



**Allen-Bradley**

**The E3  
Solid-State Overload Relay**

# **Reliable Early Warning Motor Protection**



**Allen-Bradley E3 Plus**



NETWORK  
STATUS



TRIP  
WARN

TEST /  
RESET



OUT A



OUT B



IN 1



IN 3



IN 2



IN 4

DNET S/N

FRN

YMK

SER A



**Rockwell  
Automation**

Bringing Together Leading Brands in Industrial Automation

# Early Warning Motor Protection Can Help Improve Productivity

To compete in the global economy, companies must maximize operating efficiency and productivity. Every aspect of the automation process requires scrutiny including the electric motor – the driver for virtually every movement in production and manufacturing systems. Making sure your motors are running effectively is crucial to production up time – and your bottom line.

## Integrated protective capabilities in one device.

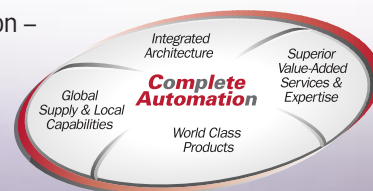
The Allen-Bradley E3 Solid-State Overload Relay can significantly enhance your system's performance, reliability and efficiency by consolidating multiple protection functions

into a single protective device. Its solid-state design offers integration and functionality built into a compact package for a lower installed system cost.

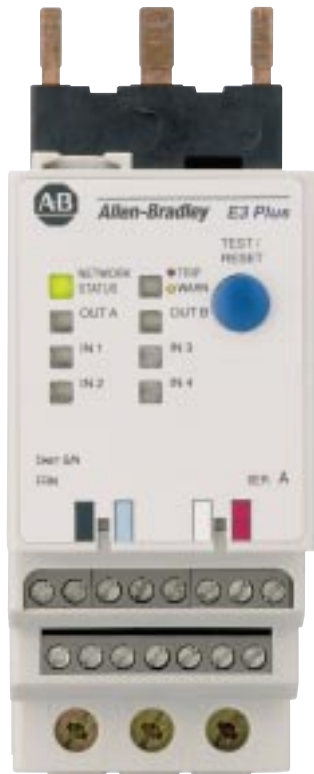
Using field bus technology, the E3 overload relay gathers, processes and communicates vital motor performance data, making it available at the local level. Motor and machine problems can be detected early and devices prevented from tripping at a critical stage in a process, helping to reduce costly downtime and unscheduled maintenance.

## Complete Automation Solutions

At Rockwell Automation we understand you need to rely on world-class products that provide Complete Automation™ solutions. For nearly a century, customers around the world have experienced the reliability of Allen-Bradley products from Rockwell Automation – your Complete Automation supplier.



# Cost Effective Motor Management In a Compact Package



Overload. Phase loss.  
Ground fault. Stall.  
Mechanical jam.  
Underload current.  
Motor over-temperature.  
Current imbalance.

To address these and other adverse conditions has historically required either combining a host of specialized protection relays or installing a costly motor protection relay.

Not any longer. The E3 overload relay offers all the tools you need in a compact package that allows you to cost-effectively manage and

monitor motor performance in order to prevent and minimize production downtime:

- Advanced protective functions
- Warning settings
- Control capabilities
- Operational data and status information
- Integrated I/O
- DeviceNet communications

Having all of this functionality in a single, compact device optimizes panel space, reduces installation time, minimizes system start-up time, and simplifies troubleshooting.



## E3 Overload Relays Offer Global Solutions

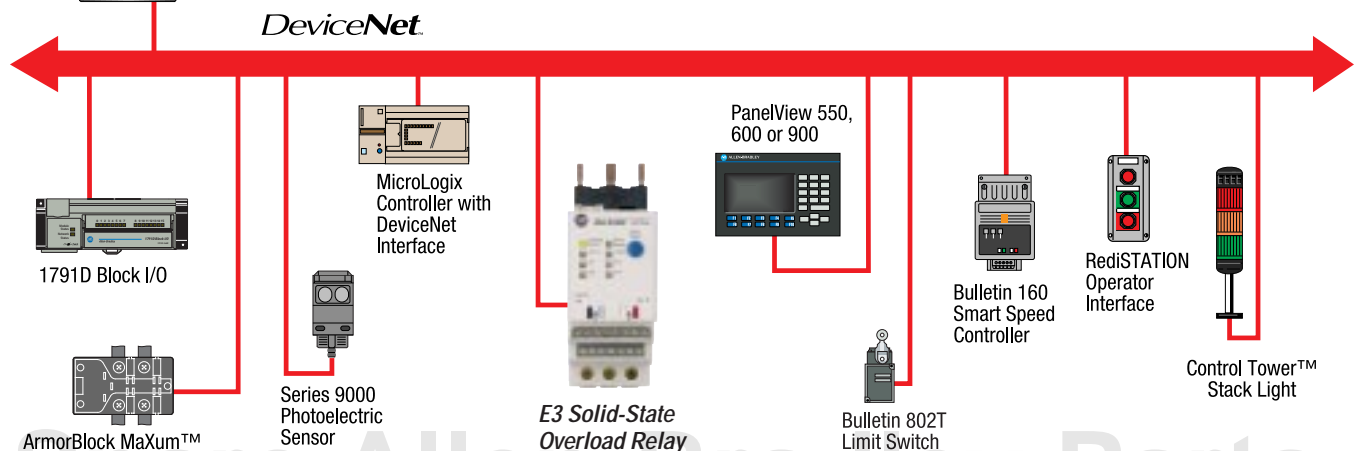
The E3 overload relay is available in both NEMA and IEC configurations for a truly global motor protection solution.



RSNetWorx s/w  
PCMCIA for  
DeviceNet

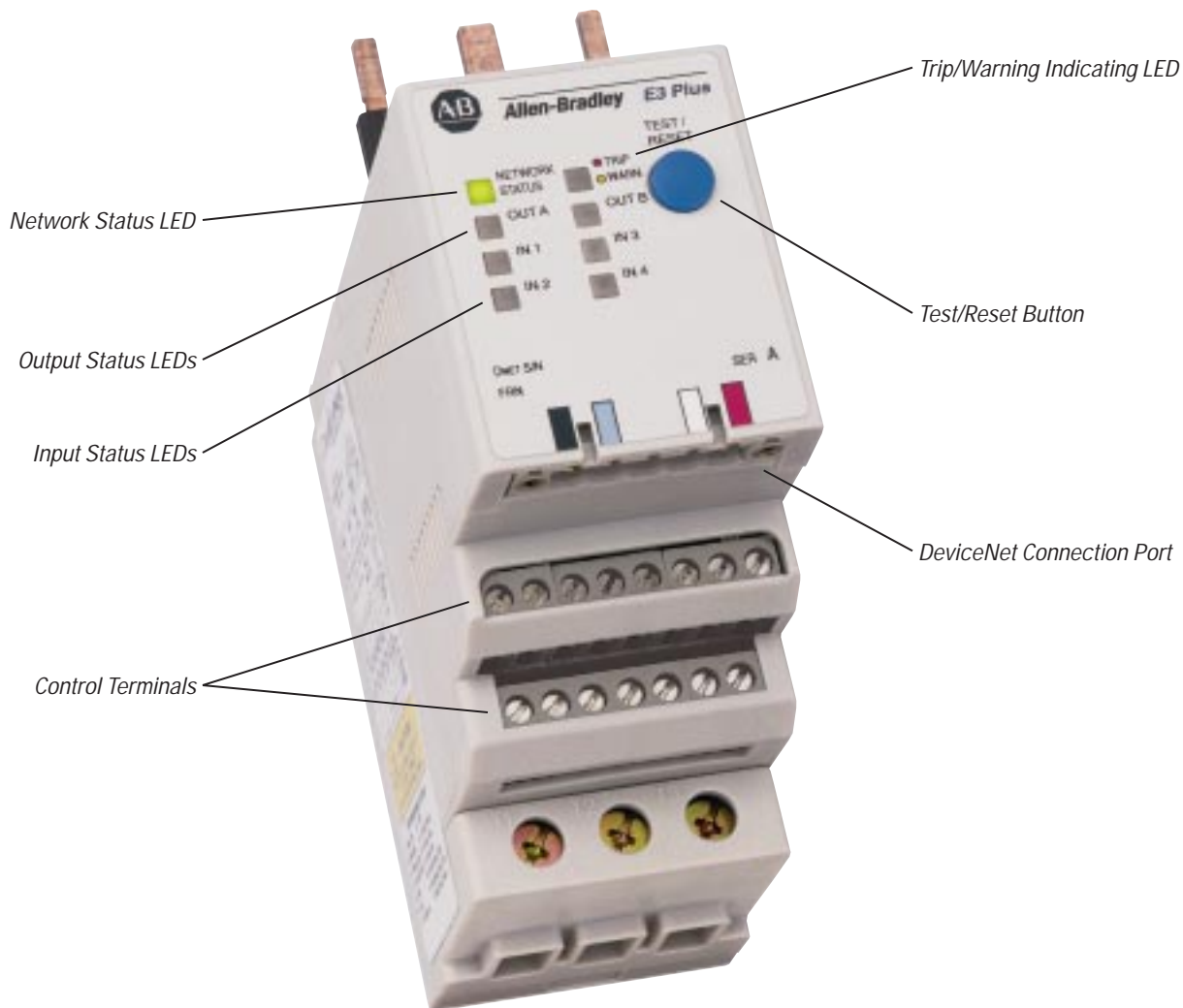
## DeviceNet ready

The E3 overload relay is DeviceNet ready and does not require accessories or communication interfaces to access DeviceNet.



Spare Allen-Bradley Parts

# E3 Overload Relay Features



## Patented, State-of-the-Art Current Sensing

The E3 overload relay uniquely combines the technologies of hall-effect current sensors with signal processing circuitry and software algorithms for precise, true RMS current measurement of the individual phase and ground fault currents. Current measurement is accurately reported over a broad frequency range of 20 to 250 hz.

*There are two versions available, the E3 and the E3 Plus, enabling you to choose the appropriate device for your application.*

## E3 and E3 Plus Comparison

Features	E3	E3 Plus
Thermal Overload	✓	✓
Phase Loss	✓	✓
Stall (high overload during start)	✓	✓
Jam (high overload during run)	✓	✓
Underload	✓	✓
Current Imbalance (asymmetry)	✓	✓
Warning Settings	✓	✓
Inputs	2	4
Outputs	1	2
Ground (Earth) Fault		✓
PTC Thermistor Input		✓

# Accessing Vital Data Via DeviceNet

## Motor Current Monitoring

The following motor performance data is accessible via the DeviceNet network:

- Individual phase currents (in amperes)
- Individual phase currents (as a percentage of motor full load current)
- Average current (in amperes)
- Average current (as a percentage of motor full load current)
- Percentage of thermal capacity utilized
- Current imbalance percentage
- Ground fault current (in amperes)

## Motor Diagnostics

The following diagnostic information is accessible via the DeviceNet network:

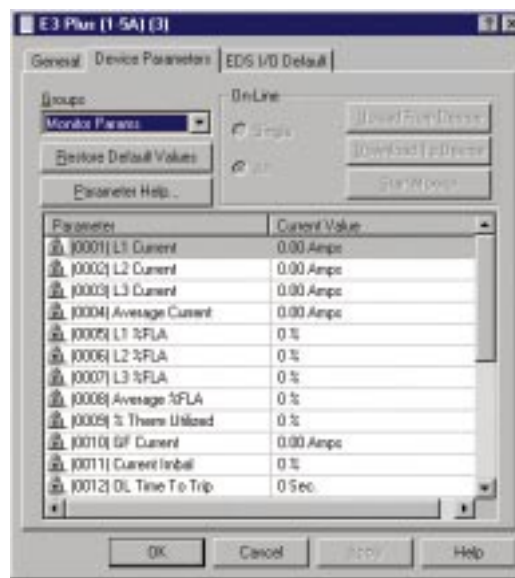
- Device status
- Trip status
- Warning status
- Time to trip (overload)
- Time to reset (overload)
- History of past 5 trips

## Integrated I/O

The E3 overload relay provides inputs and outputs that can simplify the control architecture and minimize hardware requirements.

The inputs allow the master device such as a programmable controller to monitor the status of typical devices like short circuit interrupters, contactors, pilot devices and sensors.

The output relays can be used by the master device to operate motor starting contactors, pilot lights, circuit breaker shunt trips and brake contactors.



The monitor parameter group provides motor performance data, diagnostic and device status information.

## DeviceNet Features

- Autobaud circuitry speeds up node commissioning time.
- Choice of polled I/O, cyclic or change of state(COS) messaging-provides communication mode that fits the application.
- Off-line node recovery allows commissioning of many devices onto a network at the same time.
- Full parameter object support allows a configuration tool to easily upload the device electronic data sheet (EDS).
- Configuration consistency check provides simple verification of product configuration.
- Configured using RSNetWorx™ for DeviceNet software

# Spare Allen-Bradley Parts

# Designed to Provide Maximum Protection

## Application-Specific Adjustability

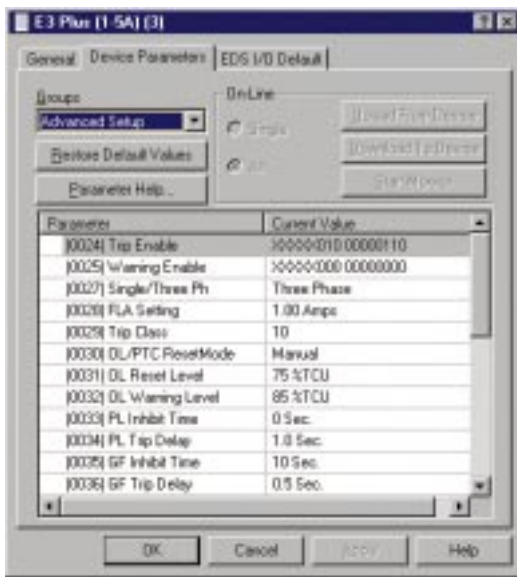
User-adjustable parameters for all trip and warning functions allow the E3 overload relay to be tailored to fit any application.

## Thermal Overload

- Trip class adjustable from 5 to 30 in increments of one
- Automatic and manual reset modes are available
- Reset level adjustable from 1 to 100% thermal capacity utilized
- Warning level adjustable from 1 to 100% thermal capacity utilized

## Phase Loss

- Trip level factory set at 100% current imbalance
- Trip delay adjustable from 0.1 to 25.0 seconds



Parameter settings are easily configured through RSNetWorx™ for DeviceNet software.

## Ground (Earth) Fault (E3 Plus)

- Built-in sensor
- Trip level adjustable from 1.0 to 5.0 amperes
- Trip delay adjustable from 0.1 to 25.0 seconds
- Warning level adjustable from 1.0 to 5.0 amperes

## Stall (high overload during start)

- Trip level adjustable from 50 to 600% FLA
- Enable time adjustable from 0 to 250 seconds

## Jam (high overload during run)

- Trip level adjustable from 50 to 600% FLA
- Trip delay adjustable from 0.1 to 25.0 seconds
- Warning level adjustable from 50 to 600% FLA

## Underload

- Trip level adjustable from 50 to 100% FLA
- Trip delay adjustable from 0.1 to 25.0 seconds
- Warning level adjustable from 50 to 100% FLA

## Motor Over-temperature (E3 Plus)

- Terminals provided for connection of motor winding-embedded positive temperature coefficient PTC thermistors
- Provides enhanced motor protection in cases where motor overheating cannot be detected by monitoring current alone (blocked ventilation and high ambient temperature)

## Current Imbalance (Asymmetry)

- Trip level adjustable from 10 to 100%
- Trip delay adjustable from 0.1 to 25.0 seconds
- Warning level adjustable from 10 to 100%

# Packaged Solutions Using the E3 Overload Relay

Pre-engineered Distributed Starters replace traditional custom, centralized panels, individual power wiring from motor starter to motors and complex hard wiring of associated control circuits. The Distributed Starter System allows daisy-chaining power wiring to motors, control and communication over one DeviceNet cable and standardized M12 micro connectors for communication and I/O in a Type 3/4/12 and IP66 enclosure. These features significantly decrease the number of terminations, reducing installation time and wiring errors, simplify the design of modular facilities, reduce plant-floor space, improve system monitoring and diagnostics, simplify changes to layouts and allow system pre-commissioning.

The core of the Distributed Starter System is the Allen-Bradley Bulletin 190S Compact Combination Starter. This product offers the next generation of fuse-less short circuit protection. This product complies with UL508 Type E allowing its use as a combination starter, provides short circuit ratings up to 100 kA, is suitable as a motor disconnect, and provides Type 2 coordination per IEC 947-4 to minimize downtime. The device is pre-wired, allowing cable harness connections directly to I/O systems.



## Motor Control Center

- Key Component within IntelliCENTER™ MCC
- No additional space required
- Provided pre-wired and pre-tested
- Available with pre-programmed node ID and trip current
- Pre-configured screens allow real-time monitoring of E3 units



## Distributed Starter System

- Pre-engineered, pre-configured and assembled product
- Bulletin 190S compact combination starter
- Enclosure with IP66 and Type 3/4/12 ratings
- Rotary disconnect handle



## Bulletins 193 and 592

- **DeviceNet™ Ready**
  - ODVA Conformance Tested
- **LED Indicators**
- **Test/Reset Button**
- **Adjustable Trip Class (5 to 30)**
- **Integrated I/O**
  - E3: 2 In / 1 Out
  - E3 Plus: 4 In / 2 Out
- **Zero Sequence Ground Fault**
  - 1...5 A Range (E3 Plus)
- **PTC Thermistor Input (E3 Plus)**
- **Programmable Trip and Warning Settings**
- **Diagnostic Functions (History of Last 5 Trips)**

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### Description

The E3 Overload Relay is a multi-function solid-state microprocessor-based electronic overload relay for the protection of single- or three-phase squirrel cage induction motors. In addition to providing ambient compensated overload protection, the E3 Overload Relay also includes advanced features such as warning diagnostics, variable frequency and true RMS current sensing, I/O capabilities, and direct DeviceNet connectivity. The E3 Plus Overload Relay offers the added features of zero sequence (core balance) ground fault protection, PTC thermistor input, and additional I/O capabilities.

#### Conformity to Standards:

- IEC 947-4
- CSA 22.2 No. 14
- UL 508
- UL 1053
- Approvals:**
- CE
- CSA Certified
- UL Listed
- PTB (pending)

#### Protective/Warning Functions:

- Thermal overload
- Phase loss ❶
- Ground Fault ❷
- Stall ❶
- Jam
- Underload
- PTC ❷
- Current imbalance
  - ❶ Trip only
  - ❷ E3 Plus

#### Your order must include:

- Cat. No. of the overload relay selected.
- If required, Cat. No. of any accessories.



## Product Configurations

The E3 Overload Relay is available in two configurations: the E3 and E3 Plus. The following table illustrates the functional differences between the two:

Feature	E3	E3 Plus
Inputs	2	4
Outputs	1	2
Thermistor Input	No	Yes
Ground Fault Protection	No	Yes

## Thermal Overload

### THERMAL UTILIZATION

The E3 Overload Relay provides overload protection through true RMS current measurement of the individual phase currents of the connected motor. Based on this information, a thermal model is calculated which simulates the actual heating of the motor. Percent of thermal capacity utilization (%TCU) reports this calculated value and can be read via the DeviceNet network. An overload trip occurs when the value reached 100%.

### ADJUSTABLE SETTINGS

Thermal overload protection setup is accomplished simply by programming the motor's full load current rating (FLA) and the desired trip class (5 to 30). Programming of the actual values through software programming ensures the accuracy of the protection.

### THERMAL MEMORY

The E3 Overload Relay includes a thermal memory circuit designed to approximate the thermal decay for a trip class 30 setting. This means that the thermal model of the connected motor is maintained at all times, even if the supply power is removed.

### RESET MODES

Flexibility is afforded the end-user in the ability to select between manual and automatic reset for an overload trip, allowing for broad application. The point of reset is user adjustable from 1 to 100% TCU.

### TIME TO TRIP

During an overload condition, the E3 Overload Relay provides an estimated time to trip that is accessible via the DeviceNet network. This allows corrective action to be taken so that production may continue uninterrupted.

### TIME TO RESET

Following an overload trip, the E3 Overload Relay will not reset until the calculated percentage of thermal capacity utilization falls below the reset level. As this value decays, the time to reset is reported which is accessible via the DeviceNet network.

### THERMAL WARNING

The E3 Overload Relay provides the capability to alert in the event of an impending overload trip. A thermal warning bit is set in the Warning Status word when the calculated percentage of thermal capacity utilization exceeds the programmed thermal warning level, which has a setting range of 0 to 100% TCU.

## Phase Loss

The E3 Overload Relay offers configurable phase loss protection in allowing the installer to enable or disable the function plus set a time delay setting, adjustable from 0.1 to 25.0 seconds. The trip level is factory-set at a current imbalance measurement of 100%.

## Ground Fault

The E3 Plus Overload Relay incorporates a zero sequence (core balance) current transformer into its design for low level (arcing) ground fault detection. Class 1 ground fault protection is provided per UL1053. Trip and warning settings are adjustable from 1.0 to 5.0 Amps.

**Note:** The E3 Plus Overload Relay is not a Ground Fault Circuit-Interrupter for personnel protection as defined in article 100 of the U.S. National Electric Code.

## Stall

Stall is defined as a condition where the motor is not able to reach full speed operation in the appropriate amount of time required by the application. This can result in motor overheating as current draw is in excess of the motor's full load current rating.

The E3 Overload Relay provides user-adjustable stall protection. The trip setting has a range of 100 to 600% FLA, and the enable time is adjustable up to 250 seconds.

## Jam

The E3 Overload Relay can respond quickly to take a motor off-line in the event of a mechanical jam, thereby reducing the potential for damage to the motor and the power transmission components.

Trip adjustments include a trip setting adjustable from 50 to 600% FLA and a trip delay time with a range of 0.1 to 25.0 seconds. A separate warning setting is adjustable from 50 to 600% FLA.

## Underload

A sudden drop in motor current can signal conditions such as;

- Pump cavitation
- Tool breakage
- Belt breakage

For these instances, rapid fault detection can help minimize damage and aid in reducing production downtime.

Additionally, monitoring for an underload event can provide enhanced protection for motors that are cooled by the medium handled (e.g., submersible pump pumping water). Such motors can become overheated despite being underloaded. This can result from an absence or an insufficient amount of the medium (due to clogged filters, closed valves, etc.).

The E3 Overload Relay offers underload trip and warning settings adjustable from 50 to 100% FLA. The trip function also includes a trip delay time with a range of 0.1 to 25.0 seconds.

# E3 and E3 Plus Solid-State Overload Relays

## Product Overview

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### Over-temperature Protection

The E3 Plus Overload Relay provides motor over-temperature protection with the added provisions for terminating and monitoring of stator winding-embedded positive temperature coefficient (PTC) thermistors. PTC thermistors are semiconductors that exhibit a large increase in resistance when the rated response temperature is exceeded. When the monitored PTC thermistor resistance exceeds the response level of the E3 Plus Overload Relay (3400Ω), it can be set to trip immediately or programmed to set the PTC bit of the Warning Status word.

### Current Imbalance

The E3 Plus Overload Relay offers current imbalance trip and warning settings adjustable from 10 to 100%. The trip function also includes a trip delay time with a range of 0.1 to 25.0 seconds.

### Current Monitoring Functions

The E3 Overload Relay allows the user to monitor the following operational data over the DeviceNet network:

- Individual phase currents (in amperes)
- Individual phase currents (as a percentage of motor full load current)
- Average current (in amperes)
- Average current (as a percentage of motor full load current)
- Percentage of thermal capacity utilized
- Current imbalance percentage
- Ground fault current (E3 Plus)

### Diagnostic Functions

The E3 Overload Relay allows the user to monitor the following diagnostic information over the DeviceNet network:

- Device status
- Trip status
- Warning status
- Time to an overload trip
- Time to reset after an overload trip
- History of past five trips

### Status Indicators

The E3 Overload Relay provides the following LED indicators:

**Network Status:** This green/red LED indicates the status of the network connection.

**TRIP/WARN:** This LED flashes an amber code under a warning condition and a red code when tripped.

**OUT A and B:** These amber LED's illuminate when the output contacts are commanded closed.

**IN 1–4:** These amber LED's illuminate when the user-connected device contact is closed.

Note: IN 3 and 4 and OUT B are available only on the E3 Plus Overload Relay.

### Inputs/Outputs

Inputs allow for the connection of such devices as contactor and disconnect auxiliary contacts, pilot devices, limit switches and float switches. Input status can be monitored via the network and mapped to a controller's input image table.

Relay contact outputs can be controlled via the network for performing such tasks as contactor operation.

### Test/Reset Button

The Test/Reset button located on the front of the E3 Overload Relay allows the user to perform the following:

**Test:** The trip relay contact will open if the E3 Overload Relay is in an un-tripped condition and the Test/Reset button is pressed.

**Reset:** The trip relay contact will close if the E3 Overload Relay is in a tripped condition, supply voltage is present, and the Test/Reset button is pressed.

### Single/Three-Phase Operation

The E3 Overload Relay can be applied to three-phase as well as single-phase applications. A programming parameter is provided for selection between single- and three-phase operation. Straight-through wiring is afforded in both cases.

### DeviceNet Communications

The E3 Overload Relay is a Group 2 "slave only" device and supports the following:

- Polled I/O messaging
- Change-of-state/cyclic messaging
- Explicit messaging
- Group 4 - Off-line node recovery messaging
- Full parameter object support
- Auto-baud network rate identification
- Configuration consistency value

**Bulletin 193-EC1 Electronic Motor Protection Relays – Direct Contactor Mount**

- 2 Inputs
- 1 Output

Mounts to Contactor	Adjustment Range [A]	Cat. No.
100-C09...100-C23	1–5	193-EC1AB
100-C09...100-C23	3–15	193-EC1BB
100-C09...100-C23	5–25	193-EC1CB
100-C30...100-C43	1–5	193-EC1AD
100-C30...100-C43	3–15	193-EC1BD
100-C30...100-C43	5–25	193-EC1CD
100-C30...100-C43	9–45	193-EC1DD

**Bulletin 193-EC2 Electronic Motor Protection Relays – Direct Contactor Mount**

- 4 Inputs
- 2 Outputs
- Built-in Ground Fault Sensor
- PTC Thermistor Input

Mounts to Contactor	Adjustment Range [A]	Cat. No.
100-C09...100-C23	1–5	193-EC2AB
100-C09...100-C23	3–15	193-EC2BB
100-C09...100-C23	5–25	193-EC2CB
100-C30...100-C43	1–5	193-EC2AD
100-C30...100-C43	3–15	193-EC2BD
100-C30...100-C43	5–25	193-EC2CD
100-C30...100-C43	9–45	193-EC2DD

**Add-on Accessories**

Description	For Use With	Package Qty.	Cat. No.
DIN Rail/Panel Adapter	193-EC_B	1	193-ECPM1
	193-EC_D		193-ECPM2

## E3 and E3 Plus Solid-State Overload Relays

### Product Selection

#### Bulletin 592-EC1 Electronic Motor Protection Relays – Direct Contactor Mount ①

- 2 Inputs
- 1 Output

Mounts to Contactor	Adjustment Range [A]	Cat. No.
500-TO_	1–5	592-EC1AT
500-TO_	3–15	592-EC1BT
500-AO_, 500-BO_, 500-CO_	5–25	592-EC1CT
500-AO_, 500-BO_, 500-CO_	1–5	592-EC1AC
500-AO_, 500-BO_, 500-CO_	3–15	592-EC1BC
500-AO_, 500-BO_, 500-CO_	5–25	592-EC1CC
500-AO_, 500-BO_, 500-CO_	9–45	592-EC1DC



#### Bulletin 592-EC2 Electronic Motor Protection Relays – Direct Contactor Mount ①

- 4 Inputs
- 2 Outputs
- Built-in Ground Fault Sensor
- PTC Thermistor Input

Mounts to Contactor	Adjustment Range [A]	Cat. No.
500-TO_	1–5	592-EC2AT
500-TO_	3–15	592-EC2BT
500-TO_	5–25	592-EC2CT
500-AO_, 500-BO_, 500-CO_	1–5	592-EC2AC
500-AO_, 500-BO_, 500-CO_	3–15	592-EC2BC
500-AO_, 500-BO_, 500-CO_	5–25	592-EC2CC
500-AO_, 500-BO_, 500-CO_	9–45	592-EC2DC

① Catalog numbers not available for sale at time of printing. Consult your Allen-Bradley Sales Office.

**Main Circuits**

	Cat. No. 193-EC_B, 193-EC_D, 592-EC_T, 592-EC_C	Cat. No. 193-EC_E, 592-EC_D
Rated Insulation Voltage (U <sub>i</sub> )	690V AC	
Rated Impulse Strength (U <sub>imp</sub> )	6 kV AC	
Rated Operating Voltage (U <sub>e</sub> ) IEC/UL	690V AC / 600 V AC	
<b>Terminal Cross-Sections</b>		
Terminal Type Terminal Screws	M5	M8
Flexible-Stranded with Ferrule Single Conductor Torque	2.5...16 mm <sup>2</sup> 2.5 Nm	4...35 mm <sup>2</sup> 4 Nm
Flexible-Stranded with Ferrule Multiple Conductor Torque	6...10 mm <sup>2</sup> 3.4 Nm	4...25 mm <sup>2</sup> 4 Nm
Coarse-Stranded/Solid Single Conductor Torque	2.5...25 mm <sup>2</sup> 2.5 Nm	4...50 mm <sup>2</sup> 4 Nm
Coarse-Stranded/Solid Multiple Conductor Torque	6...16 mm <sup>2</sup> 3.4 Nm	4...35 mm <sup>2</sup> 4 Nm
Stranded/Solid- Single Conductor Torque	14...6 AWG 22 lb-in	12...2 AWG 35 lb-in
Stranded/Solid Multiple Conductor Torque	10...6 AWG 30 lb-in	10...2 AWG 35 lb-in
Pozidrive Screwdriver Size	2	2
Slotted Screwdriver (mm)	1 x 6	—
Hexagon Socket Size SW (mm)	—	4

## E3 and E3 Plus Solid-State Overload Relays

### Specifications, Continued

#### Control Circuits

	Cat. No. 193-EC_B, 193-EC_D, 592-EC_T, 592-EC_C	Cat. No. 193-EC_E, 592-EC_D
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#### Power Supply Ratings

Rated Supply Voltage ( $U_s$ )	24V DC
Operating Range	11...25V DC
Power Consumption	
E3	3.2 Watts
E3 Plus	3.9 Watts

#### Output Relay Ratings

Type of Contacts	Form A SPDT-NO
Rated Insulation Voltage ( $U_i$ )	300V AC
Rated Operating Voltage ( $U_e$ )	250V AC
Rated Operating Current ( $I_e$ )	5 A
Minimum Operating Current	10 mA @ 5V DC
Switching Capacity	B300 AC-15
Resistive Load Rating (p.f. = 1.0)	5 A, 250V AC / 5 A, 30V DC
Inductive Load Rating (p.f. = 0.4) (L/R = 7 ms)	2 A, 250V AC / 2 A, 30V DC

#### Input Ratings

Supply Voltage	24V DC $\pm$ 10% (provided by E3)
Input Type	Current Sinking

#### Thermistor/PTC Input Ratings

Type of Control Unit	Mark A
Max. No. of Sensors in Series	6
Max. Cold Resistance of PTC Sensor Chain	1500 $\Omega$
Trip Resistance	3400 $\Omega$ $\pm$ 150 $\Omega$
Reset Resistance	1600 $\Omega$ $\pm$ 100 $\Omega$
Short-Circuit Trip Resistance	25 $\Omega$ $\pm$ 10 $\Omega$

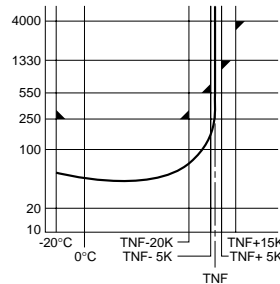
**Control Circuits, Continued**

	Cat. No. 193-EC_B, 193-EC_D, 592-EC_T, 592-EC_C	Cat. No. 193-EC_E, 592-EC_D
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**Thermistor/PTC Input Ratings, Continued**

<b>Max. Voltage @ PTC Terminals (R<sub>PTC</sub> = 4 kΩ)</b>	7.5V DC
<b>Max. Voltage @ PTC Terminals (R<sub>PTC</sub> = open)</b>	30V DC
<b>Response Time</b>	500 ms

**Sensor Characteristic**



Per IEC 34-11-2

**Control and DeviceNet Terminal Cross-Sections**

<b>Terminal Screws</b>	M3
<b>Flexible-Stranded with Ferrule – Single Conductor Torque</b>	0.25...2.5 mm <sup>2</sup> 0.55 Nm
<b>Flexible-Stranded with Ferrule – Multiple Conductor Torque</b>	0.5...0.75 mm <sup>2</sup> 0.55 Nm
<b>Coarse-Stranded/Solid– Single Conductor Torque</b>	0.2...4.0 mm <sup>2</sup> 0.55 Nm
<b>Coarse-Stranded/Solid– Multiple Conductor Torque</b>	0.2...1.5 mm <sup>2</sup> 0.55 Nm
<b>Stranded/Solid– Single Conductor Torque</b>	24...12 AWG 5 lb-in
<b>Stranded/Solid– Multiple Conductor Torque</b>	24...16 AWG 5 lb-in
<b>Slotted Screwdriver (mm)</b>	0.6 x 3.5

Bulletins 193 and 592  
**E3 and E3 Plus Solid-State Overload Relays**  
 Specifications, Continued

**Environmental Ratings**

	Cat. No. 193-EC_B, 193-EC_D, 592-EC_T, 592-EC_C	Cat. No. 193-EC_E, 592-EC_D
<b>Ambient Temperature</b> Storage Operating (open) Operating (closed)	-40°C to 85°C (-40°F to 185°F) -20°C to 55°C (-4°F to 131°F) -20°C to 40°C (-4°F to 104°F)	
<b>Humidity</b> Operating Damp Heat – Steady-State (per IEC 68-2-3) Damp Heat – Cyclic (per IEC 68-2-30)	5% to 95% Non-condensing 92% r.h., 40°C(104°F), 56 days  93% r.h., 25°C/40°C(77°F/104°F), 21 cycles	
<b>Shock (per IEC 68-2-6)</b>	30G	
<b>Pollution Environment</b>	Degree 2	
<b>Degree of Protection</b> 193-ECxxx 592-ECxxx	1P1X 1P0	

**General**

<b>Approximate Weights</b>	0.37 kg 0.8 lb	0.50 kg 1.1 lb
<b>Standards</b>	IEC 947, CSA C22.2 No.14, DIN VDE 0660, EN 60 947, UL 508, UL 1053	
<b>Approvals</b>	CE, CSA, PTB (pending), UL	

**Protection and Warning Summary**

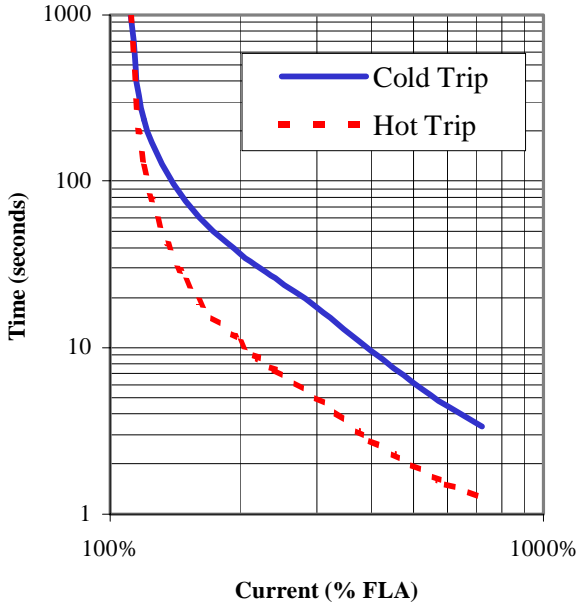
Protective Function	Trip Enable	Warning Enable	Trip Level Settings		Trip Delay Settings		Warning Level Settings		Inhibit Time Settings ❶	
	Factory Default	Factory Default	Range	Default	Range (s)	Default (s)	Range	Default	Range (s)	Default (s)
<b>Thermal Overload</b>	Enabled	Disabled	1.0...2250 A ❷	❷	Trip Class 5...30	Trip Class 10	0...100 %TCU	85%	—	—
<b>Phase Loss</b>	Enabled	—	❸	❸	0.1...25.0	1.0	—	—	0...250	0
<b>Ground (Earth) Fault</b>	Disabled	Disabled	1.0...5.0 A	2.5 A	0.1...25.0	0.5	1.0...5.0 A	2.0 A	0...250	10
<b>Stall (High Overload During Start)</b>	Disabled	—	100...600 %FLA ❹	600 %FLA ❹	0...250 ❹	10 ❹	—	—	—	—
<b>Jam (High Overload During Run)</b>	Disabled	Disabled	50...600 %FLA	250 %FLA	0.1...25.0	5.0	50...600 %FLA	150 %FLA	0...250	10
<b>Underload</b>	Disabled	Disabled	50...100 %FLA	50 %FLA	0.1...25.0	5.0	50...100 %FLA	70 %FLA	0...250	10
<b>PTC</b>	Disabled	Disabled	—	—	—	—	—	—	—	—
<b>Current Imbalance (Assymetry)</b>	Disabled	Disabled	10...100%	35%	0.1...25.0	5.0	10...100%	20%	0...250	10
<b>Comm Fault</b>	Enabled	Disabled	—	—	—	—	—	—	—	—
<b>Comm Idle</b>	Disabled	Disabled	—	—	—	—	—	—	—	—

- ❶ Inhibit Time settings are used for both trip and warning functions.
- ❷ The FLA Setting range of 1.0...2250 A is covered by 13 frame sizes. Default values are dependent upon the current rating of the product.
- ❸ Phase loss trip level is set at a current imbalance greater than or equal to 100% and is not user-adjustable.
- ❹ Stall Protection is only applicable to the motor starting sequence.

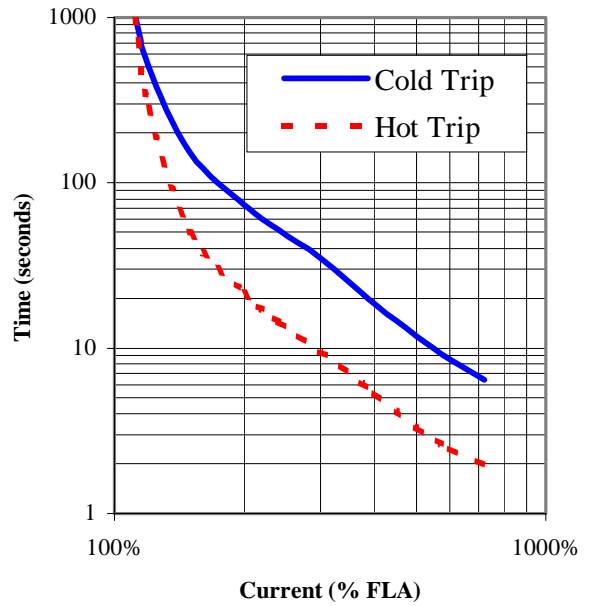


**Trip Curves**

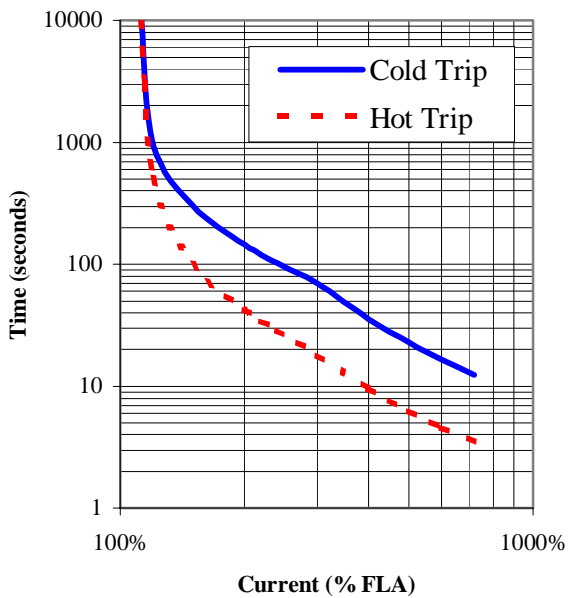
**E3 & E3 Plus Overload Relay  
 Trip Class 5**



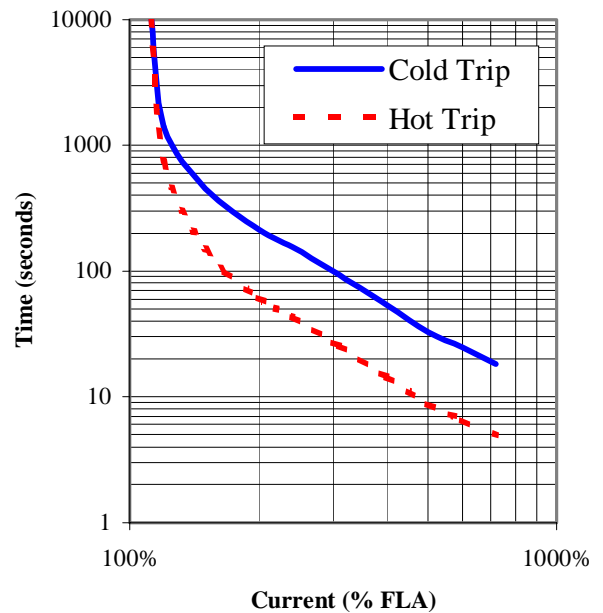
**E3 & E3 Plus Overload Relay  
 Trip Class 10**



**E3 & E3 Plus Overload Relay  
 Trip Class 20**



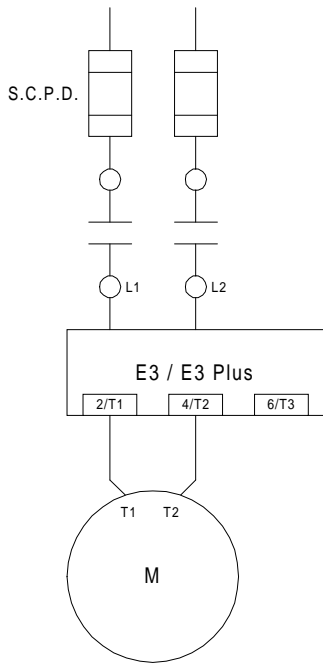
**E3 & E3 Plus Overload Relay  
 Trip Class 30**



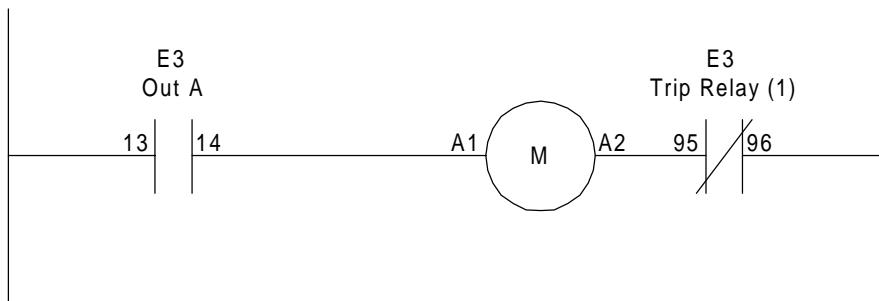
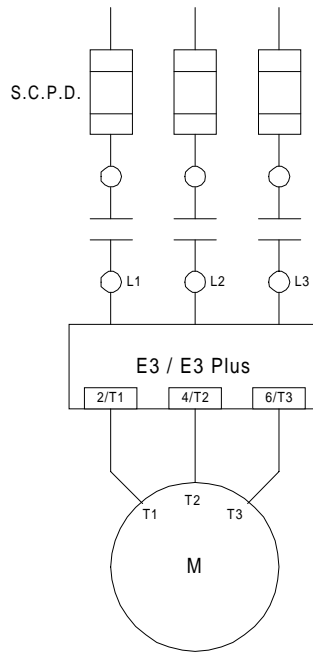
Bulletins 193 and 592  
**E3 and E3 Plus Solid-State Overload Relays**  
 Specifications, Continued

Typical Wiring Schematics – NEMA

Single-Phase



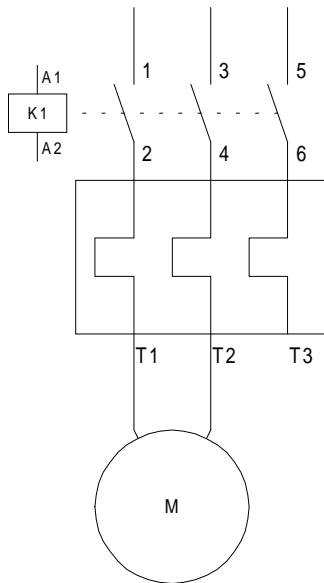
Three-Phase



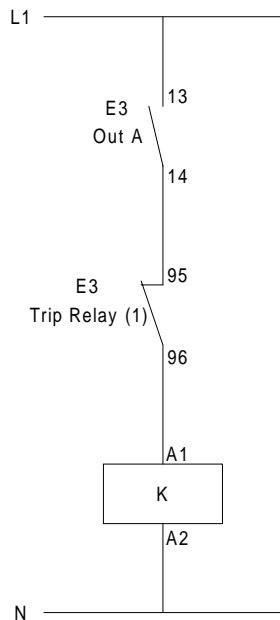
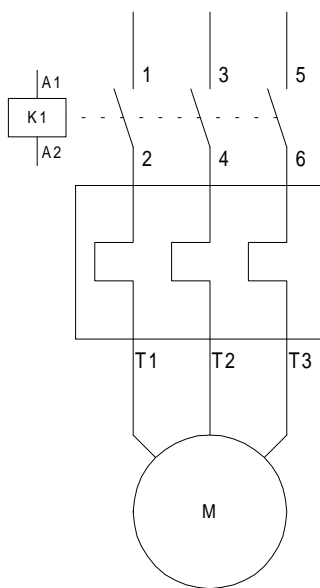
(1) Contact shown with supply voltage applied.

**Typical Wiring Schematics – IEC**

**Single-Phase**



**Three-Phase**



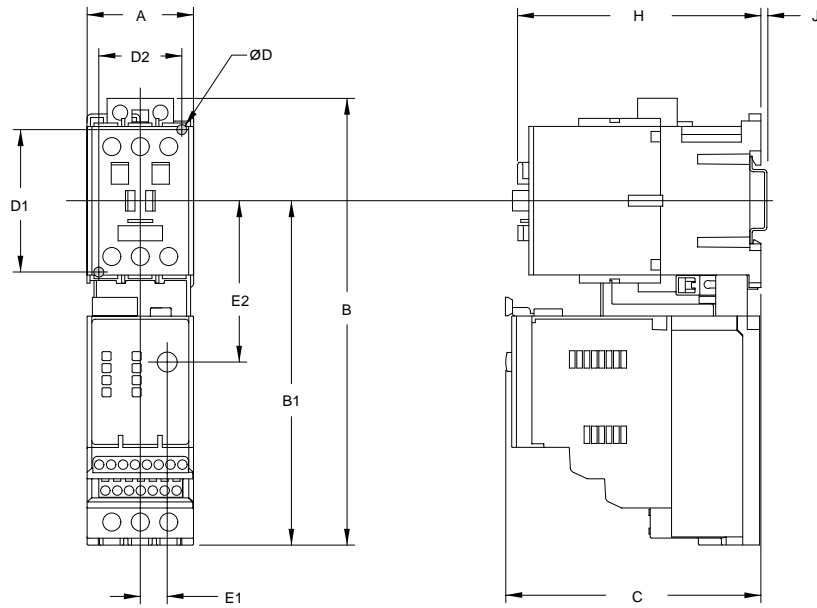
(1) Contact shown with supply voltage applied.

**Bulletins 193 and 592**  
**E3 and E3 Plus Solid-State Overload Relays**

**Approximate Dimensions**

Approximate dimensions are shown in millimeters (inches). Dimensions are not to be used for manufacturing purposes.

**Bulletin 109 Starter Approximate Dimensions**

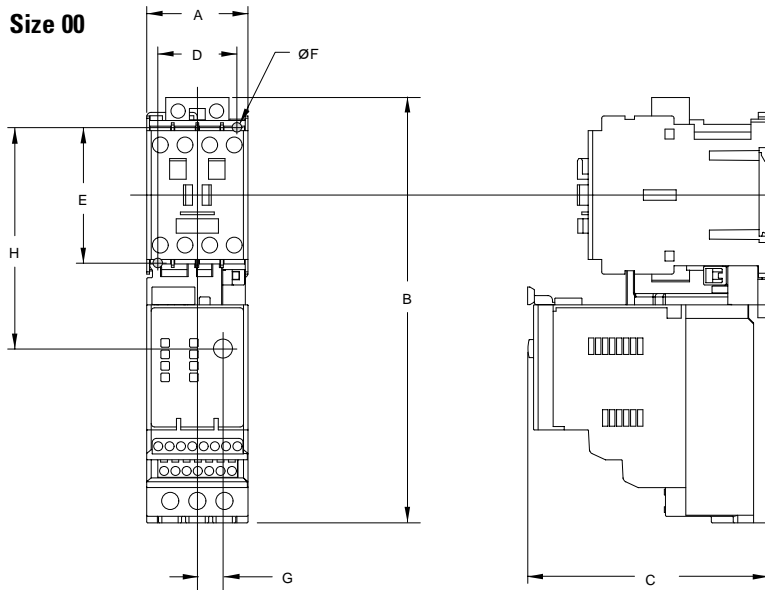


Overload Cat. No.	Contactors Cat. No.	Width A	Height B	B1	Depth C	E1	E2	D1	D2	H	J	ØD
193-EC_B	100-C09, -C12, -C16, -C23	45 (1-25/32)	188.3 (7-13/32)	145.1 (5-23/32)	107 (4-7/32)	11.4 (29/64)	67.9 (2-43/64)	60 (2-23/64)	35 (1-3/8)	85.1 (3-23/64)	2 (5/64)	Ø4.2 (11/64Ø)
193-EC_D	100-C30, -C37	45 (1-25/32)	188.3 (7-13/32)	145.1 (5-23/32)	107 (4-7/32)	11.4 (29/64)	67.9 (2-43/64)	60 (2-23/64)	35 (1-3/8)	104 (4-3/32)	2 (5/64)	Ø4.2 (11/64Ø)
193-EC_D	100-C43	54 (2-1/8)	188.3 (7-13/32)	145.1 (5-23/32)	107 (4-7/32)	11.4 (29/64)	67.9 (2-43/64)	60 (2-23/64)	45 (1-25/32)	107 (4-7/32)	2 (5/64)	Ø4.2 (11/64Ø)
193-EC_E	100-C60, -C72, -C85	72 (2-53/64)	236.1 (9-19/64)	173.2 (6-13/16)	124.6 (4-29/32)	11.4 (29/64)	89.8 (3-17/32)	100 (3-15/16)	55 (2-11/64)	125.5 (4-15/16)	2 (5/64)	Ø5.5 (7/32Ø)

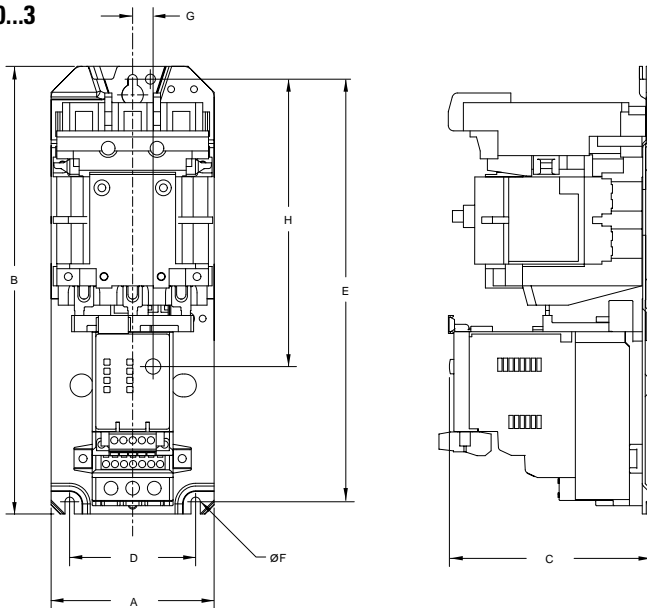
Approximate dimensions are shown in millimeters (inches). Dimensions are not to be used for manufacturing purposes.

**Bulletin 509 Starter Approximate Dimensions**

**Size 00**



**Size 0...3**



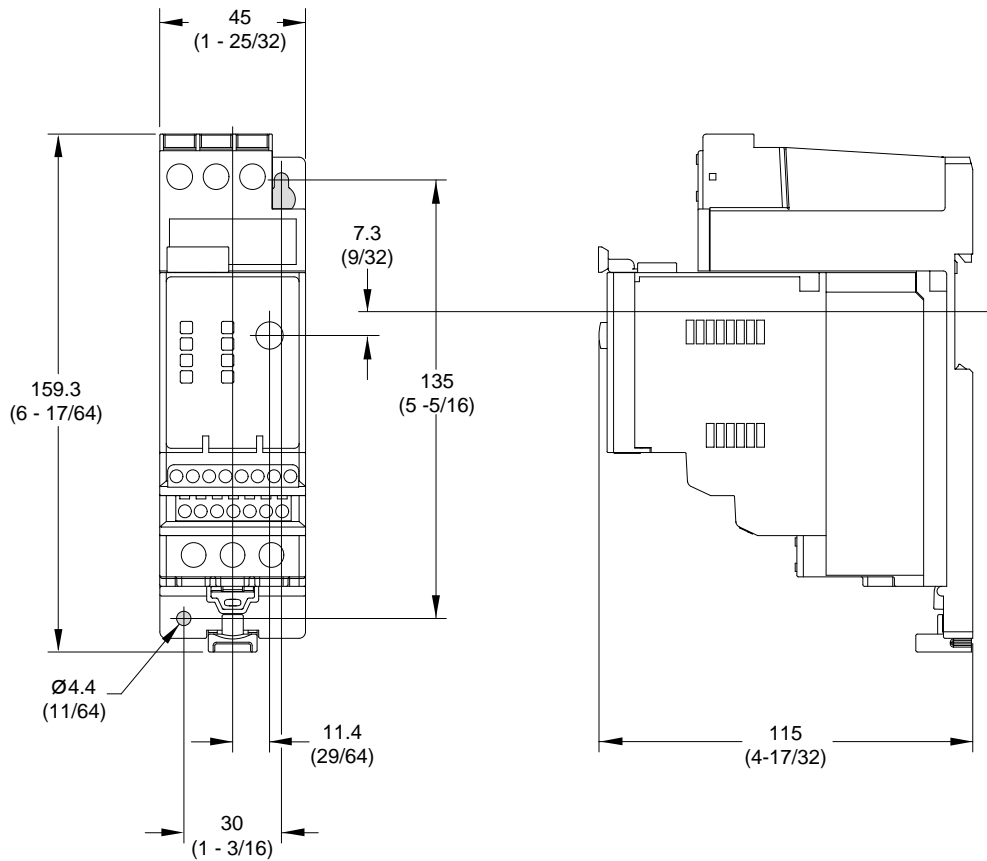
Overload Cat. No.	NEMA Contactor Size	Width A	Height B	Depth C	D	E	ØF	G	H
592-EC_T	Size 00	45 (1-25/32)	188.3 (7-13/32)	107 (4-7/32)	35 (1-3/8)	60 (2-23/64)	Ø4.2 (11/64Ø)	11.4 (29/64)	97.9 (3-27/32)
592-EC_C	Size 0,1	90.4 (3-9/16)	248.3 (9-25/32)	112.1 (4-13/32)	69.9 (2-3/4)	243.4 (9-7/32)	Ø5.15 (13/64Ø)	11.4 (29/64)	159.4 (6-9/32)
592-EC_C	Size 2	100 (3-15/16)	273.6 (10-25/32)	112.1 (4-13/32)	80 (3-5/32)	260.2 (10-1/4)	Ø5.54 (7/32Ø)	11.4 (29/64)	177.8 (7)
592-EC_D	Size 3	155.5 (6-1/8)	368 (14-1/2)	126.3 (4-31/32)	139.9 (5-1/2)	219.9 (8-21/32)	Ø7.1 (9/32Ø)	11.4 (29/64)	276.7 (10-57/64)

# E3 and E3 Plus Solid-State Overload Relays

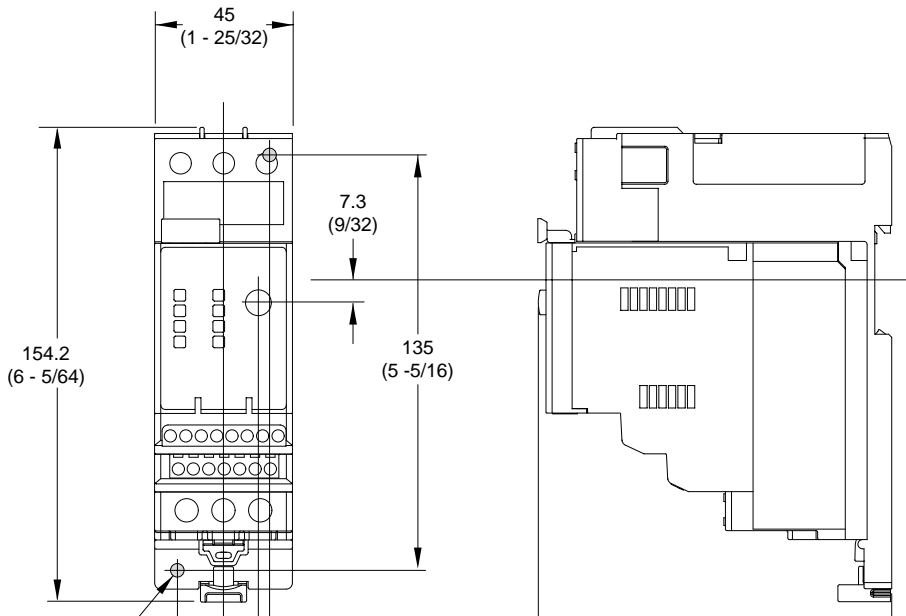
## Approximate Dimensions, Continued

Approximate dimensions are shown in millimeters (inches). Dimensions are not to be used for manufacturing purposes.

### Panel Mount Adapter (For Use With Cat. No. 193-EC\_B)

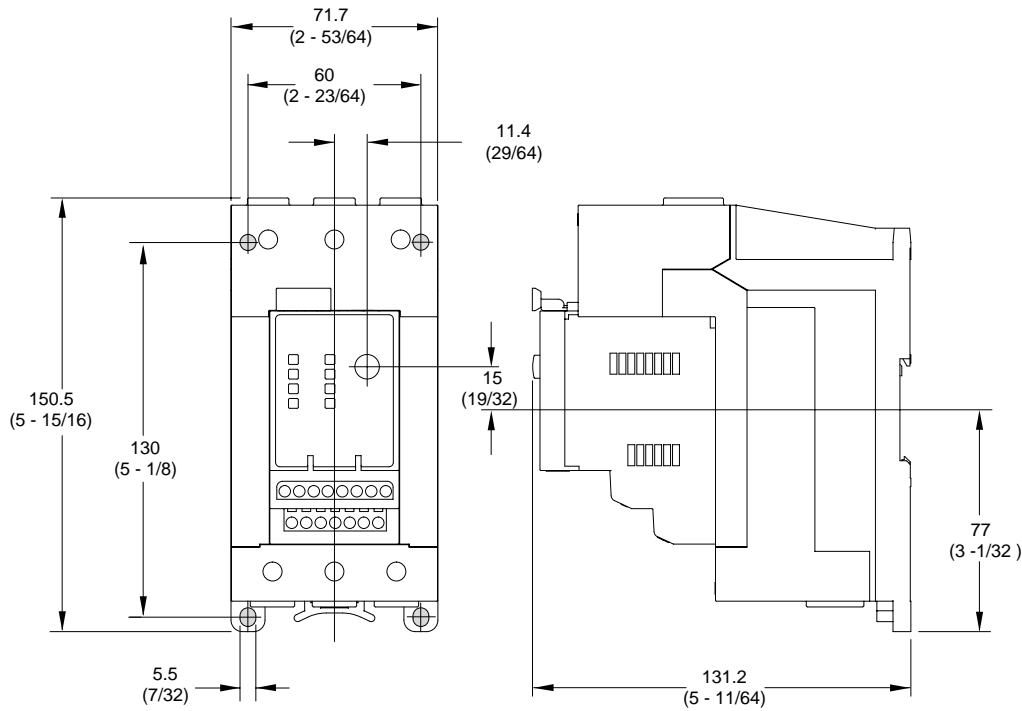


### Panel Mount Adapter (For Use With Cat. No. 193-EC\_D)



Approximate dimensions are shown in millimeters (inches). Dimensions are not to be used for manufacturing purposes.

**Panel Mount Adapter (For Use With Cat. No. 193-EC\_E)**



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