NEMA Contactors and Starters

NEMA AN16DN0AB
NEMA Size 1 Starter



NEMA Size 1 Contactor



NEMA Space-Savings Size 1C Contactor



2.1 Freedom Series

Product Overview V5-T2-2
Features, Benefits and Functions V5-T2-2
Standards and Certifications V5-T2-3
Catalog Number Selection V5-T2-3
Contactors—Non-Reversing and Reversing V5-T2-4
Starters—Three-Phase Non-Reversing and Reversing, Full Voltage V5-T2-10
Starters—Single-Phase Non-Reversing, Full Voltage, Bi-Metallic Overload V5-T2-15
Accessories V5-T2-21
Renewal Parts V5-T2-30
Technical Data and Specifications V5-T2-35
Relays—Thermal Overload V5-T2-39
C440/***XT*** Electronic Overload Relay V5-T2-48

2.2 Space-Savings Series

Contactors and Starters
- Product Description V5-T2-63
- Product Selection. V5-T2-64
- Technical Data and Specifications V5-T2-71

XTOE/***XT*** Electronic Overload Relay
- Product Description V5-T2-78
- Product Selection. V5-T2-81
- Technical Data and Specifications V5-T2-85

2.3 A200 Series

Contactors—Non-Reversing and Reversing V5-T2-97
Starters—Non-Reversing and Reversing V5-T2-103
Relays—Thermal and Fast Trip V5-T2-124
Thermal Type B, Class 20, Manual Reset V5-T2-126
Thermal Type A, Class 20, Auto/Manual Reset. V5-T2-129
Type FT Fast Trip, Class 10 . . . . . V5-T2-132
Heater Selection V5-T2-135
Relays—Current Sensing Protective V5-T2-137

2.4 Solenoids—Alternating Current

Product Description V5-T2-140
Product Selection V5-T2-141
Dimensions V5-T2-142

2.5 Shoe Brakes—AC and DC Magnetic

Product Description V5-T2-143
Product Selection V5-T2-144
Dimensions V5-T2-146

2.6 Reference Data

IEC Utilization Categories V5-T2-148
Annex A (informative) V5-T2-149
Motor Ratings Data V5-T2-151

Drawings Online

Revision notes

Volume 5—Motor Control and Protection, CA08100006E

Tab 2—NEMA Contactors and Starters

Revision date	Section	Change page(s)	Description
08/23/2018	All	All	Revision date changed to match print version date

Powering Business Worldwide

2.1 NEMA Contactors and Starters

Freedom Series

2

Freedom Series



Contents

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

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 ± 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

Listed

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

A N 1 9 A N 0 A 5E 005

Device Type
- **A** = Starter
- **C** = Contactor

Standard
- **E** = IEC
- **N** = NEMA

Device Assembly Configuration
- **70** = Multi-speed
- **1** = Non-reversing
- **5** = Reversing

OLR Type
- **5** = Contactor only—no overload relay
- **6** = Starter w/C306 bi-metal OLR
- **9** = Starter w/C440 electronic overload

Contactor Frame Size ①

	NEMA Size	Continuous Amperes
A=	00	9
B=	0	18
D=	1	27
G=	2	45
K=	3	90
N=	4	135
S=	5	270
T=	6	540
U=	7	810
V=	8	1215

NEMA Enclosure
- **N** = Open

For Starters

Starter Mounting Option
- **0** = Horizontal
- **V** = Vertical ②

For Contactors Only
- **2** = Two-pole
- **3** = Three-pole
- **4** = Four-pole
- **5** = Five-pole

AC Coil Suffix

Suffix	Coil Volts and Hertz
A	= 120/60 or 110/50
B	= 240/60 or 220/50
C	= 480/60 or 440/50
D	= 600/60 or 550/50
E	= 208/60
H	= 277/60
J	= 208 – 240/60 ③
K	= 240/50
L	= 380 – 415/50
N	= 550/50
T	= 24/60, 24/50 ④
U	= 24/50
V	= 32/50
W	= 48/60
Y	= 48/50

C440 OLR Designation (FVNR and FVR only)
- **5E** = Standard feature set SEL Reset, SEL Class (10A, 10, 20, 30)
- **5G** = Ground fault feature set SEL Reset, SEL Class (10, 20)

C440 FLA Range (FVNR and FVR only)

NEMA Size 00
- **1P6** = 0.33–1.65A
- **005** = 1–5A
- **020** = 4–20A

NEMA Size 0
- **1P6** = 0.33–1.65A
- **005** = 1–5A
- **020** = 4–20A

NEMA Size 1
- **1P6** = 0.33–1.65A
- **005** = 1–5A
- **020** = 4–20A
- **045** = 9–45A

NEMA Size 2
- **005** = 1–5A
- **020** = 4–20A
- **045** = 9–45A

NEMA Size 3
- **100** = 20–100A

NEMA Size 4
- **140** = 28–140A

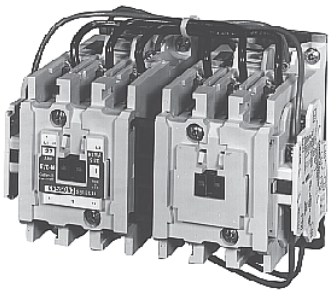
NEMA Size 5 ⑤
- **300** = 60–300A

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.

Non-Reversing and Reversing Contactors





Contents

Description	*Page*
Contactors—Non-Reversing and Reversing	
Product Selection	**V5-T2-5**
Kits and Accessories	**V5-T2-6**
Renewal Parts Publication Numbers	**V5-T2-6**
Technical Data and Specifications	**V5-T2-7**
Dimensions	**V5-T2-8**
Starters—Three-Phase Non-Reversing and Reversing, Full Voltage	**V5-T2-10**
Starters—Single-Phase Non-Reversing, Full Voltage, Bi-Metallic Overload	**V5-T2-15**
Accessories	**V5-T2-21**
Renewal Parts	**V5-T2-30**
Technical Data and Specifications	**V5-T2-35**
Relays—Thermal Overload	**V5-T2-39**

Contactors—Non-Reversing and Reversing

Product Description

Non-Reversing

Contactors are most commonly used to switch motor loads in applications where running overcurrent protection is either not required or is provided separately. Contactors consist of a magnetically actuated switch which can be remotely operated by a pushbutton station or pilot device such as a proximity switch, limit switch, float switch, auxiliary contacts, and so on.

Reversing

Reversing contactors are used primarily for reversing single- or three-phase motors in applications where running overcurrent protection is either not required or is provided separately. They consist of two contactors mechanically and electrically interlocked to prevent line shorts and energization of both contactors simultaneously.

Features, Benefits and Functions

- Designed specifically for use in applications requiring NEMA ratings. Contactors meet or exceed NEMA standards ICS 2-1993
- Long life twin break, silver cadmium oxide contacts—provide excellent conductivity and superior resistance to welding and arc erosion
- 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 contactors

Non-Reversing

- Holding circuit contact(s) supplied as standard:
  - Sizes 00–3 have 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 contact block on top right back

Reversing

- One NO-NC side mounted interlock supplied as standard on each contactor for Sizes 00–8

Product Selection

Three-Pole Contactors

NEMA Size 00
CN55AN3AB



NEMA Size 0
CN15BN3AB



NEMA Size 3
CN15KN3A



Type CN15/CN55 NEMA Contactors—Non-Reversing and Reversing

NEMA Size	Continuous Ampere Rating	Maximum UL Horsepower ① Single-Phase 115V	Single-Phase 230V	Three-Phase 208V	Three-Phase 240V	Three-Phase 480V	Three-Phase 600V	Non-Reversing Catalog Number	Reversing Catalog Number
00	9	1/3	1	1-1/2	1-1/2	2	2	**CN15AN3_B**	**CN55AN3_B**
0	18	1	2	3	3	5	5	**CN15BN3_B**	**CN55BN3_B**
1	27	2	3	7-1/2	7-1/2	10	10	**CN15DN3_B**	**CN55DN3_B**
2	45	3	7-1/2	10	15	25	25	**CN15GN3_B**	**CN55GN3_B**
3	90			25	30	50	50	**CN15KN3_**	**CN55KN3_**
4	135			40	50	100	100	**CN15NN3_**	**CN55NN3_**
5	270			75	100	200	200	**CN15SN3_**	**CN55SN3_**
6	540			150	200	400	400	**CN15TN3_B**	**CN55TN3_B**
7	810			200	300	600	600	**CN15UN3_**	**CN55UN3_**
8 ②	1215			400	450	900	900	**CN15VN3_**	**CN55VN3_**

Magnet Coils—AC and DC

Contactor coils listed in this section also have a 50 Hz rating as shown in the adjacent table. Select required contactor 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, the magnet coil alpha designation will be the next to the last digit of the listed catalog number.

EXAMPLE: For a 380V, 50 Hz coil, change CN15AN3_B to CN15AN3**L**B. 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	**A**
240/60 or 220/50	**B**
480/60 or 440/50	**C**
600/60 or 550/50	**D**
208/60	**E**
277/60	**H**
208–240/60 ③	**J**
240/50	**K**

Coil Volts and Hertz	Code Suffix
380–415/50	**L**
550/50	**N**
24/60, 24/50 ④	**T**
24/50	**U**
32/50	**V**
48/60	**W**
48/50	**Y**

Notes

① 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

② Common control. For separate 120V control, insert letter **D** in 7th position of listed catalog number. Example:CN15VN**D**3C.

③ NEMA Sizes 00 and 0 only.

④ NEMA Sizes 00 and 0 only. Sizes 1–8 are 24/60 only.

Two-, Four- and Five-Pole Contactors

2

NEMA Size 2 Five-Pole Contactor CN15GN5AB



Type CN15 NEMA Contactors—Non-Reversing

NEMA Size	Continuous Ampere Rating	Maximum UL Horsepower Single-Phase (Two-Pole) 115V	230V	Three-Phase 208V	240V	480V	600V	Two-Pole Non-Reversing Catalog Number	Four-Pole Non-Reversing Catalog Number	Five-Pole Non-Reversing Catalog Number
00	9	1/3	1	1-1/2	1-1/2	2	2	**CN15AN2_B**	**CN15AN4_B**	—
0	18	1	2	2	3	5	5	**CN15BN2_B**	—	—
1	27	2	3	7-1/2	7-1/2	10	10	**CN15DN2_B**	**CN15DN4_B**	**CN15DN5_B**
2	45	3	7-1/2	10	15	25	25	**CN15GN2_B**	**CN15GN4_B**	**CN15GN5_B**
3	90			25	30	50	50	**CN15KN2_**	—	—
4	135			40	50	100	100	**CN15NN2_**	—	—
5	270			75	100	200	200	**CN15SN2_**	—	—
6	540			150	200	400	400	**CN15TN2_B**	—	—

Magnet Coils—AC and DC

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, the magnet coil alpha designation will be the next to the last digit of the listed catalog number. EXAMPLE: For a 380V, 50 Hz coil, change CN15BN3_B to CN15BN3**L**B. 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	**A**
240/60 or 220/50	**B**
480/60 or 440/50	**C**
600/60 or 550/50	**D**
208/60	**E**
277/60	**H**
208–240/60 ①	**J**
240/50	**K**

Coil Volts and Hertz	Code Suffix
380–415/50	**L**
550/50	**N**
24/60, 24/50 ②	**T**
24/50	**U**
32/50	**V**
48/60	**W**
48/50	**Y**

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

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

Publication Numbers

Notes

① NEMA Sizes 00 and 0 only.
② NEMA Sizes 00 and 0 only. Sizes 1–8 are 24/60 only.

Technical Data and Specifications

Wire (75°C) Sizes—AWG or kcmil—Open and Enclosed

NEMA Size	Power Terminals Line or Load	Control Terminals Cu Only
00	12–16 stranded; 12–14 solid Cu	12–16 stranded 12–14 solid
0	8–16 stranded; 10–14 solid Cu	
1	8–14 stranded or solid Cu	
2	3–14 (upper) and/or 6–14 (lower) stranded or solid ① Cu	
3	1/0–14 Cu/Al	
4	250 mcm–6	
5	750 kcmil–2, or (2) 250 kcmil–3/0 Cu/Al	
6	(2) 750 kcmil–3/0 Cu/Al	
7	(3) 750 kcmil–3/0 Cu/Al	
8	(4) 750 kcmil–4/0 Cu/Al	

Plugging and Jogging Service Horsepower Ratings ②

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 Two compartment box lug.

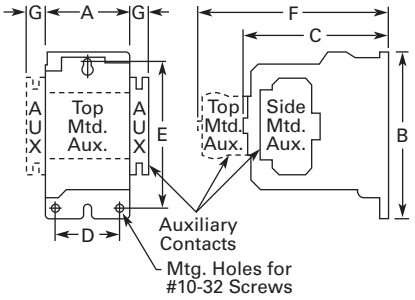
② Maximum horsepower where operation is interrupted more than 5 times per minute or more than 10 times in a 10 minute period. NEMA standard ICS 2-1993 table 2-4-3.

Dimensions

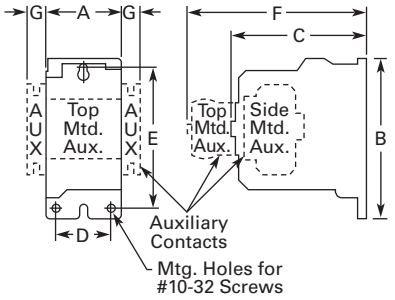
Approximate Dimensions in Inches (mm)

2

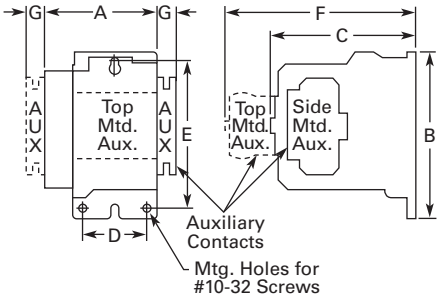
Non-Reversing Contactors—Open Type



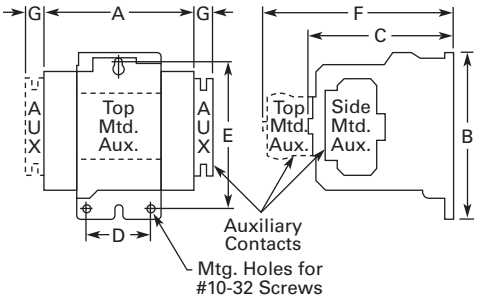
Sizes 00, Two- to Four-Pole



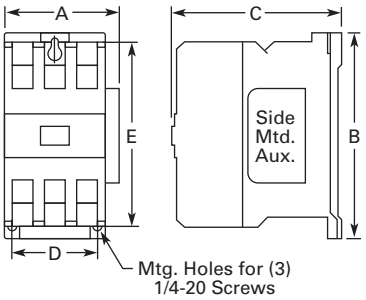
Sizes 0–2, Two- and Three-Pole



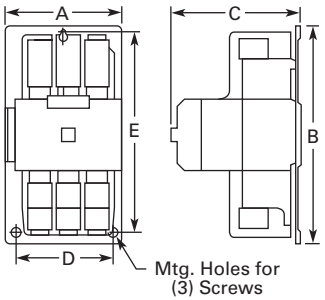
Sizes 0–2, Two- and Three-Pole



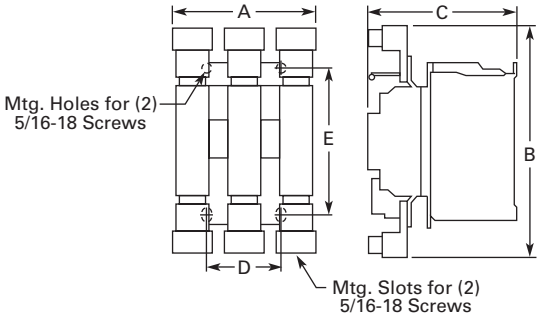
Sizes 1–2, Five-Pole



Size 3



Sizes 4–5



Size 6

Dimensions and Shipping Weights

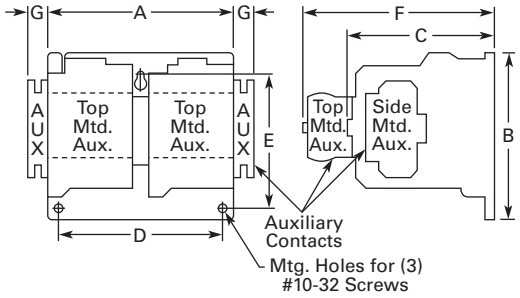
NEMA Size	Number of Poles	Wide A	High B	Deep C	Mounting D	Mounting E	F	G	Shipping Weight Lbs (kg)
00	2–4	1.75 (44.5)	3.88 (98.6)	3.49 (88.6)	1.50 (38.1) ①	3.38 (85.9)	4.62 (117.3)	0.54 (13.7)	1.7 (0.7)
0	2–3	1.75 (44.5)	3.88 (98.6)	3.49 (88.6)	1.50 (38.1) ①	3.38 (85.9)	4.62 (117.3)	0.54 (13.7)	1.8 (0.8)
1–2	2–3	2.56 (65.0)	5.05 (128.3)	4.44 (112.8)	2.00 (50.8) ①	4.50 (114.3)	5.80 (147.3)	0.54 (13.7)	3.1 (1.4)
1–2	4	3.44 (87.4)	5.05 (128.3)	4.44 (112.8)	2.00 (50.8) ①	4.50 (114.3)	5.80 (147.3)	0.54 (13.7)	3.6 (1.6)
1–2	5	4.32 (109.7)	5.05 (128.3)	4.44 (112.8)	2.00 (50.8) ①	4.50 (114.3)	5.80 (147.3)	0.54 (13.7)	4.0 (1.8)
3	2–3	4.08 (103.6)	7.17 (182.1)	5.94 (150.9)	3.00 (76.2)	6.63 (168.4)	—	—	8.5 (3.9)
4	2–3	7.05 (179.1)	9.11 (231.4)	7.25 (184.2)	6.00 (152.4)	8.50 (215.9)	—	—	20.0 (9.1)
5	2–3	7.05 (179.1)	13.12 (333.2)	7.78 (197.6)	6.00 (152.4)	12.50 (317.5)	—	—	23.0 (10.4)
6	3	8.63 (219.2)	13.54 (343.9)	8.88 (225.6)	4.33 (110.0)	8.63 (219.2)	—	—	35.0 (15.9)
7	3	11.02 (279.9)	19.30 (490.2)	11.46 (291.1)	6.89 (175.0)	11.02 (279.9)	—	—	100.0 (45.4)
8	3	13.00 (330.2)	24.50 (622.3)	13.63 (346.2)	4.22 (107.2)	14.86 (377.4)	—	—	160.0 (72.6)

Note

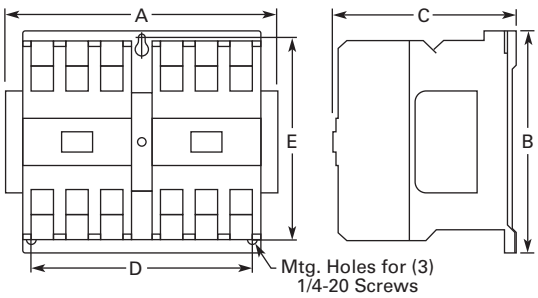
① Center mounting slot at bottom supplied only on Size 00 and 0 contactors.

Approximate Dimensions in Inches (mm)

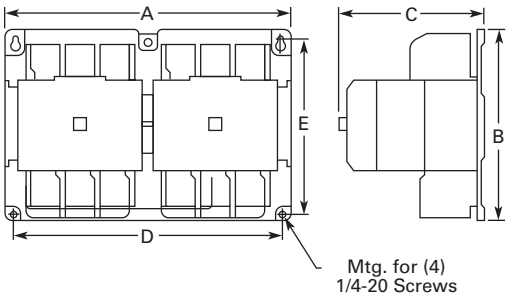
Reversing Contactors—Open Type



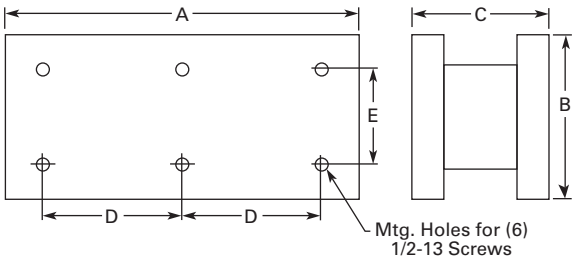
Sizes 00–2



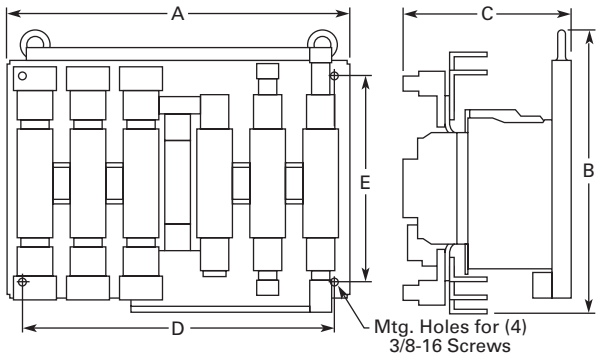
Size 3



Sizes 4–5



Open Type—Sizes 7–8 Horizontal



Size 6

Dimensions and Shipping Weights

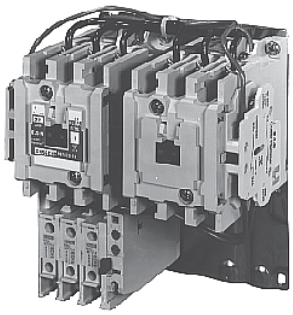
NEMA Size	Wide A	High B	Deep C	Mounting D	Mounting E	F	G	Shipping Weight Lbs (kg)
00–0	4.20 (106.7)	4.35 (110.5)	3.52 (89.4)	3.50 (88.9)	3.86 (98.0)	4.90 (124.5)	0.54 (13.7)	3.3 (1.5)
1–2	5.71 (145.0)	5.05 (128.3)	4.44 (112.8)	5.25 (133.4)	3.63 (92.2)	5.80 (147.3)	0.54 (13.7)	7.8 (3.5)
3	8.70 (221.0)	7.17 (182.1)	5.94 (150.9)	7.00 (177.8)	6.63 (168.4)	—	—	17.0 (7.7)
4	14.68 (372.9)	9.11 (231.4)	7.25 (184.2)	13.50 (342.9)	8.50 (215.9)	—	—	47.0 (21.3)
5	14.50 (368.3)	12.25 (311.2)	7.78 (197.6)	13.50 (342.9)	11.50 (292.1)	—	—	63.0 (28.6)
6	19.77 (502.2)	16.61 (421.9)	9.90 (251.5)	18.00 (457.2)	12.00 (304.8)	—	—	80.0 (36.3)
7	28.00 (711.2)	26.75 (679.5) ①	12.75 (323.9)	12.75 (323.9)	11.00 (279.4)	—	—	260.0 (118.0)
8	30.13 (765.3)	39.00 (990.6) ①	14.69 (373.1)	14.13 (358.9)	15.00 (381.0)	—	—	350.0 (158.9)

Note

① Includes cross wiring.

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





Contents

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

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 ±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 ①

NEMA Size	Continuous Ampere Rating	Service-Limit Current Rating (Amperes) ④	Maximum UL Horsepower ② Single-Phase 115V	Single-Phase 230V	Three-Phase 208V	Three-Phase 240V	Three-Phase 480V	Three-Phase 600V	Three-Pole Non-Reversing ③ Catalog Number	Three-Pole Reversing ③ Catalog Number	Vertical Reversing ③ Catalog Number
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 ⑤	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 AN16BN0**L**C. 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	**A**
240/60 or 220/50	**B**
480/60 or 440/50	**C**
600/60 or 550/50	**D**
208/60	**E**
277/60	**H**
208–240/60 ⑥	**J**
240/50	**K**

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

Notes

① 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**.

② 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

③ Underscore (_) indicates coil suffix required, see AC Suffix table.

④ 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.

⑤ Common control. For separate 120V control, insert letter **D** in 7th position of listed catalog number. Example: AN56VN**D**0CB.

⑥ NEMA Sizes 00 and 0 only.

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

Two-Speed Selective Control

When Ordering Supply

- Catalog number plus magnet coil code suffix. Example: Size 0—AN700BN022**B**
- 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 Horsepower				NEMA	Open Type
115V	200V	230V	460V/575V	115V	200V	230V	460/575V	Size	Catalog Number
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



One-Winding AN700DN0218



Reconnectable Winding ①

Maximum Horsepower—60/50 Hertz

Constant or Variable Torque				Constant Horsepower				NEMA	Open Type Constant or Variable Torque	Constant Horsepower
115V	200V	230V	460V/575V	115V	200V	230V	460/575V	Size	Catalog Number	Catalog Number
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**.

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 ① Cu Only
Power Terminals—Line	
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 ②
Power Terminals—Load—Cu Only (stranded or solid)	
00–0	14–6 AWG stranded or solid
1–2	14–2 AWG stranded or solid
Control Terminals—Cu Only	
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 ②
Power Terminals—Line and Load	
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
Control Terminals—Cu Only	
12–16 AWG stranded, 12–14 AWG solid	

Plugging and Jogging Service Horsepower Ratings ③

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.

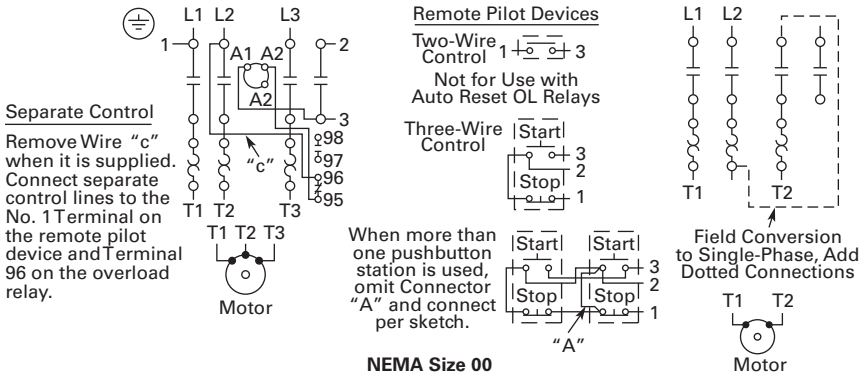
② Two compartment box lug.

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.

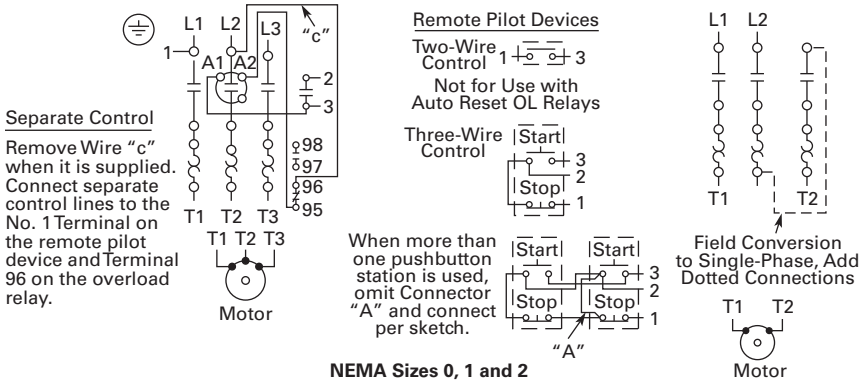
Wiring Diagrams

2

Three-Phase and Single-Phase Applications



NEMA Size 00



NEMA Sizes 0, 1 and 2

NEMA Size 1—BN15DN0AB



Contents

Description	*Page*
Contactors—Non-Reversing and Reversing	**V5-T2-4**
Starters—Three-Phase Non-Reversing and Reversing, Full Voltage	**V5-T2-10**
Starters—Single-Phase Non-Reversing, Full Voltage, Bi-Metallic Overload	
Product Selection	**V5-T2-16**
Wiring Diagrams	**V5-T2-16**
Dimensions	**V5-T2-17**
Accessories	**V5-T2-21**
Renewal Parts	**V5-T2-30**
Technical Data and Specifications	**V5-T2-35**
Relays—Thermal Overload	**V5-T2-39**
C440/***XT*** Electronic Overload Relay	**V5-T2-48**

Starters—Single-Phase Non-Reversing, Full Voltage, Bi-Metallic Overload

Product Description

Single-phase, full voltage magnetic starters connect the motor directly across the line, allowing it to draw full inrush current during start-up. These starters are most commonly used for control of self-starting single-phase motors up to 15 hp at 230V. They consist of a two-pole electromagnetic contactor to make and break the motor power circuit and an overload relay to provide running overload protection. Starters listed in the table include:

- Two-pole Freedom Series contactor with long life twin break, silver cadmium oxide contacts. Generously sized for low resistance and cool operation. Designed to 3 million electrical operations at maximum hp and 30 million mechanical operations to Size 0, 10 million operations to Size 2 and 6 million operations to Size 3
- Three-pole Freedom Series overload with poles two and three wired in series for motor overload protection. This overload is ambient compensated, selectable manual or automatic reset, interchangeable Class 10 or 20 heater packs, 1.0 or 1.15 service factor selectability, overload trip indication and electrically isolated NO-NC contacts (pull RESET button to test)
- Holding circuit NO auxiliary contact supplied as standard. On Size 00, the contact occupies the 4th power pole position. Sizes 0–3 have the NO auxiliary mounted on the right side of the contactor
- Steel mounting plate as standard on all open type starters. Wired for separate or common control

Product Selection

When Ordering Specify

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

BN16DM0AB



Type BN16 NEMA—Manual or Automatic Reset Overload Relay

NEMA Size	Maximum Horsepower Motor Voltage	Single-Phase	Magnet Coil Voltage (60 Hz)	Open Type Two-Pole Catalog Number
00	115	1/3	120 ①	**BN16AN0AC**
	230	1	240	**BN16AN0BC**
0	115	1	120 ①	**BN16BN0AC**
	230	2	240	**BN16BN0BC**
1	115	2	120 ①	**BN16DN0AB**
	230	3	240	**BN16DN0BB**
1P	115	3	120 ①	**BN16PN0AB**
	230	5	240	**BN16PN0BB**
2	115	3	120 ①	**BN16GN0AB**
	230	7-1/2	240	**BN16GN0BB**
3	115	7-1/2	120 ①	**BN16KN0A**
	230	15	240	**BN16KN0B**

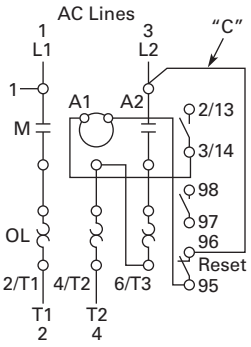
Starter catalog numbers do not include heater packs. Select one carton of three heater packs. Heater pack selection, **Pages V5-T2-41** to **V5-T2-43**.

Note

① For separate 120V control circuit. For maximum hp at listed motor voltages, use the rating of other starters of same size.

Wiring Diagrams

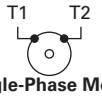
Single-Phase Applications (Factory Wired)



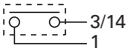
Separate Control

Remove Wire "C" if supplied and connect separate control lines to the Number 1 Terminal on the remote pilot device and to the Number 96 Terminal on the overload relay.

Front View of Panel

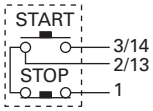


Single-Phase Motor



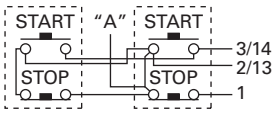
Not for Use with Auto Reset OL Relays

Two-Wire Control



Three-Wire Control

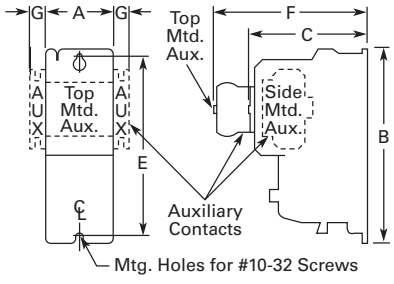
When more than one pushbutton station is used, omit Connector "A" and connect per sketch at right.



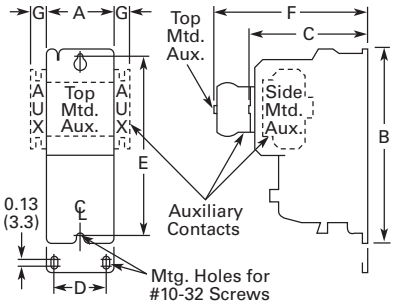
Dimensions

Approximate Dimensions in Inches (mm)

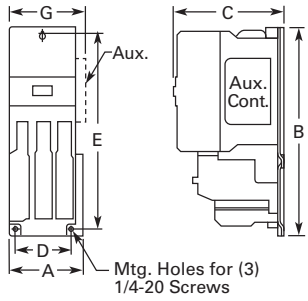
Non-Reversing Starters, Bi-Metallic Overload—Open Type



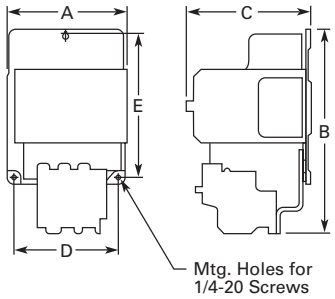
Sizes 00–0 ①



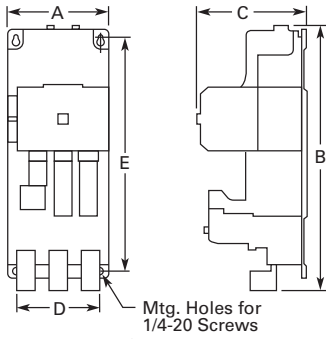
Sizes 1–2



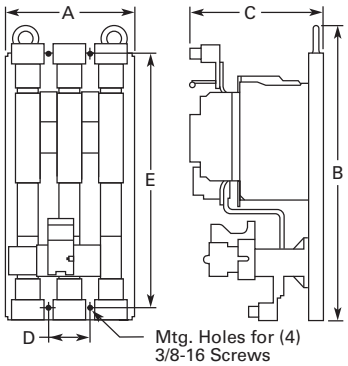
Size 3



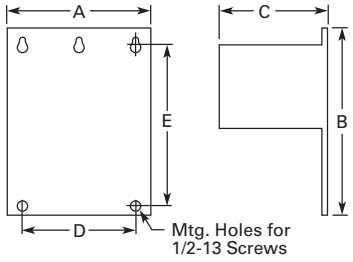
Size 4



Size 5



Size 6



Sizes 7–8

Dimensions and Shipping Weights

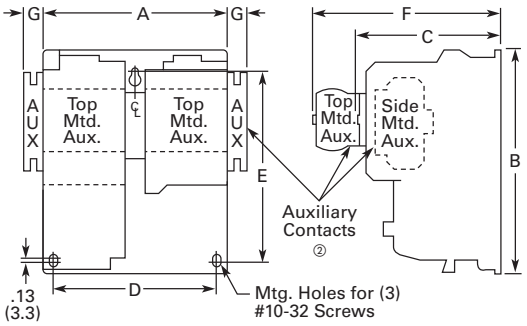
NEMA Size	Wide A	High B	Deep C	Mounting D	Mounting E	F	G	Shipping Weight Lbs (kg)
00–0	1.80 (45.7)	6.60 (167.6)	3.52 (89.4)	—	6.07 (154.2)	4.90 (124.5)	0.54 (13.7)	2.2 (1.0)
1–1P	2.56 (65.0)	7.08 (179.8)	4.44 (112.8)	2.00 (50.8)	6.63 (168.4)	5.80 (147.3)	0.54 (13.7)	4.5 (2.0)
2	2.56 (65.0)	8.08 (205.2)	4.44 (112.8)	2.00 (50.8)	7.63 (193.8)	5.80 (147.3)	0.54 (13.7)	4.7 (2.1)
3	4.08 (103.6)	11.35 (288.3)	5.94 (150.9)	3.00 (76.2)	10.81 (274.6)	—	—	11.0 (5.0)
4	7.05 (179.1)	12.06 (306.3)	7.25 (184.2)	6.00 (152.4)	8.50 (215.9)	—	—	23.0 (10.4)
5	7.00 (177.8)	17.77 (451.4)	7.76 (197.1)	6.00 (152.4)	16.00 (406.4)	—	—	36.0 (16.3)
6	9.47 (240.5)	21.69 (550.9)	9.90 (251.5)	3.10 (78.7)	18.00 (457.2)	—	—	75.0 (34.1)
7	15.13 (384.3)	29.13 (739.9)	12.64 (321.1)	13.25 (336.6)	21.25 (539.8)	—	—	120.0 (54.5)
8	15.13 (384.3)	34.50 (876.3)	15.00 (381.0)	13.25 (336.6)	16.75 (425.5)	—	—	210.0 (95.3)

Note

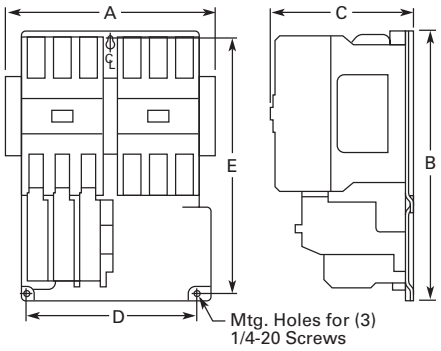
① Holding circuit contact for Size 00 occupies 4th power pole position—no increase in width.

Approximate Dimensions in Inches (mm)

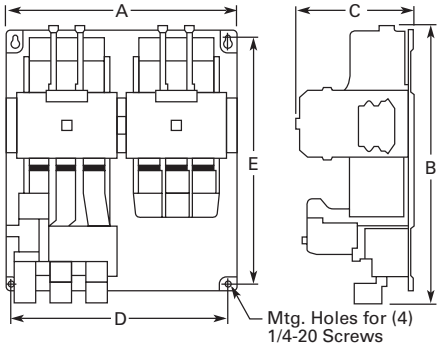
Reversing Starters, Bi-Metallic Overload—Open Type



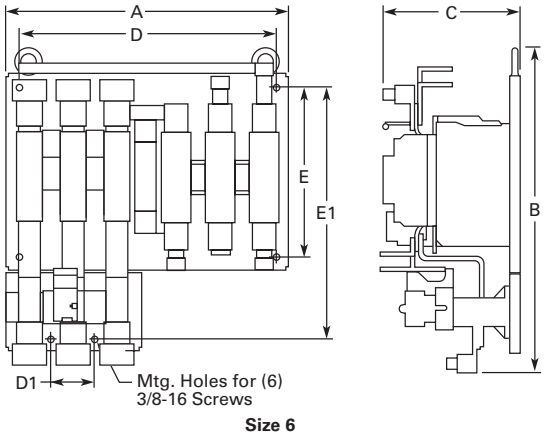
Sizes 00 – 2



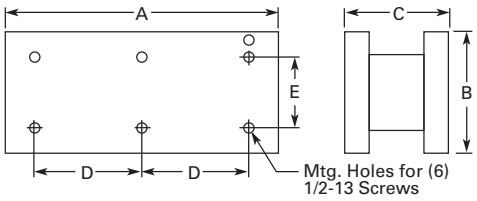
Size 3



Sizes 4 – 5



Size 6



Open Type — Sizes 7 – 8 Horizontal

Dimensions and Shipping Weights

NEMA Size	Wide A	High B	Deep C	Mounting D	Mounting E	D1	E1	F	G	Shipping Weight Lbs (kg)
00–0	4.20 (106.7)	7.38 (187.5)	3.52 (89.4)	3.50 (88.9)	6.87 (174.5)	—	—	4.90 (124.5)	0.54 (13.7	3.6 (1.6)
1	5.71 (145.0)	7.08 (179.8)	4.44 (112.8)	5.25 (133.4)	5.75 (146.1)	—	—	5.80 (147.3)	0.54 (13.7)	8.3 (3.8)
2	5.71 (145.0)	8.08 (205.2)	4.44 (112.8)	5.25 (133.4	6.75 (171.5)	—	—	5.80 (147.3)	0.54 (13.7)	8.5 (3.9)
3	8.70 (221.0)	11.35 (288.3)	5.94 (150.9)	7.00 (177.8)	10.81 (274.6)	—	—	—	—	20.0 (9.1)
4	14.68 (372.9)	12.06 (306.3)	7.25 (184.2)	13.50 (342.9)	8.50 (215.9)	—	—	—	—	49.0 (22.2)
5	14.50 (368.3)	17.77 (451.4)	7.76 (197.1)	13.50 (342.9)	16.00 (406.4)	—	—	—	—	68.0 (30.9)
6	19.77 (502.2)	22.63 (574.8)	9.90 (251.5)	18.00 (457.2)	12.00 (304.8)	3.10 (78.7)	18.00 (457.2)	—	—	90.0 (40.9)
7	28.06 (712.7)	32.13 (816.1) ①	12.70 (322.6)	12.75 (323.9)	21.25 (539.8)	—	—	—	—	175.0 (79.5)
8	30.38 (771.7)	41.50 (1054.1) ①	14.70 (373.4)	14.13 (358.9)	16.75 (425.5)	—	—	—	—	430.0 (195.2)

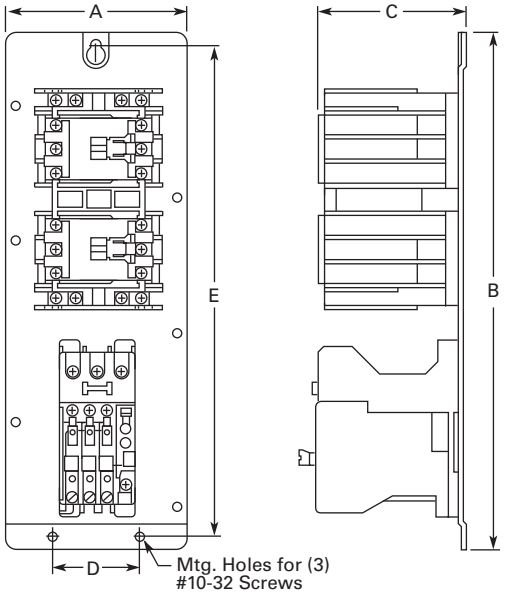
Notes

① Includes cross wiring overhang.

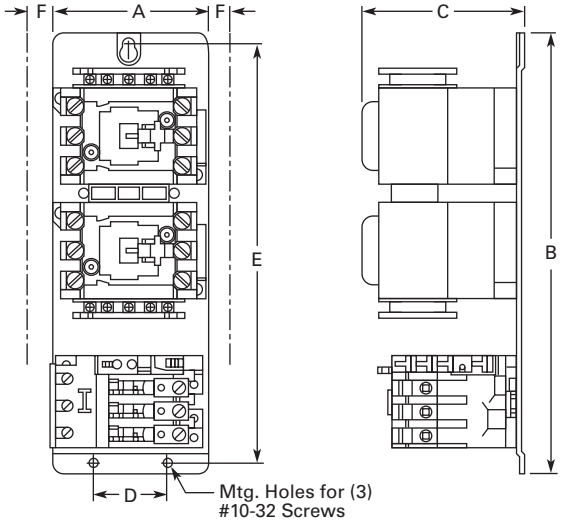
② See catalog listings for type and location of auxiliary contacts supplied with a particular starter.

Approximate Dimensions in Inches (mm)

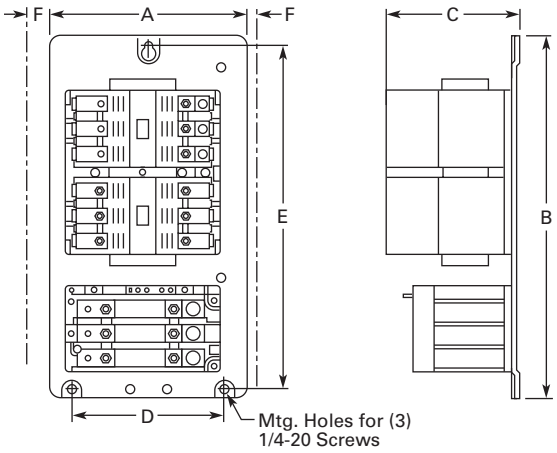
Reversing Starters—Vertical Construction, Bi-Metallic Overload—AN56V Open Vertical Starter



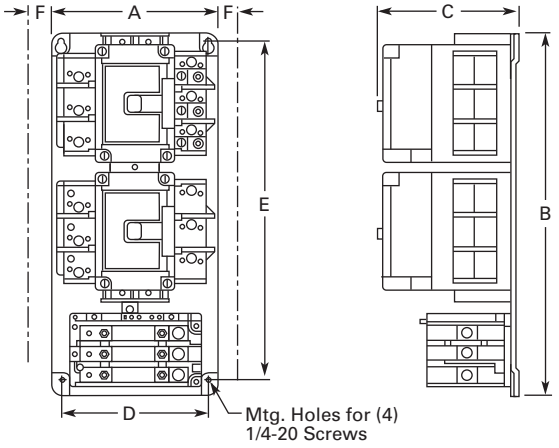
NEMA Size 0



NEMA Sizes 1 – 2



NEMA Size 3



NEMA Size 4

Dimensions and Shipping Weights

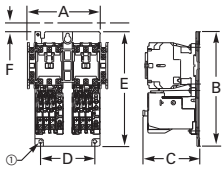
NEMA Size	Wide A	High B	Deep C	Mounting Wide D	Mounting HIgh E	Wire Zone	Shipping Weight Lbs (kg)
0	4.25 (108.0)	12.05 (306.1)	3.84 (97.5)	2.00 (50.8)	11.50 (292.1)	—	4.0 (1.8)
1	4.25 (108.0)	12.05 (306.1)	3.86 (98.0)	2.00 (50.8)	11.50 (292.1)	1.00 (25.4)	9.0 (4.1)
2	4.25 (108.0)	12.05 (306.1)	3.86 (98.0)	2.00 (50.8)	11.50 (292.1)	1.00 (25.4)	9.5 (4.3)
3	9.25 (235.0)	16.75 (425.5)	5.18 (131.6)	7.15 (181.6)	16.07 (408.2)	①	21.0 (9.5)
4	9.08 (230.6)	19.84 (503.9)	5.18 (131.6)	8.00 (203.2)	18.51 (470.2)	1.50 (38.1)	50.0 (22.7)

Note

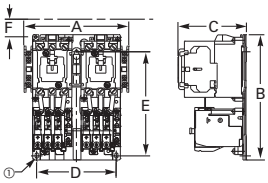
① Wire overhang 1.00 mm left, 50 mm right.

Approximate Dimensions in Inches (mm)

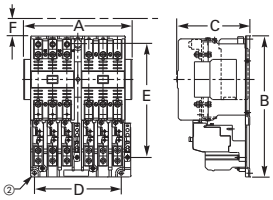
Multispeed Starters, Bi-Metallic Overload—AN700 Open Vertical Starter



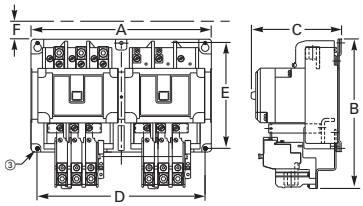
Size "0" Multispeed Starter
2-Speed, 2-Winding



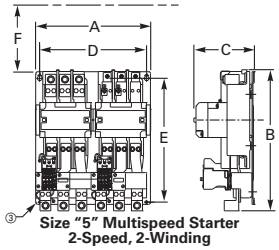
Size "1 – 2" Multispeed Starter
2-Speed, 2-Winding



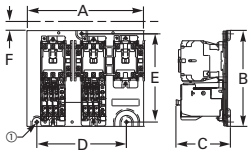
Size "3" Multispeed Starter
2-Speed, 2-Winding



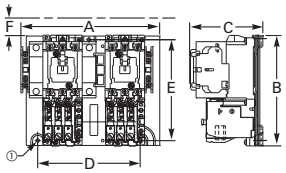
Size "4" Multispeed Starter
2-Speed, 2-Winding



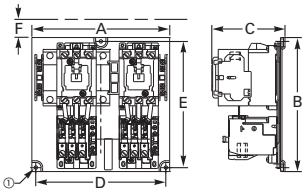
Size "5" Multispeed Starter
2-Speed, 2-Winding



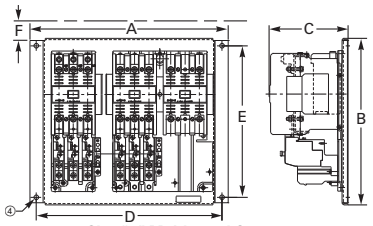
Size "0" Multispeed Starter
2-Speed, 1-Winding



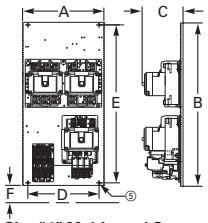
Size "1" Multispeed Starter
2-Speed, 1-Winding



Size "2" Multispeed Starter
2-Speed, 1-Winding



Size "3" Multispeed Starter
2-Speed, 1-Winding



Size "4" Multispeed Starter
2-Speed, 1-Winding

Dimensions and Shipping Weights

NEMA Size	Wide A	High B	Deep C	Mounting Wide D	Mounting High E	Wire Zone F	Shipping Weight Lbs (kg)
Two-Speed—Selective Control—Separate Winding							
0	5.19 (132)	7.38 (188)	3.52 (89)	3.50 (89)	6.87 (175)	0.89 (23)	4.5 (2.0)
1	5.66 (144)	7.08 (180)	4.42 (112)	5.25 (133)	5.75 (146)	1.23 (31)	9.0 (4.1)
2	5.66 (144)	8.08 (205)	4.42 (112)	5.25 (133)	6.75 (165)	1.63 (41)	10.0 (4.5)
3	8.72 (221)	11.35 (288)	5.89 (150)	7.00 (178)	10.81 (275)	1.77 (45)	24.0 (10.9)
4	14.68 (373)	12.06 (306)	7.25 (184)	13.50 (343)	8.50 (216)	1.95 (50)	53.0 (24.1)
5	14.50 (368)	17.82 (453)	7.76 (197)	13.50 (343)	16.00 (406)	4.56 (116)	73.0 (33.1)
Two-Speed—Selective Control—Reconnectable Winding							
0	8.62 (219)	7.06 (179)	3.82 (81)	6.62 (168)	6.50 (165)	0.50 (13)	6.0 (2.7)
1	8.97 (228)	7.12 (181)	4.72 (120)	6.62 (168)	6.50 (165)	1.04 (26)	10.0 (4.5)
2	8.90 (226)	8.62 (219)	4.75 (121)	8.40 (213)	8.12 (206)	1.03 (26)	11.0 (5.0)
3	16.00 (406)	13.46 (342)	6.38 (162)	15.00 (381)	12.25 (311)	1.24 (31)	31.0 (14.1)
4	15.46 (393)	31.00 (787)	7.74 (197)	13.50 (343)	30.00 (762)	1.84 (47)	72.0 (32.7)

Notes

① Mounting holes for (3) #10 screws.
② Mounting holes for (3) 1/4-20 screws.
③ Mounting holes for (4) 1/4-20 screws.
④ Mounting holes for (4) 5/16 screws.
⑤ Mounting holes for (4) 3/8 screws.

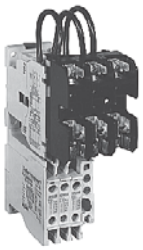
Accessories

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.

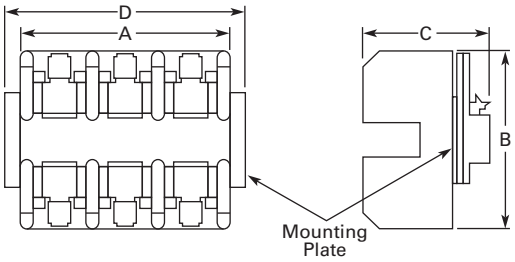
Mounted Fuse Block Kit



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			Approximate Dimensions in Inches (mm)			
Class	Amperes	Volts	Wide A	High B	Deep C	D
G	15, 20, 30 60	300	2.40 (61.0)	3.00 (76.2)	2.04 (51.8)	—
		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	Contactor 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.

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 ①②③
1–30 seconds	**C320TDN30_**
30–300 seconds	**C320TDN300_**

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	**C321SB18**
NEMA Size 4, IEC Sizes A–S	**C321SB19**
NEMA Size 6, IEC Sizes T and U	**C321SB22**

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	**C320TP1**
10 to 180 seconds	**C320TP2**

Maximum Ampere Ratings

	Vac			
Description	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	**C320PC3**
Gray cover, no accessibility, with Auto only nib	50	**C320PC4**
Gray cover, no accessibility, with Manual only nib	50	**C320PC5**
Gray cover with FLA dial accessibility, A, B, C, D positions and Auto only nib	50	**C320PC6**
Gray cover with FLA dial accessibility, A, B, C, D positions and Manual only nib	50	**C320PC7**

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

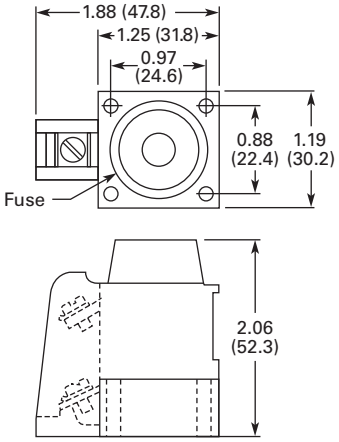


Control Circuit Fuse Block

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



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**
NEMA Sizes 1–2, IEC Sizes G–K	
Contactors	**C320LS3**
Reversing contactors	**C320LS4**
NEMA Size 1	
Starters	**C320LS5**
Reversing starters	**C320LS6**
NEMA Size 2, IEC Sizes G–K	
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.

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

Side Mounted



Top Mounted



Description	Contact Configuration Code ②	Catalog Number
Side Mounted		
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**
Top Mounted		
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.

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 ①	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 ①	Catalog Number
NO	10	**C320KGS20**
NC	01	**C320KGS21**
NO-NC ②	11	**C320KGS22**
Sealed Logic Level		
NO	10	**C320KGS20L**
NC	01	**C320KGS21L**
NO-NC ③	11	**C320KGS22L**

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

Circuit	Contact Configuration Code ①	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

① For reference only—not part of catalog number.
② NO-NC occupies two position—L2 and L3, or R2 and R3. See figure on **Page V5-T2-27**.
③ Form C contacts.

Auxiliary Contact Location

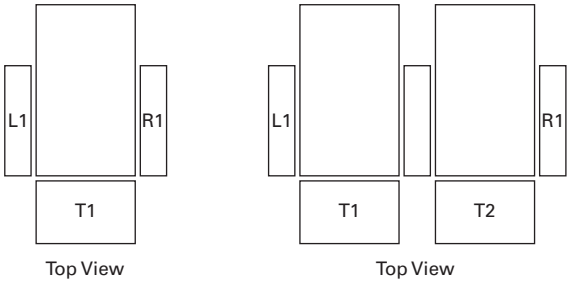
NEMA Sizes 00–2, IEC Sizes A–K

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

Auxiliary Contacts

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

Auxiliary Contact Location



Non-Reversing Contactors and Starters

Reversing Contactors and Starters

NEMA Sizes 3–8, IEC Sizes L–Z

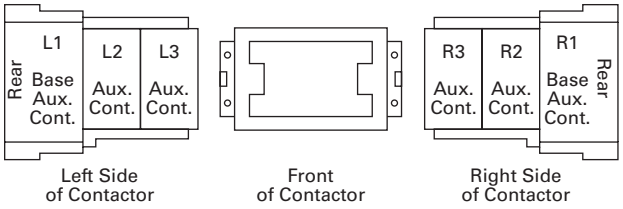
The sketches below illustrate the maximum number of auxiliary contacts that can be assembled to a contactor and their locations.

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.

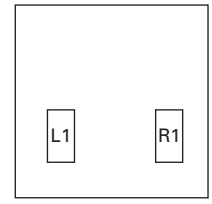
Mounting Positions

Size	Available Mounting Positions ①
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

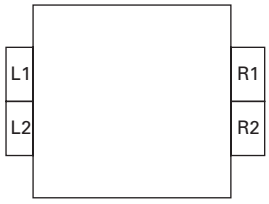
Auxiliary Contact Location



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

2

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 AN16BN0**A**C to AN16BN0**T1**C

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		Conversion Data					Complete Conversion Kit		Factory Installed
			Magnet Coil						
NEMA	IEC	Volts	Coil Number	Amps P.U./Seal	Watts P.U./Seal	NCI Interlock	Catalog Number	Ship Wt. Lbs (kg)	Code Suffix
Non-Reversing—Kit Includes NCI Side Mounted Auxiliary Contact									
00 and 0 CN35–A, B, D D15 Relays	A–F	12	**9-2988-11**	6.4/0.28	76.8/3.36	**C320KGD1**	**C335KD3R1**	1.0 (0.5)	**R1**
		24	**9-2988-12**	3.2/0.14	76.8/3.36	**C320KGD1**	**C335KD3T1**		**T1**
		48	**9-2988-13**	1.6/0.07	76.8/3.36	**C320KGD1**	**C335KD3W1**		**W1**
		120	**9-2988-14**	0.64/0.028	76.8/3.36	**C320KGD1**	**C335KD3A1**		**A1**
① 00 and 0 CN35–A, B, D D15 Relays	A–F	12	**9-2988-11**	6.4/0.28	76.8/3.36	**C320KGD2** ①	**C335KD3R4**	1.0 (0.5)	**R4**
		24	**9-2988-12**	3.2/0.14	76.8/3.36	**C320KGD2** ①	**C335KD3T4**		**T4**
		48	**9-2988-13**	1.6/0.07	76.8/3.36	**C320KGD2** ①	**C335KD3W4**		**W4**
		120	**9-2988-14**	0.64/0.028	76.8/3.36	**C320KGD2** ①	**C335KD3A4**		**A4**
1 and 2 CN35–G	G–K	12	**9-2990-1**	15.4/0.42	185/4.98	**C320KGD5**	**C335KD4R4**	1.0 (0.5)	**R4**
		24	**9-2990-2**	7.7/0.021	185/4.96	**C320KGD5**	**C335KD4T4**		**T4**
		48	**9-2990-3**	3.9/0.11	185/5.04	**C320KGD5**	**C335KD4W4**		**W4**
		120	**9-2990-4**	1.5/0.041	185/4.87	**C320KGD5**	**C335KD4A4**		**A4**
3 CN35–K	L–N	12	**9-3002-1**	24/0.40	293/4.84	**C320KGD3**	**C335KD5R1**	2.0 (0.9)	**R1**
		24	**9-3002-2**	12/0.20	288/4.75	**C320KGD3**	**C335KD5T1**		**T1**
		48	**9-3002-3**	6.1/0.097	295/4.67	**C320KGD3**	**C335KD5W1**		**W1**
		120	**9-3002-4**	2.5/0.038	298/4.57	**C320KGD3**	**C335KD5A1**		**A1**
4 and 5 CN35–N, S	P–S	24	**9-2026-4**	18/0.22	400/5.3	**C320KGD3**	**C335KA3T1**	2.5 (1.1)	**T1**
		48	**9-2026-3**	9/0.11	400/5.2	**C320KGD3**	**C335KA3W1**		**W1**
		120	**9-2026-2**	3.3/0.05	450/5.4	**C320KGD3**	**C335KA3A1**		**A1**
		240	**9-2026-1**	1.7/0.02	440/4.9	**C320KGD3**	**C335KA3B1**		**B1**
Reversing									
00 and 0 CN35–A, B, D D15 relays	A–F	12	**(2) 9-2988-1**	6.4/0.28	76.8/3.36	**(2) C320KGD1**	**C335RD3R1** ②	1.0 (0.5)	**R1** ③
		24	**(2) 9-2988-2**	3.2/0.14	76.8/3.36	**(2) C320KGD1**	**C335RD3T1** ②		**T1** ③
		48	**(2) 9-2988-3**	1.6/0.07	76.8/3.36	**(2) C320KGD1**	**C335RD3W1** ②		**W1** ③
		120	**(2) 9-2988-4**	0.64/0.028	76.8/3.36	**(2) C320KGD1**	**C335RD3A1** ②		**A1** ③
1 and 2 CN35–G	G–K	12	**(2) 9-2990-1**	15.4/0.42	185/4.98	**(2) C320KGD3**	④	—	**R1** ③
		24	**(2) 9-2990-2**	7.7/0.21	185/4.96	**(2) C320KGD3**	④		**T1** ③
		48	**(2) 9-2990-3**	3.9/0.11	185/5.04	**(2) C320KGD3**	④		**W1** ③
		120	**(2) 9-2990-4**	1.5/0.041	185/4.87	**(2) C320KGD3**	④		**A1** 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

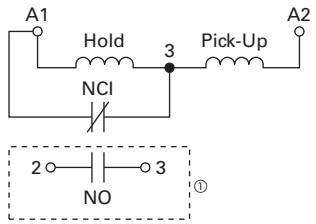
These DC coil kits have separate pick-up and seal windings. A **special** (side mounted) early-break NCI auxiliary contact is used to either disconnect the pick-up winding or insert the seal winding in series with the pick-up winding, depending on the frame size of the contactor. DC coil kits come in 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.

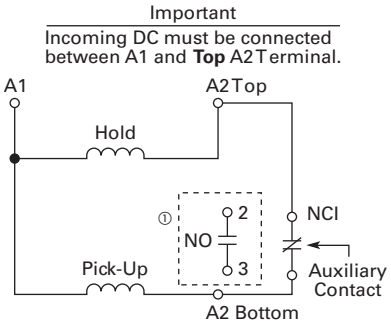
On the above sizes only, when the **special** auxiliary package is mounted on the side of a contactor or starter, **no** standard auxiliary contact may be mounted on the same side.

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.

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

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 ② 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.

Special Modifications

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

Addition or Special Feature	Starter Size —NEMA 00	0	1/—	2	3	4	5	6	7	8
Control Circuit										
Extra auxiliary circuit, factory installed NO or NC—each contact ①②	Consult sales office for pricing adders.									
Transient suppressor ①	Consult sales office for pricing adders.									
Power Circuit										
Contactor/starter for ring lug capability—add Mod Code **T16** to catalog number ③ (Power terminals only, control terminals as standard) Standalone overload relays can not accept ring lugs on line side	Consult sales office for pricing adders.									
Factory Installed Dust Covers										
Factory installed C320DSTCVR—add Mod Code **-53** to catalog number ①					NA	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 ④ and CN55 Contactors and Starters (Size 00, 0)

Description		NEMA Size 00 Series B1 Part No.	Series C1 Part No.	NEMA Size 0 Series B1 Part No.	Series C1 Part No.
Renewal Parts Publication Number		**22177**	**22177**	**22177**	**22177**
Contact Kits					
Two-pole		⑤	⑤	⑤	⑤
Three-pole		⑤	⑤	⑤	⑤
Four-pole		⑤	⑤	⑤	⑤
Five-pole		⑤	⑤	⑤	⑤
Magnet Coils	**Coil Suffix**				
120V 60 Hz or 110V 50 Hz	**A**	**9-2875-1**	**9-2875-1**	**9-2876-1**	**9-2876-1**
240V 60 Hz or 220V 50 Hz	**B**	**9-2875-2**	**9-2875-2**	**9-2876-2**	**9-2876-2**
480V 60 Hz or 440V 50 Hz	**C**	**9-2875-3**	**9-2875-3**	**9-2876-3**	**9-2876-3**
600V 60 Hz or 550V 50 Hz	**D**	**9-2875-4**	**9-2875-4**	**9-2876-4**	**9-2876-4**
208V 60 Hz	**E**	**9-2875-5**	**9-2875-5**	**9-2876-5**	**9-2876-5**
277V 60 Hz	**H**	**9-2875-12**	**9-2875-12**	**9-2876-12**	**9-2876-12**
208/240V 60 Hz	**J**	**9-2875-37**	**9-2875-37**	**9-2876-37**	**9-2876-37**
240V 50 Hz	**K**	**9-2875-11**	**9-2875-11**	**9-2876-11**	**9-2876-11**
380–415V 50 Hz	**L**	**9-2875-6**	**9-2875-6**	**9-2876-6**	**9-2876-6**
380V 50 Hz	**L**	—	—	—	—
415V 50 Hz	**M**	—	—	—	—
550V 50 Hz	**N**	—	—	—	—
24V 60 Hz–24V 50 Hz	**T**	**9-2875-36**	**9-2875-36**	**9-2876-36**	**9-2876-36**
24V 60 Hz	**T**	—	—	—	—
24V 50 Hz	**U**	**9-2875-36**	**9-2875-36**	**9-2876-36**	**9-2876-36**
32V 50 Hz	**V**	**9-2875-16**	**9-2875-16**	**9-2876-16**	**9-2876-16**
48V 60 Hz	**W**	**9-2875-8**	**9-2875-8**	**9-2876-8**	**9-2876-8**
48V 50 Hz	**Y**	**9-2875-9**	**9-2875-9**	**9-2876-9**	**9-2876-9**
Magnet Frame Armature					
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 ① and CN55 Contactors and Starters (Size 1, 2)

Description		NEMA Size 1 Series A1 Part No.	NEMA Size 1 Series B1 Part No.	NEMA Size 2 Series A1 Part No.	NEMA Size 2 Series B1 Part No.	NEMA Size 3 Part No.
Renewal Parts Publication Number		**20861**	**22177**	**20861**	**22177**	**20426**
Contact Kits						
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**	—
Magnet Coils	**Coil Suffix**					
120V 60 Hz or 110V 50 Hz	**A**	**9-3285-1**	**9-3285-1**	**9-3285-1**	**9-3285-1**	**9-2756-1 KIT**
240V 60 Hz or 220V 50 Hz	**B**	**9-3285-2KIT**	**9-3285-2KIT**	**9-3285-2KIT**	**9-3285-2KIT**	**9-2756-2 KIT**
480V 60 Hz or 440V 50 Hz	**C**	**9-2703-3 KIT**	**9-2703-3 KIT**	**9-2703-3 KIT**	**9-2703-3 KIT**	**9-2756-3 KIT**
600V 60 Hz or 550V 50 Hz	**D**	**9-2703-4 KIT**	**9-2703-4 KIT**	**9-2703-4 KIT**	**9-2703-4 KIT**	**9-2756-4 KIT**
208V 60 Hz	**E**	**9-3285-9KIT**	**9-3285-9KIT**	**9-3285-9KIT**	**9-3285-9KIT**	**9-2756-5 KIT**
277V 60 Hz	**H**	**9-2703-7 KIT**	**9-2703-7 KIT**	**9-2703-7 KIT**	**9-2703-7 KIT**	**9-2756-9 KIT**
208/240V 60 Hz	**J**	—	—	—	—	—
240V 50 Hz	**K**	**9-2703-14 KIT**	**9-2703-14 KIT**	**9-2703-14 KIT**	**9-2703-14 KIT**	**9-2756-13 KIT**
380–415V 50 Hz	**L**	**9-2703-8 KIT**	**9-2703-8 KIT**	**9-2703-8 KIT**	**9-2703-8 KIT**	—
380V 50 Hz	**L**	—	—	—	—	**9-2756-12 KIT**
415V 50 Hz	**M**	—	—	—	—	**9-2756-8 KIT**
550V 50 Hz	**N**	—	—	—	—	**9-2756-14 KIT**
24V 60 Hz–24V 50 Hz	**T**	—	—	—	—	—
24V 60 Hz	**T**	**9-3285-6KIT**	**9-3285-6KIT**	**9-3285-6KIT**	**9-3285-6KIT**	**9-2756-6 KIT**
24V 50 Hz	**U**	**9-3285-12KIT**	**9-3285-12KIT**	**9-3285-12KIT**	**9-3285-12KIT**	**9-2756-11 KIT**
32V 50 Hz	**V**	**9-2703-10 KIT**	**9-2703-10 KIT**	**9-2703-10 KIT**	**9-2703-10 KIT**	**9-2756-10 KIT**
48V 60 Hz	**W**	**9-2703-11 KIT**	**9-2703-11 KIT**	**9-2703-11 KIT**	**9-2703-11 KIT**	**9-2756-15 KIT**
48V 50 Hz	**Y**	**9-2703-13 KIT**	**9-2703-13 KIT**	**9-2703-13 KIT**	**9-2703-13 KIT**	**9-2756-7 KIT**
Magnet Frame Armature						
Lower magnet frame		**17-18200**	**17-18200**	**17-18200**	**17-18200 KIT**	**17-8955-2 KIT**
Upper magnet frame		**48-1936**	**48-1936**	**48-1936**	**48-1936 KIT**	**48-1902 KIT**

Note

① CN35A = Size 00, CN35B and CN35D = Size 0, CN35G = Size 2, CN35K = Size 3, CN35N = Size 4, and CN35S = Size 5.

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 ① and CN55 Contactors and Starters (Size 4, 5, 6)

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

Volts	Hertz	NEMA Size 4 Series A1	NEMA Size 4 Series B1	NEMA Size 5 Series A1	NEMA Size 5 Series B1	NEMA Size 6 Contactor and Starter Series A1, Starter Series B1 Part No.	Contactor 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/contactor.

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 ① and CN55 Contactors and Starters (Size 7, 8)

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

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 ①

Volts	Hertz	NEMA Size 7 Series A1	NEMA Size 7 Series B1	NEMA Size 8 Series A1	NEMA Size 8 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/contactor.

Specifications—Sizes 00–3

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
Configuration					
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
Maximum Horsepower (hp)					
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
AC Magnet Coil Data					
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, **Pages V5-T2-28** and **V5-T2-29**.	For DC magnet coils (and coil data), see Accessories, **Pages V5-T2-28** and **V5-T2-29**.	For DC magnet coils (and coil data), see Accessories, **Pages V5-T2-28** and **V5-T2-29**.	For DC magnet coils (and coil data), see Accessories, **Pages V5-T2-28** and **V5-T2-29**.	For DC magnet coils (and coil data), see Accessories, **Pages V5-T2-28** and **V5-T2-29**.
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
Electrical Life (480V/60 Hz)					
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
Wire Range					
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)	35 (14–10 AWG)
				45 (6–4 AWG)	40 (8 AWG)
				50 (3 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
Configuration					
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
Maximum Horsepower (hp)					
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
AC Magnet Coil Data					
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, **Pages V5-T2-28** and **V5-T2-29**.	For DC magnet coils (and coil data), see Accessories, **Pages V5-T2-28** and **V5-T2-29**.	For DC magnet coils (and coil data), see Accessories, **Pages V5-T2-28** and **V5-T2-29**.	For DC magnet coils (and coil data), see Accessories, **Pages V5-T2-28** and **V5-T2-29**.	For DC magnet coils (and coil data), see Accessories, **Pages V5-T2-28** and **V5-T2-29**.
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	6,00	6000
Mechanical life	5,000,000	5,000,000	5,000,000	5,000,000	5,000,000
Electrical Life (480V/60 Hz)					
AC-3	800,000	500,000	590,000	450,000	420,000
AC-4	70,000	34,000	7400	5000	4200
Wire Range					
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.

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.

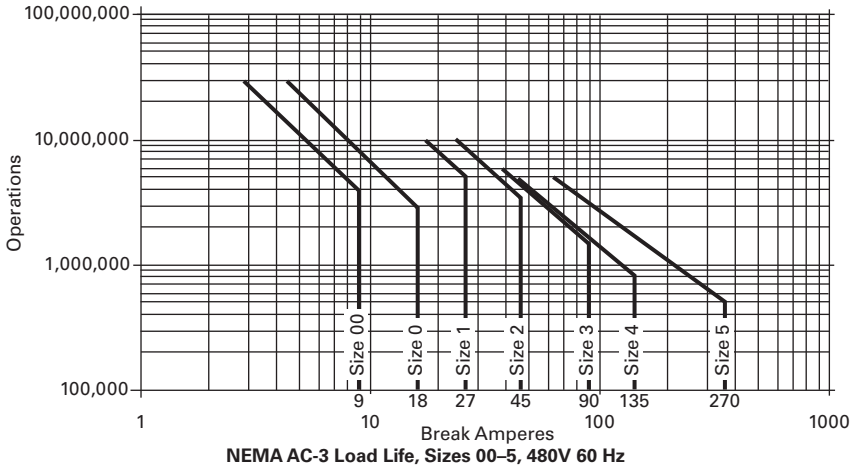
AC-4—Squirrel cage motors; starting, plugging, inching or jogging.

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.

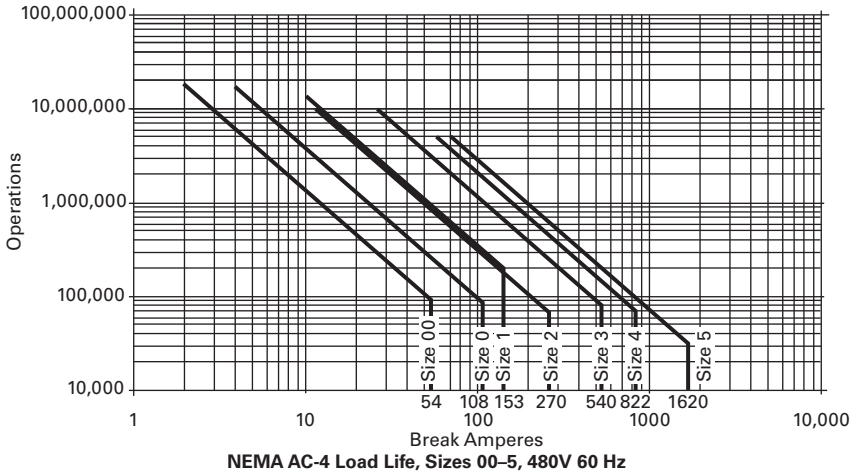
Contactor Choice

- 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_e), 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



NEMA AC-3 Load Life, Sizes 00–5, 480V 60 Hz



NEMA AC-4 Load Life, Sizes 00–5, 480V 60 Hz

32A Overload—C306DN3B



Contents

Description	*Page*
Contactors—Non-Reversing and Reversing	**V5-T2-4**
Starters—Three-Phase Non-Reversing and Reversing, Full Voltage	**V5-T2-10**
Starters—Single-Phase Non-Reversing, Full Voltage, Bi-Metallic Overload	**V5-T2-15**
Accessories	**V5-T2-21**
Renewal Parts	**V5-T2-30**
Technical Data and Specifications	**V5-T2-35**
Relays—Thermal Overload	
Product Selection	**V5-T2-40**
Accessories	**V5-T2-44**
Modifications	**V5-T2-44**
Replacement Parts	**V5-T2-44**
Technical Data and Specifications	**V5-T2-45**
Dimensions	**V5-T2-47**
C440/***XT*** Electronic Overload Relay	**V5-T2-48**

Relays—Thermal Overload

Product Description

C306 Overload Relays are designed for use with CE or CN non-reversing and reversing contactors. Four sizes are available for overload protection up to 144A.

Features

- Selectable manual or automatic reset operation
- Interchangeable heater packs adjustable ±24% to match motor FLA and calibrated for use with 1.0 and 1.15 service factor motors. Heater packs for 32A overload relay will mount in 75A overload relay—useful in derating applications such as jogging
- Class 10 or 20 heater packs
- Load lugs built into relay base
- Bimetallic, ambient compensated operated. Trip free mechanism
- Electrically isolated NO-NC contacts (pull RESET button to test). (Electrical ratings see table on **Page V5-T2-46**)
- Overload trip indication
- Shrouded or fingerproof terminals to reduce possibility of electrical shock

Standards and Certifications

- Meets UL 508 single-phasing requirements
- UL listed, CSA certified and NEMA compliance

Listed

Product Selection

C306 Thermal Overload Relays

C306DN3B



C306GN3B



Contactors

NEMA Size	Maximum Ampere Rating	Number of Poles	Open Type Catalog Number	NEMA 1 Enclosed Catalog Number
00, 0	32 ②	3	**C306DN3B**	**C306DG3B**
1, 2	75 ②	3	**C306GN3B**	**C306GG3B**
3	105 ③	3	**C306KN3**	—
4	144 ③	3	**C306NN3**	—
5–8 ①	—	—	—	—

C306DT3B



C306GT3B



Standalone Applications

NEMA Size	Maximum Ampere Rating	Number of Poles	Open Type Catalog Number
00, 0, 1 ④	32	3	**C306DT3B**
1 ④	75	3	**C306GT3B**
3 ⑤	105	3	**C306KN3**
4 ⑤	144	3	**C306NN3**
5–8 ⑥	—	—	—

Notes

① NEMA Sizes 5–8 use the 32A overload in conjunction with CTs.
② Series B overload relays have load lugs built into relay base and will only accept Series B heater packs. These relays can be directly attached to contactor or they can be DIN rail or panel mounted using adapter on **Page V5-T2-44**.
③ These relays can be panel mounted only.
④ Overload relay assembled with mounting adapter for DIN rail or panel mount.
⑤ Panel mount only.
⑥ NEMA Sizes 5–8 use the 32A overload in conjunction with CTs.

Heater Pack Selection

Heater packs H2001B to H2017B and H2101B to H2117B are to be used only with Series B overload relays Catalog Numbers C306DN3B (Part No. 10-7016) and C306GN3B (Part No. 10-7020). The load lugs are built into the overload relay base to allow load wiring prior to heater pack installation. The previous heater design had integral load lugs. The Series B heater packs are electrically equivalent to the previous heater design. Heaters H2018-3 to H2024-3 have not changed.

Starters with Series B Overload Relays ①

NEMA—AN Type		IEC—AE Type	
Size	**Series**	**Size**	**Series**
00–0	**C**	A–F	**C**
1–2	**B**	G–K	**B**
5	**B**	G–K	**B**
6	**C**	G–K	**B**
7–8	**B**	G–K	**B**

Heater Pack H2001B–H2017B



Standard Trip—Class 20 Heater

	Motor Full Load Ampere Rating Dial Position				
Overload Relay Size	**A**	**B**	**C**	**D**	**Catalog Number ②**
For Use with NEMA Sizes 00–0 Series C, NEMA Sizes 1–2 Series B; IEC Sizes A–F Series C, IEC Sizes G–K Series B					
32A or 75A	0.254	0.306	0.359	0.411	**H2001B-3**
	0.375	0.452	0.530	0.607	**H2002B-3**
	0.560	0.676	0.791	0.907	**H2003B-3**
	0.814	0.983	1.15	1.32	**H2004B-3**
	1.20	1.45	1.71	1.96	**H2005B-3**
	1.79	2.16	2.53	2.90	**H2006B-3**
	2.15	2.60	3.04	3.49	**H2007B-3**
	3.23	3.90	4.56	5.23	**H2008B-3**
	4.55	5.50	6.45	7.40	**H2009B-3**
	6.75	8.17	9.58	11.0	**H2010B-3**
	9.14	10.8	12.4	14.0	**H2011B-3**
	14.0	16.9	19.9	22.8	**H2012B-3**
	18.7	22.7	26.7	30.7	**H2013B-3**
	23.5	28.5	33.5	38.5	**H2014B-3**
For Use with NEMA Size 2, IEC Sizes G–K Only, Series B					
75A	29.0	34.0	39.1	44.1	**H2015B-3**
	39.6	45.5	51.5	57.4	**H2016B-3**
	53.9	60.9	67.9	74.9	**H2017B-3**

Notes

① The series of a starter is the last digit of the listed catalog number. Example: AN16DN0AB.

② Heater packs are shipped three to a carton. catalog numbers are for three heater packs.

Heater Pack H2018–H2024



Standard Trip—Class 20 Heater, continued

Overload Relay Size	Motor Full Load Ampere Rating Dial Position A	B	C	D	Catalog Number ①
For Use with NEMA Sizes 3–4, IEC Sizes L–N Only—Series A					
105A or 144A	8.0	9.2	10.3	11.5	**H2025-3**
	11.4	12.8	14.3	15.7	**H2026-3**
	14.3	15.7	17.4	19.0	**H2027-3**
	18.0	20.2	22.3	24.5	**H2018-3**
	24.6	27.6	30.5	33.4	**H2019-3**
	33.5	37.5	41.5	45.6	**H2020-3**
	45.7	51.2	56.7	62.1	**H2021-3**
	62.2	69.7	77.1	84.6	**H2022-3**
	84.7	95.0	105.0	115.0	**H2023-3**
	106.0	118.0	131.0	144.0	**H2024-3**
For Use with Size 5 Starters—Series B and IEC P, R and S with 300/5 CT					
32A ②	49	59	69	79	**H2004B-3**
	72	87	103	118	**H2005B-3**
	107	130	152	174	**H2006B-3**
	129	156	182	209	**H2007B-3**
	194	234	274	—	**H2008B-3**
For Use with Size 6 Starters Only—Series B and IEC T–V with 600/5 CT					
32A ②	144	174	205	235	**H2005B-3**
	215	259	304	348	**H2006B-3**
	258	312	365	419	**H2007B-3**
	388	468	547	627	**H2008B-3**
For Use with Size 7 Starters Only—Series B and IEC W–X with 1000/5 CT					
32A ②	163	197	230	264	**H2004B-3**
	240	290	342	392	**H2005B-3**
	358	432	506	580	**H2006B-3**
	430	520	608	698	**H2007B-3**
	646	780	912	—	**H2008B-3**
For Use Size 8 Starters Only—Series B and IEC Z with 1500/5 CT					
32A ②	244	295	345	396	**H2004B-3**
	360	435	513	588	**H2005B-3**
	537	648	759	870	**H2006B-3**
	645	780	912	1047	**H2007B-3**
	969	1170	1368	—	**H2008B-3**

Notes

① Heater packs are shipped three to a carton. catalog numbers are for three heater packs.

② Sizes 5–8 and IEC P–Z use the 32A overload relay with current transformers.

Heater Pack
H2101B–H2117B



Fast Trip—Class 10 Heater

	Motor Full Load Ampere Rating Dial Position				
Overload Relay Size	**A**	**B**	**C**	**D**	**Catalog Number** ①
For Use with NEMA Sizes 00–0 Series C, NEMA Sizes 1–2 Series B; IEC Sizes A–F Series C, IEC Sizes G–K Series B					
32A or 75A	0.260	0.313	0.367	0.420	**H2101B-3**
	0.384	0.464	0.543	0.623	**H2102B-3**
	0.570	0.688	0.806	0.924	**H2103B-3**
	0.846	1.02	1.20	1.37	**H2104B-3**
	1.28	1.55	1.83	2.10	**H2105B-3**
	1.92	2.33	2.74	3.15	**H2106B-3**
	2.30	2.79	3.28	3.77	**H2107B-3**
	3.38	4.10	4.82	5.54	**H2108B-3**
	4.96	6.03	7.09	8.16	**H2109B-3**
	7.07	8.58	10.1	11.6	**H2110B-3**
	9.60	11.2	12.8	14.4	**H2111B-3**
	14.4	17.5	20.7	23.8	**H2112B-3**
	18.7	21.8	25.0	28.1	**H2113B-3**
	23.5	27.3	31.0	34.8	**H2114B-3**
For Use with Size 2, IEC Sizes G–K Only—Series B					
75A	28.3	32.6	37.0	41.3	**H2115B-3**
	36.6	42.3	48.1	53.8	**H2116B-3**
	53.8	60.8	67.9	74.9	**H2117B-3**
For Use with Size 5 Starters Only—Series B and IEC P, R and S with 300/5 CT					
32A ②	51	61	72	82	**H2104B-3**
	77	93	110	126	**H2105B-3**
	115	140	164	189	**H2106B-3**
	138	167	197	226	**H2107B-3**
	203	246	289	—	**H2108B-3**
For Use with Size 6 Starters Only—Series B and IEC T–V with 600/5 CT					
32A ②	154	186	220	252	**H2105B-3**
	230	280	329	378	**H2106B-3**
	276	335	394	452	**H2107B-3**
	406	492	578	—	**H2108B-3**
For Use with Size 7 Starters Only—Series B and IEC W–X with 1000/5 CT					
32A ②	169	204	240	274	**H2104B-3**
	256	310	366	420	**H2105B-3**
	384	466	543	630	**H2106B-3**
	460	558	656	754	**H2107B-3**
	676	820	—	—	**H2108B-3**
For Use with Size 8 Starters Only—Series B and IEC Z with 1500/5 CT					
32A ②	254	306	360	411	**H2104B-3**
	384	465	549	630	**H2105B-3**
	576	699	822	945	**H2106B-3**
	690	837	984	1131	**H2107B-3**
	1014	1230	—	—	**H2108B-3**

Notes

① Heater packs are shipped three to a carton. catalog numbers are for three heater packs.

② Sizes 5–8 and IEC P–Z use the 32A overload relay with current transformers.

2

Accessories

DIN Rail and Panel Mounting Adapter

These adapters are required when component overload relays are to be separately mounted. The terminal base adapter includes line terminals and connects with the overload relays on **Page V5-T2-40**.

C306TB1



DIN Rail and Panel Mounting Adapter

Description	Catalog Number
For 32A overload relay	**C306TB1**
For 75A overload relay	**C306TB2B** ①

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.

Overload Relay Cover



Locking Cover for Overload Relay—C306 Only

Description	Min. Order Qty. (Std. Pkg.)	Catalog Number
Clear cover, no accessibility	50	**C320PC3**
Gray cover, no accessibility with auto only nib	50	**C320PC4**
Gray cover, no accessibility with manual only nib	50	**C320PC5**
Gray cover with FLA dial accessibility, A, B, C, D positions and auto only nib	50	**C320PC6**
Gray cover with FLA dial accessibility, A, B, C, D positions and manual only nib	50	**C320PC7**

Modifications

C306 Thermal Overload Relays with Mounting Adapter

Consists of a thermal overload relay mounted to a terminal base adapter—permits fast and easy installation.

C306 Thermal Overload Relays with Mounting Adapter

Description	Catalog Number
C306DN3B + C306TB1	**C306DT3B**
C306GN3B + C306TB2B	**C306GT3B**

Replacement Parts

Heater Pack Replacement

The heater pack series is determined by the 6th character of the catalog number. Series A or prior heater packs (identified by either "A" or "-" as the 6th character) have built-in load lugs. Series B or later heater packs do not (load lugs are on overload relay). Replacement of Series A or earlier heater packs with Series B or later heater packs, requires the one time addition of Lug Adapter Kit C306KAL1-3B to the Series A1 overload relay.

Superseded Series A Heater Pack



Series B Heater Pack



Heater Pack Replacement Requirements

Existing Heater Pack Catalog Numbers	Replacement Product Required
H2001-3–H2013-3 **H2001A-3–H2013A-3**	Lug adapter kit C306KAL1-3B and Series B heater pack
H2001B-3–H2013B-3	Series B heater pack
H2014-3 **H2014A-3**	Replace with lug adapter kit C306KAL1-3B and Series B heater pack
H2014B-3	Series B heater pack
H2015-3–H2017-3	Replace with heater pack chosen from table below
H2015A-3–H2017A-3	Replace with lug adapter kit C306KAL1-3B and Series B heater pack
H2015B-3–H2017B-3	Series B heater pack

Heater Pack Ratings

Motor Full Load Ampere Rating Dial Position A	B	C	D	Order Heater Pack Catalog Number
29.0	32.5	36.0	39.5	**H2015B-3**
39.6	44.3	49.1	53.8	**H2016B-3**
53.9	60.4	66.8	74.9	**H2017B-3**

Overload Relay Lug Adapter Kit

Superseded 32A Series A Overload Relay—C306DN3



Superseded 75A Series A Overload Relay—C306GN3



These kits are used in conjunction with Catalog Numbers H2001B–H2014B or H2101B–H2114B heater packs as a means of utilizing these Series B heater packs in Catalog Numbers C306DN3 and C306GN3 Series AI overload relays. The kit consists of three lug adapters and installation instructions. When installing Series B heater packs plus lug adapters in Series A overload relays, refer to heater pack FLA adjustment tables originally supplied with equipment (also supplied with kit).

C306KAL1



Overload Relay Lug

Description	Catalog Number
Series AI overload relay lug adapter kit	**C306KAL1-3B**

Overload Relay Replacement—Series A Only

When replacing a Catalog Number C306DN3 (Part No. 10-6044) or C306GN3 (10-6319) Series A overload relay on a starter, order a Series B overload relay and Series B heater packs.

Note

① This Series B adapter will accept Series A or B overload relays (C306GN3 or C306GN3B), C306TB2 can only be used with C306GN3.

Technical Data and Specifications

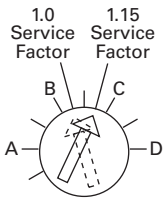
Operation

C306 Overload Relay Setting
For motors having a 1.15 service factor, rotate the FLA (Full Load Amperes) adjustment dial to correspond to the motor's FLA rating.

Estimate the dial position when the motor FLA falls between two letter values as shown in the example.

For motors having a 1.0 service factor, rotate the FLA dial one-half position counterclockwise (CCW).

FLA Dial Adjustment

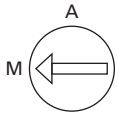


Example of 12.0 FLA setting for heater pack number H2011B showing position for 1.0 or 1.15 service factor motors.

The overload relay is factory set at M for manual reset operation. For automatic reset operation, turn the reset adjustment dial to the A position as shown in the illustration.

Automatic reset is not intended for two-wire control devices.

Manual/Automatic Reset



Example of setting for manual reset.

Test for Trip Indication

To test overload relay for trip indication when in manual reset, pull out the blue reset button. An orange flag will appear indicating that the device has tripped. Push reset button in to reset.

Warning—To provide continued protection against fire or shock hazard, the complete overload relay must be replaced if burnout of the heater element occurs.

General

"Overload relays are provided to protect motors, motor control apparatus and motor-branch circuit conductors against excessive heating due to motor overloads and failure to start. This definition does not include: 1) motor circuits over 600V, 2) short circuits, 3) ground faults and 4) fire pump control." (NEC Art. 430-31)

Time Current Characteristics

The time-current characteristics of an overload relay is an expression of performance which defines its operating time at various multiples of its current setting. Tests are run at Underwriters Laboratories (UL) in accordance with NEMA Standards and the NEC. UL requires:

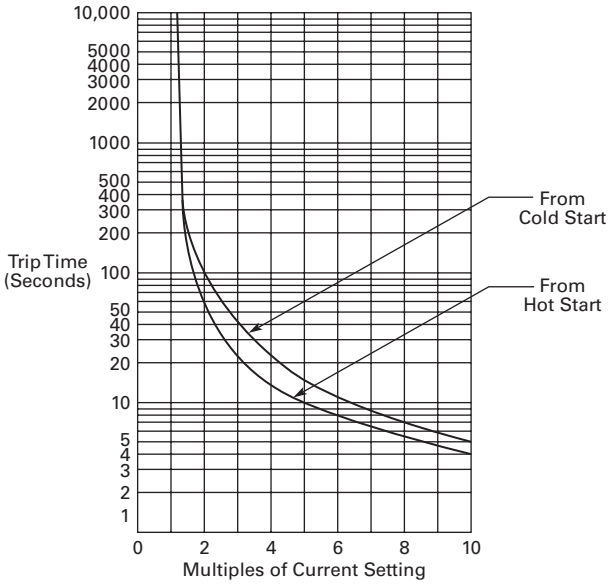
- When tested at 100 percent of its current rating, the overload relay shall trip ultimately
- When tested at 200 percent of its current rating, the overload relay shall trip in not more than 8 minutes
- When tested at 600 percent of the current rating, the overload relay shall trip in not more than 10 or 20 seconds, depending on the Class of the relay

"Current Rating" is defined as the minimum current at which the relay will trip. Per NEC, an overload must ultimately trip at 125% of FLA current (heater) setting for a 1.15 service factor motor and 115% FLA for a 1.0 service factor motor.

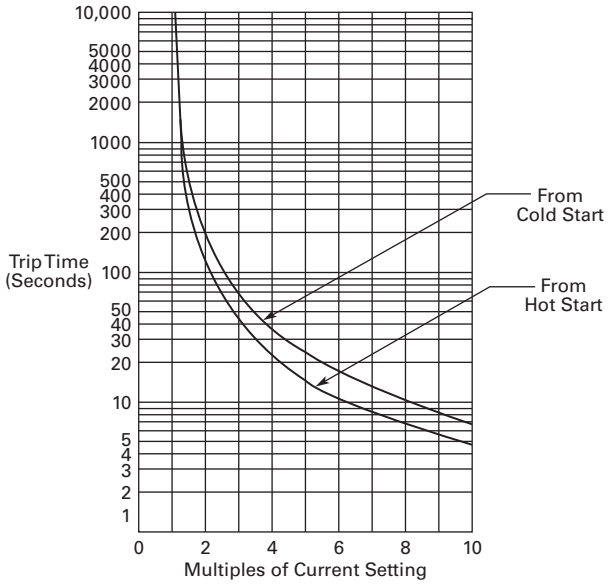
"Current Setting" is defined as the FLA of the motor and thus the overload heater pack setting.

Example: 600% of current rating is defined as 750% (600 x 1.25) of FLA current (heater) setting for a 1.15 service factor motor. A 10A heater setting must trip in 20 seconds or less at 75A motor current for a Class 20 relay.

Class 10 and Class 20 Trip Curves



Class 10 Overload Relay 25C Open Rating



Class 20 Overload Relay 25C Open Rating

2

Wire (75°C) Sizes—AWG or kcmil—NEMA Sizes 00–2, IEC A–K—Open

Power Terminals—Line

IEC Size	NEMA Size	Cu Only
A, B, C	00	12–16 stranded, 12–14 solid
D, E, F	0	8 –16 stranded, 10–14 solid
	1	8–14 stranded or solid
G, H, J, K	2	3–14 (upper) and/or 6–14 (lower) stranded or solid ①

Power Terminals—Load—Cu Only (Stranded or Solid)

Catalog Number	Terminal	Wire Size
C306DN3B	32A	14–6 AWG
C306GN3B	75A	14–2 AWG
Control Terminals—Cu Only		
12–16 AWG stranded, 12–14 AWG solid		

Wire (75°C) Sizes—AWG or kcmil—NEMA Sizes 3–8, IEC L–N—Open

Power Terminals—Line and Load

IEC Size	NEMA Size	Wire Size
L	3	1/0–14 Cu/Al
M	—	14–2/0 Cu/Al
N	—	3/0–8 Cu/Al
—	4	Open—3/0–8 Cu
		Enclosed—250 kcmil—6 Cu/Al
—	5	750 kcmil—2 or (2) 250 kcmil—3/0 Cu/Al
	6–7	(2) 750 kcmil—3/0 Cu/Al
	8	(2) 750 kcmil—1/0 Cu/Al
Control Terminals—Cu Only		
12–16 AWG stranded, 12–14 AWG solid		

Power Terminal Torque Line and Load Terminals

Catalog Number	Terminal	Torque in lb-in
C306DT3B	32A	20
C306GT3B	75A	35 (14–10 AWG)
		40 (8 AWG)
		45 (6–4 AWG)
		50 (3–2 AWG)
C306KN3 (socket head screw)	105A	120 (3/16)
		200 (1/4)
		250 (5/16)
C306NN3 (socket head screw)	144A	120 (3/16)
		200 (1/4)
		250 (5/16)
C306NN3 (slotted head screw)		35 (14–10 AWG)
		40 (8 AWG)
		45 (6–4 AWG)
		50 (3–1/0 AWG)

Plugging and Jogging Service Horsepower Ratings ②

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

Overload Relay UL/CSA Contact Ratings Control Circuit ③

AC Volts	120V	240V	480V	600V
NC Contact B600				
Make and break amperes	30	15	7.5	6
Break amperes	3	1.5	0.75	0.6
Continuous amperes	5	5	5	5
NO Contact C600				
Make and break amperes	15	7.5	3.375	3
Break amperes	1.5	0.75	0.375	0.3
Continuous amperes	2.5	2.5	2.5	2.5

Notes

① Two compartment box lug.

② Maximum horsepower where operation is interrupted more than 5 times per minute or more than 10 times in a 10 minute period. NEMA standard ICS 2-1993 table 2-4-3.

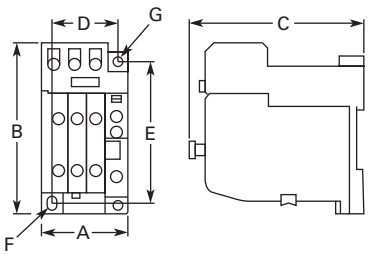
③ DC ratings cover Freedom Series coils only.

Dimensions

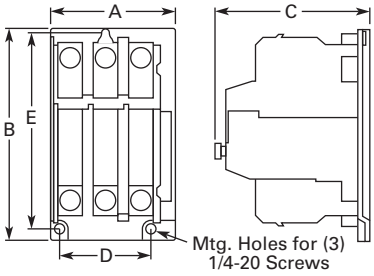
Approximate Dimensions in Inches (mm)

Stand-Alone Overload Relays

32A and 75A Sizes—C306DT38 and C306GT3B



105A and 144A Sizes—C306KN38 and C306NN3B



Dimensions and Shipping Weights

Ampere Size	Wide A	High B	Deep C	Mounting D	E	F (Slot)	G (Hole)	Shipping Weight Lbs (kg)
32A	1.77 (45.0)	4.13 (104.9)	3.69 (93.7)	1.36 (34.5)	3.74 (95.0)	0.18 x 0.30 (4.6 x 7.6)	0.18 (4.6) dia.	0.8 (0.4)
75A	2.54 (64.5)	4.69 (119.1)	3.74 (95.0)	2.00 (50.8)	3.45 (87.6)	0.22 x 0.26 (5.6 x 6.6)	0.21 (5.3) dia.	1.4 (0.6)
105 and 144A	4.00 (101.6)	7.17 (182.1)	4.91 (124.7)	3.00 (76.2)	6.62 (168.1)	—	—	4.0 (1.8)

C440/*XT* Electronic Overload Relay



Contents

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

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.

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
Motor Protection				
Thermal overload	Overload is a condition in which current draw exceeds 115% of the full load amperage rating for an inductive motor.	• An increase in the load or torque that is being driven by the motor. • A low voltage supply to the motor causes the current to go high to maintain the power needed. • A poor power factor causing above normal current draw.	• Increase in current draw leads to heat and insulation breakdown, which can cause system failure. • Increase in current can increase power consumption and waste valuable energy.	• Thermal trip behavior is defined by UL, CSA and IEC standards. • Trip class is settable from 10A, 10, 20, 30
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.

Catalog Number Selection

2

Freedom Series NEMA Starters with C440 Electronic Overload Relays ①

A N 1 9 A N 0 A 5E 005

Device Type
A = Starter

Standard
N = NEMA

Device Assembly Configuration
1 = Non-reversing
5 = Reversing

OLR Type
9 = Starter w/C440 EOLR

Contactor Frame Size

	NEMA Size	Continuous Amperes
A =	00	9
B =	0	18
C =	1C	27
D =	1	27
G =	2	45
K =	3	90
M =	4C	135
N =	4	135
S =	5	270

NEMA Enclosure
N = Open

For Starters

Starter Mounting Option
0 = Horizontal

C440 OLR Designation (FVNR and FVR only)
5E = Standard feature set
SEL Reset, SEL Class (10A, 10, 20, 30)
5G = Ground fault feature set
SEL Reset, SEL Class (10, 20)

AC Coil Suffix

Suffix	Volts and Hertz
A=	120/60 or 110/50
B=	240/60 or 220/50
C=	480/60 or 440/50
D=	600/60 or 550/50
E=	208/60
H=	277/60
J=	208–240/60 ②
K=	240/50
L=	380–415/50
N=	550/50
T=	24/60, 24/50 ③
U=	24/50
V=	32/50
W=	48/60
Y=	48/50

C440 FLA Range (FVNR and FVR only)

NEMA Size 00
1P6 = 0.33–1.65A
005 = 1–5A
020 = 4–20A

NEMA Size 0
1P6 = 0.33–1.65A
005 = 1–5A
020 = 4–20A

NEMA Size 1/1C
1P6 = 0.33–1.65A
005 = 1–5A
020 = 4–20A
045 = 9–45A

NEMA Size 2
005 = 1–5A
020 = 4–20A
045 = 9–45A

NEMA Size 3
100 = 20–100A

NEMA Size 4/4C
140 = 28–140A

NEMA Size 5 ④
300 = 60–300A

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 Single-Phase 115V	Single-Phase 230V	Three-Phase 208V	Three-Phase 240V	Three-Phase 480V	Three-Phase 600V	Three-Pole Non-Reversing ①② Catalog Number	Three-Pole Reversing ①② Catalog Number
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_**
5③	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 Single-Phase 115V	Single-Phase 230V	Three-Phase 208V	Three-Phase 240V	Three-Phase 480V	Three-Phase 600V	Three-Pole Non-Reversing ①② Catalog Number	Three-Pole Reversing ①② Catalog Number
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_**
5③	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	—	—
5③	**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

Compact NEMA Size 1 and 4 Starters

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

Non-Reversing

NEMA Size	Continuous Ampere Rating	Service Limit Current Rating (Amps)	Maximum UL Horsepower Single-Phase 115V	Single-Phase 230V	Three-Phase 208V	Three-Phase 240V	Three-Phase 480V	Three-Phase 600V	Three-Pole Non-Reversing Catalog Number
Standard Fault Overload									
1C	27	32	2	3	7.5	7.5	10	10	**AN19CN0_5E_**
4C	135	156	—	—	40	50	100	100	**AN19MN0_5E_**
Ground Fault Overload									
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) AC3/AC4	Operations
1C	27/150	2,500,000/40,000
1	27/153	5,000,000/110,000
4C	135/516	500,000/40,000
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

A N 1 9 D N 0 A 5E 020 – CRK

Device Type
A = Starter

Standard
N = NEMA

Device Assembly Configuration
1 = Non-reversing

OLR Type
9 = Starter w/C440 EOLR

Contactor Frame Size

	NEMA Size	Continuous Amperes
D =	1	27
G =	2	45
K =	3	90
N =	4	135
S =	5	270

NEMA Enclosure
N = Open

For Starters

Starter Mounting Option
0 = Horizontal

AC Coil Suffix

Suffix	Volts and Hertz
A =	120/60 or 110/50

C440 OLR Designation
5E = Standard feature set
SEL Reset,
SEL Class (10A, 10, 20, 30)

C440 FLA Range
NEMA Size 1/1C
020 = 4–20A
NEMA Size 2
045 = 9–45A
NEMA Size 3
100 = 20–100A
NEMA Size 4/4C
140 = 28–140A
NEMA Size 5
300 = 60–300A

Competitive Retrofit Kit

Accessories

CT Kits

Accessories

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

Safety Cover



Reset Bar



Remote Reset



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.

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.



Basic Communication—Modbus



Advanced Communication—Communication Module

Note

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

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.

Expansion Module



Description	Catalog Number
Expansion Module	
Expansion module (Remote Reset/Modbus RTU, RS-485 Communication)	**C440-XCOM**

Ethernet with I/O Module



Communication Modules	
DeviceNet communication module kit—120 V I/O (consists of C440-XCOM + C441KS)	**C440-DN-120**
DeviceNet communication module kit—24 Vdc I/O (consists of C440-XCOM + C441LS)	**C440-DN-24**
PROFIBUS communication module kit—120 V I/O (consists of C440-XCOM + C441SS)	**C440-DP-120**
PROFIBUS communication module kit—24 V I/O (consists of C440-XCOM + C441QS)	**C440-DP-24**
Modbus communication module kit—120 V I/O (consists of C440-XCOM + C441NS)	**C440-MOD-120**
Modbus communication module kit—24 Vdc I/O (consists of C440-XCOM + C441PS)	**C440-MOD-24**
Modbus TCP/Ethernet IP communication module kit—120 V I/O (consists of C440-XCOM + C441U)	**C440-ET-120**
Modbus TCP/Ethernet IP communication module kit—24 V I/O (consists of C440-XCOM + C441V)	**C440-ET-24**

Technical Data and Specifications

Electronic Overload Relays up to 1500A

Description	Specification 45 mm	55 mm	110 mm
Electrical Ratings	**Range**	**Range**	**Range**
Operating voltage (three-phase) and frequency	690 Vac (60/50 Hz)	690 Vac (60/50 Hz)	690 Vac (60/50 Hz)
FLA Range			
	0.33–1.65A 1–5A 4–20A 9–45A	20–100A	28–140A (NEMA) 35–175A (IEC)
Use with Contactors			
XT IEC frames	B, C, D	D, F, G	G, H
Freedom NEMA sizes	00, 0, 1, 2	3	4
Trip Class			
	10A, 10, 20, 30 Selectable	10A, 10, 20, 30 Selectable	10A, 10, 20, 30 Selectable
Motor Protection			
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
Feature	**Range**	**Range**	**Range**
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
Indicators			
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
Options			
Remote reset	Yes	Yes	Yes
Reset bar	Yes	Yes	Yes
Communication expansion module	Yes	Yes	Yes
Communication adapter	Yes	Yes	Yes
Capacity			
Load terminals			
Terminal capacity	12–10 AWG (4–6 mm^2) 8–6 AWG (6–16 mm^2)	6–1 AWG (16–50 mm^2)	8–4/0 AWG (10–95 mm^2)
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)
Voltages			
Insulation voltage U_i (three-phase)	690 Vac	690 Vac	690 Vac
Insulation voltage U_i (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

Electronic Overload Relays up to 1500A, continued

Description	Specification 45 mm	55 mm	110 mm
Auxiliary and Control Circuit Ratings			
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
Short-Circuit Rating without Welding			
Maximum fuse	6A gG/gL	6A gG/gL	6A gG/gL
Environmental Ratings			
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
Electrical/EMC			
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)	Three-phase power inputs: ±4 kV line-to-line (DM) ±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)	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)	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

Description	Modbus	DeviceNet	PROFIBUS	Ethernet
Electrical/EMC				
Radiated emissions IEC 60947-4-1—Table 15, EN 55011 (CISPIR 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 (CISPIR 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 ①: ±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 ① IEC 60947-4-1 (Table 13) IEC 61000-4-3	10 V/m	10 V/m	10 V/m	10 V/m
Environmental Ratings				
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 600068-2-27)	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
DeviceNet				
DeviceNet connections	—	Group 2, polling, bit strobe, explicit, no UCMM	—	—
DeviceNet baud rate	—	125K, 250K, 500K	—	—
Ethernet				
Ethernet connections	—	—	—	Integrated two-port switch with dual RJ45 Ethernet connections
Ethernet type	—	—	—	Ethernet 10/100 Mbs, AutoMDX, Auto Negotiation
PROFIBUS				
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

① Relates to C441M only.

Communication Modules, continued

Description	Modbus	DeviceNet	PROFIBUS	Ethernet
C441_ 24 Vdc Input				
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
Operating Voltage Range—DC Input Modules				
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
C441_ 120 Vac Input				
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
Operating Voltage Range—AC Input Modules				
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
Output Modules				
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 ①	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

① Relates to C441M only.

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)

		Standard-Fault Short Circuit Data			High-Fault Short Circuit Data					
					Fuses (RK5, J, CC)			Thermal-Magnetic Circuit Breakers		
Overload FLA Range	Maximum Operating Voltage	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 (NZMH3)

NEMA Freedom Series Starters with C440 Electronic Overload Relays

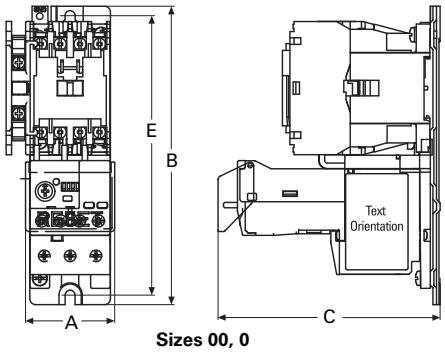
		High-Fault Short Circuit Data			Thermal-Magnetic Circuit Breakers		
		Fuses (RK5, J, CC)					
NEMA Size	Maximum Operating Voltage	480V	600V	Maximum Fuse Size	480V	600V	Maximum Breaker Size
00	0.33–1.65A	100	100	30	—	—	—
	1–5A	100	100	30	100	35	35
	4–20A	100	100	30	100	35	35
0	0.33–1.65A	100	100	60	—	—	—
	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

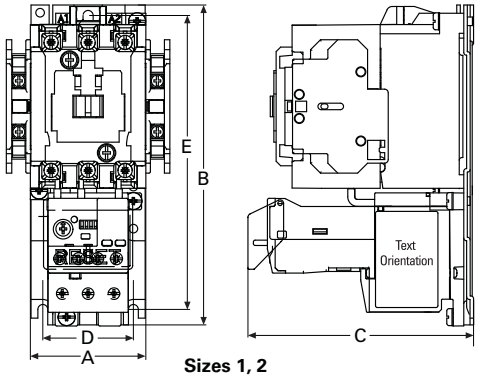
Approximate Dimensions in Inches (mm)

NEMA Starters

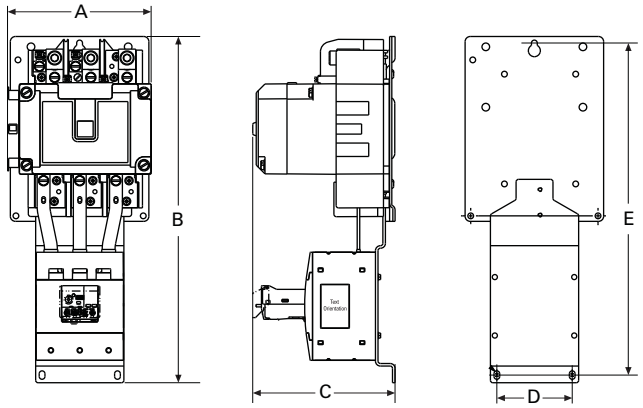
Full Voltage Non-Reversing Starters



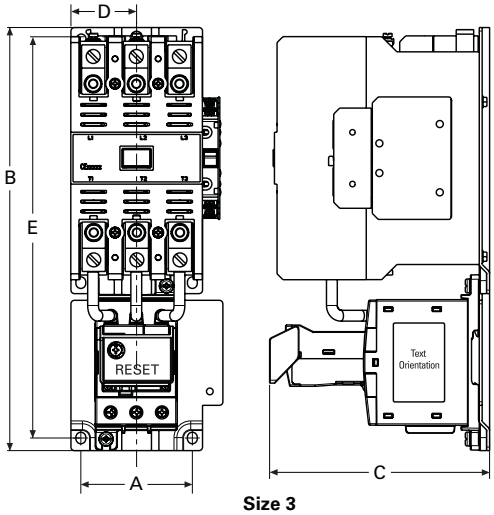
Sizes 00, 0



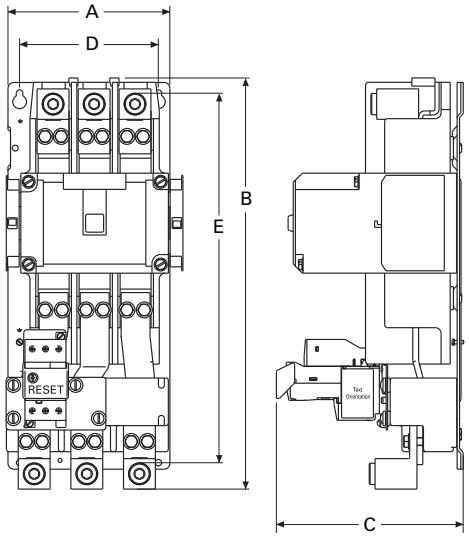
Sizes 1, 2



Size 4



Size 3

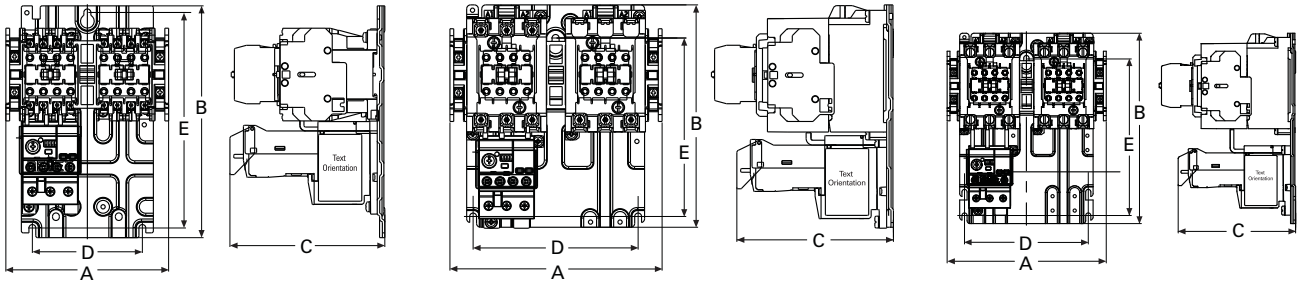


Size 5

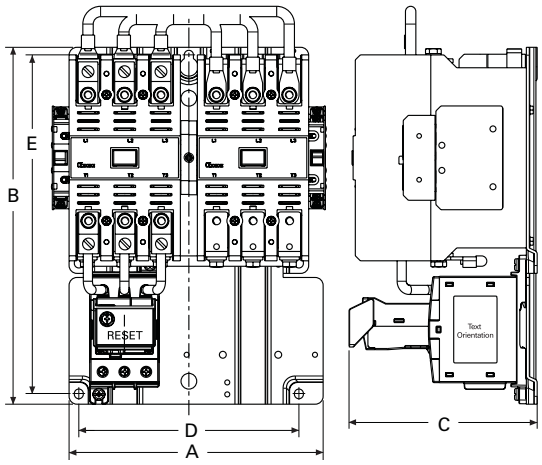
NEMA Size	A	B	C	D	E
00, 0	1.97 (50.0)	6.60 (167.6)	4.90 (124.5)	—	6.18 (157.0)
1, 2	2.60 (65.0)	7.10 (180.0)	4.98 (126.5)	2.00 (50.8)	6.50 (165.0)
3	3.00 (76.2)	11.40 (289.6)	5.92 (150.3)	1.77 (44.9)	10.81 (274.6)
4	7.10 (179.0)	17.00 (432.0)	7.00 (177.0)	3.70 (94.0)	16.30 (415.0)
5	7.00 (177.8)	17.81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

Approximate Dimensions in Inches (mm)

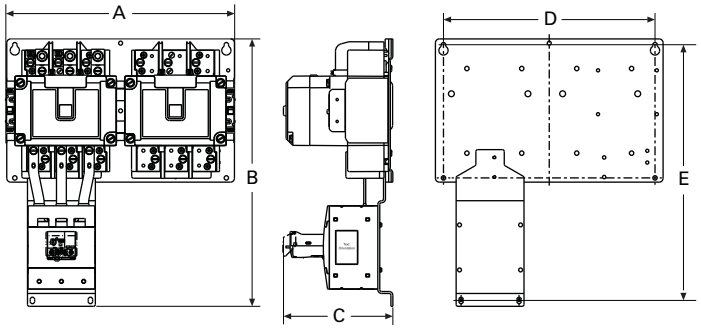
Full Voltage Reversing Starters



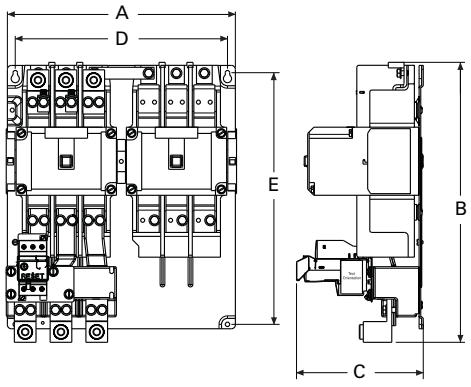
Sizes 00, 0 | Size 1 | Size 2



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 (145.0)
5	14.50 (368.3)	17.81 (452.3)	8.06 (204.8)	13.50 (342.9)	16.00 (406.6)

NEMA Space-Savings Family of Contactors and Starters



Contents

Description	*Page*
Contactors and Starters	
Catalog Number Selection	**V5-T2-64**
Product Selection	**V5-T2-64**
Accessories	**V5-T2-66**
Renewal Parts	**V5-T2-70**
Technical Data and Specifications	**V5-T2-71**
Dimensions	**V5-T2-93**

An Eaton Green Solution

Contactors and Starters

Product Description

The Eaton NEMA® Space-Savings line of contactors and starters includes non-reversing and reversing contactors, electronic overload relays and a variety of related accessories. Because the Space-Savings family meets IEC, UL®, CSA® and CE standards, it is the perfect product solution for applications all over the world. The compact and easy to install Space-Savings line of NEMA contactors and starters is the efficient and effective solution for customer applications from Size 0 through Size 5.

Application Description

The Space-Savings line of NEMA power control was engineered to provide highly effective control and protection for a variety of loads, including motors, compressors, pumps, resistive, capacitor banks, isolation and others.

The Space-Savings contactors are perfectly suited for use in Motor Control Center applications where bucket space sizing is critical. With both AC and DC control and flexible communication options, the Space-Savings family can be easily integrated into various customer applications.

Features and Benefits

- AC control from 120V to 600V 50/60 Hz
- 24 Vdc control
- Reversing or non-reversing contactors and starters
- XTOE self-powered electronic overload relay
- Non-reversing starters to NEMA Size 5
- Panel or DIN rail mounting to NEMA Size 2
- IP20 finger and back-of-hand proof
- Large ambient temperature range, –25 to 50°C [–13 to 122°F]
- AC and DC controlled contactors in the same compact frame
- Low power consumption AC and DC coils
- Built-in NO or NC auxiliary contacts to 32A
- Plug-in accessories for reduced installation time
- Coil replacement on NEMA Size 0–5
- Contact replacement on NEMA Size 1–5
- Integrated suppressor NEMA Size 0–4 DC operated contactors and NEMA Size 5 AC and DC operated contactors

Standards and Certifications

- IEC EN 60947
- CE approved
- UL
- CSA
- ATEX
- RoHS

CE UL SA RoHS COMPLIANT

Catalog Number Selection

2

Space-Savings NEMA Starters with XTOE Electronic Overload Relays

A N 1 3 C N 0 1 A 5E 005

Device Type
- **A** = Starter
- **C** = Contactor

Standard
- **N** = NEMA

Device Assembly Configuration
- **1** = Non-reversing
- **5** = Reversing

OLR Type
- **3** = Starter w/XTOE EOLR

Contactor Frame Size ②

	NEMA Size	Continuous Amperes
B =	0	18
C =	1	27
G =	2	45
K =	3	90
M =	4	135
S =	5	270

NEMA Enclosure
- **N** = Open

For Starters

Starter Mounting Option
- **0** = Horizontal

For Contactors Only

Starter Mounting Option
- **10** = 1 normally open
- **01** = 1 normally closed
- **11** = 1 normally open, 1 normally closed
- **00** = No auxiliary contacts
- **22** = 2 normally open, 2 normally closed

Coil Suffix

Suffix	Volts and Hertz
A =	120/60 or 110/50
B =	240/60 or 220/50
TD =	24 Vdc

XTOE OLR Designation (FVNR and FVR only)
- **5E** = Standard feature set SEL Reset, SEL Class (10A, 10, 20, 30)
- **5G** = Ground fault feature set SEL Reset, SEL Class (10, 20)

XTOE FLA Range (FVNR and FVR only)

NEMA Size 0
- **1P6** = 0.33–1.65A
- **005** = 1–5A
- **020** = 4–20A

NEMA Size 1
- **1P6** = 0.33–1.65A
- **005** = 1–5A
- **020** = 4–20A
- **045** = 9–45A

NEMA Size 2
- **045** = 9–45A

NEMA Size 3
- **100** = 20–100A

NEMA Size 4/4C
- **175** = 35–175A

NEMA Size 5 ②
- **300** = 60–300A

Product Selection

Type CN13/53 Space-Savings NEMA Contactors

NEMA Contactor



Non-Reversing and Reversing

NEMA Size	Continuous Ampere Rating	Service Limit Current Rating (Amps)	Maximum UL Horsepower Single-Phase 115V	Single-Phase 230V	Three-Phase 208V	Three-Phase 240V	Three-Phase 480V	Three-Phase 600V	Three-Pole Non-Reversing ① Catalog Number	Three-Pole Reversing ① Catalog Number
0	18	21	1	2	3	3	5	5	**CN13BN010_**	—
1	27	32	2	3	7-1/2	7-1/2	10	10	**CN13CN010_**	**CN53CN011_**
2	45	52	3	7-1/2	10	15	25	25	**CN13GN000_**	**CN53GN011_**
3	90	104	7.5	15	25	30	50	50	**CN13KN000_**	**CN53KN011_**
4	135	156	—	—	40	50	100	100	**CN13MN000_**	—
5	270	311	—	—	75	100	200	200	**CN13SN022_**	—

Notes

① Underscore (_) indicates coils suffix required, see Coil Suffix table above.

② NEMA Size 5 starter components to be ordered separately: Contactor (CN13SN022_), 60–300A CT kit, and 1–5A overload relay. See page **V5-T2-82** for CT kit and overload part numbers.

Type AN13/53 Space-Savings Starters with XTOE Electronic Overload Relays

NEMA Starter



Non-Reversing and Reversing

NEMA Size	Continuous Ampere Rating	Service Limit Current Rating (Amps)	Maximum UL Horsepower Single-Phase 115V	230V	Three-Phase 208V	240V	480V	600V	Three-Pole Non-Reversing ①② Catalog Number ③	Three-Pole Reversing ①② Catalog Number ③
0	18	21	1	2	3	3	5	5	**AN13BN0_ 5E _**	**AN53BN0_ 5E _**
1	27	32	2	3	7-1/2	7-1/2	10	10	**AN13CN0_ 5E _**	**AN53CN0_ 5E _**
2	45	52	3	7-1/2	10	15	25	25	**AN13GN0_ 5E _**	**AN53GN0_ 5E _**
3	90	104	—	—	25	30	50	50	**AN13KN0_ 5E _**	**AN53KN0_ 5E _**
4	135	156	—	—	40	50	100	100	**AN13MN0_ 5E _**	**AN53MN0_ 5E _**
5 ④	270	311	—	—	75	100	200	200	④	—

Type AN13/53 Space-Savings Starters with XTOE 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 Single-Phase 115V	230V	Three-Phase 208V	240V	480V	600V	Three-Pole Non-Reversing ①② Catalog Number ③	Three-Pole Reversing ①② Catalog Number ③
0	18	21	1	2	3	3	5	5	**AN13BN0_ 5G _**	**AN53BN0_ 5G _**
1	27	32	2	3	7-1/2	7-1/2	10	10	**AN13CN0_ 5G _**	**AN53CN0_ 5G _**
2	45	52	3	7-1/2	10	15	25	25	**AN13GN0_ 5G _**	**AN53GN0_ 5G _**
3	90	104	—	—	25	30	50	50	**AN13KN0_ 5G _**	**AN53KN0_ 5G _**
4	135	156	—	—	40	50	100	100	**AN13MN0_5G_**	**AN53MN0_5G_**
5 ④	270	311	—	—	75	100	200	200	④	—

XTOE Overload FLA Range (FVNR and FVR Starters Only) Magnet Coil Suffix

NEMA Size	OLR Code	FLA Range	OLR Code	FLA Rating
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	—	—	**045**	9.0–45A
	—	—	—	—
3	**100**	20–100A	—	—
4	**175**	35–175A	—	—
5 ④	**300**	60–300A	—	—

Coil Voltage	Suffix Code
Sizes 0–2	
110V 50 Hz, 120V 60 Hz	**A**
220V 50 Hz, 240V 60 Hz	**B**
24–27 Vdc	**TD**
Sizes 3, 4	
100–120V 50/60 Hz	**A**
190–240V 50/60 Hz	**B**
24–27 Vdc	**TD**
Sizes 5	
100–120V 50/60 Hz	**A**
24–48 Vdc	**TD**

Notes

① Underscore (_) indicates coils suffix required, see Coil Suffix table above.

② Underscore (_) indicates OLR designation required, see XTOE FLA Range table above.

③ For MCC replacement needs, contact MCC Aftermarket.

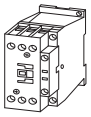
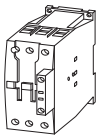
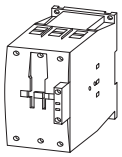
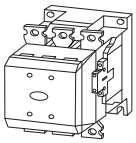
④ NEMA Size 5 starter components to be ordered separately: Contactor (CN13SN022_), 60–300A CT kit, and 1–5A overload relay. See page **V5-T2-82** for CT kit and overload part numbers.

Accessories

Auxiliary Contacts—Overview

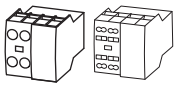
Front-mounted snap-on auxiliary contacts for Space-Savings contactors are available with screw terminals in a variety of contact configurations.

Auxiliary Contacts Possible Combinations

Frame Size	Catalog Number	Contactor	Built-In Auxiliary	Front (Top) Mount Two-Pole	Front (Top) Mount Four-Pole	Side-Mount Single-Pole	Side-Mount Two-Pole	Total Auxiliary Contacts Available
0, 1	**CN13BN0_ – CN13CN0_**		1NO or 1NC	1	—	—	—	3
				—	1	—	—	5
				—	—	—	1	3
						—		—
2	**CN13GN0_**		—	1	—	—	2	6
				—	1	—	1	6
						—		—
3, 4	**CN13KN0_ – CN13MN0_**		—	1	—	—	2	6
				—	1	—	2	8
				—	—	—	4	8
						—		—
5	**CN13SN0**		2NO–2NC	—	—		2	8
				—	—			—

Auxiliary Contacts

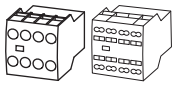
XTCEXF_



NEMA Size 0, 1— Front (Top) Mount—Two-Pole

Conventional Thermal Current, Open at 60°C $I_{th} = I_e$, AC-1 in Amps	Contact Configuration	Circuit Symbol	Pkg. Qty. ①	Screw Terminal Catalog Number
16	2NO	53 63 / 54 64	5	**XTCEXFAC20**
16	1NO-1NC	53 61 / 54 62	5	**XTCEXFAC11** ②
16	2NC	51 61 / 52 62	5	**XTCEXFAC02**

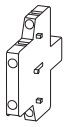
XTCEXF_



NEMA Size 0, 1— Front (Top) Mount—Four-Pole

Conventional Thermal Current, Open at 60°C $I_{th} = I_e$, AC-1 in Amps	Contact Configuration	Circuit Symbol	Pkg. Qty. ①	Screw Terminal Catalog Number
16	4NO	53 63 73 83 / 54 64 74 84	5	**XTCEXFAC40** ②
16	3NO-1NC	53 61 73 83 / 54 62 74 84	5	**XTCEXFAC31** ②
16	2NO-2NC	53 61 71 83 / 54 62 72 84	5	**XTCEXFAC22** ②
16	1NO-3NC	53 61 71 81 / 54 62 72 82	5	**XTCEXFAC13**
16	4NC	51 61 71 81 / 52 62 72 82	5	**XTCEXFAC04**

XTCEXSCC11



NEMA Size 0, 1—Side-Mount—Two-Pole

Conventional Thermal Current, Open at 60°C $I_{th} = I_e$, AC-1 in Amps	Contact Configuration	Circuit Symbol	Pkg. Qty. ①	Screw Terminal Catalog Number
10	1NO-1NC	53 61 / 54 62	1	**XTCEXSCC11** ③

Notes

No auxiliary contacts can be fitted between two contactors.

① Orders must be placed in multiples of package quantity listed.

② To avoid duplicate terminal numbers in contact sequence, these auxiliary contacts should only be used with contactors having a built-in 1NO contact (XTCE…B10_, XTCE…C10_).

③ Can be mounted to the left side of contactor only. Cannot be used in combination with front (top) mount auxiliary contacts or mechanical interlocks.

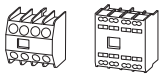
XTCEXF_



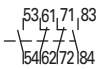
NEMA Sizes 2–4—Two-Pole

Conventional Thermal Current, Open at 60°C $I_{th} = I_e$, AC-1 in Amps	Contact Configuration	Circuit Symbol	Pkg. Qty. ①	Screw Terminal Catalog Number
16	2NO		5	**XTCEXFBG20**
16	1NO-1NC		5	**XTCEXFBG11**
16	2NC		5	**XTCEXFBG02**

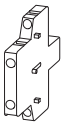
XTCEXF_



NEMA Sizes 2–4—Four-Pole

Conventional Thermal Current, Open at 60°C $I_{th} = I_e$, AC-1 in Amps	Contact Configuration	Circuit Symbol	Pkg. Qty. ①	Screw Terminal Catalog Number
16	4NO-0NC		5	**XTCEXFBG40**
16	3NO-1NC		5	**XTCEXFBG31**
16	2NO-2NC		5	**XTCEXFBG22**
16	2NO-2NC		5	**XTCEXFAG22**
16	1NO-3NC		5	**XTCEXFBG13**

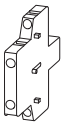
XTCEXS_



NEMA Sizes 2–4, Side Mount (Snap-On)—Two-Pole

Conventional Free Air Thermal Current, $I_{th} = I_e$, AC-1 in Amps	Contact Configuration	Circuit Symbol	Pkg. Qty. ①	Screw Terminal Catalog Number
10	1NO–1NC		1	**XTCEXSBN11**

XTCEXS_



NEMA Size 5, Side Mount (Screw Mount)—Two-Pole

Conventional Free Air Thermal Current, $I_{th} = I_e$, AC-1 in Amps	Contact Configuration	Circuit Symbol	Pkg. Qty. ①	Screw Terminal Catalog Number
10	1NO–1NC		1	**XTCEXSBR11** ②

Notes

No auxiliary contacts can be fitted between two contactors.

① Orders must be placed in multiples of package quantity listed.

② For replacement only. XTCEXSBR11 and XTCEXSBLR11 cannot be added onto side mount auxiliaries that come with the Size 5 contactors as standard. To add auxiliaries onto the included side auxiliaries on Size 5 contactors, use XTCEXSCR11.

Suppressors

The switching of contactor coils can generate voltage transients that may cause arching on switch contacts and/or damage electronics on the control line. Either an RC or varistor suppressor is recommended in these types of applications. All Space-Savings DC contactor coils have built-in suppression.

Varistor suppressors clamp the voltage transient above the maximum coil voltage and are recommended when the level of the transient is known to not exceed the coil voltage. RC suppressors slow and reduce the level of the voltage transient but do not clamp them at a specific level. The slowing of the transient can reduce electrical interference. These are recommended in applications where operating rates are high.

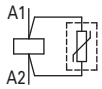
XTCEXVS_



Varistor Suppressor ①②

Voltage	For Use with…	Pkg. Qty. ③	Catalog Number
48–130	CN13BN0_ CN13CN0_	10	**XTCEXVSCA**
48–130	CN13GN0_	10	**XTCEXVSFA**

Contact Sequence



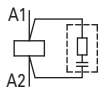
XTCEXRS_



RC Suppressor ①②

Voltage	For Use with…	Pkg. Qty. ③	Catalog Number
24–48	CN13GN0_	—	**XTCEXRSFW**
110–130		—	**XTCEXRSFA**

Contact Sequence



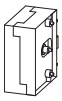
Additional Accessories

Mechanical Interlock ⑤

XTCEXML_



XTCEXMLM



For Use with…	Pkg. Qty. ③	Catalog Number
CN13BN0_, CN13CN0_	1	**XTCEXMLC**
CN13GN0_	1	**XTCEXMLD**
CN13KN0_, CN13MN0_	1	**XTCEXMLG** ⑥
CN13SN0_	1	**XTCEXMLM**

XTCEXRL_



Reversing Link Kits

For Use with…	Pkg. Qty. ③	Catalog Number
CN13BN0_, CN13CN0_	1	**XTCEXRLC**
CN13GN0_	1	**XTCEXRLD**
CN13KN0_, CN13MN0_	1	**XTCEXRLG**

Main current wiring for reversing combinations. Includes paralleling bridge and reversing bridge. Does not include mechanical interlock, see table on this page.

XTCEXTLA400



Terminal Lug Assembly

For Use with…	Pkg. Qty. ③	Catalog Number
CN13SN0_	1	**XTCEXTLA400**

For connection of: round conductor, flexible and stranded, flat strip conductor, with control circuit terminal. See **Page V5-T2-72** for terminal capacities.

XTCEXTS_



Terminal Shroud

For Use with…	Pkg. Qty. ③	Catalog Number
CN13SN0_	1	**XTCEXTS400**

Protection against direct contact with connection lugs when touched vertically from the front.

Notes

① Note dropout delay.
② For AC operated contactors, 50–60 Hz. Sizes 0–5 DC operated contactors and Size 5 AC operated contactors have a built-in suppressor circuit.
③ Orders must be placed in multiples of package quantity listed.
④ In addition to the built-in suppressor circuit for DC actuated contactors. Prevents negative breaking voltage when contactors are used in combination with a safety PLC.
⑤ For two contactors with AC or DC operated magnet system which are horizontally or vertically mounted. For Sizes 0–4, mechanical lifespan is 2.5 x 10^6 operations and the distance between contactors is 0 mm. For Size 5, mechanical lifespan is 5 x 10^6 operations and no auxiliary contact can be mounted between the mechanical interlock and the contactor—the distance between contactors is 15 mm.
⑥ XTCEXMLG and XTCEXMLN consist of an interlock element and mounting plate.

Renewal Parts

XTCERENC_





Replacement Coils

Voltage	Coil Suffix	Catalog Number
Size 0, 1		
110/50 120/60	**A**	**XTCERENCOILCA**
220/50 240/60	**B**	**XTCERENCOILCB**
24–27 Vdc	**TD**	**XTCERENCOILCTD**
Size 2		
110/50 120/60	**A**	**XTCERENCOILDA**
220/50 240/60	**B**	**XTCERENCOILDB**
24–27 Vdc	**TD**	**XTCERENCOILDTD**
Size 3, 4		
100–120V 50/60	**A**	**XTCERENCOILGA**
190–240V 50/60	**B**	**XTCERENCOILGB**
24–27 Vdc	**TD**	**XTCERENCOILGTD**
Size 5		
110–250 Vac/Vdc	**A**	**XTCERENCOILLA**
24–48 Vdc	**TD**	**XTCERENCOILLTD**

Replacement Contact Kit

For Use with…	Catalog Number
CN13GN0_	**XTCERENCONTACTD**
CN13SN0_	**XTCERENCONTACTL**

Replacement Arc Chamber

For Use with…	Catalog Number
CN13SN0_	**XTCERENARC250**

Technical Data and Specifications

Auxiliary Contacts

Description	CN13BN0_, CN13CN0_	XTCEXFAC_ XTCEXFATC_	XTCEXFCC_ XTCEXSCC_	XTCEXFAG_	XTCEXSBLN_ XTCEXSBN_ XTCEXSBNC_ XTCEXSCN_ XTCEXSCNC_
Interlocked opposing contacts with an auxiliary contact module (to IEC 60947-5 -1 Annex L)	—	Yes	Yes	Yes	Yes
Break contact (not late-break contact) suitable as a mirror contact (to IEC/EN 60947-4 -1 Annex F)	CN13BN0_, CN13CN0_	CN13BN0_, CN13CN0_	CN13BN0_, CN13CN0_	CN13GN0_	CN13GN0_, CN13SN0_
Rated impulse withstand voltage, (U_{imp}) Vac	6000	6000	6000	6000	6000
Overvoltage category/pollution degree	III/3	III/3	III/3	III/3	III/3
Rated insulation voltage, (U_i) Vac	690	690	690	690	690
Rated operational voltage, (U_e) Vac	500	500	500	500	500
Safe isolation to VDE 0106 Part 101 and Part 101(A) in Vac					
Between coil and auxiliary contacts	400	400	400	440	440
Between the auxiliary contacts	400	400	400	440	440
Rated operational current, I_e					
AC-15					
230V	6A	6A	6A	6A	6A
380/415V	4A	3A	4A	4A	4A
500V	1.5A	—	1.5A	1.5A	1.5A
DC-3 L/R ≤5 ms ①					
24V	10A	10A	10A	10A	10A
60V	6A	6A	6A	6A	6A
110V	3A	3A	3A	3A	3A
220V	1A	1A	1A	1A	1A
Conventional thermal current, I_{th}	16A	16A	16A ③	10A	10A
Control circuit reliability (at U_e = 24 Vdc, U_{min} = 17 V, I_{min} = 5.4 mA)	$<10^{-8}$, <1 failure at 100 million operations	$<10^{-8}$, <1 failure at 100 million operations	$<10^{-8}$, <1 failure at 100 million operations	$<10^{-8}$, <1 failure at 100 million operations	$<10^{-8}$, <1 failure at 100 million operations
Component lifespan, operations x 10^6 at U_e = 230V, AC-15, 3A	1.3	1.3	1.3	1.3	1.3
Short-circuit rating without welding ②					
Maximum fuse, gG/gL	10A	10A	10A	16A	16A

Notes

① Making and breaking conditions to DC-13, time L/R contact as stated.
② See fuses overlay for time/current characteristic (on request).
③ Conventional thermal current (I_{th}) of XTCEXSCC_ is 10A.

Parallel Link

Description	XTCEXPLKB	XTECXPLKC	XTCEXPLKD	XTCEXPLKG	XTCEXPLK185
Terminal capacity					
Solid (mm^2)	1–16	16	16	—	—
Flexible with ferrule (mm^2)	1 x (0.5–25) 2 x (0.5–16)	1 x (16–35)	1 x (16–120)	—	—
Stranded (mm^2)	1 x (0.5–25) 2 x (0.5–16)	1 x (16–50)	1 x (16–120)	1 x (35–300) 2 x (35–120)	—
Flat conductor—number of segments x width x thickness (mm)	6 x 9 x 0.8	—	—	2 x (11 x 21 x 1)	1 x (6 x 16 x 0.8) 2 x (20 x 32 x 0.5) 2 x (11 x 21 x 1)
Tightening torque (Nm)	4	4	14	—	—
Tools					
Pozidriv screwdriver	Size 2	Size 2	—	—	—
Hexagon socket head spanner—SW (mm)	—	—	5	6	—
Conventional thermal current					
Three-pole (I_{th}) A	50	100	180	400	—
Four-pole (I_{th}) A	60	—	—	—	—

Cable Terminal Block, Flat Cable Terminal

Description	XTCEXTLA400	XTCEXPLK185	XTCEXTFB650	XTCEXTFB820
Terminal capacity				
Stranded (mm^2)	1 x (120–300) 2 x (70–240)	—	—	—
Stranded (AWG)	1 x (250–600 kcmil) 2 x (2/0–500 kcmil)	—	—	—
Flat conductor—number of segments x width x thickness (mm)	—	1 x (6 x 16 x 0.8) 2 x (20 x 32 x 0.5) 2 x (11 x 21 x 1)	1 x (6 x 16 x 0.8) 2 x (20 x 32 x 0.5) 2 x (11 x 21 x 1)	1 x (6 x 16 x 0.8) 2 x (10 x 40 x 1) 2 x (20 x 40 x 0.5)

AC Ratings—AC-1 Operation

Description	CN13B	CN13C	CN13G	CN13K	CN13M	CN13S
Conventional free air thermal current, three-pole, 50–60 Hz						
Open						
at 40°C (I_{th})	40A	45A	80A	130A	190A	490
at 50°C (I_{th})	38A	43A	71A	125A	180A	438
at 55°C (I_{th})	37A	42A	68A	115A	170A	418
at 60°C (I_{th})	35A	40A	65A	110A	160A	400
Enclosed	32A	36A	58A	100A	144A	315
Conventional free air thermal current, single-pole (I_{th})						
Open	88A	100A	162A	275A	400A	—
Enclosed	80A	90A	145A	250A	360A	—

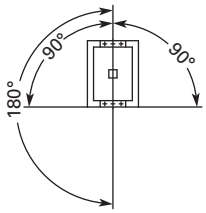
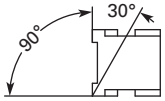
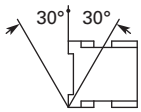
Space-Savings Contactors—NEMA Sizes 0–2

Description	Size 0 CN13BN010_	Size 1 CN13CN010_	Size 2 CN13GN000_
General			
Standards	IEC/EN 60947, VDE 0660, UL, CSA, CCC, RoHS	IEC/EN 60947, VDE 0660, UL, CSA, CCC, RoHS	IEC/EN 60947, VDE 0660, UL, CSA, CCC, RoHS
Weights in kg [lb]			
AC operated	0.42 [0.93]	0.42 [0.93]	0.9 [2.0]
DC operated	0.48 [1.06]	0.48 [1.06]	1.1 [2.4]
Mechanical life—operations	10,000,000	10,000,000	10,000,000
Climatic proofing	①	①	①
Insulation voltage (U_i) Vac	690	690	690
Impulse withstand voltage (U_{imp}) Vac	8000	8000	8000
Operating voltage (U_e) Vac	690	690	690
Safe isolation to VDE 0106 Part 101 and Part 101/A1			
Between coil and contacts (Vac)	440	440	440
Between contacts (Vac)	238	440	440
Making capacity (amps)	238	384	910
Breaking capacity (amps)			
220/230V	170	320	650
380/400V	170	320	650
500V	170	320	650
660/690V	120	180	370
Short-circuit protection rating maximum fuse (amps)			
Type 2 coordination ②			
400V; gG/gL 500V	25	63	125
690V; gG/gL 690V	25	35	80
Type 1 coordination ②			
400V; gG/gL 500V	63	125	250
690V; gG/gL 690V	50	63	100
Degree of protection	IP00	IP00	IP00
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
Terminal capacity main cable—screw terminals			
Solid (mm^2)	1 x (0.75–16) 2 x (0.75–10)	1 x (0.75–16) 2 x (0.75–10)	1 x (0.75–16) 2 x (0.75–10)
Flexible with ferrule (mm^2)	1 x (0.75–16) 2 x (0.75–10)	1 x (0.75–16) 2 x (0.75–10)	1 x (2.5–35) 2 x (2.5–25)
Stranded (mm^2)	1 x 16	1 x 16	1 x (16–50) 2 x (16–35)
Solid or stranded (AWG)	18–6	18–6	12–2
Flat conductor (number of segments x width x thickness) (mm)	—	—	2 x (6 x 9 x 0.8)

Notes

① Damp heat, constant, to IEC 60068-2-78; damp heat, cyclic, to IEC 60 068-2-30.
② IEC 60947 Standard.

Space-Savings Contactors—NEMA Sizes 0–2, continued

Description	Size 0 CN13BN010_	Size 1 CN13CN010_	Size 2 CN13GN000_
General, continued			
Main cable connection screw/bolt	M5	M5	M6
Tightening torque			
Nm	3	3	3.3
Lb-in	26.6	26.6	29.2
Terminal capacity control circuit cable—screw terminals			
Solid (mm^2)	1 x (0.75–4) 2 x (0.75–4)	1 x (0.75–4) 2 x (0.75–4)	1 x (0.75–4) 2 x (0.75–4)
Flexible with ferrule (mm^2)	1 x (0.75–2.5) 2 x (0.75–2.5)	1 x (0.75–2.5) 2 x (0.75–2.5)	1 x (0.75–2.5) 2 x (0.75–2.5)
Solid or stranded (AWG)	18–14	18–14	18–14
Control circuit cable connection screw/bolt	M3.5	M3.5	M3.5
Tightening torque			
Nm	1.2	1.2	1.2
Lb-in	10.6	10.6	10.6
Tools			
Main and control circuit cable—screw terminals	Size 2	Size 2	Size 2
Pozidriv screwdriver	0.8 x 5.5	0.8 x 5.5	0.8 x 5.5
Standard screwdriver	1 x 6	1 x 6	1 x 6
Terminal capacity control circuit cable—spring cage terminals			
Solid (mm^2)	1 x (0.75–2.5) 2 x (0.75–2.5)	1 x (0.75–2.5) 2 x (0.75–2.5)	1 x (0.75–2.5) 2 x (0.75–2.5)
Flexible (mm^2)	1 x (0.75–2.5) 2 x (0.75–2.5)	1 x (0.75–2.5) 2 x (0.75–2.5)	1 x (0.75–2.5) 2 x (0.75–2.5)
Flexible with ferrule (mm^2)	1 x (0.75–2.5) 2 x (0.75–2.5)	1 x (0.75–2.5) 2 x (0.75–2.5)	1 x (0.75–2.5) 2 x (0.75–2.5)
Solid or stranded (AWG)	18–14	18–14	18–14
Tools			
Main and control circuit cable—spring cage terminals			
Stripping length (mm)	10	10	10
Screwdriver blade width (mm)	3.5	3.5	3.5
Mounting position, AC and DC operated			
Ambient temperature			
Open	–25 to 60°C [–13 to 140°F]	–25 to 60°C [–13 to 140°F]	–25 to 60°C [–13 to 140°F]
Enclosed	–25 to 40°C [–13 to 104°F]	–25 to 40°C [–13 to 104°F]	–25 to 40°C [–13 to 104°F]
Ambient storage temperature	–40 to 80°C [–40 to 176°F]	–40 to 80°C [–40 to 176°F]	–40 to 80°C [–40 to 176°F]
Environmental			
Mechanical shock resistance (IEC/EN 60068-2-27)			
Main contact—NO Contact	10	10	1
Auxiliary contact—NO Contact	7	7	7
Auxiliary contact—NC Contact	5	5	5
Overvoltage category/pollution degree	III/3	III/3	III/3

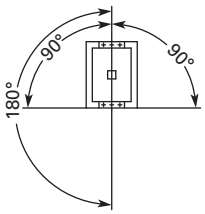
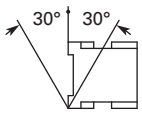
Space-Savings Contactors—NEMA Sizes 3, 4

Description	Size 3 CN13KN000_	Size 4 CN13MN000_
General		
Standards	IEC/EN 60947, VDE 0660, UL, CSA, CCC, RoHS	IEC/EN 60947, VDE 0660, UL, CSA, CCC, RoHS
Weights in kg [lb]		
AC operated	2 [4.41]	2 [4.41]
DC operated	2.1 [4.63]	2.1 [4.63]
Mechanical life—operations	10,000,000	10,000,000
Climatic proofing	①	①
Insulation voltage (U_i) Vac	690	690
Impulse withstand voltage (U_{imp}) Vac	8000	8000
Operational voltage (U_e) Vac	690	690
Safe isolation to VDE 0106 Part 101 and Part 101/A1		
Between coil and contacts (Vac)	690	690
Between contacts (Vac)	690	690
Making capacity (amps)	1610	2100
Breaking capacity (amps)		
220/230V	1150	1500
380/400V	1150	1500
500V	1150	1500
660/690V	1100	1200
1000V	—	—
Short-circuit protection rating maximum fuse		
Type 2 coordination ②		
400V; gG/gL 500V	250	25
690V; gG/gL 690V	25	250
Type 1 coordination ②		
400V; gG/gL 500V	250	250
690V; gG/gL 690V	250	250
Degree of protection	IP00	IP00
Protection against direct contact when actuated from front (IEC 536)	Finger and back-of-hand proof	Finger and back-of-hand proof
Terminal capacity main cable—screw terminals		
Solid (mm^2)	—	—
Flexible with ferrule (mm^2)	1 x (10–95) 2 x (10–70)	1 x (10–95) 2 x (10–70)
Stranded (mm^2)	1 x (10–95) 2 x (10–20)	1 x (10–95) 2 x (10–20)
Flat conductor (number of segments x width x thickness) (mm)	2 x (6 x 16 x 0.8)	2 x (6 x 16 x 0.8)
Solid or stranded (AWG)	8–3/0	8–3/0
Main cable connection screw/bolt	M10	M10
Tightening torque		
Nm	14	14
Lb-in	123.9	123.9

Notes

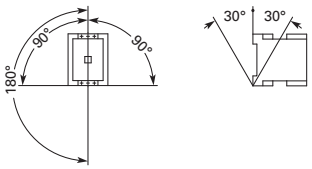
① Damp heat, constant, to IEC 60068-2-78; damp heat, cyclic, to IEC 60 068-2-30.
② IEC 60947 Standard.

Space-Savings Contactors—NEMA Sizes 3, 4, continued

Description	Size 3 CN13KN000_	Size 4 CN13MN000_
General, continued		
Terminal capacity control circuit cable—screw terminals		
Solid (mm^2)	1 x (0.75–4) 1 x (0.75–4)	1 x (0.75–4) 1 x (0.75–4)
Flexible with ferrule (mm^2)	1 x (0.75–2.5) 2 x (0.75–2.5)	1 x (0.75–2.5) 2 x (0.75–2.5)
Solid or stranded (AWG)	18–14	18–14
Control circuit cable connection screw/bolt	M3.5	M3.5
Tightening torque		
Nm	1.2	1.2
Lb-in	10.6	10.6
Tools		
Main circuit cable—screw terminals		
Hexagon socket-head spanner (mm)	5	5
Control circuit cable—screw terminals	Size 2	Size 2
Pozidriv screwdriver	0.8 x 5.5	0.8 x 5.5
Standard screwdriver	1 x 6	1 x 6
Terminal capacity control circuit cable—spring cage terminals		
Solid (mm^2)	1 x (0.75–2.5) 2 x (0.75–2.5)	1 x (0.75–2.5) 2 x (0.75–2.5)
Flexible (mm^2)	1 x (0.75–2.5) 2 x (0.75–2.5)	1 x (0.75–2.5) 2 x (0.75–2.5)
Flexible with ferrule (mm^2)	1 x (0.75–2.5) 2 x (0.75–2.5)	1 x (0.75–2.5) 2 x (0.75–2.5)
Solid or stranded (AWG)	18–14	18–14
Tools		
Control circuit cable—spring cage terminals		
Stripping length (mm)	10	10
Screwdriver blade width (mm)	3.5	3.5
Mounting position, AC and DC operated		
Ambient temperature		
Open	–25 to 60°C [–13 to 140°F]	–25 to 60°C [–13 to 140°F]
Enclosed	–25 to 40°C [–13 to 104°F]	–25 to 40°C [–13 to 104°F]
Ambient storage temperature	–40 to 80°C [–40 to 176°F]	–40 to 80°C [–40 to 176°F]
Environmental		
Mechanical shock resistance (IEC/EN 60068-2-27)		
Half-sinusoidal shock 10 ms		
Main contact—NO contact	10g	10g
Auxiliary contact—NO contact	7g	7g
Auxiliary contact—NC contact	5g	5g
Overvoltage category/pollution degree	III/3	III/3

Space-Savings Contactors—NEMA Size 5

Description	Size 5 CN13SN022_
General	
Standards	IEC/EN 60947, VDE 0660, UL, CSA
Weights in kg [lb]	6.5 [14.3]
Mechanical life—operations	10,000,000
Mechanical operating frequency (ops/hr)	
AC operated	3000
DC operated	3000
Climatic proofing	①
Insulation voltage (U_i) Vac	1000
Impulse withstand voltage (U_{imp}) Vac	8000
Operating voltage (U_e) Vac	1000
Safe isolation to VDE 0106 Part 101 and Part 101/A1	
Between coil and contacts (Vac)	500
Between contacts (Vac)	500
Making capacity (amps)	3000
Breaking capacity (amps)	
220/230V	2500
380/400V	2500
500V	2500
660/690V	2500
1000V	760
Short-circuit protection rating maximum fuse	
Type 2 coordination ②	
400V; gG/gL 500V	315
690V; gG/gL 690V	315
1000V; gG/gL 1000V	160
Type 1 coordination ②	
400V; gG/gL 500V	400
690V; gG/gL 690V	400
1000V; gG/gL 1000V	200
Degree of protection	IP00
Protection against direct contact when actuated from front (IEC 536)	Finger and back-of-hand proof with terminal shroud or terminal block
Main cable cross-section	
Flexible with cable lug (mm^2)	50–240
Stranded with cable lug (mm^2)	70–240
Solid or stranded (AWG)	1/0–250 kcmil
Flat conductor (mm)	③
Bus bar—width in mm	25
Main cable connection screw/bolt	M10
Tightening torque	
Nm	24
Lb-in	213

Description	Size 5 CN13SN022_
General, continued	
Control circuit cable cross-sections	
Solid (mm^2)	1 x (0.75–2.5) 2 x (0.75–2.5)
Flexible with ferrule (mm^2)	1 x (0.75–2.5) 2 x (0.75–2.5)
Solid or stranded (AWG)	2 x (18–12)
Control circuit cable connection screw/bolt	M3.5
Tightening torque	
Nm	1.2
Lb-in	10.6
Tools	
Main cable wrench	16 mm
Control circuit cable pozidriv screwdriver	Size 2
Mounting position, AC and DC operated	
Ambient temperature	–25 to 60°C [–13 to 140°F]
Ambient storage temperature	–40 to 80°C [–40 to 176°F]
Environmental	
Mechanical shock Resistance (IEC/EN 60068-2-27)	
Half-sinusoidal shock 10 ms	
Main contact—NO contact	10g
Auxiliary contact—NO contact	10g
Auxiliary contact—NC contact	8g
Overvoltage category/pollution degree	III/3
Switching capacity, kVAR ④	
Individual compensation	
230V	—
400/420/440V	—
525V	—
690V	—
Group compensation, with choke	
230V	100
400/420/440V	190
525V	260
690V	340
Group compensation, without choke	
230V	—
400/420/440V	—
525V	—
690V	—

Notes

① Damp heat, constant, to IEC 60068-2-78; damp heat, cyclic, to IEC 60 068-2-30.
② IEC 60947 Standard.
③ Screw tightening with flat cable terminal or cable terminal blocks. See terminal capacity for cable terminal blocks.
④ When using contactors for group compensation, a minimum inductance of approx. 6 uh per capacitor must be available to limit the high inrush current peaks. This corresponds to an air-cored coil with five windings and a coil diameter of approximately 140 mm. The conductor cross-section must be selected according to the rated current per phase.

XTOE/*XT* Electronic Overload Relay



Contents

Description	*Page*
XTOE/***XT*** Electronic Overload Relay	
Standards and Certifications	**V5-T2-79**
Catalog Number Selection	**V5-T2-80**
Product Selection	**V5-T2-81**
Accessories	**V5-T2-83**
Technical Data and Specifications	**V5-T2-85**
Dimensions	**V5-T2-93**

An Eaton Green Solution

XTOE/*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 standard NEMA and DP versions are offered with the C440 designation while the Space-Savings NEMA and IEC versions have the XTOE 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 XTOE was developed, delivering new solutions to meet today's demands.

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

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

- XTOE 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	XTOE/*XT* Protection
Motor Protection				
Thermal overload	Overload is a condition in which current draw exceeds 115% of the full load amperage rating for an inductive motor.	• An increase in the load or torque that is being driven by the motor. • A low voltage supply to the motor causes the current to go high to maintain the power needed. • A poor power factor causing above normal current draw.	• Increase in current draw leads to heat and insulation breakdown, which can cause system failure. • Increase in current can increase power consumption and waste valuable energy.	• Thermal trip behavior is defined by UL, CSA and IEC standards. • Trip class is settable from 10A, 10, 20, 30
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, i.e., 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, etc.	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 is lost.

Catalog Number Selection

XT Electronic Overload Relay—NEMA Space-Savings

XT OE 1P6 C CS S

Designation
XT = NEMA Space-Savings control

Type
OE = Electronic overload relay

Mounting
Blank = Direct to contactor **P** = Pass-through **S** = Separate mount (Frames C and G only)

Trip Type
CS = Selectable Class 10A, 10, 20, 30 **GS** = Ground fault with selectable Class 10, 20

Overload Range	Contactor Frame
1P6 = 0.33–1.65A **005** = 1–5A **020** = 4–20A	**C** = Space-Savings Size 0
1P6 = 0.33–1.65A **005** = 1–5A **020** = 4–20A **045** = 9–45A	**C** = Space-Savings Size 1
045 = 9–45A	**D** = Space-Savings Size 2
100 = 20–100A	**G** = Space-Savings Size 3
175 = 35–175A	**G** = Space-Savings Size 4

Product Selection

XT Electronic Overload Relays

XTOE for Direct Mount to NEMA Size 1



XT Electronic Overload Relays for Direct Mount to NEMA Space-Savings Contactors

NEMA Space-Savings Size	For Use with Contactor	Overload Range (Amps)	Contact Sequence	Frame Size	Auxiliary Contact Configuration	Catalog Number
0	CN13BN010_	0.35–1.65	97 95 2 4 6 98 96	45 mm	NO-NC	**XTOE1P6CCS**
		1–5				**XTOE005CCS**
		4–20				**XTOE020CCS**
1	CN13CN010_	0.35–1.65	97 95 2 4 6 98 96	45 mm	NO-NC	**XTOE1P6CCS**
		1–5				**XTOE005CCS**
		4–20				**XTOE020CCS**
		9–45				**XTOE045CCS**
2	CN13GN000_	9–45	97 95 2 4 6 98 96	45 mm	NO-NC	**XTOE045DCS**
		20–100		55 mm	NO-NC	**XTOE100DCS**
3	CN13KN000_	20–100	97 95 2 4 6 98 96	55 mm	NO-NC	**XTOE100GCS**
4	CN13MN000_	35–175	97 95 2 4 6 98 96	110 mm	NO-NC	**XTOE175GCS**

XTOE for Direct Mount to NEMA Size 4



XT Electronic Overload Relays with Ground Fault for Direct Mount to NEMA Space-Savings Contactors

NEMA Space-Savings Size	For Use with Contactor	Overload Range (Amps)	Contact Sequence	Frame Size	Auxiliary Contact Configuration	Catalog Number
0	CN13BN010_	0.33–1.65	97 95 2 4 6 98 96	45 mm	NO-NC	**XTOE1P6CGS**
		1–5				**XTOE005CGS**
		4–20				**XTOE020CGS**
1	CN13CN010_	0.33–1.65	97 95 2 4 6 98 96	45 mm	NO-NC	**XTOE1P6CGS**
		1–5				**XTOE005CGS**
		4–20				**XTOE020CGS**
		9–45				**XTOE045CGS**
2	CN13GN000_	9–45	97 95 2 4 6 98 96	45 mm	NO-NC	**XTOE045DGS**
		20–100		55 mm	NO-NC	**XTOE100DGS**
3	CN13KN000_	20–100	97 95 2 4 6 98 96	55 mm	NO-NC	**XTOE100GGS**
4	CN13MN000_	35–175	97 95 2 4 6 98 96	110 mm	NO-NC	**XTOE175GGS**

1–5A OL with CTs



XT Electronic Overload Relays for use with Size 5 NEMA Space-Savings Contactors

Use CTs and 1-5A ***XT*** overload relay. CT kit does not include overload relay (order separately).

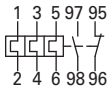
Space-Savings Contactor Size	For Use with Contactor	CT Range (Amps)	Description	CT Kit Catalog Number	Terminal Size	Overload Relay Catalog Number
1	CN13SN022_	60-300	300: 5 panel-mount CT kit with integrated lugs	**ZEB-XCT300**	750 kcmil (2) 250 kcmil 3/0 Cu/Al	**XTOE005CCSS**

45 mm *XT* for Separate Mount



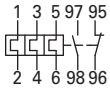
XT Electronic Overload Relays for Separate Mount

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

Overload Range (Amps)	Frame Size	Contact Sequence	Type	Overload Relay Catalog Number	Overload Relay with Ground Fault Catalog Number
Overload Relay					
0.33–1.65	45 mm		ZEB32-1,65/KK	**XTOE1P6CCSS**	**XTOE1P6CGSS**
1–5			ZEB32-5/KK	**XTOE005CCSS**	**XTOE005CGSS**
4–20			ZEB32-20/KK	**XTOE020CCSS**	**XTOE020CGSS**
9–45			ZEB32-45/KK	**XTOE045CCSS**	**XTOE045CGSS**
20–100	55 mm		ZEB150-100/KK	**XTOE100GCSS**	**XTOE100GGSS**
35–175	110 mm		ZEB150-175/KK	**XTOE175GCSS**	**XTOE175GGSS**

XT Electronic Overload Relay for Pass-Through Design

Pass-through design does not include any lugs to land wires.
Terminate motor leads directly on contactor.

Overload Range (Amps)	Frame Size	Contact Sequence	Type	Overload Relay Catalog Number	Overload Relay with Ground Fault Catalog Number
35–175	110 mm		ZEB150-175/PT	**XTOE175GCSP**	**XTOE175GGSP**

Accessories

CT Kits

Accessories

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

Safety Cover



Reset Bar



Remote Reset



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.

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.



Basic Communication—Modbus



Advanced Communication—Communication Module

Note

① Customer can wire remote mounted button to reset module (i.e., 22 mm pushbutton, catalog number M22-D-B-GB14-K10).

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.

Expansion Module



Description	Catalog Number
Expansion Module	
Expansion module (Remote Reset/Modbus RTU, RS-485 Communication)	**C440-XCOM**

Ethernet with I/O Module



Communication Modules	
DeviceNet communication module kit—120 V I/O (consists of C440-XCOM + C441KS)	**C440-DN-120**
DeviceNet communication module kit—24 Vdc I/O (consists of C440-XCOM + C441LS)	**C440-DN-24**
PROFIBUS communication module kit—120 V I/O (consists of C440-XCOM + C441SS)	**C440-DP-120**
PROFIBUS communication module kit—24 V I/O (consists of C440-XCOM + C441QS)	**C440-DP-24**
Modbus communication module kit—120 V I/O (consists of C440-XCOM + C441NS)	**C440-MOD-120**
Modbus communication module kit—24 Vdc I/O (consists of C440-XCOM + C441PS)	**C440-MOD-24**
Modbus TCP/Ethernet IP communication module kit—120 V I/O (consists of C440-XCOM + C441U)	**C440-ET-120**
Modbus TCP/Ethernet IP communication module kit—24 V I/O (consists of C440-XCOM + C441V)	**C440-ET-24**

Technical Data and Specifications

Electronic Overload Relays up to 1500A

Description	Specification 45 mm	55 mm	110 mm
Electrical Ratings	**Range**	**Range**	**Range**
Operating voltage (three-phase) and frequency	690 Vac (60/50 Hz)	690 Vac (60/50 Hz)	690 Vac (60/50 Hz)
FLA Range			
	0.33–1.65A 1–5A 4–20A 9–45A	20–100A	28–140A (NEMA) 35–175A (IEC)
Use with Contactors			
Space-Savings NEMA Size	0, 1, 2	2, 3	4
Trip Class			
	10A, 10, 20, 30 Selectable	10A, 10, 20, 30 Selectable	10A, 10, 20, 30 Selectable
Motor Protection			
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
Feature	**Range**	**Range**	**Range**
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
Indicators			
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
Options			
Remote reset	Yes	Yes	Yes
Reset bar	Yes	Yes	Yes
Communication expansion module	Yes	Yes	Yes
Communication adapter	Yes	Yes	Yes
Capacity			
Load terminals			
Terminal capacity	12–10 AWG (4–6 mm^2) 8–6 AWG (6–16 mm^2)	6–1 AWG (16–50 mm^2)	8–4/0 AWG (10–95 mm^2)
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)
Voltages			
Insulation voltage U_i (three-phase)	690 Vac	690 Vac	690 Vac
Insulation voltage U_i (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

Electronic Overload Relays up to 1500A, continued

Description	Specification 45 mm	55 mm	110 mm
Auxiliary and Control Circuit Ratings			
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
Short-Circuit Rating without Welding			
Maximum fuse	6A gG/gL	6A gG/gL	6A gG/gL
Environmental Ratings			
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% noncondensing	5% to 95% noncondensing	5% to 95% noncondensing
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
Electrical/EMC			
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)	Three-phase power inputs: ±4 kV line-to-line (DM) ±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)	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)	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

Description	Modbus	DeviceNet	PROFIBUS	Ethernet
Electrical/EMC				
Radiated emissions IEC 60947-4-1—Table 15, EN 55011 (CISPIR 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 (CISPIR 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 ①: ±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 ① IEC 60947-4-1 (Table 13) IEC 61000-4-3	10 V/m	10 V/m	10 V/m	10 V/m
Environmental Ratings				
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 600068-2-27)	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
DeviceNet				
DeviceNet connections	—	Group 2, polling, bit strobe, explicit, no UCMM	—	Group 2, polling, bit strobe, explicit, no UCMM
DeviceNet baud rate	—	125K, 250K, 500K	—	125K, 250K, 500K
Ethernet				
Ethernet connections	—	—	—	Integrated two-port switch with dual RJ45 Ethernet connections
Ethernet type	—	—	—	Ethernet 10/100 Mbs, AutoMDX, Auto Negotiation
PROFIBUS				
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

① Relates to C441M only.

Communication Modules, continued

Description	Modbus	DeviceNet	PROFIBUS	Ethernet
C441_ 24 Vdc Input				
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
Operating Voltage Range—DC Input Modules				
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
C441_ 120 Vac Input				
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
Operating Voltage Range—AC Input Modules				
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
Output Modules				
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 ①	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

① Relates to C441M only.

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 XTOE electronic overload relays combined with ***XT*** Series IEC, Freedom Series NEMA and ***XT*** 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.

XTOE Standalone Overload Relays (XTOE)

		Standard-Fault Short Circuit Data			High-Fault Short Circuit Data					
					Fuses (RK5, J, CC)			Thermal-Magnetic Circuit Breakers		
Overload FLA Range	Maximum Operating Voltage	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 (NZMH3)

NEMA Space-Savings Starters with XTOE Electronic Overload Relays

		High-Fault Short Circuit Data					
		Fuses (RK5, J, CC)			Thermal-Magnetic Circuit Breakers		
Contactor Frame Size	Overload FLA Range	480V	600V	Maximum Fuse Size	480V	600V	Maximum Breaker Size
B	1–5A	100	100	30	—	—	—
	4–20A	100	100	30	—	—	—
C	1–5A	100	100	60	—	—	—
	4–20A	100	100	60	—	—	—
	9–45A	100	100	60	—	—	—
D	9–45A	100	100	200	65	35	175
	20–100A	100	100	200	65	35	175
F	20–100A	100	100	200	65	65	350
G	20–100A	100	100	200	65	65	350
	35–175A	100	100	400	65	30	250 (480 Vac) 350 (600 Vac)
H	35–175A	100	100	400	65	30	400

Coil Data—Frames B, C, G

Description	CN13B_ NEMA Size 0	CN13C_ NEMA Size 1	CN13G_ NEMA Size 2
Voltage Tolerance			
Pickup (x U_c)			
AC operated	0.8–1.1	0.8–1.1	0.8–1.1
DC operated	0.7–1.2 ①	0.7–1.2 ①	0.7–1.2 ①
Dropout (x U_c)			
AC operated	0.3–0.6	0.3–0.6	0.3–0.6
DC operated	0.15–0.6	0.15–0.6	0.15–0.6
Power Consumption of the Coil at Cold State and 1.0 x U_c			
AC operated Single-voltage coil 50 Hz			
Pickup VA	52	52	149
Pickup W	40	40	80
Sealing VA	7.1	7.1	16
Sealing W	2.1	2.1	4.3
Single-voltage coil 60 Hz			
Pickup VA	67	67	178
Pickup W	50	50	117
Sealing VA	8.7	8.7	19
Sealing W	2.6	2.6	5.3
50/60 Hz			
Pickup VA	62 58	62 58	168 154
Pickup W	48 43	48 43	120 43
Sealing VA	9.1 6.5	9.1 6.5	22 14
Sealing W	2.5 2	2.5 2	5.3 4.3
DC operated			
Pickup W	12 at 24V	12 at 24V	24 at 24V
Sealing W	0.5 at 24V	0.5 at 24V	0.5 at 24V
Duty factor (%DF)	100	100	100
Switching Time at 100% U_c (Approximate Values)			
Main contact			
AC operated			
Closing delay (ms)	<22	<22	<18
Opening delay (ms)	<14	<14	<13
DC operated			
Closing delay (ms)	<47	<47	<54
Opening delay (ms)	<30	<30	<24
Arcing time (ms)	10	10	10
Electromagnetic Compatibility (EMC)			
Emitted interference	To EN-60947-1	To EN-60947-1	To EN-60947-1
Noise immunity	To EN-60947-1	To EN-60947-1	To EN-60947-1

Note

① Coil Suffix TD: U_{min} 24 Vdc/U_{max} 27 Vdc.
Coil Suffix WD: U_{min} 48 Vdc/U_{max} 60 Vdc.
Coil Suffix AD: U_{min} 110 Vdc/U_{max} 130 Vdc.
Coil Suffix BD: U_{min} 200 Vdc/U_{max} 240 Vdc.
Example:
U_c = 0.7 x U_{min}—1.2 x U_{max}
U_c = 0.7 x 24V—1.2 x 27 Vdc

Coil Data—Frames K–M

Description	CN13K_ NEMA Size 3	CN13M_ NEMA Size 4
Voltage Tolerance		
Pickup (x U_c)		
AC operated	0.8–1.1	0.8–1.1
DC operated	0.7–1.2 ①	0.7–1.2 ①
Dropout (x U_c)		
AC operated	0.25–0.6	0.25–0.6
DC operated	0.15–0.6	0.15–0.6
Power Consumption of the Coil at Cold State and 1.0 x U_c		
AC operated Single-voltage coil 50 Hz		
Pickup VA	180	180
Pickup W	130	130
Sealing VA	3.1	3.1
Sealing W	2.1	2.1
Single-voltage coil 60 Hz		
Pickup VA	170	170
Pickup W	130	130
Sealing VA	3.1	3.1
Sealing W	2.1	2.1
50/60 Hz		
Pickup VA	170	170
Pickup W	130	130
Sealing VA	3.1	3.1
Sealing W	2.1	2.1
DC operated		
Pickup W	149 at 24V	149 at 24V
Sealing W	2.1 at 24V	2.1 at 24V
Duty factor (%DF)	100	100
Switching Time at 100% U_c (Approximate Values)		
Main contact		
AC operated		
Closing delay (ms)	<33	<33
Opening delay (ms)	<41	<41
DC operated		
Closing delay (ms)	<35	<35
Opening delay (ms)	<30	<30
Arcing time (ms)	15	15
Permissible residual current with actuation of A1–A2 by the electronics (with 0 signal) (mA)	≤1	≤1
Electromagnetic Compatibility (EMC)		
Emitted interference	To EN60947-1	To EN60947-1
Noise immunity	To EN60947-1	To EN60947-1

Coil Data—Frame S

Description	CN13S_ NEMA Size 5
Voltage Tolerance	
Pickup (x U_c)	0.7 x U_{cmin}–1.15 x U_{cmax}
Dropout (x U_c)	0.2 x U_{cmin}–0.6 x U_{cmax}
Power Consumption of the Coil at Cold State and 1.0 x U_c	
XTCE185L–XTCEC20R	
Pickup VA	380 ②
Pickup W	250
Sealing VA	4.3
Sealing W	3.3
Switching Time at 100% Main Contact U_c (Approximate Values)	
XTCE185L–XTCEC20R	
Closing delay (ms)	<80
Opening delay (ms)	<110
Reaction in Threshold and Sealing State Transition Range	
Voltage interruptions	
(0–0.2 x U_{cmin}) ≤10 ms	Time is bridged successfully
(0–0.2 x U_{cmin}) >10 ms	Dropout of the contactor
Voltage dips	
(0.2–0.6 x U_{cmin}) ≤12 ms	Time is bridged successfully
(0.2–0.6 x U_{cmin}) >12 ms	Dropout of the contactor
(0.6–0.7 x U_{cmin})	Contactor remains switched on
Excess voltage	
(1.15–1.3 x U_{cmax})	Contactor remains switched on
(>1.3 x U_{cmax}) ≤3s	Contactor remains switched on
(>1.3 x U_{cmax}) >3s	Dropout of the contactor
Pickup phase	
(0–0.7 x U_{cmin})	Contactor does not switch on
(0.7 x U_{cmin} –1.15 x U_{cmax})	Contactor switches on with certainty
(>1.15 x U_{cmax})	Contactor switches on with certainty

Notes

① At 24V: 0.7–1.3 without additional auxiliary contact modules and ambient temperature +40°C [104°F].

② Control transformer with U_k ≤6%.

Current Heat Loss (Three-Pole) in Watts

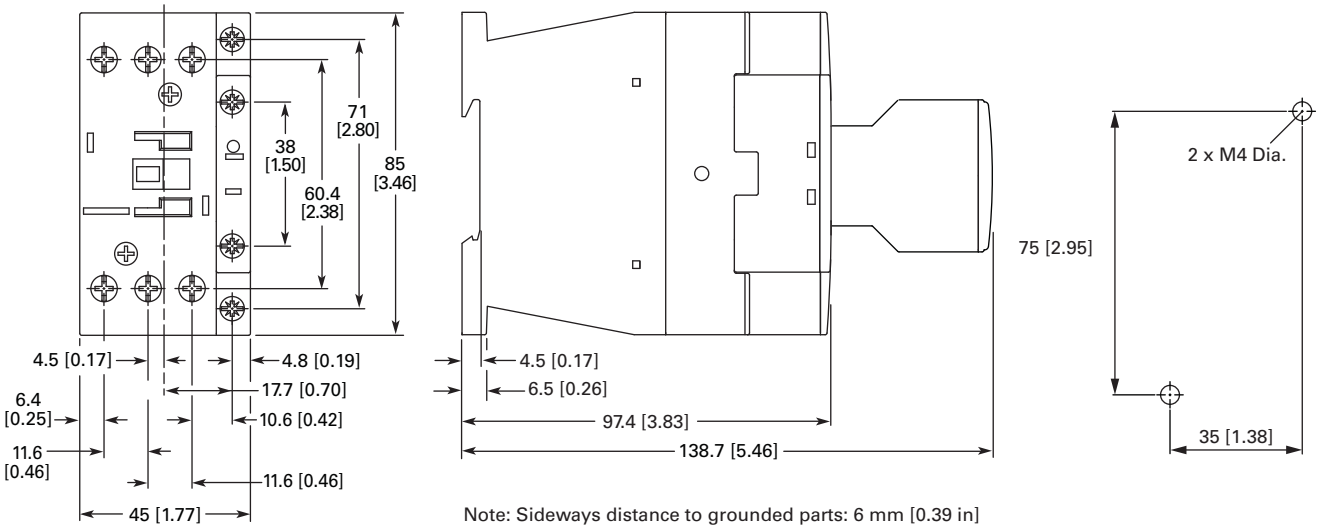
Description	CN13BN0_	CN13CN0_	CN13GN0_	CN13KN0_	CN13MN0_
Current heat loss (three-pole) in watts					
at I_{th}	7.3	12.1	28.8	20.3	30.7
at I_e to AC-3/400V	1.9	6.1	19	15.9	27.0
Impedance per pole, megohms	2	2	1.5	0.4	0.4

Dimensions

Approximate Dimensions in mm [in]

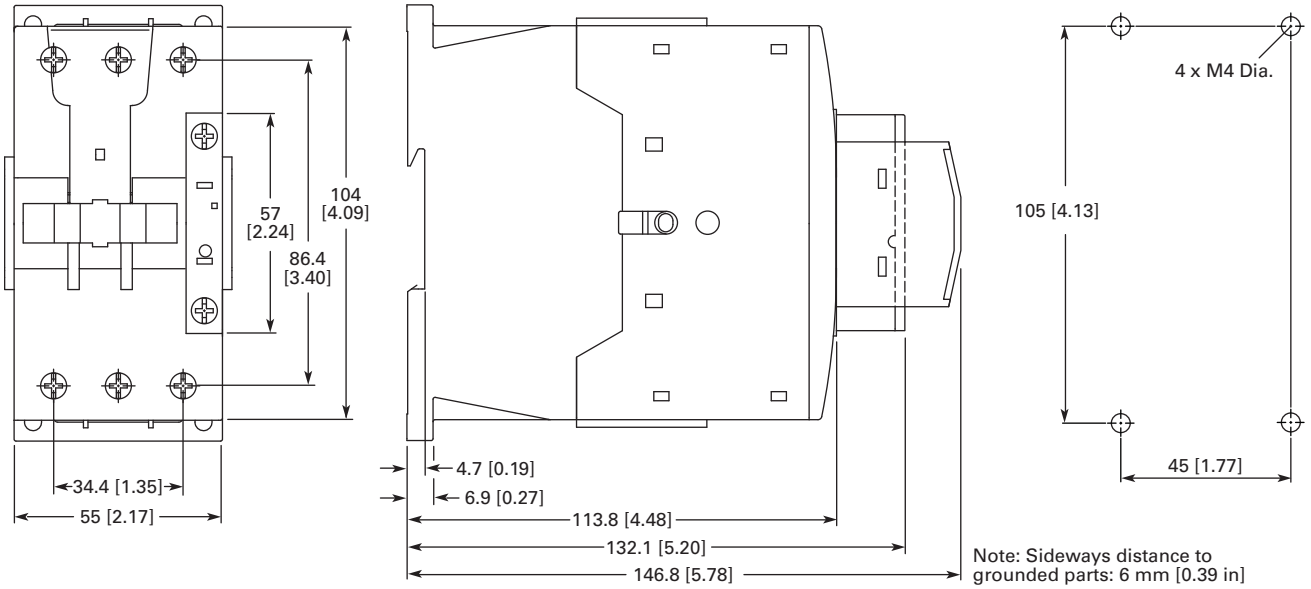
Contactors

Type CN13 NEMA Size 0 and 1



Note: Sideways distance to grounded parts: 6 mm [0.39 in]

Type CN13 NEMA Size 2

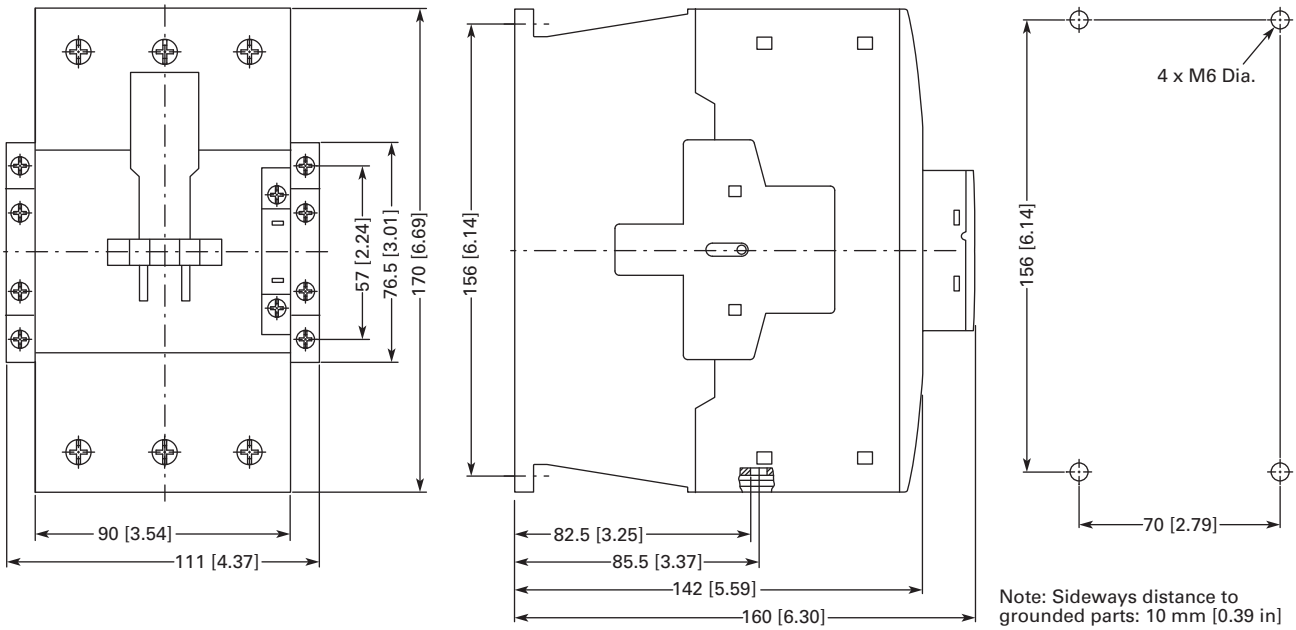


Note: Sideways distance to grounded parts: 6 mm [0.39 in]

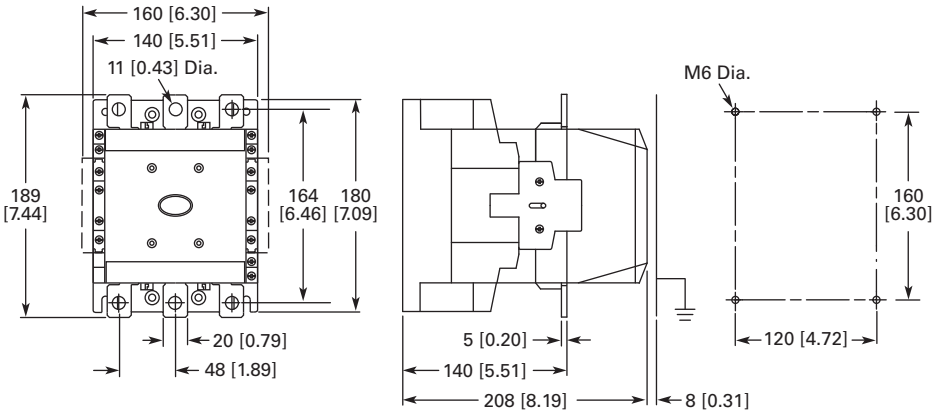
Approximate Dimensions in mm [in]

2

Type CN13 NEMA Size 3 and 4



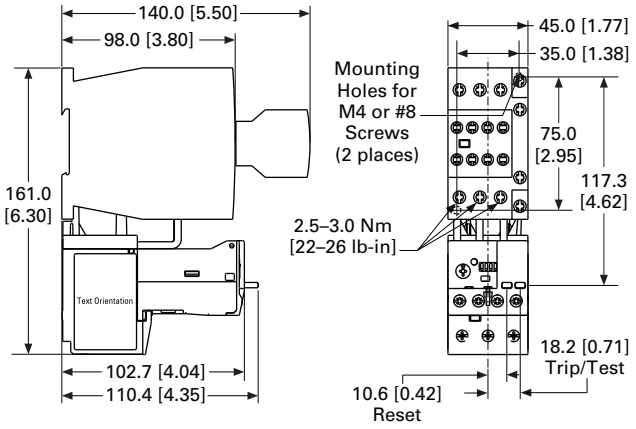
Type CN13 NEMA Size 5



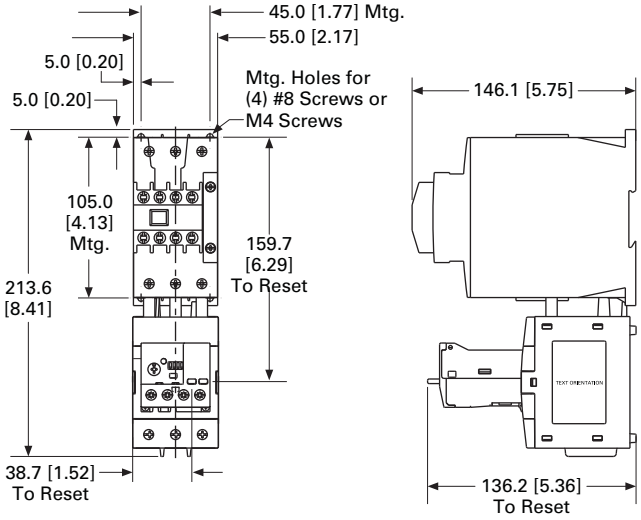
Approximate Dimensions in mm [in]

XTAE Starters with XTOE Overload Relay

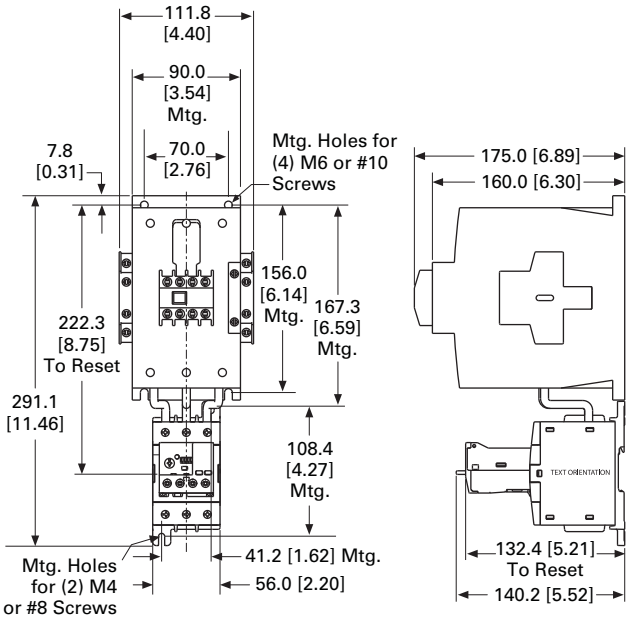
Type AN13 NEMA Size 0 and 1



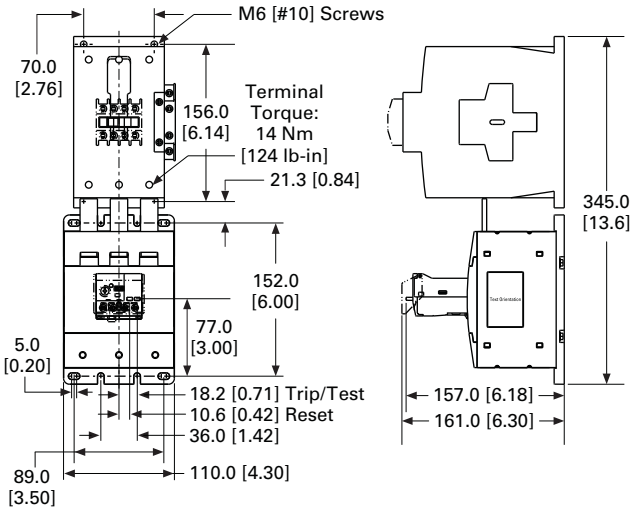
Type AN13 NEMA Size 2



Type AN13 NEMA Size 3



Type AN13 NEMA Size 4

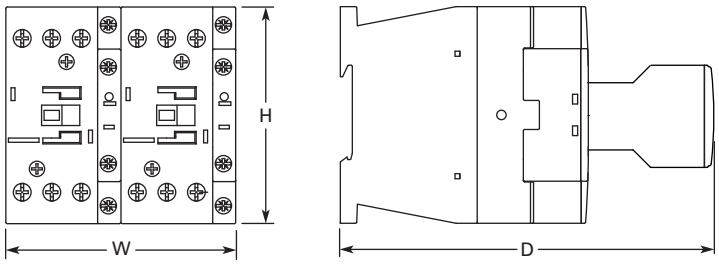


Approximate Dimensions in mm [in]

2

Reversing Contactors

Type CN53 Size 0, 1 and 2



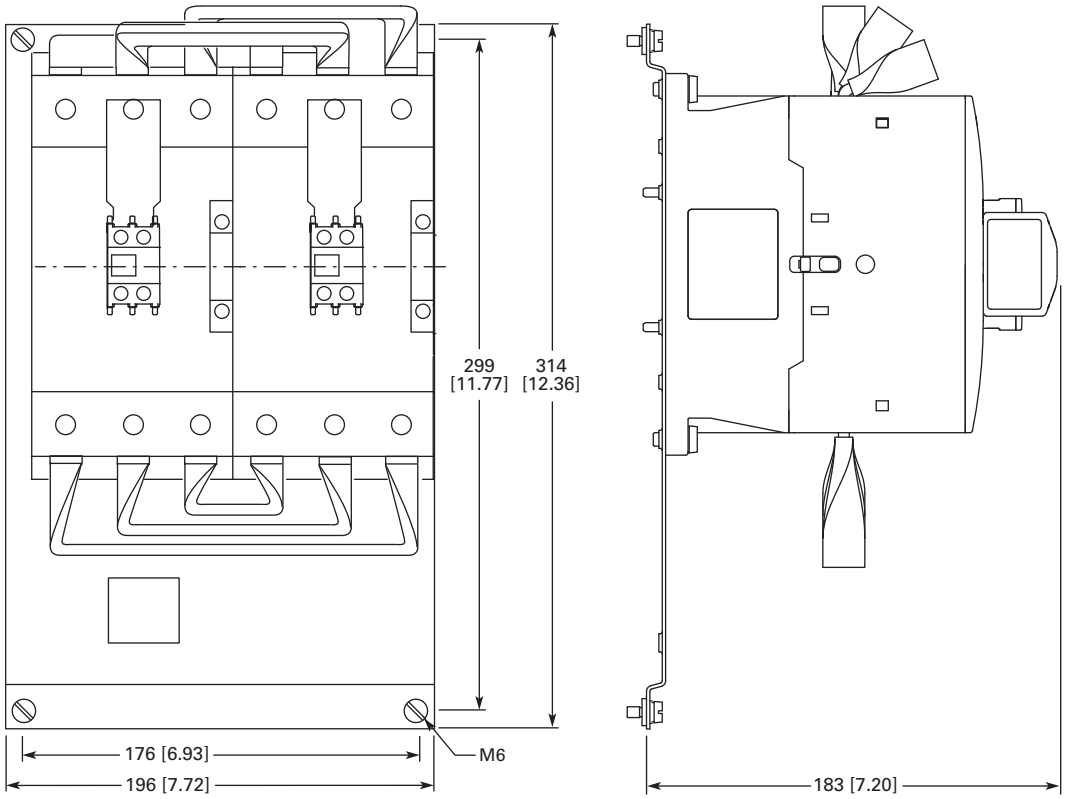
Size 0 and 1

W	H	D
90 [3.54]	85 [3.34]	138 [5.43]

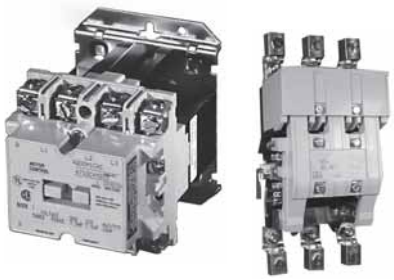
Size 2

W	H	D
110 [4.33]	115 [4.53]	146.8 [5.78]

Type CN53 Size 3 and 4



Contactors—Non-Reversing and Reversing



Contents

Description	*Page*
A200 Series	
Contactors—Non-Reversing and Reversing	
Starters—Non-Reversing and Reversing	**V5-T2-103**
Relays—Thermal and Fast Trip	**V5-T2-124**
Thermal Type B, Class 20, Manual Reset	**V5-T2-126**
Thermal Type A, Class 20, Auto/Manual Reset	**V5-T2-129**
Type FT Fast Trip, Class 10	**V5-T2-132**
Heater Selection	**V5-T2-135**
Relays—Current Sensing Protective	**V5-T2-137**

Contactors—Non-Reversing and Reversing

Product Description

Class A201 Contactors, Sizes 00–4; Three-Phase, 1-1/2–100 hp

A201 Magnetic Contactors from Eaton's Electrical Sector are 600V rated devices available in NEMA Sizes 00–4, 10A through 150A (open rating). Product features include:

- Straight-through wiring to line and load terminals located up front for ease of installation
- Moving and stationary contacts are front accessible, simplifying inspection and maintenance
- Reliable U-shaped magnet for reduced power consumption
- Coil design reduces inventory/maintenance expenses. For a given voltage, one size coil fits all contactors Sizes 00–2, and a second coil fits three-pole Model J Sizes 3 and 4. Model K coils are different design

A201 contactors have normally open holding circuit interlocks which are supplied as standard.

Panel layout and drilling are simplified through the use of common backplates, one for Sizes 00–2 and one for Sizes 3–4. In addition, panel space is reduced dramatically through the use of unique corner cavities for mounting the wide variety of modifications shown on **Page V5-T2-116.**

For reversing applications, two contactors are supplied on a common base with electrical and mechanical interlocks which prevent both contactors from being closed at the same time.

Class A201 Contactors, Sizes 5–9; Three-Phase, Over 100 hp

These AC magnetic contactors utilize clapper design and feature straight-through wiring.

Contacts are silver alloy for longer life. The contacts close with optimum wiping action which serves to keep the contacting surfaces clean. De-ion® arc quenchers draw the arc away from the contacts at opening, which reduces burning and pitting and increases contact life.

All of the contactors are complete with one unwired, normally-open (NO) auxiliary contact mounted and have accommodations for additional auxiliary contacts. No control circuit wiring or terminal markings are included.

Size 5, 300A, 600V, Open
Size 6, 600A, 600V, Open

Class A201 Size 5 and 6 contactors are front clapper design, AC operated with the armature pivoting on dual needle bearings which assure accurate contact alignment.

The contactor base is molded of a high impact, non-tracking, non-hygroscopic glass polyester material permitting front mounting and wiring on a steel panel.

Floating magnet assures quiet operation.

Size 5 and 6 contactors must be mounted with the line terminals directly above the load terminals.

Multi-voltage coil ratings allow selection of the voltage which closely matches the actual system voltage to assure optimum contactor operation.

Each contactor accommodates two Type J11 auxiliary contacts, providing up to four auxiliary circuits, normally-open or normally-closed (NO and NC).

A201 Size 5 and 6 contactors and starters are UL recognized when supplied without terminals. When supplied with terminals, the devices are UL listed.

Two special configurations of the Class A201 Size 5 and 6 contactors are available:

- **Latched Design**—This is a mechanically held, electrically released device. It is applied where the contactor must remain closed during extreme voltage fluctuations or power failure. It is also suitable for applications requiring quiet operation since the operating coil is de-energized when the contactor is closed. The latch assembly consists of a mechanical latch mechanism, electrically operated AC trip solenoid and a clearing contact
- **DC Operated**—This device is DC operated. It is used where low dropout voltage or exceptionally quiet operation is desired. The DC assembly consists of a DC operating coil, integrally mounted rectifier and shorting contact

Size 7, 900A, 600V, Open
Size 8, 1350A, 600V, Open
Size 9, 2500A, 600V, Open

Class A201 Size 7 and 8 contactors are DC operated side clapper design with the shaft mounted on dual needle bearings to ensure positive contact alignment and long contact life.

A steel panel base permits mounting on angle or channel without additional support, for versatile low cost installation.

Each stationary contact assembly is mounted on an individual molded insulator. Each pair of contacts is surrounded by a De-ion grid type arc quencher for rapid and confined arc interruption and long contact life.

The shunt for each pole is made of flexible, braided copper cable for freedom of movement and long life.

The rugged DC operating coils are designed to operate at high temperature and insulated to meet Class H service.

An integrally mounted avalanche type silicon rectifier supplies DC coil voltage from the AC control circuit.

Sizes 7 and 8 accommodate three Type L-63 auxiliary contacts which are easily converted from normally-open to normally-closed, providing auxiliary circuit flexibility. Size 9 uses L-64 auxiliary contacts with a total of four circuits.

A201 Size 7, 8 and 9 contactors and starters are UL recognized when supplied without terminals. When supplied with terminals, the devices are UL listed.

Application Description

Magnetic contactors are used to switch transformers and capacitors and to control electrical power circuits such as heating, lighting and motors that require no overload protection, or where overload protection is separately provided. They can be operated remotely by manual or automatic pilot devices.

Standards and Certifications

A201 contactors are UL listed components and also have CSA certification.

Listed

Instructional Leaflets

16960B Sizes 00–1 Magnetic Contactor, Non-reversing or Reversing

16961E Size 2 Magnetic Contactor, Non-reversing or Reversing

13238G Size 3 Magnetic Contactor, Non-reversing or Reversing

17001C Size 4 Magnetic Contactor, Non-reversing or Reversing

17049D Size 5 Magnetic Contactor, Non-reversing or Reversing

17053B Size 6 Magnetic Contactor, Non-reversing or Reversing

17048 Sizes 7–8 Magnetic Contactor, Non-reversing or Reversing

16978 Size 9 Magnetic Contactor, Non-reversing or Reversing

Product Selection

Non-Reversing, Sizes 00–9

When Ordering Specify

Order by catalog number from the table below, plus suffix for coil voltages, verifying usage of appropriate sizes.

A201 Size 1 Contactor



Front Connected Contactors

Size	Amps	Max. UL Horsepower Single-Phase 115V	230V	Three-Phase 208V	240V	480V	600V	Two Poles Open Catalog Number	Three Poles Open Catalog Number	Four Poles Open Catalog Number	Five Poles Open Catalog Number
Sizes 00–6											
00	9	1/3	1	1-1/2	1-1/2	2	2	**A201KAB_**	**A201KAC_**	**A201KAD_**	**A201KAE_**
0	18	1	2	3	3	5	5	**A201K0B_**	**A201K0C_**	**A201K0D_**	**A201K0E_**
1	27	2	3	7-1/2	7-1/2	10	10	**A201K1B_**	**A201K1C_**	**A201K1D_**	**A201K1E_**
2	45	3	7-1/2	10	15	25	25	**A201K2B_**	**A201K2C_**	**A201K2D_**	**A201K2E_**
3	90	—	—	25	30	50	50	**A201K3B_**	**A201K3C_**	**A201K3D_**	**A201K3E_**
4	135	—	—	40	50	100	100	**A201K4B_**	**A201K4C_**	**A201K4D_**	**A201K4E_**
5	270	—	—	75	100	200	200	**A201K5B_**	**A201K5C_**	—	—
6	540	—	—	150	200	400	400	**A201K6B_**	**A201K6C_**	—	—
Sizes 7–9											
7 ①	810	—	—	200	300	600	600	**A201K7B_**	**A201K7C_**	—	—
8 ①	1215	—	—	400	450	900	900	**A201K8B_**	**A201K8C_**	—	—
9 ①	2250	—	—	—	800	1600	—	**A201K9B_**	**A201K9C_Z1** ②③	—	—

Rear Connected Contactors

120V Rectified Coil/Open Only

Size	Catalog Number
7	**A201K7CJZ1Z4**
8	**A201K8CJZ1Z4**
9	**A201K9CJZ1Z4**

Coil Suffix

Coil Volts and Hz	Code Suffix
Sizes 00–6	
120/60 or 110/50	**A**
200–208/60	**B**
240/60	**W**
Sizes 7, 8 and 9 ②	
480/60	**X**
600/60	**E**
110–120/50 or 60	**J**
220–240/50 or 60	**K**
440–480/50 or 60	**U**
600/60	**E**

Notes

① Sizes 7–9 use rectifier with DC coil.
② For Size 9, only available coil voltage is 120V.
③ Supplied without terminal lugs.

Reversing, Sizes 00–9

2

When Ordering Specify

Order by catalog number from the table below, plus suffix for coil voltages, verifying usage of appropriate sizes.

Size 1 Horizontal Reversing Contactor



Class A211—Horizontally Mounted and Class A251—Vertically Mounted Reversing Contactors

Size	Amps	Max. UL Horsepower Single-Phase 115V	230V	Three-Phase 208V	240V	480V	600V	Horizontal Design Catalog Number	Vertical Design Catalog Number
Sizes 0–6									
0	18	1	2	3	3	5	5	**A211K0C_**	**A251K0C_**
1	27	2	3	7-1/2	7-1/2	10	10	**A211K1C_**	**A251K1C_**
2	45	3	7-1/2	10	15	25	25	**A211K2C_**	**A251K2C_**
3	90	—	—	25	30	50	50	**A211K3C_**	**A251K3C_**
4	135	—	—	40	50	100	100	**A211K4C_**	**A251K4C_**
5	270	—	—	75	100	200	200	**A211K5C_**	**A251K5C_**
6	540	—	—	150	200	400	400	**A211K6C_**	**A251K6C_**
Sizes 7–9									
7 ①	810	—	—	200	300	600	600	—	**A251K7C_**
8 ①	1215	—	—	400	450	900	900	—	**A251K8C_**
9 ①	2250	—	—	—	800	1600	—	—	**A251K9C_** ②

Coil Suffix

Coil Volts and Hz	Code Suffix
Sizes 00–6	
120/60 or 110/50	**A**
200–208/60	**B**
240/60	**W**
480/60	**X**
600/60	**E**
Sizes 7, 8 and 9 ②	
110–120/50 or 60	**J**
220 –240/50 or 60	**K**
440–480/50 or 60	**U**
600/60	**E**

Notes

① Sizes 7–9 use rectifier with DC coil.

② For Size 9, only available coil voltage is 120V.

Dimensions

Approximate Dimensions in Inches (mm)

Not to be used for construction purposes unless approved.

Non-Reversing Open Contactors

Figure A—Sizes 00–4 A210

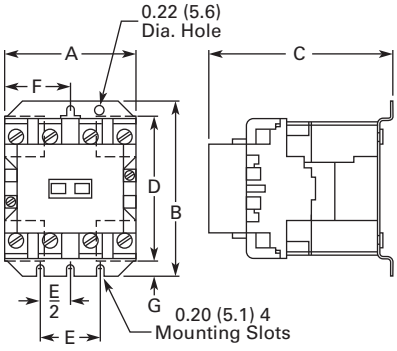


Figure B—Size 5

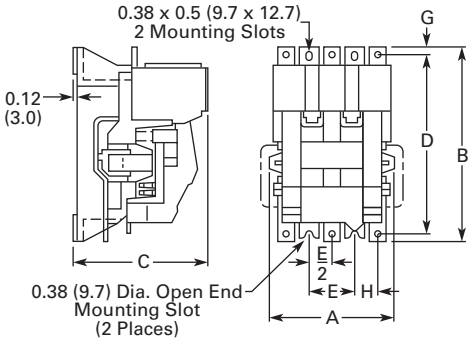


Figure C—Size 6

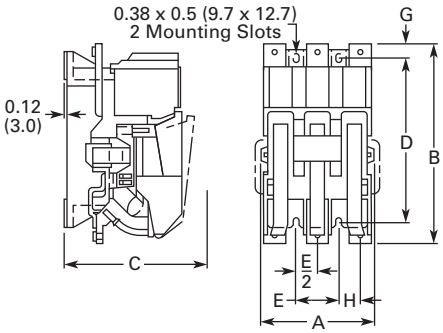
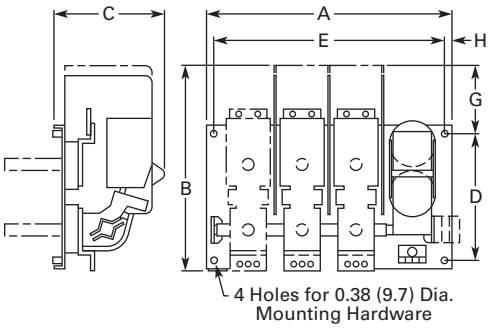


Figure D—Sizes 7–9



Dimensions and Shipping Weights

NEMA Size	No. of Poles	Fig.	Mounting Screws No.	Size	A	B	C	D	E	F	G	H	Weight, Lbs (kg)
00, 0, 1	2–4	A	3	#10	3.31 (84.1)	4.38 (111.3)	4.61 (117.1)	3.95 (100.3)	1.50 (38.1)	1.66 (42.2)	0.45 (11.5)	—	2.6 (1.2)
	5	A	3	#10	4.19 (106.4)	4.38 (111.3)	4.61 (117.1)	3.95 (100.3)	1.50 (38.1)	2.09 (53.1)	0.45 (11.5)	—	3.2 (1.5)
2	2, 3	A	3	#10	3.31 (84.1)	4.38 (111.3)	4.94 (125.5)	3.95 (100.3)	1.50 (38.1)	1.66 (42.2)	0.45 (11.5)	—	3.3 (1.5)
	4, 5	A	3	#10	5.06 (128.5)	4.38 (111.3)	4.94 (125.5)	3.95 (100.3)	1.50 (38.1)	2.53 (64.3)	0.45 (11.5)	—	4.5 (2.0)
3, 4	2, 3	A	3	1/4 in.	4.63 (117.6)	6.63 (168.4)	6.75 (171.5)	6.00 (152.4)	1.88 (47.8)	2.31 (58.7)	0.38 (9.7)	—	9.3 (4.2)
	4, 5	A	3	1/4 in.	7.25 (184.2)	6.63 (168.4)	6.75 (171.5)	6.00 (152.4)	1.88 (47.8)	3.63 (92.2)	0.38 (9.7)	—	13.0 (5.9)
5	2, 3	B	4	3/8 in.	7.22 (183.4)	12.00 (304.8)	7.75 (196.9)	11.00 (279.4)	2.75 (69.9)	—	0.59 (15.0)	2.22 (56.4)	25.0 (11.4)
6	2, 3	C	4	3/8 in.	7.22 (183.4)	13.50 (342.9)	9.50 (251.3)	11.00 (279.4)	2.75 (69.9)	—	0.59 (15.0)	2.22 (56.4)	42.0 (19.1)
7	3	D	4	3/8 in.	23.50 (596.9)	18.63 (473.2)	11.00 (279.4)	12.00 (304.8)	22.00 (558.8)	—	5.63 (143.0)	0.75 (19.1)	215.0 (97.6)
8	3	D	4	3/8 in.	23.50 (596.9)	19.25 (489.0)	11.00 (279.4)	12.00 (304.8)	22.00 (558.8)	—	5.63 (143.0)	0.75 (19.1)	265.0 (120.3)
9	3	D	4	1/2 in.	33.00 (838.2)	29.75 (755.7)	12.94 (328.7)	8.00 (203.2)	30.75 (781.1)	—	14.50 (368.3)	1.63 (41.4)	315.0 (143.0)

Approximate Dimensions in Inches (mm)

Not to be used for construction purposes unless approved.

2

Reversing Open Contactors

Figure A—Sizes 00–4 Horizontal

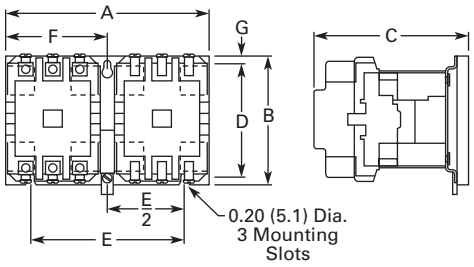


Figure C—Sizes 5, 6 Horizontal

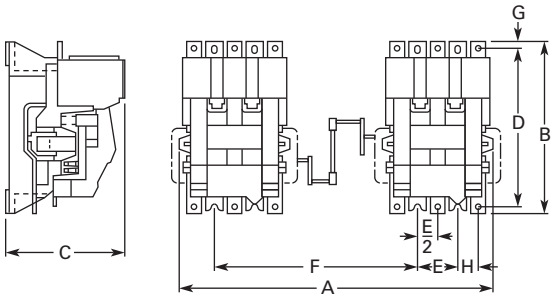


Figure B—Sizes 00–4 Vertical

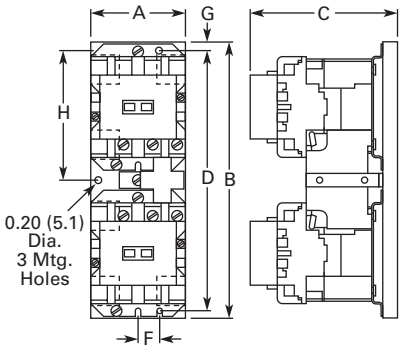


Figure D—Sizes 5, 6 Vertical

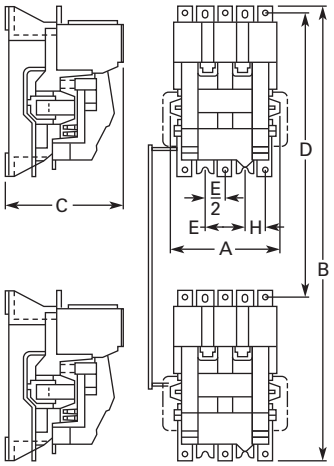
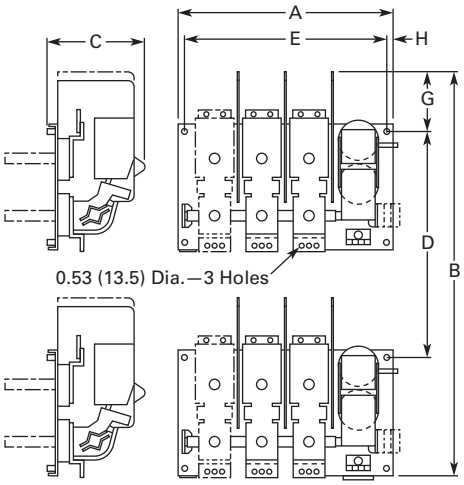


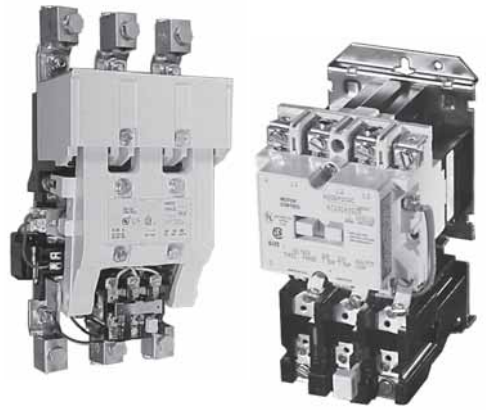
Figure E—Sizes 7–9 Vertical



Dimensions and Shipping Weights

NEMA Size	No. of Poles	Fig.	Mounting Screws No.	Mounting Screws Size	A	B	C	D	E	F	G	H	Weight, Lbs (kg)
00, 0, 1	3 x 3 H.	A	3	#10	7.13 (181.1)	4.45 (113.0)	5.05 (128.3)	3.95 (100.3)	5.31 (134.9)	3.56 (90.4)	0.25 (6.4)	—	7.8 (3.5)
	3 x 3 V.	B	3	#10	3.33 (84.6)	9.61 (244.1)	5.05 (128.3)	9.08 (230.6)	2.16 (54.9)	0.75 (19.1)	0.25 (6.4)	4.52 (114.8)	8.9 (4.0)
2	3 x 3 H.	A	3	#10	7.13 (181.1)	4.45 (113.0)	5.38 (136.7)	3.95 (100.3)	5.31 (134.9)	3.56 (90.4)	0.25 (6.4)	—	9.1 (4.1)
	3 x 3 V.	B	3	#10	3.33 (84.6)	9.61 (244.1)	5.38 (136.7)	9.08 (230.6)	2.16 (54.9)	0.75 (19.1)	0.25 (6.4)	4.52 (114.8)	10.0 (4.5)
3, 4	3 x 3 H.	A	3	1/4 in.	9.75 (247.7)	6.88 (174.8)	7.25 (184.2)	6.00 (152.4)	7.00 (177.8)	4.88 (124.0)	0.44 (11.2)	—	24.0 (10.9)
	3 x 3 V.	B	3	1/4 in.	4.63 (117.6)	16.56 (420.6)	7.25 (184.2)	15.69 (398.5)	2.75 (69.9)	0.94 (23.9)	0.44 (11.2)	7.78 (197.6)	25.0 (11.4)
5	3 x 3 H.	C	8	3/8 in.	17.22 (437.4)	12.00 (304.8)	7.75 (196.9)	11.00 (279.4)	2.75 (69.9)	10.00 (254.0	0.59 (15.0)	1.38 (35.1)	55.0 (25.0)
	3 x 3 V.	D	8	3/8 in.	8.25 (209.6)	30.00 (762.0)	7.75 (196.9)	18.00 (457.8)	2.75 (69.9)	—	—	1.38 (35.1)	55.0 (25.0)
6	3 x 3 H.	C	8	3/8 in.	17.22 (437.4)	13.50 (342.9)	8.75 (222.3)	11.00 (279.4)	2.75 (69.9)	10.00 (254.0)	0.59 (15.0)	1.38 (35.1)	90.0 (40.9)
	3 x 3 V.	D	8	3/8 in.	8.25 (209.6)	41.50 (1054.1)	8.75 (222.3)	28.00 (711.2)	2.75 (69.9)	—	—	1.38 (35.1)	90.0 (40.9)
7	3 x 3 V.	E	8	3/8 in.	23.50 (596.9)	38.63 (981.2)	11.00 (279.4)	20.00 (508.0)	22.00 (558.8)	—	5.63 (143.0)	0.75 (19.1)	450.0 (204.3)
8	3 x 3 V.	E	8	3/8 in.	23.50 (596.9)	39.25 (997.0)	11.00 (279.4)	20.00 (508.0)	22.00 (558.8)	—	5.63 (143.0)	0.75 (19.1)	550.0 (249.7)
9	3 x 3 V.	E	8	1/2 in.	33.00 (838.2)	62.75 (1593.9)	12.94 (328.7)	33.00 (838.2)	30.75 (781.1)	—	14.50 (368.3)	1.63 (41.4)	650.0 (295.1)

Starters—Non-Reversing and Reversing



Contents

Description	*Page*
Contactors—Non-Reversing and Reversing	**V5-T2-97**
Starters—Non-Reversing and Reversing	
Application Description	**V5-T2-104**
Features and Benefits	**V5-T2-104**
Standards and Certifications	**V5-T2-104**
Instructional Leaflets	**V5-T2-104**
Product Selection	**V5-T2-105**
Accessories	**V5-T2-108**
Renewal Parts	**V5-T2-111**
Modifications	**V5-T2-116**
Technical Data and Specifications	**V5-T2-117**
Mechanical Characteristics	**V5-T2-119**
Dimensions	**V5-T2-121**
Relays—Thermal and Fast Trip	**V5-T2-124**
Thermal Type B, Class 20, Manual Reset	**V5-T2-126**
Thermal Type A, Class 20, Auto/Manual Reset	**V5-T2-129**
Type FT Fast Trip, Class 10	**V5-T2-132**
Heater Selection	**V5-T2-135**
Relays—Current Sensing Protective	**V5-T2-137**

Starters—Non-Reversing and Reversing

Product Description

NEMA Sizes 00–4; Three-Phase, 1-1/2–100 hp

These Starters from Eaton's Electrical Sector use Class A201 contactors as described on **Page V5-T2-97**. Contactor features are enhanced through the ability to provide positive motor protection in the form of several types of overload relays. See **Pages V5-T2-124** to **V5-T2-136**.

Type B Overload Relay, Manual Reset Only

Supplied as standard on Class A200 and A900 starters (two-speed). The bi-metallic overload relay offers ambient compensation and trip-to-test feature (relay contact status check) as standard. In addition, an isolated normally-open contact is available in kit form for customer mounting. Type B overload relays are manual reset only.

Type A Overload Relay, Manual or Automatic Reset

This is an optional overload relay, offering the capability of field conversion to automatic reset. It is available as an ambient compensated or non-compensated type.

Non-Reversing Starters

Non-reversing starters are supplied as open devices. All starters are supplied with a normally-open holding circuit interlock.

Reversing Starters

For reversing applications (Class A210), a starter and a contactor electrically and mechanically interlocked are supplied on a common baseplate. Reversing starters are used to start, stop and reverse AC squirrel cage motors and for primary control of reversing wound-rotor motors.

For plugging or inching, when operations exceed five times per minute, decreased horsepower ratings in accordance with NEMA Standard ICS 2-321 are recommended.

Two-Speed Starters, A900s

For across-the-line starting of two-speed constant hp, constant torque and variable torque squirrel cage motors, two-speed starters (Class A900) are available. These starters consist of two starters, one for each motor speed, mechanically and electrically interlocked and wired for manual speed selection by means of pushbuttons. Auxiliary relays may be added to provide automatic acceleration or deceleration.

Starters for two-speed, two independent winding motors consist of two-, three- or four-pole starters electrically and mechanically interlocked.

Starters for two-speed, single reconnectable winding motors consist of one three-pole and one five-pole starter mechanically and electrically interlocked.

NEMA Sizes 5–9; Three-Phase 75 to 1600 hp

Non-reversing (Class A200), and reversing (Classes A210, A250) full voltage starters are used for across-the-line starting of squirrel cage induction motors. They are used with motors rated above 50 hp at 230V, and above 100 hp at 460 through 600V.

Sizes 5 and 6 starters use Class A201 contactors as described on **Page V5-T2-97**. In addition to standard motor starters, special application devices are available: Sizes 5 and 6 starters with integrally rectified AC to DC coils for applications where low voltage problems are prevalent are available.

Front Removable Parts—All operating parts can be removed quickly and easily from the front. Straight-through wiring and conveniently located connection points for external wires and cables minimize installation time.

Type B Block Type Thermal Overload Relay—Dependable overload protection is assured by these snap-action, manual reset relays. Automatic reset Type A relays are available as an option.

Types of Starters

Class A200, Sizes 5 and 6—Non-reversing starters contain an AC magnetically-operated Size 5 or Size 6 line contactor and block Type B three-pole overload relay, along with three current transformers. A control relay whose contacts handle the coil current of the starter is provided with Size 6 starters.

Class A200, Sizes 7, 8 and 9—Non-reversing starters contain a DC operated line contactor, DC power supply, block Type B three-pole overload relay with three current transformers and a control relay.

Class A960/A970/A980 Multi-Speed Starters: Refer to **Page V5-T2-107**.

Application Description

Magnetic starters are used for full-voltage, across-the-line starting and stopping of squirrel cage motors. They can be operated locally or remotely by manual or automatic pilot devices.

Features and Benefits

Sizes 00–4

- **Straight-Through Wiring, Up-Front, Out-Front Terminals** for ease in installation
- **Unique Accessory Mounting Cavities** reduce panel space requirements
- **Snap-in Accessories** for application flexibility
- **Vertical and Horizontal Interlocking** capability increases application flexibility
- **Ambient Compensated Overload Relays** available as standard, offering superior motor protection in variable motor/controller environments
- **Isolated Normally Open Relay Contact** available in kit mounting form on Type B Overload Relay

Sizes 5–9

- **Rectified AC/DC Coils** available to reduce premature drop-out or "kiss" problems due to inherent low voltage conditions
- **Clapper Design** armature assembly pivots on needle bearings resulting in quick, smooth opening and closing of the magnet
- **Stainless Steel Kick-Out Spring** assures quick, positive drop-out time
- **Front Removable Parts** all current carrying parts front removable for easy inspection and maintenance

Standards and Certifications

Class A200 starters are UL listed and recognized and also carry CSA certification.

Listed

Instructional Leaflets

16958	Sizes 00–1, 3-Pole Motor Controller
16956	Sizes 00–1, 2-Pole, Single-Phase Motor Controller
16959	Size 2, 3-Pole Motor Controller
16957	Size 2, 2-Pole, Single-Phase Motor Controller
15465C	Sizes 3 and 4J Motor Controller
17000C	Size 4, Model K Motor Controller
17054C	Size 5 Motor Controller
17055C	Size 6 Motor Controller

Product Selection

Non-Reversing, Sizes 00–9

When Ordering Specify

Order by catalog number from the tables to the right, plus suffix for coil voltages, verifying usage of appropriate sizes.

Heaters

Enter heaters as separate item by listing catalog number from the tables on **Pages V5-T2-135** and **V5-T2-136**, as required per starter.

Size 3 Starter



Non-Reversing Starters

Size	Amperes	Max. UL Horsepower Single-Phase 115V	230V	Three-Phase 208V	240V	480V	600V	Open Catalog Number ①
Two-Poles ② —Sizes 00–2								
00	9	1/3	—	1-1/2	1-1/2	2	2	**A200MABR**
0	18	1	—	3	3	5	5	**A200M0BR**
1	27	2	—	7-1/2	7-1/2	10	10	**A200M1BR**
1-1/2	36	3	—	—	—	—	—	**A200MDBR**
2	45	7-12	—	10	15	25	25	**A200M2BR**
Three Poles—Sizes 00–6								
00	9	1/3	—	1-1/2	1-1/2	2	2	**A200MAC_**
0	18	1	—	3	3	5	5	**A200M0C_**
1	27	2	—	7-1/2	7-1/2	10	10	**A200M1C_**
2	45	7-12	—	10	15	25	25	**A200M2C_**
3	90	—	—	25	30	50	50	**A200M3C_**
4	135	—	—	40	50	100	100	**A200M4C_**
5	270	—	—	75	100	200	200	**A200M5C_**
6	540	—	—	150	200	400	400	**A200M6C_**
Three Poles—Sizes 7–9								
7 ③	810	—	—	200	300	600	600	**A200M7C_**
8 ③	1215	—	—	400	450	900	900	**A200M8C_**
9 ③	2250	—	—	—	800	1600	—	**A200M9C_** ④

Coil Suffix

Coil Volts and Hz	Code Suffix
Sizes 00–6	
120/60 or 110/50	**AC**
200–208/60	**B**
240/60	**W**
480/60	**X**
600/60	**E**
Sizes 7, 8 and 9 ④	
110–120/50 or 60	**J**
220–240/50 or 60	**W**
440–480/50 or 60	**X**
600/60	**E**

Notes

① For ambient compensated overload relay with auto-reset, add Suffix **D.**
② Single-phase with one single-pole overload relay.
③ Sizes 7–9 use rectifier with DC coil.
④ For Size 9, only available coil voltage is 120V.

Reversing, Sizes 00–9

When Ordering Specify

Order by catalog number from table below, plus suffix for coil voltages, verifying usage of appropriate sizes.

Heaters

Enter heaters as separate item by listing catalog number from the tables on **Pages V5-T2-135** and **V5-T2-136**, as required per starter.

Size 1 Horizontal Reversing Starter



Reversing Starters

Size	Amps	Max. UL Horsepower Single-Phase 115V	230V	Three-Phase 208V	240V	480V	600V	Horizontal Design Catalog Number ①	Vertical Design Catalog Number ①
Sizes 00–6									
00	9	1/3	1	1-1/2	1-1/2	2	2	**A210MAC_**	**A250MAC_**
0	18	1	2	3	3	5	5	**A210M0C_**	**A250M0C_**
1	27	2	3	7-1/2	7-1/2	10	10	**A210M1C_**	**A250M1C_**
2	45	3	7-1/2	10	15	25	25	**A210M2C_**	**A250M2C_**
3	90	—	—	25	30	50	50	**A210M3C_**	**A250M3C_**
4	135	—	—	40	50	100	100	**A210M4C_**	**A250M4C_**
5	270	—	—	75	100	200	200	**A210M5C_**	**A250M5C_**
6	540	—	—	150	200	400	400	**A210M6C_**	**A250M6C_**
Sizes 7–9									
7 ②	810	—	—	200	300	600	600	—	**A250M7C_**
8 ②	1215	—	—	400	450	900	900	—	**A250M8C_**
9 ②	2250	—	—	—	800	1600	—	—	**A250M9C_** ③

Coil Suffix

Coil Volts and Hz	Code Suffix
Sizes 00–6	
120/60 or 110/50	**AC**
200–208/60	**B**
240/60	**W**
480/60	**X**
600/60	**E**
Sizes 7, 8 and 9 ③	
110–120/50 or 60	**J**
220–240/50 or 60	**W**
440–480/50 or 60	**X**
600/60	**E**

Notes

① For ambient compensated overload relay with auto-reset, add Suffix **D.**
② Sizes 7–9 use rectifier with DC coil.
③ For Size 9, only available coil voltage is 120V.

For Separate Two-Winding Motors

Heaters

Enter heaters as separate item by listing catalog number from the tables on **Pages V5-T2-135** and **V5-T2-136**, as required per starter.

Three-Phase, Non-Reversing, Reversing 60 Hz Starters—Heater Selection

		Constant or Variable Torque				Constant Horsepower				Three Poles Open
NEMA	**Amperes**	**208V**	**240V**	**480V**	**600V**	**208V**	**240V**	**480V**	**600V**	**Catalog Number** ①
Sizes 0–6										
0	18	3	3	5	5	2	2	3	3	**A960M0C_**
1	27	7-1/2	7-1/2	10	10	5	5	7-1/2	7-1/2	**A960M1C_**
2	45	10	15	25	25	7-1/2	10	20	20	**A960M2C_**
3	90	25	30	50	50	20	25	40	40	**A960M3C_**
4	135	40	50	100	100	30	40	75	75	**A960M4C_**
5	270	75	100	200	200	60	75	150	150	**A960M5C_**
6	540	150	200	400	400	100	150	300	300	**A960M6C_**

For Single-Winding Motors

Sizes 0–6

						Three Poles Open
NEMA	**Amperes**	**208V**	**240V**	**480V**	**600V**	**Catalog Number** ①
Constant Horsepower						
0	18	3	3	5	5	**A970M0C_**
1	27	7-1/2	7-1/2	10	10	**A970M1C_**
2	45	10	15	25	25	**A970M2C_**
3	90	25	30	50	50	**A970M3C_**
4	135	40	50	100	100	**A970M4C_**
5	270	75	100	200	200	**A970M5C_**
6	540	150	200	400	400	**A970M6C_**
Constant or Variable Torque						
0	18	2	2	3	3	**A980M0C_**
1	27	5	5	7-1/2	7-1/2	**A980M1C_**
2	45	7-1/2	10	20	20	**A980M2C_**
3	90	20	25	40	40	**A980M3C_**
4	135	30	40	75	75	**A980M4C_**
5	270	60	75	150	150	**A980M5C_**
6	540	100	150	300	300	**A980M6C_**

Coil Suffix

Coil Volts and Hz	Coil Suffix
Sizes 0–6	
120/60 or 110/50	**AC**
200–208/60	**B**
240/60	**W**
480/60	**X**
600/60	**E**

Note

① For ambient compensated overload relay with auto-reset, add Suffix **D**.

Accessories

SS-56 Surge Suppressor

- Designed to be used with magnetic motor controllers through Size 4 in 120V, 60 Hz control circuit applications where electronic equipment is used
- Steady state coil volts: 120, 60 Hz, rms
- Peak input volts: 169.6, 60 Hz, max. amplitude
- Max. ambient temperature: 65°C
- Nominal limiting volts: 270 peak
- Nominal rate of volt rise: 0.5 per ms

SS-56 Surge Suppressor



Surge Suppressor ①

Type Mounting	Kit Catalog Number
Starter	**SS-56**

Mechanical Interlock

- Prevents closing of one member of a reversing or multi-speed contactor until the opposite member is completely open
- Lever type mechanism assures positive action
- Can be factory assembled or field mounted on A200 and A900 starters and contactors

Mechanical Interlock

Contactor Arrangement (Number of Poles, Horizontal or Vertical)	Continuous Size	Interlock Catalog Number
3 x 3 horizontal	0, 1	**M-33-1B**
4 x 4 horizontal	0, 1	**M-33-1B**
5 x 3 horizontal	0, 1	**M-33-1B**
All pole combination, vertical	0, 1	**M-34-1A**
3 x 3 horizontal reversing	2	**M-33-2B**
3 x 3 vertical reversing	2	**M-34-2A**
5 x 3 horizontal	2	**M-35-2A**
4 x 4 horizontal	2	**M-36-2A**
All pole combination horizontal	3, 4	**M-33-3B**
All pole combination vertical	3, 4	**M-34-3**

B3NO Bell Alarm Contact

- Isolated normally open bell alarm contact
- Mounts in Type B block-type overload relay

Bell Alarm Contact

Kit Catalog Number
B3NO-2
B3NO-4 ②

Control Contact Ratings (B600)

	Maximum Amperes	
AC Volts	Make	Break
24–120	30	3.00
121–600	3600 VA	360 VA
Continuous current rating: 5A		

Overload Relay Reset Extension

- Used to adjust overload reset rod depth of Class A200 Model J starters and current design overload relays to same dimensions as obsolete B200 starters and overloads identified by suffix **B**, for example, BA13**B**

When replacing obsolete B200 device with Class A200 starter and Type B overload, order Style 6710C11H03. No charge.

When replacing obsolete B200 device with Class A200 starter and Type A overload, order Style 1490C15H10. No charge.

Notes

① Can be used on Sizes 5 and 6 with 120V coil. Mounting bracket required—order separately. Mounting bracket 177C043G04.

② For Size 3 and 4.

Power Pole Kit

- Adds 1NO or 1NC power pole to Size 00–1 A201 Class contactors
- Factory installed or field mountable in load side auxiliary cavities
- 600 Vac
- Continuous current rating of 18A for Size 0, 27A for Size 1

Power Pole Kit ①

Continuous Current Rating	Kit Size	Kit Catalog Number
Normally Open		
18	0	**PNO-0**
27	1	**PNO-1**
Normally Closed		
18	0	**PNC-0**
27	1	**PNC-1**

Replacement Auxiliary Contacts

Contactor Size	Contact Arrangement	Auxiliary Elect. Contact Catalog Number	Auxiliary Elect. Contact Style Number
5, 6	1NO + 1NC	**J11**	**9084A17G01**
	2NO	**J20**	**9084A17G02**
	2NC	**J02**	**9084A17G03**
7, 8	1NO	—	**578D461G01**
	1NC	—	**578D461G03**
9	1NO + 1NC	—	**843D943G04**
	2NO	—	**843D943G05**
	2NC	—	**843D943G06**

Extra Auxiliary Contact Kits

All starters include an auxiliary contact with 1NO and 1NC contact. These kits include an auxiliary contact with contacts as shown, plus operating arm and mounting bracket when required.

Extra Auxiliary Contact Kits

Contactor Size	Contact Arrangement	Style Number
5, 6	1NO + 1NC	**3463D94G18**
	2NO	**3463D94G04**
	2NC	**3463D94G19**
7, 8 ②	2NO	**818D498G06**
	1NO	**818D498G04**

DC Coil Conversion Kits

Kits listed below include all necessary parts to convert from AC to DC control including the DC coil with built-in diode, rectifier, auxiliary interlock and all mounting hardware.

DC Coil Conversion Kits

Size	Voltage	Kit Style Number
5	110-120	**7864A28G01**
	220-240	**7864A28G02**
	440-480	**7864A28G03**
6	110-120	**7864A29G01**
	220-240	**7864A29G02**
	440-480	**7864A29G03**

Mechanical Interlocks

Contactor Sizes	Style Numbers Horizontal	Vertical
3, 4 and 5	**2050A11G75**	**2050A11G65**
5 and 5	**2050A11G27**	**2050A11G17**
5 and 6	**2050A11G26**	**2050A11G16**
6 and 7, 8	—	**2050A11G55**
7, 8 and 7, 8	No (rear conn.)	**567D624G01**
7, 8 and 9	No (rear conn.)	**9944D56G06**
9 and 9	No (rear conn.)	**9944D56G01**

Notes

① Do not use with DC operated contactors.
② Size 7 and larger use DC coils as standard.

Overload Protection

Overload Protection Size 5 Starters

Type B overload relay is a three-pole, block type, thermal ambient compensated device with manual reset mounted integrally. Current transformers are enclosed in a protective case and integrally mounted to save panel space. Standard ratio is 300:5.

Overload Protection Size 6 Starters

Overload protection assembly consists of three current transformers, Type B three-pole block overload relay and an optional interposing relay. These parts are mounted on a panel which connects directly to the load terminal of the contactor. Current transformers are 600:5 ratio as standard.

If automatic reset is required, the Type A, three-pole block, ambient compensated relay is available upon request.

Overload Relay Kits

Each kit includes three current transformers (standard ratio) and one Type B, three-pole block overload relay, ambient compensated with manual reset.

Overload Relay Kits

Kit Size	Kit Part Number
5	**2057A34G01**
6	**6379D80G10**

Replacement Terminal Lugs ①

		Terminals		
Contactor Size	**Cable Size**	**Quantity in Kit**	**Quantity Required per Pole**	**Kit Style Number**
5	1-500 MCM	6	2	**2119A76G01**
6	2-500 MCM	6	2	**7858A96G01**
7	4-500 MCM	12	4	**7858A96G02**
8	4-500 MCM	12	4	**7858A96G03**

Note

① All mounting hardware is included in kit.

Renewal Parts

When Ordering Specify

Use this renewal parts data to identify device by style number, catalog number and/or description.

Select style number of replacement part from the following pages.

For clarification of ordering procedure, pricing and discounts, contact the Customer Support Center.

General Information

This renewal parts data will provide the proper identification of standard parts which may be required for maintenance of Eaton's components.

It is the intent of this catalog section to make it possible to quickly select the parts needed.

An investment in renewal parts and regular maintenance program will protect against downtime and ensure a proper duty cycle for your equipment.

To maintain maximum operating efficiency and dependability of your equipment, only genuine Eaton replacement parts should be used.

This section identifies the replacements parts which are available. Order by style number.

JF Autostarters

JF Autostarter Kits ①

Frame Size	Start Contacts Required	Start Contacts Style Number	Run Contacts Required	Run Contacts Style Number	Grid Stack Kit Required	Grid Stack Kit Style Number
2–3	1	**38A7018G12**	1	**38A7018G13**	1	**3354D90G10**
4–5 5L	1	**550D409G18**	1	**550D409G19**	1	**3354D90G10**
5M–5MM	1	**3354D90G08**	1	**3354D90G09**	2	**3354D90G10**

Solenoid Assembly with Coil (All Sizes) ②

Volt	Hz	Style Number ③
115	60	**5264C05H01**
230	60	**5264C05H02**
460	60	**5264C05H03**
575	60	**5264C05H04**

Notes

① Kits contain a complete set of moving contacts, stationary contacts and springs.

② When replacing solenoid assembly series 416C160 use adapter plate style 9917D02H01—one required.

③ These styles replace coil style 296B892G__. When ordering new style as replacement, customer must order adapter plate 9917D02H01, one required.

AC Starters, Contactors A200, A201

AC Contactors Model J Sizes 00, 0, 1, 2 Kits ①

Part	Poles	Size 00 Style Number	Size 0 Style Number	Size 1 Style Number	Size 2 Style Number
Contact kit	2	**373B331G17**	**373B331G02**	**373B331G07**	**373B331G11**
	3	**373B331G18**	**373B331G04**	**373B331G09**	**373B331G12**
	4	**373B331G18**	**373B331G04**	**373B331G09**	**373B331G13** ③
	5	**373B331G19**	**373B331G05**	**373B331G10**	—
Arc box ②	2, 3, 4	**6714C74G01**	**6714C74G02**	**6714C74G03**	**6714C74G07** ④
	5	**6714C74G04**	**6714C74G05**	**6714C74G06**	**6714C74G08** ⑤
Cross bar	2, 3	**N/A**	**N/A**	**N/A**	**672B788G32**
	4, 5	**N/A**	**N/A**	**N/A**	**672B788G34**
Upper base (for single rated coils only)	2, 3	**N/A**	**N/A**	**N/A**	**672B788G33**
	4, 5	**N/A**	**N/A**	**N/A**	**672B788G35**
Lower base	2, 3	**N/A**	**N/A**	**N/A**	**1250C33G09**
	4, 5	**N/A**	**N/A**	**N/A**	**1250C33G05**
KO spring (package of 10)	All	**N/A**	**N/A**	**N/A**	**503C796G01**
Terminal line/load (package of 3)	All	**N/A**	**N/A**	**N/A**	**371B870G03**

AC Coils

Voltage	Hz	Size 00, 0, 1 Two-, Three-, Four-Pole Style Number	Five-Pole Style Number	Size 2 Two-, Three-Pole Style Number	Four-, Five-Pole Style Number
120/110	60/50	**505C806G01**	**505C808G01**	**505C806G01**	**505C818G01**
208	60	**505C806G02**	**505C808G02**	**505C806G02**	**505C818G02**
600/550	60/50	**505C806G05**	**505C808G05**	**505C806G05**	**505C818G05**
380	50	**505C806G07**	**505C808G07**	**505C806G07**	**505C818G07**
240/220	60/50	**505C806G12**	**505C808G12**	**505C806G12**	**505C818G12**
480/440	60/50	**505C806G13**	**505C808G13**	**505C806G13**	**505C818G13**
24	60	**505C806G16**	**N/A**	**505C806G16**	**505C818G15**
277	60	**505C806G18**	**505C808G16**	**505C806G18**	**505C818G16**
240/480 ⑥	60/60	**505C806G03**	**505C808G03**	**505C806G03**	**505C818G03**
120/240 ⑦	60/60	**505C806G10**	**505C808G10**	**505C806G10**	**505C818G10**

DC Coil ⑦

Voltage	Size 0, 1 Single-, Two-, Three-, Four-Pole Style Number	Size 2 Single-, Two-, Three-Pole Style Number
12	**1268C86G07**	**1268C86G07**
24	**1268C86G04**	**1268C86G04**
48	**1268C86G05**	**1268C86G05**
125	**1268C86G02**	**1268C86G02**
250	**1268C86G01**	**1268C86G01**
125/250 ⑥	**1268C86G03**	**1268C86G03**

Notes

① Model C contact tips and coils 00-4, two-, three-, four- and five-pole contactors are same as Model J. All other parts are unavailable.
② Mounting hardware included.
③ Use one each of 373B331G11 and 373B331G12.
④ Two-, three-pole.
⑤ Four-, five-pole.
⑥ Dual voltage coils. Use only on contactors or starters originally supplied with a dual voltage coil.
⑦ Use only on contactors originally supplied with a DC coil.

Accessories for Size 5–9 AC Contactors

A rectifier circuit converts the AC supply to DC supply. This conversion provides pick up and drop out characteristics. All necessary parts are included in the kit.

AC-DC Coil Conversion Kits

Voltage	Size 5 Style Number	Size 6 Style Number
120 Vac	**7864A28G01**	**7864A29G01**
240 Vac	**7864A28G02**	**7864A29G02**
480 Vac	**7864A28G03**	**7864A29G03**

Replacement Coils for AC-DC Coil Conversion Kit

Voltage	Size 5 Style Number	Size 6 Style Number
120 Vac	**7856A15G05**	**7856A16G05**
240 Vac	**7856A15G10**	**7856A16G10**
480 Vac	**7856A15G15**	**7856A16G15**

Auxiliary Electrical Interlocks Size 7–9 AC and All DC Units

Type	Circuits	Application	Style Number
L63	NO	Size 7–8	**578D461G01**
L63	NC	Size 7–8	**578D461G03**
L64	NO-NC	Size 9	**843D943G04**
L64	2NO	Size 9	**843D943G05**
L64	2NC	Size 9	**843D943G06**

Accessories for Size 00–6 AC Contactors

Auxiliary Electrical Interlocks

Catalog Number (Obsolete)	Style Number (Obsolete)	Circuits	Catalog Number Current	Style Number Current
(L-56)	(2609D01G01)	1NO and 1NC	**J11**	**9084A17G01**
(L-56D)	(2609D01G02)	2NO	**J20**	**9084A17G02**
(L-56E)	(2609D01G03)	1NO and 1NC	**J11**	**9084A17G01**
(L-56B)	(2609D01G04)	2NO	**J20**	**9084A17G02**
(L-56H)	(2609D01G05)	2NO	**J20**	**9084A17G02**
(L-56J)	(2609D01G06)	1NO and1NC DB	**J1C**	**9084A17G04**
(L-56A)	(2609D01G07)	N/A	**N/A**	**N/A**
(L-56B)	(2609D01G08)	N/A	**N/A**	**N/A**
(L-56F)	(2609D01G09)	N/A	**N/A**	**N/A**
(L-56G)	(2609D01G10)	1NO and 1NC DB	**J1C**	**9084A17G04**
(L-56C)	(2609D01G11)	2NC	**J02**	**9084A17G03**
(L-56M)	(2609D01G12)	N/A	**N/A**	**N/A**
(L-56P)	(2609D01G17)	1NO and 1NC	**J11**	**9084A17G01**
(L-56R)	(2609D01G18)	2NC	**J02**	**9084A17G03**
(L-56S)	(2609D01G19)	1NO and 1NC	**J11**	**9084A17G01**

Model J–K, Sizes 3 and 4

Sizes 3 and 4 Kits ①

Part	Poles	Size 3–Model J Style Number	Size 4–Model J ② Style Number	Size 4–Model K ③ Style Number
Contact kit	2	**626B187G12**	**626B187G16**	**5250C81G16**
	3	**626B187G13**	**626B187G17**	**5250C81G17**
	4	④	⑥	**5250C81G18**
	5	⑤	⑦	**5250C81G19**
Arc box	2, 3	**6714C74G09**	**6714C74G11**	**6714C74G11**
	4, 5	**6714C74G10**	**6714C74G12**	**6714C74G12**
Cross bar	2, 3	**672B788G36**	**672B788G36**	**672B788G40**
	4, 5	**672B788G38**	**672B788G38**	—
Upper base	2, 3	**672B788G37**	**672B788G37**	**672B788G52**
	4, 5	**672B788G39**	**672B788G39**	—
Lower base	2, 3	**1250C33G03**	**1250C33G03**	**1250C33G10**
	4, 5	**1250C33G06**	**1250C33G06**	—
KO spring (package of 10)	All	**503C796G02**	**503C796G02**	**672B788G50**
Terminal line/load (package of 3)	All	**372B357G12**	**372B357G18**	**372B357G18**

Notes

① Model C contact tips and coils 00-4, two-, three-, four- and five-pole contactors are same as Model J. All other parts are unavailable.
② For 200A A202 magnetically latched lighting contactors order three-pole contact kit style 672B788G07.
③ Model K replaces Model J, offering superior design life characteristics. Renewal parts are different. Use parts for proper model only.
④ Use quantity two of 626B187G12.
⑤ Use quantity one each of 626B187G12 and 626B187G13.
⑥ Use quantity two of 626B187G16.
⑦ Use quantity one each of 626B187G16 and 626B187G17.

Accessories for Model J–K, Series 3, 4

DC Coils ①

Voltage	Model J Size 3, 4 Two-, Three-Pole Style Number
24	**1255C68G04**
48	**1255C68G05**
125	**1255C68G01**
250	**1255C68G02**
125/250 ②	**1255C68G03**

AC Coils

Voltage	Hz	Model J Size 3, 4 Two-, Three-Pole Style Number	Four-, Five-Pole Style Number	Model K Size 4 ③ Two-, Three-Pole Style Number	Four-, Five-Pole Style Number
120/110	60/50	**505C633G01**	**505C635G01**	**5250C79G01**	**5250C80G01**
208	60	**505C633G02**	**505C635G02**	**5250C79G02**	**5250C80G02**
600/550	60/50	**505C633G05**	**505C635G05**	**5250C79G05**	**5250C80G05**
380	50	**505C633G07**	**505C635G07**	**5250C79G07**	**5250C80G07**
240/220	60/50	**505C633G12**	**505C635G12**	**5250C79G12**	**5250C80G12**
480/440	60/50	**505C633G13**	**505C635G13**	**5250C79G13**	**5250C80G13**
24	60	**505C633G34**	**N/A**	**5250C79G34**	**N/A**
277	60	**505C633G14**	**N/A**	**5250C79G14**	**N/A**
240/480 ②	60/60	**505C633G03**	**505C635G03**	**5250C79G03**	**5250C80G03**
120/244 ②	60/60	**505C633G10**	**505C635G10**	**5250C79G10**	**5250C80G10**

A201 Contactors—Size 5–9

GCA 530/630—GPD 7, 8, 9 Kits ④

Part	Size 5 Style Number	Size 6 Style Number	Size 7 Style Number	Size 8 Style Number	Size 9 Style Number
Contact kit (one per pole)	**477B477G05** ⑤	**2066A10G11**	**461A757G17**	**646C829G05**	**5264C42G01** ⑥
					5264C42G02 ⑦
Arc box	**2050A15G45**	**2066A10G45**	**831D580G01**	**831D580G01**	**9917D69G02**
Magnet assembly	**2050A15G46**	**2050A15G46**	**N/A**	**N/A**	**N/A**
Mag. spg. kit	**2050A15G47**	**2050A15G47**	**N/A**	**N/A**	**N/A**
Acr cup kit	**2050A15G48**	**N/A**	**N/A**	**N/A**	**N/A**
Load conversion kit	**2050A15G49**	**2066A10G49**	**N/A**	**N/A**	**N/A**
Line conversion kit	**2050A15G50**	**2066A10G50**	**N/A**	**N/A**	**N/A**
K.O. spring–6	**2050A15G51**	**2066A10G46**	**N/A**	**N/A**	**N/A**
C.T. 300/5	**655C285H03**	**N/A**	**N/A**	**N/A**	**N/A**
C.T. 400/5	**655C285H04**	**N/A**	**N/A**	**N/A**	**N/A**
C.T. 600/5 ⑧	**N/A**	**2066A10G18**	**N/A**	**N/A**	**N/A**
C.T. 800/5 ⑧	**N/A**	**2066A10G19**	**N/A**	**N/A**	**N/A**
Phase barrier	**N/A**	**N/A**	**640C441G01**	**640C441G01**	**5264C35G03** ⑥
Cross bar	**2050A15G12**	**2066A10G15**	**N/A**	**N/A**	**N/A**
Shunt	**N/A**	**2066A10G48**	**650C129G01**	**646C831G02** ⑨	**5264C39G02** ⑩

Notes

① Use only on units originally supplied with DC coil.
② Dual voltage coils. Use only on contactors or starters originally supplied with dual voltage coil.
③ Model K replaces Model J, offering superior design life characteristics. Renewal parts are different. Use parts for proper model only.
④ Catalog Number A201/A200 Series replaces GCA/GPD series. Renewal parts are the same.
⑤ Use 477B477G06 for silver tungsten applications.
⑥ R.C.
⑦ F.C.
⑧ C.T. kit which replaces the single molded 1 C.T. assembly used on the old size 6 airbreak. The kit includes a single molded 3 C.T. assembly, 2 bus bar and hardware. This C.T. kit also replaces the single molded 3 C.T. assembly used on the present size 6 airbreak and size vacuum.
⑨ Set of three.
⑩ Set of four.

Accessories for A201 Contactors—Size 5–9

Coils (Sizes 5 and 6)

Voltage	Hz	Size 5 Style Number	Size 6 Style Number
Sizes 5 and 6			
110/120	60	**2050A14G05**	**2050A12G05**
110/120	50	**2050A14G06**	**2050A12G06**
200/208	50	**2050A14G07**	**2050A12G07**
220/240	50	**2050A14G08**	**2050A12G08**
200/208	60	**2050A14G09**	**2050A12G09**
220/240	60	**2050A14G10**	**2050A12G10**
277/303	60	**2050A14G12**	**2050A12G12**
380/415	50	**2050A14G14**	**2050A12G14**
440/480	60	**2050A14G15**	**2050A12G15**
440/480	50	**2050A14G16**	**2050A12G16**
550/600	60	**2050A14G17**	**2050A12G17**
550/600	50	**2050A14G18**	**2050A12G18**
380/415	60	**2050A14G19**	**2050A12G19**
120/240	60	**2050A14G20**	**2050A12G20**
24 DC	—	**2050A14G21**	**2050A12G21**
48 DC	—	**2050A14G22**	**2050A12G22**
125 DC	—	**2050A14G25**	**2050A12G25**
250 DC	—	**2050A14G27**	**2050A12G27**

Coils (Sizes 7–9)

Line Voltage	Style Number	Required
Sizes 7 and 8		
125 Vdc	**438C805G04**	2
230 Vdc	**438C805G02**	2
250 Vdc	**438C805G03**	2
110/120 Vac ①④	**438C805G12**	2
220/240 Vac ②④	**438C805G11**	2
380 Vac ③④	**438C805G15**	2
440/480 Vac ③④	**438C805G10**	2
550/575 Vac ③④	**438C805G13**	2
Size 9		
110 Vdc	**5264C34G01** ⑤	—

Notes

① Rectifier 125V 2018A40G01 (one required).
② Rectifier 250V 2018A40G02 (one required).
③ Rectifier 600V 2018A40G03 (one required).
④ These coils require an external rectifier. If the rectifier needs replacement, order by the appropriate style number.
⑤ Contains coil and resistor.

Modifications

Factory Modifications

Modification	Description	Catalog Number Suffix	NEMA Size 00–1	2	3	4	5	6	7	8	9
Control circuit	1 Extra auxiliary contact (1NO-1NC) non-reversing, reversing, 2-speed unwired	**J1**	Consult sales office for pricing adders.								
	2 Extra auxiliary contact non-reversing, reversing, 2-speed unwired	**J2**	Consult sales office for pricing adders.								
	3 Extra auxiliary contact non-reversing, unwired	**J3**	Consult sales office for pricing adders.								
	4 Extra auxiliary contact non-reversing, unwired	**J4**	Consult sales office for pricing adders.								
	Wired for separate control (NC)	**C**	Consult sales office for pricing adders.								
	Omit control wiring (NC)	**X**	Consult sales office for pricing adders.								
Overload relays (substitutions)	Ambient compensated with auto reset (NC)	**D**	Consult sales office for pricing adders.								
	Fast trip—ambient compensated (specify motor FLA)	**D7**	Consult sales office for pricing adders.								
	Overload relay alarm contact (NO) per overload	**E**	Consult sales office for pricing adders.								

Accessories and Field Modification Kits

Type J Auxiliary Contact



- Capable of being field mounted in a contactor or starter (Classes A200, A900 Sizes 00–6, V200, V201 vacuum and definite purpose controllers)
- Provides two separate electrical contact sets which wire vertically and are color coded; black designates NC and silver designates NO. Please note that the vertical wiring is contrary to the horizontal wiring of the L-56 auxiliary contacts
- Designed to fit within dimensions of starter; no additional panel space is required
- Provides circuit isolation (no polarity restrictions) and single break bifurcated contacts

Auxiliary Contact Ratings

Voltage	Make	Break
NEMA A600		
120–600 Vac	7200 VA	720 VA
72–120 Vac	60A	720 VA
28–72 Vac	60A	10A
NEMA R300		
28–300 Vdc	28 VA	28 VA

Auxiliary Contact Types

Contact Type	Max.	Catalog Number
1NO and 1NC	4	**J11**
2NC	4	**J02**
2NO	4	**J20**
1 coil clearing NC and 1NO	4	**J1C**

Technical Data and Specifications

Electrical Characteristics

Sizes 00–4

	Size 00	Size 0	Size 1	Size 2	Size 3	Size 4
Max. voltage rating	600V	600V	600V	600V	600V	600V
Ampere rating						
(Open)	10A	20A	30A	50A	100A	150A
(Enclosed)	9A	18A	27A	45A	90A	135A
Squirrel Cage Motor						
Maximum horsepower at:						
200V/60 Hz	1-1/2 hp	3 hp	7-1/2 hp	10 hp	25 hp	40 hp
230V/ 60 Hz	1-1/2 hp	3 hp	7-1/2 hp	15 hp	30 hp	50 hp
380V/50 Hz	1-1/2 hp	5 hp	10 hp	25 hp	50 hp	75 hp
460V–575V/60 Hz	2 hp	5 hp	10 hp	25 hp	50 hp	100 hp
Resistive Heating kW ①						
Single-phase, two-pole						
120V	—	—	3 kW	5 kW	10 kW	15 kW
240V	—	—	6 kW	10 kW	20 kW	30 kW
480V	—	—	12 kW	20 kW	40 kW	60 kW
600V	—	—	15 kW	25 kW	50 kW	75 kW
Three-phase, three-pole						
120V	—	—	5 kW	8.5 kW	17 kW	26 kW
240V	—	—	10 kW	17 kW	34 kW	68 kW
480V	—	—	20 kW	34 kW	68 kW	105 kW
600V	—	—	25 kW	43 kW	86 kW	130 kW
Capacitor Switching kVAR, Three-Phase						
240V	—	—	—	12 kVAR	27 kVAR	40 kVAR
480V	—	—	—	25 kVAR	53 kVAR	80 kVAR
600V	—	—	—	31 kVAR	67 kVAR	100 kVAR
Transformer Switching kVA ②						
Single-phase, two-pole						
120V	—	0.6 kVA	1.2 kVA	2.1 kVA	4.1 kVA	6.8 kVA
240V	—	1.2 kVA	2.4 kVA	4.1 kVA	8.1 kVA	14 kVA
480V	—	2.4 kVA	4.9 kVA	8.3 kVA	16 kVA	27 kVA
600V	—	3 kVA	6.2 kVA	10 kVA	20 kVA	34 kVA
Three-phase, three-pole						
120V	—	1.8 kVA	3.6 kVA	6.3 kVA	12 kVA	20 kVA
240V	—	2.1 kVA	4.3 kVA	7.2 kVA	14 kVA	23 kVA
480V	—	4.2 kVA	8.5 kVA	14 kVA	28 kVA	47 kVA
600V	—	5.2 kVA	11 kVA	18 kVA	35 kVA	59 kVA

Sizes 5–9

	Size 5	Size 6	Size 7	Size 8	Size 9
Max. voltage rating	600V	600V	600V	600V	600V
Ampere rating					
(Open)	300A	600A	900A	1350A	2500A
(Enclosed)	270A	540A	810A	1215A	2250A
Squirrel Cage Motor					
Maximum horsepower at:					
200V/60 Hz	75 hp	150 hp	—	—	—
230V/60 Hz	100 hp	200 hp	300 hp	450 hp	800 hp
380V/50 Hz	150 hp	300 hp	—	—	—
460V–575V/60 Hz	200 hp	400 hp	600 hp	900 hp	1600 hp
Resistive Heating kW ①					
Single-phase, two-pole					
120V	30 kW	60 kW	90 kW	③	③
240V	60 kW	120 kW	180 kW	③	③
480V	120 kW	240 kW	360 kW	③	③
600V	150 kW	300 kW	450 kW	③	③
Three-phase, three-pole					
120V	52 kW	105 kW	155 kW	③	③
240V	105 kW	210 kW	315 kW	③	③
480V	210 kW	415 kW	625 kW	③	③
600V	260 kW	515 kW	775 kW	③	③
Capacitor Switching kVAR, Three-Phase					
240V	80 kVAR	160 kVAR	240 kVAR	360 kVAR	665 kVAR
480V	160 kVAR	320 kVAR	480 kVAR	720 kVAR	1325 kVAR
600V	200 kVAR	400 kVAR	600 kVAR	900 kVAR	1670 kVAR
Transformer Switching kVA ②					
Single-phase, two-pole					
120V	14 kVA	27 kVA	41 kVA	61 kVA	112 kVA
240V	27 kVA	54 kVA	81 kVA	122 kVA	225 kVA
480V	54 kVA	108 kVA	162 kVA	244 kVA	450 kVA
600V	68 kVA	135 kVA	203 kVA	304 kVA	562 kVA
Three-phase, three-pole					
120V	41 kVA	81 kVA	122 kVA	182 kVA	337 kVA
240V	47 kVA	94 kVA	140 kVA	210 kVA	342 kVA
480V	94 kVA	188 kVA	280 kVA	420 kVA	783 kVA
600V	117 kVA	234 kVA	351 kVA	526 kVA	975 kVA

Notes

① Resistive loads having inrush currents not exceeding 1.5 times continuous rating.

② These ratings are for transformers having inrush currents not more than 20 times peak of continuous current ratings. For inrush currents greater than 20 times, refer to factory.

③ For ratings refer to factory.

DC Power Pole Ratings

The following represent typical production test values and should not be interpreted as a guarantee of actual performance.

DC Operated 120 and 240V Coils

Contactor Size	DC Contact Ampere Rating Two Poles in Series ① 120V	240V
0	—	—
1	20	10
2	45	30
3	75	40
4	90	70

380V, 50 Hz Starter Maximum Horsepower Ratings

Horsepower Ratings

NEMA Size	00	0	1	2	3	4	5	6	7	8
Maximum horsepower	1-1/2	5	10	25	50	75	150	300	450	700

Operating Coil Characteristics at Rated Coil Volts, Sizes 00–9

The following represent typical production test values and should not be interpreted as a guarantee of actual performance.

Operating Coil Characteristics

	Sizes 00, 0, 1	Size 2	Size 3	Size 4 ②	Size 5	Size 6	Size 7	Size 8	Size 9
AC Coil									
Burden									
(Open VA)	160 VA	160 VA	625 VA	700 VA	1700 VA	2900 VA	③	③	③
(Closed VA)	25 VA	25 VA	50 VA	64 VA	180 VA	220 VA	③	③	③
(Closed Watts)	7.8 W	7.8 W	18 W	21 W	32 W	42 W	—	—	—
Pick-up volts ④	85%	85%	85%	85%	78%	70%	—	—	—
Drop-out volts ④	40–60%	40–60%	40–60%	40–60%	65 to 75%	60 to 70%	—	—	—
Pick-up time Hz ⑤⑥	1–1-1/2	1-1/2–2	2–2-1/2	1–1-1/2	1.5	4.0	—	—	—
Drop-out time Hz ⑤	3/4–1	3/4–1	3/4–1	3/4–1	0.75	0.75	—	—	—
DC Coil									
Burden									
(Open VA)	17 VA	17 VA	35 VA	35 VA	600 VA	2120 VA	400 VA	400 VA	2100 VA
(Closed VA)	17 VA	17 VA	35 VA	35 VA	22 VA	21 VA	400 VA	400 VA	350 VA
(Closed Watts)	18 W	18 W	35 W	35 W	20 W	20 W	400 W	400 W	350 W
Pick-Up Volts ④	80%	80%	80%	80%	64%	73%	45%–65% ⑦	45%–65% ⑦	50%–65% ⑦
Drop-Out Volts ④	5–10%	5–10%	5–10%	5–10%	18%	13%	30%–45% ⑦	30%–45% ⑦	40%–50% ⑦
Pick-Up Time Hz ⑥	—	25–75 ms	25–75 ms	25–75 ms	2.7 Hz ⑤	3 Hz ⑤	21–41 Hz ⑦⑤	17–29 Hz ⑦⑤	16–18 ⑦⑤
Drop-Out Time Hz ⑤	—	16–25 ms	16–25 ms	16–25 ms	9.3 Hz ⑤	17.5 Hz ⑤	7–12 Hz ⑧⑤	7–12 Hz ⑧⑤	18–20 Hz ⑦⑤

Notes

① Non-inductive load.
② AC coil data pertains to Model K, DC coil data pertains to Model J.
③ DC operated only.
④ Percent of rated coil voltage.
⑤ At 60 Hz base.
⑥ To contact touch.
⑦ Lower figure when coil is cold. Higher figure when coil is hot.
⑧ Drop-out time to clear arc. Time varies with type of load and contact wear.

Mechanical Characteristics

NEMA Standard ICS 2-110

Direct-current operated contactors shall withstand 110% of their rated voltage continuously without injury to the operating coils and shall close successfully at 80% of their rated voltage.

Alternating-current operated contactors shall withstand 110% of their rated voltage continuously without injury to the operating coils and shall close successfully at 85% of their rated voltage.

Mechanical Characteristics, Sizes 00–9

	Sizes 00, 0, 1	Size 2	Size 3	Size 4	Size 5	Size 6	Size 7	Size 8	Size 9
Dimensions in inches (mm)									
Height	6.45 (163.8)	7.16 (181.9)	9.93 (252.2)	9.93 (252.2)	12.00 (304.8) ①	13.50 (342.9) ①	18.62 (472.9) ①	19.25 (489) ①	25.00 (635) ①
Width	3.31 (84.1)	3.31 (84.1)	4.62 (117.3)	4.62 (117.3)	7.00 (177.8) ①	7.00 (177.8) ①	23.50 (596.9) ①	23.50 (596.9) ①	32.00 (812.8) ①
Depth	4.61 (117.1)	4.96 (126)	6.75 (171.5)	6.75 (171.5)	7.75 (196.9) ①	8.75 (222.3) ①	11.00 (279.4) ①	11.00 (279.4) ①	13.00 (330.2) ①
Panel area—square inches	21.35	23.7	46.0	46.0	84.0	94.5	437.5	452.4	800
Weight—pounds	3.5	3.5	11.5	11.5	25	42	215	265	315
Cable connection	—	—	—	—	Front	Front	Front/rear	Front/rear	Front/rear
Maximum cable size/phase copper (AWG/MCM)	6 AWG	3 AWG	1/0	4/0	1–500 MCM	2–500 MCM	3–500 MCM	4–500 MCM	8–500 MCM
Auxiliary electrical circuits available	8	6	6	6	4	4	3	3	4
Latched version available	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No
Mechanical interlock combinations available									
Sizes									
00, 0, 1, 2, 3, 4	Vert., Horiz.	Vert., Horiz.	Vert., Horiz.	Vert., Horiz.	Vert., Horiz.	—	—	—	—
5	—	—	—	—	Vert., Horiz.	Vert., Horiz.	—	—	—
6	—	—	—	—	Vert., Horiz.	Vert., Horiz.	Vertical	Vertical	—
7, 8	—	—	—	—	—	Vertical	Vertical	Vertical	Vertical
9	—	—	—	—	—	—	Vertical	Vertical	Vertical

Data from Tables 430—147 Through 150 of 1996 NEC: Motor Amperes at Full Load ②, Three-Phase AC

	Single-Phase AC		Induction Type Squirrel Cage and Wound-Rotor Amperes				DC			Single-Phase AC		Induction Type Squirrel Cage and Wound-Rotor Amperes				DC	
hp	115V	230V	200V	230V	460V	575V	120V	240V	hp	115V	230V	200V	230V	460V	575V	120V	240V
1/6	4.4	2.2	—	—	—	—	—	—	30	—	—	92	80	40	32	—	106
1/4	5.8	2.9	—	—	—	—	3.1	1.6	40	—	—	120	104	52	41	—	140
1/3	7.2	3.6	—	—	—	—	4.1	2.0	50	—	—	150	130	65	52	—	173
1/2	9.8	4.9	2.5	2.2	1.1	0.9	5.4	2.7	60	—	—	177	154	77	62	—	206
3/4	13.8	6.9	3.7	3.2	1.6	1.3	7.6	3.8	75	—	—	221	192	96	77	—	255
1	16	8	4.8	4.2	2.1	1.7	9.5	4.7	100	—	—	285	248	124	99	—	341
1-1/2	20	10	6.9	6.0	3.0	2.4	13.2	6.6	125	—	—	359	312	156	125	—	425
2	24	12	7.8	6.8	3.4	2.7	17	8.5	150	—	—	414	360	180	144	—	506
3	34	17	11.0	9.6	4.8	3.9	25	12.2	200	—	—	552	480	240	192	—	675
5	56	28	17.5	15.2	7.6	6.1	40	20	250	—	—	—	—	302	242	—	—
7-1/2	80	40	25.3	22	11	9	58	29	300	—	—	—	—	361	289	—	—
10	100	50	32.2	28	14	11	76	38	350	—	—	—	—	414	336	—	—
15	—	—	48.3	42	21	17	—	55	400	—	—	—	—	477	382	—	—
20	—	—	62.1	54	27	22	—	72	450	—	—	—	—	515	412	—	—
25	—	—	78.2	68	34	27	—	89	500	—	—	—	—	590	472	—	—

Notes

① For Sizes 5–9 contactors only; for starter Sizes 5–9, refer to factory.

② These current values are for motors running at usual speeds and with normal torque characteristics. Motors for special low speed or high torque may require higher current. In all cases, heaters should be selected on basis of information on motor nameplate or motor card data.

Combination Ratings

Sizes 00–2

Short-Circuit Protective Device (SCPD)	Max. Rating SCPD	Circuit Breaker Interrupting Rating	Short-Circuit Withstand Capability Current	Voltage
Sizes 00, 0, 1				
Class H fuse	60A	—	5000A	600V
Class J fuse	60A	—	100,000A	600V
Class R fuse	60A	—	100,000A	600V
Class T fuse	60A	—	100,000A	600V
Magnetic only ① Type CB ②	30A	Marked HMCP	100,000A	480V
			50,000A	600V
Thermal/magnetic Type CB ③	50A	65,000A	65,000A	480V
		25,000A	25,000A	600V
		100,000A	100,000A	480V
		35,000A	35,000A	600V
Magnetic only Type CB + CL ④	30A	HMCP + current limiter	100,000A	600V
Thermal/magnetic Type CLB ⑤	50A	150,000A	100,000A	480V
Size 2				
Class H fuse	100A	—	5000A	600V
Class J fuse	100A	—	100,000A	600V
Class R fuse	100A	—	100,000A	600V
Class T fuse	100A	—	100,000A	600V
Magnetic only ① Type CB ②	50A	Marked HMCP	100,000A	480V
			50,000A	600V
Thermal/magnetic Type CB ③	90A	65,000A	65,000A	480V
		25,000A	25,000A	600V
		100,000A	100,000A	480V
		35,000A	35,000A	600V
Magnetic only Type CB + CL ④	50A	HMCP + current limiter	100,000A	600V
Thermal/magnetic Type CLB ⑤	50A	150,000A	100,000A	480V

Sizes 3 and 4

Short-Circuit Protective Device (SCPD)	Max. Rating SCPD	Circuit Breaker Interrupting Rating	Short-Circuit Withstand Capability Current	Voltage
Size 3				
Class H fuse	60A	—	5000A	600V
Class J fuse	60A	—	100,000A	600V
Class R fuse	60A	—	100,000A	600V
Class T fuse	60A	—	100,000A	600V
Magnetic only ① Type CB ②	100A	Marked HMCP	100,000A	480V
			50,000A	600V
Thermal/magnetic Type CB ③	150A	65,000A	65,000A	480V
		25,000A	25,000A	600V
		100,000A	100,000A	480V
		35,000A	35,000A	600V
Magnetic only Type CB + CL ④	100A	HMCP + current limiter	100,000A	600V
Thermal/magnetic Type CLB ⑤	150A	50,000A	100,000A	480V
Size 4				
Class H fuse	400A	—	10,000A	600V
Class J fuse	400A	—	100,000A	600V
Class R fuse	400A	—	100,000A	600V
Class T fuse	400A	—	100,000A	600V
Magnetic only ① Type CB ②	150A	Marked HMCP	100,000A	480V
			50,000A	600V
Thermal/magnetic Type CB ③	250A	65,000A	65,000A	480V
		25,000A	25,000A	600V
		100,000A	100,000A	480V
		35,000A	35,000A	600V
Magnetic only Type CB + CL ④	150A	HMCP + current limiter	100,000A	600V
Thermal/magnetic Type CB + CL ⑤	250A	200,000A	100,000A	600V
Thermal/magnetic Type CLB ⑥	250A	150,000A	100,000A	480V

Coil Suffix

Other Available Coil Voltages—AC and DC Coils ⑦

Coils	Catalog Number Suffix	Coil Rating (Volts/Hertz)	Catalog Number Suffix	Coil Rating (Volts/Hertz)
AC	**A**	120/60, 110/50	**N**	110/50
	B	200-208/60	**P**	48/60
	C	240/60 and 480/60	**R**	120/60 and 240/60
	D	440/50	**U**	440-480/50 or 60 Rect. to DC
	E	600/60 Hz	**V**	110/60
	G	220/50	**W**	240/60
	H	380/50	**X**	480/60
	I	24/60	**Y**	415/50
	J	110-120/50 or 60 Rect. to DC	**Z**	277/60
	K	220-240/50 or 60 Rect. to DC	—	—
DC ⑧⑨	**L**	24 Vdc	**S**	125 Vdc
	M	48 Vdc	**T**	250 Vdc

Notes

① Instantaneous adjustable trip.
② Circuit breaker.
③ Inverse time circuit breaker.
④ Instantaneous adjustable trip with current limiting attachment.
⑤ Inverse time with built-in current limiting attachment.
⑥ Inverse time current limiting breaker.
⑦ Availability may be limited.
⑧ DC coils for Size 5 and 6 contactors and starters are intermittent duty rated only. A mechanical latch is required.
⑨ DC coils. Use only on contactors originally supplied with a DC coil.

Dimensions

Approximate Dimensions in Inches (mm)

Not to be used for construction purposes unless approved.

Open Non-Reversing Starters

Figure A—Sizes 00–4

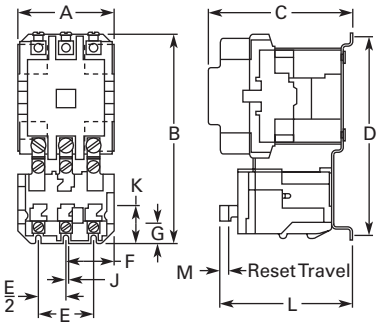


Figure B—Size 5

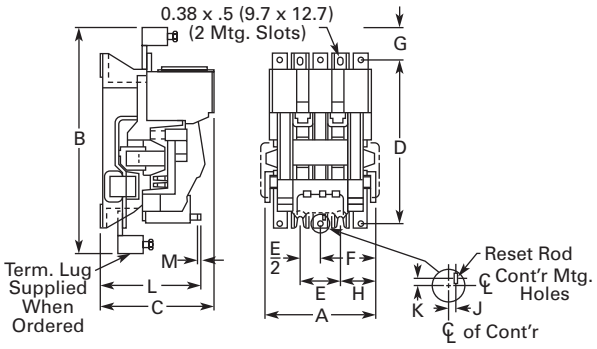
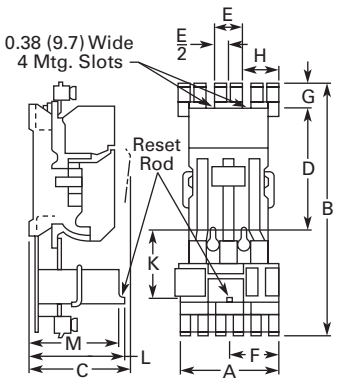


Figure C—Size 6



Dimensions and Shipping Weights

NEMA Size	No. of Poles	Fig.	Mounting Screws No.	Mounting Screws Size	A	B	C	D	E	F	G	H	J	K	L	M	Weight, Lbs (kg)
00, 0, 1	2, 3	A	3	#10	3.31 (84.1)	6.42 (163.1)	4.61 (117.1)	6.00 (152.4)	1.88 (47.8)	1.66 (42.2)	0.23 (5.8)	—	0.39 (9.9)	0.59 (15.0)	4.48 (113.8)	0.27 (6.9)	35.0 (15.9)
2	2, 3	A	3	#10	3.31 (84.1)	7.17 (182.1)	4.94 (125.5)	6.75 (171.5)	1.88 (47.8)	1.66 (42.2)	0.23 (5.8)	—	0.41 (10.4)	0.77 (19.6)	4.53 (115.1)	0.27 (6.9)	43.0 (19.5)
3, 4	2, 3	A	3	1/4 in.	4.63 (117.6)	9.94 (252.5)	6.75 (171.5)	9.25 (235.0)	2.88 (73.2)	.94 (23.9)	0.38 (9.7)	—	0.55 (14.0)	0.80 (20.3)	6.36 (161.5)	0.27 (6.9)	115.0 (52.2)
5	3	B	4	3/8 in.	7.59 (192.8)	16.22 (412.0)	7.75 (196.9)	11.00 (279.4)	2.75 (69.9)	3.81 (96.8)	2.69 (68.3)	2.42 (61.5)	0.33 (8.4)	0.33 (8.4)	7.00 (177.8)	0.27 (6.9)	29.0 (13.2)
6	3	C	4	3/8 in.	9.25 (235.0)	23.50 (596.9)	9.50 (241.3)	11.00 (279.4)	2.75 (69.9)	4.81 (122.2)	2.75 (69.9)	3.06 (77.7)	—	6.50 (165.1)	8.44 (214.4)	0.27 (6.9)	55.0 (25.0)
7	3	①	①	①	37.88 (962.2)	21.50 (546.1)	11.75 (298.5)	—	—	—	—	—	—	—	—	—	—
8	3	①	①	①	37.88 (962.2)	21.50 (546.1)	11.75 (298.5)	—	—	—	—	—	—	—	—	—	—
9	3	①	①	①	①	①	①	①	①	①	①	①	①	①	①	①	①

Note

① Refer to factory.

Approximate Dimensions in Inches (mm)

Not to be used for construction purposes unless approved.

2

Open Reversing Starters

Figure A—Sizes 00–4 Horizontal

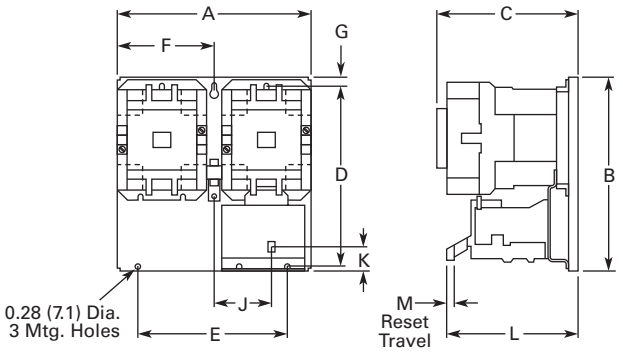
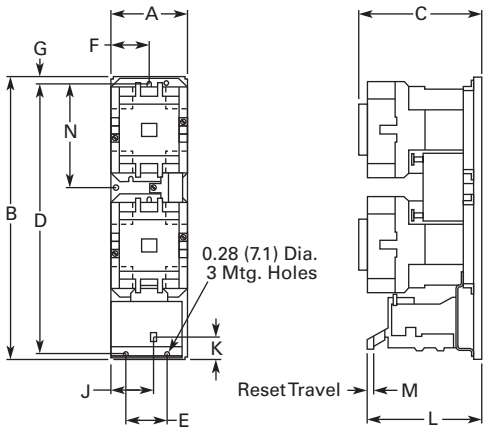


Figure B—Sizes 00–4 Vertical



Dimensions and Shipping Weights

NEMA Size	Number of Poles	Fig.	Mounting Screws No.	Mounting Screws Size	A	B	C	D	E	F	G	J	K	L	M	N	Weight, Lbs (kg)
00, 0, 1	3 x 3 Horiz.	A	3	#10	7.13 (181.1)	6.50 (165.1)	5.05 (128.3)	6.00 (152.4)	5.69 (144.5)	3.56 (90.4)	0.25 (6.4)	2.3 (58.4)	0.59 (15.0)	4.92 (125.0	0.27 (6.9)	—	9.0 (4.0)
	3 x 3 Vert.	B	3	#10	3.33 (84.6)	11.63 (295.4)	5.05 (128.3)	11.13 (282.7)	1.88 (47.8)	1.66 (42.2)	0.25 (6.4)	0.39 (9.9)	0.59 (15.0)	4.92 (125.0)	0.27 (6.9)	4.52 (114.8)	9.8 (4.4)
2	3 x 3 Horiz.	A	3	#10	7.13 (181.1)	7.25 (184.2)	5.38 (136.7)	6.75 (171.5)	5.69 (144.5)	3.56 (90.4)	0.25 (6.4)	2.31 (58.7)	0.77 (19.6)	4.97 (126.2)	0.27 (6.9)	—	10.8 (4.9)
	3 x 3 Vert.	B	3	#10	3.33 (84.6)	12.38 (314.5)	5.38 (136.7)	11.88 (301.8)	1.88 (47.8)	1.66 (42.2)	0.25 (6.4)	0.39 (9.9)	0.77 (19.6)	4.97 (126.2)	0.27 (6.9)	4.52 (114.8)	12.2 (5.5)
3, 4	3 x 3 Horiz.	A	3	1/4 in.	9.75 (247.7)	10.13 (257.3)	7.25 (184.2)	9.25 (235.0)	8.00 (203.2)	4.88 (124.0)	0.44 (11.2)	3.11 (79.0)	0.80 (20.3)	6.86 (174.2)	0.27 (6.9)	—	26.0 (11.8)
	3 x 3 Vert.	B	3	1/4 in.	4.63 (117.6)	19.81 (503.2)	7.25 (184.2)	18.94 (481.1)	2.88 (73.2)	2.94 (74.7)	0.44 (11.2)	0.55 (14.0)	0.80 (20.3)	6.86 (174.2)	0.27 (6.9)	7.91 (200.9)	28.0 (12.7)
5	3 x 3 Horiz.	—	4	3/8 in.	35.25 (895.4)	25.50 (647.7)	8.75 (222.3)	—	—	—	—	—	—	—	—	—	73.0 (33.1)
6	3 x 3 Horiz.	—	4	3/8 in.	35.25 (895.4)	25.50 (647.7)	10.50 (266.7)	—	—	—	—	—	—	—	—	—	127.0 (57.7)
7	①	①	①	①	①	①	①	①	①	①	①	①	①	①	①	①	①
8	①	①	①	①	①	①	①	①	①	①	①	①	①	①	①	①	①
9	①	①	①	①	①	①	①	①	①	①	①	①	①	①	①	①	①

Note

① Refer to factory.

Approximate Dimensions in Inches (mm)

Not to be used for construction purposes unless approved.

Open Multi-Speed Starters

Figure A—Sizes 00–4

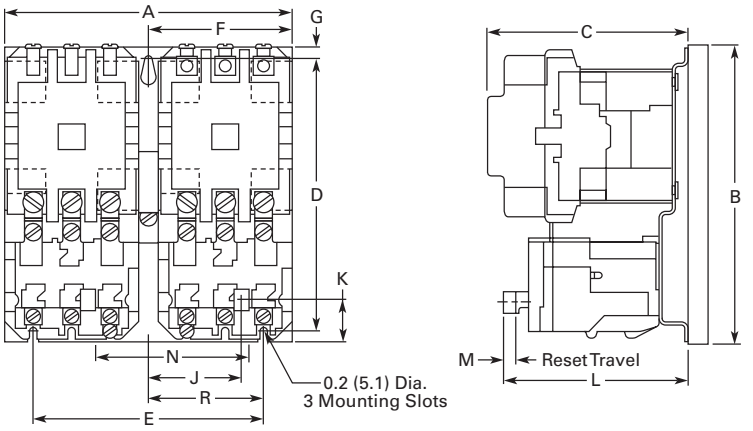
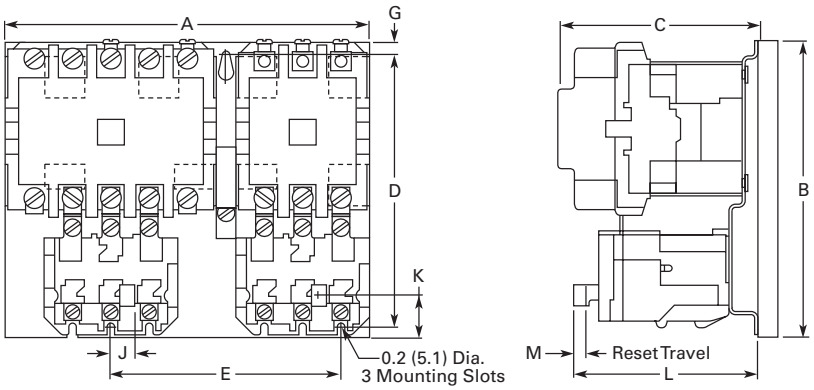


Figure B—Sizes 2



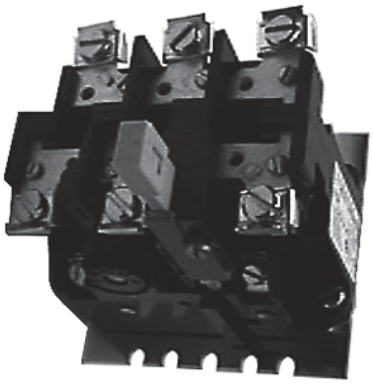
Dimensions and Shipping Weights

NEMA Size	Number of Poles	Fig.	Mounting Screws No.	Mounting Screws Size	A	B	C	D	E	F	G	J	K	L	M	N	P	R	Weight, Lbs (kg)
00, 0, 1	3 x 3 Horiz.	A	3	#10	7.13 (181.1)	6.50 (165.1)	5.05 (128.3)	6.00 (152.4)	5.69 (144.5)	3.56 (90.4)	0.25 (6.4)	2.30 (58.4)	0.33 (8.4)	4.92 (125.0)	0.27 (6.9)	3.81 (96.8)	—	2.91 (73.9)	10.0 (4.5)
	5 x 3 Horiz.	B	3	#10	8.00 (203.2)	6.50 (165.1)	5.05 (128.3)	6.00 (152.4)	6.53 (165.9)	3.56 (90.4)	0.25 (6.4)	2.30 (58.4)	0.48 (12.2)	4.92 (125.0)	0.27 (6.9)	4.66 (118.4)	—	2.91 (73.9)	11.0 (5.0)
2	3 x 3 Horiz.	A	3	#10	7.13 (181.1)	7.25 (184.2)	5.38 (136.7)	6.75 (171.5)	5.69 (144.5)	3.56 (90.4)	0.25 (6.4)	2.69 (68.3)	0.69 (17.5)	4.97 (126.2)	0.27 (6.9)	3.81 (96.8)	—	2.91 (73.9)	11.0 (5.0)
	5 x 3 Horiz.	B	3	#10	8.88 (225.6)	7.25 (184.2)	5.38 (136.7)	6.75 (171.5)	6.56 (166.6)	3.56 (90.4)	0.25 (6.4)	2.69 (68.3)	0.69 (17.5)	4.97 (126.2)	0.27 (6.9)	4.66 (118.4)	—	2.84 (72.1)	13.0 (5.9)
3, 4	3 x 3 Horiz.	A	3	1/4 in.	9.75 (247.7)	10.13 (257.3)	7.25 (184.2)	9.25 (235.0)	8.00 (203.2)	4.88 (124.0)	0.44 (11.2)	3.11 (79.0)	0.80 (20.3)	6.86 (174.2)	0.27 (6.9)	5.13 (130.3)	—	4.00 (101.6)	28.0 (12.7)
	5 x 3 Horiz.	B	3	1/4 in.	12.38 (314.5)	10.13 (257.3)	7.25 (184.2)	9.25 (235.0)	9.31 (236.5)	4.88 (124.0)	0.44 (11.2)	3.11 (79.0)	0.80 (20.3)	6.86 (174.2)	0.27 (6.9)	6.44 (163.6)	—	4.00 (101.6)	33.5 (15.2)
5	①	①	①	①	①	①	①	①	①	①	①	①	①	①	①	①	①	①	①
6	①	①	①	①	①	①	①	①	①	①	①	①	①	①	①	①	①	①	①

Notes

Three-pole x three-pole devices are for Wye-Wye two-winding motors only.

① Refer to factory.



Contents

Description	*Page*
Contactors—Non-Reversing and Reversing	**V5-T2-97**
Starters—Non-Reversing and Reversing	**V5-T2-103**
Relays—Thermal and Fast Trip	
Standards and Certifications	**V5-T2-125**
Instruction Leaflets	**V5-T2-125**
Thermal Type B, Class 20, Manual Reset	**V5-T2-126**
Thermal Type A, Class 20, Auto/Manual Reset	**V5-T2-129**
Type FT Fast Trip, Class 10	**V5-T2-132**
Heater Selection	**V5-T2-135**
Relays—Current Sensing Protective	**V5-T2-137**

Relays—Thermal and Fast Trip

Product Overview

Type B and Type A, Class 20 Thermal Overload Relays from Eaton's Electrical Sector will protect the motor against abnormal overload conditions. Bimetallic actuated, they are available as either ambient compensated or non-compensated in either single-pole or block type three-pole design. Type B use one pole of the three-pole block for single-phase.

Single-pole relays are also available as Fast Trip Class 10 ambient compensated type, which provides approximately 125% motor protection with a tripping time of less than 10 seconds, at 600% of heater current rating.

Fast trip relays can be identified by the green reset rods. They are available for panel or starter mounting. The three-pole fast trip design is composed of three single-pole relays on a common baseplate, with a common reset bar.

The bimetal element is actuated by precisely calibrated heater elements which are connected directly in the circuit to be protected. Thermal actuation of this device opens the contacts in the coil circuit of a contactor or relay which results in the disconnection of power to the overloaded circuit.

Interchangeable thermal heater elements for single-pole standard trip and block type overload relays are available to cover motor full load currents from 0.29 to 133A in approximately 10% steps (see Heater Application Table). Fast trip overload relays do not have interchangeable heater elements but are available in a series of ratings to cover motor full load currents from 1.6 to 150A in approximately 50% steps.

Features

Manual or Automatic Reset

Type B is furnished with a manual reset. Type A is normally furnished set for manual reset operation and may be quickly adjusted for automatic reset when required. Automatic reset should not be used with two-wire control or where automatic restarting would endanger either personnel or equipment.

Trip Indication

An immediate visible indication of trip is provided on the overload relay. When an overload occurs, which causes the relay to operate, a trip indicator projects out and thus shows positive visual indication of trip. Type B has a mechanical trip bar to manually check the NC contact operation on the overload relay.

Adjustable Trip

On Type A, the trip rating of a specific heater element can be adjusted over a range of approximately 85% to 115% of its respective rating to permit the desired close protection.

This is accomplished by turning the adjusting knob on the relay to the respective stop position.

Positive Contact Break

A follow-through contact, provided on the stationary terminal of the snap action control switch, provides reliable electrical continuity during toggling, thus eliminating false trip sometimes prevalent with thermally operated switches. This contact also allows contact wipe for further reliability.

Ambient Compensation

Motor overload protection can be provided with the same trip characteristics in ambient temperature from –40° to 77°C (–40° to 167°F). A compensating bimetal maintains a constant "travel to trip" distance independent of ambient conditions. The compensating feature is fully automatic and no adjustments are required over wide fluctuations in ambient temperatures. Compensated relays are identified by black reset rods on Type A and light gray reset rods on Type B, while non-compensated relays use red reset rods. AA three-pole units have gray reset rods. AA one-pole units have black reset rods.

Control Contact

Single-pole and block type relays are supplied as standard with a SPST NC control contact. A SPDT NO-NC with common is available as a factory modification on Type A. An isolated NO contact can be supplied on Type B as either a factory modification or as a field kit.

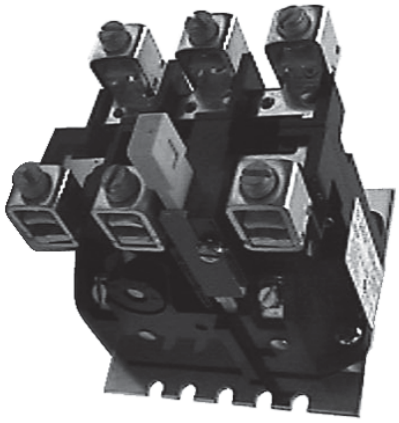
Standards and Certifications

- UL 508
- CSA
- ANSI/NEMA ICS 2-222

Instruction Leaflets

14885B	Fast Trip A Sizes 0–4, 3-Pole OL Relay
14567E	Type A Sizes 1–2, 1-Pole OL Relay Mod A
14568	Type A Sizes 1–2, 3-Pole OL Relay Mod J
14570D	Type A Sizes 3–4, 3-Pole OL Relay Mod J
14569C	Type A Sizes 3–4, 1-Pole OL Relay Mod A
17093A	Type B OLR for Sizes 7, 8 and 9 Contactors
16955A	Type B Sizes 1–2, 1-Pole OL Relay
16954A	Type B Sizes 1–2, 3-Pole OL Relay
15392B	Type B Sizes 3–4, 3-Pole OL Relay
13676F	Fast Trip Sizes 0–4, 1-Pole OL Relay

Thermal Type B, Class 20, Manual Reset



Contents

Description	*Page*
Contactors—Non-Reversing and Reversing	**V5-T2-97**
Starters—Non-Reversing and Reversing	**V5-T2-103**
Relays—Thermal and Fast Trip	**V5-T2-124**
Thermal Type B, Class 20, Manual Reset	
Product Selection	**V5-T2-127**
Accessories	**V5-T2-127**
Technical Data	**V5-T2-128**
Dimensions	**V5-T2-128**
Thermal Type A, Class 20, Auto/Manual Reset	**V5-T2-129**
Type FT Fast Trip, Class 10	**V5-T2-132**
Heater Selection	**V5-T2-135**
Relays—Current Sensing Protective	**V5-T2-137**

Thermal Type B, Class 20, Manual Reset

Application Description

The Type B overload relay is designed to protect industrial motors against overload conditions. Using modern block type, bimetallic design, this relay will provide Class 20 operation in either single-phase or three-phase applications.

Operation

The Type B overload relay is a bimetallic actuated device. The bimetal elements are operated by precisely calibrated heaters. The heater elements are connected either directly in the circuit to be measured, or through current transformers on applications NEMA Size 5 and larger.

As the bimetals are heated by motor current flow, a deflection force is produced. Upon a sustained level of abnormal current flow, the deflection becomes great enough to open the snap-action output contact.

Ambient Compensation

The Type B ambient compensated design is supplied as standard on all A200 starters. This design uses a second compensating bimetal responsive to ambient air temperature in the surrounding enclosure. This feature reduces nuisance tripping in applications using compact control panels and motor control centers where internal temperature rise is significant compared to motor ambient temperature. The compensating characteristic is maintained in ambient temperatures from 40° to 77°C.

Features

- Ambient compensation standard
- Alarm contact field mountable
- Class 20—600V design
- Inverse time delay trip
- Test trip device for weld check
- Hi-visibility up-front trip indication
- Trip-free reset mechanism

Product Selection

Heaters

Enter heaters as separate item by listing catalog number from tables, **Pages V5-T2-135** and **V5-T2-136**, as required per starter.

Relays

Type B Overload Relay Panel Mounting



Thermal Type B Overload Relay

Motor Full Load Amps	Panel Mounted Ambient Comp. Catalog Number	Panel Mounted Non-Comp. Catalog Number	Starter Mounted Replacement for Type B Overload Relays Ambient Comp. Catalog Number	Starter Mounted Replacement for Type B Overload Relays Non-Comp. Catalog Number	Replacement for Type A Overload Relays in Manual Reset Mode (Three-Pole Only) ① Ambient Comp. Catalog Number	Replacement for Type A Overload Relays in Manual Reset Mode (Three-Pole Only) ① Non-Comp. Catalog Number
Single-Pole (One NC Contact)						
0.25–26.2	**BA11JP**	**BN11JP**	**BA11A**	**BN11A**	—	—
26.3–45	**BA21JP**	**BN21JP**	**BA21A**	**BN21A**	—	—
19–90	Use three-pole design, wire three poles in series	Use three-pole design, wire three poles in series	Use three-pole design, wire three poles in series	Use three-pole design, wire three poles in series	Use three-pole design, wire three poles in series	Use three-pole design, wire three poles in series
19–135	Use three-pole design, wire three poles in series	Use three-pole design, wire three poles in series	Use three-pole design, wire three poles in series	Use three-pole design, wire three poles in series	Use three-pole design, wire three poles in series	Use three-pole design, wire three poles in series
Three-Pole (One NC Contact)						
0.25–26.2	**BA13JP**	**BN13JP**	**BA13A** ②	**BN13A** ②	**BA13J**	**BN13J**
26.3–45	**BA23JP**	**BN23JP**	**BA23A**	**BN23A**	**BA23J**	**BN23J**
19–90	**BA33P**	**BN33P**	**BA33A**	**BN33A**	**BA33A**	**BN33A**
19–135	**BA43P**	**BN43P**	**BA43A**	**BN43A**	**BA43A**	**BN43A**

Accessories

Alarm Contact Kit Selection ①

Type B Overload Relay Size	Catalog Number
1, 2	**B3NO-2**
3, 4	**B3NO-4**

Notes

① Includes contactor mounting bracket, overload relay and connection straps to contactor.

② For replacement on B200 size 00, 0, 1 use BA23A instead of BA13A and use BN23A instead of BN13A.

Technical Data

2

Control Contact Ratings—NEMA B600 NO and NC Control Contact Rating

AC Volts	Make	Break
24–120	30A	3A
120–600	3600 VA	360 VA

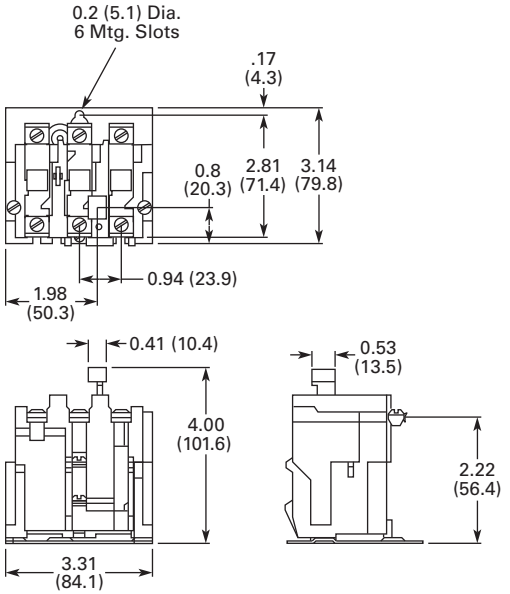
Dimensions

Approximate Dimensions in Inches (mm)

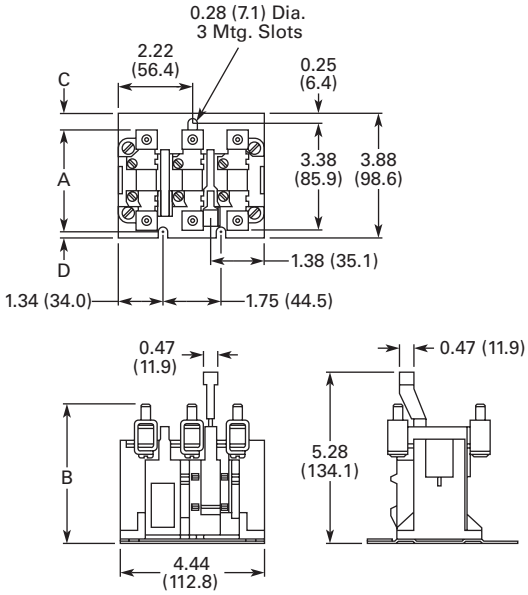
Not to be used for construction purposes unless approved.

Thermal Type B Overload Relays

Sizes 1 and 2—Three-Pole, Panel Mounted



Sizes 3 and 4—Three-Pole, Panel Mounted



Dimensions

Relay Size	A	B	C	D
3	3.13 (79.5)	4.06 (103.1)	044 (11.2)	0.31 (7.9)
4	3.38 (85.9)	4.38 (111.3)	0.31 (7.9)	0.19 (4.8)

Note

① Alarm contact available as factory modification of field mountable. For factory modification, add suffix B.

Thermal Type A, Class 20, Auto/Manual Reset



Contents

Description	*Page*
Contactors—Non-Reversing and Reversing	**V5-T2-97**
Starters—Non-Reversing and Reversing	**V5-T2-103**
Relays—Thermal and Fast Trip	**V5-T2-124**
Thermal Type B, Class 20, Manual Reset	**V5-T2-126**
Thermal Type A, Class 20, Auto/Manual Reset	
Product Selection	**V5-T2-130**
Technical Data and Specifications	**V5-T2-130**
Dimensions	**V5-T2-131**
Type FT Fast Trip, Class 10	**V5-T2-132**
Heater Selection	**V5-T2-135**
Relays—Current Sensing Protective	**V5-T2-137**

Thermal Type A, Class 20, Auto/Manual Reset

Application Description

The Type A overload relay is designed to protect industrial motors against overload conditions. Using modern block type, bimetallic design, this relay will provide Class 20 operation in either single- or three-phase applications.

Features

- Field selectable manual/auto reset
- Alarm contact factory available
- Class 20—600V design
- Inverse time delay trip
- Adjustable trip rating ±15%
- Color coded reset rod:
  - Compensated (gray)
  - Non-compensated (red)

Operation

The Type A overload relay is a bimetallic actuated device. The bimetal elements are operated by precisely calibrated heaters. The heater elements are connected either directly in the circuit to be measured, or through current transformers on applications NEMA Size 5 and larger.

As the bimetals are heated by motor current flow, a deflection force is produced. Upon a sustained level of abnormal current flow, the deflection becomes great enough to open the snap-action output contact.

Automatic Reset

The Type A overload relay can be supplied as an option on all A200 starters to provide automatic reset operation. The overload relay is always shipped in the non-automatic mode. To set up auto operation, reposition the reset rod by loosening and re-tightening a hold-down clamp at the base of overload relay.

Product Selection

Heaters

Enter heaters as separate item by listing catalog number from tables, **Pages V5-T2-135** and **V5-T2-136**, as required per starter.

Relays

Type A Overload Relay Single-Pole Panel Mounting



Thermal Type A Overload Relay ①

Motor Full Load Amps	Panel Mounted Ambient Comp. Catalog Number	Panel Mounted Non-Comp. Catalog Number	Starter Replacement Ambient Comp. Catalog Number	Starter Replacement Non-Comp. Catalog Number
Single-Pole (One NC Contact)				
0.25–26.2	**AA11P**	**AN11P**	**AA11A**	**AN11A**
26.3–45	**AA21P**	**AN21P**	**AA21A**	**AN21A**
19–90	**AA31P**	**AN31P**	**AA31A**	**AN31A**
19–135	**AA41P**	**AN41P**	**AA41A**	**AN41A**
Three-Pole (One NC Contact)				
0.25–26.2	**AA13P** ②	**AN13P** ②	**AA13A** ②	**AN13A** ②
26.3–45	**AA23P** ②	**AN23P** ②	**AA23A** ②	**AN23A** ②
19–90	**AA33P** ②	**AN33P** ②	**AA33A** ②	**AN33A** ②
19–135	**AA43P** ②	**AN43P** ②	**AA43A** ②	**AN43A** ②

Technical Data and Specifications

Control Contact Ratings

AC Volts	Normally Closed Make	Normally Closed Break	Normally Open Make	Normally Open Break
Three-Pole Control Contact Ratings				
24–120	20A	2A	0.5A	0.5A
120–600	2400 VA	240 VA	600 VA	60 VA
Single-Pole Control Contact Ratings				
24–120	30A	3A	10A	1A
120–600	3600 VA	360 VA	1200 VA	120 VA

Notes

① For alarm contact (Form C), add Suffix **B**. Available only as factory modification on Type A relay.

② Three-pole Type B overload relay is a suitable alternative to a three-pole Type A overload relay in manual reset mode. For example, BA13JP for AA13P, BN23J for AN23A, and so on. (See **Page V5-T2-127**.)

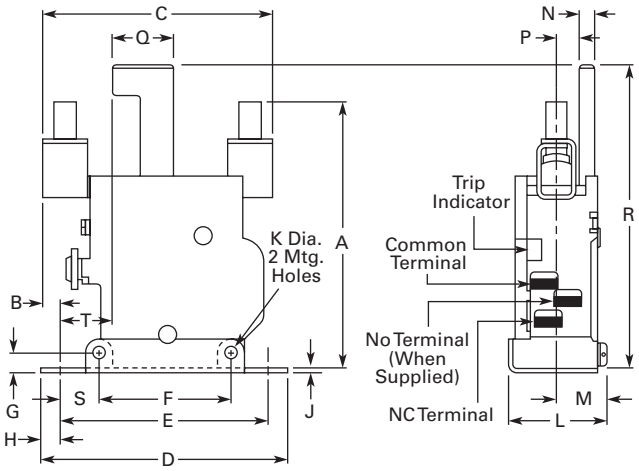
Dimensions

Approximate Dimensions in Inches (mm)

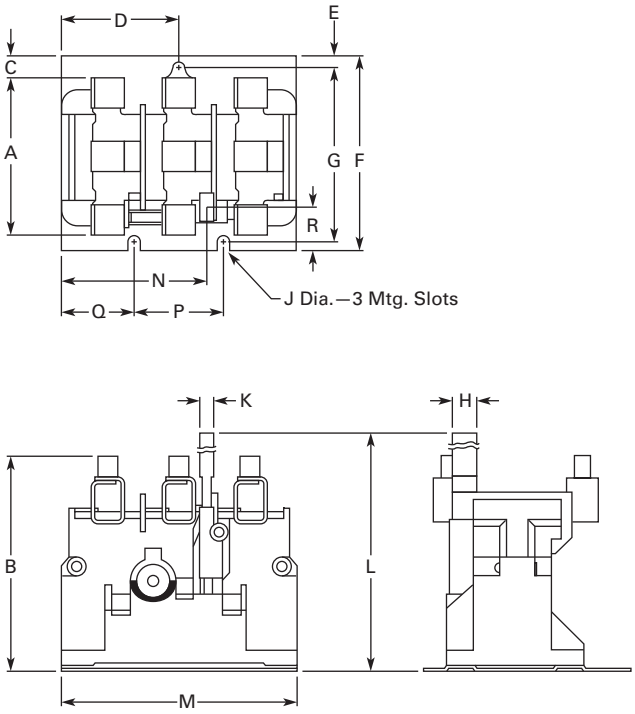
Not to be used for construction purposes unless approved.

Type A

Single-Pole (Sizes 4 Shown)



Three-Pole (Size 4 Shown)



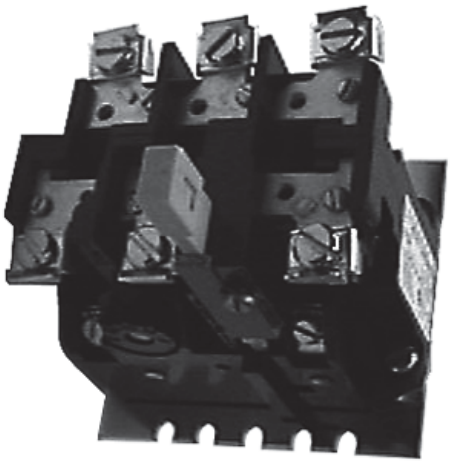
Dimensions

Dimension	Relay Size 1	2	3	4
A	2.72 (69.1)	3.48 (88.4)	4.19 (106.4)	4.5 (114.3)
B	0.94 (23.9)	0.67 (17.0)	0.25 (6.4)	0.38 (9.7)
C	2.75 (69.9)	3.5 (88.9)	3.53 (89.7)	3.78 (96.0)
D	3.25 (82.6)	3.25 (82.6)	4.13 (104.9)	4.13 (104.9)
E	2.63 (66.8)	2.63 (66.8)	3.38 (85.9)	3.38 (85.9)
F	1.34 (34.0)	1.34 (34.0)	2.19 (55.6)	2.19 (55.6)
G	0.25 (6.4)	0.25 (6.4)	0.28 (7.1)	0.28 (7.1)
H	0.31 (7.9)	0.31 (7.9)	0.38 (9.7)	0.38 (9.7)
J	0.06 (1.5)	0.06 (1.5)	0.06 (1.5)	0.06 (1.5)
K	0.22 (5.6)	0.22 (5.6)	0.27 (6.8)	0.27 (6.8)
L	1.34 (34.0)	1.34 (34.0)	1.69 (42.9)	1.69 (42.9)
M	0.66 (16.8)	0.66 (16.8)	0.88 (22.4)	0.88 (22.4)
N	0.16 (4.1)	0.16 (4.1)	0.27 (6.8)	0.27 (6.8)
P	0.22 (5.6)	0.22 (5.6)	0.34 (8.6)	0.34 (8.6)
Q	0.06 (1.5)	0.06 (1.5)	0.69 (17.5)	0.69 (17.5)
R	4.00 (101.6)	4.00 (101.6)	5.19 (131.8)	5.19 (131.8)
S	0.47 (11.9)	0.47 (11.9)	0.59 (15.0)	0.59 (15.0)
T	1.11 (28.2)	1.11 (28.2)	0.69 (17.5)	0.69 (17.5)

Dimensions

Dimension	Relay Size 1	2	3	4
A	2.38 (60.5)	2.44 (62.0)	3.13 (79.5)	3.38 (85.9)
B	3.13 (79.5)	3.17 (80.5)	4.06 (103.1)	4.38 (111.3)
C	0.36 (9.1)	0.33 (8.4)	0.44 (11.2)	0.31 (7.9)
D	1.66 (42.2)	1.66 (42.2)	2.22 (56.4)	2.22 (56.4)
E	0.17 (4.3)	0.17 (4.3)	0.25 (6.4)	0.25 (6.4)
F	2.81 (71.4)	2.81 (71.4)	3.38 (85.9)	3.38 (85.9)
G	3.08 (78.2)	3.08 (78.2)	3.88 (98.6)	3.88 (98.6)
H	0.47 (11.9)	0.47 (11.9)	0.47 (11.9)	0.47 (11.9)
J	0.20 (5.1)	0.20 (5.1)	0.28 (7.1)	0.28 (7.1)
K	0.28 (7.1)	0.28 (7.1)	0.47 (11.9)	0.47 (11.9)
L	4.00 (101.6)	4.00 (101.6)	5.28 (134.1)	5.28 (134.1)
M	3.31 (84.1)	3.31 (84.1)	4.44 (112.8)	4.44 (112.8)
N	1.80 (45.7)	1.80 (45.7)	2.77 (70.4)	2.77 (70.4)
P	1.89 (48.0)	1.89 (48.0)	1.75 (44.5)	1.75 (44.5)
Q	1.00 (25.4)	1.00 (25.4)	1.34 (34.0)	1.34 (34.0)
R	—	—	1.03 (26.2)	1.03 (26.2)

Type FT Fast Trip, Class 10



Contents

Description	*Page*
Contactors—Non-Reversing and Reversing	**V5-T2-97**
Starters—Non-Reversing and Reversing	**V5-T2-103**
Relays—Thermal and Fast Trip	**V5-T2-124**
Thermal Type B, Class 20, Manual Reset	**V5-T2-126**
Thermal Type A, Class 20, Auto/Manual Reset	**V5-T2-129**
Type FT Fast Trip, Class 10	
Product Selection	**V5-T2-133**
Technical Data and Specifications	**V5-T2-133**
Dimensions	**V5-T2-134**
Heater Selection	**V5-T2-135**
Relays—Current Sensing Protective	**V5-T2-137**

Type FT Fast Trip, Class 10

Application Description

The Type FT overload relay is designed to protect special purpose motors having restricted thermal and locked rotor capabilities. Using modern block type, bimetallic design, this relay will provide Class 10 operation in single- or three-phase applications.

Operation

The Type FT overload relay is a bimetallic actuated device. The bimetal elements are operated directly from line current, thus separate calibrating heater elements are not utilized. The overload relay may be wired directly in the motor circuit, or through-current transformers on applications larger than 150A.

As the bimetals are heated by motor current flow, a deflection force is produced. Upon a sustained level of abnormal current flow, the deflection becomes great enough to open the snap action output contact.

Features

- Class 10—600V design
- Inverse time delay trip
- Color coded reset rod—green
- Alarm contact factory available
- Field selectable manual/auto reset
- Adjustable trip rating ±20%
- Ambient compensation included

Product Selection

Type FT Single-Pole



Type FT Single-Pole (One NC Contact); Three-Phase (Three NC Contacts in Series) ①

Motor Full Load Amperes	Panel Mounted Single-Pole Catalog Number	Three-Pole Catalog Number	Starter Replacement NEMA Size	Single-Pole Catalog Number
0.76–1.1	**FT11P-1.1**	**FT13P-1.1**	—	**FT11A-1.1**
1.1–1.6	**FT11P-1.6**	**FT13P-1.6**	—	**FT11A-1.6**
1.6–2.4	**FT11P-2.4**	**FT13P-2.4**	0, 1	**FT11A-2.4**
2.4–3.6	**FT11P-3.6**	**FT13P-3.6**	0, 1	**FT11A-3.6**
3.6–5.4	**FT11P-5.4**	**FT13P-5.4**	0, 1	**FT11A-5.4**
5.4–8.0	**FT11P-8.0**	**FT13P-8**	0, 1	**FT11A-8**
8.0–12	**FT11P-12**	**FT13P-12**	0, 1	**FT11A-12**
12–18	**FT11P-18**	**FT13P-18**	1	**FT11A-18**
16–24	—	**FT13P-24**		—
22–32	**FT11P-32**	**FT13P-32**	0, 1	**FT11A-32**
24–36	**FT21P-36**	**FT23P-36**	2	**FT21A-36**
36–54	**FT21P-54**	**FT23P-54**	12	**FT21A-54**
22–32	**FT31P-32**	**FT33P-32**	3	**FT31A-32**
32–48	**FT31P-48**	**FT33P-48**	3	**FT31A-48**
48–72	**FT31P-72**	**FT33P-72**	3	**FT31A-72**
72–110	**FT41P-110**	**FT43P-110**	4	**FT41A-110**
100–150	**FT41P-150**	**FT43P-150**	4	**FT41A-150**

Technical Data and Specifications

Control Contact Ratings

AC Volts	Normally Closed Make	Normally Closed Break	Normally Open Make	Normally Open Break
24–120	30A	3A	10A	1A
120–600	3600 VA	360 VA	1200 VA	120 VA

Note

① Single-pole (1NO-NC contact): add suffix **B**. Three-pole (3NO-NC contacts): add suffix **B**. Example: FT13P**B**-12.

Dimensions

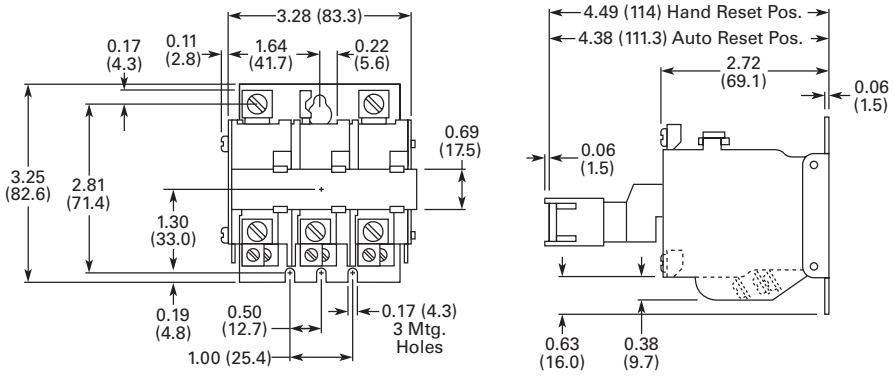
Approximate Dimensions in Inches (mm)

2

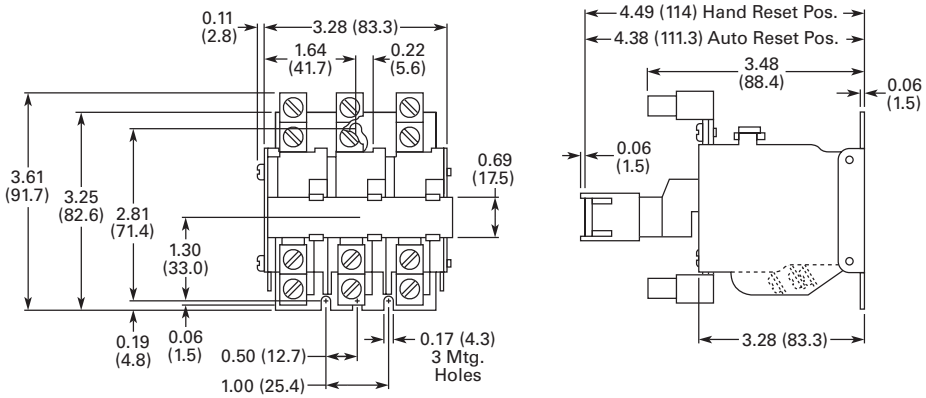
Not to be used for construction purposes unless approved.

Type FT Overload Relays

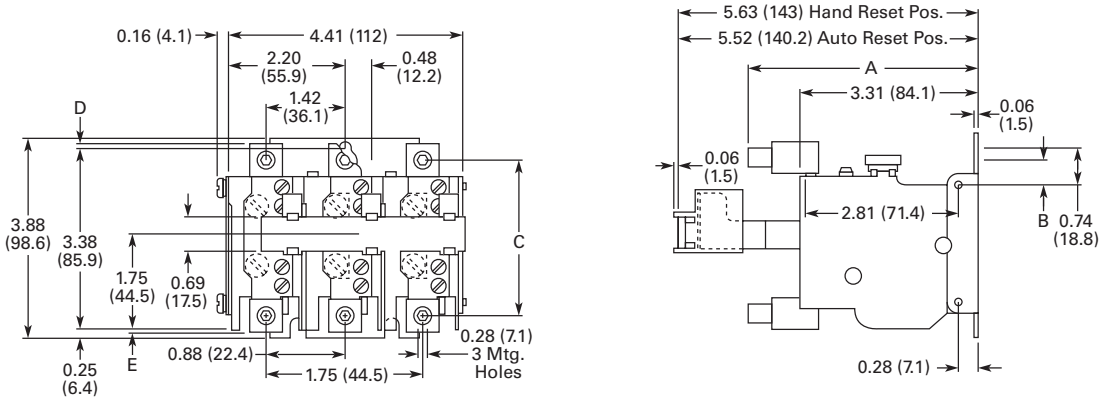
Three-Pole, Size 1



Three-Pole, Size 2



Three-Pole, Sizes 3, 4



Dimensions

Relay Size	A	B	C	D	E
3	4.25 (108.0)	0.53 (13.5)	2.91 (73.9)	0.09 (2.3)	0.06 (1.5)
4	4.50 (114.3)	0.59 (15.0)	3.03 (77.0)	0.22 (5.6)	0.19 (4.8)

Heater Selection

General Information on Heater Coil Selection

For maximum motor protection and compliance with Article 430-32 of the National Electrical Code, select heater coils from the tables in this section on the basis of motor nameplate full load current.

When the full load current is unknown, selection may be made on the basis of average full load currents as shown on **Pages V5-T2-151** and **V5-T2-152**. **Caution—The average ratings could be high or low for a specific motor and therefore selection on this basis always involves risk. For fully reliable motor protection, select heater coils on the basis of full load current rating as shown on the motor nameplate.**

Heater coils are rated to protect 40°C rise motors, and open and drip-proof motors having a **service factor of 1.15** where the motor and the controller are at the same ambient temperature.

For other conditions:

1. For 50°C, 55°C, 75°C rise motors and **enclosed motors having a service factor of 1.0, select one size smaller coil.**
2. Ambient temperature of controller lower than motor by 26°C (47°F), use one size smaller coil.
3. Ambient temperature of controller higher than motor by 26°C (47°F), use one size larger coil.

Ultimate tripping current of heater coils is approximately 1.25 times the minimum current rating listed in the tables.

Type A and B Overload Relays, Sizes 3 and 4

Size Starter	Ambient Compensated Enclosed Starters All Applications Full Load Current of Motor Amps	Non-Compensating Enclosed Starters	Heater (One Heater per Catalog Number) Catalog Number
For Size 4 Starters	12.8–14.1	11.9–13.0	**FH68**
	14.2–15.5	13.1–14.3	**FH69**
	15.6–17.1	14.4–15.9	**FH70**
	17.2–18.9	16.0–17.4	**FH71**
	19.0–20.8	17.5–19.1	**FH72**
For Size 3 Starters	20.9–22.9	19.2–21.1	**FH73**
	23.0–25.2	21.2–23.2	**FH74**
	25.3–27.8	23.3–25.6	**FH75**
	27.9–30.6	25.7–28.1	**FH76**
	30.7–33.5	28.2–30.8	**FH77**
	33.6–37.5	30.9–34.5	**FH78**
	37.6–41.5	34.6–38.2	**FH79**
	41.6–56.3	38.3–42.6	**FH80**
	46.4–50	42.7–46	**FH81**
	51–55	47–51	**FH82**
	56–61	52–56	**FH83**
	62–66	57–61	**FH84**
	67–73	62–67	**FH85**
	74–78	68–72	**FH86**
	79–84	73–77	**FH87**
	85–92	78–84	**FH88**
	93–101	85–91	**FH89**
	102–110	92–99	**FH90**
	111–122	100–110	**FH91**
	123–129	111–122	**FH92**
	130–133	123–128	**FH93**
	—	129–133	**FH94**

Type A and B Overload Relays, Sizes 5 and 6 ①

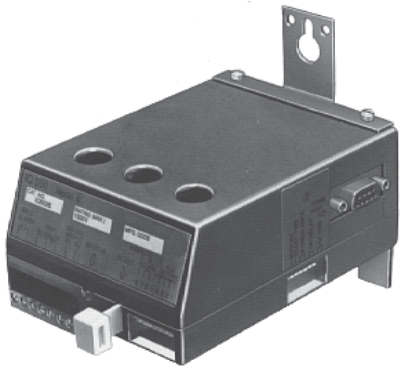
Compensated Overload Relay Open Starter Full Load Current of Motor (Amps)	Enclosed Starter	Heater (One Heater per Catalog Number) Catalog Number
Size 5 (with 300/5 Current Transformers)		
—	—	**FH23**
118–129	118–129	**FH24**
130–141	130–141	**FH25**
142–155	142–155	**FH26**
156–170	156–170	**FH27**
171–187	171–187	**FH28**
188–205	188–205	**FH29**
206–224	206–224	**FH30**
225–244	225–244	**FH31**
245–263	245–263	**FH32**
264–292	264–292	**FH33**
293–300	—	**FH34**
Size 6 (with 600/5 Current Transformers)		
—	—	**FH23**
236–259	236–259	**FH24**
260–283	260–283	**FH25**
284–310	284–310	**FH26**
311–340	311–340	**FH27**
341–374	341–374	**FH28**
375–411	375–411	**FH29**
412–448	412–448	**FH30**
449–489	449–489	**FH31**
490–527	490–527	**FH32**
528–585	528–540	**FH33**
586–600	—	**FH34**

Note

① Size 7 and larger—advise full load current.

Type A and B Overload Relays, Sizes 0, 1 and 2

Size Starter	Non-Compensated Open Starters and Ambient Comp. Open and Enclosed Starters: Block Type Overload sing Three Heaters	Non-Compensated Open Starters and Ambient Comp. Open and Enclosed Starters: Single-Pole Type Overload	Heater (One Heater per Catalog Number) Catalog Number	Non-Compensating Enclosed Starters: Block Type Overload Using Three Heaters	Non-Compensating Enclosed Starters: Single-Pole Type Overload	Heater Catalog Number
Full Load Current of Motor (Amps)						
For Size 0 Starters	0.25–0.27	0.29–0.31	**FH03**	0.24–0.25	0.28–0.30	**FH03**
	0.28–0.31	0.32–0.35	**FH04**	0.26–0.28	0.31–0.34	**FH04**
	0.32–0.34	0.36–0.39	**FH05**	0.29–0.31	0.35–0.37	**FH05**
	0.35–0.38	0.40–0.43	**FH06**	0.32–0.35	0.38–0.42	**FH06**
	0.39–0.42	0.44–0.48	**FH07**	0.36–0.39	0.43–0.47	**FH07**
	0.43–0.46	0.49–.053	**FH08**	0.40–0.43	0.48–0.52	**FH08**
	0.47–0.50	0.54–0.58	**FH09**	0.44–0.47	0.53–0.56	**FH09**
	0.51–0.55	0.59–0.64	**FH10**	0.48–0.51	0.57–0.63	**FH10**
	0.56–0.62	0.65–0.71	**FH11**	0.52–0.57	0.64–0.70	**FH11**
	0.63–0.68	0.72–0.79	**FH12**	0.58–0.63	0.71–0.77	**FH12**
	0.69–0.75	0.80–0.87	**FH13**	0.64–0.70	0.78–0.85	**FH13**
	0.76–0.83	0.88–0.96	**FH14**	0.71–0.77	0.86–0.94	**FH14**
	0.84–0.91	0.97–1.06	**FH15**	0.78–0.85	0.95–1.03	**FH15**
	0.92–1.00	1.07–1.16	**FH16**	0.86–0.93	1.04–1.13	**FH16**
	1.01–1.11	1.17–1.28	**FH17**	0.94–1.03	1.14–1.25	**FH17**
	1.12–1.22	1.29–1.41	**FH18**	1.04–1.13	1.26–1.38	**FH18**
	1.23–1.34	1.42–1.55	**FH19**	1.14–1.25	1.39–1.52	**FH19**
	1.35–1.47	1.56–1.71	**FH20**	1.26–1.37	1.53–1.67	**FH20**
	1.48–1.62	1.72–1.87	**FH21**	1.38–1.51	1.68–1.83	**FH21**
	1.63–1.78	1.88–2.06	**FH22**	1.52–1.65	1.84–2.01	**FH22**
	1.79–1.95	2.07–2.26	**FH23**	1.66–1.81	2.02–2.21	**FH23**
	1.96–2.15	2.27–2.48	**FH24**	1.82–1.99	2.22–2.43	**FH24**
	2.16–2.35	2.49–2.72	**FH25**	2.00–2.19	2.44–2.66	**FH25**
	2.36–2.58	2.73–2.99	**FH26**	2.20–2.39	2.67–2.92	**FH26**
	2.59–2.83	3.00–3.28	**FH27**	2.40–2.63	2.93–3.21	**FH27**
	2.84–3.11	3.29–3.60	**FH28**	2.64–2.89	3.22–3.53	**FH28**
	3.12–3.42	3.61–3.95	**FH29**	2.90–3.17	3.54–3.87	**FH29**
	3.43–3.73	3.96–4.31	**FH30**	3.18–3.47	3.88–4.22	**FH30**
	3.74–4.07	4.32–4.71	**FH31**	3.48–3.79	4.23–4.61	**FH31**
	4.08–4.39	4.72–5.14	**FH32**	3.80–4.11	4.62–4.9	**FH32**
	4.40–4.87	5.15–5.6	**FH33**	4.12–4.55	5.0–5.5	**FH33**
	4.88–5.3	5.7–6.2	**FH34**	4.56–5.0	5.6–6.0	**FH34**
	5.4–5.9	6.3–6.8	**FH35**	5.1–5.5	6.1–6.6	**FH35**
	6.0–6.4	6.9–7.5	**FH36**	5.6–5.9	6.7–7.3	**FH36**
	6.5–7.1	7.6–8.2	**FH37**	6.0–6.6	7.4–8.0	**FH37**
	7.2–.78	8.3–9.0	**FH38**	6.7–7.2	8.1–8.7	**FH38**
	7.9–8.5	9.1–9.9	**FH39**	7.3–7.9	8.8–9.7	**FH39**
	8.6–9.4	10.0–10.8	**FH40**	8.0–8.7	9.8–10.5	**FH40**
	9.5–10.3	10.9–11.9	**FH41**	8.8–9.5	10.6–11.7	**FH41**
	10.4–11.3	12.0–13.1	**FH42**	9.6–10.5	11.8–12.7	**FH42**
	11.4–12.4	13.2–14.3	**FH43**	10.6–11.5	12.8–14.0	**FH43**
	12.5–13.5	14.4–15.7	**FH44**	11.6–12.6	14.1–15.3	**FH44**
	13.6–14.9	15.8–17.2	**FH45**	12.7–13.8	15.4–16.6	**FH45**
	15.0–16.3	17.3–18.9	**FH46**	13.9–15.1	16.7–18.3	**FH46**
	16.4–18.0	19.0–20.8	**FH47**	15.2–16.7	18.4–20.0	**FH47**
For Size 1 Starters	18.1–19.8	20.9–22.9	**FH48**	16.8–18.3	20.1–21.9	**FH48**
	19.9–21.7	23.0–25.2	**FH49**	18.4–20.2	22.0–23.9	**FH49**
	21.8–23.9	25.3–27.6	**FH50**	20.3–22.2	24.0–26.2	**FH50**
	24.0–26.2	27.7–30.3	**FH51**	22.3–24.3	26.3–28.8	**FH51**
	26.3–28.7	30.4–33.3	**FH52**	24.4–26.6	28.9–31.4	**FH52**
For Size 2 Starters	28.8–31.4	33.4–36.4	**FH53**	26.7–29.1	31.5–34.5	**FH53**
	31.5–34.5	36.5–39.9	**FH54**	29.2–32.0	34.6–37.9	**FH54**
	34.6–37.9	40.0–43.9	**FH55**	32.1–35.2	3.80–41.9	**FH55**
	38.0–41.5		**FH56**	35.3–38.5	42.0–45.0	**FH56**
	41.6–45.0		**FH57**	38.6–42.3		**FH57**



Contents

Description	*Page*
Contactors—Non-Reversing and Reversing	**V5-T2-97**
Starters—Non-Reversing and Reversing	**V5-T2-103**
Relays—Thermal and Fast Trip	**V5-T2-124**
Thermal Type B, Class 20, Manual Reset	**V5-T2-126**
Thermal Type A, Class 20, Auto/Manual Reset	**V5-T2-129**
Type FT Fast Trip, Class 10	**V5-T2-132**
Heater Selection	**V5-T2-135**
Relays—Current Sensing Protective	
Features	**V5-T2-138**
Standards and Certifications	**V5-T2-138**
Product Selection	**V5-T2-138**
Dimensions	**V5-T2-139**

Relays—Current Sensing Protective

Product Description

The IQ500 is a heaterless, current-sensing, solid-state motor protective relay with optional communications capabilities. Several functions are incorporated into the base relay (IQ502/IQ504) as standard:

- Overload (overcurrent) protection
- Phase unbalance and phase loss protection
- Ground current protection (Class II)

The base relay can serve as the initial building block for a motor protection system by adding the IQ500M Special Function Module. The module can address application related motor load functions with the additional features:

- Underload protection
- Long acceleration
- Jam protection
- Load control

The IQ500 can provide a cost-effective alternative to conventional protective relays such as current relays, ground fault relays and phase loss or phase unbalance relays. Used with the PowerNet system, a low-cost, local area communication network, information such as current values, status, setpoint values and cause of trip can be displayed remotely. The IQ500 relay is ideal for a variety of industrial applications such as mining, timber, material handling, air conditioning compressors, wastewater treatment plants and petrochemical industries.

Features

- Overload class is adjustable using DIP switches for 5, 10, 20 or 30 seconds, maximum trip times at six times rated current
- Designed for 1000V and less distribution systems
- Form C (NO/NC) contact on output relay
- Isolated alarm relay output contact
- Communications capability using IMPACC network
- Manual or automatic reset (either a true manual or remote electrical reset)—selectable
- Overload, Class II ground current, phase unbalance and single-phase protection are standard
- LED indication (bi-colored—red/green) for device status, including overload, phase unbalance or ground current trip
- Special Function Module adds protection for underload and jam conditions, also provides for long acceleration
- Optional load control feature available with special function module
- Feed-through current transformer windows for contactors, NEMA Sizes 1–4 (for Size 5 and larger, external current transformers can be used)
- Fits mounting footprint of Eaton's MORA relay
- Panel or starter mountable
- Cause of trip is held in memory through a power loss
- Bell alarm contact available for remote status indication
- DIP switch provided for setting operating frequency—50 or 60 Hz
- Plug-in terminal block for control power, trip relay and bell alarm relay connections
- Operating temperature: –20° to 60°C (–4° to 140°F)

Benefits

- No external current transformers are required since they are internal to the IQ500
- DIP switches used to select functions and settings on base relay are clearly marked and covered with screw-on plastic covers
- On the automatic reset, the reset times can be selected for long (90 second) or short (10 second) delay
- Device can be set for different motor full load currents without additional parts or modules

Optional Benefits

- With the addition of the IQ500M Special Function Module, the enhanced protection includes jam (overtorque) and underload and provides long acceleration time (high inertia load)
- The underload and jam protection functions each have independent Form C output relays as part of the module. In addition, the underload and jam functions each have their own LEDs for status indication
- The underload and jam functions also have separate selectable trip levels and adjustable trip-delay and start-delay settings
- The IQ500M can be used as a load control module that allows "shedding and restoring" a particular load that contributes to the load being monitored
- The PONI (Product Operated Network Interface) card attaches directly to the base relay or special function module for interfacing with the Eaton's PowerNet communications system
- Localized display can be achieved with the Central Monitoring Unit

Standards and Certifications

- UL File No. E19223

Product Selection

IQ502A



Current Sensing Protective Relay

Maximum Horsepower				Control Voltage	
200V	230V	460–475V	Ampere Rating	110/120V 50/60 Hz Catalog Number	220/240V 50/60 Hz Catalog Number
20	25	50	3.4–66A	**IQ502A**	**IQ502B**
60	75	150	10.8–207A	**IQ504A**	**IQ504B**
—	—	—	0.32–5.4A	**IQ500LA** ①	**IQ500LB** ①
Special function module				**IQ500M**	**IQ500M**

Note

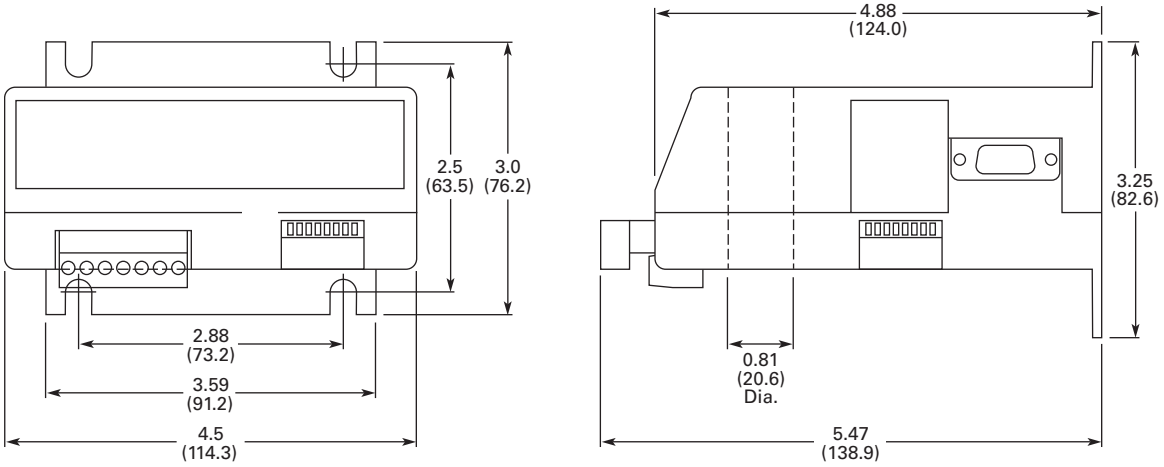
① Can be used with external CTs having 5A secondary.

Dimensions

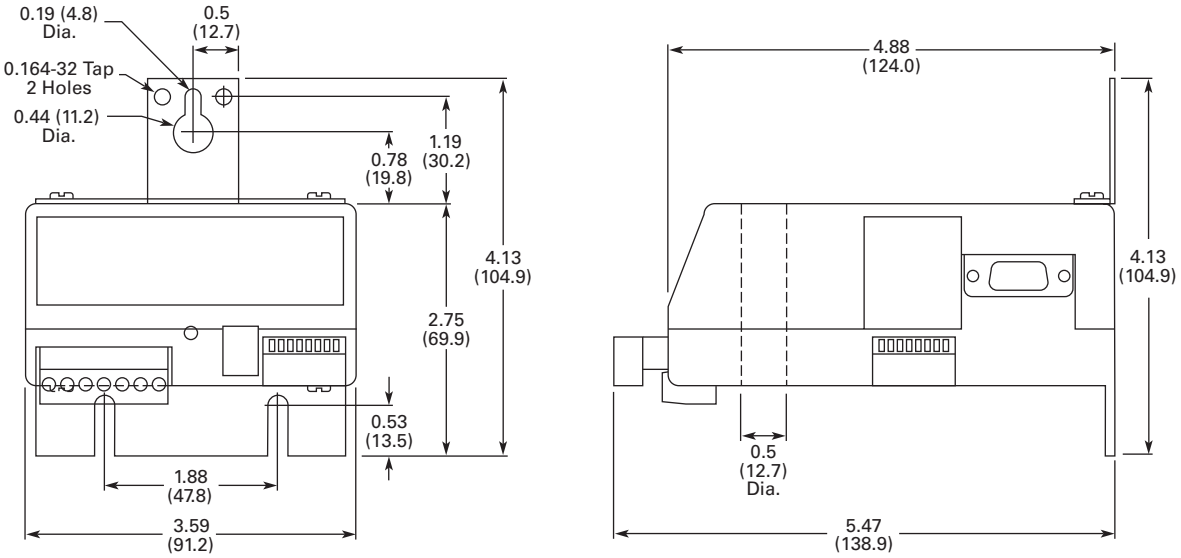
Approximate Dimensions in Inches (mm)

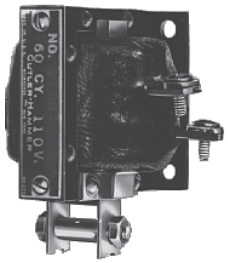
Current Sensing Protective Relays

IQ504



IQ500L and IQ502





Contents

Description	*Page*
Solenoids—Alternating Current	
Product Selection	**V5-T2-141**
Dimensions	**V5-T2-142**

Product Description

Solenoids from Eaton's Electrical Sector are used for a wide variety of applications where straight line motion is to be obtained automatically or at a remote point.

Features

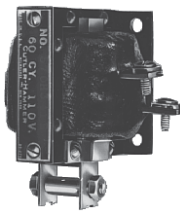
- Plunger and frame are machined to ensure quiet operation
- Push- and pull-type operation
- With and without terminal box
- Plunger provided with connecting pin
- Size C and D solenoids are provided with special bearing to minimize wear in clevis under severe service

Product Selection

When Ordering Specify

- Catalog number

10370



AC Solenoids—60 Hz, Continuous Duty

Size	Volt.	Operating Data ① Magnetic Force in Lbs Horizontal Position With Gravity At 100% Voltage	With Gravity At 85% Voltage	Against Gravity At 100% Voltage	Against Gravity At 85% Voltage	Max. Stroke in Inches (mm)	Current Inrush	Current Sealed	Without Conduit Box Floor Mtg. Catalog Number	Wall Mtg. Catalog Number	With Conduit Box Mtg. ② Catalog Number
60 Hertz Pull Type											
A	110	0.72	0.50	0.90	0.68	0.55	0.33	1 (25.4)	1.83	0.34	—	**10370H1**	**10370H610**
	220	0.72	0.50	0.90	0.68	0.55	0.33	1 (25.4)	0.92	0.17	—	**10370H2**	**10370H611**
	440	0.72	0.50	0.90	0.68	0.55	0.33	1 (25.4)	0.45	0.08	—	**10370H3**	**10370H612**
B	110	4.2	3	4.5	3.3	3.9	2.7	1 (25.4)	5.4	0.87	**10370H57**	**10370H694**	**10370H69**
	220	4.2	3	4.5	3.3	3.9	2.7	1 (25.4)	2.6	0.42	**10370H58**	**10370H696**	**10370H70**
	440	4.2	3	4.5	3.3	3.9	2.7	1 (25.4)	1.29	0.20	**10370H59**	**10370H697**	**10370H71**
C	110	7	5.25	8	6.25	6	4.25	1.25 (31.8)	10.4	1.07	**10370H244**	—	**10370H256**
	220	7	5.25	8	6.25	6	4.25	1.25 (31.8)	5.2	0.52	**10370H245**	—	**10370H257**
	440	7	5.25	8	6.25	6	4.25	1.25 (31.8)	2.5	0.26	**10370H246**	—	**10370H258**
D	110	12.4	10	13.65	11.25	11.15	8.75	1.25 (31.8)	18	1.58	**10370H356**	**10370H814** ③	**10370H368**
	220	12.4	10	13.65	11.25	11.15	8.75	1.25 (31.8)	9.3	0.81	**10370H357**	**10370H816** ③	**10370H369**
	440	12.4	10	13.65	11.25	11.15	8.75	1.25 (31.8)	4.4	0.40	**10370H358**	**10370H817** ③	**10370H370**
60 Hertz Push Type											
A	110	0.72	0.50	0.90	0.68	0.55	0.33	1 (25.4)	1.83	0.34	—	**10370H13**	**10370H25**
	220	0.72	0.50	0.90	0.68	0.55	0.33	1 (25.4)	0.92	0.17	—	**10370H14** ③	**10370H26**
	440	0.72	0.50	0.90	0.68	0.55	0.33	1 (25.4)	0.45	0.08	—	**10370H15**	**10370H27**
B	110	4.2	3	4.5	3.3	3.9	2.7	1 (25.4)	5.4	0.87	**10370H81**	**10370H708**	**10370H93**
	220	4.2	3	4.5	3.3	3.9	2.7	1 (25.4)	2.6	0.42	**10370H82**	**10370H710**	**10370H94**
	440	4.2	3	4.5	3.3	3.9	2.7	1 (25.4)	1.29	0.20	**10370H83**	**10370H711**	**10370H95**
C	110	7	5.25	8	6.25	6	4.25	1.25 (31.8)	10.4	1.07	**10370H268**	—	**10370H280**
	220	7	5.25	8	6.25	6	4.25	1.25 (31.8)	5.2	0.52	—	**10370H774**	**10370H281**
	440	7	5.25	8	6.25	6	4.25	1.25 (31.8)	2.5	0.26	—	**10370H775**	**10370H282**
D	110	12.4	10	13.65	11.25	11.15	8.75	1.25 (31.8)	18	1.58	**10370H380**	**10370H828** ③	**10370H392**
	220	12.4	10	13.65	11.25	11.15	8.75	1.25 (31.8)	9.3	0.81	**10370H381**	**10370H830** ③	**10370H393**
	440	12.4	10	13.65	11.25	11.15	8.75	1.25 (31.8)	4.4	0.40	**10370H382**	**10370H831** ③	**10370H394**

Notes

① Mounting of solenoids "with conduit box"—Size A are for wall mounting—Size B, C and D are for floor mounting.

② Recommended selection of solenoids on basis of 85% voltage values.

③ Part numbers are now obsolete.

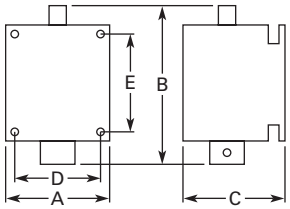
Dimensions

Approximate Dimensions in Inches (mm)

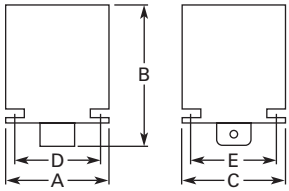
2

AC Solenoids

Wall Mounted



Floor Mounted



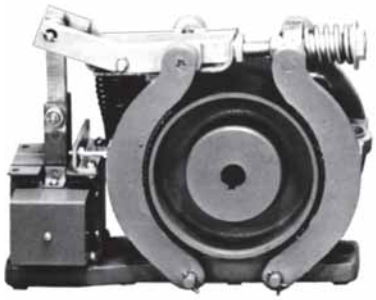
Dimensions and Shipping Weights

Size	Push Type Wide A	High B ①	Deep C	Mounting D	Mounting E	Shipping Weight Lbs (kg)	Pull Type Wide A	High B ①	Deep C	Mounting D	Mounting E	Shipping Weight Lbs (kg)
Wall Mounted												
A	2.38 (60.5)	3.63 (92.2)	2.25 (57.2)	1.13 (28.7)	1.63 (41.4)	2.0 (0.9)	2.38 (60.5)	2.63 (66.8)	2.25 (57.2)	1.13 (28.7)	1.63 (41.4)	2.0 (0.9)
B	2.63 (66.8)	4.88 (124.0)	3.00 (76.2)	2.00 (50.8)	2.13 (54.1)	2.5 (1.1)	2.63 (66.8)	3.63 (92.2)	3.00 (76.2)	2.00 (50.8)	2.13 (54.1)	2.5 (1.1)
C	3.00 (76.2)	6.13 (155.7)	4.13 (104.9)	2.38 (60.5)	3.13 (79.5)	5.0 (2.3)	3.00 (76.2)	4.88 (124.0)	4.13 (104.9)	2.38 (60.5)	3.13 (79.5)	5.0 (2.3)
D	4.00 (101.6)	6.13 (155.7)	4.13 (104.9)	2.75 (69.9)	3.13 (79.5)	7.0 (3.2)	4.00 (101.6)	4.88 (124.0)	4.13 (104.9)	2.75 (69.9)	3.13 (79.5)	7.0 (3.2)
Floor Mounted												
B	3.13 (79.5)	4.88 (124.0)	3.00 (76.2)	1.50 (38.1)	2.25 (57.2)	2.5 (1.1)	3.13 (79.5)	3.88 (98.6)	3.00 (76.2)	1.50 (38.1)	2.25 (57.2)	2.5 (1.1)
C	3.50 (88.9)	6.13 (155.7)	3.75 (95.3)	1.75 (44.5)	3.13 (79.5)	5.0 (2.3)	3.50 (88.9)	4.88 (124.0)	3.75 (95.3)	1.75 (44.5)	3.13 (79.5)	5.0 (2.3)
D	3.88 (98.6)	6.13 (155.7)	3.75 (95.3)	2.25 (57.2)	3.13 (79.5)	7.0 (3.2)	3.88 (98.6)	4.88 (124.0)	3.75 (95.3)	2.25 (57.2)	3.13 (79.5)	7.0 (3.2)

Note

① In sealed state.

Shoe Brakes—AC and DC, 511 Series



Contents

Description *Page*

Shoe Brakes—AC and DC Magnetic

Product Selection **V5-T2-144**
Dimensions **V5-T2-146**

Product Description

Type S Brakes from Eaton's Electrical Sector are electrically released and spring applied providing "fail-safe" operation. The retarding torque developed is directly proportional to the spring pressure.

Application Description

- Conveyors
- Machine tools
- Printing presses
- Small cranes
- Overhead doors
- Dumb waiters
- Vacuum molding machines
- Carnival rides

Features

The brake wheel is of relatively large size in relation to the torque developed by the brake. This permits use of a larger brake shoe lining and lower shoe pressures. Low shoe pressure, equally distributed over a large lining area, results in even wear of the friction surfaces and even braking torque. The oversize wheel type construction also permits use of a smaller operating solenoid that requires less current for a given torque rating.

DC Brakes

Standard DC brakes are equipped with shunt coils. The magnet coil circuit on DC brakes consists of two separate windings and a protective switch.

Mounting

Type S brakes are designed and recommended for use and mounting only in the horizontal position. Side or vertical mountings are not recommended because the solenoid loading is altered, resulting in accelerated wear and premature coil failure.

Product Selection

When Ordering Specify

- Brake
  - Catalog number plus suffix number for coil
  - Example: 511H1193-**41**
  - Wheel
  - Catalog number plus suffix number for bore size
  - Example: 511H1150-**3**

Size S-4 Brake and Wheel



Type S Brakes—Floor Mounting

Torque—lb-ft			AC	For Type S4, S5-1/2, S7, S10		DC		
Continuous	Intermittent ①	Brake Size	Base Catalog Number ②③	Coil Volts and Hertz	Coil Suffix ②	Base Catalog Number ②③	Coil Voltage	Coil Suffix ②
3	3	S-4	**511H1194**	120V 60 Hz	**-39**	**511H955**	120 Vdc	**-97**
10	10	S-4	**511H1193**	208V 60 Hz	**-45**	**511H956**	240 Vdc	**-98**
—	15	S-4	**511H1192**	240V 60 Hz	**-40**	**511H957**		
25	25	S-5-1/2	**511H992**	480V 60 Hz	**-41**	**511H994**		
—	35	S-5-1/2	**511H993**	600V 60 Hz	**-58**	**511H995**		
50	50	S-7	**511H970**	110V 50 Hz	**-5**	**511H975**		
—	75	S-7	**511H971**	220V 50 Hz	**-6**	**511H976**		
85	85	S-7	**511H1195**	380V 50 Hz	**-7**	**511H1197**		
—	110	S-7	**511H1196**	440V 50 Hz	**-8**	**511H1198**		
				550V 50 Hz	**-9**			

Notes

① Intermittent duty indicates that the coil can be placed across the line continuously for one hour maximum without excessive heating. It is equivalent to 1/2 time ON and 1/2 time OFF.

② Add suffix number for coil voltage to base catalog number.

③ Does not include wheel.

Brake Selection

The method most generally used to determine required braking torque is to calculate the full load motor torque by the following formula:

$$T = \frac{5252 \times hp}{rpm}$$

T = Full load motor torque in lb-ft

hp = Motor horsepower

rpm = Speed of shaft on which brake wheel is mounted

The torque rating of the brake selected should be at least equal to the full load motor torque for the duty considered.

Brake Wheels

Wheel Size in Inches	Min. Bore in Inches (mm)	Max. Bore in Inches (mm)	Pilot Bore in Inches (mm)	WK^2	Straight Bore ① Base ③ Catalog Number	Tapered Bore ② Base ③ Catalog Number
4.0	0.50 (12.7)	1.38 (35.1)	0.50 (12.7)	0.06	**511H1150**	**511H1151**
5.5	0.75 (19.1)	2.00 (50.8)	0.75 (19.1)	0.26	**511H1160**	**511H1161**
7.0	1.00 (25.4)	2.25 (57.2)	0.75 (19.1)	0.77	**511H1170**	**511H1171**

Brake Wheel Suffix Numbers

Bore Size Suffix Number—Add to Base Catalog Number

Bore ④ in Inches (mm)	Keyway in Inches	Suffix Number	Bore ④ in Inches (mm)	Keyway in Inches (mm)	Suffix Number
Standard Bore Sizes					
Pilot bore	None	**-1**	1.625 (41.28)	3/38 x 3/16	**-9**
0.625 (15.88)	3/16 x 3/32	**-2**	1.875 (47.63)	1/2 x 1/4	**-10**
0.750 (19.05)	3/16 x 3/32	**-3**	2.125 (53.98)	1/2 x 1/4	**-11**
0.875 (22.23)	3/16 x 3/32	**-4**	—	—	**—**
1.000 (25.40)	1/4 x 1/8	**-5**	—	—	**—**
1.125 (28.58)	1/4 x 1/8	**-6**	—	—	**—**
1.250 (31.75)	1/4 x 1/8	**-7**	—	—	**—**
1.375 (34.93)	5/16 x 5/32	**-8**	—	—	**—**
Non-Standard Bore Sizes					
0.500 (12.70)	1/8 x 1/16	**-50**	1.687 (42.85)	3/8 x 3/16	**-58**
0.750 (19.05)	1/4 x 1/8	**-51**	1.750 (44.45)	3/8 x 3/16	**-59**
0.875 (22.23)	1/4 x 1/8	**-52**	1.937 (49.20)	1/2 x 1/4	**-60**
1.000 (25.40)	5/16 x 5/32	**-53**	2.000 (50.80)	1/2 x 1/4	**-61**
1.187 (30.15)	1/4 x 1/8	**-54**	2.250 (57.15)	1/2 x 1/4	**-62**
1.375 (34.93)	3/8 x 3/16	**-55**	—	—	**—**
1.437 (36.50)	3/8 x 3/16	**-56**	—	—	**—**
1.500 (38.10)	3/8 x 3/16	**-57**	—	—	**—**

Notes

① Bore tolerance: +0.000–0.001 in.

② Taper is at rate of 1.25 in per ft on diameter. In bore size selection, use diameter of tapered shaft. Bore tolerance: +0.000–0.005 in.

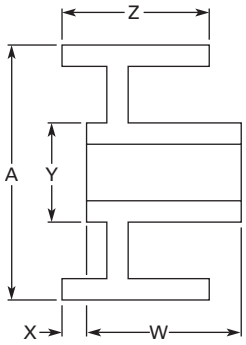
③ Add suffix number for bore size to base catalog number.

④ Bore size selected must be between minimum and maximum dimensions listed in brake wheel selection table.

Dimensions

Approximate Dimensions in Inches (mm)

Standard Brake Wheels



Standard Brake Wheel Dimensions

A	Z	W ①	X	Y	Bore Max.	Bore Min.
4.00 (101.6)	2.75 (69.9)	1.63 (41.4)	1.38 (35.1)	2.50 (63.5)	1.38 (35.1)	0.50 (12.7)
5.50 (139.7)	3.25 (82.6)	2.00 (50.8)	1.63 (41.4)	3.25 (82.6)	2.00 (50.8)	0.75 (19.1)
7.00 (177.8)	4.25 (108.0)	3.00 (76.2)	1.25 (31.8)	4.00 (101.6)	2.25 (57.2)	1.00 (25.4)

Approximate Shipping Weights

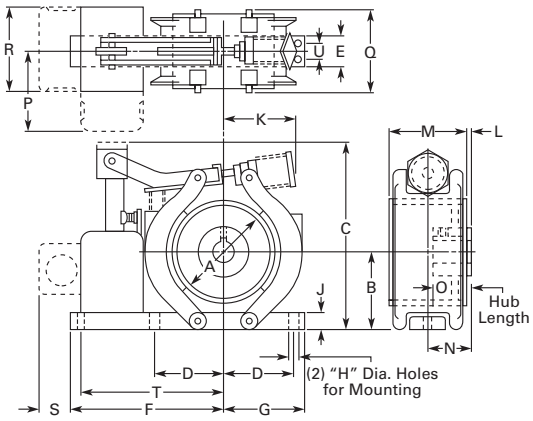
Brake Size	Torque Rating ft-lb	Weight in Lbs (kg) Net — Brake with Wheel	Net — Wheel Only	Boxed — Brake with Wheel
Type "S" AC Shoe Brakes				
S-4	3	15.8 (7.2)	3.4 (1.5)	17.0 (7.7)
S-4	10	15.8 (7.2)	3.4 (1.5)	17.0 (7.7)
S-4	15	15.8 (7.2)	3.4 (1.5)	17.0 (7.7)
S-5-1/2	25	33.2 (15.1)	7.5 (3.4)	36.0 (16.3)
S-5-1/2	35	33.2 (15.1)	7.5 (3.4)	36.0 (16.3)
S-7	50	52.1 (23.7)	18.8 (8.5)	55.0 (25.0)
S-7	75	52.1 (23.7)	18.8 (8.5)	55.0 (25.0)
Type "S" DC Shoe Brakes				
S-4	3	18.0 (8.2)	3.4 (1.5)	20.0 (9.1)
S-4	10	18.0 (8.2)	3.4 (1.5)	20.0 (9.1)
S-4	15	18.0 (8.2)	3.4 (1.5)	20.0 (9.1)
S-5-1/2	25	35.0 (15.9)	7.5 (3.4)	38.0 (17.3)
S-5-1/2	35	35.0 (15.9)	7.5 (3.4)	38.0 (17.3)
S-7	50	54.0 (24.5)	18.8 (8.5)	58.0 (26.3)
S-7	75	54.0 (24.5)	18.8 (8.5)	58.0 (26.3)
S-7	85	54.0 (24.5)	18.8 (8.5)	58.0 (26.3)
S-7	110	54.0 (24.5)	18.8 (8.5)	58.0 (26.3)

Note

① Hub lengths other than standard are not available.

Approximate Dimensions in Inches (mm)

Type S4, S5-1/2 and S7 Solenoid Operated



Type "S" AC Shoe Brakes

Brake Size	Torque Rating ft-lb	A	B ①	C	D	E	F	G	H	J	K	L	M	N	O	P	Q	R
S-4	3	4.00 (101.6)	2.88 (73.2)	7.50 (190.5)	2.63 (66.8)	1.25 (31.8)	7.50 (190.5)	3.13 (79.5)	0.38 (9.7)	0.63 (16.0)	2.88 (73.2)	0.25 (6.4)	2.75 (69.9)	1.63 (41.4)	1.63 (41.4)	2.88 (73.2)	3.00 (76.2)	3.13 (79.5)
S-4	10	4.00 (101.6)	2.88 (73.2)	7.50 (190.5)	2.63 (66.8)	1.25 (31.8)	7.50 (190.5)	3.13 (79.5)	0.38 (9.7)	0.63 (16.0)	2.88 (73.2)	0.25 (6.4)	2.75 (69.9)	1.63 (41.4)	1.63 (41.4)	2.88 (73.2)	3.00 (76.2)	3.13 (79.5)
S-4	15	4.00 (101.6)	2.88 (73.2)	7.50 (190.5)	2.63 (66.8))	1.25 (31.8)	7.50 (190.5)	3.13 (79.5)	0.38 (9.7)	0.63 (16.0)	2.88 (73.2)	0.25 (6.4)	2.75 (69.9)	1.63 (41.4)	1.63 (41.4)	2.88 (73.2)	3.00 (76.2)	3.13 (79.5))
S-5-1/2	25	5.50 (139.7)	4.00 (101.6)	9.50 (241.3)	3.50 (88.9)	2.00 (50.8)	8.38 (212.9)	4.13 (104.9)	0.44 (11.2)	1.00 (25.4)	4.88 (124.0)	0.38 (9.7)	3.25 (82.6)	2.00 (50.8)	2.00 (50.8)	3.13 (79.5)	3.75 (95.3)	3.13 (79.5)
S-5-1/2	35	5.50 (139.7)	4.00 (101.6)	9.50 (241.3)	3.50 (88.9)	2.00 (50.8)	8.38 (212.9)	4.13 (104.9)	0.44 (11.2)	1.00 (25.4)	7.88 (200.2)	0.38 (9.7)	3.25 (82.6)	2.00 (50.8)	2.00 (50.8)	3.13 (79.5)	3.75 (95.3)	3.13 (79.5)
S-7	50	7.00 (177.8)	5.00 (127.0)	11.50 (292.1)	4.38 (111.3)	2.50 (63.5)	9.50 (241.3)	5.00 (127.0)	0.56 (14.2)	1.00 (25.4)	6.00 (152.4)	—	4.25 (108.0)	2.13 (54.1)	3.00 (76.2)	3.13 (79.5)	4.75 (120.7)	3.13 (79.5)
S-7	75	7.00 (177.8)	5.00 (127.0)	11.50 (292.1)	4.38 (111.3)	2.50 (63.5)	9.50 (241.3)	5.00 (127.0)	0.56 (14.2)	1.00 (25.4)	6.00 (152.4)	—	4.25 (108.0)	2.13 (54.1)	3.00 (76.2)	3.13 (79.5)	4.75 (120.7)	3.13 (79.5)

Type "S" DC Shoe Brakes

Brake Size	Torque Rating ft-lb	A	B ①	C	D	E	F	G	H	J	K	L	M	N	O	P	Q	R
S-4	3	4.00 (101.6)	3.50 (88.9)	8.00 (203.2)	2.63 (66.8)	1.25 (31.8)	7.56 (192.0)	3.25 (82.6)	0.38 (9.7)	0.75 (19.1)	2.88 (73.2)	0.25 (6.4)	2.75 (69.9)	1.63 (41.4)	1.63 (41.4)	2.63 (66.8)	3.00 (76.2))	4.06 (103.1)
S-4	10	4.00 (101.6)	3.50 (88.9)	8.00 (203.2)	2.63 (66.8)	1.25 (31.8)	7.56 (192.0)	3.25 (82.6)	0.38 (9.7)	0.75 (19.1)	2.88 (73.2)	0.25 (6.4)	2.75 (69.9)	1.63 (41.4)	1.63 (41.4)	2.63 (66.8)	3.00 (76.2)	4.06 (103.1))
S-4	15	4.00 (101.6)	3.50 (88.9)	8.00 (203.2)	2.63 (66.8)	1.25 (31.8)	7.56 (192.0)	3.25 (82.6))	0.38 (9.7)	0.75 (19.1)	2.88 (73.2)	.25 (6.4)	2.75 (69.9)	1.63 (41.4)	1.63 (41.4)	2.63 (66.8)	3.00 (76.2)	4.06 (103.1)
S-5-1/2	25	5.50 (139.7)	4.00 (101.6)	9.50 (241.3)	3.50 (88.9)	2.00 (50.8)	8.38 (212.9)	4.13 (104.9)	0.44 (11.2)	0.75 (19.1)	4.88 (124.0)	0.38 (9.7)	3.25 (82.6)	2.00 (50.8)	2.00 (50.8)	2.88 (73.2)	3.75 (95.3)	4.06 (103.1)
S-5-1/2	35	5.50 (139.7)	4.00 (101.6)	9.50 (241.3)	3.50 (88.9)	2.00 (50.8)	8.38 (212.9)	4.13 (104.9)	0.44 (11.2)	0.75 (19.1)	4.88 (124.0)	0.38 (9.7)	3.25 (82.6)	2.00 (50.8)	2.00 (50.8)	2.88 (73.2)	3.75 (95.3)	4.06 (103.1)
S-7	50	7.00 (177.8)	5.00 (127.0)	11.50 (292.1)	4.38 (111.3)	2.50 (63.5)	9.50 (241.3)	5.00 (127.0)	0.56 (14.2)	0.75 (19.1)	6.00 (152.4)	—	4.25 (108.0)	2.13 (54.1)	3.00 (76.2)	2.88 (73.2)	4.88 (124.0)	4.06 (103.1)
S-7	75	7.00 (177.8)	5.00 (127.0)	11.50 (292.1)	4.38 (111.3)	2.50 (63.5)	9.50 (241.3)	5.00 (127.0)	0.56 (14.2)	0.75 (19.1)	6.00 (152.4)	—	4.25 (108.0)	2.13 (54.1)	3.00 (76.2)	2.88 (73.2)	4.88 (124.0)	4.06 (103.1)
S-7	85	7.00 (177.8)	5.00 (127.0)	11.50 (292.1)	4.38 (111.3)	2.50 (63.5)	9.50 (241.3)	5.00 (127.0)	0.56 (14.2)	0.75 (19.1)	6.00 (152.4)	—	4.25 (108.0)	2.13 (54.1)	3.00 (76.2)	2.88 (73.2)	4.88 (124.0)	4.06 (103.1)
S-7	110	7.00 (177.8)	5.00 (127.0)	11.50 (292.1)	4.38 (111.3)	2.50 (63.5)	9.50 (241.3)	5.00 (127.0)	0.56 (14.2)	0.75 (19.1)	6.00 (152.4)	—	4.25 (108.0)	2.13 (54.1)	3.00 (76.2)	2.88 (73.2)	4.88 (124.0)	4.06 (103.1)

Note

① Open type brake only.

Reference Data

IEC Utilization Categories

(See also IEC/EN 60947-1; 2.1.18/IEV 441-17-19)

A combination of specified requirements relating to the condition in which the switching device or fuse fulfills its purpose and selected to represent a characteristic group of real-life applications. The specified requirements may, for example, relate to the values of making and breaking capacity and other characteristic values, data concerning associated circuits and the applicable conditions of use and operational behavior.

Used in Technical Data and Formulas

Code	Descriptions
DF	Duty factory
I_{Dn}	Response value of earth-fault release
I_{cm}	Rated short-circuit making capacity
I_{cn}	Rated short-circuit breaking capacity
I_{cs}	Rated service short-circuit breaking capacity
I_{cu}	Rated ultimate short-circuit breaking capacity
I_{cw}	Rated short-time withstand current
I_e	Rated operational current
I_k	Transformer initial short-circuit AC current
I_L	Load monitoring response value
I_n	Rated current
I_{NT}	Transformer rated current
I_{PK}	Rated peak withstand current
I_q	Rated conditional short-circuit current
I_r	Overcurrent release set value
I_{rm}	Response value of non-delayed short-circuit release
I_i	Response value of non-delayed short-circuit release
I_{rmf}	Response value of fixed, non-delayed short-circuit release

Code	Descriptions
I_{rmv}	Response value of short-time delayed short-circuit release
I_{sd}	Response value of short-time delayed short-circuit release
I_T	Response value of earth-fault release
I_g	Response value of earth-fault release
I_{th}	Conventional free air thermal current
I_{the}	Conventional thermal current of enclosed devices
I_u	Rated uninterrupted current
S_{NT}	Transformer rating
t_r	Time delay of overload release response
t_T	Time delay of earth-fault release response
t_g	Time delay of earth-fault release response
t_v	Time delay of short-circuit release response
U_c	Rated actuating voltage
U_e	Rated operational voltage
U_i	Rated insulation voltage
U_{imp}	Rated impulse withstand voltage
U_k	Transformer short-circuit voltage
U_s	Rated control voltage

Annex A (informative)

Examples of Utilization Categories for Low-Voltage Switchgear and Controlgear ①

Category	Typical Applications	Relevant IEC Product Standard
Nature of Current—AC		
AC-1	Non-inductive or slightly inductive loads, resistance furnaces	60947-4-1
AC-2	Slip-ring motors: starting, switching off	60947-4-1
AC-3	Squirrel-cage motors: starting, switching off motors during running	60947-4-1
AC-4	Squirrel-cage motors: starting, plugging ②, inching ③	60947-4-1
AC-5a	Switching of electric discharge lamp controls	60947-4-1
AC-5b	Switching of incandescent lamps	60947-4-1
AC-6a	Switching of transformers	60947-4-1
AC-6b	Switching of capacitor banks	60947-4-1
AC-7a	Slightly inductive loads for household appliances and similar applications	61095
AC-7b	Motor-loads for household applications	61095
AC-8a	Hermetic refrigerant compressor motor control with manual resetting of overload releases	60947-4-1
AC-8b	Hermetic refrigerant compressor motor control with automatic resetting of overload releases	60947-4-1
AC-12	Control of resistive loads and solid-state loads with isolation by optocouplers	60947-5-1
AC-12	Control of resistive loads and solid-state loads with optical isolation	60947-5-2
AC-13	Control of solid-state loads with transformer isolation	60947-5-1
AC-14	Control of small electromagnetic loads	60947-5-1
AC-15	Control of AC electromagnetic loads	60947-5-1
AC-20	Connecting and disconnecting under no-load conditions	60947-3
AC-21	Switching of resistive loads, including moderate overloads	60947-3
AC-22	Switching of mixed resistive and inductive loads, including moderate overloads	60947-3
AC-23	Switching of motor loads or other highly inductive loads	60947-3
AC-31	Non inductive or slightly inductive loads	60947-6-1
AC-33	Motor loads or mixed loads including motors, resistive loads and up to 30% incandescent lamp loads	60947-6-1
AC-35	Electric discharge lamp loads	60947-6-1
AC-36	Incandescent lamp loads	60947-6-1
AC-40	Distribution circuits comprising mixed resistive and reactive loads having a resultant inductive reactance	60947-6-2
AC-41	Non-inductive or slightly inductive loads, resistance furnaces	60947-6-2
AC-42	Slip-ring motors: starting, switching off	60947-6-2
AC-43	Squirrel cage motors: starting, switching off motors during running	60947-6-2
AC-44	Squirrel cage motors: starting, plugging ②, inching ③	60947-6-2
AC-45a	Switching of electric discharge lamp controls	60947-6-2
AC-45b	Switching of incandescent lamps	60947-6-2
AC-51	Non-inductive or slightly inductive loads, resistance furnaces	60947-4-3
AC-52a	Control of slip ring motor stators: 8 h duty with on-load currents for start, acceleration, run	60947-4-2
AC-52b	Control of slip ring motor stators: intermittent duty	60947-4-2
AC-53a	Control of squirrel cage motors: 8 h duty with on-load currents for start, acceleration, run	60947-4-2
AC-53b	Control of squirrel cage motors: intermittent duty	60947-4-2

Notes

① 60947-1 © IEC: 2004.
② Plugging is understood to be stopping or reversing the motor rapidly by reversing motor primary connections while the motor is running.
③ Inching is understood to be energizing a motor once or repeatedly for short periods to obtain small movements of the driven mechanism.

Examples of Utilization Categories for Low-Voltage Switchgear and Controlgear, continued ①

Category	Typical Applications	Relevant IEC Product Standard
Nature of Current—AC, continued		
AC-55a	Switching of electric discharge lamp controls	60947-4-3
AC-55b	Switching of incandescent lamps	60947-4-3
AC-56a	Switching of transformers	60947-4-3
AC-56b	Switching of capacitor banks	60947-4-3
AC-58a	Control of hermetic refrigerant compressor motors with automatic resetting of overload releases: 8 h duty with on-load currents for start, acceleration, run	60947-4-2
AC-58b	Control of hermetic refrigerant compressor motors with automatic resetting of overload releases: intermittent duty	60947-4-2
AC-140	Control of small electromagnetic loads with holding (closed) current ≤0,2 A, for example contactor relays	60947-5-2
Nature of Current—AC and DC		
A	Protection of circuits, with no rated short-time withstand current	60947-2
B	Protection of circuits, with a rated short-time withstand current	60947-2
Nature of Current—DC		
DC-1	Non-inductive or slightly inductive loads, resistance furnaces	60947-4-1
DC-3	Shunt-motors: starting, plugging ②, inching ③, dynamic breaking of motors	60947-4-1
DC-5	Series-motors: starting, plugging ②, inching ③, dynamic breaking of motors	60947-4-1
DC-6	Switching of incandescent lamps	60947-4-1
DC-12	Control of resistive loads and solid-state loads with isolation by optocouplers	60947-5-1
DC-12	Control of resistive loads and solid-state loads with optical isolation	60947-5-2
DC-13	Control of electromagnets	60947-5-1
DC-13	Control of electromagnets	60947-5-2
DC-14	Control of electromagnetic loads having economy resistors in circuit	60947-5-1
DC-20	Connecting and disconnecting under no-load conditions	60947-3
DC-21	Switching of resistive loads, including moderate overloads	60947-3
DC-22	Switching of mixed resistive and inductive loads, including moderate overloads (for example shunt motors)	60947-3
DC-23	Switching of motor loads or other highly inductive loads (for example series motors)	60947-3
DC-31	Resistive loads	60947-6-1
DC-33	Motor loads or mixed loads including motors	60947-6-1
DC-36	Incandescent lamp loads	60947-6-1
DC-40	Distribution circuits comprising mixed resistive and reactive loads having a resultant inductive reactance	60947-6-2
DC-41	Non-inductive or slightly inductive loads, resistance furnaces	60947-6-2
DC-43	Shunt-motors: starting, plugging ②, inching ③, dynamic breaking of DC	60947-6-2
DC-45	Series-motors: starting, plugging ②, inching ③, dynamic breaking of DC	60947-6-2
DC-46	Switching of incandescent lamps	60947-6-2

Notes

① 60947-1 © IEC: 2004.
② Plugging is understood to be stopping or reversing the motor rapidly by reversing motor primary connections while the motor is running.
③ Inching is understood to be energizing a motor once or repeatedly for short periods to obtain small movements of the driven mechanism.

Motor Ratings Data

Ampere Rating of AC and DC Motors

Ampere ratings of motors vary somewhat, depending upon the type of motor. The values given below are for drip-proof, Class B insulated (T Frame) where available, 1.15 service factor, NEMA Design B motors. These values represent an average full load motor current which was calculated from the motor performance data published by several motor manufacturers. In the case of high torque squirrel cage motors, the ampere ratings will be at least 10% greater than the values given in the following table.

Caution—These average ratings could be high or low for a specific motor and therefore heater coil selection on this basis always involves risk. For fully reliable motor protection, select heater coils on the basis of full load current rating as shown on the motor nameplate.

Ampere Ratings of Three-Phase, 60 Hz, AC Induction Motor

hp	Syn. Speed RPM	Current in Amperes 200V	230V	380V ①	460V	575V	2200V
1/4	1800	1.09	.95	0.55	0.48	0.38	—
	1200	1.61	1.40	0.81	0.70	0.56	—
	900	1.84	1.60	0.93	0.80	0.64	—
1/3	1800	1.37	1.19	0.69	0.60	0.48	—
	1200	1.83	1.59	0.92	0.80	0.64	—
	900	2.07	1.80	1.04	0.90	0.72	—
1/2	1800	1.98	1.72	0.99	0.86	0.69	—
	1200	2.47	2.15	1.24	1.08	0.86	—
	900	2.74	2.38	1.38	1.19	0.95	—
3/4	1800	2.83	2.46	1.42	1.23	0.98	—
	1200	3.36	2.92	1.69	1.46	1.17	—
	900	3.75	3.26	1.88	1.63	1.30	—
1	3600	3.22	2.80	1.70	1.40	1.12	—
	1800	4.09	3.56	2.06	1.78	1.42	—
	1200	4.32	3.76	2.28	1.88	1.50	—
	900	4.95	4.30	2.60	2.15	1.72	—
1-1/2	3600	5.01	4.36	2.64	2.18	1.74	—
	1800	5.59	4.86	2.94	2.43	1.94	—
	1200	6.07	5.28	3.20	2.64	2.11	—
	900	6.44	5.60	3.39	2.80	2.24	—
2	3600	6.44	5.60	3.39	2.80	2.24	—
	1800	7.36	6.40	3.87	3.20	2.56	—
	1200	7.87	6.84	4.14	3.42	2.74	—
	900	9.09	7.90	4.77	3.95	3.16	—
3	3600	9.59	8.34	5.02	4.17	3.34	—
	1800	10.8	9.40	5.70	4.70	3.76	—
	1200	11.7	10.2	6.20	5.12	4.10	—
	900	13.1	11.4	6.90	5.70	4.55	—
5	3600	15.5	13.5	8.20	6.76	5.41	—
	1800	16.6	14.4	8.74	7.21	5.78	—
	1200	18.2	15.8	9.59	7.91	6.32	—
	900	18.3	15.9	9.60	7.92	6.33	—
7-1/2	3600	22.4	19.5	11.8	9.79	7.81	—
	1800	24.7	21.5	13.0	10.7	8.55	—
	1200	25.1	21.8	13.2	10.9	8.70	—
	900	26.5	23.0	13.9	11.5	9.19	—
10	3600	29.2	25.4	15.4	12.7	10.1	—
	1800	30.8	26.8	16.3	13.4	10.7	—
	1200	32.2	28.0	16.9	14.0	11.2	—
	900	35.1	30.5	18.5	15.2	12.2	—
15	3600	41.9	36.4	22.0	18.2	14.5	—
	1800	45.1	39.2	23.7	19.6	15.7	—
	1200	47.6	41.4	25.0	20.7	16.5	—
	900	51.2	44.5	26.9	22.2	17.8	—
20	3600	58.0	50.4	30.5	25.2	20.1	—
	1800	58.9	51.2	31.0	25.6	20.5	—
	1200	60.7	52.8	31.9	26.4	21.1	—
	900	63.1	54.9	33.2	27.4	21.9	—

Note

① 380V 50 Hz.

Ampere Ratings of Three-Phase, 60 Hz, AC Induction Motor, continued

hp	Syn. Speed RPM	Current in Amperes 200V	230V	380V ①	460V	575V	2200V
25	3600	69.9	60.8	36.8	30.4	24.3	—
	1800	74.5	64.8	39.2	32.4	25.9	—
	1200	75.4	65.6	39.6	32.8	26.2	—
	900	77.4	67.3	40.7	33.7	27.0	—
30	3600	84.8	73.7	44.4	36.8	29.4	—
	1800	86.9	75.6	45.7	37.8	30.2	—
	1200	90.6	78.8	47.6	39.4	31.5	—
	900	94.1	81.8	49.5	40.9	32.7	—
40	3600	111	96.4	58.2	48.2	38.5	—
	1800	116	101	61.0	50.4	40.3	—
	1200	117	102	61.2	50.6	40.4	—
	900	121	105	63.2	52.2	41.7	—
50	3600	138	120	72.9	60.1	48.2	—
	1800	143	124	75.2	62.2	49.7	—
	1200	145	126	76.2	63.0	50.4	—
	900	150	130	78.5	65.0	52.0	—
60	3600	164	143	86.8	71.7	57.3	—
	1800	171	140	90.0	74.5	59.4	—
	1200	173	150	91.0	75.0	60.0	—
	900	177	154	93.1	77.0	61.5	—
75	3600	206	179	108	89.6	71.7	—
	1800	210	183	111	91.6	73.2	—
	1200	212	184	112	92.0	73.5	—
	900	222	193	117	96.5	77.5	—
100	3600	266	231	140	115	92.2	—
	1800	271	236	144	118	94.8	23.6
	1200	275	239	145	120	95.6	24.2
	900	290	252	153	126	101	24.8
125	3600	—	292	176	146	116	—
	1800	—	293	177	147	117	29.2
	1200	—	298	180	149	119	29.9
	900	—	305	186	153	122	30.9
150	3600	—	343	208	171	137	—
	1800	—	348	210	174	139	34.8
	1200	—	350	210	174	139	35.5
	900	—	365	211	183	146	37.0
200	3600	—	452	257	226	181	—
	1800	—	458	265	229	184	46.7
	1200	—	460	266	230	184	47.0
	900	—	482	279	241	193	49.4
250	3600	—	559	338	279	223	—
	1800	—	568	343	284	227	57.5
	1200	—	573	345	287	229	58.5
	900	—	600	347	300	240	60.5
300	1800	—	678	392	339	271	69.0
	1200	—	684	395	342	274	70.0
400	1800	—	896	518	448	358	91.8
500	1800	—	1110	642	555	444	116

Single-Phase AC Motors

The following values of full-load currents are for motors running at usual speeds and motors with normal torque characteristics. Motors built for especially low speeds or high torques may have higher full-load currents and multispeed motors will have full-load current varying with speed, in which case the nameplate current ratings shall be used.

The voltages listed are rated motor voltages. The currents listed shall be permitted for system voltage ranges of 110 to 120 and 220 to 240V.

Table 430.248. Full-Load Currents in Amperes, Single-Phase Alternating-Current Motors

hp	115V	200V	208V	230V
1/6	4.4	2.5	2.4	2.2
1/4	5.8	3.3	3.2	2.9
1/3	7.2	4.1	4.0	3.6
1/2	9.8	5.6	5.4	4.9
3/4	13.8	7.9	7.6	6.9
1	16	9.2	8.8	8
1-1/2	20	11.5	11	10
2	24	13.8	13.2	12
3	34	19.6	18.7	17
5	56	32.2	30.8	28
7-1/2	80	46	44	40
10	100	57.5	55	50

Note

① 380V 50 Hz.

DC Motors

The following values of full-load currents are for motors running at base speed.

These are average direct-current quantities.

Three-Phase AC Motors

The following values of full-load currents are typical for motors running at speeds usual for belted motors and motors with normal torque characteristics.

Motors built for low speeds (1,200 RPM or less) or high torques may require more running current and multispeed motors will have full-load current varying with speed. In these cases the nameplate current rating shall be used.

The voltages listed are rated motor voltages. The currents listed shall be permitted for system voltage ranges of 110 to 120, 220 to 240, 440 to 480 and 550 to 600V.

Table 430.247 Full-Load Current in Amperes, Direct-Current Motors

	Armature Voltage Rating ①		Ampere Capacity of Fuses for Motors Recommended Values	
hp	120V	240V	120V	240V
1/4	3.1	1.6	5	3
1/3	4.1	2.0	5	3
1/2	5.4	2.7	7	3
3/4	7.6	3.8	10	5
1	9.5	4.7	15	7
1-1/2	13.2	6.6	20	10
2	17	8.5	25	12
3	25	12.2	30	15
5	40	20	50	25
7-1/2	58	29	80	40
10	76	38	100	50
15	—	55	—	75
20	—	72	—	100
25	—	89	—	125
30	—	106	—	150
40	—	140	—	200
50	—	173	—	250
60	—	206	—	275
75	—	255	—	350
100	—	341	—	500
125	—	425	—	600
150	—	506	—	—
200	—	675	—	—

Table 430.250. Full-Load Current Three-Phase Alternating-Current Motors

	Induction Type Squirrel Cage and Wound-Rotor Amperes							Synchronous Type Unity Power Factor ② Amperes			
hp	115V	200V	208V	230V	460V	575V	2300V	230V	460V	575V	2300V
1/2	4.4	2.5	2.4	2.2	1.1	0.9	—	—	—	—	—
3/4	6.4	3.7	3.5	3.2	1.6	1.3	—	—	—	—	—
1	8.4	4.8	4.6	4.2	2.1	1.7	—	—	—	—	—
1-1/2	12.0	6.9	6.6	6.0	3.0	2.4	—	—	—	—	—
2	13.6	7.8	7.5	6.8	3.4	2.7	—	—	—	—	—
3	—	11.0	10.6	9.6	4.8	3.9	—	—	—	—	—
5	—	17.5	16.7	15.2	7.6	6.1	—	—	—	—	—
7-1/2	—	25.3	24.2	22	11	9	—	—	—	—	—
10	—	32.2	30.8	28	14	11	—	—	—	—	—
15	—	48.3	46.2	42	21	17	—	—	—	—	—
20	—	62.1	59.4	54	27	22	—	—	—	—	—
25	—	78.2	74.8	68	34	27	—	53	26	21	—
30	—	92	88	80	40	32	—	63	32	26	—
40	—	120	114	104	52	41	—	83	41	33	—
50	—	150	143	130	65	52	—	104	52	42	—
60	—	177	169	154	77	62	16	123	61	49	12
75	—	221	211	192	96	77	20	155	78	62	15
100	—	285	273	248	124	99	26	202	101	81	20
125	—	359	343	312	156	125	31	253	126	101	25
150	—	414	396	360	180	144	37	302	151	121	30
200	—	552	528	480	240	192	49	400	201	161	40
250	—	—	—	—	302	242	60	—	—	—	—
300	—	—	—	—	361	289	72	—	—	—	—
350	—	—	—	—	414	336	83	—	—	—	—
400	—	—	—	—	477	382	95	—	—	—	—
450	—	—	—	—	515	412	103	—	—	—	—
500	—	—	—	—	590	472	118	—	—	—	—

Notes

① These are average direct-current quantities.

② For 90 and 80 percent power factor, the above figures shall be multiplied by 1.1 and 1.25 respectively.

NEMA Contactors and Starters

NEMA AN16DN0AB
NEMA Size 1 Starter



NEMA Size 1 Contactor



NEMA Space-Savings Size 1C Contactor



2.1 Freedom Series

Product Overview V5-T2-2
Features, Benefits and Functions V5-T2-2
Standards and Certifications V5-T2-3
Catalog Number Selection V5-T2-3
Contactors—Non-Reversing and Reversing V5-T2-4
Starters—Three-Phase Non-Reversing and Reversing, Full Voltage V5-T2-10
Starters—Single-Phase Non-Reversing, Full Voltage, Bi-Metallic Overload V5-T2-15
Accessories V5-T2-21
Renewal Parts V5-T2-30
Technical Data and Specifications V5-T2-35
Relays—Thermal Overload V5-T2-39
C440/***XT*** Electronic Overload Relay V5-T2-48

2.2 Space-Savings Series

Contactors and Starters
- Product Description V5-T2-63
- Product Selection. V5-T2-64
- Technical Data and Specifications V5-T2-71

XTOE/***XT*** Electronic Overload Relay
- Product Description V5-T2-78
- Product Selection. V5-T2-81
- Technical Data and Specifications V5-T2-85

2.3 A200 Series

Contactors—Non-Reversing and Reversing V5-T2-97
Starters—Non-Reversing and Reversing V5-T2-103
Relays—Thermal and Fast Trip V5-T2-124
Thermal Type B, Class 20, Manual Reset V5-T2-126
Thermal Type A, Class 20, Auto/Manual Reset. V5-T2-129
Type FT Fast Trip, Class 10 . . . . . V5-T2-132
Heater Selection V5-T2-135
Relays—Current Sensing Protective V5-T2-137

2.4 Solenoids—Alternating Current

Product Description V5-T2-140
Product Selection V5-T2-141
Dimensions V5-T2-142

2.5 Shoe Brakes—AC and DC Magnetic

Product Description V5-T2-143
Product Selection V5-T2-144
Dimensions V5-T2-146

2.6 Reference Data

IEC Utilization Categories V5-T2-148
Annex A (informative) V5-T2-149
Motor Ratings Data V5-T2-151

Drawings Online

Revision notes

Volume 5—Motor Control and Protection, CA08100006E

Tab 2—NEMA Contactors and Starters

Revision date	Section	Change page(s)	Description
08/23/2018	All	All	Revision date changed to match print version date

Powering Business Worldwide

2.1 NEMA Contactors and Starters

Freedom Series

2

Freedom Series



Contents

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

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 ± 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

Listed

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

A N 1 9 A N 0 A 5E 005

Device Type
- **A** = Starter
- **C** = Contactor

Standard
- **E** = IEC
- **N** = NEMA

Device Assembly Configuration
- **70** = Multi-speed
- **1** = Non-reversing
- **5** = Reversing

OLR Type
- **5** = Contactor only—no overload relay
- **6** = Starter w/C306 bi-metal OLR
- **9** = Starter w/C440 electronic overload

Contactor Frame Size ①

	NEMA Size	Continuous Amperes
A=	00	9
B=	0	18
D=	1	27
G=	2	45
K=	3	90
N=	4	135
S=	5	270
T=	6	540
U=	7	810
V=	8	1215

NEMA Enclosure
- **N** = Open

For Starters

Starter Mounting Option
- **0** = Horizontal
- **V** = Vertical ②

For Contactors Only
- **2** = Two-pole
- **3** = Three-pole
- **4** = Four-pole
- **5** = Five-pole

AC Coil Suffix

Suffix	Coil Volts and Hertz
A	= 120/60 or 110/50
B	= 240/60 or 220/50
C	= 480/60 or 440/50
D	= 600/60 or 550/50
E	= 208/60
H	= 277/60
J	= 208 – 240/60 ③
K	= 240/50
L	= 380 – 415/50
N	= 550/50
T	= 24/60, 24/50 ④
U	= 24/50
V	= 32/50
W	= 48/60
Y	= 48/50

C440 OLR Designation (FVNR and FVR only)
- **5E** = Standard feature set SEL Reset, SEL Class (10A, 10, 20, 30)
- **5G** = Ground fault feature set SEL Reset, SEL Class (10, 20)

C440 FLA Range (FVNR and FVR only)

NEMA Size 00
- **1P6** = 0.33–1.65A
- **005** = 1–5A
- **020** = 4–20A

NEMA Size 0
- **1P6** = 0.33–1.65A
- **005** = 1–5A
- **020** = 4–20A

NEMA Size 1
- **1P6** = 0.33–1.65A
- **005** = 1–5A
- **020** = 4–20A
- **045** = 9–45A

NEMA Size 2
- **005** = 1–5A
- **020** = 4–20A
- **045** = 9–45A

NEMA Size 3
- **100** = 20–100A

NEMA Size 4
- **140** = 28–140A

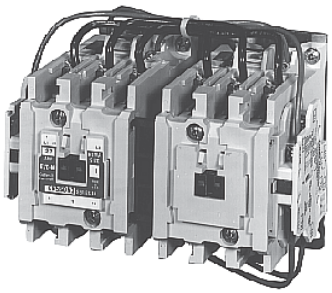
NEMA Size 5 ⑤
- **300** = 60–300A

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.

Non-Reversing and Reversing Contactors





Contents

Description	*Page*
Contactors—Non-Reversing and Reversing	
Product Selection	**V5-T2-5**
Kits and Accessories	**V5-T2-6**
Renewal Parts Publication Numbers	**V5-T2-6**
Technical Data and Specifications	**V5-T2-7**
Dimensions	**V5-T2-8**
Starters—Three-Phase Non-Reversing and Reversing, Full Voltage	**V5-T2-10**
Starters—Single-Phase Non-Reversing, Full Voltage, Bi-Metallic Overload	**V5-T2-15**
Accessories	**V5-T2-21**
Renewal Parts	**V5-T2-30**
Technical Data and Specifications	**V5-T2-35**
Relays—Thermal Overload	**V5-T2-39**

Contactors—Non-Reversing and Reversing

Product Description

Non-Reversing

Contactors are most commonly used to switch motor loads in applications where running overcurrent protection is either not required or is provided separately. Contactors consist of a magnetically actuated switch which can be remotely operated by a pushbutton station or pilot device such as a proximity switch, limit switch, float switch, auxiliary contacts, and so on.

Reversing

Reversing contactors are used primarily for reversing single- or three-phase motors in applications where running overcurrent protection is either not required or is provided separately. They consist of two contactors mechanically and electrically interlocked to prevent line shorts and energization of both contactors simultaneously.

Features, Benefits and Functions

- Designed specifically for use in applications requiring NEMA ratings. Contactors meet or exceed NEMA standards ICS 2-1993
- Long life twin break, silver cadmium oxide contacts—provide excellent conductivity and superior resistance to welding and arc erosion
- 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 contactors

Non-Reversing

- Holding circuit contact(s) supplied as standard:
  - Sizes 00–3 have 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 contact block on top right back

Reversing

- One NO-NC side mounted interlock supplied as standard on each contactor for Sizes 00–8

Product Selection

Three-Pole Contactors

NEMA Size 00
CN55AN3AB



NEMA Size 0
CN15BN3AB



NEMA Size 3
CN15KN3A



Type CN15/CN55 NEMA Contactors—Non-Reversing and Reversing

NEMA Size	Continuous Ampere Rating	Maximum UL Horsepower ① Single-Phase 115V	Single-Phase 230V	Three-Phase 208V	Three-Phase 240V	Three-Phase 480V	Three-Phase 600V	Non-Reversing Catalog Number	Reversing Catalog Number
00	9	1/3	1	1-1/2	1-1/2	2	2	**CN15AN3_B**	**CN55AN3_B**
0	18	1	2	3	3	5	5	**CN15BN3_B**	**CN55BN3_B**
1	27	2	3	7-1/2	7-1/2	10	10	**CN15DN3_B**	**CN55DN3_B**
2	45	3	7-1/2	10	15	25	25	**CN15GN3_B**	**CN55GN3_B**
3	90			25	30	50	50	**CN15KN3_**	**CN55KN3_**
4	135			40	50	100	100	**CN15NN3_**	**CN55NN3_**
5	270			75	100	200	200	**CN15SN3_**	**CN55SN3_**
6	540			150	200	400	400	**CN15TN3_B**	**CN55TN3_B**
7	810			200	300	600	600	**CN15UN3_**	**CN55UN3_**
8 ②	1215			400	450	900	900	**CN15VN3_**	**CN55VN3_**

Magnet Coils—AC and DC

Contactor coils listed in this section also have a 50 Hz rating as shown in the adjacent table. Select required contactor 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, the magnet coil alpha designation will be the next to the last digit of the listed catalog number.

EXAMPLE: For a 380V, 50 Hz coil, change CN15AN3_B to CN15AN3**L**B. 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	**A**
240/60 or 220/50	**B**
480/60 or 440/50	**C**
600/60 or 550/50	**D**
208/60	**E**
277/60	**H**
208–240/60 ③	**J**
240/50	**K**

Coil Volts and Hertz	Code Suffix
380–415/50	**L**
550/50	**N**
24/60, 24/50 ④	**T**
24/50	**U**
32/50	**V**
48/60	**W**
48/50	**Y**

Notes

① 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

② Common control. For separate 120V control, insert letter **D** in 7th position of listed catalog number. Example:CN15VN**D**3C.

③ NEMA Sizes 00 and 0 only.

④ NEMA Sizes 00 and 0 only. Sizes 1–8 are 24/60 only.

Two-, Four- and Five-Pole Contactors

2

NEMA Size 2 Five-Pole Contactor CN15GN5AB



Type CN15 NEMA Contactors—Non-Reversing

NEMA Size	Continuous Ampere Rating	Maximum UL Horsepower Single-Phase (Two-Pole) 115V	230V	Three-Phase 208V	240V	480V	600V	Two-Pole Non-Reversing Catalog Number	Four-Pole Non-Reversing Catalog Number	Five-Pole Non-Reversing Catalog Number
00	9	1/3	1	1-1/2	1-1/2	2	2	**CN15AN2_B**	**CN15AN4_B**	—
0	18	1	2	2	3	5	5	**CN15BN2_B**	—	—
1	27	2	3	7-1/2	7-1/2	10	10	**CN15DN2_B**	**CN15DN4_B**	**CN15DN5_B**
2	45	3	7-1/2	10	15	25	25	**CN15GN2_B**	**CN15GN4_B**	**CN15GN5_B**
3	90			25	30	50	50	**CN15KN2_**	—	—
4	135			40	50	100	100	**CN15NN2_**	—	—
5	270			75	100	200	200	**CN15SN2_**	—	—
6	540			150	200	400	400	**CN15TN2_B**	—	—

Magnet Coils—AC and DC

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, the magnet coil alpha designation will be the next to the last digit of the listed catalog number. EXAMPLE: For a 380V, 50 Hz coil, change CN15BN3_B to CN15BN3**L**B. 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	**A**
240/60 or 220/50	**B**
480/60 or 440/50	**C**
600/60 or 550/50	**D**
208/60	**E**
277/60	**H**
208–240/60 ①	**J**
240/50	**K**

Coil Volts and Hertz	Code Suffix
380–415/50	**L**
550/50	**N**
24/60, 24/50 ②	**T**
24/50	**U**
32/50	**V**
48/60	**W**
48/50	**Y**

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

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

Publication Numbers

Notes

① NEMA Sizes 00 and 0 only.
② NEMA Sizes 00 and 0 only. Sizes 1–8 are 24/60 only.

Technical Data and Specifications

Wire (75°C) Sizes—AWG or kcmil—Open and Enclosed

NEMA Size	Power Terminals Line or Load	Control Terminals Cu Only
00	12–16 stranded; 12–14 solid Cu	12–16 stranded 12–14 solid
0	8–16 stranded; 10–14 solid Cu	
1	8–14 stranded or solid Cu	
2	3–14 (upper) and/or 6–14 (lower) stranded or solid ① Cu	
3	1/0–14 Cu/Al	
4	250 mcm–6	
5	750 kcmil–2, or (2) 250 kcmil–3/0 Cu/Al	
6	(2) 750 kcmil–3/0 Cu/Al	
7	(3) 750 kcmil–3/0 Cu/Al	
8	(4) 750 kcmil–4/0 Cu/Al	

Plugging and Jogging Service Horsepower Ratings ②

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 Two compartment box lug.

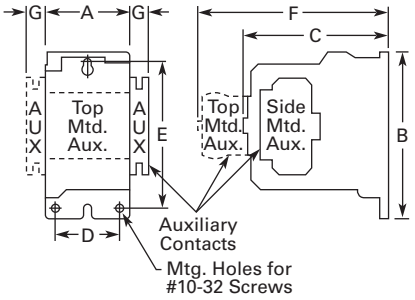
② Maximum horsepower where operation is interrupted more than 5 times per minute or more than 10 times in a 10 minute period. NEMA standard ICS 2-1993 table 2-4-3.

Dimensions

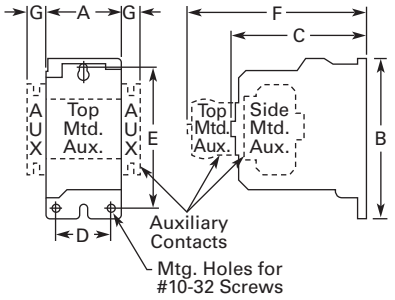
Approximate Dimensions in Inches (mm)

2

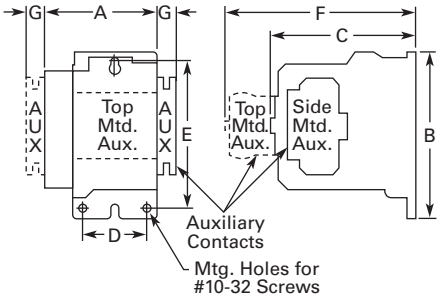
Non-Reversing Contactors—Open Type



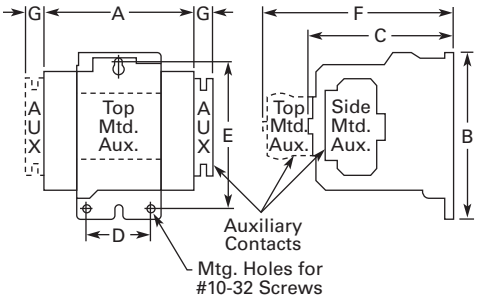
Sizes 00, Two- to Four-Pole



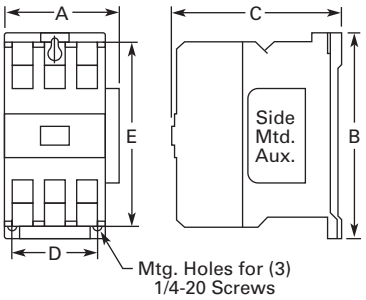
Sizes 0–2, Two- and Three-Pole



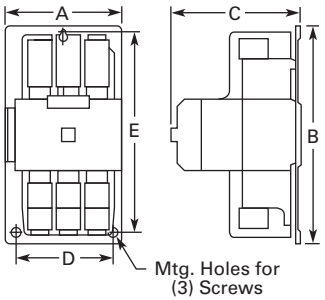
Sizes 0–2, Two- and Three-Pole



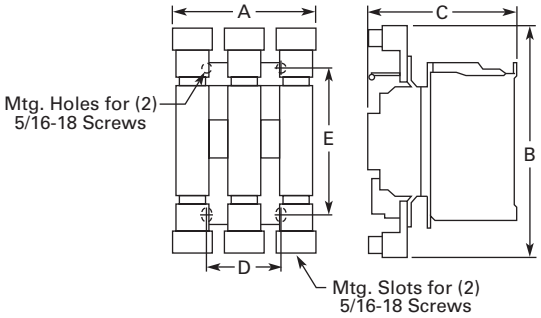
Sizes 1–2, Five-Pole



Size 3



Sizes 4–5



Size 6

Dimensions and Shipping Weights

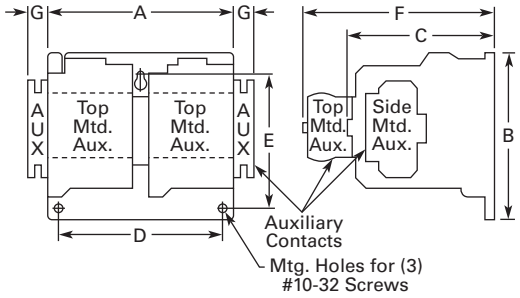
NEMA Size	Number of Poles	Wide A	High B	Deep C	Mounting D	Mounting E	F	G	Shipping Weight Lbs (kg)
00	2–4	1.75 (44.5)	3.88 (98.6)	3.49 (88.6)	1.50 (38.1) ①	3.38 (85.9)	4.62 (117.3)	0.54 (13.7)	1.7 (0.7)
0	2–3	1.75 (44.5)	3.88 (98.6)	3.49 (88.6)	1.50 (38.1) ①	3.38 (85.9)	4.62 (117.3)	0.54 (13.7)	1.8 (0.8)
1–2	2–3	2.56 (65.0)	5.05 (128.3)	4.44 (112.8)	2.00 (50.8) ①	4.50 (114.3)	5.80 (147.3)	0.54 (13.7)	3.1 (1.4)
1–2	4	3.44 (87.4)	5.05 (128.3)	4.44 (112.8)	2.00 (50.8) ①	4.50 (114.3)	5.80 (147.3)	0.54 (13.7)	3.6 (1.6)
1–2	5	4.32 (109.7)	5.05 (128.3)	4.44 (112.8)	2.00 (50.8) ①	4.50 (114.3)	5.80 (147.3)	0.54 (13.7)	4.0 (1.8)
3	2–3	4.08 (103.6)	7.17 (182.1)	5.94 (150.9)	3.00 (76.2)	6.63 (168.4)	—	—	8.5 (3.9)
4	2–3	7.05 (179.1)	9.11 (231.4)	7.25 (184.2)	6.00 (152.4)	8.50 (215.9)	—	—	20.0 (9.1)
5	2–3	7.05 (179.1)	13.12 (333.2)	7.78 (197.6)	6.00 (152.4)	12.50 (317.5)	—	—	23.0 (10.4)
6	3	8.63 (219.2)	13.54 (343.9)	8.88 (225.6)	4.33 (110.0)	8.63 (219.2)	—	—	35.0 (15.9)
7	3	11.02 (279.9)	19.30 (490.2)	11.46 (291.1)	6.89 (175.0)	11.02 (279.9)	—	—	100.0 (45.4)
8	3	13.00 (330.2)	24.50 (622.3)	13.63 (346.2)	4.22 (107.2)	14.86 (377.4)	—	—	160.0 (72.6)

Note

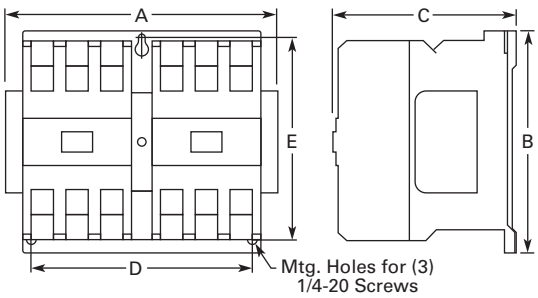
① Center mounting slot at bottom supplied only on Size 00 and 0 contactors.

Approximate Dimensions in Inches (mm)

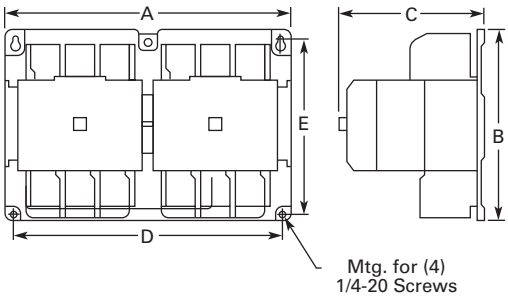
Reversing Contactors—Open Type



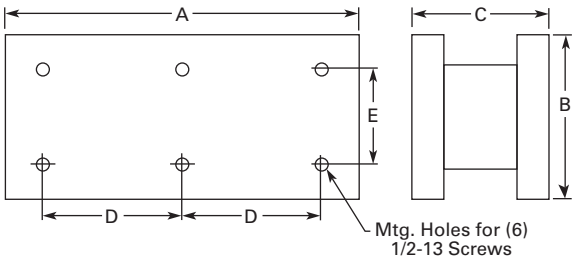
Sizes 00–2



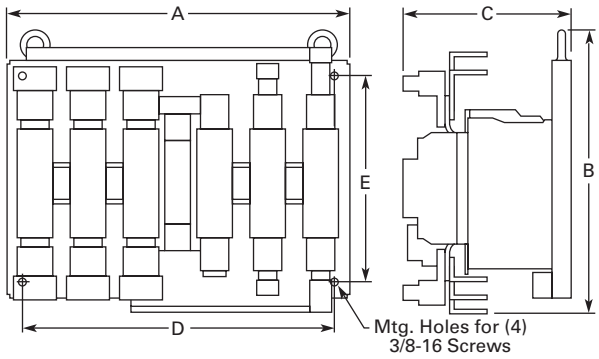
Size 3



Sizes 4–5



Open Type—Sizes 7–8 Horizontal



Size 6

Dimensions and Shipping Weights

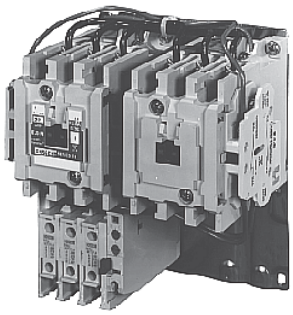
NEMA Size	Wide A	High B	Deep C	Mounting D	Mounting E	F	G	Shipping Weight Lbs (kg)
00–0	4.20 (106.7)	4.35 (110.5)	3.52 (89.4)	3.50 (88.9)	3.86 (98.0)	4.90 (124.5)	0.54 (13.7)	3.3 (1.5)
1–2	5.71 (145.0)	5.05 (128.3)	4.44 (112.8)	5.25 (133.4)	3.63 (92.2)	5.80 (147.3)	0.54 (13.7)	7.8 (3.5)
3	8.70 (221.0)	7.17 (182.1)	5.94 (150.9)	7.00 (177.8)	6.63 (168.4)	—	—	17.0 (7.7)
4	14.68 (372.9)	9.11 (231.4)	7.25 (184.2)	13.50 (342.9)	8.50 (215.9)	—	—	47.0 (21.3)
5	14.50 (368.3)	12.25 (311.2)	7.78 (197.6)	13.50 (342.9)	11.50 (292.1)	—	—	63.0 (28.6)
6	19.77 (502.2)	16.61 (421.9)	9.90 (251.5)	18.00 (457.2)	12.00 (304.8)	—	—	80.0 (36.3)
7	28.00 (711.2)	26.75 (679.5) ①	12.75 (323.9)	12.75 (323.9)	11.00 (279.4)	—	—	260.0 (118.0)
8	30.13 (765.3)	39.00 (990.6) ①	14.69 (373.1)	14.13 (358.9)	15.00 (381.0)	—	—	350.0 (158.9)

Note

① Includes cross wiring.

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





Contents

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

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 ±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 ①

NEMA Size	Continuous Ampere Rating	Service-Limit Current Rating (Amperes) ④	Maximum UL Horsepower ② Single-Phase 115V	Single-Phase 230V	Three-Phase 208V	Three-Phase 240V	Three-Phase 480V	Three-Phase 600V	Three-Pole Non-Reversing ③ Catalog Number	Three-Pole Reversing ③ Catalog Number	Vertical Reversing ③ Catalog Number
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 ⑤	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 AN16BN0**L**C. 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	**A**
240/60 or 220/50	**B**
480/60 or 440/50	**C**
600/60 or 550/50	**D**
208/60	**E**
277/60	**H**
208–240/60 ⑥	**J**
240/50	**K**

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

Notes

① 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**.

② 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

③ Underscore (_) indicates coil suffix required, see AC Suffix table.

④ 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.

⑤ Common control. For separate 120V control, insert letter **D** in 7th position of listed catalog number. Example: AN56VN**D**0CB.

⑥ NEMA Sizes 00 and 0 only.

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

Two-Speed Selective Control

When Ordering Supply

- Catalog number plus magnet coil code suffix. Example: Size 0—AN700BN022**B**
- 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 Horsepower				NEMA	Open Type
115V	200V	230V	460V/575V	115V	200V	230V	460/575V	Size	Catalog Number
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



One-Winding AN700DN0218



Reconnectable Winding ①

Maximum Horsepower—60/50 Hertz

Constant or Variable Torque				Constant Horsepower				NEMA	Open Type Constant or Variable Torque	Constant Horsepower
115V	200V	230V	460V/575V	115V	200V	230V	460/575V	Size	Catalog Number	Catalog Number
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**.

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 ① Cu Only
Power Terminals—Line	
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 ②
Power Terminals—Load—Cu Only (stranded or solid)	
00–0	14–6 AWG stranded or solid
1–2	14–2 AWG stranded or solid
Control Terminals—Cu Only	
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 ②
Power Terminals—Line and Load	
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
Control Terminals—Cu Only	
12–16 AWG stranded, 12–14 AWG solid	

Plugging and Jogging Service Horsepower Ratings ③

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.

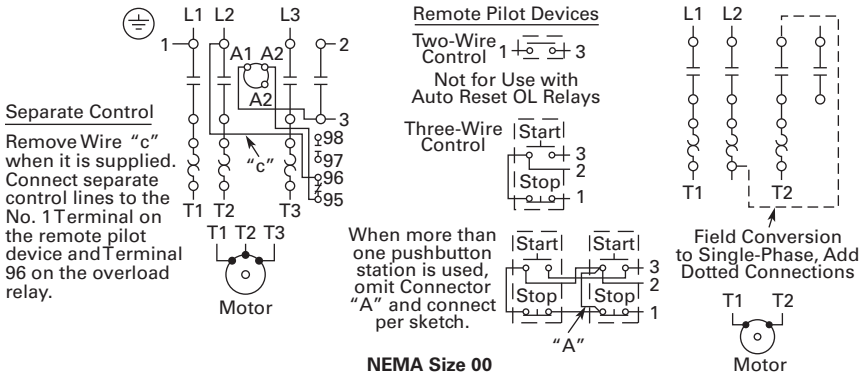
② Two compartment box lug.

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.

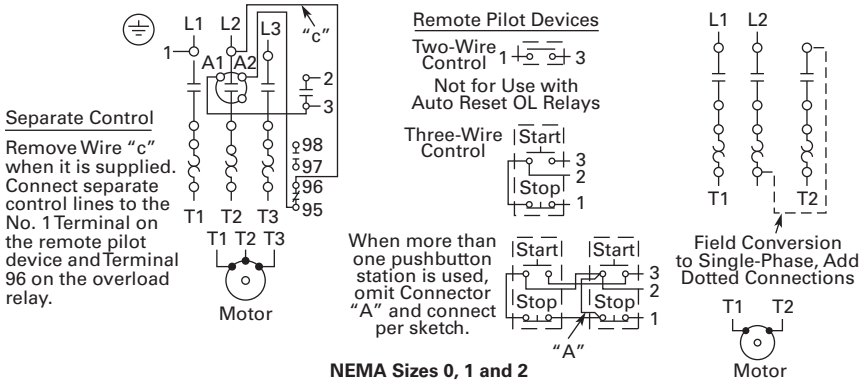
Wiring Diagrams

2

Three-Phase and Single-Phase Applications



NEMA Size 00



NEMA Sizes 0, 1 and 2

NEMA Size 1—BN15DN0AB



Contents

Description	*Page*
Contactors—Non-Reversing and Reversing	**V5-T2-4**
Starters—Three-Phase Non-Reversing and Reversing, Full Voltage	**V5-T2-10**
Starters—Single-Phase Non-Reversing, Full Voltage, Bi-Metallic Overload	
Product Selection	**V5-T2-16**
Wiring Diagrams	**V5-T2-16**
Dimensions	**V5-T2-17**
Accessories	**V5-T2-21**
Renewal Parts	**V5-T2-30**
Technical Data and Specifications	**V5-T2-35**
Relays—Thermal Overload	**V5-T2-39**
C440/***XT*** Electronic Overload Relay	**V5-T2-48**

Starters—Single-Phase Non-Reversing, Full Voltage, Bi-Metallic Overload

Product Description

Single-phase, full voltage magnetic starters connect the motor directly across the line, allowing it to draw full inrush current during start-up. These starters are most commonly used for control of self-starting single-phase motors up to 15 hp at 230V. They consist of a two-pole electromagnetic contactor to make and break the motor power circuit and an overload relay to provide running overload protection. Starters listed in the table include:

- Two-pole Freedom Series contactor with long life twin break, silver cadmium oxide contacts. Generously sized for low resistance and cool operation. Designed to 3 million electrical operations at maximum hp and 30 million mechanical operations to Size 0, 10 million operations to Size 2 and 6 million operations to Size 3
- Three-pole Freedom Series overload with poles two and three wired in series for motor overload protection. This overload is ambient compensated, selectable manual or automatic reset, interchangeable Class 10 or 20 heater packs, 1.0 or 1.15 service factor selectability, overload trip indication and electrically isolated NO-NC contacts (pull RESET button to test)
- Holding circuit NO auxiliary contact supplied as standard. On Size 00, the contact occupies the 4th power pole position. Sizes 0–3 have the NO auxiliary mounted on the right side of the contactor
- Steel mounting plate as standard on all open type starters. Wired for separate or common control

Product Selection

When Ordering Specify

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

BN16DM0AB



Type BN16 NEMA—Manual or Automatic Reset Overload Relay

NEMA Size	Maximum Horsepower Motor Voltage	Single-Phase	Magnet Coil Voltage (60 Hz)	Open Type Two-Pole Catalog Number
00	115	1/3	120 ①	**BN16AN0AC**
	230	1	240	**BN16AN0BC**
0	115	1	120 ①	**BN16BN0AC**
	230	2	240	**BN16BN0BC**
1	115	2	120 ①	**BN16DN0AB**
	230	3	240	**BN16DN0BB**
1P	115	3	120 ①	**BN16PN0AB**
	230	5	240	**BN16PN0BB**
2	115	3	120 ①	**BN16GN0AB**
	230	7-1/2	240	**BN16GN0BB**
3	115	7-1/2	120 ①	**BN16KN0A**
	230	15	240	**BN16KN0B**

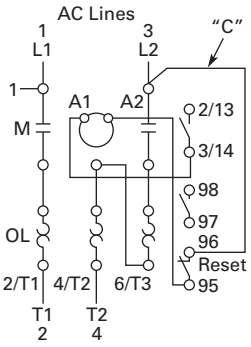
Starter catalog numbers do not include heater packs. Select one carton of three heater packs. Heater pack selection, **Pages V5-T2-41** to **V5-T2-43**.

Note

① For separate 120V control circuit. For maximum hp at listed motor voltages, use the rating of other starters of same size.

Wiring Diagrams

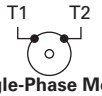
Single-Phase Applications (Factory Wired)



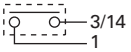
Separate Control

Remove Wire "C" if supplied and connect separate control lines to the Number 1 Terminal on the remote pilot device and to the Number 96 Terminal on the overload relay.

Front View of Panel

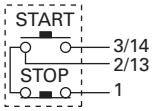


Single-Phase Motor



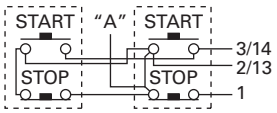
Not for Use with Auto Reset OL Relays

Two-Wire Control



Three-Wire Control

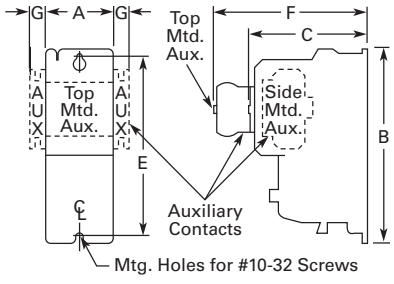
When more than one pushbutton station is used, omit Connector "A" and connect per sketch at right.



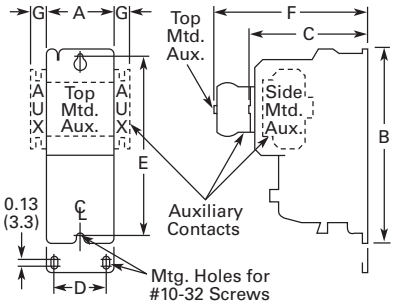
Dimensions

Approximate Dimensions in Inches (mm)

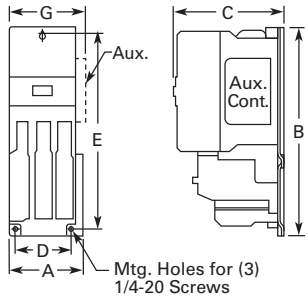
Non-Reversing Starters, Bi-Metallic Overload—Open Type



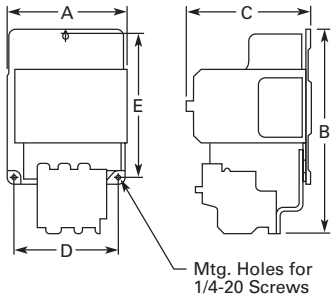
Sizes 00–0 ①



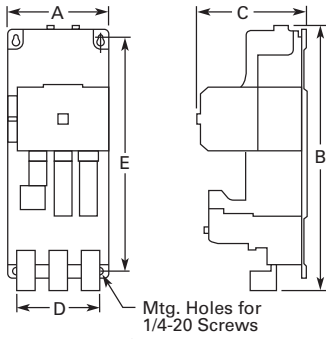
Sizes 1–2



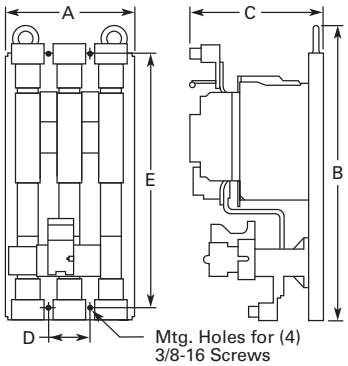
Size 3



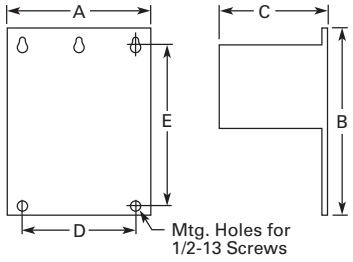
Size 4



Size 5



Size 6



Sizes 7–8

Dimensions and Shipping Weights

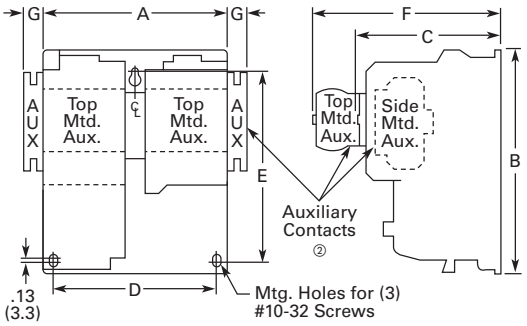
NEMA Size	Wide A	High B	Deep C	Mounting D	Mounting E	F	G	Shipping Weight Lbs (kg)
00–0	1.80 (45.7)	6.60 (167.6)	3.52 (89.4)	—	6.07 (154.2)	4.90 (124.5)	0.54 (13.7)	2.2 (1.0)
1–1P	2.56 (65.0)	7.08 (179.8)	4.44 (112.8)	2.00 (50.8)	6.63 (168.4)	5.80 (147.3)	0.54 (13.7)	4.5 (2.0)
2	2.56 (65.0)	8.08 (205.2)	4.44 (112.8)	2.00 (50.8)	7.63 (193.8)	5.80 (147.3)	0.54 (13.7)	4.7 (2.1)
3	4.08 (103.6)	11.35 (288.3)	5.94 (150.9)	3.00 (76.2)	10.81 (274.6)	—	—	11.0 (5.0)
4	7.05 (179.1)	12.06 (306.3)	7.25 (184.2)	6.00 (152.4)	8.50 (215.9)	—	—	23.0 (10.4)
5	7.00 (177.8)	17.77 (451.4)	7.76 (197.1)	6.00 (152.4)	16.00 (406.4)	—	—	36.0 (16.3)
6	9.47 (240.5)	21.69 (550.9)	9.90 (251.5)	3.10 (78.7)	18.00 (457.2)	—	—	75.0 (34.1)
7	15.13 (384.3)	29.13 (739.9)	12.64 (321.1)	13.25 (336.6)	21.25 (539.8)	—	—	120.0 (54.5)
8	15.13 (384.3)	34.50 (876.3)	15.00 (381.0)	13.25 (336.6)	16.75 (425.5)	—	—	210.0 (95.3)

Note

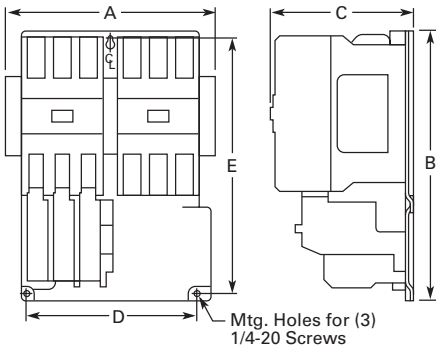
① Holding circuit contact for Size 00 occupies 4th power pole position—no increase in width.

Approximate Dimensions in Inches (mm)

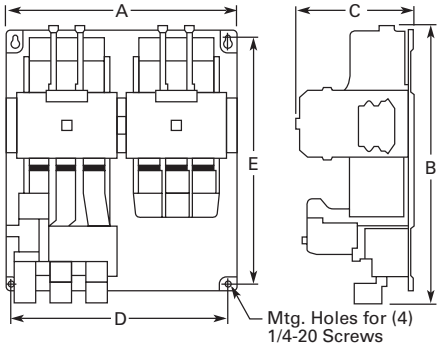
Reversing Starters, Bi-Metallic Overload—Open Type



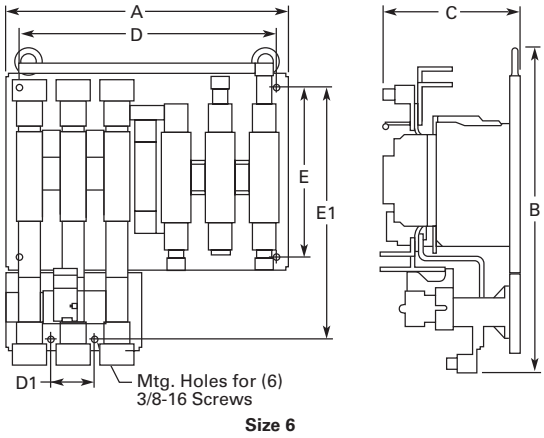
Sizes 00 – 2



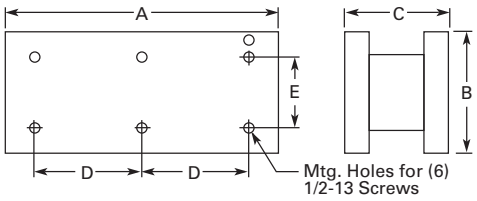
Size 3



Sizes 4 – 5



Size 6



Open Type — Sizes 7 – 8 Horizontal

Dimensions and Shipping Weights

NEMA Size	Wide A	High B	Deep C	Mounting D	Mounting E	D1	E1	F	G	Shipping Weight Lbs (kg)
00–0	4.20 (106.7)	7.38 (187.5)	3.52 (89.4)	3.50 (88.9)	6.87 (174.5)	—	—	4.90 (124.5)	0.54 (13.7	3.6 (1.6)
1	5.71 (145.0)	7.08 (179.8)	4.44 (112.8)	5.25 (133.4)	5.75 (146.1)	—	—	5.80 (147.3)	0.54 (13.7)	8.3 (3.8)
2	5.71 (145.0)	8.08 (205.2)	4.44 (112.8)	5.25 (133.4	6.75 (171.5)	—	—	5.80 (147.3)	0.54 (13.7)	8.5 (3.9)
3	8.70 (221.0)	11.35 (288.3)	5.94 (150.9)	7.00 (177.8)	10.81 (274.6)	—	—	—	—	20.0 (9.1)
4	14.68 (372.9)	12.06 (306.3)	7.25 (184.2)	13.50 (342.9)	8.50 (215.9)	—	—	—	—	49.0 (22.2)
5	14.50 (368.3)	17.77 (451.4)	7.76 (197.1)	13.50 (342.9)	16.00 (406.4)	—	—	—	—	68.0 (30.9)
6	19.77 (502.2)	22.63 (574.8)	9.90 (251.5)	18.00 (457.2)	12.00 (304.8)	3.10 (78.7)	18.00 (457.2)	—	—	90.0 (40.9)
7	28.06 (712.7)	32.13 (816.1) ①	12.70 (322.6)	12.75 (323.9)	21.25 (539.8)	—	—	—	—	175.0 (79.5)
8	30.38 (771.7)	41.50 (1054.1) ①	14.70 (373.4)	14.13 (358.9)	16.75 (425.5)	—	—	—	—	430.0 (195.2)

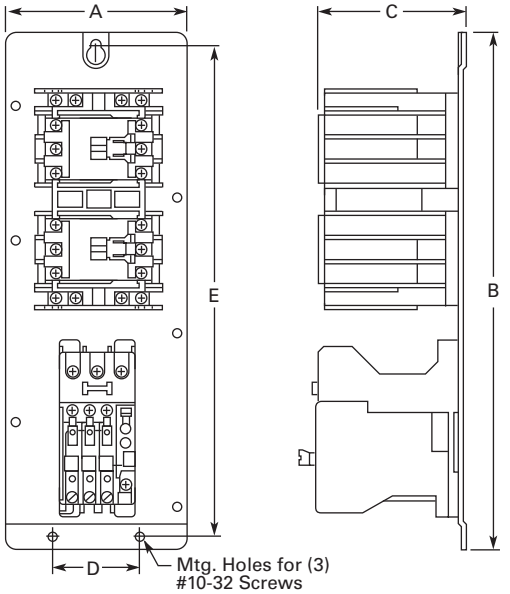
Notes

① Includes cross wiring overhang.

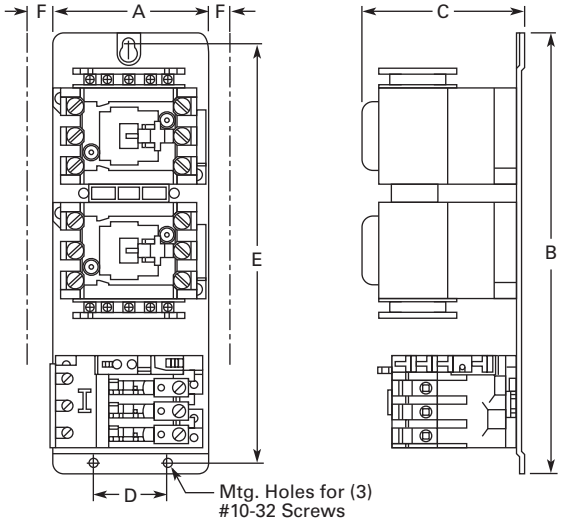
② See catalog listings for type and location of auxiliary contacts supplied with a particular starter.

Approximate Dimensions in Inches (mm)

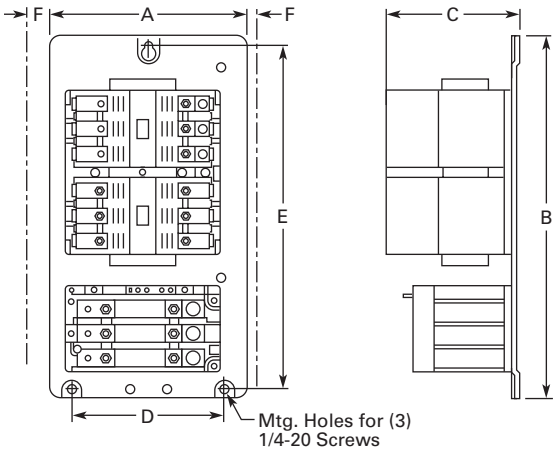
Reversing Starters—Vertical Construction, Bi-Metallic Overload—AN56V Open Vertical Starter



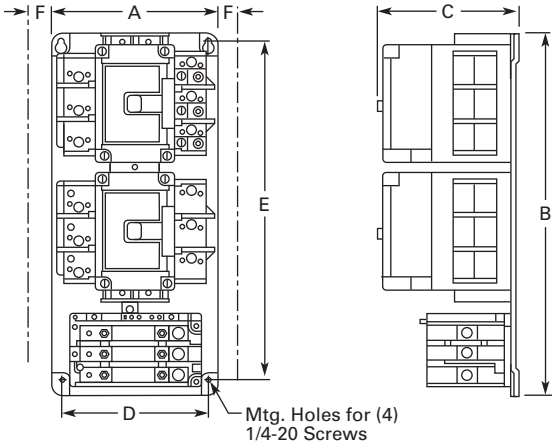
NEMA Size 0



NEMA Sizes 1 – 2



NEMA Size 3



NEMA Size 4

Dimensions and Shipping Weights

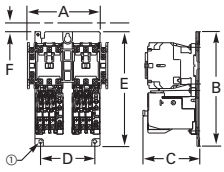
NEMA Size	Wide A	High B	Deep C	Mounting Wide D	Mounting HIgh E	Wire Zone	Shipping Weight Lbs (kg)
0	4.25 (108.0)	12.05 (306.1)	3.84 (97.5)	2.00 (50.8)	11.50 (292.1)	—	4.0 (1.8)
1	4.25 (108.0)	12.05 (306.1)	3.86 (98.0)	2.00 (50.8)	11.50 (292.1)	1.00 (25.4)	9.0 (4.1)
2	4.25 (108.0)	12.05 (306.1)	3.86 (98.0)	2.00 (50.8)	11.50 (292.1)	1.00 (25.4)	9.5 (4.3)
3	9.25 (235.0)	16.75 (425.5)	5.18 (131.6)	7.15 (181.6)	16.07 (408.2)	①	21.0 (9.5)
4	9.08 (230.6)	19.84 (503.9)	5.18 (131.6)	8.00 (203.2)	18.51 (470.2)	1.50 (38.1)	50.0 (22.7)

Note

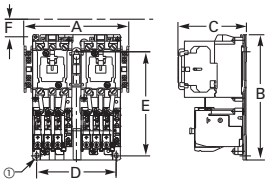
① Wire overhang 1.00 mm left, 50 mm right.

Approximate Dimensions in Inches (mm)

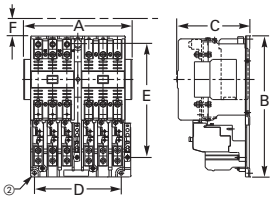
Multispeed Starters, Bi-Metallic Overload—AN700 Open Vertical Starter



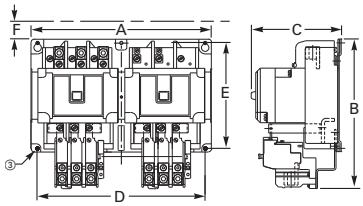
Size "0" Multispeed Starter
2-Speed, 2-Winding



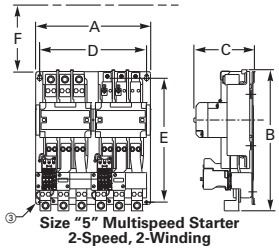
Size "1 – 2" Multispeed Starter
2-Speed, 2-Winding



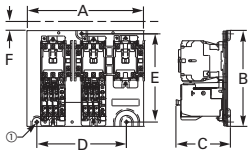
Size "3" Multispeed Starter
2-Speed, 2-Winding



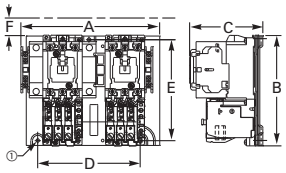
Size "4" Multispeed Starter
2-Speed, 2-Winding



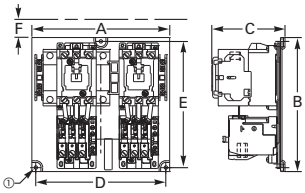
Size "5" Multispeed Starter
2-Speed, 2-Winding



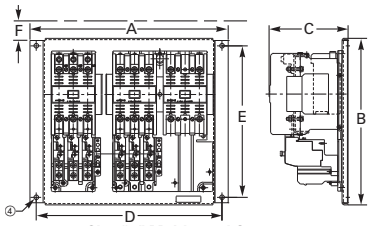
Size "0" Multispeed Starter
2-Speed, 1-Winding



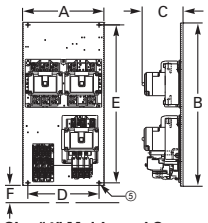
Size "1" Multispeed Starter
2-Speed, 1-Winding



Size "2" Multispeed Starter
2-Speed, 1-Winding



Size "3" Multispeed Starter
2-Speed, 1-Winding



Size "4" Multispeed Starter
2-Speed, 1-Winding

Dimensions and Shipping Weights

NEMA Size	Wide A	High B	Deep C	Mounting Wide D	Mounting High E	Wire Zone F	Shipping Weight Lbs (kg)
Two-Speed—Selective Control—Separate Winding							
0	5.19 (132)	7.38 (188)	3.52 (89)	3.50 (89)	6.87 (175)	0.89 (23)	4.5 (2.0)
1	5.66 (144)	7.08 (180)	4.42 (112)	5.25 (133)	5.75 (146)	1.23 (31)	9.0 (4.1)
2	5.66 (144)	8.08 (205)	4.42 (112)	5.25 (133)	6.75 (165)	1.63 (41)	10.0 (4.5)
3	8.72 (221)	11.35 (288)	5.89 (150)	7.00 (178)	10.81 (275)	1.77 (45)	24.0 (10.9)
4	14.68 (373)	12.06 (306)	7.25 (184)	13.50 (343)	8.50 (216)	1.95 (50)	53.0 (24.1)
5	14.50 (368)	17.82 (453)	7.76 (197)	13.50 (343)	16.00 (406)	4.56 (116)	73.0 (33.1)
Two-Speed—Selective Control—Reconnectable Winding							
0	8.62 (219)	7.06 (179)	3.82 (81)	6.62 (168)	6.50 (165)	0.50 (13)	6.0 (2.7)
1	8.97 (228)	7.12 (181)	4.72 (120)	6.62 (168)	6.50 (165)	1.04 (26)	10.0 (4.5)
2	8.90 (226)	8.62 (219)	4.75 (121)	8.40 (213)	8.12 (206)	1.03 (26)	11.0 (5.0)
3	16.00 (406)	13.46 (342)	6.38 (162)	15.00 (381)	12.25 (311)	1.24 (31)	31.0 (14.1)
4	15.46 (393)	31.00 (787)	7.74 (197)	13.50 (343)	30.00 (762)	1.84 (47)	72.0 (32.7)

Notes

① Mounting holes for (3) #10 screws.
② Mounting holes for (3) 1/4-20 screws.
③ Mounting holes for (4) 1/4-20 screws.
④ Mounting holes for (4) 5/16 screws.
⑤ Mounting holes for (4) 3/8 screws.

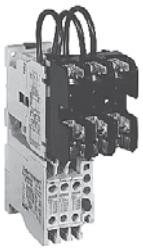
Accessories

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.

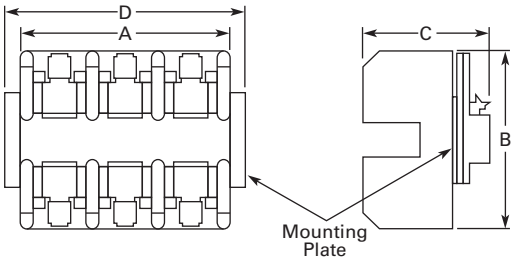
Mounted Fuse Block Kit



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			Approximate Dimensions in Inches (mm)			
Class	Amperes	Volts	Wide A	High B	Deep C	D
G	15, 20, 30 60	300	2.40 (61.0)	3.00 (76.2)	2.04 (51.8)	—
		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	Contactor 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.

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 ①②③
1–30 seconds	**C320TDN30_**
30–300 seconds	**C320TDN300_**

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	**C321SB18**
NEMA Size 4, IEC Sizes A–S	**C321SB19**
NEMA Size 6, IEC Sizes T and U	**C321SB22**

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	**C320TP1**
10 to 180 seconds	**C320TP2**

Maximum Ampere Ratings

	Vac			
Description	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	**C320PC3**
Gray cover, no accessibility, with Auto only nib	50	**C320PC4**
Gray cover, no accessibility, with Manual only nib	50	**C320PC5**
Gray cover with FLA dial accessibility, A, B, C, D positions and Auto only nib	50	**C320PC6**
Gray cover with FLA dial accessibility, A, B, C, D positions and Manual only nib	50	**C320PC7**

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

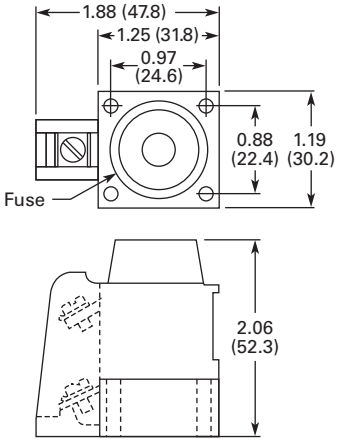


Control Circuit Fuse Block

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



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**
NEMA Sizes 1–2, IEC Sizes G–K	
Contactors	**C320LS3**
Reversing contactors	**C320LS4**
NEMA Size 1	
Starters	**C320LS5**
Reversing starters	**C320LS6**
NEMA Size 2, IEC Sizes G–K	
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.

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

Side Mounted



Top Mounted



Description	Contact Configuration Code ②	Catalog Number
Side Mounted		
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**
Top Mounted		
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.

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 ①	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 ①	Catalog Number
NO	10	**C320KGS20**
NC	01	**C320KGS21**
NO-NC ②	11	**C320KGS22**
Sealed Logic Level		
NO	10	**C320KGS20L**
NC	01	**C320KGS21L**
NO-NC ③	11	**C320KGS22L**

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

Circuit	Contact Configuration Code ①	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

① For reference only—not part of catalog number.
② NO-NC occupies two position—L2 and L3, or R2 and R3. See figure on **Page V5-T2-27**.
③ Form C contacts.

Auxiliary Contact Location

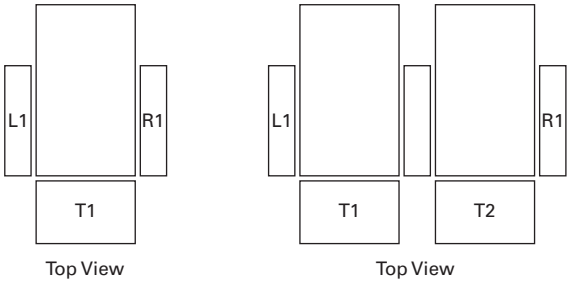
NEMA Sizes 00–2, IEC Sizes A–K

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

Auxiliary Contacts

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

Auxiliary Contact Location



Non-Reversing Contactors and Starters

Reversing Contactors and Starters

NEMA Sizes 3–8, IEC Sizes L–Z

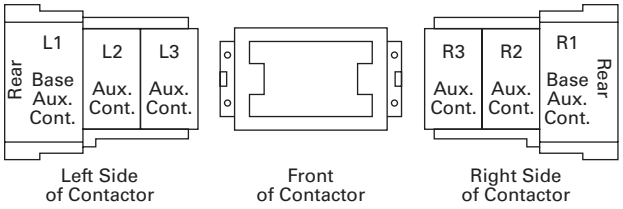
The sketches below illustrate the maximum number of auxiliary contacts that can be assembled to a contactor and their locations.

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.

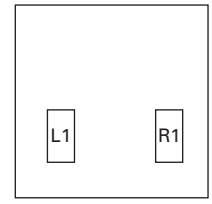
Mounting Positions

Size	Available Mounting Positions ①
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

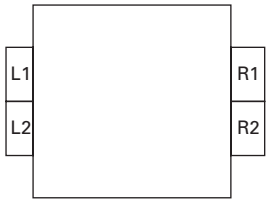
Auxiliary Contact Location



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

2

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 AN16BN0**A**C to AN16BN0**T1**C

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		Conversion Data					Complete Conversion Kit		Factory Installed
			Magnet Coil						
NEMA	IEC	Volts	Coil Number	Amps P.U./Seal	Watts P.U./Seal	NCI Interlock	Catalog Number	Ship Wt. Lbs (kg)	Code Suffix
Non-Reversing—Kit Includes NCI Side Mounted Auxiliary Contact									
00 and 0 CN35–A, B, D D15 Relays	A–F	12	**9-2988-11**	6.4/0.28	76.8/3.36	**C320KGD1**	**C335KD3R1**	1.0 (0.5)	**R1**
		24	**9-2988-12**	3.2/0.14	76.8/3.36	**C320KGD1**	**C335KD3T1**		**T1**
		48	**9-2988-13**	1.6/0.07	76.8/3.36	**C320KGD1**	**C335KD3W1**		**W1**
		120	**9-2988-14**	0.64/0.028	76.8/3.36	**C320KGD1**	**C335KD3A1**		**A1**
① 00 and 0 CN35–A, B, D D15 Relays	A–F	12	**9-2988-11**	6.4/0.28	76.8/3.36	**C320KGD2** ①	**C335KD3R4**	1.0 (0.5)	**R4**
		24	**9-2988-12**	3.2/0.14	76.8/3.36	**C320KGD2** ①	**C335KD3T4**		**T4**
		48	**9-2988-13**	1.6/0.07	76.8/3.36	**C320KGD2** ①	**C335KD3W4**		**W4**
		120	**9-2988-14**	0.64/0.028	76.8/3.36	**C320KGD2** ①	**C335KD3A4**		**A4**
1 and 2 CN35–G	G–K	12	**9-2990-1**	15.4/0.42	185/4.98	**C320KGD5**	**C335KD4R4**	1.0 (0.5)	**R4**
		24	**9-2990-2**	7.7/0.021	185/4.96	**C320KGD5**	**C335KD4T4**		**T4**
		48	**9-2990-3**	3.9/0.11	185/5.04	**C320KGD5**	**C335KD4W4**		**W4**
		120	**9-2990-4**	1.5/0.041	185/4.87	**C320KGD5**	**C335KD4A4**		**A4**
3 CN35–K	L–N	12	**9-3002-1**	24/0.40	293/4.84	**C320KGD3**	**C335KD5R1**	2.0 (0.9)	**R1**
		24	**9-3002-2**	12/0.20	288/4.75	**C320KGD3**	**C335KD5T1**		**T1**
		48	**9-3002-3**	6.1/0.097	295/4.67	**C320KGD3**	**C335KD5W1**		**W1**
		120	**9-3002-4**	2.5/0.038	298/4.57	**C320KGD3**	**C335KD5A1**		**A1**
4 and 5 CN35–N, S	P–S	24	**9-2026-4**	18/0.22	400/5.3	**C320KGD3**	**C335KA3T1**	2.5 (1.1)	**T1**
		48	**9-2026-3**	9/0.11	400/5.2	**C320KGD3**	**C335KA3W1**		**W1**
		120	**9-2026-2**	3.3/0.05	450/5.4	**C320KGD3**	**C335KA3A1**		**A1**
		240	**9-2026-1**	1.7/0.02	440/4.9	**C320KGD3**	**C335KA3B1**		**B1**
Reversing									
00 and 0 CN35–A, B, D D15 relays	A–F	12	**(2) 9-2988-1**	6.4/0.28	76.8/3.36	**(2) C320KGD1**	**C335RD3R1** ②	1.0 (0.5)	**R1** ③
		24	**(2) 9-2988-2**	3.2/0.14	76.8/3.36	**(2) C320KGD1**	**C335RD3T1** ②		**T1** ③
		48	**(2) 9-2988-3**	1.6/0.07	76.8/3.36	**(2) C320KGD1**	**C335RD3W1** ②		**W1** ③
		120	**(2) 9-2988-4**	0.64/0.028	76.8/3.36	**(2) C320KGD1**	**C335RD3A1** ②		**A1** ③
1 and 2 CN35–G	G–K	12	**(2) 9-2990-1**	15.4/0.42	185/4.98	**(2) C320KGD3**	④	—	**R1** ③
		24	**(2) 9-2990-2**	7.7/0.21	185/4.96	**(2) C320KGD3**	④		**T1** ③
		48	**(2) 9-2990-3**	3.9/0.11	185/5.04	**(2) C320KGD3**	④		**W1** ③
		120	**(2) 9-2990-4**	1.5/0.041	185/4.87	**(2) C320KGD3**	④		**A1** 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

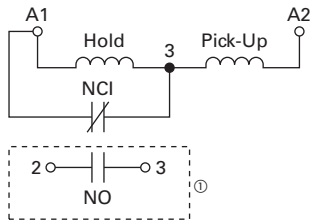
These DC coil kits have separate pick-up and seal windings. A **special** (side mounted) early-break NCI auxiliary contact is used to either disconnect the pick-up winding or insert the seal winding in series with the pick-up winding, depending on the frame size of the contactor. DC coil kits come in 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.

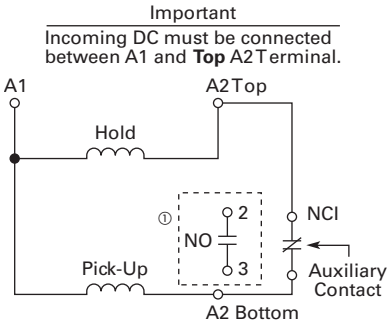
On the above sizes only, when the **special** auxiliary package is mounted on the side of a contactor or starter, **no** standard auxiliary contact may be mounted on the same side.

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.

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

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 ② 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.

Special Modifications

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

Addition or Special Feature	Starter Size —NEMA 00	0	1/—	2	3	4	5	6	7	8
Control Circuit										
Extra auxiliary circuit, factory installed NO or NC—each contact ①②	Consult sales office for pricing adders.									
Transient suppressor ①	Consult sales office for pricing adders.									
Power Circuit										
Contactor/starter for ring lug capability—add Mod Code **T16** to catalog number ③ (Power terminals only, control terminals as standard) Standalone overload relays can not accept ring lugs on line side	Consult sales office for pricing adders.									
Factory Installed Dust Covers										
Factory installed C320DSTCVR—add Mod Code **-53** to catalog number ①					NA	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 ④ and CN55 Contactors and Starters (Size 00, 0)

Description		NEMA Size 00 Series B1 Part No.	Series C1 Part No.	NEMA Size 0 Series B1 Part No.	Series C1 Part No.
Renewal Parts Publication Number		**22177**	**22177**	**22177**	**22177**
Contact Kits					
Two-pole		⑤	⑤	⑤	⑤
Three-pole		⑤	⑤	⑤	⑤
Four-pole		⑤	⑤	⑤	⑤
Five-pole		⑤	⑤	⑤	⑤
Magnet Coils	**Coil Suffix**				
120V 60 Hz or 110V 50 Hz	**A**	**9-2875-1**	**9-2875-1**	**9-2876-1**	**9-2876-1**
240V 60 Hz or 220V 50 Hz	**B**	**9-2875-2**	**9-2875-2**	**9-2876-2**	**9-2876-2**
480V 60 Hz or 440V 50 Hz	**C**	**9-2875-3**	**9-2875-3**	**9-2876-3**	**9-2876-3**
600V 60 Hz or 550V 50 Hz	**D**	**9-2875-4**	**9-2875-4**	**9-2876-4**	**9-2876-4**
208V 60 Hz	**E**	**9-2875-5**	**9-2875-5**	**9-2876-5**	**9-2876-5**
277V 60 Hz	**H**	**9-2875-12**	**9-2875-12**	**9-2876-12**	**9-2876-12**
208/240V 60 Hz	**J**	**9-2875-37**	**9-2875-37**	**9-2876-37**	**9-2876-37**
240V 50 Hz	**K**	**9-2875-11**	**9-2875-11**	**9-2876-11**	**9-2876-11**
380–415V 50 Hz	**L**	**9-2875-6**	**9-2875-6**	**9-2876-6**	**9-2876-6**
380V 50 Hz	**L**	—	—	—	—
415V 50 Hz	**M**	—	—	—	—
550V 50 Hz	**N**	—	—	—	—
24V 60 Hz–24V 50 Hz	**T**	**9-2875-36**	**9-2875-36**	**9-2876-36**	**9-2876-36**
24V 60 Hz	**T**	—	—	—	—
24V 50 Hz	**U**	**9-2875-36**	**9-2875-36**	**9-2876-36**	**9-2876-36**
32V 50 Hz	**V**	**9-2875-16**	**9-2875-16**	**9-2876-16**	**9-2876-16**
48V 60 Hz	**W**	**9-2875-8**	**9-2875-8**	**9-2876-8**	**9-2876-8**
48V 50 Hz	**Y**	**9-2875-9**	**9-2875-9**	**9-2876-9**	**9-2876-9**
Magnet Frame Armature					
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 ① and CN55 Contactors and Starters (Size 1, 2)

Description		NEMA Size 1 Series A1 Part No.	NEMA Size 1 Series B1 Part No.	NEMA Size 2 Series A1 Part No.	NEMA Size 2 Series B1 Part No.	NEMA Size 3 Part No.
Renewal Parts Publication Number		**20861**	**22177**	**20861**	**22177**	**20426**
Contact Kits						
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**	—
Magnet Coils	**Coil Suffix**					
120V 60 Hz or 110V 50 Hz	**A**	**9-3285-1**	**9-3285-1**	**9-3285-1**	**9-3285-1**	**9-2756-1 KIT**
240V 60 Hz or 220V 50 Hz	**B**	**9-3285-2KIT**	**9-3285-2KIT**	**9-3285-2KIT**	**9-3285-2KIT**	**9-2756-2 KIT**
480V 60 Hz or 440V 50 Hz	**C**	**9-2703-3 KIT**	**9-2703-3 KIT**	**9-2703-3 KIT**	**9-2703-3 KIT**	**9-2756-3 KIT**
600V 60 Hz or 550V 50 Hz	**D**	**9-2703-4 KIT**	**9-2703-4 KIT**	**9-2703-4 KIT**	**9-2703-4 KIT**	**9-2756-4 KIT**
208V 60 Hz	**E**	**9-3285-9KIT**	**9-3285-9KIT**	**9-3285-9KIT**	**9-3285-9KIT**	**9-2756-5 KIT**
277V 60 Hz	**H**	**9-2703-7 KIT**	**9-2703-7 KIT**	**9-2703-7 KIT**	**9-2703-7 KIT**	**9-2756-9 KIT**
208/240V 60 Hz	**J**	—	—	—	—	—
240V 50 Hz	**K**	**9-2703-14 KIT**	**9-2703-14 KIT**	**9-2703-14 KIT**	**9-2703-14 KIT**	**9-2756-13 KIT**
380–415V 50 Hz	**L**	**9-2703-8 KIT**	**9-2703-8 KIT**	**9-2703-8 KIT**	**9-2703-8 KIT**	—
380V 50 Hz	**L**	—	—	—	—	**9-2756-12 KIT**
415V 50 Hz	**M**	—	—	—	—	**9-2756-8 KIT**
550V 50 Hz	**N**	—	—	—	—	**9-2756-14 KIT**
24V 60 Hz–24V 50 Hz	**T**	—	—	—	—	—
24V 60 Hz	**T**	**9-3285-6KIT**	**9-3285-6KIT**	**9-3285-6KIT**	**9-3285-6KIT**	**9-2756-6 KIT**
24V 50 Hz	**U**	**9-3285-12KIT**	**9-3285-12KIT**	**9-3285-12KIT**	**9-3285-12KIT**	**9-2756-11 KIT**
32V 50 Hz	**V**	**9-2703-10 KIT**	**9-2703-10 KIT**	**9-2703-10 KIT**	**9-2703-10 KIT**	**9-2756-10 KIT**
48V 60 Hz	**W**	**9-2703-11 KIT**	**9-2703-11 KIT**	**9-2703-11 KIT**	**9-2703-11 KIT**	**9-2756-15 KIT**
48V 50 Hz	**Y**	**9-2703-13 KIT**	**9-2703-13 KIT**	**9-2703-13 KIT**	**9-2703-13 KIT**	**9-2756-7 KIT**
Magnet Frame Armature						
Lower magnet frame		**17-18200**	**17-18200**	**17-18200**	**17-18200 KIT**	**17-8955-2 KIT**
Upper magnet frame		**48-1936**	**48-1936**	**48-1936**	**48-1936 KIT**	**48-1902 KIT**

Note

① CN35A = Size 00, CN35B and CN35D = Size 0, CN35G = Size 2, CN35K = Size 3, CN35N = Size 4, and CN35S = Size 5.

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 ① and CN55 Contactors and Starters (Size 4, 5, 6)

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

Volts	Hertz	NEMA Size 4 Series A1	NEMA Size 4 Series B1	NEMA Size 5 Series A1	NEMA Size 5 Series B1	NEMA Size 6 Contactor and Starter Series A1, Starter Series B1 Part No.	Contactor 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/contactor.

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 ① and CN55 Contactors and Starters (Size 7, 8)

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

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 ①

Volts	Hertz	NEMA Size 7 Series A1	NEMA Size 7 Series B1	NEMA Size 8 Series A1	NEMA Size 8 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/contactor.

Specifications—Sizes 00–3

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
Configuration					
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
Maximum Horsepower (hp)					
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
AC Magnet Coil Data					
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, **Pages V5-T2-28** and **V5-T2-29**.	For DC magnet coils (and coil data), see Accessories, **Pages V5-T2-28** and **V5-T2-29**.	For DC magnet coils (and coil data), see Accessories, **Pages V5-T2-28** and **V5-T2-29**.	For DC magnet coils (and coil data), see Accessories, **Pages V5-T2-28** and **V5-T2-29**.	For DC magnet coils (and coil data), see Accessories, **Pages V5-T2-28** and **V5-T2-29**.
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
Electrical Life (480V/60 Hz)					
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
Wire Range					
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)	35 (14–10 AWG)
				45 (6–4 AWG)	40 (8 AWG)
				50 (3 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
Configuration					
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
Maximum Horsepower (hp)					
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
AC Magnet Coil Data					
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, **Pages V5-T2-28** and **V5-T2-29**.	For DC magnet coils (and coil data), see Accessories, **Pages V5-T2-28** and **V5-T2-29**.	For DC magnet coils (and coil data), see Accessories, **Pages V5-T2-28** and **V5-T2-29**.	For DC magnet coils (and coil data), see Accessories, **Pages V5-T2-28** and **V5-T2-29**.	For DC magnet coils (and coil data), see Accessories, **Pages V5-T2-28** and **V5-T2-29**.
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	6,00	6000
Mechanical life	5,000,000	5,000,000	5,000,000	5,000,000	5,000,000
Electrical Life (480V/60 Hz)					
AC-3	800,000	500,000	590,000	450,000	420,000
AC-4	70,000	34,000	7400	5000	4200
Wire Range					
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.

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.

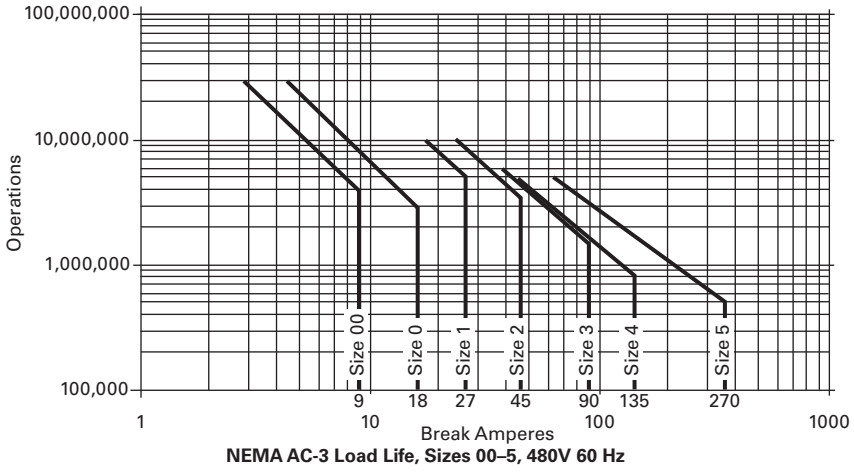
AC-4—Squirrel cage motors; starting, plugging, inching or jogging.

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.

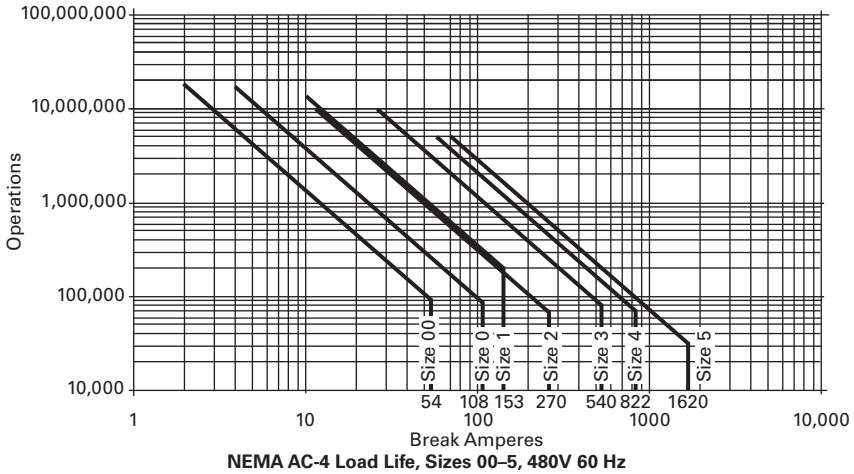
Contactor Choice

- 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_e), 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



NEMA AC-3 Load Life, Sizes 00–5, 480V 60 Hz



NEMA AC-4 Load Life, Sizes 00–5, 480V 60 Hz

32A Overload—C306DN3B



Contents

Description	*Page*
Contactors—Non-Reversing and Reversing	**V5-T2-4**
Starters—Three-Phase Non-Reversing and Reversing, Full Voltage	**V5-T2-10**
Starters—Single-Phase Non-Reversing, Full Voltage, Bi-Metallic Overload	**V5-T2-15**
Accessories	**V5-T2-21**
Renewal Parts	**V5-T2-30**
Technical Data and Specifications	**V5-T2-35**
Relays—Thermal Overload	
Product Selection	**V5-T2-40**
Accessories	**V5-T2-44**
Modifications	**V5-T2-44**
Replacement Parts	**V5-T2-44**
Technical Data and Specifications	**V5-T2-45**
Dimensions	**V5-T2-47**
C440/***XT*** Electronic Overload Relay	**V5-T2-48**

Relays—Thermal Overload

Product Description

C306 Overload Relays are designed for use with CE or CN non-reversing and reversing contactors. Four sizes are available for overload protection up to 144A.

Features

- Selectable manual or automatic reset operation
- Interchangeable heater packs adjustable ±24% to match motor FLA and calibrated for use with 1.0 and 1.15 service factor motors. Heater packs for 32A overload relay will mount in 75A overload relay—useful in derating applications such as jogging
- Class 10 or 20 heater packs
- Load lugs built into relay base
- Bimetallic, ambient compensated operated. Trip free mechanism
- Electrically isolated NO-NC contacts (pull RESET button to test). (Electrical ratings see table on **Page V5-T2-46**)
- Overload trip indication
- Shrouded or fingerproof terminals to reduce possibility of electrical shock

Standards and Certifications

- Meets UL 508 single-phasing requirements
- UL listed, CSA certified and NEMA compliance

Listed

Product Selection

C306 Thermal Overload Relays

C306DN3B



C306GN3B



Contactors

NEMA Size	Maximum Ampere Rating	Number of Poles	Open Type Catalog Number	NEMA 1 Enclosed Catalog Number
00, 0	32 ②	3	**C306DN3B**	**C306DG3B**
1, 2	75 ②	3	**C306GN3B**	**C306GG3B**
3	105 ③	3	**C306KN3**	—
4	144 ③	3	**C306NN3**	—
5–8 ①	—	—	—	—

C306DT3B



C306GT3B



Standalone Applications

NEMA Size	Maximum Ampere Rating	Number of Poles	Open Type Catalog Number
00, 0, 1 ④	32	3	**C306DT3B**
1 ④	75	3	**C306GT3B**
3 ⑤	105	3	**C306KN3**
4 ⑤	144	3	**C306NN3**
5–8 ⑥	—	—	—

Notes

① NEMA Sizes 5–8 use the 32A overload in conjunction with CTs.
② Series B overload relays have load lugs built into relay base and will only accept Series B heater packs. These relays can be directly attached to contactor or they can be DIN rail or panel mounted using adapter on **Page V5-T2-44**.
③ These relays can be panel mounted only.
④ Overload relay assembled with mounting adapter for DIN rail or panel mount.
⑤ Panel mount only.
⑥ NEMA Sizes 5–8 use the 32A overload in conjunction with CTs.

Heater Pack Selection

Heater packs H2001B to H2017B and H2101B to H2117B are to be used only with Series B overload relays Catalog Numbers C306DN3B (Part No. 10-7016) and C306GN3B (Part No. 10-7020). The load lugs are built into the overload relay base to allow load wiring prior to heater pack installation. The previous heater design had integral load lugs. The Series B heater packs are electrically equivalent to the previous heater design. Heaters H2018-3 to H2024-3 have not changed.

Starters with Series B Overload Relays ①

NEMA—AN Type		IEC—AE Type	
Size	**Series**	**Size**	**Series**
00–0	**C**	A–F	**C**
1–2	**B**	G–K	**B**
5	**B**	G–K	**B**
6	**C**	G–K	**B**
7–8	**B**	G–K	**B**

Heater Pack H2001B–H2017B



Standard Trip—Class 20 Heater

	Motor Full Load Ampere Rating Dial Position				
Overload Relay Size	**A**	**B**	**C**	**D**	**Catalog Number ②**
For Use with NEMA Sizes 00–0 Series C, NEMA Sizes 1–2 Series B; IEC Sizes A–F Series C, IEC Sizes G–K Series B					
32A or 75A	0.254	0.306	0.359	0.411	**H2001B-3**
	0.375	0.452	0.530	0.607	**H2002B-3**
	0.560	0.676	0.791	0.907	**H2003B-3**
	0.814	0.983	1.15	1.32	**H2004B-3**
	1.20	1.45	1.71	1.96	**H2005B-3**
	1.79	2.16	2.53	2.90	**H2006B-3**
	2.15	2.60	3.04	3.49	**H2007B-3**
	3.23	3.90	4.56	5.23	**H2008B-3**
	4.55	5.50	6.45	7.40	**H2009B-3**
	6.75	8.17	9.58	11.0	**H2010B-3**
	9.14	10.8	12.4	14.0	**H2011B-3**
	14.0	16.9	19.9	22.8	**H2012B-3**
	18.7	22.7	26.7	30.7	**H2013B-3**
	23.5	28.5	33.5	38.5	**H2014B-3**
For Use with NEMA Size 2, IEC Sizes G–K Only, Series B					
75A	29.0	34.0	39.1	44.1	**H2015B-3**
	39.6	45.5	51.5	57.4	**H2016B-3**
	53.9	60.9	67.9	74.9	**H2017B-3**

Notes

① The series of a starter is the last digit of the listed catalog number. Example: AN16DN0AB.

② Heater packs are shipped three to a carton. catalog numbers are for three heater packs.

Heater Pack H2018–H2024



Standard Trip—Class 20 Heater, continued

Overload Relay Size	Motor Full Load Ampere Rating Dial Position A	B	C	D	Catalog Number ①
For Use with NEMA Sizes 3–4, IEC Sizes L–N Only—Series A					
105A or 144A	8.0	9.2	10.3	11.5	**H2025-3**
	11.4	12.8	14.3	15.7	**H2026-3**
	14.3	15.7	17.4	19.0	**H2027-3**
	18.0	20.2	22.3	24.5	**H2018-3**
	24.6	27.6	30.5	33.4	**H2019-3**
	33.5	37.5	41.5	45.6	**H2020-3**
	45.7	51.2	56.7	62.1	**H2021-3**
	62.2	69.7	77.1	84.6	**H2022-3**
	84.7	95.0	105.0	115.0	**H2023-3**
	106.0	118.0	131.0	144.0	**H2024-3**
For Use with Size 5 Starters—Series B and IEC P, R and S with 300/5 CT					
32A ②	49	59	69	79	**H2004B-3**
	72	87	103	118	**H2005B-3**
	107	130	152	174	**H2006B-3**
	129	156	182	209	**H2007B-3**
	194	234	274	—	**H2008B-3**
For Use with Size 6 Starters Only—Series B and IEC T–V with 600/5 CT					
32A ②	144	174	205	235	**H2005B-3**
	215	259	304	348	**H2006B-3**
	258	312	365	419	**H2007B-3**
	388	468	547	627	**H2008B-3**
For Use with Size 7 Starters Only—Series B and IEC W–X with 1000/5 CT					
32A ②	163	197	230	264	**H2004B-3**
	240	290	342	392	**H2005B-3**
	358	432	506	580	**H2006B-3**
	430	520	608	698	**H2007B-3**
	646	780	912	—	**H2008B-3**
For Use Size 8 Starters Only—Series B and IEC Z with 1500/5 CT					
32A ②	244	295	345	396	**H2004B-3**
	360	435	513	588	**H2005B-3**
	537	648	759	870	**H2006B-3**
	645	780	912	1047	**H2007B-3**
	969	1170	1368	—	**H2008B-3**

Notes

① Heater packs are shipped three to a carton. catalog numbers are for three heater packs.

② Sizes 5–8 and IEC P–Z use the 32A overload relay with current transformers.

Heater Pack
H2101B–H2117B



Fast Trip—Class 10 Heater

	Motor Full Load Ampere Rating Dial Position				
Overload Relay Size	**A**	**B**	**C**	**D**	**Catalog Number** ①
For Use with NEMA Sizes 00–0 Series C, NEMA Sizes 1–2 Series B; IEC Sizes A–F Series C, IEC Sizes G–K Series B					
32A or 75A	0.260	0.313	0.367	0.420	**H2101B-3**
	0.384	0.464	0.543	0.623	**H2102B-3**
	0.570	0.688	0.806	0.924	**H2103B-3**
	0.846	1.02	1.20	1.37	**H2104B-3**
	1.28	1.55	1.83	2.10	**H2105B-3**
	1.92	2.33	2.74	3.15	**H2106B-3**
	2.30	2.79	3.28	3.77	**H2107B-3**
	3.38	4.10	4.82	5.54	**H2108B-3**
	4.96	6.03	7.09	8.16	**H2109B-3**
	7.07	8.58	10.1	11.6	**H2110B-3**
	9.60	11.2	12.8	14.4	**H2111B-3**
	14.4	17.5	20.7	23.8	**H2112B-3**
	18.7	21.8	25.0	28.1	**H2113B-3**
	23.5	27.3	31.0	34.8	**H2114B-3**
For Use with Size 2, IEC Sizes G–K Only—Series B					
75A	28.3	32.6	37.0	41.3	**H2115B-3**
	36.6	42.3	48.1	53.8	**H2116B-3**
	53.8	60.8	67.9	74.9	**H2117B-3**
For Use with Size 5 Starters Only—Series B and IEC P, R and S with 300/5 CT					
32A ②	51	61	72	82	**H2104B-3**
	77	93	110	126	**H2105B-3**
	115	140	164	189	**H2106B-3**
	138	167	197	226	**H2107B-3**
	203	246	289	—	**H2108B-3**
For Use with Size 6 Starters Only—Series B and IEC T–V with 600/5 CT					
32A ②	154	186	220	252	**H2105B-3**
	230	280	329	378	**H2106B-3**
	276	335	394	452	**H2107B-3**
	406	492	578	—	**H2108B-3**
For Use with Size 7 Starters Only—Series B and IEC W–X with 1000/5 CT					
32A ②	169	204	240	274	**H2104B-3**
	256	310	366	420	**H2105B-3**
	384	466	543	630	**H2106B-3**
	460	558	656	754	**H2107B-3**
	676	820	—	—	**H2108B-3**
For Use with Size 8 Starters Only—Series B and IEC Z with 1500/5 CT					
32A ②	254	306	360	411	**H2104B-3**
	384	465	549	630	**H2105B-3**
	576	699	822	945	**H2106B-3**
	690	837	984	1131	**H2107B-3**
	1014	1230	—	—	**H2108B-3**

Notes

① Heater packs are shipped three to a carton. catalog numbers are for three heater packs.

② Sizes 5–8 and IEC P–Z use the 32A overload relay with current transformers.

2

Accessories

DIN Rail and Panel Mounting Adapter

These adapters are required when component overload relays are to be separately mounted. The terminal base adapter includes line terminals and connects with the overload relays on **Page V5-T2-40**.

C306TB1



DIN Rail and Panel Mounting Adapter

Description	Catalog Number
For 32A overload relay	**C306TB1**
For 75A overload relay	**C306TB2B** ①

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.

Overload Relay Cover



Locking Cover for Overload Relay—C306 Only

Description	Min. Order Qty. (Std. Pkg.)	Catalog Number
Clear cover, no accessibility	50	**C320PC3**
Gray cover, no accessibility with auto only nib	50	**C320PC4**
Gray cover, no accessibility with manual only nib	50	**C320PC5**
Gray cover with FLA dial accessibility, A, B, C, D positions and auto only nib	50	**C320PC6**
Gray cover with FLA dial accessibility, A, B, C, D positions and manual only nib	50	**C320PC7**

Modifications

C306 Thermal Overload Relays with Mounting Adapter

Consists of a thermal overload relay mounted to a terminal base adapter—permits fast and easy installation.

C306 Thermal Overload Relays with Mounting Adapter

Description	Catalog Number
C306DN3B + C306TB1	**C306DT3B**
C306GN3B + C306TB2B	**C306GT3B**

Replacement Parts

Heater Pack Replacement

The heater pack series is determined by the 6th character of the catalog number. Series A or prior heater packs (identified by either "A" or "-" as the 6th character) have built-in load lugs. Series B or later heater packs do not (load lugs are on overload relay). Replacement of Series A or earlier heater packs with Series B or later heater packs, requires the one time addition of Lug Adapter Kit C306KAL1-3B to the Series A1 overload relay.

Superseded Series A Heater Pack



Series B Heater Pack



Heater Pack Replacement Requirements

Existing Heater Pack Catalog Numbers	Replacement Product Required
H2001-3–H2013-3 **H2001A-3–H2013A-3**	Lug adapter kit C306KAL1-3B and Series B heater pack
H2001B-3–H2013B-3	Series B heater pack
H2014-3 **H2014A-3**	Replace with lug adapter kit C306KAL1-3B and Series B heater pack
H2014B-3	Series B heater pack
H2015-3–H2017-3	Replace with heater pack chosen from table below
H2015A-3–H2017A-3	Replace with lug adapter kit C306KAL1-3B and Series B heater pack
H2015B-3–H2017B-3	Series B heater pack

Heater Pack Ratings

Motor Full Load Ampere Rating Dial Position A	B	C	D	Order Heater Pack Catalog Number
29.0	32.5	36.0	39.5	**H2015B-3**
39.6	44.3	49.1	53.8	**H2016B-3**
53.9	60.4	66.8	74.9	**H2017B-3**

Overload Relay Lug Adapter Kit

Superseded 32A Series A Overload Relay—C306DN3



Superseded 75A Series A Overload Relay—C306GN3



These kits are used in conjunction with Catalog Numbers H2001B–H2014B or H2101B–H2114B heater packs as a means of utilizing these Series B heater packs in Catalog Numbers C306DN3 and C306GN3 Series AI overload relays. The kit consists of three lug adapters and installation instructions. When installing Series B heater packs plus lug adapters in Series A overload relays, refer to heater pack FLA adjustment tables originally supplied with equipment (also supplied with kit).

C306KAL1



Overload Relay Lug

Description	Catalog Number
Series AI overload relay lug adapter kit	**C306KAL1-3B**

Overload Relay Replacement—Series A Only

When replacing a Catalog Number C306DN3 (Part No. 10-6044) or C306GN3 (10-6319) Series A overload relay on a starter, order a Series B overload relay and Series B heater packs.

Note

① This Series B adapter will accept Series A or B overload relays (C306GN3 or C306GN3B), C306TB2 can only be used with C306GN3.

Technical Data and Specifications

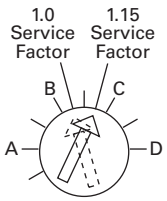
Operation

C306 Overload Relay Setting
For motors having a 1.15 service factor, rotate the FLA (Full Load Amperes) adjustment dial to correspond to the motor's FLA rating.

Estimate the dial position when the motor FLA falls between two letter values as shown in the example.

For motors having a 1.0 service factor, rotate the FLA dial one-half position counterclockwise (CCW).

FLA Dial Adjustment

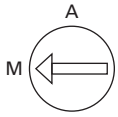


Example of 12.0 FLA setting for heater pack number H2011B showing position for 1.0 or 1.15 service factor motors.

The overload relay is factory set at M for manual reset operation. For automatic reset operation, turn the reset adjustment dial to the A position as shown in the illustration.

Automatic reset is not intended for two-wire control devices.

Manual/Automatic Reset



Example of setting for manual reset.

Test for Trip Indication

To test overload relay for trip indication when in manual reset, pull out the blue reset button. An orange flag will appear indicating that the device has tripped. Push reset button in to reset.

Warning—To provide continued protection against fire or shock hazard, the complete overload relay must be replaced if burnout of the heater element occurs.

General

"Overload relays are provided to protect motors, motor control apparatus and motor-branch circuit conductors against excessive heating due to motor overloads and failure to start. This definition does not include: 1) motor circuits over 600V, 2) short circuits, 3) ground faults and 4) fire pump control." (NEC Art. 430-31)

Time Current Characteristics

The time-current characteristics of an overload relay is an expression of performance which defines its operating time at various multiples of its current setting. Tests are run at Underwriters Laboratories (UL) in accordance with NEMA Standards and the NEC. UL requires:

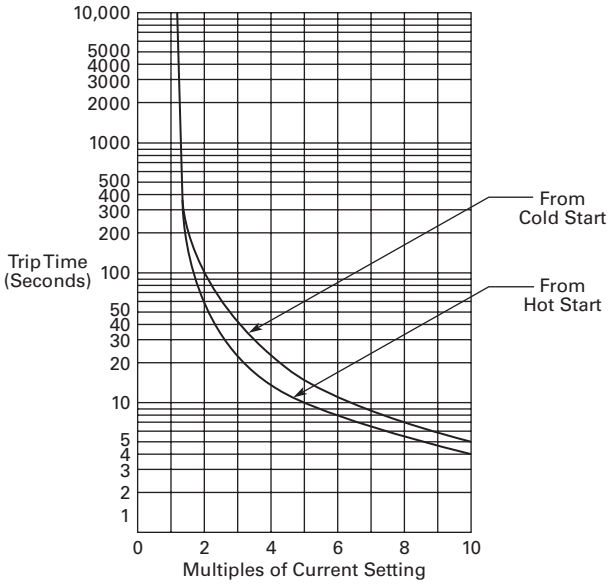
- When tested at 100 percent of its current rating, the overload relay shall trip ultimately
- When tested at 200 percent of its current rating, the overload relay shall trip in not more than 8 minutes
- When tested at 600 percent of the current rating, the overload relay shall trip in not more than 10 or 20 seconds, depending on the Class of the relay

"Current Rating" is defined as the minimum current at which the relay will trip. Per NEC, an overload must ultimately trip at 125% of FLA current (heater) setting for a 1.15 service factor motor and 115% FLA for a 1.0 service factor motor.

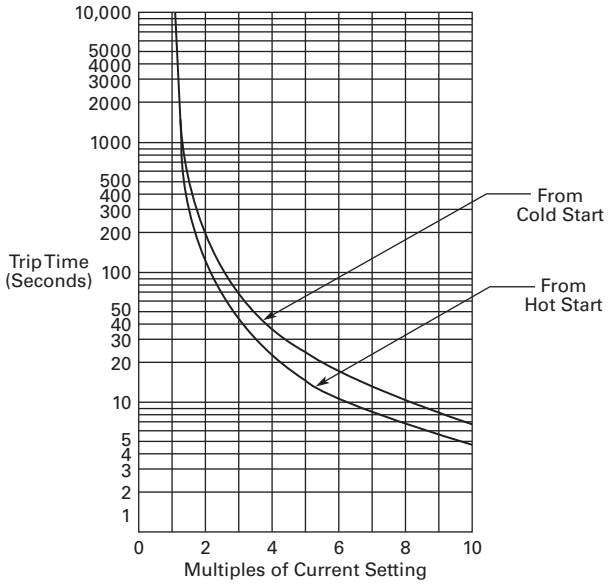
"Current Setting" is defined as the FLA of the motor and thus the overload heater pack setting.

Example: 600% of current rating is defined as 750% (600 x 1.25) of FLA current (heater) setting for a 1.15 service factor motor. A 10A heater setting must trip in 20 seconds or less at 75A motor current for a Class 20 relay.

Class 10 and Class 20 Trip Curves



Class 10 Overload Relay 25C Open Rating



Class 20 Overload Relay 25C Open Rating

2

Wire (75°C) Sizes—AWG or kcmil—NEMA Sizes 00–2, IEC A–K—Open

Power Terminals—Line

IEC Size	NEMA Size	Cu Only
A, B, C	00	12–16 stranded, 12–14 solid
D, E, F	0	8 –16 stranded, 10–14 solid
	1	8–14 stranded or solid
G, H, J, K	2	3–14 (upper) and/or 6–14 (lower) stranded or solid ①

Power Terminals—Load—Cu Only (Stranded or Solid)

Catalog Number	Terminal	Wire Size
C306DN3B	32A	14–6 AWG
C306GN3B	75A	14–2 AWG
Control Terminals—Cu Only		
12–16 AWG stranded, 12–14 AWG solid		

Wire (75°C) Sizes—AWG or kcmil—NEMA Sizes 3–8, IEC L–N—Open

Power Terminals—Line and Load

IEC Size	NEMA Size	Wire Size
L	3	1/0–14 Cu/Al
M	—	14–2/0 Cu/Al
N	—	3/0–8 Cu/Al
—	4	Open—3/0–8 Cu
		Enclosed—250 kcmil—6 Cu/Al
—	5	750 kcmil—2 or (2) 250 kcmil—3/0 Cu/Al
	6–7	(2) 750 kcmil—3/0 Cu/Al
	8	(2) 750 kcmil—1/0 Cu/Al
Control Terminals—Cu Only		
12–16 AWG stranded, 12–14 AWG solid		

Power Terminal Torque Line and Load Terminals

Catalog Number	Terminal	Torque in lb-in
C306DT3B	32A	20
C306GT3B	75A	35 (14–10 AWG)
		40 (8 AWG)
		45 (6–4 AWG)
		50 (3–2 AWG)
C306KN3 (socket head screw)	105A	120 (3/16)
		200 (1/4)
		250 (5/16)
C306NN3 (socket head screw)	144A	120 (3/16)
		200 (1/4)
		250 (5/16)
C306NN3 (slotted head screw)		35 (14–10 AWG)
		40 (8 AWG)
		45 (6–4 AWG)
		50 (3–1/0 AWG)

Plugging and Jogging Service Horsepower Ratings ②

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

Overload Relay UL/CSA Contact Ratings Control Circuit ③

AC Volts	120V	240V	480V	600V
NC Contact B600				
Make and break amperes	30	15	7.5	6
Break amperes	3	1.5	0.75	0.6
Continuous amperes	5	5	5	5
NO Contact C600				
Make and break amperes	15	7.5	3.375	3
Break amperes	1.5	0.75	0.375	0.3
Continuous amperes	2.5	2.5	2.5	2.5

Notes

① Two compartment box lug.

② Maximum horsepower where operation is interrupted more than 5 times per minute or more than 10 times in a 10 minute period. NEMA standard ICS 2-1993 table 2-4-3.

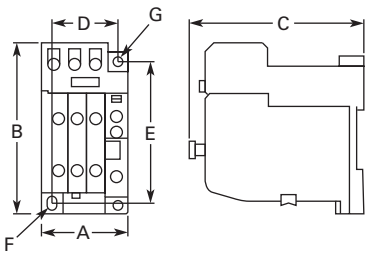
③ DC ratings cover Freedom Series coils only.

Dimensions

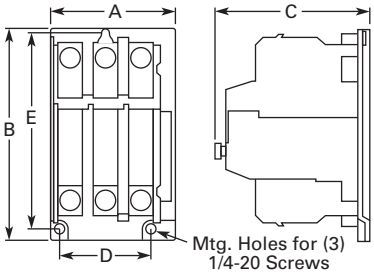
Approximate Dimensions in Inches (mm)

Stand-Alone Overload Relays

32A and 75A Sizes—C306DT38 and C306GT3B



105A and 144A Sizes—C306KN38 and C306NN3B



Dimensions and Shipping Weights

Ampere Size	Wide A	High B	Deep C	Mounting D	E	F (Slot)	G (Hole)	Shipping Weight Lbs (kg)
32A	1.77 (45.0)	4.13 (104.9)	3.69 (93.7)	1.36 (34.5)	3.74 (95.0)	0.18 x 0.30 (4.6 x 7.6)	0.18 (4.6) dia.	0.8 (0.4)
75A	2.54 (64.5)	4.69 (119.1)	3.74 (95.0)	2.00 (50.8)	3.45 (87.6)	0.22 x 0.26 (5.6 x 6.6)	0.21 (5.3) dia.	1.4 (0.6)
105 and 144A	4.00 (101.6)	7.17 (182.1)	4.91 (124.7)	3.00 (76.2)	6.62 (168.1)	—	—	4.0 (1.8)

C440/*XT* Electronic Overload Relay



Contents

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

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.

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
Motor Protection				
Thermal overload	Overload is a condition in which current draw exceeds 115% of the full load amperage rating for an inductive motor.	• An increase in the load or torque that is being driven by the motor. • A low voltage supply to the motor causes the current to go high to maintain the power needed. • A poor power factor causing above normal current draw.	• Increase in current draw leads to heat and insulation breakdown, which can cause system failure. • Increase in current can increase power consumption and waste valuable energy.	• Thermal trip behavior is defined by UL, CSA and IEC standards. • Trip class is settable from 10A, 10, 20, 30
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.

Catalog Number Selection

2

Freedom Series NEMA Starters with C440 Electronic Overload Relays ①

A N 1 9 A N 0 A 5E 005

Device Type
A = Starter

Standard
N = NEMA

Device Assembly Configuration
1 = Non-reversing
5 = Reversing

OLR Type
9 = Starter w/C440 EOLR

Contactor Frame Size

	NEMA Size	Continuous Amperes
A =	00	9
B =	0	18
C =	1C	27
D =	1	27
G =	2	45
K =	3	90
M =	4C	135
N =	4	135
S =	5	270

NEMA Enclosure
N = Open

For Starters

Starter Mounting Option
0 = Horizontal

C440 OLR Designation (FVNR and FVR only)
5E = Standard feature set
SEL Reset, SEL Class (10A, 10, 20, 30)
5G = Ground fault feature set
SEL Reset, SEL Class (10, 20)

AC Coil Suffix

Suffix	Volts and Hertz
A=	120/60 or 110/50
B=	240/60 or 220/50
C=	480/60 or 440/50
D=	600/60 or 550/50
E=	208/60
H=	277/60
J=	208–240/60 ②
K=	240/50
L=	380–415/50
N=	550/50
T=	24/60, 24/50 ③
U=	24/50
V=	32/50
W=	48/60
Y=	48/50

C440 FLA Range (FVNR and FVR only)

NEMA Size 00
1P6 = 0.33–1.65A
005 = 1–5A
020 = 4–20A

NEMA Size 0
1P6 = 0.33–1.65A
005 = 1–5A
020 = 4–20A

NEMA Size 1/1C
1P6 = 0.33–1.65A
005 = 1–5A
020 = 4–20A
045 = 9–45A

NEMA Size 2
005 = 1–5A
020 = 4–20A
045 = 9–45A

NEMA Size 3
100 = 20–100A

NEMA Size 4/4C
140 = 28–140A

NEMA Size 5 ④
300 = 60–300A

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 Single-Phase 115V	Single-Phase 230V	Three-Phase 208V	Three-Phase 240V	Three-Phase 480V	Three-Phase 600V	Three-Pole Non-Reversing ①② Catalog Number	Three-Pole Reversing ①② Catalog Number
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_**
5③	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 Single-Phase 115V	Single-Phase 230V	Three-Phase 208V	Three-Phase 240V	Three-Phase 480V	Three-Phase 600V	Three-Pole Non-Reversing ①② Catalog Number	Three-Pole Reversing ①② Catalog Number
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_**
5③	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	—	—
5③	**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

Compact NEMA Size 1 and 4 Starters

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

Non-Reversing

NEMA Size	Continuous Ampere Rating	Service Limit Current Rating (Amps)	Maximum UL Horsepower Single-Phase 115V	Single-Phase 230V	Three-Phase 208V	Three-Phase 240V	Three-Phase 480V	Three-Phase 600V	Three-Pole Non-Reversing Catalog Number
Standard Fault Overload									
1C	27	32	2	3	7.5	7.5	10	10	**AN19CN0_5E_**
4C	135	156	—	—	40	50	100	100	**AN19MN0_5E_**
Ground Fault Overload									
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) AC3/AC4	Operations
1C	27/150	2,500,000/40,000
1	27/153	5,000,000/110,000
4C	135/516	500,000/40,000
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

A N 1 9 D N 0 A 5E 020 – CRK

Device Type
A = Starter

Standard
N = NEMA

Device Assembly Configuration
1 = Non-reversing

OLR Type
9 = Starter w/C440 EOLR

Contactor Frame Size

	NEMA Size	Continuous Amperes
D =	1	27
G =	2	45
K =	3	90
N =	4	135
S =	5	270

NEMA Enclosure
N = Open

For Starters

Starter Mounting Option
0 = Horizontal

AC Coil Suffix

Suffix	Volts and Hertz
A =	120/60 or 110/50

C440 OLR Designation
5E = Standard feature set
SEL Reset,
SEL Class (10A, 10, 20, 30)

C440 FLA Range
NEMA Size 1/1C
020 = 4–20A
NEMA Size 2
045 = 9–45A
NEMA Size 3
100 = 20–100A
NEMA Size 4/4C
140 = 28–140A
NEMA Size 5
300 = 60–300A

Competitive Retrofit Kit

Accessories

CT Kits

Accessories

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

Safety Cover



Reset Bar



Remote Reset



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.

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.



Basic Communication—Modbus



Advanced Communication—Communication Module

Note

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

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.

Expansion Module



Description	Catalog Number
Expansion Module	
Expansion module (Remote Reset/Modbus RTU, RS-485 Communication)	**C440-XCOM**

Ethernet with I/O Module



Communication Modules	
DeviceNet communication module kit—120 V I/O (consists of C440-XCOM + C441KS)	**C440-DN-120**
DeviceNet communication module kit—24 Vdc I/O (consists of C440-XCOM + C441LS)	**C440-DN-24**
PROFIBUS communication module kit—120 V I/O (consists of C440-XCOM + C441SS)	**C440-DP-120**
PROFIBUS communication module kit—24 V I/O (consists of C440-XCOM + C441QS)	**C440-DP-24**
Modbus communication module kit—120 V I/O (consists of C440-XCOM + C441NS)	**C440-MOD-120**
Modbus communication module kit—24 Vdc I/O (consists of C440-XCOM + C441PS)	**C440-MOD-24**
Modbus TCP/Ethernet IP communication module kit—120 V I/O (consists of C440-XCOM + C441U)	**C440-ET-120**
Modbus TCP/Ethernet IP communication module kit—24 V I/O (consists of C440-XCOM + C441V)	**C440-ET-24**

Technical Data and Specifications

Electronic Overload Relays up to 1500A

Description	Specification 45 mm	55 mm	110 mm
Electrical Ratings	**Range**	**Range**	**Range**
Operating voltage (three-phase) and frequency	690 Vac (60/50 Hz)	690 Vac (60/50 Hz)	690 Vac (60/50 Hz)
FLA Range			
	0.33–1.65A 1–5A 4–20A 9–45A	20–100A	28–140A (NEMA) 35–175A (IEC)
Use with Contactors			
XT IEC frames	B, C, D	D, F, G	G, H
Freedom NEMA sizes	00, 0, 1, 2	3	4
Trip Class			
	10A, 10, 20, 30 Selectable	10A, 10, 20, 30 Selectable	10A, 10, 20, 30 Selectable
Motor Protection			
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
Feature	**Range**	**Range**	**Range**
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
Indicators			
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
Options			
Remote reset	Yes	Yes	Yes
Reset bar	Yes	Yes	Yes
Communication expansion module	Yes	Yes	Yes
Communication adapter	Yes	Yes	Yes
Capacity			
Load terminals			
Terminal capacity	12–10 AWG (4–6 mm^2) 8–6 AWG (6–16 mm^2)	6–1 AWG (16–50 mm^2)	8–4/0 AWG (10–95 mm^2)
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)
Voltages			
Insulation voltage U_i (three-phase)	690 Vac	690 Vac	690 Vac
Insulation voltage U_i (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

Electronic Overload Relays up to 1500A, continued

Description	Specification 45 mm	55 mm	110 mm
Auxiliary and Control Circuit Ratings			
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
Short-Circuit Rating without Welding			
Maximum fuse	6A gG/gL	6A gG/gL	6A gG/gL
Environmental Ratings			
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
Electrical/EMC			
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)	Three-phase power inputs: ±4 kV line-to-line (DM) ±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)	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)	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

Description	Modbus	DeviceNet	PROFIBUS	Ethernet
Electrical/EMC				
Radiated emissions IEC 60947-4-1—Table 15, EN 55011 (CISPIR 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 (CISPIR 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 ①: ±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 ① IEC 60947-4-1 (Table 13) IEC 61000-4-3	10 V/m	10 V/m	10 V/m	10 V/m
Environmental Ratings				
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 600068-2-27)	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
DeviceNet				
DeviceNet connections	—	Group 2, polling, bit strobe, explicit, no UCMM	—	—
DeviceNet baud rate	—	125K, 250K, 500K	—	—
Ethernet				
Ethernet connections	—	—	—	Integrated two-port switch with dual RJ45 Ethernet connections
Ethernet type	—	—	—	Ethernet 10/100 Mbs, AutoMDX, Auto Negotiation
PROFIBUS				
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

① Relates to C441M only.

Communication Modules, continued

Description	Modbus	DeviceNet	PROFIBUS	Ethernet
C441_ 24 Vdc Input				
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
Operating Voltage Range—DC Input Modules				
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
C441_ 120 Vac Input				
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
Operating Voltage Range—AC Input Modules				
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
Output Modules				
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 ①	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

① Relates to C441M only.

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)

		Standard-Fault Short Circuit Data			High-Fault Short Circuit Data					
					Fuses (RK5, J, CC)			Thermal-Magnetic Circuit Breakers		
Overload FLA Range	Maximum Operating Voltage	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 (NZMH3)

NEMA Freedom Series Starters with C440 Electronic Overload Relays

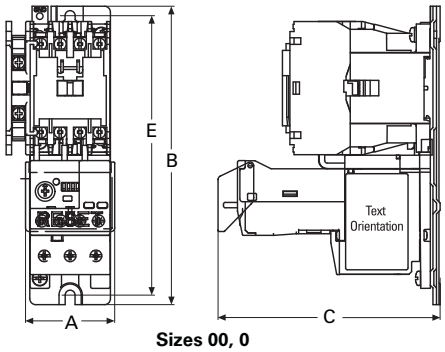
		High-Fault Short Circuit Data			Thermal-Magnetic Circuit Breakers		
		Fuses (RK5, J, CC)					
NEMA Size	Maximum Operating Voltage	480V	600V	Maximum Fuse Size	480V	600V	Maximum Breaker Size
00	0.33–1.65A	100	100	30	—	—	—
	1–5A	100	100	30	100	35	35
	4–20A	100	100	30	100	35	35
0	0.33–1.65A	100	100	60	—	—	—
	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

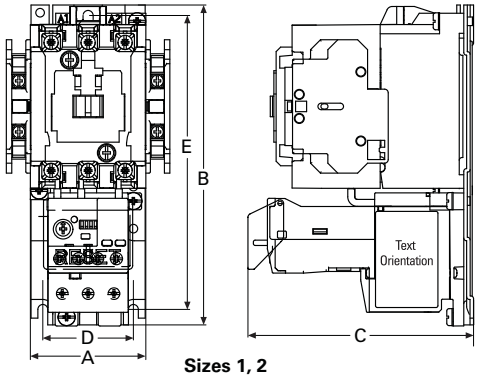
Approximate Dimensions in Inches (mm)

NEMA Starters

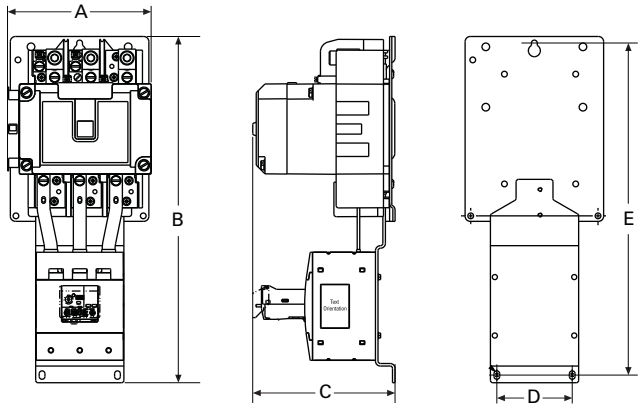
Full Voltage Non-Reversing Starters



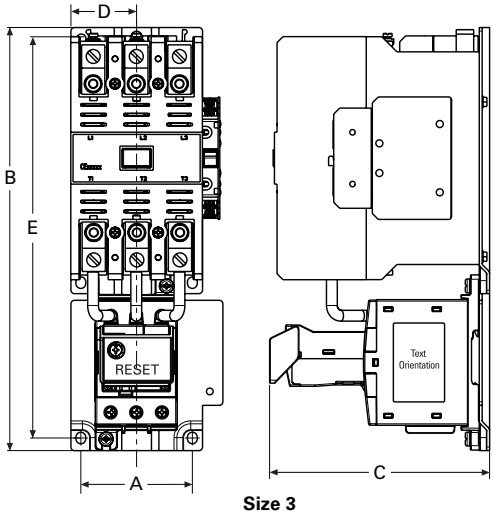
Sizes 00, 0



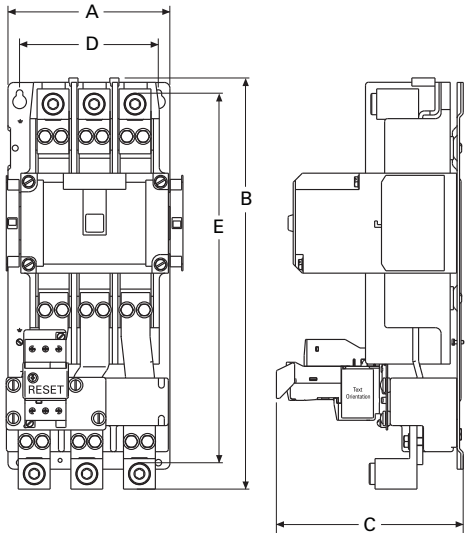
Sizes 1, 2



Size 4



Size 3

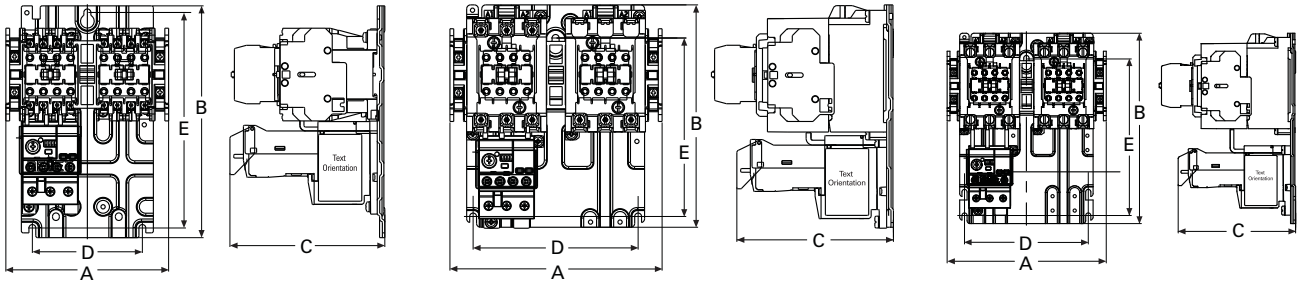


Size 5

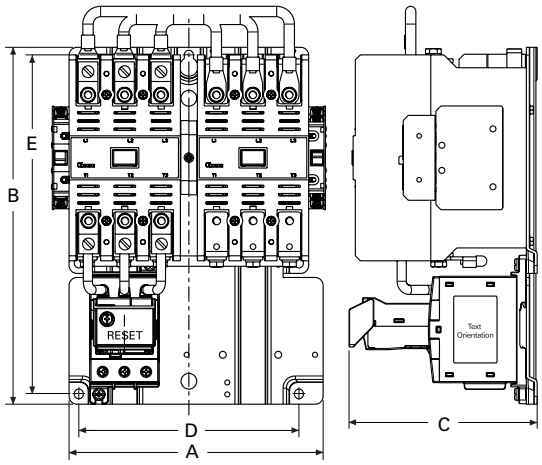
NEMA Size	A	B	C	D	E
00, 0	1.97 (50.0)	6.60 (167.6)	4.90 (124.5)	—	6.18 (157.0)
1, 2	2.60 (65.0)	7.10 (180.0)	4.98 (126.5)	2.00 (50.8)	6.50 (165.0)
3	3.00 (76.2)	11.40 (289.6)	5.92 (150.3)	1.77 (44.9)	10.81 (274.6)
4	7.10 (179.0)	17.00 (432.0)	7.00 (177.0)	3.70 (94.0)	16.30 (415.0)
5	7.00 (177.8)	17.81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

Approximate Dimensions in Inches (mm)

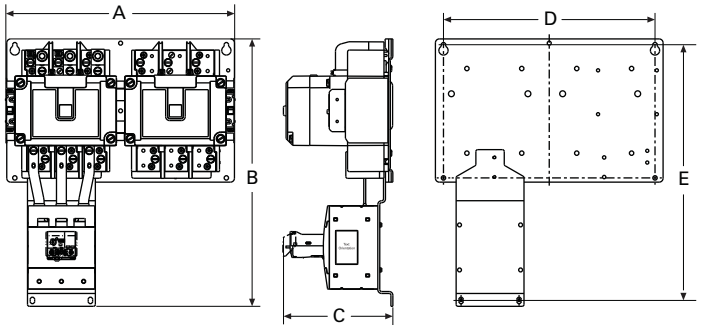
Full Voltage Reversing Starters



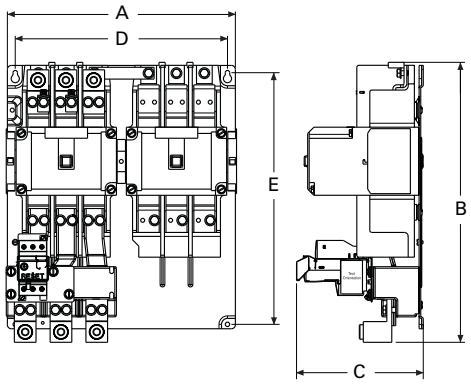
Sizes 00, 0 | Size 1 | Size 2



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 (145.0)
5	14.50 (368.3)	17.81 (452.3)	8.06 (204.8)	13.50 (342.9)	16.00 (406.6)

NEMA Space-Savings Family of Contactors and Starters



Contents

Description	*Page*
Contactors and Starters	
Catalog Number Selection	**V5-T2-64**
Product Selection	**V5-T2-64**
Accessories	**V5-T2-66**
Renewal Parts	**V5-T2-70**
Technical Data and Specifications	**V5-T2-71**
Dimensions	**V5-T2-93**

An Eaton Green Solution

Contactors and Starters

Product Description

The Eaton NEMA® Space-Savings line of contactors and starters includes non-reversing and reversing contactors, electronic overload relays and a variety of related accessories. Because the Space-Savings family meets IEC, UL®, CSA® and CE standards, it is the perfect product solution for applications all over the world. The compact and easy to install Space-Savings line of NEMA contactors and starters is the efficient and effective solution for customer applications from Size 0 through Size 5.

Application Description

The Space-Savings line of NEMA power control was engineered to provide highly effective control and protection for a variety of loads, including motors, compressors, pumps, resistive, capacitor banks, isolation and others.

The Space-Savings contactors are perfectly suited for use in Motor Control Center applications where bucket space sizing is critical. With both AC and DC control and flexible communication options, the Space-Savings family can be easily integrated into various customer applications.

Features and Benefits

- AC control from 120V to 600V 50/60 Hz
- 24 Vdc control
- Reversing or non-reversing contactors and starters
- XTOE self-powered electronic overload relay
- Non-reversing starters to NEMA Size 5
- Panel or DIN rail mounting to NEMA Size 2
- IP20 finger and back-of-hand proof
- Large ambient temperature range, –25 to 50°C [–13 to 122°F]
- AC and DC controlled contactors in the same compact frame
- Low power consumption AC and DC coils
- Built-in NO or NC auxiliary contacts to 32A
- Plug-in accessories for reduced installation time
- Coil replacement on NEMA Size 0–5
- Contact replacement on NEMA Size 1–5
- Integrated suppressor NEMA Size 0–4 DC operated contactors and NEMA Size 5 AC and DC operated contactors

Standards and Certifications

- IEC EN 60947
- CE approved
- UL
- CSA
- ATEX
- RoHS

CE UL SA RoHS COMPLIANT

Catalog Number Selection

2

Space-Savings NEMA Starters with XTOE Electronic Overload Relays

A N 1 3 C N 0 1 A 5E 005

Device Type
- **A** = Starter
- **C** = Contactor

Standard
- **N** = NEMA

Device Assembly Configuration
- **1** = Non-reversing
- **5** = Reversing

OLR Type
- **3** = Starter w/XTOE EOLR

Contactor Frame Size ②

	NEMA Size	Continuous Amperes
B =	0	18
C =	1	27
G =	2	45
K =	3	90
M =	4	135
S =	5	270

NEMA Enclosure
- **N** = Open

For Starters

Starter Mounting Option
- **0** = Horizontal

For Contactors Only

Starter Mounting Option
- **10** = 1 normally open
- **01** = 1 normally closed
- **11** = 1 normally open, 1 normally closed
- **00** = No auxiliary contacts
- **22** = 2 normally open, 2 normally closed

Coil Suffix

Suffix	Volts and Hertz
A =	120/60 or 110/50
B =	240/60 or 220/50
TD =	24 Vdc

XTOE OLR Designation (FVNR and FVR only)
- **5E** = Standard feature set SEL Reset, SEL Class (10A, 10, 20, 30)
- **5G** = Ground fault feature set SEL Reset, SEL Class (10, 20)

XTOE FLA Range (FVNR and FVR only)

NEMA Size 0
- **1P6** = 0.33–1.65A
- **005** = 1–5A
- **020** = 4–20A

NEMA Size 1
- **1P6** = 0.33–1.65A
- **005** = 1–5A
- **020** = 4–20A
- **045** = 9–45A

NEMA Size 2
- **045** = 9–45A

NEMA Size 3
- **100** = 20–100A

NEMA Size 4/4C
- **175** = 35–175A

NEMA Size 5 ②
- **300** = 60–300A

Product Selection

Type CN13/53 Space-Savings NEMA Contactors

NEMA Contactor



Non-Reversing and Reversing

NEMA Size	Continuous Ampere Rating	Service Limit Current Rating (Amps)	Maximum UL Horsepower Single-Phase 115V	Single-Phase 230V	Three-Phase 208V	Three-Phase 240V	Three-Phase 480V	Three-Phase 600V	Three-Pole Non-Reversing ① Catalog Number	Three-Pole Reversing ① Catalog Number
0	18	21	1	2	3	3	5	5	**CN13BN010_**	—
1	27	32	2	3	7-1/2	7-1/2	10	10	**CN13CN010_**	**CN53CN011_**
2	45	52	3	7-1/2	10	15	25	25	**CN13GN000_**	**CN53GN011_**
3	90	104	7.5	15	25	30	50	50	**CN13KN000_**	**CN53KN011_**
4	135	156	—	—	40	50	100	100	**CN13MN000_**	—
5	270	311	—	—	75	100	200	200	**CN13SN022_**	—

Notes

① Underscore (_) indicates coils suffix required, see Coil Suffix table above.

② NEMA Size 5 starter components to be ordered separately: Contactor (CN13SN022_), 60–300A CT kit, and 1–5A overload relay. See page **V5-T2-82** for CT kit and overload part numbers.

Type AN13/53 Space-Savings Starters with XTOE Electronic Overload Relays

NEMA Starter



Non-Reversing and Reversing

NEMA Size	Continuous Ampere Rating	Service Limit Current Rating (Amps)	Maximum UL Horsepower Single-Phase 115V	230V	Three-Phase 208V	240V	480V	600V	Three-Pole Non-Reversing ①② Catalog Number ③	Three-Pole Reversing ①② Catalog Number ③
0	18	21	1	2	3	3	5	5	**AN13BN0_ 5E _**	**AN53BN0_ 5E _**
1	27	32	2	3	7-1/2	7-1/2	10	10	**AN13CN0_ 5E _**	**AN53CN0_ 5E _**
2	45	52	3	7-1/2	10	15	25	25	**AN13GN0_ 5E _**	**AN53GN0_ 5E _**
3	90	104	—	—	25	30	50	50	**AN13KN0_ 5E _**	**AN53KN0_ 5E _**
4	135	156	—	—	40	50	100	100	**AN13MN0_ 5E _**	**AN53MN0_ 5E _**
5 ④	270	311	—	—	75	100	200	200	④	—

Type AN13/53 Space-Savings Starters with XTOE 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 Single-Phase 115V	230V	Three-Phase 208V	240V	480V	600V	Three-Pole Non-Reversing ①② Catalog Number ③	Three-Pole Reversing ①② Catalog Number ③
0	18	21	1	2	3	3	5	5	**AN13BN0_ 5G _**	**AN53BN0_ 5G _**
1	27	32	2	3	7-1/2	7-1/2	10	10	**AN13CN0_ 5G _**	**AN53CN0_ 5G _**
2	45	52	3	7-1/2	10	15	25	25	**AN13GN0_ 5G _**	**AN53GN0_ 5G _**
3	90	104	—	—	25	30	50	50	**AN13KN0_ 5G _**	**AN53KN0_ 5G _**
4	135	156	—	—	40	50	100	100	**AN13MN0_5G_**	**AN53MN0_5G_**
5 ④	270	311	—	—	75	100	200	200	④	—

XTOE Overload FLA Range (FVNR and FVR Starters Only) Magnet Coil Suffix

NEMA Size	OLR Code	FLA Range	OLR Code	FLA Rating
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	—	—	**045**	9.0–45A
	—	—	—	—
3	**100**	20–100A	—	—
4	**175**	35–175A	—	—
5 ④	**300**	60–300A	—	—

Coil Voltage	Suffix Code
Sizes 0–2	
110V 50 Hz, 120V 60 Hz	**A**
220V 50 Hz, 240V 60 Hz	**B**
24–27 Vdc	**TD**
Sizes 3, 4	
100–120V 50/60 Hz	**A**
190–240V 50/60 Hz	**B**
24–27 Vdc	**TD**
Sizes 5	
100–120V 50/60 Hz	**A**
24–48 Vdc	**TD**

Notes

① Underscore (_) indicates coils suffix required, see Coil Suffix table above.

② Underscore (_) indicates OLR designation required, see XTOE FLA Range table above.

③ For MCC replacement needs, contact MCC Aftermarket.

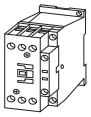
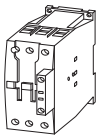
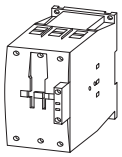
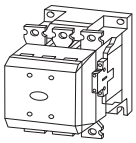
④ NEMA Size 5 starter components to be ordered separately: Contactor (CN13SN022_), 60–300A CT kit, and 1–5A overload relay. See page **V5-T2-82** for CT kit and overload part numbers.

Accessories

Auxiliary Contacts—Overview

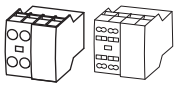
Front-mounted snap-on auxiliary contacts for Space-Savings contactors are available with screw terminals in a variety of contact configurations.

Auxiliary Contacts Possible Combinations

Frame Size	Catalog Number	Contactor	Built-In Auxiliary	Front (Top) Mount Two-Pole	Front (Top) Mount Four-Pole	Side-Mount Single-Pole	Side-Mount Two-Pole	Total Auxiliary Contacts Available
0, 1	**CN13BN0_ – CN13CN0_**		1NO or 1NC	1	—	—	—	3
				—	1	—	—	5
				—	—	—	1	3
						—		—
2	**CN13GN0_**		—	1	—	—	2	6
				—	1	—	1	6
						—		—
3, 4	**CN13KN0_ – CN13MN0_**		—	1	—	—	2	6
				—	1	—	2	8
				—	—	—	4	8
						—		—
5	**CN13SN0**		2NO–2NC	—	—		2	8
				—	—			—

Auxiliary Contacts

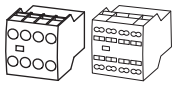
XTCEXF_



NEMA Size 0, 1— Front (Top) Mount—Two-Pole

Conventional Thermal Current, Open at 60°C $I_{th} = I_e$, AC-1 in Amps	Contact Configuration	Circuit Symbol	Pkg. Qty. ①	Screw Terminal Catalog Number
16	2NO	53 63 / 54 64	5	**XTCEXFAC20**
16	1NO-1NC	53 61 / 54 62	5	**XTCEXFAC11** ②
16	2NC	51 61 / 52 62	5	**XTCEXFAC02**

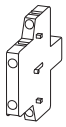
XTCEXF_



NEMA Size 0, 1— Front (Top) Mount—Four-Pole

Conventional Thermal Current, Open at 60°C $I_{th} = I_e$, AC-1 in Amps	Contact Configuration	Circuit Symbol	Pkg. Qty. ①	Screw Terminal Catalog Number
16	4NO	53 63 73 83 / 54 64 74 84	5	**XTCEXFAC40** ②
16	3NO-1NC	53 61 73 83 / 54 62 74 84	5	**XTCEXFAC31** ②
16	2NO-2NC	53 61 71 83 / 54 62 72 84	5	**XTCEXFAC22** ②
16	1NO-3NC	53 61 71 81 / 54 62 72 82	5	**XTCEXFAC13**
16	4NC	51 61 71 81 / 52 62 72 82	5	**XTCEXFAC04**

XTCEXSCC11



NEMA Size 0, 1—Side-Mount—Two-Pole

Conventional Thermal Current, Open at 60°C $I_{th} = I_e$, AC-1 in Amps	Contact Configuration	Circuit Symbol	Pkg. Qty. ①	Screw Terminal Catalog Number
10	1NO-1NC	53 61 / 54 62	1	**XTCEXSCC11** ③

Notes

No auxiliary contacts can be fitted between two contactors.

① Orders must be placed in multiples of package quantity listed.

② To avoid duplicate terminal numbers in contact sequence, these auxiliary contacts should only be used with contactors having a built-in 1NO contact (XTCE…B10_, XTCE…C10_).

③ Can be mounted to the left side of contactor only. Cannot be used in combination with front (top) mount auxiliary contacts or mechanical interlocks.

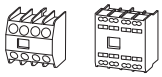
XTCEXF_



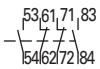
NEMA Sizes 2–4—Two-Pole

Conventional Thermal Current, Open at 60°C $I_{th} = I_e$, AC-1 in Amps	Contact Configuration	Circuit Symbol	Pkg. Qty. ①	Screw Terminal Catalog Number
16	2NO		5	**XTCEXFBG20**
16	1NO-1NC		5	**XTCEXFBG11**
16	2NC		5	**XTCEXFBG02**

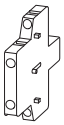
XTCEXF_



NEMA Sizes 2–4—Four-Pole

Conventional Thermal Current, Open at 60°C $I_{th} = I_e$, AC-1 in Amps	Contact Configuration	Circuit Symbol	Pkg. Qty. ①	Screw Terminal Catalog Number
16	4NO-0NC		5	**XTCEXFBG40**
16	3NO-1NC		5	**XTCEXFBG31**
16	2NO-2NC		5	**XTCEXFBG22**
16	2NO-2NC		5	**XTCEXFAG22**
16	1NO-3NC		5	**XTCEXFBG13**

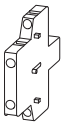
XTCEXS_



NEMA Sizes 2–4, Side Mount (Snap-On)—Two-Pole

Conventional Free Air Thermal Current, $I_{th} = I_e$, AC-1 in Amps	Contact Configuration	Circuit Symbol	Pkg. Qty. ①	Screw Terminal Catalog Number
10	1NO–1NC		1	**XTCEXSBN11**

XTCEXS_



NEMA Size 5, Side Mount (Screw Mount)—Two-Pole

Conventional Free Air Thermal Current, $I_{th} = I_e$, AC-1 in Amps	Contact Configuration	Circuit Symbol	Pkg. Qty. ①	Screw Terminal Catalog Number
10	1NO–1NC		1	**XTCEXSBR11** ②

Notes

No auxiliary contacts can be fitted between two contactors.

① Orders must be placed in multiples of package quantity listed.

② For replacement only. XTCEXSBR11 and XTCEXSBLR11 cannot be added onto side mount auxiliaries that come with the Size 5 contactors as standard. To add auxiliaries onto the included side auxiliaries on Size 5 contactors, use XTCEXSCR11.

Suppressors

The switching of contactor coils can generate voltage transients that may cause arching on switch contacts and/or damage electronics on the control line. Either an RC or varistor suppressor is recommended in these types of applications. All Space-Savings DC contactor coils have built-in suppression.

Varistor suppressors clamp the voltage transient above the maximum coil voltage and are recommended when the level of the transient is known to not exceed the coil voltage. RC suppressors slow and reduce the level of the voltage transient but do not clamp them at a specific level. The slowing of the transient can reduce electrical interference. These are recommended in applications where operating rates are high.

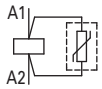
XTCEXVS_



Varistor Suppressor ①②

Voltage	For Use with…	Pkg. Qty. ③	Catalog Number
48–130	CN13BN0_ CN13CN0_	10	**XTCEXVSCA**
48–130	CN13GN0_	10	**XTCEXVSFA**

Contact Sequence



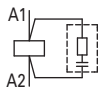
XTCEXRS_



RC Suppressor ①②

Voltage	For Use with…	Pkg. Qty. ③	Catalog Number
24–48	CN13GN0_	—	**XTCEXRSFW**
110–130		—	**XTCEXRSFA**

Contact Sequence



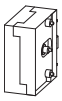
Additional Accessories

Mechanical Interlock ⑤

XTCEXML_



XTCEXMLM



For Use with…	Pkg. Qty. ③	Catalog Number
CN13BN0_, CN13CN0_	1	**XTCEXMLC**
CN13GN0_	1	**XTCEXMLD**
CN13KN0_, CN13MN0_	1	**XTCEXMLG** ⑥
CN13SN0_	1	**XTCEXMLM**

XTCEXRL_



Reversing Link Kits

For Use with…	Pkg. Qty. ③	Catalog Number
CN13BN0_, CN13CN0_	1	**XTCEXRLC**
CN13GN0_	1	**XTCEXRLD**
CN13KN0_, CN13MN0_	1	**XTCEXRLG**

Main current wiring for reversing combinations. Includes paralleling bridge and reversing bridge. Does not include mechanical interlock, see table on this page.

XTCEXTLA400



Terminal Lug Assembly

For Use with…	Pkg. Qty. ③	Catalog Number
CN13SN0_	1	**XTCEXTLA400**

For connection of: round conductor, flexible and stranded, flat strip conductor, with control circuit terminal. See **Page V5-T2-72** for terminal capacities.

XTCEXTS_



Terminal Shroud

For Use with…	Pkg. Qty. ③	Catalog Number
CN13SN0_	1	**XTCEXTS400**

Protection against direct contact with connection lugs when touched vertically from the front.

Notes

① Note dropout delay.
② For AC operated contactors, 50–60 Hz. Sizes 0–5 DC operated contactors and Size 5 AC operated contactors have a built-in suppressor circuit.
③ Orders must be placed in multiples of package quantity listed.
④ In addition to the built-in suppressor circuit for DC actuated contactors. Prevents negative breaking voltage when contactors are used in combination with a safety PLC.
⑤ For two contactors with AC or DC operated magnet system which are horizontally or vertically mounted. For Sizes 0–4, mechanical lifespan is 2.5 x 10^6 operations and the distance between contactors is 0 mm. For Size 5, mechanical lifespan is 5 x 10^6 operations and no auxiliary contact can be mounted between the mechanical interlock and the contactor—the distance between contactors is 15 mm.
⑥ XTCEXMLG and XTCEXMLN consist of an interlock element and mounting plate.

Renewal Parts

XTCERENC_





Replacement Coils

Voltage	Coil Suffix	Catalog Number
Size 0, 1		
110/50 120/60	**A**	**XTCERENCOILCA**
220/50 240/60	**B**	**XTCERENCOILCB**
24–27 Vdc	**TD**	**XTCERENCOILCTD**
Size 2		
110/50 120/60	**A**	**XTCERENCOILDA**
220/50 240/60	**B**	**XTCERENCOILDB**
24–27 Vdc	**TD**	**XTCERENCOILDTD**
Size 3, 4		
100–120V 50/60	**A**	**XTCERENCOILGA**
190–240V 50/60	**B**	**XTCERENCOILGB**
24–27 Vdc	**TD**	**XTCERENCOILGTD**
Size 5		
110–250 Vac/Vdc	**A**	**XTCERENCOILLA**
24–48 Vdc	**TD**	**XTCERENCOILLTD**

Replacement Contact Kit

For Use with…	Catalog Number
CN13GN0_	**XTCERENCONTACTD**
CN13SN0_	**XTCERENCONTACTL**

Replacement Arc Chamber

For Use with…	Catalog Number
CN13SN0_	**XTCERENARC250**

Technical Data and Specifications

Auxiliary Contacts

Description	CN13BN0_, CN13CN0_	XTCEXFAC_ XTCEXFATC_	XTCEXFCC_ XTCEXSCC_	XTCEXFAG_	XTCEXSBLN_ XTCEXSBN_ XTCEXSBNC_ XTCEXSCN_ XTCEXSCNC_
Interlocked opposing contacts with an auxiliary contact module (to IEC 60947-5 -1 Annex L)	—	Yes	Yes	Yes	Yes
Break contact (not late-break contact) suitable as a mirror contact (to IEC/EN 60947-4 -1 Annex F)	CN13BN0_, CN13CN0_	CN13BN0_, CN13CN0_	CN13BN0_, CN13CN0_	CN13GN0_	CN13GN0_, CN13SN0_
Rated impulse withstand voltage, (U_{imp}) Vac	6000	6000	6000	6000	6000
Overvoltage category/pollution degree	III/3	III/3	III/3	III/3	III/3
Rated insulation voltage, (U_i) Vac	690	690	690	690	690
Rated operational voltage, (U_e) Vac	500	500	500	500	500
Safe isolation to VDE 0106 Part 101 and Part 101(A) in Vac					
Between coil and auxiliary contacts	400	400	400	440	440
Between the auxiliary contacts	400	400	400	440	440
Rated operational current, I_e					
AC-15					
230V	6A	6A	6A	6A	6A
380/415V	4A	3A	4A	4A	4A
500V	1.5A	—	1.5A	1.5A	1.5A
DC-3 L/R ≤5 ms ①					
24V	10A	10A	10A	10A	10A
60V	6A	6A	6A	6A	6A
110V	3A	3A	3A	3A	3A
220V	1A	1A	1A	1A	1A
Conventional thermal current, I_{th}	16A	16A	16A ③	10A	10A
Control circuit reliability (at U_e = 24 Vdc, U_{min} = 17 V, I_{min} = 5.4 mA)	$<10^{-8}$, <1 failure at 100 million operations	$<10^{-8}$, <1 failure at 100 million operations	$<10^{-8}$, <1 failure at 100 million operations	$<10^{-8}$, <1 failure at 100 million operations	$<10^{-8}$, <1 failure at 100 million operations
Component lifespan, operations x 10^6 at U_e = 230V, AC-15, 3A	1.3	1.3	1.3	1.3	1.3
Short-circuit rating without welding ②					
Maximum fuse, gG/gL	10A	10A	10A	16A	16A

Notes

① Making and breaking conditions to DC-13, time L/R contact as stated.
② See fuses overlay for time/current characteristic (on request).
③ Conventional thermal current (I_{th}) of XTCEXSCC_ is 10A.

Parallel Link

Description	XTCEXPLKB	XTECXPLKC	XTCEXPLKD	XTCEXPLKG	XTCEXPLK185
Terminal capacity					
Solid (mm^2)	1–16	16	16	—	—
Flexible with ferrule (mm^2)	1 x (0.5–25) 2 x (0.5–16)	1 x (16–35)	1 x (16–120)	—	—
Stranded (mm^2)	1 x (0.5–25) 2 x (0.5–16)	1 x (16–50)	1 x (16–120)	1 x (35–300) 2 x (35–120)	—
Flat conductor—number of segments x width x thickness (mm)	6 x 9 x 0.8	—	—	2 x (11 x 21 x 1)	1 x (6 x 16 x 0.8) 2 x (20 x 32 x 0.5) 2 x (11 x 21 x 1)
Tightening torque (Nm)	4	4	14	—	—
Tools					
Pozidriv screwdriver	Size 2	Size 2	—	—	—
Hexagon socket head spanner—SW (mm)	—	—	5	6	—
Conventional thermal current					
Three-pole (I_{th}) A	50	100	180	400	—
Four-pole (I_{th}) A	60	—	—	—	—

Cable Terminal Block, Flat Cable Terminal

Description	XTCEXTLA400	XTCEXPLK185	XTCEXTFB650	XTCEXTFB820
Terminal capacity				
Stranded (mm^2)	1 x (120–300) 2 x (70–240)	—	—	—
Stranded (AWG)	1 x (250–600 kcmil) 2 x (2/0–500 kcmil)	—	—	—
Flat conductor—number of segments x width x thickness (mm)	—	1 x (6 x 16 x 0.8) 2 x (20 x 32 x 0.5) 2 x (11 x 21 x 1)	1 x (6 x 16 x 0.8) 2 x (20 x 32 x 0.5) 2 x (11 x 21 x 1)	1 x (6 x 16 x 0.8) 2 x (10 x 40 x 1) 2 x (20 x 40 x 0.5)

AC Ratings—AC-1 Operation

Description	CN13B	CN13C	CN13G	CN13K	CN13M	CN13S
Conventional free air thermal current, three-pole, 50–60 Hz						
Open						
at 40°C (I_{th})	40A	45A	80A	130A	190A	490
at 50°C (I_{th})	38A	43A	71A	125A	180A	438
at 55°C (I_{th})	37A	42A	68A	115A	170A	418
at 60°C (I_{th})	35A	40A	65A	110A	160A	400
Enclosed	32A	36A	58A	100A	144A	315
Conventional free air thermal current, single-pole (I_{th})						
Open	88A	100A	162A	275A	400A	—
Enclosed	80A	90A	145A	250A	360A	—

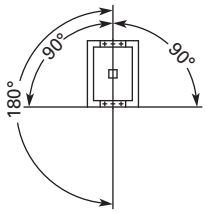
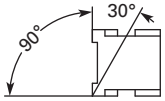
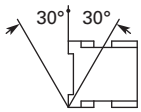
Space-Savings Contactors—NEMA Sizes 0–2

Description	Size 0 CN13BN010_	Size 1 CN13CN010_	Size 2 CN13GN000_
General			
Standards	IEC/EN 60947, VDE 0660, UL, CSA, CCC, RoHS	IEC/EN 60947, VDE 0660, UL, CSA, CCC, RoHS	IEC/EN 60947, VDE 0660, UL, CSA, CCC, RoHS
Weights in kg [lb]			
AC operated	0.42 [0.93]	0.42 [0.93]	0.9 [2.0]
DC operated	0.48 [1.06]	0.48 [1.06]	1.1 [2.4]
Mechanical life—operations	10,000,000	10,000,000	10,000,000
Climatic proofing	①	①	①
Insulation voltage (U_i) Vac	690	690	690
Impulse withstand voltage (U_{imp}) Vac	8000	8000	8000
Operating voltage (U_e) Vac	690	690	690
Safe isolation to VDE 0106 Part 101 and Part 101/A1			
Between coil and contacts (Vac)	440	440	440
Between contacts (Vac)	238	440	440
Making capacity (amps)	238	384	910
Breaking capacity (amps)			
220/230V	170	320	650
380/400V	170	320	650
500V	170	320	650
660/690V	120	180	370
Short-circuit protection rating maximum fuse (amps)			
Type 2 coordination ②			
400V; gG/gL 500V	25	63	125
690V; gG/gL 690V	25	35	80
Type 1 coordination ②			
400V; gG/gL 500V	63	125	250
690V; gG/gL 690V	50	63	100
Degree of protection	IP00	IP00	IP00
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
Terminal capacity main cable—screw terminals			
Solid (mm^2)	1 x (0.75–16) 2 x (0.75–10)	1 x (0.75–16) 2 x (0.75–10)	1 x (0.75–16) 2 x (0.75–10)
Flexible with ferrule (mm^2)	1 x (0.75–16) 2 x (0.75–10)	1 x (0.75–16) 2 x (0.75–10)	1 x (2.5–35) 2 x (2.5–25)
Stranded (mm^2)	1 x 16	1 x 16	1 x (16–50) 2 x (16–35)
Solid or stranded (AWG)	18–6	18–6	12–2
Flat conductor (number of segments x width x thickness) (mm)	—	—	2 x (6 x 9 x 0.8)

Notes

① Damp heat, constant, to IEC 60068-2-78; damp heat, cyclic, to IEC 60 068-2-30.
② IEC 60947 Standard.

Space-Savings Contactors—NEMA Sizes 0–2, continued

Description	Size 0 CN13BN010_	Size 1 CN13CN010_	Size 2 CN13GN000_
General, continued			
Main cable connection screw/bolt	M5	M5	M6
Tightening torque			
Nm	3	3	3.3
Lb-in	26.6	26.6	29.2
Terminal capacity control circuit cable—screw terminals			
Solid (mm^2)	1 x (0.75–4) 2 x (0.75–4)	1 x (0.75–4) 2 x (0.75–4)	1 x (0.75–4) 2 x (0.75–4)
Flexible with ferrule (mm^2)	1 x (0.75–2.5) 2 x (0.75–2.5)	1 x (0.75–2.5) 2 x (0.75–2.5)	1 x (0.75–2.5) 2 x (0.75–2.5)
Solid or stranded (AWG)	18–14	18–14	18–14
Control circuit cable connection screw/bolt	M3.5	M3.5	M3.5
Tightening torque			
Nm	1.2	1.2	1.2
Lb-in	10.6	10.6	10.6
Tools			
Main and control circuit cable—screw terminals	Size 2	Size 2	Size 2
Pozidriv screwdriver	0.8 x 5.5	0.8 x 5.5	0.8 x 5.5
Standard screwdriver	1 x 6	1 x 6	1 x 6
Terminal capacity control circuit cable—spring cage terminals			
Solid (mm^2)	1 x (0.75–2.5) 2 x (0.75–2.5)	1 x (0.75–2.5) 2 x (0.75–2.5)	1 x (0.75–2.5) 2 x (0.75–2.5)
Flexible (mm^2)	1 x (0.75–2.5) 2 x (0.75–2.5)	1 x (0.75–2.5) 2 x (0.75–2.5)	1 x (0.75–2.5) 2 x (0.75–2.5)
Flexible with ferrule (mm^2)	1 x (0.75–2.5) 2 x (0.75–2.5)	1 x (0.75–2.5) 2 x (0.75–2.5)	1 x (0.75–2.5) 2 x (0.75–2.5)
Solid or stranded (AWG)	18–14	18–14	18–14
Tools			
Main and control circuit cable—spring cage terminals			
Stripping length (mm)	10	10	10
Screwdriver blade width (mm)	3.5	3.5	3.5
Mounting position, AC and DC operated			
Ambient temperature			
Open	–25 to 60°C [–13 to 140°F]	–25 to 60°C [–13 to 140°F]	–25 to 60°C [–13 to 140°F]
Enclosed	–25 to 40°C [–13 to 104°F]	–25 to 40°C [–13 to 104°F]	–25 to 40°C [–13 to 104°F]
Ambient storage temperature	–40 to 80°C [–40 to 176°F]	–40 to 80°C [–40 to 176°F]	–40 to 80°C [–40 to 176°F]
Environmental			
Mechanical shock resistance (IEC/EN 60068-2-27)			
Main contact—NO Contact	10	10	1
Auxiliary contact—NO Contact	7	7	7
Auxiliary contact—NC Contact	5	5	5
Overvoltage category/pollution degree	III/3	III/3	III/3

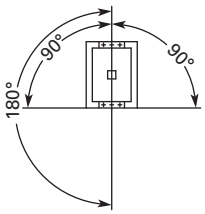
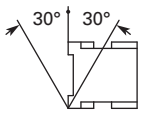
Space-Savings Contactors—NEMA Sizes 3, 4

Description	Size 3 CN13KN000_	Size 4 CN13MN000_
General		
Standards	IEC/EN 60947, VDE 0660, UL, CSA, CCC, RoHS	IEC/EN 60947, VDE 0660, UL, CSA, CCC, RoHS
Weights in kg [lb]		
AC operated	2 [4.41]	2 [4.41]
DC operated	2.1 [4.63]	2.1 [4.63]
Mechanical life—operations	10,000,000	10,000,000
Climatic proofing	①	①
Insulation voltage (U_i) Vac	690	690
Impulse withstand voltage (U_{imp}) Vac	8000	8000
Operational voltage (U_e) Vac	690	690
Safe isolation to VDE 0106 Part 101 and Part 101/A1		
Between coil and contacts (Vac)	690	690
Between contacts (Vac)	690	690
Making capacity (amps)	1610	2100
Breaking capacity (amps)		
220/230V	1150	1500
380/400V	1150	1500
500V	1150	1500
660/690V	1100	1200
1000V	—	—
Short-circuit protection rating maximum fuse		
Type 2 coordination ②		
400V; gG/gL 500V	250	25
690V; gG/gL 690V	25	250
Type 1 coordination ②		
400V; gG/gL 500V	250	250
690V; gG/gL 690V	250	250
Degree of protection	IP00	IP00
Protection against direct contact when actuated from front (IEC 536)	Finger and back-of-hand proof	Finger and back-of-hand proof
Terminal capacity main cable—screw terminals		
Solid (mm^2)	—	—
Flexible with ferrule (mm^2)	1 x (10–95) 2 x (10–70)	1 x (10–95) 2 x (10–70)
Stranded (mm^2)	1 x (10–95) 2 x (10–20)	1 x (10–95) 2 x (10–20)
Flat conductor (number of segments x width x thickness) (mm)	2 x (6 x 16 x 0.8)	2 x (6 x 16 x 0.8)
Solid or stranded (AWG)	8–3/0	8–3/0
Main cable connection screw/bolt	M10	M10
Tightening torque		
Nm	14	14
Lb-in	123.9	123.9

Notes

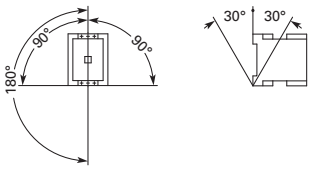
① Damp heat, constant, to IEC 60068-2-78; damp heat, cyclic, to IEC 60 068-2-30.
② IEC 60947 Standard.

Space-Savings Contactors—NEMA Sizes 3, 4, continued

Description	Size 3 CN13KN000_	Size 4 CN13MN000_
General, continued		
Terminal capacity control circuit cable—screw terminals		
Solid (mm^2)	1 x (0.75–4) 1 x (0.75–4)	1 x (0.75–4) 1 x (0.75–4)
Flexible with ferrule (mm^2)	1 x (0.75–2.5) 2 x (0.75–2.5)	1 x (0.75–2.5) 2 x (0.75–2.5)
Solid or stranded (AWG)	18–14	18–14
Control circuit cable connection screw/bolt	M3.5	M3.5
Tightening torque		
Nm	1.2	1.2
Lb-in	10.6	10.6
Tools		
Main circuit cable—screw terminals		
Hexagon socket-head spanner (mm)	5	5
Control circuit cable—screw terminals	Size 2	Size 2
Pozidriv screwdriver	0.8 x 5.5	0.8 x 5.5
Standard screwdriver	1 x 6	1 x 6
Terminal capacity control circuit cable—spring cage terminals		
Solid (mm^2)	1 x (0.75–2.5) 2 x (0.75–2.5)	1 x (0.75–2.5) 2 x (0.75–2.5)
Flexible (mm^2)	1 x (0.75–2.5) 2 x (0.75–2.5)	1 x (0.75–2.5) 2 x (0.75–2.5)
Flexible with ferrule (mm^2)	1 x (0.75–2.5) 2 x (0.75–2.5)	1 x (0.75–2.5) 2 x (0.75–2.5)
Solid or stranded (AWG)	18–14	18–14
Tools		
Control circuit cable—spring cage terminals		
Stripping length (mm)	10	10
Screwdriver blade width (mm)	3.5	3.5
Mounting position, AC and DC operated		
Ambient temperature		
Open	–25 to 60°C [–13 to 140°F]	–25 to 60°C [–13 to 140°F]
Enclosed	–25 to 40°C [–13 to 104°F]	–25 to 40°C [–13 to 104°F]
Ambient storage temperature	–40 to 80°C [–40 to 176°F]	–40 to 80°C [–40 to 176°F]
Environmental		
Mechanical shock resistance (IEC/EN 60068-2-27)		
Half-sinusoidal shock 10 ms		
Main contact—NO contact	10g	10g
Auxiliary contact—NO contact	7g	7g
Auxiliary contact—NC contact	5g	5g
Overvoltage category/pollution degree	III/3	III/3

Space-Savings Contactors—NEMA Size 5

Description	Size 5 CN13SN022_
General	
Standards	IEC/EN 60947, VDE 0660, UL, CSA
Weights in kg [lb]	6.5 [14.3]
Mechanical life—operations	10,000,000
Mechanical operating frequency (ops/hr)	
AC operated	3000
DC operated	3000
Climatic proofing	①
Insulation voltage (U_i) Vac	1000
Impulse withstand voltage (U_{imp}) Vac	8000
Operating voltage (U_e) Vac	1000
Safe isolation to VDE 0106 Part 101 and Part 101/A1	
Between coil and contacts (Vac)	500
Between contacts (Vac)	500
Making capacity (amps)	3000
Breaking capacity (amps)	
220/230V	2500
380/400V	2500
500V	2500
660/690V	2500
1000V	760
Short-circuit protection rating maximum fuse	
Type 2 coordination ②	
400V; gG/gL 500V	315
690V; gG/gL 690V	315
1000V; gG/gL 1000V	160
Type 1 coordination ②	
400V; gG/gL 500V	400
690V; gG/gL 690V	400
1000V; gG/gL 1000V	200
Degree of protection	IP00
Protection against direct contact when actuated from front (IEC 536)	Finger and back-of-hand proof with terminal shroud or terminal block
Main cable cross-section	
Flexible with cable lug (mm^2)	50–240
Stranded with cable lug (mm^2)	70–240
Solid or stranded (AWG)	1/0–250 kcmil
Flat conductor (mm)	③
Bus bar—width in mm	25
Main cable connection screw/bolt	M10
Tightening torque	
Nm	24
Lb-in	213

Description	Size 5 CN13SN022_
General, continued	
Control circuit cable cross-sections	
Solid (mm^2)	1 x (0.75–2.5) 2 x (0.75–2.5)
Flexible with ferrule (mm^2)	1 x (0.75–2.5) 2 x (0.75–2.5)
Solid or stranded (AWG)	2 x (18–12)
Control circuit cable connection screw/bolt	M3.5
Tightening torque	
Nm	1.2
Lb-in	10.6
Tools	
Main cable wrench	16 mm
Control circuit cable pozidriv screwdriver	Size 2
Mounting position, AC and DC operated	
Ambient temperature	–25 to 60°C [–13 to 140°F]
Ambient storage temperature	–40 to 80°C [–40 to 176°F]
Environmental	
Mechanical shock Resistance (IEC/EN 60068-2-27)	
Half-sinusoidal shock 10 ms	
Main contact—NO contact	10g
Auxiliary contact—NO contact	10g
Auxiliary contact—NC contact	8g
Overvoltage category/pollution degree	III/3
Switching capacity, kVAR ④	
Individual compensation	
230V	—
400/420/440V	—
525V	—
690V	—
Group compensation, with choke	
230V	100
400/420/440V	190
525V	260
690V	340
Group compensation, without choke	
230V	—
400/420/440V	—
525V	—
690V	—

Notes

① Damp heat, constant, to IEC 60068-2-78; damp heat, cyclic, to IEC 60 068-2-30.
② IEC 60947 Standard.
③ Screw tightening with flat cable terminal or cable terminal blocks. See terminal capacity for cable terminal blocks.
④ When using contactors for group compensation, a minimum inductance of approx. 6 uh per capacitor must be available to limit the high inrush current peaks. This corresponds to an air-cored coil with five windings and a coil diameter of approximately 140 mm. The conductor cross-section must be selected according to the rated current per phase.

XTOE/*XT* Electronic Overload Relay



Contents

Description	*Page*
XTOE/***XT*** Electronic Overload Relay	
Standards and Certifications	**V5-T2-79**
Catalog Number Selection	**V5-T2-80**
Product Selection	**V5-T2-81**
Accessories	**V5-T2-83**
Technical Data and Specifications	**V5-T2-85**
Dimensions	**V5-T2-93**

An Eaton Green Solution

XTOE/*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 standard NEMA and DP versions are offered with the C440 designation while the Space-Savings NEMA and IEC versions have the XTOE 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 XTOE was developed, delivering new solutions to meet today's demands.

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

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

- XTOE 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	XTOE/*XT* Protection
Motor Protection				
Thermal overload	Overload is a condition in which current draw exceeds 115% of the full load amperage rating for an inductive motor.	• An increase in the load or torque that is being driven by the motor. • A low voltage supply to the motor causes the current to go high to maintain the power needed. • A poor power factor causing above normal current draw.	• Increase in current draw leads to heat and insulation breakdown, which can cause system failure. • Increase in current can increase power consumption and waste valuable energy.	• Thermal trip behavior is defined by UL, CSA and IEC standards. • Trip class is settable from 10A, 10, 20, 30
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, i.e., 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, etc.	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 is lost.

Catalog Number Selection

XT Electronic Overload Relay—NEMA Space-Savings

XT OE 1P6 C CS S

Designation
XT = NEMA Space-Savings control

Type
OE = Electronic overload relay

Mounting
Blank = Direct to contactor **P** = Pass-through **S** = Separate mount (Frames C and G only)

Trip Type
CS = Selectable Class 10A, 10, 20, 30 **GS** = Ground fault with selectable Class 10, 20

Overload Range	Contactor Frame
1P6 = 0.33–1.65A **005** = 1–5A **020** = 4–20A	**C** = Space-Savings Size 0
1P6 = 0.33–1.65A **005** = 1–5A **020** = 4–20A **045** = 9–45A	**C** = Space-Savings Size 1
045 = 9–45A	**D** = Space-Savings Size 2
100 = 20–100A	**G** = Space-Savings Size 3
175 = 35–175A	**G** = Space-Savings Size 4

Product Selection

XT Electronic Overload Relays

XTOE for Direct Mount to NEMA Size 1



XT Electronic Overload Relays for Direct Mount to NEMA Space-Savings Contactors

NEMA Space-Savings Size	For Use with Contactor	Overload Range (Amps)	Contact Sequence	Frame Size	Auxiliary Contact Configuration	Catalog Number
0	CN13BN010_	0.35–1.65	97 95 2 4 6 98 96	45 mm	NO-NC	**XTOE1P6CCS**
		1–5				**XTOE005CCS**
		4–20				**XTOE020CCS**
1	CN13CN010_	0.35–1.65	97 95 2 4 6 98 96	45 mm	NO-NC	**XTOE1P6CCS**
		1–5				**XTOE005CCS**
		4–20				**XTOE020CCS**
		9–45				**XTOE045CCS**
2	CN13GN000_	9–45	97 95 2 4 6 98 96	45 mm	NO-NC	**XTOE045DCS**
		20–100		55 mm	NO-NC	**XTOE100DCS**
3	CN13KN000_	20–100	97 95 2 4 6 98 96	55 mm	NO-NC	**XTOE100GCS**
4	CN13MN000_	35–175	97 95 2 4 6 98 96	110 mm	NO-NC	**XTOE175GCS**

XTOE for Direct Mount to NEMA Size 4



XT Electronic Overload Relays with Ground Fault for Direct Mount to NEMA Space-Savings Contactors

NEMA Space-Savings Size	For Use with Contactor	Overload Range (Amps)	Contact Sequence	Frame Size	Auxiliary Contact Configuration	Catalog Number
0	CN13BN010_	0.33–1.65	97 95 2 4 6 98 96	45 mm	NO-NC	**XTOE1P6CGS**
		1–5				**XTOE005CGS**
		4–20				**XTOE020CGS**
1	CN13CN010_	0.33–1.65	97 95 2 4 6 98 96	45 mm	NO-NC	**XTOE1P6CGS**
		1–5				**XTOE005CGS**
		4–20				**XTOE020CGS**
		9–45				**XTOE045CGS**
2	CN13GN000_	9–45	97 95 2 4 6 98 96	45 mm	NO-NC	**XTOE045DGS**
		20–100		55 mm	NO-NC	**XTOE100DGS**
3	CN13KN000_	20–100	97 95 2 4 6 98 96	55 mm	NO-NC	**XTOE100GGS**
4	CN13MN000_	35–175	97 95 2 4 6 98 96	110 mm	NO-NC	**XTOE175GGS**

1–5A OL with CTs



XT Electronic Overload Relays for use with Size 5 NEMA Space-Savings Contactors

Use CTs and 1-5A ***XT*** overload relay. CT kit does not include overload relay (order separately).

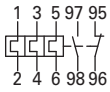
Space-Savings Contactor Size	For Use with Contactor	CT Range (Amps)	Description	CT Kit Catalog Number	Terminal Size	Overload Relay Catalog Number
1	CN13SN022_	60-300	300: 5 panel-mount CT kit with integrated lugs	**ZEB-XCT300**	750 kcmil (2) 250 kcmil 3/0 Cu/Al	**XTOE005CCSS**

45 mm *XT* for Separate Mount



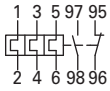
XT Electronic Overload Relays for Separate Mount

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

Overload Range (Amps)	Frame Size	Contact Sequence	Type	Overload Relay Catalog Number	Overload Relay with Ground Fault Catalog Number
Overload Relay					
0.33–1.65	45 mm		ZEB32-1,65/KK	**XTOE1P6CCSS**	**XTOE1P6CGSS**
1–5			ZEB32-5/KK	**XTOE005CCSS**	**XTOE005CGSS**
4–20			ZEB32-20/KK	**XTOE020CCSS**	**XTOE020CGSS**
9–45			ZEB32-45/KK	**XTOE045CCSS**	**XTOE045CGSS**
20–100	55 mm		ZEB150-100/KK	**XTOE100GCSS**	**XTOE100GGSS**
35–175	110 mm		ZEB150-175/KK	**XTOE175GCSS**	**XTOE175GGSS**

XT Electronic Overload Relay for Pass-Through Design

Pass-through design does not include any lugs to land wires.
Terminate motor leads directly on contactor.

Overload Range (Amps)	Frame Size	Contact Sequence	Type	Overload Relay Catalog Number	Overload Relay with Ground Fault Catalog Number
35–175	110 mm		ZEB150-175/PT	**XTOE175GCSP**	**XTOE175GGSP**

Accessories

CT Kits

Accessories

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

Safety Cover



Reset Bar



Remote Reset



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.

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.



Basic Communication—Modbus



Advanced Communication—Communication Module

Note

① Customer can wire remote mounted button to reset module (i.e., 22 mm pushbutton, catalog number M22-D-B-GB14-K10).

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.

Expansion Module



Description	Catalog Number
Expansion Module	
Expansion module (Remote Reset/Modbus RTU, RS-485 Communication)	**C440-XCOM**

Ethernet with I/O Module



Communication Modules	
DeviceNet communication module kit—120 V I/O (consists of C440-XCOM + C441KS)	**C440-DN-120**
DeviceNet communication module kit—24 Vdc I/O (consists of C440-XCOM + C441LS)	**C440-DN-24**
PROFIBUS communication module kit—120 V I/O (consists of C440-XCOM + C441SS)	**C440-DP-120**
PROFIBUS communication module kit—24 V I/O (consists of C440-XCOM + C441QS)	**C440-DP-24**
Modbus communication module kit—120 V I/O (consists of C440-XCOM + C441NS)	**C440-MOD-120**
Modbus communication module kit—24 Vdc I/O (consists of C440-XCOM + C441PS)	**C440-MOD-24**
Modbus TCP/Ethernet IP communication module kit—120 V I/O (consists of C440-XCOM + C441U)	**C440-ET-120**
Modbus TCP/Ethernet IP communication module kit—24 V I/O (consists of C440-XCOM + C441V)	**C440-ET-24**

Technical Data and Specifications

Electronic Overload Relays up to 1500A

Description	Specification 45 mm	55 mm	110 mm
Electrical Ratings	**Range**	**Range**	**Range**
Operating voltage (three-phase) and frequency	690 Vac (60/50 Hz)	690 Vac (60/50 Hz)	690 Vac (60/50 Hz)
FLA Range			
	0.33–1.65A 1–5A 4–20A 9–45A	20–100A	28–140A (NEMA) 35–175A (IEC)
Use with Contactors			
Space-Savings NEMA Size	0, 1, 2	2, 3	4
Trip Class			
	10A, 10, 20, 30 Selectable	10A, 10, 20, 30 Selectable	10A, 10, 20, 30 Selectable
Motor Protection			
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
Feature	**Range**	**Range**	**Range**
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
Indicators			
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
Options			
Remote reset	Yes	Yes	Yes
Reset bar	Yes	Yes	Yes
Communication expansion module	Yes	Yes	Yes
Communication adapter	Yes	Yes	Yes
Capacity			
Load terminals			
Terminal capacity	12–10 AWG (4–6 mm^2) 8–6 AWG (6–16 mm^2)	6–1 AWG (16–50 mm^2)	8–4/0 AWG (10–95 mm^2)
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)
Voltages			
Insulation voltage U_i (three-phase)	690 Vac	690 Vac	690 Vac
Insulation voltage U_i (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

Electronic Overload Relays up to 1500A, continued

Description	Specification 45 mm	55 mm	110 mm
Auxiliary and Control Circuit Ratings			
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
Short-Circuit Rating without Welding			
Maximum fuse	6A gG/gL	6A gG/gL	6A gG/gL
Environmental Ratings			
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% noncondensing	5% to 95% noncondensing	5% to 95% noncondensing
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
Electrical/EMC			
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)	Three-phase power inputs: ±4 kV line-to-line (DM) ±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)	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)	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

Description	Modbus	DeviceNet	PROFIBUS	Ethernet
Electrical/EMC				
Radiated emissions IEC 60947-4-1—Table 15, EN 55011 (CISPIR 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 (CISPIR 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 ①: ±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 ① IEC 60947-4-1 (Table 13) IEC 61000-4-3	10 V/m	10 V/m	10 V/m	10 V/m
Environmental Ratings				
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 600068-2-27)	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
DeviceNet				
DeviceNet connections	—	Group 2, polling, bit strobe, explicit, no UCMM	—	Group 2, polling, bit strobe, explicit, no UCMM
DeviceNet baud rate	—	125K, 250K, 500K	—	125K, 250K, 500K
Ethernet				
Ethernet connections	—	—	—	Integrated two-port switch with dual RJ45 Ethernet connections
Ethernet type	—	—	—	Ethernet 10/100 Mbs, AutoMDX, Auto Negotiation
PROFIBUS				
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

① Relates to C441M only.

Communication Modules, continued

Description	Modbus	DeviceNet	PROFIBUS	Ethernet
C441_ 24 Vdc Input				
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
Operating Voltage Range—DC Input Modules				
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
C441_ 120 Vac Input				
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
Operating Voltage Range—AC Input Modules				
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
Output Modules				
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 ①	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

① Relates to C441M only.

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 XTOE electronic overload relays combined with ***XT*** Series IEC, Freedom Series NEMA and ***XT*** 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.

XTOE Standalone Overload Relays (XTOE)

		Standard-Fault Short Circuit Data			High-Fault Short Circuit Data					
					Fuses (RK5, J, CC)			Thermal-Magnetic Circuit Breakers		
Overload FLA Range	Maximum Operating Voltage	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 (NZMH3)

NEMA Space-Savings Starters with XTOE Electronic Overload Relays

		High-Fault Short Circuit Data					
		Fuses (RK5, J, CC)			Thermal-Magnetic Circuit Breakers		
Contactor Frame Size	Overload FLA Range	480V	600V	Maximum Fuse Size	480V	600V	Maximum Breaker Size
B	1–5A	100	100	30	—	—	—
	4–20A	100	100	30	—	—	—
C	1–5A	100	100	60	—	—	—
	4–20A	100	100	60	—	—	—
	9–45A	100	100	60	—	—	—
D	9–45A	100	100	200	65	35	175
	20–100A	100	100	200	65	35	175
F	20–100A	100	100	200	65	65	350
G	20–100A	100	100	200	65	65	350
	35–175A	100	100	400	65	30	250 (480 Vac) 350 (600 Vac)
H	35–175A	100	100	400	65	30	400

Coil Data—Frames B, C, G

Description	CN13B_ NEMA Size 0	CN13C_ NEMA Size 1	CN13G_ NEMA Size 2
Voltage Tolerance			
Pickup (x U_c)			
AC operated	0.8–1.1	0.8–1.1	0.8–1.1
DC operated	0.7–1.2 ①	0.7–1.2 ①	0.7–1.2 ①
Dropout (x U_c)			
AC operated	0.3–0.6	0.3–0.6	0.3–0.6
DC operated	0.15–0.6	0.15–0.6	0.15–0.6
Power Consumption of the Coil at Cold State and 1.0 x U_c			
AC operated Single-voltage coil 50 Hz			
Pickup VA	52	52	149
Pickup W	40	40	80
Sealing VA	7.1	7.1	16
Sealing W	2.1	2.1	4.3
Single-voltage coil 60 Hz			
Pickup VA	67	67	178
Pickup W	50	50	117
Sealing VA	8.7	8.7	19
Sealing W	2.6	2.6	5.3
50/60 Hz			
Pickup VA	62 58	62 58	168 154
Pickup W	48 43	48 43	120 43
Sealing VA	9.1 6.5	9.1 6.5	22 14
Sealing W	2.5 2	2.5 2	5.3 4.3
DC operated			
Pickup W	12 at 24V	12 at 24V	24 at 24V
Sealing W	0.5 at 24V	0.5 at 24V	0.5 at 24V
Duty factor (%DF)	100	100	100
Switching Time at 100% U_c (Approximate Values)			
Main contact			
AC operated			
Closing delay (ms)	<22	<22	<18
Opening delay (ms)	<14	<14	<13
DC operated			
Closing delay (ms)	<47	<47	<54
Opening delay (ms)	<30	<30	<24
Arcing time (ms)	10	10	10
Electromagnetic Compatibility (EMC)			
Emitted interference	To EN-60947-1	To EN-60947-1	To EN-60947-1
Noise immunity	To EN-60947-1	To EN-60947-1	To EN-60947-1

Note

① Coil Suffix TD: U_{min} 24 Vdc/U_{max} 27 Vdc.
Coil Suffix WD: U_{min} 48 Vdc/U_{max} 60 Vdc.
Coil Suffix AD: U_{min} 110 Vdc/U_{max} 130 Vdc.
Coil Suffix BD: U_{min} 200 Vdc/U_{max} 240 Vdc.
Example:
U_c = 0.7 x U_{min}—1.2 x U_{max}
U_c = 0.7 x 24V—1.2 x 27 Vdc

Coil Data—Frames K–M

Description	CN13K_ NEMA Size 3	CN13M_ NEMA Size 4
Voltage Tolerance		
Pickup (x U_c)		
AC operated	0.8–1.1	0.8–1.1
DC operated	0.7–1.2 ①	0.7–1.2 ①
Dropout (x U_c)		
AC operated	0.25–0.6	0.25–0.6
DC operated	0.15–0.6	0.15–0.6
Power Consumption of the Coil at Cold State and 1.0 x U_c		
AC operated Single-voltage coil 50 Hz		
Pickup VA	180	180
Pickup W	130	130
Sealing VA	3.1	3.1
Sealing W	2.1	2.1
Single-voltage coil 60 Hz		
Pickup VA	170	170
Pickup W	130	130
Sealing VA	3.1	3.1
Sealing W	2.1	2.1
50/60 Hz		
Pickup VA	170	170
Pickup W	130	130
Sealing VA	3.1	3.1
Sealing W	2.1	2.1
DC operated		
Pickup W	149 at 24V	149 at 24V
Sealing W	2.1 at 24V	2.1 at 24V
Duty factor (%DF)	100	100
Switching Time at 100% U_c (Approximate Values)		
Main contact		
AC operated		
Closing delay (ms)	<33	<33
Opening delay (ms)	<41	<41
DC operated		
Closing delay (ms)	<35	<35
Opening delay (ms)	<30	<30
Arcing time (ms)	15	15
Permissible residual current with actuation of A1–A2 by the electronics (with 0 signal) (mA)	≤1	≤1
Electromagnetic Compatibility (EMC)		
Emitted interference	To EN60947-1	To EN60947-1
Noise immunity	To EN60947-1	To EN60947-1

Coil Data—Frame S

Description	CN13S_ NEMA Size 5
Voltage Tolerance	
Pickup (x U_c)	0.7 x U_{cmin}–1.15 x U_{cmax}
Dropout (x U_c)	0.2 x U_{cmin}–0.6 x U_{cmax}
Power Consumption of the Coil at Cold State and 1.0 x U_c	
XTCE185L–XTCEC20R	
Pickup VA	380 ②
Pickup W	250
Sealing VA	4.3
Sealing W	3.3
Switching Time at 100% Main Contact U_c (Approximate Values)	
XTCE185L–XTCEC20R	
Closing delay (ms)	<80
Opening delay (ms)	<110
Reaction in Threshold and Sealing State Transition Range	
Voltage interruptions	
(0–0.2 x U_{cmin}) ≤10 ms	Time is bridged successfully
(0–0.2 x U_{cmin}) >10 ms	Dropout of the contactor
Voltage dips	
(0.2–0.6 x U_{cmin}) ≤12 ms	Time is bridged successfully
(0.2–0.6 x U_{cmin}) >12 ms	Dropout of the contactor
(0.6–0.7 x U_{cmin})	Contactor remains switched on
Excess voltage	
(1.15–1.3 x U_{cmax})	Contactor remains switched on
(>1.3 x U_{cmax}) ≤3s	Contactor remains switched on
(>1.3 x U_{cmax}) >3s	Dropout of the contactor
Pickup phase	
(0–0.7 x U_{cmin})	Contactor does not switch on
(0.7 x U_{cmin} –1.15 x U_{cmax})	Contactor switches on with certainty
(>1.15 x U_{cmax})	Contactor switches on with certainty

Notes

① At 24V: 0.7–1.3 without additional auxiliary contact modules and ambient temperature +40°C [104°F].

② Control transformer with U_k ≤6%.

Current Heat Loss (Three-Pole) in Watts

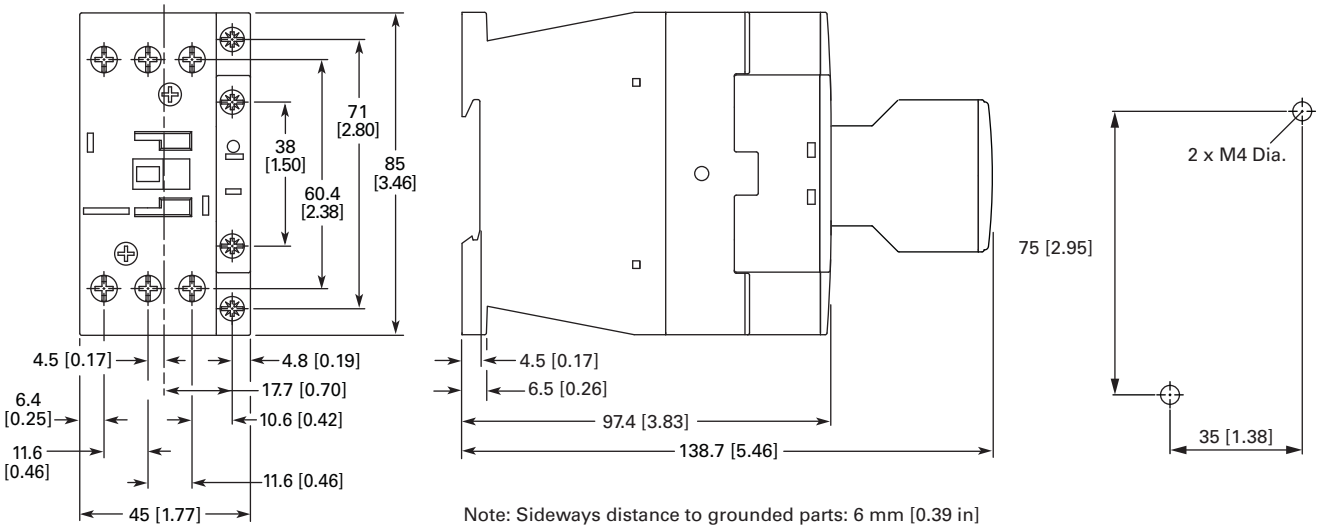
Description	CN13BN0_	CN13CN0_	CN13GN0_	CN13KN0_	CN13MN0_
Current heat loss (three-pole) in watts					
at I_{th}	7.3	12.1	28.8	20.3	30.7
at I_e to AC-3/400V	1.9	6.1	19	15.9	27.0
Impedance per pole, megohms	2	2	1.5	0.4	0.4

Dimensions

Approximate Dimensions in mm [in]

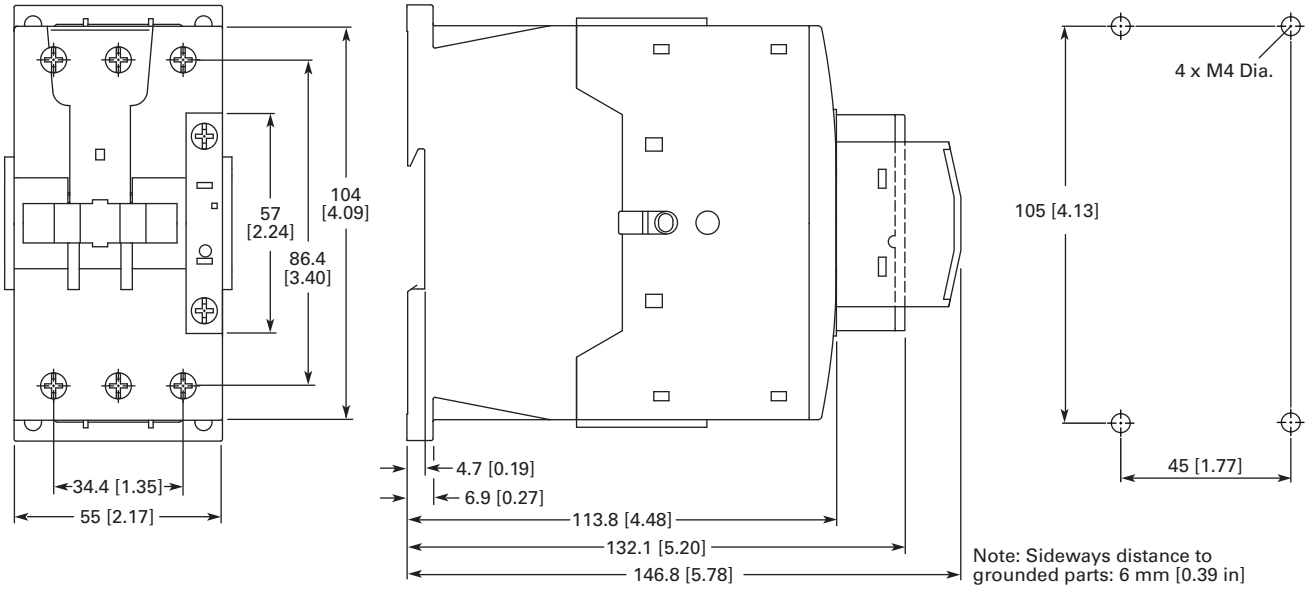
Contactors

Type CN13 NEMA Size 0 and 1



Note: Sideways distance to grounded parts: 6 mm [0.39 in]

Type CN13 NEMA Size 2

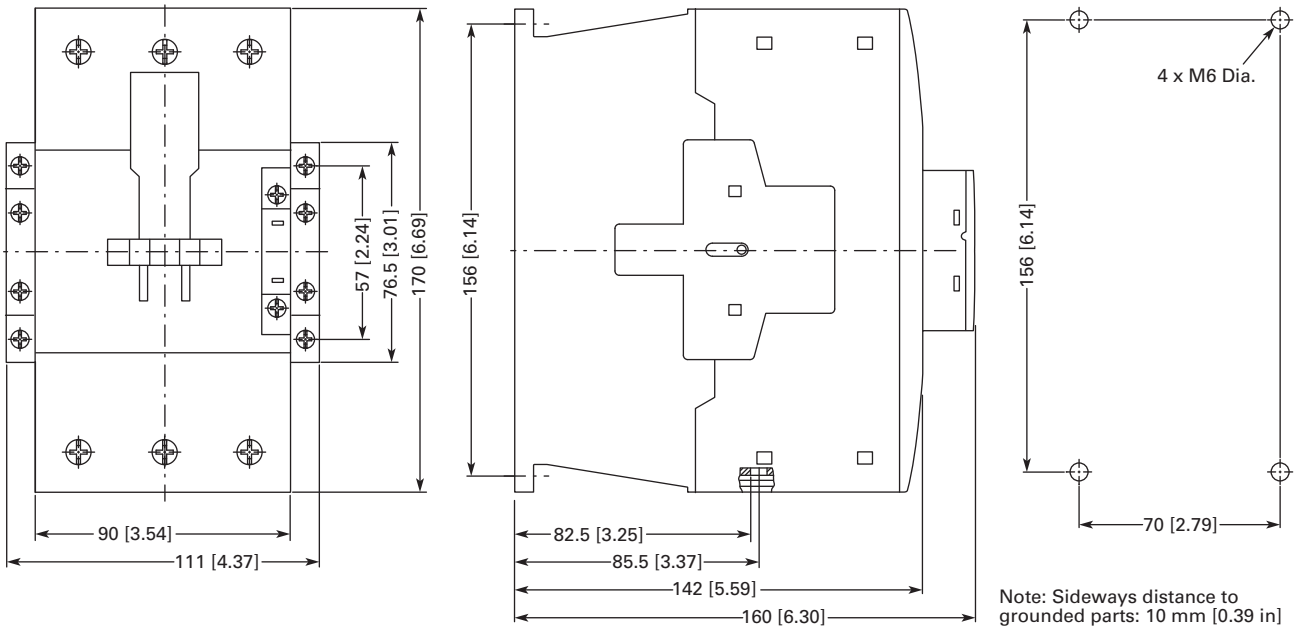


Note: Sideways distance to grounded parts: 6 mm [0.39 in]

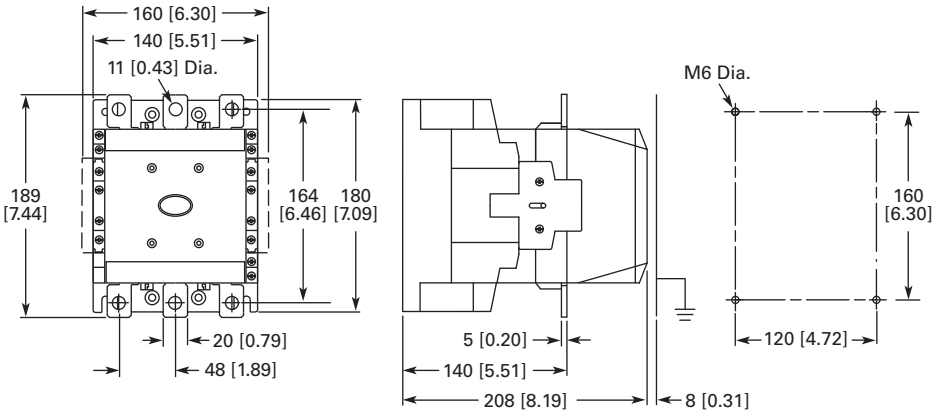
Approximate Dimensions in mm [in]

2

Type CN13 NEMA Size 3 and 4



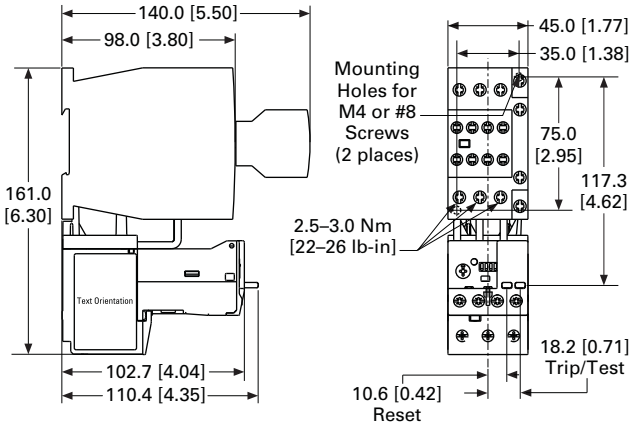
Type CN13 NEMA Size 5



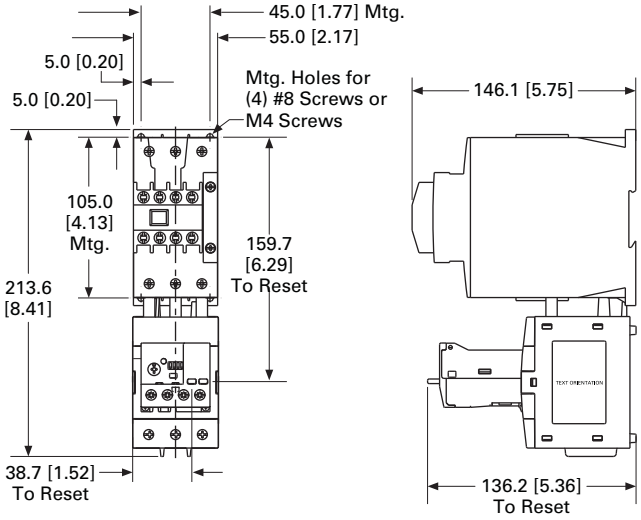
Approximate Dimensions in mm [in]

XTAE Starters with XTOE Overload Relay

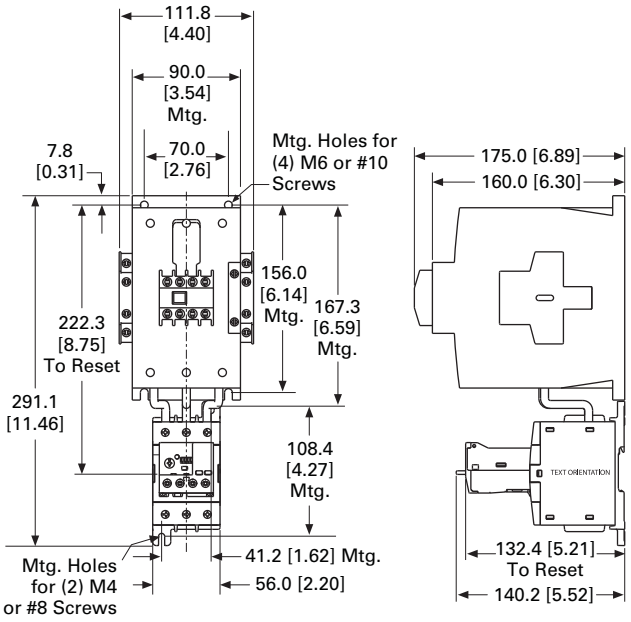
Type AN13 NEMA Size 0 and 1



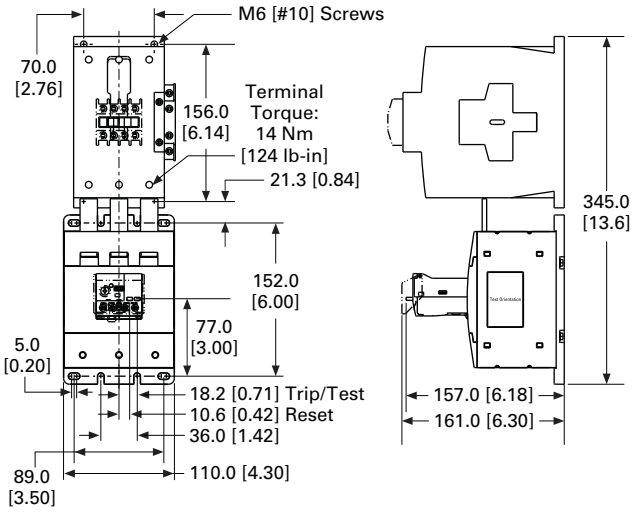
Type AN13 NEMA Size 2



Type AN13 NEMA Size 3



Type AN13 NEMA Size 4

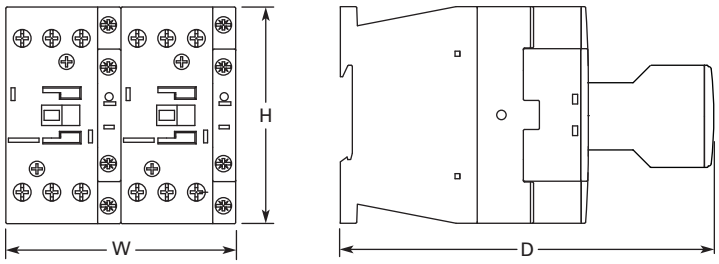


Approximate Dimensions in mm [in]

2

Reversing Contactors

Type CN53 Size 0, 1 and 2



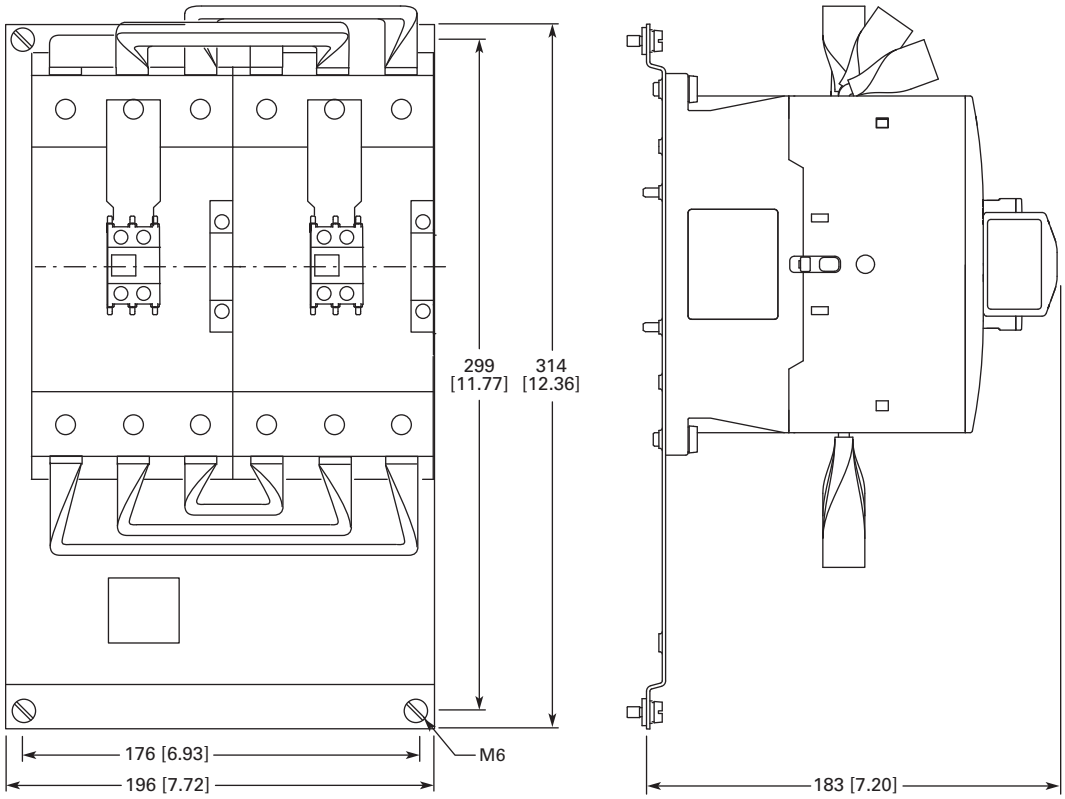
Size 0 and 1

W	H	D
90 [3.54]	85 [3.34]	138 [5.43]

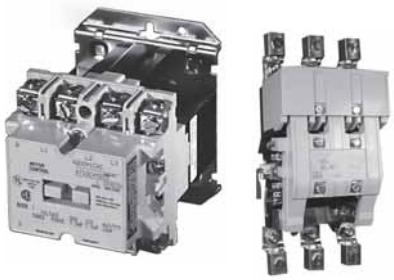
Size 2

W	H	D
110 [4.33]	115 [4.53]	146.8 [5.78]

Type CN53 Size 3 and 4



Contactors—Non-Reversing and Reversing



Contents

Description	*Page*
A200 Series	
Contactors—Non-Reversing and Reversing	
Starters—Non-Reversing and Reversing	**V5-T2-103**
Relays—Thermal and Fast Trip	**V5-T2-124**
Thermal Type B, Class 20, Manual Reset	**V5-T2-126**
Thermal Type A, Class 20, Auto/Manual Reset	**V5-T2-129**
Type FT Fast Trip, Class 10	**V5-T2-132**
Heater Selection	**V5-T2-135**
Relays—Current Sensing Protective	**V5-T2-137**

Contactors—Non-Reversing and Reversing

Product Description

Class A201 Contactors, Sizes 00–4; Three-Phase, 1-1/2–100 hp

A201 Magnetic Contactors from Eaton's Electrical Sector are 600V rated devices available in NEMA Sizes 00–4, 10A through 150A (open rating). Product features include:

- Straight-through wiring to line and load terminals located up front for ease of installation
- Moving and stationary contacts are front accessible, simplifying inspection and maintenance
- Reliable U-shaped magnet for reduced power consumption
- Coil design reduces inventory/maintenance expenses. For a given voltage, one size coil fits all contactors Sizes 00–2, and a second coil fits three-pole Model J Sizes 3 and 4. Model K coils are different design

A201 contactors have normally open holding circuit interlocks which are supplied as standard.

Panel layout and drilling are simplified through the use of common backplates, one for Sizes 00–2 and one for Sizes 3–4. In addition, panel space is reduced dramatically through the use of unique corner cavities for mounting the wide variety of modifications shown on **Page V5-T2-116.**

For reversing applications, two contactors are supplied on a common base with electrical and mechanical interlocks which prevent both contactors from being closed at the same time.

Class A201 Contactors, Sizes 5–9; Three-Phase, Over 100 hp

These AC magnetic contactors utilize clapper design and feature straight-through wiring.

Contacts are silver alloy for longer life. The contacts close with optimum wiping action which serves to keep the contacting surfaces clean. De-ion® arc quenchers draw the arc away from the contacts at opening, which reduces burning and pitting and increases contact life.

All of the contactors are complete with one unwired, normally-open (NO) auxiliary contact mounted and have accommodations for additional auxiliary contacts. No control circuit wiring or terminal markings are included.

Size 5, 300A, 600V, Open
Size 6, 600A, 600V, Open

Class A201 Size 5 and 6 contactors are front clapper design, AC operated with the armature pivoting on dual needle bearings which assure accurate contact alignment.

The contactor base is molded of a high impact, non-tracking, non-hygroscopic glass polyester material permitting front mounting and wiring on a steel panel.

Floating magnet assures quiet operation.

Size 5 and 6 contactors must be mounted with the line terminals directly above the load terminals.

Multi-voltage coil ratings allow selection of the voltage which closely matches the actual system voltage to assure optimum contactor operation.

Each contactor accommodates two Type J11 auxiliary contacts, providing up to four auxiliary circuits, normally-open or normally-closed (NO and NC).

A201 Size 5 and 6 contactors and starters are UL recognized when supplied without terminals. When supplied with terminals, the devices are UL listed.

Two special configurations of the Class A201 Size 5 and 6 contactors are available:

- **Latched Design**—This is a mechanically held, electrically released device. It is applied where the contactor must remain closed during extreme voltage fluctuations or power failure. It is also suitable for applications requiring quiet operation since the operating coil is de-energized when the contactor is closed. The latch assembly consists of a mechanical latch mechanism, electrically operated AC trip solenoid and a clearing contact
- **DC Operated**—This device is DC operated. It is used where low dropout voltage or exceptionally quiet operation is desired. The DC assembly consists of a DC operating coil, integrally mounted rectifier and shorting contact

Size 7, 900A, 600V, Open
Size 8, 1350A, 600V, Open
Size 9, 2500A, 600V, Open

Class A201 Size 7 and 8 contactors are DC operated side clapper design with the shaft mounted on dual needle bearings to ensure positive contact alignment and long contact life.

A steel panel base permits mounting on angle or channel without additional support, for versatile low cost installation.

Each stationary contact assembly is mounted on an individual molded insulator. Each pair of contacts is surrounded by a De-ion grid type arc quencher for rapid and confined arc interruption and long contact life.

The shunt for each pole is made of flexible, braided copper cable for freedom of movement and long life.

The rugged DC operating coils are designed to operate at high temperature and insulated to meet Class H service.

An integrally mounted avalanche type silicon rectifier supplies DC coil voltage from the AC control circuit.

Sizes 7 and 8 accommodate three Type L-63 auxiliary contacts which are easily converted from normally-open to normally-closed, providing auxiliary circuit flexibility. Size 9 uses L-64 auxiliary contacts with a total of four circuits.

A201 Size 7, 8 and 9 contactors and starters are UL recognized when supplied without terminals. When supplied with terminals, the devices are UL listed.

Application Description

Magnetic contactors are used to switch transformers and capacitors and to control electrical power circuits such as heating, lighting and motors that require no overload protection, or where overload protection is separately provided. They can be operated remotely by manual or automatic pilot devices.

Standards and Certifications

A201 contactors are UL listed components and also have CSA certification.

Listed

Instructional Leaflets

16960B Sizes 00–1 Magnetic Contactor, Non-reversing or Reversing

16961E Size 2 Magnetic Contactor, Non-reversing or Reversing

13238G Size 3 Magnetic Contactor, Non-reversing or Reversing

17001C Size 4 Magnetic Contactor, Non-reversing or Reversing

17049D Size 5 Magnetic Contactor, Non-reversing or Reversing

17053B Size 6 Magnetic Contactor, Non-reversing or Reversing

17048 Sizes 7–8 Magnetic Contactor, Non-reversing or Reversing

16978 Size 9 Magnetic Contactor, Non-reversing or Reversing

Product Selection

Non-Reversing, Sizes 00–9

When Ordering Specify

Order by catalog number from the table below, plus suffix for coil voltages, verifying usage of appropriate sizes.

A201 Size 1 Contactor



Front Connected Contactors

Size	Amps	Max. UL Horsepower Single-Phase 115V	230V	Three-Phase 208V	240V	480V	600V	Two Poles Open Catalog Number	Three Poles Open Catalog Number	Four Poles Open Catalog Number	Five Poles Open Catalog Number
Sizes 00–6											
00	9	1/3	1	1-1/2	1-1/2	2	2	**A201KAB_**	**A201KAC_**	**A201KAD_**	**A201KAE_**
0	18	1	2	3	3	5	5	**A201K0B_**	**A201K0C_**	**A201K0D_**	**A201K0E_**
1	27	2	3	7-1/2	7-1/2	10	10	**A201K1B_**	**A201K1C_**	**A201K1D_**	**A201K1E_**
2	45	3	7-1/2	10	15	25	25	**A201K2B_**	**A201K2C_**	**A201K2D_**	**A201K2E_**
3	90	—	—	25	30	50	50	**A201K3B_**	**A201K3C_**	**A201K3D_**	**A201K3E_**
4	135	—	—	40	50	100	100	**A201K4B_**	**A201K4C_**	**A201K4D_**	**A201K4E_**
5	270	—	—	75	100	200	200	**A201K5B_**	**A201K5C_**	—	—
6	540	—	—	150	200	400	400	**A201K6B_**	**A201K6C_**	—	—
Sizes 7–9											
7 ①	810	—	—	200	300	600	600	**A201K7B_**	**A201K7C_**	—	—
8 ①	1215	—	—	400	450	900	900	**A201K8B_**	**A201K8C_**	—	—
9 ①	2250	—	—	—	800	1600	—	**A201K9B_**	**A201K9C_Z1** ②③	—	—

Rear Connected Contactors

120V Rectified Coil/Open Only

Size	Catalog Number
7	**A201K7CJZ1Z4**
8	**A201K8CJZ1Z4**
9	**A201K9CJZ1Z4**

Coil Suffix

Coil Volts and Hz	Code Suffix
Sizes 00–6	
120/60 or 110/50	**A**
200–208/60	**B**
240/60	**W**
Sizes 7, 8 and 9 ②	
480/60	**X**
600/60	**E**
110–120/50 or 60	**J**
220–240/50 or 60	**K**
440–480/50 or 60	**U**
600/60	**E**

Notes

① Sizes 7–9 use rectifier with DC coil.
② For Size 9, only available coil voltage is 120V.
③ Supplied without terminal lugs.

Reversing, Sizes 00–9

2

When Ordering Specify

Order by catalog number from the table below, plus suffix for coil voltages, verifying usage of appropriate sizes.

Size 1 Horizontal Reversing Contactor



Class A211—Horizontally Mounted and Class A251—Vertically Mounted Reversing Contactors

Size	Amps	Max. UL Horsepower Single-Phase 115V	230V	Three-Phase 208V	240V	480V	600V	Horizontal Design Catalog Number	Vertical Design Catalog Number
Sizes 0–6									
0	18	1	2	3	3	5	5	**A211K0C_**	**A251K0C_**
1	27	2	3	7-1/2	7-1/2	10	10	**A211K1C_**	**A251K1C_**
2	45	3	7-1/2	10	15	25	25	**A211K2C_**	**A251K2C_**
3	90	—	—	25	30	50	50	**A211K3C_**	**A251K3C_**
4	135	—	—	40	50	100	100	**A211K4C_**	**A251K4C_**
5	270	—	—	75	100	200	200	**A211K5C_**	**A251K5C_**
6	540	—	—	150	200	400	400	**A211K6C_**	**A251K6C_**
Sizes 7–9									
7 ①	810	—	—	200	300	600	600	—	**A251K7C_**
8 ①	1215	—	—	400	450	900	900	—	**A251K8C_**
9 ①	2250	—	—	—	800	1600	—	—	**A251K9C_** ②

Coil Suffix

Coil Volts and Hz	Code Suffix
Sizes 00–6	
120/60 or 110/50	**A**
200–208/60	**B**
240/60	**W**
480/60	**X**
600/60	**E**
Sizes 7, 8 and 9 ②	
110–120/50 or 60	**J**
220 –240/50 or 60	**K**
440–480/50 or 60	**U**
600/60	**E**

Notes

① Sizes 7–9 use rectifier with DC coil.

② For Size 9, only available coil voltage is 120V.

Dimensions

Approximate Dimensions in Inches (mm)

Not to be used for construction purposes unless approved.

Non-Reversing Open Contactors

Figure A—Sizes 00–4 A210

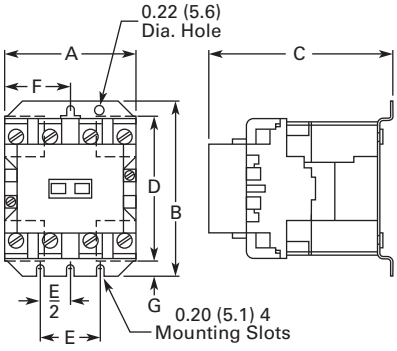


Figure B—Size 5

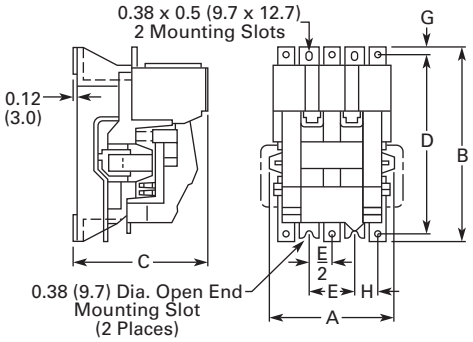


Figure C—Size 6

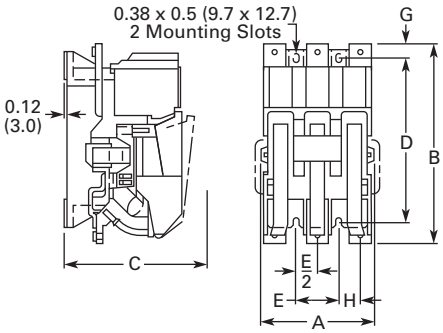
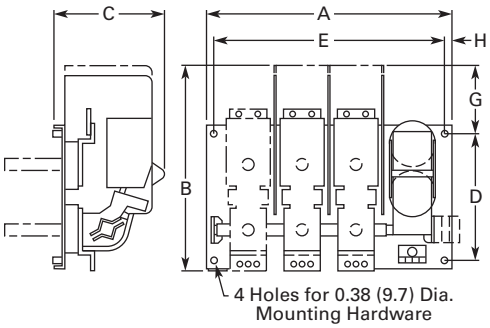


Figure D—Sizes 7–9



Dimensions and Shipping Weights

NEMA Size	No. of Poles	Fig.	Mounting Screws No.	Size	A	B	C	D	E	F	G	H	Weight, Lbs (kg)
00, 0, 1	2–4	A	3	#10	3.31 (84.1)	4.38 (111.3)	4.61 (117.1)	3.95 (100.3)	1.50 (38.1)	1.66 (42.2)	0.45 (11.5)	—	2.6 (1.2)
	5	A	3	#10	4.19 (106.4)	4.38 (111.3)	4.61 (117.1)	3.95 (100.3)	1.50 (38.1)	2.09 (53.1)	0.45 (11.5)	—	3.2 (1.5)
2	2, 3	A	3	#10	3.31 (84.1)	4.38 (111.3)	4.94 (125.5)	3.95 (100.3)	1.50 (38.1)	1.66 (42.2)	0.45 (11.5)	—	3.3 (1.5)
	4, 5	A	3	#10	5.06 (128.5)	4.38 (111.3)	4.94 (125.5)	3.95 (100.3)	1.50 (38.1)	2.53 (64.3)	0.45 (11.5)	—	4.5 (2.0)
3, 4	2, 3	A	3	1/4 in.	4.63 (117.6)	6.63 (168.4)	6.75 (171.5)	6.00 (152.4)	1.88 (47.8)	2.31 (58.7)	0.38 (9.7)	—	9.3 (4.2)
	4, 5	A	3	1/4 in.	7.25 (184.2)	6.63 (168.4)	6.75 (171.5)	6.00 (152.4)	1.88 (47.8)	3.63 (92.2)	0.38 (9.7)	—	13.0 (5.9)
5	2, 3	B	4	3/8 in.	7.22 (183.4)	12.00 (304.8)	7.75 (196.9)	11.00 (279.4)	2.75 (69.9)	—	0.59 (15.0)	2.22 (56.4)	25.0 (11.4)
6	2, 3	C	4	3/8 in.	7.22 (183.4)	13.50 (342.9)	9.50 (251.3)	11.00 (279.4)	2.75 (69.9)	—	0.59 (15.0)	2.22 (56.4)	42.0 (19.1)
7	3	D	4	3/8 in.	23.50 (596.9)	18.63 (473.2)	11.00 (279.4)	12.00 (304.8)	22.00 (558.8)	—	5.63 (143.0)	0.75 (19.1)	215.0 (97.6)
8	3	D	4	3/8 in.	23.50 (596.9)	19.25 (489.0)	11.00 (279.4)	12.00 (304.8)	22.00 (558.8)	—	5.63 (143.0)	0.75 (19.1)	265.0 (120.3)
9	3	D	4	1/2 in.	33.00 (838.2)	29.75 (755.7)	12.94 (328.7)	8.00 (203.2)	30.75 (781.1)	—	14.50 (368.3)	1.63 (41.4)	315.0 (143.0)

Approximate Dimensions in Inches (mm)

Not to be used for construction purposes unless approved.

2

Reversing Open Contactors

Figure A—Sizes 00–4 Horizontal

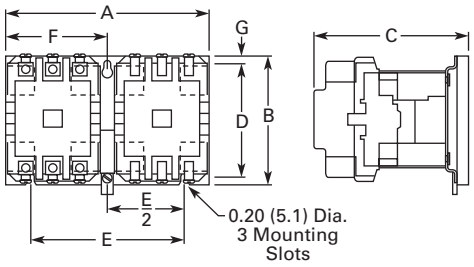


Figure C—Sizes 5, 6 Horizontal

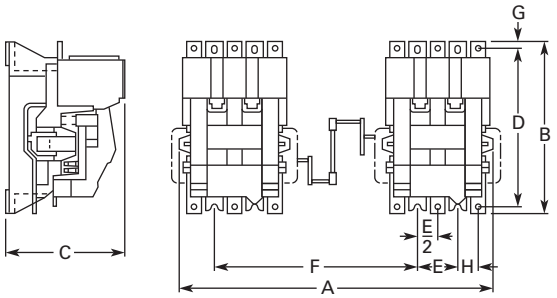


Figure B—Sizes 00–4 Vertical

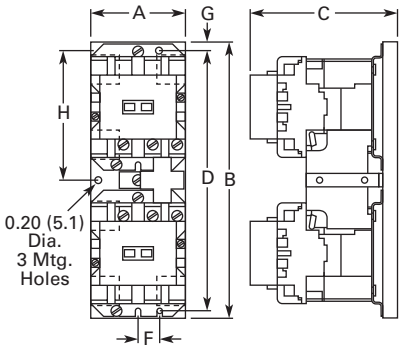


Figure D—Sizes 5, 6 Vertical

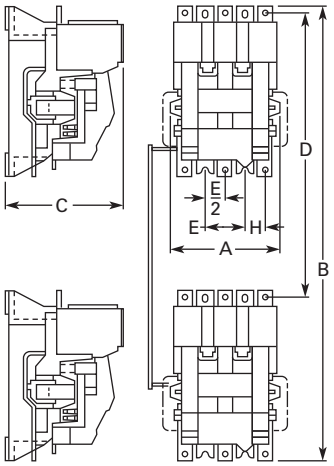
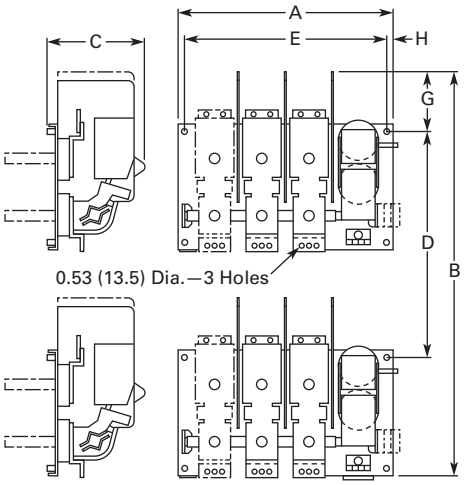


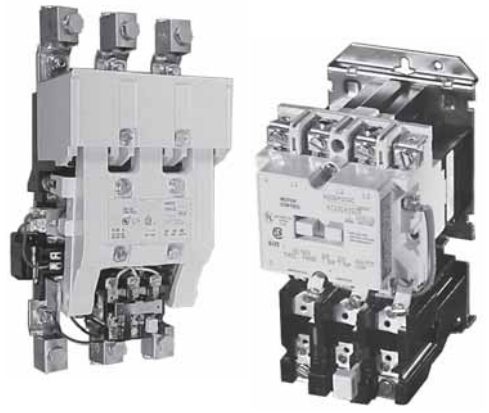
Figure E—Sizes 7–9 Vertical



Dimensions and Shipping Weights

NEMA Size	No. of Poles	Fig.	Mounting Screws No.	Mounting Screws Size	A	B	C	D	E	F	G	H	Weight, Lbs (kg)
00, 0, 1	3 x 3 H.	A	3	#10	7.13 (181.1)	4.45 (113.0)	5.05 (128.3)	3.95 (100.3)	5.31 (134.9)	3.56 (90.4)	0.25 (6.4)	—	7.8 (3.5)
	3 x 3 V.	B	3	#10	3.33 (84.6)	9.61 (244.1)	5.05 (128.3)	9.08 (230.6)	2.16 (54.9)	0.75 (19.1)	0.25 (6.4)	4.52 (114.8)	8.9 (4.0)
2	3 x 3 H.	A	3	#10	7.13 (181.1)	4.45 (113.0)	5.38 (136.7)	3.95 (100.3)	5.31 (134.9)	3.56 (90.4)	0.25 (6.4)	—	9.1 (4.1)
	3 x 3 V.	B	3	#10	3.33 (84.6)	9.61 (244.1)	5.38 (136.7)	9.08 (230.6)	2.16 (54.9)	0.75 (19.1)	0.25 (6.4)	4.52 (114.8)	10.0 (4.5)
3, 4	3 x 3 H.	A	3	1/4 in.	9.75 (247.7)	6.88 (174.8)	7.25 (184.2)	6.00 (152.4)	7.00 (177.8)	4.88 (124.0)	0.44 (11.2)	—	24.0 (10.9)
	3 x 3 V.	B	3	1/4 in.	4.63 (117.6)	16.56 (420.6)	7.25 (184.2)	15.69 (398.5)	2.75 (69.9)	0.94 (23.9)	0.44 (11.2)	7.78 (197.6)	25.0 (11.4)
5	3 x 3 H.	C	8	3/8 in.	17.22 (437.4)	12.00 (304.8)	7.75 (196.9)	11.00 (279.4)	2.75 (69.9)	10.00 (254.0	0.59 (15.0)	1.38 (35.1)	55.0 (25.0)
	3 x 3 V.	D	8	3/8 in.	8.25 (209.6)	30.00 (762.0)	7.75 (196.9)	18.00 (457.8)	2.75 (69.9)	—	—	1.38 (35.1)	55.0 (25.0)
6	3 x 3 H.	C	8	3/8 in.	17.22 (437.4)	13.50 (342.9)	8.75 (222.3)	11.00 (279.4)	2.75 (69.9)	10.00 (254.0)	0.59 (15.0)	1.38 (35.1)	90.0 (40.9)
	3 x 3 V.	D	8	3/8 in.	8.25 (209.6)	41.50 (1054.1)	8.75 (222.3)	28.00 (711.2)	2.75 (69.9)	—	—	1.38 (35.1)	90.0 (40.9)
7	3 x 3 V.	E	8	3/8 in.	23.50 (596.9)	38.63 (981.2)	11.00 (279.4)	20.00 (508.0)	22.00 (558.8)	—	5.63 (143.0)	0.75 (19.1)	450.0 (204.3)
8	3 x 3 V.	E	8	3/8 in.	23.50 (596.9)	39.25 (997.0)	11.00 (279.4)	20.00 (508.0)	22.00 (558.8)	—	5.63 (143.0)	0.75 (19.1)	550.0 (249.7)
9	3 x 3 V.	E	8	1/2 in.	33.00 (838.2)	62.75 (1593.9)	12.94 (328.7)	33.00 (838.2)	30.75 (781.1)	—	14.50 (368.3)	1.63 (41.4)	650.0 (295.1)

Starters—Non-Reversing and Reversing



Contents

Description	*Page*
Contactors—Non-Reversing and Reversing	**V5-T2-97**
Starters—Non-Reversing and Reversing	
Application Description	**V5-T2-104**
Features and Benefits	**V5-T2-104**
Standards and Certifications	**V5-T2-104**
Instructional Leaflets	**V5-T2-104**
Product Selection	**V5-T2-105**
Accessories	**V5-T2-108**
Renewal Parts	**V5-T2-111**
Modifications	**V5-T2-116**
Technical Data and Specifications	**V5-T2-117**
Mechanical Characteristics	**V5-T2-119**
Dimensions	**V5-T2-121**
Relays—Thermal and Fast Trip	**V5-T2-124**
Thermal Type B, Class 20, Manual Reset	**V5-T2-126**
Thermal Type A, Class 20, Auto/Manual Reset	**V5-T2-129**
Type FT Fast Trip, Class 10	**V5-T2-132**
Heater Selection	**V5-T2-135**
Relays—Current Sensing Protective	**V5-T2-137**

Starters—Non-Reversing and Reversing

Product Description

NEMA Sizes 00–4; Three-Phase, 1-1/2–100 hp

These Starters from Eaton's Electrical Sector use Class A201 contactors as described on **Page V5-T2-97**. Contactor features are enhanced through the ability to provide positive motor protection in the form of several types of overload relays. See **Pages V5-T2-124** to **V5-T2-136**.

Type B Overload Relay, Manual Reset Only

Supplied as standard on Class A200 and A900 starters (two-speed). The bi-metallic overload relay offers ambient compensation and trip-to-test feature (relay contact status check) as standard. In addition, an isolated normally-open contact is available in kit form for customer mounting. Type B overload relays are manual reset only.

Type A Overload Relay, Manual or Automatic Reset

This is an optional overload relay, offering the capability of field conversion to automatic reset. It is available as an ambient compensated or non-compensated type.

Non-Reversing Starters

Non-reversing starters are supplied as open devices. All starters are supplied with a normally-open holding circuit interlock.

Reversing Starters

For reversing applications (Class A210), a starter and a contactor electrically and mechanically interlocked are supplied on a common baseplate. Reversing starters are used to start, stop and reverse AC squirrel cage motors and for primary control of reversing wound-rotor motors.

For plugging or inching, when operations exceed five times per minute, decreased horsepower ratings in accordance with NEMA Standard ICS 2-321 are recommended.

Two-Speed Starters, A900s

For across-the-line starting of two-speed constant hp, constant torque and variable torque squirrel cage motors, two-speed starters (Class A900) are available. These starters consist of two starters, one for each motor speed, mechanically and electrically interlocked and wired for manual speed selection by means of pushbuttons. Auxiliary relays may be added to provide automatic acceleration or deceleration.

Starters for two-speed, two independent winding motors consist of two-, three- or four-pole starters electrically and mechanically interlocked.

Starters for two-speed, single reconnectable winding motors consist of one three-pole and one five-pole starter mechanically and electrically interlocked.

NEMA Sizes 5–9; Three-Phase 75 to 1600 hp

Non-reversing (Class A200), and reversing (Classes A210, A250) full voltage starters are used for across-the-line starting of squirrel cage induction motors. They are used with motors rated above 50 hp at 230V, and above 100 hp at 460 through 600V.

Sizes 5 and 6 starters use Class A201 contactors as described on **Page V5-T2-97**. In addition to standard motor starters, special application devices are available: Sizes 5 and 6 starters with integrally rectified AC to DC coils for applications where low voltage problems are prevalent are available.

Front Removable Parts—All operating parts can be removed quickly and easily from the front. Straight-through wiring and conveniently located connection points for external wires and cables minimize installation time.

Type B Block Type Thermal Overload Relay—Dependable overload protection is assured by these snap-action, manual reset relays. Automatic reset Type A relays are available as an option.

Types of Starters

Class A200, Sizes 5 and 6—Non-reversing starters contain an AC magnetically-operated Size 5 or Size 6 line contactor and block Type B three-pole overload relay, along with three current transformers. A control relay whose contacts handle the coil current of the starter is provided with Size 6 starters.

Class A200, Sizes 7, 8 and 9—Non-reversing starters contain a DC operated line contactor, DC power supply, block Type B three-pole overload relay with three current transformers and a control relay.

Class A960/A970/A980 Multi-Speed Starters: Refer to **Page V5-T2-107**.

Application Description

Magnetic starters are used for full-voltage, across-the-line starting and stopping of squirrel cage motors. They can be operated locally or remotely by manual or automatic pilot devices.

Features and Benefits

Sizes 00–4

- **Straight-Through Wiring, Up-Front, Out-Front Terminals** for ease in installation
- **Unique Accessory Mounting Cavities** reduce panel space requirements
- **Snap-in Accessories** for application flexibility
- **Vertical and Horizontal Interlocking** capability increases application flexibility
- **Ambient Compensated Overload Relays** available as standard, offering superior motor protection in variable motor/controller environments
- **Isolated Normally Open Relay Contact** available in kit mounting form on Type B Overload Relay

Sizes 5–9

- **Rectified AC/DC Coils** available to reduce premature drop-out or "kiss" problems due to inherent low voltage conditions
- **Clapper Design** armature assembly pivots on needle bearings resulting in quick, smooth opening and closing of the magnet
- **Stainless Steel Kick-Out Spring** assures quick, positive drop-out time
- **Front Removable Parts** all current carrying parts front removable for easy inspection and maintenance

Standards and Certifications

Class A200 starters are UL listed and recognized and also carry CSA certification.

Listed

Instructional Leaflets

16958	Sizes 00–1, 3-Pole Motor Controller
16956	Sizes 00–1, 2-Pole, Single-Phase Motor Controller
16959	Size 2, 3-Pole Motor Controller
16957	Size 2, 2-Pole, Single-Phase Motor Controller
15465C	Sizes 3 and 4J Motor Controller
17000C	Size 4, Model K Motor Controller
17054C	Size 5 Motor Controller
17055C	Size 6 Motor Controller

Product Selection

Non-Reversing, Sizes 00–9

When Ordering Specify

Order by catalog number from the tables to the right, plus suffix for coil voltages, verifying usage of appropriate sizes.

Heaters

Enter heaters as separate item by listing catalog number from the tables on **Pages V5-T2-135** and **V5-T2-136**, as required per starter.

Size 3 Starter



Non-Reversing Starters

Size	Amperes	Max. UL Horsepower Single-Phase 115V	230V	Three-Phase 208V	240V	480V	600V	Open Catalog Number ①
Two-Poles ② —Sizes 00–2								
00	9	1/3	—	1-1/2	1-1/2	2	2	**A200MABR**
0	18	1	—	3	3	5	5	**A200M0BR**
1	27	2	—	7-1/2	7-1/2	10	10	**A200M1BR**
1-1/2	36	3	—	—	—	—	—	**A200MDBR**
2	45	7-12	—	10	15	25	25	**A200M2BR**
Three Poles—Sizes 00–6								
00	9	1/3	—	1-1/2	1-1/2	2	2	**A200MAC_**
0	18	1	—	3	3	5	5	**A200M0C_**
1	27	2	—	7-1/2	7-1/2	10	10	**A200M1C_**
2	45	7-12	—	10	15	25	25	**A200M2C_**
3	90	—	—	25	30	50	50	**A200M3C_**
4	135	—	—	40	50	100	100	**A200M4C_**
5	270	—	—	75	100	200	200	**A200M5C_**
6	540	—	—	150	200	400	400	**A200M6C_**
Three Poles—Sizes 7–9								
7 ③	810	—	—	200	300	600	600	**A200M7C_**
8 ③	1215	—	—	400	450	900	900	**A200M8C_**
9 ③	2250	—	—	—	800	1600	—	**A200M9C_** ④

Coil Suffix

Coil Volts and Hz	Code Suffix
Sizes 00–6	
120/60 or 110/50	**AC**
200–208/60	**B**
240/60	**W**
480/60	**X**
600/60	**E**
Sizes 7, 8 and 9 ④	
110–120/50 or 60	**J**
220–240/50 or 60	**W**
440–480/50 or 60	**X**
600/60	**E**

Notes

① For ambient compensated overload relay with auto-reset, add Suffix **D.**
② Single-phase with one single-pole overload relay.
③ Sizes 7–9 use rectifier with DC coil.
④ For Size 9, only available coil voltage is 120V.

Reversing, Sizes 00–9

When Ordering Specify

Order by catalog number from table below, plus suffix for coil voltages, verifying usage of appropriate sizes.

Heaters

Enter heaters as separate item by listing catalog number from the tables on **Pages V5-T2-135** and **V5-T2-136**, as required per starter.

Size 1 Horizontal Reversing Starter



Reversing Starters

Size	Amps	Max. UL Horsepower Single-Phase 115V	230V	Three-Phase 208V	240V	480V	600V	Horizontal Design Catalog Number ①	Vertical Design Catalog Number ①
Sizes 00–6									
00	9	1/3	1	1-1/2	1-1/2	2	2	**A210MAC_**	**A250MAC_**
0	18	1	2	3	3	5	5	**A210M0C_**	**A250M0C_**
1	27	2	3	7-1/2	7-1/2	10	10	**A210M1C_**	**A250M1C_**
2	45	3	7-1/2	10	15	25	25	**A210M2C_**	**A250M2C_**
3	90	—	—	25	30	50	50	**A210M3C_**	**A250M3C_**
4	135	—	—	40	50	100	100	**A210M4C_**	**A250M4C_**
5	270	—	—	75	100	200	200	**A210M5C_**	**A250M5C_**
6	540	—	—	150	200	400	400	**A210M6C_**	**A250M6C_**
Sizes 7–9									
7 ②	810	—	—	200	300	600	600	—	**A250M7C_**
8 ②	1215	—	—	400	450	900	900	—	**A250M8C_**
9 ②	2250	—	—	—	800	1600	—	—	**A250M9C_** ③

Coil Suffix

Coil Volts and Hz	Code Suffix
Sizes 00–6	
120/60 or 110/50	**AC**
200–208/60	**B**
240/60	**W**
480/60	**X**
600/60	**E**
Sizes 7, 8 and 9 ③	
110–120/50 or 60	**J**
220–240/50 or 60	**W**
440–480/50 or 60	**X**
600/60	**E**

Notes

① For ambient compensated overload relay with auto-reset, add Suffix **D.**
② Sizes 7–9 use rectifier with DC coil.
③ For Size 9, only available coil voltage is 120V.

For Separate Two-Winding Motors

Heaters

Enter heaters as separate item by listing catalog number from the tables on **Pages V5-T2-135** and **V5-T2-136**, as required per starter.

Three-Phase, Non-Reversing, Reversing 60 Hz Starters—Heater Selection

		Constant or Variable Torque				Constant Horsepower				Three Poles Open
NEMA	**Amperes**	**208V**	**240V**	**480V**	**600V**	**208V**	**240V**	**480V**	**600V**	**Catalog Number** ①
Sizes 0–6										
0	18	3	3	5	5	2	2	3	3	**A960M0C_**
1	27	7-1/2	7-1/2	10	10	5	5	7-1/2	7-1/2	**A960M1C_**
2	45	10	15	25	25	7-1/2	10	20	20	**A960M2C_**
3	90	25	30	50	50	20	25	40	40	**A960M3C_**
4	135	40	50	100	100	30	40	75	75	**A960M4C_**
5	270	75	100	200	200	60	75	150	150	**A960M5C_**
6	540	150	200	400	400	100	150	300	300	**A960M6C_**

For Single-Winding Motors

Sizes 0–6

						Three Poles Open
NEMA	**Amperes**	**208V**	**240V**	**480V**	**600V**	**Catalog Number** ①
Constant Horsepower						
0	18	3	3	5	5	**A970M0C_**
1	27	7-1/2	7-1/2	10	10	**A970M1C_**
2	45	10	15	25	25	**A970M2C_**
3	90	25	30	50	50	**A970M3C_**
4	135	40	50	100	100	**A970M4C_**
5	270	75	100	200	200	**A970M5C_**
6	540	150	200	400	400	**A970M6C_**
Constant or Variable Torque						
0	18	2	2	3	3	**A980M0C_**
1	27	5	5	7-1/2	7-1/2	**A980M1C_**
2	45	7-1/2	10	20	20	**A980M2C_**
3	90	20	25	40	40	**A980M3C_**
4	135	30	40	75	75	**A980M4C_**
5	270	60	75	150	150	**A980M5C_**
6	540	100	150	300	300	**A980M6C_**

Coil Suffix

Coil Volts and Hz	Coil Suffix
Sizes 0–6	
120/60 or 110/50	**AC**
200–208/60	**B**
240/60	**W**
480/60	**X**
600/60	**E**

Note

① For ambient compensated overload relay with auto-reset, add Suffix **D**.

Accessories

SS-56 Surge Suppressor

- Designed to be used with magnetic motor controllers through Size 4 in 120V, 60 Hz control circuit applications where electronic equipment is used
- Steady state coil volts: 120, 60 Hz, rms
- Peak input volts: 169.6, 60 Hz, max. amplitude
- Max. ambient temperature: 65°C
- Nominal limiting volts: 270 peak
- Nominal rate of volt rise: 0.5 per ms

SS-56 Surge Suppressor



Surge Suppressor ①

Type Mounting	Kit Catalog Number
Starter	**SS-56**

Mechanical Interlock

- Prevents closing of one member of a reversing or multi-speed contactor until the opposite member is completely open
- Lever type mechanism assures positive action
- Can be factory assembled or field mounted on A200 and A900 starters and contactors

Mechanical Interlock

Contactor Arrangement (Number of Poles, Horizontal or Vertical)	Continuous Size	Interlock Catalog Number
3 x 3 horizontal	0, 1	**M-33-1B**
4 x 4 horizontal	0, 1	**M-33-1B**
5 x 3 horizontal	0, 1	**M-33-1B**
All pole combination, vertical	0, 1	**M-34-1A**
3 x 3 horizontal reversing	2	**M-33-2B**
3 x 3 vertical reversing	2	**M-34-2A**
5 x 3 horizontal	2	**M-35-2A**
4 x 4 horizontal	2	**M-36-2A**
All pole combination horizontal	3, 4	**M-33-3B**
All pole combination vertical	3, 4	**M-34-3**

B3NO Bell Alarm Contact

- Isolated normally open bell alarm contact
- Mounts in Type B block-type overload relay

Bell Alarm Contact

Kit Catalog Number
B3NO-2
B3NO-4 ②

Control Contact Ratings (B600)

	Maximum Amperes	
AC Volts	Make	Break
24–120	30	3.00
121–600	3600 VA	360 VA
Continuous current rating: 5A		

Overload Relay Reset Extension

- Used to adjust overload reset rod depth of Class A200 Model J starters and current design overload relays to same dimensions as obsolete B200 starters and overloads identified by suffix **B**, for example, BA13**B**

When replacing obsolete B200 device with Class A200 starter and Type B overload, order Style 6710C11H03. No charge.

When replacing obsolete B200 device with Class A200 starter and Type A overload, order Style 1490C15H10. No charge.

Notes

① Can be used on Sizes 5 and 6 with 120V coil. Mounting bracket required—order separately. Mounting bracket 177C043G04.

② For Size 3 and 4.

Power Pole Kit

- Adds 1NO or 1NC power pole to Size 00–1 A201 Class contactors
- Factory installed or field mountable in load side auxiliary cavities
- 600 Vac
- Continuous current rating of 18A for Size 0, 27A for Size 1

Power Pole Kit ①

Continuous Current Rating	Kit Size	Kit Catalog Number
Normally Open		
18	0	**PNO-0**
27	1	**PNO-1**
Normally Closed		
18	0	**PNC-0**
27	1	**PNC-1**

Replacement Auxiliary Contacts

Contactor Size	Contact Arrangement	Auxiliary Elect. Contact Catalog Number	Auxiliary Elect. Contact Style Number
5, 6	1NO + 1NC	**J11**	**9084A17G01**
	2NO	**J20**	**9084A17G02**
	2NC	**J02**	**9084A17G03**
7, 8	1NO	—	**578D461G01**
	1NC	—	**578D461G03**
9	1NO + 1NC	—	**843D943G04**
	2NO	—	**843D943G05**
	2NC	—	**843D943G06**

Extra Auxiliary Contact Kits

All starters include an auxiliary contact with 1NO and 1NC contact. These kits include an auxiliary contact with contacts as shown, plus operating arm and mounting bracket when required.

Extra Auxiliary Contact Kits

Contactor Size	Contact Arrangement	Style Number
5, 6	1NO + 1NC	**3463D94G18**
	2NO	**3463D94G04**
	2NC	**3463D94G19**
7, 8 ②	2NO	**818D498G06**
	1NO	**818D498G04**

DC Coil Conversion Kits

Kits listed below include all necessary parts to convert from AC to DC control including the DC coil with built-in diode, rectifier, auxiliary interlock and all mounting hardware.

DC Coil Conversion Kits

Size	Voltage	Kit Style Number
5	110-120	**7864A28G01**
	220-240	**7864A28G02**
	440-480	**7864A28G03**
6	110-120	**7864A29G01**
	220-240	**7864A29G02**
	440-480	**7864A29G03**

Mechanical Interlocks

Contactor Sizes	Style Numbers Horizontal	Vertical
3, 4 and 5	**2050A11G75**	**2050A11G65**
5 and 5	**2050A11G27**	**2050A11G17**
5 and 6	**2050A11G26**	**2050A11G16**
6 and 7, 8	—	**2050A11G55**
7, 8 and 7, 8	No (rear conn.)	**567D624G01**
7, 8 and 9	No (rear conn.)	**9944D56G06**
9 and 9	No (rear conn.)	**9944D56G01**

Notes

① Do not use with DC operated contactors.
② Size 7 and larger use DC coils as standard.

Overload Protection

Overload Protection Size 5 Starters

Type B overload relay is a three-pole, block type, thermal ambient compensated device with manual reset mounted integrally. Current transformers are enclosed in a protective case and integrally mounted to save panel space. Standard ratio is 300:5.

Overload Protection Size 6 Starters

Overload protection assembly consists of three current transformers, Type B three-pole block overload relay and an optional interposing relay. These parts are mounted on a panel which connects directly to the load terminal of the contactor. Current transformers are 600:5 ratio as standard.

If automatic reset is required, the Type A, three-pole block, ambient compensated relay is available upon request.

Overload Relay Kits

Each kit includes three current transformers (standard ratio) and one Type B, three-pole block overload relay, ambient compensated with manual reset.

Overload Relay Kits

Kit Size	Kit Part Number
5	**2057A34G01**
6	**6379D80G10**

Replacement Terminal Lugs ①

		Terminals		
Contactor Size	**Cable Size**	**Quantity in Kit**	**Quantity Required per Pole**	**Kit Style Number**
5	1-500 MCM	6	2	**2119A76G01**
6	2-500 MCM	6	2	**7858A96G01**
7	4-500 MCM	12	4	**7858A96G02**
8	4-500 MCM	12	4	**7858A96G03**

Note

① All mounting hardware is included in kit.

Renewal Parts

When Ordering Specify

Use this renewal parts data to identify device by style number, catalog number and/or description.

Select style number of replacement part from the following pages.

For clarification of ordering procedure, pricing and discounts, contact the Customer Support Center.

General Information

This renewal parts data will provide the proper identification of standard parts which may be required for maintenance of Eaton's components.

It is the intent of this catalog section to make it possible to quickly select the parts needed.

An investment in renewal parts and regular maintenance program will protect against downtime and ensure a proper duty cycle for your equipment.

To maintain maximum operating efficiency and dependability of your equipment, only genuine Eaton replacement parts should be used.

This section identifies the replacements parts which are available. Order by style number.

JF Autostarters

JF Autostarter Kits ①

Frame Size	Start Contacts Required	Start Contacts Style Number	Run Contacts Required	Run Contacts Style Number	Grid Stack Kit Required	Grid Stack Kit Style Number
2–3	1	**38A7018G12**	1	**38A7018G13**	1	**3354D90G10**
4–5 5L	1	**550D409G18**	1	**550D409G19**	1	**3354D90G10**
5M–5MM	1	**3354D90G08**	1	**3354D90G09**	2	**3354D90G10**

Solenoid Assembly with Coil (All Sizes) ②

Volt	Hz	Style Number ③
115	60	**5264C05H01**
230	60	**5264C05H02**
460	60	**5264C05H03**
575	60	**5264C05H04**

Notes

① Kits contain a complete set of moving contacts, stationary contacts and springs.

② When replacing solenoid assembly series 416C160 use adapter plate style 9917D02H01—one required.

③ These styles replace coil style 296B892G__. When ordering new style as replacement, customer must order adapter plate 9917D02H01, one required.

AC Starters, Contactors A200, A201

AC Contactors Model J Sizes 00, 0, 1, 2 Kits ①

Part	Poles	Size 00 Style Number	Size 0 Style Number	Size 1 Style Number	Size 2 Style Number
Contact kit	2	**373B331G17**	**373B331G02**	**373B331G07**	**373B331G11**
	3	**373B331G18**	**373B331G04**	**373B331G09**	**373B331G12**
	4	**373B331G18**	**373B331G04**	**373B331G09**	**373B331G13** ③
	5	**373B331G19**	**373B331G05**	**373B331G10**	—
Arc box ②	2, 3, 4	**6714C74G01**	**6714C74G02**	**6714C74G03**	**6714C74G07** ④
	5	**6714C74G04**	**6714C74G05**	**6714C74G06**	**6714C74G08** ⑤
Cross bar	2, 3	**N/A**	**N/A**	**N/A**	**672B788G32**
	4, 5	**N/A**	**N/A**	**N/A**	**672B788G34**
Upper base (for single rated coils only)	2, 3	**N/A**	**N/A**	**N/A**	**672B788G33**
	4, 5	**N/A**	**N/A**	**N/A**	**672B788G35**
Lower base	2, 3	**N/A**	**N/A**	**N/A**	**1250C33G09**
	4, 5	**N/A**	**N/A**	**N/A**	**1250C33G05**
KO spring (package of 10)	All	**N/A**	**N/A**	**N/A**	**503C796G01**
Terminal line/load (package of 3)	All	**N/A**	**N/A**	**N/A**	**371B870G03**

AC Coils

Voltage	Hz	Size 00, 0, 1 Two-, Three-, Four-Pole Style Number	Five-Pole Style Number	Size 2 Two-, Three-Pole Style Number	Four-, Five-Pole Style Number
120/110	60/50	**505C806G01**	**505C808G01**	**505C806G01**	**505C818G01**
208	60	**505C806G02**	**505C808G02**	**505C806G02**	**505C818G02**
600/550	60/50	**505C806G05**	**505C808G05**	**505C806G05**	**505C818G05**
380	50	**505C806G07**	**505C808G07**	**505C806G07**	**505C818G07**
240/220	60/50	**505C806G12**	**505C808G12**	**505C806G12**	**505C818G12**
480/440	60/50	**505C806G13**	**505C808G13**	**505C806G13**	**505C818G13**
24	60	**505C806G16**	**N/A**	**505C806G16**	**505C818G15**
277	60	**505C806G18**	**505C808G16**	**505C806G18**	**505C818G16**
240/480 ⑥	60/60	**505C806G03**	**505C808G03**	**505C806G03**	**505C818G03**
120/240 ⑦	60/60	**505C806G10**	**505C808G10**	**505C806G10**	**505C818G10**

DC Coil ⑦

Voltage	Size 0, 1 Single-, Two-, Three-, Four-Pole Style Number	Size 2 Single-, Two-, Three-Pole Style Number
12	**1268C86G07**	**1268C86G07**
24	**1268C86G04**	**1268C86G04**
48	**1268C86G05**	**1268C86G05**
125	**1268C86G02**	**1268C86G02**
250	**1268C86G01**	**1268C86G01**
125/250 ⑥	**1268C86G03**	**1268C86G03**

Notes

① Model C contact tips and coils 00-4, two-, three-, four- and five-pole contactors are same as Model J. All other parts are unavailable.
② Mounting hardware included.
③ Use one each of 373B331G11 and 373B331G12.
④ Two-, three-pole.
⑤ Four-, five-pole.
⑥ Dual voltage coils. Use only on contactors or starters originally supplied with a dual voltage coil.
⑦ Use only on contactors originally supplied with a DC coil.

Accessories for Size 5–9 AC Contactors

A rectifier circuit converts the AC supply to DC supply. This conversion provides pick up and drop out characteristics. All necessary parts are included in the kit.

AC-DC Coil Conversion Kits

Voltage	Size 5 Style Number	Size 6 Style Number
120 Vac	**7864A28G01**	**7864A29G01**
240 Vac	**7864A28G02**	**7864A29G02**
480 Vac	**7864A28G03**	**7864A29G03**

Replacement Coils for AC-DC Coil Conversion Kit

Voltage	Size 5 Style Number	Size 6 Style Number
120 Vac	**7856A15G05**	**7856A16G05**
240 Vac	**7856A15G10**	**7856A16G10**
480 Vac	**7856A15G15**	**7856A16G15**

Auxiliary Electrical Interlocks Size 7–9 AC and All DC Units

Type	Circuits	Application	Style Number
L63	NO	Size 7–8	**578D461G01**
L63	NC	Size 7–8	**578D461G03**
L64	NO-NC	Size 9	**843D943G04**
L64	2NO	Size 9	**843D943G05**
L64	2NC	Size 9	**843D943G06**

Accessories for Size 00–6 AC Contactors

Auxiliary Electrical Interlocks

Catalog Number (Obsolete)	Style Number (Obsolete)	Circuits	Catalog Number Current	Style Number Current
(L-56)	(2609D01G01)	1NO and 1NC	**J11**	**9084A17G01**
(L-56D)	(2609D01G02)	2NO	**J20**	**9084A17G02**
(L-56E)	(2609D01G03)	1NO and 1NC	**J11**	**9084A17G01**
(L-56B)	(2609D01G04)	2NO	**J20**	**9084A17G02**
(L-56H)	(2609D01G05)	2NO	**J20**	**9084A17G02**
(L-56J)	(2609D01G06)	1NO and1NC DB	**J1C**	**9084A17G04**
(L-56A)	(2609D01G07)	N/A	**N/A**	**N/A**
(L-56B)	(2609D01G08)	N/A	**N/A**	**N/A**
(L-56F)	(2609D01G09)	N/A	**N/A**	**N/A**
(L-56G)	(2609D01G10)	1NO and 1NC DB	**J1C**	**9084A17G04**
(L-56C)	(2609D01G11)	2NC	**J02**	**9084A17G03**
(L-56M)	(2609D01G12)	N/A	**N/A**	**N/A**
(L-56P)	(2609D01G17)	1NO and 1NC	**J11**	**9084A17G01**
(L-56R)	(2609D01G18)	2NC	**J02**	**9084A17G03**
(L-56S)	(2609D01G19)	1NO and 1NC	**J11**	**9084A17G01**

Model J–K, Sizes 3 and 4

Sizes 3 and 4 Kits ①

Part	Poles	Size 3–Model J Style Number	Size 4–Model J ② Style Number	Size 4–Model K ③ Style Number
Contact kit	2	**626B187G12**	**626B187G16**	**5250C81G16**
	3	**626B187G13**	**626B187G17**	**5250C81G17**
	4	④	⑥	**5250C81G18**
	5	⑤	⑦	**5250C81G19**
Arc box	2, 3	**6714C74G09**	**6714C74G11**	**6714C74G11**
	4, 5	**6714C74G10**	**6714C74G12**	**6714C74G12**
Cross bar	2, 3	**672B788G36**	**672B788G36**	**672B788G40**
	4, 5	**672B788G38**	**672B788G38**	—
Upper base	2, 3	**672B788G37**	**672B788G37**	**672B788G52**
	4, 5	**672B788G39**	**672B788G39**	—
Lower base	2, 3	**1250C33G03**	**1250C33G03**	**1250C33G10**
	4, 5	**1250C33G06**	**1250C33G06**	—
KO spring (package of 10)	All	**503C796G02**	**503C796G02**	**672B788G50**
Terminal line/load (package of 3)	All	**372B357G12**	**372B357G18**	**372B357G18**

Notes

① Model C contact tips and coils 00-4, two-, three-, four- and five-pole contactors are same as Model J. All other parts are unavailable.
② For 200A A202 magnetically latched lighting contactors order three-pole contact kit style 672B788G07.
③ Model K replaces Model J, offering superior design life characteristics. Renewal parts are different. Use parts for proper model only.
④ Use quantity two of 626B187G12.
⑤ Use quantity one each of 626B187G12 and 626B187G13.
⑥ Use quantity two of 626B187G16.
⑦ Use quantity one each of 626B187G16 and 626B187G17.

Accessories for Model J–K, Series 3, 4

DC Coils ①

Voltage	Model J Size 3, 4 Two-, Three-Pole Style Number
24	**1255C68G04**
48	**1255C68G05**
125	**1255C68G01**
250	**1255C68G02**
125/250 ②	**1255C68G03**

AC Coils

Voltage	Hz	Model J Size 3, 4 Two-, Three-Pole Style Number	Four-, Five-Pole Style Number	Model K Size 4 ③ Two-, Three-Pole Style Number	Four-, Five-Pole Style Number
120/110	60/50	**505C633G01**	**505C635G01**	**5250C79G01**	**5250C80G01**
208	60	**505C633G02**	**505C635G02**	**5250C79G02**	**5250C80G02**
600/550	60/50	**505C633G05**	**505C635G05**	**5250C79G05**	**5250C80G05**
380	50	**505C633G07**	**505C635G07**	**5250C79G07**	**5250C80G07**
240/220	60/50	**505C633G12**	**505C635G12**	**5250C79G12**	**5250C80G12**
480/440	60/50	**505C633G13**	**505C635G13**	**5250C79G13**	**5250C80G13**
24	60	**505C633G34**	**N/A**	**5250C79G34**	**N/A**
277	60	**505C633G14**	**N/A**	**5250C79G14**	**N/A**
240/480 ②	60/60	**505C633G03**	**505C635G03**	**5250C79G03**	**5250C80G03**
120/244 ②	60/60	**505C633G10**	**505C635G10**	**5250C79G10**	**5250C80G10**

A201 Contactors—Size 5–9

GCA 530/630—GPD 7, 8, 9 Kits ④

Part	Size 5 Style Number	Size 6 Style Number	Size 7 Style Number	Size 8 Style Number	Size 9 Style Number
Contact kit (one per pole)	**477B477G05** ⑤	**2066A10G11**	**461A757G17**	**646C829G05**	**5264C42G01** ⑥
					5264C42G02 ⑦
Arc box	**2050A15G45**	**2066A10G45**	**831D580G01**	**831D580G01**	**9917D69G02**
Magnet assembly	**2050A15G46**	**2050A15G46**	**N/A**	**N/A**	**N/A**
Mag. spg. kit	**2050A15G47**	**2050A15G47**	**N/A**	**N/A**	**N/A**
Acr cup kit	**2050A15G48**	**N/A**	**N/A**	**N/A**	**N/A**
Load conversion kit	**2050A15G49**	**2066A10G49**	**N/A**	**N/A**	**N/A**
Line conversion kit	**2050A15G50**	**2066A10G50**	**N/A**	**N/A**	**N/A**
K.O. spring–6	**2050A15G51**	**2066A10G46**	**N/A**	**N/A**	**N/A**
C.T. 300/5	**655C285H03**	**N/A**	**N/A**	**N/A**	**N/A**
C.T. 400/5	**655C285H04**	**N/A**	**N/A**	**N/A**	**N/A**
C.T. 600/5 ⑧	**N/A**	**2066A10G18**	**N/A**	**N/A**	**N/A**
C.T. 800/5 ⑧	**N/A**	**2066A10G19**	**N/A**	**N/A**	**N/A**
Phase barrier	**N/A**	**N/A**	**640C441G01**	**640C441G01**	**5264C35G03** ⑥
Cross bar	**2050A15G12**	**2066A10G15**	**N/A**	**N/A**	**N/A**
Shunt	**N/A**	**2066A10G48**	**650C129G01**	**646C831G02** ⑨	**5264C39G02** ⑩

Notes

① Use only on units originally supplied with DC coil.
② Dual voltage coils. Use only on contactors or starters originally supplied with dual voltage coil.
③ Model K replaces Model J, offering superior design life characteristics. Renewal parts are different. Use parts for proper model only.
④ Catalog Number A201/A200 Series replaces GCA/GPD series. Renewal parts are the same.
⑤ Use 477B477G06 for silver tungsten applications.
⑥ R.C.
⑦ F.C.
⑧ C.T. kit which replaces the single molded 1 C.T. assembly used on the old size 6 airbreak. The kit includes a single molded 3 C.T. assembly, 2 bus bar and hardware. This C.T. kit also replaces the single molded 3 C.T. assembly used on the present size 6 airbreak and size vacuum.
⑨ Set of three.
⑩ Set of four.

Accessories for A201 Contactors—Size 5–9

Coils (Sizes 5 and 6)

Voltage	Hz	Size 5 Style Number	Size 6 Style Number
Sizes 5 and 6			
110/120	60	**2050A14G05**	**2050A12G05**
110/120	50	**2050A14G06**	**2050A12G06**
200/208	50	**2050A14G07**	**2050A12G07**
220/240	50	**2050A14G08**	**2050A12G08**
200/208	60	**2050A14G09**	**2050A12G09**
220/240	60	**2050A14G10**	**2050A12G10**
277/303	60	**2050A14G12**	**2050A12G12**
380/415	50	**2050A14G14**	**2050A12G14**
440/480	60	**2050A14G15**	**2050A12G15**
440/480	50	**2050A14G16**	**2050A12G16**
550/600	60	**2050A14G17**	**2050A12G17**
550/600	50	**2050A14G18**	**2050A12G18**
380/415	60	**2050A14G19**	**2050A12G19**
120/240	60	**2050A14G20**	**2050A12G20**
24 DC	—	**2050A14G21**	**2050A12G21**
48 DC	—	**2050A14G22**	**2050A12G22**
125 DC	—	**2050A14G25**	**2050A12G25**
250 DC	—	**2050A14G27**	**2050A12G27**

Coils (Sizes 7–9)

Line Voltage	Style Number	Required
Sizes 7 and 8		
125 Vdc	**438C805G04**	2
230 Vdc	**438C805G02**	2
250 Vdc	**438C805G03**	2
110/120 Vac ①④	**438C805G12**	2
220/240 Vac ②④	**438C805G11**	2
380 Vac ③④	**438C805G15**	2
440/480 Vac ③④	**438C805G10**	2
550/575 Vac ③④	**438C805G13**	2
Size 9		
110 Vdc	**5264C34G01** ⑤	—

Notes

① Rectifier 125V 2018A40G01 (one required).
② Rectifier 250V 2018A40G02 (one required).
③ Rectifier 600V 2018A40G03 (one required).
④ These coils require an external rectifier. If the rectifier needs replacement, order by the appropriate style number.
⑤ Contains coil and resistor.

Modifications

Factory Modifications

Modification	Description	Catalog Number Suffix	NEMA Size 00–1	2	3	4	5	6	7	8	9
Control circuit	1 Extra auxiliary contact (1NO-1NC) non-reversing, reversing, 2-speed unwired	**J1**	Consult sales office for pricing adders.								
	2 Extra auxiliary contact non-reversing, reversing, 2-speed unwired	**J2**	Consult sales office for pricing adders.								
	3 Extra auxiliary contact non-reversing, unwired	**J3**	Consult sales office for pricing adders.								
	4 Extra auxiliary contact non-reversing, unwired	**J4**	Consult sales office for pricing adders.								
	Wired for separate control (NC)	**C**	Consult sales office for pricing adders.								
	Omit control wiring (NC)	**X**	Consult sales office for pricing adders.								
Overload relays (substitutions)	Ambient compensated with auto reset (NC)	**D**	Consult sales office for pricing adders.								
	Fast trip—ambient compensated (specify motor FLA)	**D7**	Consult sales office for pricing adders.								
	Overload relay alarm contact (NO) per overload	**E**	Consult sales office for pricing adders.								

Accessories and Field Modification Kits

Type J Auxiliary Contact



- Capable of being field mounted in a contactor or starter (Classes A200, A900 Sizes 00–6, V200, V201 vacuum and definite purpose controllers)
- Provides two separate electrical contact sets which wire vertically and are color coded; black designates NC and silver designates NO. Please note that the vertical wiring is contrary to the horizontal wiring of the L-56 auxiliary contacts
- Designed to fit within dimensions of starter; no additional panel space is required
- Provides circuit isolation (no polarity restrictions) and single break bifurcated contacts

Auxiliary Contact Ratings

Voltage	Make	Break
NEMA A600		
120–600 Vac	7200 VA	720 VA
72–120 Vac	60A	720 VA
28–72 Vac	60A	10A
NEMA R300		
28–300 Vdc	28 VA	28 VA

Auxiliary Contact Types

Contact Type	Max.	Catalog Number
1NO and 1NC	4	**J11**
2NC	4	**J02**
2NO	4	**J20**
1 coil clearing NC and 1NO	4	**J1C**

Technical Data and Specifications

Electrical Characteristics

Sizes 00–4

	Size 00	Size 0	Size 1	Size 2	Size 3	Size 4
Max. voltage rating	600V	600V	600V	600V	600V	600V
Ampere rating						
(Open)	10A	20A	30A	50A	100A	150A
(Enclosed)	9A	18A	27A	45A	90A	135A
Squirrel Cage Motor						
Maximum horsepower at:						
200V/60 Hz	1-1/2 hp	3 hp	7-1/2 hp	10 hp	25 hp	40 hp
230V/ 60 Hz	1-1/2 hp	3 hp	7-1/2 hp	15 hp	30 hp	50 hp
380V/50 Hz	1-1/2 hp	5 hp	10 hp	25 hp	50 hp	75 hp
460V–575V/60 Hz	2 hp	5 hp	10 hp	25 hp	50 hp	100 hp
Resistive Heating kW ①						
Single-phase, two-pole						
120V	—	—	3 kW	5 kW	10 kW	15 kW
240V	—	—	6 kW	10 kW	20 kW	30 kW
480V	—	—	12 kW	20 kW	40 kW	60 kW
600V	—	—	15 kW	25 kW	50 kW	75 kW
Three-phase, three-pole						
120V	—	—	5 kW	8.5 kW	17 kW	26 kW
240V	—	—	10 kW	17 kW	34 kW	68 kW
480V	—	—	20 kW	34 kW	68 kW	105 kW
600V	—	—	25 kW	43 kW	86 kW	130 kW
Capacitor Switching kVAR, Three-Phase						
240V	—	—	—	12 kVAR	27 kVAR	40 kVAR
480V	—	—	—	25 kVAR	53 kVAR	80 kVAR
600V	—	—	—	31 kVAR	67 kVAR	100 kVAR
Transformer Switching kVA ②						
Single-phase, two-pole						
120V	—	0.6 kVA	1.2 kVA	2.1 kVA	4.1 kVA	6.8 kVA
240V	—	1.2 kVA	2.4 kVA	4.1 kVA	8.1 kVA	14 kVA
480V	—	2.4 kVA	4.9 kVA	8.3 kVA	16 kVA	27 kVA
600V	—	3 kVA	6.2 kVA	10 kVA	20 kVA	34 kVA
Three-phase, three-pole						
120V	—	1.8 kVA	3.6 kVA	6.3 kVA	12 kVA	20 kVA
240V	—	2.1 kVA	4.3 kVA	7.2 kVA	14 kVA	23 kVA
480V	—	4.2 kVA	8.5 kVA	14 kVA	28 kVA	47 kVA
600V	—	5.2 kVA	11 kVA	18 kVA	35 kVA	59 kVA

Sizes 5–9

	Size 5	Size 6	Size 7	Size 8	Size 9
Max. voltage rating	600V	600V	600V	600V	600V
Ampere rating					
(Open)	300A	600A	900A	1350A	2500A
(Enclosed)	270A	540A	810A	1215A	2250A
Squirrel Cage Motor					
Maximum horsepower at:					
200V/60 Hz	75 hp	150 hp	—	—	—
230V/60 Hz	100 hp	200 hp	300 hp	450 hp	800 hp
380V/50 Hz	150 hp	300 hp	—	—	—
460V–575V/60 Hz	200 hp	400 hp	600 hp	900 hp	1600 hp
Resistive Heating kW ①					
Single-phase, two-pole					
120V	30 kW	60 kW	90 kW	③	③
240V	60 kW	120 kW	180 kW	③	③
480V	120 kW	240 kW	360 kW	③	③
600V	150 kW	300 kW	450 kW	③	③
Three-phase, three-pole					
120V	52 kW	105 kW	155 kW	③	③
240V	105 kW	210 kW	315 kW	③	③
480V	210 kW	415 kW	625 kW	③	③
600V	260 kW	515 kW	775 kW	③	③
Capacitor Switching kVAR, Three-Phase					
240V	80 kVAR	160 kVAR	240 kVAR	360 kVAR	665 kVAR
480V	160 kVAR	320 kVAR	480 kVAR	720 kVAR	1325 kVAR
600V	200 kVAR	400 kVAR	600 kVAR	900 kVAR	1670 kVAR
Transformer Switching kVA ②					
Single-phase, two-pole					
120V	14 kVA	27 kVA	41 kVA	61 kVA	112 kVA
240V	27 kVA	54 kVA	81 kVA	122 kVA	225 kVA
480V	54 kVA	108 kVA	162 kVA	244 kVA	450 kVA
600V	68 kVA	135 kVA	203 kVA	304 kVA	562 kVA
Three-phase, three-pole					
120V	41 kVA	81 kVA	122 kVA	182 kVA	337 kVA
240V	47 kVA	94 kVA	140 kVA	210 kVA	342 kVA
480V	94 kVA	188 kVA	280 kVA	420 kVA	783 kVA
600V	117 kVA	234 kVA	351 kVA	526 kVA	975 kVA

Notes

① Resistive loads having inrush currents not exceeding 1.5 times continuous rating.

② These ratings are for transformers having inrush currents not more than 20 times peak of continuous current ratings. For inrush currents greater than 20 times, refer to factory.

③ For ratings refer to factory.

DC Power Pole Ratings

The following represent typical production test values and should not be interpreted as a guarantee of actual performance.

DC Operated 120 and 240V Coils

Contactor Size	DC Contact Ampere Rating Two Poles in Series ① 120V	240V
0	—	—
1	20	10
2	45	30
3	75	40
4	90	70

380V, 50 Hz Starter Maximum Horsepower Ratings

Horsepower Ratings

NEMA Size	00	0	1	2	3	4	5	6	7	8
Maximum horsepower	1-1/2	5	10	25	50	75	150	300	450	700

Operating Coil Characteristics at Rated Coil Volts, Sizes 00–9

The following represent typical production test values and should not be interpreted as a guarantee of actual performance.

Operating Coil Characteristics

	Sizes 00, 0, 1	Size 2	Size 3	Size 4 ②	Size 5	Size 6	Size 7	Size 8	Size 9
AC Coil									
Burden									
(Open VA)	160 VA	160 VA	625 VA	700 VA	1700 VA	2900 VA	③	③	③
(Closed VA)	25 VA	25 VA	50 VA	64 VA	180 VA	220 VA	③	③	③
(Closed Watts)	7.8 W	7.8 W	18 W	21 W	32 W	42 W	—	—	—
Pick-up volts ④	85%	85%	85%	85%	78%	70%	—	—	—
Drop-out volts ④	40–60%	40–60%	40–60%	40–60%	65 to 75%	60 to 70%	—	—	—
Pick-up time Hz ⑤⑥	1–1-1/2	1-1/2–2	2–2-1/2	1–1-1/2	1.5	4.0	—	—	—
Drop-out time Hz ⑤	3/4–1	3/4–1	3/4–1	3/4–1	0.75	0.75	—	—	—
DC Coil									
Burden									
(Open VA)	17 VA	17 VA	35 VA	35 VA	600 VA	2120 VA	400 VA	400 VA	2100 VA
(Closed VA)	17 VA	17 VA	35 VA	35 VA	22 VA	21 VA	400 VA	400 VA	350 VA
(Closed Watts)	18 W	18 W	35 W	35 W	20 W	20 W	400 W	400 W	350 W
Pick-Up Volts ④	80%	80%	80%	80%	64%	73%	45%–65% ⑦	45%–65% ⑦	50%–65% ⑦
Drop-Out Volts ④	5–10%	5–10%	5–10%	5–10%	18%	13%	30%–45% ⑦	30%–45% ⑦	40%–50% ⑦
Pick-Up Time Hz ⑥	—	25–75 ms	25–75 ms	25–75 ms	2.7 Hz ⑤	3 Hz ⑤	21–41 Hz ⑦⑤	17–29 Hz ⑦⑤	16–18 ⑦⑤
Drop-Out Time Hz ⑤	—	16–25 ms	16–25 ms	16–25 ms	9.3 Hz ⑤	17.5 Hz ⑤	7–12 Hz ⑧⑤	7–12 Hz ⑧⑤	18–20 Hz ⑦⑤

Notes

① Non-inductive load.
② AC coil data pertains to Model K, DC coil data pertains to Model J.
③ DC operated only.
④ Percent of rated coil voltage.
⑤ At 60 Hz base.
⑥ To contact touch.
⑦ Lower figure when coil is cold. Higher figure when coil is hot.
⑧ Drop-out time to clear arc. Time varies with type of load and contact wear.

Mechanical Characteristics

NEMA Standard ICS 2-110

Direct-current operated contactors shall withstand 110% of their rated voltage continuously without injury to the operating coils and shall close successfully at 80% of their rated voltage.

Alternating-current operated contactors shall withstand 110% of their rated voltage continuously without injury to the operating coils and shall close successfully at 85% of their rated voltage.

Mechanical Characteristics, Sizes 00–9

	Sizes 00, 0, 1	Size 2	Size 3	Size 4	Size 5	Size 6	Size 7	Size 8	Size 9
Dimensions in inches (mm)									
Height	6.45 (163.8)	7.16 (181.9)	9.93 (252.2)	9.93 (252.2)	12.00 (304.8) ①	13.50 (342.9) ①	18.62 (472.9) ①	19.25 (489) ①	25.00 (635) ①
Width	3.31 (84.1)	3.31 (84.1)	4.62 (117.3)	4.62 (117.3)	7.00 (177.8) ①	7.00 (177.8) ①	23.50 (596.9) ①	23.50 (596.9) ①	32.00 (812.8) ①
Depth	4.61 (117.1)	4.96 (126)	6.75 (171.5)	6.75 (171.5)	7.75 (196.9) ①	8.75 (222.3) ①	11.00 (279.4) ①	11.00 (279.4) ①	13.00 (330.2) ①
Panel area—square inches	21.35	23.7	46.0	46.0	84.0	94.5	437.5	452.4	800
Weight—pounds	3.5	3.5	11.5	11.5	25	42	215	265	315
Cable connection	—	—	—	—	Front	Front	Front/rear	Front/rear	Front/rear
Maximum cable size/phase copper (AWG/MCM)	6 AWG	3 AWG	1/0	4/0	1–500 MCM	2–500 MCM	3–500 MCM	4–500 MCM	8–500 MCM
Auxiliary electrical circuits available	8	6	6	6	4	4	3	3	4
Latched version available	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No
Mechanical interlock combinations available									
Sizes									
00, 0, 1, 2, 3, 4	Vert., Horiz.	Vert., Horiz.	Vert., Horiz.	Vert., Horiz.	Vert., Horiz.	—	—	—	—
5	—	—	—	—	Vert., Horiz.	Vert., Horiz.	—	—	—
6	—	—	—	—	Vert., Horiz.	Vert., Horiz.	Vertical	Vertical	—
7, 8	—	—	—	—	—	Vertical	Vertical	Vertical	Vertical
9	—	—	—	—	—	—	Vertical	Vertical	Vertical

Data from Tables 430—147 Through 150 of 1996 NEC: Motor Amperes at Full Load ②, Three-Phase AC

	Single-Phase AC		Induction Type Squirrel Cage and Wound-Rotor Amperes				DC			Single-Phase AC		Induction Type Squirrel Cage and Wound-Rotor Amperes				DC	
hp	115V	230V	200V	230V	460V	575V	120V	240V	hp	115V	230V	200V	230V	460V	575V	120V	240V
1/6	4.4	2.2	—	—	—	—	—	—	30	—	—	92	80	40	32	—	106
1/4	5.8	2.9	—	—	—	—	3.1	1.6	40	—	—	120	104	52	41	—	140
1/3	7.2	3.6	—	—	—	—	4.1	2.0	50	—	—	150	130	65	52	—	173
1/2	9.8	4.9	2.5	2.2	1.1	0.9	5.4	2.7	60	—	—	177	154	77	62	—	206
3/4	13.8	6.9	3.7	3.2	1.6	1.3	7.6	3.8	75	—	—	221	192	96	77	—	255
1	16	8	4.8	4.2	2.1	1.7	9.5	4.7	100	—	—	285	248	124	99	—	341
1-1/2	20	10	6.9	6.0	3.0	2.4	13.2	6.6	125	—	—	359	312	156	125	—	425
2	24	12	7.8	6.8	3.4	2.7	17	8.5	150	—	—	414	360	180	144	—	506
3	34	17	11.0	9.6	4.8	3.9	25	12.2	200	—	—	552	480	240	192	—	675
5	56	28	17.5	15.2	7.6	6.1	40	20	250	—	—	—	—	302	242	—	—
7-1/2	80	40	25.3	22	11	9	58	29	300	—	—	—	—	361	289	—	—
10	100	50	32.2	28	14	11	76	38	350	—	—	—	—	414	336	—	—
15	—	—	48.3	42	21	17	—	55	400	—	—	—	—	477	382	—	—
20	—	—	62.1	54	27	22	—	72	450	—	—	—	—	515	412	—	—
25	—	—	78.2	68	34	27	—	89	500	—	—	—	—	590	472	—	—

Notes

① For Sizes 5–9 contactors only; for starter Sizes 5–9, refer to factory.

② These current values are for motors running at usual speeds and with normal torque characteristics. Motors for special low speed or high torque may require higher current. In all cases, heaters should be selected on basis of information on motor nameplate or motor card data.

Combination Ratings

Sizes 00–2

Short-Circuit Protective Device (SCPD)	Max. Rating SCPD	Circuit Breaker Interrupting Rating	Short-Circuit Withstand Capability Current	Voltage
Sizes 00, 0, 1				
Class H fuse	60A	—	5000A	600V
Class J fuse	60A	—	100,000A	600V
Class R fuse	60A	—	100,000A	600V
Class T fuse	60A	—	100,000A	600V
Magnetic only ① Type CB ②	30A	Marked HMCP	100,000A	480V
			50,000A	600V
Thermal/magnetic Type CB ③	50A	65,000A	65,000A	480V
		25,000A	25,000A	600V
		100,000A	100,000A	480V
		35,000A	35,000A	600V
Magnetic only Type CB + CL ④	30A	HMCP + current limiter	100,000A	600V
Thermal/magnetic Type CLB ⑤	50A	150,000A	100,000A	480V
Size 2				
Class H fuse	100A	—	5000A	600V
Class J fuse	100A	—	100,000A	600V
Class R fuse	100A	—	100,000A	600V
Class T fuse	100A	—	100,000A	600V
Magnetic only ① Type CB ②	50A	Marked HMCP	100,000A	480V
			50,000A	600V
Thermal/magnetic Type CB ③	90A	65,000A	65,000A	480V
		25,000A	25,000A	600V
		100,000A	100,000A	480V
		35,000A	35,000A	600V
Magnetic only Type CB + CL ④	50A	HMCP + current limiter	100,000A	600V
Thermal/magnetic Type CLB ⑤	50A	150,000A	100,000A	480V

Sizes 3 and 4

Short-Circuit Protective Device (SCPD)	Max. Rating SCPD	Circuit Breaker Interrupting Rating	Short-Circuit Withstand Capability Current	Voltage
Size 3				
Class H fuse	60A	—	5000A	600V
Class J fuse	60A	—	100,000A	600V
Class R fuse	60A	—	100,000A	600V
Class T fuse	60A	—	100,000A	600V
Magnetic only ① Type CB ②	100A	Marked HMCP	100,000A	480V
			50,000A	600V
Thermal/magnetic Type CB ③	150A	65,000A	65,000A	480V
		25,000A	25,000A	600V
		100,000A	100,000A	480V
		35,000A	35,000A	600V
Magnetic only Type CB + CL ④	100A	HMCP + current limiter	100,000A	600V
Thermal/magnetic Type CLB ⑤	150A	50,000A	100,000A	480V
Size 4				
Class H fuse	400A	—	10,000A	600V
Class J fuse	400A	—	100,000A	600V
Class R fuse	400A	—	100,000A	600V
Class T fuse	400A	—	100,000A	600V
Magnetic only ① Type CB ②	150A	Marked HMCP	100,000A	480V
			50,000A	600V
Thermal/magnetic Type CB ③	250A	65,000A	65,000A	480V
		25,000A	25,000A	600V
		100,000A	100,000A	480V
		35,000A	35,000A	600V
Magnetic only Type CB + CL ④	150A	HMCP + current limiter	100,000A	600V
Thermal/magnetic Type CB + CL ⑤	250A	200,000A	100,000A	600V
Thermal/magnetic Type CLB ⑥	250A	150,000A	100,000A	480V

Coil Suffix

Other Available Coil Voltages—AC and DC Coils ⑦

Coils	Catalog Number Suffix	Coil Rating (Volts/Hertz)	Catalog Number Suffix	Coil Rating (Volts/Hertz)
AC	**A**	120/60, 110/50	**N**	110/50
	B	200-208/60	**P**	48/60
	C	240/60 and 480/60	**R**	120/60 and 240/60
	D	440/50	**U**	440-480/50 or 60 Rect. to DC
	E	600/60 Hz	**V**	110/60
	G	220/50	**W**	240/60
	H	380/50	**X**	480/60
	I	24/60	**Y**	415/50
	J	110-120/50 or 60 Rect. to DC	**Z**	277/60
	K	220-240/50 or 60 Rect. to DC	—	—
DC ⑧⑨	**L**	24 Vdc	**S**	125 Vdc
	M	48 Vdc	**T**	250 Vdc

Notes

① Instantaneous adjustable trip.
② Circuit breaker.
③ Inverse time circuit breaker.
④ Instantaneous adjustable trip with current limiting attachment.
⑤ Inverse time with built-in current limiting attachment.
⑥ Inverse time current limiting breaker.
⑦ Availability may be limited.
⑧ DC coils for Size 5 and 6 contactors and starters are intermittent duty rated only. A mechanical latch is required.
⑨ DC coils. Use only on contactors originally supplied with a DC coil.

Dimensions

Approximate Dimensions in Inches (mm)

Not to be used for construction purposes unless approved.

Open Non-Reversing Starters

Figure A—Sizes 00–4

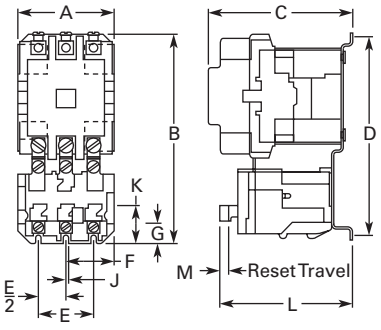


Figure B—Size 5

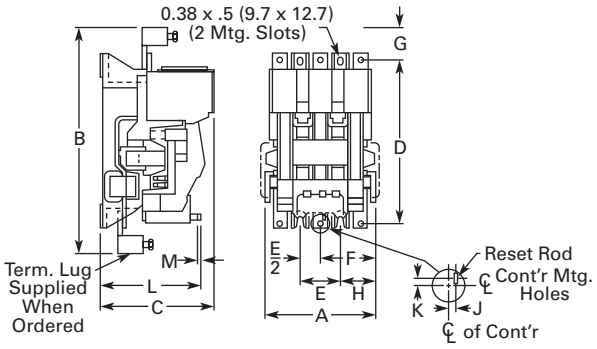
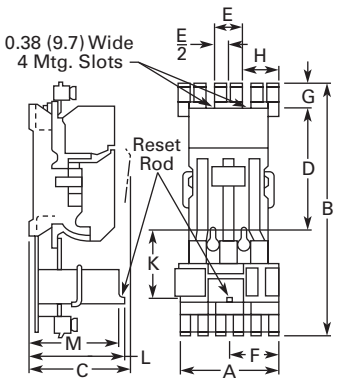


Figure C—Size 6



Dimensions and Shipping Weights

NEMA Size	No. of Poles	Fig.	Mounting Screws No.	Mounting Screws Size	A	B	C	D	E	F	G	H	J	K	L	M	Weight, Lbs (kg)
00, 0, 1	2, 3	A	3	#10	3.31 (84.1)	6.42 (163.1)	4.61 (117.1)	6.00 (152.4)	1.88 (47.8)	1.66 (42.2)	0.23 (5.8)	—	0.39 (9.9)	0.59 (15.0)	4.48 (113.8)	0.27 (6.9)	35.0 (15.9)
2	2, 3	A	3	#10	3.31 (84.1)	7.17 (182.1)	4.94 (125.5)	6.75 (171.5)	1.88 (47.8)	1.66 (42.2)	0.23 (5.8)	—	0.41 (10.4)	0.77 (19.6)	4.53 (115.1)	0.27 (6.9)	43.0 (19.5)
3, 4	2, 3	A	3	1/4 in.	4.63 (117.6)	9.94 (252.5)	6.75 (171.5)	9.25 (235.0)	2.88 (73.2)	.94 (23.9)	0.38 (9.7)	—	0.55 (14.0)	0.80 (20.3)	6.36 (161.5)	0.27 (6.9)	115.0 (52.2)
5	3	B	4	3/8 in.	7.59 (192.8)	16.22 (412.0)	7.75 (196.9)	11.00 (279.4)	2.75 (69.9)	3.81 (96.8)	2.69 (68.3)	2.42 (61.5)	0.33 (8.4)	0.33 (8.4)	7.00 (177.8)	0.27 (6.9)	29.0 (13.2)
6	3	C	4	3/8 in.	9.25 (235.0)	23.50 (596.9)	9.50 (241.3)	11.00 (279.4)	2.75 (69.9)	4.81 (122.2)	2.75 (69.9)	3.06 (77.7)	—	6.50 (165.1)	8.44 (214.4)	0.27 (6.9)	55.0 (25.0)
7	3	①	①	①	37.88 (962.2)	21.50 (546.1)	11.75 (298.5)	—	—	—	—	—	—	—	—	—	—
8	3	①	①	①	37.88 (962.2)	21.50 (546.1)	11.75 (298.5)	—	—	—	—	—	—	—	—	—	—
9	3	①	①	①	①	①	①	①	①	①	①	①	①	①	①	①	①

Note

① Refer to factory.

Approximate Dimensions in Inches (mm)

Not to be used for construction purposes unless approved.

2

Open Reversing Starters

Figure A—Sizes 00–4 Horizontal

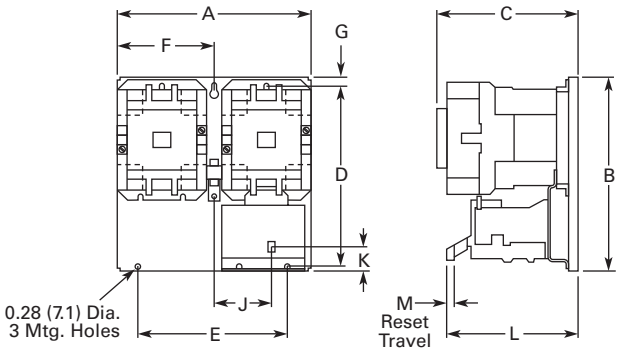
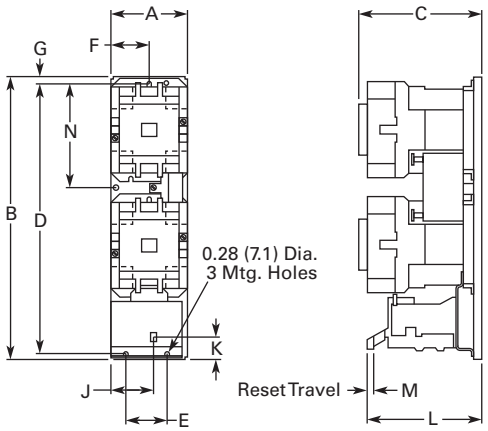


Figure B—Sizes 00–4 Vertical



Dimensions and Shipping Weights

NEMA Size	Number of Poles	Fig.	Mounting Screws No.	Mounting Screws Size	A	B	C	D	E	F	G	J	K	L	M	N	Weight, Lbs (kg)
00, 0, 1	3 x 3 Horiz.	A	3	#10	7.13 (181.1)	6.50 (165.1)	5.05 (128.3)	6.00 (152.4)	5.69 (144.5)	3.56 (90.4)	0.25 (6.4)	2.3 (58.4)	0.59 (15.0)	4.92 (125.0	0.27 (6.9)	—	9.0 (4.0)
	3 x 3 Vert.	B	3	#10	3.33 (84.6)	11.63 (295.4)	5.05 (128.3)	11.13 (282.7)	1.88 (47.8)	1.66 (42.2)	0.25 (6.4)	0.39 (9.9)	0.59 (15.0)	4.92 (125.0)	0.27 (6.9)	4.52 (114.8)	9.8 (4.4)
2	3 x 3 Horiz.	A	3	#10	7.13 (181.1)	7.25 (184.2)	5.38 (136.7)	6.75 (171.5)	5.69 (144.5)	3.56 (90.4)	0.25 (6.4)	2.31 (58.7)	0.77 (19.6)	4.97 (126.2)	0.27 (6.9)	—	10.8 (4.9)
	3 x 3 Vert.	B	3	#10	3.33 (84.6)	12.38 (314.5)	5.38 (136.7)	11.88 (301.8)	1.88 (47.8)	1.66 (42.2)	0.25 (6.4)	0.39 (9.9)	0.77 (19.6)	4.97 (126.2)	0.27 (6.9)	4.52 (114.8)	12.2 (5.5)
3, 4	3 x 3 Horiz.	A	3	1/4 in.	9.75 (247.7)	10.13 (257.3)	7.25 (184.2)	9.25 (235.0)	8.00 (203.2)	4.88 (124.0)	0.44 (11.2)	3.11 (79.0)	0.80 (20.3)	6.86 (174.2)	0.27 (6.9)	—	26.0 (11.8)
	3 x 3 Vert.	B	3	1/4 in.	4.63 (117.6)	19.81 (503.2)	7.25 (184.2)	18.94 (481.1)	2.88 (73.2)	2.94 (74.7)	0.44 (11.2)	0.55 (14.0)	0.80 (20.3)	6.86 (174.2)	0.27 (6.9)	7.91 (200.9)	28.0 (12.7)
5	3 x 3 Horiz.	—	4	3/8 in.	35.25 (895.4)	25.50 (647.7)	8.75 (222.3)	—	—	—	—	—	—	—	—	—	73.0 (33.1)
6	3 x 3 Horiz.	—	4	3/8 in.	35.25 (895.4)	25.50 (647.7)	10.50 (266.7)	—	—	—	—	—	—	—	—	—	127.0 (57.7)
7	①	①	①	①	①	①	①	①	①	①	①	①	①	①	①	①	①
8	①	①	①	①	①	①	①	①	①	①	①	①	①	①	①	①	①
9	①	①	①	①	①	①	①	①	①	①	①	①	①	①	①	①	①

Note

① Refer to factory.

Approximate Dimensions in Inches (mm)

Not to be used for construction purposes unless approved.

Open Multi-Speed Starters

Figure A—Sizes 00–4

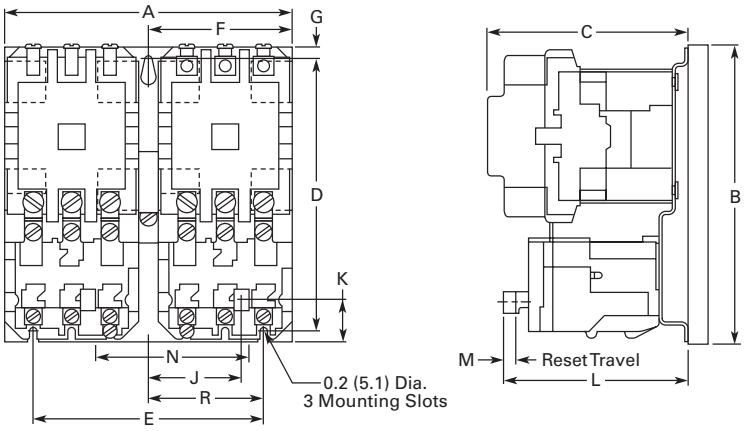
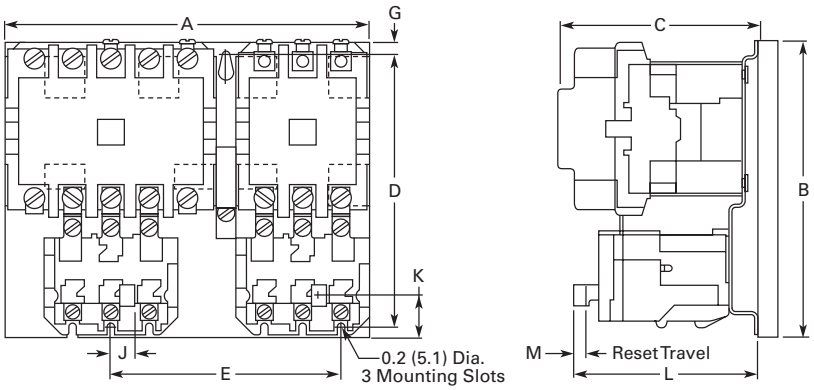


Figure B—Sizes 2



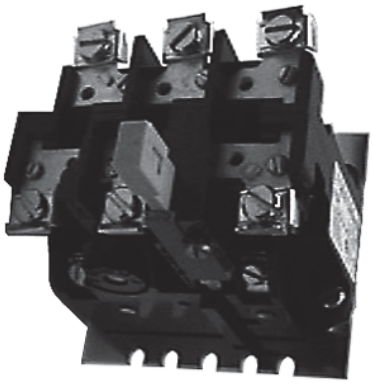
Dimensions and Shipping Weights

NEMA Size	Number of Poles	Fig.	Mounting Screws No.	Mounting Screws Size	A	B	C	D	E	F	G	J	K	L	M	N	P	R	Weight, Lbs (kg)
00, 0, 1	3 x 3 Horiz.	A	3	#10	7.13 (181.1)	6.50 (165.1)	5.05 (128.3)	6.00 (152.4)	5.69 (144.5)	3.56 (90.4)	0.25 (6.4)	2.30 (58.4)	0.33 (8.4)	4.92 (125.0)	0.27 (6.9)	3.81 (96.8)	—	2.91 (73.9)	10.0 (4.5)
	5 x 3 Horiz.	B	3	#10	8.00 (203.2)	6.50 (165.1)	5.05 (128.3)	6.00 (152.4)	6.53 (165.9)	3.56 (90.4)	0.25 (6.4)	2.30 (58.4)	0.48 (12.2)	4.92 (125.0)	0.27 (6.9)	4.66 (118.4)	—	2.91 (73.9)	11.0 (5.0)
2	3 x 3 Horiz.	A	3	#10	7.13 (181.1)	7.25 (184.2)	5.38 (136.7)	6.75 (171.5)	5.69 (144.5)	3.56 (90.4)	0.25 (6.4)	2.69 (68.3)	0.69 (17.5)	4.97 (126.2)	0.27 (6.9)	3.81 (96.8)	—	2.91 (73.9)	11.0 (5.0)
	5 x 3 Horiz.	B	3	#10	8.88 (225.6)	7.25 (184.2)	5.38 (136.7)	6.75 (171.5)	6.56 (166.6)	3.56 (90.4)	0.25 (6.4)	2.69 (68.3)	0.69 (17.5)	4.97 (126.2)	0.27 (6.9)	4.66 (118.4)	—	2.84 (72.1)	13.0 (5.9)
3, 4	3 x 3 Horiz.	A	3	1/4 in.	9.75 (247.7)	10.13 (257.3)	7.25 (184.2)	9.25 (235.0)	8.00 (203.2)	4.88 (124.0)	0.44 (11.2)	3.11 (79.0)	0.80 (20.3)	6.86 (174.2)	0.27 (6.9)	5.13 (130.3)	—	4.00 (101.6)	28.0 (12.7)
	5 x 3 Horiz.	B	3	1/4 in.	12.38 (314.5)	10.13 (257.3)	7.25 (184.2)	9.25 (235.0)	9.31 (236.5)	4.88 (124.0)	0.44 (11.2)	3.11 (79.0)	0.80 (20.3)	6.86 (174.2)	0.27 (6.9)	6.44 (163.6)	—	4.00 (101.6)	33.5 (15.2)
5	①	①	①	①	①	①	①	①	①	①	①	①	①	①	①	①	①	①	①
6	①	①	①	①	①	①	①	①	①	①	①	①	①	①	①	①	①	①	①

Notes

Three-pole x three-pole devices are for Wye-Wye two-winding motors only.

① Refer to factory.



Contents

Description	*Page*
Contactors—Non-Reversing and Reversing	**V5-T2-97**
Starters—Non-Reversing and Reversing	**V5-T2-103**
Relays—Thermal and Fast Trip	
Standards and Certifications	**V5-T2-125**
Instruction Leaflets	**V5-T2-125**
Thermal Type B, Class 20, Manual Reset	**V5-T2-126**
Thermal Type A, Class 20, Auto/Manual Reset	**V5-T2-129**
Type FT Fast Trip, Class 10	**V5-T2-132**
Heater Selection	**V5-T2-135**
Relays—Current Sensing Protective	**V5-T2-137**

Relays—Thermal and Fast Trip

Product Overview

Type B and Type A, Class 20 Thermal Overload Relays from Eaton's Electrical Sector will protect the motor against abnormal overload conditions. Bimetallic actuated, they are available as either ambient compensated or non-compensated in either single-pole or block type three-pole design. Type B use one pole of the three-pole block for single-phase.

Single-pole relays are also available as Fast Trip Class 10 ambient compensated type, which provides approximately 125% motor protection with a tripping time of less than 10 seconds, at 600% of heater current rating.

Fast trip relays can be identified by the green reset rods. They are available for panel or starter mounting. The three-pole fast trip design is composed of three single-pole relays on a common baseplate, with a common reset bar.

The bimetal element is actuated by precisely calibrated heater elements which are connected directly in the circuit to be protected. Thermal actuation of this device opens the contacts in the coil circuit of a contactor or relay which results in the disconnection of power to the overloaded circuit.

Interchangeable thermal heater elements for single-pole standard trip and block type overload relays are available to cover motor full load currents from 0.29 to 133A in approximately 10% steps (see Heater Application Table). Fast trip overload relays do not have interchangeable heater elements but are available in a series of ratings to cover motor full load currents from 1.6 to 150A in approximately 50% steps.

Features

Manual or Automatic Reset

Type B is furnished with a manual reset. Type A is normally furnished set for manual reset operation and may be quickly adjusted for automatic reset when required. Automatic reset should not be used with two-wire control or where automatic restarting would endanger either personnel or equipment.

Trip Indication

An immediate visible indication of trip is provided on the overload relay. When an overload occurs, which causes the relay to operate, a trip indicator projects out and thus shows positive visual indication of trip. Type B has a mechanical trip bar to manually check the NC contact operation on the overload relay.

Adjustable Trip

On Type A, the trip rating of a specific heater element can be adjusted over a range of approximately 85% to 115% of its respective rating to permit the desired close protection.

This is accomplished by turning the adjusting knob on the relay to the respective stop position.

Positive Contact Break

A follow-through contact, provided on the stationary terminal of the snap action control switch, provides reliable electrical continuity during toggling, thus eliminating false trip sometimes prevalent with thermally operated switches. This contact also allows contact wipe for further reliability.

Ambient Compensation

Motor overload protection can be provided with the same trip characteristics in ambient temperature from –40° to 77°C (–40° to 167°F). A compensating bimetal maintains a constant "travel to trip" distance independent of ambient conditions. The compensating feature is fully automatic and no adjustments are required over wide fluctuations in ambient temperatures. Compensated relays are identified by black reset rods on Type A and light gray reset rods on Type B, while non-compensated relays use red reset rods. AA three-pole units have gray reset rods. AA one-pole units have black reset rods.

Control Contact

Single-pole and block type relays are supplied as standard with a SPST NC control contact. A SPDT NO-NC with common is available as a factory modification on Type A. An isolated NO contact can be supplied on Type B as either a factory modification or as a field kit.

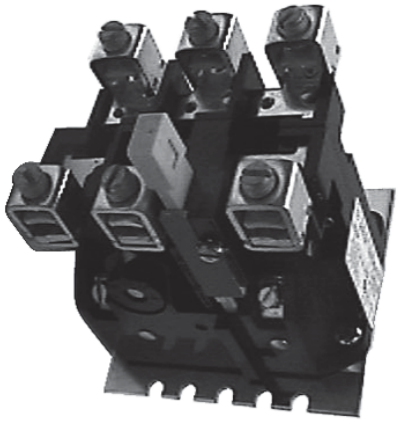
Standards and Certifications

- UL 508
- CSA
- ANSI/NEMA ICS 2-222

Instruction Leaflets

14885B	Fast Trip A Sizes 0–4, 3-Pole OL Relay
14567E	Type A Sizes 1–2, 1-Pole OL Relay Mod A
14568	Type A Sizes 1–2, 3-Pole OL Relay Mod J
14570D	Type A Sizes 3–4, 3-Pole OL Relay Mod J
14569C	Type A Sizes 3–4, 1-Pole OL Relay Mod A
17093A	Type B OLR for Sizes 7, 8 and 9 Contactors
16955A	Type B Sizes 1–2, 1-Pole OL Relay
16954A	Type B Sizes 1–2, 3-Pole OL Relay
15392B	Type B Sizes 3–4, 3-Pole OL Relay
13676F	Fast Trip Sizes 0–4, 1-Pole OL Relay

Thermal Type B, Class 20, Manual Reset



Contents

Description	*Page*
Contactors—Non-Reversing and Reversing	**V5-T2-97**
Starters—Non-Reversing and Reversing	**V5-T2-103**
Relays—Thermal and Fast Trip	**V5-T2-124**
Thermal Type B, Class 20, Manual Reset	
Product Selection	**V5-T2-127**
Accessories	**V5-T2-127**
Technical Data	**V5-T2-128**
Dimensions	**V5-T2-128**
Thermal Type A, Class 20, Auto/Manual Reset	**V5-T2-129**
Type FT Fast Trip, Class 10	**V5-T2-132**
Heater Selection	**V5-T2-135**
Relays—Current Sensing Protective	**V5-T2-137**

Thermal Type B, Class 20, Manual Reset

Application Description

The Type B overload relay is designed to protect industrial motors against overload conditions. Using modern block type, bimetallic design, this relay will provide Class 20 operation in either single-phase or three-phase applications.

Operation

The Type B overload relay is a bimetallic actuated device. The bimetal elements are operated by precisely calibrated heaters. The heater elements are connected either directly in the circuit to be measured, or through current transformers on applications NEMA Size 5 and larger.

As the bimetals are heated by motor current flow, a deflection force is produced. Upon a sustained level of abnormal current flow, the deflection becomes great enough to open the snap-action output contact.

Ambient Compensation

The Type B ambient compensated design is supplied as standard on all A200 starters. This design uses a second compensating bimetal responsive to ambient air temperature in the surrounding enclosure. This feature reduces nuisance tripping in applications using compact control panels and motor control centers where internal temperature rise is significant compared to motor ambient temperature. The compensating characteristic is maintained in ambient temperatures from 40° to 77°C.

Features

- Ambient compensation standard
- Alarm contact field mountable
- Class 20—600V design
- Inverse time delay trip
- Test trip device for weld check
- Hi-visibility up-front trip indication
- Trip-free reset mechanism

Product Selection

Heaters

Enter heaters as separate item by listing catalog number from tables, **Pages V5-T2-135** and **V5-T2-136**, as required per starter.

Relays

Type B Overload Relay Panel Mounting



Thermal Type B Overload Relay

Motor Full Load Amps	Panel Mounted Ambient Comp. Catalog Number	Panel Mounted Non-Comp. Catalog Number	Starter Mounted Replacement for Type B Overload Relays Ambient Comp. Catalog Number	Starter Mounted Replacement for Type B Overload Relays Non-Comp. Catalog Number	Replacement for Type A Overload Relays in Manual Reset Mode (Three-Pole Only) ① Ambient Comp. Catalog Number	Replacement for Type A Overload Relays in Manual Reset Mode (Three-Pole Only) ① Non-Comp. Catalog Number
Single-Pole (One NC Contact)						
0.25–26.2	**BA11JP**	**BN11JP**	**BA11A**	**BN11A**	—	—
26.3–45	**BA21JP**	**BN21JP**	**BA21A**	**BN21A**	—	—
19–90	Use three-pole design, wire three poles in series	Use three-pole design, wire three poles in series	Use three-pole design, wire three poles in series	Use three-pole design, wire three poles in series	Use three-pole design, wire three poles in series	Use three-pole design, wire three poles in series
19–135	Use three-pole design, wire three poles in series	Use three-pole design, wire three poles in series	Use three-pole design, wire three poles in series	Use three-pole design, wire three poles in series	Use three-pole design, wire three poles in series	Use three-pole design, wire three poles in series
Three-Pole (One NC Contact)						
0.25–26.2	**BA13JP**	**BN13JP**	**BA13A** ②	**BN13A** ②	**BA13J**	**BN13J**
26.3–45	**BA23JP**	**BN23JP**	**BA23A**	**BN23A**	**BA23J**	**BN23J**
19–90	**BA33P**	**BN33P**	**BA33A**	**BN33A**	**BA33A**	**BN33A**
19–135	**BA43P**	**BN43P**	**BA43A**	**BN43A**	**BA43A**	**BN43A**

Accessories

Alarm Contact Kit Selection ①

Type B Overload Relay Size	Catalog Number
1, 2	**B3NO-2**
3, 4	**B3NO-4**

Notes

① Includes contactor mounting bracket, overload relay and connection straps to contactor.

② For replacement on B200 size 00, 0, 1 use BA23A instead of BA13A and use BN23A instead of BN13A.

Technical Data

2

Control Contact Ratings—NEMA B600 NO and NC Control Contact Rating

AC Volts	Make	Break
24–120	30A	3A
120–600	3600 VA	360 VA

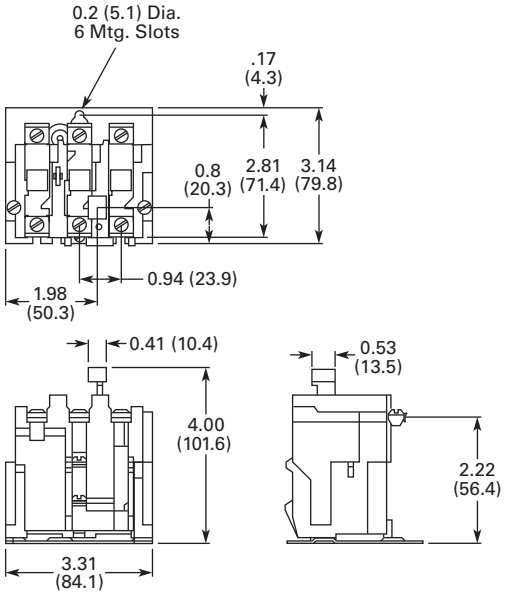
Dimensions

Approximate Dimensions in Inches (mm)

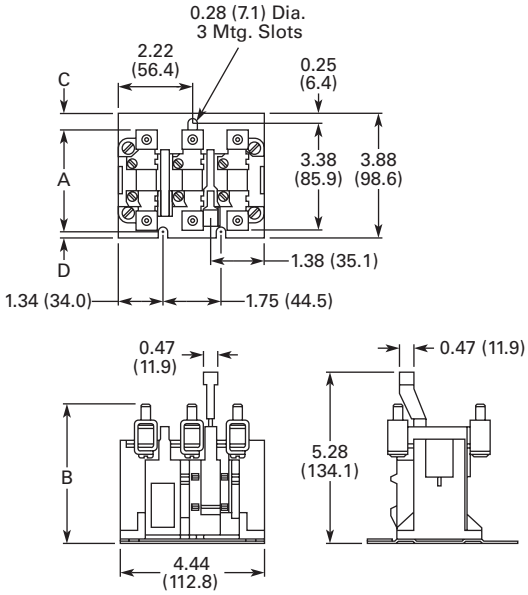
Not to be used for construction purposes unless approved.

Thermal Type B Overload Relays

Sizes 1 and 2—Three-Pole, Panel Mounted



Sizes 3 and 4—Three-Pole, Panel Mounted



Dimensions

Relay Size	A	B	C	D
3	3.13 (79.5)	4.06 (103.1)	044 (11.2)	0.31 (7.9)
4	3.38 (85.9)	4.38 (111.3)	0.31 (7.9)	0.19 (4.8)

Note

① Alarm contact available as factory modification of field mountable. For factory modification, add suffix B.

Thermal Type A, Class 20, Auto/Manual Reset



Contents

Description	*Page*
Contactors—Non-Reversing and Reversing	**V5-T2-97**
Starters—Non-Reversing and Reversing	**V5-T2-103**
Relays—Thermal and Fast Trip	**V5-T2-124**
Thermal Type B, Class 20, Manual Reset	**V5-T2-126**
Thermal Type A, Class 20, Auto/Manual Reset	
Product Selection	**V5-T2-130**
Technical Data and Specifications	**V5-T2-130**
Dimensions	**V5-T2-131**
Type FT Fast Trip, Class 10	**V5-T2-132**
Heater Selection	**V5-T2-135**
Relays—Current Sensing Protective	**V5-T2-137**

Thermal Type A, Class 20, Auto/Manual Reset

Application Description

The Type A overload relay is designed to protect industrial motors against overload conditions. Using modern block type, bimetallic design, this relay will provide Class 20 operation in either single- or three-phase applications.

Features

- Field selectable manual/auto reset
- Alarm contact factory available
- Class 20—600V design
- Inverse time delay trip
- Adjustable trip rating ±15%
- Color coded reset rod:
  - Compensated (gray)
  - Non-compensated (red)

Operation

The Type A overload relay is a bimetallic actuated device. The bimetal elements are operated by precisely calibrated heaters. The heater elements are connected either directly in the circuit to be measured, or through current transformers on applications NEMA Size 5 and larger.

As the bimetals are heated by motor current flow, a deflection force is produced. Upon a sustained level of abnormal current flow, the deflection becomes great enough to open the snap-action output contact.

Automatic Reset

The Type A overload relay can be supplied as an option on all A200 starters to provide automatic reset operation. The overload relay is always shipped in the non-automatic mode. To set up auto operation, reposition the reset rod by loosening and re-tightening a hold-down clamp at the base of overload relay.

Product Selection

Heaters

Enter heaters as separate item by listing catalog number from tables, **Pages V5-T2-135** and **V5-T2-136**, as required per starter.

Relays

Type A Overload Relay Single-Pole Panel Mounting



Thermal Type A Overload Relay ①

Motor Full Load Amps	Panel Mounted Ambient Comp. Catalog Number	Panel Mounted Non-Comp. Catalog Number	Starter Replacement Ambient Comp. Catalog Number	Starter Replacement Non-Comp. Catalog Number
Single-Pole (One NC Contact)				
0.25–26.2	**AA11P**	**AN11P**	**AA11A**	**AN11A**
26.3–45	**AA21P**	**AN21P**	**AA21A**	**AN21A**
19–90	**AA31P**	**AN31P**	**AA31A**	**AN31A**
19–135	**AA41P**	**AN41P**	**AA41A**	**AN41A**
Three-Pole (One NC Contact)				
0.25–26.2	**AA13P** ②	**AN13P** ②	**AA13A** ②	**AN13A** ②
26.3–45	**AA23P** ②	**AN23P** ②	**AA23A** ②	**AN23A** ②
19–90	**AA33P** ②	**AN33P** ②	**AA33A** ②	**AN33A** ②
19–135	**AA43P** ②	**AN43P** ②	**AA43A** ②	**AN43A** ②

Technical Data and Specifications

Control Contact Ratings

AC Volts	Normally Closed Make	Normally Closed Break	Normally Open Make	Normally Open Break
Three-Pole Control Contact Ratings				
24–120	20A	2A	0.5A	0.5A
120–600	2400 VA	240 VA	600 VA	60 VA
Single-Pole Control Contact Ratings				
24–120	30A	3A	10A	1A
120–600	3600 VA	360 VA	1200 VA	120 VA

Notes

① For alarm contact (Form C), add Suffix **B**. Available only as factory modification on Type A relay.

② Three-pole Type B overload relay is a suitable alternative to a three-pole Type A overload relay in manual reset mode. For example, BA13JP for AA13P, BN23J for AN23A, and so on. (See **Page V5-T2-127**.)

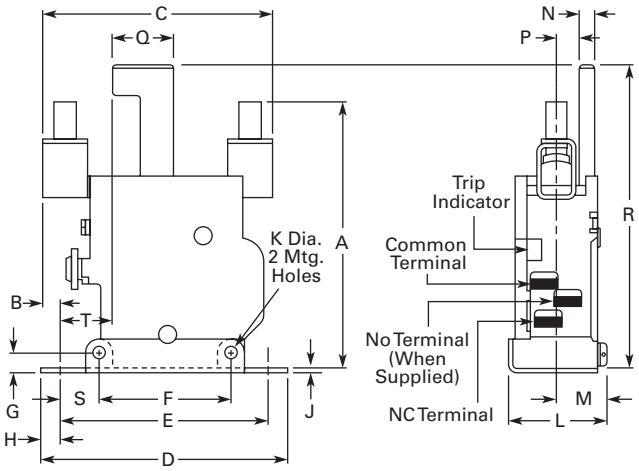
Dimensions

Approximate Dimensions in Inches (mm)

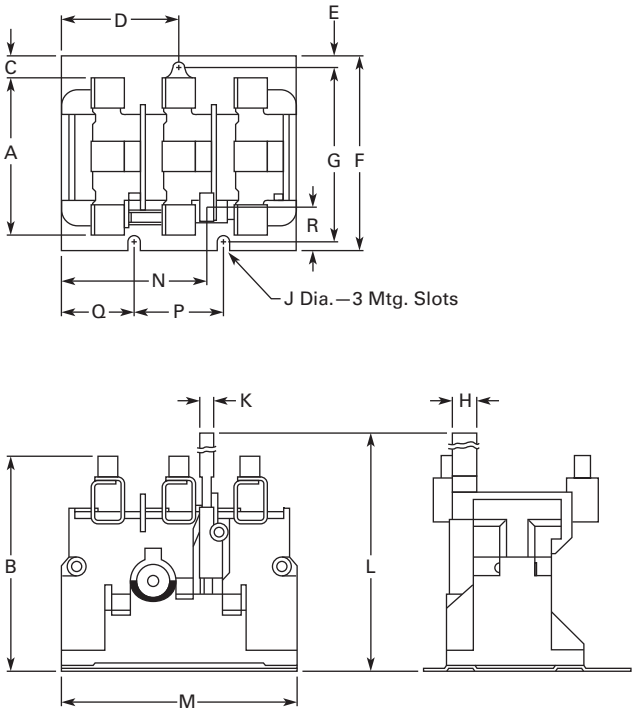
Not to be used for construction purposes unless approved.

Type A

Single-Pole (Sizes 4 Shown)



Three-Pole (Size 4 Shown)



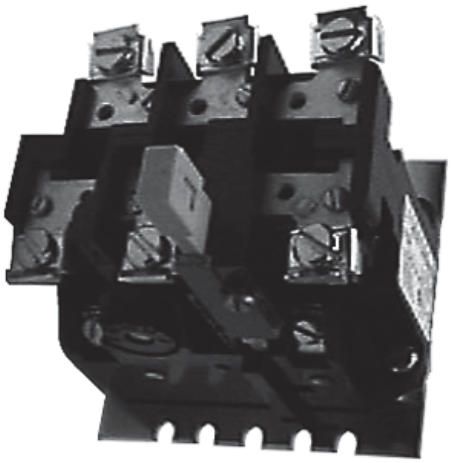
Dimensions

Dimension	Relay Size 1	2	3	4
A	2.72 (69.1)	3.48 (88.4)	4.19 (106.4)	4.5 (114.3)
B	0.94 (23.9)	0.67 (17.0)	0.25 (6.4)	0.38 (9.7)
C	2.75 (69.9)	3.5 (88.9)	3.53 (89.7)	3.78 (96.0)
D	3.25 (82.6)	3.25 (82.6)	4.13 (104.9)	4.13 (104.9)
E	2.63 (66.8)	2.63 (66.8)	3.38 (85.9)	3.38 (85.9)
F	1.34 (34.0)	1.34 (34.0)	2.19 (55.6)	2.19 (55.6)
G	0.25 (6.4)	0.25 (6.4)	0.28 (7.1)	0.28 (7.1)
H	0.31 (7.9)	0.31 (7.9)	0.38 (9.7)	0.38 (9.7)
J	0.06 (1.5)	0.06 (1.5)	0.06 (1.5)	0.06 (1.5)
K	0.22 (5.6)	0.22 (5.6)	0.27 (6.8)	0.27 (6.8)
L	1.34 (34.0)	1.34 (34.0)	1.69 (42.9)	1.69 (42.9)
M	0.66 (16.8)	0.66 (16.8)	0.88 (22.4)	0.88 (22.4)
N	0.16 (4.1)	0.16 (4.1)	0.27 (6.8)	0.27 (6.8)
P	0.22 (5.6)	0.22 (5.6)	0.34 (8.6)	0.34 (8.6)
Q	0.06 (1.5)	0.06 (1.5)	0.69 (17.5)	0.69 (17.5)
R	4.00 (101.6)	4.00 (101.6)	5.19 (131.8)	5.19 (131.8)
S	0.47 (11.9)	0.47 (11.9)	0.59 (15.0)	0.59 (15.0)
T	1.11 (28.2)	1.11 (28.2)	0.69 (17.5)	0.69 (17.5)

Dimensions

Dimension	Relay Size 1	2	3	4
A	2.38 (60.5)	2.44 (62.0)	3.13 (79.5)	3.38 (85.9)
B	3.13 (79.5)	3.17 (80.5)	4.06 (103.1)	4.38 (111.3)
C	0.36 (9.1)	0.33 (8.4)	0.44 (11.2)	0.31 (7.9)
D	1.66 (42.2)	1.66 (42.2)	2.22 (56.4)	2.22 (56.4)
E	0.17 (4.3)	0.17 (4.3)	0.25 (6.4)	0.25 (6.4)
F	2.81 (71.4)	2.81 (71.4)	3.38 (85.9)	3.38 (85.9)
G	3.08 (78.2)	3.08 (78.2)	3.88 (98.6)	3.88 (98.6)
H	0.47 (11.9)	0.47 (11.9)	0.47 (11.9)	0.47 (11.9)
J	0.20 (5.1)	0.20 (5.1)	0.28 (7.1)	0.28 (7.1)
K	0.28 (7.1)	0.28 (7.1)	0.47 (11.9)	0.47 (11.9)
L	4.00 (101.6)	4.00 (101.6)	5.28 (134.1)	5.28 (134.1)
M	3.31 (84.1)	3.31 (84.1)	4.44 (112.8)	4.44 (112.8)
N	1.80 (45.7)	1.80 (45.7)	2.77 (70.4)	2.77 (70.4)
P	1.89 (48.0)	1.89 (48.0)	1.75 (44.5)	1.75 (44.5)
Q	1.00 (25.4)	1.00 (25.4)	1.34 (34.0)	1.34 (34.0)
R	—	—	1.03 (26.2)	1.03 (26.2)

Type FT Fast Trip, Class 10



Contents

Description	*Page*
Contactors—Non-Reversing and Reversing	**V5-T2-97**
Starters—Non-Reversing and Reversing	**V5-T2-103**
Relays—Thermal and Fast Trip	**V5-T2-124**
Thermal Type B, Class 20, Manual Reset	**V5-T2-126**
Thermal Type A, Class 20, Auto/Manual Reset	**V5-T2-129**
Type FT Fast Trip, Class 10	
Product Selection	**V5-T2-133**
Technical Data and Specifications	**V5-T2-133**
Dimensions	**V5-T2-134**
Heater Selection	**V5-T2-135**
Relays—Current Sensing Protective	**V5-T2-137**

Type FT Fast Trip, Class 10

Application Description

The Type FT overload relay is designed to protect special purpose motors having restricted thermal and locked rotor capabilities. Using modern block type, bimetallic design, this relay will provide Class 10 operation in single- or three-phase applications.

Operation

The Type FT overload relay is a bimetallic actuated device. The bimetal elements are operated directly from line current, thus separate calibrating heater elements are not utilized. The overload relay may be wired directly in the motor circuit, or through-current transformers on applications larger than 150A.

As the bimetals are heated by motor current flow, a deflection force is produced. Upon a sustained level of abnormal current flow, the deflection becomes great enough to open the snap action output contact.

Features

- Class 10—600V design
- Inverse time delay trip
- Color coded reset rod—green
- Alarm contact factory available
- Field selectable manual/auto reset
- Adjustable trip rating ±20%
- Ambient compensation included

Product Selection

Type FT Single-Pole



Type FT Single-Pole (One NC Contact); Three-Phase (Three NC Contacts in Series) ①

Motor Full Load Amperes	Panel Mounted Single-Pole Catalog Number	Three-Pole Catalog Number	Starter Replacement NEMA Size	Single-Pole Catalog Number
0.76–1.1	**FT11P-1.1**	**FT13P-1.1**	—	**FT11A-1.1**
1.1–1.6	**FT11P-1.6**	**FT13P-1.6**	—	**FT11A-1.6**
1.6–2.4	**FT11P-2.4**	**FT13P-2.4**	0, 1	**FT11A-2.4**
2.4–3.6	**FT11P-3.6**	**FT13P-3.6**	0, 1	**FT11A-3.6**
3.6–5.4	**FT11P-5.4**	**FT13P-5.4**	0, 1	**FT11A-5.4**
5.4–8.0	**FT11P-8.0**	**FT13P-8**	0, 1	**FT11A-8**
8.0–12	**FT11P-12**	**FT13P-12**	0, 1	**FT11A-12**
12–18	**FT11P-18**	**FT13P-18**	1	**FT11A-18**
16–24	—	**FT13P-24**		—
22–32	**FT11P-32**	**FT13P-32**	0, 1	**FT11A-32**
24–36	**FT21P-36**	**FT23P-36**	2	**FT21A-36**
36–54	**FT21P-54**	**FT23P-54**	12	**FT21A-54**
22–32	**FT31P-32**	**FT33P-32**	3	**FT31A-32**
32–48	**FT31P-48**	**FT33P-48**	3	**FT31A-48**
48–72	**FT31P-72**	**FT33P-72**	3	**FT31A-72**
72–110	**FT41P-110**	**FT43P-110**	4	**FT41A-110**
100–150	**FT41P-150**	**FT43P-150**	4	**FT41A-150**

Technical Data and Specifications

Control Contact Ratings

AC Volts	Normally Closed Make	Normally Closed Break	Normally Open Make	Normally Open Break
24–120	30A	3A	10A	1A
120–600	3600 VA	360 VA	1200 VA	120 VA

Note

① Single-pole (1NO-NC contact): add suffix **B**. Three-pole (3NO-NC contacts): add suffix **B**. Example: FT13P**B**-12.

Dimensions

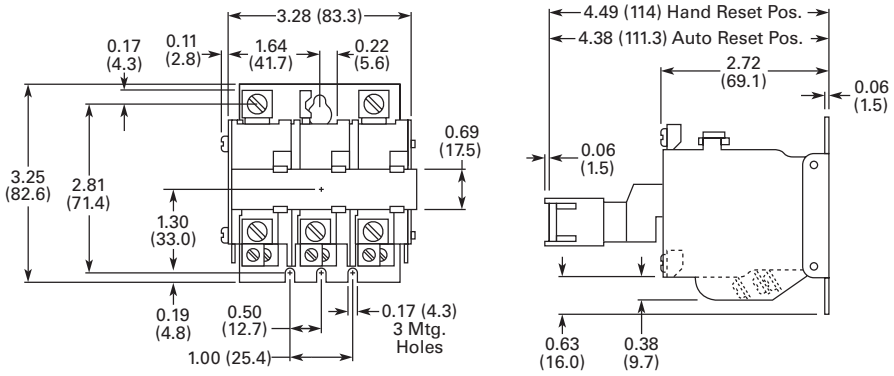
Approximate Dimensions in Inches (mm)

2

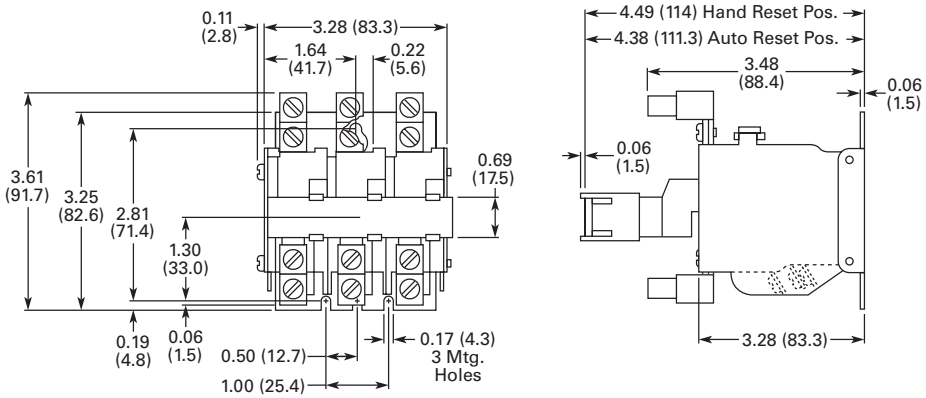
Not to be used for construction purposes unless approved.

Type FT Overload Relays

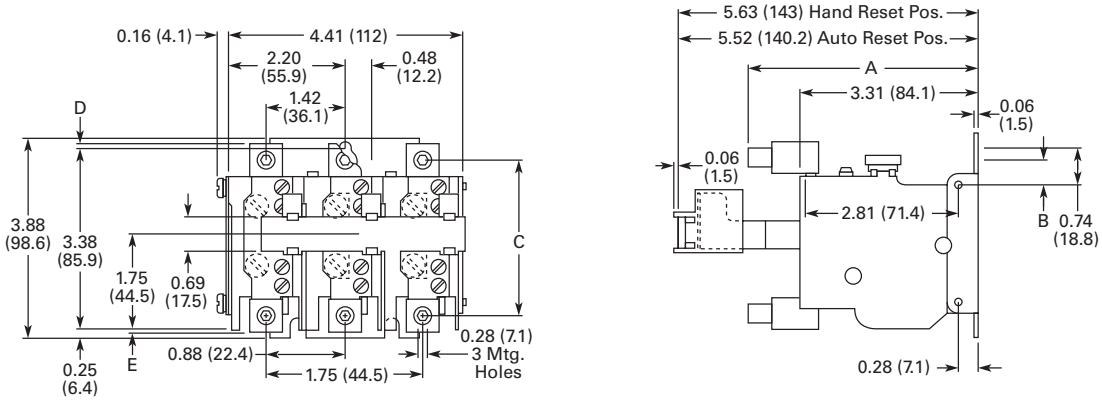
Three-Pole, Size 1



Three-Pole, Size 2



Three-Pole, Sizes 3, 4



Dimensions

Relay Size	A	B	C	D	E
3	4.25 (108.0)	0.53 (13.5)	2.91 (73.9)	0.09 (2.3)	0.06 (1.5)
4	4.50 (114.3)	0.59 (15.0)	3.03 (77.0)	0.22 (5.6)	0.19 (4.8)

Heater Selection

General Information on Heater Coil Selection

For maximum motor protection and compliance with Article 430-32 of the National Electrical Code, select heater coils from the tables in this section on the basis of motor nameplate full load current.

When the full load current is unknown, selection may be made on the basis of average full load currents as shown on **Pages V5-T2-151** and **V5-T2-152**. **Caution—The average ratings could be high or low for a specific motor and therefore selection on this basis always involves risk. For fully reliable motor protection, select heater coils on the basis of full load current rating as shown on the motor nameplate.**

Heater coils are rated to protect 40°C rise motors, and open and drip-proof motors having a **service factor of 1.15** where the motor and the controller are at the same ambient temperature.

For other conditions:

1. For 50°C, 55°C, 75°C rise motors and **enclosed motors having a service factor of 1.0, select one size smaller coil.**
2. Ambient temperature of controller lower than motor by 26°C (47°F), use one size smaller coil.
3. Ambient temperature of controller higher than motor by 26°C (47°F), use one size larger coil.

Ultimate tripping current of heater coils is approximately 1.25 times the minimum current rating listed in the tables.

Type A and B Overload Relays, Sizes 3 and 4

Size Starter	Ambient Compensated Enclosed Starters All Applications Full Load Current of Motor Amps	Non-Compensating Enclosed Starters	Heater (One Heater per Catalog Number) Catalog Number
For Size 4 Starters	12.8–14.1	11.9–13.0	**FH68**
	14.2–15.5	13.1–14.3	**FH69**
	15.6–17.1	14.4–15.9	**FH70**
	17.2–18.9	16.0–17.4	**FH71**
	19.0–20.8	17.5–19.1	**FH72**
For Size 3 Starters	20.9–22.9	19.2–21.1	**FH73**
	23.0–25.2	21.2–23.2	**FH74**
	25.3–27.8	23.3–25.6	**FH75**
	27.9–30.6	25.7–28.1	**FH76**
	30.7–33.5	28.2–30.8	**FH77**
	33.6–37.5	30.9–34.5	**FH78**
	37.6–41.5	34.6–38.2	**FH79**
	41.6–56.3	38.3–42.6	**FH80**
	46.4–50	42.7–46	**FH81**
	51–55	47–51	**FH82**
	56–61	52–56	**FH83**
	62–66	57–61	**FH84**
	67–73	62–67	**FH85**
	74–78	68–72	**FH86**
	79–84	73–77	**FH87**
	85–92	78–84	**FH88**
	93–101	85–91	**FH89**
	102–110	92–99	**FH90**
	111–122	100–110	**FH91**
	123–129	111–122	**FH92**
	130–133	123–128	**FH93**
	—	129–133	**FH94**

Type A and B Overload Relays, Sizes 5 and 6 ①

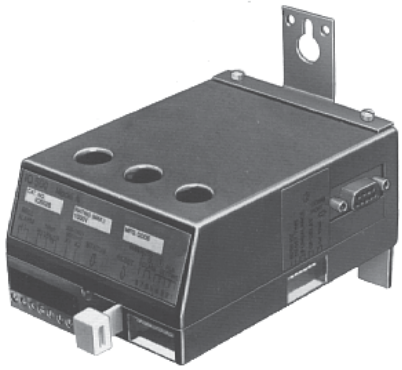
Compensated Overload Relay Open Starter Full Load Current of Motor (Amps)	Enclosed Starter	Heater (One Heater per Catalog Number) Catalog Number
Size 5 (with 300/5 Current Transformers)		
—	—	**FH23**
118–129	118–129	**FH24**
130–141	130–141	**FH25**
142–155	142–155	**FH26**
156–170	156–170	**FH27**
171–187	171–187	**FH28**
188–205	188–205	**FH29**
206–224	206–224	**FH30**
225–244	225–244	**FH31**
245–263	245–263	**FH32**
264–292	264–292	**FH33**
293–300	—	**FH34**
Size 6 (with 600/5 Current Transformers)		
—	—	**FH23**
236–259	236–259	**FH24**
260–283	260–283	**FH25**
284–310	284–310	**FH26**
311–340	311–340	**FH27**
341–374	341–374	**FH28**
375–411	375–411	**FH29**
412–448	412–448	**FH30**
449–489	449–489	**FH31**
490–527	490–527	**FH32**
528–585	528–540	**FH33**
586–600	—	**FH34**

Note

① Size 7 and larger—advise full load current.

Type A and B Overload Relays, Sizes 0, 1 and 2

Size Starter	Non-Compensated Open Starters and Ambient Comp. Open and Enclosed Starters: Block Type Overload sing Three Heaters	Non-Compensated Open Starters and Ambient Comp. Open and Enclosed Starters: Single-Pole Type Overload	Heater (One Heater per Catalog Number) Catalog Number	Non-Compensating Enclosed Starters: Block Type Overload Using Three Heaters	Non-Compensating Enclosed Starters: Single-Pole Type Overload	Heater Catalog Number
Full Load Current of Motor (Amps)						
For Size 0 Starters	0.25–0.27	0.29–0.31	**FH03**	0.24–0.25	0.28–0.30	**FH03**
	0.28–0.31	0.32–0.35	**FH04**	0.26–0.28	0.31–0.34	**FH04**
	0.32–0.34	0.36–0.39	**FH05**	0.29–0.31	0.35–0.37	**FH05**
	0.35–0.38	0.40–0.43	**FH06**	0.32–0.35	0.38–0.42	**FH06**
	0.39–0.42	0.44–0.48	**FH07**	0.36–0.39	0.43–0.47	**FH07**
	0.43–0.46	0.49–.053	**FH08**	0.40–0.43	0.48–0.52	**FH08**
	0.47–0.50	0.54–0.58	**FH09**	0.44–0.47	0.53–0.56	**FH09**
	0.51–0.55	0.59–0.64	**FH10**	0.48–0.51	0.57–0.63	**FH10**
	0.56–0.62	0.65–0.71	**FH11**	0.52–0.57	0.64–0.70	**FH11**
	0.63–0.68	0.72–0.79	**FH12**	0.58–0.63	0.71–0.77	**FH12**
	0.69–0.75	0.80–0.87	**FH13**	0.64–0.70	0.78–0.85	**FH13**
	0.76–0.83	0.88–0.96	**FH14**	0.71–0.77	0.86–0.94	**FH14**
	0.84–0.91	0.97–1.06	**FH15**	0.78–0.85	0.95–1.03	**FH15**
	0.92–1.00	1.07–1.16	**FH16**	0.86–0.93	1.04–1.13	**FH16**
	1.01–1.11	1.17–1.28	**FH17**	0.94–1.03	1.14–1.25	**FH17**
	1.12–1.22	1.29–1.41	**FH18**	1.04–1.13	1.26–1.38	**FH18**
	1.23–1.34	1.42–1.55	**FH19**	1.14–1.25	1.39–1.52	**FH19**
	1.35–1.47	1.56–1.71	**FH20**	1.26–1.37	1.53–1.67	**FH20**
	1.48–1.62	1.72–1.87	**FH21**	1.38–1.51	1.68–1.83	**FH21**
	1.63–1.78	1.88–2.06	**FH22**	1.52–1.65	1.84–2.01	**FH22**
	1.79–1.95	2.07–2.26	**FH23**	1.66–1.81	2.02–2.21	**FH23**
	1.96–2.15	2.27–2.48	**FH24**	1.82–1.99	2.22–2.43	**FH24**
	2.16–2.35	2.49–2.72	**FH25**	2.00–2.19	2.44–2.66	**FH25**
	2.36–2.58	2.73–2.99	**FH26**	2.20–2.39	2.67–2.92	**FH26**
	2.59–2.83	3.00–3.28	**FH27**	2.40–2.63	2.93–3.21	**FH27**
	2.84–3.11	3.29–3.60	**FH28**	2.64–2.89	3.22–3.53	**FH28**
	3.12–3.42	3.61–3.95	**FH29**	2.90–3.17	3.54–3.87	**FH29**
	3.43–3.73	3.96–4.31	**FH30**	3.18–3.47	3.88–4.22	**FH30**
	3.74–4.07	4.32–4.71	**FH31**	3.48–3.79	4.23–4.61	**FH31**
	4.08–4.39	4.72–5.14	**FH32**	3.80–4.11	4.62–4.9	**FH32**
	4.40–4.87	5.15–5.6	**FH33**	4.12–4.55	5.0–5.5	**FH33**
	4.88–5.3	5.7–6.2	**FH34**	4.56–5.0	5.6–6.0	**FH34**
	5.4–5.9	6.3–6.8	**FH35**	5.1–5.5	6.1–6.6	**FH35**
	6.0–6.4	6.9–7.5	**FH36**	5.6–5.9	6.7–7.3	**FH36**
	6.5–7.1	7.6–8.2	**FH37**	6.0–6.6	7.4–8.0	**FH37**
	7.2–.78	8.3–9.0	**FH38**	6.7–7.2	8.1–8.7	**FH38**
	7.9–8.5	9.1–9.9	**FH39**	7.3–7.9	8.8–9.7	**FH39**
	8.6–9.4	10.0–10.8	**FH40**	8.0–8.7	9.8–10.5	**FH40**
	9.5–10.3	10.9–11.9	**FH41**	8.8–9.5	10.6–11.7	**FH41**
	10.4–11.3	12.0–13.1	**FH42**	9.6–10.5	11.8–12.7	**FH42**
	11.4–12.4	13.2–14.3	**FH43**	10.6–11.5	12.8–14.0	**FH43**
	12.5–13.5	14.4–15.7	**FH44**	11.6–12.6	14.1–15.3	**FH44**
	13.6–14.9	15.8–17.2	**FH45**	12.7–13.8	15.4–16.6	**FH45**
	15.0–16.3	17.3–18.9	**FH46**	13.9–15.1	16.7–18.3	**FH46**
	16.4–18.0	19.0–20.8	**FH47**	15.2–16.7	18.4–20.0	**FH47**
For Size 1 Starters	18.1–19.8	20.9–22.9	**FH48**	16.8–18.3	20.1–21.9	**FH48**
	19.9–21.7	23.0–25.2	**FH49**	18.4–20.2	22.0–23.9	**FH49**
	21.8–23.9	25.3–27.6	**FH50**	20.3–22.2	24.0–26.2	**FH50**
	24.0–26.2	27.7–30.3	**FH51**	22.3–24.3	26.3–28.8	**FH51**
	26.3–28.7	30.4–33.3	**FH52**	24.4–26.6	28.9–31.4	**FH52**
For Size 2 Starters	28.8–31.4	33.4–36.4	**FH53**	26.7–29.1	31.5–34.5	**FH53**
	31.5–34.5	36.5–39.9	**FH54**	29.2–32.0	34.6–37.9	**FH54**
	34.6–37.9	40.0–43.9	**FH55**	32.1–35.2	3.80–41.9	**FH55**
	38.0–41.5		**FH56**	35.3–38.5	42.0–45.0	**FH56**
	41.6–45.0		**FH57**	38.6–42.3		**FH57**



Contents

Description	*Page*
Contactors—Non-Reversing and Reversing	**V5-T2-97**
Starters—Non-Reversing and Reversing	**V5-T2-103**
Relays—Thermal and Fast Trip	**V5-T2-124**
Thermal Type B, Class 20, Manual Reset	**V5-T2-126**
Thermal Type A, Class 20, Auto/Manual Reset	**V5-T2-129**
Type FT Fast Trip, Class 10	**V5-T2-132**
Heater Selection	**V5-T2-135**
Relays—Current Sensing Protective	
Features	**V5-T2-138**
Standards and Certifications	**V5-T2-138**
Product Selection	**V5-T2-138**
Dimensions	**V5-T2-139**

Relays—Current Sensing Protective

Product Description

The IQ500 is a heaterless, current-sensing, solid-state motor protective relay with optional communications capabilities. Several functions are incorporated into the base relay (IQ502/IQ504) as standard:

- Overload (overcurrent) protection
- Phase unbalance and phase loss protection
- Ground current protection (Class II)

The base relay can serve as the initial building block for a motor protection system by adding the IQ500M Special Function Module. The module can address application related motor load functions with the additional features:

- Underload protection
- Long acceleration
- Jam protection
- Load control

The IQ500 can provide a cost-effective alternative to conventional protective relays such as current relays, ground fault relays and phase loss or phase unbalance relays. Used with the PowerNet system, a low-cost, local area communication network, information such as current values, status, setpoint values and cause of trip can be displayed remotely. The IQ500 relay is ideal for a variety of industrial applications such as mining, timber, material handling, air conditioning compressors, wastewater treatment plants and petrochemical industries.

Features

- Overload class is adjustable using DIP switches for 5, 10, 20 or 30 seconds, maximum trip times at six times rated current
- Designed for 1000V and less distribution systems
- Form C (NO/NC) contact on output relay
- Isolated alarm relay output contact
- Communications capability using IMPACC network
- Manual or automatic reset (either a true manual or remote electrical reset)—selectable
- Overload, Class II ground current, phase unbalance and single-phase protection are standard
- LED indication (bi-colored—red/green) for device status, including overload, phase unbalance or ground current trip
- Special Function Module adds protection for underload and jam conditions, also provides for long acceleration
- Optional load control feature available with special function module
- Feed-through current transformer windows for contactors, NEMA Sizes 1–4 (for Size 5 and larger, external current transformers can be used)
- Fits mounting footprint of Eaton's MORA relay
- Panel or starter mountable
- Cause of trip is held in memory through a power loss
- Bell alarm contact available for remote status indication
- DIP switch provided for setting operating frequency—50 or 60 Hz
- Plug-in terminal block for control power, trip relay and bell alarm relay connections
- Operating temperature: –20° to 60°C (–4° to 140°F)

Benefits

- No external current transformers are required since they are internal to the IQ500
- DIP switches used to select functions and settings on base relay are clearly marked and covered with screw-on plastic covers
- On the automatic reset, the reset times can be selected for long (90 second) or short (10 second) delay
- Device can be set for different motor full load currents without additional parts or modules

Optional Benefits

- With the addition of the IQ500M Special Function Module, the enhanced protection includes jam (overtorque) and underload and provides long acceleration time (high inertia load)
- The underload and jam protection functions each have independent Form C output relays as part of the module. In addition, the underload and jam functions each have their own LEDs for status indication
- The underload and jam functions also have separate selectable trip levels and adjustable trip-delay and start-delay settings
- The IQ500M can be used as a load control module that allows "shedding and restoring" a particular load that contributes to the load being monitored
- The PONI (Product Operated Network Interface) card attaches directly to the base relay or special function module for interfacing with the Eaton's PowerNet communications system
- Localized display can be achieved with the Central Monitoring Unit

Standards and Certifications

- UL File No. E19223

Product Selection

IQ502A



Current Sensing Protective Relay

Maximum Horsepower				Control Voltage	
200V	230V	460–475V	Ampere Rating	110/120V 50/60 Hz Catalog Number	220/240V 50/60 Hz Catalog Number
20	25	50	3.4–66A	**IQ502A**	**IQ502B**
60	75	150	10.8–207A	**IQ504A**	**IQ504B**
—	—	—	0.32–5.4A	**IQ500LA** ①	**IQ500LB** ①
Special function module				**IQ500M**	**IQ500M**

Note

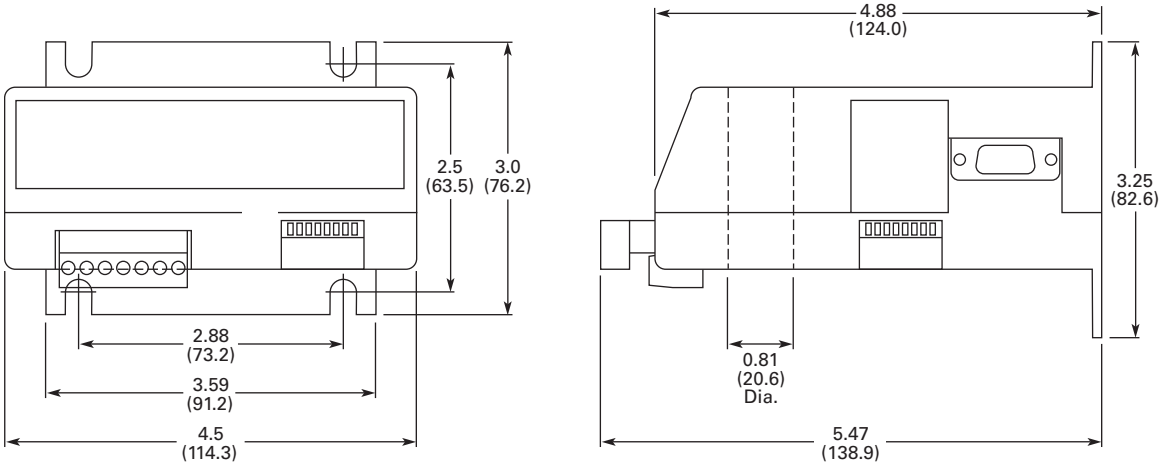
① Can be used with external CTs having 5A secondary.

Dimensions

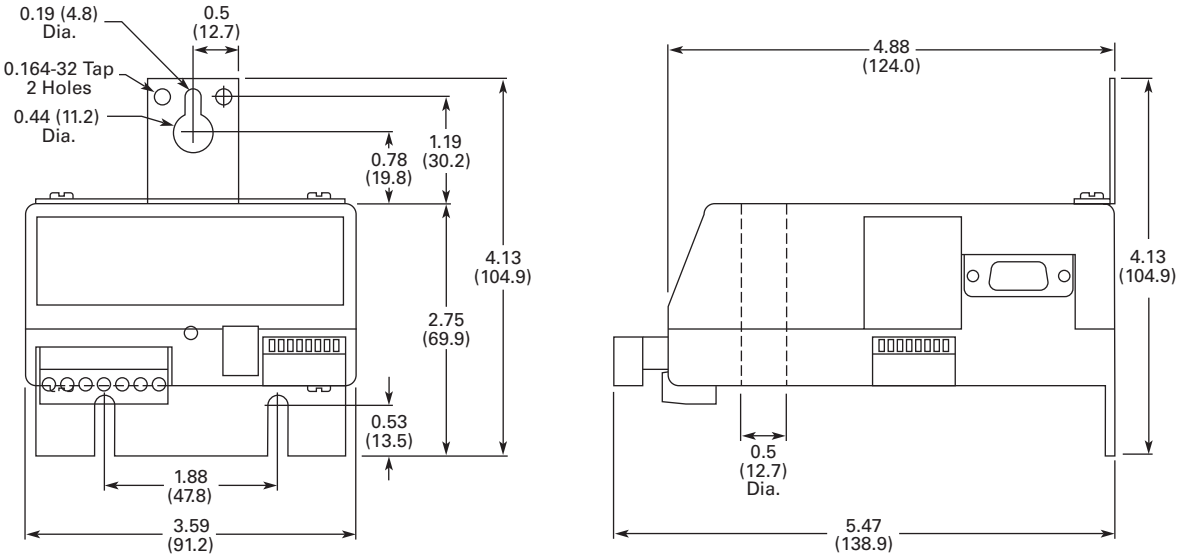
Approximate Dimensions in Inches (mm)

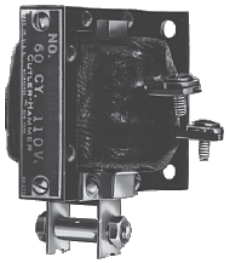
Current Sensing Protective Relays

IQ504



IQ500L and IQ502





Contents

Description	*Page*
Solenoids—Alternating Current	
Product Selection	**V5-T2-141**
Dimensions	**V5-T2-142**

Product Description

Solenoids from Eaton's Electrical Sector are used for a wide variety of applications where straight line motion is to be obtained automatically or at a remote point.

Features

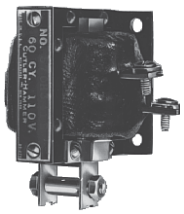
- Plunger and frame are machined to ensure quiet operation
- Push- and pull-type operation
- With and without terminal box
- Plunger provided with connecting pin
- Size C and D solenoids are provided with special bearing to minimize wear in clevis under severe service

Product Selection

When Ordering Specify

- Catalog number

10370



AC Solenoids—60 Hz, Continuous Duty

Size	Volt.	Operating Data ① Magnetic Force in Lbs Horizontal Position With Gravity At 100% Voltage	With Gravity At 85% Voltage	Against Gravity At 100% Voltage	Against Gravity At 85% Voltage	Max. Stroke in Inches (mm)	Current Inrush	Current Sealed	Without Conduit Box Floor Mtg. Catalog Number	Wall Mtg. Catalog Number	With Conduit Box Mtg. ② Catalog Number
60 Hertz Pull Type											
A	110	0.72	0.50	0.90	0.68	0.55	0.33	1 (25.4)	1.83	0.34	—	**10370H1**	**10370H610**
	220	0.72	0.50	0.90	0.68	0.55	0.33	1 (25.4)	0.92	0.17	—	**10370H2**	**10370H611**
	440	0.72	0.50	0.90	0.68	0.55	0.33	1 (25.4)	0.45	0.08	—	**10370H3**	**10370H612**
B	110	4.2	3	4.5	3.3	3.9	2.7	1 (25.4)	5.4	0.87	**10370H57**	**10370H694**	**10370H69**
	220	4.2	3	4.5	3.3	3.9	2.7	1 (25.4)	2.6	0.42	**10370H58**	**10370H696**	**10370H70**
	440	4.2	3	4.5	3.3	3.9	2.7	1 (25.4)	1.29	0.20	**10370H59**	**10370H697**	**10370H71**
C	110	7	5.25	8	6.25	6	4.25	1.25 (31.8)	10.4	1.07	**10370H244**	—	**10370H256**
	220	7	5.25	8	6.25	6	4.25	1.25 (31.8)	5.2	0.52	**10370H245**	—	**10370H257**
	440	7	5.25	8	6.25	6	4.25	1.25 (31.8)	2.5	0.26	**10370H246**	—	**10370H258**
D	110	12.4	10	13.65	11.25	11.15	8.75	1.25 (31.8)	18	1.58	**10370H356**	**10370H814** ③	**10370H368**
	220	12.4	10	13.65	11.25	11.15	8.75	1.25 (31.8)	9.3	0.81	**10370H357**	**10370H816** ③	**10370H369**
	440	12.4	10	13.65	11.25	11.15	8.75	1.25 (31.8)	4.4	0.40	**10370H358**	**10370H817** ③	**10370H370**
60 Hertz Push Type											
A	110	0.72	0.50	0.90	0.68	0.55	0.33	1 (25.4)	1.83	0.34	—	**10370H13**	**10370H25**
	220	0.72	0.50	0.90	0.68	0.55	0.33	1 (25.4)	0.92	0.17	—	**10370H14** ③	**10370H26**
	440	0.72	0.50	0.90	0.68	0.55	0.33	1 (25.4)	0.45	0.08	—	**10370H15**	**10370H27**
B	110	4.2	3	4.5	3.3	3.9	2.7	1 (25.4)	5.4	0.87	**10370H81**	**10370H708**	**10370H93**
	220	4.2	3	4.5	3.3	3.9	2.7	1 (25.4)	2.6	0.42	**10370H82**	**10370H710**	**10370H94**
	440	4.2	3	4.5	3.3	3.9	2.7	1 (25.4)	1.29	0.20	**10370H83**	**10370H711**	**10370H95**
C	110	7	5.25	8	6.25	6	4.25	1.25 (31.8)	10.4	1.07	**10370H268**	—	**10370H280**
	220	7	5.25	8	6.25	6	4.25	1.25 (31.8)	5.2	0.52	—	**10370H774**	**10370H281**
	440	7	5.25	8	6.25	6	4.25	1.25 (31.8)	2.5	0.26	—	**10370H775**	**10370H282**
D	110	12.4	10	13.65	11.25	11.15	8.75	1.25 (31.8)	18	1.58	**10370H380**	**10370H828** ③	**10370H392**
	220	12.4	10	13.65	11.25	11.15	8.75	1.25 (31.8)	9.3	0.81	**10370H381**	**10370H830** ③	**10370H393**
	440	12.4	10	13.65	11.25	11.15	8.75	1.25 (31.8)	4.4	0.40	**10370H382**	**10370H831** ③	**10370H394**

Notes

① Mounting of solenoids "with conduit box"—Size A are for wall mounting—Size B, C and D are for floor mounting.

② Recommended selection of solenoids on basis of 85% voltage values.

③ Part numbers are now obsolete.

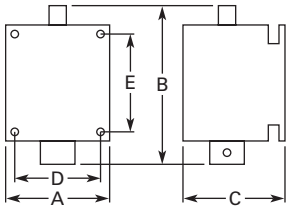
Dimensions

Approximate Dimensions in Inches (mm)

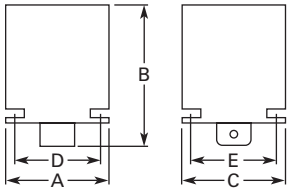
2

AC Solenoids

Wall Mounted



Floor Mounted



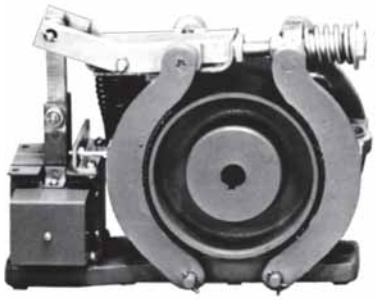
Dimensions and Shipping Weights

Size	Push Type Wide A	High B ①	Deep C	Mounting D	Mounting E	Shipping Weight Lbs (kg)	Pull Type Wide A	High B ①	Deep C	Mounting D	Mounting E	Shipping Weight Lbs (kg)
Wall Mounted												
A	2.38 (60.5)	3.63 (92.2)	2.25 (57.2)	1.13 (28.7)	1.63 (41.4)	2.0 (0.9)	2.38 (60.5)	2.63 (66.8)	2.25 (57.2)	1.13 (28.7)	1.63 (41.4)	2.0 (0.9)
B	2.63 (66.8)	4.88 (124.0)	3.00 (76.2)	2.00 (50.8)	2.13 (54.1)	2.5 (1.1)	2.63 (66.8)	3.63 (92.2)	3.00 (76.2)	2.00 (50.8)	2.13 (54.1)	2.5 (1.1)
C	3.00 (76.2)	6.13 (155.7)	4.13 (104.9)	2.38 (60.5)	3.13 (79.5)	5.0 (2.3)	3.00 (76.2)	4.88 (124.0)	4.13 (104.9)	2.38 (60.5)	3.13 (79.5)	5.0 (2.3)
D	4.00 (101.6)	6.13 (155.7)	4.13 (104.9)	2.75 (69.9)	3.13 (79.5)	7.0 (3.2)	4.00 (101.6)	4.88 (124.0)	4.13 (104.9)	2.75 (69.9)	3.13 (79.5)	7.0 (3.2)
Floor Mounted												
B	3.13 (79.5)	4.88 (124.0)	3.00 (76.2)	1.50 (38.1)	2.25 (57.2)	2.5 (1.1)	3.13 (79.5)	3.88 (98.6)	3.00 (76.2)	1.50 (38.1)	2.25 (57.2)	2.5 (1.1)
C	3.50 (88.9)	6.13 (155.7)	3.75 (95.3)	1.75 (44.5)	3.13 (79.5)	5.0 (2.3)	3.50 (88.9)	4.88 (124.0)	3.75 (95.3)	1.75 (44.5)	3.13 (79.5)	5.0 (2.3)
D	3.88 (98.6)	6.13 (155.7)	3.75 (95.3)	2.25 (57.2)	3.13 (79.5)	7.0 (3.2)	3.88 (98.6)	4.88 (124.0)	3.75 (95.3)	2.25 (57.2)	3.13 (79.5)	7.0 (3.2)

Note

① In sealed state.

Shoe Brakes—AC and DC, 511 Series



Contents

Description *Page*

Shoe Brakes—AC and DC Magnetic

Product Selection **V5-T2-144**
Dimensions **V5-T2-146**

Product Description

Type S Brakes from Eaton's Electrical Sector are electrically released and spring applied providing "fail-safe" operation. The retarding torque developed is directly proportional to the spring pressure.

Application Description

- Conveyors
- Machine tools
- Printing presses
- Small cranes
- Overhead doors
- Dumb waiters
- Vacuum molding machines
- Carnival rides

Features

The brake wheel is of relatively large size in relation to the torque developed by the brake. This permits use of a larger brake shoe lining and lower shoe pressures. Low shoe pressure, equally distributed over a large lining area, results in even wear of the friction surfaces and even braking torque. The oversize wheel type construction also permits use of a smaller operating solenoid that requires less current for a given torque rating.

DC Brakes

Standard DC brakes are equipped with shunt coils. The magnet coil circuit on DC brakes consists of two separate windings and a protective switch.

Mounting

Type S brakes are designed and recommended for use and mounting only in the horizontal position. Side or vertical mountings are not recommended because the solenoid loading is altered, resulting in accelerated wear and premature coil failure.

Product Selection

When Ordering Specify

- Brake
  - Catalog number plus suffix number for coil
  - Example: 511H1193-**41**
  - Wheel
  - Catalog number plus suffix number for bore size
  - Example: 511H1150-**3**

Size S-4 Brake and Wheel



Type S Brakes—Floor Mounting

Torque—lb-ft			AC	For Type S4, S5-1/2, S7, S10		DC		
Continuous	Intermittent ①	Brake Size	Base Catalog Number ②③	Coil Volts and Hertz	Coil Suffix ②	Base Catalog Number ②③	Coil Voltage	Coil Suffix ②
3	3	S-4	**511H1194**	120V 60 Hz	**-39**	**511H955**	120 Vdc	**-97**
10	10	S-4	**511H1193**	208V 60 Hz	**-45**	**511H956**	240 Vdc	**-98**
—	15	S-4	**511H1192**	240V 60 Hz	**-40**	**511H957**		
25	25	S-5-1/2	**511H992**	480V 60 Hz	**-41**	**511H994**		
—	35	S-5-1/2	**511H993**	600V 60 Hz	**-58**	**511H995**		
50	50	S-7	**511H970**	110V 50 Hz	**-5**	**511H975**		
—	75	S-7	**511H971**	220V 50 Hz	**-6**	**511H976**		
85	85	S-7	**511H1195**	380V 50 Hz	**-7**	**511H1197**		
—	110	S-7	**511H1196**	440V 50 Hz	**-8**	**511H1198**		
				550V 50 Hz	**-9**			

Notes

① Intermittent duty indicates that the coil can be placed across the line continuously for one hour maximum without excessive heating. It is equivalent to 1/2 time ON and 1/2 time OFF.

② Add suffix number for coil voltage to base catalog number.

③ Does not include wheel.

Brake Selection

The method most generally used to determine required braking torque is to calculate the full load motor torque by the following formula:

$$T = \frac{5252 \times hp}{rpm}$$

T = Full load motor torque in lb-ft

hp = Motor horsepower

rpm = Speed of shaft on which brake wheel is mounted

The torque rating of the brake selected should be at least equal to the full load motor torque for the duty considered.

Brake Wheels

Wheel Size in Inches	Min. Bore in Inches (mm)	Max. Bore in Inches (mm)	Pilot Bore in Inches (mm)	WK^2	Straight Bore ① Base ③ Catalog Number	Tapered Bore ② Base ③ Catalog Number
4.0	0.50 (12.7)	1.38 (35.1)	0.50 (12.7)	0.06	**511H1150**	**511H1151**
5.5	0.75 (19.1)	2.00 (50.8)	0.75 (19.1)	0.26	**511H1160**	**511H1161**
7.0	1.00 (25.4)	2.25 (57.2)	0.75 (19.1)	0.77	**511H1170**	**511H1171**

Brake Wheel Suffix Numbers

Bore Size Suffix Number—Add to Base Catalog Number

Bore ④ in Inches (mm)	Keyway in Inches	Suffix Number	Bore ④ in Inches (mm)	Keyway in Inches (mm)	Suffix Number
Standard Bore Sizes					
Pilot bore	None	**-1**	1.625 (41.28)	3/38 x 3/16	**-9**
0.625 (15.88)	3/16 x 3/32	**-2**	1.875 (47.63)	1/2 x 1/4	**-10**
0.750 (19.05)	3/16 x 3/32	**-3**	2.125 (53.98)	1/2 x 1/4	**-11**
0.875 (22.23)	3/16 x 3/32	**-4**	—	—	**—**
1.000 (25.40)	1/4 x 1/8	**-5**	—	—	**—**
1.125 (28.58)	1/4 x 1/8	**-6**	—	—	**—**
1.250 (31.75)	1/4 x 1/8	**-7**	—	—	**—**
1.375 (34.93)	5/16 x 5/32	**-8**	—	—	**—**
Non-Standard Bore Sizes					
0.500 (12.70)	1/8 x 1/16	**-50**	1.687 (42.85)	3/8 x 3/16	**-58**
0.750 (19.05)	1/4 x 1/8	**-51**	1.750 (44.45)	3/8 x 3/16	**-59**
0.875 (22.23)	1/4 x 1/8	**-52**	1.937 (49.20)	1/2 x 1/4	**-60**
1.000 (25.40)	5/16 x 5/32	**-53**	2.000 (50.80)	1/2 x 1/4	**-61**
1.187 (30.15)	1/4 x 1/8	**-54**	2.250 (57.15)	1/2 x 1/4	**-62**
1.375 (34.93)	3/8 x 3/16	**-55**	—	—	**—**
1.437 (36.50)	3/8 x 3/16	**-56**	—	—	**—**
1.500 (38.10)	3/8 x 3/16	**-57**	—	—	**—**

Notes

① Bore tolerance: +0.000–0.001 in.

② Taper is at rate of 1.25 in per ft on diameter. In bore size selection, use diameter of tapered shaft. Bore tolerance: +0.000–0.005 in.

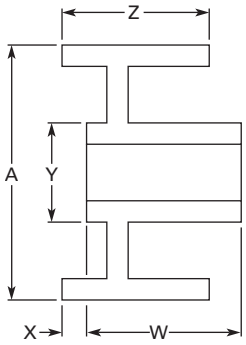
③ Add suffix number for bore size to base catalog number.

④ Bore size selected must be between minimum and maximum dimensions listed in brake wheel selection table.

Dimensions

Approximate Dimensions in Inches (mm)

Standard Brake Wheels



Standard Brake Wheel Dimensions

A	Z	W ①	X	Y	Bore Max.	Bore Min.
4.00 (101.6)	2.75 (69.9)	1.63 (41.4)	1.38 (35.1)	2.50 (63.5)	1.38 (35.1)	0.50 (12.7)
5.50 (139.7)	3.25 (82.6)	2.00 (50.8)	1.63 (41.4)	3.25 (82.6)	2.00 (50.8)	0.75 (19.1)
7.00 (177.8)	4.25 (108.0)	3.00 (76.2)	1.25 (31.8)	4.00 (101.6)	2.25 (57.2)	1.00 (25.4)

Approximate Shipping Weights

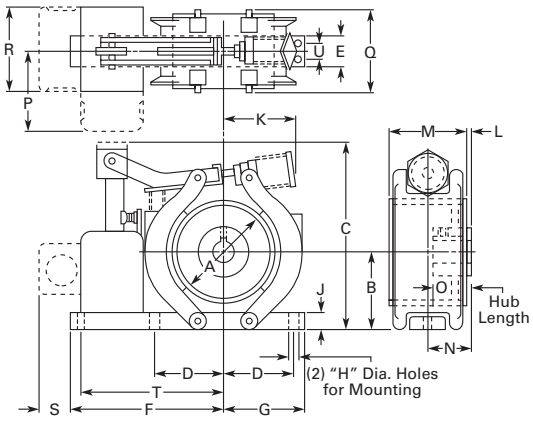
Brake Size	Torque Rating ft-lb	Weight in Lbs (kg) Net — Brake with Wheel	Net — Wheel Only	Boxed — Brake with Wheel
Type "S" AC Shoe Brakes				
S-4	3	15.8 (7.2)	3.4 (1.5)	17.0 (7.7)
S-4	10	15.8 (7.2)	3.4 (1.5)	17.0 (7.7)
S-4	15	15.8 (7.2)	3.4 (1.5)	17.0 (7.7)
S-5-1/2	25	33.2 (15.1)	7.5 (3.4)	36.0 (16.3)
S-5-1/2	35	33.2 (15.1)	7.5 (3.4)	36.0 (16.3)
S-7	50	52.1 (23.7)	18.8 (8.5)	55.0 (25.0)
S-7	75	52.1 (23.7)	18.8 (8.5)	55.0 (25.0)
Type "S" DC Shoe Brakes				
S-4	3	18.0 (8.2)	3.4 (1.5)	20.0 (9.1)
S-4	10	18.0 (8.2)	3.4 (1.5)	20.0 (9.1)
S-4	15	18.0 (8.2)	3.4 (1.5)	20.0 (9.1)
S-5-1/2	25	35.0 (15.9)	7.5 (3.4)	38.0 (17.3)
S-5-1/2	35	35.0 (15.9)	7.5 (3.4)	38.0 (17.3)
S-7	50	54.0 (24.5)	18.8 (8.5)	58.0 (26.3)
S-7	75	54.0 (24.5)	18.8 (8.5)	58.0 (26.3)
S-7	85	54.0 (24.5)	18.8 (8.5)	58.0 (26.3)
S-7	110	54.0 (24.5)	18.8 (8.5)	58.0 (26.3)

Note

① Hub lengths other than standard are not available.

Approximate Dimensions in Inches (mm)

Type S4, S5-1/2 and S7 Solenoid Operated



Type "S" AC Shoe Brakes

Brake Size	Torque Rating ft-lb	A	B ①	C	D	E	F	G	H	J	K	L	M	N	O	P	Q	R
S-4	3	4.00 (101.6)	2.88 (73.2)	7.50 (190.5)	2.63 (66.8)	1.25 (31.8)	7.50 (190.5)	3.13 (79.5)	0.38 (9.7)	0.63 (16.0)	2.88 (73.2)	0.25 (6.4)	2.75 (69.9)	1.63 (41.4)	1.63 (41.4)	2.88 (73.2)	3.00 (76.2)	3.13 (79.5)
S-4	10	4.00 (101.6)	2.88 (73.2)	7.50 (190.5)	2.63 (66.8)	1.25 (31.8)	7.50 (190.5)	3.13 (79.5)	0.38 (9.7)	0.63 (16.0)	2.88 (73.2)	0.25 (6.4)	2.75 (69.9)	1.63 (41.4)	1.63 (41.4)	2.88 (73.2)	3.00 (76.2)	3.13 (79.5)
S-4	15	4.00 (101.6)	2.88 (73.2)	7.50 (190.5)	2.63 (66.8))	1.25 (31.8)	7.50 (190.5)	3.13 (79.5)	0.38 (9.7)	0.63 (16.0)	2.88 (73.2)	0.25 (6.4)	2.75 (69.9)	1.63 (41.4)	1.63 (41.4)	2.88 (73.2)	3.00 (76.2)	3.13 (79.5))
S-5-1/2	25	5.50 (139.7)	4.00 (101.6)	9.50 (241.3)	3.50 (88.9)	2.00 (50.8)	8.38 (212.9)	4.13 (104.9)	0.44 (11.2)	1.00 (25.4)	4.88 (124.0)	0.38 (9.7)	3.25 (82.6)	2.00 (50.8)	2.00 (50.8)	3.13 (79.5)	3.75 (95.3)	3.13 (79.5)
S-5-1/2	35	5.50 (139.7)	4.00 (101.6)	9.50 (241.3)	3.50 (88.9)	2.00 (50.8)	8.38 (212.9)	4.13 (104.9)	0.44 (11.2)	1.00 (25.4)	7.88 (200.2)	0.38 (9.7)	3.25 (82.6)	2.00 (50.8)	2.00 (50.8)	3.13 (79.5)	3.75 (95.3)	3.13 (79.5)
S-7	50	7.00 (177.8)	5.00 (127.0)	11.50 (292.1)	4.38 (111.3)	2.50 (63.5)	9.50 (241.3)	5.00 (127.0)	0.56 (14.2)	1.00 (25.4)	6.00 (152.4)	—	4.25 (108.0)	2.13 (54.1)	3.00 (76.2)	3.13 (79.5)	4.75 (120.7)	3.13 (79.5)
S-7	75	7.00 (177.8)	5.00 (127.0)	11.50 (292.1)	4.38 (111.3)	2.50 (63.5)	9.50 (241.3)	5.00 (127.0)	0.56 (14.2)	1.00 (25.4)	6.00 (152.4)	—	4.25 (108.0)	2.13 (54.1)	3.00 (76.2)	3.13 (79.5)	4.75 (120.7)	3.13 (79.5)

Type "S" DC Shoe Brakes

Brake Size	Torque Rating ft-lb	A	B ①	C	D	E	F	G	H	J	K	L	M	N	O	P	Q	R
S-4	3	4.00 (101.6)	3.50 (88.9)	8.00 (203.2)	2.63 (66.8)	1.25 (31.8)	7.56 (192.0)	3.25 (82.6)	0.38 (9.7)	0.75 (19.1)	2.88 (73.2)	0.25 (6.4)	2.75 (69.9)	1.63 (41.4)	1.63 (41.4)	2.63 (66.8)	3.00 (76.2))	4.06 (103.1)
S-4	10	4.00 (101.6)	3.50 (88.9)	8.00 (203.2)	2.63 (66.8)	1.25 (31.8)	7.56 (192.0)	3.25 (82.6)	0.38 (9.7)	0.75 (19.1)	2.88 (73.2)	0.25 (6.4)	2.75 (69.9)	1.63 (41.4)	1.63 (41.4)	2.63 (66.8)	3.00 (76.2)	4.06 (103.1))
S-4	15	4.00 (101.6)	3.50 (88.9)	8.00 (203.2)	2.63 (66.8)	1.25 (31.8)	7.56 (192.0)	3.25 (82.6))	0.38 (9.7)	0.75 (19.1)	2.88 (73.2)	.25 (6.4)	2.75 (69.9)	1.63 (41.4)	1.63 (41.4)	2.63 (66.8)	3.00 (76.2)	4.06 (103.1)
S-5-1/2	25	5.50 (139.7)	4.00 (101.6)	9.50 (241.3)	3.50 (88.9)	2.00 (50.8)	8.38 (212.9)	4.13 (104.9)	0.44 (11.2)	0.75 (19.1)	4.88 (124.0)	0.38 (9.7)	3.25 (82.6)	2.00 (50.8)	2.00 (50.8)	2.88 (73.2)	3.75 (95.3)	4.06 (103.1)
S-5-1/2	35	5.50 (139.7)	4.00 (101.6)	9.50 (241.3)	3.50 (88.9)	2.00 (50.8)	8.38 (212.9)	4.13 (104.9)	0.44 (11.2)	0.75 (19.1)	4.88 (124.0)	0.38 (9.7)	3.25 (82.6)	2.00 (50.8)	2.00 (50.8)	2.88 (73.2)	3.75 (95.3)	4.06 (103.1)
S-7	50	7.00 (177.8)	5.00 (127.0)	11.50 (292.1)	4.38 (111.3)	2.50 (63.5)	9.50 (241.3)	5.00 (127.0)	0.56 (14.2)	0.75 (19.1)	6.00 (152.4)	—	4.25 (108.0)	2.13 (54.1)	3.00 (76.2)	2.88 (73.2)	4.88 (124.0)	4.06 (103.1)
S-7	75	7.00 (177.8)	5.00 (127.0)	11.50 (292.1)	4.38 (111.3)	2.50 (63.5)	9.50 (241.3)	5.00 (127.0)	0.56 (14.2)	0.75 (19.1)	6.00 (152.4)	—	4.25 (108.0)	2.13 (54.1)	3.00 (76.2)	2.88 (73.2)	4.88 (124.0)	4.06 (103.1)
S-7	85	7.00 (177.8)	5.00 (127.0)	11.50 (292.1)	4.38 (111.3)	2.50 (63.5)	9.50 (241.3)	5.00 (127.0)	0.56 (14.2)	0.75 (19.1)	6.00 (152.4)	—	4.25 (108.0)	2.13 (54.1)	3.00 (76.2)	2.88 (73.2)	4.88 (124.0)	4.06 (103.1)
S-7	110	7.00 (177.8)	5.00 (127.0)	11.50 (292.1)	4.38 (111.3)	2.50 (63.5)	9.50 (241.3)	5.00 (127.0)	0.56 (14.2)	0.75 (19.1)	6.00 (152.4)	—	4.25 (108.0)	2.13 (54.1)	3.00 (76.2)	2.88 (73.2)	4.88 (124.0)	4.06 (103.1)

Note

① Open type brake only.

Reference Data

IEC Utilization Categories

(See also IEC/EN 60947-1; 2.1.18/IEV 441-17-19)

A combination of specified requirements relating to the condition in which the switching device or fuse fulfills its purpose and selected to represent a characteristic group of real-life applications. The specified requirements may, for example, relate to the values of making and breaking capacity and other characteristic values, data concerning associated circuits and the applicable conditions of use and operational behavior.

Used in Technical Data and Formulas

Code	Descriptions
DF	Duty factory
I_{Dn}	Response value of earth-fault release
I_{cm}	Rated short-circuit making capacity
I_{cn}	Rated short-circuit breaking capacity
I_{cs}	Rated service short-circuit breaking capacity
I_{cu}	Rated ultimate short-circuit breaking capacity
I_{cw}	Rated short-time withstand current
I_e	Rated operational current
I_k	Transformer initial short-circuit AC current
I_L	Load monitoring response value
I_n	Rated current
I_{NT}	Transformer rated current
I_{PK}	Rated peak withstand current
I_q	Rated conditional short-circuit current
I_r	Overcurrent release set value
I_{rm}	Response value of non-delayed short-circuit release
I_i	Response value of non-delayed short-circuit release
I_{rmf}	Response value of fixed, non-delayed short-circuit release

Code	Descriptions
I_{rmv}	Response value of short-time delayed short-circuit release
I_{sd}	Response value of short-time delayed short-circuit release
I_T	Response value of earth-fault release
I_g	Response value of earth-fault release
I_{th}	Conventional free air thermal current
I_{the}	Conventional thermal current of enclosed devices
I_u	Rated uninterrupted current
S_{NT}	Transformer rating
t_r	Time delay of overload release response
t_T	Time delay of earth-fault release response
t_g	Time delay of earth-fault release response
t_v	Time delay of short-circuit release response
U_c	Rated actuating voltage
U_e	Rated operational voltage
U_i	Rated insulation voltage
U_{imp}	Rated impulse withstand voltage
U_k	Transformer short-circuit voltage
U_s	Rated control voltage

Annex A (informative)

Examples of Utilization Categories for Low-Voltage Switchgear and Controlgear ①

Category	Typical Applications	Relevant IEC Product Standard
Nature of Current—AC		
AC-1	Non-inductive or slightly inductive loads, resistance furnaces	60947-4-1
AC-2	Slip-ring motors: starting, switching off	60947-4-1
AC-3	Squirrel-cage motors: starting, switching off motors during running	60947-4-1
AC-4	Squirrel-cage motors: starting, plugging ②, inching ③	60947-4-1
AC-5a	Switching of electric discharge lamp controls	60947-4-1
AC-5b	Switching of incandescent lamps	60947-4-1
AC-6a	Switching of transformers	60947-4-1
AC-6b	Switching of capacitor banks	60947-4-1
AC-7a	Slightly inductive loads for household appliances and similar applications	61095
AC-7b	Motor-loads for household applications	61095
AC-8a	Hermetic refrigerant compressor motor control with manual resetting of overload releases	60947-4-1
AC-8b	Hermetic refrigerant compressor motor control with automatic resetting of overload releases	60947-4-1
AC-12	Control of resistive loads and solid-state loads with isolation by optocouplers	60947-5-1
AC-12	Control of resistive loads and solid-state loads with optical isolation	60947-5-2
AC-13	Control of solid-state loads with transformer isolation	60947-5-1
AC-14	Control of small electromagnetic loads	60947-5-1
AC-15	Control of AC electromagnetic loads	60947-5-1
AC-20	Connecting and disconnecting under no-load conditions	60947-3
AC-21	Switching of resistive loads, including moderate overloads	60947-3
AC-22	Switching of mixed resistive and inductive loads, including moderate overloads	60947-3
AC-23	Switching of motor loads or other highly inductive loads	60947-3
AC-31	Non inductive or slightly inductive loads	60947-6-1
AC-33	Motor loads or mixed loads including motors, resistive loads and up to 30% incandescent lamp loads	60947-6-1
AC-35	Electric discharge lamp loads	60947-6-1
AC-36	Incandescent lamp loads	60947-6-1
AC-40	Distribution circuits comprising mixed resistive and reactive loads having a resultant inductive reactance	60947-6-2
AC-41	Non-inductive or slightly inductive loads, resistance furnaces	60947-6-2
AC-42	Slip-ring motors: starting, switching off	60947-6-2
AC-43	Squirrel cage motors: starting, switching off motors during running	60947-6-2
AC-44	Squirrel cage motors: starting, plugging ②, inching ③	60947-6-2
AC-45a	Switching of electric discharge lamp controls	60947-6-2
AC-45b	Switching of incandescent lamps	60947-6-2
AC-51	Non-inductive or slightly inductive loads, resistance furnaces	60947-4-3
AC-52a	Control of slip ring motor stators: 8 h duty with on-load currents for start, acceleration, run	60947-4-2
AC-52b	Control of slip ring motor stators: intermittent duty	60947-4-2
AC-53a	Control of squirrel cage motors: 8 h duty with on-load currents for start, acceleration, run	60947-4-2
AC-53b	Control of squirrel cage motors: intermittent duty	60947-4-2

Notes

① 60947-1 © IEC: 2004.
② Plugging is understood to be stopping or reversing the motor rapidly by reversing motor primary connections while the motor is running.
③ Inching is understood to be energizing a motor once or repeatedly for short periods to obtain small movements of the driven mechanism.

Examples of Utilization Categories for Low-Voltage Switchgear and Controlgear, continued ①

Category	Typical Applications	Relevant IEC Product Standard
Nature of Current—AC, continued		
AC-55a	Switching of electric discharge lamp controls	60947-4-3
AC-55b	Switching of incandescent lamps	60947-4-3
AC-56a	Switching of transformers	60947-4-3
AC-56b	Switching of capacitor banks	60947-4-3
AC-58a	Control of hermetic refrigerant compressor motors with automatic resetting of overload releases: 8 h duty with on-load currents for start, acceleration, run	60947-4-2
AC-58b	Control of hermetic refrigerant compressor motors with automatic resetting of overload releases: intermittent duty	60947-4-2
AC-140	Control of small electromagnetic loads with holding (closed) current ≤0,2 A, for example contactor relays	60947-5-2
Nature of Current—AC and DC		
A	Protection of circuits, with no rated short-time withstand current	60947-2
B	Protection of circuits, with a rated short-time withstand current	60947-2
Nature of Current—DC		
DC-1	Non-inductive or slightly inductive loads, resistance furnaces	60947-4-1
DC-3	Shunt-motors: starting, plugging ②, inching ③, dynamic breaking of motors	60947-4-1
DC-5	Series-motors: starting, plugging ②, inching ③, dynamic breaking of motors	60947-4-1
DC-6	Switching of incandescent lamps	60947-4-1
DC-12	Control of resistive loads and solid-state loads with isolation by optocouplers	60947-5-1
DC-12	Control of resistive loads and solid-state loads with optical isolation	60947-5-2
DC-13	Control of electromagnets	60947-5-1
DC-13	Control of electromagnets	60947-5-2
DC-14	Control of electromagnetic loads having economy resistors in circuit	60947-5-1
DC-20	Connecting and disconnecting under no-load conditions	60947-3
DC-21	Switching of resistive loads, including moderate overloads	60947-3
DC-22	Switching of mixed resistive and inductive loads, including moderate overloads (for example shunt motors)	60947-3
DC-23	Switching of motor loads or other highly inductive loads (for example series motors)	60947-3
DC-31	Resistive loads	60947-6-1
DC-33	Motor loads or mixed loads including motors	60947-6-1
DC-36	Incandescent lamp loads	60947-6-1
DC-40	Distribution circuits comprising mixed resistive and reactive loads having a resultant inductive reactance	60947-6-2
DC-41	Non-inductive or slightly inductive loads, resistance furnaces	60947-6-2
DC-43	Shunt-motors: starting, plugging ②, inching ③, dynamic breaking of DC	60947-6-2
DC-45	Series-motors: starting, plugging ②, inching ③, dynamic breaking of DC	60947-6-2
DC-46	Switching of incandescent lamps	60947-6-2

Notes

① 60947-1 © IEC: 2004.
② Plugging is understood to be stopping or reversing the motor rapidly by reversing motor primary connections while the motor is running.
③ Inching is understood to be energizing a motor once or repeatedly for short periods to obtain small movements of the driven mechanism.

Motor Ratings Data

Ampere Rating of AC and DC Motors

Ampere ratings of motors vary somewhat, depending upon the type of motor. The values given below are for drip-proof, Class B insulated (T Frame) where available, 1.15 service factor, NEMA Design B motors. These values represent an average full load motor current which was calculated from the motor performance data published by several motor manufacturers. In the case of high torque squirrel cage motors, the ampere ratings will be at least 10% greater than the values given in the following table.

Caution—These average ratings could be high or low for a specific motor and therefore heater coil selection on this basis always involves risk. For fully reliable motor protection, select heater coils on the basis of full load current rating as shown on the motor nameplate.

Ampere Ratings of Three-Phase, 60 Hz, AC Induction Motor

hp	Syn. Speed RPM	Current in Amperes 200V	230V	380V ①	460V	575V	2200V
1/4	1800	1.09	.95	0.55	0.48	0.38	—
	1200	1.61	1.40	0.81	0.70	0.56	—
	900	1.84	1.60	0.93	0.80	0.64	—
1/3	1800	1.37	1.19	0.69	0.60	0.48	—
	1200	1.83	1.59	0.92	0.80	0.64	—
	900	2.07	1.80	1.04	0.90	0.72	—
1/2	1800	1.98	1.72	0.99	0.86	0.69	—
	1200	2.47	2.15	1.24	1.08	0.86	—
	900	2.74	2.38	1.38	1.19	0.95	—
3/4	1800	2.83	2.46	1.42	1.23	0.98	—
	1200	3.36	2.92	1.69	1.46	1.17	—
	900	3.75	3.26	1.88	1.63	1.30	—
1	3600	3.22	2.80	1.70	1.40	1.12	—
	1800	4.09	3.56	2.06	1.78	1.42	—
	1200	4.32	3.76	2.28	1.88	1.50	—
	900	4.95	4.30	2.60	2.15	1.72	—
1-1/2	3600	5.01	4.36	2.64	2.18	1.74	—
	1800	5.59	4.86	2.94	2.43	1.94	—
	1200	6.07	5.28	3.20	2.64	2.11	—
	900	6.44	5.60	3.39	2.80	2.24	—
2	3600	6.44	5.60	3.39	2.80	2.24	—
	1800	7.36	6.40	3.87	3.20	2.56	—
	1200	7.87	6.84	4.14	3.42	2.74	—
	900	9.09	7.90	4.77	3.95	3.16	—
3	3600	9.59	8.34	5.02	4.17	3.34	—
	1800	10.8	9.40	5.70	4.70	3.76	—
	1200	11.7	10.2	6.20	5.12	4.10	—
	900	13.1	11.4	6.90	5.70	4.55	—
5	3600	15.5	13.5	8.20	6.76	5.41	—
	1800	16.6	14.4	8.74	7.21	5.78	—
	1200	18.2	15.8	9.59	7.91	6.32	—
	900	18.3	15.9	9.60	7.92	6.33	—
7-1/2	3600	22.4	19.5	11.8	9.79	7.81	—
	1800	24.7	21.5	13.0	10.7	8.55	—
	1200	25.1	21.8	13.2	10.9	8.70	—
	900	26.5	23.0	13.9	11.5	9.19	—
10	3600	29.2	25.4	15.4	12.7	10.1	—
	1800	30.8	26.8	16.3	13.4	10.7	—
	1200	32.2	28.0	16.9	14.0	11.2	—
	900	35.1	30.5	18.5	15.2	12.2	—
15	3600	41.9	36.4	22.0	18.2	14.5	—
	1800	45.1	39.2	23.7	19.6	15.7	—
	1200	47.6	41.4	25.0	20.7	16.5	—
	900	51.2	44.5	26.9	22.2	17.8	—
20	3600	58.0	50.4	30.5	25.2	20.1	—
	1800	58.9	51.2	31.0	25.6	20.5	—
	1200	60.7	52.8	31.9	26.4	21.1	—
	900	63.1	54.9	33.2	27.4	21.9	—

Note

① 380V 50 Hz.

Ampere Ratings of Three-Phase, 60 Hz, AC Induction Motor, continued

hp	Syn. Speed RPM	Current in Amperes 200V	230V	380V ①	460V	575V	2200V
25	3600	69.9	60.8	36.8	30.4	24.3	—
	1800	74.5	64.8	39.2	32.4	25.9	—
	1200	75.4	65.6	39.6	32.8	26.2	—
	900	77.4	67.3	40.7	33.7	27.0	—
30	3600	84.8	73.7	44.4	36.8	29.4	—
	1800	86.9	75.6	45.7	37.8	30.2	—
	1200	90.6	78.8	47.6	39.4	31.5	—
	900	94.1	81.8	49.5	40.9	32.7	—
40	3600	111	96.4	58.2	48.2	38.5	—
	1800	116	101	61.0	50.4	40.3	—
	1200	117	102	61.2	50.6	40.4	—
	900	121	105	63.2	52.2	41.7	—
50	3600	138	120	72.9	60.1	48.2	—
	1800	143	124	75.2	62.2	49.7	—
	1200	145	126	76.2	63.0	50.4	—
	900	150	130	78.5	65.0	52.0	—
60	3600	164	143	86.8	71.7	57.3	—
	1800	171	140	90.0	74.5	59.4	—
	1200	173	150	91.0	75.0	60.0	—
	900	177	154	93.1	77.0	61.5	—
75	3600	206	179	108	89.6	71.7	—
	1800	210	183	111	91.6	73.2	—
	1200	212	184	112	92.0	73.5	—
	900	222	193	117	96.5	77.5	—
100	3600	266	231	140	115	92.2	—
	1800	271	236	144	118	94.8	23.6
	1200	275	239	145	120	95.6	24.2
	900	290	252	153	126	101	24.8
125	3600	—	292	176	146	116	—
	1800	—	293	177	147	117	29.2
	1200	—	298	180	149	119	29.9
	900	—	305	186	153	122	30.9
150	3600	—	343	208	171	137	—
	1800	—	348	210	174	139	34.8
	1200	—	350	210	174	139	35.5
	900	—	365	211	183	146	37.0
200	3600	—	452	257	226	181	—
	1800	—	458	265	229	184	46.7
	1200	—	460	266	230	184	47.0
	900	—	482	279	241	193	49.4
250	3600	—	559	338	279	223	—
	1800	—	568	343	284	227	57.5
	1200	—	573	345	287	229	58.5
	900	—	600	347	300	240	60.5
300	1800	—	678	392	339	271	69.0
	1200	—	684	395	342	274	70.0
400	1800	—	896	518	448	358	91.8
500	1800	—	1110	642	555	444	116

Single-Phase AC Motors

The following values of full-load currents are for motors running at usual speeds and motors with normal torque characteristics. Motors built for especially low speeds or high torques may have higher full-load currents and multispeed motors will have full-load current varying with speed, in which case the nameplate current ratings shall be used.

The voltages listed are rated motor voltages. The currents listed shall be permitted for system voltage ranges of 110 to 120 and 220 to 240V.

Table 430.248. Full-Load Currents in Amperes, Single-Phase Alternating-Current Motors

hp	115V	200V	208V	230V
1/6	4.4	2.5	2.4	2.2
1/4	5.8	3.3	3.2	2.9
1/3	7.2	4.1	4.0	3.6
1/2	9.8	5.6	5.4	4.9
3/4	13.8	7.9	7.6	6.9
1	16	9.2	8.8	8
1-1/2	20	11.5	11	10
2	24	13.8	13.2	12
3	34	19.6	18.7	17
5	56	32.2	30.8	28
7-1/2	80	46	44	40
10	100	57.5	55	50

Note

① 380V 50 Hz.

DC Motors

The following values of full-load currents are for motors running at base speed.

These are average direct-current quantities.

Three-Phase AC Motors

The following values of full-load currents are typical for motors running at speeds usual for belted motors and motors with normal torque characteristics.

Motors built for low speeds (1,200 RPM or less) or high torques may require more running current and multispeed motors will have full-load current varying with speed. In these cases the nameplate current rating shall be used.

The voltages listed are rated motor voltages. The currents listed shall be permitted for system voltage ranges of 110 to 120, 220 to 240, 440 to 480 and 550 to 600V.

Table 430.247 Full-Load Current in Amperes, Direct-Current Motors

	Armature Voltage Rating ①		Ampere Capacity of Fuses for Motors Recommended Values	
hp	120V	240V	120V	240V
1/4	3.1	1.6	5	3
1/3	4.1	2.0	5	3
1/2	5.4	2.7	7	3
3/4	7.6	3.8	10	5
1	9.5	4.7	15	7
1-1/2	13.2	6.6	20	10
2	17	8.5	25	12
3	25	12.2	30	15
5	40	20	50	25
7-1/2	58	29	80	40
10	76	38	100	50
15	—	55	—	75
20	—	72	—	100
25	—	89	—	125
30	—	106	—	150
40	—	140	—	200
50	—	173	—	250
60	—	206	—	275
75	—	255	—	350
100	—	341	—	500
125	—	425	—	600
150	—	506	—	—
200	—	675	—	—

Table 430.250. Full-Load Current Three-Phase Alternating-Current Motors

	Induction Type Squirrel Cage and Wound-Rotor Amperes							Synchronous Type Unity Power Factor ② Amperes			
hp	115V	200V	208V	230V	460V	575V	2300V	230V	460V	575V	2300V
1/2	4.4	2.5	2.4	2.2	1.1	0.9	—	—	—	—	—
3/4	6.4	3.7	3.5	3.2	1.6	1.3	—	—	—	—	—
1	8.4	4.8	4.6	4.2	2.1	1.7	—	—	—	—	—
1-1/2	12.0	6.9	6.6	6.0	3.0	2.4	—	—	—	—	—
2	13.6	7.8	7.5	6.8	3.4	2.7	—	—	—	—	—
3	—	11.0	10.6	9.6	4.8	3.9	—	—	—	—	—
5	—	17.5	16.7	15.2	7.6	6.1	—	—	—	—	—
7-1/2	—	25.3	24.2	22	11	9	—	—	—	—	—
10	—	32.2	30.8	28	14	11	—	—	—	—	—
15	—	48.3	46.2	42	21	17	—	—	—	—	—
20	—	62.1	59.4	54	27	22	—	—	—	—	—
25	—	78.2	74.8	68	34	27	—	53	26	21	—
30	—	92	88	80	40	32	—	63	32	26	—
40	—	120	114	104	52	41	—	83	41	33	—
50	—	150	143	130	65	52	—	104	52	42	—
60	—	177	169	154	77	62	16	123	61	49	12
75	—	221	211	192	96	77	20	155	78	62	15
100	—	285	273	248	124	99	26	202	101	81	20
125	—	359	343	312	156	125	31	253	126	101	25
150	—	414	396	360	180	144	37	302	151	121	30
200	—	552	528	480	240	192	49	400	201	161	40
250	—	—	—	—	302	242	60	—	—	—	—
300	—	—	—	—	361	289	72	—	—	—	—
350	—	—	—	—	414	336	83	—	—	—	—
400	—	—	—	—	477	382	95	—	—	—	—
450	—	—	—	—	515	412	103	—	—	—	—
500	—	—	—	—	590	472	118	—	—	—	—

Notes

① These are average direct-current quantities.

② For 90 and 80 percent power factor, the above figures shall be multiplied by 1.1 and 1.25 respectively.