Allen-Bradley

E3 and E3 Plus Overload Relay Specifications

Bulletin Number 193, 592

Additional Resources

These documents contain additional information concerning related products from Rockwell Automation.

Resource	Description
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation industrial system.
Product Certifications website, http://www.ab.com	Provides declarations of conformity, certificates, and other certification details.

You can view or download publications at http://www.rockwellautomation.com/literature/. To order paper copies of technical documentation, contact your local Allen-Bradley distributor or Rockwell Automation sales representative.

				
Bulletin	**193-EC1**	**193-EC2/EC3**	**193-EC5**	**193-EC4**
Type	E3 Electronic Overload Relay	E3 Plus Electronic Overload Relay		E3 Plus Current Monitoring Relay
Rated Current (Range)	0.4…5000 A			
NEMA Operating Voltage, Nominal	600V			
IEC Operating Voltage, Nominal	690/1000V			
Overload Type	Microprocessor-Based			
Trip Class (Fixed)	—			
Trip Class (Adjustable)	5…30			—
Ambient Temperature Compensated	✓			—
Reset Type	Automatic and Manual			
Adjustment Range	5:1			
Phase Loss	Adjustable Delay			—
Ground (Earth) Fault	—	Sensitive	Sensitive	Sensitive
Overcurrent (Jam) Detection	✓	✓	✓	—
Stall Detection	✓	✓	✓	—
Underload Detection	✓	✓	✓	—
Current Imbalance	✓	✓	✓	—
PTC Thermistor Monitoring	—	✓	—	—
Warning Settings	✓	✓	✓	✓
N.C. Trip Contact	✓	✓	✓	✓
N.O. Alarm Contact	—	—	—	—
No. of Outputs	1	2	2	2
No. of Inputs	2	4	6	4
ODVA (DeviceNet) Conformance	✓	✓	✓	✓
Variable Frequency Drive (VFD) Compatible	✓	✓	✓	✓

Standards Compliance

EN 60947-4-1
CSA C22.2 No. 14
UL 508, UL1053 (class 1)

Certifications

ABS
CE
cULus Listed (File No. E14840, Guide NKCR, NKCR7; File No. E53935, Guide KDAX)
C-tick
CCC

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

Feature	E3	EC Plus			
	193/592-EC1	193/592-EC2	193/592-EC3	193-EC4	193/592-EC5‡
Inputs★	2	4	4	4	6
Outputs	1	2	2	2	2
PTC Thermistor Input		✓	✓		
Ground Fault Protection		Internal 1…5 A	External 20 mA… 5 A§	External 20 mA… 5 A§	External 20 mA… 5 A§
DeviceLogix		✓	✓	✓	✓
Heat Trace				✓	
Voltage Monitoring					✓

★ Inputs are rated 24V DC.
‡ Voltage sensing range is 43…65 Hz
§ Requires the use of an external ground fault sensor, Cat. No. 193-CBCT_.

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 that simulates the actual heating of the motor is calculated. 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 reaches 100%.

Adjustable Settings

Thermal overload protection setup is accomplished simply by programming the motor's full load current (FLC) rating and the desired trip class (5…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

This flexibility allows 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…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, which is accessible via the DeviceNet network, is reported.

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 when the calculated percentage of thermal capacity utilization exceeds the programmed thermal warning level, which has a setting range of 0…100% TCU.

Two-Speed Protection

The E3 Plus Overload Relay offers a second FLA setting for 2-speed motor protection. What used to require two separate overload relays - one for each set of motor windings - can now be accomplished with one device. Improved protection is delivered as thermal utilization is maintained in one device during operation in both speeds.

Phase Loss

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

Ground (Earth) Fault

The E3 Plus Overload Relay incorporates zero sequence (core balance) sensing into its design through the 90 A rating for low level (arcing) ground fault detection. Trip and warning settings are adjustable from 20 mA…5.0 A. For devices rated greater than 90 A and for ground fault detection less than 1.0 A, the external core balance current transformer accessory is required. Class I protection is provided as defined by UL1053. Series B or later devices provide a trip-inhibit setting, offering flexibility to prevent tripping when the ground fault current magnitude exceeds 10 A. This can be useful to guard against the opening of the controller when the fault current could potentially exceed the controller's interrupting capacity rating.

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…600% FLA, and the enable time is adjustable up to 250 seconds.

Jam (Overcurrent)

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

Underload (Undercurrent)

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 coded by the medium handled (e.g., submersible pumps that pump 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 10…100% FLA. The trip function also includes a trip delay time with a range of 0.1…25.0 seconds.

Over-temperature Protection

The E3 Plus Overload Relay provides motor over-temperature protection with the added provisions for terminating and monitoring of stator windingembedded 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 (3400 Ω), it can be set to trip immediately or programmed to set the PTC bit of the Warning Status word.

Current Imbalance (Asymmetry)

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