

XTOE/XT Electronic Overload Relay



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.

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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



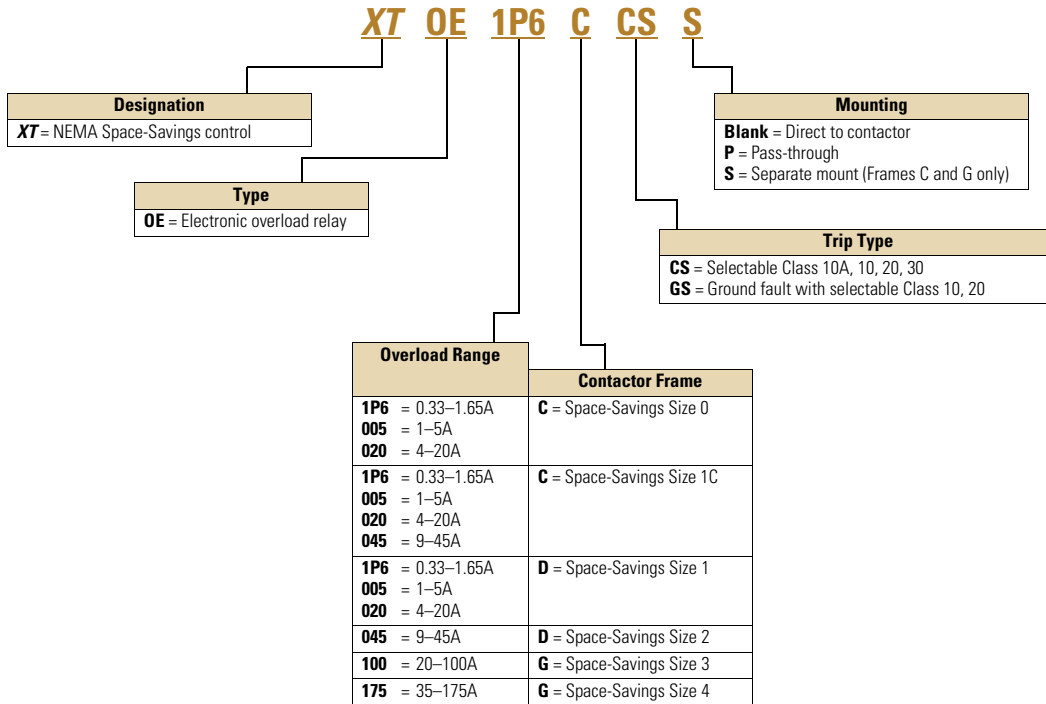
Electronic Overload Education

| 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. | <ul style="list-style-type: none"> • 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. | <ul style="list-style-type: none"> • 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. | <ul style="list-style-type: none"> • 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

2

XT Electronic Overload Relay—NEMA Space-Savings



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 | 45 mm | NO-NC | XTOE1P6CCS |
| | | 1–5 | | | | XTOE005CCS |
| | | 4–20 | 2 4 6 98 96 | | | XTOE020CCS |
| 1C | CN13CN010_ | 0.35–1.65 | 97 95 | 45 mm | NO-NC | XTOE1P6CCS |
| | | 1–5 | | | | XTOE005CCS |
| | | 4–20 | 2 4 6 98 96 | | | XTOE020CCS |
| | | 9–45 | | | | XTOE045CCS |
| 1 | CN13DN000_ | 1–5 | 97 95 | 55 mm | NO-NC | XTOE005DCS |
| | | 4–20 | | | | XTOE020DCS |
| | | 9–45 | 2 4 6 98 96 | | | XTOE045DCS |
| 2 | CN13GN000_ | 9–45 | 97 95 | 55 mm | NO-NC | XTOE045DCS |
| | | 20–100 | | | | XTOE100DCS |
| 3 | CN13KN000_ | 20–100 | 97 95 | 55 mm | NO-NC | XTOE100GCS |
| 4 | CN13MN000_ | 35–175 | 97 95 | 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 | 45 mm | NO-NC | XTOE1P6CGS |
| | | 1–5 | | | | XTOE005CGS |
| | | 4–20 | 2 4 6 98 96 | | | XTOE020CGS |
| 1C | CN13CN010_ | 0.33–1.65 | 97 95 | 45 mm | NO-NC | XTOE1P6CGS |
| | | 1–5 | | | | XTOE005CGS |
| | | 4–20 | 2 4 6 98 96 | | | XTOE020CGS |
| | | 9–45 | | | | XTOE045CGS |
| 1 | CN13DN000_ | 0.33–1.65 | 97 95 | 55 mm | NO-NC | XTOE1P6DGS |
| | | 1–5 | | | | XTOE005DGS |
| | | 4–20 | 2 4 6 98 96 | | | XTOE020DGS |
| | | 9–45 | | | | XTOE045DGS |
| 2 | CN13GN000_ | 9–45 | 97 95 | 55 mm | NO-NC | XTOE045DGS |
| | | 20–100 | | | | XTOE100DGS |
| 3 | CN13KN000_ | 20–100 | 97 95 | 55 mm | NO-NC | XTOE100GGS |
| 4 | CN13MN000_ | 35–175 | 97 95 | 110 mm | NO-NC | XTOE175GGS |

2.2

NEMA Contactors and Starters

Space-Savings Series

2

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 | Overload Relay with Ground Fault 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 | XTOE005CGSS |

45 mm XT for Separate Mount



XT Electronic Overload Relays for Separate Mount

| 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 | 1 3 5 97 95 | ZEB32-1,65/KK | XTOE1P6CCSS | XTOE1P6CGSS |
| 1-5 | | | ZEB32-5/KK | XTOE005CCSS | XTOE005CGSS |
| 4-20 | | 2 4 6 98 96 | 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 | 1 3 5 97 95 | ZEB150-175/PT | XTOE175GCSP | XTOE175GGSP |

Accessories

CT Kits

Accessories

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

Communication

The XTOE is provided with two levels of communication capability.

Basic Communication via Expansion Module—Monitoring Only

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



Basic Communication—Modbus

Advanced Communication—Monitoring and Control

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

An expansion module (mentioned earlier) combined with a communication adapter and a communication module allows easy integration onto the customer’s network. See figure below.



Advanced Communication—Communication Adapter with Communication Module

Advanced Communication—Communication Module

The communication adapter comes standard with four inputs and two outputs (24 Vdc or 120 Vac) while providing the customer with flexible mounting options (DIN rail or panel). See figure below,

Note

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

2.2

NEMA Contactors and Starters



Space-Savings Series

2

The following information can be viewed using the communication option:

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

Communication Accessories

| | Description | Catalog Number |
|--|--|-----------------------|
| Expansion Module | Expansion module (Remote Reset/Modbus RTU, RS-485 Communication) | C440-XCOM |
|  | | |
| Communication Adapter | Communication adapter kit (DIN C Panel mounted adapter, required for advance communication option) | C440-COM-ADP ① |
|  | | |
| | DeviceNet communication module kit—120V I/O (consists of C440-XCOM + C441K + C440-COM-ADP) | C440-DN-120 |
| | DeviceNet communication module kit—24 Vdc I/O (consists of C440-XCOM + C441L + C440-COM-ADP) | C440-DN-24 |
| | PROFIBUS communication module kit—120V I/O (consists of C440-XCOM + C441S + C440-COM-ADP) | C440-DP-120 |
| | PROFIBUS communication module kit—24V I/O (consists of C440-XCOM + C441Q + C440-COM-ADP) | C440-DP-24 |
| | Modbus communication module kit—120V I/O (consists of C440-XCOM + C441N + C440-COM-ADP) | C440-MOD-120 |
| | Modbus communication module kit—24 Vdc I/O (consists of C440-XCOM + C441P + C440-COM-ADP) | C440-MOD-24 |
| | Modbus TCP/Ethernet IP communication module kit—120V I/O (consists of C440-XCOM + C441U) | C440-ET-120 |
| | Modbus TCP/Ethernet IP communication module kit—24V I/O (consists of C440-XCOM + C441V) | C440-ET-24 |

Note

① C440-COM-ADP Din C Panel adapter not required for ModbusTCP / EtherNet/IP communication module.

Modbus Communication Module

The Modbus module combined with an expansion module and a communication adapter provide Modbus communication capability to the XTOE electronic overload relay.



**Modbus
Communication Module**

Features and Benefits

- The Modbus communication module is capable of baud rates up to 115K
- The Modbus address and baud rate configuration can be easily changed using the HMI user interface
- Modbus address and baud rate are set via convenient DIP switches; LEDs are provided to display Modbus traffic
- Configuration with common Modbus configuration tools
- Terminals
 - Unique locking mechanism provides for easy removal of the terminal block with the field wiring installed
 - Each terminal is marked for ease of wiring and troubleshooting
- Selectable I/O assemblies
 - 4IN/2OUT
 - Signal types include 24 Vdc I/O and 120 Vac I/O
- Each I/O module is optically isolated between the field I/O and the network adapter to protect the I/O and communication circuits from possible damage due to transients and ground loops
- Input Module features a user-definable input debounce, which limits the effects of transients and electrical noise
- Output Module supports a user-definable safe state for loss of communication; hold last state, ON or OFF

DeviceNet Communication Modules

The DeviceNet Communication Module provides monitoring and control for the XTOE overload relay from a single DeviceNet node. These modules also offer convenient I/O in two voltage options, 24 Vdc and 120 Vac.



**DeviceNet
Communication Module**

Features and Benefits

- Communication to DeviceNet uses only one DeviceNet MAC ID
- Configuration
 - DeviceNet MAC ID and Baud rate are set via convenient DIP switches with an option to set from the network
 - Advanced configuration available using common DeviceNet tools
- Terminals
 - Unique locking mechanism provides for easy removal of the terminal block with the field wiring installed
 - Each terminal is marked for ease of wiring and troubleshooting
- Selectable I/O assemblies
 - 4IN/2OUT
 - Signal types include 24 Vdc I/O and 120 Vac I/O
- Each I/O module is optically isolated between the field I/O and the network adapter to protect the I/O and communication circuits from possible damage due to transients and ground loops
- Input Module features a user-definable input debounce, which limits the effects of transients and electrical noise
- Output Module supports a user-definable safe state for loss of communication; hold last state, ON or OFF
- Combined status LED

PROFIBUS Communication Modules

The PROFIBUS module combined with an expansion module and a communication adapter provide Modbus communication capability to the XTOE electronic overload relay.



**PROFIBUS
Communication Module**

Features and Benefits

- The PROFIBUS communication module is capable of baud rates up to 12 Mb
- PROFIBUS address is set via convenient DIP switches; LEDs are provided to display PROFIBUS status
- Intuitive configuration with common PROFIBUS configuration tools
- Terminals
 - Unique locking mechanism provides for easy removal of the terminal block with the field wiring installed
 - Each terminal is marked for ease of wiring and troubleshooting
- Selectable I/O assemblies
 - 4IN/2OUT
 - Signal types include 24 Vdc I/O and 120 Vac I/O
- Each I/O module is optically isolated between the field I/O and the network adapter to protect the I/O and communication circuits from possible damage due to transients and ground loops
- Input Module features a user-definable input debounce, which limits the effects of transients and electrical noise
- Output Module supports a user-definable safe state for loss of communication; hold last state, ON or OFF

Modbus TCP / EtherNet/IP Communication Modules

The Ethernet module combines user selectable Modbus TCP and EtherNet/IP protocols in a single device. A communication adapter is not required for this module as it is designed for DIN/ Panel-Mounting. Combined with an expansion module, Modbus TCP and EtherNet/IP capability are added to the XTOE overload relay.



**Modbus TCP / EtherNet/IP
Communication Module**

Features and Benefits

- Supports EtherNet/IP Protocol
- Supports Modbus TCP Protocol
- Integrated web page for device monitoring and configuration
- Dual Ethernet ports with integrated switch
- Can simultaneously support data access from EtherNet/IP originators and Modbus TCP clients

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

Communication Modules

2

| Description | Modbus | DeviceNet | PROFIBUS | Ethernet |
|--|--|--|--|--|
| Electrical/EMC | | | | |
| Radiated emissions IEC 60947-4-1—Table 15, EN 55011 (CISPR 11) Group 1, Class A | 30–1000 MHz | 30–1000 MHz | 30–1000 MHz | 30–1000 MHz |
| Conducted emissions IEC 60947-4-1—Table 14, EN 55011 (CISPR 11) Group 1, Class A | 0.15–30 MHz | 0.15–30 MHz | 0.15–30 MHz | 0.15–30 MHz |
| ESD immunity IEC 60947-4-1 (Table 13) | ±8 kV air, ±4 kV contact | ±8 kV air, ±4 kV contact | ±8 kV air, ±4 kV contact | ±8 kV air, ±4 kV contact |
| Radiated immunity IEC 60947-4-1 | 10 V/m 80–1000 MHz 80% amplitude modulated 1 kHz sine wave | 10 V/m 80–1000 MHz 80% amplitude modulated 1 kHz sine wave | 10 V/m 80–1000 MHz 80% amplitude modulated 1 kHz sine wave | 10 V/m 80–1000 MHz 80% amplitude modulated 1 kHz sine wave |
| Conducted immunity IEC 60947-4-1 | 140 dBuV (10V rms) 150 kHz–80 MHz | 140 dBuV (10V rms) 150 kHz–80 MHz | 140 dBuV (10V rms) 150 kHz–80 MHz | 140 dBuV (10V rms) 150 kHz–80 MHz |
| Fast transient immunity IEC 60947-4-1 (Table 13) IEC 6100-4-4 | ±2 kV using direct method | ±2 kV supply and control, ±1 kV communication | ±2 kV supply and control, ±1 kV communication | ±2 kV supply and control, ±1 kV communication |
| Surge immunity IEC 60947-4-1 (Table 13) IEC 61000-4-5 Class 3 | User IO and communication lines ^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 60068-2-27) | 15G any direction | 15G any direction | 15G any direction | 15G any direction |
| Vibration (IEC 60068-2-6) | 3G any direction | 3G any direction | 3G any direction | 3G any direction |
| Pollution degree per IEC 60947-1 | 3 | 3 | 3 | 3 |
| Degree of protection | IP20 | IP20 | IP20 | IP20 |
| Overvoltage category per UL 508 | III | III | III | III |
| 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.

2.2

NEMA Contactors and Starters

Space-Savings Series

2

Short Circuit Ratings (North America CSA, cUL)

Changes to UL 508A and NEC in recent years have brought a focus to control panel safety with regard to short-circuit current ratings (SCCR). Eaton's 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)

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

NEMA Space-Savings Starters with XTOE Electronic Overload Relays

| Contactor Frame Size | Overload FLA Range | High-Fault Short Circuit Data Fuses (RK5, J, CC) | | | Thermal-Magnetic Circuit Breakers | | |
|----------------------|--------------------|--|------|-------------------|-----------------------------------|------|--------------------------------|
| | | 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–D

| Description | CN13B_ NEMA Size 0 | CN13C_ NEMA Size 1C | CN13D_ 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 | 0.8–1.1 |
| DC operated | 0.7–1.2 ^① | 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 | 0.3–0.6 |
| DC operated | 0.15–0.6 | 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 | 149 |
| Pickup W | 40 | 40 | 80 | 80 |
| Sealing VA | 7.1 | 7.1 | 16 | 16 |
| Sealing W | 2.1 | 2.1 | 4.3 | 4.3 |
| Single-voltage coil 60 Hz | | | | |
| Pickup VA | 67 | 67 | 178 | 178 |
| Pickup W | 50 | 50 | 117 | 117 |
| Sealing VA | 8.7 | 8.7 | 19 | 19 |
| Sealing W | 2.6 | 2.6 | 5.3 | 5.3 |
| 50/60 Hz | | | | |
| Pickup VA | 62 | 62 | 168 | 168 |
| | 58 | 58 | 154 | 154 |
| Pickup W | 48 | 48 | 120 | 120 |
| | 43 | 43 | 43 | 43 |
| Sealing VA | 9.1 | 9.1 | 22 | 22 |
| | 6.5 | 6.5 | 14 | 14 |
| Sealing W | 2.5 | 2.5 | 5.3 | 5.3 |
| | 2 | 2 | 4.3 | 4.3 |
| DC operated | | | | |
| Pickup W | 12 at 24V | 12 at 24V | 24 at 24V | 24 at 24V |
| Sealing W | 0.5 at 24V | 0.5 at 24V | 0.5 at 24V | 0.5 at 24V |
| Duty factor (%DF) | 100 | 100 | 100 | 100 |
| Switching Time at 100% U_c (Approximate Values) | | | | |
| Main contact | | | | |
| AC operated | | | | |
| Closing delay (ms) | <22 | <22 | <18 | <18 |
| Opening delay (ms) | <14 | <14 | <13 | <13 |
| DC operated | | | | |
| Closing delay (ms) | <47 | <47 | <54 | <54 |
| Opening delay (ms) | <30 | <30 | <24 | <24 |
| Arcing time (ms) | 10 | 10 | 10 | 10 |
| Electromagnetic Compatibility (EMC) | | | | |
| Emitted interference | To EN-60947-1 | 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 | 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 F–G

| Description | CN13K_ NEMA Size 3 | CN13M_ NEMA Size 4 |
|--|-----------------------|-----------------------|
| Voltage Tolerance | | |
| Pickup ($\times U_c$) | | |
| AC operated | 0.8–1.1 | 0.8–1.1 |
| DC operated | 0.7–1.2 ^① | 0.7–1.2 ^① |
| Dropout ($\times U_c$) | | |
| 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 $\times U_c$ | | |
| 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—Frames L–R

| Description | CN13S_ NEMA Size 5 |
|---|--|
| Voltage Tolerance | |
| Pickup ($\times U_c$) | |
| XTCE185L–XTCEC20R | $0.7 \times U_{cmin} - 1.15 \times U_{cmax}$ |
| XTCS185L–XTCS500M | $0.85 \times U_{cmin} - 1.1 \times U_{cmax}$ |
| Dropout ($\times U_c$) | |
| XTCE185L–XTCEC20R | $0.2 \times U_{cmin} - 0.6 \times U_{cmax}$ |
| XTCS185L–XTCS500M | $0.2 \times U_{cmin} - 0.4 \times U_{cmax}$ |
| Power Consumption of the Coil at Cold State and 1.0 $\times U_c$ | |
| XTCE185L–XTCEC20R | |
| Pickup VA | 250 ^② |
| Pickup W | 200 |
| Sealing VA | 4.3 |
| Sealing W | 3.3 |
| XTCS185L–XTCS500M | |
| Pickup VA | 360 |
| Pickup W | 325 |
| Sealing VA | 4.3 |
| Sealing W | 3.3 |
| Duty factor (%DF) | 100 |
| Switching Time at 100% Main Contact U_c (Approximate Values) | |
| XTCE185L–XTCEC20R | |
| Closing delay (ms) | <100 |
| Opening delay (ms) | <80 |
| XTCS185L–XTCS500M | |
| Closing delay (ms) | <50 |
| Opening delay (ms) | <40 |
| Reaction in Threshold and Sealing State Transition Range (XTCE185L–XTCEC20R) | |
| Voltage interruptions | |
| $(0 - 0.2 \times U_{cmin}) \leq 10$ ms | Time is bridged successfully |
| $(0 - 0.2 \times U_{cmin}) > 10$ ms | Dropout of the contactor |
| Voltage dips | |
| $(0.2 - 0.6 \times U_{cmin}) \leq 12$ ms | Time is bridged successfully |
| $(0.2 - 0.6 \times U_{cmin}) > 12$ ms | Dropout of the contactor |
| $(0.6 - 0.7 \times U_{cmin})$ | Contactor remains switched on |
| Excess voltage | |
| $(1.15 - 1.3 \times U_{cmax})$ | Contactor remains switched on |
| $(> 1.3 \times U_{cmax}) \leq 3$ s | Contactor remains switched on |
| $(> 1.3 \times U_{cmax}) > 3$ s | Dropout of the contactor |
| Pickup phase | |
| $(0 - 0.7 \times U_{cmin})$ | Contactor does not switch on |
| $(0.7 \times U_{cmin} - 1.15 \times U_{cmax})$ | Contactor switches on with certainty |
| $(> 1.15 \times U_{cmax})$ | 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 $U_k \leq 6\%$.

Current Heat Loss (Three-Pole) in Watts

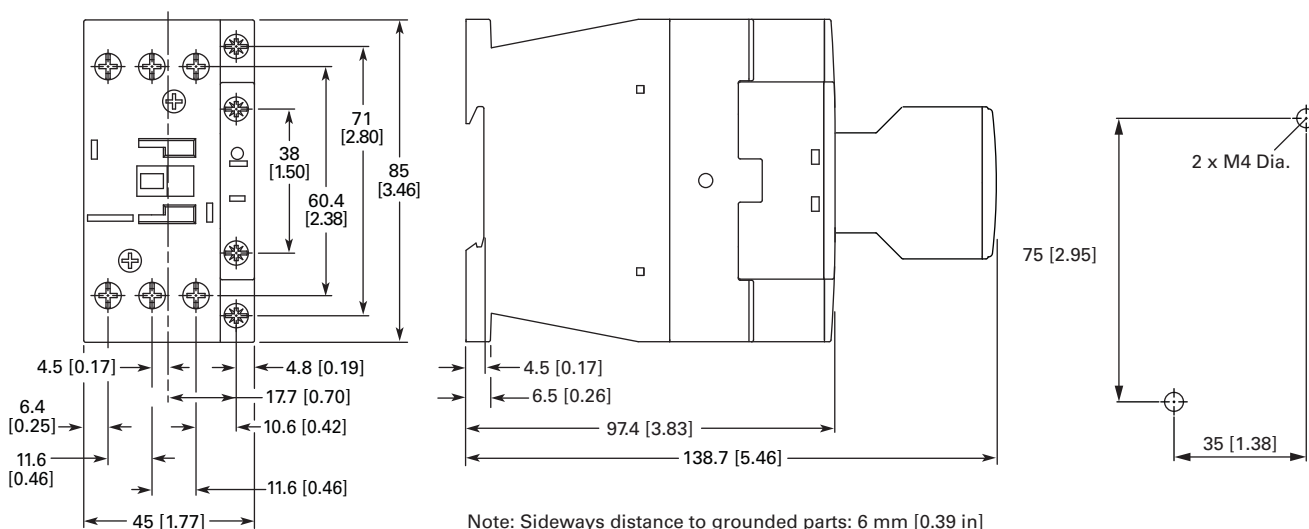
| Description | CN13BN0_ | CN13CN0_ | CN13DN0_ | CN13GN0_ | CN13KN0_ | CN13MN0_ |
|---|----------|----------|----------|----------|----------|----------|
| Current heat loss (three-pole) in watts | | | | | | |
| at I_{th} | 7.3 | 12.1 | 11.3 | 28.8 | 20.3 | 30.7 |
| at I_b to AC-3/400V | 1.9 | 6.1 | 7.2 | 19 | 15.9 | 27.0 |
| Impedance per pole, megohms | 2 | 2 | 1.5 | 1.5 | 0.4 | 0.4 |

Dimensions

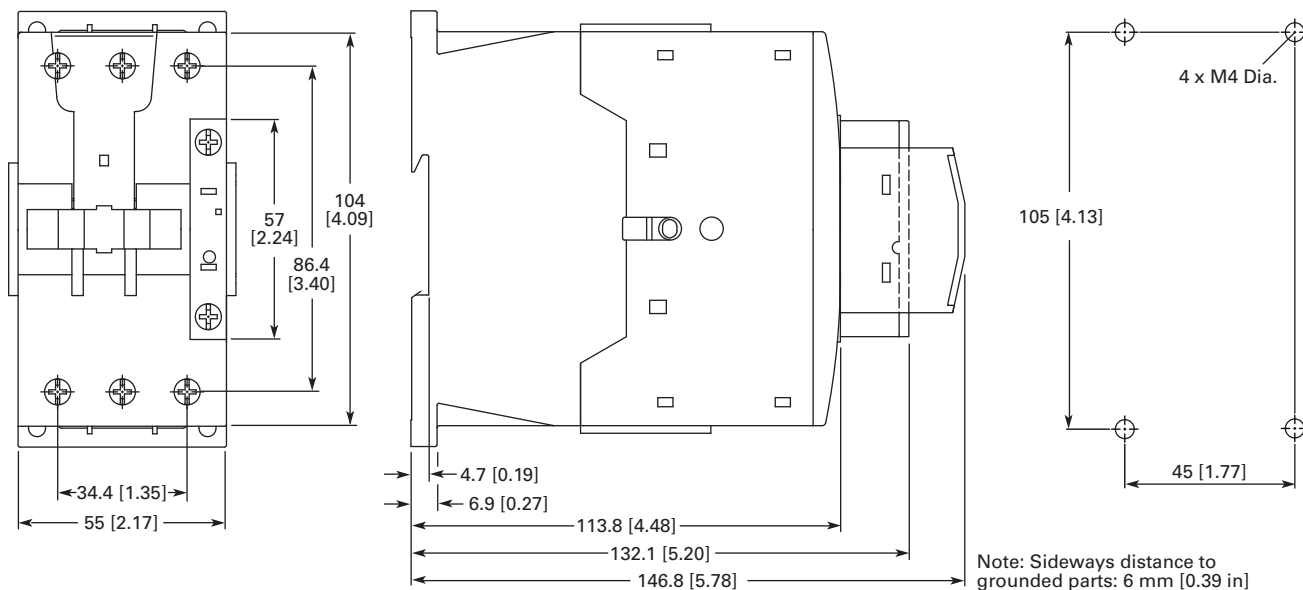
Approximate Dimensions in mm [in]

Contactors

Type CN13 NEMA Size 0 and 1C



Type CN13 NEMA Size 1 and 2



2.2

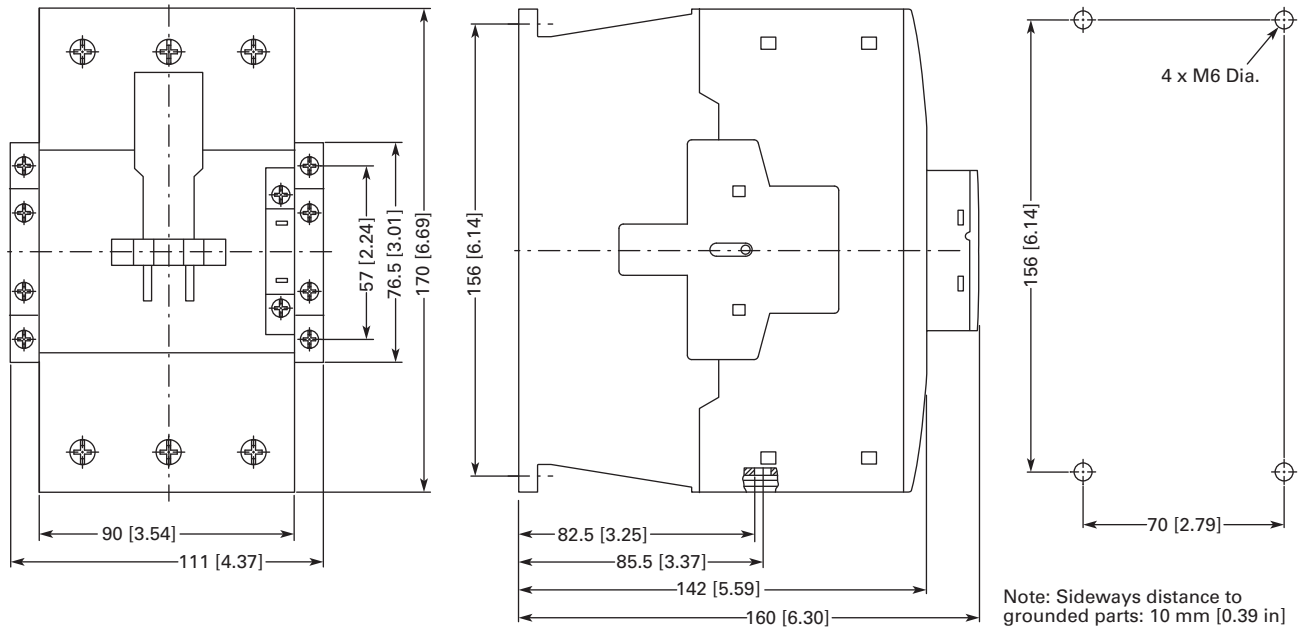
NEMA Contactors and Starters

Space-Savings Series

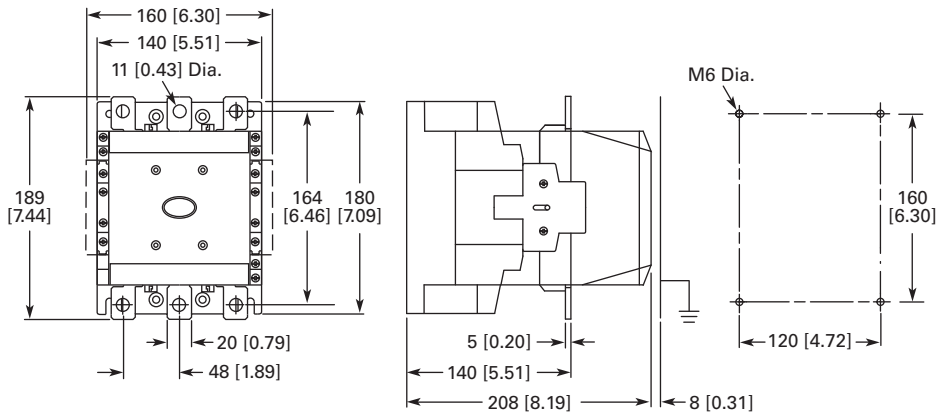
Approximate Dimensions in mm [in]

2

Type CN13 NEMA Size 3 and 4



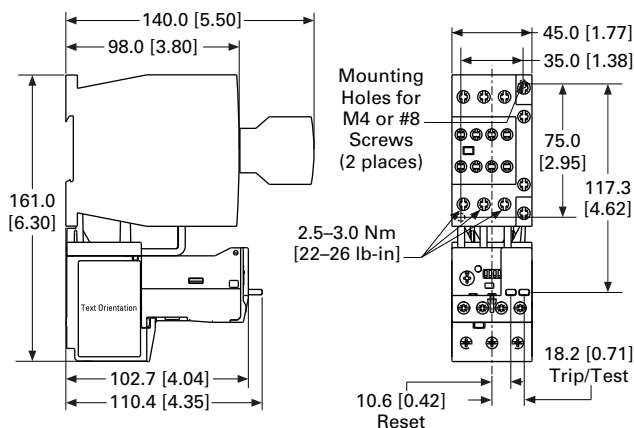
Type CN13 NEMA Size 5



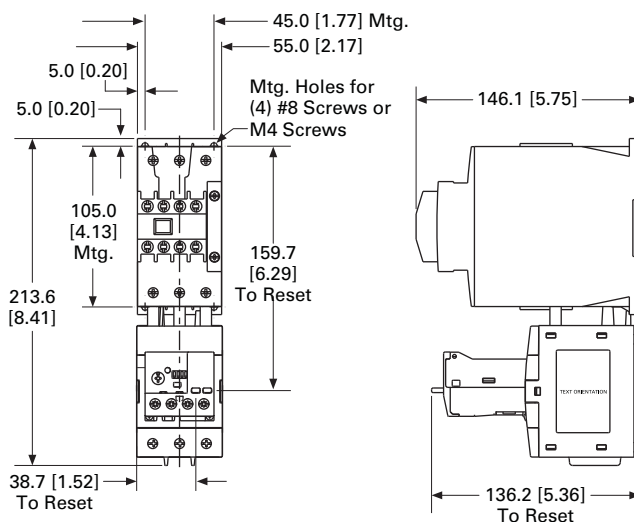
Approximate Dimensions in mm [in]

XTAE Starters with XTOE Overload Relay

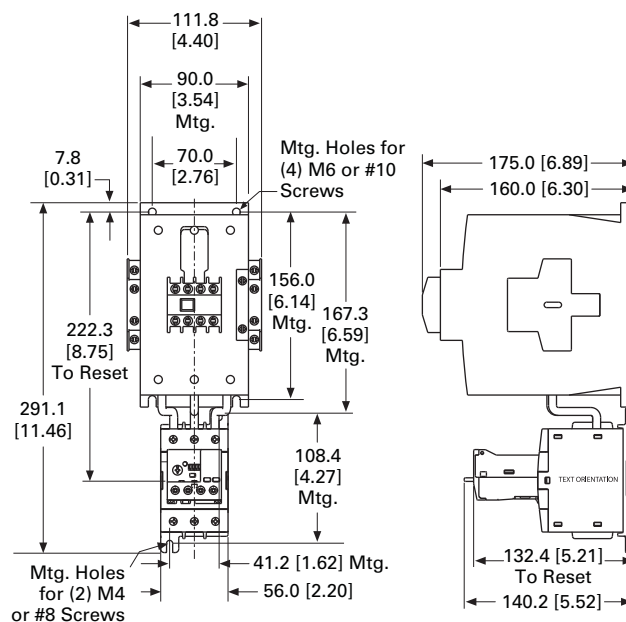
Type AN13 NEMA Size 0 and 1C



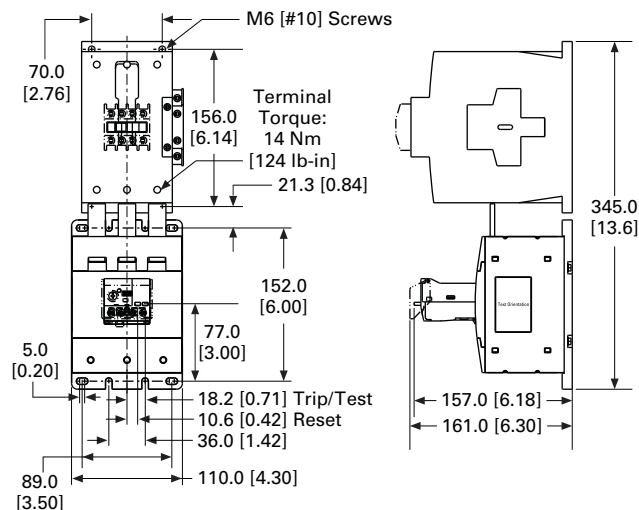
Type AN13 NEMA Size 1 and 2



Type AN13 NEMA Size 3



Type AN13 NEMA Size 4



2.2

NEMA Contactors and Starters

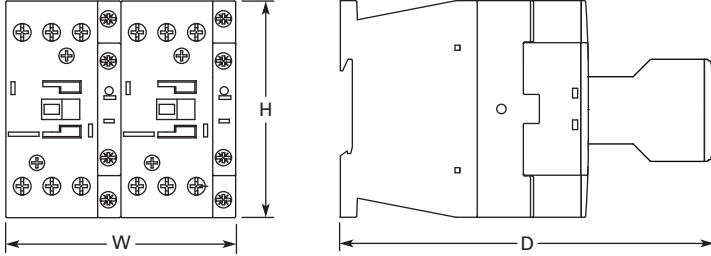
Space-Savings Series

Approximate Dimensions in mm [in]

2

Reversing Contactors

Type CN53 Size 0, 1C, 1 and 2



Size 0 and 1C

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

Size 1 and 2

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

Type CN53 Size 3 and 4

