Motor Protection and Monitoring

Motor Protection Circuit Breaker

Manual Motor Protector

Overload Relay—C440

Overload Relays—C441, Motor Insight

Monitoring Relays

Contents

Product Overview—Monitoring Relays

Current Monitoring Relays

Eaton offers two different series of current monitoring relays:

CurrentWatch™ Series

- The CurrentWatch ECS and ECSJ Series from Eaton's electrical sector is a family of solid-state adjustable current switches, ideal for providing status information on electrical equipment

D65C Series

- The D65C Series Current Monitoring Relays monitor AC single-phase currents for over- or undercurrent conditions in three current ranges: 0.1–1A, 0.5–5A and 1–10A. An external current transformer may be used to extend the range of the product. A separate 24V or 120 Vac input (supply) voltage is required to power the unit. All versions are available in a compact plug-in case using industry standard 8- or 11-pin octal sockets

Phase Monitoring Relays

The D65 Series Phase Monitoring Relays provide protection against premature equipment failure caused by voltage faults on three-phase systems. All D65 phase monitoring relays are compatible with most wye or delta systems. In wye systems, a connection to neutral is not required. Phase Monitoring relays protect against single-phasing regardless of any regenerative voltages.

Voltage Monitoring Relays

The D65 Series Voltage Monitoring Relays monitor either AC single-phase (50/60 Hz) or DC voltages to protect equipment against voltage fault conditions. No separate supply (input) voltage is required. All versions are available in a compact plug-in case using an 8-pin octal socket.

There are two styles of voltage monitoring relays:

- Over/Undervoltage Relays
- Voltage Band Relays

Ground Fault Monitoring Relays

Eaton offers two different series of ground fault monitoring relays:

D64R Series

- The new D64R digital ground fault relays are microprocessor-based and replace the previous generation of analog-based devices
- Microprocessor-based D64R GFRs combine more selectable features into a single model, which makes easier model selection and reduces spares inventory requirements

D64L Series

- Type D64L ground fault monitors are designed to monitor ungrounded supplies on three-phase AC power systems up to 600V. If an insulation fault develops anywhere on the system between the source and the load, the D64L will detect it and give an alarm or trip, depending on the adjustable field settings selected
- The D64L is ideally suited for systems supplied from the secondary of either an ungrounded delta or an ungrounded wye connected transformer

ECS Series CurrentWatch Current Switches

Contents

ECS Series CurrentWatch™ Current Switches

ECS Series

Product Description

The CurrentWatch™ ECS Series from Eaton's electrical sector is a family of solid-state adjustable current switches, ideal for providing status information on electrical equipment. The ECS is excellent for new installations, where the conductors run through the housing, requiring no cutting. These switches are also ideal for retrofits, since split-core models can be opened to fit around existing conductors. The current switch is accurate, reliable and easy to install.

The ECS can sense continuous currents from 1 to 150A and does not require any supply voltage, as the power required is induced from the monitored conductor. The output is a non-polarity-sensitive solid-state contact for switching AC and DC circuits up to 240 Vac/Vdc. This switch also includes an LED indicating two states: on and below trip point, and above trip point with contacts energized. All ECS Series switches carry an unconditional five-year warranty.

Any change in current can be sensed with the ECS Series. A change in current may indicate motor failure, belt loss/slippage or mechanical failure. Any of these events can cause the current to drop significantly, tripping the switch and notifying the controller.

Standards and Certifications

- UL Listed
- cUL Listed
- CE Certified

UL Listed c UL Listed CE

Reference

Refer to Volume 8—Sensing Solutions, **PG08301004E**, Tab 51, section 51.2 for additional Product information.

ECSJ Series CurrentWatch Current Switches

Contents

ECSJ Series CurrentWatch™ Current Switches

ECSJ Series

Product Description

The CurrentWatch™ ECSJ Series current operated switches from Eaton's electrical sector provide the same dependable indication of status offered by the CurrentWatch ECS Series, but with the added benefit of increased setpoint precision. A choice of three, jumper-selectable input ranges allows the ECSJ Series to be tailored to an application, providing more precise control through improved setpoint resolution. Self-powering, isolated solid-state outputs, 1–6A, 6–40A and 40–200A input ranges, and a choice of split- or solid-core enclosures are standard.

For typical applications of the CurrentWatch ECSJ Series, see listing on this page.

Application Description

Typical Applications

- **Electronic Proof of Flow**—Current operated switches eliminate the need for multiple pipe or duct penetrations and are more reliable than electro-mechanical pressure or flow switches
- **Conveyors**—Detect jams and overloads
- **Lighting Circuits**—Easier to install and more accurate than photocells
- **Fans, Pumps and Heating Elements**—Faster response than temperature sensors
- **Critical Motors**
- **Ancillary Equipment**

Standards and Certifications

- UL Listed
- cUL Listed
- CE Certified
- UL 508 Industrial Equipment (USA and Canada)

UL Listed c UL Listed CE

Reference

Refer to Volume 8—Sensing Solutions, **PG08301004E**, Tab 51, section 51.3 for additional Product information.

Current Monitoring Relays

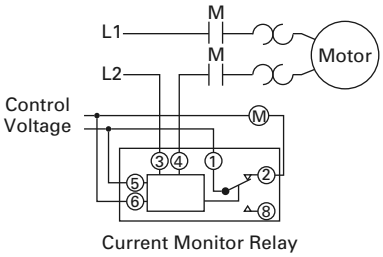
Contents

Product Overview

The D65C Series Current Monitoring Relays monitor AC single-phase currents for over- or undercurrent conditions in three current ranges: 0.1–1A, 0.5–5A and 1–10A. An external current transformer may be used to extend the range of the product. A separate 24V or 120 Vac input (supply) voltage is required to power the unit. All versions are available in a compact plug-in case using industry standard 8- or 11-pin octal sockets.

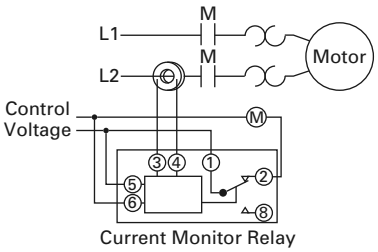
Application Description

Typical Installation without External CT



Current Monitor Relay

Typical Installation with External CT



Current Monitor Relay

Standards and Certifications

- CE
- cRUus listed
- UL listed ①②
- RoHS compliant

Listed

Notes

① When used with accompanying Eaton socket.

② In addition to the above approvals, all plug-in products are also UL Listed when used with the appropriate Eaton socket.

Product Selection Guide

Standard

Fixed time delay on both pickup and dropout current settings.

D65C Standard Function

Series	Pickup Setting	Time Delay	Dropout Setting	Time Delay	Page
D65CE	Adjustable (across monitored range)	Fixed 100 ms ①	Fixed (–5% pickup)	Fixed 100 ms ①	**V5-T31-8**
D65CEK			Adjustable (50–95% pickup)		

Overcurrent

Adjustable time delay on pickup and fixed time delay on dropout current settings.

D65C Overcurrent Function

Series	Pickup Setting	Time Delay	Dropout Setting	Time Delay	Page
D65CH	Adjustable (across monitored range)	0.1–10 sec adjustable	Fixed (–5% pickup)	Fixed 100 ms ①	**V5-T31-11**
D65CHK			Adjustable (50–95% pickup)		

Undercurrent

Fixed time delay on pickup and adjustable time delay on dropout current settings.

D65C Undercurrent Function

Series	Pickup Setting	Time Delay	Dropout Setting	Time Delay	Page
D65CL	Fixed (+5% dropout)	Fixed 100 ms ①	Adjustable (across monitored range)	0.1–10 sec adjustable	**V5-T31-14**

Note

① Fixed time delay eliminates nuisance tripping due to short current surges or drops.

D65CE Series—Standard Current Monitors

Contents

31

D65CE Series—Standard Current Monitors

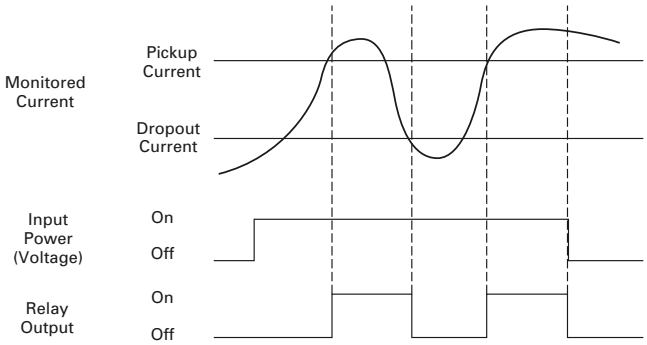
Product Description

The D65CE Series Standard Current Monitors are used to detect either an overcurrent or undercurrent condition. The pickup current setting is user-adjustable within three ranges (0.1–1A), (0.5–5A), or (1–10A). The range can be extended beyond 10A with the use of an external current transformer. Choose between a fixed dropout current setting at 95% of the selected pickup setting or an adjustable dropout setting of 50–95% of the selected pickup setting. The relay will energize when the monitored AC current is above the pickup setting, and will de-energize when the monitored AC current is below the dropout setting. The time delay on both pickup and dropout is fixed at 100 ms. Adjustable time delays are available with the D65CH and D65CL Series.

Features

- Monitors AC single-phase currents
- Three separate current monitoring ranges covering 0.1–10 amperes
- External CT can be used to extend ranges
- Adjustable pickup setting with either fixed or adjustable dropout setting
- LED indicates output relay status
- Choice of compact 8-pin SPDT or 11-pin DPDT plug-in case
- 10A output contacts

Standard Current Monitoring



Product Selection

D65CE_

D65CE Series—Standard Current Monitors, SPDT, 8-Pin Plug-In

Pickup Setting	Dropout Setting	Input Voltage	Current Range Monitored	Catalog Number
Adjustable	Fixed (at 95% of pickup)	24 Vac	0.1–1A	**D65CE1C01T**
			0.5–5A	**D65CE1C5T**
			1–10A	**D65CE1C10T**
		120 Vac	0.1–1A	**D65CE1C01A**
			0.5–5A	**D65CE1C5A**
			1–10A	**D65CE1C10A**
	Adjustable (from 50–95% of pickup)	24 Vac	0.1–1A	**D65CEK1C01T**
			0.5–5A	**D65CEK1C5T**
			1–10A	**D65CEK1C10T**
		120 Vac	0.1–1A	**D65CEK1C01A**
			0.5–5A	**D65CEK1C5A**
			1–10A	**D65CEK1C10A**

D65CE_

D65CE Series—Standard Current Monitors, SPDT, 11-Pin Plug-In

Pickup Setting	Dropout Setting	Input Voltage	Current Range Monitored	Catalog Number
Adjustable	Fixed (at 95% of pickup)	24 Vac	0.1–1A	**D65CE2C01T**
			0.5–5A	**D65CE2C5T**
			1–10A	**D65CE2C10T**
		120 Vac	0.1–1A	**D65CE2C01A**
			0.5–5A	**D65CE2C5A**
			1–10A	**D65CE2C10A**
	Adjustable (from 50–95% of pickup)	24 Vac	0.1–1A	**D65CEK2C01T**
			0.5–5A	**D65CEK2C5T**
			1–10A	**D65CEK2C10T**
		120 Vac	0.1–1A	**D65CEK2C01A**
			0.5–5A	**D65CEK2C5A**
			1–10A	**D65CEK2C10A**

Accessories

D65CE Current Monitors

Description	Standard Pack	Catalog Number
8-pin socket	10	**D3PA2**
11-pin socket	10	**D3PA3-A2**
Hold-down spring	10	**D65CHDS**

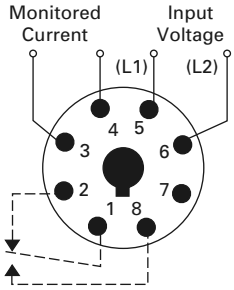
Technical Data and Specifications

D65CE Series, Standard Current Monitors

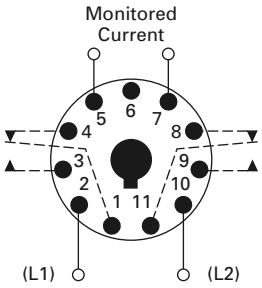
Description	Specification
Input voltage tolerance	AC operation: +10/–15% of nominal voltage at 50/60 Hz
Load (burden)	Less than 5 VA
Current settings	
Pickup	Adjustable throughout current range monitored
Dropout	Fixed at 95% of pickup setting for D65CE Adjustable from 50–95% of pickup setting for D65CEK
Temperature	–20° to 131°F (–28° to 55°C)
Response times	
Pickup	100 ms
Dropout	100 ms
Output contacts	10A resistive at 240 Vac/30 Vdc 1/2 hp at 240 Vac (NO); 1/3 hp at 240 Vac (NC)
Mechanical life	10,000,000 operations
Electrical life	100,000 operations
Indicator LED	Green when input voltage is applied; red when relay is energized
Reset	Automatic
Mounting	Requires an 8- or 11-pin socket

Wiring Diagrams

Wiring for 8-Pin Socket



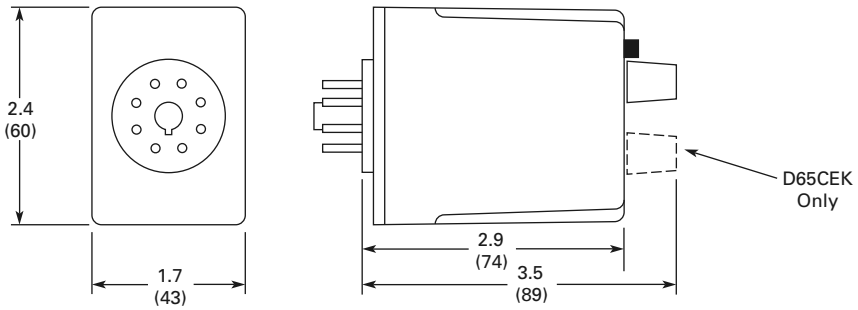
Wiring for 11-Pin Socket



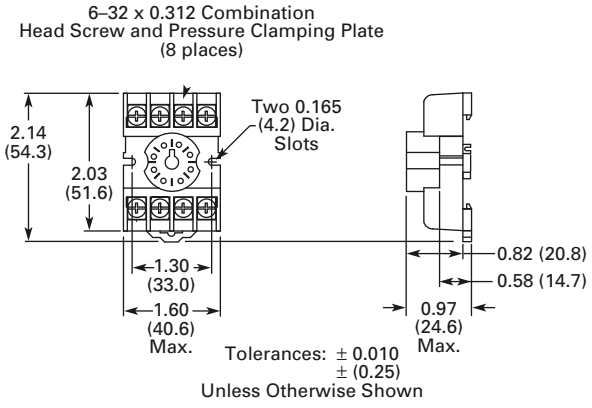
Dimensions

Approximate Dimensions in Inches (mm)

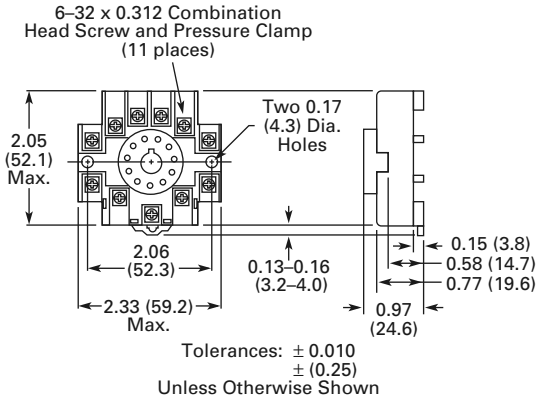
D65CE Series, Standard Current Monitors



D3PA2 Sockets



D3PA3 Sockets



D65CH Series—Overcurrent Monitors

Contents

D65CH Series—Overcurrent Monitors

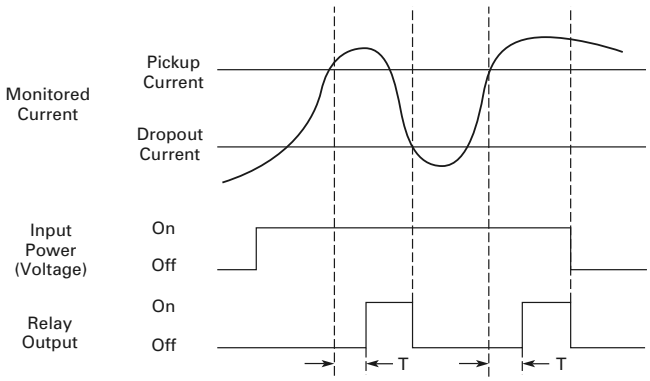
Product Description

The D65CH Series Overcurrent Monitoring Relays are used to detect an overcurrent condition. The pickup current setting is user-adjustable within one of three ranges as shown in product selection table. An external current transformer can be used to extend the range beyond 10A. Users may select a fixed dropout current setting (95% of the selected pick-up setting) or an adjustable drop-out setting (50–95% of the selected pickup setting). The relay will energize when the monitored AC current is above the pickup setting for a period longer than the adjustable time delay of 0.1–10 seconds. This delay prevents nuisance tripping caused by inrush currents. It will de-energize when the monitored AC current is below the dropout setting.

Features

- Monitors AC single-phase currents for overcurrent conditions
- Three separate current monitoring ranges covering 0.1–10 amperes
- External CT can be used to extend ranges
- Adjustable pickup setting with either fixed or adjustable dropout setting
- Adjustable time delay of 0.1–10 seconds on pickup
- LED indicates output relay status
- Choice of compact SPDT (8-pin) or DPDT (11-pin) plug-in case
- 10A output contacts

Overcurrent Monitoring



Product Selection

D65CH Series—Overcurrent Monitors, SPDT, 8-Pin Plug-In

D65CH_

Pick-Up Setting	Drop-Out Setting	Input Voltage	Current Range Monitored	Catalog Number
Adjustable	Fixed (at 95% of pickup)	24 Vac	0.1–1A	**D65CH1C1T**
			0.5–5A	**D65CH1C5T**
			1–10A	**D65CH1C10T**
		120 Vac	0.1–1A	**D65CH1C1A**
			0.5–5A	**D65CH1C5A**
			1–10A	**D65CH1C10A**
	Adjustable (from 50–95% of pickup)	24 Vac	0.1–1A	**D65CHK1C1T**
			0.5–5A	**D65CHK1C5T**
			1–10A	**D65CHK1C10T**
		120 Vac	0.1–1A	**D65CHK1C1A**
			0.5–5A	**D65CHK1C5A**
			1–10A	**D65CHK1C10A**

D65CH Series—Overcurrent Monitors, SPDT, 11-Pin Plug-In

D65CH_

Pick-Up Setting	Drop-Out Setting	Input Voltage	Current Range Monitored	Catalog Number
Adjustable	Fixed (at 95% of pickup)	24 Vac	0.1–1A	**D65CH2C1T**
			0.5–5A	**D65CH2C5T**
			1–10A	**D65CH2C10T**
		120 Vac	0.1–1A	**D65CH2C1A**
			0.5–5A	**D65CH2C5A**
			1–10A	**D65CH2C10A**
	Adjustable (from 50–95% of pickup)	24 Vac	0.1–1A	**D65CHK2C1T**
			0.5–5A	**D65CHK2C5T**
			1–10A	**D65CHK2C10T**
		120 Vac	0.1–1A	**D65CHK2C1A**
			0.5–5A	**D65CHK2C5A**
			1–10A	**D65CHK2C10A**

Accessories

D65CH Overcurrent Monitors

Description	Standard Pack	Catalog Number
8-pin socket	10	**D3PA2**
11-pin socket	10	**D3PA3-A2**
Hold-down spring	10	**D65CHDS**

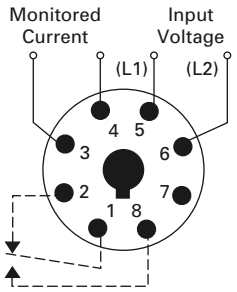
Technical Data and Specifications

D65CH Series, Overcurrent Monitors

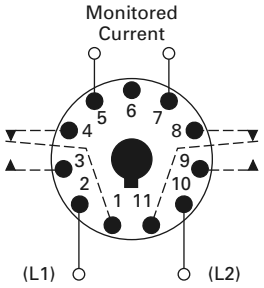
Description	Specification
Input voltage tolerance	AC operation: +10/–15% of nominal voltage at 50/60 Hz
Load (burden)	Less than 5 VA
Current settings	
Pickup	Adjustable throughout current range monitored
Dropout	Fixed at 95% of pickup setting for D65CE Adjustable from 50–95% of pickup setting for D65CEK
Temperature	–20° to 131°F (–28° to 55°C)
Response times	
Pickup	Adjustable 0.1–10 seconds
Dropout	Fixed at 100 ms
Output contacts	10A resistive at 240 Vac/30 Vdc 1/2 hp at 240 Vac (NO); 1/3 hp at 240 Vac (NC)
Mechanical life	10,000,000 operations
Electrical life	100,000 operations
Indicator LED	Green when input voltage is applied; red flashing when in time delay; red steady when relay is energized
Reset	Automatic
Mounting	Requires an 8- or 11-pin socket

Wiring Diagrams

Wiring for 8-Pin Socket



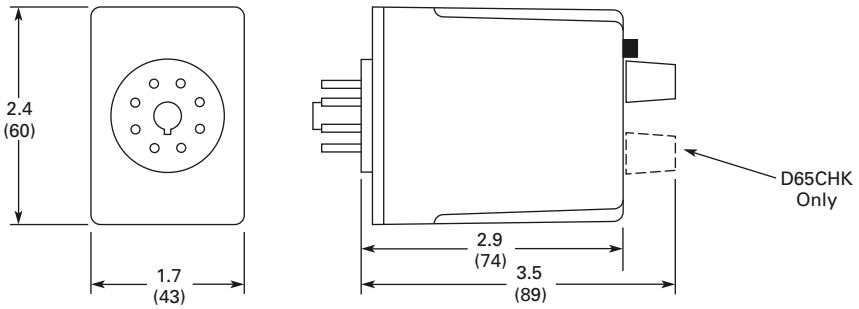
Wiring for 11-Pin Socket



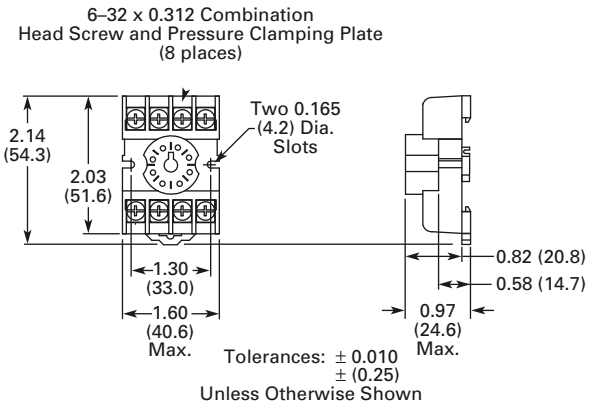
Dimensions

Approximate Dimensions in Inches (mm)

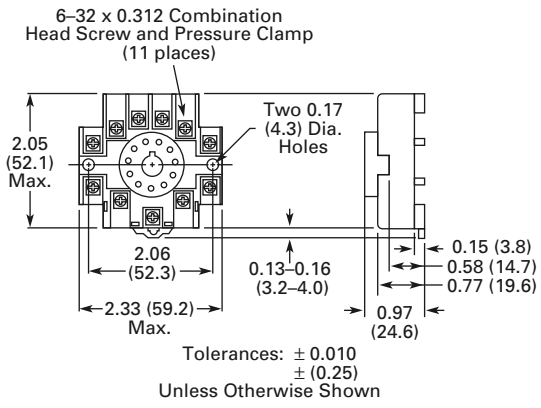
D65CH Series, Overcurrent Monitors



D3PA2 Sockets



D3PA3 Sockets



D65CL Series—Undercurrent Monitors

Contents

D65CL Series—Undercurrent Monitors

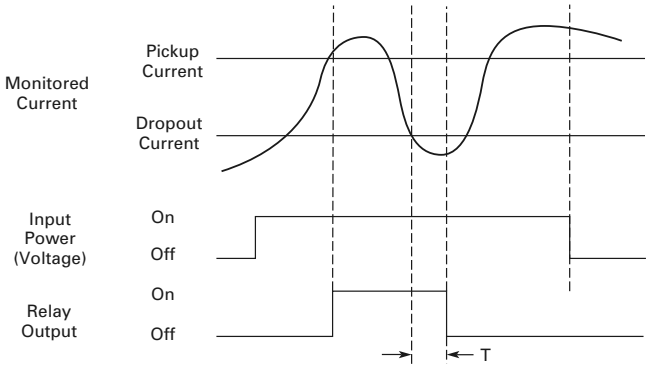
Product Description

The D65CL Series is designed to detect an undercurrent condition. The dropout current setting is user-adjustable within one of three ranges as shown in the product selection table. An external current transformer can be used to extend the range beyond 10A. The pickup current setting is fixed at +5% of the selected drop-out setting. The relay will energize when the monitored AC current is above the pickup setting. It will de-energize when the monitored AC current is below the dropout setting for a period longer than the adjustable time delay of 0.1–10 seconds. This delay prevents nuisance tripping caused by momentary line dips. The relay will energize when the current rises 5% above the dropout setting.

Features

- Monitors AC single-phase currents for undercurrent conditions
- Three separate current monitoring ranges covering 0.1–10 amperes
- External CT can be used to extend ranges
- Adjustable dropout setting with fixed pickup setting
- Adjustable time delay of 0.1–10 seconds on dropout
- LED indicates output relay status
- Choice of compact SPDT (8-pin) or DPDT (11-pin) plug-in case
- 10A output contacts

Undercurrent Monitoring



Product Selection

D65CL_

D65CL Series—Undercurrent Monitors, SPDT, 8-Pin Plug-In

Pickup Setting	Dropout Setting	Input Voltage	Current Range Monitored	Catalog Number
Fixed (at 5% of Dropout)	Adjustable	24 Vac	0.1–1A	**D65CL1C1T**
			0.5–5A	**D65CL1C5T**
			1–10A	**D65CL1C10T**
		120 Vac	0.1–1A	**D65CL1C1A**
			0.5–5A	**D65CL1C5A**
			1–10A	**D65CL1C10A**

D65CL_

D65CL Series—Undercurrent Monitors, SPDT, 11-Pin Plug-In

Pickup Setting	Dropout Setting	Input Voltage	Current Range Monitored	Catalog Number
Adjustable	Fixed (at 95% of pickup)	24 Vac	0.1–1A	**D65CL2C1T**
			0.5–5A	**D65CL2C5T**
			1–10A	**D65CL210T**
		120 Vac	0.1–1A	**D65CL2C1A**
			0.5–5A	**D65CL2C5A**
			1–10A	**D65CL2C10A**

Accessories

D65CL Undercurrent Monitors

Description	Standard Pack	Catalog Number
8-pin socket	10	**D3PA2**
11-pin socket	10	**D3PA3-A2**
Hold-down spring	10	**D65CHDS**

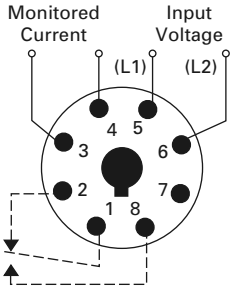
Technical Data and Specifications

D65CL Series, Undercurrent Monitors

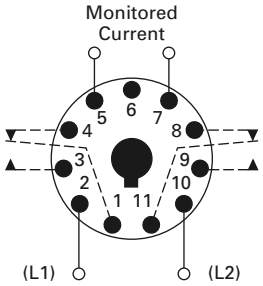
Description	Specification
Input voltage tolerance	AC operation: +10/–15% of nominal voltage at 50/60 Hz
Load (burden)	Less than 5 VA
Current settings	
Pickup	Fixed at 5% above adjustable dropout setting
Dropout	Adjustable throughout current range monitored
Temperature	–20° to 131°F (–28° to 55°C)
Response times	
Pickup	Fixed at 100 ms
Dropout	Adjustable 0.1–10 seconds
Output contacts	10A resistive at 240 Vac/30 Vdc 1/2 hp at 240 Vac (NO); 1/3 hp at 240 Vac (NC)
Mechanical life	10,000,000 operations
Electrical life	100,000 operations
Indicator LED	Green when input voltage is applied; red flashing when in time delay; red steady when relay is energized
Reset	Automatic
Mounting	Requires an 8- or 11-pin socket

Wiring Diagrams

Wiring for 8-Pin Socket



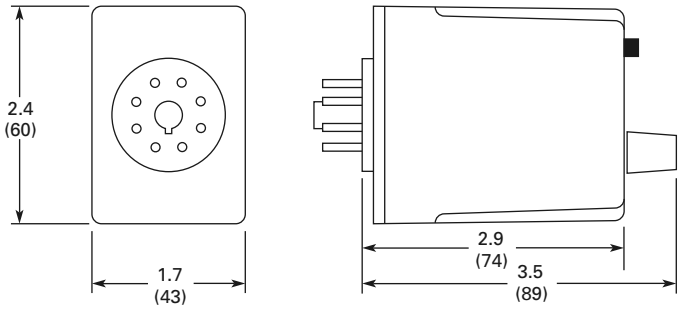
Wiring for 11-Pin Socket



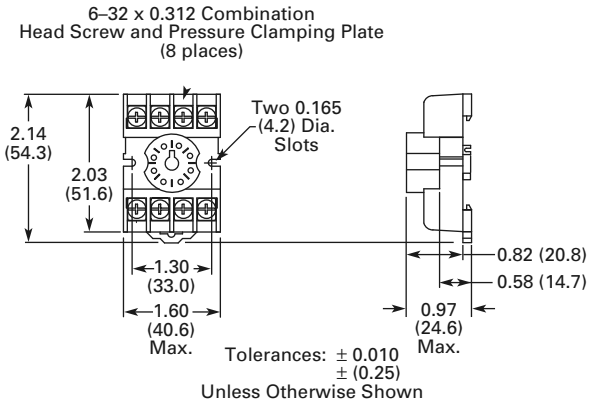
Dimensions

Approximate Dimensions in Inches (mm)

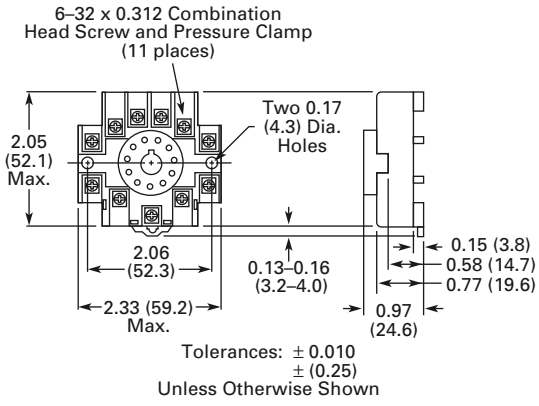
D65CL Series, Undercurrent Monitors



D3PA2 Sockets



D3PA3 Sockets



Phase Monitoring Relays

Contents

Product Overview

The D65 Series Phase Monitoring Relays provide protection against premature equipment failure caused by voltage faults on three-phase systems. All D65 phase monitoring relays are compatible with most wye or delta systems. In wye systems, a connection to neutral is not required. Phase Monitoring relays protect against single-phasing regardless of any regenerative voltages.

Application Description

Protection

Depending on the unit selected, it will protect three-phase equipment against:

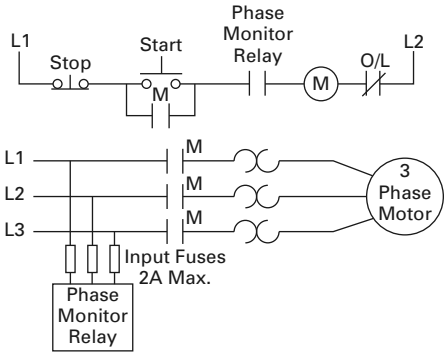
- **Phase Loss**—total loss of one or more of the three phases. Also known as "single phasing." Typically caused by a blown fuse, broken wire or worn contact. This condition would result in a motor drawing locked rotor current during startup. In addition, a three-phase motor will continue to run after losing a phase, resulting in possible motor burn-out.
- **Phase Reversal**—reversing any two of the three phases will cause a three-phase motor to run in the opposite direction. This may cause damage to driven machinery or injury to personnel. The condition usually occurs as a result of mistakes made during routine maintenance or when modifications are made to the circuit.
- **Phase Imbalance**—imbalance of a three-phase system occurs when single-phase loads are connected such that one or two of the lines (phases) carry more or less of the load. This could cause motors to run at temperatures above published ratings.
- **Undervoltage**—when voltage in all three lines of a three-phase system drop simultaneously.
- **Overvoltage**—when voltage in all three lines of a three-phase system increase simultaneously.

Typical Connections

Line Side Monitoring

With the relay connected before the motor starter, the motor can be started in the reverse direction. However, the motor is unprotected against phase failures between the relay and the motor.

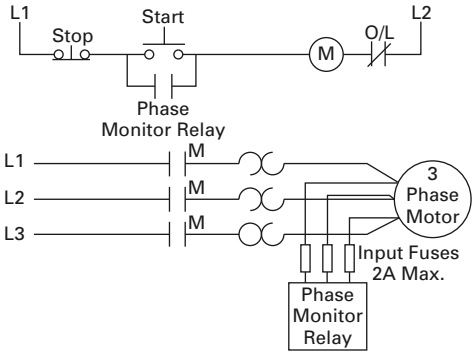
Line Side Monitoring



Load Side Monitoring

With the relay connected directly to the motor, the total feed lines are monitored. This connection should not be used with reversing motors.

Load Side Monitoring



Standards and Certifications

D65VMC, D65PLR and D65PAR Series

- cRUus listed
- RoHS recognized
- CE marked (pending)

D65VMLP Series

- cRUus listed
- RoHS recognized
- CE marked

D65VMLS Series

- cULus listed
- RoHS recognized
- CE marked

Product Selection Guide

D65 Series—Product Family Selection

Series	Mounting Style	Phase Reversal	Phase Loss and Reversal	Undervoltage	Overvoltage	Phase Imbalance	Time Delay on Undervoltage
D65VMC	Plug-in ①	3	—	—	—	—	—
D65PLR	Plug-in ①	3	3	—	—	—	—
D65PAR	Plug-in ①	3	3	✓ (adjustable)	—	—	50 ms fixed
D65VMLP	Plug-in ①	3	3	✓ (adjustable)	✓ (fixed)	3	0.1–20 sec
D65VMLS	Surface	3	3	✓ (adjustable)	✓ (fixed)	3	0.1–20 sec

Note

① In addition to the above approvals, all plug-in products are also UL Listed when used with the appropriate Eaton socket.

D65VMC Series—Phase Reversal

Contents

D65VMC Series—Phase Reversal

Product Description

The D65VMC Series Monitoring Relays provide protection against phase reversal in a compact plug-in design. One version will work on any three-phase system from 208V to 480V (a separate 120V-only version is also available). These devices are designed to be compatible with most wye or delta systems. In wye systems, a connection to a neutral is not required.

The relay is energized and the LED on when the sequence is correct. Any fault will de-energize the relay and turn off the LED. Re-energization is automatic upon correction of the fault condition.

Features

- Protects against phase reversal
- One version works on 208–480V three-phase systems
- LED indicates both normal and fault conditions
- Compact plug-in case utilizing industry-standard 8-pin octal socket
- 10A SPDT output contacts

Standards and Certifications

- cRUus
- UL listed ①
- RoHS compliant

c UL us Listed RoHS COMPLIANT

Note

① When used with appropriate Eaton socket.

Product Selection

D65VMC120

D65VMC Series, Phase Reversal

Mounting Style	Nominal Voltage 50/60 Hz	Catalog Number
Plug-in	120V	**D65VMC120**
Plug-in	208–480V	**D65VMC480** ①

Accessories

D65VMC Series, Phase Reversal

Description	Standard Pack	Catalog Number
8-pin socket	10	**D3PA2**
Hold-down spring	10	**D65CHDS**

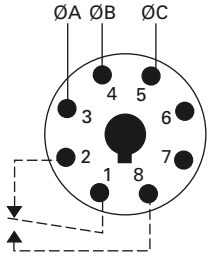
Technical Data and Specifications

D65VMC Series, Phase Reversal

Description	Specification
Phase reversal	Unit trips if sequence of the three phases is anything other than A-B-C
Output contacts	10A SPDT at 240 Vac, 1/3 hp at 240 Vac (NO), 1/6 hp at 240 Vac (NC)
Life	Full load—100,000 operations
Response times	
Operate	50 ms
Release	50 ms
Load (burden)	3 VA
Temperature	–20° to 150°F (–28° to 65°C)
Transient protection	10,000 volts for 20 microseconds
Mounting	Uses an 8-pin octal socket. Requires a 600V rated socket when used on system voltages greater than 300V
Indicator LED	Red LED on when all conditions are normal, and off when a fault condition has occurred
Reset	Automatic upon correction of fault

Wiring Diagram

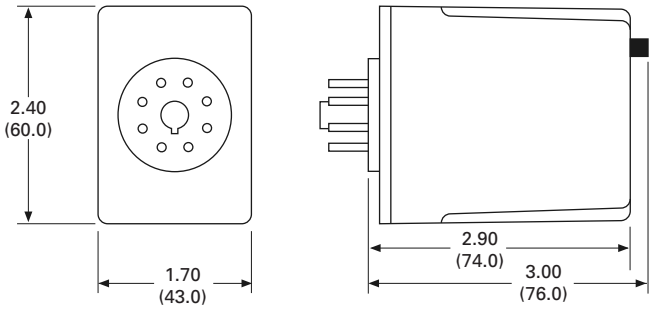
Wiring for 8-Pin Socket



Dimensions

Approximate Dimensions in Inches (mm)

D65VMC Series, Phase Reversal



Note

① Requires a 600V rated socket when used on system voltages greater than 300V.

D65PLR Series—Phase Loss and Reversal

Contents

D65PLR Series—Phase Loss and Reversal

Product Description

The D65PLR Series Monitoring Relays provide protection against phase loss and phase reversal in a compact plug-in design. These devices are designed to be compatible with most wye or delta systems. In wye systems, a connection to a neutral is not required. Phase monitoring relays protect against single-phasing regardless of any regenerative voltages.

The relay is energized and the LED on when all three phases are present and in the correct sequence. Any fault will instantaneously de-energize the relay and turn off the LED. Re-energization is automatic upon correction of the fault condition.

Features

- Protects against phase loss and phase reversal
- LED indicates both normal and fault conditions
- Compact plug-in case utilizing industry-standard 8-pin octal socket
- 10A SPDT output contacts

Standards and Certifications

- cRUus
- UL listed ①
- RoHS compliant

c US Listed RoHS COMPLIANT

Note

① When used with appropriate Eaton socket.

Product Selection

D65PLR120

D65PLR Series, Phase Loss and Reversal

Mounting Style	Nominal Voltage 50/60 Hz	Catalog Number
Plug-in	120V	**D65PLR120**
Plug-in	208V	**D65PLR208**
Plug-in	240V	**D65PLR240**
Plug-in	400V	**D65PLR400** ①
Plug-in	480V	**D65PLR480** ①

Accessories

D65PLR Series, Phase Loss and Reversal

Description	Standard Pack	Catalog Number
8-pin socket	10	**D3PA2**
Hold-down spring	10	**D65CHDS**

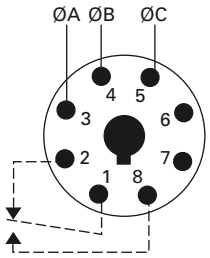
Technical Data and Specifications

D65PLR Series, Phase Loss and Reversal

Description	Specification
Phase loss	Unit trips on loss of any Phase A, B or C
Phase reversal	Unit trips if sequence of the three phases is anything other than A-B-C
Output contacts	10A SPDT at 240 Vac, 1/3 hp at 240 Vac (NO), 1/6 hp at 240 Vac (NC)
Life	Full load—100,000 operations
Response times	
Operate	50 ms
Release	50 ms
Load (burden)	3 VA
Temperature	–20° to 150°F (–28° to 65°C)
Transient protection	10,000 volts for 20 microseconds
Mounting	Uses an 8-pin octal socket. Requires a 600V rated socket when used on system voltages greater than 300V
Indicator LED	Red LED on when all conditions are normal, and off when a fault condition has occurred
Reset	Automatic upon correction of fault

Wiring Diagram

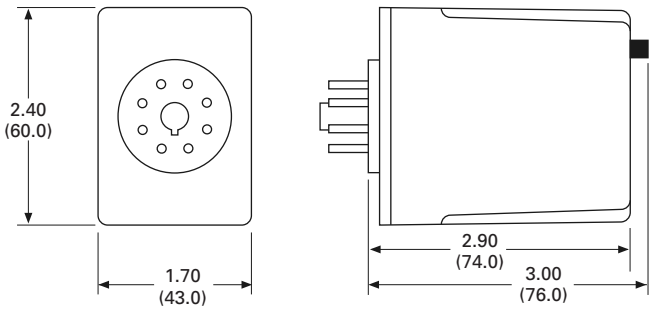
Wiring for 8-Pin Socket



Dimensions

Approximate Dimensions in Inches (mm)

D65PLR Series, Phase Loss and Reversal



Note

① Requires a 600V rated socket when used on system voltages greater than 300V.

D65PAR Series—Phase Loss, Reversal and Undervoltage

Contents

D65PAR Series—Phase Loss, Reversal and Undervoltage

Product Description

The D65PAR Series Monitoring Relays provide protection against phase loss, phase reversal and undervoltage in a compact plug-in design. These devices are designed to be compatible with most wye or delta systems. In wye systems, a connection to a neutral is not required. Phase monitoring relays protect against single-phasing regardless of any regenerative voltages.

The relay is energized and the LED on when all three phases are present in the correct sequence at a voltage level above the undervoltage setting. The undervoltage drop-out can be set at 75–95% of operating voltage. Any fault will instantaneously de-energize the relay and turn off the LED. Re-energization is automatic upon correction of the fault condition.

Features

- Protects against phase loss, phase reversal and undervoltage
- Undervoltage setting is adjustable from 75–95% of nominal
- LED indicates both normal and fault conditions
- Compact plug-in case utilizing industry-standard 8-pin octal socket
- 10A SPDT output contacts

Standards and Certifications

- cRUus
- UL listed ①
- RoHS compliant

c UL us Listed RoHS COMPLIANT

Note

① When used with appropriate Eaton socket.

Product Selection

D65PAR_

D65PAR Series, Phase Loss, Reversal and Undervoltage

Mounting Style	Nominal Voltage 60 Hz	Undervoltage Range	Catalog Number
Plug-in	120V	90–115V	**D65PAR120**
Plug-in	208V	156–198V	**D65PAR208**
Plug-in	240V	180–230V	**D65PAR240**
Plug-in	400V	300–380V	**D65PAR400** ①
Plug-in	480V	360–460V	**D65PAR480** ①

Accessories

D65PAR Series, Phase Loss, Reversal and Undervoltage

Description	Standard Pack	Catalog Number
8-pin socket	10	**D3PA2**
Hold-down spring	10	**D65CHDS**

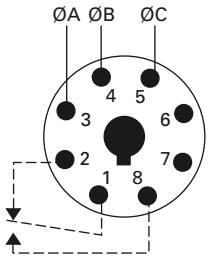
Technical Data and Specifications

D65PAR Series, Phase Loss, Reversal and Undervoltage

Description	Specification
Phase loss	Unit trips on loss of any Phase A, B or C
Phase reversal	Unit trips if sequence of the three phases is anything other than A-B-C
Undervoltage	Adjustable over a range per product selection table. Unit trips when the average of all three lines is less than the adjusted set point.
Output contacts	10A SPDT at 240 Vac, 1/3 hp at 240 Vac (NO), 1/6 hp at 240 Vac (NC)
Life	Full load—100,000 operations
Response times	
Operate	50 ms
Release	50 ms
Load (burden)	3 VA
Temperature	–20° to 150°F (–28° to 65°C)
Transient protection	10,000 volts for 20 microseconds
Mounting	Uses an 8-pin octal socket. Requires a 600V rated socket when used on system voltages greater than 300V
Indicator LED	Red LED on when all conditions are normal, and off when a fault condition has occurred
Reset	Automatic upon correction of fault

Wiring Diagram

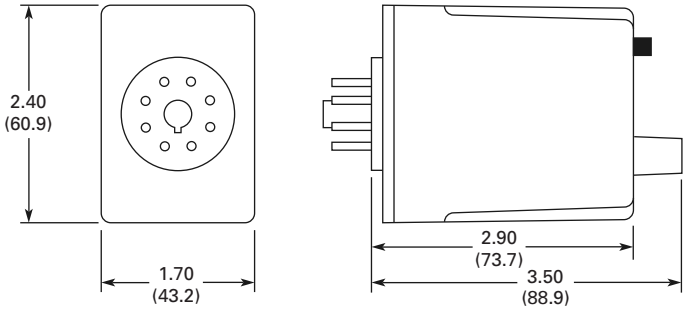
Wiring for 8-Pin Socket



Dimensions

Approximate Dimensions in Inches (mm)

D65PAR Series, Phase Loss, Reversal and Undervoltage



Note

① Requires a 600V rated socket when used on system voltages greater than 300V.

D65VM Series—Phase Loss, Reversal, Imbalance and Under/Overvoltage

Contents

D65VM Series—Phase Loss, Reversal, Imbalance and Under/Overvoltage

Product Description

Eaton's D65 Phase Monitoring Relay protects distribution systems supplying motor feeder or branch circuits against premature equipment failure caused by voltage faults on three-phase systems—wye or delta connected. Phase monitoring relays protect against voltage imbalance and single-phasing regardless of any regenerative voltages. The relay is energized when the phase sequence and all voltages are correct. Any of five abnormal conditions (phase loss, phase reversal, overvoltage, undervoltage or phase imbalance) will de-energize the relay. As standard, re-energization is automatic upon correction of the fault condition. The D65 can also be wired for manual reset.

Application Description

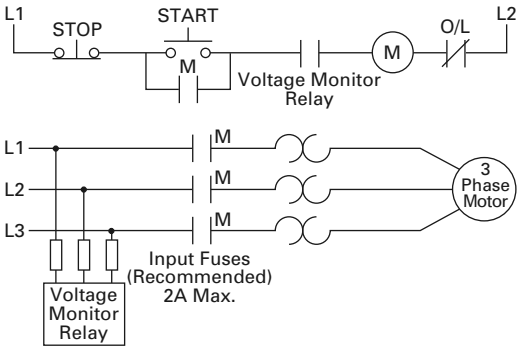
Protective Functions

The D65 Series Relay makes separate trip decisions based on the status of the three-phase voltage inputs. Control power is derived from the three-phase voltage inputs. Separate control power is not required. The device will trip in response to any combination of the following conditions:

- **Undervoltage**—When voltage in all three lines of a three-phase system drops simultaneously. Undervoltage drop-out can be set at 80–95% of operating voltage. Unit trips when the average of all three lines is less than the adjusted set point for a period longer than the adjustable time delay drop-out (0.1–20 seconds). This time delay eliminates nuisance tripping caused by momentary voltage fluctuation.
- **Overvoltage**—Fixed at 110% of nominal, unit trips when the average of all three lines is greater than the fixed set point for a period longer than the time delay drop-out.
- **Phase Imbalance**—Imbalance of a three-phase system occurs when single-phase loads are connected such that one or two of the lines (phases) carry more or less of the load. This could cause motors to run at temperatures above published ratings. Unit trips when any one of the three lines is more than the adjusted set point below the average of all three lines. The percent phase imbalance is adjustable from 2–10% and also has a Disable setting for applications where poor voltage conditions could cause nuisance tripping.
- **Phase Loss (Single-Phasing)**—Total loss of one or more of the three phases. Typically caused by a blown fuse, broken wire or worn contact. This condition would result in a motor drawing locked rotor current during start-up. In addition, a three-phase motor will continue to run after losing a phase, resulting in potential motor burn-out. Unit trips on loss of any phase.
- **Phase Reversal**—Reversing any two of the three phases will cause a three-phase motor to run in the opposite direction. This may cause damage to machinery or injury to personnel. Unit trips if rotation (sequence) of the three phases is anything other than A-B-C.

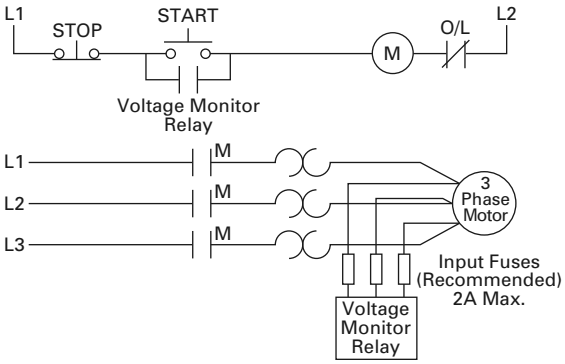
Typical Connections

Line Side Monitoring



With the relay connected before the motor starter, the motor can be started in the reverse direction. However, the motor is unprotected against phase failures between the relay and the motor.

Load Side Monitoring



With the relay connected directly to the motor, the total feed lines are monitored. This connection should not be used with reversing motors.

Features

- Universal voltage range of 208–480V provides the flexibility to cover a variety of applications (120V and 600V units also available)
- Automatic or manual reset after the fault condition is corrected
- Multi-color LED indicates normal condition and defines fault type for simpler troubleshooting
- D65VMLS can be either mounted directly on 35 mm DIN rail with no additional parts or to a back-panel with two screws. No socket required. D65VMLP will plug into D3PA2 socket and mount on 35 mm DIN rail
- Small, compact size
- User-adjustable settings include nominal voltage, percent phase imbalance, undervoltage drop-out, time delay on undervoltage and time delay on restart after fault

Operation

The D65 provides protection against premature equipment failure caused by voltage faults on three-phase systems. The D65 is designed to be compatible with most wye or delta systems. In wye systems, a connection to a neutral is not required. D65 Phase Monitoring Relays protect against imbalanced voltages or single-phasing regardless of any regenerative voltages. The relay is energized when the phase sequence and all voltages are correct. Any one of five fault conditions will de-energize the relay. Re-energization is automatic upon correction of the fault condition.

Manual reset is available if a NC switch is wired to the appropriate terminals. A multi-color LED indicates normal condition and also provides specific fault indication to simplify troubleshooting. The percent phase imbalance is adjustable from 2–10%, and the undervoltage drop-out can be set at 80–95% of operating voltage. The adjustable time delay drop-out on undervoltage (0.1–20 sec.) eliminates nuisance tripping caused by momentary voltage fluctuations.

LED Operation

LED Status	Indicator
Green steady	Normal/relay ON
Green flashing	Power-up/restart delay
Red steady	Imbalance
Red flashing	Undervoltage/overvoltage
Amber steady	Reversal
Amber flashing	Loss
Alternating green/red	Undervoltage/overvoltage trip pending
Alternating red/amber	Nominal voltage set error

Standards and Certifications

- CE (Low Voltage + EMC Directive EN60947-5-1)
- cULus listed (D65VMLS only)
- cRUus (D65VMLP only)
- RoHS compliant
- UL Listed ①

Product Selection

D65VM_

D65VM Series—Phase Loss, Reversal, Imbalance and Under/Overvoltage ②

Mounting Style	Operating Voltage 50/60 Hz	Catalog Number
Surface-mount (DIN rail or panel)	120V	**D65VMLS120**
	208–480V	**D65VMLS480**
	600V	**D65VMLS600**
Plug-in (DIN rail)	120V	**D65VMLP120**
	208–480V	**D65VMLP480** ③
8-pin socket	—	**D3PA2**
8-pin IP20 rated socket	—	**D3PA6**

Technical Data and Specifications

D65VM Series—Phase Loss, Reversal, Imbalance and Under/Overvoltage

Description	Specification
Nominal voltages (50–60 Hz)	120V, 208–480V, 575V
Connections	Three-wire wye or delta
Output contacts	
For D65VMLS	SPDT and SPNC (surface mount version only) NO: 10A resistive at 240 Vac/30 Vdc, 1/2 hp at 240 Vac NC: 10A resistive at 240 Vac/30 Vdc, 1/3 hp at 240 Vac
For D65VMLP	SPDT: 10A Resistive at 240 Vac/30 Vdc; 1/2 hp at 120/240 Vac
Dielectric	1000V + (2 * nominal voltage rating) between input terminals and case or active circuitry
Operating temp.	–20° to 150°F (–28° to 65°C)
Response times	
Power up	1–300 seconds adjustable
Restart after fault	1–300 seconds adjustable
Dropout due to fault	100 ms fixed on phase loss and phase reversal; 2 seconds fixed on phase imbalance; 0.1–20 sec. adjustable on undervoltage only; inverse time curve for overvoltage
Mechanical life	10,000,000 operations
Electrical life	100,000 operations
Power consumption	3 VA
Net weight	10.3 oz. (292g) D65VMLS 6.4 oz. (181g) D65VMLP
Hysteresis	2–3%

Notes

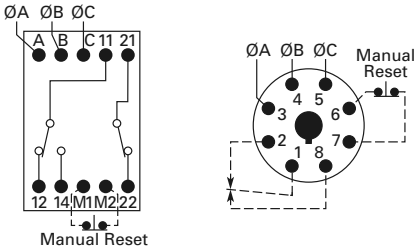
① When used with accompanying Eaton Socket (D65VMLP only).

② Additional models available. Please visit our Web site for the latest offering.

③ Requires a 600V-rated socket when used on system voltages greater than 300V. The D3PA2 socket is rated 10A, 600V.

Wiring Diagrams

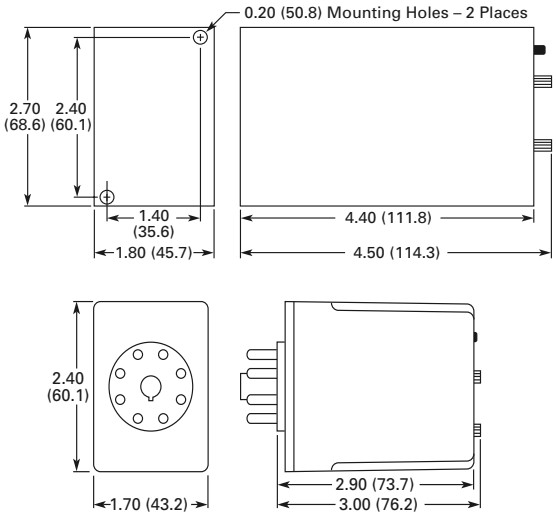
Surface-Mount and Plug-In



Dimensions

Approximate Dimensions in Inches (mm)

Surface-Mount and Plug-In



Voltage Monitoring Relays

Contents

Product Overview

Voltage Monitoring Relays monitor either AC single-phase (50/60 Hz) or DC voltages to protect equipment against voltage fault conditions. No separate supply (input) voltage is required. All versions are available in a compact plug-in case using an 8-pin octal socket.

There are two styles of voltage monitoring relays:

- Over/Undervoltage Relays
- Voltage Band Relays

Over/Undervoltage Relays

Over/Undervoltage Relays provide protection to equipment where either an over- or undervoltage condition is potentially damaging. Each relay can be used as either an overvoltage or an undervoltage relay, depending on the output contact used. When used as an undervoltage relay, it provides protection to equipment that is required to operate above a minimum voltage. When used as an overvoltage relay, it protects equipment against excessive voltage conditions. Over/undervoltage relays are designed to operate when the operating voltage reaches a preset value and drop out when the operating voltage drops to a level below the preset value.

Voltage Band Relays

Voltage Band Relays provide protection to equipment that is required to operate within an upper and lower voltage limit. As long as the operating voltage remains within an over- and undervoltage range, the internal relay stays energized. If the operating voltage falls outside this range, the relay will drop out.

Standards and Certifications

- CE
- cRUus listed
- UL listed ①
- RoHS recognized

Listed

Note

① When used with accompanying Eaton socket.

Product Selection Guide

D65V Product Family Selection—Over/Undervoltage Relays

Series	Pickup Voltage	Dropout Voltage	Time Delay Dropout	Fixed Time Delay for Over/Undervoltage Relays	Adjustable Time Delay Over/Undervoltage Relays
D65VMP	Adjustable 85–115% nominal	Fixed at 95% of pickup	Fixed 500 ms ①	**Page V5-T31-31**	—
D65VMKP		Adjustable 75–95% of pickup		**Page V5-T31-31**	—
D65VAP		Fixed at 95% of pickup	Adjustable 0.5–10 seconds	—	**Page V5-T31-34**
D65VAKP		Adjustable 75–95% of pickup		—	**Page V5-T31-34**

D65V Product Family Selection—Voltage Band Relays

Series	Pickup Voltage	Dropout Voltage	Time Delay Dropout	Voltage Band Relays
D65VWP	Adjustable 100–125% nominal	Adjustable 75–100% of nominal	Fixed 500 ms ①	**Page V5-T31-37**
D65VWKP			Adjustable 0.5–10 seconds	**Page V5-T31-37**

Note

① Fixed time delay eliminates nuisance tripping due to short voltage surges or drops.

D65VMRP and D65VMKP—Fixed Time Delay Over/Undervoltage Relays

Contents

D65VMRP and D65VMKP Over/Undervoltage Relays (Fixed Time Delay)

Product Description

The D65VMRP and D65VMKP Over/Undervoltage Relays provide protection to equipment where either an over- or undercurrent condition is potentially damaging. They are designed to operate when the operating voltage reaches a preset value and drop out when the operating voltage drops to a level below the preset value.

The pickup voltage setting is user-adjustable from 85–115% of the nominal voltage rating. As standard, the D65VMRP Series has a dropout voltage setting fixed at 95% of the pickup voltage setting. An adjustable drop-out setting of 75–95% of the pickup setting is available on the D65VMKP Series. The relay energizes when the monitored voltage is above the pickup setting. The relay de-energizes when the monitored voltage is below the dropout setting for a period longer than the drop-out time delay, which is fixed at 500 ms. An adjustable time delay on dropout of 0.5–10 seconds is available.

Application Description

Each relay can be used as either an overvoltage or an undervoltage relay, depending on the output contact used.

Overvoltage Relay

Provides protection to equipment that cannot handle excess voltages. Uses a normally closed contact (NC). As long as the monitored voltage remains below the maximum voltage the equipment can withstand (pickup setting), the relay remains energized and the NC contact remains closed, keeping the load energized. If the operating voltage increases beyond the maximum rating of the equipment, the relay energizes and the NC contact opens, turning off the load. When the voltage falls below the dropout settings (hysteresis), the relay de-energizes and the NC contact re-closes, turning on the load.

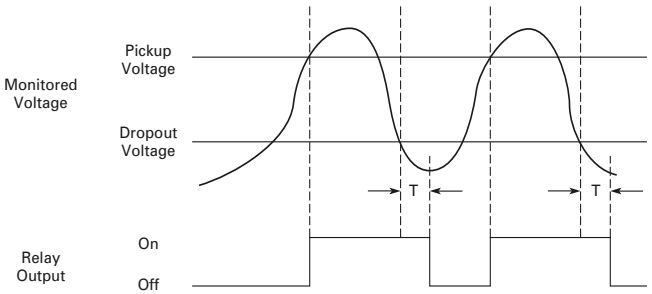
Undervoltage Relay

Provides protection to equipment that is required to operate above a certain minimum voltage. Uses a normally open contact (NO). As long as the monitored voltage is above the minimum value required (pickup setting), the relay will energize and the NO contact closes, turning on the load. If the voltage drops below the dropout setting (the minimum voltage required minus hysteresis), the relay will de-energize and the NO contact will re-open, turning off the load.

Features

- Monitors AC single-phase and DC voltages
- Wide range of user-adjustable pickup and dropout settings
- Fixed time delay on dropout of 500 ms
- LED indicates output relay status
- Compact plug-in case using industry standard 8-pin socket
- 10A DPDT output contacts

Fixed Time Delay Over/Undervoltage Current Monitoring



Product Selection

D65VM_

D65VMP and D65VMKP Series—Over/Undervoltage Relay ①, Adjustable Pickup, Fixed Dropout Settings ②

Nominal Voltage	Voltage Range Pickup	Dropout	Catalog Number
24 Vac	21–27 Vac	20–26 Vac	**D65VMRPT**
120 Vac	102–138 Vac	97–131 Vac	**D65VMRPA**
12 Vdc	10–14 Vdc	9–13 Vdc	**D65VMRPR1**
24 Vdc	21–27 Vdc	20–26 Vdc	**D65VMRPT1**
48 Vdc	41–55 Vdc	39–52 Vdc	**D65VMRPW1**
110 Vdc	94–126 Vdc	89–121 Vdc	**D65VMRPA1**

D65VM_

D65VMP and D65VMKP Series—Over/Undervoltage Relay ①, Adjustable Pickup and Dropout Settings ③

Nominal Voltage	Voltage Range Pickup	Dropout	Catalog Number
24 Vac	21–27 Vac	16–26 Vac	**D65VMKPT**
120 Vac	102–138 Vac	77–131 Vac	**D65VMKPA**
12 Vdc	10–14 Vdc	8–13 Vdc	**D65VMKPR1**
24 Vdc	21–27 Vdc	16–26 Vdc	**D65VMKPT1**
48 Vdc	41–55 Vdc	32–52 Vdc	**D65VMKPW1**
110 Vdc	94–126 Vdc	71–121 Vdc	**D65VMKPA1**

Accessories

D65VMP and D65VMKP Series—Over/Undervoltage Relays

Description	Standard Pack	Catalog Number
8-pin socket	10	**D3PA2**
Hold-down spring	10	**D65CHDS**

Notes

① Time delay on dropout fixed at 500 ms.
② Dropout voltage is fixed at 95% of the adjusted pickup setting.
③ Dropout voltage is adjustable from 75–95% of the adjusted pickup setting.

Technical Data and Specifications

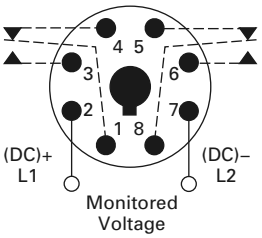
D65V Series—Fixed and Adjustable Time Delay Over/Undervoltage Relays

D65VMP, D65VMKP, D65VAP and D65VAKP Series, Over/Undervoltage Relays

Description	Specification
Voltage tolerance	+25%/–50% of nominal voltage; AC voltages are 50/60 Hz No supply (input) voltage is required
Load (burden)	Less than 3 VA
Current settings	
Pickup	Adjustable from 85–115% of nominal voltage
Dropout	Fixed at 95% of the pickup setting for D65VMP and D65VAP Adjustable from 75–95% of the pickup setting for D65VMKP and D65VAKP
Temperature	–20° to 131°F (–28° to 55°C)
Response times	
Pickup	500 ms
Dropout	Fixed 500 ms for D65VMP and D65VMKP Adjustable 0.5–10 seconds for D65VAP and D65VAKP
Output contacts	10A Resistive at 240 Vac/30 Vdc, 1/2 hp at 240 Vac (NO), 1/3 hp at 240 Vac (NC)
Mechanical life	10,000,000 operations
Electrical life	100,000 operations
Indicator LED	Red steady when relay is energized; green when relay is OFF
Transient protection	10,000 volts for 20 microseconds
Reset	Automatic
Mounting	Requires an 8-pin socket

Wiring Diagram

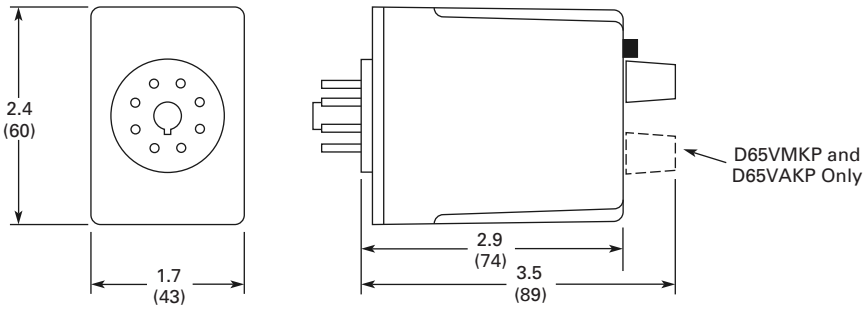
Wiring for 8-Pin Socket



Dimensions

Approximate Dimensions in Inches (mm)

D65V Series—Fixed and Adjustable Time Delay Over/Undervoltage Relays



D65VAP & D65VAKP—Adjustable Time Delay Over/Undervoltage Relays

Contents

D65VAP and D65VAKP Over/Undervoltage Relays (Adjustable Time Delay)

Product Description

The D65VAP and D65VAKP Over/Undervoltage Relays provide protection to equipment where either an over- or undercurrent condition is potentially damaging. They are designed to operate when the operating voltage reaches a preset value and drop out when the operating voltage drops to a level below the preset value.

The pickup voltage setting is user-adjustable from 85–115% of the nominal voltage rating. As standard, the D65VAP Series has a dropout voltage setting fixed at 95% of the pickup voltage setting. An adjustable dropout setting of 75–95% of the pickup setting is available on the D65VAKP Series. The relay energizes when the monitored voltage is above the pickup setting. The relay de-energizes when the monitored voltage is below the dropout setting for a period longer than the dropout time delay, which is adjustable from 0.5–10 seconds. A fixed time delay of 500 ms is available with the D65VMP Series.

Application Description

Each relay can be used as either an overvoltage or an undervoltage relay, depending on the output contact used.

Overvoltage Relay

Provides protection to equipment that cannot handle excess voltages. Uses a normally closed contact (NC). As long as the monitored voltage remains below the maximum voltage the equipment can withstand (pickup setting), the relay remains energized and the NC contact remains closed, keeping the load energized. If the operating voltage increases beyond the maximum rating of the equipment, the relay energizes and the NC contact opens, turning off the load. When the voltage falls below the dropout settings (hysteresis), the relay de-energizes and the NC contact re-closes, turning on the load.

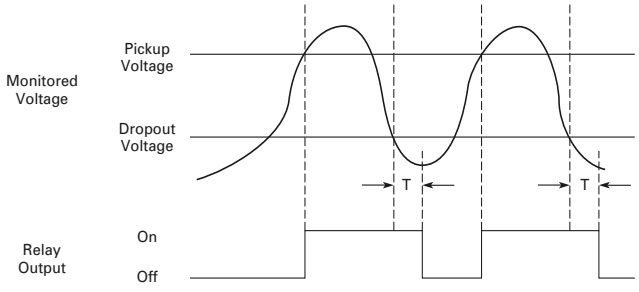
Undervoltage Relay

Provides protection to equipment that is required to operate above a certain minimum voltage. Uses a normally open contact (NO). As long as the monitored voltage is above the minimum value required (pickup setting), the relay will energize and the NO contact closes, turning on the load. If the voltage drops below the dropout setting (the minimum voltage required minus hysteresis), the relay will de-energize and the NO contact will re-open, turning off the load.

Features

- Monitors AC single-phase and DC voltages
- Wide range of user-adjustable pickup and dropout settings
- Adjustable time delay on dropout of 0.5–10 seconds
- LED indicates output relay status
- Compact plug-in case using industry standard 8-pin socket
- 10A DPDT output contacts

Adjustable Time Delay Over/Undervoltage Current Monitoring



Product Selection

D65VA_

D65VAP and D65VAKP Series—Over/Undervoltage Relay ①, Adjustable Pickup, Fixed Dropout Settings ②

Nominal Voltage	Voltage Range Pickup	Dropout	Catalog Number
24 Vac	21–27 Vac	20–26 Vac	**D65VAPT**
120 Vac	102–138 Vac	97–131 Vac	**D65VAPA**
12 Vdc	10–14 Vdc	9–13 Vdc	**D65VAPR1**
24 Vdc	21–27 Vdc	20–26 Vdc	**D65VAPT1**
48 Vdc	41–55 Vdc	39–53 Vdc	**D65VAPW1**
110 Vdc	94–126 Vdc	89–121 Vdc	**D65VAPA1**

D65VA_

D65VAP and D65VAKP Series—Over/Undervoltage Relay ①, Adjustable Pickup and Dropout Settings ③

Nominal Voltage	Voltage Range Pickup	Dropout	Catalog Number
24 Vac	21–27 Vac	16–26 Vac	**D65VAKPT**
120 Vac	102–138 Vac	77–131 Vac	**D65VAKPA**
12 Vdc	10–14 Vdc	8–13 Vdc	**D65VAKPR1**
24 Vdc	21–27 Vdc	16–26 Vdc	**D65VAKPT1**
48 Vdc	41–55 Vdc	32–52 Vdc	**D65VAKPW1**
110 Vdc	94–126 Vdc	71–121 Vdc	**D65VAKPA1**

Accessories

D65VMP and D65VMKP Series—Over/Undervoltage Relays

Description	Standard Pack	Catalog Number
8-pin socket	10	**D3PA2**
Hold-down spring	10	**D65CHDS**

Notes

① Time delay on dropout fixed at 500 ms.
② Dropout voltage is fixed at 95% of the adjusted pickup setting.
③ Dropout voltage is adjustable from 75–95% of the adjusted pickup setting.

Technical Data and Specifications

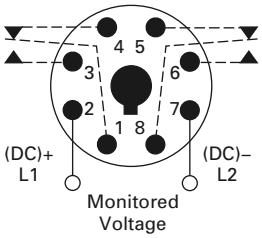
D65V Series—Fixed and Adjustable Time Delay Over/Undervoltage Relays

D65VMP, D65VMKP, D65VAP and D65VAKP Series, Over/Undervoltage Relays

Description	Specification
Voltage tolerance	+25%/–50% of nominal voltage; AC voltages are 50/60 Hz No supply (input) voltage is required
Load (burden)	Less than 3 VA
Current settings	
Pickup	Adjustable from 85–115% of nominal voltage
Dropout	Fixed at 95% of the pickup setting for D65VMP and D65VAP Adjustable from 75–95% of the pickup setting for D65VMKP and D65VAKP
Temperature	–20° to 131°F (–28° to 55°C)
Response times	
Pickup	500 ms
Dropout	Fixed 500 ms for D65VMP and D65VMKP Adjustable 0.5–10 seconds for D65VAP and D65VAKP
Output contacts	10A resistive at 240 Vac/30 Vdc, 1/2 hp at 240 Vac (NO), 1/3 hp at 240 Vac (NC)
Mechanical life	10,000,000 operations
Electrical life	100,000 operations
Indicator LED	Red steady when relay is energized; green when relay is OFF
Transient protection	10,000 volts for 20 microseconds
Reset	Automatic
Mounting	Requires an 8-pin socket

Wiring Diagram

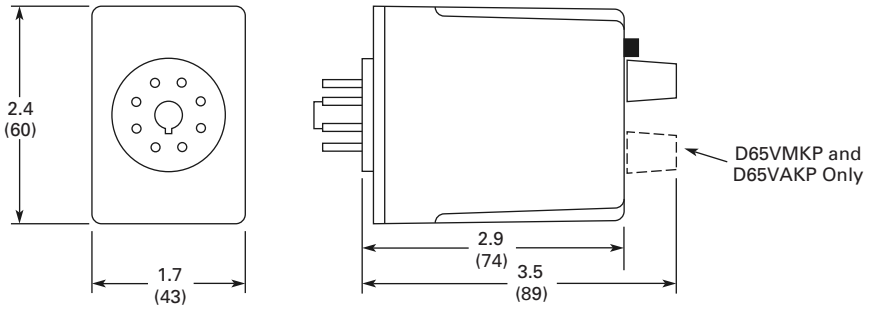
Wiring for 8-Pin Socket



Dimensions

Approximate Dimensions in Inches (mm)

D65V Series—Fixed and Adjustable Time Delay Over/Undervoltage Relays



D65VWP and D65VWKP Voltage Band Relays

Contents

D65VWP and D65VWKP Voltage Band Relays

Product Description

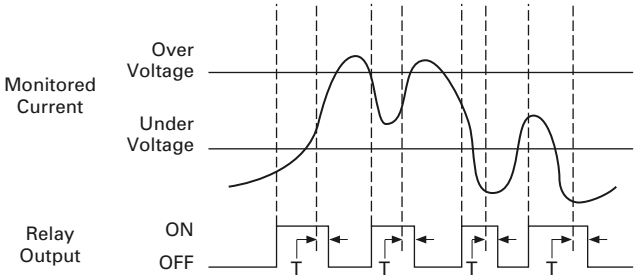
The D65VWP and D65VWKP Series Voltage Band Relays provide protection to equipment that is required to operate within an upper and lower voltage limit. As long as the operating voltage remains within an over- and undervoltage range, the internal relay stays energized. If the operating voltage falls outside this range, the relay will drop out.

When nominal operating voltage is applied, the internal relay will energize (pickup). If the operating voltage falls outside the preset over trip point (adjustable 100–125% of nominal), or under trip point (adjustable 75–100% of nominal), for a period longer than the dropout time delay, the relay will de-energize (dropout). When the voltage returns to normal (within the preset over- and undervoltage trip points), the unit automatically resets and the relay energizes. Choose between a unit with fixed dropout time of 500 ms or one with an adjustable 0.5–10 seconds dropout time.

Features

- Monitors AC single-phase and DC voltages
- Provides voltage band (window) protection
- Wide range of user-adjustable overvoltage and undervoltage settings
- Fixed or adjustable time delay on dropout
- LED indicates output relay status
- Compact plug-in case using industry standard 8-pin octal socket
- 10A DPDT output contacts

Voltage Band Relay Current Monitoring



Product Selection

D65VW_

D65VWP and D65VWKP Voltage Band Relays
Fixed Dropout Time Delay, 500 ms

Nominal Voltage	Voltage Range Over	Under	Catalog Number
24 Vac	24–30 Vac	18–24 Vac	**D65VWPT**
120 Vac	120–150 Vac	90–120 Vac	**D65VWPA**
12 Vdc	12–15 Vdc	9–12 Vdc	**D65VWPR1**
24 Vdc	24–30 Vdc	18–24 Vdc	**D65VWPT1**
48 Vdc	48–60 Vdc	36–48 Vdc	**D65VWPW1**
110 Vdc	110–137 Vdc	83–110 Vdc	**D65VWPA1**

D65VW_

D65VWP and D65VWKP Voltage Band Relays
Adjustable Dropout Time Delay (0.5–10 Seconds)

Nominal Voltage	Voltage Range Over	Under	Catalog Number
24 Vac	24–30 Vac	18–24 Vac	**D65VWKPT**
120 Vac	120–150 Vac	90–120 Vac	**D65VWKPA**
12 Vdc	12–15 Vdc	9–12 Vdc	**D65VWKPR1**
24 Vdc	24–30 Vdc	18–24 Vdc	**D65VWKPT1**
48 Vdc	48–60 Vdc	36–48 Vdc	**D65VWKPW1**
110 Vdc	110–137 Vdc	83–110 Vdc	**D65VWKPA1**

Accessories

D65VWP and D65VWKP Voltage Band Relays

Description	Standard Pack	Catalog Number
8-pin socket	10	**D3PA2**
Hold-down spring	10	**D65CHDS**

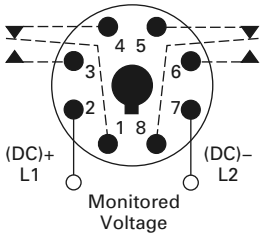
Technical Data and Specifications

D65VWP and D65VWPK Series, Voltage Band Relays

Description	Specification
Voltage tolerance	+25%/–50% of nominal voltage; AC voltages are 50/60 Hz No separate supply (input) voltage is required
Load (burden)	Less than 3 VA
Voltage settings	
Overvoltage	100–125% of nominal voltage
Undervoltage	75–100% of nominal voltage
Temperature	–20° to 131°F (–28° to 55°C)
Indicator LED	Red steady when relay is energized; green when relay is OFF
Reset	Automatic Contact Eaton for information on how to order a unit with manual reset
Response times	
Operate	500 ms
Release	Fixed 500 ms (D65VWP Series) Adjustable 0.5–10 seconds (D65VWKP Series)
Output contacts	10A resistive at 240 Vac/30 Vdc, 1/2 hp at 240 Vac (NO), 1/3 hp at 240 Vac (NC)
Mechanical life	10,000,000 operations
Electrical life	100,000 operations
Transient protection	10,000 volts for 20 microseconds

Wiring Diagram

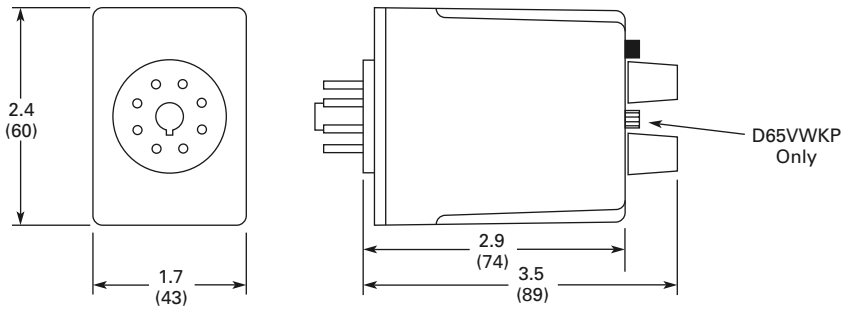
Wiring for 8-Pin Socket



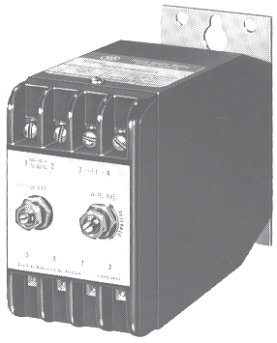
Dimensions

Approximate Dimensions in Inches (mm)

D65VWP and D65VWPK Series, Voltage Band Relays



VSR Series—Solid-State, Single-Phase Voltage Sensing



Contents

31

VSR Series—Solid-State, Single-Phase Voltage Sensing

Product Description

The Catalog Number VSR voltage sensing relays are highly accurate, solid-state, AC voltage sensing devices available in both overvoltage and undervoltage types. They include built-in locking shaft potentiometers for voltage and differential adjustment.

Relay circuit boards are conformal contact for environment-free operation. Input is transformer isolated from solid-state output contact. Mounting dimensions are the same as Catalog Number BF relays.

Features

- Same base plate as Catalog Number BF relay, mounts in same area
- Captive, pressure clamp terminals—accept 1 or 2 solid or stranded 14 AWG or smaller wires
- Adjustment potentiometer with locking shafts—provides shock-proof adjustment
- Conformal coated printed circuit board—protects relay against shock, moisture, dirt and other environmental hazards
- Built-in surge protection—protects internal solid-state contact from damage due to load and line transients

Product Selection

When Ordering, Specify

- Catalog Number of Basic Relay

VSRU_

Voltage Sensing Relays—Undervoltage

Voltage Range	Catalog Number
70–120 Vac	**VSRUA**
200–280 Vac	**VSRUB**

VSRO_

Voltage Sensing Relays—Overvoltage

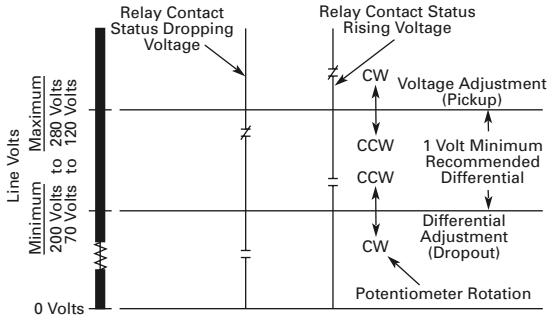
Voltage Range	Catalog Number
100–140 Vac	**VSROA**
200–280 Vac	**VSROB**

Technical Data and Specifications

VSR Series—Solid-State, Single-Phase Voltage Sensing

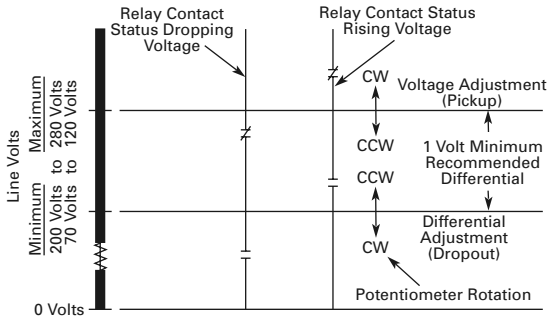
Description	Specification
Electrical ratings	
Operating voltage range	70–140 Vac, 200–280 Vac 3 VA burden
Variable differential range	See Operating Curves below
Repeatability	±0.5 Vac of setting
Solid-state contacts	2A continuous maximum inductive or resistive, 132 Vac maximum ①②
Ambient temperature range ③	–4° to 140°F (–20° to 60°C)
Open contact leakage current	3 mA maximum
Closed contact voltage drop	3 Vac maximum

Operating Curves—Undervoltage Relay



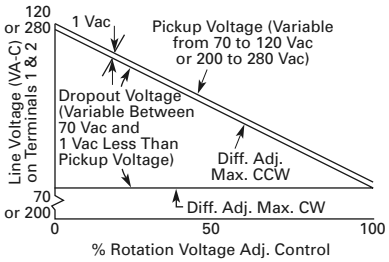
Solid-state NO contact closes when voltage exceeds upper limit set by voltage adjustment potentiometer. Contact remains closed until voltage drops below the value set with differential adjustment. Contact will not reclose until voltage once again exceeds upper limit.

Operating Curves—Overvoltage Relay

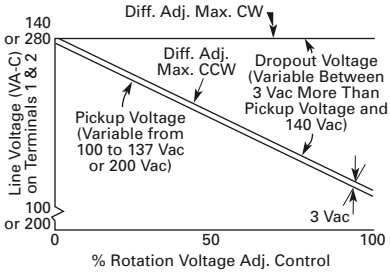


Providing a minimum of 60V input is present, solid-state contact is NC. Differential adjustment sets upper limit where contact will open. After opening, contact will remain open until voltage drops below value set with voltage adjustment potentiometer.

Relay Pick-Up and Drop-Out Voltage Ranges—Undervoltage



Relay Pick-Up and Drop-Out Voltage Ranges—Overvoltage



Notes

① Can initiate a Size 4 motor starter.

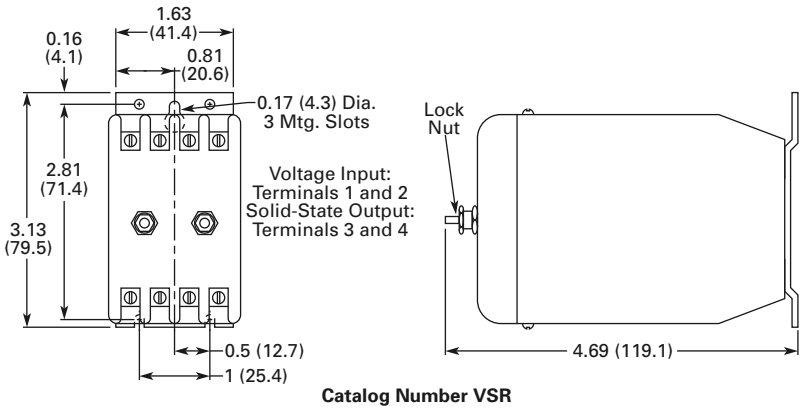
② 12A rms maximum inrush for three cycles. If inrush current is greater than 12A and relay is operated more than 30 times per minute, derating may be necessary. If surge current is 12A or less, no derating is necessary. If currents exceeding these ratings could occur, a series fuse having an I^2t rating equal to 3A squared seconds is recommended.

③ For operation in a higher ambient temperature, derating may be necessary.

Dimensions

Approximate Dimensions in Inches (mm)

VSR Series—Solid-State, Single-Phase Voltage Sensing



Catalog Number VSR

Ground Fault Relays and Monitors

Contents

Product Overview

D64R Series—Digital Ground Fault Relays

The new D64R digital ground fault relays are microprocessor-based and replace the previous generation of analog-based devices.

Microprocessor-based D64R GFRs combine more selectable features into a single model, which makes easier model selection and reduces spares inventory requirements.

These devices are designed to provide reliable detection of ground fault conditions on three-phase AC resistance grounded or solidly grounded electrical distribution systems.

D64L Series—Ground Fault Monitors

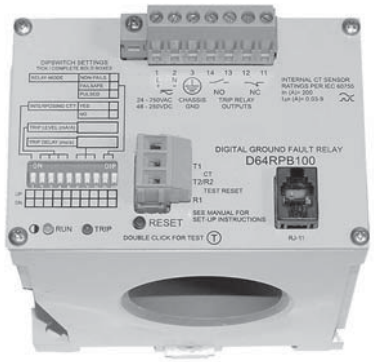
Type D64L ground fault monitors are designed to monitor ungrounded supplies on three-phase AC power systems up to 600V. If an insulation fault develops anywhere on the system between the source and the load, the D64L will detect it and give an alarm or trip, depending on the adjustable field settings selected.

The D64L is ideally suited for systems supplied from the secondary of either an ungrounded delta or an ungrounded wye connected transformer.

Because D64L has high immunity from the effects of voltage transients and cable capacitance, it may be applied in automotive, sub-sea, mobile lighting, portable generators, sensitive equipment and other installations where ungrounded systems are used extensively.

The user is able to individually set the alarm level and the trip level from 20%–80% of the maximum leakage current limit of the D64L selected. Any leakage current above the alarm level will activate the alarm relay and light the alarm LED. Should the leakage current rise above the trip level, the trip relay and trip LED will activate.

D64R Series—Digital Ground Fault Relays



Contents

D64R Series—Digital Ground Fault Relays

Product Description

The new D64R digital ground fault relays are microprocessor-based and replace the previous generation of analog-based devices.

Microprocessor-based D64R GFRs combine more selectable features into a single model, which makes easier model selection and reduces spares inventory requirements.

These devices are designed to provide reliable detection of ground fault conditions on three-phase AC resistance grounded or solidly grounded electrical distribution systems.

Application Description

D64R ground fault relays feature adjustable trip settings for both trip current and trip time. This allows the user to set the ground fault trip current just above the "charging" current of the system. This prevents nuisance tripping and provides meaningful protection of additional ground fault leakage currents.

Every system has a "charging" current that can cause nuisance tripping if the trip current is set too low. The "charging" current is caused by the capacitance-to-ground effect of phase conductors in a system and will vary depending on:

- The overall length of the cables
- The types of loads
- The quality of the insulation on the phase conductors
- Surrounding equipment grounding, cable trays, junction boxes, etc.
- Type and size of transformer

A "rule-of-thumb" for systems 600V and lower: the "charging" current is 0.5A per 1000 kVA of transformer capacity.

Features

Standard Models

- Built-in current sensor (zero sequence CT)
- Run and trip indicating LEDs
- Built-in harmonic filtering for variable frequency drives or standard 50/60 Hz applications (see **Page V5-T31-47** for frequency response range)
- DIN rail or panel mounting
- Rugged epoxy encapsulated construction
- Pull-apart terminal block connectors
- Form "Z" (4 terminal) NO and NC output contacts, 5 amps at 250 Vac
- Pulsed (trip) auto reset mode

The pulsed (trip) auto reset mode is designed for applications where the output relay is operating a shunt trip device. The D64R relay resets automatically, three seconds after the ground fault current is interrupted by the tripping action of the circuit breaker. This opens the output contact wired to the shunt trip coil and prevents damage to the internal mechanism of the circuit breaker in the event that the operator tries to reset the circuit breaker.

- Suitable for use on 600V systems—may be applied on higher voltages by using separate CTs with power conductors insulated for the system voltage
- Built-in test circuitry—no external power or additional wiring is necessary—tests trip time and current settings
- Communications port (standard RJ-10 jack) for connection to optional remote display (D64D1) and door mounted units (on D64RPB100 models only)
- Fail-safe selectable mode (on D64RPB100 models only)

In the fail-safe mode, the relay is energized when control voltage is applied and will trip when either:

- a ground fault trip is detected or,
- there is a loss of control power.

Service Protection Models

- Service protection models require C311CT 10,000:1 ratio CTs
- Trip current range of 50 to 1200A
- Green LED indicates "Power On"
- Circuit breaker toggle position indicates "Normal" or "Tripped" condition
- Form "C" (3 terminal) NO-NC output contacts, 3 amps at 250 Vac
- Frequency response range of 40 to 200 Hz
- Zone interlocking feature with green LED to indicate "Grading Input Active" and DIP switch array for zone grading backup delay and block signal override (on D64RPBH15 model only)
- Test button to invoke test at 20A trip current—tests external CT, electronics and circuit breaker trip
- Fail-safe selectable mode (see above for description)
- Inhibit selectable mode—this allows the relay to differentiate between normal ground fault trip levels and short circuit conditions

The trip inhibit function is useful when the relay is being used to trip a contactor or motor starter on a solidly grounded system. Under a bolted fault condition, the relay would trip and could cause the contactor or motor starter to interrupt the high fault current with harmful results. By inhibiting the trip, the ground fault relay will not trip on bolted faults and will allow the upstream protective device to clear the fault instead.

- Through-the-door or rear panel mounting

Options

- Other ranges of trip currents and times
- Fixed trip current and times
- Other control voltages
- Custom packaging for volume OEM requirements
- Separate outputs for alarming vs trip
- Relays for neutral grounding resistance monitoring
- Relays for ground fault detection on DC power systems
- Other sizes of current transformers

Standards and Certifications

- UL 1053
  - Ground Fault Sensing and Relaying Equipment, Class 1 (UL File # E195341)
- CSA C22.2 No. 144-M91
  - Ground Fault Circuit Interrupters (CSA File # 700103)
- CE Mark—Declaration of Conformity
- IEC 60755
  - General Requirements for residual current operated protective devices
- EN 50081-1
  - Electromagnetic compatibility (radiated emission), "household" directive

D64R ground fault relays are UL listed as Class 1 devices designed to protect electrical equipment against extensive damage from arcing ground faults.

Product Selection

Standard Models

When Ordering, Specify

- Catalog number of relay from tables
- Catalog number of zero sequence current transformers, if or when required, remote digital display or remote indicator units

Ground Fault Relay with Built-In Current Sensor

	Control Power	Trip Current Range	Current Transformer Selection	Catalog Number
D64RP18 without Plug-In 	24–240 Vac/Vdc	30 mA–6A	Built-in 1.1 in CT ① If external CT is required for specific application, select 500:1 ratio CT ②	**D64RP18**
D64RPB100 Full-Featured Ground Fault Relay 	24–240 Vac/Vdc	30 mA–9A	Built-in 2.0 in CT ③ If external CT is required for specific application, select 500:1 ratio CT ②	**D64RPB100_**
		3A–900A	Select 500:5 ratio CT ④	**D64RPB100_**
		30A–9000A	Select 5000:5 ratio CT ④	**D64RPB100_**
D64RPB30 without Internal CT 	24–240 Vac/Vdc	30 mA–9A	Requires use of applicable C331CT, see **Page V5-T31-46**.	**D64RPB30**

Service Protection Models

When Ordering, Specify

- Catalog number of relay from tables
- Catalog number of zero sequence current transformers, if or when required, remote digital display or remote indicator units

D64RPBH15 Ground Fault Relay with Zone Interlocking


Ground Fault Relay

Control Power	Zone Interlocking Feature	Trip Current Range	Current Transformer Selection	Catalog Number
120 Vac	No	50A–1200A	Select 10,000:1 ratio CT ⑤	**D64RPBH13**
120 Vac	Yes	50A–1200A	Select 10,000:1 ratio CT ⑤	**D64RPBH15**

Notes

① Maximum allowable continuous current through built-in CT is 100 amps.
② For 500:1 ratio CTs, select from Protective Relays in **CA08101001E**, Distribution Products Catalog, Tab 26, section 26.3.
③ Maximum allowable continuous current through built-in CT is 200 amps.
④ For 500:5 or 5000:5 ratio CTs, select any commercially available 5 amp secondary CT with the same ratio.
⑤ For 10,000: 1 ratio CTs, select from Protective Relays in **CA08101001E**, Distribution Products Catalog, Tab 26, section 26.3.

Accessories

Zero Sequence Current Transformers

- A complete size range of zero sequence CTs designed specifically for use with D64R relays provide excellent coupling to the monitored circuit. This means accurate ground fault leakage current detection over the full setting range of the relay with no saturation
- Built-in back-to-back zeners across the output terminals of all 500:1 and 10,000:1 CTs provide personnel safety should the secondary circuit be opened
- Rectangular split core CTs make retro-fitting easy
- All CTs are epoxy potted, panel mounted and come with either secondary screw terminals or threaded studs
- The core is very high grade silicon iron to give superior coupling characteristics and to withstand high shock and vibration
- All CTs are 600 Volt class. They may be used on higher voltage circuits provided that power conductors are insulated for the system voltage

Zero Sequence Current Transformers for D64RP18 and D64RPB100 Relay ①②③

C311CT9

Toroidal

Description/Window Size	Ratio 500:1 CTs ④ Catalog Number
1.1 in (28 mm)	**C311CT8**
1.8 in (46 mm)	**C311CT1**
2.5 in (65 mm)	**C311CT9**
3.5 in (90 mm)	**C311CT2**
5.7 in (144 mm)	**C311CT5**
9.5 in (240 mm)	**C311CT6**

Split Core (Rectangular/Square)

Description/Window Size	Ratio 500:1 CTs ④ Catalog Number
5.9 x 6.7 in (150 x 170 mm)	**C311CT3**
4.0 x 13.8 in (100 x 350 mm)	**C311CT4**
11.8 x 11.8 in (300 x 300 mm)	**C311CT7**

Zero Sequence Current Transformers for D64RPBH13 and D64RPBH15 Relays

Toroidal

Description/Window Size	Ratio 10,000:1 CTs ⑤ Catalog Number
2.5 in (65 mm)	**C311CT11**
5.7 in (144 mm)	**C311CT12**
9.5 in (240 mm)	**C311CT13**

Notes

① D64RP18 relays use 500:1 ratio CTs if needed.
② D64RPB100 relays can use 500:1 ratio CTs when needed for 30 mA–9A, 500:5 ratio for 3A–900A and 5000:5 ratio for 30A–9000A trip current ranges.
③ For 500:5 or 5000:5 ratio CTs, select any commercially available 5 Amp secondary CT with the same ratio.
④ The maximum allowable continuous current through CTs is 1000A.
⑤ The maximum allowable continuous current through 10,000:1 ratio CTs is 10,000A.

D64D1 Digital Display Unit

The D64D1 digital display unit is connected to the D64RPB100 by up to 30 ft (10m) of standard four-wire telephone type cable. It is supplied with door-mounting hardware. It provides the following remote indications and functions:

- Continuous reading of actual ground fault current, employing auto ranging
- Display of the pre-trip ground fault current, after a trip has occurred (flashing display)
- Display of the trip current setting, after a Test Trip has been activated
- Green RUN LED, red TRIP LED
- TEST and RESET pushbuttons. The RESET button must be held pressed before the TEST is pressed to invoke the test procedure. The function of this button can be enabled/disabled by inserting the interconnecting cable from the D64RPB100 relay into one of two sockets, TEST ON or TEST OFF, on the right side of the display
- Pushing VERIFY pushbutton shows if D64RPB100 tripped due to a ground fault prior to loss of its control voltage—red TRIP LED lights, or if there was no ground fault trip—green RUN LED lights. This indication will remain available for at least ten hours
- The Numerical LCD window displays actual ground fault current in amps. When a 5000:5 ratio interposing CT is used, all displayed values are to be interpreted as kA rather than amps

D64D1

Remote Display Unit for D64RPB100

Description	Catalog Number
Remote digital display with numerical LCD, RUN and TRIP LEDs, TEST, RESET and VERIFY pushbuttons: C/W 3 ft (1m) of cable.	**D64D1**

Technical Data and Specifications

D64R Series—Digital Ground Fault Relays

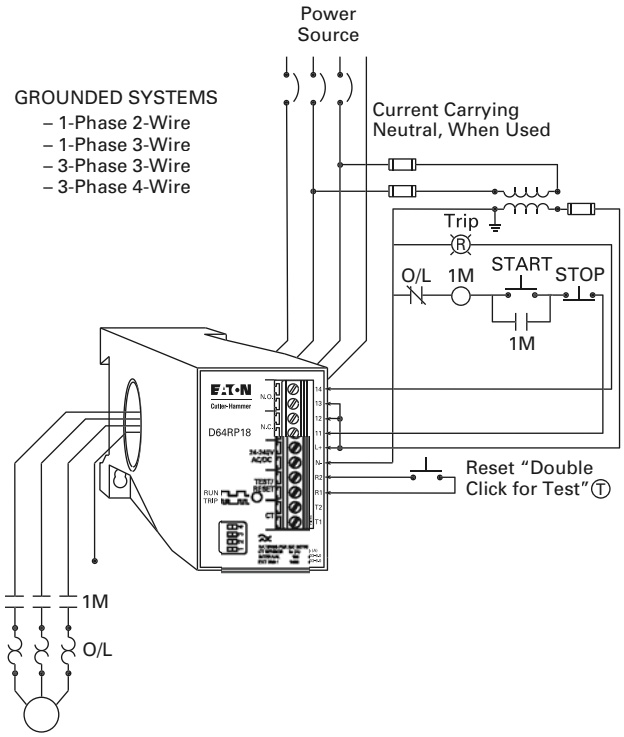
Catalog Number	Control Power (Volts)	Frequency Response (Hz)	Trip Current Range		Trip Time Delay Range		Built-In Current Sensor	External Current Transformer		Test/Reset Provision	
			Min.	Max.	Min.	Max.		Required	Ratio	Pushbutton on Cover	Remote
D64RP18	24–240 Vac/Vdc non-isolated	45–450 Hz	30 mA	6A	20 ms	500 ms	1.1 in	Optional	500:1	No	Pushbutton
D64RPB100	24–240 Vac/Vdc isolated	45–450 Hz	30 mA	9A	20 ms	5 sec	2.0 in	Optional	500:1	Yes	Pushbutton or RJ-11 Communications port
			3A	900A				Required	500:5		
			30A	9000A				Required	5000:5		
D64RPBH13	120 Vac	45–200 Hz	50A	1200A	35 ms	1 sec	None	Required	10000:1	Yes	Pushbutton
D64RPBH15 ①	120 Vac	40–200 Hz	50A	1200A	35 ms	1 sec	None	Required	10000:1	Yes	Pushbutton

Note

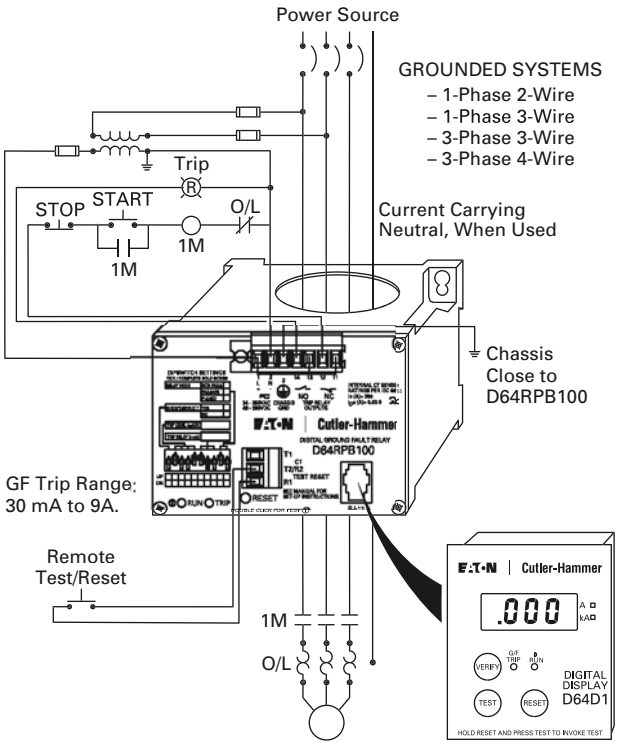
① With zone interlocking feature.

Wiring Diagrams

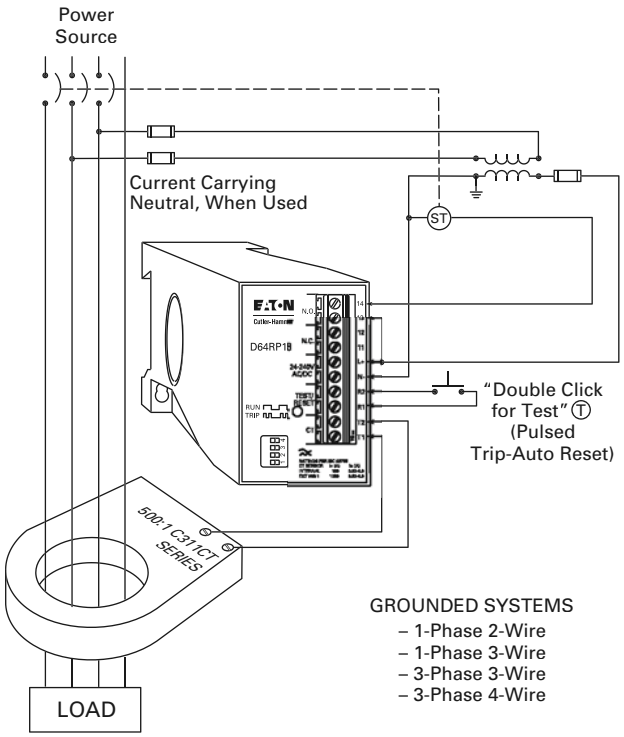
Typical Field Connection of D64RP18 Using Built-In Current Transformer



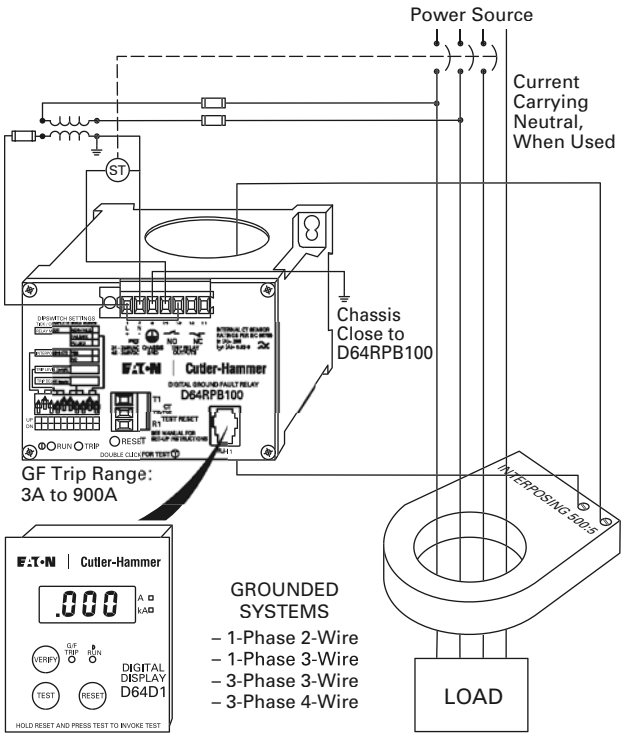
Typical Field Connection of D64RPB100 Using Built-In Current Transformer and Remote Test/Reset



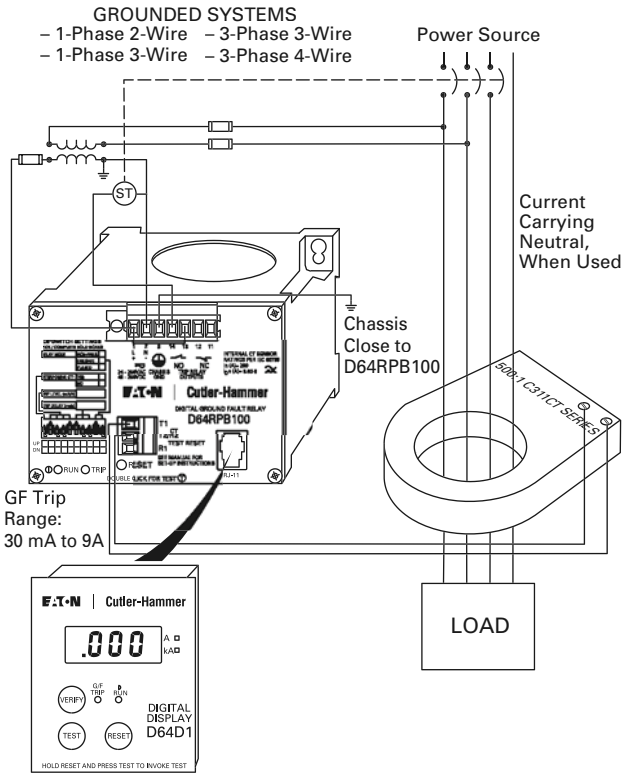
Typical Field Connection of D64RP18 with External 500:1 Current Transformer and Pulsed Trip-Auto Reset



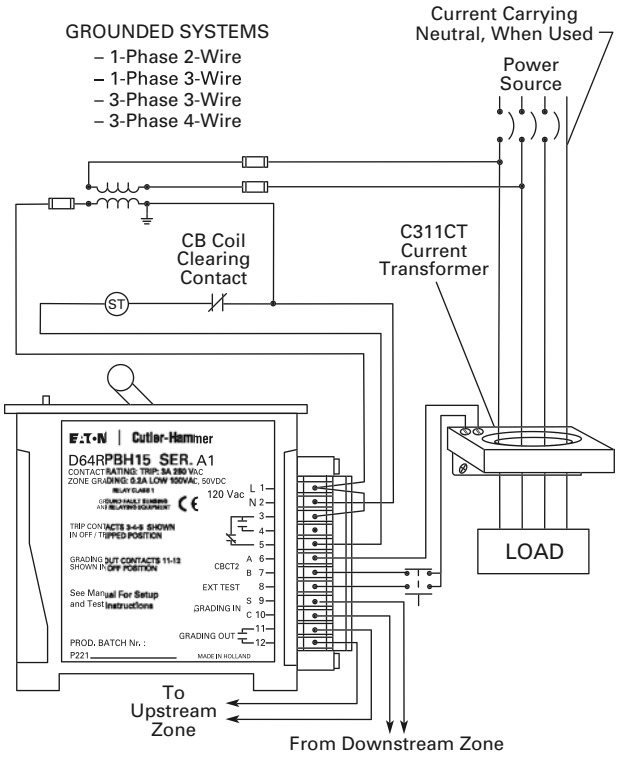
Typical Field Connection of D64RPB100 with Interposing 500:5 Current Transformer, Pulsed Trip-Auto Reset for Shunt Trip Breaker



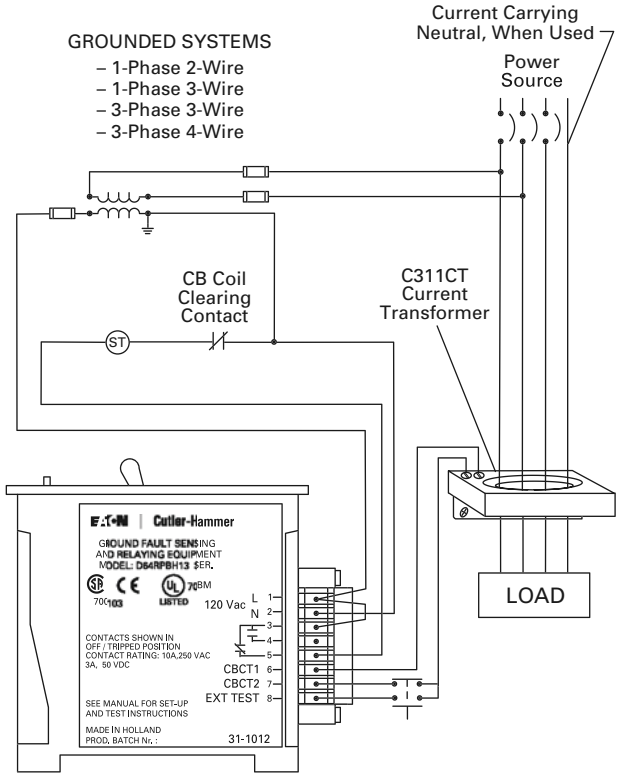
Typical Field Connection of D64RPB100 with External 500:1 Current Transformer (C311CT Series) Pulsed Trip-Auto Reset for Shunt Trip Breaker



D64RPBH15 Typical Field Connection



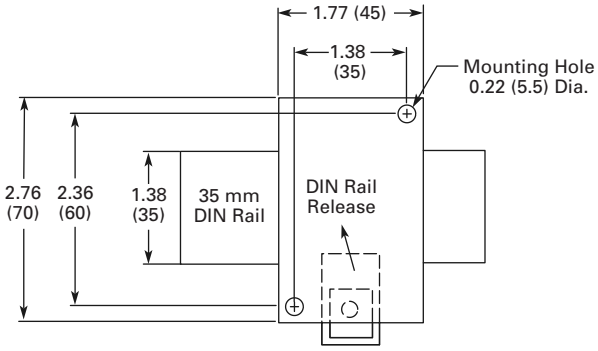
D64RPBH13 Typical Field Connections



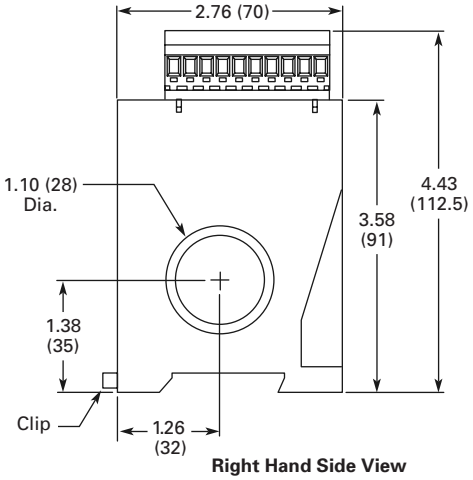
Dimensions

Approximate Dimensions in Inches (mm)

D64RP18

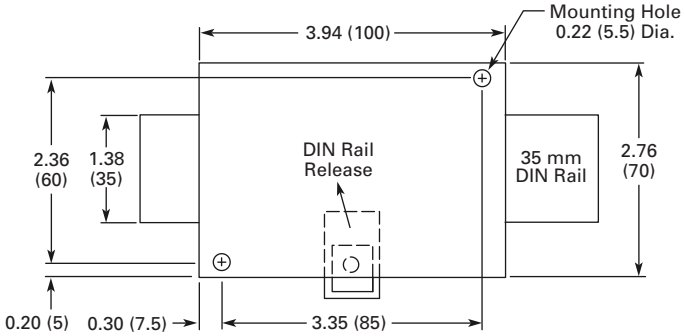


Rear Panel Mounting DIN Rail or Two Screw

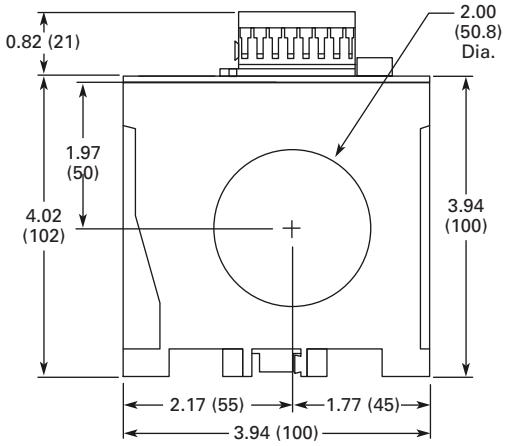


Right Hand Side View

D64RPB100



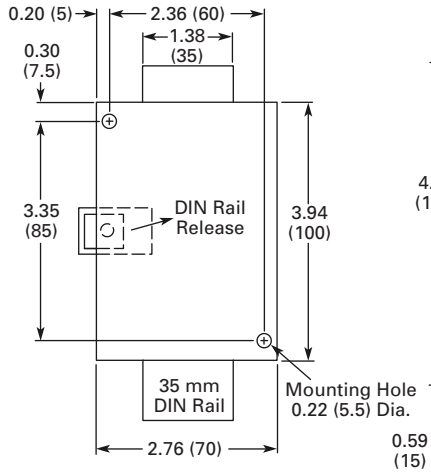
Rear Panel Mounting DIN Rail or Two Screw



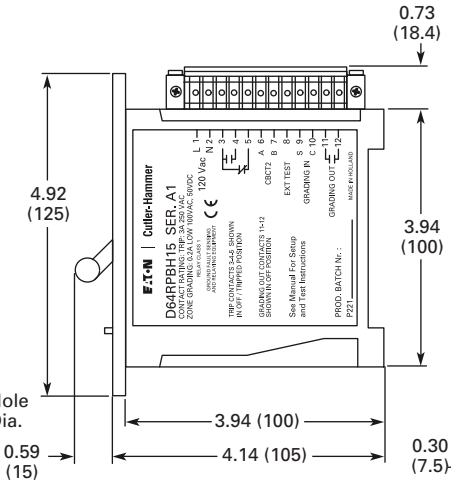
Bottom Side View

Approximate Dimensions in Inches (mm)

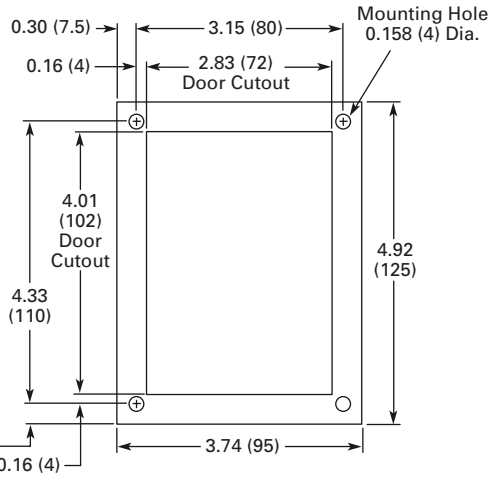
D64RPBH13 and D64RPBH15



Rear Panel Mounting DIN Rail or Two Screw

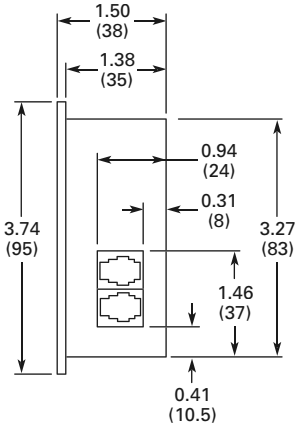


Right Side View

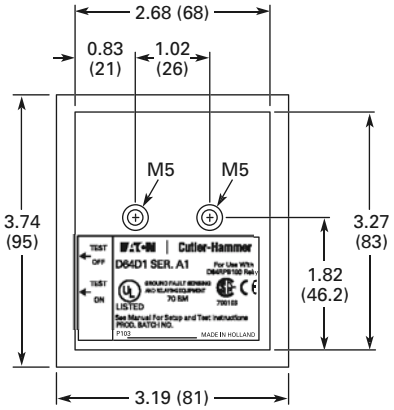


Through-the-Door Mounting

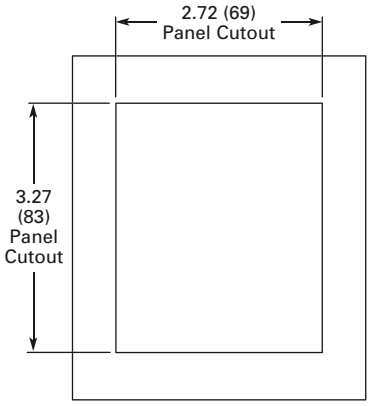
D64D1 and D64D2



Right Side View



Rear View



Through-the-Panel Mounting

Approximate Dimensions in Inches (mm)

C311CT Series

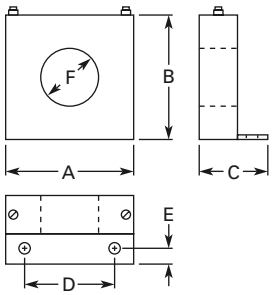


Figure A

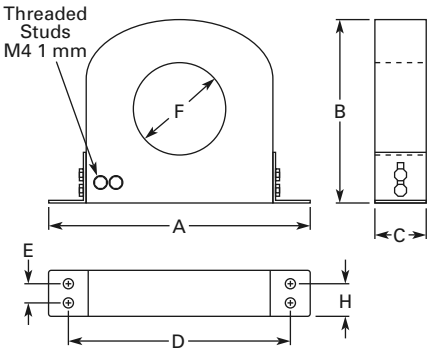


Figure B

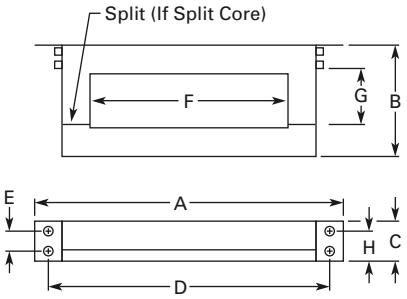


Figure C

Note: All Mounting Holes Are 0.25 (6.4) Dia.

Catalog Number	Figure	Wide A	High B	Deep C	Mounting D	Mounting E	F	G	H
C311CT1	A	3.35 (85)	3.35 (85)	1.57 (40)	0.98 (25)	0.39 (10)	1.81 (46)	—	—
C311CT2	B	7.30 (185)	5.50 (140)	1.20 (30)	6.42 (163)	0.59 (15)	3.54 (90)	—	0.89 (22.5)
C311CT3	C	13.58 (345)	8.75 (222)	1.57 (40)	12.80 (325)	0.59 (15)	6.70 (170)	5.90 (150)	0.89 (22.5)
C311CT4	C	20.87 (530)	7.87 (200)	1.57 (40)	20.08 (510)	0.59 (15)	13.78 (350)	3.94 (100)	0.89 (22.5)
C311CT5	B	10.12 (257)	8.27 (210)	1.46 (37)	9.33 (237)	0.59 (15)	5.70 (145)	—	0.89 (22.5)
C311CT6	B	13.86 (352)	11.89 (302)	1.46 (37)	13.07 (332)	0.59 (15)	9.45 (240)	—	0.89 (22.5)
C311CT8	A	2.17 (55)	2.56 (65)	2.20 (56)	0.98 (25)	0.59 (15)	1.10 (28)	—	—
C311CT9	B	6.68 (167)	4.84 (123)	1.18 (30)	5.78 (147)	0.59 (15)	2.56 (65)	—	0.89 (22.5)
C311CT11	B	6.68 (167)	4.84 (123)	1.18 (30)	5.78 (147)	0.59 (15)	2.56 (65)	—	0.89 (22.5)
C311CT12	B	10.12 (257)	8.27 (210)	1.85 (47)	9.33 (237)	0.59 (15)	5.70 (145)	—	0.89 (22.5)
C311CT13	B	13.86 (352)	11.89 (302)	1.85 (47)	13.07 (332)	0.59 (15)	9.45 (240)	—	0.89 (22.5)

D64L Series—Ground Fault Monitors

Contents

31

D64L Series—Ground Fault Monitors

Product Description

Type D64L ground fault monitors are designed to monitor ungrounded supplies on three-phase AC power systems up to 600V. If an insulation fault develops anywhere on the system between the source and the load, the D64L will detect it and give an alarm or trip, depending on the adjustable field settings selected.

The D64L is ideally suited for systems supplied from the secondary of either an ungrounded delta or an ungrounded wye connected transformer.

Because D64L has high immunity from the effects of voltage transients and cable capacitance, it may be applied in automotive, sub-sea, mobile lighting, portable generators, sensitive equipment and other installations where ungrounded systems are used extensively.

The user is able to individually set the alarm level and the trip level from 20%–80% of the maximum leakage current limit of the D64L selected. Any leakage current above the alarm level will activate the alarm relay and light the alarm LED. Should the leakage current rise above the trip level, the trip relay and trip LED will activate.

Features

- Adjustable leakage current limit setting (20 mA, 35 mA or 50 mA). Factory set at 20 mA
- Built-in RESET button on all models
- Selectable fail-safe/non-fail-safe operation
- Auto reset after alarm condition
- Selectable auto/manual reset after trip
- Three LEDs for POWER ON, ALARM and TRIP
- Three LEDs to indicate which phase is faulted
- Adjustable alarm setting 20%–80% of leakage current limit
- Adjustable trip setting 20%–80% of leakage current limit
- 70 ms response time for alarm and trip level. Resample time—2 seconds
- Minimum alarm signal duration—70 ms
- 110/120V or 220/240V 50/60 Hz control power, 4 VA
- Isolated voltage free Form Z NO and NC contacts on both alarm and trip relays, 5A at 250 Vac
- 30A 600V screw terminals, 12 AWG capacity, for phase and ground connections
- 10A 300V screw clamp terminals, 12 AWG capacity for relay outputs and control supply
- CSA certified
- 35 mm DIN rail or two screw mounting

Suggested Fuse Block and Fuses

- DIN rail mounting
  - 1–C350BD3C61 600V 30A three-pole fuse block

3–Class CC 600V 5A fuses

Product Selection

When Ordering, Specify

- Catalog number of ground fault monitor.
- Catalog number of fuse block and fuses as required.

Fuse Block

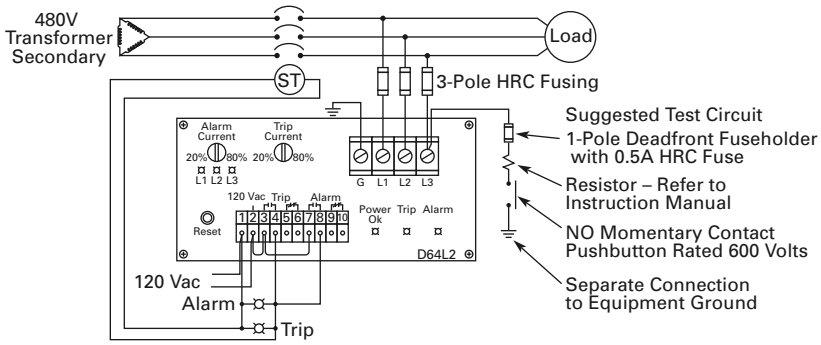
Mounting Type	Fuse Holder Rating	Fuse Type	Catalog Number
DIN rail	600V 30A three-pole	Class CC 600V 5A	**WMR633G**

Line Insulation Monitors

Line Voltage Range 50/60 Hz	Fuse Type	Catalog Number
380–600V	110/120V 50/60 Hz	**D64L2A**
	220/240V 50/60 Hz	**D64L2B**

Wiring Diagram

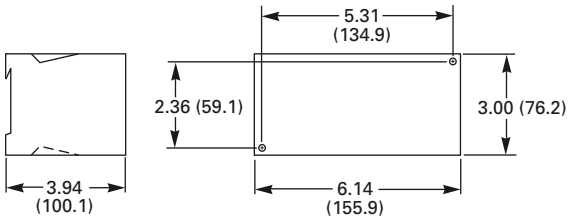
D64L Series—Ground Fault Monitors



Dimensions

Approximate Dimensions in Inches (mm)

D64L Series—Ground Fault Monitors



Motor Protection Circuit Breakers

Contents

Motor Protection Circuit Breakers (MPCB)

Product Description

- Eliminates need for separate overload relay

Application Description

- Can be used with contactor to eliminate need for overload relay and still create manual motor control
- Meets requirement for motor branch protection, including:
  - Disconnecting means
  - Branch circuit short circuit protection
  - Overload protection

Features and Benefits

- Phase imbalance protection
- Phase loss protection
- Hot trip/cold trip
- High load alarm
- Pre-detection trip relay option
- Class 10, 15, 20, 30 protection

Standards and Certifications

- IEC 60947-2
- UL 489 100% rated
- UL 508
- CSA C22.2

UL Listed

Reference

Refer to Volume 4—Circuit Protection, **CA08100005E**, Tab 25, section 25.2 for additional Product information.

Motor Protection Circuit Breakers	***Tab Section***
Product Selection	**25.2**
Technical Data and Specifications	**25.2**

Manual Motor Protection

Contents

Manual Motor Protectors—XTPB, XTPR and XTPE

Product Description

Eaton's new ***XT*** family of manual motor protectors (MMPs) features a pushbutton or rotary ON/OFF manual disconnect, Class 10 adjustable bimetallic overload relay and fixed magnetic short-circuit trip capability in one compact unit. Two frame sizes are available: Frame B (45 mm) for motors with FLA ratings up to 32A and Frame D (55 mm) covers motor FLA ratings up to 65A.

Application Description

The XTPB and XTPR MMPs can be used in the following applications.

Motor Protective Circuit Breaker

In many countries outside of the United States and Canada, especially Europe, the MMPs are tested and classified as thermal-magnetic circuit breakers for use in motor branch circuits. This can be an important consideration for all companies who export their equipment and machines internationally. Both the XTPB and XTPR conform to IEC/EN 60947 and have the CE Mark.

Manual Motor Protectors

The XTPB and XTPR MMPs are UL listed under UL 508 as manual motor protectors. They provide an economical solution for applications requiring simple manual starting and stopping of motors. When used as a manual starter, they are typically installed in an enclosure. Many enclosures are offered as accessories for the MMPs. Separate short-circuit protective devices, such as circuit breakers or fuses, are wired ahead of the MMPs. The short-circuit protective device should be sized per the NEC and should not exceed 400% of the maximum FLA dial setting of the MMP.

Individual Branch Motor Applications

A UL 508 Type E self-protected manual combination starter/motor controller consists of a single device possessing four essential elements: disconnect, short circuit protection, motor controller, and motor overload protection. Some MMPs require use of a lineside adapter for this type of approval. When tested as an official combination by UL, this device takes the place of a fuse-starter or breaker-starter, ***XT*** Type E MMPs are self-protected, meaning they do not need additional short circuit protection of a fuse or breaker. Type E devices can also be used with a contactor or other types of UL approved controllers. If tested with a contactor, the combination motor controller becomes a Type F device. See **CA08102001E**, Control Products Catalog, Tab 34, section 34.1 for XTFC Type F devices.

Features and Benefits

- ON/OFF rotary handle with lockout provision
- Visible trip indication
- Class 10 overload protection
- Phase loss sensitivity
- Ambient temperature compensation to IEC/EN 60947, VDE 0660
- Fixed short-circuit trip—14 times maximum setting of overload FLA dial
- Type 2 coordination per IEC 947
- Identification markers standard on starter faceplate
- Motor applications from 0.1A to 65A
- Built-in heater and magnetic trip elements to protect the motor
- Adjustment dial for setting motor FLA
- DIN rail mount
- Terminal types available:
  - Screw terminals
  - Screw (line) and spring cage (load) terminals
  - Spring cage terminals
- Accessories include:
  - Front and side auxiliary contacts
  - Trip indicating contacts
  - Tamperproof cover for OLR dial
  - Undervoltage release
  - Shunt trip
  - Through-the-door operators
  - Enclosures
  - Three-phase line side connecting links

Standards and Certifications

- CE approved
- UL listed File No. E245398
- UL 508 group motor and Type E compliant
- IEC/EN 60947
- CSA File 229767, Class 3211-05
- DIN VDE 0660 Part 100, Part 101 and Part 102

Catalog Number Selection

XT Manual Motor Protectors

XT PR 012 B C1

Designation
XT = ***XT*** IEC power control

Type
PB = Manual motor protector—pushbutton
PR = Manual motor protector—rotary
PM = Manual motor protector—magnetic only
PT = Manual transformer protector (high mag.)

Current Ratings	
Frame B	**Frame D**
P16 = 0.16A	**016** = 16A
P25 = 0.25A	**025** = 25A
P40 = 0.40A	**032** = 32A
P63 = 0.63A	**040** = 40A
001 = 1A	**050** = 50A
1P6 = 1.6A	**058** = 58A
2P5 = 2.5A	**063** = 63A
004 = 4A	
6P3 = 6.3A	
010 = 10A	
012 = 12A	
016 = 16A	
020 = 20A	
025 = 25A	
032 = 32A	

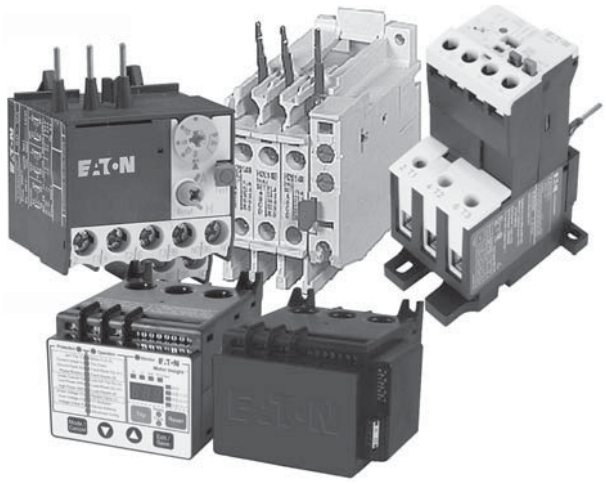
Frame Size
B = 45 mm
D = 55 mm

Trip Class
C1 = Class 10
Blank = Magnetic only (no thermal trip)

Reference

Refer to Tab 27 of this volume, section 27.1 for additional Product information.

Overload Relays



Contents

Product Overview

Overload Relays

XT IEC—Miniature

Product Description

Eaton's new line of ***XT*** miniature controls includes non-reversing and reversing mini contactors, mini overload relays and snap-on accessories. A wide range of applications is possible, including small electrical motors from fractional to 5 hp (460 Vac) or up to 4 kW (400 Vac).

Features

- Phase failure sensitivity
- Direct mount to XTMC and XTMF mini contactors
- Trip Class 10
- 11 settings to cover 0.1 to 12A
- Ambient temperature compensated –5° to 50°C [23° to 122°F]
- Manual and automatic reset by selector switch
- One make (NO) or one break (NC) auxiliary contact as standard
- Test/Off button
- Trip-free release

XT IEC—Thermal

Product Description

The ***XT*** line of IEC motor thermal overload relays provides an efficient motor protection solution, available up to 630A. XTOB units can be directly mounted to the contactor or mounted separately.

Features

- Direct connect up to 250A
- Stand alone and CT type up to 630A
- Large thermal overcurrent range
- Test button
- Manual/automatic selectable reset
- NO-NC auxiliary as standard
- Class 10A (to 250A)
- Class 30 (CT type)

Freedom

Product Description

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

Features

- Selectable manual or automatic reset operation
- Interchangeable heater packs adjustable ±24% to match motor FLA and calibrated for use with 1.0 and 1.15 service factor motors. Heater packs for 32A overload relay will mount in 75A overload relay—useful in derating applications such as jogging
- Class 10 or 20 heater packs
- Load lugs built into relay base
- Bimetallic, ambient compensated operated. Trip free mechanism
- Overload trip indication

C440/XTOE

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.

C440 is a self-powered electronic overload relay available up to 100A as a self contained unit. With external CTs, C440 can protect motor up to 1500 FLA. Available add-on accessories include remote reset capability and communication modules with I/O for DeviceNet, PROFIBUS, and Modbus.

IQ500

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

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

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

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

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

C441

Eaton's Motor Insight, the first product in the Intelligent Power Control Solutions family, is a highly configurable motor, load and line protection device with power monitoring, diagnostics and flexible communications allowing the customer to save energy, optimize their maintenance schedules and configure greater system protection, thus reducing overall costs and downtime.

Motor Insight is available in either a line-powered or 120 Vac control powered design, capable of monitoring voltages up to 660 Vac. Each of these units is available in a 1–9 amp or a 5–90 amp FLA model. With external CTs, Motor Insight can protect motors up to 540 amps FLA. Available add-on accessories include communication modules for Modbus®, DeviceNet and PROFIBUS®, all with I/O options. For ease-of-use and operator safety, Motor Insight offers a remote display that mounts easily with two 30 mm knockouts.

The Motor Insight's functions consist of:

- Motor control
- Motor protection
- Load protection
- Line protection
- Monitoring capabilities

MP-3000

- Microprocessor-based, multi-function motor protection
- Current only device—no need to add PTs
- Intel-I-Trip™ overload protection based on motor data
- Event recording and operational logging

The protection functions are listed below.

- I^2t overload protection (49/51)
- Locked rotor (49S/51)
- Ultimate trip current (51)
- Negative sequence phase imbalance (46)
- Instantaneous overcurrent (50)
- Ground fault protection (50G)
- RTD trip and alarm with URTD module (49/38)
- Underload trip (37)
- Starts per time (66)
- Jam or stall (51R)
- Auto or manual reset (86)
- Fail-safe or non-fail-safe trip modes

The metering functions are:

- Motor currents:
  - Average current (Iave)
  - Individual phase and ground current in primary amperes
  - Percent of full load
  - Percent of phase imbalance
- RTD temperatures:
  - Individual winding
  - Motor bearing
  - Load
  - Auxiliary temperatures
- Motor conditions:
  - Percent of I^2t thermal bucket
  - Time before start
  - Remaining starts allowed
  - Oldest start time

MP-4000

- Microprocessor-based, multi-function motor protection
- Current and Voltage device
- Intel-I-Trip overload protection based on motor data
- Event recording and operational logging

The protection functions are listed below.

- All functions listed under MP-3000 as well as:
  - Undervoltage (27)
  - Overvoltage (59)
  - Under power (32)
  - Negative sequence voltage imbalance (47)
  - Power factor (55)

The metering functions are:

- All functions listed under MP-3000 as well as:

  Metering—
  - Average current
  - Amperes: magnitude and angle in primary values
  - Amperes: positive, negative and zero sequence
  - Average voltage (V ave)
  - Voltage: magnitude and angle
  - Voltage: positive, negative and zero sequence
  - % of full load
  - % current imbalance
  - % voltage imbalance
  - Power, vars and VA
  - Power factor
  - Frequency
  - Energy metering with time and date stamps

  RTD temperatures—
  - Individual winding
  - Motor bearing
  - Load
  - Auxiliary temperatures

  Motor conditions—
  - Percent of I^2t thermal bucket
  - Time before start
  - Remaining starts allowed
  - Oldest start time

Miniature Overload Relays

Contents

XT IEC Overload Relays

Miniature Overload Relays

Product Description

Eaton's new line of ***XT*** miniature controls includes non-reversing and reversing mini contactors, mini overload relays and snap-on accessories. A wide range of applications is possible, including small electrical motors from fractional to 5 hp (460 Vac) or up to 4 kW (400 Vac).

Application Description

Due to its compact size, the ***XT*** line of mini controls is best suited to be applied in light-duty loads, such as hoisting, packaging, material handling, heating, lighting and automation systems. ***XT*** mini contactors are a particularly compact, economic and environmentally friendly solution wherever control of small motors or loads is required.

Features

Mini Overload Relays—Bimetallic Type XTOM

- Phase failure sensitivity
- Direct mount to XTMC and XTMF mini contactors
- Trip Class 10
- 11 settings to cover 0.1 to 12A
- Ambient temperature compensated –5° to 50°C [23° to 122°F]
- Manual and automatic reset by selector switch
- One make (NO) or one break (NC) auxiliary contact as standard
- Test/Off button
- Trip-free release

Standards and Certifications

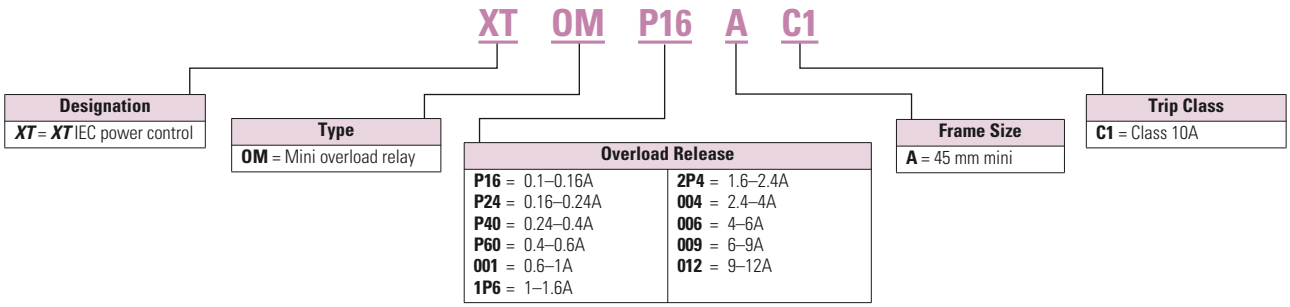
- IEC EN 60947
- CE approved
- UL
- CSA
- CCC
- ATEX

Instructional Leaflets

Pub51219	XTMC, XTMF Mini Contactors, XTRM Mini Control Relay and Accessories
Pub51243	XTOM Mini Overload Relays
Pub51206	Mini Reversing Link Kits
MN03402002E	XTOM Mini Overload Relays Installation and User Manual

Catalog Number Selection

XT IEC Miniature Overload Relays



Mini Overload Relay Settings (A)

Setting	Starting
A: I_N x 0.58 Motor protection in the Y and delta configurations.	≤15 sec
B: I_N x 1 Only partial motor protection in star position	15–40 sec
C: I_N x 0.58 Motor not protected in star position.	>40 sec
Timing relay set to approximately 10 sec.	

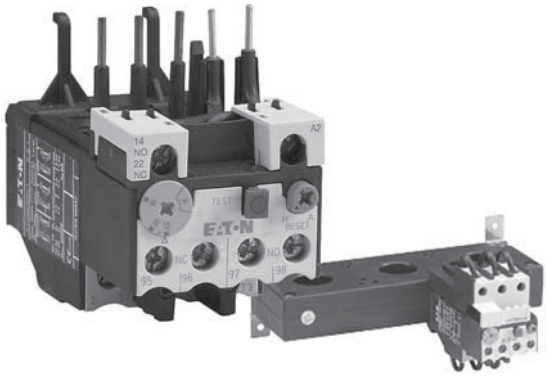
Note

Depending on the coordination type required (i.e., Type 1 or Type 2) it must be established whether the fuse protection and the input wiring for the main and delta contactors are to be common or separate.

Reference

Refer to Tab 27 of this volume, section 27.1 for additional Product information.

Thermal Overload Relays



Contents

Thermal Overload Relays

Product Description

The ***XT*** line of IEC motor thermal overload relays provides an efficient motor protection solution, available up to 630A. XTOB units can be directly mounted to the contactor or mounted separately.

Features and Benefits

- Direct connect up to 250A
- Stand alone and CT type up to 630A
- Large thermal overcurrent range
- Test button
- Manual/automatic selectable reset
- NO-NC auxiliary as standard
- Class 10A (to 250A)
- Class 30 (CT type)

Standards and Certifications

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

Instructional Leaflets

Pub51221	XTOB, D Frame overload relays (inside of packaging)
Pub51222	XTOB, B–C Frame overload relays (inside of packaging)

Notes

Short-circuit protection: Observe the maximum permissible fuse of the contactor with direct device mounting. See MN03402001E for more information on overload relays for Frames B–G.

Trip Class: 10A

Suitable for protection of EEx e-motors. EC prototype test certificate available upon request.

See manuals MN03402001E and MN03407001E, Page 135.

Catalog Number Selection

XT IEC Overload Relays

XT OB P16 B C1 S

Device Type
XT = ***XT*** line of IEC control

Type
OB = Bimetallic overload relay
OT = Current transformer overload relay

Overload Release	
Frame B	**Frame G**
P16 = 0.1–0.16A	**035** = 25–35A
P24 = 0.16–0.24A	**050** = 35–50A
P40 = 0.24–0.4A	**070** = 50–70A
P60 = 0.4–0.6A	**100** = 70–100A
001 = 0.6–1A	**125** = 95–125A
1P6 = 1.0–1.6A	**150** = 120–150A
2P4 = 1.6–2.4A	**175** = 145–175A
004 = 2.4–4A	
006 = 4–6A	**Frame L**
010 = 6–10A	**070** = 50–70A
012 = 9–12A	**100** = 70–100A
016 = 12–16A	**125** = 95–125A
	160 = 120–160A
Frame C	**220** = 160–220A
P16 = 0.1–0.16A	**250** = 200–250A
P24 = 0.16–0.24A	
P40 = 0.24–0.4A	**Frame M**
P60 = 0.4–0.6A	**063** = 42–63A
001 = 0.6–1A	**090** = 60–90A
1P6 = 1.0–1.6A	**125** = 85–125A
2P4 = 1.6–2.4A	**160** = 110–160A
004 = 2.4–4A	**240** = 160–240A
006 = 4–6A	**290** = 190–290A
010 = 6–10A	**400** = 170–400A
016 = 12–16A	**540** = 360–540A
024 = 16–24A	
032 = 24–32A	**Frame N**
	063 = 42–63A
Frame D	**090** = 60–90A
010 = 6–10A	**125** = 85–125A
016 = 12–16A	**160** = 110–160A
024 = 16–24A	**240** = 160–240A
040 = 24–40A	**290** = 190–290A
057 = 40–57A	**400** = 170–400A
065 = 50–65A	**540** = 360–540A
075 = 65–75A	**630** = 420–630A
Frame F	
035 = 25–35A	
050 = 35–50A	
070 = 50–70A	
100 = 70–100A	

Frame Size Designation
B = 45 mm
C = 45 mm
D = 55 mm
G = 90 mm
L = 140 mm
Blank = XTOT only

Trip Class
C1 = Class 10A
C3 = Class 30

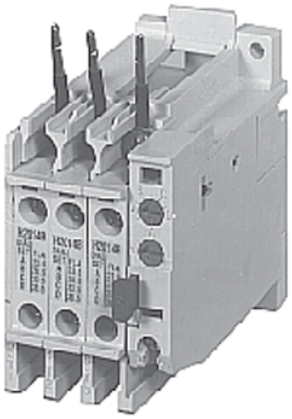
Mounting
Blank = Direct to contactor
S = Separate mount

Reference

Refer to Tab 27 of this volume, section 27.1 for additional Product information.

Thermal Overload Relays	***Tab Section***
Product Selection	**27.1**
Accessories	**27.1**
Technical Data and Specifications	**27.1**
Dimensions	**27.1**

32A Overload—C306DN3B



Contents

31

Freedom Overload Relays

Product Description

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

Features

- Selectable manual or automatic reset operation
- Interchangeable heater packs adjustable ±24% to match motor FLA and calibrated for use with 1.0 and 1.15 service factor motors. Heater packs for 32A overload relay will mount in 75A overload relay—useful in derating applications such as jogging
- Class 10 or 20 heater packs
- Load lugs built into relay base
- Bimetallic, ambient compensated operated. Trip free mechanism
- Electrically isolated NO-NC contacts (pull RESET button to test). (Electrical ratings see tables in **CA08102001E**, Control Products Catalog, Tab 33, section 33.1)
- Overload trip indication
- Shrouded or fingerproof terminals to reduce possibility of electrical shock

Standards and Certifications

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

Reference

Refer to Tab 28 of this volume, section 28.1 for additional Product information.

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 100A as a self contained unit. With external CTs, C440 can protect motor up to 1500 FLA. Available add-on accessories include remote reset capability and communication modules with I/O for DeviceNet, PROFIBUS, and Modbus.

Features and Benefits

Features

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

Size/Range

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

Motor Control

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

Motor Protection

- Thermal overload
- Phase loss
- Selectable (ON/OFF) phase 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 (Q4 2010)
  - Ethernet IP (planned)

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

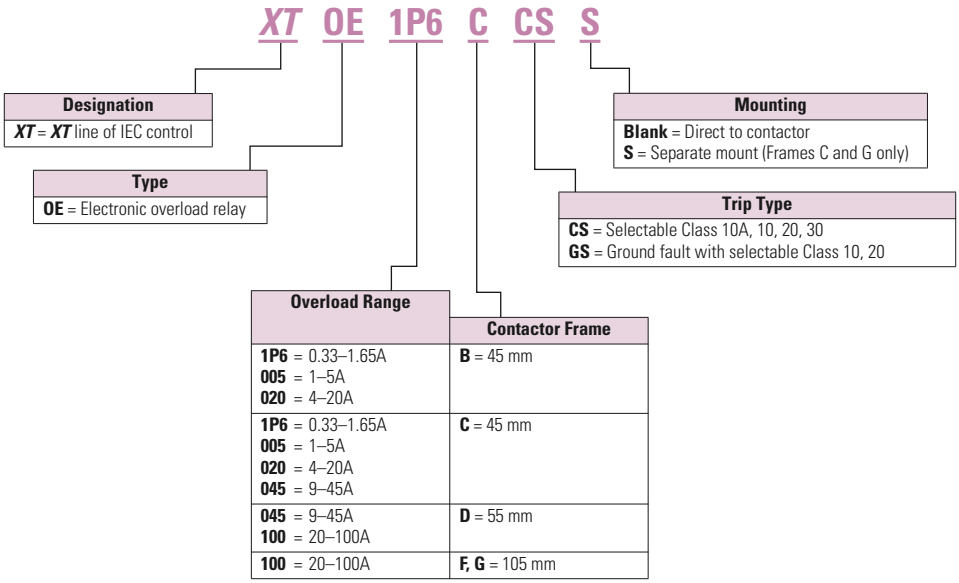
- UL
- CSA
- CE
- NEMA
- IEC/EN 60947 VDE 0660
- ISO 13849-1 (EN954-1)
- RoHS
- ATEX directive 94/9/EC
- Equipment Group 2, Category 2

Electronic Overload Education

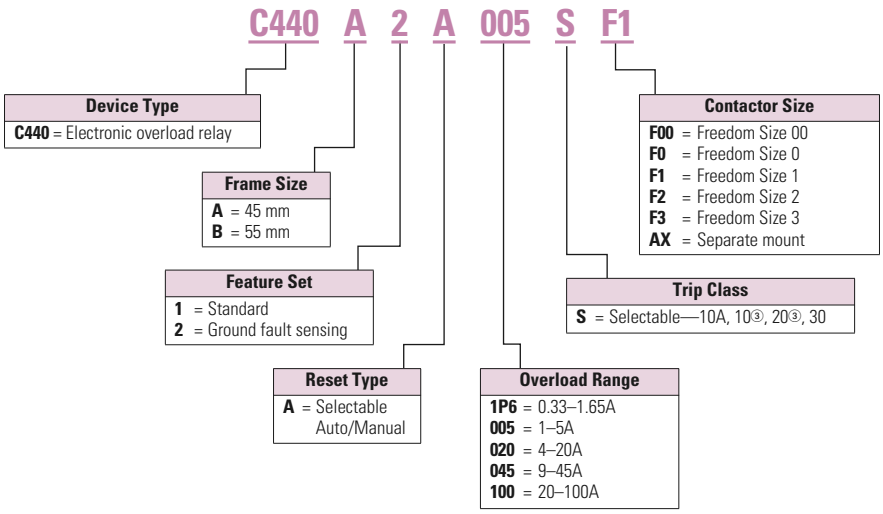
Description	Definition	Cause	Effect if not Protected	C440/*XT* Protection
Motor Protection				
Thermal overload	Overload is a condition in which current draw exceeds 115% of the full load amperage rating for an inductive motor.	• An increase in the load or torque that is being driven by the motor. • 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, i.e., 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, etc.	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-T31-69** for Product Selection.
② See **Page V5-T31-71** for Product Selection.
③ On GF version only.

Freedom Series NEMA Starters with C440 Electronic Overload Relays ①

A N 1 9 A N 0 A 5E 005

Device Type
A = Starter

Standard
N = NEMA

Device Assembly Configuration
1 = Non-reversing
5 = Reversing

OLR Type
9 = Starter w/C440 EOLR

Contactor Frame Size

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

NEMA Enclosure
N = Open

For Starters

Starter Mounting Option
0 = Horizontal

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

AC Coil Suffix

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

C440 FLA Range (FVNR and FVR only)

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

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

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

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

NEMA Size 3
100 = 20–100A

NEMA Size 4 ④
—

NEMA Size 5 ⑤
300 = 60–300A

Notes

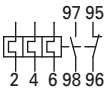
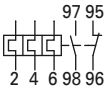
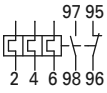
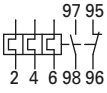
① See **Page V5-T31-72** for Product Selection.
② NEMA Sizes 00 and 0 only.
③ NEMA Sizes 00 and 0 only. Sizes 1–3 are 24/60 only.
④ Starter not shipped as an assembled unit. Order NEMA Size 4 contactor (CN15NN3A) plus current transformers (ZEB-XCT300) and 1–5A C440 overload relay (C440A1A005SELAX or C440A2A005SELAX).
⑤ NEMA Size 5 starter available with 60-300A panel mounted CTs. Starter shipped as an assembled unit with 1–5A C440 overload relay (C440A1A005SELAX or C440A2A005SELAX).

Product Selection

XT Electronic Overload Relays

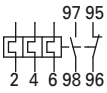
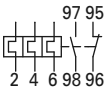
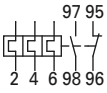
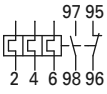
45 mm *XT* for Direct Mount

XT Electronic Overload Relays for Direct Mount to *XT* Contactors

For Use with *XT* Contactor Frame	For Use with Contactor	Overload Range (Amps)	Contact Sequence	Frame Size	Auxiliary Contact Configuration	Type	Catalog Number
B	XTCE007B…, XTCE009B…, XTCE012B…, XTCE015B…	0.33–1.65		45 mm	NO-NC	ZEB12-1,65	**XTOE1P6BCS**
		1–5				ZEB12-5	**XTOE005BCS**
		4–20				ZEB12-20	**XTOE020BCS**
C	XTCE018C…, XTCE025C…, XTCE032C	0.33–1.65		45 mm	NO-NC	ZEB32-1,65	**XTOE1P6CCS**
		1–5				ZEB32-5	**XTOE005CCS**
		4–20				ZEB32-20	**XTOE020CCS**
		9–45				ZEB32-45	**XTOE045CCS**
D	XTCE040D…, XTCE050D…, XTCE065D…, XTCE072D…	9–45		45 mm	NO-NC	ZEB65-45	**XTOE045DCS**
		20–100		55 mm		ZEB65-100	**XTOE100DCS**
F, G	XTCE080F…, XTCE095F…, XTCE115G…, XTCE150G…, XTCE170G…	20–100		55 mm	NO-NC	ZEB150-100	**XTOE100GCS**

45 mm *XT* for Direct Mount with Ground Fault

XT Electronic Overload Relays with Ground Fault for Direct Mount to *XT* Contactors

For Use with *XT* Contactor Frame	For Use with Contactor	Overload Range (Amps)	Contact Sequence	Frame Size	Auxiliary Contact Configuration	Type	Catalog Number
B	XTCE007B…, XTCE009B…, XTCE012B…, XTCE015B…	0.33–1.65		45 mm	NO-NC	ZEB12-1.65-GF	**XTOE1P6BGS**
		1–5				ZEB12-5-GF	**XTOE005BGS**
		4–20				ZEB12-20-GF	**XTOE020BGS**
C	XTCE018C…, XTCE025C…, XTCE032C	0.33–1.65		45 mm	NO-NC	ZEB32-1.65-GF	**XTOE1P6CGS**
		1–5				ZEB32-5-GF	**XTOE005CGS**
		4–20				ZEB32-20-GF	**XTOE020CGS**
		9–45				ZEB32-45-GF	**XTOE045CGS**
D	XTCE040D…, XTCE050D…, XTCE065D…, XTCE072D…	9–45		45 mm	NO-NC	ZEB65-45-GF	**XTOE045DGS**
		20–100		55 mm		ZEB65-100-GF	**XTOE100DGS**
F, G	XTCE080F…, XTCE095F…, XTCE115G…, XTCE150G…, XTCE170G…	20–100		55 mm	NO-NC	ZEB150-100-GF	**XTOE100GGS**

1–5A OL with CTs

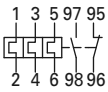
XT Electronic Overload Relays for use with Large Frame *XT* Contactors (L–R)

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

XT Contactor Frame	For Use with IEC Contactor Amp Range (AC-3)	CT Range (Amps)	Description	CT Kit Catalog Number	Terminal Size	Overload Relay Catalog Number	Overload Relay with Ground Fault Catalog Number
L, M	185–500A	60-300	300: 5 panel-mount CT kit with integrated lugs	**ZEB-XCT300**	750 kcmil (2) 250 kcmil 3/0 Cu/Al	**XTOE005CCSS**	**XTOE005CGSS**
M, N	300–820A	120-600	600: 5 panel-mount CT kit with integrated, pass through holes	**ZEB-XCT600**	(2) 750 kcmil 3/0 Cu/Al	**XTOE005CCSS**	**XTOE005CGSS**
N	580–1000A	200-1000	1000: 5 panel-mount CT kit with integrated, pass through holes	**ZEB-XCT1000**	(3) 750 kcmil 3/0 Cu/Al	**XTOE005CCSS**	**XTOE005CGSS**
R	1600A	300-1500	1500: 5 panel-mount CT kit with integrated, pass through holes	**ZEB-XCT1500**	(4) 750 kcmil 1/0 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		ZEB32-1.65/KK	**XTOE1P6CCSS**	**XTOE1P6CGSS**
1–5			ZEB32-5/KK	**XTOE005CCSS**	**XTOE005CGSS**
4–20			ZEB32-20/KK	**XTOE020CCSS**	**XTOE020CGSS**
9–45			ZEB32-45/KK	**XTOE045CCSS**	**XTOE045CGSS**
20–100	55 mm		ZEB150-100/KK	**XTOE100GCSS**	**XTOE100GGSS**

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**

1–5A OL with CTs

C440 Electronic Overload Relays for use with NEMA Contactors Sizes 4–8

Use CTs and 1-5A 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	Terminal Size	Overload Relay Catalog Number	Overload Relay with Ground Fault Catalog Number
4 and 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**	**C440A2A005SAX**
6	120-600	600: 5 panel-mount CT kit with integrated, pass through holes	**ZEB-XCT600**	(2) 750 kcmil 3/0 Cu/Al	**C440A1A005SAX**	**C440A2A005SAX**
7	200-1000	1000: 5 panel-mount CT kit with integrated, pass through holes	**ZEB-XCT1000**	(3) 750 kcmil 3/0 Cu/Al	**C440A1A005SAX**	**C440A2A005SAX**
8	300-1500	1500: 5 panel-mount CT kit with integrated, pass through holes	**ZEB-XCT1500**	(4) 750 kcmil 1/0 Cu/Al	**C440A1A005SAX**	**C440A2A005SAX**

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**

Notes

① CN15 contactor listed is non-reversing with a 120 Vac coil. For more options, see CA08102001E, Control Products Catalog, **Tab 33**, section 33.1.

Type AN19/59 Freedom Series Starters

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

NEMA Starter

Non-Reversing and Reversing

NEMA Size	Continuous Ampere Rating	Service Limit Current Rating (Amps)	Maximum UL Horsepower Single-Phase 115V	Single-Phase 230V	Three-Phase 208V	Three-Phase 240V	Three-Phase 480V	Three-Phase 600V	Three-Pole Non-Reversing ①② Catalog Number	Three-Pole Reversing ①② Catalog Number
00	9	11	1/3	1	1-1/2	1-1/2	2	2	**AN19AN0_5E _**	**AN59AN0_5E _**
0	18	21	1	2	3	3	5	5	**AN19BN0_5E _**	**AN59BN0_5E _**
1	27	32	2	3	7-1/2	7-1/2	10	10	**AN19DN0_5E _**	**AN59DN0_5E _**
2	45	52	3	7-1/2	10	15	25	25	**AN19GN0_5E _**	**AN59GN0_5E _**
3	90	104	—	—	25	30	50	50	**AN19KN0_5E _**	**AN59KN0_5E _**
4 ③	135	156	—	—	40	50	100	100	③	③
5 ④	270	311	—	—	75	100	200	200	**AN19SN0_5E _**	**AN59SN0_5E _**

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

NEMA Starter with Ground Fault

Non-Reversing and Reversing

NEMA Size	Continuous Ampere Rating	Service Limit Current Rating (Amps)	Maximum UL Horsepower Single-Phase 115V	Single-Phase 230V	Three-Phase 208V	Three-Phase 240V	Three-Phase 480V	Three-Phase 600V	Three-Pole Non-Reversing ①② Catalog Number	Three-Pole Reversing ①② Catalog Number
00	9	11	1/3	1	1-1/2	1-1/2	2	2	**AN19AN0_5G _**	**AN59AN0_5G _**
0	18	21	1	2	3	3	5	5	**AN19BN0_5G _**	**AN59BN0_5G _**
1	27	32	2	3	7-1/2	7-1/2	10	10	**AN19DN0_5G _**	**AN59DN0_5G _**
2	45	52	3	7-1/2	10	15	25	25	**AN19GN0_5G _**	**AN59GN0_5G _**
3	90	104	—	—	25	30	50	50	**AN19KN0_5G _**	**AN59KN0_5G _**
4 ③	135	156	—	—	40	50	100	100	③	③
5 ④	270	311	—	—	75	100	200	200	**AN19SN0_5G _**	**AN59SN0_5G _**

Coil Suffix Codes

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

C440 FLA Range (FVNR and FVR Starters Only)

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

Notes

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

② Underscore (_) indicates OLR designation required, see C440 FLA Range table above.

③ Starter not shipped as an assembled unit. Order NEMA Size 4 contactor (CN15NN3A) plus current transformers (ZEB-XCT300) and 1–5A C440 overload relay (C440A1A005SELAX or C440A2A005SELAX).

④ NEMA Size 5 starter available with 60-300A panel mounted CTs. Starter shipped as an assembled unit with 1–5A C440 overload relay (C440A1A005SELAX or C440A2A005SELAX).

Accessories

CT Kits

Accessories

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

Safety Cover

Reset Bar

Remote Reset

Communication

The C440 is provided with two levels of communication capability.

Basic Communication via Expansion Module—Monitoring Only

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

Basic Communication—Modbus

Advanced Communication—Monitoring and Control

C440 also has the ability to communicate on industrial protocols such as DeviceNet, PROFIBUS, Modbus RTU and Modbus TCP, and Ethernet (planned) 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).

Note

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

The following information can be viewed using the communication option:

- Motor status—running, stopped, tripped or resetting
- Individual rms phase currents (A, B, C)
- Average of three-phase rms current
- Percent thermal capacity
- Fault codes (only available prior to reset)
- Percent phase imbalance
- 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**
	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**
	Ethernet IP communication module kit—120V I/O (consists of C440-XCOM + C441R + C440-COM-ADP)	**C440-EIP-120**

Modbus Communication Module

The Modbus module combined with an expansion module and a communication adapter provide Modbus communication capability to the C440 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 C440 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 C440 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

Technical Data and Specifications

Electronic Overload Relays up to 1500A

Description	Specification 45 mm	 55 mm
Electrical Ratings	**Range**	**Range**
Operating voltage (three-phase) and frequency	690 Vac (60/50 Hz)	690 Vac (60/50 Hz)
FLA Range		
	0.33–1.65A 1–5A 4–20A 9–45A	 20–100A
Use with Contactors		
XT IEC frames	B, C, D	F, G
Freedom NEMA sizes	00, 0, 1, 2	3
Trip Class		
	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
Feature	**Range**	**Range**
Phase loss	Fixed threshold 50%	Fixed threshold 50%
Phase imbalance (selectable: enable/disable)	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
Reset	Manual/automatic	Manual/automatic
Indicators		
Trip status	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
Options		
Remote reset	Yes	Yes
Reset bar	Yes	Yes
Communication expansion module	Yes	Yes
Communication adapter	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)
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)
Input, auxiliary contact and remote reset terminals		
Terminal capacity	2 x (18–12) AWG	2 x (18–12) AWG
Tightening torque	5.3 lb-in (0.8–1.2 Nm)	5.3 lb-in (0.8–1.2 Nm)
Voltages		
Insulation voltage U_i (three-phase)	690 Vac	690 Vac
Insulation voltage U_i (control)	500 Vac	500 Vac
Rated impulse withstand voltage	6000 Vac	6000 Vac
Overvoltage category/pollution degree	III/3	III/3

Electronic Overload Relays up to 1500A, continued

Description	Specification 45 mm	55 mm
Auxiliary and Control Circuit Ratings		
Conventional thermal continuous current	5A	5A
Rated operational current—IEC AC-15		
Make contact (1800 VA)		
120V	15A	15A
240V	15A	15A
415V	0.5A	0.5A
500V	0.5A	0.5A
Break contact (180 VA)		
120V	1.5A	1.5A
240V	1.5A	1.5A
415V	0.9A	0.9A
500V	0.8A	0.8A
IEC DC-13 (L/R F 15 ms1)		
0–250V	1.0A	1.0A
Rated operational current—UL B600		
Make contact (3600 VA)		
120V	30A	30A
240V	15A	15A
480V	7.5A	7.5A
600V	6A	6A
Break contact (360 VA)		
120V	3A	3A
240V	1.5A	1.5A
480V	0.75A	0.75A
600V	0.6A	0.6A
R300—Vdc ratings (28 VA)		
0–120V	0.22A	0.22A
250V	0.11A	0.11A
Short-Circuit Rating without Welding		
Maximum fuse	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)
Ambient temperature (storage)	–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
Altitude (no derating) NEMA ICS1	2000m	2000m
Shock (IEC 600068-2-27)	15g any direction	15g any direction
Vibration (IEC 60068-2-6)	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)
Ingress protection	IP20	IP20
Protection against direct contact when actuated from front (IEC 536)	Finger- and back-of-hand proof	Finger- and back-of-hand proof
Mounting position	Any	Any
Climatic proofing	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
Electrical/EMC		
Radiated emissions IEC 60947-4-1-Table 15 EN 55011 (CISPIR 11) Group 1, Class A, ISM	30 mHz to 1000 mHz	30 mHz to 1000 mHz
Conducted emissions IEC 60947-4-1-Table 14 EN 55011 (CISPIR 11) Group 1; Class ISM	0.15 mHz to 30 mHz	0.15 mHz to 30 mHz
ESD immunity IEC 60947-4-1 (Table 13)	±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
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
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
Surge immunity IEC 60947-4-1 (Table 13) IEC 61000-4-5 a Class 4	Three-phase power inputs: ±4 kV line-to-line (DM) ±4 kV line-to-ground (CM)	Three-phase power inputs: ±4 kV line-to-line (DM) ±4 kV line-to-ground (CM)
	With accessory installed in expansion bay: ±2 kV line-to-line (DM) –>1.2/50 us; 2 kV line-to-earth, 1 kV line-to-line ±4 kV line-to-ground (CM)	With accessory installed in expansion bay: ±2 kV line-to-line (DM) –>1.2/50 us; 2 kV line-to-earth, 1 kV line-to-line ±4 kV line-to-ground (CM)
Power freq. magnetic field immunity IEC 60947-4-1, IEC 61000-4-8	30 A/m, 50 Hz	30 A/m, 50 Hz
Electromagnetic field IEC 60947-4-1 Table 13, IEC 61000-4-3	10 V/m	10 V/m
Distortion IEEE 519	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
Electrical fast transient (EFT) IEC 61000-4-4, EN 61131-2	±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)

Communication Modules

Description	Modbus	DeviceNet	PROFIBUS
Electrical/EMC			
Radiated emissions IEC 60947-4-1—Table 15, EN 55011 (CISPIR 11) Group 1, Class A	30–1000 mHz	30–1000 mHz	30–1000 mHz
Conducted emissions IEC 60947-4-1—Table 14, EN 55011 (CISPIR 11) Group 1, Class A	0.15–30 mHz	0.15–30 mHz	0.15–30 mHz
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
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
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
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
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)
Electromagnetic field ① IEC 60947-4-1 (Table 13) IEC 61000-4-3	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)
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	5–95% noncondensing	5–95% noncondensing	5–95% noncondensing
Altitude (no derating)	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 60947-1	3	3	3
Degree of protection	IP20	IP20	IP20
Overvoltage category per UL 508	III	III	III
DeviceNet			
DeviceNet connections	—	Group 2, polling, bit strobe, explicit, no UCMM	—
DeviceNet baud rate	—	125K, 250K, 500K	—
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
C441_ 24 Vdc Input			
Nominal input voltage	24 Vdc	24 Vdc	24 Vdc
Operating voltage	18–30 Vdc	18–30 Vdc	18–30 Vdc
Number of inputs	4	4	4
Signal delay	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
ON-state voltage	>18 Vdc	>18 Vdc	>10 Vdc
Nominal input current	5 mA	5 mA	5 mA
Isolation	1500V	1500V	1500V
Terminal screw torque	7–9 in-lb	7–9 in-lb	7–9 in-lb
24V source current	50 mA	50 mA	50 mA

Note

① Relates to C441M only.

Communication Modules, continued

Description	Modbus	DeviceNet	PROFIBUS
Operating Voltage Range—DC Input Modules			
OFF state	0–6 Vdc	0–6 Vdc	0–6 Vdc
Transition region	6–18 Vdc	6–18 Vdc	6–18 Vdc
ON state	18–30 Vdc	18–30 Vdc	18–30 Vdc
C441_ 120 Vac Input			
Nominal input voltage	120 Vac	120 Vac	120 Vac
Operating voltage	80–140 Vac	80–140 Vac	80–140 Vac
Number of inputs	4	4	4
OFF-state voltage	<30 Vac	<30 Vac	<20 Vac
ON-state voltage	>80 Vac	>80 Vac	>70 Vac
Nominal input current	15 mA	15 mA	15 mA
Signal delay	1/2 cycle	1/2 cycle	1/2 cycle
Isolation	1500V	1500V	1500V
Terminal screw torque	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
Transition region	30–80 Vac	30–80 Vac	30–80 Vac
ON state	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
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
Relay OFF time	3 ms	3 ms	3 ms
Relay ON time	7 ms	7 ms	7 ms
Max. current per point ①	5A (B300 rated)	5A (B300 rated)	5A (B300 rated)
Electrical life	100,000 cycles	100,000 cycles	100,000 cycles
Mechanical life	1,000,000 cycles	1,000,000 cycles	1,000,000 cycles

Note

① Resistive current at 55°C ambient.

Short Circuit Ratings (North America CSA, cUL)

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

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

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

NEMA Freedom Series Starters with C440 Electronic Overload Relays

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

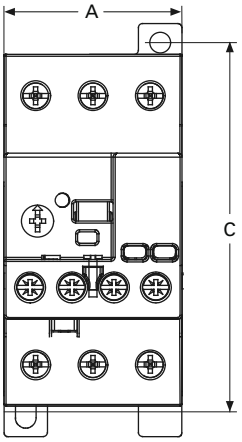
IEC *XT* Starters with *XT* Electronic Overload Relays

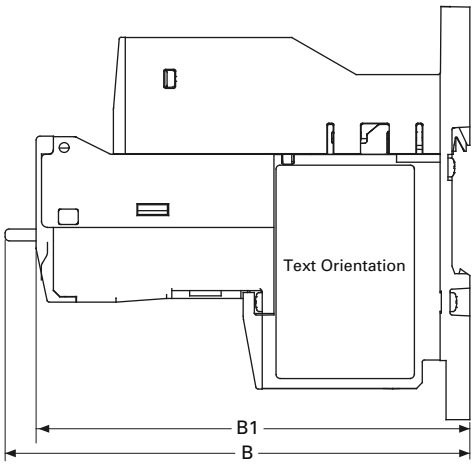
		High-Fault Short Circuit Data			Thermal-Magnetic Circuit Breakers		
	Maximum	Fuses (RK5, J, CC)					
Contactor Frame Size	Operating Voltage	480V	600V	Maximum Fuse Size	480V	600V	Maximum Breaker Size
B	1–5A	100	100	30	—	—	—
	4–20A	100	100	30	—	—	—
C	1–5A	100	100	60	—	—	—
	4–20A	100	100	60	—	—	—
	9–45A	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

Dimensions

Approximate Dimensions in Inches (mm)

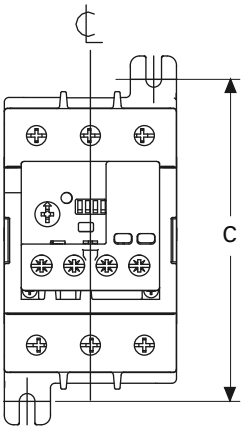
45 mm C440/*XT* Electronic Overload Relays

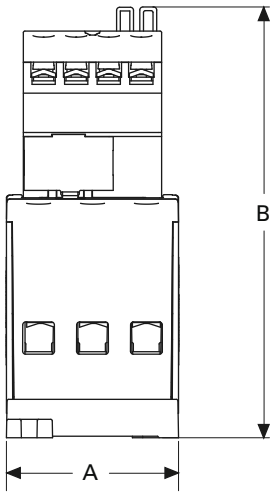


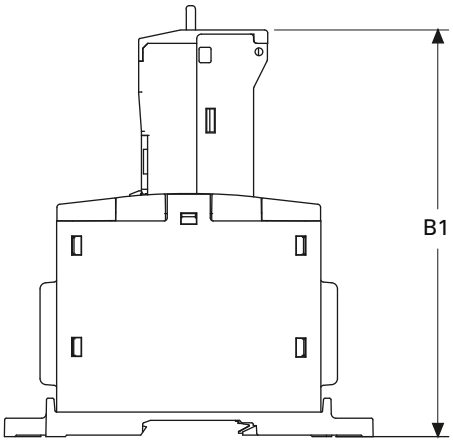


	Width A	Depth B1	Depth to Reset B	Mounting Hole (Height) C
NEMA Starter Size				
00–2	1.80 (45.0)	4.32 (109.7)	4.63 (117.5)	—
***XT* IEC Frame Size**				
B, C, D	1.80 (45.0)	4.32 (109.7)	4.30 (109.2)	—
Standalone				
0.35–45A	1.80 (45.0)	4.32 (109.7)	4.63 (117.5)	3.68 (93.5)

55 mm C440/*XT* Electronic Overload Relays





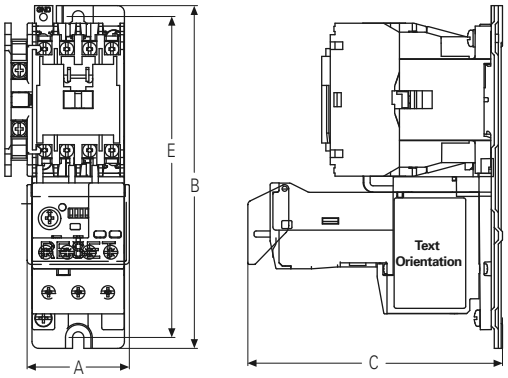


	Width A	Depth to Reset B	Depth B1	Mounting Hole (Height) C
NEMA Starter Size				
3	2.21 (55.0)	5.52 (140.2)	5.21 (132.4)	4.13 (104.8)
***XT* IEC Frame Size**				
D, F, G	2.21 (55.0)	5.52 (140.2)	5.21 (132.4)	4.13 (104.8)
Standalone				
20–100A	2.21 (55.0)	5.52 (140.2)	5.21 (132.4)	4.13 (104.8)

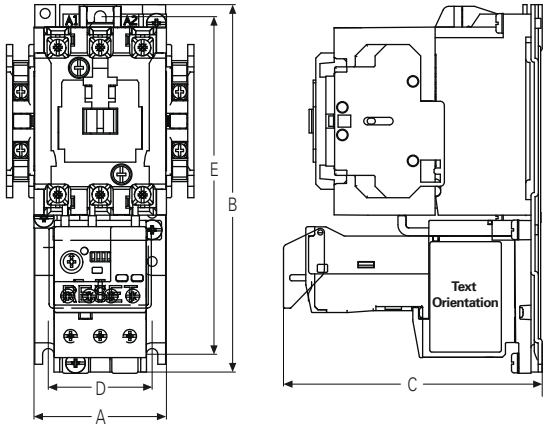
Approximate Dimensions in Inches (mm)

NEMA Starters

Full Voltage Non-Reversing Starters



Sizes 00, 0



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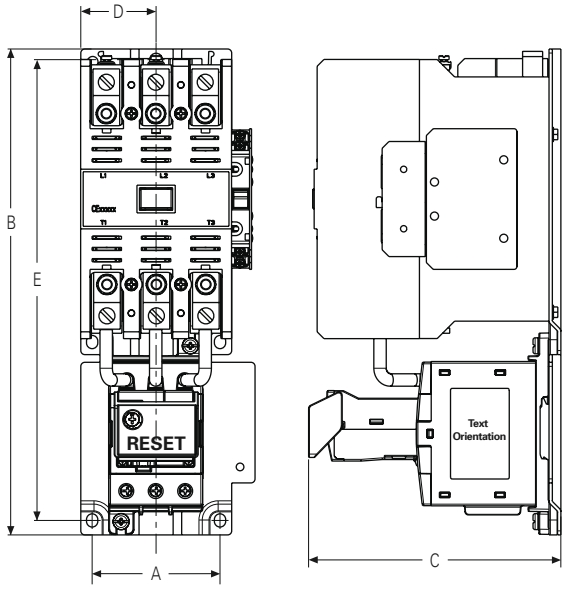

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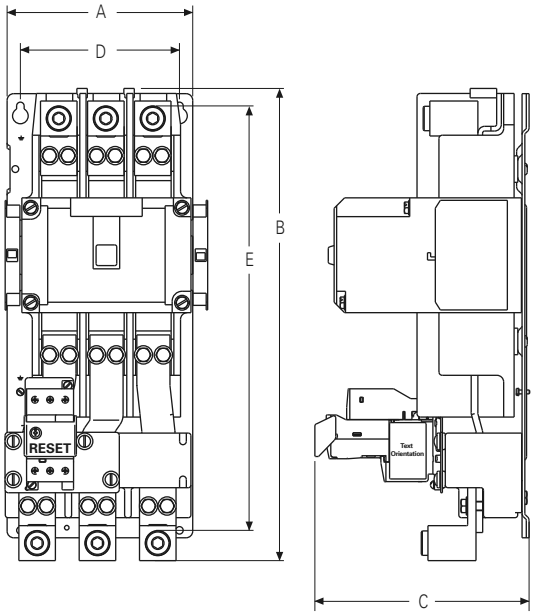
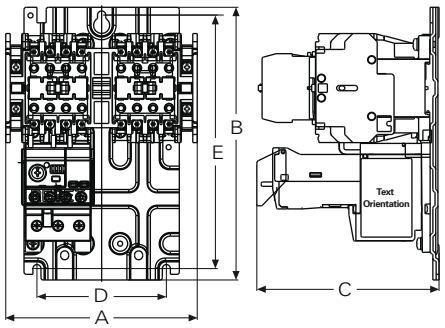


Size 5

NEMA Size	A	B	C	D	E
00, 0	1.97 (50.0)	6.60 (167.6)	4.90 (124.5)	—	6.18 (157.0)
1, 2	2.60 (65.0)	7.10 (180.0)	4.98 (126.5)	2.00 (50.8)	6.50 (165.0)
3	4.09 (103.8)	11.40 (289.6)	5.92 (150.3)	1.77 (44.9)	10.81 (274.6)
5	7.00 (177.8)	17.81 (452.3)	8.08 (205.2)	6.00 (152.4)	16.01 (406.6)

Approximate Dimensions in Inches (mm)

Full Voltage Reversing Starters



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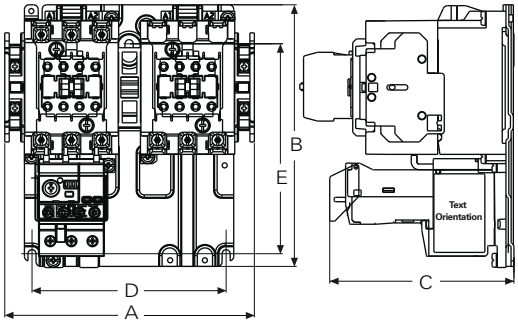

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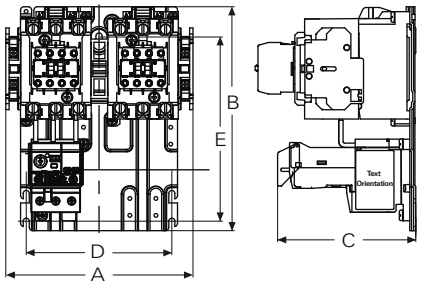

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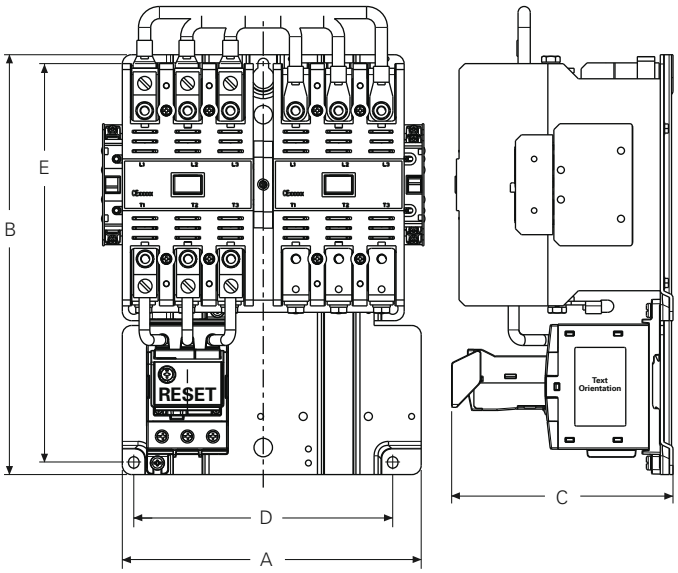

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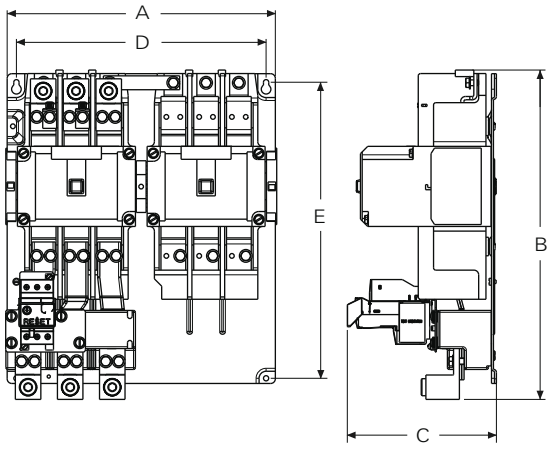
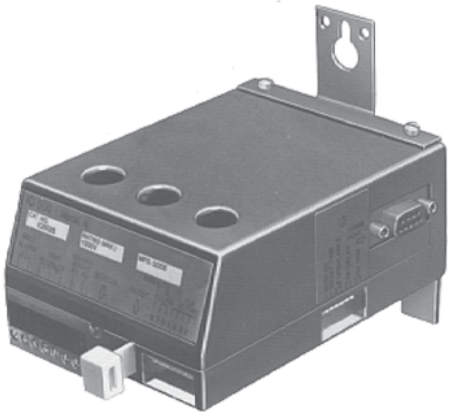


Size 5

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

IQ500 Overload Relays



Contents

31

IQ500 Overload Relays

Product Description

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

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

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

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

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

Reference

Refer to Tab 28 of this volume, section 28.2 for additional Product information.

IQ500 Overload Relays	*Tab Section*
Benefits	**28.2**
Product Selection	**28.2**
Dimensions	**28.2**

Features

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

Standards and Certifications

- UL File No. E19223

Motor Insight Overload and Monitoring Relay

Contents

C441 Overload Relays

Product Description

Eaton's Motor Insight, the first product in the Intelligent Power Control Solutions family, is a highly configurable motor, load and line protection device with power monitoring, diagnostics and flexible communications allowing the customer to save energy, optimize their maintenance schedules and configure greater system protection, thus reducing overall costs and downtime.

Motor Insight is available in either a line-powered or 120 Vac control powered design, capable of monitoring voltages up to 660 Vac. Each of these units is available in a 1–9 amp or a 5–90 amp FLA model. With external CTs, Motor Insight can protect motors up to 540 amps FLA. Available add-on accessories include communication modules for Modbus®, DeviceNet™ and PROFIBUS®, all with I/O options. For ease-of-use and operator safety, Motor Insight offers a remote display that mounts easily with two 30 mm knockouts.

Features and Benefits

Features

Size/Range
- Broad FLA range of 1–540A
- Selectable trip class (5–30)
- Four operating voltage options
  - Line-powered from 240 Vac, 480 Vac, 600 Vac
  - Control-powered from 120 Vac

Motor Control
- Two output relays
  - One B300 Form C fault relay and one B300 ground fault shunt relay
  - Other relay configurations are available, including one Form A and one Form B SPST (fault and auxiliary relays) allowing programmable isolated relay behavior and unique voltages
- One external remote reset terminal
- Trip status indicator

Motor Protection
- Thermal overload
- Jam protection
- Current imbalance
- Current phase loss
- Ground fault
- Phase reversal

Load Protection
- Under current
- Low power (kW)
- High power (kW)

Line Protection
- Over voltage
- Under voltage
- Voltage imbalance
- Voltage phase loss

Monitoring Capabilities
- Current—average and phase rms
- Voltage—average and phase rms
- Power—motor kW
- Power factor
- Frequency
- Thermal capacity
- Run hours
- Ground fault current
- Current imbalance %
- Voltage imbalance %
- Motor starts
- Motor run hours

Options
- Type 1, 12 remote display
- Type 3R remote display kit
- Communication modules
  - Modbus
  - Modbus with I/O
  - DeviceNet with I/O
  - PROFIBUS with I/O
  - Modbus TCP with I/O (Contact Product Line)
  - Ethernet IP (Contact Product Line)

Benefits

Reliability and Improved Uptime
- Advanced diagnostics allows for quick and accurate identification of the root source of a motor, pump or power quality fault; reducing trouble-shooting time and the loss of productivity, reducing repeat faults due to misdiagnosis, and increasing process output and profitability
- Provides superior protection of motors and pumps before catastrophic failure occurs
- Increases profitability with greater process uptime and throughput, reduced costs per repair, reduced energy consumption and extended equipment life
- Adjustments to overload configuration can be made at any time

Safety
- IP20 rated terminal blocks
- Terminal blocks are set back from the display to reduce operator shock hazard
- Remote display (optional) does not require that the operator open the panel to configure the device

Flexibility
- Communications modules
  - Offered in a variety of configurations
  - External snap-on modules provide support for multiple communications protocols
- Advanced power, voltage and current monitoring capabilities
- Communications modules and remote display can be used simultaneously
- Highly configurable fault and reset characteristics for numerous applications
- Fully programmable isolated fault and auxiliary relays

Ease of Use
- Bright LED display with easy-to-understand setting and references
- Powered from line voltage or 120 Vac control power
- Remote display powered from base unit
- Full word descriptions and units on user interface

Standards and Certifications
- cULus listed NKCR, NKCR7, 508
- UL® 1053 applicable sections for ground fault detection
- CSA® certified (Class 3211-02)
- CE
- NEMA®
- IEC EN 60947-4-1
- RoHS

Advanced Overload Education

Description	Definition	Source	Result	Motor Insight Protection
Motor Protection				
Thermal overload	Overload is a condition in which current draw to a motor exceeds 115% of the full load amperage rating over a period of time 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 would cause the current to go high to maintain the power needed. A poor power factor would cause above normal current draw.	Increase in current draw. Current leads to heat and insulation breakdown, which can cause system failure. Additionally, an 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 5–30 by 1 Provides power factor monitoring and low voltage protection features.
Jam	Jam is similar to thermal overload in that it is a current draw on the motor above normal operating conditions.	Mechanical stall, interference, jam or seizure of the motor or motor load.	The motor attempts to drive the load, which has more resistive force due to the mechanical interference. In order to drive the load, the motor draws an abnormal amount of current, which can lead to insulation breakdown and system failure.	Provides a configurable Jam setting that is active during "motor run state" to avoid nuisance trips. Trip Threshold 150–400% of FLA. Trip Delay 1–20 seconds.
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.	Motor Insight has ground fault protection capability down to 0.15 amps estimated from the existing three-phase CTs using the residual current method. That is, the three-phase current signals should sum to zero unless a ground fault (GF) condition is present. In the case of a GF, Motor Insight can alarm, trip the starter, or trip an alternative relay that can be used to shunt trip a breaker or light up a warning light. GF current can also be monitored in real-time through the advanced monitoring capabilities. **Note:** GF settable thresholds vary with motor FLA. 0.15 amps may not be available in all cases.
Imbalanced phases (voltage and current)	Uneven voltage or currents 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.	Provides two protection settings that address this problem. The user can choose to set current imbalance thresholds or voltage imbalance thresholds, each of which can trip the starter. Additionally, both of these may be monitored through Motor Insight's advanced monitoring capabilities, allowing the customer to notice in real-time when and where a condition is present.
Phase loss—current (single-phasing)	One of the three-phase current 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 imbalanced phases as listed above.	Fixed protective setting that takes the starter offline if a phase drops below 60% of the other two phases.
Phase rotation (phase-reversal)	Improper wiring, leading to phases being connected to the motor improperly.	A miswired motor. Inadvertent phase-reversal by the utility.	Phase-reversal can cause unwanted directional rotation of a motor. In the event that the load attached to the motor can only be driven in one direction, the result could be significant mechanical failure and/or injury to an operator.	Configurable phase protection, allowing the user to define the phase sequencing intended for that application. If no phase sequence is required, the user has the ability to disable this feature.
Frequency variance	When line frequency is inconsistent.	Malfunctioning alternator speed regulator, or poor line quality caused by an overload of a supply powered by individual sources.	Variations in frequency can cause increases in losses, decreasing the efficiency of the motor. In addition, this can result in interference with synchronous devices.	Advanced monitoring capabilities allow the user to monitor frequency in real-time.

Advanced Overload Education, continued

Description	Definition	Source	Result	Motor Insight Protection
Load Protection				
Under current or low power	Average rms current provided to the motor falls below normal operating conditions.	Under current is usually associated with a portion of the user's load disappearing. Examples of this would be a broken belt, a dry-pump (low suction head) or a dead-headed centrifugal pump.	If under current goes undetected, a mechanical failure can and has occurred. In the case of a pump, running a pump dry or running a pump in a dead-headed condition can cause excessive heating, damaging expensive seals and breaking down desired fluid properties.	Motor Insight has two protection settings to detect this: under current and low power. Low power is a more consistent way of ensuring detection as power is linear with motor load, where as current is not. An unloaded motor may draw 50% of its rated current, but the power draw will be less than 10% of rated power due to a low power factor.
High power	The motor load is drawing more power than it should at normal operating conditions.	This is typical of batch processing applications where several ingredients flow into a mixer. When a substance's consistency changes and viscosity increases from what is expected, the motor may use more power to blend the mixture. Out-of-tolerance conditions can be detected using the High Power and Low Power settings.	If a high-power fault goes undetected, the result may be a batch of material that does not meet specification.	Monitors the three-phase real power. If the real power value is estimated above the set threshold for the set length of time, a fault is detected and the overload will trip the starter. Additionally, power can be monitored in real-time.
Line Protection				
Over voltage	When the line voltage to the motor exceeds the specified rating.	Poor line quality.	An over voltage condition leads to a lower than rated current draw and a poor power factor. A trip limit of 110% of rated voltage is recommended. Over voltage can also lead to exceeding insulation ratings.	Monitors the maximum rms value of the three-phase voltages. If the rms value rises above the set threshold for the set length of time, a fault is detected and the overload can trip the starter or send and display an alarm of the condition. All line-related faults have an "alarm-no-trip" mode.
Under voltage	When the line voltage to the motor is below the specified rating.	Poor line quality.	An under voltage condition leads to excessive current draw. This increases the heating of the motor windings and can shorten insulation life. A trip limit set to 90% of rated voltage is recommended.	Monitors the minimum rms value of the three-phase voltages. If the rms value drops below the set threshold for the set length of time, a fault is detected and the overload can trip the starter or send and display an alarm of the condition. All line-related faults have an "alarm-no-trip" mode.
Power-up delay	Allows for starting motors and loads in a deliberate fashion.	When there is a power failure, or power cycle, multiple loads come online simultaneously.	Multiple loads starting simultaneously can cause sags affecting the operation of devices that may prevent successful startup. If power is lost to a motor driving a pump, it may be necessary to delay a restart to allow the pump to come to a complete stop to prevent starting a motor during backspin.	Configurable to delay closing the fault relay on power-up. For each Motor Insight controlling a motor, a different setting can be programmed, helping to maintain the integrity of your line power.

Catalog Number Selection

Motor Insight Overload Relays

C441 B A NOUI

Device Type	Overload Relay Power Source Voltage	Overload Relay Current Rating	Internal User Interface
C441 = Motor Insight overload relay	**B** = 240 Vac (170–264 Vac) **C** = 480 Vac (323–528 Vac) **D** = 600 Vac (487–660 Vac) **Blank** = 120 Vac control power (170–660 Vac)	**A** = 1–9A (1–540A refer to **Page V5-T31-91**) **B** = 5–90A (5–90A refer to **Page V5-T31-91**) **0109** = 120 Vac control power (0–660 Vac, 1–9A) **0590** = 120 Vac control power (0–660 Vac, 5–90A)	**Blank** = With user interface **NOUI** = Without user interface

Motor Insight Overload Relays—Communications Modules and Accessory Types

C441 K

Device Type	Communication Module	Accessory Type
C441 = Motor Insight overload relay	**K** = DeviceNet module 4IN/2OUT 120 Vac **L** = DeviceNet module 4IN/2OUT 24 Vdc **M** = Modbus module **N** = Modbus module 4IN/2OUT 120 Vac **P** = Modbus module 4IN/2OUT 24 Vdc **Q** = PROFIBUS module 4IN/2OUT 24 Vdc **R** = Ethernet IP module 4IN/2OUT 120 Vac **S** = PROFIBUS module 4IN/2OUT 120 Vac	**1** = Type 1 and 12 remote mounted display **3** = Type 3R kit for remote display **CMP1** = Mounting plate

Product Selection

Motor Insight

Motor Insight

Power Source	Monitoring Range	Current Range	Catalog Number
240 Vac (170–264)	170–264 Vac	1–9A	**C441BA**
		5–90A	**C441BB**
480 Vac (323–528)	323–528 Vac	1–9A	**C441CA**
		5–90A	**C441CB**
600 Vac (489–660)	489–660 Vac	1–9A	**C441DA**
		5–90A	**C441DB**
120 Vac (93.5–132)	170–660 Vac	1–9A	**C4410109NOUI**
		5–90A	**C4410590NOUI**

Motor Insight CT Multiplier and Wire Wrap Schedule

Catalog Number ①	Motor FLA	Number of Loops	Number of Conductors Through CT Primary	CT Multiplier Setting	External CT Kit Catalog Number ②
Current Range: 5–90A					
C441_B and C4410590NOUI	5–22.5A	3	4	4	—
	6.67–30A	2	3	3	—
	10–45A	1	2	2	—
	20–90A	0	1	1	—
Current Range: 1–9A					
C441_A and C4410109NOUI	1–5A	1	2	2	—
	2–9A	0	1	1	—
	60–135A	0	1	150–(150:5)	**C441CTKIT150**
	120–270A	0	1	300–(300:5)	**C441CTKIT300**
	240–540A	0	1	600–(600:5)	**C441CTKIT600**

Notes

① Underscore indicates Operating Voltage Code required.
Operating Voltage Codes:

Code	Voltage
B	240 Vac
C	480 Vac
D	600 Vac
<empty>	120 Vac Control Power

② Any manufacturer's CTs may be used.

Accessories

Modbus Communication Module

The Motor Insight Modbus Communication Module is a side-mounted device providing Modbus communication capability to the Motor Insight overload relay.

The Modbus Communication Module with I/O provides communication, monitoring and control for the Motor Insight overload relay.

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 Motor Insight user interface (C441M only)
- Modbus address and baud rate are set via convenient DIP switches (C441N and C441P); 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

Modbus Communication Module

	Description	I/O	Catalog Number
Modbus Module 	Modbus Communication Module	None	**C441M**
Modbus with I/O Module 	Modbus Communication Module 4IN/2OUT	120 Vac	**C441N**
	Modbus Communication Module 4IN/2OUT	24 Vdc	**C441P**

DeviceNet Communication Modules

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

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

DeviceNet Module

DeviceNet Modules

Description	I/O	Catalog Number
DeviceNet Communication Module	120 Vac	**C441K**
DeviceNet Communication Module	24 Vdc	**C441L**

PROFIBUS Communication Module

The Motor Insight PROFIBUS Communication Module is a side-mounted device providing PROFIBUS communication capability to the Motor Insight overload relay.

The PROFIBUS Communication Module with I/O provides communication, monitoring and control for the Motor Insight overload relay.

Features and Benefits

- The PROFIBUS communication module is capable of baud rates up to 12 Mb
- PROFIBUS address is set via convenient DIP switches (C441Q and C441S); 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

PROFIBUS with I/O Module

PROFIBUS Communication Module

Description	I/O	Catalog Number
PROFIBUS Communication Module 4IN/2OUT	120 Vac	**C441S**
PROFIBUS Communication Module 4IN/2OUT	24 Vdc	**C441Q**

Type 3R Kit with Remote Display Mounted Inside

Motor Insight offers several accessories for the customer's ease of use and safety:

- Types 1 and 12 remote display
- Type 3R remote display kit
- Mounting plate adapter

Features and Benefits

- Remote display unit:
  - Same user interface as the overload relay
  - Enhanced operator safety—operator can configure the overload without opening the enclosure door
- Type 3R kit mounts with standard 30 mm holes
- Mounting plate for retrofit in existing installations

Type 3R Kit with Remote Display Mounted Inside

	Description	Catalog Number
C4411 	Remote display Types 1 and 12 (UL 508)	**C4411**
C4413 	Type 3R kit for remote display (UL 508)	**C4413**
	Conversion plate (not shown)	**C441CMP1**

Communication Cables

The Remote Display requires a communication cable to connect to the Motor Insight overload relay:

Communication Cable Lengths

Length in Inches (meters)	Catalog Number
9.8 (0.25)	**D77E-QPIP25**
39.4 (1.0)	**D77E-QPIP100**
78.7 (2.0)	**D77E-QPIP200**
118.1 (3.0)	**D77E-QPIP300**

Current Transformer Kits

Description	Catalog Number
Three 150:5 CTs to be used with Motor Insight	**C441CTKIT150**
Three 300:5 CTs to be used with Motor Insight	**C441CTKIT300**
Three 600:5 CTs to be used with Motor Insight	**C441CTKIT600**

Technical Data and Specifications

Motor Insight

Description	Specification C441B_	C441C_	C441D_	C441_ _ _ _NOUI	
Electrical Ratings					
Feature	**Range**				
Operating voltage (three-phase) and frequency	170–264 Vac 50/60 Hz	323–528 Vac 50/60 Hz	489–660 Vac 50/60 Hz	170–660 Vac 50/60 Hz	
Trip Class					
5–30	Selectable	Selectable	Selectable	Selectable	
FLA Range					
C441_A and C4410109NOUI	1–9A	Up to 540A with external CTs Refer to **Page V5-T31-91** for CT multiplier and wire wrap schedule.	Up to 540A with external CTs Refer to **Page V5-T31-91** for CT multiplier and wire wrap schedule.	Up to 540A with external CTs Refer to **Page V5-T31-91** for CT multiplier and wire wrap schedule.	
C441_B and C4410590NOUI	5–90A				
Monitoring Capabilities					
Feature	**Value**				
Current	Per phase rms (1A, 1B, 1C), 2% accuracy Average rms, 2% accuracy Imbalance percent (0–100%) Ground fault current, 10% accuracy	Per phase rms (1A, 1B, 1C), 2% accuracy Average rms, 2% accuracy Imbalance percent (0–100%) Ground fault current, 10% accuracy	Per phase rms (1A, 1B, 1C), 2% accuracy Average rms, 2% accuracy Imbalance percent (0–100%) Ground fault current, 10% accuracy	Per phase rms (1A, 1B, 1C), 2% accuracy Average rms, 2% accuracy Imbalance percent (0–100%) Ground fault current, 10% accuracy	
Voltage	Per phase rms (1A, 1B, 1C), 2% accuracy Average rms, 2% accuracy Imbalance percent (0–100%)	Per phase rms (1A, 1B, 1C), 2% accuracy Average rms, 2% accuracy Imbalance percent (0–100%)	Per phase rms (1A, 1B, 1C), 2% accuracy Average rms, 2% accuracy Imbalance percent (0–100%)	Per phase rms (1A, 1B, 1C), 2% accuracy Average rms, 2% accuracy Imbalance percent (0–100%)	
Power	Motor kW, 5% accuracy Motor power factor, inductive 0–1.0, 1% accuracy	Motor kW, 5% accuracy Motor power factor, inductive 0–1.0, 1% accuracy	Motor kW, 5% accuracy Motor power factor, inductive 0–1.0, 1% accuracy	Motor kW, 5% accuracy Motor power factor, inductive 0–1.0, 1% accuracy	
Thermal capacity	0% cold, 100% trip	0% cold, 100% trip	0% cold, 100% trip	0% cold, 100% trip	
Motor run hours	0–65,535 hours	0–65,535 hours	0–65,535 hours	0–65,535 hours	
Frequency	47–63 Hz, 1% accuracy	47–63 Hz, 1% accuracy	47–63 Hz, 1% accuracy	47–63 Hz, 1% accuracy	
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	1.05 x FLA: Does not trip 1.15 x FLA: Overload trip	
Feature	**Range**				**Fault Delay Setting**
Jam	150–400% of motor FLA, OFF	150–400% of motor FLA, OFF	150–400% of motor FLA, OFF	50–400% of motor FLA, OFF	1–20 seconds
Current imbalance	1–30%, OFF	1–30%, OFF	1–30%, OFF	1–30%, OFF	1–20 seconds
Current phase loss	Fixed threshold 60%	Fixed threshold 60%	Fixed threshold 60%	Fixed threshold 60%	1–20 seconds
Ground fault current					
C441_A and C4410109NOUI 1–9A	0.3–2.0A with one pass through the CTs ①	0.3–2.0A with one pass through the CTs ①	0.3–2.0A with one pass through the CTs ①	0.3–2.0A with one pass through the CTs ①	<150%, 1–60 seconds >150%, 2 seconds >250%, 1 second
C441_B and C4410590NOUI 5–90A	3.0–20A with one pass through the CTs ①	3.0–20A with one pass through the CTs ①	3.0–20A with one pass through the CTs ①	3.0–20A with one pass through the CTs ①	<150%, 1–60 seconds >150%, 2 seconds >250%, 1 second
Phase reversal	OFF = Ignore, 1 = ACB, 2 = ABC	OFF = Ignore, 1 = ACB, 2 = ABC	OFF = Ignore, 1 = ACB, 2 = ABC	OFF = Ignore, 1 = ACB, 2 = ABC	
Fault reset delay	2–500 minutes, auto ②	2–500 minutes, auto ②	2–500 minutes, auto ②	2–500 minutes, auto ②	
Fault reset attempts	0–4 restarts allowed or automatic reset ②	0–4 restarts allowed or automatic reset ②	0–4 restarts allowed or automatic reset ②	0–4 restarts allowed or automatic reset ②	

Notes

① Lower levels are achievable with multiple passes.

② Motor fault reset characteristics can be programmed as a group or for motor overloads only. Reference the user manual for more detailed information.

Motor Insight, continued

Description	Specification C441B_	C441C_	C441D_	C441_ _ _ _NOUI	
Load Protection					
Feature	**Range**				**Fault Delay Setting**
Under current	50–90% of motor FLA	50–90% of motor FLA	50–90% of motor FLA	50–90% of motor FLA	1–60 seconds
Low power (kW)	20–80% of rated kW	20–80% of rated kW	20–80% of rated kW	20–80% of rated kW	1–60 seconds
High power (kW)	50–110% of rated kW	50–110% of rated kW	50–110% of rated kW	50–110% of rated kW	1–60 seconds
Load reset delay	2–500 minutes, auto	2–500 minutes, auto	2–500 minutes, auto	2–500 minutes, auto	
Load reset attempts	0–4, auto	0–4, auto	0–4, auto	0–4, auto	
Supply Protection					
Feature	**Range**				**Fault Delay Setting**
Over voltage	170–264 Vac	323–528 Vac	489–660 Vac	0–660 Vac	1–20 seconds
Under voltage	170–264 Vac	323–528 Vac	489–660 Vac	0–660 Vac	1–20 seconds
Voltage imbalance	1–20% imbalance	1–20% imbalance	1–20% imbalance	1–20% imbalance	1–20% imbalance
Restart delay setting	1–500 seconds	1–500 seconds	1–500 seconds	1–500 seconds	1–500 seconds
Electrical/EMC					
Radiated emissions IEC 60947-4-1—Table 15, EN 55011 (CISPIR 11) Group 1, Class A	30–1000 mHz	30–1000 mHz	30–1000 mHz	30–1000 mHz	30–1000 mHz
Conducted emissions IEC 60947-4-1—Table 14, EN 55011 (CISPIR 11) Group 1, Class A	0.15–30 mHz	0.15–30 mHz	0.15–30 mHz	0.15–30 mHz	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	±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	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	140 dBuV (10V rms) 150 kHz–80 mHz
Fast transient immunity IEC 60947-4-1 (Table 13) IEC 61000-4-4	±2 kV using direct method	±2 kV using direct method	±2 kV using direct method	±2 kV using direct method	±2 kV using direct method
Surge immunity IEC 60947-4-1 (Table 13) IEC 61000-4-4	Three-phase power inputs: ±2 kV line-to-line (DM) ±4 kV line-to-ground (CM)	Three-phase power inputs: ±2 kV line-to-line (DM) ±4 kV line-to-ground (CM)	Three-phase power inputs: ±2 kV line-to-line (DM) ±4 kV line-to-ground (CM)	Three-phase power inputs: ±2 kV line-to-line (DM) ±4 kV line-to-ground (CM)	Three-phase power inputs: ±2 kV line-to-line (DM) ±4 kV line-to-ground (CM)
	IEC 61000-4-5 Class 3 User IO and communication lines: ±1 kV line-to-line (DM) ±2 kV line-to-ground (CM)	IEC 61000-4-5 Class 3 User IO and communication lines: ±1 kV line-to-line (DM) ±2 kV line-to-ground (CM)	IEC 61000-4-5 Class 3 User IO and communication lines: ±1 kV line-to-line (DM) ±2 kV line-to-ground (CM)	IEC 61000-4-5 Class 3 User IO and communication lines: ±1 kV line-to-line (DM) ±2 kV line-to-ground (CM)	IEC 61000-4-5 Class 3 User IO and communication lines: ±1 kV line-to-line (DM) ±2 kV line-to-ground (CM)
Voltage variations immunity IEC 60947-4-1	30% dip, at 100 ms 60% dip at 10 ms >95% interrupt at 5 ms	30% dip, at 100 ms 60% dip at 10 ms >95% interrupt at 5 ms	30% dip, at 100 ms 60% dip at 10 ms >95% interrupt at 5 ms	30% dip, at 100 ms 60% dip at 10 ms >95% interrupt at 5 ms	30% dip, at 100 ms 60% dip at 10 ms >95% interrupt at 5 ms
Electromagnetic field IEC 60947-4-1 (Table 13) IEC 61000-4-3	10 V/m	10 V/m	10 V/m	10 V/m	10 V/m
Ground fault	UL 508, UL 1053 Sections 21 and 27	UL 508, UL 1053 Sections 21 and 27	UL 508, UL 1053 Sections 21 and 27	UL 508, UL 1053 Sections 21 and 27	UL 508, UL 1053 Sections 21 and 27

Motor Insight, continued

Description	Specification C441B_	C441C_	C441D_	C441_ _ _ _NOUI
Environmental Ratings				
Feature	**Range**			
Ambient temperature (operating)	–4° to 122°F (–20° to 50°C)	–4° to 122°F (–20° to 50°C)	–4° to 122°F (–20° to 50°C)	–4° to 122°F (–20° to 50°C)
Ambient temperature (storage)	–40° to 85°C	–40° to 85°C	–40° to 85°C	–40° to 85°C
Operating humidity	5% to 95% noncondensing	5% to 95% noncondensing	5% to 95% noncondensing	5% to 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
Ingress protection	IP20	IP20	IP20	IP20
Capacity				
Input, auxiliary contact and external reset terminals				
Terminal capacity	18–12 AWG	18–12 AWG	18–12 AWG	18–12 AWG
Tightening torque	5.3 lb-in (0.6 Nm)	5.3 lb-in (0.6 Nm)	5.3 lb-in (0.6 Nm)	5.3 lb-in (0.6 Nm)
Voltages				
Monitoring voltage	170–264 Vac 50/60Hz	323–528 Vac 50/60Hz	489–660 Vac 60Hz	0–660 Vac 50/60Hz
Insulation voltage U_i (three-phase voltage)	600 Vac	600 Vac	600 Vac	600 Vac
Insulation voltage U_i (control)	240 Vac	240 Vac	240 Vac	240 Vac
Impulse withstand U_{imp} (main/control)	6 kV	6 kV	6 kV	6 kV
Expected Life				
Mechanical/electrical	10 years	10 years	10 years	10 years
Output Contact Ratings				
Two output relays One Form C SPDT (fault relay) One Form A SPST (ground fault relay) C441_ _ _ _NOUI models: One Form A SPST One Form B SPST	B300 pilot duty 5A thermal continuous current 30A make 3.00A break at 120 Vac and 15A make 1.50A break at 240 Vac	B300 pilot duty 5A thermal continuous current 30A make 3.00A break at 120 Vac and 15A make 1.50A break at 240 Vac	B300 pilot duty 5A thermal continuous current 30A make 3.00A break at 120 Vac and 15A make 1.50A break at 240 Vac	B300 pilot duty 5A thermal continuous current 30A make 3.00A break at 120 Vac and 30A make 1.50A break at 240 Vac ①
External remote reset terminal	Isolated 120 Vac digital input IEC 61131-2 Section 5 Type 1	Isolated 120 Vac digital input IEC 61131-2 Section 5 Type 1	Isolated 120 Vac digital input IEC 61131-2 Section 5 Type 1	Isolated 120 Vac digital input IEC 61131-2 Section 5 Type 1
Indications				
Trip	Fault	Fault	Fault	Fault
Reset	Ready	Ready	Ready	Ready
Autoreset	Trip faulted/Ready flashing	Trip faulted/Ready flashing	Trip faulted/Ready flashing	Trip faulted/Ready flashing
Power Consumption				
Maximum	5W	5W	5W	5W
Options				
Remote display	Type 1, 12 and Type 3R kit	Type 1, 12 and Type 3R kit	Type 1, 12 and Type 3R kit	Type 1, 12 and Type 3R kit
Communications modules	Modbus, DeviceNet and PROFIBUS with I/O	Modbus, DeviceNet and PROFIBUS with I/O	Modbus, DeviceNet and PROFIBUS with I/O	Modbus, DeviceNet and PROFIBUS with I/O

Note

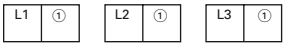
① In this model, there are two isolated relays: one Form A and one Form B SPST. One is the fault relay, and one is a programmable auxiliary relay.

Motor Insight Short Circuit Ratings (North America CSA and UL)

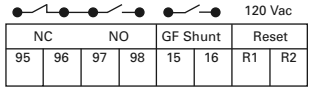
		Standard-Fault Short Circuit Data						
Overload FLA Range	**Maximum Operating Voltage**	**Withstand Rating**	**Maximum Fuse (RK5)**	**Maximum Thermal-Magnetic Circuit Breaker**	**Maximum Withstand Rating**	**Maximum Fuse (RK5)**	**Eaton Thermal-Magnetic Circuit Breaker**	**Catalog Number**
1–9A	264 Vac	5000A at 240 Vac	35A	35A	100 kA at 240 Vac	35A	—	**C441BA**
					100 kA at 240 Vac	—	FDC3035L	
1–9A	528 Vac	5000A at 480 Vac	35A	35A	100 kA at 480 Vac	35A	—	**C441CA**
					100 kA at 480 Vac	—	FDC3035L	
1–9A	660 Vac	5000A at 600 Vac	35A	35A	100 kA at 600 Vac	35A	—	**C441DA**
					35 kA at 600 Vac	—	FDC3035L	
1–9A	660 Vac	5000A at 600 Vac	35A	35A	100 kA at 240 Vac	35A	—	**C4410109NOUI**
					100 kA at 240 Vac	—	FDC3035L	
					100 kA at 480 Vac	35A	—	
					100 kA at 480 Vac	—	FDC3035L	
					100 kA at 600 Vac	35A	—	
					35 kA at 600 Vac	—	FDC3035L	
5–90A	264 Vac	10,000A at 240 Vac	350A	350A	100 kA at 240 Vac	350A	—	**C441BB**
					100 kA at 240 Vac	—	KDC3350	
5–90A	528 Vac	10,000A at 480 Vac	350A	350A	100 kA at 480 Vac	350A	—	**C441CB**
					100 kA at 480 Vac	—	KDC3350	
5–90A	660 Vac	10,000A at 600 Vac	350A	350A	100 kA at 600 Vac	350A	—	**C441DB**
					65 kA at 600 Vac	—	KDC3350	
5–90A	660 Vac	10,000A at 600 Vac	350A	350A	100 kA at 240 Vac	350A	—	**C4410590NOUI**
					100 kA at 240 Vac	—	KDC3350	
					100 kA at 480 Vac	350A	—	
					100 kA at 480 Vac	—	KDC3350	
					100 kA at 600 Vac	350A	—	
					35 kA at 600 Vac	—	KDC3350	

Terminal Connection Diagram

Use 75C CU wire only



18–12 AWG; Torque 5.3 lb-in/0.6 Nm
B300 Pilot Duty Only

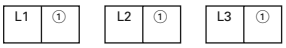


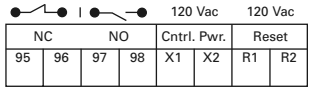
For C441BA, BB, CA, CB, DA and DB

Terminal Connection Specifications

Name	Designation	Input	Description
Line voltage	L1, L2, L3	Line voltage	Three-phase line voltage input L1, L2, L3 connections must correspond to the respective CT1, CT2, CT3 current leads
Fault relay	95/96 96/97 (common) 97/98	B300 UL 508	Form C contact: 95/96 Contact opens when the unit is faulted or unpowered 97/98 Contact closes when the unit is faulted or unpowered
GF shunt	15 16	B300 UL 508	Form A contact: Contact closes when a ground fault is active
Reset input	R1, R2	120 Vac	Fault reset input IEC 61131-2 Type 1

Terminal Connection Diagram





For C4410109NOUI and C441059NOUI

Terminal Connection Specifications

Name	Designation	Input	Description
Line voltage	L1, L2, L3	Line voltage	Three-phase line voltage input L1, L2, L3 connections must correspond to the respective CT1, CT2, CT3 current leads Terminal provided for wiring control power transformer (9A maximum capacity)
Control power	X1, X2	110–120 Vac 50–60Hz (+10/–15%)	Control power option for C441_ _ _ _NOUI
Fault relay For C441_ _ _ _NOUI, the fault relay and auxiliary relay are isolated and do not share a common. By default they will behave like a Form C, but they can be programmed to act independently from one another.	95/96 96/97 (isolated) 97/98	B300 UL 508	Form C contact: 95/96 Contact opens when the unit is faulted or unpowered 97/98 Contact closes when the unit is faulted or unpowered Can be programmed to act independently of the 95/96 only in the C441_ _ _ _NOUI models
GF shunt This relay does not exist on the C441_ _ _ _NOUI models. Instead, this functionality is available in the fully programmable 97/98 auxiliary relay.	97/98	B300 UL 508	Form A contact: Contact closes when a ground fault is active Separate GF control can still be achieved by programming auxiliary relay 97/98 to act independently of the 95/96 relay
Reset input	R1, R2	120 Vac	Fault reset input IEC 61131-2 Type 1

Note

① No motor loads, 9A maximum.

Modbus Communication Modules

Description	Specification	
Electrical/EMC		
Radiated emissions IEC 60947-4-1—Table 15, EN 55011 (CISPIR 11) Group 1, Class A	30–1000 mHz	
Conducted emissions IEC 60947-4-1—Table 14, EN 55011 (CISPIR 11) Group 1, Class A	0.15–30 mHz	
ESD immunity IEC 60947-4-1 (Table 13) IEC 61000-4-2	±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	
Conducted immunity IEC 60947-4-1	140 dBuV (10V rms) 150 kHz–80 mHz	
Fast transient immunity IEC 60947-4-1 (Table 13) IEC 61000-4-4	±2 kV using direct method	
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)	
Electromagnetic field ① IEC 60947-4-1 (Table 13) IEC 61000-4-3	10 V/m	
Environmental Ratings		
Ambient temperature (operating)	–20° to 50°C	
Ambient temperature (storage)	–40° to 85°C	
Operating humidity	5 to 95% noncondensing	
Altitude (no derating)	2000m	
Shock (IEC 60068-2-27)	15G any direction	
Vibration (IEC 60068-2-6)	3G any direction	
Pollution degree per IEC 60947-1	3	
Degree of protection	IP20	
Over voltage category per UL 508	III	
C441P 24 Vdc Input		
Nominal input voltage	24 Vdc	
Operating voltage	18–30 Vdc	
Number of inputs	4	
Signal delay	5 ms (programmable to 65 sec)	
OFF-state voltage	<6 Vdc	
ON-state voltage	>18 Vdc	
Nominal input current	5 mA	
Isolation	1500V	
Terminal screw torque	7–9 in-lb	
24 Vdc source current	50 mA	
Operating Voltage Range—DC Input Modules		
OFF State	**Transition Region**	**ON State**
0–6 Vdc	6–18 Vdc	18–30 Vdc
C441N 120 Vac Input		
Nominal input voltage	120 Vac	
Operating voltage	80–140 Vac	
Number of inputs	4	
OFF-state voltage	<30 Vac	
ON-state voltage	>80 Vac	
Nominal input current	15 mA	
Signal delay	1/2 cycle	
Isolation	1500V	
Terminal screw torque	7–9 in-lb	

Note

① Relates to C441M only.

Modbus Communication Modules, continued

Description	Specification	
Operating Voltage Range—AC Input Modules		
OFF State	**Transition Region**	**ON State**
0–30 Vac	30–80 Vac	80–140 Vac
Output Modules		
Nominal voltage	120 Vac 24 Vdc	
Number of outputs	(2) 1NO Form A 1NO/NC Form C	
Relay OFF time	3 ms	
Relay ON time	7 ms	
Max. current per point ①	5A (B300 rated)	
Electrical life	100,000 cycles	
Mechanical life	1,000,000 cycles	

DeviceNet Communication Modules

Description	Specification
Electrical/EMC	
Radiated emissions IEC 60947-4-1—Table 15, EN 55011 (CISPIR 11) Group 1, Class A	30–1000 mHz
Conducted emissions IEC 60947-4-1—Table 14, EN 55011 (CISPIR 11) Group 1, Class A	0.15–30 mHz
ESD immunity IEC 60947-4-1 (Table 13) IEC 61000-4-2	±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
Conducted immunity IEC 60947-4-1	140 dBuV (10V rms) 150 kHz–80 mHz
Fast transient immunity IEC 60947-4-1 (Table 13) IEC 61000-4-4	±2 kV using direct method
Surge immunity IEC 60947-4-1 (Table 13) IEC 61000-4-5 Class 2	User IO and communication lines: ±1 kV line-to-line (DM) ±2 kV line-to-ground (CM)
Electromagnetic field IEC 60947-4-1 Table 13, IEC 61000-4-3	10 V/m
Environmental Ratings	
Ambient temperature (operating)	–20° to 50°C
Ambient temperature (storage)	–40° to 85°C
Operating humidity	5–95% noncondensing
Altitude (no derating)	2000m
Shock (IEC 60068-2-27)	15G any direction
Vibration (IEC 60068-2-6)	3G any direction
Pollution degree per IEC 60947-1	3
Degree of protection	IP20
DeviceNet	
DeviceNet connections	Group 2, polling, bit strobe, explicit, no UCMM
DeviceNet baud rate	125K, 250K, 500K

Note

① Resistive current at 55°C ambient.

DeviceNet Communication Modules, continued

Description	Specification	
C441L 24 Vdc Input		
Nominal input voltage	24 Vdc	
Operating voltage	18–30 Vdc	
Number of inputs	4	
Signal delay	5 ms (programmable to 65 sec)	
OFF-state voltage	<6 Vdc	
ON-state voltage	>18 Vdc	
Nominal input current	5 mA	
Isolation	250V	
Terminal screw torque	7–9 in-lb	
24V source current	50 mA	
Operating Voltage Range—DC Input Modules		
OFF State	**Transition Region**	**ON State**
0–6 Vdc	6–18 Vdc	18–30 Vdc
C441K 120 Vac Input		
Nominal input voltage	120 Vac	
Operating voltage	80–140 Vac	
Number of inputs	4	
OFF-state voltage	<30 Vac	
ON-state voltage	>80 Vac	
Nominal input current	15 mA	
Signal delay	1/2 cycle	
Isolation	250V	
Terminal screw torque	7–9 in-lb	
Operating Voltage Range—AC Input Modules		
OFF State	**Transition Region**	**ON State**
0–30 Vac	30–80 Vac	80–140 Vac
Output Modules		
Nominal voltage	120 Vac 24 Vdc	
Number of outputs	(2) 1NO Form A 1NO/NC Form C	
Relay OFF time	3 ms	
Relay ON time	7 ms	
Max. current per point ①	5A (B300 rated)	
Electrical life	100,000 cycles	
Mechanical life	1,000,000 cycles	

Note

① Resistive current at 55°C ambient.

PROFIBUS Communication Modules

Description	Specification
Electrical/EMC	
Radiated emissions IEC 60947-4-1—Table 15, EN 55011 (CISPIR 11) Group 1, Class A	30–1000 mHz
Conducted emissions IEC 60947-4-1—Table 14, EN 55011 (CISPIR 11) Group 1, Class A	0.15–30 mHz
ESD immunity IEC 60947-4-1 (Table 13) IEC 61000-4-2	±8 kV air, ±4 kV contact
Radiated immunity IEC 60947-4-1 Table 13, IEC 61000-4-3	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
Fast transient immunity IEC 60947-4-1 (Table 13) IEC 61000-4-4	±2 kV using direct method
Surge immunity IEC 60947-4-1 (Table 13) IEC 61000-4-5 Class 2	User IO and communication lines: ±1 kV line-to-line (DM) ±2 kV line-to-ground (CM)
Environmental Ratings	
Ambient temperature (operating)	–20° to 50°C
Ambient temperature (storage)	–40° to 85°C
Operating humidity	5–95% noncondensing
Altitude (no derating)	2000m
Shock (IEC 60068-2-27)	15G any direction
Vibration (IEC 60068-2-6)	3G any direction
Pollution degree per IEC 60947-1	3
Degree of protection	IP20
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
C441Q 24 Vdc Input	
Nominal input voltage	24 Vdc
Operating voltage	18–30 Vdc
Number of inputs	4
Signal delay	5 ms (programmable to 65 sec)
OFF-state voltage	<6 Vdc
ON-state voltage	>10 Vdc
Nominal input current	5 mA
Isolation	1500V
Terminal screw torque	7–9 in-lb
24V source current	50 mA

PROFIBUS Communication Modules, continued

Description	Specification	
Operating Voltage Range—DC Input Modules		
OFF State	**Transition Region**	**ON State**
0–6 Vdc	6–18 Vdc	18–30 Vdc
C441S 120 Vac Input		
Nominal input voltage	120 Vac	
Operating voltage	80–140 Vac	
Number of inputs	4	
OFF-state voltage	<20 Vac	
ON-state voltage	>70 Vac	
Nominal input current	15 mA	
Signal delay	1/2 cycle	
Isolation	1500V	
Terminal screw torque	7–9 in-lb	
Operating Voltage Range—AC Input Modules		
OFF State	**Transition Region**	**ON State**
0–30 Vac	30–80 Vac	80–140 Vac
Output Modules		
Nominal voltage	120 Vac 24 Vdc	
Number of outputs	(2) 1NO Form A 1NO/NC Form C	
Relay OFF time	3 ms	
Relay ON time	7 ms	
Max. current per point ①	5A (B300 rated)	
Electrical life	100,000 cycles	
Mechanical life	1,000,000 cycles	

Note

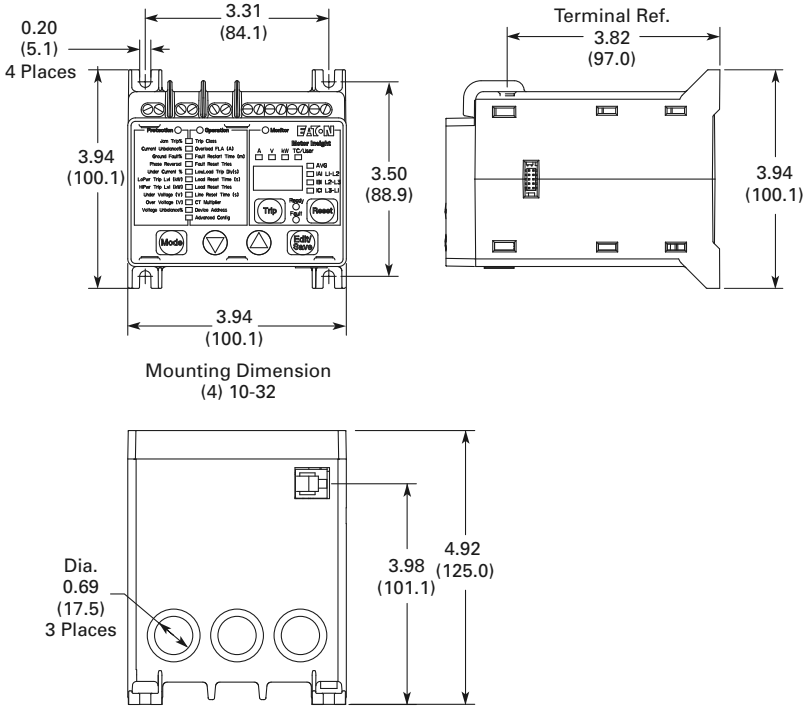
① Resistive current at 55°C ambient.

31

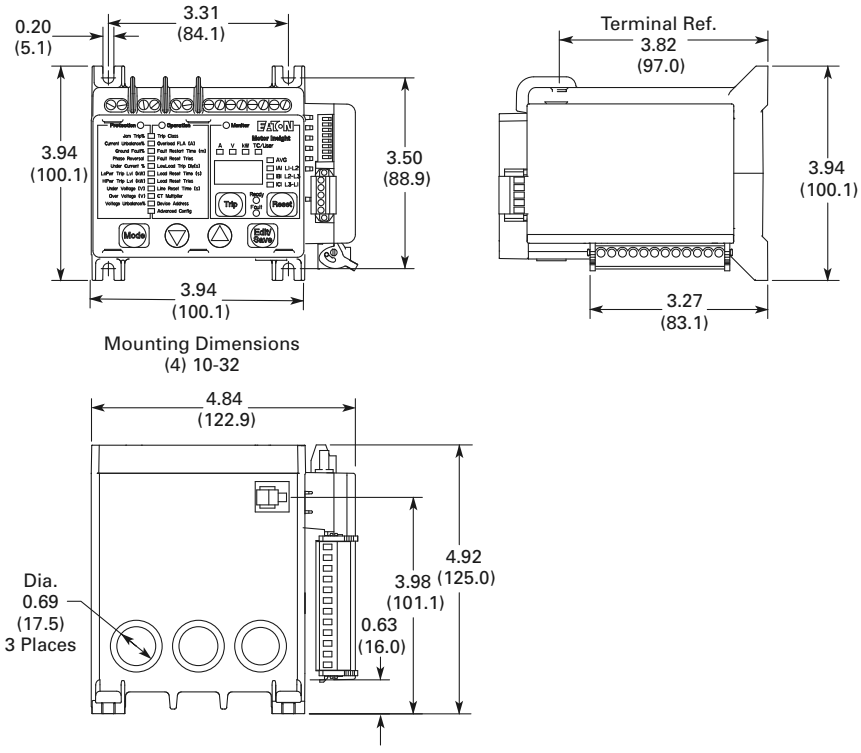
Dimensions

Approximate Dimensions in Inches (mm)

Motor Insight Overload Relay

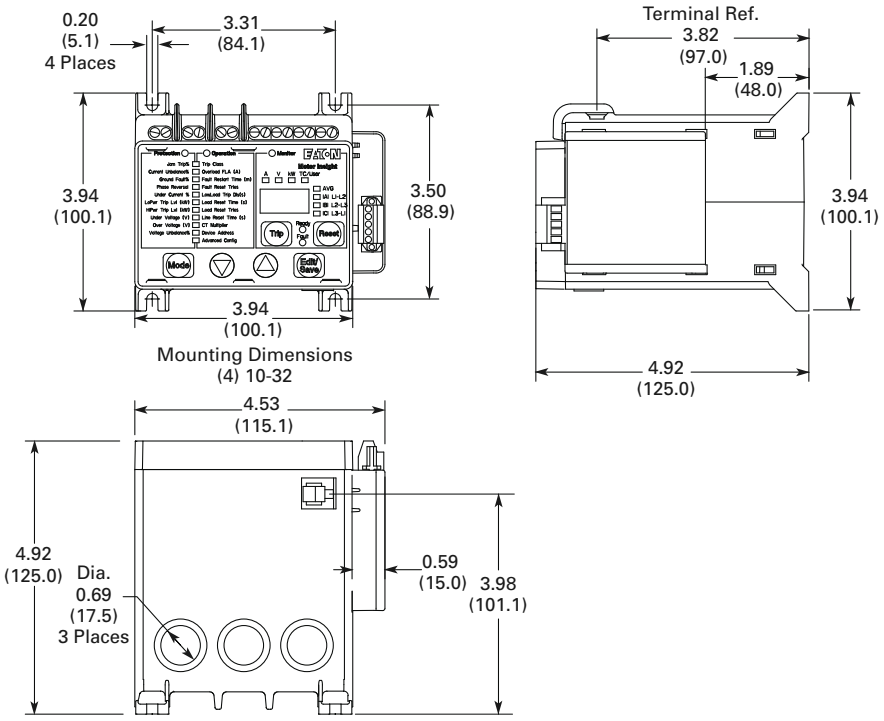


Motor Insight with Mounted DeviceNet, PROFIBUS or Modbus with I/O Communication Module

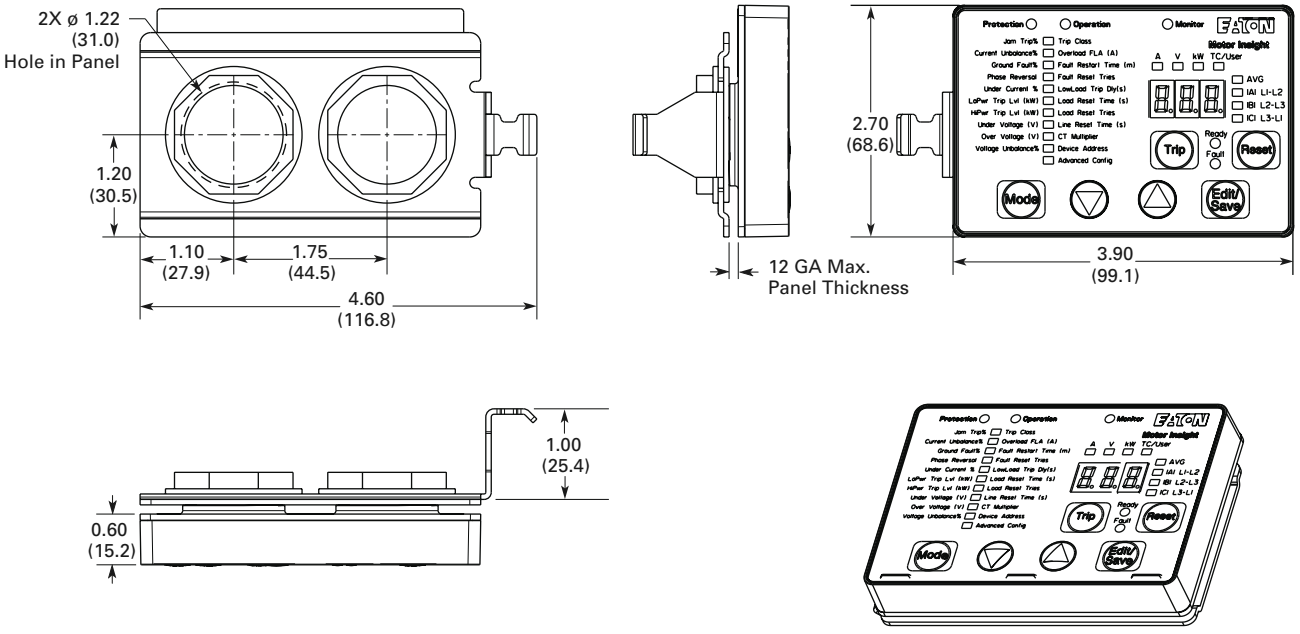


Approximate Dimensions in Inches (mm)

Motor Insight with Mounted Modbus Communication Module

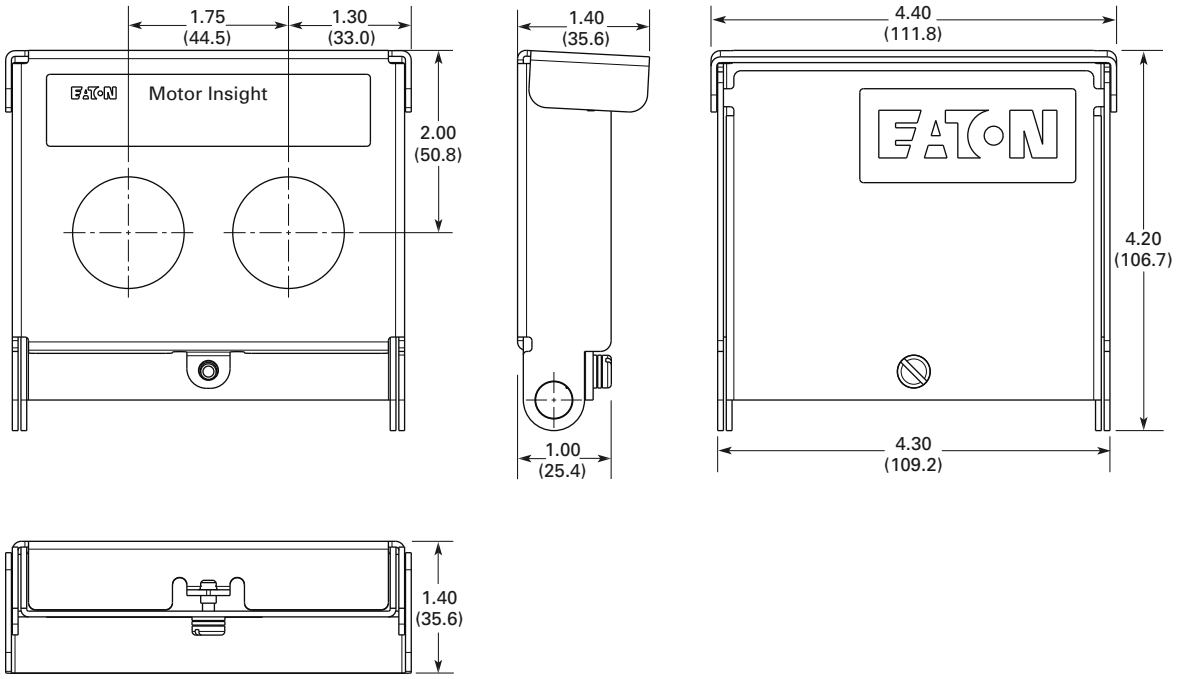


Motor Insight Remote Display

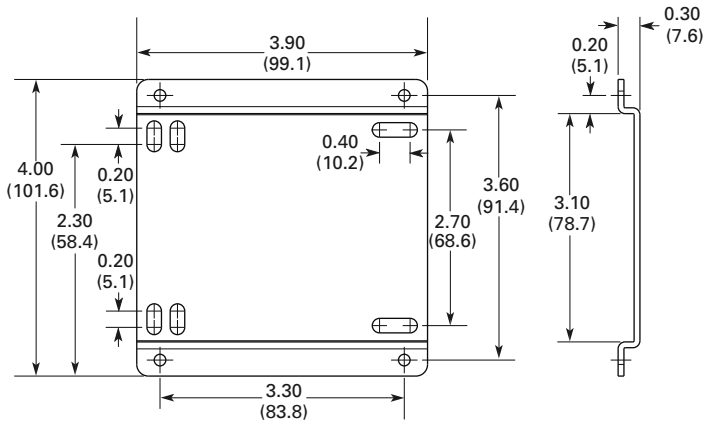


Approximate Dimensions in Inches (mm)

Motor Insight Cover Assembly



Motor Insight Conversion Plate



MP-3000 Overload Relays

Contents

MP-3000 Overload Relays

Product Description

- Microprocessor-based, multi-function motor protection
- Current only device—no need to add PTs
- Intel-I-Trip™ overload protection based on motor data
- Event recording and operational logging
- Motor Start Profile™
- Optional Quick Release Drawout Case
- Used on AMPGARD® and medium voltage assemblies
- "Help" menu provides user operational assistance

Application Description

Eaton's MP-3000 motor protection relay is a multifunctional microprocessor-based protective relay for the protection of three-phase AC motors. The MP-3000 motor relay may be applied to any size motor at any voltage level. It is most commonly used on large, medium voltage three-phase induction motors. It has also been widely used on important low voltage (480 volt) motor applications and synchronous motors.

The MP-3000 motor relay is a current only device that monitors three-phase and ground currents. It provides motor overload, stall, short circuit, phase imbalance, single phasing and ground fault motor protection.

It can also be used to provide protection for a load jam or loss of load condition. Please refer to **CAO8101001E**, Distribution Products Catalog, Tab 26, section 26.4 for additional Product information.

The MP-3000 motor relay provides start control logic to protect the motor against excessive starts or starting the motor before it has had sufficient time to cool down. The MP-3000 motor relay may be applied to either across the line starters or reduced voltage starters. On reduced voltage starters, the MP-3000 relay can control the switch from reduced voltage to full voltage based on time and/or motor transition. The MP-3000 can protect the starter against failure to transition to full voltage through contact feedback and an incomplete sequence function.

The MP-3000 motor relay is generally used on a motor starter or a breaker used for a motor load. The MP-3000 motor relay provides the intelligence to protect and control the motor against abnormal operating conditions. It monitors the currents from either a 5A or 1A secondary of a CT circuit. Ground current may be obtained from either a ground CT or from the residual connection of the phase CTs. It provides a Form C contact output for controlling the starter contacts or breaker operation.

Features, Benefits and Functions

- Complete motor protection and control in a single compact case reduces panel space requirements and wiring costs
- Microprocessor design with self diagnostics eliminates calibration and reduces installation, commissioning and maintenance
- Programmable stop 2–20% of PCT
- Intel-I-Trip overload protection develops customized curve from manufacturer's supplied motor data
- Intel-I-Trip overload protection provides adaptive trip characteristics based on motor temperature when motor RTDs are connected through an optional URTD module
- Meets UL 1053 ground fault protection standards that eliminates the need for a separate ground relay saving cost, space, wiring and time
- Voltage dip/loss ride through capability reduces unnecessary trips caused by poor power quality
- Motor currents, temperatures and conditions are monitored and displayed either locally or remotely
- Event log provides motor operating records for the most recent 20 Trip or Alarm events with date and time stamping. This information can improve troubleshooting and reduce downtime
- Log book records the most recent 100 events such as motor START/STOP and set point changes to provide a log of motor operation with date and time stamping
- RTD diagnostics reduces unnecessary tripping caused by faulty RTD, RTD wiring or communications
- Arm/Disarm feature improves security for critical motor applications
- Motor Start profile verifies protection and motor starting coordination. This feature can be used to develop protection settings on old motors where data is not available
- Optional communication module and Eaton's software simplifies setting, configuration, monitoring, commissioning and data retrieval either locally or remotely
- Optional Quick Release Drawout Case construction simplifies relay removal and replacement

The protection functions are listed below.

- I^2t overload protection (49/51)
- Locked rotor (49S/51)
- Ultimate trip current (51)
- Negative sequence phase imbalance (46)
- Instantaneous overcurrent (50)
- Ground fault protection (50G)
- RTD trip and alarm with URTD module (49/38)
- Underload trip (37)
- Starts per time (66)
- Jam or stall (51R)
- Auto or manual reset (86)
- Fail-safe or non-fail-safe trip modes

The metering functions are:

- Motor currents:
  - Average current (Iave)
  - Individual phase and ground current in primary amperes
  - Percent of full load
  - Percent of phase imbalance
- RTD temperatures:
  - Individual winding
  - Motor bearing
  - Load
  - Auxiliary temperatures
- Motor conditions:
  - Percent of I^2t thermal bucket
  - Time before start
  - Remaining starts allowed
  - Oldest start time

Standards and Certifications

The MP-3000 motor protection was designed to meet the industry standards for protective relays. It is recognized under UL 1053 Ground Fault Protection Standard.

- UL recognized (File No. E154862)
- UL 1053 recognized
- UL 508 recognized
- ANSI C37.90, C37.90.1
- cUL
- CSA

Listed

Reference

Refer to Volume 3—Power Distribution and Control Assemblies, **CA08100004E**, Tab 22, section 22.4 for additional Product information.

MP-4000 Overload Relays

Contents

MP-4000 Overload Relays

Product Description

- Microprocessor-based, multi-function motor protection
- Intel-I-Trip overload protection based on motor data
- Event recording and operational logging
- Motor Start Profile
- Optional Quick Release Drawout Case
- Used on AMPGARD and medium voltage assemblies
- "Help" menu provides user operational assistance

Application Description

Eaton's MP-4000 motor protection relay is a multi-functional microprocessor-based protective relay for the protection of three-phase AC motors. The MP-4000 motor relay may be applied to any size motor at any voltage level. It is most commonly used on large, medium voltage three-phase induction motors. It has also been widely used on important low voltage (480 volt) motor applications and synchronous motors.

The MP-4000 motor relay monitors three-phase and ground currents, and three-phase voltages. It provides motor overload, stall, short circuit, phase imbalance, single phasing over/undervoltage, underpower, power factor and ground fault motor protection.

It can also be used to provide protection for a load jam or loss of load condition.

The MP-4000 motor relay provides start control logic to protect the motor against excessive starts or starting the motor before it has had sufficient time to cool down. The MP-4000 motor relay may be applied to either across the line starters or reduced voltage starters. On reduced voltage starters, the MP-4000 relay can control the switch from reduced voltage to full voltage based on time and/or motor transition. The MP-4000 can protect the starter against failure to transition to full voltage through contact feedback and an incomplete sequence function.

The MP-4000 motor relay is generally used on a motor starter or a breaker used for a motor load. The MP-4000 motor relay provides the intelligence to protect and control the motor against abnormal operating conditions. It monitors the currents from either a 5A or 1A secondary of a CT circuit. Ground current may be obtained from either a ground CT or from the residual connection of the phase CTs. It provides a form C contact output for controlling the starter contacts or breaker operation.

Features, Benefits and Functions

- Complete motor protection and control in a single compact case reduces panel space requirements and wiring costs
- Microprocessor design with self diagnostics eliminates calibration and reduces installation, commissioning and maintenance
- Programmable stop 2–20% of PCT
- Intel-I-Trip overload protection develops customized curve from manufacturer's supplied motor data
- Intel-I-Trip overload protection provides adaptive trip characteristics based on motor temperature when motor RTDs are connected through an optional URTD module
- Meets UL 1053 ground fault protection standards that eliminates the need for a separate ground relay saving cost, space, wiring and time
- Voltage dip/loss ride through capability reduces unnecessary trips caused by poor power quality
- Motor currents, temperatures and conditions are monitored and displayed either locally or remotely
- Event log provides motor operating records for the most recent 20 Trip or Alarm events with date and time stamping. This information can improve troubleshooting and reduce downtime
- Log book records the most recent 100 events such as motor START/STOP and set point changes to provide a log of motor operation with date and time stamping
- RTD diagnostics reduces unnecessary tripping caused by faulty RTD, RTD wiring or communications
- Arm/Disarm feature improves security for critical motor applications
- Motor Start profile verifies protection and motor starting coordination. This feature can be used to develop protection settings on old motors where data is not available
- Optional communication module and Eaton's software simplifies setting, configuration, monitoring, commissioning and data retrieval either locally or remotely
- Optional Quick Release Drawout Case construction simplifies relay removal and replacement

The metering functions are:

- Metering:
  - Average current
  - Amperes: magnitude and angle in primary values
  - Amperes: positive, negative and zero sequence
  - Average voltage (V ave)
  - Voltage: magnitude and angle
  - Voltage: positive, negative and zero sequence
  - % of full load
  - % current imbalance
  - % voltage imbalance
  - Power, vars and VA
  - Power factor
  - Frequency
  - Energy metering with time and date stamps
- RTD temperatures:
  - Individual winding
  - Motor bearing
  - Load
  - Auxiliary temperatures
- Motor conditions:
  - Percent of I^2t thermal bucket
  - Time before start
  - Remaining starts allowed
  - Oldest start time

The protection functions are listed below:

- I^2t overload protection (49/51)
- Locked rotor (49S/51)
- Ultimate trip current (51)
- Negative sequence phase imbalance (46)
- Instantaneous overcurrent (50)
- Ground fault protection (50G)
- Undervoltage (27)
- Overvoltage (59)
- Under power (32)
- Negative sequence voltage imbalance (47)
- Power factor (55)
- RTD trip and alarm with URTD module (49/38)
- Underload trip (37)
- Starts per time (66)
- Jam or stall (51R)
- Auto or manual reset (86)
- Fail-safe or non-fail-safe trip modes

Standards and Certifications

The MP-4000 motor protection was designed to meet the industry standards for protective relays. It is recognized under UL 1053 Ground Fault Protection Standard.

- UL recognized (File No. E154862)
- UL 1053 recognized
- UL 508 recognized
- ANSI C37.90, C37.90.1
- cUL
- CSA

Listed

Reference

Refer to Volume 3—Power Distribution and Control Assemblies, **CA08100004E**, Tab 22, section 22.4 for additional Product information.