**Power Xpert C445 Motor Management Relay**


## Contents



## Power Xpert C445 Motor Management Relay

### Product Description

The Power Xpert® C445 global motor management relay is Eaton's newest addition to the C400 series of advanced motor protection. The Power Xpert C445 is fully configurable, providing the highest level of monitoring accuracy and protection for the entire power system—from the incoming power source feeding the motor all the way to the individual pump or load. By utilizing integrated power quality and energy usage analytics along with built-in efficiency algorithms, users can save significant energy costs through increased awareness of energy usage at the individual load level.

Due to its unrivaled compact size and modular format, the Power Xpert C445 allows for simple integration into NEMA and IEC Motor Control Center platforms as well as OEM control panels. Based on this smaller size, users can reduce costs and improve system flexibility through simplified wiring, smaller enclosure footprint and seamless field modifications as systems evolve over time. By separating the monitoring and control functionality into separate modules, users can easily customize the Power Xpert C445 mounting configuration to match their individual applications.

The Power Xpert C445 global motor management relay was designed with user safety in mind. Users can access, monitor and configure data parameters within the device without opening the panel door via a variety of communication network options or a micro USB port on the front of the user interface. To configure the Power Xpert C445, users can utilize Eaton's Power Xpert *in*Control programming software. In addition to this software tool, the Power Xpert C445 can be easily integrated into a variety of PLC and DCS systems through integrated communication protocols including Modbus Serial, PROFIBUS, Modbus TCP and EtherNet/IP.

## Features and Benefits

### *Features*

**Product Range**

- 0.3–800 A
- Up to 690 Vac
- 4160 Vac with PT ratios
- 20–80 Hz operation
- Selectable trip class (5–40)

**Product Hardware**

- Modular design with multiple options:
  - Base control module: protections, monitoring, communications, I/O
  - Measurement module: sensing capability
  - User interface: control and diagnostics
- AC (120/240) or DC (24) control-power options
- 2% monitoring accuracy on current and voltage values
- Standard on-board I/O
  - (4) DI (AC or DC options)
  - (3) Relay out
    - 2 Form A (NO)
    - 1 Form C (NO/NC) latching or non-latching
- Superior motor protection solutions, including:
  - Motor (current)
  - Line (voltage)
  - Load (power)
- Advanced monitoring algorithms
- Pre-configured operation modes
  - Overload only
  - Direct (FVNR)
  - Reverser (FVR)
  - Star/delta
  - Two speed pole changing
  - Two speed Dahlander
  - Auto transformer
  - Solenoid valve
  - HMCP/MCCB actuation
  - Contactor feeder
  - General purpose input/output
- Compact footprint
- Pass-through modular design
- Flexible communication options
  - Modbus Serial
  - Modbus TCP
  - EtherNet/IP
  - PROFIBUS
- Real-time clock and memory backup module
- Integrated USB communication port
- Power Xpert *in*Control software tool
  - Configuration
  - Monitoring
  - Diagnostics

### *Benefits*

**Reliability**

- Advanced diagnostics allow for quick and accurate identification of the root cause of a fault
- Allows for greater system coverage through line-, load- and motor-based protections
- Voltage loss restart functionality allows for automatic revival after outages from voltage loss without the need for user intervention
- On-board I/O meets needs of most communication requirements without the need for additional modules
- Seamless integration into EtherNet/IP networks via EIP-Assist tool
- Pre-programmed operation modes support fast, easy installation for most applications
- MTBF 20 years at 50 °C

**Flexibility**

- Modular format with scalable options allows for customization to exact needs of application
- Widest range of communication options for easy integration into majority of PLC/DCS systems
- Fully programmable output relays
- Fully programmable trip and alarm thresholds and time delays

## Standards and Certifications

- CE, UL, CSA
- IEC EN 60947-4-1
- ATEX 95

## System Overview

The Power Xpert C445 Motor Management Relay is a solid-state based electronic overload device designed to protect single- or three-phase AC electric induction motors from 0.3 to 800 A. The C445 provides intelligent monitoring, protection and efficiency calculations for motor, load and line conditions. It's ideal for oil and gas, water treatment, mining, utility and industrial motor control applications. The C445 offers a modular pass-through design, breaking the sensing, protection, and control into separate modules. This allows the user to select the appropriate options for each module and combine them to meet the exact needs of their application. Together, these modules provide a fully configurable and industry-leading intelligent motor protection solution for the entire system.



### *Base Control Module*

The base control module is the core of the C445 system, providing the various monitoring, protection and control algorithms. Equipped with native I/O connections, communication card options and USB connectivity, the base control module provides users with real-time data on the health and status of their application. Various pre-configured operation modes are available that simplify the wiring and logic requirements for the user.

### *Measurement Module*

The measurement module is a pass-through device that samples current and voltage data consumed by the system. This data is continuously transmitted back to the base control module for analysis. Various frame sizes are available for applications up to 800 A, with voltage measurement and positive temperature coefficient (PTC) protection options.

### *User Interface*

The user interface provides local motor control and status indication that can be operated from outside of the system's enclosure. An external micro USB connection allows for device commissioning, configuration and monitoring. Various overlay options are available to match the specific operation mode of the application. Two color schemes are available for NEMA (English) or IEC (symbols) based applications.

## Protection Summary ①

### Current-Based Protection Summary

| | | | Trip | | | | Alarm | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Trip | Alarm | Level Range | Default Level | Delay Range (Seconds) | Default Level (Seconds) | Level Range | Default Level | Delay Range (Seconds) | Default Level (Seconds) |
| Thermal overload | X | X | 0.3–800 A | Low end of FLA range | Trip Class 5–40 | Trip Class 5 | 1–100% | 90% | Instantaneous | Instantaneous |
| Instantaneous overcurrent | X | X | 50–400% FLA | 400% | 0.001–2.000 | 2 | 50–400% FLA | 400% | 0.2–5.0 | 2 |
| Jam | X | X | 50–400% FLA | 400% | 1–60 | 10 | 50–400% FLA | 400% | 0.2–5.0 | 2 |
| Stall | X | — | 50–400% FLA | 200% | Instantaneous | Instantaneous | — | — | — | — |
| Undercurrent | X | X | 10–90% FLA | 50% | 1–60 | 20 | 10–90% FLA | 50% | 0.2–5.0 | 2 |
| Current unbalance | X | X | 1–60% | 15% | 1–60 | 15 | 1–60% | 15% | 0.2–5.0 | 2 |
| Current phase loss | X | — | 60% | 60% | 2 | 2 | — | — | — | — |
| Ground (earth) fault | X | X | ② | ② | 1–60 | 5 | ② | ② | 0.2–5.0 | 2 |
| PTC (requires option) | X | X | Overtemperature<br>Shorted<br>Open | OFF | — | — | Overtemperature<br>Shorted<br>Open | OFF | — | — |

### Voltage-Based Protection Summary ③

| | | | Trip | | | | Alarm | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Trip | Alarm | Level Range | Default Level | Delay Range (Seconds) | Default Level (Seconds) | Level Range | Default Level | Delay Range (Seconds) | Default Level (Seconds) |
| Phase rotation | X | — | ABC, ACB | ABC | Instantaneous | Instantaneous | — | — | — | — |
| Voltage phase loss | X | — | 70% | 70% | 2 | 2 | — | — | — | — |
| Overvoltage | X | X | 90–150% | 110% | 1–60 | 20 | 90–150% | 110% | 0.2–5.0 | 2 |
| Undervoltage | X | X | 10–100% | 90% | 1–60 | 20 | 10–100% | 90% | 0.2–5.0 | 2 |
| Voltage unbalance | X | X | 2–20% | 6% | 1–20 | 20 | 1–20% | 6% | 0.2–5.0 | 2 |
| Frequency deviation (slow) | X | X | 0.1–5 Hz | 0.1 Hz | 1–60 | 20 | 0.1–5 Hz | 0.1 Hz | 0.2–5.0 | 2 |
| Frequency deviation (fast) | X | X | 0.02–2 Hz | 0.1 Hz | 0.02–60 | 1 | 0.02–2 Hz | 0.1 Hz | 0.2–5.0 | 2 |

### Power-Based Protection Summary ③

| | | | Trip | | | | Alarm | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Trip | Alarm | Level Range | Default Level | Delay Range (Seconds) | Default Level (Seconds) | Level Range | Default Level | Delay Range (Seconds) | Default Level (Seconds) |
| Low power | X | X | –200 to 200% | 50% | 1–60 | 20 | –200 to 200% | 50% | 1–60 | 2 |
| High power | X | X | –200 to 200% | 110% | 1–60 | 20 | –200 to 200% | 110% | 1–60 | 2 |
| Power factor deviation (low) | X | X | –100 to 100% | 0% | 1–60 | 20 | –100 to 100% | 0 | 1–60 | 2 |
| Power factor deviation (high) | X | X | –100 to 100% | 100% | 1–60 | 20 | –100 to 100% | 100% | 1–60 | 2 |

### Advanced Protection Summary ③

| | | | Trip | | | | Alarm | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Trip | Alarm | Level Range | Default Level | Delay Range (Seconds) | Default Level (Seconds) | Level Range | Default Level | Delay Range (Seconds) | Default Level (Seconds) |
| Voltage loss restart ④ | — | — | — | — | — | — | — | — | — | — |
| Peak demand alarm | — | X | User settable ⑤ | — | — | — | — | — | — | — |

***Notes***

① Not all trips/alarms are enabled by default. Consult C445 user manual for further information.
② Sensing level depends on Measurement Module frame size and amperage range. Consult C445 user manual for further information.
③ Voltage, Power and Advanced Protections require voltage option on the measurement module.
④ Voltage loss restart is a control functionality used for reacceleration schemes after power loss. Consult C445 user manual for further information.
⑤ Consult C445 user manual for further information.

## Monitoring Summary

### Current-Based Monitoring

| Parameter Name | Range / Units | Description |
|---|---|---|
| IA (L1) float | Depends on frame size (amps) | Phase A (L1) motor current; 2% accuracy within 30–125% of FLA |
| IB (L2) float | Depends on frame size (amps) | Phase B (L2) motor current; 2% accuracy within 30–125% of FLA |
| IC (L3) float | Depends on frame size (amps) | Phase C (L3) motor current; 2% accuracy within 30–125% of FLA |
| I Average float | Depends on frame size (amps) | Average motor current; 2% accuracy within 30–125% of FLA |
| I Unbalance percent | 0–100% | Motor current unbalance percent |
| I Average % of FLA (nominal current) | 0–720% of FLA (amps) | Average motor current as a percentage of FLA |
| Maximum start current floating point | Depends on frame size (amps) | Maximum motor starting current |
| Motor residual GF RMS | Depends on frame size (amps), scaled via fieldbus | Motor residual ground fault current RMS; Accuracy meets UL 1053 / IEC Class II-B |

### Voltage-Based Monitoring ①

| Parameter Name | Range / Units | Description |
|---|---|---|
| Voltage AB (L1-L2) | 0–690 V; max. 4,160 V with PT ratios | Supply line-to-line voltage AB (L1-L2); 2% accuracy up to 690 Vac |
| Voltage BC (L2-L3) | 0–690 V; max. 4,160 V with PT ratios | Supply line-to-line voltage BC (L2-L3); 2% accuracy up to 690 Vac |
| Voltage CA (L3-L1) | 0–690 V; max. 4,160 V with PT ratios | Supply line-to-line voltage CA (L3-L1); 2% accuracy up to 690 Vac |
| Average line-to-line voltage | 0–690 V; max. 4,160 V with PT ratios | Supply line-to-line voltage average; 2% accuracy up to 690 Vac |
| Line frequency x 100 | 20–80 Hz (Centi-Hz) | Supply Frequency in centi-Hz |
| Voltage phase order | 0: unknown; 1: ABC (L1-L2-L3); 2: ACB (L1-L3-L2) | Reports phase sequence of the line voltage |
| Voltage unbalance percent | 0–100% | Supply voltage unbalance percentage |

### Power-Based Monitoring ①

| Parameter Name | Range / Units | Description |
|---|---|---|
| Total watts | Depends on frame size (Watts) | Total Real Power; 5% accuracy |
| Total VA | Depends on frame size (Volt-Amps) | Total Apparent Power; 5% accuracy |
| Total VARs | Depends on frame size (VARs) | Total Reactive Power; 5% accuracy |
| Power factor | 0–100%, Scaled by 0.01% via fieldbus | Apparent power factor in percentage; 1% accuracy |
| Motor speed RPM | Depends on motor (RPM) | Motor speed in RPM |
| Motor torque | Depends on motor (Nm) | Motor torque |
| Motor efficiency percent | PC Tool in %, Scaled by 0.01% via fieldbus | Motor efficiency in percentage |
| Real energy | Depends on frame size (0.1 kWh) | Real energy scaled; 5% accuracy |
| Real energy (resettable) | Depends on frame size (0.1 kWh) | Real energy (resettable) scaled; 5% accuracy |
| Apparent energy | Depends on frame size (0.1 kVAh) | Apparent energy scaled; 5% accuracy |
| Apparent energy (resettable) | Depends on frame size (0.1 kVAh) | Apparent energy (resettable) scaled; 5% accuracy |
| Reactive energy | Depends on frame size (0.1 kVARh) | Reactive energy scaled; 5% accuracy |
| Reactive energy (resettable) | Depends on frame size (0.1 kVARh) | Reactive energy (resettable) scaled; 5% accuracy |
| Current demand value | Depends on frame size (Watts) | Latest estimate of the demand; 5% accuracy |
| Demand (resettable) | Depends on frame size (Watts) | Peak demand, user resettable; 5% accuracy |
| Peak demand time stamp | Time in seconds | Peak demand time stamp (in Unix time) |
| Demand window duration | Time in minutes | Demand window duration |

***Note***

① Voltage option must be selected for the measurement module.

## System Monitoring

| Parameter Name | Range / Units | Description |
|---|---|---|
| Motor state (current based) | 0: Stopped; 1: Accelerating; 2: Running | Current Based motor state (independent of command) |
| Motor control status | Various | Present motor control status bits |
| Number of operating seconds | Time in seconds | Number of operating seconds |
| Operating seconds (resettable) | Time in seconds | Number of operating seconds (resettable) |
| Time to trip overload | Time in seconds | Time for overload to reach trip threshold (100%) |
| Time to reset overload | Time in seconds | Time for overload to reach reset threshold (thermal memory must drop below 75%) |
| PTC status | Various | PTC status |
| Digital input status | 0/1 | ON/OFF status of digital inputs |
| Base control module relay status | 0/1 | Base control module relay status (output status) |
| Total motor run time | Time in seconds | Total motor run time in seconds |
| Total motor run time (resettable) | Time in seconds | Total run time user (resettable) |
| Last measured starting time | Time in seconds | The amount of time the motor took to reach up to speed on the last start. |
| Number of starts | Number | Total number of motor starts |
| Number of starts (resettable) | Number | Number of starts (resettable) |
| Number of contactor operations last hour | Number | Number of contactor operations during the last hour |
| Latest run time | Time in seconds | Duration in seconds of the last start-to-stop motor run time |
| Thermal memory percent | 0–250% | Thermal memory in percent—overload trip occurs at 100% |

## Faults and Events

| Parameter Name | Range / Units | Description |
|---|---|---|
| Active fault | Various | Provides reason for trip in form of fault code |
| Active warning | Various | Provides reason for warning in form of fault code |
| Active inhibit | Various | Provides reason for inhibit in form of fault code |
| Fault queue—event order | Various | A list of the last 10 faults shown in the order they occurred. Most recent at top |
| Trip snapshot | Various | Time-stamp log of (12) parameters at time of trip |

## Catalog Number Selection

***Power Xpert C445 Global Motor Management Relay***

### Required System Components

Order these catalog numbers for a complete C445 system.

- 1 Base Control Module (C445B…)
- 1 Measurement Module (C445M…)
- 1–2 Connection cables (D77E…), required to provide power and communications from the Base Control Module to the Measurement Module and the User Interface (if used). These must be ordered separately in the length desired.
- 1 programming cable (C445XS-USB-MICRO or C445XS-USB-LEADS), required to configure the device using Power Xpert *in*Control. The same programming cable can be used for multiple systems.

### Optional Accessories

These system accessories are compatible with any C445 system but are not required.

- Communication Modules (C445XC…)
- Real-time Clock and Memory Backup Module (C445XO-RTC)
- User Interfaces (C445UC…)
- User Interface Digital Input Wiring Harnesses (C445XU…), required only if utilizing optional digital inputs on User Interfaces

### Relay

C445 B ____

| Family | Module | Options |
|---|---|---|
| **C445** = Power Xpert C445 global motor management relay | **B** = Base control module<br>**M** = Measurement module<br>**U** = User interface<br>**X** = Accessory | Options depend on module selected |

### Base Control Module

C445 B A – S A L N

| Family | Module | Supply Voltage | Version | Inputs | Outputs | Options ①② |
|---|---|---|---|---|---|---|
| **C445** = Power Xpert C445 global motor management relay | **B** = Base control module | **A** = 120–240 Vac<br>**D** = 24 Vdc | **S** = Standard | **A** = 120 Vac<br>**D** = 24 Vdc | **L** = 2 Form A (NO); 1 Form C (NO/NC) latching<br>**N** = 2 Form A (NO); 1 Form C (NO/NC) non-latching | **N** = None<br>**M** = On-board Modbus Serial |

### Measurement Module

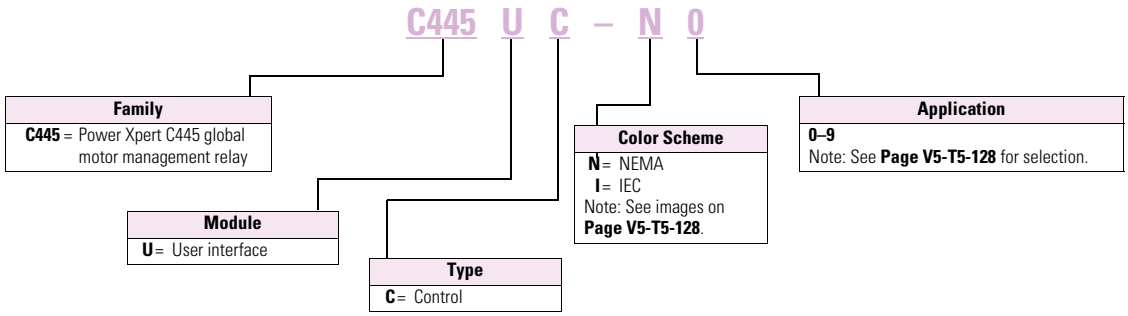
C445 M A – 005 A

| Family | Module | Frame Size | Inputs ③ | Sensing Capability |
|---|---|---|---|---|
| **C445** = Power Xpert C445 global motor management relay | **M** = Measurement module | **A** = 45 mm (0.3–45 A)<br>**B** = 55 mm (9–72 A)<br>**C** = 90 mm (17–136 A) | **45 mm**<br>**2P4** = 0.3–2.4 A<br>**005** = 1–5 A<br>**032** = 4–32 A<br>**045** = 6–45 A<br>**55 mm**<br>**072** = 9–72 A<br>**90 mm**<br>**090** = 11–90 A<br>**136** = 17–136 A | **I** = Current only<br>**V** = Current and voltage<br>**P** = Current and PTC<br>**A** = Current, voltage and PTC |

***Notes***

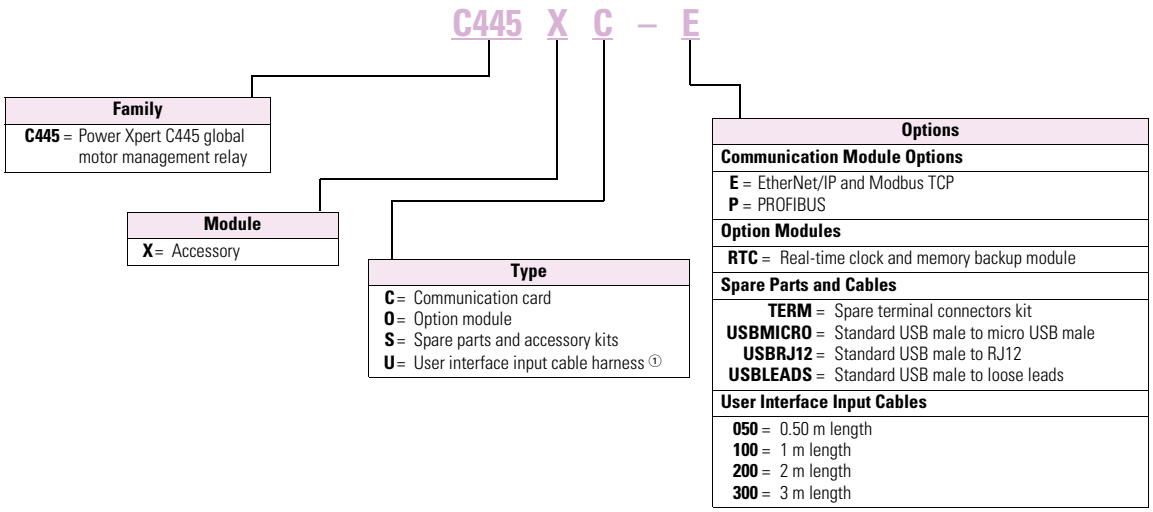
① For other communication protocol options, see Accessories chart on **Page V5-T5-125**.
② If a real-time clock and memory backup module are required, see Accessories chart on **Page V5-T5-125**.
③ For applications above 136 A, see Accessories chart on **Page V5-T5-125**.

## User Interface




***Power Xpert C445 Global Motor Management Relay***

## Accessories




***Note***

① This cable harness is to utilize the user interface inputs. For other C445 connector cables, see Accessories on **Page V5-T5-130**.

## Product Selection

### *Power Xpert C445 Global Motor Management Relay*

**C445B_**

### Base Control Module

| Power Source | Voltage Range ① | Digital Inputs | Relay Outputs | On-board Communications | Catalog Number |
|---|---|---|---|---|---|
| 120/240 Vac | 0–690 Vac | (4) 120 Vac | (2) Form A, (1) Form C (non-latching) | — | **C445BA-SANN** |
| | | | | Modbus Serial | **C445BA-SANM** |
| | | | (2) Form A, (1) Form C (latching) | — | **C445BA-SALN** |
| | | | | Modbus Serial | **C445BA-SALM** |
| | | (4) 24 Vdc | (2) Form A, (1) Form C (non-latching) | — | **C445BA-SDNN** |
| | | | | Modbus Serial | **C445BA-SDNM** |
| | | | (2) Form A, (1) Form C (latching) | — | **C445BA-SDLN** |
| | | | | Modbus Serial | **C445BA-SDLM** |
| 24 Vdc | 0–690 Vac | (4) 120 Vac | (2) Form A, (1) Form C (non-latching) | — | **C445BD-SANN** |
| | | | | Modbus Serial | **C445BD-SANM** |
| | | | (2) Form A, (1) Form C (latching) | — | **C445BD-SALN** |
| | | | | Modbus Serial | **C445BD-SALM** |
| | | (4) 24 Vdc | (2) Form A, (1) Form C (non-latching) | — | **C445BD-SDNN** |
| | | | | Modbus Serial | **C445BD-SDNM** |
| | | | (2) Form A, (1) Form C (latching) | — | **C445BD-SDLN** |
| | | | | Modbus Serial | **C445BD-SDLM** |

***Note***

① Can be used for 4160 Vac applications with PT ratios.

C445M_

## Measurement Module

| Frame Size | Current Range (A) | Current (I) Sensing | Voltage (V) Sensing | PTC Sensing | Catalog Number |
|---|---|---|---|---|---|
| 45 mm | 0.3–2.4 | Yes | — | — | **C445MA-2P4I** |
| | | Yes | — | Yes | **C445MA-2P4P** |
| | | Yes | Yes | — | **C445MA-2P4V** |
| | | Yes | Yes | Yes | **C445MA-2P4A** |
| | 1–5 | Yes | — | — | **C445MA-005I** |
| | | Yes | — | Yes | **C445MA-005P** |
| | | Yes | Yes | — | **C445MA-005V** |
| | | Yes | Yes | Yes | **C445MA-005A** |
| | 4–32 | Yes | — | — | **C445MA-032I** |
| | | Yes | — | Yes | **C445MA-032P** |
| | | Yes | Yes | — | **C445MA-032V** |
| | | Yes | Yes | Yes | **C445MA-032A** |
| | 6–45 ① | Yes | — | — | **C445MA-045I** |
| | | Yes | — | Yes | **C445MA-045P** |
| | | Yes | Yes | — | **C445MA-045V** |
| | | Yes | Yes | Yes | **C445MA-045A** |
| 55 mm | 9–72 | Yes | — | — | **C445MB-072I** |
| | | Yes | — | Yes | **C445MB-072P** |
| | | Yes | Yes | — | **C445MB-072V** |
| | | Yes | Yes | Yes | **C445MB-072A** |
| 90 mm | 11–90 | Yes | — | — | **C445MC-090I** |
| | | Yes | — | Yes | **C445MC-090P** |
| | | Yes | Yes | — | **C445MC-090V** |
| | | Yes | Yes | Yes | **C445MC-090A** |
| | 17–136 | Yes | — | — | **C445MC-136I** |
| | | Yes | — | Yes | **C445MC-136P** |
| | | Yes | Yes | — | **C445MC-136V** |
| | | Yes | Yes | Yes | **C445MC-136A** |

***Note***

① The 45 mm frame is capable of 6 AWG wire maximum with the exception of insulation types RHH, RHW and RHW-2. If these insulation types are being used, use the 55 mm frame.

## Options

**NEMA Color Scheme**

### User Interface—NEMA Color Scheme (English) ①②

| Operation Mode | Control Type (Local = UI) | Control Button(s) Action | | LED Indicator Labels | | Diagnostic LED Label(s) | Catalog Number |
|---|---|---|---|---|---|---|---|
| FVNR Starter | Local Only | START<br>— | OFF<br>— | RUN<br>— | OFF<br>— | FAULT, WARNING, OVERLOAD | **C445UC-N0** |
| FVNR Starter | Remote Only | —<br>— | F1 ③<br>— | RUN<br>— | OFF<br>— | FAULT, WARNING, OVERLOAD | **C445UC-N1** |
| FVR Starter | Remote Only | —<br>— | F1 ③<br>— | FWD<br>REV | OFF<br>— | FAULT, WARNING, OVERLOAD | **C445UC-N2** |
| 2-Speed Starter | Remote Only | —<br>— | F1 ③<br>— | SLOW<br>FAST | OFF<br>— | FAULT, WARNING, OVERLOAD | **C445UC-N3** |
| FVNR Starter | Local/Remote | —<br>HAND | OFF<br>AUTO | RUN<br>HAND | OFF<br>AUTO | FAULT, WARNING, OVERLOAD | **C445UC-N4** |
| FVR Starter | Local/Remote | FWD<br>REV | OFF<br>AUTO | FWD<br>REV | OFF<br>AUTO | FAULT, WARNING, OVERLOAD | **C445UC-N5** |
| 2-Speed Starter | Local/Remote | SLOW<br>FAST | OFF<br>AUTO | SLOW<br>FAST | OFF<br>AUTO | FAULT, WARNING, OVERLOAD | **C445UC-N6** |
| MCCB Actuation | Local/Remote | CLOSE<br>— | OFF<br>AUTO | CLOSE<br>— | OFF<br>AUTO | FAULT, WARNING, TRIPPED | **C445UC-N7** |
| MCCB Actuation | Local Only | CLOSE<br>— | OFF<br>— | CLOSE<br>— | OFF<br>— | FAULT, WARNING, TRIPPED | **C445UC-N8** |
| Overload | Local/Remote | —<br>TEST | F1<br>AUTO | RUN<br>— | OFF<br>AUTO | FAULT, WARNING, OVERLOAD | **C445UC-N9** |

### NEMA User Interface Example


*C445UC-N5*

***Notes***

① All options include a reset button, micro USB port, and four self-powered 24 Vdc digital inputs. Please see Accessories on **Page V5-T5-130** for digital inputs wiring harness options.

② Not all operation modes are stock items. Check with EatonCare for availability.

③ F1 function key is reserved for future use.

**IEC Color Scheme**

## User Interface—IEC Color Scheme (Symbols) ①②

| Operation Mode | Control Type (Local = UI) | Control Button(s) Action | | LED Indicator Labels | | Diagnostic LED Label(s) | Catalog Number |
|---|---|---|---|---|---|---|---|
| FVNR Starter | Local Only | \| | ○ | — | — | FAULT, WARNING, EARTH FAULT | **C445UC-I0** |
| | | — | — | — | — | | |
| FVNR Starter | Remote Only | — | F1 ③ | RUN | OFF | FAULT, WARNING, EARTH FAULT | **C445UC-I1** |
| | | — | — | — | — | | |
| 2-Speed Starter | Local Only | ► | ○ | — | — | FAULT, WARNING, EARTH FAULT | **C445UC-I2** |
| | | ►► | — | — | — | | |
| FVR Starter | Local Only | ► | ○ | — | — | FAULT, WARNING, EARTH FAULT | **C445UC-I3** |
| | | ◄ | — | — | — | | |
| FVNR Starter | Local/Remote | \| | ○ | — | — | FAULT, WARNING, EARTH FAULT | **C445UC-I4** |
| | | — | AUTO | — | — | | |
| FVR Starter | Local/Remote | ► | ○ | — | — | FAULT, WARNING, EARTH FAULT | **C445UC-I5** |
| | | ◄ | AUTO | — | — | | |
| 2-Speed Starter | Local/Remote | ► | ○ | — | — | FAULT, WARNING, EARTH FAULT | **C445UC-I6** |
| | | ►► | AUTO | — | — | | |
| MCCB Actuation | Local/Remote | \| | ○ | — | — | FAULT, WARNING, TRIPPED | **C445UC-I7** |
| | | — | AUTO | — | — | | |
| MCCB Actuation | Local Only | \| | ○ | — | — | FAULT, WARNING, TRIPPED | **C445UC-I8** |
| | | — | — | — | — | | |
| Overload | Local/Remote | — | F1 ③ | RUN | OFF | FAULT, WARNING, EARTH FAULT | **C445UC-I9** |
| | | TEST | AUTO | — | — | | |

## IEC User Interface Example


***C445UC-I6***

***Notes***

① All options include a reset button, micro USB port, and four self-powered 24 Vdc digital inputs. Please see Accessories on **Page V5-T5-130** for digital inputs wiring harness options.

② Not all operation modes are stock items. Check with EatonCare for availability.

③ F1 function key is reserved for future use.

## Accessories

ZEB-XCT_

### External Current Transformers

Use CTs and 1–5 A C445 measurement module. CT kit does not include measurement module (order separately).

| CT Range (A) | Description | Terminal Size | Measurement Module | Catalog Number ①② |
|---|---|---|---|---|
| 17–300 | 300:5 single-phase CT, 1.25 inch dia hole, UL and CSA ANSI/IEEE C57.13, 50–400 Hz, 600 Vac, 10 kV, relay class C50, accuracy 0.3% B0.1 | (2) 8–32 brass terminals, comes with mounting bracket kit | **C445MA-005_** | **XCT300-5** |
| 75–600 | 600:5 single-phase CT, 2.00 inch dia hole, UL and CSA ANSI/IEEE C57.13, 50–400 Hz, 600 Vac, 10 kV, relay class C50, accuracy 0.3% B0.1 | (2) 8–32 brass terminals, comes with mounting bracket kit | **C445MA-005_** | **XCT600-5** |
| 100–800 | 800:5 single-phase CT, 2.50 inch dia hole, UL and CSA ANSI/IEEE C57.13, 50–400 Hz, 600 Vac, 10 kV, relay class C50, accuracy 0.3% B0.1 | (2) 8–32 brass terminals, comes with mounting bracket kit | **C445MA-005_** | **XCT800-5** |

C445X_

### Communication and Option Modules

| Description | Catalog Number |
|---|---|
| EtherNet/IP and Modbus TCP card with 2-port switch | **C445XC-E** |
| PROFIBUS DPV0 and DVP1 card | **C445XC-P** |
| Real-time clock and memory backup module | **C445XO-RTC** |

### Cables, Wiring Harnesses and Spare Parts

***Connection Cables and Accessories***

D77E connection cables are required to connect the base control module to the measurement module and to the user interface. Order the appropriate lengths for each connection.

User interface wiring harnesses are required to utilize the digital inputs on the user interface. Order one wiring harness per user interface to connect to these inputs. C445XS-USBMICRO and C445XS-USBLEADS are used to connect the Power Xpert *in*Control tool (see next page for details). C445XS-USBRJ12 is used for firmware upgrades.

| Description | Catalog Number |
|---|---|
| Connection cable (base control module to measurement module or user interface), 13 cm length, 600 V rating | **D77E-QPIP13** |
| Connection cable (base control module to measurement module or user interface), 13 cm length, 1000 V rating | **D77E-QPIP13-HV** |
| Connection cable (base control module to measurement module or user interface), 25 cm length, 600 V rating | **D77E-QPIP25** |
| Connection cable (base control module to measurement module or user interface), 25 cm length, 1000 V rating | **D77E-QPIP25-HV** |
| Connection cable (base control module to measurement module or user interface), 100 cm length, 600 V rating | **D77E-QPIP100** |
| Connection cable (base control module to measurement module or user interface), 100 cm length, 1000 V rating | **D77E-QPIP100-HV** |
| Connection cable (base control module to measurement module or user interface), 200 cm length, 600 V rating | **D77E-QPIP200** |
| Connection cable (base control module to measurement module or user interface), 300 cm length, 600 V rating | **D77E-QPIP300** |
| Connection cable (base control module to measurement module or user interface), 300 cm length, 1000 V rating | **D77E-QPIP300-HV** |
| User interface digital inputs wiring harness, 50 cm, 16 AWG wires | **C445XU-050** |
| User interface digital inputs wiring harness, 100 cm, 16 AWG wires | **C445XU-100** |
| User interface digital inputs wiring harness, 200 cm, 16 AWG wires | **C445XU-200** |
| User interface digital inputs wiring harness, 300 cm, 16 AWG wires | **C445XU-300** |
| Spare parts kit—terminal connectors, mounting feet | **C445XS-TERM** |
| Standard USB A male to micro USB male cable | **C445XS-USBMICRO** |
| Standard USB A male to loose leads cable (for use with Modbus Serial terminals) | **C445XS-USBLEADS** |
| Standard USB A male to RJ-12 cable (for firmware upgrades) | **C445XS-USBRJ12** |

***Notes***

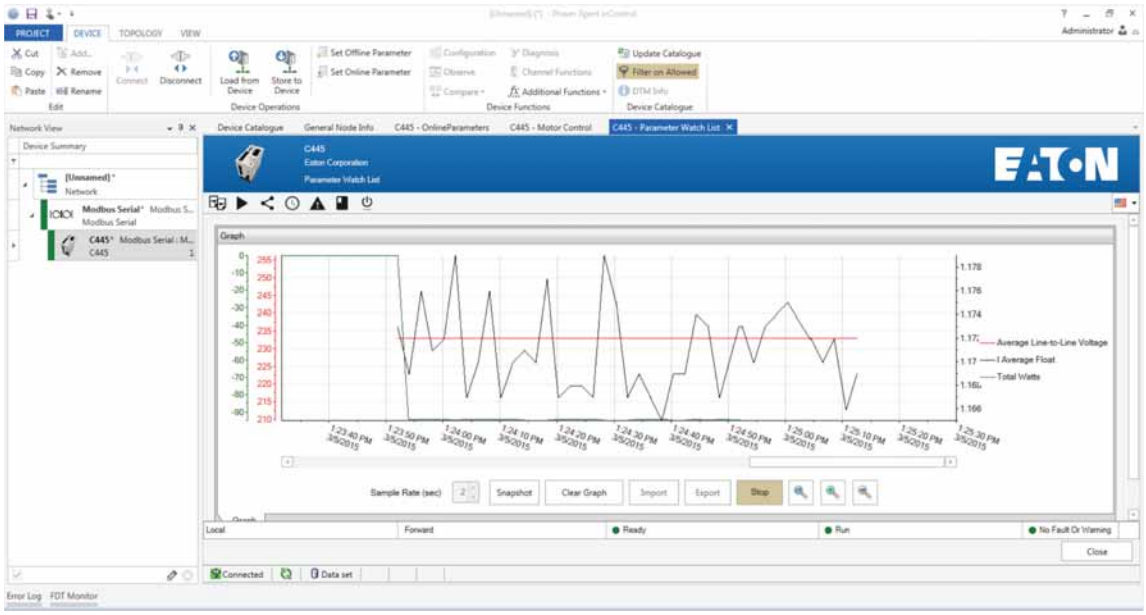
① Contact factory for availability.

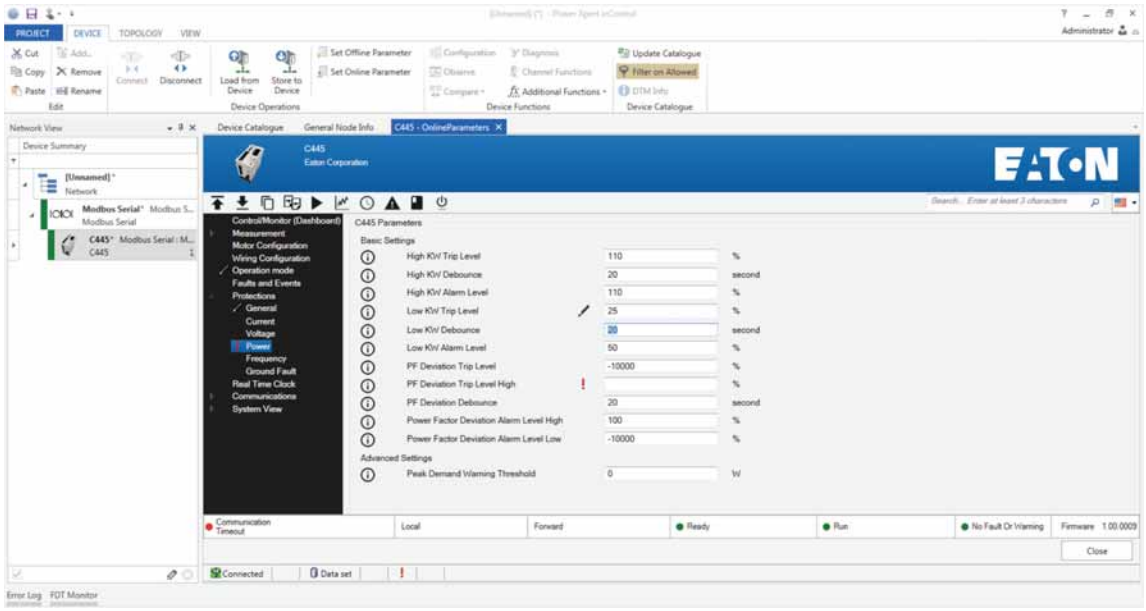
② Catalog numbers are for one single-phase CT, order quantity of 3 for a complete C445 system.

***Power Xpert inControl Software***

The Power Xpert *in*Control software tool is designed for programming, controlling and monitoring the Power Xpert C445 motor management relay. Features include loading parameters that can be saved to a file or printed, setting references, starting and stopping the motor, monitoring signals in graphical or text form and real-time display.

Power Xpert *in*Control is available for download free of charge at www.eaton.com/C445. Refer to Power Xpert *in*Control User Manual MN040013EN for more information.





**Power Xpert *in*Control Connection Cables**

The following connection methods are possible between the PC running the *in*Control software and C445:

1. USB/Micro USB cable (C445XS-USBMICRO) connected to the Micro USB port on the User Interface.
2. USB/Micro USB cable (C445-USBMICRO) connected to the Micro USB port on the Base Control Module.
3. USB/RS-485 cable (C445XS-USBLEADS) connected to the RS-485 Modbus port on the Base Control Module (if ordered with the Modbus option).

## Technical Data and Specifications

### Power Xpert C445 Motor Management Relay Short Circuit Ratings (North American CSA and UL) ①

| Measurement Module Frame | Overload FLA Range | Standard-Fault Short Circuit Data 480 V (kA) | 600 V (kA) | Max. Fuse Size (A) (RK5) | Max. Breaker Size (A) | High-Fault Short Circuit Data Fuses (RK5) 480 V (kA) | 600 V (kA) | Max. Fuse Size (A) (RK5) | Thermal-Magnetic Circuit Breakers 480 V (kA) | 600 V (kA) | Max. Breaker Size (A) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 45 mm | 0.3–2.4 A | 5 | 5 | 6 A | 15 A | 100 | 100 | 6 A | 100 | 35 | 15 A |
| 45 mm | 1–5 A | 5 | 5 | 20 A | 20 A | 100 | 100 | 20 A | 100 | 35 | 20 A |
| 45 mm | 4–32 A | 5 | 5 | 125 A | 125 A | 100 | 100 | 125 A | 100 | 35 | 125 A |
| 45 mm | 6–45 A | 5 | 5 | 175 A | 175 A | 100 | 100 | 175 A | 100 | 35 | 175 A |
| 55 mm | 9–72 A | 10 | 10 | 250 A | 250 A | 100 | 100 | 250 A | 100 | 35 | 250 A |
| 90 mm | 11–90 A | 10 | 10 | 360 A | 360 A | 100 | 100 | 360 A | 100 | 50 | 360 A |
| 90 mm | 17–136 A | 10 | 10 | 400 A | 400 A | 100 | 100 | 400 A | 100 | 50 | 400 A |

### Power Xpert C445 Motor Management Relay Short Circuit Ratings (IEC) ①

| Measurement Module Frame | Overload FLA Range | Standard-Fault Short Circuit Data 480 V (kA) | 690 V (kA) | Max. Fuse Size (A) (gG) | Max. Breaker Size (A) 480 V | Max. Breaker Size (A) 690 V | High-Fault Short Circuit Data Fuses (gG) 480 V (kA) | 690 V (kA) | Max. Fuse Size (A) (gG) | Thermal-Magnetic Circuit Breakers 480 V (kA) | 690 V (kA) | Max. Breaker Size (A) 480 V | Max. Breaker Size (A) 690 V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 45 mm | 0.3–2.4 A | 1 | 1 | 16 A | 15 A | N/A | 100 | 100 | 10 A | 100 | N/A | 15 A | N/A |
| 45 mm | 1–5 A | 1 | 1 | 20 A | 20 A | 20 A | 100 | 100 | 20 A | 100 | 80 | 20 A | 20 A |
| 45 mm | 4–32 A | 3 | 3 | 125 A | 125 A | 125 A | 100 | 100 | 125 A | 100 | 80 | 125 A | 125 A |
| 45 mm | 6–45 A | 3 | 3 | 200 A | 175 A | 160 A | 100 | 100 | 125 A | 100 | 80 | 175 A | 160 A |
| 55 mm | 9–72 A | 5 | 5 | 250 A | 250 A | 250 A | 100 | 100 | 160 A | 100 | 80 | 250 A | 250 A |
| 90 mm | 11–90 A | 5 | 5 | 360 A | 360 A | 360 A | 100 | 100 | 360 A | 100 | 80 | 360 A | 360 A |
| 90 mm | 17–136 A | 10 | 10 | 400 A | 400 A | 400 A | 100 | 100 | 400 A | 100 | 80 | 400 A | 400 A |

### Power Xpert C445 Technical Data and Specifications

| Description | Specification |
|---|---|
| **Electrical, Motor/Load Ratings** | |
| Operating voltage | 110–690 Vac<br>4160 Vac with Potential Transformer (PT) ratios between 35:1 and 6:1 (purchased separately) (PT) ② |
| Trip class | 5–40, selectable in 5 step increments |
| Operating current (FLA) range | Varies by measurement module frame. See below. |
| 45 mm measurement module | 0.3–2.4 A; 1.0–5.0 A; 4.0–32.0 A; 6–45 A |
| 55 mm measurement module | 9.0–72.0 A |
| 90 mm measurement module | 11.0–90.0 A; 17.0–136.0 A |
| Rated frequency | 20–80 Hz ② |
| Application(s) | Single-phase, three-phase |
| Accuracy | Current: 2% within 30–125% of FLA; 3% ≤ 500% of FLA<br>Voltage: 2% within 110 Vac, 690 Vac<br>Power: 5% |
| Rated supply voltage | 120/240 Vac (or) 24 Vdc |
| Operating supply voltage range | 94–264 Vac (or) 18–30 Vdc |
| Overvoltage category | 24 Vdc = III<br>120/240 = II |
| Maximum power consumption | Less than 8 W—varies by module, see below |
| Base control module + measurement module | Less than 5 W |
| User interface | Less than 1.5 W |
| Communication card | Less than 2 W |

***Notes***

① Short circuit protective device (SCPD) sizing per NEC: Max = 400% of FLA under 100 A, 300% of FLA over 100 A.

② Published monitoring accuracies are across the frequency range of 47–63 Hz.

## Power Xpert C445 Technical Data and Specifications, continued

| Description | Specification |
|---|---|
| **Environmental Ratings** | |
| Ambient temperature (operating) | –40 to 60 °C (–40 to 140 °F) |
| Ambient temperature (storage) | –40 to 85 °C (–40 to 185 °F) |
| Operating humidity [UL991 (H3)] | 5–95% noncondensing |
| Altitude NEMA ICS1 | 2000 meters (6600 feet) |
| Shock IEC 60068-2-27 | 15 g any direction for 11 milliseconds, non-operating |
| Vibration IEC 60068-2-6 | 5 g non-operating and 3 g operating in any direction |
| Pollution degree per IEC 60947-4-1 | 3 |
| Ingress protection | IP20 (Base Control Module / Measurement Module)<br>IP54 (User Interface) |
| Mean time between failures (MTBF) | 20 years at 50 °C |
| **Safety** | |
| Thermal overload protection | Per UL 60947-4-1, IEC 60947-4-1 |
| Binary PTC protection | IEC 60947-8 |
| Safety integrity level | SIL 1 (reference 50495) |
| **Electrical / EMC** | |
| Radiated emissions IEC/EN 60947-4-1, Table 15<br>EN 55011 (CISPIR 11) Group 1, Class A | 30–1000 MHz |
| Conducted emissions IEC/EN 60947-4-1, Table 14<br>EN 55011 (CISPIR 11) Group 1, Class A | 0.15–30 MHz |
| ESD immunity per IEC 61000-4-2 | ± 8 kV air, ± 4 kV contact |
| Radiated immunity per IEC 61000-4-3 | 10 V/m 80–1000 MHz<br>80% amplitude modulation<br>1 kHz sine wave |
| Fast transient per IEC 61000-4-4 | ± 2 kV power<br>± 1 kV signals, data and control |
| Surge per IEC 61000-4-5 | ± 1 kV line-to-line<br>± 2 kV line-to-ground |
| Conducted immunity per IEC 61000-4-6 | 10 V, 0.15–80 MHz<br>80% amplitude modulation<br>1 kHz sine wave |
| Magnetic field per IEC 61000-4-8 | 30 A 50/60 Hz |
| Voltage dips per IEC 61000-4-11 | Class 2, 110 Vac 60 Hz, 230 Vac 50 Hz<br>0% during 1/2 cycle<br>0% during 1 cycle<br>70% during 25/30 cycles<br>Note: 70% refers to 70% of nominal operating voltage, 0% refers to 0% of operating voltage, 25/30 cycles correlates to 50/60 Hz. |
| **Output Relay Ratings (Base Control Module)** | |
| Three mono-stable output relays<br>One Form C (NO/NC)<br>Two Form A (NO) | <br>B300 pilot duty on all relays<br>R300 pilot duty on NO relays only |
| Rated operating current | 3 A at 120 Vac, 1.5 A at 240 Vac<br>1.5 A at 24 Vdc, 0.22 A at 125 Vdc, 0.1 A at 250 Vdc |
| Utilization category | AC-15; DC-13 |

## Power Xpert C445 Technical Data and Specifications, continued

| Description | Specification | | | | | | |
|---|---|---|---|---|---|---|---|
| **Input Ratings (Base Control Module)** | | | | | | | |
| Supply voltage | 24 Vdc | 120 Vac | | | | | |
| Number of inputs | 4 | 4 | | | | | |
| Type of inputs | Digital | Digital | | | | | |
| On-state voltage | 15–20 Vdc | 79–132 Vac | | | | | |
| Off-state voltage | 0–5 Vdc | 0–30 Vac | | | | | |
| Overvoltage category | III | II | | | | | |
| **Input/Output Terminal Blocks** | | | | | | | |
| Wire capacity | 30–12 AWG ① | | | | | | |
| Screw torque requirement | 3.5–4.4 in-lb<br>(0.4–0.5 Nm) | | | | | | |
| **Measurement Module Current Pass Through** | | | | | | | |
| Measurement module size (current range) | 45 mm<br>(0.3–2.4 A) | 45 mm<br>(1–5 A) | 45 mm<br>(4–32 A) | 45 mm<br>(6–45 A) | 55 mm<br>(9–72 A) | 90 mm<br>(11–90 A) | 90 mm<br>(17–136 A) |
| Supported conductor<br>NA 600 V (AWG)<br>EMEA 690 V ($mm^2$) | <br>6 AWG<br>16 $mm^2$ | <br>6 AWG<br>16 $mm^2$ | <br>6 AWG<br>16 $mm^2$ | <br>6 AWG<br>16 $mm^2$ | <br>3 AWG<br>25 $mm^2$ | <br>2/0 AWG<br>70 $mm^2$ | <br>2/0 AWG<br>70 $mm^2$ |
| **Voltage Terminals** | | | | | | | |
| Terminal screw torque requirement | 3.5–4.4 in-lb<br>(0.4–0.5 Nm) | | | | | | |
| Maximum wire capacity<br>(for voltage input terminals) | 12–26 AWG solid<br>0.13 to 3.31 $mm^2$ | | | | | | |

## PTC Specifications

| Description | Specification |
|---|---|
| Standard | EN 60947-8/A1:2006 "Mark A Control Unit" |
| Compatible thermal detectors | Mark A type (abrupt characteristic change) as described in EN 60947-8/A1:2006 Annex A wired in series |
| Terminals | Marked T1 and T2<br>12–30 AWG solid (0.13–4 $mm^2$) |
| Cold resistance | ≤1500 ohms |
| Measuring voltage | ≤2.5 V for resistance ≤1330 ohms<br>≤7.5 V for resistance ≤4 kohms<br>≤9.0 V open circuit |
| Temperature rise response | 3600 ohms ±10% |
| Over temperature reset | 1500 ohms ±10% |
| Short-circuit response | Between 10 and 20 ohms |
| Short-circuit reset | Between 20 and 40 ohms |
| Wire break response | 20 k to 40 kohms |
| Isolation | $U_{imp}$ = 4 kV |

***Note***

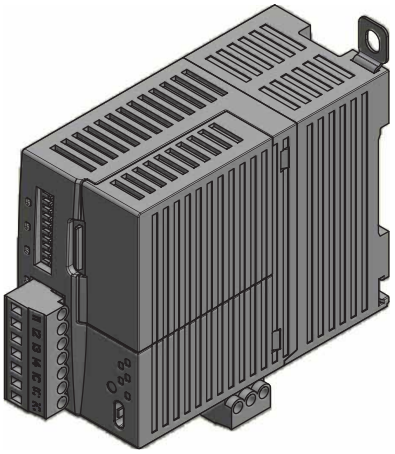
① Use only UL Listed or recognized conductors. Copper wire rated 75C for all field wiring terminals and main conductor wiring.

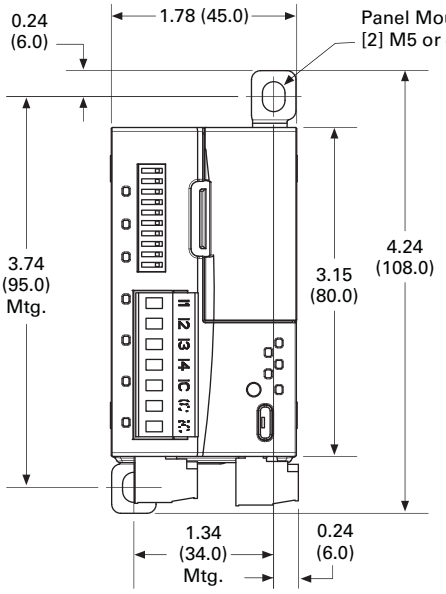
## Dimensions

***Power Xpert C445 Motor Management Relay***

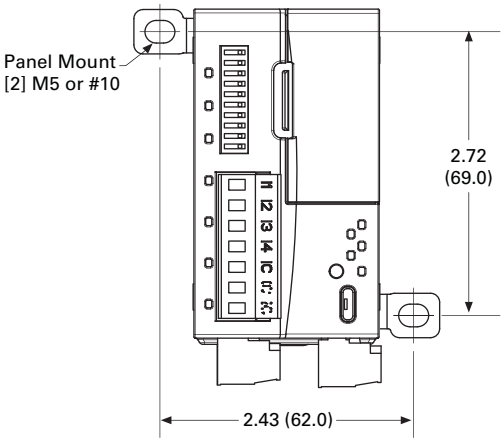
Approximate Dimensions in Inches (mm)

### Base Control Module

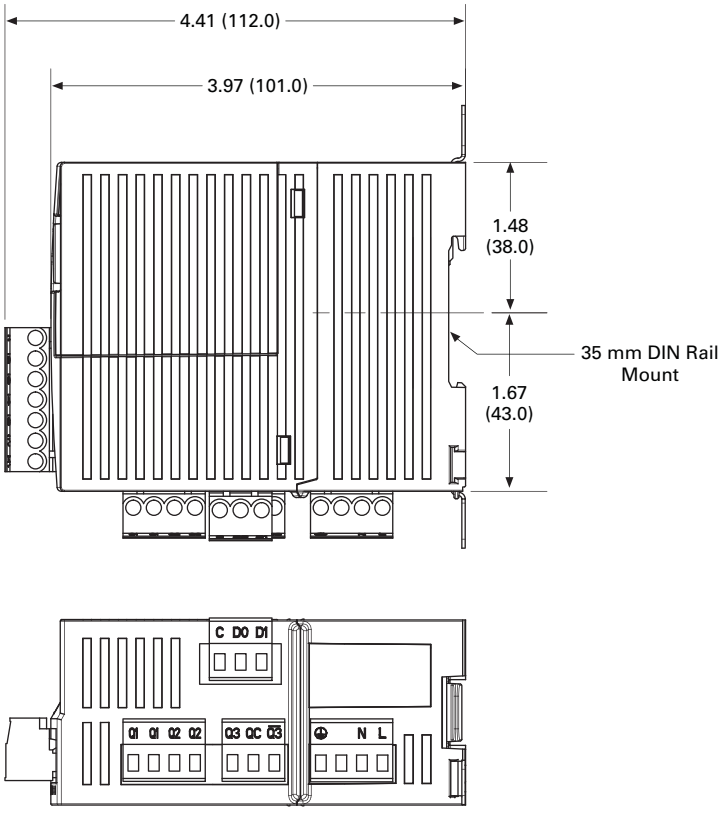





**Panel Mount Option 1**

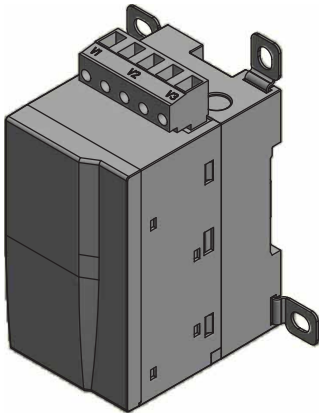


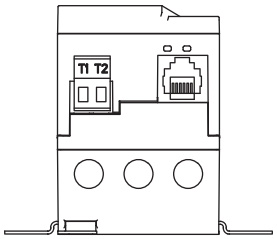

**Panel Mount Option 2**

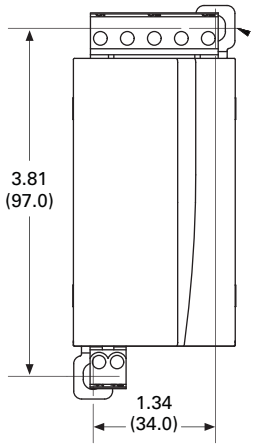


Approximate Dimensions in Inches (mm)

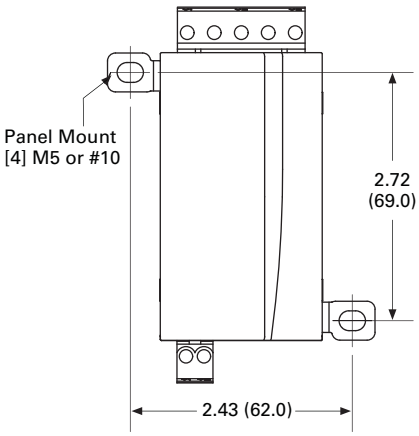
## Measurement Module—45 mm Frame



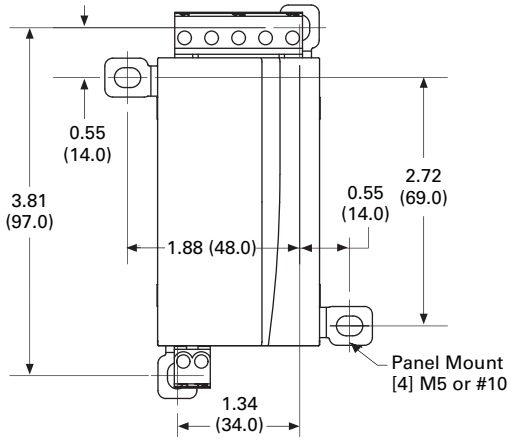


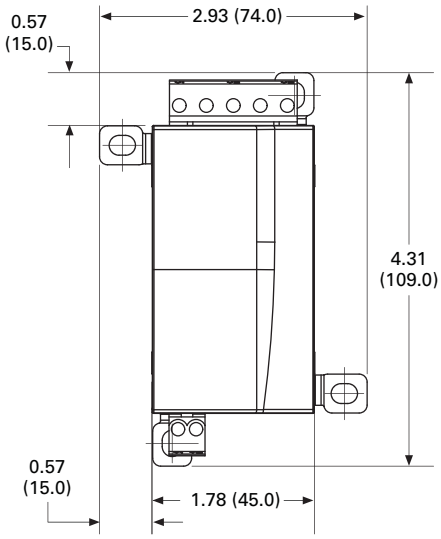

**Panel Mount Option 1**

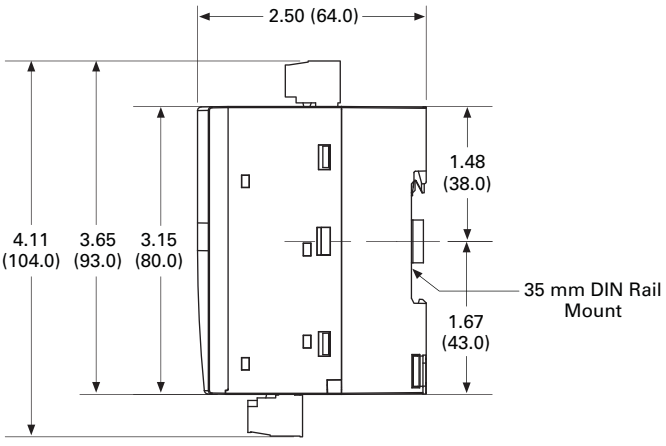



**Panel Mount Option 2**




**Panel Mount Option 3**



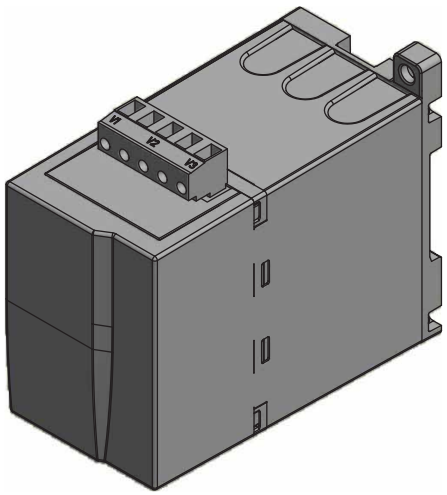



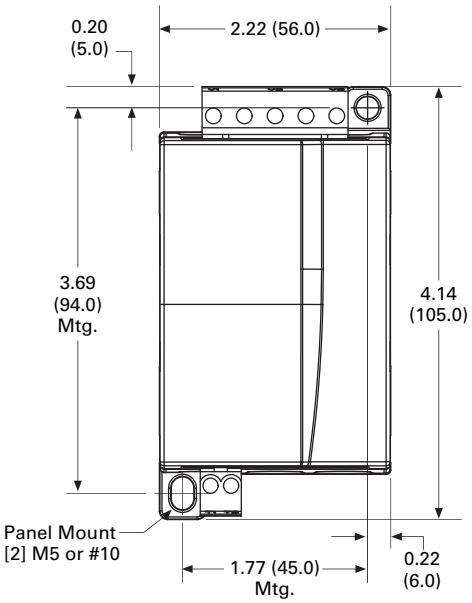

**DIN Mount Option 4**

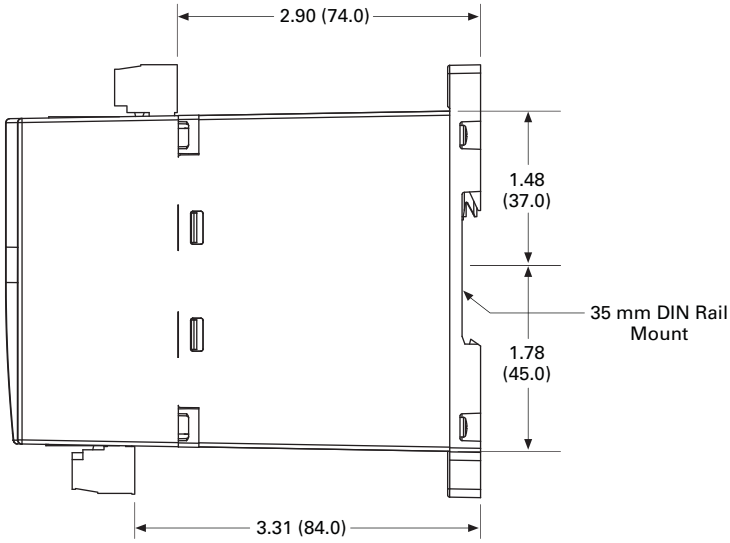
**Note:** Measurement Module part shown has factory-installed terminals for all measurement options (current, voltage and PTC).

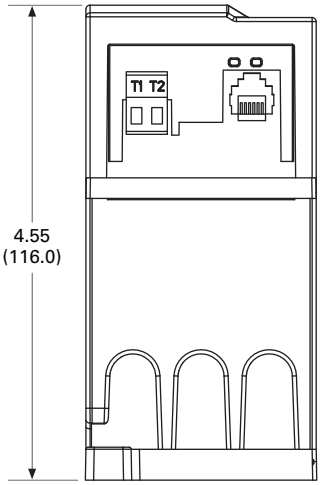
Approximate Dimensions in Inches (mm)

## Measurement Module—55 mm Frame





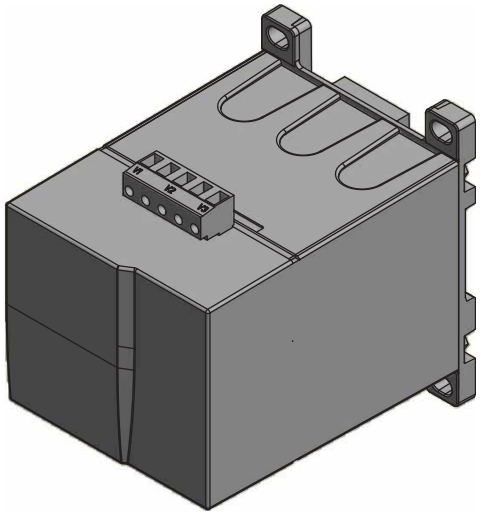



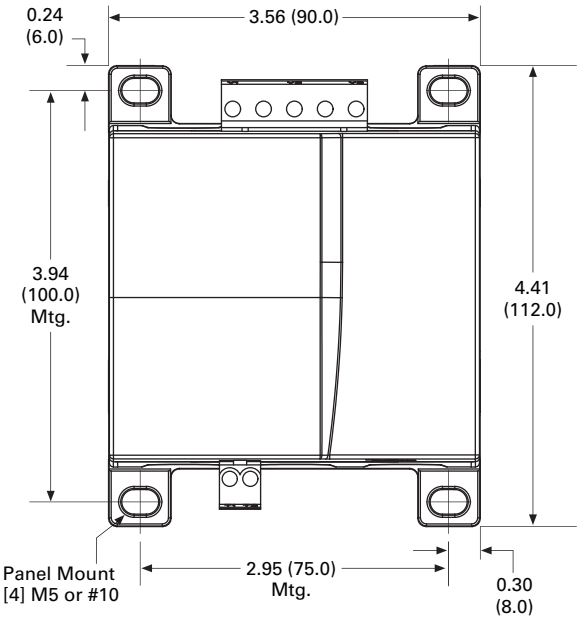



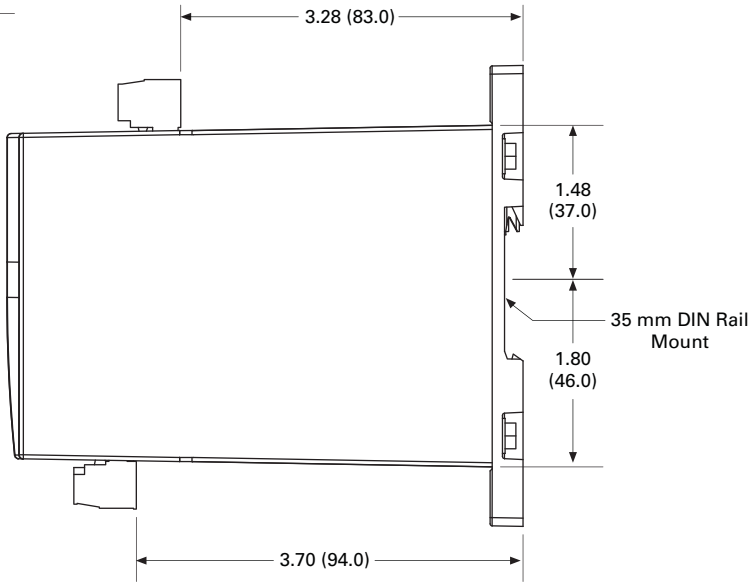

**Note:** Measurement Module part shown has factory-installed terminals for all measurement options (current, voltage and PTC).

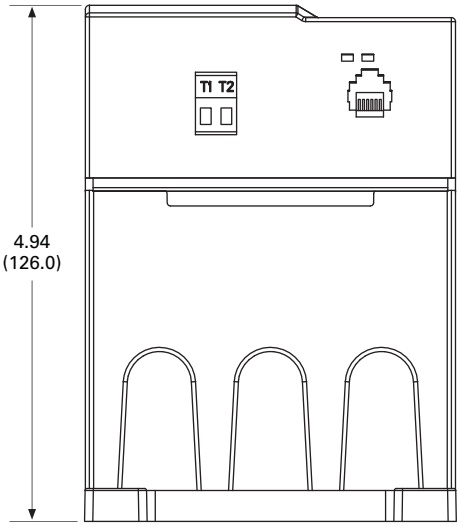
Approximate Dimensions in Inches (mm)

## Measurement Module—90 mm Frame






**Note:** Measurement Module part shown has factory-installed terminals for all measurement options (current, voltage and PTC).

Approximate Dimensions in Inches (mm)

## User Interface