdc coil, change AN16BN0AC to AN16BN0T1C

#### Application

- Connect for separate control
- Not for use with cover control switch operators
- Use twin break, heavy-duty pilot devices
- Designed for +10%, -20% rated voltage, continuous duty operation

#### Non-Reversing Kit Consists of:

- One encapsulated DC magnet coil
- One NCI or NO/NCI side mounted auxiliary contact

**Note:** These kits are supplied with a NO/NCI side mounted auxiliary contact in place of the NCI contact.

- Two blue colored connection wires
- One instruction publication

#### Operation

See next page for operation details.

### DC Magnet Coils

Contactor or Starter Size	IEC	Volts	Conversion Data			NCI Interlock	Complete Conversion Kit		Factory Installed Code Suffix
			Magnet Coil	Amps P.U./Seal	Watts P.U./Seal		Catalog Number	Ship Wt. Lbs (kg)	
NEMA			Coil Number						
<b>Non-Reversing—Kit Includes NCI Side Mounted Auxiliary Contact</b>									
00 and 0 CN35–A, B, D D15 Relays	A–F	12	<b>9-2988-11</b>	6.4/0.28	76.8/3.36	<b>C320KGD1</b>	<b>C335KD3R1</b>	1.0 (0.5)	<b>R1</b>
		24	<b>9-2988-12</b>	3.2/0.14	76.8/3.36	<b>C320KGD1</b>	<b>C335KD3T1</b>		<b>T1</b>
		48	<b>9-2988-13</b>	1.6/0.07	76.8/3.36	<b>C320KGD1</b>	<b>C335KD3W1</b>		<b>W1</b>
		120	<b>9-2988-14</b>	0.64/0.028	76.8/3.36	<b>C320KGD1</b>	<b>C335KD3A1</b>		<b>A1</b>
① 00 and 0 CN35–A, B, D D15 Relays	A–F	12	<b>9-2988-11</b>	6.4/0.28	76.8/3.36	<b>C320KGD2</b> ①	<b>C335KD3R4</b>	1.0 (0.5)	<b>R4</b>
		24	<b>9-2988-12</b>	3.2/0.14	76.8/3.36	<b>C320KGD2</b> ①	<b>C335KD3T4</b>		<b>T4</b>
		48	<b>9-2988-13</b>	1.6/0.07	76.8/3.36	<b>C320KGD2</b> ①	<b>C335KD3W4</b>		<b>W4</b>
		120	<b>9-2988-14</b>	0.64/0.028	76.8/3.36	<b>C320KGD2</b> ①	<b>C335KD3A4</b>		<b>A4</b>
1 and 2 CN35–G	G–K	12	<b>9-2990-1</b>	15.4/0.42	185/4.98	<b>C320KGD5</b>	<b>C335KD4R4</b>	1.0 (0.5)	<b>R4</b>
		24	<b>9-2990-2</b>	7.7/0.21	185/4.96	<b>C320KGD5</b>	<b>C335KD4T4</b>		<b>T4</b>
		48	<b>9-2990-3</b>	3.9/0.11	185/5.04	<b>C320KGD5</b>	<b>C335KD4W4</b>		<b>W4</b>
		120	<b>9-2990-4</b>	1.5/0.041	185/4.87	<b>C320KGD5</b>	<b>C335KD4A4</b>		<b>A4</b>
3 CN35–K	L–N	12	<b>9-3002-1</b>	24/0.40	293/4.84	<b>C320KGD3</b>	<b>C335KD5R1</b>	2.0 (0.9)	<b>R1</b>
		24	<b>9-3002-2</b>	12/0.20	288/4.75	<b>C320KGD3</b>	<b>C335KD5T1</b>		<b>T1</b>
		48	<b>9-3002-3</b>	6.1/0.097	295/4.67	<b>C320KGD3</b>	<b>C335KD5W1</b>		<b>W1</b>
		120	<b>9-3002-4</b>	2.5/0.038	298/4.57	<b>C320KGD3</b>	<b>C335KD5A1</b>		<b>A1</b>
4 and 5 CN35–N, S	P–S	24	<b>9-2026-4</b>	18/0.22	400/5.3	<b>C320KGD3</b>	<b>C335KA3T1</b>	2.5 (1.1)	<b>T1</b>
		48	<b>9-2026-3</b>	9/0.11	400/5.2	<b>C320KGD3</b>	<b>C335KA3W1</b>		<b>W1</b>
		120	<b>9-2026-2</b>	3.3/0.05	450/5.4	<b>C320KGD3</b>	<b>C335KA3A1</b>		<b>A1</b>
		240	<b>9-2026-1</b>	1.7/0.02	440/4.9	<b>C320KGD3</b>	<b>C335KA3B1</b>		<b>B1</b>
<b>Reversing</b>									
00 and 0 CN35–A, B, D D15 relays	A–F	12	<b>(2) 9-2988-1</b>	6.4/0.28	76.8/3.36	<b>(2) C320KGD1</b>	<b>C335RD3R1</b> ②	1.0 (0.5)	<b>R1</b> ③
		24	<b>(2) 9-2988-2</b>	3.2/0.14	76.8/3.36	<b>(2) C320KGD1</b>	<b>C335RD3T1</b> ②		<b>T1</b> ③
		48	<b>(2) 9-2988-3</b>	1.6/0.07	76.8/3.36	<b>(2) C320KGD1</b>	<b>C335RD3W1</b> ②		<b>W1</b> ③
		120	<b>(2) 9-2988-4</b>	0.64/0.028	76.8/3.36	<b>(2) C320KGD1</b>	<b>C335RD3A1</b> ②		<b>A1</b> ③
1 and 2 CN35–G	G–K	12	<b>(2) 9-2990-1</b>	15.4/0.42	185/4.98	<b>(2) C320KGD3</b> ④	—	—	<b>R1</b> ③
		24	<b>(2) 9-2990-2</b>	7.7/0.21	185/4.96	<b>(2) C320KGD3</b> ④	—		<b>T1</b> ③
		48	<b>(2) 9-2990-3</b>	3.9/0.11	185/5.04	<b>(2) C320KGD3</b> ④	—		<b>W1</b> ③
		120	<b>(2) 9-2990-4</b>	1.5/0.041	185/4.87	<b>(2) C320KGD3</b> ④	—		<b>A1</b> ③

#### Notes

- ① These kits are supplied with a NO/NCI side mounted auxiliary contact in place of the NCI contact.
- ② Kit does not include mechanical interlock or crossover wiring. Two NO/NCI top mounted auxiliary contacts are supplied for electrical interlocking.
- ③ Factory installed DC coils on NEMA contactors and starters include a NO/NC top mounted auxiliary contact on each contactor for electrical interlocking. On IEC contactors and starters, a NC top mounted auxiliary contact is supplied on each contactor for electrical interlocking.
- ④ Available factory assembled only.

### Operation

These DC coil kits have separate pick-up and seal windings. A **special** (side mounted) early-break NCI auxiliary contact is used to either disconnect the pick-up winding or insert the seal winding in series with the pick-up winding, depending on the frame size of the contactor. DC coil kits come in two styles, a suffix **1** and a suffix **4**. Suffix 1 contains only the **special** (side mounted) early break NCI auxiliary contact. Suffix 4 contains a NO contact in the same package as the **special** (side mounted) early-break NCI auxiliary contact.

**Note:** For NEMA Sizes 00 and 0 and IEC Sizes A–F, contactors

may utilize either suffix 1 or 4 DC coil kits; starters may utilize suffix 4 DC coil kits only. For NEMA Sizes 1 and 2 and IEC Sizes G–K, both contactors and starters may utilize a suffix 4 DC coil kit only.

On the above sizes only, when the **special** auxiliary package is mounted on the side of a contactor or starter, **no** standard auxiliary contact may be mounted on the same side.

**Note:** For NEMA Sizes 3–5 and IEC Sizes L–S, special coil NCI clearing contact is an add-on auxiliary (**must** mount on a base mount auxiliary contact; normally a 1NO). This arrangement will normally account for two of the three contact positions on the side of each contactor or starter.

### Competitive Mounting Plates

The C321 adapter plates permit direct replacement of competitive starters with Freedom Series starters without drilling and tapping new mounting holes. Allen-Bradley 509, Eaton's A10

(adapter plate not required for replacing A10 Starter Sizes 1, 4 and 5), Furnas 14, ESP100, General Electric CR206, CR306, Siemens SXL, Square D 8536, Westinghouse A200, B200.

#### C321CMP1



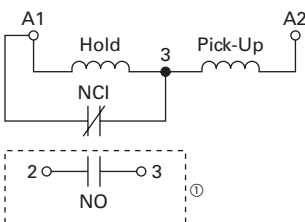
#### Competitive Mounting Plates

Freedom NEMA Size	Index Number <sup>②</sup> Catalog Number
00, 0	C321CMP0
1	C321CMP1
2	C321CMP2
3	C321CMP3
4	C321CMP4
5	C321CMP5

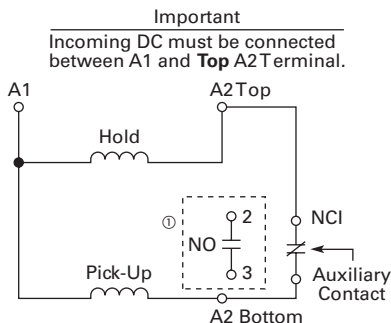
#### Note

- ① 1NO available in Suffix 4 kits only.
- ② Handling number only—does not appear on product. The handling number is stamped on the carton label only.

### Elementary Diagrams



DC Coil Elementary Diagram for NEMA Sizes 1–3 and IEC Sizes G–N Contactors and Starters



DC Coil Elementary Diagram for NEMA Sizes 00, 0, 4 and 5 and IEC Sizes A–F and P–S Contactors and Starters

# 2.1

## NEMA Contactors and Starters

### Freedom Series

2

### Special Modifications

For Catalog Numbers AN19, AN16, AN59, AN56, CE15, CN15, CN35, CN55

Addition or Special Feature	Starter Size —NEMA									
	00	0	1/—	2	3	4	5	6	7	8
<b>Control Circuit</b>										
Extra auxiliary circuit, factory installed NO or NC—each contact <sup>①②</sup>	Consult sales office for pricing adders.									
Transient suppressor <sup>①</sup>	Consult sales office for pricing adders.									
<b>Power Circuit</b>										
Contactor/starter for ring lug capability—add Mod Code <b>T16</b> to catalog number <sup>③</sup> (Power terminals only, control terminals as standard) Standalone overload relays can not accept ring lugs on line side	Consult sales office for pricing adders.									
<b>Factory Installed Dust Covers</b>										
Factory installed C320DSTCVR—add Mod Code <b>-53</b> to catalog number <sup>①</sup>						NA	NA	NA	NA	NA

### Renewal Parts

For a complete listing of parts, refer to the Renewal Parts Publication Number referenced below.

For Catalog Numbers AN19, AN16, AN30, AN40, AN59, AN56, AN70, AN80, AN800, CN15, CN35 <sup>④</sup> and CN55 Contactors and Starters (Size 00, 0)

Description	NEMA Size 00		NEMA Size 0	
	Series B1 Part No.	Series C1 Part No.	Series B1 Part No.	Series C1 Part No.
<b>Renewal Parts Publication Number</b>	<b>22177</b>	<b>22177</b>	<b>22177</b>	<b>22177</b>
<b>Contact Kits</b>				
Two-pole	⑤	⑤	⑤	⑤
Three-pole	⑤	⑤	⑤	⑤
Four-pole	⑤	⑤	⑤	⑤
Five-pole	⑤	⑤	⑤	⑤
<b>Magnet Coils</b>				
	<b>Coil Suffix</b>			
120V 60 Hz or 110V 50 Hz	<b>A</b>	<b>9-2875-1</b>	<b>9-2875-1</b>	<b>9-2876-1</b>
240V 60 Hz or 220V 50 Hz	<b>B</b>	<b>9-2875-2</b>	<b>9-2875-2</b>	<b>9-2876-2</b>
480V 60 Hz or 440V 50 Hz	<b>C</b>	<b>9-2875-3</b>	<b>9-2875-3</b>	<b>9-2876-3</b>
600V 60 Hz or 550V 50 Hz	<b>D</b>	<b>9-2875-4</b>	<b>9-2875-4</b>	<b>9-2876-4</b>
208V 60 Hz	<b>E</b>	<b>9-2875-5</b>	<b>9-2875-5</b>	<b>9-2876-5</b>
277V 60 Hz	<b>H</b>	<b>9-2875-12</b>	<b>9-2875-12</b>	<b>9-2876-12</b>
208/240V 60 Hz	<b>J</b>	<b>9-2875-37</b>	<b>9-2875-37</b>	<b>9-2876-37</b>
240V 50 Hz	<b>K</b>	<b>9-2875-11</b>	<b>9-2875-11</b>	<b>9-2876-11</b>
380–415V 50 Hz	<b>L</b>	<b>9-2875-6</b>	<b>9-2875-6</b>	<b>9-2876-6</b>
380V 50 Hz	<b>L</b>	—	—	—
415V 50 Hz	<b>M</b>	—	—	—
550V 50 Hz	<b>N</b>	—	—	—
24V 60 Hz—24V 50 Hz	<b>T</b>	<b>9-2875-36</b>	<b>9-2875-36</b>	<b>9-2876-36</b>
24V 60 Hz	<b>T</b>	—	—	—
24V 50 Hz	<b>U</b>	<b>9-2875-36</b>	<b>9-2875-36</b>	<b>9-2876-36</b>
32V 50 Hz	<b>V</b>	<b>9-2875-16</b>	<b>9-2875-16</b>	<b>9-2876-16</b>
48V 60 Hz	<b>W</b>	<b>9-2875-8</b>	<b>9-2875-8</b>	<b>9-2876-8</b>
48V 50 Hz	<b>Y</b>	<b>9-2875-9</b>	<b>9-2875-9</b>	<b>9-2876-9</b>
<b>Magnet Frame Armature</b>				
Lower magnet frame	⑤	⑤	⑤	⑤
Upper magnet frame	⑤	⑤	⑤	⑤

#### Notes

- ① These modifications are generally available in kit form at lower cost. See specific product sections for kit listings.
- ② Terminal extensions provided on Size 2 and up; not required for Size 1.
- ③ The T16 modifications are only available on C306 overloads and the following three-pole devices: CN15, CN55, AN16, AN56 and AN700 (separate winding only).  
The 45 mm and 65 mm frames (NEMA Size 0–2) reversing devices (CN55B, CN55D, CN55G, AN56B, AN56D, AN56G, AN700 and AN700G) with the T16 modification are supplied without crossover wires.
- ④ CN35A = Size 00, CN35B and CN35D = Size 0, CN35G = Size 2, CN35K = Size 3, CN35N = Size 4, and CN35S = Size 5.
- ⑤ Replace with complete contactor.

For Catalog Numbers AN19, AN16, AN30, AN40, AN59, AN56, AN70, AN80, AN800, CN15, CN35 <sup>Ⓢ</sup> and CN55 Contactors and Starters (Size 1, 2)

Description	NEMA Size 1		NEMA Size 2		NEMA Size 3
	Series A1 Part No.	Series B1 Part No.	Series A1 Part No.	Series B1 Part No.	
<b>Renewal Parts Publication Number</b>	20861	22177	20861	22177	20426
<b>Contact Kits</b>					
Two-pole	6-65	6-65	6-65-7	6-65-7	6-43-5
Three-pole	6-65-2	6-65-2	6-65-8	6-65-8	6-43-6
Four-pole	6-65-9	6-65-9	6-65-15	6-65-15	—
Five-pole	6-65-10	6-65-10	6-65-16	6-65-16	—
<b>Magnet Coils</b>	<b>Coil Suffix</b>				
120V 60 Hz or 110V 50 Hz	<b>A</b>	9-3285-1	9-3285-1	9-3285-1	9-2756-1 KIT
240V 60 Hz or 220V 50 Hz	<b>B</b>	9-3285-2KIT	9-3285-2KIT	9-3285-2KIT	9-2756-2 KIT
480V 60 Hz or 440V 50 Hz	<b>C</b>	9-2703-3 KIT	9-2703-3 KIT	9-2703-3 KIT	9-2756-3 KIT
600V 60 Hz or 550V 50 Hz	<b>D</b>	9-2703-4 KIT	9-2703-4 KIT	9-2703-4 KIT	9-2756-4 KIT
208V 60 Hz	<b>E</b>	9-3285-9KIT	9-3285-9KIT	9-3285-9KIT	9-2756-5 KIT
277V 60 Hz	<b>H</b>	9-2703-7 KIT	9-2703-7 KIT	9-2703-7 KIT	9-2756-9 KIT
208/240V 60 Hz	<b>J</b>	—	—	—	—
240V 50 Hz	<b>K</b>	9-2703-14 KIT	9-2703-14 KIT	9-2703-14 KIT	9-2756-13 KIT
380–415V 50 Hz	<b>L</b>	9-2703-8 KIT	9-2703-8 KIT	9-2703-8 KIT	—
380V 50 Hz	<b>L</b>	—	—	—	9-2756-12 KIT
415V 50 Hz	<b>M</b>	—	—	—	9-2756-8 KIT
550V 50 Hz	<b>N</b>	—	—	—	9-2756-14 KIT
24V 60 Hz–24V 50 Hz	<b>T</b>	—	—	—	—
24V 60 Hz	<b>T</b>	9-3285-6KIT	9-3285-6KIT	9-3285-6KIT	9-2756-6 KIT
24V 50 Hz	<b>U</b>	9-3285-12KIT	9-3285-12KIT	9-3285-12KIT	9-2756-11 KIT
32V 50 Hz	<b>V</b>	9-2703-10 KIT	9-2703-10 KIT	9-2703-10 KIT	9-2756-10 KIT
48V 60 Hz	<b>W</b>	9-2703-11 KIT	9-2703-11 KIT	9-2703-11 KIT	9-2756-15 KIT
48V 50 Hz	<b>Y</b>	9-2703-13 KIT	9-2703-13 KIT	9-2703-13 KIT	9-2756-7 KIT
<b>Magnet Frame Armature</b>					
Lower magnet frame		17-18200	17-18200	17-18200	17-18200 KIT
Upper magnet frame		48-1936	48-1936	48-1936	48-1936 KIT

**Note**

<sup>Ⓢ</sup> CN35A = Size 00, CN35B and CN35D = Size 0, CN35G = Size 2, CN35K = Size 3, CN35N = Size 4, and CN35S = Size 5.

# 2.1

## NEMA Contactors and Starters

### Freedom Series

For a complete listing of parts, refer to the Renewal Parts Publication Number referenced below.

For Catalog Numbers AN19, AN16, AN30, AN40, AN59, AN56, AN70, AN80, AN800, CN15, CN35 <sup>①</sup> and CN55 Contactors and Starters (Size 4, 5, 6)

2

Description	NEMA Size 4		NEMA Size 5		NEMA Size 6		
	Series A1 Part No.	Series B1 Part No.	Series A1 Part No.	Series B1 Part No.	Contact and Starter Series A1, Starter Series B1 Part No.	Contact and Starter Series B1, Starter Series C1 Part No.	
<b>Renewal Parts Publication Number</b>	20428	20428	20429	20429	20146	23349	
<b>Contact Kits</b>							
Two-pole	6-44	6-26	6-45	6-45	6-601-2	—	
Three-pole	6-44-2	6-26-2	6-45-2	6-45-2	6-601	6-648	
<b>Magnet Coils</b>							
	<b>Coil Suffix</b>						
120V 60 Hz or 110V 50 Hz	<b>A</b>	9-1891-1 KIT	9-1891-1 KIT	9-1891-1 KIT	9-1891-1 KIT	9-2698	9-3006
240V 60 Hz or 220V 50 Hz	<b>B</b>	9-1891-2 KIT	9-1891-2 KIT	9-1891-2 KIT	9-1891-2 KIT	9-2698-2	9-3006-2
480V 60 Hz or 440V 50 Hz	<b>C</b>	9-1891-3 KIT	9-1891-3 KIT	9-1891-3 KIT	9-1891-3 KIT	9-2698-3	9-3006-3
600V 60 Hz or 550V 50 Hz	<b>D</b>	9-1891-4 KIT	9-1891-4 KIT	9-1891-4 KIT	9-1891-4 KIT	9-2698-4	9-3006-4
208V 60 Hz	<b>E</b>	9-1891-13 KIT	9-1891-13 KIT	9-1891-13 KIT	9-1891-13 KIT	9-2698-5	—
277V 60 Hz	<b>H</b>	9-1891-26 KIT	9-1891-26 KIT	9-1891-26 KIT	9-1891-26 KIT	—	—
208/240V 60 Hz	<b>J</b>	—	—	—	—	—	—
240V 50 Hz	<b>K</b>	9-1891-20 KIT	9-1891-20 KIT	9-1891-20 KIT	9-1891-20 KIT	—	—
380–415V 50 Hz	<b>L</b>	—	—	—	—	9-2698-6	9-3006-7
380V 50 Hz	<b>L</b>	9-1891-14 KIT	9-1891-14 KIT	9-1891-14 KIT	9-1891-14 KIT	—	—
415V 50 Hz	<b>M</b>	9-1891-21 KIT	9-1891-21 KIT	9-1891-21 KIT	9-1891-21 KIT	—	—
550V 50 Hz	<b>N</b>	9-1891-8 KIT	9-1891-8 KIT	9-1891-8 KIT	9-1891-8 KIT	—	—
24V 60 Hz–24V 50 Hz	<b>T</b>	—	—	—	—	—	9-3006-8
24V 60 Hz	<b>T</b>	9-1891-15 KIT	9-1891-15 KIT	9-1891-15 KIT	9-1891-15 KIT	—	—
24V 50 Hz	<b>U</b>	9-1891-16 KIT	9-1891-16 KIT	9-1891-16 KIT	9-1891-16 KIT	—	—
48V 60 Hz	<b>W</b>	—	—	—	—	9-2698-8	9-3006-9
48V 50 Hz	<b>Y</b>	9-1891-18 KIT	9-1891-18 KIT	9-1891-18 KIT	9-1891-18 KIT	—	—
<b>Overload Relays</b>							
For replacement on existing starters three-pole—ambient compensated bimetallic <sup>②</sup>	10-6530-4	10-6530-4	C306DN3B	C306DN3B	C306DN3B	C306DN3B	
For replacement on existing AN19 / AN59 starters—C440 solid-state overload	—	④	—	④	—	④	
<b>Current Transformer</b>	—	—	42-3564	42-3564	42-3598	42-3598	
<b>Magnet Frame Armature <sup>③</sup></b>							
Lower Magnet Frame	48-1030-2	48-1030-2	48-1030-2	48-1030-2	—	—	
Upper Magnet Frame	48-1029-4	48-1029-4	48-1029-4	48-1029-4	—	—	

### Feeder Group Renewal <sup>⑤</sup>

Volts	Hertz	NEMA Size 4		NEMA Size 5		NEMA Size 6	
		Series A1	Series B1	Series A1	Series B1	Contact and Starter Series A1, Starter Series B1 Part No.	Contact and Starter Series B1, Starter Series C1 Part No.
110–120	50/60	—	—	—	—	9-2705	9-3007
220–240	50/60	—	—	—	—	9-2705-2	9-3007-2
440–480	50/60	—	—	—	—	9-2705-3	9-3007-3
550–600	50/60	—	—	—	—	9-2705-4	9-3007-4
208	50/60	—	—	—	—	9-2705-5	9-3007-5
380–415	50/60	—	—	—	—	9-2705-6	9-3007-7
48–52	50/60	—	—	—	—	9-2705-8	9-3007-9
24	50/60	—	—	—	—	9-2705-9	9-3007-8

#### Notes

- ① CN35A = Size 00, CN35B and CN35D = Size 0, CN35G = Size 2, CN35K = Size 3, CN35N = Size 4, and CN35S = Size 5.
- ② Not for use with AN19 and AN59 starters.
- ③ Consult factory.
- ④ See C440 electronic overload relay chart for C440 overload replacement options.
- ⑤ Voltage ratings of the main coils must match those of the feeder group for proper operation of the starter/contactors.

For a complete listing of parts, refer to the Renewal Parts Publication Number referenced below.

For Catalog Numbers AN16, AN30, AN40, AN56, AN70, AN80, AN800, CN15, CN35 <sup>①</sup> and CN55 Contactors and Starters (Size 7, 8)

Description	NEMA Size 7		NEMA Size 8	
	Series A1 Part No.	Series B1 Part No.	Series A1 Part No.	Series B1 Part No.
<b>Renewal Parts Publication Number</b>	<b>20848</b>	<b>20848</b>	<b>20849</b>	<b>20849</b>
<b>Contact Kits</b>				
Two-pole	—	—	—	—
Three-pole	<b>6-613</b>	<b>6-613</b>	<b>6-571</b>	<b>6-571</b>
<b>Magnet Coils</b>				
	<b>Coil Suffix</b>			
120V 60 Hz or 110V 50 Hz	<b>A</b>	<b>9-2698</b>	<b>9-2698</b>	<b>9-2654</b>
240V 60 Hz or 220V 50 Hz	<b>B</b>	<b>9-2698-2</b>	<b>9-2698-2</b>	<b>9-2654-2</b>
480V 60 Hz or 440V 50 Hz	<b>C</b>	<b>9-2698-3</b>	<b>9-2698-3</b>	<b>9-2654-3</b>
600V 60 Hz or 550V 50 Hz	<b>D</b>	<b>9-2698-4</b>	<b>9-2698-4</b>	<b>9-2654-4</b>
208V 60 Hz	<b>E</b>	<b>9-2698-5</b>	<b>9-2698-5</b>	<b>9-2654-6</b>
277V 60 Hz	<b>H</b>	—	—	—
208/240V 60 Hz	<b>J</b>	—	—	—
240V 50 Hz	<b>K</b>	—	—	—
380–415V 50 Hz	<b>L</b>	—	—	—
380V 50 Hz	<b>L</b>	<b>9-2698-6</b>	<b>9-2698-6</b>	<b>9-2654-5</b>
415V 50 Hz	<b>M</b>	—	—	—
550V 50 Hz	<b>N</b>	—	—	—
24V 60 Hz–24V 50 Hz	<b>T</b>	—	—	—
24V 60 Hz	<b>T</b>	—	—	—
24V 50 Hz	<b>U</b>	—	—	—
32V 50 Hz	<b>V</b>	—	—	—
48V 60 Hz	<b>W</b>	—	—	—
48V 50 Hz	<b>Y</b>	—	—	—
<b>Overload Relays</b>				
For replacement on existing starters three-pole—ambient compensated bimetallic <sup>②</sup>	<b>C306DN3B</b>	<b>C306DN3B</b>	<b>C306DN3B</b>	<b>C306DN3B</b>
<b>Current Transformer</b>	<b>42-3598-2</b>	<b>42-3598-2</b>	<b>42-3598-3</b>	<b>42-3598-3</b>
<b>Magnet Frame Armature <sup>③</sup></b>				
Lower magnet frame	—	—	—	—
Upper magnet frame	—	—	—	—

**Notes**

- ① CN35A = Size 00, CN35B and CN35D = Size 0, CN35G = Size 2, CN35K = Size 3, CN35N = Size 4, and CN35S = Size 5.
- ② Not for use with AN19 and AN59 starters.
- ③ Consult factory.

# 2.1

## NEMA Contactors and Starters

### Freedom Series

#### C440 Electronic Overload Relays

2

45 mm C440 for Direct Mount



#### C440 Electronic Overload Relays for Direct Mount to Freedom Series Contactors

For Use with Freedom NEMA Contactor Size	For Use with Contactor ①	Overload Range (Amps)	Standard Feature Set Catalog Number	Standard Feature Set with Ground Fault Catalog Number
00	CN15AN3_B	0.33–1.65	C440A1A1P6SF00	C440A2A1P6SF00
		1–5	C440A1A005SF00	C440A2A005SF00
		4–20	C440A1A020SF00	C440A2A020SF00
0	CN15BN3_B	0.33–1.65	C440A1A1P6SF0	C440A2A1P6SF0
		1–5	C440A1A005SF0	C440A2A005SF0
		4–20	C440A1A020SF0	C440A2A020SF0
1	CN15DN3_B	0.33–1.65	C440A1A1P6SF1	C440A2A1P6SF1
		1–5	C440A1A005SF1	C440A2A005SF1
		4–20	C440A1A020SF1	C440A2A020SF1
		9–45	C440A1A045SF1	C440A2A045SF1
2	CN15GN3_B	1–5	C440A1A005SF2	C440A2A005SF2
		4–20	C440A1A020SF2	C440A2A020SF2
		9–45	C440A1A045SF2	C440A2A045SF2
3	CN15KN3_	20–100	C440B1A100SF3	C440B2A100SF3
4	CN15NN3_	28–140	C440C1A140SF4	C440C2A140SF4

1–5 A OL with CTs



#### C440 Electronic Overload Relays for use with NEMA Contactors Sizes 5–8

Use CTs and 1–5 A C440 overload relay. CT kit does not include overload relay (order separately).

For Use with NEMA Contactor Size	CT Range (Amps)	Description	CT Kit Catalog Number ②	Terminal Size	Overload Relay Catalog Number
5	60–300	300: 5 panel-mount CT kit with integrated, pass through holes	ZEB-XCT300	750 kcmil (2) 250 kcmil 3/0 Cu/Al	C440A1A005SAX
6	120–600	600: 5 panel-mount CT kit with integrated, pass through holes	ZEB-XCT600	(2) 750 kcmil 3/0 Cu/Al	C440A1A005SAX
7	200–1000	1000: 5 panel-mount CT kit with integrated, pass through holes	ZEB-XCT1000	(3) 750 kcmil 3/0 Cu/Al	C440A1A005SAX
8	300–1500	1500: 5 panel-mount CT kit with integrated, pass through holes	ZEB-XCT1500	(4) 750 kcmil 1/0 Cu/Al	C440A1A005SAX

#### Notes

① CN15 contactor listed is non-reversing with a 120 Vac coil. For more options, see Tab 2 in this volume, section 2.1.

② ZEB kits are not recommended for use with C440 overload relays with ground fault option.

### Feeder Group Renewal <sup>①</sup>

Volts	Hertz	NEMA Size 7		NEMA Size 8	
		Series A1	Series B1	Series A1	Series B1
110–120	50/60	9-2705	9-2705	—	—
220–240	50/60	9-2705-2	9-2705-2	—	—
440–480	50/60	9-2705-3	9-2705-3	—	—
550–600	50/60	9-2705-4	9-2705-4	—	—
208	50/60	9-2705-5	9-2705-5	—	—
380–415	50/60	9-2705-6	9-2705-6	—	—
48–52	50/60	9-2705-8	9-2705-8	—	—
120	50/60	—	—	9-2664	9-2664
240	50/60	—	—	9-2664-2	9-2664-2
480	50/60	—	—	9-2664-3	9-2664-3
600	50/60	—	—	9-2664-4	9-2664-4
380	50/60	—	—	9-2664-5	9-2664-5
208	50/60	—	—	9-2664-6	9-2664-6
415	50/60	—	—	9-2664-7	9-2664-7
110	50/60	—	—	9-2664-8	9-2664-8
220	50/60	—	—	9-2664-9	9-2664-9
550	50/60	—	—	9-2664-10	9-2664-10
440	50/60	—	—	9-2664-11	9-2664-11

### Technical Data and Specifications

All data is based on a standard contactor with no auxiliary devices and a 120 Vac or 24 Vdc magnet coil. Coil data has a ±5% range depending on the application, therefore specific data may vary.

#### Coil Data Notes

- P.U. Pick-up time is the average time taken from closing of the coil circuit to main contact touch
- D.O. Drop-out time is the average time taken from opening of the coil circuit to main contact separation
- Cold Coil data with a cold coil
- Hot Coil data with a hot coil

#### Note

① Voltage ratings of the main coils must match those of the feeder group for proper operation of the starter/contactator.



# 2.1

## NEMA Contactors and Starters

### Freedom Series

#### Specifications—Sizes 00–3

2

Description	Contactor Catalog Number/Size				
	CN15A NEMA Size 00	CN15B NEMA Size 0	CN15D NEMA Size 1	CN15G NEMA Size 2	CN15K NEMA Size 3
<b>Configuration</b>					
Number of poles	2, 3, 4	2, 3	2, 3, 4, 5	2, 3, 4, 5	2, 3
Auxiliary contacts, standard	4th pole NO (1)	Side NO (1)	Side NO (1)	Side NO (1)	Side NO (1)
Add-on auxiliary contacts	Top (4) or side (4)	Top (4) or side (3)	Top (4) or side (3)	Top (4) or side (3)	Left side (4) or right side (3)
Frame size	45 mm	45 mm	65 mm	65 mm	90 mm
Maximum voltage rating	600 Vac	600 Vac	600 Vac	600 Vac	600 Vac
Continuous ampere ratings (I)	9A	18A	27A	45A	90A
<b>Maximum Horsepower (hp)</b>					
Single-phase					
115V	1/3	1	2	3	7-1/2
230V	1	2	3	7-1/2	15
Three-phase					
200V	1-1/2	3	7-1/2	10	25
230V	1-1/2	3	7-1/2	15	30
460V	2	5	10	25	50
575V	2	5	10	25	50
<b>AC Magnet Coil Data</b>					
Pick-up volts—cold	85%	85%	85%	85%	85%
Pick-up volts—hot	85%	85%	85%	85%	85%
Pick-up voltamperes	80	100	230	230	390
Pick-up watts	49	65	95	95	112
Sealed voltamperes	7.5	10	28	28	49.8
Sealed watts	2.4	3.1	7.8	7.8	13
Drop-out volts—cold	75%	75%	75%	75%	75%
Drop-out volts—hot	75%	75%	75%	75%	75%
Maximum operation rate—ops/hour	12,000	12,000	12,000	12,000	7,200
Pick-up time (ms)	12	12	20	20	14
Drop-out time (ms)	12	12	14	14	11
Coil operating range % of rated voltage	-15% to +10%	-15% to +10%	-15% to +10%	-15% to +10%	-15% to +10%
DC magnet coil data	For DC magnet coils (and coil data), see Accessories, <b>Pages V5-T2-28 and V5-T2-29.</b>	For DC magnet coils (and coil data), see Accessories, <b>Pages V5-T2-28 and V5-T2-29.</b>	For DC magnet coils (and coil data), see Accessories, <b>Pages V5-T2-28 and V5-T2-29.</b>	For DC magnet coils (and coil data), see Accessories, <b>Pages V5-T2-28 and V5-T2-29.</b>	For DC magnet coils (and coil data), see Accessories, <b>Pages V5-T2-28 and V5-T2-29.</b>
Operating temperature	-20° to 65°C	-20° to 65°C	-20° to 65°C	-20° to 65°C	-20° to 65°C
Maximum operating altitude (ft)	6000	6000	6000	6000	6000
Mechanical life	20,000,000	20,000,000	10,000,000	10,000,000	6,000,000
<b>Electrical Life (480V/60 Hz)</b>					
AC-3	4,000,000	3,000,000	5,000,000	3,500,000	1,700,000
AC-4	90,000	85,000	200,000	62,000	80,000
<b>Wire Range</b>					
Power terminals	12–16 stranded, 12–14 solid Cu	8–16 stranded, 10–14 solid Cu	8–14 stranded or solid Cu	2–14 (upper) and/or 6–14 (lower) stranded or solid Cu	1/0–14 Cu
Control terminals	12–16 stranded, 12–14 solid Cu	12–16 stranded, 12–14 solid Cu	12–16 stranded, 12–14 solid Cu	12–16 stranded, 12–14 solid Cu	12–16 stranded, 12–14 solid Cu
Power terminal torque Line and load—lb-in	7	15	20	40 (14–8 AWG) 45 (6–4 AWG) 50 (3 AWG)	35 (14–10 AWG) 40 (8 AWG) 45 (6–4 AWG) 50 (3–1/0 AWG)
Auxiliary contact rating	A600, P300	A600, P300	A600, P300	A600, P300	A600, P300

## Specifications—Sizes 4–8

Description	Contactor Catalog Number/Size				
	CN15N NEMA Size 4	CN15S NEMA Size 5	CN15T NEMA Size 6	CN15U NEMA Size 7	CN15V NEMA Size 8
<b>Configuration</b>					
Number of poles	2, 3	2, 3	3	3	3
Auxiliary contacts, standard	Side NO (1)	Side NO (1)	Top left 2NO/2NC (1)	Top left 2NO/2NC (1)	Side 2NO/NC (1)
Add-on auxiliary contacts	Left side (3) or right side (4)	Left side (3) or right side (4)	Top right 2NO/2NC (1)	Top right 2NO/2NC (1)	NO/NC (2)
Frame size	180 mm	180 mm	280 mm	280 mm	334 mm
Maximum voltage rating	600 Vac	600 Vac	600 Vac	600 Vac	600 Vac
Continuous ampere ratings (I)	135A	270A	540A	810A	1215A
<b>Maximum Horsepower (hp)</b>					
Single-phase					
115V	—	—	—	—	—
230V	—	—	—	—	—
Three-phase					
200V	40	75	150	200	400
230V	50	100	200	300	450
460V	100	200	400	600	900
575V	100	200	400	600	900
<b>AC Magnet Coil Data</b>					
Pick-up volts—cold	85%	85%	85%	85%	85%
Pick-up volts—hot	85%	85%	85%	85%	85%
Pick-up voltamperes	1158	1158	1600	1600	2450
Pick-up watts	240	240	1345	1345	2060
Sealed voltamperes	100	100	25	25	75
Sealed watts	27.2	27.2	22	22	60
Drop-out volts—cold	75%	75%	①	①	①
Drop-out volts—hot	75%	75%	①	①	①
Maximum operation rate—ops/hour	2400	2400	N/A	N/A	N/A
Pick-up time (ms)	28	25	105	105	70
Drop-out time (ms)	14	13	200	200	50
Coil operating range % of rated voltage	–15% to +10%	–15% to +10%	–15% to +10%	–15% to +10%	–15% to +10%
DC magnet coil data	For DC magnet coils (and coil data), see Accessories, <b>Pages V5-T2-28 and V5-T2-29.</b>	For DC magnet coils (and coil data), see Accessories, <b>Pages V5-T2-28 and V5-T2-29.</b>	For DC magnet coils (and coil data), see Accessories, <b>Pages V5-T2-28 and V5-T2-29.</b>	For DC magnet coils (and coil data), see Accessories, <b>Pages V5-T2-28 and V5-T2-29.</b>	For DC magnet coils (and coil data), see Accessories, <b>Pages V5-T2-28 and V5-T2-29.</b>
Operating temperature	–20° to 65°C	–20° to 65°C	–20° to 65°C	–20° to 65°C	–20° to 65°C
Maximum operating altitude (ft)	6000	6000	6000	6,000	6000
Mechanical life	5,000,000	5,000,000	5,000,000	5,000,000	5,000,000
<b>Electrical Life (480V/60 Hz)</b>					
AC-3	800,000	500,000	590,000	450,000	420,000
AC-4	70,000	34,000	7400	5000	4200
<b>Wire Range</b>					
Power terminals	Open—3/0–8 Cu; Enclosed—250 kcmil– 6 Cu/Al	750 kcmil—2 or (2) 250 kcmil—3/0 Cu/Al	(2) 750 kcmil—3/0 Cu/Al	(3) 750 kcmil—3/0 Cu/Al	(4) 750 kcmil—1/0 Cu/Al
Control Terminals	12–16 stranded, 12–14 solid Cu	12–16 stranded, 12–14 solid Cu	12–16 stranded, 12–14 solid Cu	12–16 stranded, 12–14 solid Cu	12–16 stranded, 12–14 solid Cu
Power terminal torque line and load—lb-in	200	550	550	550	500
Auxiliary contact rating	A600, P300	A600, P300	A600, P300	A600, P300	A600, P300

**Note**

① 20–30% of rated coil voltage.

# 2.1

## NEMA Contactors and Starters

### Freedom Series

2

#### Electrical Life—AC-3 and AC-4 Utilization Categories

##### Life Load Curves

Eaton's Freedom Series NEMA contactors have been designed and manufactured for superior life performance in any worldwide application. All testing has been based on requirements as found in NEMA and UL standards and conducted by Eaton. Actual application life may vary depending on environmental conditions and application duty cycle.

##### Utilization Categories

The International Electrotechnical Commission (IEC) has developed utilization categories for contactors and auxiliary contacts. The IEC utilization categories are used to define the type of electrical load for estimating electrical life, and do not imply the devices are IEC rated.

AC-1—Non-inductive or slightly inductive loads, such as resistance furnaces and heating.

AC-2—Starting of slip-ring motors.

AC-3—Squirrel cage motors; starting, switching off motors during running.

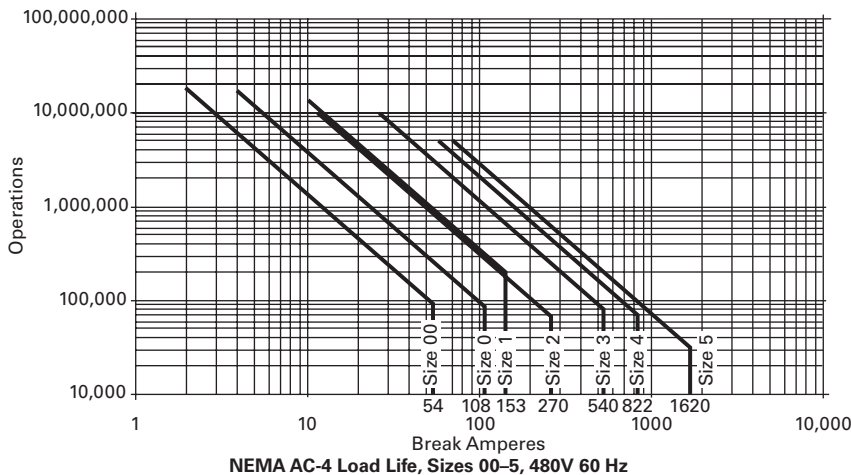
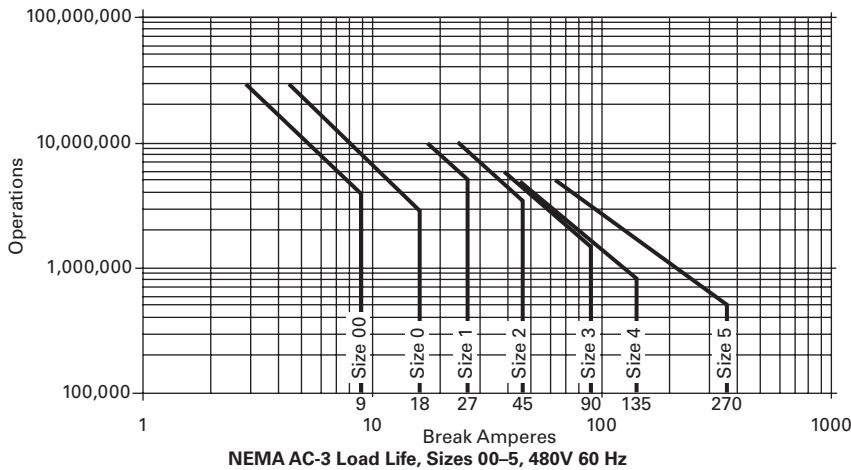
AC-4—Squirrel cage motors; starting, plugging, inching or jogging.

**Note:** AC-3 tests are conducted at rated device currents and AC-4 tests are conducted at six times rated device currents. All tests have been run at 460V, 60 Hz.

##### Contactor Choice

- Decide what utilization category your application is and choose the appropriate curve
- Locate the intersection of the life-load curve of the appropriate contactor with the applications operational current ( $I_o$ ), as found on the horizontal axis
- Read the estimated contact life along the vertical axis in number of operational cycles

#### AC-3 and AC-4 Utilization Categories



C440/XT Electronic Overload Relay

2



## C440/XT Electronic Overload Relay

### Product Description

Eaton's new electronic overload relay (EOL) is the most compact, high-featured, economical product in its class. Designed on a global platform, the new EOL covers the entire power control spectrum including NEMA, IEC and DP contactors. The NEMA and DP versions are offered with the *C440* designation while the IEC offering has the *XT* designation. The electronic design provides reliable, accurate and value driven protection and communications capabilities in a single compact device. It is the flexible choice for any application requiring easy-to-use, reliable protection.

Eaton has a long history of innovations and product development in motor control and protection, including both traditional NEMA, as well as IEC control. It was from this experience that the C440 was developed, delivering new solutions to meet today's demands.

C440 is a self-powered electronic overload relay available up to 175A as a self contained unit. With external CTs, C440 can protect motor up to 1500 FLA. Available add-on accessories include remote reset capability and communication modules with I/O for DeviceNet, PROFIBUS, and Modbus.

## Contents

### Description

	<i>Page</i>
Contactors—Non-Reversing and Reversing . . . . .	<b>V5-T2-4</b>
Starters—Three-Phase Non-Reversing and Reversing, Full Voltage . . . . .	<b>V5-T2-10</b>
Starters—Single-Phase Non-Reversing, Full Voltage, Bi-Metallic Overload . . . . .	<b>V5-T2-15</b>
Accessories . . . . .	<b>V5-T2-21</b>
Renewal Parts . . . . .	<b>V5-T2-30</b>
Technical Data and Specifications . . . . .	<b>V5-T2-35</b>
Relays—Thermal Overload. . . . .	<b>V5-T2-39</b>
C440/XT Electronic Overload Relay	
Standards and Certifications . . . . .	<b>V5-T2-49</b>
Catalog Number Selection . . . . .	<b>V5-T2-50</b>
Product Selection . . . . .	<b>V5-T2-51</b>
Accessories . . . . .	<b>V5-T2-53</b>
Technical Data and Specifications . . . . .	<b>V5-T2-55</b>
Dimensions . . . . .	<b>V5-T2-61</b>

### Features and Benefits

#### Features

- Reliable, accurate, electronic motor protection
- Easy to select, install and maintain
- Compact size
- Flexible, intelligent design
- Global product offering—available with NEMA, IEC and DP power control

#### Size/Range

- Broad FLA range (0.33–1500A)
- Selectable trip class (10A, 10, 20, 30)
- Direct mounting to NEMA, IEC and DP contactors
- Most compact electronic overload in its class

#### Motor Control

- Two B600 alarm (NO) and fault (NC) contacts
- Test/Trip button

#### Motor Protection

- Thermal overload
- Phase loss
- Selectable (ON/OFF) phase unbalance
- Selectable (ON/OFF) ground fault

#### User Interface

- Large FLA selection dial
- Trip status indicator
- Operating mode LED
- DIP switch selectable trip class, phase unbalance and ground fault
- Selectable Auto/Manual reset

#### Feature Options

- Remote reset
  - 120 Vac
  - 24 Vac
  - 24 Vdc
- Tamper-proof cover
- Communications modules
  - Modbus RTU RS-485
  - DeviceNet with I/O
  - PROFIBUS with I/O
  - Modbus RTU with I/O
  - Ethernet IP with I/O
  - Modbus TCP with I/O

**Benefits**

**Reliability and Improved Uptime**

- C440 provides the users with peace of mind knowing that their assets are protected with the highest level of motor protection and communication capability in its class
- Extends the life of plant assets with selectable motor protection features such as trip class, phase unbalance and ground fault
- Protects against unnecessary downtime by discovering changes in your system (line/load) with remote monitoring capabilities
- Status LED provides added assurance that valuable assets are protected by indicating the overload operational status

**Flexibility**

- Available with NEMA, IEC and DP contactors
- Improves return on investment by reducing inventory carrying costs with wide FLA adjustment (5:1) and selectable trip class
- Design incorporates built-in ground fault protection thus eliminating the need for separate CTs and modules
- Flexible communication with optional I/O enables easy integration into plant management systems for remote monitoring and control
- Available as an open component and in enclosed control and motor control center assemblies

**Monitoring Capabilities**

- Individual phase currents RMS
- Average three-phase current RMS
- Thermal memory
- Fault indication (overload, phase loss, phase unbalance, ground fault)

**Safety**

- IP 20 rated terminal blocks
- Available in Eaton's industry leading FlashGard MCCs
- Tested to the highest industry standards such as UL, CSA, CE and IEC
- RoHS compliant

**Standards and Certifications**

- UL
- CSA
- CE
- NEMA
- IEC/EN 60947 VDE 0660
- ISO 13849-1 (EN954-1)
- RoHS
- ATEX directive 94/9/EC
- Equipment Group 2, Category 2



**Electronic Overload Education**

Description	Definition	Cause	Effect if not Protected	C440/XT Protection
<b>Motor Protection</b>				
Thermal overload	Overload is a condition in which current draw exceeds 115% of the full load amperage rating for an inductive motor.	<ul style="list-style-type: none"> <li>• An increase in the load or torque that is being driven by the motor.</li> <li>• A low voltage supply to the motor causes the current to go high to maintain the power needed.</li> <li>• A poor power factor causing above normal current draw.</li> </ul>	<ul style="list-style-type: none"> <li>• Increase in current draw leads to heat and insulation breakdown, which can cause system failure.</li> <li>• Increase in current can increase power consumption and waste valuable energy.</li> </ul>	<ul style="list-style-type: none"> <li>• Thermal trip behavior is defined by UL, CSA and IEC standards.</li> <li>• Trip class is settable from 10A, 10, 20, 30</li> </ul>
Ground fault	A line to ground fault.	A current leakage path to ground.	An undetected ground fault can burn through multiple insulation windings, ultimately leading to motor failure, not to mention risk to equipment or personnel	Fixed protective setting that takes the starter offline if ground fault current exceeds 50% of the FLA dial setting, that is, if the FLA dial is set to 12A, the overload relay will trip if the ground current exceeds 6A.
Unbalanced phases (voltage and current)	Uneven voltage or current between phases in a three-phase system.	When a three-phase load is powered with a poor quality line, the voltage per phase may be unbalanced.	Unbalanced voltage causes large unbalanced currents and as a result this can lead to motor stator windings being overloaded, causing excessive heating, reduced motor efficiency and reduced insulation life.	Fixed protective setting that takes the starter offline if a phase drops below 50% of the other two phases.
Phase loss—current (single-phasing)	One of the three-phase voltages is not present.	Multiple causes, loose wire, improper wiring, grounded phase, open fuse, and so on.	Single-phasing can lead to unwanted motor vibrations in addition to the results of unbalanced phases as listed above.	Fixed protective setting that takes the starter offline if a phase drops below 50% of the other two phases.

# 2.1

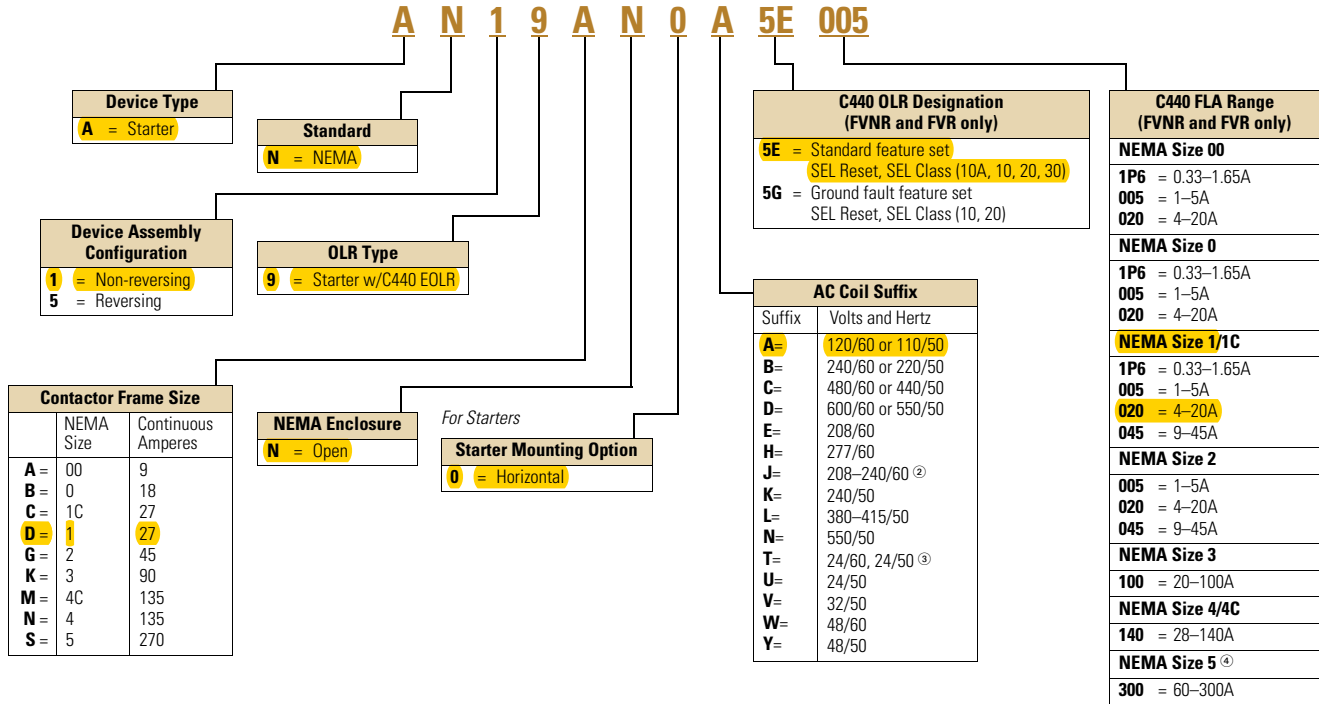
## NEMA Contactors and Starters

### Freedom Series

#### Catalog Number Selection

2

#### Freedom Series NEMA Starters with C440 Electronic Overload Relays <sup>①</sup>



#### Notes

- ① See Page V5-T2-51 for Product Selection.
- ② NEMA Sizes 00 and 0 only.
- ③ NEMA Sizes 00 and 0 only. Sizes 1–3 are 24/60 only.
- ④ NEMA Size 5 starter available with 60–300A panel mounted CTs. Starter shipped as an assembled unit with 1–5A C440 overload relay (C440A1A005SELAX or C440A2A005SELAX).

### Product Selection

#### Type AN19/59 Freedom Series Starters

#### Type AN19/59 Freedom Series Starters with C440 Electronic Overload Relays

##### NEMA Starter



#### Non-Reversing and Reversing

NEMA Size	Continuous Ampere Rating	Service Limit Current Rating (Amps)	Maximum UL Horsepower						Three-Pole Non-Reversing <sup>①②</sup> Catalog Number	Three-Pole Reversing <sup>①②</sup> Catalog Number
			Single-Phase		Three-Phase		480V	600V		
			115V	230V	208V	240V				
00	9	11	1/3	1	1-1/2	1-1/2	2	2	AN19AN0_5E_	AN59AN0_5E_
0	18	21	1	2	3	3	5	5	AN19BN0_5E_	AN59BN0_5E_
1	27	32	2	3	7-1/2	7-1/2	10	10	AN19DN0_5E_	AN59DN0_5E_
2	45	52	3	7-1/2	10	15	25	25	AN19GN0_5E_	AN59GN0_5E_
3	90	104	—	—	25	30	50	50	AN19KN0_5E_	AN59KN0_5E_
4	135	156	—	—	40	50	100	100	AN19NN0_5E_	AN59NN0_5E_
5 <sup>③</sup>	270	311	—	—	75	100	200	200	AN19SN0_5E_	AN59SN0_5E_

#### Type AN19/59 Freedom Series Starters with C440 with Ground Fault Electronic Overload Relays

##### NEMA Starter with Ground Fault



#### Non-Reversing and Reversing

NEMA Size	Continuous Ampere Rating	Service Limit Current Rating (Amps)	Maximum UL Horsepower						Three-Pole Non-Reversing <sup>①②</sup> Catalog Number	Three-Pole Reversing <sup>①②</sup> Catalog Number
			Single-Phase		Three-Phase		480V	600V		
			115V	230V	208V	240V				
00	9	11	1/3	1	1-1/2	1-1/2	2	2	AN19AN0_5G_	AN59AN0_5G_
0	18	21	1	2	3	3	5	5	AN19BN0_5G_	AN59BN0_5G_
1	27	32	2	3	7-1/2	7-1/2	10	10	AN19DN0_5G_	AN59DN0_5G_
2	45	52	3	7-1/2	10	15	25	25	AN19GN0_5G_	AN59GN0_5G_
3	90	104	—	—	25	30	50	50	AN19KN0_5G_	AN59KN0_5G_
4	135	156	—	—	40	50	100	100	AN19NN0_5G_	AN59NN0_5G_
5 <sup>③</sup>	270	311	—	—	75	100	200	200	AN19SN0_5G_	AN59SN0_5G_

#### Coil Suffix Codes

Suffix	Coil Volts and Hertz	Suffix	Coil Volts and Hertz
A	120/60 or 110/50	L	380–415/50
B	240/60 or 220/50	N	550/50
C	480/60 or 440/50	T	24/60, 24/50
D	600/60 or 550/50	U	24/50
E	208/60	V	32/50
H	277/60	W	48/60
J	208–240/60	Y	48/50
K	240/50		

#### C440 FLA Range (FVNR and FVR Starters Only)

NEMA Size	OLR Code	FLA Range	OLR Code	FLA Rating
00	1P6	0.33–1.65A	020	4.0–20A
	005	1.0–5.0A	—	—
0	1P6	0.33–1.65A	020	4.0–20A
	005	1.0–5.0A	—	—
1	1P6	0.33–1.65A	020	4.0–20A
	005	1.0–5.0A	045	9.0–45A
2	005	1.0–5.0A	045	9.0–45A
	020	4.0–20A	—	—
3	100	20–100A	—	—
4	140	28–140A	—	—
5 <sup>③</sup>	300	60–300A	—	—

#### Notes

- ① Underscore ( \_ ) indicates coils suffix required, see Coil Suffix table above.
- ② Underscore ( \_ ) indicates OLR designation required, see C440 FLA Range table above.
- ③ NEMA Size 5 starter available with 60-300A panel mounted CTs. Starter shipped as an assembled unit with 1–5A C440 overload relay (C440A1A005SELAX or C440A2A005SELAX).

# 2.1

## NEMA Contactors and Starters

### Freedom Series

#### Compact NEMA Size 1 and 4 Starters

New Compact NEMA Size 1 and 4 starters—available with electronic overload relay **only**.

2

#### Non-Reversing

NEMA Size	Continuous Ampere Rating	Service Limit Current Rating (Amps)	Maximum UL Horsepower				480V	600V	Three-Pole Non-Reversing Catalog Number
			Single-Phase 115V	230V	208V	240V			
<b>Standard Fault Overload</b>									
1C	27	32	2	3	7.5	7.5	10	10	AN19CN0_5E_
4C	135	156	—	—	40	50	100	100	AN19MN0_5E_
<b>Ground Fault Overload</b>									
1C	27	32	2	3	7.5	7.5	10	10	AN19CN0_5G_
4C	135	156	—	—	40	50	100	100	AN19MN0_5G_

#### Electrical Life at Rated Continuous Current

NEMA Size	Rated Current (Amperage)		Operations	NEMA Size	Rated Current (Amperage)		Operations
	AC3/AC4	Operations			AC3/AC4	Operations	
1C	27/150	2,500,000/40,000		4C	135/516	500,000/40,000	
1	27/153	5,000,000/110,000		4	135/822	800,000/70,000	

#### AN19 Competitive Retrofit Kits

The retrofit kits provide a packaged solution to replace competitive starters with the Freedom AN19 starter using existing hole patterns. Suitable for replacement of Allen-Bradley, Square D, GE and Siemens starters.

#### Kit contents

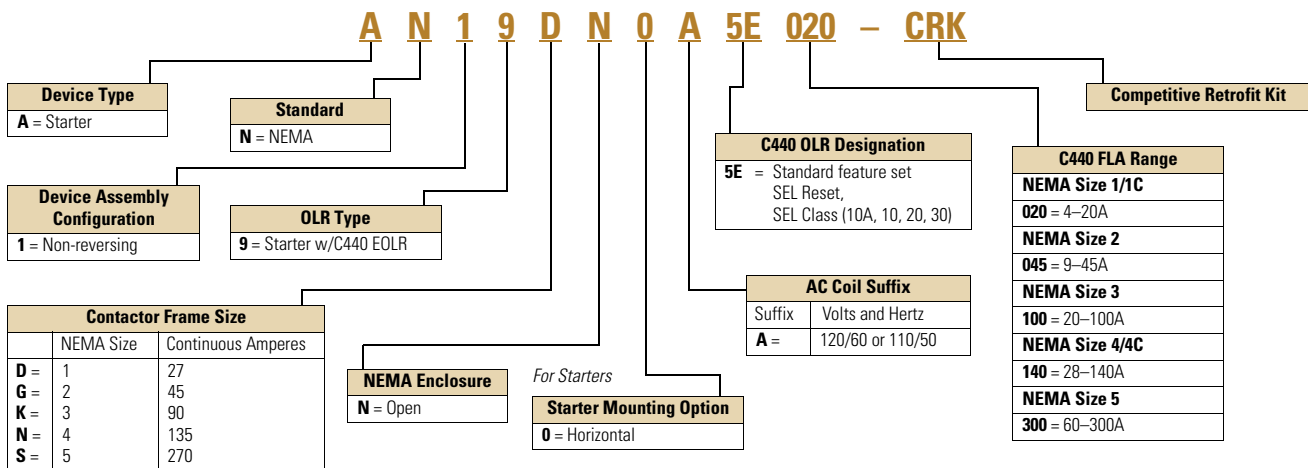
- Competitive mounting plate
- AN19 starter
- Remote reset module
- NO 10250T pushbutton
- RESET pushbutton legend plate
- 16 gauge control wire



#### AN19 Competitive Retrofit Kit—Product Selection

Size	Description	Catalog Number
1	120 Vac coil, 4–20A overload	AN19DN0A5E020-CRK
2	120 Vac coil, 9–45A overload	AN19GN0A5E045-CRK
3	120 Vac coil, 20–100A overload	AN19KN0A5E100-CRK
4	120 Vac coil, 28–140A overload	AN19NN0A5E140-CRK
5	120 Vac coil, 60–300A overload	AN19SN0A5E300-CRK

#### AN19 Competitive Retrofit Kit—Catalog Number Selection








**Accessories**

**CT Kits**

**Accessories**

	Description	Catalog Number
<b>Safety Cover</b> 	<b>Safety Cover</b> Clear Lexan cover that mounts on top of the FLA dial and DIP switches when closed.	<b>ZEB-XSC</b>
<b>Reset Bar</b> 	<b>Reset Bar</b> Assembles to the top of the overload to provide a larger target area for door mounted reset operators.	<b>ZEB-XRB</b>
<b>Remote Reset</b> 	<b>Remote Reset</b> Remote reset module (24 Vdc) <sup>①</sup> <b>Remote reset module (120 Vac)</b> <sup>①</sup> Remote reset module (24 Vac) <sup>①</sup>	<b>C440-XCOM</b> <b>ZEB-XRR-120</b> <b>ZEB-XRR-24</b>

**Communication**

The C440/XTOE is provided with two levels of communication capability.

**Basic Communication via Expansion Module—Monitoring Only**

Basic communication on the C440 is accomplished using an expansion module (C440-XCOM). The expansion module plugs into the expansion bay on the C440 overload relay, enabling communications with the overload via their Modbus RTU (RS-485) network. No additional cards or modules are required. See figure below.



**Basic Communication—Modbus**

**Advanced Communication—Monitoring and Control**

C440 also has the ability to communicate on industrial protocols such as Modbus RTU, DeviceNet, PROFIBUS, Modbus TCP, and EtherNet/IP while providing control capability using I/O.

An expansion module (C440-XCOM) combined with a communication module allows easy integration onto the customer's network. See figure below.

C440 communication modules, wired to the C440-XCOM give C440 control capability via communications. The communication modules offer flexible mounting options (DIN rail or panel) along with four inputs (24 Vdc or 120 Vac) and two outputs as standard.



**Advanced Communication—Communication Module**

**Note**

<sup>①</sup> Customer can wire remote mounted button to reset module (that is, 22 mm pushbutton, catalog number M22-D-B-GB14-K10).

# 2.1

## NEMA Contactors and Starters

### Freedom Series

2

The following information can be viewed using the communication option:

- Motor status—running, stopped, tripped or resetting
- Individual rms phase currents (A, B, C)
- Average of three-phase rms current
- Percent thermal capacity
- Fault codes (only available prior to reset)
- Percent phase unbalance
- Ground fault current and percent
- Overload relay settings—trip class, DIP switch selections, reset selections
- Modbus address (can be set over the network)

#### Features and Benefits

##### Ethernet modules

- Single device supports both EtherNet/IP, Modbus TCP
- Internal switch with two Ethernet ports allows linear or ring network configurations
- Embedded web-services for easy configuration and monitoring with Internet Explorer

##### DeviceNet

- I/O assemblies with the same size and layout as the legacy Advantage (WPONIDNA) and **IT** (DSNAP) Starter platforms for seamless upgrades to C441 technology with no program changes
- Communication uses only one DeviceNet MAC ID

##### PROFIBUS

- Capable of baud rates up to 12 Mb
- Intuitive configuration with common PROFIBUS tools

##### Modbus

- Modbus address and baud rate can be changed easily with C441's user interface (C441M only)

##### Terminals



- Unique locking mechanism provides easy removal of terminal block with field wiring installed
- Marked terminals for ease of wiring and troubleshooting

##### On-board I/O assemblies

- Modules offer 4 IN / 2 OUT of network programmable I/O
- 24 Vdc or 120 Vac signal options
- Optical isolation protects the I/O and communication circuits from possible damage due to transients and ground loops
- Inputs feature user-definable debounce, which limits the effects of transients and electrical noise
- Outputs feature a user-definable state for loss of communication: hold last state, ON or OFF

#### Communication Accessories

Communication modules mount on their own to be used as stand-alone network based I/O or be wired to the C440-XCOM. Parts are available for purchase individually (see "consists of" below) or as part of a kit for C440 communications.

	Description	Catalog Number
<b>Expansion Module</b> 	<b>Expansion Module</b>	
	Expansion module (Remote Reset/Modbus RTU, RS-485 Communication)	<b>C440-XCOM</b>
<b>Ethernet with I/O Module</b> 	<b>Communication Modules</b>	
	DeviceNet communication module kit—120 V I/O (consists of C440-XCOM + C441KS)	<b>C440-DN-120</b>
	DeviceNet communication module kit—24 Vdc I/O (consists of C440-XCOM + C441LS)	<b>C440-DN-24</b>
	PROFIBUS communication module kit—120 V I/O (consists of C440-XCOM + C441SS)	<b>C440-DP-120</b>
	PROFIBUS communication module kit—24 V I/O (consists of C440-XCOM + C441QS)	<b>C440-DP-24</b>
	Modbus communication module kit—120 V I/O (consists of C440-XCOM + C441NS)	<b>C440-MOD-120</b>
	Modbus communication module kit—24 Vdc I/O (consists of C440-XCOM + C441PS)	<b>C440-MOD-24</b>
	Modbus TCP/Ethernet IP communication module kit—120 V I/O (consists of C440-XCOM + C441U)	<b>C440-ET-120</b>
Modbus TCP/Ethernet IP communication module kit—24 V I/O (consists of C440-XCOM + C441V)	<b>C440-ET-24</b>	

## Technical Data and Specifications

### Electronic Overload Relays up to 1500A

Description	Specification		
	45 mm	55 mm	110 mm
<b>Electrical Ratings</b>	<b>Range</b>	<b>Range</b>	<b>Range</b>
Operating voltage (three-phase) and frequency	690 Vac (60/50 Hz)	690 Vac (60/50 Hz)	690 Vac (60/50 Hz)
<b>FLA Range</b>			
	0.33–1.65A 1–5A 4–20A 9–45A	20–100A	28–140A (NEMA) 35–175A (IEC)
<b>Use with Contactors</b>			
<b>X7</b> IEC frames	B, C, D	D, F, G	G, H
Freedom NEMA sizes	00, 0, 1, 2	3	4
<b>Trip Class</b>			
	10A, 10, 20, 30 Selectable	10A, 10, 20, 30 Selectable	10A, 10, 20, 30 Selectable
<b>Motor Protection</b>			
Thermal overload setting	1.05 x FLA: does not trip 1.15 x FLA: overload trip	1.05 x FLA: does not trip 1.15 x FLA: overload trip	1.05 x FLA: does not trip 1.15 x FLA: overload trip
<b>Feature</b>	<b>Range</b>	<b>Range</b>	<b>Range</b>
Phase loss	Fixed threshold 50%	Fixed threshold 50%	Fixed threshold 50%
Phase unbalance (selectable: enable/disable)	Fixed threshold 50%	Fixed threshold 50%	Fixed threshold 50%
Ground fault (selectable: enable/disable)	50% of FLA dial setting >150% = 2 sec >250% = 1 sec	50% of FLA dial setting >150% = 2 sec >250% = 1 sec	50% of FLA dial setting >150% = 2 sec >250% = 1 sec
Reset	Manual/automatic	Manual/automatic	Manual/automatic
<b>Indicators</b>			
Trip status	Orange flag	Orange flag	Orange flag
Mode LED	One flash: Overload operating properly Two flashes: Current is above FLA dial setting—pending trip	One flash: Overload operating properly Two flashes: Current is above FLA dial setting—pending trip	One flash: Overload operating properly Two flashes: Current is above FLA dial setting—pending trip
<b>Options</b>			
Remote reset	Yes	Yes	Yes
Reset bar	Yes	Yes	Yes
Communication expansion module	Yes	Yes	Yes
Communication adapter	Yes	Yes	Yes
<b>Capacity</b>			
Load terminals			
Terminal capacity	12–10 AWG (4–6 mm <sup>2</sup> ) 8–6 AWG (6–16 mm <sup>2</sup> )	6–1 AWG (16–50 mm <sup>2</sup> )	8–4/0 AWG (10–95 mm <sup>2</sup> )
Tightening torque	20–25 lb-in (2.3–2.8 Nm) 25–30 lb-in (2.8–3.4 Nm)	25–30 lb-in (2.8–3.4 Nm)	124 lb-in (14 Nm)
Input, auxiliary contact and remote reset terminals			
Terminal capacity	2 x (18–12) AWG	2 x (18–12) AWG	2 x (18–12) AWG
Tightening torque	7–11 lb-in (0.8–1.2 Nm)	7–11 lb-in (0.8–1.2 Nm)	7–11 lb-in (0.8–1.2 Nm)
<b>Voltages</b>			
Insulation voltage U <sub>i</sub> (three-phase)	690 Vac	690 Vac	690 Vac
Insulation voltage U <sub>i</sub> (control)	500 Vac	500 Vac	500 Vac
Rated impulse withstand voltage	6000 Vac	6000 Vac	6000 Vac
Overvoltage category/pollution degree	III/3	III/3	III/3

# 2.1

## NEMA Contactors and Starters

### Freedom Series

#### Electronic Overload Relays up to 1500A, continued

2

Description	Specification		
	45 mm	55 mm	110 mm
<b>Auxiliary and Control Circuit Ratings</b>			
Conventional thermal continuous current	5A	5A	5A
Rated operational current—IEC AC-15			
Make contact (1800 VA)			
120V	15A	15A	15A
240V	15A	15A	15A
415V	0.5A	0.5A	0.5A
500V	0.5A	0.5A	0.5A
Break contact (180 VA)			
120V	1.5A	1.5A	1.5A
240V	1.5A	1.5A	1.5A
415V	0.9A	0.9A	0.9A
500V	0.8A	0.8A	0.8A
IEC DC-13 (L/R F 15 ms1)			
0–250V	1.0A	1.0A	1.0A
Rated operational current—UL B600			
Make contact (3600 VA)			
120V	30A	30A	30A
240V	15A	15A	15A
480V	7.5A	7.5A	7.5A
600V	6A	6A	6A
Break contact (360 VA)			
120V	3A	3A	3A
240V	1.5A	1.5A	1.5A
480V	0.75A	0.75A	0.75A
600V	0.6A	0.6A	0.6A
R300—Vdc ratings (28 VA)			
0–120V	0.22A	0.22A	0.22A
250V	0.11A	0.11A	0.11A
<b>Short-Circuit Rating without Welding</b>			
Maximum fuse	6A gG/gL	6A gG/gL	6A gG/gL
<b>Environmental Ratings</b>			
Ambient temperature (operating)	–13° to 149°F (–25° to 65°C)	–13° to 149°F (–25° to 65°C)	–13° to 149°F (–25° to 65°C)
Ambient temperature (storage)	–40° to 185°F (–40° to 85°C)	–40° to 185°F (–40° to 85°C)	–40° to 185°F (–40° to 85°C)
Operating humidity UL 991 (H3)	5% to 95% non-condensing	5% to 95% non-condensing	5% to 95% non-condensing
Altitude (no derating) NEMA ICS1	2000m	2000m	2000m
Shock (IEC 600068-2-27)	15g any direction	15g any direction	15g any direction
Vibration (IEC 60068-2-6)	3g any direction	3g any direction	3g any direction
Pollution degree per IEC 60947-4-1	3 for product (2 for pcb)	3 for product (2 for pcb)	3 for product (2 for pcb)
Ingress protection	IP20	IP20	IP20
Protection against direct contact when actuated from front (IEC 536)	Finger- and back-of-hand proof	Finger- and back-of-hand proof	Finger- and back-of-hand proof
Mounting position	Any	Any	Any
Climatic proofing	Damp heat, constant to IEC 60068-2-30	Damp heat, constant to IEC 60068-2-30	Damp heat, constant to IEC 60068-2-30

## Electronic Overload Relays up to 1500A, continued

Description	Specification		
	45 mm	55 mm	110 mm
<b>Electrical/EMC</b>			
Radiated emissions IEC 60947-4-1-Table 15 EN 55011 (CISPIR 11) Group 1, Class A, ISM	30 mHz to 1000 mHz	30 mHz to 1000 mHz	30 mHz to 1000 mHz
Conducted emissions IEC 60947-4-1-Table 14 EN 55011 (CISPIR 11) Group 1; Class ISM	0.15 mHz to 30 mHz	0.15 mHz to 30 mHz	0.15 mHz to 30 mHz
ESD immunity IEC 60947-4-1 (Table 13)	±8 kV air, ±6 kV contact	±8 kV air, ±6 kV contact	±8 kV air, ±6 kV contact
Radiated immunity IEC 60947-4-1 IEC 61000-4-3	10 V/m 80 mHz–1000 mHz 3 V/m from 1.4 to 2.7 GHz 80% amplitude modulated 1 kHz sine wave	10 V/m 80 mHz–1000 mHz 3 V/m from 1.4 to 2.7 GHz 80% amplitude modulated 1 kHz sine wave	10 V/m 80 mHz–1000 mHz 3 V/m from 1.4 to 2.7 GHz 80% amplitude modulated 1 kHz sine wave
Conducted immunity IEC 60947-4-1, IEC 61000-4-6	140 dub (10V rms) 150 kHz–100 mHz	140 dub (10V rms) 150 kHz–100 mHz	140 dub (10V rms) 150 kHz–100 mHz
Fast transient immunity IEC 60947-4-1 (Table 13) IEC 61000-4-4	±4 kV using direct method with accessory installed in expansion bay ±2 kV using direct method	±4 kV using direct method with accessory installed in expansion bay ±2 kV using direct method	±4 kV using direct method with accessory installed in expansion bay ±2 kV using direct method
Surge immunity IEC 60947-4-1 (Table 13) IEC 61000-4-5 a Class 4	Three-phase power inputs: ±4 kV line-to-line (DM) ±4 kV line-to-ground (CM)  With accessory installed in expansion bay: ±2 kV line-to-line (DM) →1.2/50 us; 2 kV line-to-earth, 1 kV line-to-line ±4 kV line-to-ground (CM)	Three-phase power inputs: ±4 kV line-to-line (DM) ±4 kV line-to-ground (CM)  With accessory installed in expansion bay: ±2 kV line-to-line (DM) →1.2/50 us; 2 kV line-to-earth, 1 kV line-to-line ±4 kV line-to-ground (CM)	Three-phase power inputs: ±4 kV line-to-line (DM) ±4 kV line-to-ground (CM)  With accessory installed in expansion bay: ±2 kV line-to-line (DM) →1.2/50 us; 2 kV line-to-earth, 1 kV line-to-line ±4 kV line-to-ground (CM)
Power freq. magnetic field immunity IEC 60947-4-1, IEC 61000-4-8	30 A/m, 50 Hz	30 A/m, 50 Hz	30 A/m, 50 Hz
Electromagnetic field IEC 60947-4-1 Table 13, IEC 61000-4-3	10 V/m	10 V/m	10 V/m
Distortion IEEE 519	5% THD max., 5th harmonic 3% max.	5% THD max., 5th harmonic 3% max.	5% THD max., 5th harmonic 3% max.
Electrostatic discharge (ESD) IEC 61000-4-2, EN 61131-2	4 kV contact 8 kV air discharge	4 kV contact 8 kV air discharge	4 kV contact 8 kV air discharge
Electrical fast transient (EFT) IEC 61000-4-4, EN 61131-2	±2 kV using direct method	±2 kV using direct method	±2 kV using direct method
Surge immunity IEC 61000-4-5, EN 61131-2	±2 kV line-to-ground (CM)	±2 kV line-to-ground (CM)	±2 kV line-to-ground (CM)

## Communication Modules

2

Description	Modbus	DeviceNet	PROFIBUS	Ethernet
<b>Electrical/EMC</b>				
Radiated emissions IEC 60947-4-1—Table 15, EN 55011 (CISPR 11) Group 1, Class A	30–1000 mHz	30–1000 mHz	30–1000 mHz	30–1000 mHz
Conducted emissions IEC 60947-4-1—Table 14, EN 55011 (CISPR 11) Group 1, Class A	0.15–30 mHz	0.15–30 mHz	0.15–30 mHz	0.15–30 mHz
ESD immunity IEC 60947-4-1 (Table 13)	±8 kV air, ±4 kV contact	±8 kV air, ±4 kV contact	±8 kV air, ±4 kV contact	±8 kV air, ±4 kV contact
Radiated immunity IEC 60947-4-1	10 V/m 80–1000 mHz 80% amplitude modulated 1 kHz sine wave	10 V/m 80–1000 mHz 80% amplitude modulated 1 kHz sine wave	10 V/m 80–1000 mHz 80% amplitude modulated 1 kHz sine wave	10 V/m 80–1000 mHz 80% amplitude modulated 1 kHz sine wave
Conducted immunity IEC 60947-4-1	140 dBuV (10V rms) 150 kHz–80 mHz	140 dBuV (10V rms) 150 kHz–80 mHz	140 dBuV (10V rms) 150 kHz–80 mHz	140 dBuV (10V rms) 150 kHz–80 mHz
Fast transient immunity IEC 60947-4-1 (Table 13) IEC 6100-4-4	±2 kV using direct method	±2 kV supply and control, ±1 kV communication	±2 kV supply and control, ±1 kV communication	±2 kV supply and control, ±1 kV communication
Surge immunity IEC 60947-4-1 (Table 13) IEC 61000-4-5 Class 3	User IO and communication lines <sup>①</sup> : ±1 kV line-to-line (DM) ±2 kV line-to-ground (CM)	User IO and communication lines: ±0.5 kV line-to-line (DM) ±1 kV line-to-ground (CM)	User IO and communication lines: ±0.5 kV line-to-line (DM) ±1 kV line-to-ground (CM)	User IO and communication lines: ±0.5 kV line-to-line (DM) ±1 kV line-to-ground (CM)
Electromagnetic field <sup>①</sup> IEC 60947-4-1 (Table 13) IEC 61000-4-3	10 V/m	10 V/m	10 V/m	10 V/m
<b>Environmental Ratings</b>				
Ambient temperature (operating)	–4° to 122°F (–20° to 50°C)	–13° to 122°F (–25° to 50°C)	–13° to 122°F (–25° to 50°C)	–13° to 122°F (–25° to 50°C)
Ambient temperature (storage)	–40° to 185°F (–40° to 85°C)	–40° to 185°F (–40° to 85°C)	–40° to 185°F (–40° to 85°C)	–40° to 185°F (–40° to 85°C)
Operating humidity	5–95% noncondensing	5–95% noncondensing	5–95% noncondensing	5–95% noncondensing
Altitude (no derating)	2000m	2000m	2000m	2000m
Shock (IEC 60068-2-27)	15G any direction	15G any direction	15G any direction	15G any direction
Vibration (IEC 60068-2-6)	3G any direction	3G any direction	3G any direction	3G any direction
Pollution degree per IEC 60947-1	3	3	3	3
Degree of protection	IP20	IP20	IP20	IP20
Overvoltage category per UL 508	III	III	III	III
<b>DeviceNet</b>				
DeviceNet connections	—	Group 2, polling, bit strobe, explicit, no UCMM	—	—
DeviceNet baud rate	—	125K, 250K, 500K	—	—
<b>Ethernet</b>				
Ethernet connections	—	—	—	Integrated two-port switch with dual RJ45 Ethernet connections
Ethernet type	—	—	—	Ethernet 10/100 Mbs, AutoMDX, Auto Negotiation
<b>PROFIBUS</b>				
PROFIBUS connections	—	—	Group 2, polling, bit strobe, explicit, no UCMM	—
PROFIBUS baud rate	—	—	9.6K, 19.2K, 45.45K, 93.75K, 187.5K, 500K, 1.5M, 3M, 6M, 12M	—

**Note**

<sup>①</sup> Relates to C441M only.

## Communication Modules, continued

Description	Modbus	DeviceNet	PROFIBUS	Ethernet
<b>C441_ 24 Vdc Input</b>				
Nominal input voltage	24 Vdc	24 Vdc	24 Vdc	24 Vdc
Operating voltage	18–30 Vdc	18–30 Vdc	18–30 Vdc	18–30 Vdc
Number of inputs	4	4	4	4
Signal delay	5 ms (programmable to 65 sec)	5 ms (programmable to 65 sec)	5 ms (programmable to 65 sec)	5 ms (programmable to 65 sec)
OFF-state voltage	<6 Vdc	<6 Vdc	<6 Vdc	<6 Vdc
ON-state voltage	>18 Vdc	>18 Vdc	>10 Vdc	>18 Vdc
Nominal input current	5 mA	5 mA	5 mA	5 mA
Isolation	1500V	1500V	1500V	1500V
Terminal screw torque	7–9 in-lb	7–9 in-lb	7–9 in-lb	7–9 in-lb
24V source current	50 mA	50 mA	50 mA	50 mA
<b>Operating Voltage Range—DC Input Modules</b>				
OFF state	0–6 Vdc	0–6 Vdc	0–6 Vdc	0–6 Vdc
Transition region	6–18 Vdc	6–18 Vdc	6–18 Vdc	6–18 Vdc
ON state	18–30 Vdc	18–30 Vdc	18–30 Vdc	18–30 Vdc
<b>C441_ 120 Vac Input</b>				
Nominal input voltage	120 Vac	120 Vac	120 Vac	120 Vac
Operating voltage	80–140 Vac	80–140 Vac	80–140 Vac	80–140 Vac
Number of inputs	4	4	4	4
OFF-state voltage	<30 Vac	<30 Vac	<20 Vac	<30 Vac
ON-state voltage	>80 Vac	>80 Vac	>70 Vac	>80 Vac
Nominal input current	15 mA	15 mA	15 mA	15 mA
Signal delay	1/2 cycle	1/2 cycle	1/2 cycle	1/2 cycle
Isolation	1500V	1500V	1500V	1500V
Terminal screw torque	7–9 in-lb	7–9 in-lb	7–9 in-lb	7–9 in-lb
<b>Operating Voltage Range—AC Input Modules</b>				
OFF state	0–30 Vac	0–30 Vac	0–30 Vac	0–30 Vac
Transition region	30–80 Vac	30–80 Vac	30–80 Vac	30–80 Vac
ON state	80–140 Vac	80–140 Vac	80–140 Vac	80–140 Vac
<b>Output Modules</b>				
Nominal voltage	120 Vac 24 Vdc	120 Vac 24 Vdc	120 Vac 24 Vdc	120 Vac 24 Vdc
Number of outputs	(2) 1NO Form A 1NO/NC Form C	(2) 1NO Form A 1NO/NC Form C	(2) 1NO Form A 1NO/NC Form C	(2) 1NO Form A 1NO/NC Form C
Relay OFF time	3 ms	3 ms	3 ms	3 ms
Relay ON time	7 ms	7 ms	7 ms	7 ms
Max. current per point <sup>①</sup>	5A (B300 rated)	5A (B300 rated)	5A (B300 rated)	5A (B300 rated)
Electrical life	100,000 cycles	100,000 cycles	100,000 cycles	100,000 cycles
Mechanical life	1,000,000 cycles	1,000,000 cycles	1,000,000 cycles	1,000,000 cycles

**Note**

<sup>①</sup> Relates to C441M only.

# 2.1

## NEMA Contactors and Starters

### Freedom Series

2

#### Short Circuit Ratings (North America CSA, cUL)

Changes to UL 508A and NEC in recent years have brought a focus to control panel safety with regard to short-circuit current ratings (SCCR). Eaton's C440 electronic overload relays combined with **XT** series IEC and Freedom Series NEMA contactors provide a wide variety of SCCR solutions needed for a variety of applications. The SCCR data in this document reflects the latest information as of April 2010.

#### C440/XT Standalone Overload Relays (XT, C440)

Overload FLA Range	Maximum Operating Voltage	Standard-Fault Short Circuit Data			High-Fault Short Circuit Data Fuses (RK5, J, CC)			Thermal-Magnetic Circuit Breakers		
		600V (kA)	Maximum Fuse Size (A) (RK5)	Maximum Breaker Size (A)	480V (kA)	600V (kA)	Maximum Fuse Size	480V (kA)	600V (kA)	Maximum Breaker Size
0.33–1.65A	600 Vac	1	6	15	—	—	—	—	—	—
1–5A	600 Vac	5	20	20	100	100	30	100	35	20
4–20A	600 Vac	5	80	80	100	100	100	100	35	80
9–45A	600 Vac	5	175	175	100	100	100	100	35	100/175 (480/600)
20–100A	600 Vac	10	400	400	100	100	200	150	35	250/400 (480/600)
28–140A	600 Vac	10	450	500	100	100	400	100	65	400
35–175A	690 Vac	10	500 (gG)	350 (690 Vac) 320 (415 Vac)	100	100	500 (gG)	100 (415 Vac)	—	350 (LGC3350) 320 (N2MH3)

#### NEMA Freedom Series Starters with C440 Electronic Overload Relays

NEMA Size	Maximum Operating Voltage	High-Fault Short Circuit Data Fuses (RK5, J, CC)			Thermal-Magnetic Circuit Breakers		
		480V	600V	Maximum Fuse Size	480V	600V	Maximum Breaker Size
00	0.33–1.65A	100	100	30	—	—	—
	1–5A	100	100	30	100	35	35
	4–20A	100	100	30	100	35	35
0	0.33–1.65A	100	100	60	—	—	—
	1–5A	100	100	60	100	35	70
	4–20A	100	100	60	100	35	70
1	0.33–1.65A	100	100	100	—	—	—
	1–5A	100	100	100	100	35	100
	4–20A	100	100	100	100	35	100
	9–45A	100	100	100	100	35	100
2	1–5A	100	100	100	100	35	175
	4–20A	100	100	100	100	35	175
	9–45A	100	100	100	100	35	175
3	20–100A	100	100	200	50	50	250
4	28–140A	100	100	400	100	65	300

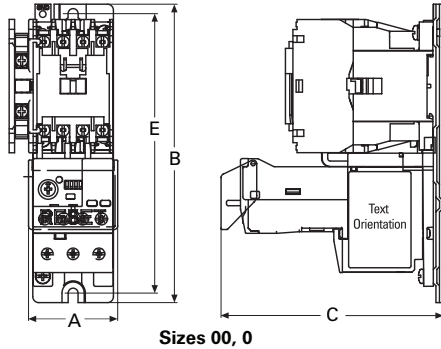


### Dimensions

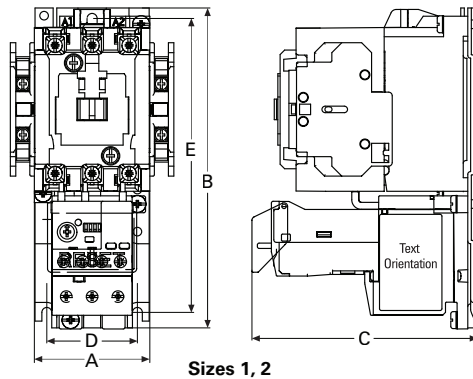
Approximate Dimensions in Inches (mm)

#### NEMA Starters

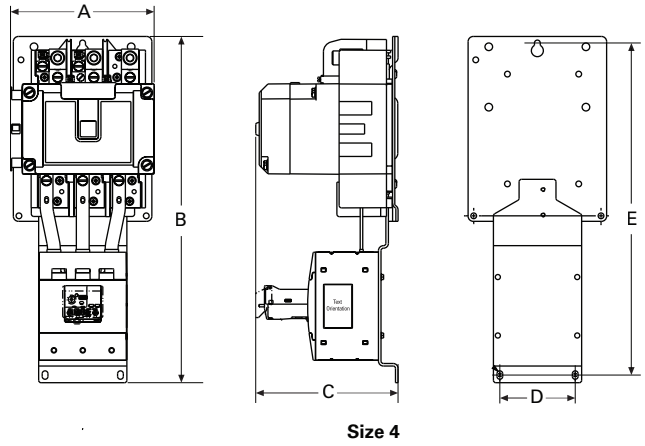
#### Full Voltage Non-Reversing Starters



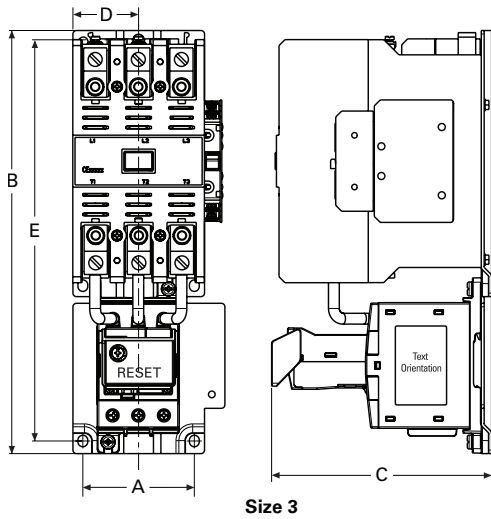
Sizes 00, 0



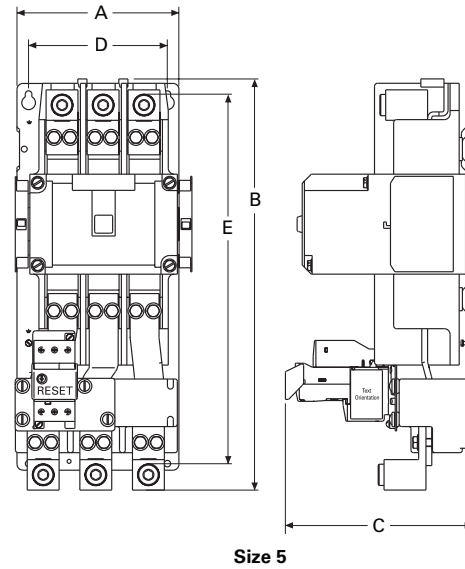
Sizes 1, 2



Size 4



Size 3



Size 5

NEMA Size	A	B	C	D	E
00, 0	1.97 (50.0)	6.60 (167.6)	4.90 (124.5)	—	6.18 (157.0)
1, 2	2.60 (65.0)	7.10 (180.0)	4.98 (126.5)	2.00 (50.8)	6.50 (165.0)
3	3.00 (76.2)	11.40 (289.6)	5.92 (150.3)	1.77 (44.9)	10.81 (274.6)
4	7.10 (179.0)	17.00 (432.0)	7.00 (177.0)	3.70 (94.0)	16.30 (415.0)
5	7.00 (177.8)	17.81 (452.3)	8.08 (205.2)	6.00 (152.4)	16.01 (406.6)

# 2.1

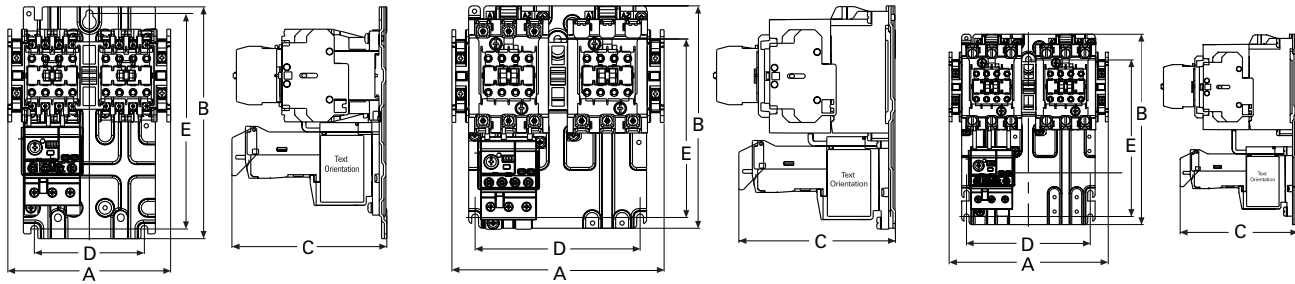
## NEMA Contactors and Starters

### Freedom Series

Approximate Dimensions in Inches (mm)

2

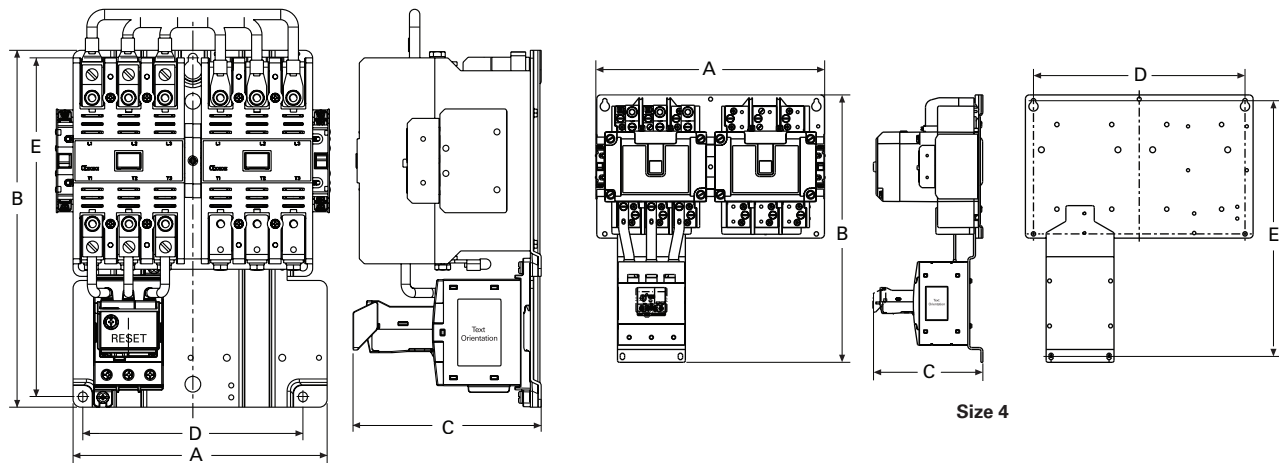
#### Full Voltage Reversing Starters



Sizes 00, 0

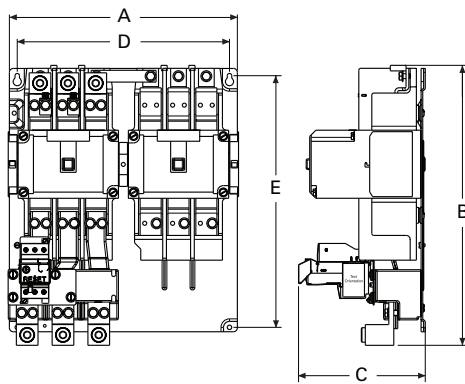
Size 1

Size 2



Size 3

Size 4



Size 5

NEMA Size	A	B	C	D	E
00, 0	5.20 (132.0)	7.40 (187.0)	4.90 (125.0)	3.50 (89.0)	6.90 (174.0)
1	6.70 (171.0)	7.10 (180.0)	4.98 (126.5)	5.25 (133.0)	5.70 (144.0)
2	6.70 (171.0)	8.10 (205.0)	4.98 (126.5)	5.25 (133.0)	6.70 (170.0)
3	8.08 (205.2)	11.35 (288.3)	6.00 (152.0)	7.00 (177.8)	10.77 (273.6)
4	14.60 (371.0)	17.10 (433.0)	7.00 (177.0)	13.50 (343.0)	16.30 (415.0)
5	14.50 (368.3)	17.81 (452.3)	8.06 (204.8)	13.50 (342.9)	16.00 (406.6)

### Industrial Control Transformers



### Contents

Description	Page
Transformers	
Type MTE .....	V7-T7-4
Type MTK .....	V7-T7-13
CE Marked .....	V7-T7-18
Type AP .....	V7-T7-25

### Standards and Certifications

Eaton dry-type distribution transformers are approved, listed, recognized or may comply with the following standards.

#### Engineering Standards

Catalog Product Name	UL Standard ①	UL/cUL File Number	UL Listed Control Number	cUL Energy Efficiency File Number	CSA File Number	Insulation System Temp/°C	kVA Single-Phase	kVA Three-Phase	Applicable IEC Standard
<b>Industrial Control Transformer</b>									
MTE	5085	E46323	702X	—	—	105	0.025–1.5	N/A	61558
MTK	5085	E46323	702X	—	—	180	0.05–5	N/A	61558
<b>Encapsulated Transformer</b>									
AP	5085	E10156	591H	—	—	180	3–10	N/A	61558
AP	1561	E78389	591H	—	—	180	15	N/A	61558
EP	5085	E10156	591H	—	LR60545	180	0.05–10	N/A	61558
EP	1561	E78389	591H	EV157 ②	LR60545 ③	180	15–50	N/A	61558 ④ / 726 ⑤
EPT	5085	E10156	591H	—	LR60545	180	N/A	3–9	61558 ⑥ / 726 ⑦
EPT	1561	E78389	591H	EV157 ⑧	LR60545 ⑨	180	N/A	15–75	726
MPC	1062	E53449	591H	—	LR60546	180	3–25	15–30	—
<b>Ventilated Transformer</b>									
DS-3	1561	E78389	591H	—	—	220	15–167	N/A	60726
DT-3	1561	E78389	591H	—	—	220	N/A	15–750	60726
KT	1561	E78389	591H	—	—	220	N/A	9–500	N/A

#### Notes

- ① UL 5085 replaces UL 506.
- ② Applies to 25–50 kVA.
- ③ Applies to 25 kVA.
- ④ Applies to 15–25 kVA.
- ⑤ Applies to 37.5 kVA.
- ⑥ Applies to 3 kVA.
- ⑦ Applies to 5–9 kVA.
- ⑧ Applies to 30–75 kVA.
- ⑨ Applies to 30 kVA.

In addition to the above standards, Eaton dry-type distribution transformers are also manufactured in compliance with the applicable standards listed below.

Not all of the following standards apply to every transformer.

- NEC:** National Electrical Code®
- NEMA ST-1:** Specialty Transformers (C89.1) (control transformers).
- NEMA ST-20:** General-Purpose Transformers.
- NEMA 250:** Enclosures for Electrical Equipment (1000 volts maximum).
- IEEE C57.12.01:** General Requirements for Dry-Type Distribution and Power Transformers (including those with solid-cast and/or resin-encapsulated windings).

**ANSI C57.12.70:** Terminal Markings and Connections for Distribution and Power Transformers.

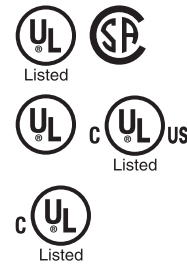
**ANSI C57.12.91:** Standard Test Code for Dry-Type Distribution and Power Transformers.

**CSA C22 No. 47-M90:** Air-Cooled Transformers (Dry-Type).

**CSA C9-M1981:** Dry-Type Transformers.

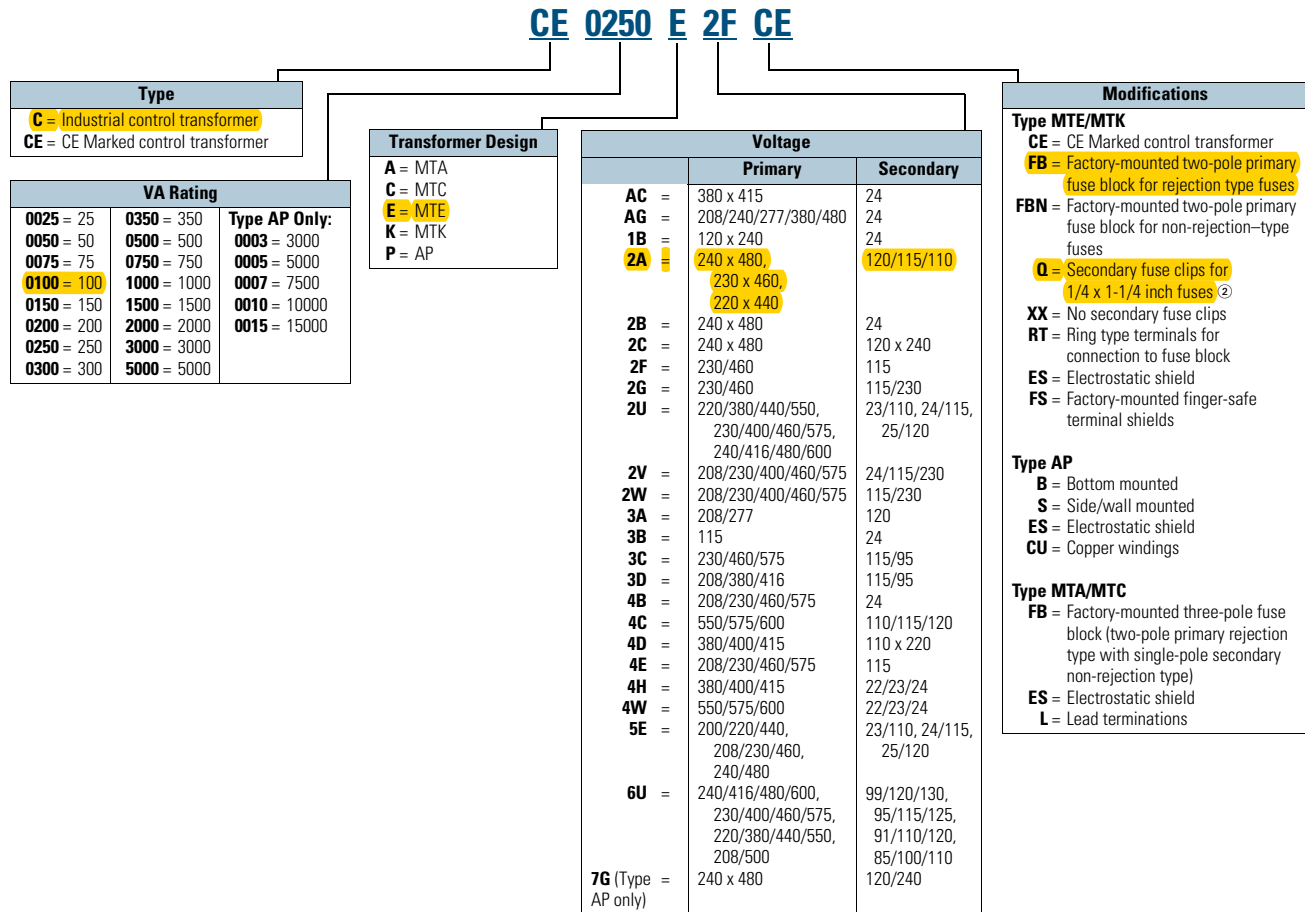
**CSA C22.2 No. 66:** Specialty Transformers.

**CSA 802-94:** Maximum Losses for Distribution, Power and Dry-Type Transformers.



### Catalog Number Selection

Industrial Control Transformers, CE Marked Control Transformers—Example: CE0250E2FCE ①



**Notes**

① For Eaton's dry-type transformers catalog number selection, see Volume 2, CA08100003E.

② Fuse clip covers not available with this option.

Contact your local Eaton sales office for voltage combinations not shown. Use table for catalog number breakdown only. Do not use to create catalog numbers because all combinations may not be valid.

#### Type MTE Transformer



### Contents

<b>Description</b>	<b>Page</b>
Type MTE	
Product Selection . . . . .	V7-T7-5
Accessories . . . . .	V7-T7-10
Technical Data and Specifications . . . . .	V7-T7-10
Wiring Diagrams . . . . .	V7-T7-11
Type MTK . . . . .	V7-T7-13
CE Marked . . . . .	V7-T7-18
Type AP . . . . .	V7-T7-25

### Type MTE

#### Product Description

**Note:** The following pages provide listings for most standard transformer ratings and styles. For other ratings or styles not shown, or for special enclosure types (including stainless steel), refer to Eaton.

- Epoxy-encapsulated coils

#### Application Description

Transformers provide stepped-down voltages to machine tool control devices, enabling control circuits to be isolated from all power and lighting circuits. This allows the use of grounded or ungrounded circuits that are independent of the power or lighting grounds; thus, greater safety is afforded the operator. The control transformer line is particularly adaptable on applications where compact construction is demanded.

**Note:** The MTG “open core-coil design” has been superseded by the epoxy-encapsulated core-coil design MTE with no change to dimensions or functionality.

#### Features, Benefits and Functions

- Epoxy encapsulated
- Laminations of high-quality silicon steel to minimize core losses and optimize performance
- Copper magnet wire for high-quality, efficient operation
- Secondary fuse clips where applicable
- Optional primary fusing
- Molded-in terminals
- 50/60 Hz operation
- 130°C insulation system standard
- Performance meets/exceeds requirements of ANSI/NEMA ST-1
- Regulation exceeds ANSI/NEMA requirements for all ratings
- 25–1500 VA ratings
- Molded-in terminals for maximum durability

#### Standards and Certifications

- UL listed
- cUL listed
- RoHS compliant



#### Industry Standards

All Eaton dry-type distribution and control transformers are built and tested in accordance with applicable NEMA, ANSI and IEEE Standards. All 600 volt class transformers are UL listed unless otherwise noted.

#### Catalog Number Selection

Please refer to **Page V7-T7-3**.

**Transformers with Primary Fuse Blocks**

**Primary: 240 x 480, 230 x 460, 220 x 440 with Jumpers and Two-Pole Primary Fuse Block for Rejection-Type Fuses  
Secondary: 120/115/110 with Fuse Clips for 13/32 x 1-1/2 Fuses**

VA	Wiring Diagram <sup>①</sup>	Weight Lbs (kg)	Style Number
50	1	2.8 (1.3)	<b>C0050E2AFB</b> <sup>②</sup>
75	1	3.7 (1.7)	<b>C0075E2AFB</b> <sup>②</sup>
<b>100</b>	<b>1</b>	<b>4.4 (2.0)</b>	<b>C0100E2AFB</b> <sup>②</sup>
150	1	6.9 (3.1)	<b>C0150E2AFB</b>
200	1	8.7 (3.9)	<b>C0200E2AFB</b>
250	1	10.2 (4.6)	<b>C0250E2AFB</b>
300	1	11.5 (5.2)	<b>C0300E2AFB</b>
350	1	13.8 (6.3)	<b>C0350E2AFB</b>
500	1	19.4 (8.8)	<b>C0500E2AFB</b>
750	1	28.3 (12.8)	<b>C0750E2AFB</b>
1000	1	29.7 (13.4)	<b>C1000E2AFB</b>
1500	1	40.2 (18.1)	<b>C1500E2AFB</b>

**Notes**

- ① See **Page V7-T7-11** for wiring diagrams.
- ② 105°C insulation system.
- ③ Type MTG open core-coil universal design has been superseded by Type MTE epoxy encapsulated universal design with no changes to form, fit or function.
- ④ Type MTE epoxy encapsulated universal design.

#### Accessories

##### Primary Fuse Kit

The primary fuse kit includes a two-pole class CC fuse block, instructions, and all associated mounting and wiring hardware. Fuses are not included. When installed, the primary fuse kit will add a maximum of 11/16 inch to the transformer depth and 1-15/16 inches to the transformer height.

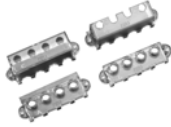

##### Primary Fuse Kit

Description	Catalog Number
Primary fuse kit	PFK1

##### Finger-Safe Terminal Covers (Optional)

- Fits CE Marked designs 50–750 VA
- Fits MTE designs 0.25–750 VA


##### Finger-Safe Terminal Covers

Description	Catalog Number
 <p>FSK4 Four terminal transformers</p>	FSK4
<p>Four terminal Series 2 transformers only</p>	FSK4S2
 <p>FSK6 Six terminal transformers</p>	FSK6

##### Finger-Safe Primary Fuse Block Covers

- Fits two-pole primary fuse blocks on MTE designs
- No fuse block covers are available for transformers with suffix "FBQ"

##### Finger-Safe Primary Fuse Block Covers

Description	Catalog Number
 <p>FSKFB Primary fuse block covers</p>	FSKFB

##### Secondary Fuse Clip

##### Secondary Fuse Clip

Description	Catalog Number
Fits 500 VA and smaller models	SFCS
Fits models greater than 500 VA	SFCL

#### Technical Data and Specifications

##### Insulation System and Temperature Rise

Industry standards classify insulation systems and rise as shown below:

##### Insulation System Classification

Ambient	+ Winding Rise	+ Hot Spot	= Temp. Class
40°C	55°C	10°C	105°C
40°C	80°C	30°C	150°C
25°C	135°C	20°C	180°C
40°C	115°C	30°C	185°C
40°C	150°C	30°C	220°C

The design life of transformers having different insulation systems is the same—the lower-temperature systems are designed for the same life as the higher-temperature systems.

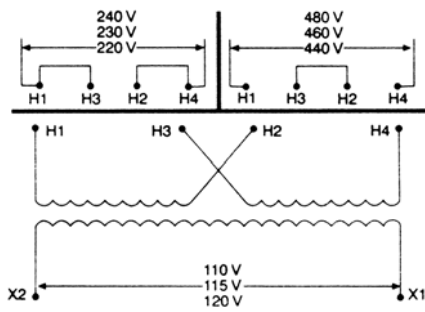
##### Series-Multiple Windings

Series-multiple windings consist of two similar coils in each winding that can be connected in series or parallel (multiple). Transformers with series-multiple windings are designated with an "x" or "/" between the voltage ratings, such as voltages of "120/240" or "240 x 480." If the series-multiple winding is designated by an "x," the winding can be connected only for a series or parallel. With the "/" designation, a mid-point also becomes available in addition to the series or parallel connection. As an example, a 120 x 240 winding can be connected for either 120 (parallel) or 240 (series), but a 120/240 winding can be connected for 120 (parallel), 240 (series) or 240 with a 120 mid-point.

For additional information, please refer to Volume 2, CA08100003E.

### Wiring Diagrams

Diagram 1





# Class CC Fuses

## KLDR Series

600 V ac • 300 V dc • Time-Delay •  $\frac{1}{10}$ –30 A



### Description

KLDR Series time-delay fuses are designed to protect control transformers, solenoids, and similar inductive components with high-magnetizing currents during the first half-cycle. These small-sized fuses provide excellent protection of motor branch circuits containing IEC or NEMA-rated motor controllers or contactors. The KLDR Series fuses closely match most control power transformer characteristics, which permits them to be sized in accordance with the latest revisions of UL 508 (Industrial Control) and UL 845 (Motor Control Centers).

### Features & Benefits

FEATURES	BENEFITS
<b>Current-limiting</b>	Reduces damage caused by heating and magnetic effects of short-circuit currents
<b>Short-circuit protection</b>	Improves safety with faster response times to fault currents
<b>Rejection capability</b>	Prevents use of fuses with lower interrupting ratings or voltage when used with corresponding fuse holders
<b>Time-delay</b>	Allows for a temporary current surge for a short period of time without blowing

### Applications

- Transformer and solenoid protection

### Specifications

<b>Voltage Rating</b>	Ac: 600 V Dc: 300 V
<b>Amperage Range</b>	$\frac{1}{10}$ – 30 A
<b>Interrupting Ratings</b>	Ac: 200,000 A rms symmetrical Dc: 20,000 A self-certified
<b>Material</b>	Body: Melamine Caps: Nickel-plated Bronze
<b>Fuse Weight</b>	.019 lb (8.62g)
<b>Applicable Standards</b>	UL 248-4, Class CC
<b>Environmental</b>	RoHS Compliant
<b>Country of Origin</b>	Mexico

# Class CC Fuses

## KLDR Series

### Certification & Compliance

<b>UL</b>	UL Listed (File: E81895)
<b>CSA</b>	CSA Certified (File: LR29862)
<b>CE</b>	EU_DOC-KLDR_P_210128
<b>RoHS</b>	RoHS 2 Directive 2011/65/EU; Directive (EU) 2015/863

### Accessories

L60030C series fuse holder  
 LPSC/LFPSC Touch-Safe series fuse holder  
 LEC series inline fuse holder  
 571/572 series panel mount fuse holder

### Ordering Information

AMPERE RATING	CATALOG NUMBER	PRODUCT MARKING	PACK QUANTITY	ORDERING NUMBER	UPC
1/10	KLDR.100	KLDR 1/10 A	10 100	KLDR.100TXP KLDR.100HXP	07945896877 07945879278
1/8	KLDR.125	KLDR 1/8 A	10 100	KLDR.125TXP KLDR.125HXP	07945896878 07945879279
15/100	KLDR.150	KLDR 15/100 A	10 100	KLDR.150TXP KLDR.150HXP	07945896879 07945879280
3/16	KLDR.187	KLDR 3/16 A	10 100	KLDR.187TXP KLDR.187HXP	07945896880 07945879281
3/10	KLDR.200	KLDR 3/10 A	10 100	KLDR.200TXP KLDR.200HXP	07945879239 07945879282
1/4	KLDR.250	KLDR 1/4 A	10 100	KLDR.250TXP KLDR.250HXP	07945879240 07945879283
3/10	KLDR.300	KLDR 3/10 A	10 100	KLDR.300TXP KLDR.300HXP	07945879241 07945879284
4/10	KLDR.400	KLDR 4/10 A	10 100	KLDR.400TXP KLDR.400HXP	07945879242 07945879285
1/2	<b>KLDR.500</b>	<b>KLDR 1/2 A</b>	10 100	KLDR.500TXP KLDR.500HXP	07945879243 07945879286
6/10	KLDR.600	KLDR 6/10 A	10 100	KLDR.600TXP KLDR.600HXP	07945879244 07945879287
3/4	KLDR.750	KLDR 3/4 A	10 100	KLDR.750TXP KLDR.750HXP	07945879245 07945879288
8/10	KLDR.800	KLDR 8/10 A	10 100	KLDR.800TXP KLDR.800HXP	07945879246 07945879289
1	KLDR001	KLDR 1 A	10 100	KLDR001.TXP KLDR001.HXP	07945879247 07945879290
1 1/8	KLDR1.12	KLDR 1 1/8 A	10 100	KLDR1.12TXP KLDR1.12HXP	07945879248 07945879291
1 1/4	KLDR1.25	KLDR 1 1/4 A	10 100	KLDR1.25TXP KLDR1.25HXP	07945879249 07945879292
1 3/10	KLDR01.4	KLDR 1 3/10 A	10 100	KLDR01.4TXP KLDR01.4HXP	07945879250 07945879293

# Class CC Fuses

## KLDR Series

### Ordering Information

AMPERE RATING	CATALOG NUMBER	PRODUCT MARKING	PACK QUANTITY	ORDERING NUMBER	UPC
1 ½	KLDR01.5	KLDR 1 ½A	10 100	KLDR01.5TXP KLDR01.5HXP	07945879251 07945879294
1 ⅝	KLDR01.6	KLDR 1 ⅝A	10 100	KLDR01.6TXP KLDR01.6HXP	07945879252 07945879295
1 ⅞	KLDR01.8	KLDR 1 ⅞A	10 100	KLDR01.8TXP KLDR01.8HXP	07945879253 07945879296
2	KLDR002	KLDR 2A	10 100	KLDR002.TXP KLDR002.HXP	07945879254 07945879297
2 ¼	KLDR2.25	KLDR 2 ¼A	10 100	KLDR2.25TXP KLDR2.25HXP	07945879255 07945879298
2 ½	KLDR02.5	KLDR 2 ½A	10 100	KLDR02.5TXP KLDR02.5HXP	07945879256 07945879299
2 ⅝	KLDR02.8	KLDR 2 ⅝A	10 100	KLDR02.8TXP KLDR02.8HXP	07945879257 07945879300
3	KLDR003	KLDR 3A	10 100	KLDR003.TXP KLDR003.HXP	07945879258 07945879301
3 ⅝	KLDR03.2	KLDR 3 ⅝A	10 100	KLDR03.2TXP KLDR03.2HXP	07945879259 07945879302
3 ½	KLDR03.5	KLDR 3 ½A	10 100	KLDR03.5TXP KLDR03.5HXP	07945879260 07945879303
4	KLDR004	KLDR 4A	10 100	KLDR004.TXP KLDR004.HXP	07945879261 07945879304
4 ½	KLDR04.5	KLDR 4 ½A	10 100	KLDR04.5TXP KLDR04.5HXP	07945879262 07945879305
5	KLDR005	KLDR 5A	10 100	KLDR005.TXP KLDR005.HXP	07945879263 07945879306
5 ⅝	KLDR05.6	KLDR 5 ⅝A	10 100	KLDR05.6TXP KLDR05.6HXP	07945879264 07945879307
6	KLDR006	KLDR 6A	10 100	KLDR006.TXP KLDR006.HXP	07945879265 07945879308
6 ¼	KLDR6.25	KLDR 6 ¼A	10 100	KLDR6.25TXP KLDR6.25HXP	07945879266 07945879309
7	KLDR007	KLDR 7A	10 100	KLDR007.TXP KLDR007.HXP	07945879267 07945879310
7 ½	KLDR07.5	KLDR 7 ½A	10 100	KLDR07.5TXP KLDR07.5HXP	07945879268 07945879311
8	KLDR008	KLDR 8A	10 100	KLDR008.TXP KLDR008.HXP	07945879269 07945879312
9	KLDR009	KLDR 9A	10 100	KLDR009.TXP KLDR009.HXP	07945879270 07945879313
10	KLDR010	KLDR 10A	10 100	KLDR010.TXP KLDR010.HXP	07945879271 07945879314
12	KLDR012	KLDR 12A	10 100	KLDR012.TXP KLDR012.HXP	07945879272 07945879315
15	KLDR015	KLDR 15A	10 100	KLDR015.TXP KLDR015.HXP	07945879273 07945879316
17 ½	KLDR17.5	KLDR 17 ½A	10 100	KLDR17.5TXP KLDR17.5HXP	07945879274 07945879317

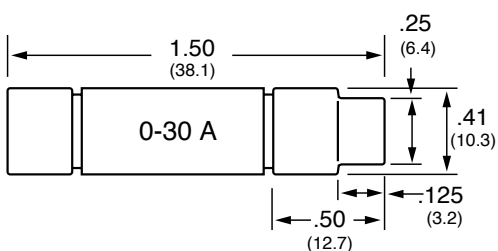
# Class CC Fuses

## KLDR Series

### Ordering Information

AMPERE RATING	CATALOG NUMBER	PRODUCT MARKING	PACK QUANTITY	ORDERING NUMBER	UPC
20	KLDR020	KLDR 20A	10	KLDR020.TXP	07945879275
			100	KLDR020.HXP	07945879318
25	KLDR025	KLDR 25A	10	KLDR025.TXP	07945879276
			100	KLDR025.HXP	07945879319
30	KLDR030	KLDR 30A	10	KLDR030.TXP	07945879277
			100	KLDR030.HXP	07945879320

### Dimensions Inches (mm)



### Electrical Specification - Agency Requirements

AMPERAGE RATING	OPENING TIME		
	100 % OF AMP RATING PER UL	135 % OF AMP RATING PER UL	200 % OF AMP RATING PER UL
1/10-30	Temperature Stabilization	60 Minutes Max	12 Seconds Minimum

### Electrical Specifications

CATALOG NUMBER	VOLTAGE RATING (V)		INTERRUPTING RATING (A)		MELT (PRE-ARC) I <sup>2</sup> T (A <sup>2</sup> S)	TOTAL CLEARING I <sup>2</sup> T (A <sup>2</sup> SEC) 200 KA	AGENCY APPROVALS	
	AC	DC	AC	DC			UL	CSA
KLDR.100	600	300	200,000	20,000	.0004	.0059	•	•
KLDR.125	600	300	200,000	20,000	.0007	.0055	•	•
KLDR.150	600	300	200,000	20,000	.0016	.0059	•	•
KLDR.187	600	300	200,000	20,000	.0040	.0267	•	•
KLDR.200	600	300	200,000	20,000	.0018	.0230	•	•
KLDR.250	600	300	200,000	20,000	.0138	.0967	•	•
KLDR.300	600	300	200,000	20,000	.0111	.1005	•	•
KLDR.400	600	300	200,000	20,000	.0579	.1420	•	•
<b>KLDR.500</b>	<b>600</b>	<b>300</b>	<b>200,000</b>	<b>20,000</b>	<b>.0877</b>	<b>.3121</b>	<b>•</b>	<b>•</b>
KLDR.600	600	300	200,000	20,000	.1404	.3742	•	•
KLDR.750	600	300	200,000	20,000	.2911	1.972	•	•
KLDR.800	600	300	200,000	20,000	.2416	2.064	•	•
KLDR001	600	300	200,000	20,000	.4494	5.883	•	•
KLDR1.12	600	300	200,000	20,000	.5049	5.149	•	•

# Class CC Fuses

## KLDR Series

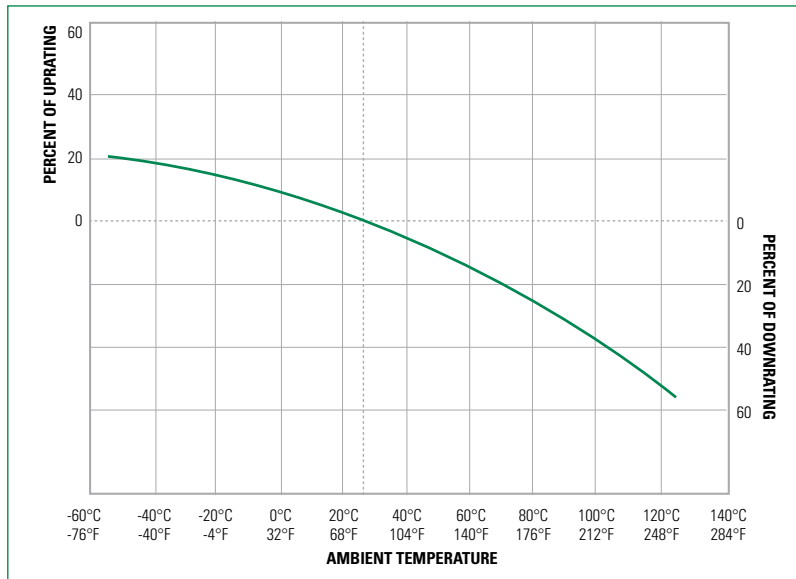
CATALOG NUMBER	VOLTAGE RATING (V)		INTERRUPTING RATING (A)		MELT (PRE-ARC) I <sup>2</sup> T (A <sup>2</sup> S)	TOTAL CLEARING I <sup>2</sup> T (A <sup>2</sup> SEC) 200 KA	AGENCY APPROVALS	
	AC	DC	AC	DC			UL	CSA
KLDR1.25	600	300	200,000	20,000	.4367	7.354	•	•
KLDR01.4	600	300	200,000	20,000	.8135	7.639	•	•
KLDR01.5	600	300	200,000	20,000	.9302	5.885	•	•
KLDR01.6	600	300	200,000	20,000	.7495	6.682	•	•
KLDR01.8	600	300	200,000	20,000	.9964	6.594	•	•
KLDR002	600	300	200,000	20,000	.8615	14.01	•	•
KLDR2.25	600	300	200,000	20,000	1.126	26.41	•	•
KLDR02.5	600	300	200,000	20,000	2.087	35.35	•	•
KLDR02.8	600	300	200,000	20,000	21.28	45.47	•	•
KLDR003	600	300	200,000	20,000	23.21	55.99	•	•
KLDR03.2	600	300	200,000	20,000	37.92	57.27	•	•
KLDR03.5	600	300	200,000	20,000	21.42	109.4	•	•
KLDR004	600	300	200,000	20,000	83.81	258.6	•	•
KLDR04.5	600	300	200,000	20,000	83.89	110.6	•	•
KLDR005	600	300	200,000	20,000	63.33	84.04	•	•
KLDR05.6	600	300	200,000	20,000	87.66	114.0	•	•
KLDR006	600	300	200,000	20,000	129.5	161.9	•	•
KLDR6.25	600	300	200,000	20,000	147.6	261.7	•	•
KLDR007.	600	300	200,000	20,000	202.4	513.4	•	•
KLDR07.5	600	300	200,000	20,000	321.8	813.0	•	•
KLDR008	600	300	200,000	20,000	111.2	1,145	•	•
KLDR009	600	300	200,000	20,000	73.40	1,334	•	•
KLDR010	600	300	200,000	20,000	132.0	934.8	•	•
KLDR012	600	300	200,000	20,000	154.7	1,723	•	•
KLDR015	600	300	200,000	20,000	200.5	2,248	•	•
KLDR17.5	600	300	200,000	20,000	87.50	722.8	•	•
KLDR020	600	300	200,000	20,000	123.8	1,363	•	•
KLDR025	600	300	200,000	20,000	226.0	1,710	•	•
KLDR030	600	300	200,000	20,000	299.6	1,990	•	•

# Class CC Fuses

## KLDR Series

### Temperature Derating Curve

Ambient temperature: temperature of air immediately surrounding fuse



### Current-Limiting Effects

SHORT CIRCUIT CURRENT*	APPARENT RMS SYMMETRICAL CURRENT FOR VARIOUS FUSE RATINGS								
	4 A	6 A	7.5 A	8 A	10 A	12 A	15 A	20 A	30 A
5,000	349	420	521	437	359	369	435	456	621
10,000	440	529	656	551	452	465	548	575	783
15,000	504	605	751	631	517	532	627	658	896
20,000	554	666	827	694	569	585	690	724	986
25,000	597	718	890	748	613	630	743	780	1063
30,000	634	763	946	795	651	670	790	829	1129
35,000	668	803	996	837	686	705	832	872	1189
40,000	698	840	1041	875	717	737	870	912	1243
50,000	752	904	1122	942	772	794	937	983	1339
60,000	799	961	1192	1001	821	844	995	1044	1423
80,000	880	1058	1312	1102	903	929	1096	1149	1566
100,000	948	1139	1413	1187	973	1001	1180	1238	1687
150,000	1085	1304	1618	1359	1114	1146	1351	1417	1931
200,000	1194	1436	1781	1496	1226	1261	1487	1560	2125

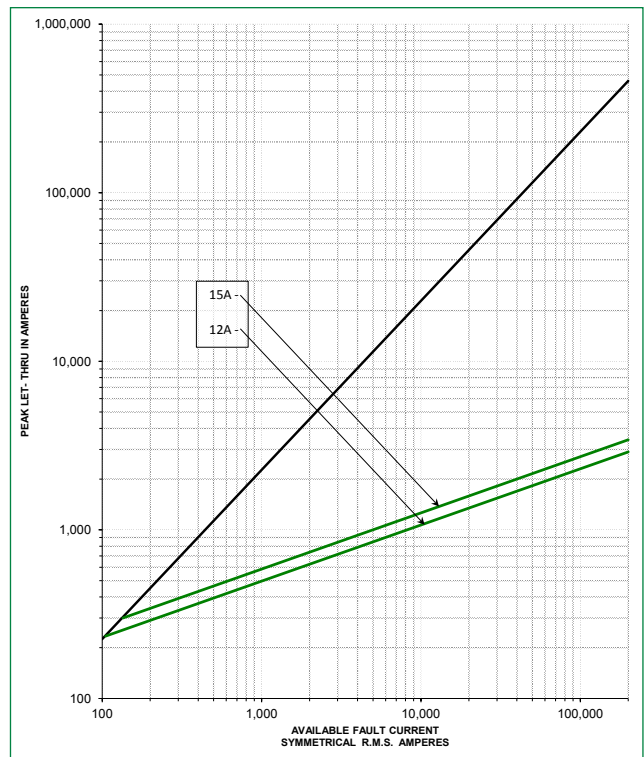
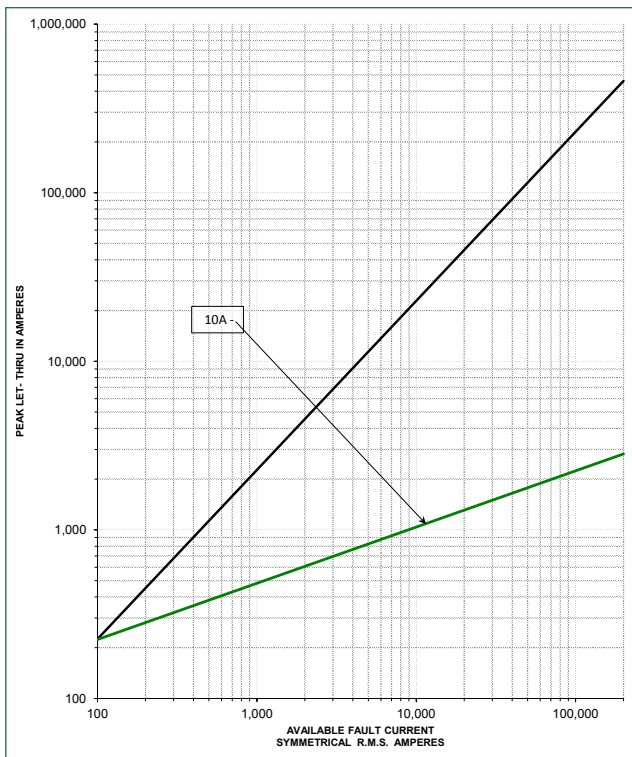
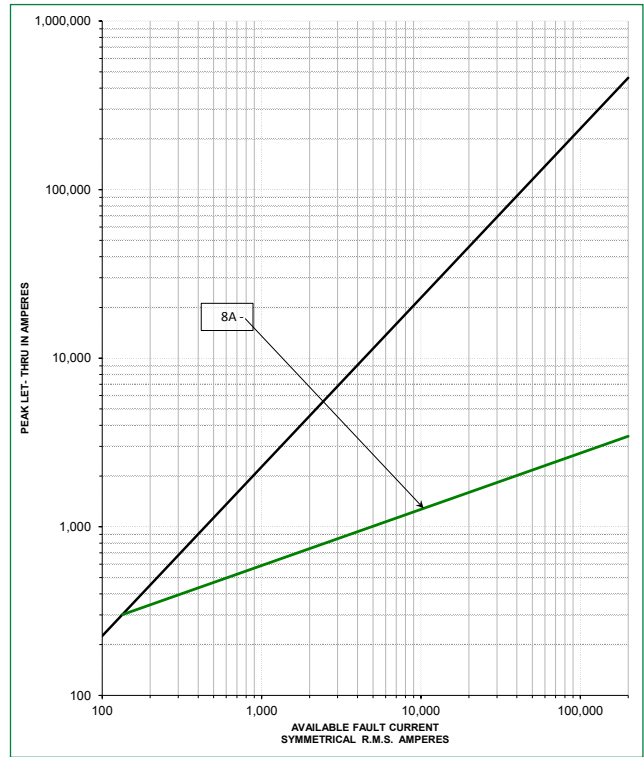
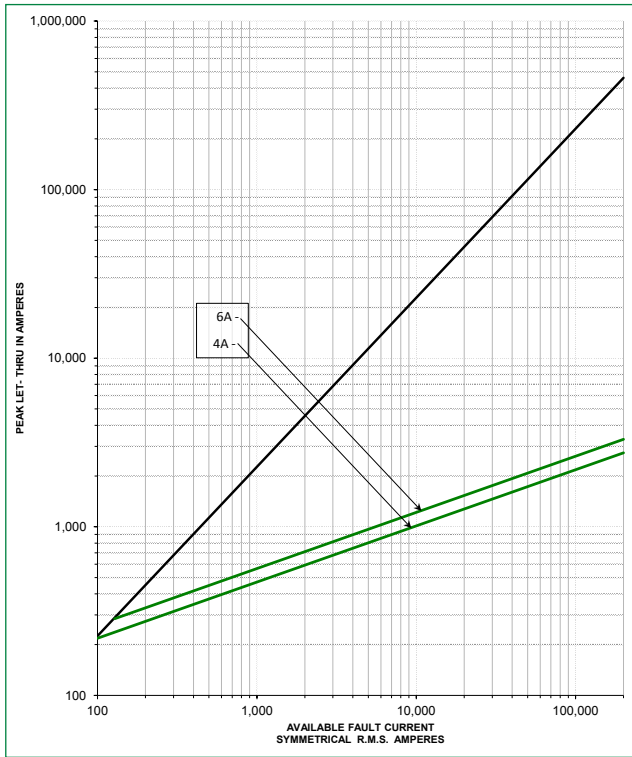
\*Prospective RMS Symmetrical Amperes Short-Circuit Current

Note: Data Derived from Peak Let-Thru Curve

# Class CC Fuses

## KLDR Series

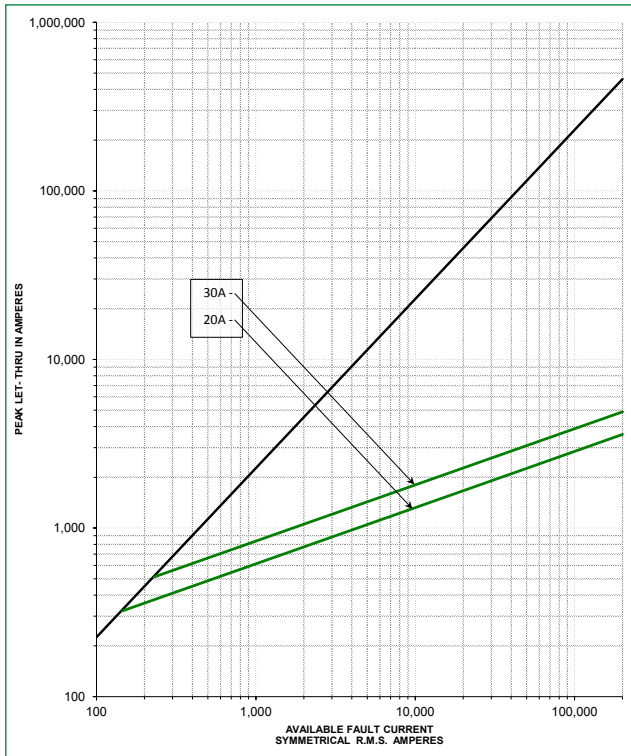
### Peak Let-Thru Curves



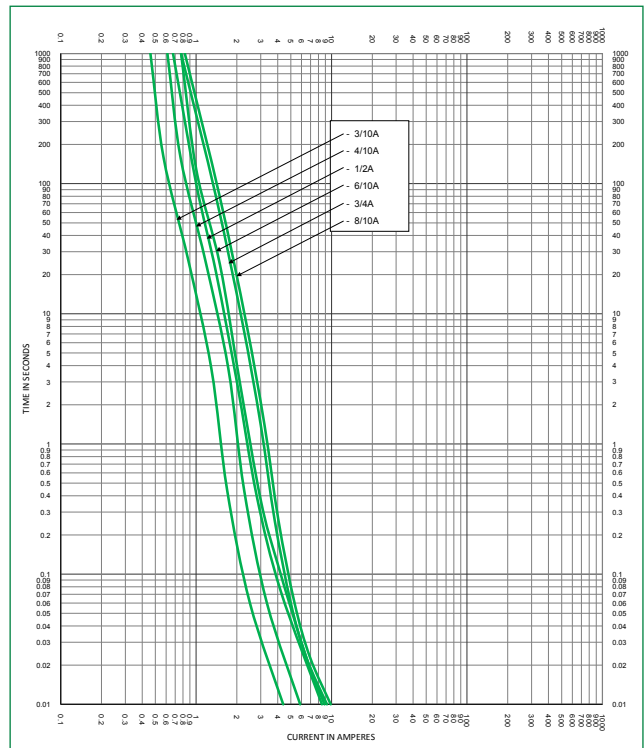
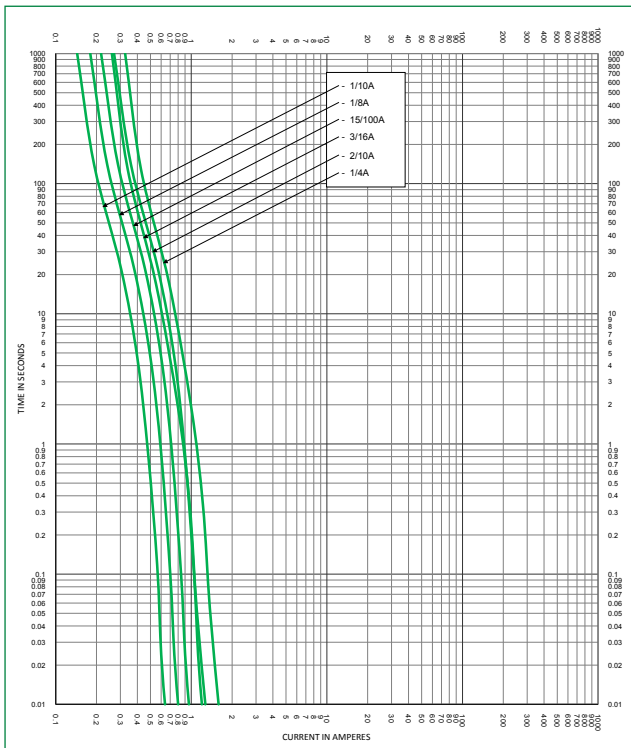
# Class CC Fuses

## KLDR Series

### Peak Let-Thru Curves



### Time Current Curves

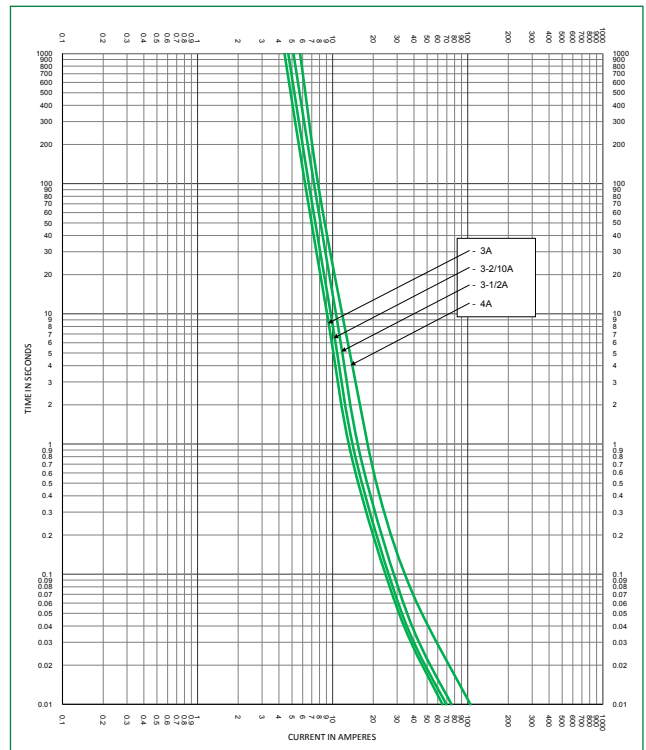
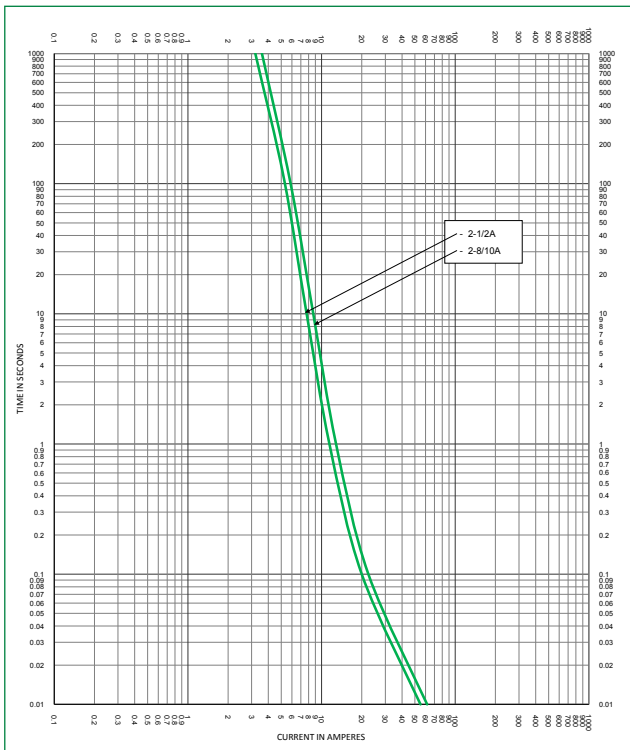
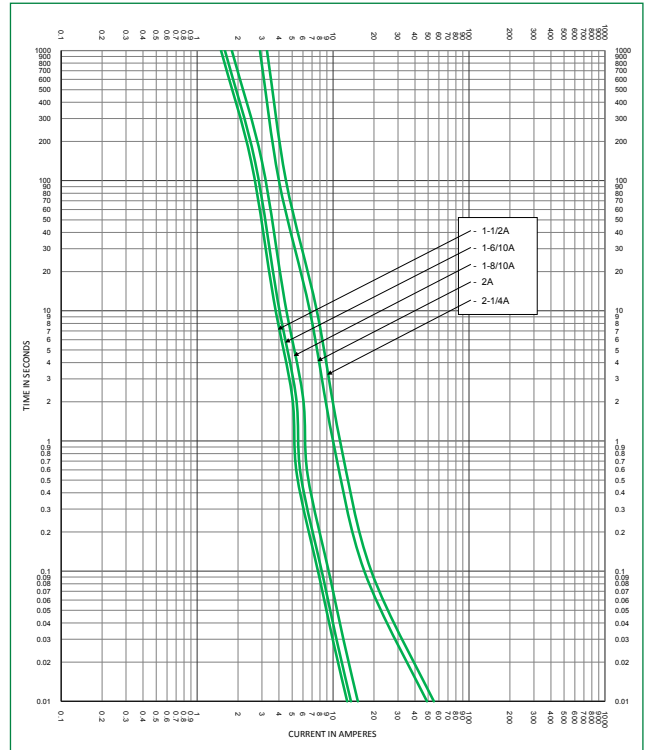
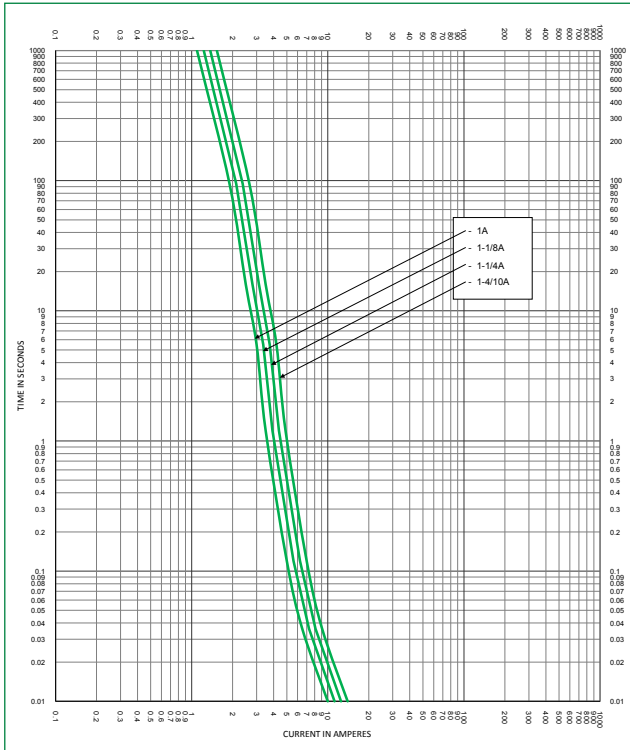




# Class CC Fuses

## KLDR Series

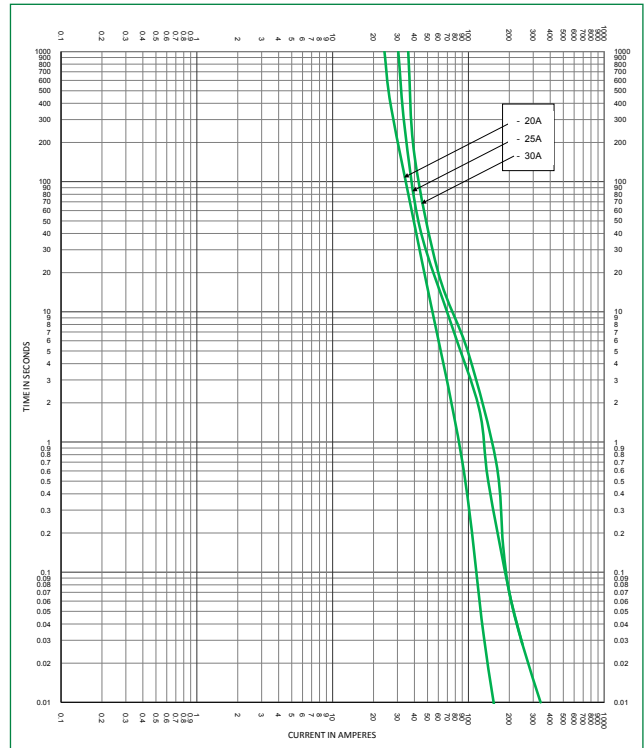
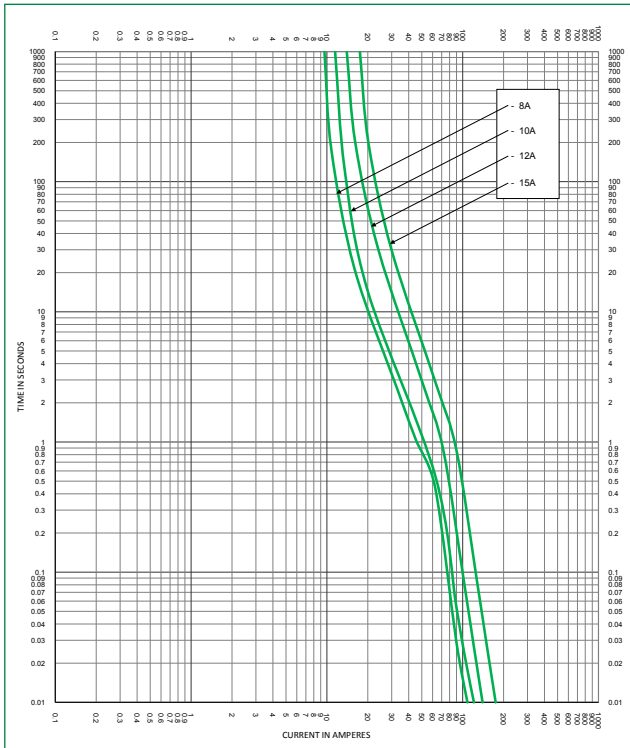
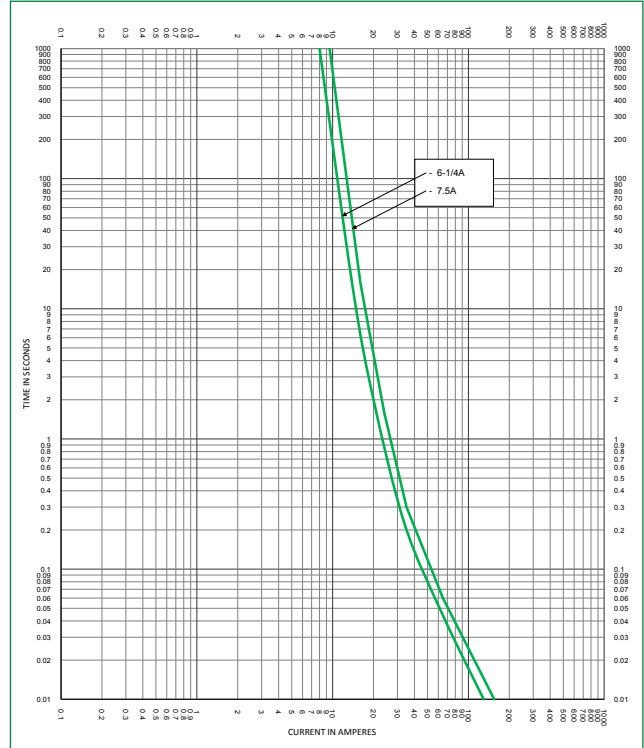
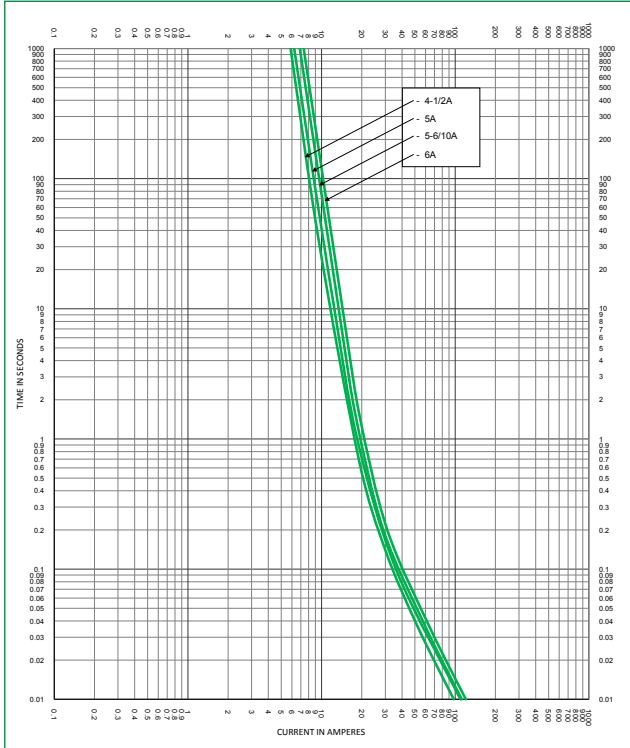
### Time Current Curves



# Class CC Fuses

## KLDR Series

### Time Current Curves



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# Supplemental Fuses

## FLM Series

250 V ac • 10x38 (Midget) • Time-Delay • 1/10–30 A



### Description

The FLM series 250 V fuses are designed to protect control circuit transformers, solenoids, and other circuits with high in-rush currents. They are also excellent for supplemental protection of small motors. The time-delay design can carry an overload several times the normal load for a short period of time without blowing. The FLM fuses are non-indicating and may be used with an indicating fuse block to identify a blown fuse.

### Features & Benefits

FEATURES	BENEFITS
<b>10x38 mm size</b>	Common dimensions used in a variety of applications
<b>Time-delay</b>	Allows for temporary current surge for a short period of time without blowing
<b>Paper body</b>	Cost effective materials provide a lower cost alternative for supplemental circuit protection
<b>POWR-GARD® technology</b>	Ensures quality backup overcurrent protection

### Applications

- Control circuit transformers
- Solenoids
- Circuits with high in-rush currents
- Small motors

# Supplemental Fuses

## FLM Series

### Specifications

<b>Voltage Rating</b>	Ac: 250 V Dc: 125 V
<b>Interrupting Ratings</b>	Ac: 10,000 A Dc: 10,000 A Self Certified
<b>Ampere Range</b>	$\frac{1}{10}$ –30 A
<b>Applicable Standards</b>	UL 248-14
<b>Environmental</b>	REACH, RoHS
<b>Material</b>	Body: Paper Cap: Nickel plated bronze
<b>Country of Origin</b>	Mexico
<b>Fuse Weight</b>	.010 lbs (4.54g)

### Certification & Compliance

<b>UL</b>	UL Listed (File: E10480)
<b>CSA</b>	CSA Certified (File: LR29862)
<b>CE</b>	EU_DOC-FLM_210323
<b>QPL</b>	MIL-F-15160/9
<b>RoHS</b>	RoHS 2 Directive 2011/65/EU; Directive (EU) 2015/863

### Accessories

L60030M series fuse block  
LEB/LEX series inline fuse holder  
LPSM Touch-safe series fuse holder  
571/572 series panel mount fuse holder

### Ordering Information

AMPERE	CATALOG NUMBER	PRODUCT MARKING	PACK QUANTITY	ORDERING NUMBER	UPC
$\frac{1}{10}$	FLM.100	FLM $\frac{1}{10}$ A	10	OFLM.100T	07945814011
$\frac{15}{100}$	FLM.125	FLM $\frac{15}{100}$ A	10	OFLM.125T	07945814013
$\frac{3}{10}$	FLM.200	FLM $\frac{3}{10}$ A	10	OFLM.200T	07945814018
$\frac{1}{4}$	FLM.250	FLM $\frac{1}{4}$ A	10	OFLM.250T	07945814019
$\frac{3}{10}$	FLM.300	FLM $\frac{3}{10}$ A	10	OFLM.300T	07945800083
$\frac{3}{10}$	FLM.400	FLM $\frac{3}{10}$ A	10	OFLM.400T	07945814023
$\frac{1}{2}$	FLM.500	FLM $\frac{1}{2}$ A	10	OFLM.500T	07945814024
$\frac{3}{10}$	FLM.600	FLM $\frac{3}{10}$ A	10	OFLM.600T	07945800084
$\frac{3}{10}$	FLM.800	FLM $\frac{3}{10}$ A	10	OFLM.800T	07945800085
<b>1</b>	<b>FLM001</b>	<b>FLM 1A</b>	10	OFLM001.T	07945814031
$1\frac{1}{8}$	FLM1.12	FLM 1- $\frac{1}{8}$ A	10	OFLM1.12T	07945814032
$1\frac{1}{4}$	FLM1.25	FLM 1- $\frac{1}{4}$ A	10	OFLM1.25T	07945814034
$1\frac{1}{10}$	FLM01.4	FLM 1- $\frac{1}{10}$ A	10	OFLM01.4T	07945814036
$1\frac{1}{2}$	FLM01.5	FLM 1- $\frac{1}{2}$ A	10	OFLM01.5T	07945814037

# Supplemental Fuses

## FLM Series

### Ordering Information

AMPERE	CATALOG NUMBER	PRODUCT MARKING	PACK QUANTITY	ORDERING NUMBER	UPC
1 $\frac{5}{10}$	FLM01.6	FLM 1- $\frac{5}{10}$ A	10	OFLM01.6T	07945814038
1 $\frac{5}{10}$	FLM01.8	FLM 1- $\frac{5}{10}$ A	10	OFLM01.8T	07945814040
2	FLM002	FLM 2A	10	OFLM002.T	07945814041
2 $\frac{1}{4}$	FLM2.25	FLM 2- $\frac{1}{4}$ A	10	OFLM2.25T	07945814042
2 $\frac{1}{2}$	FLM02.5	FLM 2- $\frac{1}{2}$ A	10	OFLM02.5T	07945814043
2 $\frac{5}{10}$	FLM02.8	FLM 2- $\frac{5}{10}$ A	10	OFLM02.8T	07945814046
3	FLM003	FLM 3A	10	OFLM003.T	07945814047
3 $\frac{3}{10}$	FLM03.2	FLM 3- $\frac{3}{10}$ A	10	OFLM03.2T	07945814049
3 $\frac{1}{2}$	FLM03.5	FLM 3- $\frac{1}{2}$ A	10	OFLM03.5T	07945814051
4	FLM004	FLM 4A	10	OFLM004.T	07945814053
4 $\frac{1}{2}$	FLM04.5	FLM 4- $\frac{1}{2}$ A	10	OFLM04.5T	07945814054
5	FLM005	FLM 5A	10	OFLM005.T	07945814055
5 $\frac{5}{10}$	FLM05.6	FLM 5- $\frac{5}{10}$ A	10	OFLM05.6T	07945814056
6	FLM006	FLM 6A	10	OFLM006.T	07945814058
6 $\frac{1}{4}$	FLM6.25	FLM 6- $\frac{1}{4}$ A	10	OFLM6.25T	07945814059
7	FLM007	FLM 7A	10	OFLM007.T	07945814061
8	FLM008	FLM 8A	10	OFLM008.T	07945814063
9	FLM009	FLM 9A	10	OFLM009.T	07945814064
10	FLM010	FLM 10A	10	OFLM010.T	07945814065
12	FLM012	FLM 12A	10	OFLM012.T	07945814066
15	FLM015	FLM 15A	10	OFLM015.T	07945814068
20	FLM020	FLM 20A	10	OFLM020.T	07945814071
25	FLM025	FLM 25A	10	OFLM025.T	07945814072
30	FLM030	FLM 30A	10	OFLM030.T	07945814073

### Electrical Specification - Agency Requirements

AMPERAGE RATING	OPENING TIME (MINUTES)		
	100 % OF AMP RATING PER UL	135 % OF AMP RATING PER UL	200 % OF AMP RATING PER UL
$\frac{1}{10}$ –3	Temperature Stabilization	60 Minutes Max	5 Seconds Minimum
3 $\frac{3}{10}$ –30	Temperature Stabilization	60 Minutes Max	12 Seconds Minimum

### Electrical Specifications

CATALOG NUMBER	VOLTAGE AC (V)	INTERRUPTING RATING (A)	NOMINAL COLD RESISTANCE (OHMS)	AGENCY APPROVALS			
				UL	CSA	QPL	CE
FLM.100	250	10,000	188.0	•	•	•	•
FLM.125	250	10,000	87.00	•	•	•	•
FLM.200	250	10,000	35.10	•	•	•	•
FLM.250	250	10,000	16.82	•	•	•	•
FLM.300	250	10,000	6.739	•	•	•	•
FLM.400	250	10,000	5.413	•	•	•	•

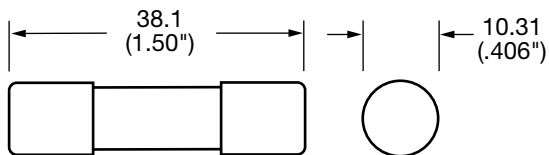
# Supplemental Fuses

## FLM Series

### Electrical Specifications

CATALOG NUMBER	VOLTAGE AC (V)	INTERRUPTING RATING (A)	NOMINAL COLD RESISTANCE (OHMS)	AGENCY APPROVALS			
				UL	CSA	QPL	CE
FLM.500	250	10,000	3.790	•	•	•	•
FLM.600	250	10,000	2.050	•	•	•	•
FLM.800	250	10,000	1.024	•	•	•	•
<b>FLM001</b>	<b>250</b>	<b>10,000</b>	<b>1.024</b>	•	•	•	•
FLM1.12	250	10,000	.6231	•	•	•	•
FLM1.25	250	10,000	.6231	•	•	•	•
FLM01.4	250	10,000	.3950	•	•	•	•
FLM01.5	250	10,000	.3390	•	•	•	•
FLM01.6	250	10,000	.2860	•	•	•	•
FLM01.8	250	10,000	.2530	•	•	•	•
FLM002	250	10,000	.2191	•	•	•	•
FLM2.25	250	10,000	.1840	•	•	•	•
FLM02.5	250	10,000	.1620	•	•	•	•
FLM02.8	250	10,000	.1250	•	•	•	•
FLM003	250	10,000	.1020	•	•	•	•
FLM03.2	250	10,000	.0904	•	•	•	•
FLM03.5	250	10,000	.0735	•	•	•	•
FLM004	250	10,000	.0700	•	•	•	•
FLM04.5	250	10,000	.0561	•	•	•	•
FLM005	250	10,000	.0413	•	•	•	•
FLM05.6	250	10,000	.0326	•	•	•	•
FLM006	250	10,000	.0280	•	•	•	•
FLM6.25	250	10,000	.0277	•	•	•	•
FLM007	250	10,000	.0213	•	•	•	•
FLM008	250	10,000	.0124	•	•	•	•
FLM009	250	10,000	.0106	•	•	•	•
FLM010	250	10,000	.0090	•	•	•	•
FLM012	250	10,000	.0069	•	•	•	•
FLM015	250	10,000	.0053	•	•	•	•
FLM020	250	10,000	.0038	•	•	•	•
FLM025	250	10,000	.0027	•	•	•	•
FLM030	250	10,000	.0022	•	•	•	•

### Dimensions Millimeters (inches)

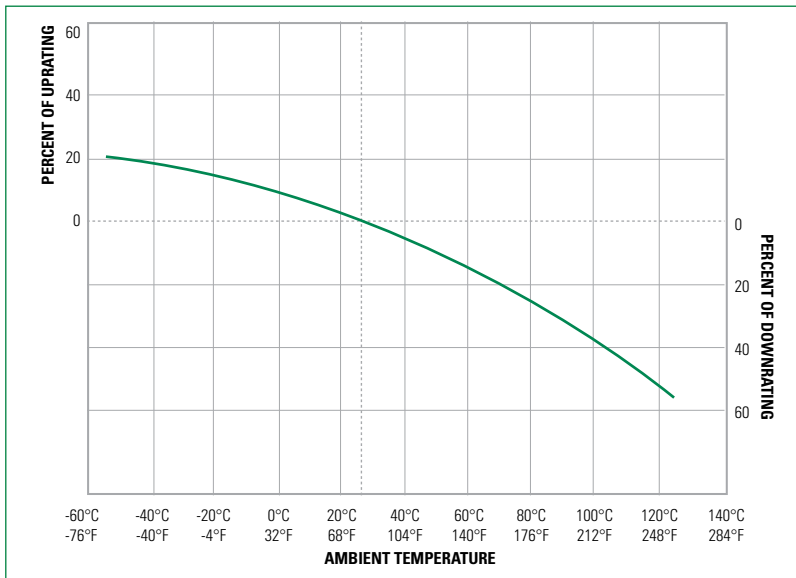


# Supplemental Fuses

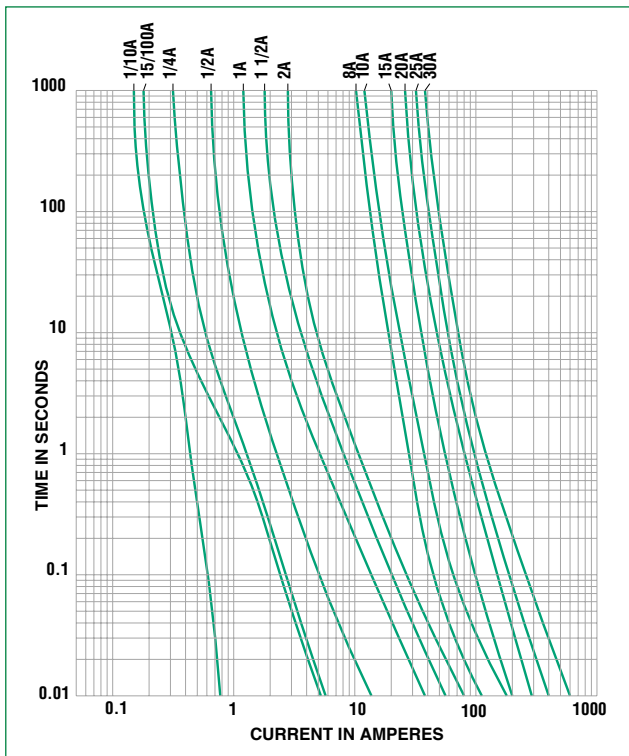
## FLM Series

### Temperature Derating Curve

Ambient temperature: temperature of air immediately surrounding fuse



### Time Current Curves



**Disclaimer Notice** – Information furnished is believed to be accurate and reliable. However, users should independently evaluate the suitability of and test each product selected for their own applications. Littelfuse products are not designed for, and may not be used in, all applications. Read complete Disclaimer Notice at [www.littelfuse.com/product-disclaimer](http://www.littelfuse.com/product-disclaimer).

### 30.5 mm Heavy-Duty Watertight/Oiltight—10250T



### Contents

<i>Description</i>	<i>Page</i>
30.5 mm Heavy-Duty Watertight/Oiltight—10250T	
Product Overview . . . . .	V7-T1-214
Product Identification . . . . .	V7-T1-214
Catalog Number Selection . . . . .	V7-T1-215
Product Selection	
Point-of-Purchase Packaging . . . . .	V7-T1-217
Non-Illuminated Momentary Pushbutton Units . . . . .	V7-T1-218
Pushbuttons . . . . .	V7-T1-219
Illuminated Momentary Pushbutton Units . . . . .	V7-T1-222
Indicating Light Units . . . . .	V7-T1-223
Illuminated Pushbuttons and Indicating Lights . . . . .	V7-T1-224
Push-Pull Emergency Stop . . . . .	V7-T1-226
Illuminated Push-Pull Units . . . . .	V7-T1-229
Potentiometers . . . . .	V7-T1-232
Push-Pull Operators . . . . .	V7-T1-233
Selector Switch Units . . . . .	V7-T1-237
Selector Switch Selection . . . . .	V7-T1-238
Selector Switch Operators . . . . .	V7-T1-241
Illuminated Selector Switch Operators . . . . .	V7-T1-244
Joystick Units . . . . .	V7-T1-245
Joysticks . . . . .	V7-T1-246
Roto-Push Units . . . . .	V7-T1-249
Roto-Push Operators . . . . .	V7-T1-250
Accessories . . . . .	V7-T1-255
Options . . . . .	V7-T1-260
Replacement Parts . . . . .	V7-T1-269
Technical Data and Specifications . . . . .	V7-T1-271
Dimensions . . . . .	V7-T1-274



### Application Description

#### Contact Operation

Slow make and break. All normally closed contacts have positive opening operation, i.e., normally closed contacts are forced open in the event of contact weld or spring breakage.

### Standards and Certifications

- CE EN 60947-5-1 and 60947-5-5
- UL 508—File No. 131568
- CSA C22.2 No. 14—File No. LR68551



### Ingress Protection

When mounted in similarly rated enclosure—

- Standard indicating lights
  - UL (NEMA) Type 1, 2, 3, 3R, 3S, 4, 4X, 12, 13
  - IEC IP65
- Most other operators
  - UL (NEMA) Type 1, 2, 3, 3R, 4, 4X, 12, 13
  - IEC IP65

### Product Description

The 30.5 mm pushbutton line features a zinc die cast construction with chrome-plated housing and mounting nut. The same durable construction is also available with the corrosive resistant E34 line of pushbuttons. See E34 section on **Pages V7-T1-284 to V7-T1-325**.

### Features

- Heavy-duty zinc die cast construction
- Enclosed silver contacts with reliability nibs
- Diaphragm seals with drainage holes
- Grounding nibs on the operator casing

### Benefits

- Reliability nibs improve contact reliability even under dry circuit and fine dust conditions
- Drainage holes prevent buildup of liquid inside the operator which can prevent operation in freezing environments
- Grounding nibs bit through paint and other coatings to provide secure ground



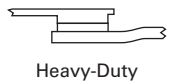
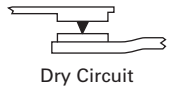
#### 1

### Product Overview

#### Reliability Nibs

Eaton's contact blocks feature enclosed silver contacts with pointed "reliability nibs" for reliable performance from logic level up to 600V. To ensure reliable switching, nibs bite through oxide which can form on silver contacts, eliminating the need for expensive logic level blocks for most applications.

#### Reliability Nibs



Reliability nibs improve performance in dry circuit, corrosive, fine dust and other contaminated atmospheres. Under normal environmental conditions, the minimum operational voltage is 5V and the minimum operational current is 1 mA, AC/DC. For operation under a wider range of environmental conditions, logic level contact blocks with inert palladium tipped contacts are recommended.

#### Grounding Nibs

10250T line operators have "grounding nibs"—four metal points on the operator casting designed to bite through most paints and other coatings on metal panels to enhance the ground connection when the operator is securely tightened.

#### Grounding Nibs

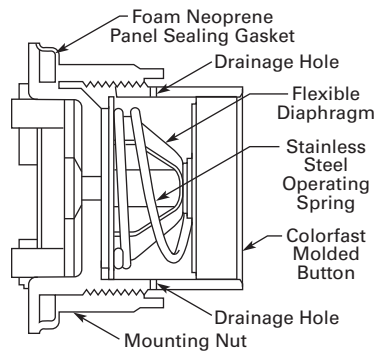


#### Diaphragm Seal with Drainage Holes

##### Liquid Drainage

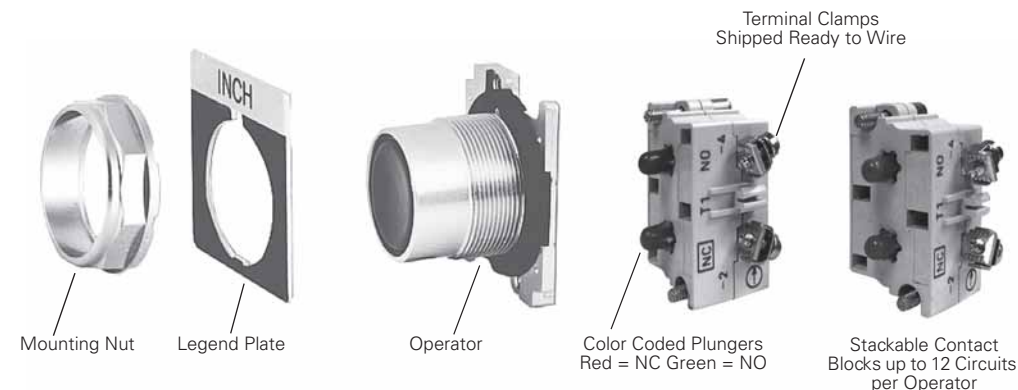
Eaton's pushbutton operators offer front of panel drainage via holes in the operator bushing. Hidden from view by the mounting nut, these holes prevent buildup of liquid inside the operator, which can prevent operation in freezing environments. The holes also provide a route for escaping liquid in high pressure washdowns, effectively relieving pressure from the internal diaphragm seal, ensuring reliable sealing in applications even beyond NEMA 4.

#### Diaphragm Seal



### Product Identification

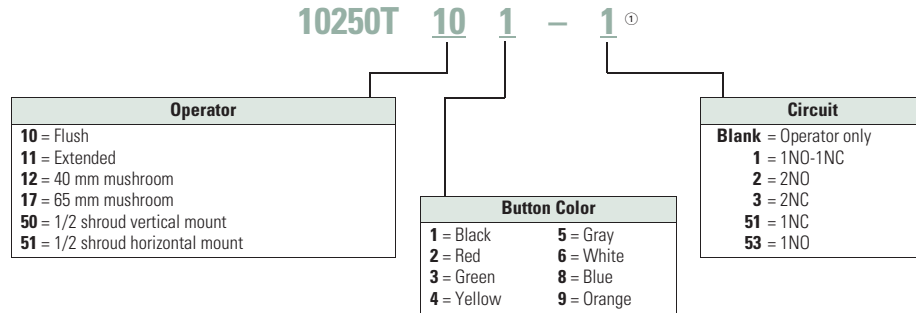
#### 30.5 mm Heavy-Duty Watertight/Oiltight—10250T Series



### Catalog Number Selection

Catalog Number Selection is for illustrative purposes only and not to be used to create new catalog numbers.

### Non-Illuminated Pushbuttons



**Note**

① Add **X** at end of catalog number to receive parts assembled from factory.

# 1.9

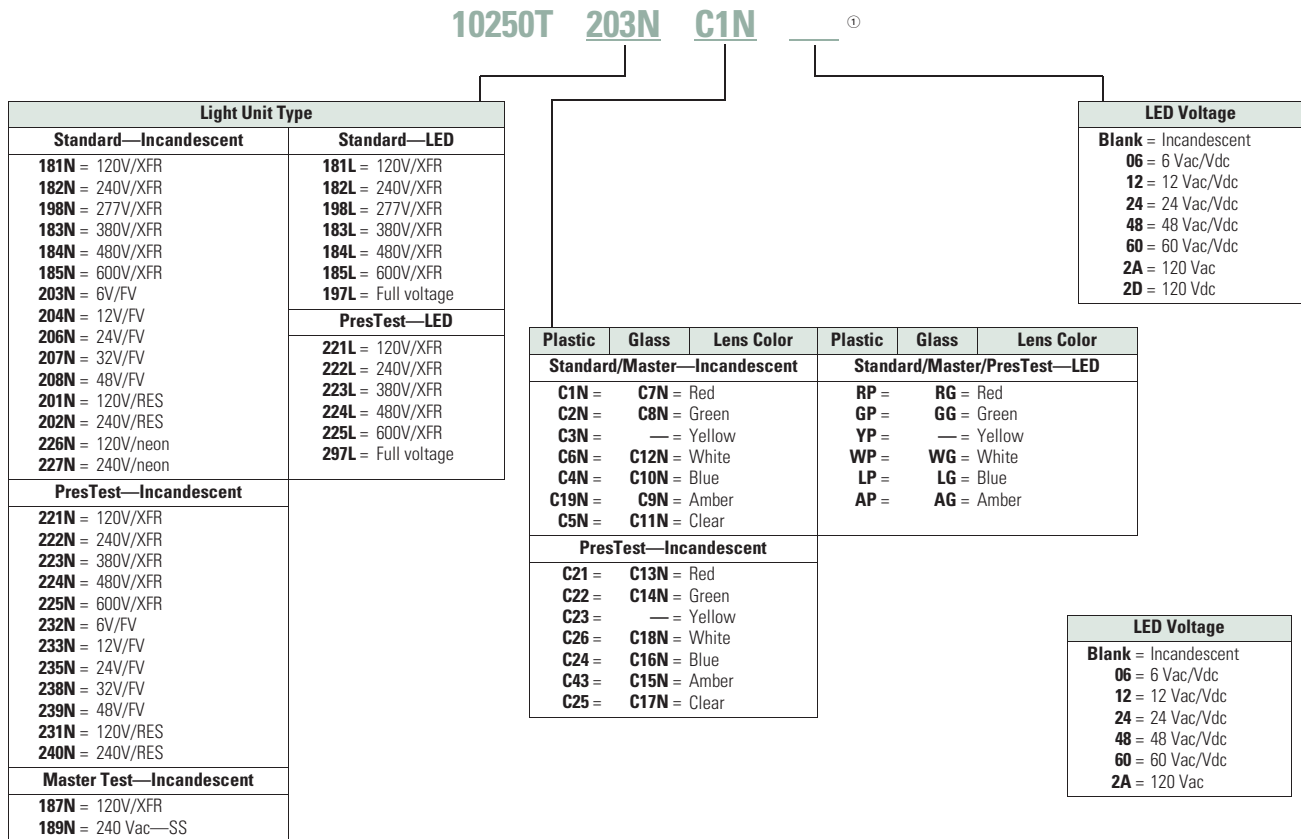
## Pushbuttons and Indicating Lights

30.5 mm Heavy-Duty Watertight/Oiltight—10250T

1

Catalog Number Selection is for illustrative purposes only and not to be used to create new catalog numbers.

### Standard Indicating Lights, PresTest and Master Test



**Note**

① Add X at end of catalog number to receive parts assembled from factory.

**Non-Illuminated Momentary Pushbutton Units**

UL (NEMA) Type 3, 3R, 4, 4X, 12, 13

**Flush Button****Extended Button****Mushroom Button****Jumbo Mushroom****Pushbutton Units—Flush, Extended, Mushroom Head or Jumbo Mushroom Head Operators**

Contact Type	Button Color	Flush Button Catalog Number	Extended Button Catalog Number	Mushroom Button Catalog Number	Jumbo Mushroom <sup>①</sup> Catalog Number
1NO	Black	10250T23B	10250T25B	10250T26B	10250T27B
	Red	10250T23R	10250T112-53	10250T122-53	10250T172-53
	Green	10250T23G	10250T25G	10250T26G	10250T27G
	Yellow	10250T23Y	10250T25Y	10250T26Y	10250T27Y
	Red—Engraved EMERG. STOP	—	—	—	10250T17213-53
1NC	Black	10250T101-51	10250T111-51	10250T121-51	10250T171-51
	Red	10250T102-51	10250T25R	10250T26R	10250T27R
	Green	10250T103-51	10250T113-51	10250T123-51	10250T173-51
	Yellow	10250T104-51	10250T120-51	10250T124-51	10250T174-51
	Red—Engraved EMERG. STOP	—	—	—	10250T29
1NO-1NC	Black	10250T30B	10250T31B	10250T32B	10250T33B
	Red	10250T30R	10250T31R	10250T32R	10250T33R
	Green	10250T30G	10250T31G	10250T32G	10250T33G
	Yellow	10250T30Y	10250T31Y	10250T32Y	10250T33Y
	Red—Engraved EMERG. STOP	—	—	—	10250T33
2NO	Black	10250T101-2	10250T111-2	10250T121-2	10250T171-2
	Red	10250T102-2	10250T112-2	10250T122-2	10250T172-2
	Green	10250T103-2	10250T113-2	10250T123-2	10250T173-2
	Yellow	10250T104-2	10250T120-2	10250T124-2	10250T174-2
	Red—Engraved EMERG. STOP	—	—	—	10250T17213-2
2NC	Black	10250T101-3	10250T111-3	10250T121-3	10250T171-3
	Red	10250T102-3	10250T112-3	10250T122-3	10250T172-3
	Green	10250T103-3	10250T113-3	10250T123-3	10250T173-3
	Yellow	10250T104-3	10250T120-3	10250T124-3	10250T174-3
	Red—Engraved EMERG. STOP	—	—	—	10250T17213-3







**Note**

① Anodized aluminum head is not suitable for use in ultraviolet light applications.

### Pushbuttons

UL (NEMA) Type 3, 3R, 4, 4X, 12, 13

#### Momentary Pushbutton Operators, Non-illuminated

Part Number	Button	Color	Catalog Number			
			Vertical	Horizontal		
<b>10250T10_</b> 	Flush button ①	Black	<b>10250T101</b>			
		Red	<b>10250T102</b>			
		Green	<b>10250T103</b>			
		Yellow	<b>10250T104</b>			
		Gray	<b>10250T105</b>			
		White	<b>10250T106</b>			
		Blue	<b>10250T108</b>			
		Orange	<b>10250T109</b>			
		<b>10250T11_</b> 	Extended button	Black	<b>10250T111</b>	
Red	<b>10250T112</b>					
Green	<b>10250T113</b>					
Yellow	<b>10250T120</b>					
White	<b>10250T116</b>					
Blue	<b>10250T118</b>					
Orange	<b>10250T119</b>					
<b>10250T5_</b> 	Half shrouded button			Black	<b>10250T501</b>	<b>10250T511</b>
				Red	<b>10250T502</b>	<b>10250T512</b>
		Green	<b>10250T503</b>	<b>10250T513</b>		
		Yellow	<b>10250T504</b>	<b>10250T514</b>		
		Gray	<b>10250T505</b>	<b>10250T515</b>		
		White	<b>10250T506</b>	<b>10250T516</b>		
		Blue	<b>10250T508</b>	<b>10250T518</b>		
		Orange	<b>10250T509</b>	<b>10250T519</b>		
		<b>10250T12_</b> 	Mushroom button	Black	<b>10250T121</b>	
Red	<b>10250T122</b>					
Green	<b>10250T123</b>					
Yellow	<b>10250T124</b>					
Blue	<b>10250T129</b>					
<b>10250T17_</b> 	Jumbo mushroom button ②	Black	<b>10250T171</b>			
		Red	<b>10250T172</b>			
		Red (EMERG. STOP)	<b>10250T17213</b>			
		Green	<b>10250T173</b>			
		Yellow	<b>10250T174</b>			
<b>10250ED1164_</b> 	Low operating force— jumbo mushroom ②③	Black	<b>10250ED1164-2</b>			
		Red	<b>10250ED1164-3</b>			
		Green	<b>10250ED1164-4</b>			
		Yellow	<b>10250ED1164-5</b>			
		Clear	<b>10250ED1164</b>			

**Note:** To order complete assembled unit using one composite catalog number, add contact block and legend plate suffix to the end of operator catalog number. Example: 10250T101-1TS33



**Operator**  
**10250T101**

+



**Contact Block**  
**10250T1**

+



**Legend Plate**  
**10250TS33**

#### Notes

- ① To order operator with factory assembled extended retaining nut, **10250TA12**, for thick panel applications, add suffix letter **E** to listed catalog number. Example: 10250T101E.
- ② Anodized aluminum head is not suitable for use in ultraviolet light applications.
- ③ Operating force—Standard = 2.4 lb; low force = 1.6 lb.

### Indicating Light Units ①

UL (NEMA) Type 3, 3R, 4, 4X, 12, 13

- LED or incandescent
- Full voltage, resistor or transformer type
- Standard and PresTest types
- Plastic lenses

PresTest—This device incorporates a press-to-test feature whereby depressing the lens disconnects the light from the source being

monitored and connects the lamp to a continuously energized circuit for immediate detection of faulty lamps.

24V Full Voltage Illuminated Light



120 Vac Transformer PresTest



### Indicating Light Units

Type	Voltage	Color	LED/Lamp Number	Indicating Light Catalog Number	PresTest Catalog Number		
<b>LED Lamp</b>							
Full voltage	24 Vac/Vdc	Red	Bayonet base	10250T197LRP24	10250T297LRP24		
		Green		10250T197LGP24	10250T297LGP24		
		Amber		10250T197LAP24	10250T297LAP24		
		Yellow		10250T197LYP24	10250T297LYP24		
		Blue		10250T197LLP24	10250T297LLP24		
		White		10250T197LWP24	10250T297LWP24		
		120 Vac		Red	10250T197LRP2A	10250T297LRP2A	
				Green	10250T197LGP2A	10250T297LGP2A	
	Amber		10250T197LAP2A	10250T297LAP2A			
	Yellow		10250T197LYP2A	10250T297LYP2A			
	Blue		10250T197LLP2A	10250T297LLP2A			
	White		10250T197LWP2A	10250T297LWP2A			
	Transformer		120 Vac	Red	10250T181LRP06	10250T221LRP06	
				Green	10250T181LGP06	10250T221LGP06	
		Amber		10250T181LAP06	10250T221LAP06		
		Yellow		10250T181LYP06	10250T221LYP06		
Blue		10250T181LLP06		10250T221LLP06			
White		10250T181LWP06		10250T221LWP06			
<b>Incandescent Lamp</b>							
Full voltage		24 Vac/Vdc		Red	#757	10250T206NC1N	10250T235NC21
	Green		10250T206NC2N	10250T235NC22			
	Amber		10250T206NC19N	10250T235NC43			
	Yellow		10250T206NC3N	10250T235NC23			
	Blue		10250T206NC4N	10250T235NC24			
	Clear		10250T206NC5N	10250T235NC25			
	White		10250T206NC6N	10250T235NC26			
Resistor	120 Vac/Vdc	Red	120MB	10250T201NC1N	10250T231NC21		
		Green		10250T201NC2N	10250T231NC22		
		Amber		10250T201NC19N	10250T231NC43		
		Yellow		10250T201NC3N	10250T231NC23		
		Blue		10250T201NC4N	10250T231NC24		
		Clear		10250T201NC5N	10250T231NC25		
		White		10250T201NC6N	10250T231NC26		
Transformer ②	120 Vac	Red	#755	10250T34R	10250T74NR		
		Green		10250T34G	10250T74NG		
		Amber		10250T34A	10250T74NA		
		Yellow		10250T34Y	10250T74NY		
		Blue		10250T34B	10250T74NB		
		Clear		10250T34C	10250T74NC		
		White		10250T34W	10250T74NW		

**Notes**

- ① Standard indicating lights are rated UL (NEMA) 3S as well.
- ② For flashing lamp add letter **F** to listed catalog number. Example: 10250T34RF.

**Illuminated Pushbuttons and Indicating Lights**

- LED or incandescent
- Full voltage, resistor or transformer type

**Illuminated Pushbutton****Operators without Lens****Indicating Light****PresTest****Master Test**

Type	Voltage	LED/Lamp Number	Illuminated Pushbutton Catalog Number	Indicating Light Catalog Number	PresTest Catalog Number	Master Test Catalog Number
<b>Incandescent Unit</b>						
Full voltage AC/DC	6	#755	10250T473	10250T203N	10250T232N	—
	12	#756	10250T474	10250T204N	10250T233N	—
	24	#757	10250T476	10250T206N	10250T235N	—
	32	#1828	10250T477	10250T207N	10250T238N	—
	48	#1835	10250T478	10250T208N	10250T239N	—
Resistor AC/DC <sup>②</sup>	120	120MB	10250T471	10250T201N	10250T231N	—
	240	120MB	10250T472	10250T202N	10250T240N	—
Transformer AC only <sup>③</sup>	24	#755	10250T416	—	—	—
	120		10250T411	10250T181N	10250T221N	—
	240		10250T422	10250T182N	10250T222N	—
	277		10250T419	10250T198N	—	—
	380		10250T413	10250T183N	10250T223N	—
	480		10250T414	10250T184N	10250T224N	—
Neon AC/DC <sup>④</sup>	120	NE51H-R22	—	10250T226N	—	—
	240	NE51H-R68	—	10250T227N	—	—
Solid-state 50/60 Hz only	120	120MB	—	—	—	10250T189N
<b>LED (LEDs not included) <sup>①</sup></b>						
Full voltage	—	Bayonet base	10250T397L	10250T197L	10250T297L	—
Transformer AC only	24		10250T416L	—	—	—
	120		10250T411L	10250T181L	10250T221L	—
	240		10250T412L	10250T182L	10250T222L	—
	277		10250T419L	10250T198L	—	—
	380		10250T413L	10250T183L	10250T223L	—
	480		10250T414L	10250T184L	10250T224L	—
	600		10250T415L	10250T185L	10250T225L	—

**Notes**

- <sup>①</sup> These units do not include lamps. Order LED separately to match lens color. See **Page V7-T1-269** for LED Selection and **Page V7-T1-216** for Catalog Numbering System.
- <sup>②</sup> Resistor units are not available for use with LEDs, choose either transformer or full voltage LED style.
- <sup>③</sup> For flashing lamp, add letter **F** to listed catalog number. Example: 10250T181NF.
- <sup>④</sup> Resistant to shock and vibration. For best illumination use amber, yellow or clear lens.

Plastic

### Indicating and Master Test Lenses



Color	Plastic Catalog Number	Glass Catalog Number
Red	10250TC1N	10250TC7N
Green	10250TC2N	10250TC8N
Amber	10250TC19N	10250TC9N
Yellow	10250TC3N	—
Blue	10250TC4N	10250TC10N
Clear	10250TC5N	10250TC11N
White	10250TC6N	10250TC12N

Glass



### Illuminated Pushbutton Lenses

10250TC2



Color	Catalog Number
Red	10250TC21
Green	10250TC22
Yellow	10250TC23
Amber	10250TC43
Blue	10250TC24
Clear	10250TC25
White	10250TC26

Plastic

### PresTest Lenses



Color	Plastic Catalog Number	Glass Catalog Number
Red	10250TC21	10250TC13N
Green	10250TC22	10250TC14N
Amber	10250TC43	10250TC15N
Yellow	10250TC23	—
Blue	10250TC24	10250TC16N
Clear	10250TC25	10250TC17N
White	10250TC26	10250TC18N

Glass





### Selector Switch Units

UL (NEMA) Type 3, 3R, 4, 4X, 12, 13

- Two-, three- and four-position maintained
- Non-illuminated and illuminated

#### Two-Position Maintained Switch



#### Two-Position Selector Switch

Operator Position <sup>①</sup>		Operator Action <sup>②</sup>	Contact Type	Mounting Location		Non-Illuminated		Illuminated—120V Transformer	
X	O			A	B	Black Knob Catalog Number <sup>③</sup>	Black Lever Catalog Number <sup>③</sup>	Red Knob Catalog Number <sup>③</sup>	Red Lever Catalog Number <sup>③</sup>
X	O		1NC			<u>10250T20KB</u>	<u>10250T20LB</u>	<u>10250ED1117-KR</u>	<u>10250ED1117-LR</u>
O	X		1NO						

#### Three-Position Maintained Switch



#### Three-Position Selector Switch

Operator Position <sup>①</sup>			Operator Action <sup>②</sup>	Contact Type	Mounting Location		Non-Illuminated		Illuminated—120V Transformer	
X	O	O			A	B	Black Knob Catalog Number <sup>③</sup>	Black Lever Catalog Number <sup>③</sup>	Red Knob Catalog Number <sup>③</sup>	Red Lever Catalog Number <sup>③</sup>
X	O	O		1NO			<u>10250T21KB</u>	<u>10250T21LB</u>	<u>10250ED1117-2KR</u>	<u>10250ED1117-2LR</u>
O	O	X		1NO						

#### Three-Position Maintained Switch



X	O	O		1NO			<u>10250T22KB</u>	<u>10250T22LB</u>	<u>10250ED1117-3KR</u>	<u>10250ED1117-3LR</u>
O	X	O		2NC (Series)						
O	O	X		1NO						

#### Three-Position Maintained Switch



#### Four-Position Selector Switch

Operator Position <sup>①</sup>				Operator Action <sup>②</sup>	Contact Type	Mounting Location		Non-Illuminated		Illuminated—120V Transformer	
X	O	O	O			A	B	Black Knob Catalog Number <sup>③</sup>	Black Lever Catalog Number <sup>③</sup>	Red Knob Catalog Number <sup>③</sup>	Red Lever Catalog Number <sup>③</sup>
X	O	O	O		1NC			<u>10250T46KB</u>	<u>10250T46LB</u>	<u>10250ED1117-4KR</u>	<u>10250ED1117-4LR</u>
O	X	O	O		1NO						
O	O	X	O		1NO						
O	O	O	X		1NC						

#### Color Selection

Illuminated						Non-Illuminated					
Color	Code Letter	Color	Code Letter	Color	Code Letter	Color	Code Letter	Color	Code Letter	Color	Code Letter
Red	<b>R</b>	White	<b>W</b>	Amber	<b>A</b>	Black	<b>B</b>	Green	<b>G</b>	Blue	<b>L</b>
Green	<b>G</b>	Blue	<b>B</b>	Clear	<b>C</b>	Red	<b>R</b>	White	<b>W</b>	Orange	<b>O</b>

#### Notes

- ① X = closed circuit, O = open circuit.
- ② M = Maintained.
- ③ To order different type or color selector switch, substitute the underlined character with appropriate suffix code from the Color Selection table. Example: 10250T20KG.

#### 1

### Selector Switch Selection



#### Cam and Contact Block Selection

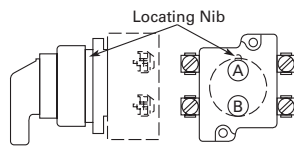
Selector switches in their varied forms (two-position, three-position and four-position) are a big factor contributing to the great flexibility of control that a well rounded line of “pushbuttons” can achieve. Because of their flexibility, they tend to cause difficulty with product selection and application. The following systematic approach should simplify that task.

Cam and contact block selection is better understood if you:

- Work with each incoming and outgoing wire/circuit separately.
- Recognize the terms NO and NC only identify the type of contact by its mode before mounting to the operator. The “X-O” table (Page V7-T1-240) shows how that contact will act after assembly to the operator with the selected cam shape. X = closed circuit, O = open circuit.

- Up to six NO or NC contacts may be mounted behind each plunger location for a total of twelve contacts. Single circuit contact blocks have only one plunger with the other side of the block “open.” Therefore, single circuit contact blocks transmit motion to blocks behind them only for the position containing the circuit.
- Each cam has two separate lobes, each of which operates one of the two contact block plungers independently of each other. Those are identified as position A (locating nib side) and position B (opposite of locating nib). The position designations give direction in selecting and mounting of the contact blocks.

#### Contact Circuit Locations

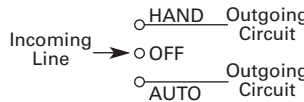


#### Systematic Approach

Application: **HAND-OFF-AUTO** selector switch. In this circuit, one incoming line is distributed to two other outgoing circuits by the switch. The two circuits can be looked at individually.

#### Step 1: Elementary Diagram.

Construct on paper, or in your mind, a simple elementary diagram of the switching scheme as follows:



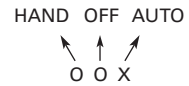
#### Step 2: “X-O” Pattern.

From the elementary diagram, you can construct an “X-O” diagram which describes when the contacts are to be closed (X) or open (O) in the various positions of the switch. The “X-O” for the **HAND** circuit looks like this:



In this circuit, you want a contact closed on the left (HAND) but open in the center and right.

For the **AUTO** circuit, the “X-O” diagram would look like this:



Putting them together, the complete “X-O” diagram is:



Once the “X-O” diagram has been generated the next step is to select the cam and contact block, or blocks, needed to perform the desired “X-O” functions. The selection tables on the following pages list the various types (shapes) of cams by number to choose from and the type of contact and position to achieve the function outlined in your “X-O” diagram.

### Step 3: Cam Selection.

The cam you select determines the operation of all contact blocks mounted to the operator. It is selected on the basis that it provides the simplest circuitry for the desired “X-O” diagram. The selection tables show all the “X-O” combinations. For the purpose of this example, the applicable portion of those tables is shown on this page.

Now to make the cam selection, make a simple worksheet such as:

	Cam 2	Cam 3
X O O	(A)NO-(B)NC	(A)NO
O O X	(B)NO	(B)NO

It becomes immediately obvious that cam 3 is the better choice for two reasons, (1) the series combination can be avoided making it simpler to wire, (2) only two contacts are required, which is less expensive than the three contacts required by cam 2.

### Step 4: Contact Block Selection.

Having selected the cam, contact block selection is simply a matter of gathering the A position and B position circuits into pairs which make up the most convenient contact block arrangement. If there is an imbalance in the number of circuits under A or B, then single circuit blocks must be selected for these leftover circuits.

Back to the worksheet, having selected cam 3 do this:



### Step 5: Selector Switch Operator.

Lastly, you have to choose from the many types of operators—knob and lever in various colors or keyed. Also what combinations of maintained and spring return functions are required. Selection of these operators can be found on **Page V7-T1-242**. For the example in step 4 you may want a three-position maintained black knob, cam 3—Catalog Number 10250T1323.

**The Complete Switch:** 10250T1323 with one 10250T2 or, for one composite catalog number, 10250T21KB found on **Page V7-T1-237**.

### Diagrams

Circuits shown illustrate connections to obtain a selector switch circuit combination and are shown with their appropriate line diagrams. Field wiring of jumper connections required as shown.

X = Closed circuit  
O = Open circuit

### Wiring of Jumper Connections



Four-position selector switches are limited to four contact blocks.

### Contact Blocks

For selection and number of available contact blocks per operator, see **Pages V7-T1-265 to V7-T1-268**.

### Example Selection Table

No.	“X-O” Pattern	Cam Code #2		Cam Code #3	
		Top A	Bottom B	Top A	Bottom B
1	X 0 0				—
4	0 0 X	—		—	

### Two-Position Selector Switch Contact Block Selection

No.	Desired Circuit and Operator Position		Contact Blocks Required to Accomplish Circuit Function	
			Top Plunger A	Bottom Plunger B
1	X	0		or
2	0	X		or

**Note**  
① Wired in series.

#### 1 Three-Position Switch—Cam and Contact Block Selection

No.	Desired Circuit and Operator Position			Operator with Cam Code #2		Operator with Cam Code #3	
				Mounting Location		Mounting Location	
	X	0	0	Top Plunger A	Bottom Plunger B	Top Plunger A	Bottom Plunger B
1	X	0	0				
2	X	X	0				
3	X	0	X				
4	0	0	X				
5	0	X	X				
6	0	X	0				





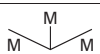
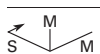
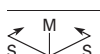
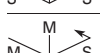


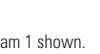
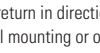
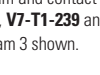
#### Four-Position Switch—Contact Block Selection

No.	Desired Circuit and Operator Position				Contact Blocks Required to Accomplish Circuit Function		No.	Desired Circuit and Operator Position				Contact Blocks Required to Accomplish Circuit Function	
					Mounting Location			Mounting Location		Mounting Location			
	X	0	0	0	Top Plunger A	Bottom Plunger B		Top Plunger A	Bottom Plunger B	Top Plunger A	Bottom Plunger B		
1	X	0	0	0			10	X	0	X	0		
2	0	X	0	0									
3	0	0	X	0			11	X	X	X	0		
4	0	0	0	X									
5	X	0	0	X			12	0	X	X	X		
6	0	X	X	0									
7	0	0	X	X			13	X	0	X	X		
8	X	X	0	0									
9	0	X	0	X			14	X	X	0	X		

#### Selector Switch Operators with Caps

UL (NEMA) Type 3, 3R, 4, 4X, 12, 13

#### Selector Switch Operators with Caps

	Positions	Operator Action <sup>②</sup>	Black Knob Selector Switch— Vertical Mounting <sup>③</sup>		Black Lever Selector Switch— Vertical Mounting <sup>③</sup>	
			Cam Code <sup>④</sup>	Catalog Number	Cam Code <sup>④</sup>	Catalog Number
<b>Two-Position Maintained</b> <sup>①</sup> 	Two-position—60° throw		1	10250T1311	1	10250T3011
			1	10250T1371	1	10250T3071
<b>Three-Position Maintained</b> <sup>⑤</sup> 	Three-position—60° throw		2	10250T1322	2	10250T3022
			3	10250T1323	3	10250T3023
			2	10250T1332	2	10250T3032
			3	10250T1333	3	10250T3033
			2	10250T1342	2	10250T3042
			3	10250T1343	3	10250T3043
			2	10250T1352	2	10250T3052
			3	10250T1353	3	10250T3053
	Four-position—40° throw		7	10250T1367	7	10250T3067

#### Notes

- ① Black knob selector switch, cam 1 shown.
- ② M = Maintained. S = Spring return in direction of arrow (R).
- ③ Field convertible to horizontal mounting or order operator only and separate operator cap.
- ④ For selection of the proper cam and contact block to obtain the proper circuit sequence, see selection instructions and tables on **Pages V7-T1-238, V7-T1-239 and V7-T1-240**.
- ⑤ Black lever selector switch, cam 3 shown.

### Selector Switch Operators without Caps

Operators can be ordered with caps assembled to them by adding the code number from the table on this page to the end of catalog number below.  
Example: 10250T4011**KB**

#### Two-Position Selector Switch Maintained



### Selector Switch Operators without Caps

Positions	Operator Action ①	Cam Code ②	Catalog Number
Two-position—60° throw		1	<b>10250T4011</b>
		1	<b>10250T4081</b>
Three-position—60° throw		2	<b>10250T4022</b>
		3	<b>10250T4023</b>
		2	<b>10250T4032</b>
		3	<b>10250T4033</b>
		2	<b>10250T4042</b>
		3	<b>10250T4043</b>
Four-position—40° throw		2	<b>10250T4052</b>
		3	<b>10250T4053</b>
		7	<b>10250T4067</b>

#### Knob



#### Lever



#### Lever for Use with Maintained Operators



#### Coin Slot



### Operating Caps

Color	Knob Catalog and Code Number	Lever Catalog and Code Number	Color	Lever ③ Catalog and Code Number	Coin Slot Catalog and Code Number
Black	<b>10250TKB</b>	<b>10250TLB</b>	Black	<b>10250TSB</b>	<b>10250TCB</b>
Red	<b>10250TKR</b>	<b>10250TLR</b>	Red	<b>10250TSR</b>	<b>10250TCR</b>
Green	<b>10250TKG</b>	<b>10250TLG</b>	Green	<b>10250TSG</b>	<b>10250TCG</b>
Yellow	<b>10250TKY</b>	<b>10250TLY</b>	Yellow	<b>10250TSY</b>	<b>10250TCY</b>
White	<b>10250TKW</b>	<b>10250TLW</b>	White	<b>10250TSW</b>	<b>10250TCW</b>
Gray	<b>10250TKA</b>	<b>10250TLA</b>	Gray	<b>10250TSA</b>	<b>10250TCA</b>
Blue	<b>10250TKL</b>	<b>10250TLL</b>	Blue	<b>10250TSL</b>	<b>10250TCL</b>
Orange	<b>10250TKD</b>	<b>10250TLO</b>	Orange	<b>10250TSO</b>	<b>10250TCO</b>

#### Notes

- ① M = Maintained. S = Spring return in direction of arrow (R).
- ② For selection of the proper cam and contact block to obtain the proper circuit sequence, see selection instructions and tables on **Pages V7-T1-238, V7-T1-239 and V7-T1-240**.
- ③ Designed for added ingress protection. For use in maintained operators only.

### Contact Blocks

#### Standard Contact Blocks

- UL A600/P600 rated
- Color-coded plungers—red/green for NC/NO circuits
- Silver contact tips with “reliability nibs”
- Gray (opaque) or amber (translucent) housings
- Pressure plate or spade terminals
- Fingerproof shrouds (for pressure terminals only)

#### Logic Level Contact Blocks

- UL A600/P600 rated
- Color-coded plungers
- Inert palladium knife-blade contacts
- Gray (opaque) housings
- Pressure plate or spade terminals

#### Special Function Contact Blocks

- UL A600/P600 rated
- Color-coded plungers
- Silver contact tips with “reliability nibs”
- Gray (opaque) housings
- Pressure plate terminals only

#### Special Purpose Contact Block

- Maximum 300V rated
- Black plungers
- Silver contact tips with “reliability nibs”
- Black (opaque) housings
- Pressure plate terminals only
- Fingerproof shrouds not available

#### Reliability Nibs

Reliability nibs are the hallmark of Eaton’s contact blocks. A pointed silver nib on the contact tip ensures reliable switching from logic level (5V) up to 600V applications. Therefore standard contact blocks can be used for most logic level applications where the contacts are not exposed to any harsh environmental conditions.

#### Palladium Contacts

Palladium, which is more inert than gold, is well suited for voltages and currents approaching zero and is recommended for applications where environmental conditions are a factor.

#### Maximum Contact Block Mounting per Operator Type

Operator	Max. Stack
Pushbuttons	6
Push-pull operators	2
Roto-push operators	4
Two- or three-position selector switches	6
Four-position selector switches	4
Joysticks	4

10250T1



Contact Blocks

Symbol	Circuit	Description <sup>①</sup>	Standard	Spade Terminal <sup>②</sup>	Logic Level	Spade Terminal <sup>②</sup>
			Pressure Terminal Catalog Number	Catalog Number	Pressure Terminal Catalog Number	Catalog Number
	Blank No Plunger 1NC	Stack up to six blocks (six circuits) unless otherwise noted.	<b>10250T51</b>	<b>10250T59</b>	<b>10250T51E</b>	<b>10250T59E</b>
	Blank No Plunger 1NO	Stack up to six blocks (six circuits) unless otherwise noted.	<b>10250T53</b>	<b>10250T60</b>	<b>10250T53E</b>	<b>10250T60E</b>
	<b>NO-NC</b>	Stack up to six blocks (12 circuits) unless otherwise noted.	<b>10250T1</b>	<b>10250T40</b>	<b>10250T1E</b>	<b>10250T40E</b>
	2NC	Stack up to six blocks (12 circuits) unless otherwise noted.	<b>10250T3</b>	<b>10250T42</b>	<b>10250T3E</b>	<b>10250T42E</b>
	2NO	Stack up to six blocks (12 circuits) unless otherwise noted.	<b>10250T2</b>	<b>10250T41</b>	<b>10250T2E</b>	<b>10250T41E</b>
<b>Special Function Blocks <sup>③</sup></b>						
	Blank No Plunger LONC	Late opening NC. Stack up to six blocks (six circuits) unless otherwise noted.	<b>10250T71 <sup>③</sup></b>	—	<b>10250T71E <sup>③</sup></b>	—
	ECNO-NC	Early closing NO and standard NC. Stack up to six blocks unless otherwise noted.	<b>10250T47 <sup>③④</sup></b>	—	<b>10250T47E <sup>③</sup></b>	—
	ECNO-NO	Early closing NO and standard NO. Stack up to four blocks unless otherwise noted.	<b>10250T57 <sup>③④</sup></b>	—	<b>10250T57E <sup>③</sup></b>	—
	2LONC	Two late opening NC contacts. Stack up to six blocks unless otherwise noted.	<b>10250T45 <sup>③</sup></b>	—	<b>10250T45E <sup>③</sup></b>	—
	LONC-ECNO	Overlapping contacts. Stack up to four blocks unless otherwise noted.	<b>10250T55 <sup>③④</sup></b>	—	<b>10250T55E <sup>③</sup></b>	—
<b>Special Purpose Blocks <sup>⑤</sup></b>						
	2NO-2NC	Four circuits in single block depth. Rated 300V max. Stack up to four blocks unless otherwise noted.	<b>10250T44 <sup>⑤</sup></b>	—		

Notes

- ① All 10250T contact blocks shown are suitable for use on standard 10250T and E34 operators. These contact blocks are not suitable for Class I Division 2 type 10250T or E34 devices.
- ② Contact blocks with spade terminals are limited to a maximum of one contact block per operator and minimum spacing between devices is 2.5 in (63.5 mm). Not suitable for use in 10250T or E34 enclosures. Also available in amber housing. Not available with fingerproof shrouds.
- ③ Special function contact blocks are not suitable for use with roto-push operators, three-position push-pull operators, or four-position selector switches.
- ④ ECNO contact blocks are not suitable for use with two-position joysticks or when operators are used with padlock attachments.
- ⑤ Special purpose 10250T44 contact blocks are not suitable on selector switches or roto-push operators. Okay to use with three-position push-pull operators only on low voltage (30V or less) circuits. Fingerproof shrouds not available.



**Replacement Parts**

**Replacement Lamps—For 10250T Illuminated Operators**

Mfg. Lamp Type	Voltage	Base Style	Application	Part Number
120MB	120V	T 3-1/4 bayonet	10250T resistor indicating light	28-3044
#267	6.3V	T 3-1/4 bayonet	10250T flasher	10250ED986-4
#755	6.3V	T 3-1/4 bayonet	10250T transformer, PresTest and full voltage	28-2202
#756	12V	T 3-1/4 bayonet	10250T full voltage	28-5184
#757	24V	T 3-1/4 bayonet	10250T full voltage	28-5185
#1828	32V	T 3-1/4 bayonet	10250T full voltage	28-5186
#1835	55V	T 3-1/4 bayonet	10250T resistor	28-5187
NE48	120V	T 4-1/2 bayonet	10250T neon	28-494
NE51H-R22	120V	T 3-1/4 bayonet	10250T neon	28-3754
NE51H-R68	240V	T 3-1/4 bayonet	10250T neon	28-3755

**Standard LED Lamp**



**Replacement LED Lamps—For 10250T, E34 and E22 Units**

Voltage	Color	Continuous AC/DC Catalog Number	Flashing AC Catalog Number	DC Catalog Number
6–12V	Red	E22LED612RN	E22LED006RAF	E22LED006RDF
	Orange	E22LED612ON	E22LED006OAF	E22LED006ODF
	Yellow	E22LED612YN	E22LED006YAF	E22LED006YDF
	Green	E22LED612GN	E22LED006GAF	E22LED006GDF
	Blue	E22LED612BN	E22LED006BAF	E22LED006BDF
	White	E22LED612WN	E22LED006WAF	E22LED006WDF
24V	Red	E22LED024RN	E22LED024RAF	E22LED024RDF
	Orange	E22LED024ON	E22LED024OAF	E22LED024ODF
	Yellow	E22LED024YN	E22LED024YAF	E22LED024YDF
	Green	E22LED024GN	E22LED024GAF	E22LED024GDF
	Blue	E22LED024BN	E22LED024BAF	E22LED024BDF
	White	E22LED024WN	E22LED024WAF	E22LED024WDF
48V	Red	E22LED048RN	E22LED048RAF	E22LED048RDF
	Orange	E22LED048ON	E22LED048OAF	E22LED048ODF
	Yellow	E22LED048YN	E22LED048YAF	E22LED048YDF
	Green	E22LED048GN	E22LED048GAF	E22LED048GDF
	Blue	E22LED048BN	E22LED048BAF	E22LED048BDF
	White	E22LED048WN	E22LED048WAF	E22LED048WDF
60V	Red	E22LED060RN	E22LED060RAF	E22LED060RDF
	Orange	E22LED060ON	E22LED060OAF	E22LED060ODF
	Yellow	E22LED060YN	E22LED060YAF	E22LED060YDF
	Green	E22LED060GN	E22LED060GAF	E22LED060GDF
	Blue	E22LED060BN	E22LED060BAF	E22LED060BDF
	White	E22LED060WN	E22LED060WAF	E22LED060WDF
120V	Red	E22LED120RN	E22LED120RAF	E22LED120RDF
	Orange	E22LED120ON	E22LED120OAF	E22LED120ODF
	Yellow	E22LED120YN	E22LED120YAF	E22LED120YDF
	Green	E22LED120GN	E22LED120GAF	E22LED120GDF
	Blue	E22LED120BN	E22LED120BAF	E22LED120BDF
	White	E22LED120WN	E22LED120WAF	E22LED120WDF



**Two-Position Joystick Operator**



**Flush Head Pushbutton Operator**



**Mushroom Head Pushbutton Operator**



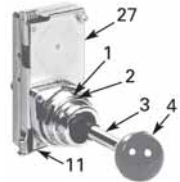
**Mushroom Head Operator with Padlock Attachment**



**Jumbo Mushroom Head Operator**



**Knob-Operated Selector Switch Operator**



**Four-Position Joystick Operator (without Latch)**



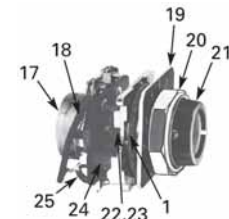
**Illuminated Pushbutton Operator**



**Full Voltage, Resistor and Transformer Type Illuminated Selector Switch**



**Transformer Type Indicating Light**



**Potentiometers**

#### 10250T Style Operator Replacement Parts

Item No.	Description	No. Req.	Part Number
1	Gasket	1	16-1548
2	Mounting nut	1	15-1530
3	Handle	1	24-5045
4	Knob	1	53-3157
	Knob (not shown) for joystick operator with latch	1	53-3159
5	Common gate (supplied with operator)	2	16-3400
6	Set screw (#6-32 x 0.250 in long hollow hex)	2	11-2014
7	Mushroom head button (includes [2] Item 6)	1	As Req. Below
	Black	—	53-1317
	Red	—	53-1317-2
	Yellow	—	53-1317-3
	Green	—	53-1317-4
	Blue	—	53-1317-22
8	Set screw (#10-32 x 0.250 in long hollow hex)	2	11-544
9	Jumbo mushroom head button (aluminum—includes [2] Item 8)	1	As Req. Below
	Red	—	53-1317-9
	Black	—	53-1317-10
	Yellow	—	53-1317-11
	Green	—	53-1317-12
10	Jumbo mushroom head button (aluminum—red EMERG. STOP) does not include Item 8	1	53-1349-18
11	Position gate:		
	Two-position	1	54-7278
	Three-position	1	54-7173
	Four-position	1	54-12278
	Eight-position	1	54-12279
12	Mounting screw (#6-32 x 0.710 in long)	2	10250TA79
	Washer	2	16-2038
13	Terminal screw and lug (captives)	Req.	80-5502KIT

Item No.	Description	No. Req.	Part Number
14	Gasket (supplied with basic unit)	1	32-803
15	Round head screw (#4-40 x 0.344 in long) (supplied with basic unit)	2	11-4553
16	Mounting screw	2	11-1632
17	Simple potentiometer (does not include items 18, 28 or 29)	1	As Req. Below
	1,000 ohms	—	41-782-2
	2,500 ohms	—	41-782-3
	5,000 ohms	—	41-782-10
	10,000 ohms	—	41-782-4
	25,000 ohms	—	41-782-5
	50,000 ohms	—	41-782-6
18	Connector (includes screw and lug)	2	25-1851
19	Indicating plate	1	As Req. Above
	Standard size (without legend)	—	30-4460
	Large size (specify legend)	—	10250TR30
20	Retaining nut	1	15-1547
21	Knob	1	53-1314
	Socket set screw (#6-32 x 0.250 in long)	2	11-2014
22	Coupling	1	29-3749-2
23	Set screw (#6-32 x 0.188 in long)	1	11-1199
24	Spacer	2	56-1066-18
25	Connector (includes screw and lug)	1	25-1851-2
26	Mounting nut	1	15-1938
27	Four-position joystick operating mechanism (complete)	1	24-6565
28	Four-position joystick operating mechanism (not shown) (with latch) complete	1	24-6565-2
29	Spring loaded latch	1	52-1214-2
30	Hand operated latch	1	52-913-3

## Technical Data and Specifications

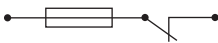
### Mechanical Ratings

Description	Specification
<b>Frequency of Operation</b>	
All pushbuttons	6000 operations/hr.
Key and lever selection switches	3000 operations/hr.
Auto-latch devices	1200 operations/hr.
<b>Life</b>	
Pushbuttons	10 x 10 <sup>6</sup> operations
Contact blocks	10 x 10 <sup>6</sup> operations
PresTest units	10 x 10 <sup>6</sup> operations
Lever and key selector switches	0.25 x 10 <sup>6</sup> operations
Twist to release pushbuttons	0.3 x 10 <sup>6</sup> operations
<b>Shock Resistance</b>	
Duration	20 ms ≥5g

### General Specifications

Description	Specification
<b>Climate Conditions</b>	
Operating temperature	1° to 150°F (–17° to 66°C)
Storage temperature	–40° to 176°F (–40° to 80°C)
Altitude	6,562 ft (2,000m)
Humidity	Max. 95% RH at 60°C
<b>Terminals</b>	
Marking	NC-NO on the contact block to meet the NEMA requirements. Dual marking system 1–2 for normally closed, 3–4 for normally open to meet BS5472 (Cenelec EN50 005).
Clamps	Terminals are saddle clamp type for 1 x 22 AWG (0.34 mm <sup>2</sup> ) to 2 x 14 AWG (2.5 mm <sup>2</sup> ) conductors
Torque	7 lb-in (0.8 Nm)
Degree of protection against direct electrical contact	IP2X with fingerproof shroud
<b>Light Units</b>	
Transformers	Will withstand short-circuit for 1 hour per IEC 60997-5-1
Bulbs—average life:	
Transformer type	20,000 hrs.
Resistor/direct voltage type	2500 hrs. minimum at rated voltage
LED	60,000 to 100,000 hrs.

#### Electrical Ratings

Description	Specification
Insulation	$U_i = 660 \text{ Vac or Vdc}$
Thermal	$I_{th} = 10\text{A}$
<b>Short Circuit Coordination to IEC/EN 60947-5-1</b>	
Rated conditional short circuit current	1 kA
Fuse type	GE power controls TIA 10, red spot type gG, 10A, 660 Vac, 460 Vdc, BS88-2, IEC 60269-2-1
	
UL rating	A600, P600
AC load life duty cycle 1200 operations/hour	
10A	110V pf 0.4— $1 \times 10^6$ operations
5A	250V pf 0.4— $1 \times 10^6$ operations
2A	600V pf 0.4— $1 \times 10^6$ operations
Switching capacity	
AC 15 rated make/break ( $11 \times I_b$ at $1.1 \times U_b$ )	
6A	120V pf 0.3
4A	240V pf 0.3
2A	660V pf 0.3
DC13 rated make/break ( $1.1 \times I_b$ at $1.1 \times U_b$ )	
1.0A	125V L/R $\geq 0.95$ at 300 ms
0.55A	250V L/R $\geq 0.95$ at 300 ms
0.1A	660V L/R $\geq 0.95$ at 300 ms
10A	110V pure resistive
Maximum ratings for logic level and hostile atmosphere application	
Maximum amperes	0.5A
Maximum volts	120 Vac/Vdc

#### Electrical Ratings—Contact Block

Description	50 Vac or 60 Hz				Vdc		
	120	240	480	600	24/28	125	250
<b>Meet or Exceed NEMA Rating Designations A600, A300 and B300 for AC and P600 for DC</b>							
Make and emerg. interrupting capacity (amp)	60	30	15	12	5.7	1.1	0.55
Normal load break (amp)	6	3	1.5	1.2	5.7	1.1	0.55
Thermal current (amp)	10	10	10	10	5.0	5.0	5.0
Voltamperes:							
Make and emerg. interrupting capacity	7200	7200	7200	7200	138	138	138
Normal load break	720	720	720	720	138	138	138

### Mounting Options

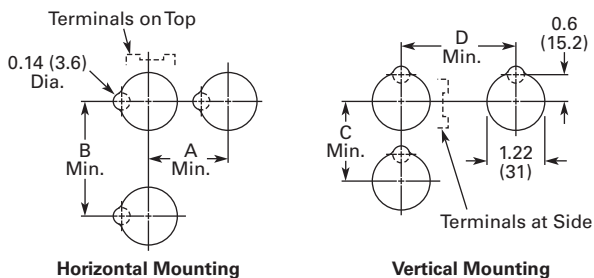
#### Panel Thickness

- Minimum: 0.06 in (1.6 mm)
- Maximum: 0.25 in (8 mm) including legend plate
- Maximum can be increased to 0.375 in (15.9 mm) using optional retaining nut
  - Indicating light: 10250TA30
  - Pushbutton/selector switch: 10250TA31

### Mounting Matrix

Legend Plate	Dimensions in Inches (mm)			
	A	B	C	D
Small	1.63 (41.3)	2.25 (57.2)	2.25 (57.2)	1.63 (41.3)
Medium	1.75 (44.5)	2.25 (57.2)	2.25 (57.2)	1.75 (44.5)
Large	2.25 (57.2)	2.25 (57.2)	2.25 (57.2)	2.25 (57.2)

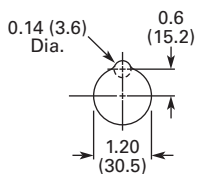
### Mounting Options in Inches (mm)



Horizontal mounting means terminals are located top and bottom of contact block. Vertical mounting means terminals are left and right of contact block. This allows close spacing of adjacent operators with easy access to terminals.

Locating nib hole or notch is 0.14 in (3.6 mm) #29 drill.

### Drilling Dimensions in Inches (mm)



## RR Series Power Relays

### Key features:

- SPDT through 3PDT, 10A contacts
- Midget power type relays
- Available in pin and blade terminal styles.
- Options include an indicator, check button for test operations and side flange.
- DIN rail, surface and panel mount sockets are available for a wide a variety of mounting applications.



### Part Number Selection

Contact	Model	Part Number		Coil Voltage Code (Standard Stock Items in Bold)
		Pin Terminal	Blade Terminal*	
	Standard	—	RR1BA-U <input type="checkbox"/>	AC6V, AC12V, AC24V, AC110V, <b>AC120V</b> , AC240V, DC6V, DC12V, <b>DC24V</b> , DC48V, DC110V
	With Indicator		RR1BA-UL <input type="checkbox"/>	
	With Check Button		RR1BA-UC <input type="checkbox"/>	
	With Indicator and Check Button		RR1BA-ULC <input type="checkbox"/>	
	Side Flange Model		RR1BA-US <input type="checkbox"/>	
	Standard	RR2P-U <input type="checkbox"/>	RR2BA-U <input type="checkbox"/>	
	With Indicator	RR2P-UL <input type="checkbox"/>	RR2BA-UL <input type="checkbox"/>	
	With Check Button	RR2P-UC <input type="checkbox"/>	RR2BA-UC <input type="checkbox"/>	
	With Indicator and Check Button	RR2P-ULC <input type="checkbox"/>	RR2BA-ULC <input type="checkbox"/>	
	Side Flange Model	—	RR2BA-US <input type="checkbox"/>	
<b>3PDT</b> 	Standard	RR3PA-U <input type="checkbox"/>	RR3B-U <input type="checkbox"/>	
	With Indicator	RR3PA-UL <input type="checkbox"/>	RR3B-UL <input type="checkbox"/>	
	With Check Button	RR3PA-UC <input type="checkbox"/>	RR3B-UC <input type="checkbox"/>	
	<b>With Indicator and Check Button</b>	<b>RR3PA-ULC <input type="checkbox"/></b>	RR3B-ULC <input type="checkbox"/>	
	Side Flange Model	—	RR3B-US <input type="checkbox"/>	

\*Blade type not TUV tested or CE marked.  
Side flange model mounts directly to panel with no socket required.

**Ordering Information**  
When ordering, specify the Part No. and coil voltage code:

(example) **RR3B-U** **AC120V**

Part No.      Coil Voltage Code

### Sockets

Relays	Standard DIN Rail Mount	Finger-safe DIN Rail Mount	Through Panel Mount
RR2P	SR2P-05 SR2P-06	SR2P-05C	SR2P-51
<b>RR3PA</b>	SR3P-05 SR3P-06	<b>SR3P-05C</b>	SR3P-51
RR1BA RR2BA RR3B	SR3B-05	—	SR3B-51



All DIN rail mount sockets shown here can be mounted using DIN rail BNDN1000.

Switches & Pilot Lights

Signaling Lights

Relays & Sockets



Timers

Contactors





Terminal Blocks

Circuit Breakers

## Hold Down Springs &amp; Clips

Appearance	Description	Relay	For DIN Mount Socket	For Through Panel & PCB Mount Socket
	Pullover Wire Spring	RR2P	SR2B-02F1	SR3P-01F1
		RR3PA	SR3B-02F1	
		RR1BA, RR2BA, RR3B	SR3B-02F1	SR3B-02F1
	Leaf Spring (side latch)	RR2P, RR3PA	SFA-203	—

## Accessories

Item	Appearance	Use with	Part No.	Remarks
Aluminum DIN Rail (1 meter length)		All DIN rail sockets	BNDN1000	The BNDN1000 is designed to accommodate DIN mount sockets. Made of durable extruded aluminum, the BNDN1000 measures 0.413 (10.5mm) in height and 1.37 (35mm) in width (DIN standard). Standard length is 39" (1,000mm).
DIN Rail End Stop		DIN rail	BNL5	9.1 mm wide.
Replacement Hold-Down Spring Anchor		Horseshoe clip for sockets SR3B-05, SR2P-06, SR3P-06	Y778-011	For use on DIN rail mount socket when using pullover wire hold down spring. 2 pieces included with each socket.
		Chair clip for sockets SR2P-05(C), SR3P-05(C)	Y703-102	

## Specifications

Contact Material	Silver		
Contact Resistance <sup>1</sup>	30 mΩ maximum		
Minimum Applicable Load	1V DC, 10 mA		
Operating Time <sup>2</sup>	25 ms maximum		
Release Time <sup>2</sup>	25 ms maximum		
Power Consumption (approx.)	AC: 3 VA (50 Hz), 2.5 VA (60 Hz) DC: 1.5W		
Insulation Resistance	100 MΩ minimum (500V DC megger)		
Dielectric Strength	Pin Terminal	Between live and dead parts:	1500V AC, 1 minute
		Between contact and coil:	1500V AC, 1 minute
		Between contacts of different poles:	1500V AC, 1 minute
		Between contacts of the same pole:	1000V AC, 1 minute
	Blade Terminal	Between live and dead parts:	2000V AC, 1 minute
		Between contact and coil:	2000V AC, 1 minute
		Between contacts of different poles:	2000V AC, 1 minute
		Between contacts of the same pole:	1000V AC, 1 minute
Operating Frequency	Electrical:	1800 operations/h maximum	
	Mechanical:	18,000 operations/h maximum	
Vibration Resistance	Damage limits:	10 to 55 Hz, amplitude 0.5 mm	
	Operating extremes:	10 to 55 Hz, amplitude 0.5 mm	
Shock Resistance	Damage limits:	1000 m/s <sup>2</sup> (100g)	
	Operating extremes:	100 m/s <sup>2</sup> (10G)	
Mechanical Life	10,000,000 operations		
Electrical Life	200,000 operations (220V AC, 5A)		
Operating Temperature <sup>3</sup>	-25 to +40°C (no freezing)		
Operating Humidity	5 to 85% RH (no condensation)		
Weight (approx.) (Standard type)	RR2P: 90g, RR3PA: 96g, RR1BA/RR2BA/RR3B: 82g		



1. Measured using 5V DC, 1A voltage drop method
2. Measured at the rated voltage (at 20°C), excluding contact bouncing
3. For use under different temperature conditions, refer to Continuous Load Current vs. Operating Temperature Curve.

## Coil Ratings

Rated Voltage (V)	Rated Current (mA) ±15% (at 20°C)		Coil Resistance (Ω) ±10% (at 20°C)	Operating Characteristics (values at 20°C)		
	50 Hz	60 Hz		Maximum Continuous Applied Voltage	Pickup Voltage	Dropout Voltage
AC (50/60 Hz)	6	490	420	110%	80% maximum	30% minimum
	12	245	210			
	24	121	105			
	110	27	23			
	120	24	20.5			
	240	12.1	10.5			
DC	6	240		110%	80% maximum	10% minimum
	12	120				
	24	60				
	48	30				
	110	13				



## Contact Ratings

Maximum Contact Capacity					
Continuous Current	Allowable Contact Power		Rated Load		
	Resistive Load	Inductive Load	Voltage (V)	Res. Load	Ind. Load
			110 AC	10A	7.5A
10A	1650VA AC 300W DC	1100VA AC 150W DC	220 AC	7.5A	5A
			30 DC	10A	5A



Note: Inductive load for the rated load —  $\cos \phi = 0.3$ , L/R = 7 ms

## TÜV Ratings

Voltage	
240V AC	10A
30V DC	10A



AC:  $\cos \phi = 1.0$ , DC: L/R = 0 ms

## UL Ratings

Voltage	Resistive	General use	Horse Power Rating
240V AC	10A	7A	1/3 HP
120V AC	10A	7.5A	1/4 HP
30V DC	10A	7A	—

## CSA Ratings

Voltage	Resistive	General use
240V AC	10A	7A
120V AC	10A	7.5A
100V DC	—	0.5A
30V DC	10A	7.5A

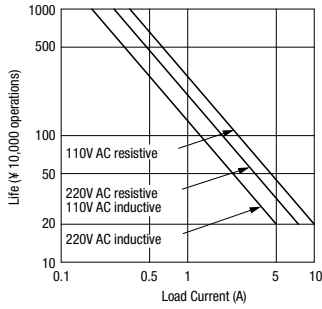
## Socket Specifications

	Relays	Terminal	Electrical Rating	Wire Size	Torque
DIN Rail Sockets	SR2P-05	M3 screw with captive wire clamp	300V, 10A	Maximum 2 - #12 AWG	9 - 11.5in•lbs
	SR2P-05C	M3 screw with captive wire clamp, fingersafe	300V, 10A	Maximum 2 - #12 AWG	9 - 11.5in•lbs
	SR2P-06	M3 screw with captive wire clamp	300V, 10A	Maximum 2 - #12 AWG	9 - 11.5in•lbs
	SR3P-05	M3 screw with captive wire clamp	300V, 10A	Maximum 2 - #12 AWG	9 - 11.5in•lbs
	SR3P-05C	M3 screw with captive wire clamp, fingersafe	300V, 10A	Maximum 2 - #12 AWG	9 - 11.5in•lbs
	SR3P-06	M3 screw with captive wire clamp	300V, 10A	Maximum 2 - #12 AWG	9 - 11.5in•lbs
	SR3B-05	M3 screw with captive wire clamp	300V, 15A (10A)* (*CSA rating)	Maximum 2 - #12 AWG	9 - 11.5in•lbs
Through Panel Mount Sockets	SR2P-51	Solder	300V, 10A	—	—
	SR3P-51	Solder	300V, 10A	—	—
	SR3B-51	Solder	300V, 10A	—	—

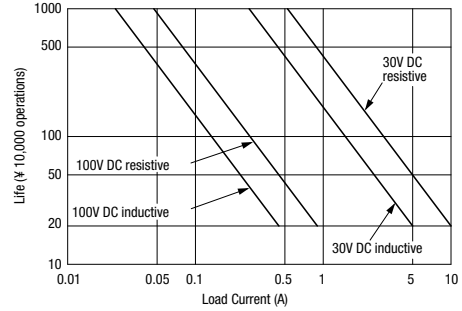
## Characteristics (Reference Data)

### Electrical Life Curves

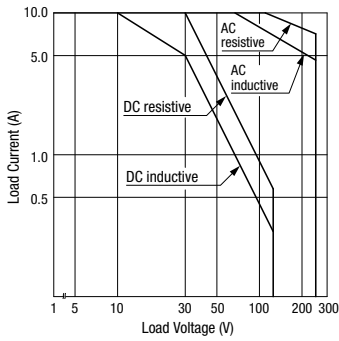
#### AC Load



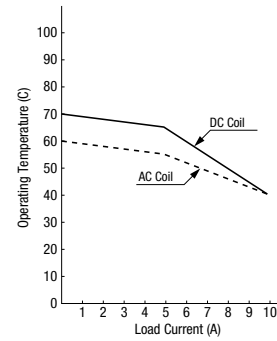
#### DC Load



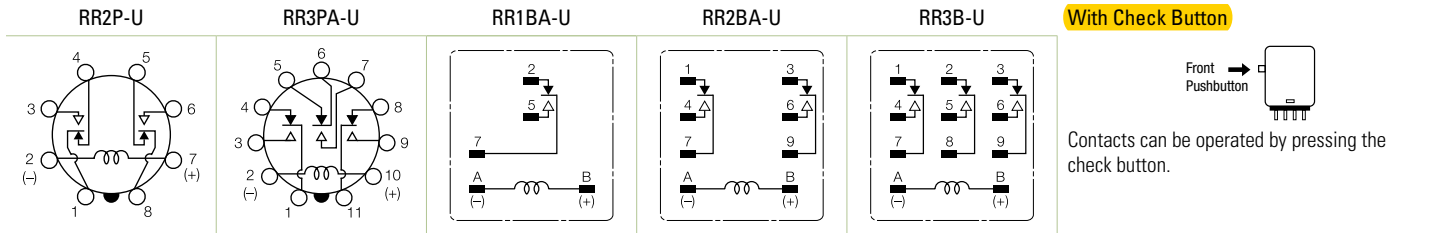
### Maximum Switching Capacity



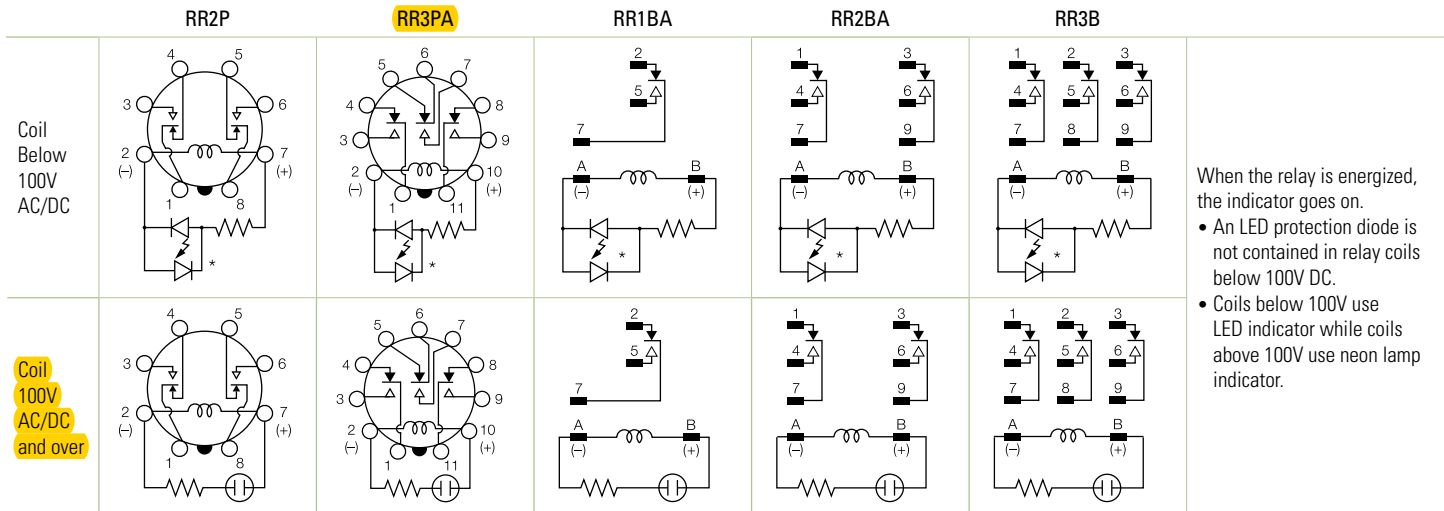
### Continuous Load Current vs. Operating Temperature Curve (Standard Type, With Check Button, and Side Flange Type)



### Internal Connection (View from Bottom) Standard Type



### With Indicator (-UL type)



Switches & Pilot Lights

Signaling Lights

Relays & Sockets

Timers

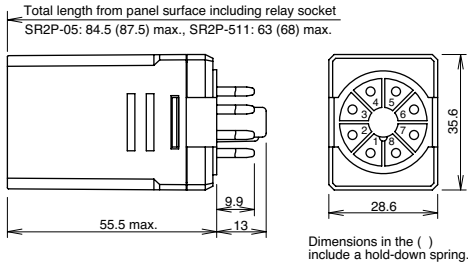
Contactors

Terminal Blocks

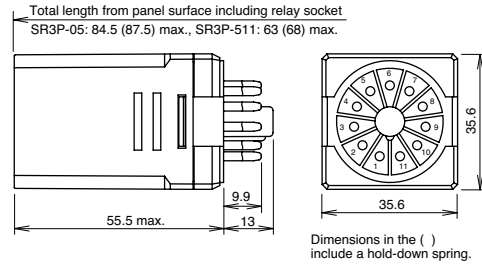
Circuit Breakers

Dimensions (mm)

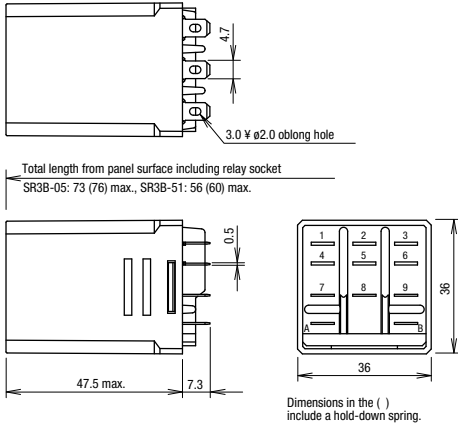
RR2P-U/RR2P-UL



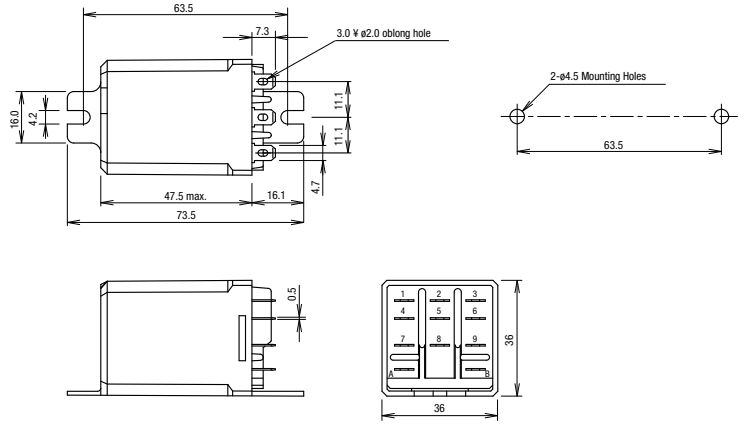
RR3PA-U/RR3PA-UL



RR1BA-U/RR2BA-UL/RR2BA-U  
RR2BA-UL/RR3B-U/RR3B-UL

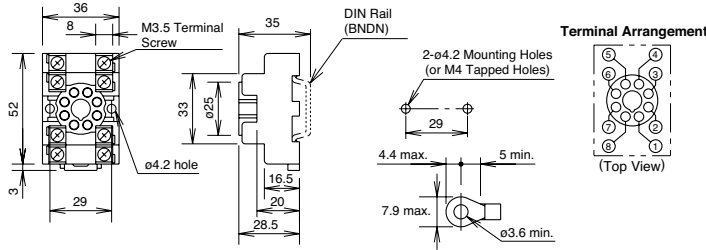


RR1BA-US/RR2BA-US/RR3B-US

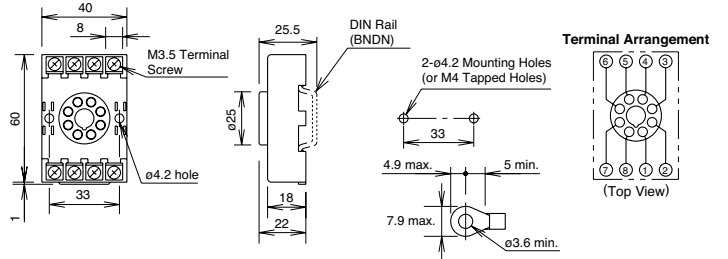


Standard DIN Rail Mount Sockets

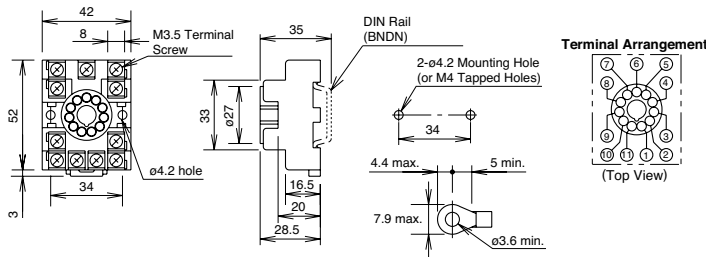
SR2P-05



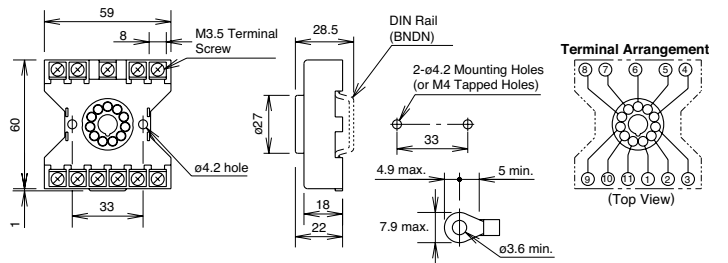
SR2P-06



SR3P-05



SR3P-06



Switches & Pilot Lights

Signaling Lights

Relays & Sockets

Timers

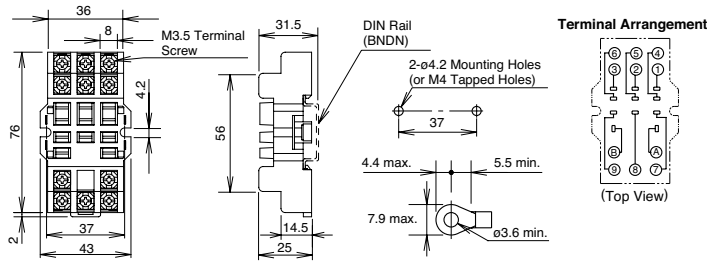
Contactors

Terminal Blocks

Circuit Breakers

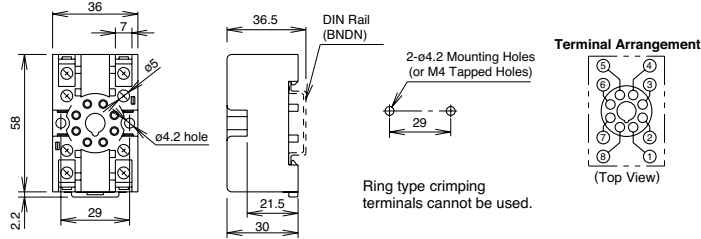
## Standard DIN Rail Mount Sockets

**SR3B-05**

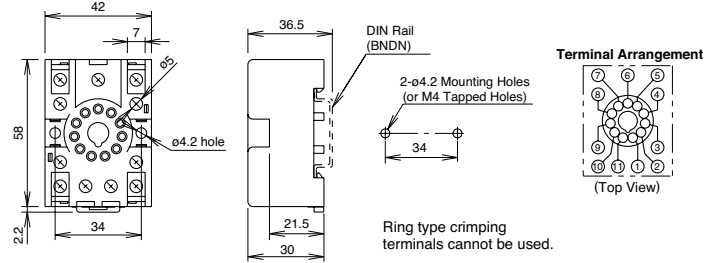


## Finger-safe DIN Rail Mount Sockets

**SR2P-05C**

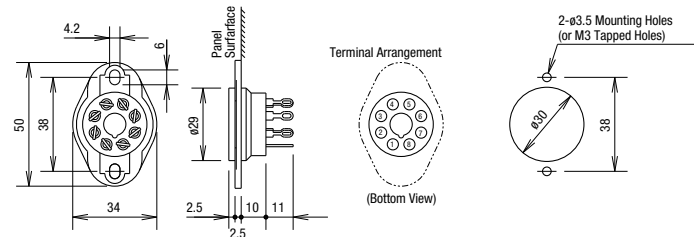


**SR3P-05C**

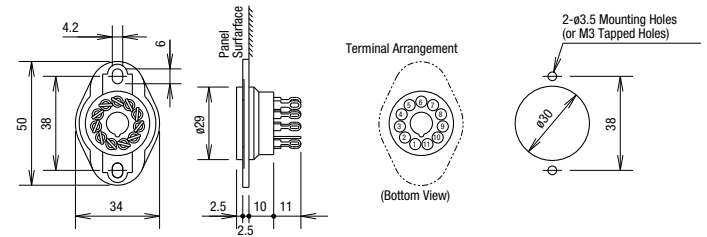


## Through Panel Mount Socket

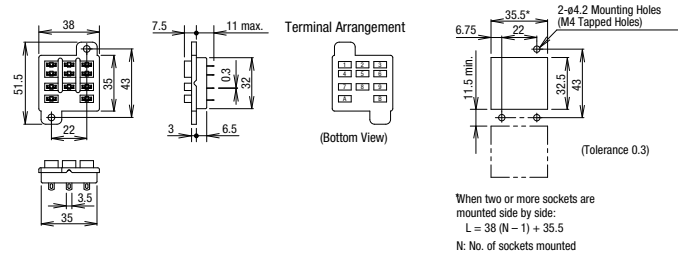
**SR2P-51**



**SR3P-51**



**SR3B-51**



Switches & Pilot Lights

Signaling Lights

Relays & Sockets

Timers

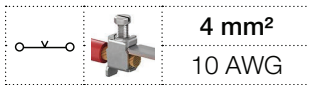
Contactors

Terminal Blocks

Circuit Breakers

# M4/6 screw clamp terminal blocks

## Feed-through - 6 mm 0.236 in spacing

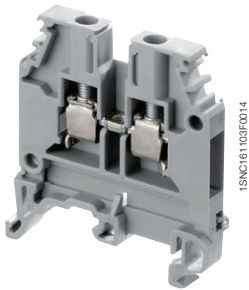


### Description

- Flexibility: snap onto symmetrical and asymmetrical rails,
- Many colors are available in addition to our generic grey, to help you quickly identify any of specific functions.

### Ordering details

Description	Color	Type	Part Number	Pkg qty	Weight (1 pce) g
<b>Feed-through</b>	Grey <input type="checkbox"/>	M4/6	1SNA115116R0700	50	8.20
	Blue <input type="checkbox"/>	M4/6.N	1SNA125116R0100	50	8.20
	Orange <input type="checkbox"/>	M4/6	1SNA105002R2000	50	8.20
	Yellow <input type="checkbox"/>	M4/6	1SNA105116R1600	50	8.20
	Green <input type="checkbox"/>	M4/6	1SNA105001R2700	50	8.20
	Red <input type="checkbox"/>	M4/6	1SNA105032R1500	50	8.20
	Purple <input type="checkbox"/>	M4/6	1SNA206404R0500	50	8.20
	Brown <input type="checkbox"/>	M4/6	1SNA105209R1400	50	8.20
	White <input type="checkbox"/>	M4/6	1SNA105051R2000	50	8.20
	Black <input type="checkbox"/>	M4/6	1SNA105031R1400	50	8.20
	Beige <input type="checkbox"/>	M4/6	1SNA195116R0000	50	8.20



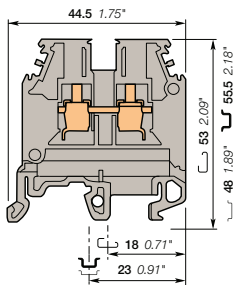
M4/6

### Main technical data

Connecting capacity	IEC	UL	CSA
<b>1 conductor per clamp</b>	Rigid - Solid / Stranded Flexible with insulated ferrule Gauge	0.2-4 mm <sup>2</sup> 0.22-4 mm <sup>2</sup> A4	22-10 AWG 24-10 AWG
<b>Rated current / Rated cross section</b>	32 A / 4 mm <sup>2</sup>	30 A / 10 AWG	30 A / 10 AWG
<b>Rated short-time withstand current (1s)</b>	480 A		
<b>Rated voltage</b>	1000 V	600 V	600 V
<b>Impulse withstand voltage</b>	8000 V		
<b>Protection</b>	IP20	NEMA 1	

### Mounting instructions

Rail		G32, TH 35-7.5, TH 35-15
Wire stripping length		9.5 mm 0.37 in
Tool		Flat screwdriver Ø 4 mm Ø 0.157 in
Torque		0.5 - 0.8 N.m 4.4 - 7.1 lb.in



6 mm 0.236 in spacing

The connecting capacity data for one Rigid - Solid / Stranded - Flexible conductor (when applicable) is a mandatory information required by IEC, UL and CSA standards. All other data are provided as supplementary information only. For more details, please consult our CB, UL or CSA certificates and technical datasheet available on <http://www.te.com>

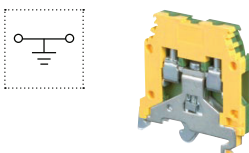
CE	RoHS	UR	CSA	Gost R

### Accessories

Description	Color	Type	Part Number	Pkg qty	Weight (1 pce) g
<b>1 End stops</b>	Grey <input type="checkbox"/>	BAM4	1SNK900001R0000	50	12.00
		BAZ1	1SNK900002R0000	50	4.70
<b>2 End sections</b>	Grey <input type="checkbox"/>	FEM6	1SNA118368R1600	20	2.40
<b>3 Jumper bars</b>		BJM6-2	1SNA176663R0000	10	4.40
		BJM6-3	1SNA176664R0100	10	6.70
		BJM6-4	1SNA176665R0200	10	8.90
		BJM6-5	1SNA176666R0300	10	11.20
		BJM6-10	1SNA176667R0400	10	22.40
<b>4 Lateral jumper bars</b>	Grey <input type="checkbox"/>	PC6-2	1SNA113546R1400	10	2.00
		PC6-10	1SNA113548R2600	10	8.00
<b>5 Cross spacing jumpers</b>		EL6	1SNA173627R2100	10	0.10
		BJDP1	1SNA179623R0300	10	7.00
		BJDP3	1SNA179625R0500	10	5.00
<b>6 Insulating tips</b>		EIP	1SNA113550R2400	10	
<b>7 Circuit separators</b>	Grey <input type="checkbox"/>	SCM6	1SNA113003R1000	10	0.30
		SCF6	1SNA118707R0300	20	
<b>8 Shield connectors</b>		CBM5	1SNA178745R1400	50	
<b>9 Protecting covers</b>	Transparent <input type="checkbox"/>	CPM	1SNA187312R1400	1	
<b>10 Terminal block markers</b>	White <input type="checkbox"/>	RC610	1SNA233000R0100	1	7.50

Complete list of accessories is indicated in the terminal block datasheet.

Some accessories such as jumper bars may modify the terminal block's ratings: complete information in the accessories catalogue pages.



### Ground screw clamp terminal blocks

Description	Color	Type	Part Number	Pkg qty	Weight (1 pce) g
<b>Ground</b>	Green-yellow <input type="checkbox"/>	M4/6.P	1SNA165113R1600	50	21.00

Technical data valid for copper conductors only.

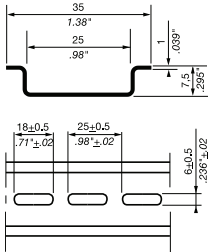
# PR mounting rail

## Common terminal block accessories



1SNK6007ZF0000

PR30



2000 mm 78.74 in spacing

### Description

- Pre-punched symmetrical mounting rail,
- The slotted holes ease the mounting and allow to use existing and/or numerous fixings,
- Particularly well designed for fixing onto back-plates and for terminal assemblies of small dimensions.

### Ordering details

Description	Color	Type	Part Number	Pkg meter	Weight (1 pce) g
Prepunched rail		PR30	1SNA173220R0500	2	328.00

Please note that for all rails: 1 part number equal 1 meter (39 in). Packing of 2 meters (78 in) minimum.  
Check that your order quantity is a multiple of 2.

### Main technical data

Material	Zinc plating and passivation steel				
Rail	TH 35-7.5				
	IEC	UL - CSA			
<b>Equivalent E-Cu cross section</b>					
All the main technical data provided are "manufacturer" values.					
	RoHS				
	RoHS				

### Mounting instructions

- In order to guarantee the performances and security of your installation, please ensure the rail and its fixings can withstand the static and dynamic loads of the components mounted on it;
- To prevent the rail from flexing (1 mm 0.039 in rail thickness only), fixing is recommended every 250 mm 9.84 in;
- To prevent any issues during mounting, screw heads used for rail fixing should not protrude from the rail (7,5 mm 0.295 in rail height only).

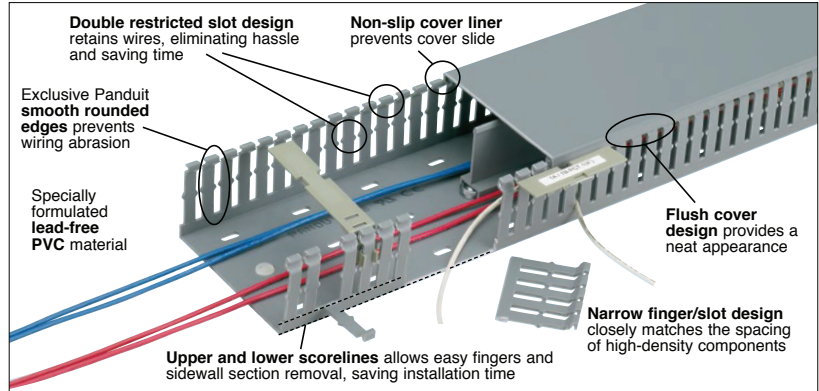
Technical data valid for copper conductors only.

## Features and Benefits – Panduct® Type F Narrow Slot Wiring Duct

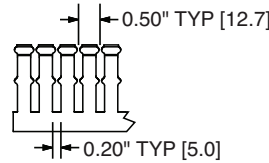
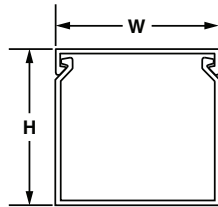
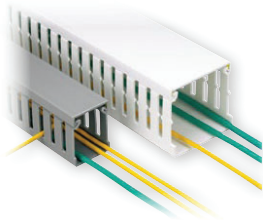


### Panduct® Type F Narrow Slot Wiring Duct

- Narrow slot/finger design provides more slots to fit the spacing of high-density terminal blocks and other hardware
- Material: Lead-free PVC
- UL recognized continuous use temperature: 122°F (50°C)
- UL 94 flammability rating of V-0



- Conforms with NFPA 79-2015 section 13.3.1 requirement for flame retardant material
- Provided with mounting holes
- Base and cover length is 6 feet



Multiple slot restrictors present with 2" and greater duct wall height.

Part Number	Duct Size (W x H)*		Slot Width		Cover Part Number	Std. Pkg. Qty.	Base Ctn. Qty.	Cover Ctn. Qty.
	In.	mm	In.	mm				
<b>F.75X1.5LG6</b>	0.94 x 1.57	23.6 x 39.9	0.20	5.0	<b>C.75LG6</b>	6	120	120
<b>F1X1LG6</b>	1.25 x 1.13	32.0 x 28.7			<b>C1LG6</b>			
<b>F1X1.5LG6</b>	1.25 x 1.62	32.0 x 41.1			<b>C1LG6</b>			
<b>F1X2LG6</b>	1.25 x 2.12	32.0 x 53.8			<b>C1LG6</b>			
<b>F1X3LG6</b>	1.25 x 3.13	32.0 x 79.4			<b>C1LG6</b>			
<b>F1X4LG6</b>	1.25 x 4.10	32.0 x 104.1			<b>C1LG6</b>			
<b>F1.5X1.5LG6</b>	1.75 x 1.62	44.5 x 41.1			<b>C1.5LG6</b>			
<b>F1.5X2LG6</b>	1.75 x 2.12	44.5 x 53.8			<b>C1.5LG6</b>			
<b>F1.5X3LG6</b>	1.75 x 3.12	44.5 x 79.2			<b>C1.5LG6</b>			
<b>F1.5X4LG6</b>	1.75 x 4.10	44.5 x 104.1			<b>C1.5LG6</b>			
<b>F2X2LG6</b>	2.25 x 2.12	57.2 x 53.8			<b>C2LG6</b>			
<b>F2X3LG6</b>	2.25 x 3.14	57.2 x 79.8			<b>C2LG6</b>			
<b>F2X4LG6</b>	2.25 x 4.10	57.2 x 104.1			<b>C2LG6</b>			
<b>F2X5LG6</b>	2.25 x 5.10	57.2 x 129.5			<b>C2LG6</b>			
<b>F2.5X3LG6</b>	2.75 x 3.12	69.9 x 79.2			<b>C2.5LG6</b>			
<b>F3X2LG6</b>	3.25 x 2.12	82.6 x 53.8			<b>C3LG6</b>			
<b>F3X3LG6</b>	3.25 x 3.13	82.6 x 78.7			<b>C3LG6</b>			
<b>F3X4LG6</b>	3.25 x 4.10	82.6 x 104.1			<b>C3LG6</b>			
<b>F3X5LG6</b>	3.25 x 5.10	82.6 x 129.5			<b>C3LG6</b>			
<b>F4X3LG6</b>	4.25 x 3.12	108.0 x 79.2			<b>C4LG6</b>			
<b>F4X4LG6</b>	4.25 x 4.10	108.0 x 104.1			<b>C4LG6</b>			
<b>F4X5LG6</b>	4.25 x 5.10	108.0 x 129.5			<b>C4LG6</b>			
<b>F6X4LG6</b>	6.25 x 4.15	158.8 x 105.4			<b>C6LG6</b>			

Part number shown for LG (Light Gray). For other sizes and color availability visit [www.panduit.com](http://www.panduit.com).

Base and cover sold separately.

\*"H" dimension includes duct and cover.