



**Bulletin 150 — Smart Motor Controllers — SMC-3™ Smart Motor Controller**

The SMC-3™ is a compact, simple to use, solid-state motor controller designed to operate 3-phase motors. It features a built-in overload relay and a built-in SCR bypass contactor on all three phases, allowing a smaller footprint than other soft starters on the market. This product is designed for many applications, including compressors, chillers, pumps, conveyors, and crushers. Modes of operation for the controller are as follows:

- Soft Start
- Current Limit Start
- Kick Start
- Soft Stop
- Coast-to-Rest

The controllers are available in ten sizes: 3, 9, 16, 19, 25, 30, 37, 43, 60, and 85 A. They offer two voltage ranges: 200...480V AC and 200...600V AC. All voltage ranges will operate at either 50 or 60 Hz.

- 1...85 A Range
- Built-In Electronic Motor Overload Protection
- Built-In SCR/Run Bypass

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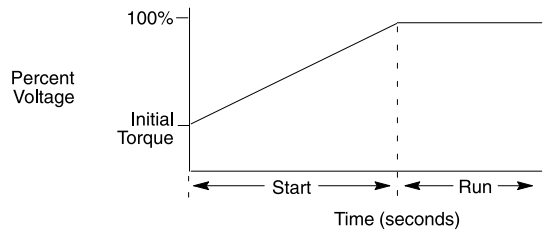
**Standards Compliance/Approvals**

- UL 508
- CSA C22.2 No. 14
- EN/IEC 60947-4-2
- cULus Listed (Open Type) (File No. E96956)
- CE Marked (Open Type) per EMC Directive and Low Voltage Directive

**Modes of Operation**

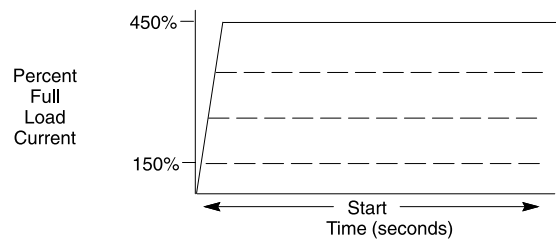
**Soft Start**

This method has the most general application. The motor is raised from an initial torque value to full voltage. This initial torque can be adjusted to 15%, 25%, 35%, or 65% of locked rotor torque. The motor voltage is gradually increased during the acceleration ramp time, which can be adjusted from 2, 5, 10, 15, 20, 25, or 30 s. (3...37 A, 2...15 s only)



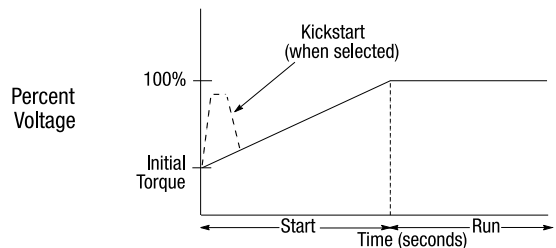
**Current Limit Start**

This starting mode is used when it is necessary to limit the maximum starting current. It can be adjusted to 150%, 250%, 350%, or 450% of full load amps. Start times are selectable from 2, 5, 10, 15, 20, 25, or 30 s. (3...37 A, 2...15 s only)



**Selectable Kick Start**

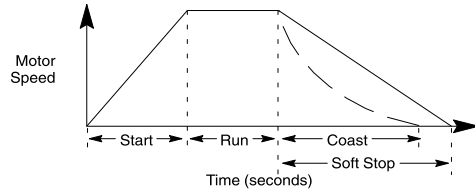
A kickstart, or boost, at the beginning of the start mode is intended to provide a current pulse of 450% of full load current. The kickstart time is adjustable from 0.5...1.5 seconds. This allows the motor to develop additional torque during starting for loads which may need a boost to get initial shaft rotation.



## Modes of Operation, Continued

### Soft Stop

The Soft Stop function can be used with applications that require an extended coast to rest. When enabled, the voltage ramp down time can be selected to one, two, or three times the starting time. The motor will stop when the motor voltage drops to a point where the load torque is greater than the motor torque.



## Description of Features

### Electronic Motor Overload Protection

The SMC-3 controller incorporates, as standard, electronic motor overload protection. This motor overload protection is accomplished electronically with the use of current transformers on each of the three phases. The controller's overload protection is programmable, providing the user with flexibility. The overload trip class selection consists of either OFF, 10, 15, or 20. The trip current is easily selected by adjusting the rotary potentiometer to the motor full load current rating. Trip reset is selectable to either automatic or manual mode.

**Note:** Trip rating is 120% of dial setting.

### Over-temperature

The SMC-3 monitors the SCR temperature by means of internal thermistors. When the power poles maximum rated temperature is reached, the microcomputer switches off the SMC and a TEMP fault is indicated via LED.

### Phase Reversal Protection

When enabled via a DIP switch, 3-phase input power will be verified before starting. If input power phasing is detected to be incorrect, the start will be aborted and a fault indicated.

### Phase Loss/Open Load

The unit will not attempt a start if there is a single-phase condition on the line. This protects from motor burnout during single-phase starting.

### Phase Imbalance

The unit monitors for imbalance between phase currents. To prevent motor damage, the unit will trip if the phase imbalance exceeds specified limits and a fault will be indicated on the LED.

### Push to Test

The unit with control wiring can be tested for fault conditions by using the Push to Test function. Hold down the Reset button for 5 seconds to activate the fault Aux (97, 98) and shut down the SMC-3. To clear, either push the Reset button or cycle control power to the device.

### Shorted SCR

Prior to every start and during starting, the unit will check all SCRs for shorts and unit load connections to the motor. If there is a shorted SCR in the SMC-3 and/or open load, the start will be aborted and a shorted SCR or open load fault will be indicated. This prevents damage from phase imbalance.

### LED Description (Number of Flashes)

1. Overload
2. Overtemperature
3. Phase Reversal
4. Phase Loss/Open Load
5. Phase Imbalance
6. Shorted SCR
7. Test

**Cat. No. Explanation**

Open and Non-Combination

**150 – C 30 F B D – 8L**  
*a b c d e f g*

**a**

| Bulletin Number |                        |
|-----------------|------------------------|
| Code            | Description            |
| 150             | Solid-State Controller |

**b**

| Controller Type |             |
|-----------------|-------------|
| Code            | Description |
| C               | SMC-3       |

**c**

| Ampere Ratings |             |
|----------------|-------------|
| Code           | Description |
| 3              | 3 A         |
| 9              | 9 A         |
| 16             | 16 A        |
| 19             | 19 A        |
| 25             | 25 A        |
| 30             | 30 A        |
| 37             | 37 A        |
| 43             | 43 A        |
| 60             | 60 A        |
| 85             | 85 A        |

**d**

| Enclosure Type |                  |
|----------------|------------------|
| Code           | Description      |
| N              | Open             |
| F              | IP65 (NEMA 4/12) |

**e**

| Input Line Voltage<br>Open Type |                                  |
|---------------------------------|----------------------------------|
| Code                            | Description                      |
| B                               | 200...460V AC, 3-Phase, 50/60 Hz |
| C                               | 200...600V AC, 3-Phase, 50/60 Hz |
| Non-Combination Enclosed Only   |                                  |
| H                               | 200...208V AC, 3-Phase, 50/60 Hz |
| A                               | 230V AC, 3-Phase, 50/60 Hz       |
| B                               | 400...460V AC, 3-Phase, 50/60 Hz |
| C                               | 500...575V AC, 3-Phase, 50/60 Hz |

**f**

| Control Voltage |                            |
|-----------------|----------------------------|
| Code            | Description                |
| D               | 100...240V AC              |
| R               | 24V AC/DC (Open Type only) |

**g**

| Options |   |
|---------|---|
| Code    | Description   |
| 8L      | Line Mounted Protective Module (Enclosed Type only) |

Combination

**152H – C 30 F BD 43 – 8L**  
*a b c d e f g*

**a**

| Bulletin Number |  |
|-----------------|--|
| Code            | Description                                    |
| 152H            | Solid-State Controller with Fusible Disconnect |
| 153H            | Solid-State Controller with Circuit Breaker    |

**b**

| Controller Type |             |
|-----------------|-------------|
| Code            | Description |
| C               | SMC-3       |

**c**

| Ampere Ratings |             |
|----------------|-------------|
| Code           | Description |
| 3              | 3 A         |
| 9              | 9 A         |
| 16             | 16 A        |
| 19             | 19 A        |
| 25             | 25 A        |
| 30             | 30 A        |
| 37             | 37 A        |
| 43             | 43 A        |
| 60             | 60 A        |
| 85             | 85 A        |

**d**

| Enclosure Type |                  |
|----------------|------------------|
| Code           | Description      |
| F              | IP65 (NEMA 4/12) |

**e**

| Input Line Voltage<br>Open Type |                                  |
|---------------------------------|----------------------------------|
| Code                            | Description                      |
| HD                              | 200...208V AC, 3-Phase, 50/60 Hz |
| AD                              | 230V AC, 3-Phase, 50/60 Hz       |
| BD                              | 400...460V AC, 3-Phase, 50/60 Hz |
| CD                              | 500...575V AC, 3-Phase, 50/60 Hz |

**f**

| Horsepower |      |      |     |
|------------|------|------|-----|
| Code       | Hp   | Code | Hp  |
| 33         | 0.5  | 42   | 15  |
| 34         | 0.75 | 43   | 20  |
| 35         | 1    | 44   | 25  |
| 36         | 1.5  | 45   | 30  |
| 37         | 2    | 46   | 40  |
| 38         | 3    | 47   | 50  |
| 39         | 5    | 48   | 60  |
| 40         | 7.5  | 49   | 75  |
| 41         | 10   | 50   | 100 |

**g**

| Options |   |
|---------|---|
| Code    | Description   |
| 8L      | Line Mounted Protective Module (Enclosed Type only) |

Bulletin 150  
**Smart Motor Controllers — SMC-3™**  
 Product Selection

Open Type and Non-Combination Enclosed (IP65, NEMA 4/12) Controllers

| Rated Voltage<br>[V AC] | Current<br>Rating (A)<br>* | kW            |      | Hp<br>(0.5 = 1/2, 0.75 = 3/4, 7.5 = 7-1/2) |            | Open Type                            |                      | IP65 (Type 4/12)<br>Enclosed Non-<br>Combination<br>Controllers † |
|-------------------------|----------------------------|---------------|------|--|------------|--------------------------------------|----------------------|---|
|                         |                            | Starting Duty |      |  |            | 100...240V AC<br>50/60 Hz<br>Control | 24V AC/DC<br>Control |   |
|                         |                            | 350%          | 450% | 350%                                       | 450%       | Cat. No.                             | Cat. No.             |   |
| 200/208                 | 1...3                      | —             | —    | 0.5  | 0.5        | 150-C3NBD                            | 150-C3NBR            | 150-C3FHD   |
|                         | 3...9                      | —             | —    | 0.75...2                                   | 0.75...1.5 | 150-C9NBD                            | 150-C9NBR            | 150-C9FHD   |
|                         | 5.3...16                   | —             | —    | 1.5...3                                    | 1.5...3    | 150-C16NBD                           | 150-C16NBR           | 150-C16FHD  |
|                         | 6.3...19                   | —             | —    | 1.5...5                                    | 1.5...3    | 150-C19NBD                           | 150-C19NBR           | 150-C25FHD  |
|                         | 9.2...27.7                 | —             | —    | 3...7.5                                    | 3...5      | 150-C25NBD                           | 150-C25NBR           | 150-C25FHD  |
|                         | 10...30                    | —             | —    | 3...7.5                                    | 3...5      | 150-C30NBD                           | 150-C30NBR           | 150-C30FHD  |
|                         | 12.3...37                  | —             | —    | 5...10                                     | 5...7.5    | 150-C37NBD                           | 150-C37NBR           | 150-C37FHD  |
|                         | 14.3...43                  | —             | —    | 5...10                                     | 5...10     | 150-C43NBD                           | 150-C43NBR           | 150-C43FHD  |
| 230                     | 1...3                      | 0.55          | 0.37 | 0.5  | 0.5        | 150-C3NBD                            | 150-C3NBR            | 150-C3FAD   |
|                         | 3...9                      | 2.2           | 1.5  | 0.75...2                                   | 0.75...2   | 150-C9NBD                            | 150-C9NBR            | 150-C9FAD   |
|                         | 5.3...16                   | 4             | 3    | 1.5...5                                    | 1.5...3    | 150-C16NBD                           | 150-C16NBR           | 150-C16FAD  |
|                         | 6.3...19                   | 4             | 4    | 2...5                                      | 2...3      | 150-C19NBD                           | 150-C19NBR           | 150-C25FAD  |
|                         | 9.2...27.7                 | 5.5           | 4    | 3...7.5                                    | 3...5      | 150-C25NBD                           | 150-C25NBR           | 150-C25FAD  |
|                         | 10...30                    | 7.5           | 5.5  | 5...10                                     | 5...7.5    | 150-C30NBD                           | 150-C30NBR           | 150-C30FAD  |
|                         | 12.3...37                  | 7.5           | 7.5  | 5...10                                     | 5...10     | 150-C37NBD                           | 150-C37NBR           | 150-C37FAD  |
|                         | 14.3...43                  | 11            | 7.5  | 5...15                                     | 5...15     | 150-C43NBD                           | 150-C43NBR           | 150-C43FAD  |
| 380/400/<br>415/460     | 1...3                      | 1.1           | 0.75 | 0.5...1.5                                  | 0.5...1    | 150-C3NBD                            | 150-C3NBR            | 150-C3FBD   |
|                         | 3...9                      | 4             | 3    | 1.5...5                                    | 1.5...3    | 150-C9NBD                            | 150-C9NBR            | 150-C9FBD   |
|                         | 5.3...16                   | 7.5           | 5.5  | 5...10                                     | 5...7.5    | 150-C16NBD                           | 150-C16NBR           | 150-C16FBD  |
|                         | 6.3...19                   | 7.5           | 5.5  | 5...10                                     | 5...10     | 150-C19NBD                           | 150-C19NBR           | 150-C25FBD  |
|                         | 9.2...27.7                 | 11            | 9.5  | 7.5...15                                   | 7.5...10   | 150-C25NBD                           | 150-C25NBR           | 150-C25FBD  |
|                         | 10...30                    | 15            | 11   | 7.5...20                                   | 7.5...15   | 150-C30NBD                           | 150-C30NBR           | 150-C30FBD  |
|                         | 12.3...37                  | 18.5          | 15   | 10...25                                    | 10...20    | 150-C37NBD                           | 150-C37NBR           | 150-C37FBD  |
|                         | 14.3...43                  | 22            | 15   | 10...30                                    | 10...30    | 150-C43NBD                           | 150-C43NBR           | 150-C43FBD  |
| 500/575                 | 1...3                      | 1.1           | 0.75 | 0.5...1.5                                  | 0.5...1    | 150-C3NCD                            | 150-C3NCR            | 150-C3FCD   |
|                         | 3...9                      | 4             | 3    | 1.5...5                                    | 1.5...3    | 150-C9NCD                            | 150-C9NCR            | 150-C9FCD   |
|                         | 5.3...16                   | 7.5           | 5.5  | 5...10                                     | 5...7.5    | 150-C16NCD                           | 150-C16NCR           | 150-C16FCD  |
|                         | 6.3...19                   | 7.5           | 5.5  | 5...10                                     | 5...10     | 150-C19NCD                           | 150-C19NCR           | 150-C25FCD  |
|                         | 8.3...25                   | 11            | 9.5  | 7.5...15                                   | 7.5...10   | 150-C25NCD                           | 150-C25NCR           | 150-C25FCD  |
|                         | 10...30                    | 15            | 11   | 7.5...20                                   | 7.5...15   | 150-C30NCD                           | 150-C30NCR           | 150-C30FCD  |
|                         | 12.3...37                  | 18.5          | 15   | 10...25                                    | 10...20    | 150-C37NCD                           | 150-C37NCR           | 150-C37FCD  |
|                         | 14.3...43                  | 22            | 15   | 10...30                                    | 10...30    | 150-C43NCD                           | 150-C43NCR           | 150-C43FCD  |
|                         | 20...60                    | 30            | 22   | 15...40                                    | 15...40    | 150-C60NCD                           | 150-C60NCR           | 150-C60FCD  |
|                         | 28.3...85                  | 45            | 37   | 25...60                                    | 25...60    | 150-C85NCD                           | 150-C85NCR           | 150-C85FCD  |

\* Motor FLA rating must fall within specified current range for unit to operate properly.

† These controllers require a separate 100...240V, 50/60 Hz single-phase control source. To add a control circuit transformer to the enclosure, add the appropriate option code to the catalog string.

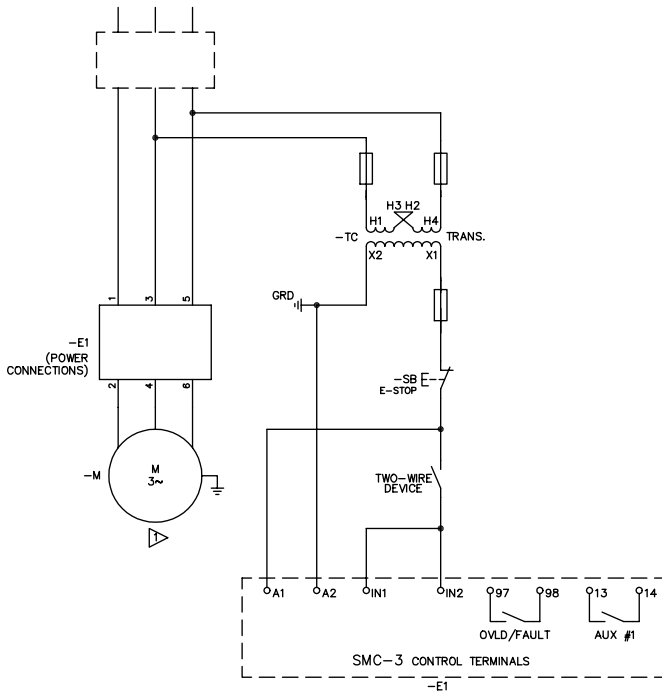
Combination Enclosed (IP65, NEMA 4/12) Controllers with Fusible Disconnect or Circuit Breaker

| Rated Voltage<br>[V AC] | Current<br>Rating (A) | Hp<br>(0.5 = 1/2, 0.75 = 3/4, 7.5 = 7-1/2) | IP65 (Type 4/12) Enclosed Combination<br>Controllers with Fusible Disconnect * | IP65 (Type 4/12) Enclosed Combination<br>Controllers with Circuit Breaker * |
|-------------------------|-----------------------|--|--|---|
|                         |                       |  | Cat. No.   | Cat. No.  |
| 200/208                 | 3                     | 0.5  | 152H-C3FHD-33  | 153H-C3FHD-33   |
|                         | 9                     | 0.75                                       | 152H-C9FHD-34  | 153H-C9FHD-34   |
|                         | 9                     | 1  | 152H-C9FHD-35  | 153H-C9FHD-35   |
|                         | 9                     | 1.5  | 152H-C9FHD-36  | 153H-C9FHD-36   |
|                         | 9                     | 1  | 152H-C9FHD-35  | 153H-C16FHD-37  |
|                         | 16                    | 3  | 152H-C16FHD-38   | 153H-C16FHD-38  |
|                         | 25                    | 5  | 152H-C25FHD-39   | 153H-C25FHD-39  |
|                         | 37                    | 7.5  | 152H-C37FHD-40   | 153H-C37FHD-40  |
|                         | 43                    | 10   | 152H-C43FHD-41   | 153H-C43FHD-41  |
|                         | 60                    | 15   | 152H-C60FHD-42   | 153H-C60FHD-42  |
| 230                     | 85                    | 20   | 152H-C85FHD-43   | 153H-C85FHD-43  |
|                         | 85                    | 25   | 152H-C85FHD-44   | 153H-C85FHD-44  |
|                         | 3                     | 0.5  | 152H-C3FAD-33  | 153H-C3FAD-33   |
|                         | 9                     | 0.75                                       | 152H-C9FAD-34  | 153H-C9FAD-34   |
|                         | 9                     | 1  | 152H-C9FAD-35  | 153H-C9FAD-35   |
|                         | 9                     | 1.5  | 152H-C9FAD-36  | 153H-C9FAD-36   |
|                         | 9                     | 2  | 152H-C9FAD-37  | 153H-C9FAD-37   |
|                         | 16                    | 3  | 152H-C16FAD-38   | 153H-C16FAD-38  |
|                         | 25                    | 5  | 152H-C25FAD-39   | 153H-C25FAD-39  |
|                         | 30                    | 7.5  | 152H-C30FAD-40   | 153H-C30FAD-40  |
| 380/400/<br>415/460     | 37                    | 10   | 152H-C37FAD-41   | 153H-C37FAD-41  |
|                         | 43                    | 15   | 152H-C43FAD-42   | 153H-C43FAD-42  |
|                         | 60                    | 20   | 152H-C60FAD-43   | 153H-C60FAD-43  |
|                         | 85                    | 25   | 152H-C85FAD-44   | 153H-C85FAD-44  |
|                         | 85                    | 30   | 152H-C85FAD-45   | 153H-C85FAD-45  |
|                         | 3                     | 0.5  | 152H-C3FBD-33  | 153H-C3FBD-33   |
|                         | 3                     | 0.75                                       | 152H-C3FBD-34  | 153H-C3FBD-34   |
|                         | 3                     | 1  | 152H-C3FBD-35  | 153H-C3FBD-35   |
|                         | 9                     | 1.5  | 152H-C9FBD-36  | 153H-C9FBD-36   |
|                         | 9                     | 2  | 152H-C9FBD-37  | 153H-C9FBD-37   |
| 500/575                 | 9                     | 3  | 152H-C9FBD-38  | 153H-C9FBD-38   |
|                         | 16                    | 5  | 152H-C16FBD-39   | 153H-C16FBD-39  |
|                         | 16                    | 7.5  | 152H-C16FBD-40   | 153H-C16FBD-40  |
|                         | 25                    | 10   | 152H-C25FBD-41   | 153H-C25FBD-41  |
|                         | 30                    | 15   | 152H-C30FBD-42   | 153H-C30FBD-42  |
|                         | 37                    | 20   | 152H-C37FBD-43   | 153H-C37FBD-43  |
|                         | 43                    | 25   | 152H-C43FBD-44   | 153H-C43FBD-44  |
|                         | 43                    | 30   | 152H-C43FBD-45   | 153H-C43FBD-45  |
|                         | 60                    | 40   | 152H-C60FBD-46   | 153H-C60FBD-46  |
|                         | 85                    | 50   | 152H-C85FBD-47   | 153H-C85FBD-47  |
| 500/575                 | 85                    | 60   | 152H-C85FBD-48   | 153H-C85FBD-48  |
|                         | 3                     | 0.75                                       | 152H-C3FCD-34  | 153H-C3FCD-34   |
|                         | 3                     | 1  | 152H-C3FCD-35  | 153H-C3FCD-35   |
|                         | 9                     | 1.5  | 152H-C9FCD-36  | 153H-C9FCD-36   |
|                         | 9                     | 2  | 152H-C9FCD-37  | 153H-C9FCD-37   |
|                         | 9                     | 3  | 152H-C9FCD-38  | 153H-C9FCD-38   |
|                         | 9                     | 5  | 152H-C9FCD-39  | 153H-C9FCD-39   |
|                         | 16                    | 7.5  | 152H-C16FCD-40   | 153H-C16FCD-40  |
|                         | 16                    | 10   | 152H-C16FCD-41   | 153H-C16FCD-41  |
|                         | 25                    | 15   | 152H-C25FCD-42   | 153H-C25FCD-42  |
| 500/575                 | 30                    | 20   | 152H-C30FCD-43   | 153H-C30FCD-43  |
|                         | 37                    | 25   | 152H-C37FCD-44   | 153H-C37FCD-44  |
|                         | 43                    | 30   | 152H-C43FCD-45   | 153H-C43FCD-45  |
|                         | 43                    | 40   | 152H-C43FCD-46   | 153H-C43FCD-46  |
|                         | 60                    | 50   | 152H-C60FCD-47   | 153H-C60FCD-47  |
|                         | 85                    | 60   | 152H-C85FCD-48   | 153H-C85FCD-48  |
|                         | 85                    | 75   | 152H-C85FCD-49   | 153H-C85FCD-49  |

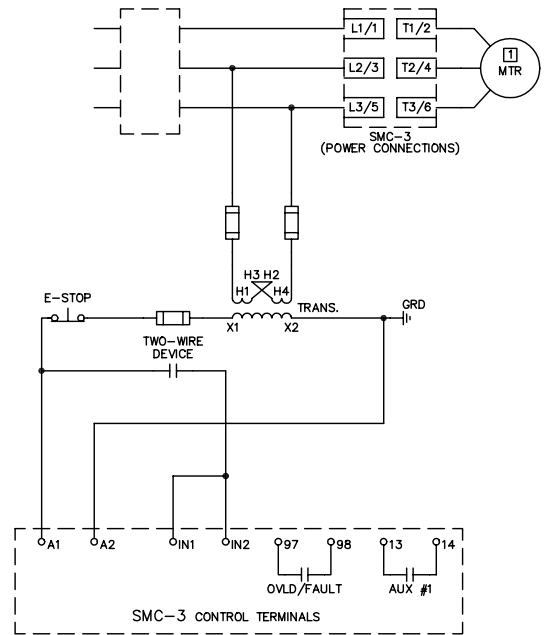
\* These controllers require a separate 100...240V, 50/60 Hz single-phase control source. To add a control circuit transformer to the enclosure, add the appropriate option code to the catalog string.

**Two-Wire Configuration**

IEC

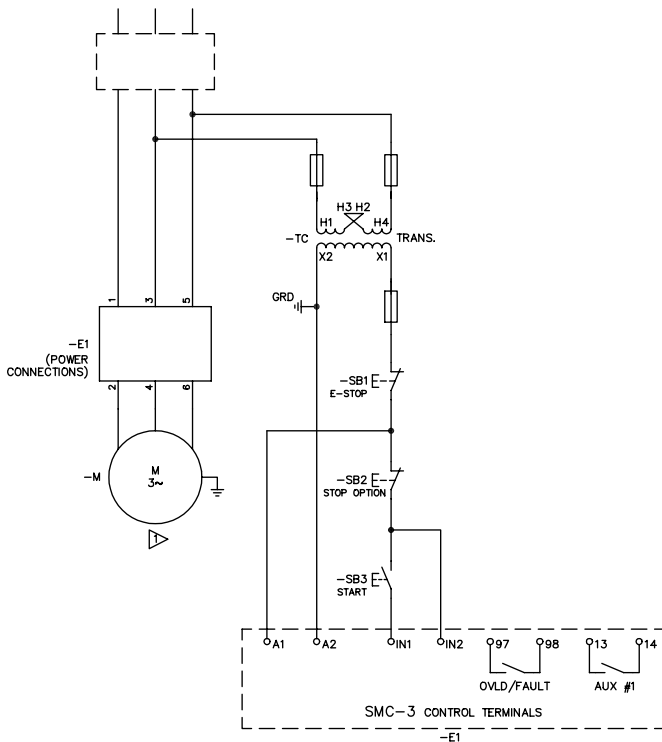


NEMA

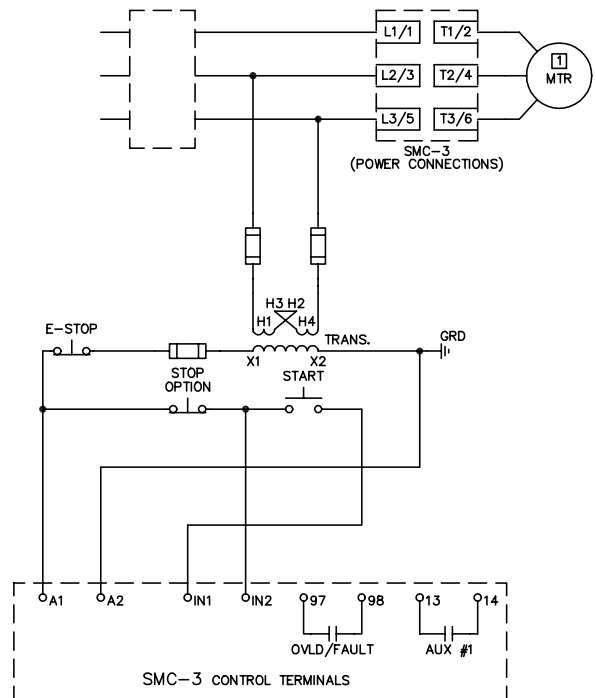


**Three-Wire Configuration**

IEC

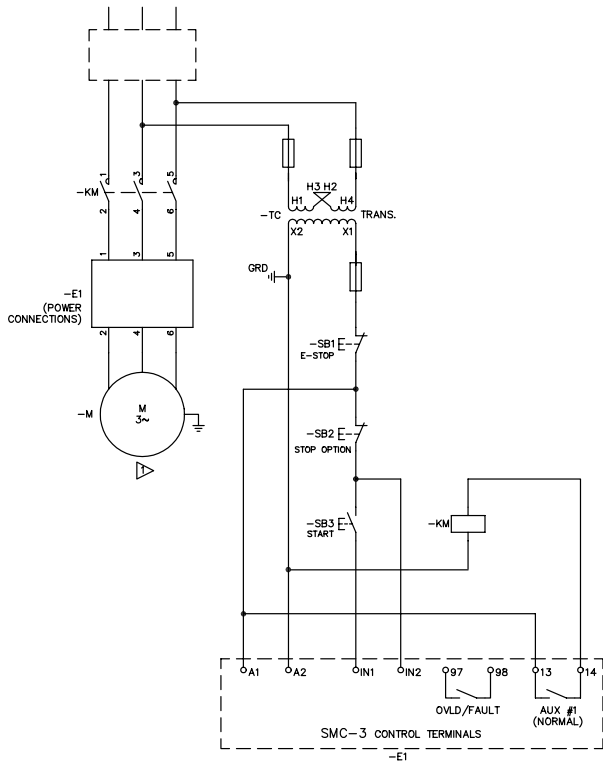


NEMA

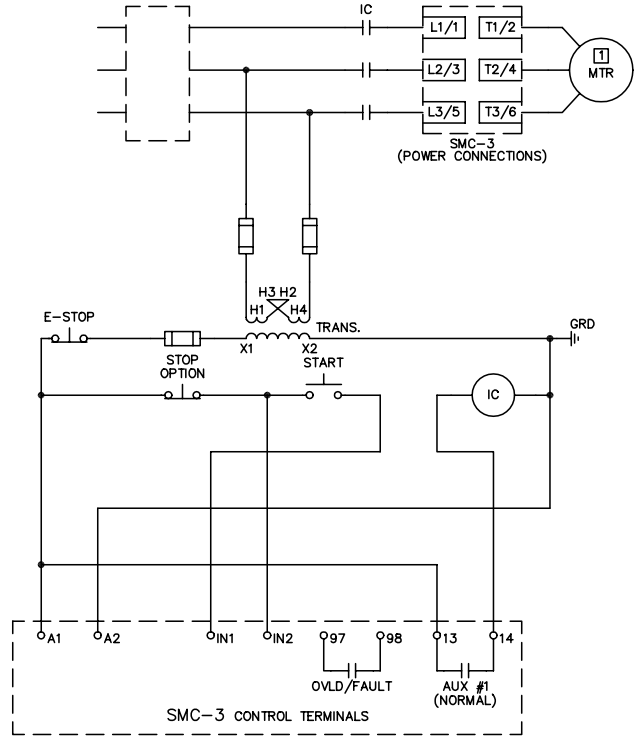


**Isolation Contactor Configuration**

IEC



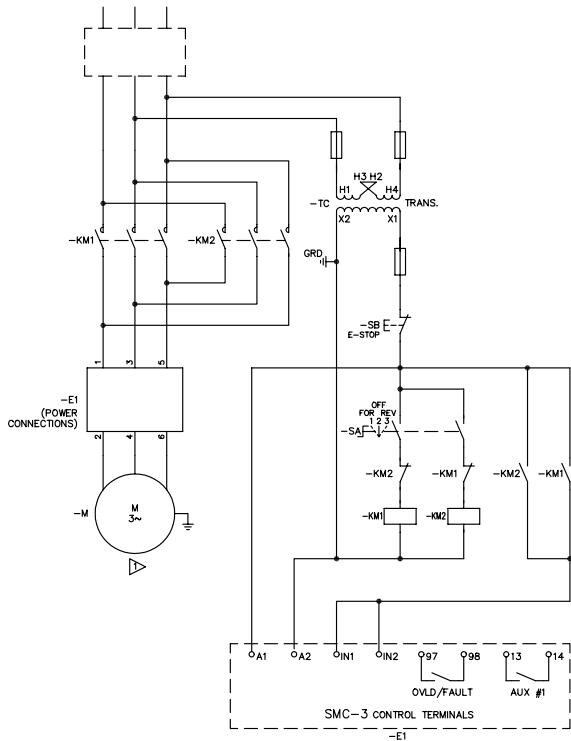
NEMA



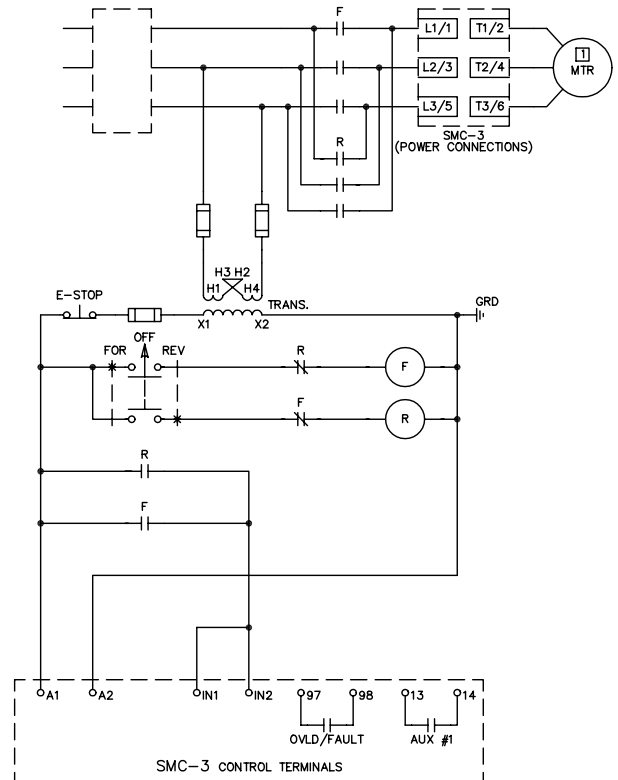
**Reversing Configuration**

Note: Minimum Off time equals 1.0 s.

IEC



NEMA



**Bulletin 150**  
**Smart Motor Controllers — SMC-3™**  
**Specifications**

| Electrical Ratings Cat. Nos. 150-...  |   |  |   |          |            |                                      |           |  |         |           |  |
|---|---|--|---|----------|------------|--------------------------------------|-----------|--|---------|-----------|--|
| Cat. No.  | C3  | C9   | C16   | C19      | C25        | C30                                  | C37       | C43  | C60     | C85       |  |
| Rated operating current $I_e$ (A)   | 3   | 9  | 16  | 19       | 25         | 30                                   | 37        | 43   | 60      | 85        |  |
| Heat dissipation (W)  | Continuous  |  |   |          |            |                                      |           |  |         |           |  |
| Rated operating voltage   | 200...480, 200...600V AC 50/60 Hz, 3-phase (+10%, -15%) |  |   |          |            |                                      |           |  |         |           |  |
| Line Power terminals  | Cable size:<br>Tightening torque:                       |  | 2.5...25 mm <sup>2</sup> (14...4 AWG)<br>2.3...3.4 N•m (20...30 in-lbs)     |          |            |                                      |           | 2.5...95 mm <sup>2</sup> (14...3/0 AWG)<br>11.3...12.4 N•m<br>(100...110 in-lbs) |         |           |  |
| Load Power terminals  | Cable size:<br>Tightening torque:                       |  | 2.5...16 mm <sup>2</sup> (14...6 AWG)<br>2.3...3.4 N•m (20...30 in-lbs)     |          |            |                                      |           | 2.5...50 mm <sup>2</sup> (14...1 AWG)<br>11.3...12.4 N•m<br>(100...110 in-lbs)   |         |           |  |
| Control terminals   | Cable size:<br>Tightening torque:                       |  | 0.2...2.5 mm <sup>2</sup> (24...14 AWG)<br>0.5...0.9 N•m (4.4...8.0 in-lbs) |          |            |                                      |           |  |         |           |  |
| Maximum continuous current  | 3 A   | 9 A  | 16 A  | 19 A     | 25 A       | 30 A                                 | 37 A      | 43 A   | 60 A    | 85 A      |  |
| Overload current range (A)  | 1...3   | 3...9  | 5.3...16  | 6.3...19 | 9.2...27.7 | 10...30                              | 12.3...37 | 14.3...43  | 20...60 | 28.3...85 |  |
| Control Voltage Requirements  | 100...240V AC or 24V AC/DC 50/60 Hz                     |  |   |          |            |                                      |           |  |         |           |  |
| Short Circuit Coordination (Max Fuse or Circuit Breaker Size) Type 1          |   |  |   |          |            |                                      |           |  |         |           |  |
| UL Class K5 Fuses<br>UL Listed Combination (600V)                             | 5 kA Available Fault Current                            |  |   |          |            |                                      |           |  |         |           |  |
|   | 10 A  | 35 A   | 60 A  | 70 A     | 100 A      | 110 A                                | 125 A     | 150 A  | —       | —         |  |
| UL Class K5 Fuses<br>UL Listed Combination (600V)                             | 10 kA Available Fault Current                           |  |   |          |            |                                      |           |  |         |           |  |
|   | —   | —  | —   | —        | —          | —                                    | —         | —  | 225 A   | 300 A     |  |
| UL Class RK5 Fuses<br>UL Listed Combination (600V)                            | 5 kA Available Fault Current                            |  |   |          |            |                                      |           |  |         |           |  |
|   | 10 A  | 35 A   | 60 A  | 70 A     | 100 A      | 110 A                                | 125 A     | 150 A  | —       | —         |  |
| UL Class RK5 Fuses<br>UL Listed Combination (600V)                            | 10 kA Available Fault Current                           |  |   |          |            |                                      |           |  |         |           |  |
|   | —   | —  | —   | —        | —          | —                                    | —         | —  | 225 A   | 300 A     |  |
| UL Listed Thermal Magnetic Circuit Breaker<br>UL Listed Combination (600V)    | 5 kA Available Fault Current                            |  |   |          |            |                                      |           |  |         |           |  |
|   | 15 A  | 35 A   | 60 A  | 70 A     | 100 A      | 110 A                                | 125 A     | 150 A  | —       | —         |  |
| UL Listed Thermal Magnetic Circuit Breaker<br>UL Listed Combination (600V)    | 10 kA Available Fault Current                           |  |   |          |            |                                      |           |  |         |           |  |
|   | —   | —  | —   | —        | —          | —                                    | —         | —  | 225 A   | 300 A     |  |
| UL Listed Bulletin 140M Motor Protection C.B.<br>UL Listed Combination (600V) | 5 kA Available Fault Current                            |  |   |          |            |                                      |           |  |         |           |  |
|   | C25   | C25  | F45   | F45      | F45        | F45                                  | F45       | —  | —       | —         |  |
| Power Circuit   |   |  |   |          |            |                                      |           |  |         |           |  |
|   | UL/cUL  |  |   |          |            | IEC                                  |           |  |         |           |  |
| Rated operational voltage   | 200...480V AC<br>200...600V AC                          |  |   |          |            | 200...480V~ — 400V~<br>500V~ — 500V~ |           |  |         |           |  |
| Rated insulation voltage  | 600V AC   |  |   |          |            | 500V~                                |           |  |         |           |  |
| Dielectric withstand  | 2200V AC  |  |   |          |            | 2500V~                               |           |  |         |           |  |
| Repetitive peak   | 200...480V AC — 1400V<br>200...600V AC — 1600V          |  |   |          |            | 200...480V~ — 1400V<br>500V~ — 1600V |           |  |         |           |  |
| Operating frequency   | 50/60 Hz  |  |   |          |            | 50/60 Hz                             |           |  |         |           |  |
| Utilization category  | 1...37 A  | Intermittent duty  |   |          |            | AC-53b: 3.5-15:3585                  |           |  |         |           |  |
|   | 43...85 A   |  |   |          |            | AC-53b: 4.5-30:3570                  |           |  |         |           |  |
| Number of poles   | Equipment designed for 3-phase only                     |  |   |          |            |                                      |           |  |         |           |  |
| Rated impulse voltage   | 6 kV  |  |   |          |            |                                      |           |  |         |           |  |
| DV/DT protection  | 1000V/μs  |  |   |          |            |                                      |           |  |         |           |  |
| Overvoltage category  | III   |  |   |          |            | III                                  |           |  |         |           |  |
| Control Circuit   |   |  |   |          |            |                                      |           |  |         |           |  |
|   | UL/cUL  |  |   |          |            | IEC                                  |           |  |         |           |  |
| Rated operational voltage (+10%, -15%)  | 100...240V AC, 24V AC/DC                                |  |   |          |            | 100...240V~, 24V AC/DC               |           |  |         |           |  |
| Rated insulation voltage  | 250V  |  |   |          |            | 250V~                                |           |  |         |           |  |
| Rated impulse voltage   | —   |  |   |          |            | 4 kV                                 |           |  |         |           |  |
| Dielectric withstand  | 1500V AC  |  |   |          |            | 2000V~                               |           |  |         |           |  |
| Overvoltage category  | —   |  |   |          |            | III *                                |           |  |         |           |  |
| Operating frequency   | 50/60 Hz  |  |   |          |            | 50/60 Hz                             |           |  |         |           |  |
| Input onstate voltage minimum, during start (IN1, IN2)                        | 85V AC, 19.2V DC / 13.5V AC                             |  |   |          |            |                                      |           |  |         |           |  |
| Input onstate current (IN1, IN2)  | 9.8 mA @120V AC/19.6 mA @ 240V AC, 7.3 mA @ 24V AC/DC   |  |   |          |            |                                      |           |  |         |           |  |
| Input offstate voltage maximum (IN1, IN2)                                     | 40V AC, 17V DC / 12V AC                                 |  |   |          |            |                                      |           |  |         |           |  |
| Input offstate current @ input offstate voltage (IN1, IN2)                    | <10 mA, <12 mA  |  |   |          |            |                                      |           |  |         |           |  |
| Control power with fan, during start  | 3...37 A  | 215 mA @ 120V AC / 180 mA @ 240V AC, 800 mA @ 24V DC / 660 mA @ 24V AC |   |          |            |                                      |           |  |         |           |  |
|   | 43...85 A   | 200 mA @ 120V AC / 100 mA @ 240V AC, 700 mA @ 24V AC/DC                |   |          |            |                                      |           |  |         |           |  |
| Control power without fan, during start                                       | 3...37 A  | 205 mA @ 120V AC / 145 mA @ 240V AC, 705 mA @ 24V DC / 580 mA @ 24V AC |   |          |            |                                      |           |  |         |           |  |

\* Overvoltage category II, when either control or auxiliary circuit is wired to a SELV or PELV circuit.



| Auxiliary Contacts                                 |   |   |                   |
|--|---|---|-------------------|
|  | UL/cUL  | IEC   |                   |
| Rated operational voltage                          | 250V AC / 30V DC  | 250V~ / 30V DC                                |                   |
| Rated insulation voltage                           | 250V  | 250V~   |                   |
| Rated impulse voltage                              | —   | 4 kV  |                   |
| Dielectric withstand                               | 1500V AC  | 2000V~  |                   |
| Overvoltage category                               | —   | III *   |                   |
| Operating frequency                                | 50/60 Hz  | 50/60 Hz                                      |                   |
| Utilization category                               | D300  | AC15  |                   |
| TB-97, -98<br>(OVL/D/Fault)                        | Type of control circuit   | Electromagnetic relay                         |                   |
|  | Number of contacts  | 1   |                   |
|  | Type of contacts  | Normally Open (N.O.)                          |                   |
|  | Kind of current   | AC/DC   |                   |
|  | Rated operational current (max.)  | 0.6 A @ 120V~ and 0.3 A @ 240V~               |                   |
|  | Conventional thermal current $I_{th}$   | 1 A   |                   |
|  | Make VA/break VA  | 432/72  |                   |
| TB-13, -14<br>(Normal/Up-to-Speed)                 | Type of control circuit   | Electromagnetic relay                         |                   |
|  | Number of contacts  | 1   |                   |
|  | Type of contacts  | Normally Open (N.O.)                          |                   |
|  | Kind of current   | AC/DC   |                   |
|  | Rated operational current (max.)  | 0.6 A @ 120V~ and 0.3 A @ 240V~               |                   |
|  | Conventional thermal current $I_{th}$   | 1 A   |                   |
|  | Make VA/break VA  | 432/72  |                   |
| Standard Features                                  |   |   |                   |
| Selectable start times                             | 2, 5, 10, or 15 s (3...85 A)<br>20, 25, or 30 s (43...85 A only)  |   |                   |
| Selectable initial torque                          | 15%, 25%, 35%, and 65% of locked rotor torque   |   |                   |
| Selectable current limit                           | 150%, 250%, 350%, and 450% of full load current   |   |                   |
| Selectable kick start — 450% FLA                   | 0, 0.5, 1.0, or 1.5 s   |   |                   |
| Selectable soft stop                               | Off, 100%, 200%, or 300% of the start time setting when wired   |   |                   |
| Weight — kg<br>(lbs)                               | 1...37 A  | 0.86 (1.9)                                    |                   |
|  | 43...85 A   | 2.25 (5)                                      |                   |
| Mechanical Design Specifications/Test Requirements |   |   |                   |
| Resistance to vibration                            | Operational   | 1.0 G peak, 0.152 mm (0.006 in.) displacement |                   |
|  | Non-operational   | 2.5 G peak, 0.381 mm (0.015 in.) displacement |                   |
| Resistance to shock                                | Operational   | 15 G  |                   |
|  | Non-operational   | 30 G  |                   |
| Environmental                                      |   |   |                   |
| Operating temperature                              | 0...50 °C (32...122 °F) (open)<br>0...40 °C (32...104 °F) (enclosed)                                    |   |                   |
| Storage temperature                                | -25...85 °C (-13...185 °F)  |   |                   |
| Altitude   | 2000 m (6560 ft)  |   |                   |
| Humidity   | 5...95% (non-condensing)  |   |                   |
| Pollution degree                                   | 2   |   |                   |
| Type of Protection                                 | IP2X  |   |                   |
| Other  |   |   |                   |
|  | UL/cUL  | IEC   |                   |
| EMC emission levels                                | Conducted radio frequency emissions   | —   |                   |
|  | Radiated emissions  | —   |                   |
| EMC immunity levels                                | Electrostatic discharge   | 4 kV contact and 8kV air discharge            |                   |
|  | Radio frequency electromagnetic field   | —   | Per IEC 60947-4-2 |
|  | Fast transient  | —   | Per IEC 60947-4-2 |
|  | Surge transient   | —   | Per IEC 60947-4-2 |
| Wiring Diagrams                                    | Can be found in pub. 150-SG006C-EN-P or at <a href="http://www.ab.com/catalogs">www.ab.com/catalogs</a> |   |                   |

\* Overvoltage category II, when either control or auxiliary circuit is wired to a SELV or PELV circuit.

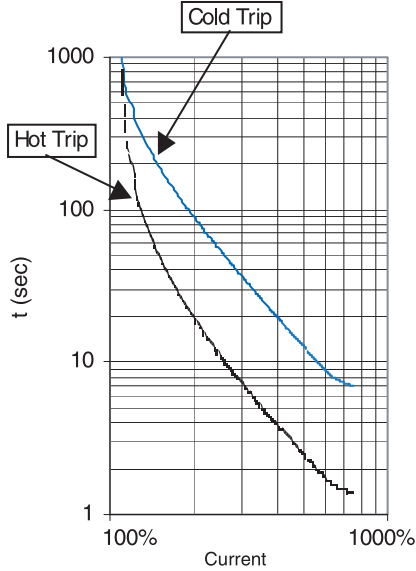
Bulletin 150  
**Smart Motor Controllers — SMC-3™**  
 Specifications, Continued

| Side-Mount Auxiliary Contact Specifications                              |                                       |   |                |
|--|---------------------------------------|---|----------------|
|  |                                       | UL/cUL  | IEC            |
| Rated Operational Voltage  |                                       | 250V AC/30V DC                                    | 250V AC/30V DC |
| Rated Insulation Voltage   |                                       | 250V  | 250V AC        |
| Rated Impulse Voltage  |                                       | —   | 4 kV           |
| Dielectric Withstand   |                                       | 1500V AC  | 2000V AC       |
| Overvoltage Category   |                                       | —   | III *          |
| Operating Frequency  |                                       | 50/60 Hz  | 50/60 Hz       |
| TB-23, -24<br>(Normal/Up-to-Speed)<br>TB-33, -34<br>(Normal/Up-to-Speed) | Utilization Category                  | C300/R150   | AC-15/DC-13    |
|  | Type of Control Circuit               | Electromagnetic Relay                             |                |
|  | No. of Contacts                       | 1   |                |
|  | Type of Contact                       | Normally Open (N.O.)                              |                |
|  | Current                               | AC/DC   |                |
|  | Rated Operational Current (max.)      | 1.5 A @ 120V AC, 0.75A @ 240V AC, 1.17 A @ 24V DC |                |
|  | Conventional Thermal Current $I_{th}$ | 2.5 A   |                |
|  | Make VA/Break VA                      | 1800/180V AC, 28V DC                              |                |
| TB-11, -12<br>(Normal/Up-to-Speed)                                       | Utilization Category                  | B300/R300   | AC-15/DC-13    |
|  | Type of Control Circuit               | Electromagnetic Relay                             |                |
|  | No. of Contacts                       | 1   |                |
|  | Type of Contact                       | Normally Closed (N.C.)                            |                |
|  | Current                               | AC/DC   |                |
|  | Rated Operational Current (max.)      | 3 A @ 120V AC, 1.5A @ 240V AC, 1.17 A @ 24V DC    |                |
|  | Conventional Thermal Current $I_{th}$ | 5 A   |                |
|  | Make VA/Break VA                      | 3600/360 V AC, 28V DC                             |                |

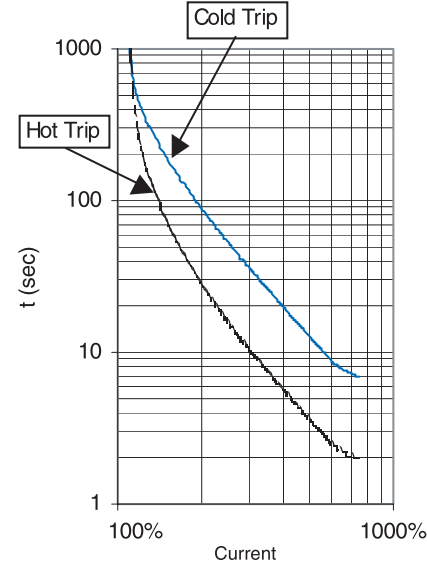
\* Overvoltage category II when either control or auxiliary circuit is wired to a SELV or PELV circuit.

**SMC-3 Overload Trip Curves**

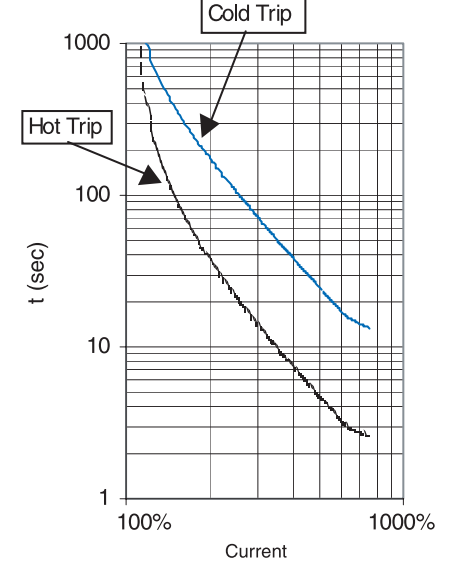
**Trip Class 10**



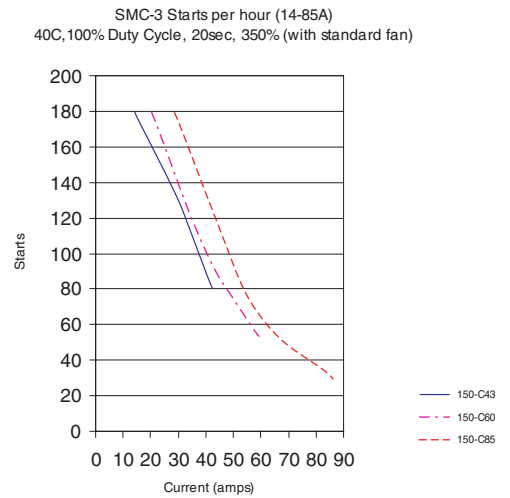
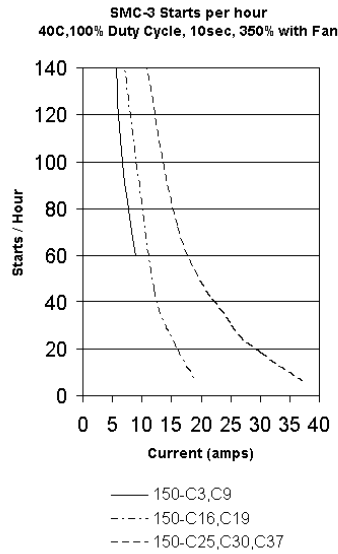
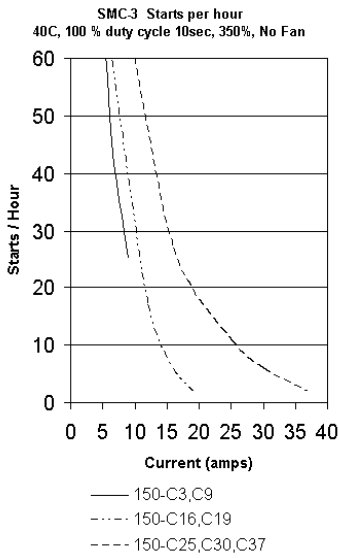
**Trip Class 15**



**Trip Class 20**



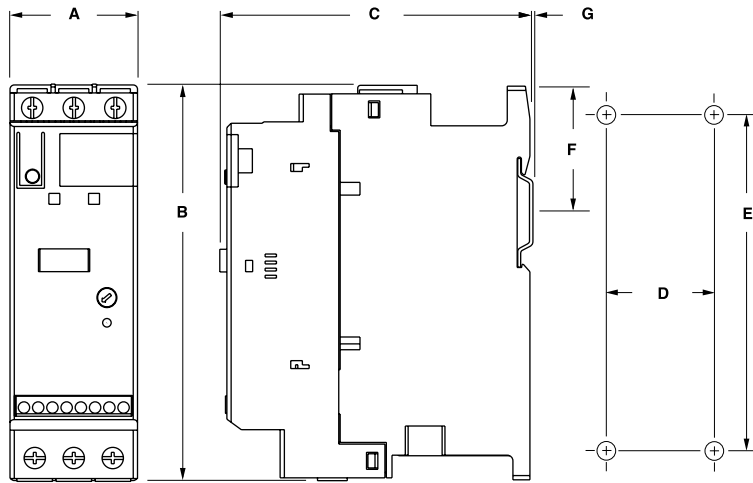
**Starts per Hour Curves**



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**Smart Motor Controllers — SMC-3™**  
 Approximate Dimensions

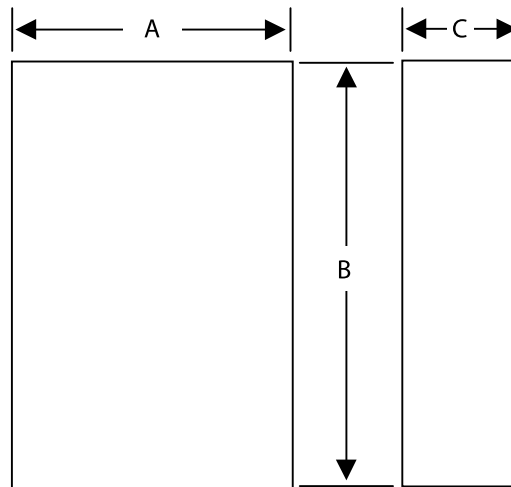
Dimensions in millimeters (inches). Dimensions are not intended to be used for manufacturing purposes. All dimensions are subject to change.

Open Type



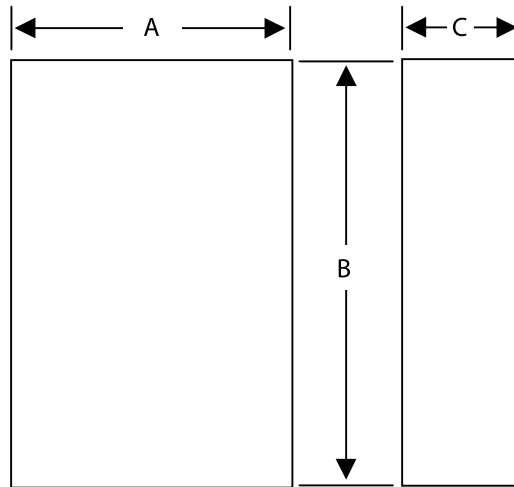
| Controller | A              | B             | C             | D          | E             | F           | G        | Mounting Hole Size |
|------------|----------------|---------------|---------------|------------|---------------|-------------|----------|--------------------|
| 1...37 A   | 44.8 (1-49/64) | 139.7 (5-1/2) | 100 (4-21/64) | 35 (1-3/8) | 132 (5-13/64) | 46.4 (1.81) | 2 (1/16) | 4.6 (0.18)         |
| 43...85 A  | 72 (2.83)      | 206 (8.11)    | 130 (5.12)    | 55 (2.17)  | 198 (7.8)     | 102 (4.02)  | 2 (1/16) | 5.3 (0.21)         |

Minimum Enclosure Size



| Controller | A Width  | B Height | C Depth | Fan Requirements |
|------------|----------|----------|---------|------------------|
| 1...37 A   | 224 (9)  | 305 (12) | 152 (6) | none             |
| 43...85 A  | 406 (16) | 305 (12) | 203 (8) | none             |

Enclosed Type Controllers



| Controller Rating (A)                                  | Disconnect Rating (A) | IP65 (Type 4/12) |          |          |
|--|-----------------------|------------------|----------|----------|
|  |                       | B Height         | A Width  | C Depth  |
| <b>Non-Combination Controller</b>                      |                       |                  |          |          |
| 3  | —                     | 305 (12)         | 305 (12) | 152 (6)  |
| 9  | —                     | 305 (12)         | 305 (12) | 152 (6)  |
| 16   | —                     | 305 (12)         | 305 (12) | 152 (6)  |
| 25   | —                     | 305 (12)         | 305 (12) | 152 (6)  |
| 30   | —                     | 305 (12)         | 305 (12) | 152 (6)  |
| 37   | —                     | 305 (12)         | 305 (12) | 152 (6)  |
| 43   | —                     | 356 (14)         | 406 (16) | 203 (8)  |
| 60   | —                     | 356 (14)         | 406 (16) | 203 (8)  |
| 85   | —                     | 356 (14)         | 406 (16) | 203 (8)  |
| <b>Combination Controllers with Fusible Disconnect</b> |                       |                  |          |          |
| 3  | 30 A/J                | 356 (14)         | 406 (16) | 203 (8)  |
| 9  | 30 A/J                | 356 (14)         | 406 (16) | 203 (8)  |
| 16   | 30 A/J                | 356 (14)         | 406 (16) | 203 (8)  |
| 25   | 30 A/J                | 356 (14)         | 406 (16) | 203 (8)  |
| 30   | 60 A/J                | 356 (14)         | 406 (16) | 203 (8)  |
| 37   | 60 A/J                | 356 (14)         | 406 (16) | 203 (8)  |
| 43   | 60 A/J                | 356 (14)         | 406 (16) | 203 (8)  |
| 60   | 100 A/J               | 610 (24)         | 406 (16) | 229 (9)  |
| 85*  | 100 A/J               | 610 (24)         | 406 (16) | 229 (9)  |
| 85*  | 100 A/J               | 762 (30)         | 610 (24) | 305 (12) |
| <b>Combination Controllers with Circuit Breaker</b>    |                       |                  |          |          |
| 3  | 15 A                  | 356 (14)         | 406 (16) | 203 (8)  |
| 9  | 15 A                  | 356 (14)         | 406 (16) | 203 (8)  |
| 16   | 20 A                  | 356 (14)         | 406 (16) | 203 (8)  |
| 25   | 30 A                  | 356 (14)         | 406 (16) | 203 (8)  |
| 30   | 40 A                  | 356 (14)         | 406 (16) | 203 (8)  |
| 37   | 50 A                  | 356 (14)         | 406 (16) | 203 (8)  |
| 43   | 80 A                  | 610 (24)         | 406 (16) | 229 (9)  |
| 60   | 100 A                 | 610 (24)         | 406 (16) | 229 (9)  |
| 85   | 125 A                 | 610 (24)         | 406 (16) | 229 (9)  |

\* Dimensions for FHD-43, FAD-44, FBD-47, and FCD-48.






\* Dimensions for FHD-44, FAD-45, FBD-48, and FCD-49




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**Smart Motor Controllers — SMC-3™**  
 Enclosed Options


Enclosed Options



| Option                      | Description  | Cat. No. Modification |
|-----------------------------|--|-----------------------|
| Push Buttons                | Start-Stop Push Button                                       | -1                    |
| Selector Switch             | Hand-Off-Auto Selector Switch                                | -3                    |
| Pilot Light                 | Transformer Pilot Light (Red Lens)                           | -4R                   |
| Control Circuit Transformer | Control Circuit Transformer (fused primary and secondary)    | -6P                   |
| Protective Module           | 480V Line Side Protective Module                             | 3...85 A              |
|                             | 600V Line Side Protective Module                             | 3...85 A              |
|                             | 480V Load Side Protective Module                             | 43...85 A             |
|                             | 600V Load Side Protective Module                             | 43...85 A             |
|                             | 480V Both Line and Load Side Protective Module               | 43...85 A             |
|                             | 600V Both Line and Load Side Protective Module               | 43...85 A             |
| Auxiliary Contacts          | 1 N.O. auxiliary contact                                     | for 3...85 A units    |
|                             | 2 N.O. auxiliary contacts                                    | for 3...85 A units    |
|                             | 1 N.O. and 1 N.C. auxiliary contacts                         | for 3...85 A units    |
| Disconnect Auxiliary        | N.O. disconnect auxiliary mounted on the operating mechanism | -98                   |
|                             | N.C. disconnect auxiliary mounted on the operating mechanism | -99                   |

Accessories (SMC-3 and SMC-Delta)

| Description   | N.O. | N.C. | Connection Diagram  |   |   |   | Cat. No.          |
|---|------|------|---|---|---|---|-------------------|
|  <p><b>Auxiliary Contact Blocks for Side Mounting with Sequence Terminal Designations</b><br/>                     1- and 2-pole<br/>                     Quick and easy mounting without tools<br/>                     One block per device only</p> | 1    | 0    |  |  |  |  | 150-CA10          |
|   | 2    | 0    |   |   |   |   | 150-CA20          |
|   | 0    | 1    |   |   |   |   | 150-CA01          |
|   | 1    | 1    |   |   |   |   | 150-CA11 (Form C) |

| Description   | For Use With                                     | Pkg. Qty. | Cat. No.  |
|---|--|-----------|-----------|
|  <p><b>Fan</b><br/>                     Field installed.</p>   | 150-C3...37/150-D3...64                          | 1         | 150-CF64  |
|   | 150-C43...85/150-D74...147                       |           | 150-CF147 |
|  <p><b>Connecting modules to 140M</b><br/>                     Electrical interconnection between SMC-Delta/SMC-3 and 140M.<br/>                     Motor protector and SMC must be mounted separately.</p> | Connects 140M-C to 150-C3...25/150-D3...25       | 1         | 150-CC25  |
|   | Connects 140M-D to 150-C3...25/150-D3...25       | 1         | 150-CD25  |
|   | Connects 140M-F to 150-C3...37/150-D3...32       | 1         | 150-CF45  |
|  <p><b>Connecting modules to 100C</b><br/>                     Electrical interconnection between SMC-Delta/SMC-3 and 100C.<br/>                     Contactor and SMC must be mounted separately.</p>       | Connects 100-C09...23 to 150-C3...19/150-D3...20 | 1         | 150-CI23  |
|   | Connects 100-C30...37 to 150-C3...37/150-D3...32 | 1         | 150-CI37  |

| Description   | For Use With                      | Cat. No. |
|---|-----------------------------------|----------|
|  <p><b>480V Protective Module</b></p> | 150-C3...37NB or 150-D3...64NB    | 150-C84  |
|   | 150-C43...85NB or 150-D74...147NB | 150-C84P |
| <p><b>600V Protective Module</b></p>  | 150-C3...37NC or 150-D3...64NC    | 150-C86  |
|   | 150-C43...85NC or 150-D74...147NC | 150-C86P |

| Description  | For Use With | Pkg. Qty. | Cat. No. |
|--|--------------|-----------|----------|
|  <p><b>Marking Tag Sheet</b><br/>                     10 sheets with 160 perforated paper labels each, 6 x 17 mm<br/>                     To be used with a transparent cover</p> | 150-C, 150-D | 10        | 100-FMP  |
|  |              |           |          |
| <p><b>Transparent Cover</b><br/>                     100 each<br/>                     To be used with marking tag sheets</p>  | 150-C, 150-D | 100       | 100-FMC  |
|  <p>Remote Reset Solenoid for remote reset of electronic overload</p>   | 150-C, 150-D | 1         | 193-ER1⊗ |

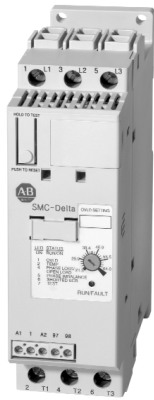
⊗ Voltage Suffix Code

Available Coil Voltages 12... 600V 50 Hz/12...600V 60 Hz

Standard Coil Voltages

| Voltage | 24  | 48  | 110 | 115 | 120 | 220 | 220...230 | 240 |
|---------|-----|-----|-----|-----|-----|-----|-----------|-----|
| 50 Hz   | J   | —   | D   | —   | —   | A   | F         | —   |
| 60 Hz   | J   | —   | —   | —   | D   | —   | —         | A   |
| DC      | Z24 | Z48 | —   | Z01 | —   | —   | —         | —   |

Surcharge for special voltages up to 20 pcs. (no surcharge for quantities greater than 20 pcs.)



**Bulletin 150 — Smart Motor Controllers — SMC-Delta™ Smart Motor Controller**

The **SMC-Delta™** is a compact, simple to use, solid-state motor controller designed to operate 3-phase **star-delta** motors wired on an inside-the-delta configuration. This **star-delta replacer** is ideally designed for 6-lead motor applications. It features a built-in overload relay and a built-in silicon controlled rectifier (SCR) bypass contactor on all three phases, allowing a smaller footprint than traditional methods of starting. This product is designed for many applications including compressors, chillers, pumps, conveyors, and crushers. Modes of operation for the controller are as follows:

- Current Limit Start
- Coast to Rest

The controllers are available in 11 sizes: 3, 9, 16, 20, 25, 32, 51, 64, 74, 104, and 147 A. They offer two voltage ranges: 200...460V AC and 200...575V AC. All voltage ranges will operate at either 50 or 60 Hz.

- 1...147 A Range
- Built-in Motor Overload Protection
- Built-in SCR Bypass

**Table of Contents**

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 Typical Wiring Diagrams ..... 29  
 Specifications ..... 31  
 Approximate Dimensions ..... 34  
 Accessories (SMC-3 and SMC-Delta) ..... 25

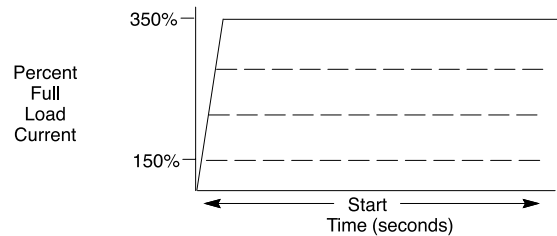
**Standards Compliance/Approvals**

- UL 508
- CSA C22.2 No. 14
- EN/IEC 60947-4-2
- cULus Listed (Open Type) (File No. E96956)
- CE Marked (Open Type) per EMC Directive and Low Voltage Directive

**Mode of Operation**

**Current Limit Start**

This starting mode is used when it is necessary to limit the maximum starting current. It can be adjusted for 150%, 250%, 300%, or 350% of full load amps. Start times are selectable from 2, 5, 10, or 15 s.



**Description of Protection Features**

**Overload Protection**

The SMC-Delta has a built-in overload feature. Trip class selection consists of either OFF, 10, 15, or 20. It provides improved protection against the damage caused to motors when operated under phase loss conditions. Trip reset is selectable to either automatic or manual mode. As standard, it includes a manually generated trip function, LED indication, and N.O. alarm contact.

**Over-temperature**

The SMC-Delta monitors the SCR temperature by means of internal thermistors. When the power poles maximum rated temperature is reached, the microcomputer switches off the SMC and a TEMP fault is indicated via LED.

**Phase Loss/Open Load**

The unit will not attempt a start if there is a single-phase condition on the line. This protects from motor burnout during single-phase starting.

**Phase Imbalance**

The unit monitors for imbalance between phase currents. To prevent motor damage, the unit will trip if the phase imbalance exceeds specified limits and a fault will be indicated on the LED.

**Shorted SCR**

Prior to every start, the unit will check all SCRs for shorts and unit load connections to the motor. If there is a shorted SCR in the SMC-Delta, the start will be aborted and a shorted SCR fault will be indicated. This prevents damage from phase imbalance.

**Push to Test**

The unit with control wiring can be tested for fault conditions by using the Push to Test function. Hold down the Reset button for 5 seconds to activate the fault Aux (97, 98) and shut down the SMC-3.

**LED Description (Number of Flashes)**

1. Overload
2. Overtemperature
3. Not Used
4. Phase Loss/Open Load
5. Phase Imbalance
6. Shorted SCR
7. Test



Open Type

**150 – D 32 N B D**  
*a b c d e f*

**a**

| Bulletin Number |                        |
|-----------------|------------------------|
| Code            | Description            |
| 150             | Solid-State Controller |

**b**

| Controller Type |             |
|-----------------|-------------|
| Code            | Description |
| D               | SMC-Delta   |

**c**

| Ampere Ratings |             |
|----------------|-------------|
| Code           | Description |
| 3              | 3 A         |
| 9              | 9 A         |
| 16             | 16 A        |
| 20             | 20 A        |
| 25             | 25 A        |
| 32             | 32 A        |
| 51             | 51 A        |
| 64             | 64 A        |
| 74             | 74 A        |
| 104            | 104 A       |
| 147            | 147 A       |

**d**

| Enclosure Type |             |
|----------------|-------------|
| Code           | Description |
| N              | Open        |

**e**

| Input Line Voltage<br>Open Type |                                  |
|---------------------------------|----------------------------------|
| Code                            | Description                      |
| B                               | 200...460V AC, 3-Phase, 50/60 Hz |
| C                               | 200...575V AC, 3-Phase, 50/60 Hz |

**f**

| Control Voltage |               |
|-----------------|---------------|
| Code            | Description   |
| D               | 100...240V AC |
| R               | 24V AC/DC     |

Bulletin 150  
**Smart Motor Controllers - SMC-Delta™**  
 Product Selection

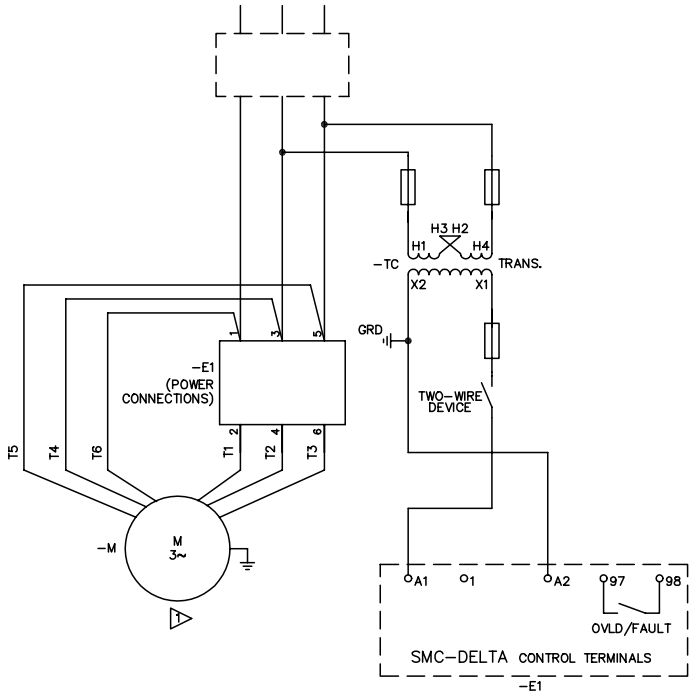
Product Selection  
 Open Type Controllers

| Rated Voltage<br>[V AC] | Current<br>Rating (A)<br>* | kW   | Hp        | 100...240V<br>AC, 50/60 Hz<br>Control | 24V AC/DC<br>Control |
|-------------------------|----------------------------|------|-----------|---------------------------------------|----------------------|
|                         |                            |      |           | Cat. No.                              | Cat. No.             |
| 200/208                 | 1...3                      | —    | 0.5       | 150-D3NBD                             | 150-D3NBR            |
|                         | 3...9                      | —    | 0.75...2  | 150-D9NBD                             | 150-D9NBR            |
|                         | 5.3...16                   | —    | 1.5...3   | 150-D16NBD                            | 150-D16NBR           |
|                         | 6.7...20                   | —    | 2...5     | 150-D20NBD                            | 150-D20NBR           |
|                         | 9.2...27.7                 | —    | 3...7.5   | 150-D25NBD                            | 150-D25NBR           |
|                         | 10.6...32.9                | —    | 3...10    | 150-D32NBD                            | 150-D32NBR           |
|                         | 17.3...51.9                | —    | 5...15    | 150-D51NBD                            | 150-D51NBR           |
|                         | 21.3...64                  | —    | 7.5...20  | 150-D64NBD                            | 150-D64NBR           |
|                         | 24.7...74                  | —    | 7.5...20  | 150-D74NBD                            | 150-D74NBR           |
|                         | 34.7...104                 | —    | 15...30   | 150-D104NBD                           | 150-D104NBR          |
| 230                     | 49...147                   | —    | 15...40   | 150-D147NBD                           | 150-D147NBR          |
|                         | 1...3                      | 0.55 | 0.5       | 150-D3NBD                             | 150-D3NBR            |
|                         | 3...9                      | 2.2  | 0.75...2  | 150-D9NBD                             | 150-D9NBR            |
|                         | 5.3...16                   | 4    | 1.5...5   | 150-D16NBD                            | 150-D16NBR           |
|                         | 6.7...20                   | 5.5  | 2...5     | 150-D20NBD                            | 150-D20NBR           |
|                         | 9.2...27.7                 | 5.5  | 3...7.5   | 150-D25NBD                            | 150-D25NBR           |
|                         | 10.6...32.9                | 7.5  | 5...10    | 150-D32NBD                            | 150-D32NBR           |
|                         | 17.3...51.9                | 15   | 7.5...15  | 150-D51NBD                            | 150-D51NBR           |
|                         | 21.3...64                  | 18.5 | 7.5...20  | 150-D64NBD                            | 150-D64NBR           |
|                         | 24.7...74                  | 22   | 7.5...25  | 150-D74NBD                            | 150-D74NBR           |
| 380/400/<br>415/460     | 34.7...104                 | 30   | 15...40   | 150-D104NBD                           | 150-D104NBR          |
|                         | 49...147                   | 45   | 20...50   | 150-D147NBD                           | 150-D147NBR          |
|                         | 1...3                      | 1.1  | 0.5...1.5 | 150-D3NBD                             | 150-D3NBR            |
|                         | 3...9                      | 4    | 1.5...5   | 150-D9NBD                             | 150-D9NBR            |
|                         | 5.3...16                   | 7.5  | 5...10    | 150-D16NBD                            | 150-D16NBR           |
|                         | 6.7...20                   | 7.5  | 5...10    | 150-D20NBD                            | 150-D20NBR           |
|                         | 9.2...27.7                 | 11   | 7.5...15  | 150-D25NBD                            | 150-D25NBR           |
|                         | 10.6...32.9                | 15   | 7.5...20  | 150-D32NBD                            | 150-D32NBR           |
|                         | 17.3...51.9                | 22   | 15...30   | 150-D51NBD                            | 150-D51NBR           |
|                         | 21.3...64                  | 30   | 20...40   | 150-D64NBD                            | 150-D64NBR           |
| 500/575                 | 24.7...74                  | 37   | 15...50   | 150-D74NBD                            | 150-D74NBR           |
|                         | 34.7...104                 | 55   | 25...75   | 150-D104NBD                           | 150-D104NBR          |
|                         | 49...147                   | 75   | 40...100  | 150-D147NBD                           | 150-D147NBR          |
|                         | 1...3                      | 0.55 | 0.5       | 150-D3NCD                             | 150-D3NCR            |
|                         | 3...9                      | 2.2  | 0.75...2  | 150-D9NCD                             | 150-D9NCR            |
|                         | 5.3...16                   | 4    | 1.5...3   | 150-D16NCD                            | 150-D16NCR           |
|                         | 6.7...20                   | 5.5  | 2...5     | 150-D20NCD                            | 150-D20NCR           |
|                         | 9.2...25                   | 5.5  | 3...7.5   | 150-D25NCD                            | 150-D25NCR           |
|                         | 10.6...32                  | 7.5  | 3...10    | 150-D32NCD                            | 150-D32NCR           |
|                         | 17...51                    | 15   | 5...15    | 150-D51NCD                            | 150-D51NCR           |
| 500/575                 | 21.3...64                  | 18.5 | 7.5...20  | 150-D64NCD                            | 150-D64NCR           |
|                         | 24.7...74                  | 22   | 7.5...20  | 150-D74NCD                            | 150-D74NCR           |
|                         | 34.7...104                 | 30   | 15...30   | 150-D104NCD                           | 150-D104NCR          |
|                         | 49...147                   | 45   | 15...40   | 150-D147NCD                           | 150-D147NCR          |

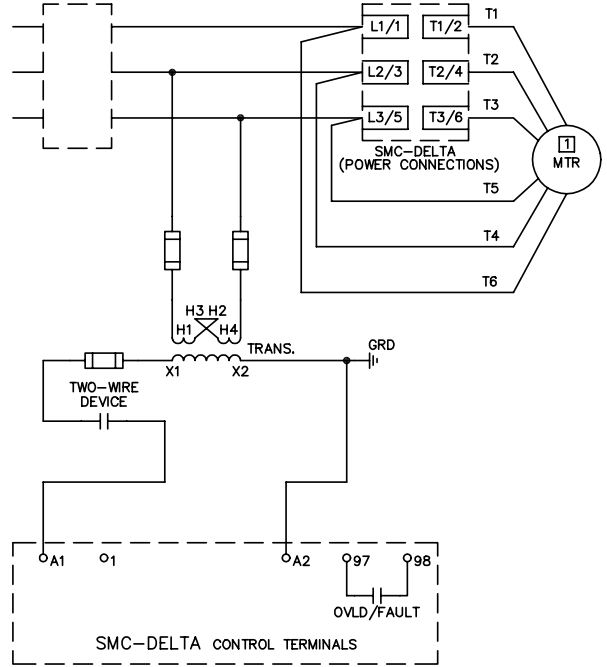
\* Motor FLA must fall within the current range of the device.

**Two-Wire Configuration**

IEC

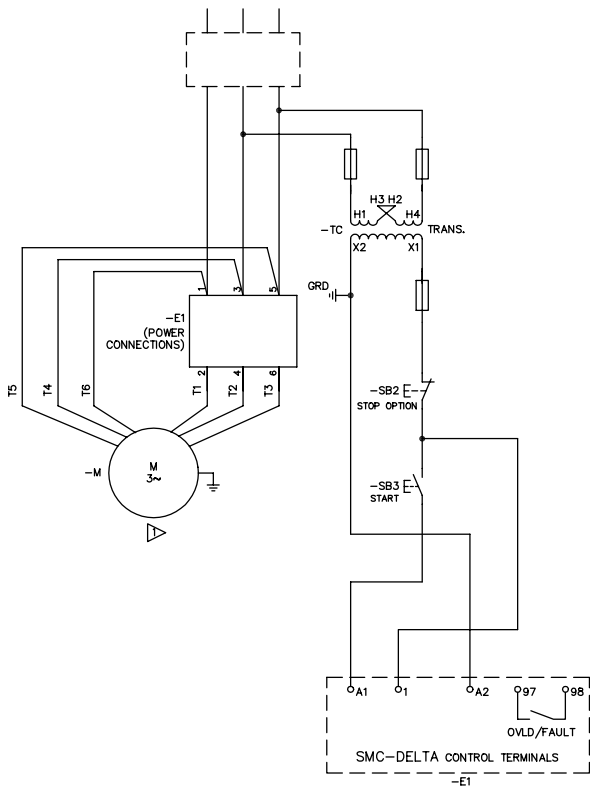


NEMA

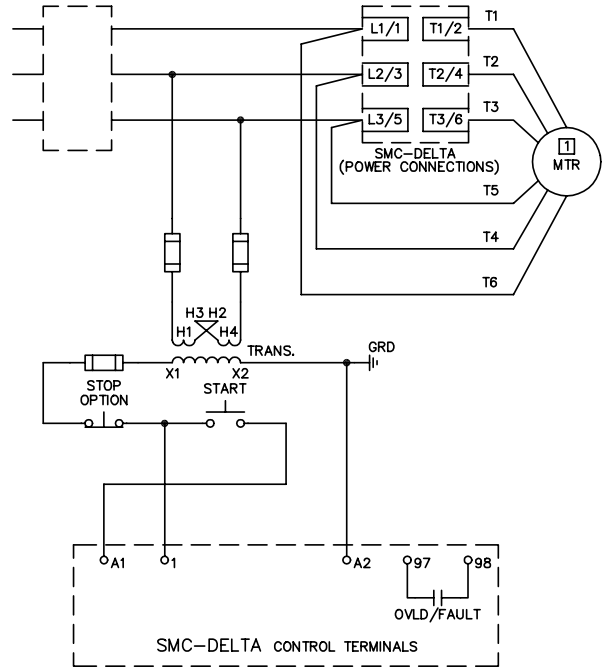


**Three-Wire Configuration**

IEC

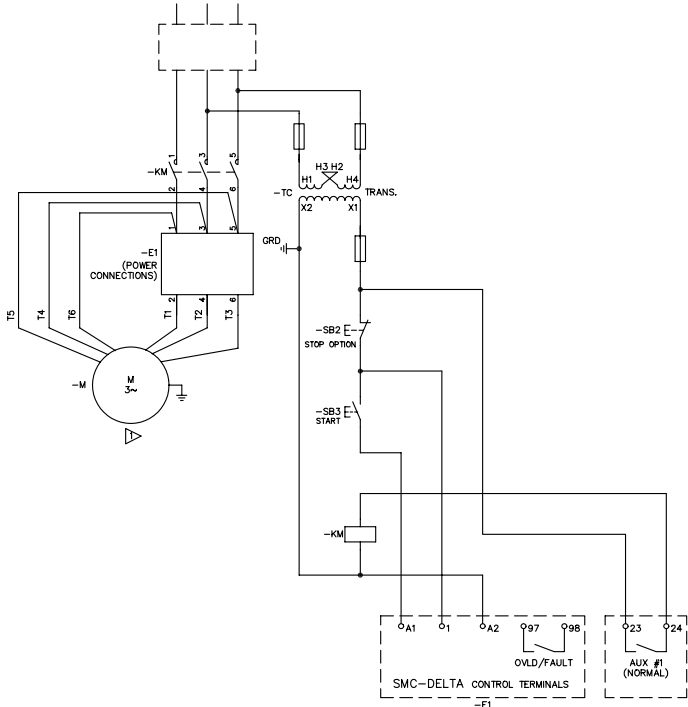


NEMA

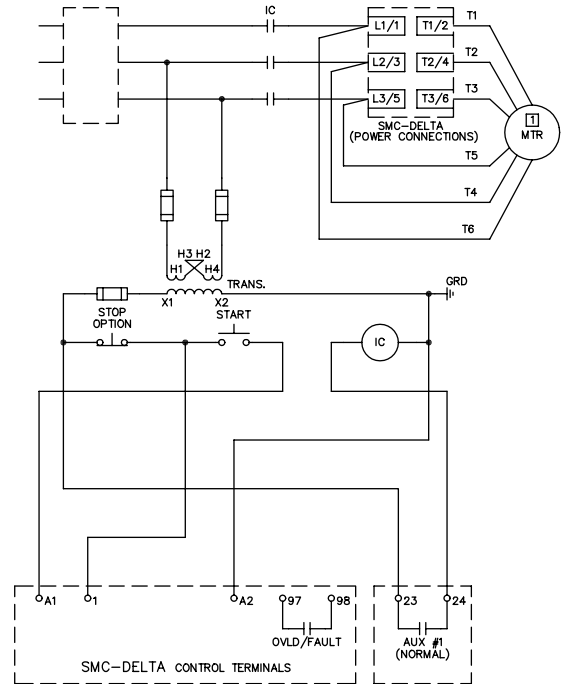


Isolation Contactor Configuration

IEC



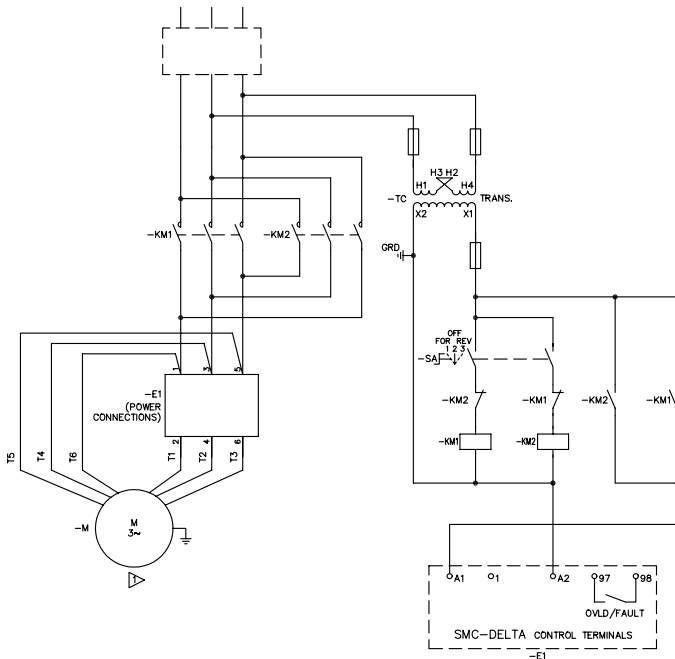
NEMA



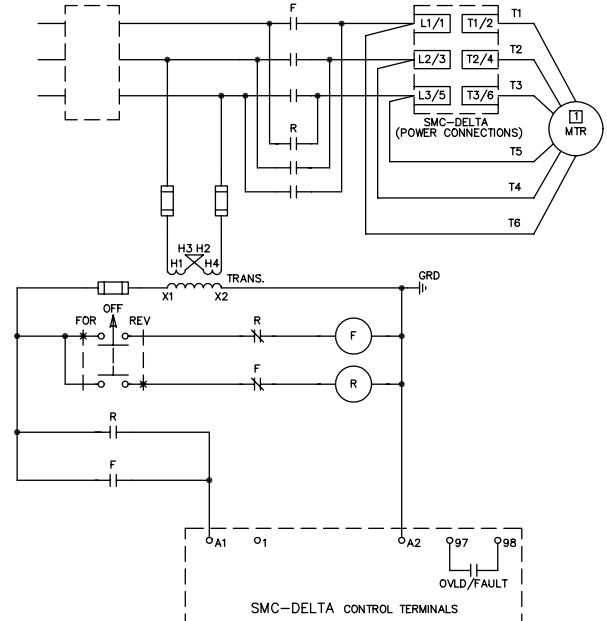
Reversing Configuration

Note: Minimum Off time equals 1.0 s.

IEC



NEMA



| Electrical Ratings Cat. Nos. 150-...                                 |                                     |   |          |          |            |                     |                     |   |           |            |          |    |
|--|-------------------------------------|---|----------|----------|------------|---------------------|---------------------|---|-----------|------------|----------|----|
| Cat. No.   | D3                                  | D9  | D16      | D20      | D25        | D32                 | D51                 | D64                                     | D74       | D104       | D147     |    |
| Rated operating current $I_g$ (A)                                    | 3                                   | 9   | 16       | 20       | 25         | 32                  | 51                  | 64                                      | 74        | 104        | 147      |    |
| Heat dissipation (W)   | Continuous                          | 7   | 7        | 7        | 8          | 8                   | 10                  | 14                                      | 19        | 27         | 42       | 74 |
|  | Rated operating voltage             | 200...480, 500...600V AC 50/60 Hz, 3-phase (+10%, -15%) |          |          |            |                     |                     |   |           |            |          |    |
| Line Power terminals   | Cable size:                         | 2.5...25 mm <sup>2</sup> (14...4 AWG)                   |          |          |            |                     |                     | 2.5...95 mm <sup>2</sup> (14...3/0 AWG) |           |            |          |    |
|  | Tightening torque:                  | 2.3...3.4 N•m (20...30 in-lbs)                          |          |          |            |                     |                     | 11.3...12.4 N•m (100...110 in-lbs)      |           |            |          |    |
| Load Power terminals   | Cable size:                         | 2.5...16 mm <sup>2</sup> (14...6 AWG)                   |          |          |            |                     |                     | 2.5...50 mm <sup>2</sup> (14...1 AWG)   |           |            |          |    |
|  | Tightening torque:                  | 2.3...3.4 N•m (20...30 in-lbs)                          |          |          |            |                     |                     | 11.3...12.4 N•m (100...110 in-lbs)      |           |            |          |    |
| Control terminals  | Cable size:                         | 0.2...2.5 mm <sup>2</sup> (24...14 AWG)                 |          |          |            |                     |                     |   |           |            |          |    |
|  | Tightening torque:                  | 0.5...0.9 N•m (4.4...8.0 in-lbs)                        |          |          |            |                     |                     |   |           |            |          |    |
| Maximum continuous current   | 3 A                                 | 9 A   | 16 A     | 20 A     | 25 A       | 32 A                | 51 A                | 64 A                                    | 74 A      | 104 A      | 147 A    |    |
| Maximum delta amps   | 1.74                                | 5.2   | 9.3      | 11.6     | 14.5       | 17.4                | 29.6                | 36.5                                    | 42.8      | 60.1       | 85       |    |
| Overload current range (A)   | 1...3                               | 3...9   | 5.3...16 | 6.7...20 | 9.2...27.7 | 10.6...32.9         | 17.3...51.9         | 21.3...64                               | 24.7...74 | 34.7...104 | 49...147 |    |
| Control Voltage Requirements   | 100...240V AC or 24V AC/DC 50/60 Hz |   |          |          |            |                     |                     |   |           |            |          |    |
| Short Circuit Coordination (Max Fuse or Circuit Breaker Size) Type 1 |                                     |   |          |          |            |                     |                     |   |           |            |          |    |
| UL Class K5 Fuses  | 5 kA Available Fault Current        |   |          |          |            |                     |                     |   |           |            |          |    |
| UL Listed Combination (600V)   | 10 A                                | 35 A  | 60 A     | 80 A     | 100 A      | 125 A               | —                   | —                                       | —         | —          | —        |    |
| UL Class K5 Fuses  | 10 kA Available Fault Current       |   |          |          |            |                     |                     |   |           |            |          |    |
| UL Listed Combination (600V)   | —                                   | —   | —        | —        | —          | —                   | 200 A               | 250 A                                   | 250 A     | 400 A      | 400 A    |    |
| UL Class RK5 Fuses   | 5 kA Available Fault Current        |   |          |          |            |                     |                     |   |           |            |          |    |
| UL Listed Combination (600V)   | 10 A                                | 35 A  | 60 A     | 80 A     | 100 A      | 125 A               | —                   | —                                       | —         | —          | —        |    |
| UL Class RK5 Fuses   | 10 kA Available Fault Current       |   |          |          |            |                     |                     |   |           |            |          |    |
| UL Listed Combination (600V)   | —                                   | —   | —        | —        | —          | —                   | 200 A               | 250 A                                   | 250 A     | 400 A      | 400 A    |    |
| UL Listed Thermal Magnetic Circuit Breaker                           | 5 kA Available Fault Current        |   |          |          |            |                     |                     |   |           |            |          |    |
| UL Listed Combination (600V)   | 10 A                                | 35 A  | 60 A     | 80 A     | 100 A      | 125 A               | —                   | —                                       | —         | —          | —        |    |
| UL Listed Thermal Magnetic Circuit Breaker                           | 10 kA Available Fault Current       |   |          |          |            |                     |                     |   |           |            |          |    |
| UL Listed Combination (600V)   | —                                   | —   | —        | —        | —          | —                   | 200 A               | 250 A                                   | 250 A     | 300 A      | 400 A    |    |
| UL Listed Bulletin 140M Motor Protection C.B.                        | 5 kA Available Fault Current        |   |          |          |            |                     |                     |   |           |            |          |    |
| UL Listed Combination (600V)   | C25                                 | C25   | C25      | F45      | F45        | F45                 | —                   | —                                       | —         | —          | —        |    |
| Power Circuit  |                                     |   |          |          |            |                     |                     |   |           |            |          |    |
|  | UL/cUL                              |   |          |          |            | IEC                 |                     |   |           |            |          |    |
| Rated operational voltage  | 200...480V AC                       |   |          |          |            | 200...480V~ — 400V~ |                     |   |           |            |          |    |
|  | 500...600V AC                       |   |          |          |            | 500V~ — 500V~       |                     |   |           |            |          |    |
| Rated insulation voltage   | 600V AC                             |   |          |          |            | 500V~               |                     |   |           |            |          |    |
| Dielectric withstand   | 2200V AC                            |   |          |          |            | 2500V~              |                     |   |           |            |          |    |
| Repetitive peak  | 200...480V AC — 1400V               |   |          |          |            | 200...480V~ — 1400V |                     |   |           |            |          |    |
|  | 500...600V AC — 1600V               |   |          |          |            | 500V~ — 1600V       |                     |   |           |            |          |    |
| Operating frequency  | 50/60 Hz                            |   |          |          |            | 50/60 Hz            |                     |   |           |            |          |    |
| Utilization category   | 1...64 A                            | Intermittent duty                                       |          |          |            |                     | AC-53b: 3.5-15:3585 |   |           |            |          |    |
|  | 74...147 A                          |   |          |          |            |                     | AC-53b: 3.5-30:3570 |   |           |            |          |    |
| Number of poles  | Equipment designed for 3-phase only |   |          |          |            |                     |                     |   |           |            |          |    |
| Rated impulse voltage  | 6 kV                                |   |          |          |            |                     |                     |   |           |            |          |    |
| DV/DT protection   | 1000 V/μs                           |   |          |          |            |                     |                     |   |           |            |          |    |
| Overvoltage Category   | III                                 |   |          |          |            | III                 |                     |   |           |            |          |    |
| Environmental  |                                     |   |          |          |            |                     |                     |   |           |            |          |    |
| Operating temperature  | 0...50 °C (32...122 °F) (open)      |   |          |          |            |                     |                     |   |           |            |          |    |
|  | 0...40 °C (32...104 °F) (enclosed)  |   |          |          |            |                     |                     |   |           |            |          |    |
| Storage temperature  | -25...85 °C (-13...185 °F)          |   |          |          |            |                     |                     |   |           |            |          |    |
| Altitude   | 2000 m (6560 ft)                    |   |          |          |            |                     |                     |   |           |            |          |    |
| Humidity   | 5...95% (non-condensing)            |   |          |          |            |                     |                     |   |           |            |          |    |
| Pollution degree   | 2                                   |   |          |          |            |                     |                     |   |           |            |          |    |
| Type of Protection   | IP2X                                |   |          |          |            |                     |                     |   |           |            |          |    |

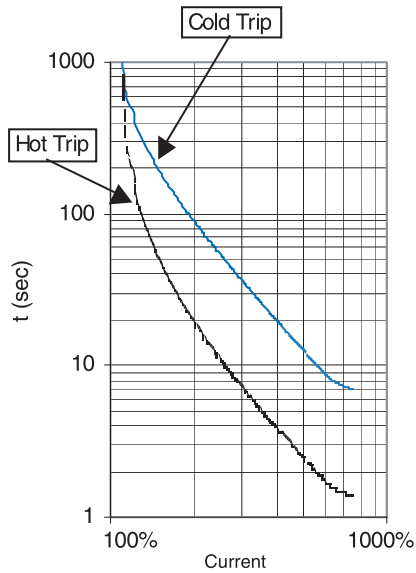
**Bulletin 150**  
**Smart Motor Controllers - SMC-Delta™**  
**Specifications, Continued**

| Control Circuit   |   |  |                   |
|---|---|--|-------------------|
|   | UL/cUL  | IEC  |                   |
| Rated operational voltage (+10%, -15%)                  | 100...240V AC, 24V AC/DC  | 100...240V~, 24V AC/DC   |                   |
| Rated insulation voltage                                | 250V  | 250V~  |                   |
| Rated impulse voltage                                   | —   | 4 kV   |                   |
| Dielectric withstand                                    | 1500V AC  | 2000V~   |                   |
| Overtoltage category                                    | —   | III *  |                   |
| Operating frequency                                     | 50/60 Hz  | 50/60 Hz   |                   |
| Input onstate voltage minimum, during start (A1, 1)     | 85V AC, 19.2V DC/13.5V AC   |  |                   |
| Input onstate current, during start with fan (A1, 1)    | 3...64 A  | 195 mA @ 120V AC/140 mA @ 240V AC, 790mA @24V DC/650 mA @24V AC        |                   |
|   | 74...147 A  | 200 mA @ 120V AC/100 mA @ 240V AC, 700 mA @24V AC/DC                   |                   |
| Input offstate voltage maximum (A1, 1)                  | 30V AC, 17V DC/12V AC   |  |                   |
| Input offstate current @ input offstate voltage (A1, 1) | <2 mA   |  |                   |
| Control power with fan, during start                    | 3...64 A  | 195 mA @ 120V AC / 140 mA @ 240V AC, 790 mA @ 24V DC / 650 mA @ 24V AC |                   |
|   | 74...147 A  | 200 mA @ 120V AC/100 mA @ 240V AC, 700 mA @24V AC/DC                   |                   |
| Control power without fan, during start                 | 185 mA @ 120V AC/125 mA @ 240V AC, 695 mA @24V DC/ 570 mA @ 24V AC                                      |  |                   |
| Auxiliary Contact                                       |   |  |                   |
|   | UL/cUL  | IEC  |                   |
| Rated operational voltage                               | 250V AC/30V DC  | 250V~/30V DC   |                   |
| Rated insulation voltage                                | 250V  | 250V~  |                   |
| Rated impulse voltage                                   | —   | 4 kV   |                   |
| Dielectric withstand                                    | 1500V AC  | 2000V~   |                   |
| Overtoltage category                                    | —   | III *  |                   |
| Operating frequency                                     | 50/60 Hz  | 50/60 Hz   |                   |
| Utilization category                                    | D300  | AC15   |                   |
| TB-97, -98<br>(OVLD/Fault)                              | Type of control circuit   | Electromagnetic relay  |                   |
|   | Number of contacts  | 1  |                   |
|   | Type of contacts  | Normally Open (N.O.)   |                   |
|   | Kind of current   | AC/DC  |                   |
|   | Rated operational current (max.)  | 0.6 A @ 120V~ and 0.3 A @ 240V~  |                   |
|   | Conventional thermal current Ith  | 1 A  |                   |
| Make VA/break VA  | 432/72  |  |                   |
| Standard Features                                       |   |  |                   |
| Start times   | 2, 5, 10, or 15 s   |  |                   |
| Selectable current limit                                | 150%, 250%, 300%, and 350% of full load current   |  |                   |
| Weight — kg (lbs)                                       | 1...64 A  | 0.86 (1.9)   |                   |
|   | 74...147 A  | 2.25 (5)   |                   |
| Mechanical Design Specifications/Test Requirements      |   |  |                   |
| Resistance to vibration                                 | Operational   | 1.0 G peak, 0.152 mm (0.006 in.) displacement                          |                   |
|   | Non-operational   | 2.5 G peak, 0.381 mm (0.015 in.) displacement                          |                   |
| Resistance to shock                                     | Operational   | 15 G   |                   |
|   | Non-operational   | 30 G   |                   |
| Other   |   |  |                   |
|   | UL/cUL  | IEC  |                   |
| EMC emission levels                                     | Conducted radio frequency emissions   | —  |                   |
|   | Radiated emissions  | —  |                   |
| EMC immunity levels                                     | Electrostatic discharge   | 4 kV contact and 8kV air discharge                                     |                   |
|   | Radio frequency electromagnetic field   | —  | Per IEC 60947-4-2 |
|   | Fast transient  | —  | Per IEC 60947-4-2 |
|   | Surge transient   | —  | Per IEC 60947-4-2 |
| Wiring Diagrams   | Can be found in pub. 150-SG006C-EN-P or at <a href="http://www.ab.com/catalogs">www.ab.com/catalogs</a> |  |                   |

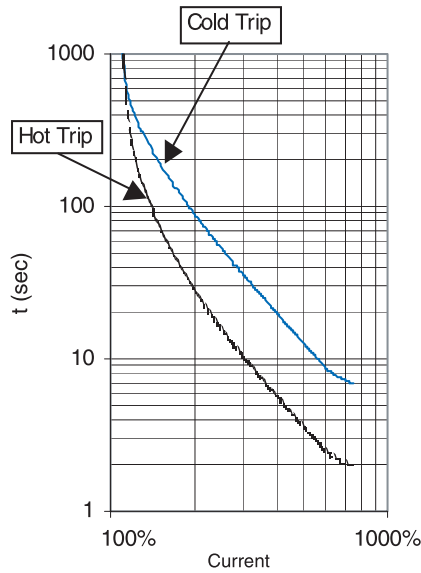
\* Overtoltage category II, when either control or auxiliary circuit is wired to a SELV or PELV circuit.

**SMC-Delta Overload Trip Curves**

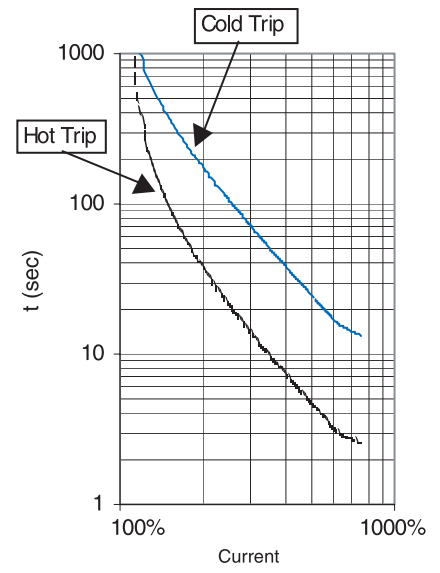
Trip Class 10



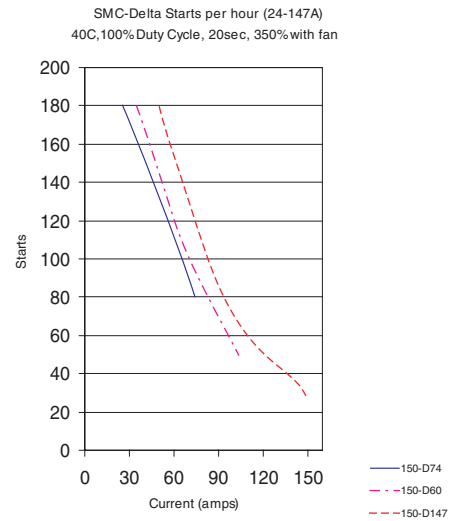
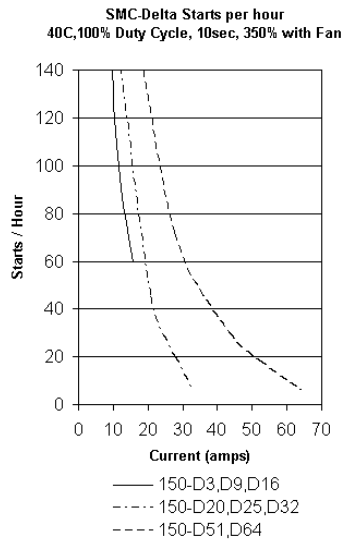
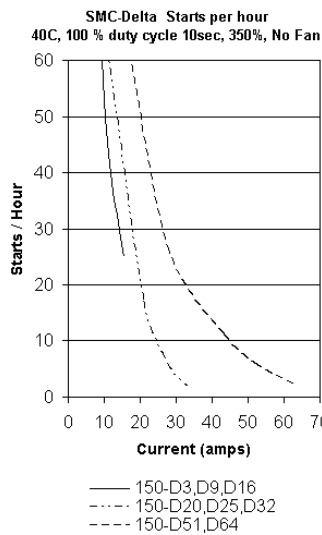
Trip Class 15



Trip Class 20



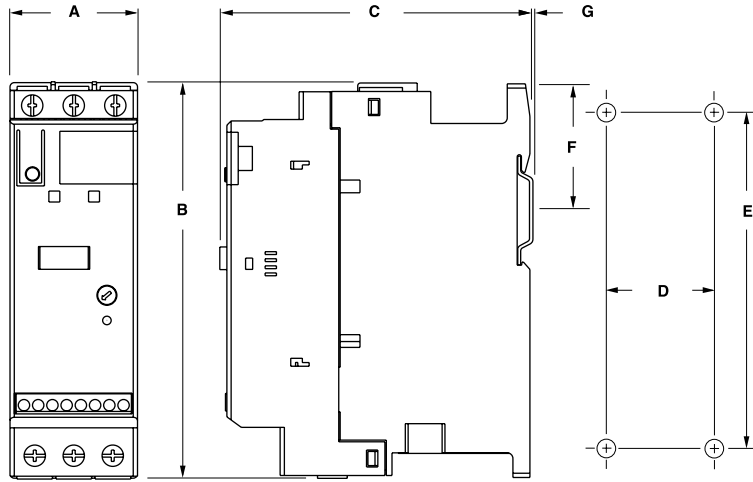
**Starts per Hour Curves**



Bulletin 150  
**Smart Motor Controllers - SMC-Delta™**  
 Approximate Dimensions

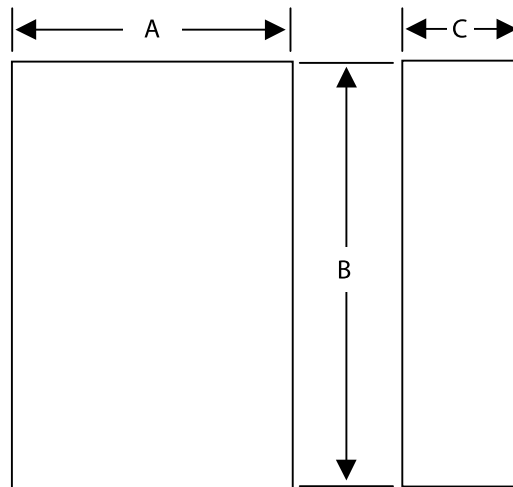
Dimensions in millimeters (inches). Dimensions are not intended to be used for manufacturing purposes. All dimensions are subject to change.

Open Type



| Controller | A              | B             | C             | D          | E             | F           | G        | Mounting Hole Size |
|------------|----------------|---------------|---------------|------------|---------------|-------------|----------|--------------------|
| 1...64 A   | 44.8 (1-49/64) | 139.7 (5-1/2) | 100 (4-21/64) | 35 (1-3/8) | 132 (5-13/64) | 46.4 (1.81) | 2 (1/16) | 4.6 (0.18)         |
| 74...147 A | 72 (2.83)      | 206 (8.11)    | 130 (5.12)    | 55 (2.17)  | 198 (7.8)     | 102 (4.02)  | 2 (1/16) | 5.3 (0.21)         |

Minimum Enclosure Size



| Controller | A Width  | B Height | C Depth | Fan Requirements |
|------------|----------|----------|---------|------------------|
| 1...64 A   | 224 (9)  | 305 (12) | 152 (6) | none             |
| 74...147 A | 406 (16) | 305 (12) | 203 (8) | none             |