C440/*XT* Electronic Overload Relay

Contents

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 175 A 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 for Modbus RTU, DeviceNet, PROFIBUS, Modbus TCP, EtherNet/IP and HTTP web services all with I/O options.

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 (0.33–1500 A)
- 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 imbalance
- Selectable (ON/OFF) ground fault

User Interface

- Large FLA selection dial
- Trip status indicator
- Operating mode LED
- DIP switch selectable trip class, phase imbalance 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 imbalance 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 imbalance, 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

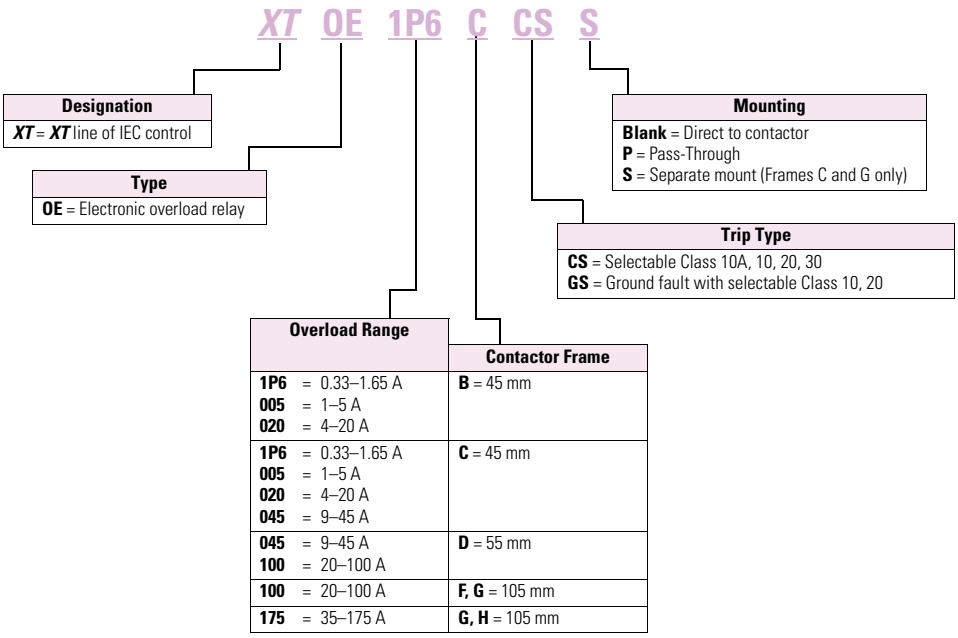
- UL
- CSA
- CE
- NEMA
- IEC/EN 60947 VDE 0660
- ISO® 13849-1 (EN954-1)
- RoHS
- ATEX directive 94/9/EC
- Equipment Group 2, Category 2

Electronic Overload Education

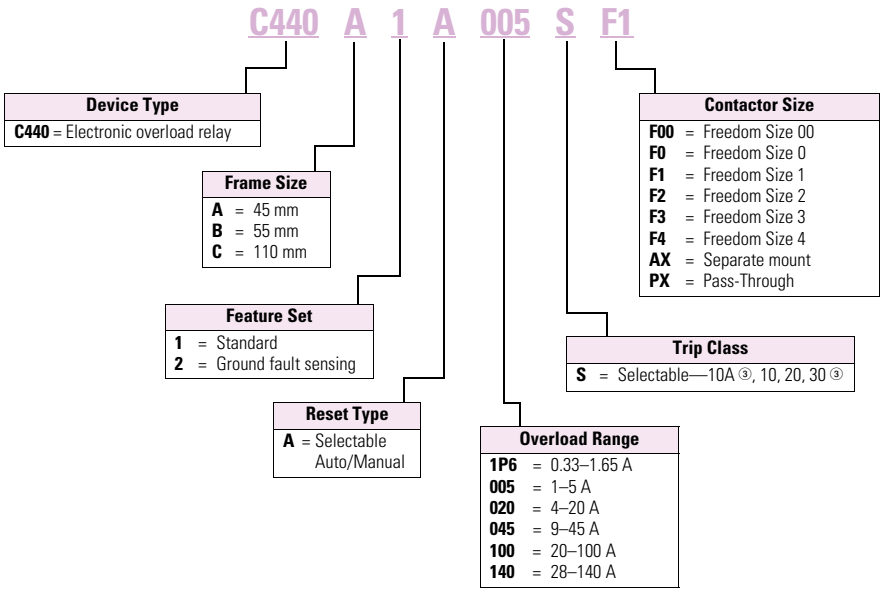
Description	Definition	Cause	Effect if not Protected	C440/*XT* Protection
Motor Protection				
Thermal overload	Overload is a condition in which current draw exceeds 115% of the full load amperage rating for an inductive motor.	• An increase in the load or torque that is being driven by the motor. • 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.
Imbalanced 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 imbalanced.	Imbalanced voltage causes large imbalanced 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 imbalanced 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

XT Electronic Overload Relay—IEC ①



C440 Electronic Overload Relay—NEMA ②



Notes

① See **Page V5-T5-70** for Product Selection.
② See **Page V5-T5-72** for Product Selection.
③ On non-GF version only.

C440 Electronic Overload Relays

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**

45 mm C440 for Separate Mount

C440 Electronic Overload Relays for Separate Mount

Overload Range	Frame Size	Overload Relay Catalog Number	Overload Relay with Ground Fault Catalog Number
0.33–1.65	45 mm	**C440A1A1P6SAX**	**C440A2A1P6SAX**
1–5		**C440A1A005SAX**	**C440A2A005SAX**
4–20		**C440A1A020SAX**	**C440A2A020SAX**
9–45		**C440A1A045SAX**	**C440A2A045SAX**
20–100	55 mm	**C440B1A100SAX**	**C440B2A100SAX**
28–140	110 mm	**C440C1A140SAX**	**C440C2A140SAX**

C440 Electronic Overload Relays for Pass-Through Design

Overload Range	Frame Size	Overload Relay Catalog Number	Overload Relay with Ground Fault Catalog Number
28–140	110 mm	**C440C1A140SPX**	**C440C2A140SPX**
35–175		**XTOE175GCSP**	**XTOE175GGSP**

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.

Technical Data and Specifications

Electronic Overload Relays up to 1500 A

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			
	0.33–1.65 A 1–5 A 4–20 A 9–45 A	20–100 A	28–140 A (NEMA) 35–175 A (IEC)
Use with Contactors			
XT IEC frames	B, C, 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
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 1500 A, continued

Description	Specification 45 mm	55 mm	110 mm
Auxiliary and Control Circuit Ratings			
Conventional thermal continuous current	5 A	5 A	5 A
Rated operational current—IEC AC-15			
Make contact (1800 VA)			
120 V	15 A	15 A	15 A
240 V	15 A	15 A	15 A
415 V	0.5 A	0.5 A	0.5 A
500 V	0.5 A	0.5 A	0.5 A
Break contact (180 VA)			
120 V	1.5 A	1.5 A	1.5 A
240 V	1.5 A	1.5 A	1.5 A
415 V	0.9 A	0.9 A	0.9 A
500 V	0.8 A	0.8 A	0.8 A
IEC DC-13 (L/R F 15 ms1)			
0–250 V	1.0 A	1.0 A	1.0 A
Rated operational current—UL B600			
Make contact (3600 VA)			
120 V	30 A	30 A	30 A
240 V	15 A	15 A	15 A
480 V	7.5 A	7.5 A	7.5 A
600 V	6 A	6 A	6 A
Break contact (360 VA)			
120 V	3 A	3 A	3 A
240 V	1.5 A	1.5 A	1.5 A
480 V	0.75 A	0.75 A	0.75 A
600 V	0.6 A	0.6 A	0.6 A
R300—Vdc ratings (28 VA)			
0–120 V	0.22 A	0.22 A	0.22 A
250 V	0.11 A	0.11 A	0.11 A
Short-Circuit Rating without Welding			
Maximum fuse	6 A gG/gL	6 A gG/gL	6 A 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	2000 m	2000 m	2000 m
Shock (IEC 600068-2-27)	15 g any direction	15 g any direction	15 g any direction
Vibration (IEC 60068-2-6)	3 g any direction	3 g any direction	3 g 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

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	600 V (kA)	Maximum Fuse Size (A) (RK5)	Maximum Breaker Size (A)	480 V (kA)	600 V (kA)	Maximum Fuse Size	480 V (kA)	600 V (kA)	Maximum Breaker Size
0.33–1.65A	600 Vac	1	6	15	—	—	—	—	—	—
1–5 A	600 Vac	5	20	20	100	100	30	100	35	20
4–20 A	600 Vac	5	80	80	100	100	100	100	35	80
9–45 A	600 Vac	5	175	175	100	100	100	100	35	100/175 (480/600)
20–100 A	600 Vac	10	400	400	100	100	200	150	35	250/400 (480/600)
28–140 A	600 Vac	10	450	500	100	100	400	100	65	400
35–175 A	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 Fuses (RK5, J, CC)			Thermal-Magnetic Circuit Breakers		
NEMA Size	Maximum Operating Voltage	480 V	600 V	Maximum Fuse Size	480 V	600 V	Maximum Breaker Size
00	0.33–1.65 A	100	100	30	—	—	—
	1–5 A	100	100	30	100	35	35
	4–20 A	100	100	30	100	35	35
0	0.33–1.65 A	100	100	60	—	—	—
	1–5 A	100	100	60	100	35	70
	4–20 A	100	100	60	100	35	70
1	0.33–1.65 A	100	100	100	—	—	—
	1–5 A	100	100	100	100	35	100
	4–20 A	100	100	100	100	35	100
	9–45 A	100	100	100	100	35	100
2	1–5 A	100	100	100	100	35	175
	4–20 A	100	100	100	100	35	175
	9–45 A	100	100	100	100	35	175
3	20–100 A	100	100	200	50	50	250
4	28–140 A	100	100	400	100	65	300

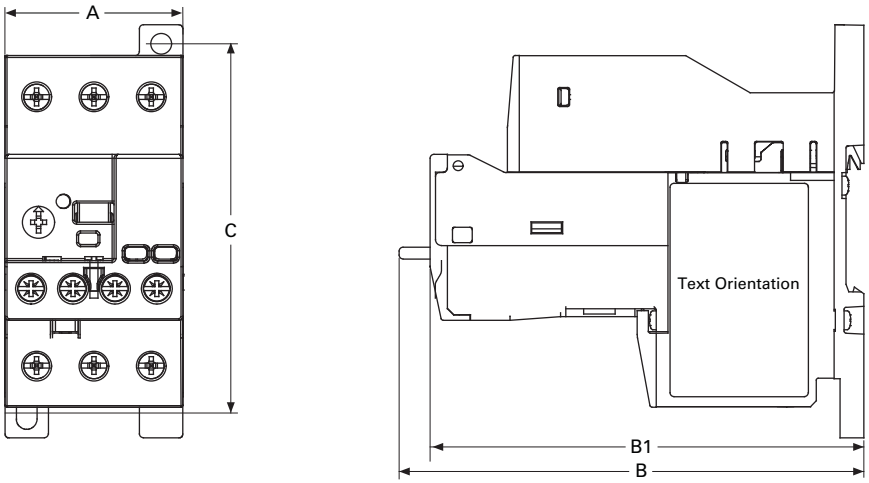
IEC *XT* Starters with *XT* Electronic Overload Relays

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

Dimensions

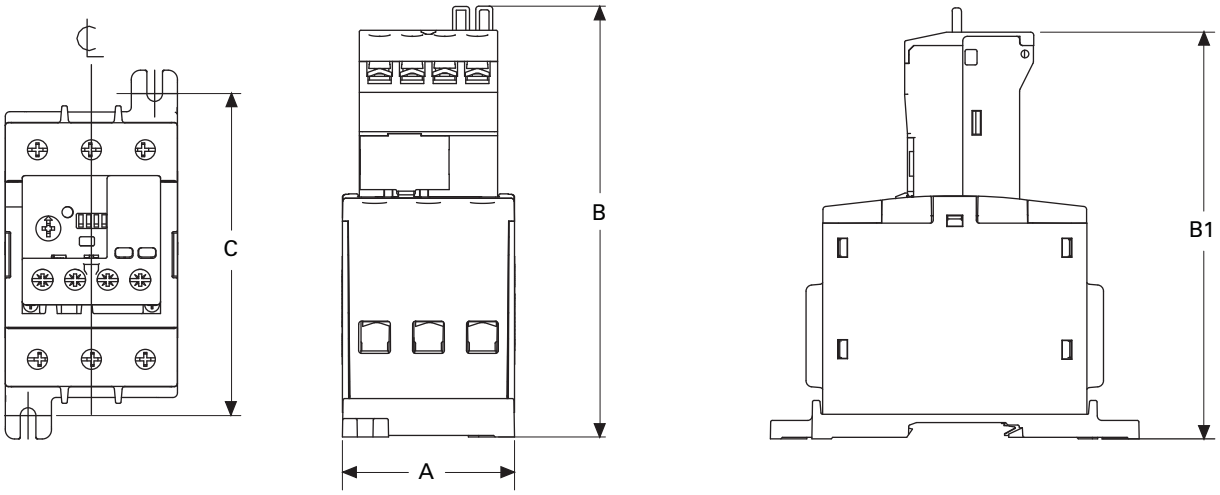
Approximate Dimensions in Inches (mm)

45 mm C440/*XT* Electronic Overload Relays



	Width A	Depth B1	Depth to Reset B	Mounting Hole (Height) C
NEMA Starter Size				
00–2	1.80 (45.0)	4.32 (109.7)	4.63 (117.5)	—
***XT* IEC Frame Size**				
B, C, D	1.80 (45.0)	4.32 (109.7)	4.30 (109.2)	—
Standalone				
0.35–45 A	1.80 (45.0)	4.32 (109.7)	4.63 (117.5)	3.68 (93.5)

55 mm C440/*XT* Electronic Overload Relays



	Width A	Depth to Reset B	Depth B1	Mounting Hole (Height) C
NEMA Starter Size				
3	2.21 (55.0)	5.52 (140.2)	5.21 (132.4)	4.13 (104.8)
***XT* IEC Frame Size**				
D, F, G	2.21 (55.0)	5.52 (140.2)	5.21 (132.4)	4.13 (104.8)
Standalone				
20–100 A	2.21 (55.0)	5.52 (140.2)	5.21 (132.4)	4.13 (104.8)