



# SMC-3, SMC Flex, and SMC-50 Smart Motor Controller Specifications

Bulletin 150

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# Summary of Changes

This publication contains the following new or updated information. This list includes substantive updates only and is not intended to reflect all changes.

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Rockwell Automation offers a wide array of starting solutions that range from electromechanical to solid-state. Products that use these methods include across-the-line starters, Smart Motor Controllers (SMC™s), and variable frequency drives.

## SMC Controllers

Allen-Bradley® SMC controllers are micro-processor based soft starters that are designed to maximize the efficiency of motor starts and stops. SMC controllers are designed to operate 3-phase motors. They feature built-in overload protection and use six silicon-controlled rectifiers (SCRs) (two per phase) to vary the conduction period and control the voltage (and thus, the torque) to the motor during starting, running, and stopping.

Once the motor has been started and is up to speed, full input voltage is applied to the motor. At this point, units with internal bypass power structures bridge the SCRs with their integral bypass contacts, which are rated for AC1 current levels. Bridging the SCR minimizes heat and allows a smaller product for space-conscious applications. In solid-state power structures, the SCRs are always in the circuit switching current. This allows increased robustness for harsher environments (such as shock-type loads) and more aggressive duty cycles.

Allen-Bradley SMCs are ideal for a wide range of applications. The product family consists of three major offerings.

### SMC-3

Compact design provides true three-phase control, increased intelligence and unmatched performance. Motor and system diagnostics and an electronic overload with adjustable trip class reduce downtime and protect valuable assets.

- Compact footprint
- Easy and secure setup
- Integrated bypass
- Five start/stop modes

### SMC Flex

Modular design features advanced intelligence, performance, and diagnostics; communications flexibility; removable control module, power modules, and fan assembly in a cost-effective package for your demanding production applications.

- Modular for simplified installation and maintenance
- Built-in LCD and keypad or personal computer (PC) software setup
- Integrated bypass
- Nine start/stop modes and three slow-speed modes
- Full metering and diagnostics

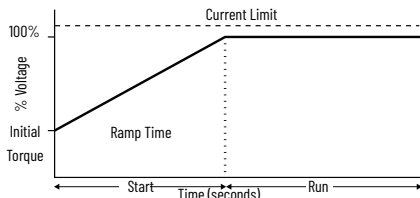
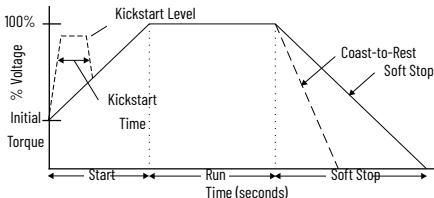
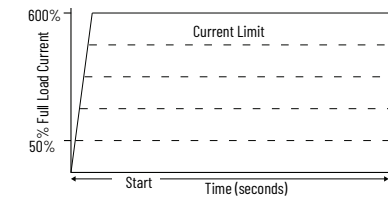
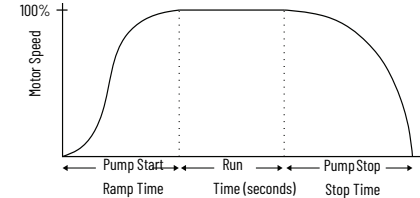
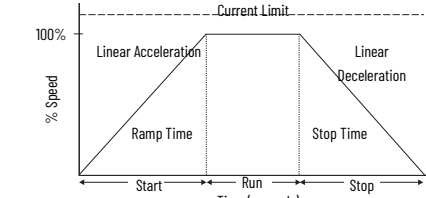
## SMC-50

Designed for customer flexibility – advanced monitoring and protection, superior communications capabilities, and energy saver mode help increase efficiency and reduce downtime.

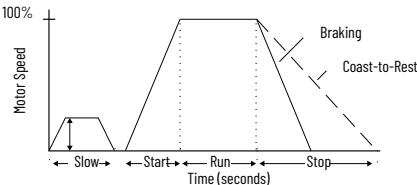
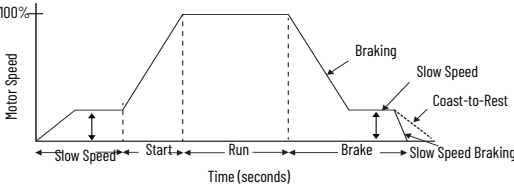
- Application scalability
  - Normal and heavy-duty ratings
  - Expandable I/O and sensor capability
  - Network integration capabilities
- LCD or personal computer PC software setup
- Integrated bypass or solid-state power structures available
- External bypass optional
- Seventeen start/stop modes and three slow-speed modes

## Control Mode Overview

Allen-Bradley SMC controllers have multiple control modes available to control standard 3-phase induction motors, depending upon the product selected. For a full description of the control modes available for each product type, consult the appropriate product user manual.

| Control Mode                                          | Description                                                                                                                                                    | Diagram                                                                              | Available With              |
|-------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|-----------------------------|
| Soft Start                                            | Output voltage is ramped from user-adjustable initial torque setting out to user selectable start time.                                                        |   | SMC-3<br>SMC Flex<br>SMC-50 |
| Kickstart                                             | User-selectable voltage boost at startup to break away loads                                                                                                   |  | SMC-3<br>SMC Flex<br>SMC-50 |
| Current Limit                                         | User-adjustable current limit start by maintaining a constant current to the motor.                                                                            |  | SMC-3<br>SMC Flex<br>SMC-50 |
| Pump Control                                          | Used to reduce fluid surges during starting and/or stopping of a pump.                                                                                         |  | SMC Flex<br>SMC-50          |
| Sensorless Linear Speed Acceleration and Deceleration | Motor acceleration and deceleration are kept at a constant rate during starting and/or stopping. Presents the least amount of stress on mechanical components. |  | SMC-50                      |

| Control Mode               | Description                                                                                                                                                            | Diagram | Available With              |
|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-----------------------------|
| Torque Control             | Provides a torque ramp from user-selectable initial torque setting to user-selectable maximum torque setting over the defined ramp time.                               |         | SMC-50                      |
| Dual Ramp Start            | Ability to select between two start profiles with separately adjustable ramp times and initial torque levels.                                                          |         | SMC Flex<br>SMC-50          |
| Full Voltage Start         | Full-voltage start in which the SMC performs like a solid-state contactor.                                                                                             |         | SMC Flex<br>SMC-50          |
| Preset Slow Speed          | Used on applications that require slow speed moves for positioning, alignment, or maintenance. Both forward and reverse motion are possible at user selectable speeds. |         | SMC Flex<br>SMC-50          |
| Coast                      | Voltage is removed and the motor coasts to rest.                                                                                                                       |         | SMC-3<br>SMC Flex<br>SMC-50 |
| Soft Stop                  | Output voltage is ramped down from full voltage to zero voltage according to a user selectable ramp time.                                                              |         | SMC-3<br>SMC Flex<br>SMC-50 |
| Smart Motor Braking (SMB™) | Provides motor braking for Braking applications that require stopping faster than a coast-to-rest.                                                                     |         | SMC Flex<br>SMC-50          |

| Control Mode            | Description                                                                                                                                                                   | Diagram                                                                            | Available With                    |
|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-----------------------------------|
| Slow Speed with Braking | Combines slow-speed operation with smart motor braking. Used in positioning or alignment.                                                                                     |  | SMC Flex<br>SMC-50                |
| Accu-Stop™              | Used for applications that require position stopping. Combines SMB and slow speed.                                                                                            |  | SMC Flex<br>SMC-50 <sup>(1)</sup> |
| Resistor Loads          | Can directly control 3-phase resistive loads by using phase angle control that is based on a reference value. This mode is typically used for resistive heating applications. |                                                                                    | Solid-state<br>SMC-50             |

(1) Accu-Stop is not included as a parameter/function for the SMC-50 controller. However, the Accu-Stop function can be accomplished with the Stop Option and Slow Speed with Braking functions.

|                                                                                    |  |  |  |                           |
|------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|---------------------------|
| Controller Features <sup>(1)</sup>                                                 | SMC™-3                                                                            | SMC™ Flex                                                                          | SMC™-50 Controller                                                                  |                           |
|                                                                                    |                                                                                   |                                                                                    | Solid-state                                                                         | with Internal Bypass      |
|                                                                                    | 200...690V;<br>1...480 A                                                          | 200...690V;<br>1...1250 A                                                          | 200...690V;<br>90...520 A                                                           | 200...690V<br>108...480 A |
| Soft Start                                                                         | S                                                                                 | S                                                                                  | S                                                                                   | S                         |
| Linear Acceleration/Deceleration                                                   | —                                                                                 | S                                                                                  | S                                                                                   | S                         |
| Torque Control                                                                     | —                                                                                 | —                                                                                  | S                                                                                   | S                         |
| Kickstart                                                                          | S                                                                                 | S                                                                                  | S                                                                                   | S                         |
| Pump Control                                                                       | —                                                                                 | 0                                                                                  | S                                                                                   | S                         |
| Current Limit                                                                      | S                                                                                 | S                                                                                  | S                                                                                   | S                         |
| Dual Ramp Start                                                                    | —                                                                                 | S                                                                                  | S                                                                                   | S                         |
| Full Voltage                                                                       | —                                                                                 | S                                                                                  | S                                                                                   | S                         |
| Phase Rebalance                                                                    | —                                                                                 | —                                                                                  | S                                                                                   | —                         |
| Soft Stop                                                                          | S                                                                                 | S                                                                                  | S                                                                                   | S                         |
| Preset Slow Speed                                                                  | —                                                                                 | S <sup>(2)</sup>                                                                   | S <sup>(3)</sup>                                                                    | S <sup>(3)</sup>          |
| Dual Slow Speed Commands                                                           | —                                                                                 | —                                                                                  | S                                                                                   | S                         |
| SMB™ Smart Motor Braking                                                           | —                                                                                 | 0                                                                                  | S                                                                                   | S                         |
| Accu-Stop™                                                                         | —                                                                                 | 0                                                                                  | S <sup>(4)</sup>                                                                    | S <sup>(4)</sup>          |
| Slow Speed with Braking                                                            | —                                                                                 | 0                                                                                  | S                                                                                   | S                         |
| Integrated Bypass Contactor (SMC-50 firmware rev. 5.XXX and higher)                | S                                                                                 | S                                                                                  | — <sup>(5)</sup>                                                                    | S                         |
| Integrated Motor Overload Protection                                               | S                                                                                 | S                                                                                  | S                                                                                   | S                         |
| DPI™ Communication                                                                 | —                                                                                 | S                                                                                  | S                                                                                   | S                         |
| Metering                                                                           | —                                                                                 | S                                                                                  | S                                                                                   | S                         |
| Real Time Clock                                                                    | —                                                                                 | —                                                                                  | S                                                                                   | S                         |
| Energy Saver Mode                                                                  | —                                                                                 | —                                                                                  | S                                                                                   | —                         |
| Motor Winding Heater Function                                                      | —                                                                                 | (6)                                                                                | S                                                                                   | S                         |
| Resistive Load Control (Firmware rev. 5.XXX and higher, solid-state devices only.) | —                                                                                 | —                                                                                  | S                                                                                   | —                         |
| Diagnostic Faults and Alarms                                                       | —                                                                                 | S                                                                                  | S                                                                                   | S                         |
| Parameter Configuration/Programming Tools                                          | —                                                                                 | S                                                                                  | 0                                                                                   | 0                         |
| Human Interface Module (HIM)                                                       | —                                                                                 | 0                                                                                  | 0                                                                                   | 0                         |
| Parameter Configuration Module                                                     | —                                                                                 | —                                                                                  | 0                                                                                   | 0                         |
| DriveExplorer™ and DriveExecutive™                                                 | —                                                                                 | 0                                                                                  | 0                                                                                   | 0                         |
| Configuration Software: Connected Components Workbench                             | —                                                                                 | 0                                                                                  | 0                                                                                   | 0                         |
| Network Communications                                                             | —                                                                                 | 0                                                                                  | 0                                                                                   | 0                         |
| Inside-the-Delta Functionality                                                     | S                                                                                 | S                                                                                  | S                                                                                   | S                         |
| Individual Bit Enable of Faults and Alarms                                         | —                                                                                 | —                                                                                  | S                                                                                   | S                         |
| Automatic Tuning of Motor Parameters                                               | —                                                                                 | —                                                                                  | S                                                                                   | S                         |
| Digital I/O Expansion Module <sup>(7)</sup>                                        | —                                                                                 | —                                                                                  | 0                                                                                   | 0                         |
| Analog I/O Expansion Module <sup>(7)</sup>                                         | —                                                                                 | —                                                                                  | 0                                                                                   | 0                         |
| Ground Fault/CT/PTC Module <sup>(7)</sup>                                          | —                                                                                 | —                                                                                  | 0                                                                                   | 0                         |
| DeviceLogix™ (Firmware rev. 4.XXX and higher.)                                     | —                                                                                 | —                                                                                  | S                                                                                   | S                         |

(1) S = Standard Feature; 0 = Optional Feature

(2) Limited slow speed capability

(3) Advanced slow speed capability

(4) Accu-Stop is not included as a parameter/function for the SMC-50 controller. However, the Accu-Stop function can be accomplished with the Stop Option and Slow Speed with Braking functions.

(5) You can add an external bypass contactor as an option.

(6) Option using a Bulletin 1410 motor winding heater

(7) With removable terminal block.

The compact design of the SMC-3 controller provides three-phase control, increased intelligence, and unmatched performance in a cost-effective package with overload protection, integrated bypass, and motor system diagnostics. DIP switches and a rotary dial make secure setup easy. This controller features an electronic overload with adjustable trip class.

Modes of operation include the following:

- Soft Start
- Current Limit Start
- Selectable Kickstart
- Coast-to-rest
- Soft Stop

## Catalog Number Explanation

Examples that are given in this section are not intended to be used for product selection. Use ProposalWorks software to configure the SMC-3 controller. ProposalWorks software is available from [rok.auto/systemtools](http://rok.auto/systemtools).

**150**    **-**    **C**    **30**    **N**    **B**    **D**  
 a                      b                      c                      d                      e                      f

| 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        |
| 108            | 108 A       |
| 135            | 135 A       |
| 201            | 201 A       |
| 251            | 251 A       |
| 317            | 317 A       |
| 361            | 361 A       |
| 480            | 480 A       |

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

| e                  |                                  |
|--------------------|----------------------------------|
| Input Line Voltage |                                  |
| Code               | Description                      |
| B                  | 200...460V AC, 3-Phase, 50/60 Hz |
| C                  | 200...600V AC, 3-Phase, 50/60 Hz |

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

# Product Selection

## For use with Line-connected Motors



Use the SMC Estimation Wizard and SMC Thermal Estimation Wizard to confirm that the SMC controller selection meets the application requirements. See [Sizing and Selection Tools](#) for more information. For additional assistance, visit [rok.auto](http://rok.auto) or contact Industrial Controls Technical Support by email at [raictechsupport@ra.rockwell.com](mailto:raictechsupport@ra.rockwell.com) or by phone at +1 440-646-5800.

**Table 1 - 200/208V AC SMC-3 Controllers for Use with Line-connected Motors**

| Rated Voltage [V AC] | Motor Current [A] <sup>(1)</sup> | Max. kW, 50 Hz | Max. Hp, 60 Hz | Control Power            | Open Type Cat. No. |
|----------------------|----------------------------------|----------------|----------------|--------------------------|--------------------|
| 200/208              | 1...3                            | —              | 0.5            | 100...240V AC, 50/60 Hz  | 150-C3NBD          |
|                      |                                  | —              |                | 24V AC/DC                | 150-C3NBR          |
|                      | 3...9                            | —              | 0.75...2       | 100...240V AC, 50/60 Hz  | 150-C9NBD          |
|                      |                                  | —              |                | 24V AC/DC                | 150-C9NBR          |
|                      | 5.3...16                         | —              | 1.5...3        | 100...240V AC, 50/60 Hz  | 150-C16NBD         |
|                      |                                  | —              |                | 24V AC/DC                | 150-C16NBR         |
|                      | 6.3...19                         | —              | 1.5...3        | 100...240V AC, 50/60 Hz  | 150-C19NBD         |
|                      |                                  | —              |                | 24V AC/DC                | 150-C19NBR         |
|                      | 9.2...25                         | —              | 3...7.5        | 100...240V AC, 50/60 Hz  | 150-C25NBD         |
|                      |                                  | —              |                | 24V AC/DC                | 150-C25NBR         |
|                      | 10...30                          | —              | 3...7.5        | 100...240V AC, 50/60 Hz  | 150-C30NBD         |
|                      |                                  | —              |                | 24V AC/DC                | 150-C30NBR         |
|                      | 12.3...37                        | —              | 5...10         | 100...240V AC, 50/60 Hz  | 150-C37NBD         |
|                      |                                  | —              |                | 24V AC/DC                | 150-C37NBR         |
|                      | 14.3...43                        | —              | 5...10         | 100...240V AC, 50/60 Hz  | 150-C43NBD         |
|                      |                                  | —              |                | 24V AC/DC                | 150-C43NBR         |
|                      | 20...60                          | —              | 7.5...15       | 100...240V AC, 50/60 Hz  | 150-C60NBD         |
|                      |                                  | —              |                | 24V AC/DC                | 150-C60NBR         |
|                      | 28.3...85                        | —              | 10...25        | 100...240V AC, 50/60 Hz  | 150-C85NBD         |
|                      |                                  | —              |                | 24V AC/DC                | 150-C85NBR         |
|                      | 27...108                         | —              | 20...30        | 100...240V AC, 50/60 Hz  | 150-C108NBD        |
|                      |                                  | —              |                | 24V AC/DC <sup>(2)</sup> | 150-C108NBR        |
|                      | 34...135                         | —              | 25...40        | 100...240V AC, 50/60 Hz  | 150-C135NBD        |
|                      |                                  | —              |                | 24V AC/DC <sup>(2)</sup> | 150-C135NBR        |
|                      | 67...201                         | —              | 40...60        | 100...240V AC, 50/60 Hz  | 150-C201NBD        |
|                      |                                  | —              |                | 24V AC/DC <sup>(2)</sup> | 150-C201NBR        |
|                      | 84...251                         | —              | 50...75        | 100...240V AC, 50/60 Hz  | 150-C251NBD        |
|                      |                                  | —              |                | 24V AC/DC <sup>(2)</sup> | 150-C251NBR        |
|                      | 106...317                        | —              | 60...100       | 100...240V AC, 50/60 Hz  | 150-C317NBD        |
|                      |                                  | —              |                | 24V AC/DC <sup>(2)</sup> | 150-C317NBR        |
|                      | 120...361                        | —              | 75...125       | 100...240V AC, 50/60 Hz  | 150-C361NBD        |
|                      |                                  | —              |                | 24V AC/DC <sup>(2)</sup> | 150-C361NBR        |
|                      | 160...480                        | —              | 100...150      | 100...240V AC, 50/60 Hz  | 150-C480NBD        |
|                      |                                  | —              |                | 24V AC/DC <sup>(2)</sup> | 150-C480NBR        |

(1) Motor FLA rating must fall within specified current range for unit to operate properly.

(2) Separate 120V or 240V single phase is required for fan operation.

Table 2 - 230V AC SMC-3 Controllers for Use with Line-connected Motors

| Rated Voltage [V AC] | Motor Current [A] <sup>(1)</sup> | Max. kW, 50 Hz | Max. Hp, 60 Hz | Control Power            | Open Type Cat. No. |
|----------------------|----------------------------------|----------------|----------------|--------------------------|--------------------|
| 230                  | 1...3                            | 0.55           | 0.5            | 100...240V AC, 50/60 Hz  | 150-C3NBD          |
|                      |                                  |                |                | 24V AC/DC                | 150-C3NBR          |
|                      | 3...9                            | 2.2            | 0.75...2       | 100...240V AC, 50/60 Hz  | 150-C9NBD          |
|                      |                                  |                |                | 24V AC/DC                | 150-C9NBR          |
|                      | 5.3...16                         | 4              | 1.5...5        | 100...240V AC, 50/60 Hz  | 150-C16NBD         |
|                      |                                  |                |                | 24V AC/DC                | 150-C16NBR         |
|                      | 6.3...19                         | 4              | 2...5          | 100...240V AC, 50/60 Hz  | 150-C19NBD         |
|                      |                                  |                |                | 24V AC/DC                | 150-C19NBR         |
|                      | 9.2...25                         | 5.5            | 3...7.5        | 100...240V AC, 50/60 Hz  | 150-C25NBD         |
|                      |                                  |                |                | 24V AC/DC                | 150-C25NBR         |
|                      | 10...30                          | 7.5            | 5...10         | 100...240V AC, 50/60 Hz  | 150-C30NBD         |
|                      |                                  |                |                | 24V AC/DC                | 150-C30NBR         |
|                      | 12.3...37                        | 7.5            | 5...10         | 100...240V AC, 50/60 Hz  | 150-C37NBD         |
|                      |                                  |                |                | 24V AC/DC                | 150-C37NBR         |
|                      | 14.3...43                        | 11             | 5...15         | 100...240V AC, 50/60 Hz  | 150-C43NBD         |
|                      |                                  |                |                | 24V AC/DC                | 150-C43NBR         |
|                      | 20...60                          | 15             | 7.5...20       | 100...240V AC, 50/60 Hz  | 150-C60NBD         |
|                      |                                  |                |                | 24V AC/DC                | 150-C60NBR         |
|                      | 28.3...85                        | 22             | 15...30        | 100...240V AC, 50/60 Hz  | 150-C85NBD         |
|                      |                                  |                |                | 24V AC/DC                | 150-C85NBR         |
|                      | 27...108                         | 30             | 20...40        | 100...240V AC, 50/60 Hz  | 150-C108NBD        |
|                      |                                  |                |                | 24V AC/DC <sup>(2)</sup> | 150-C108NBR        |
|                      | 34...135                         | 37             | 25...50        | 100...240V AC, 50/60 Hz  | 150-C135NBD        |
|                      |                                  |                |                | 24V AC/DC <sup>(2)</sup> | 150-C135NBR        |
|                      | 67...201                         | 55             | 40...75        | 100...240V AC, 50/60 Hz  | 150-C201NBD        |
|                      |                                  |                |                | 24V AC/DC <sup>(2)</sup> | 150-C201NBR        |
|                      | 84...251                         | 75             | 50...100       | 100...240V AC, 50/60 Hz  | 150-C251NBD        |
|                      |                                  |                |                | 24V AC/DC <sup>(2)</sup> | 150-C251NBR        |
|                      | 106...317                        | 90             | 60...125       | 100...240V AC, 50/60 Hz  | 150-C317NBD        |
|                      |                                  |                |                | 24V AC/DC <sup>(2)</sup> | 150-C317NBR        |
|                      | 120...361                        | 110            | 75...150       | 100...240V AC, 50/60 Hz  | 150-C361NBD        |
|                      |                                  |                |                | 24V AC/DC <sup>(2)</sup> | 150-C361NBR        |
|                      | 160...480                        | 132            | 100...200      | 100...240V AC, 50/60 Hz  | 150-C480NBD        |
|                      |                                  |                |                | 24V AC/DC <sup>(2)</sup> | 150-C480NBR        |

(1) Motor FLA rating must fall within specified current range for unit to operate properly.

(2) Separate 120V or 240V single phase is required for fan operation.

Table 3 - 380/400/415/460V AC SMC-3 Controllers for Use with Line-connected Motors

| Rated Voltage [V AC]         | Motor Current [A] <sup>(1)</sup> | Max. kW, 50 Hz | Max. Hp, 60 Hz | Control Power            | Open Type Cat. No. |
|------------------------------|----------------------------------|----------------|----------------|--------------------------|--------------------|
| 380/400/415 (kW)<br>460 (Hp) | 1...3                            | 1.1            | 0.5...1.5      | 100...240V AC, 50/60 Hz  | 150-C3NBD          |
|                              |                                  |                |                | 24V AC/DC                | 150-C3NBR          |
|                              | 3...9                            | 4              | 1.5...5        | 100...240V AC, 50/60 Hz  | 150-C9NBD          |
|                              |                                  |                |                | 24V AC/DC                | 150-C9NBR          |
|                              | 5.3...16                         | 7.5            | 5...10         | 100...240V AC, 50/60 Hz  | 150-C16NBD         |
|                              |                                  |                |                | 24V AC/DC                | 150-C16NBR         |
|                              | 6.3...19                         | 7.5            | 5...10         | 100...240V AC, 50/60 Hz  | 150-C19NBD         |
|                              |                                  |                |                | 24V AC/DC                | 150-C19NBR         |
|                              | 9.2...25                         | 11             | 7.5...15       | 100...240V AC, 50/60 Hz  | 150-C25NBD         |
|                              |                                  |                |                | 24V AC/DC                | 150-C25NBR         |
|                              | 10...30                          | 15             | 7.5...20       | 100...240V AC, 50/60 Hz  | 150-C30NBD         |
|                              |                                  |                |                | 24V AC/DC                | 150-C30NBR         |
|                              | 12.3...37                        | 18.5           | 10...25        | 100...240V AC, 50/60 Hz  | 150-C37NBD         |
|                              |                                  |                |                | 24V AC/DC                | 150-C37NBR         |
|                              | 14.3...43                        | 22             | 10...30        | 100...240V AC, 50/60 Hz  | 150-C43NBD         |
|                              |                                  |                |                | 24V AC/DC                | 150-C43NBR         |
|                              | 20...60                          | 30             | 15...40        | 100...240V AC, 50/60 Hz  | 150-C60NBD         |
|                              |                                  |                |                | 24V AC/DC                | 150-C60NBR         |
|                              | 28.3...85                        | 45             | 25...60        | 100...240V AC, 50/60 Hz  | 150-C85NBD         |
|                              |                                  |                |                | 24V AC/DC                | 150-C85NBR         |
|                              | 27...108                         | 55             | 50...75        | 100...240V AC, 50/60 Hz  | 150-C108NBD        |
|                              |                                  |                |                | 24V AC/DC <sup>(2)</sup> | 150-C108NBR        |
|                              | 34...135                         | 75             | 60...100       | 100...240V AC, 50/60 Hz  | 150-C135NBD        |
|                              |                                  |                |                | 24V AC/DC <sup>(2)</sup> | 150-C135NBR        |
|                              | 67...201                         | 95...110       | 75...150       | 100...240V AC, 50/60 Hz  | 150-C201NBD        |
|                              |                                  |                |                | 24V AC/DC <sup>(2)</sup> | 150-C201NBR        |
|                              | 84...251                         | 95...132       | 100...200      | 100...240V AC, 50/60 Hz  | 150-C251NBD        |
|                              |                                  |                |                | 24V AC/DC <sup>(2)</sup> | 150-C251NBR        |
|                              | 106...317                        | 95...160       | 125...250      | 100...240V AC, 50/60 Hz  | 150-C317NBD        |
|                              |                                  |                |                | 24V AC/DC <sup>(2)</sup> | 150-C317NBR        |
|                              | 120...361                        | 110...200      | 250...300      | 100...240V AC, 50/60 Hz  | 150-C361NBD        |
|                              |                                  |                |                | 24V AC/DC <sup>(2)</sup> | 150-C361NBR        |
|                              | 160...480                        | 160...250      | 300...400      | 100...240V AC, 50/60 Hz  | 150-C480NBD        |
|                              |                                  |                |                | 24V AC/DC <sup>(2)</sup> | 150-C480NBR        |

(1) Motor FLA rating must fall within specified current range for unit to operate properly.

(2) Separate 120V or 240V single phase is required for fan operation.

Table 4 - 500/575V AC SMC-3 Controllers for Use with Line-connected Motors

| Rated Voltage [V AC] | Motor Current [A] <sup>(1)</sup> | Max. kW, 50 Hz | Max. Hp, 60 Hz | Control Power            | Open Type Cat. No. |
|----------------------|----------------------------------|----------------|----------------|--------------------------|--------------------|
| 500 (kW)<br>575 (Hp) | 1...3                            | 1.5            | 0.75...2       | 100...240V AC, 50/60 Hz  | 150-C3NCD          |
|                      |                                  |                |                | 24V AC/DC                | 150-C3NCR          |
|                      | 3...9                            | 5.5            | 3...7.5        | 100...240V AC, 50/60 Hz  | 150-C9NCD          |
|                      |                                  |                |                | 24V AC/DC                | 150-C9NCR          |
|                      | 5.3...16                         | 7.5            | 5...10         | 100...240V AC, 50/60 Hz  | 150-C16NCD         |
|                      |                                  |                |                | 24V AC/DC                | 150-C16NCR         |
|                      | 6.3...19                         | 11             | 7.5...15       | 100...240V AC, 50/60 Hz  | 150-C19NCD         |
|                      |                                  |                |                | 24V AC/DC                | 150-C19NCR         |
|                      | 9.2...25                         | 15             | 7.5...20       | 100...240V AC, 50/60 Hz  | 150-C25NCD         |
|                      |                                  |                |                | 24V AC/DC                | 150-C25NCR         |
|                      | 10...30                          | 18.5           | 10...25        | 100...240V AC, 50/60 Hz  | 150-C30NCD         |
|                      |                                  |                |                | 24V AC/DC                | 150-C30NCR         |
|                      | 12.3...37                        | 22             | 15...30        | 100...240V AC, 50/60 Hz  | 150-C37NCD         |
|                      |                                  |                |                | 24V AC/DC                | 150-C37NCR         |
|                      | 14.3...43                        | 22             | 15...40        | 100...240V AC, 50/60 Hz  | 150-C43NCD         |
|                      |                                  |                |                | 24V AC/DC                | 150-C43NCR         |
|                      | 20...60                          | 37             | 20...50        | 100...240V AC, 50/60 Hz  | 150-C60NCD         |
|                      |                                  |                |                | 24V AC/DC                | 150-C60NCR         |
|                      | 28.3...85                        | 55             | 30...75        | 100...240V AC, 50/60 Hz  | 150-C85NCD         |
|                      |                                  |                |                | 24V AC/DC                | 150-C85NCR         |
|                      | 27...108                         | 75             | 60...100       | 100...240V AC, 50/60 Hz  | 150-C108NCD        |
|                      |                                  |                |                | 24V AC/DC <sup>(2)</sup> | 150-C108NCR        |
|                      | 34...135                         | 90             | 75...125       | 100...240V AC, 50/60 Hz  | 150-C135NCD        |
|                      |                                  |                |                | 24V AC/DC <sup>(2)</sup> | 150-C135NCR        |
|                      | 67...201                         | 75...132       | 100...200      | 100...240V AC, 50/60 Hz  | 150-C201NCD        |
|                      |                                  |                |                | 24V AC/DC <sup>(2)</sup> | 150-C201NCR        |
|                      | 84...251                         | 90...160       | 125...250      | 100...240V AC, 50/60 Hz  | 150-C251NCD        |
|                      |                                  |                |                | 24V AC/DC <sup>(2)</sup> | 150-C251NCR        |
|                      | 106...317                        | 100...200      | 200...300      | 100...240V AC, 50/60 Hz  | 150-C317NCD        |
|                      |                                  |                |                | 24V AC/DC <sup>(2)</sup> | 150-C317NCR        |
|                      | 120...361                        | 132...250      | 200...350      | 100...240V AC, 50/60 Hz  | 150-C361NCD        |
|                      |                                  |                |                | 24V AC/DC <sup>(2)</sup> | 150-C361NCR        |
|                      | 160...480                        | 200...315      | 250...500      | 100...240V AC, 50/60 Hz  | 150-C480NCD        |
|                      |                                  |                |                | 24V AC/DC <sup>(2)</sup> | 150-C480NCR        |

(1) Motor FLA rating must fall within specified current range for unit to operate properly.

(2) Separate 120V or 240V single phase is required for fan operation.

## For use with Delta-connected Motors



Use the SMC Estimation Wizard and SMC Thermal Estimation Wizard to confirm that the SMC controller selection meets the application requirements. See [Sizing and Selection Tools](#) for more information. For additional assistance, visit [rok.auto](http://rok.auto) or contact Industrial Controls Technical Support by email at [raictechsupport@ra.rockwell.com](mailto:raictechsupport@ra.rockwell.com) or by phone at +1 440-646-5800.

**Table 5 - 200/208V AC SMC-3 Controllers for Use with Delta-connected Motors**

| Rated Voltage [V AC] | Motor Current [A] <sup>(1)</sup> | Max. kW, 50 Hz | Max. Hp, 60 Hz | Control Power            | Open Type Cat. No. |
|----------------------|----------------------------------|----------------|----------------|--------------------------|--------------------|
| 200/208              | 1.7...5.1                        | —              | 1              | 100...240V AC, 50/60 Hz  | 150-C3NBD          |
|                      |                                  | —              |                | 24V AC/DC                | 150-C3NBR          |
|                      | 5.1...16                         | —              | 1.5...3        | 100...240V AC, 50/60 Hz  | 150-C9NBD          |
|                      |                                  | —              |                | 24V AC/DC                | 150-C9NBR          |
|                      | 9.1...27.6                       | —              | 3...7.5        | 100...240V AC, 50/60 Hz  | 150-C16NBD         |
|                      |                                  | —              |                | 24V AC/DC                | 150-C16NBR         |
|                      | 10.9...32.8                      | —              | 3...10         | 100...240V AC, 50/60 Hz  | 150-C19NBD         |
|                      |                                  | —              |                | 24V AC/DC                | 150-C19NBR         |
|                      | 14.3...43                        | —              | 3...10         | 100...240V AC, 50/60 Hz  | 150-C25NBD         |
|                      |                                  | —              |                | 24V AC/DC                | 150-C25NBR         |
|                      | 17.3...52                        | —              | 5...10         | 100...240V AC, 50/60 Hz  | 150-C30NBD         |
|                      |                                  | —              |                | 24V AC/DC                | 150-C30NBR         |
|                      | 21...64                          | —              | 7.5...20       | 100...240V AC, 50/60 Hz  | 150-C37NBD         |
|                      |                                  | —              |                | 24V AC/DC                | 150-C37NBR         |
|                      | 25...74                          | —              | 7.5...20       | 100...240V AC, 50/60 Hz  | 150-C43NBD         |
|                      |                                  | —              |                | 24V AC/DC                | 150-C43NBR         |
|                      | 34.6...104                       | —              | 15...30        | 100...240V AC, 50/60 Hz  | 150-C60NBD         |
|                      |                                  | —              |                | 24V AC/DC                | 150-C60NBR         |
|                      | 50...147                         | —              | 15...40        | 100...240V AC, 50/60 Hz  | 150-C85NBD         |
|                      |                                  | —              |                | 24V AC/DC                | 150-C85NBR         |
|                      | 47...187                         | —              | 20...60        | 100...240V AC, 50/60 Hz  | 150-C108NBD        |
|                      |                                  | —              |                | 24V AC/DC <sup>(2)</sup> | 150-C108NBR        |
|                      | 59...234                         | —              | 20...75        | 100...240V AC, 50/60 Hz  | 150-C135NBD        |
|                      |                                  | —              |                | 24V AC/DC <sup>(2)</sup> | 150-C135NBR        |
|                      | 116...348                        | —              | 75...100       | 100...240V AC, 50/60 Hz  | 150-C201NBD        |
|                      |                                  | —              |                | 24V AC/DC <sup>(2)</sup> | 150-C201NBR        |
|                      | 145...435                        | —              | 100...150      | 100...240V AC, 50/60 Hz  | 150-C251NBD        |
|                      |                                  | —              |                | 24V AC/DC <sup>(2)</sup> | 150-C251NBR        |
|                      | 183...549                        | —              | 100...200      | 100...240V AC, 50/60 Hz  | 150-C317NBD        |
|                      |                                  | —              |                | 24V AC/DC <sup>(2)</sup> | 150-C317NBR        |
|                      | 208...625                        | —              | 125...200      | 100...240V AC, 50/60 Hz  | 150-C361NBD        |
|                      |                                  | —              |                | 24V AC/DC <sup>(2)</sup> | 150-C361NBR        |
|                      | 277...831                        | —              | 200...300      | 100...240V AC, 50/60 Hz  | 150-C480NBD        |
|                      |                                  | —              |                | 24V AC/DC <sup>(2)</sup> | 150-C480NBR        |

(1) Motor FLA rating must fall within specified current range for unit to operate properly.

(2) Separate 120V or 240V single phase is required for fan operation.

Table 6 - 230V AC SMC-3 Controllers for Use with Delta-connected Motors

| Rated Voltage [V AC] | Motor Current [A] <sup>(1)</sup> | Max. kW, 50 Hz | Max. Hp, 60 Hz | Control Power            | Open Type Cat. No. |
|----------------------|----------------------------------|----------------|----------------|--------------------------|--------------------|
| 230                  | 1.7...5.1                        | 0.25...1.1     | 1              | 100...240V AC, 50/60 Hz  | 150-C3NBD          |
|                      |                                  |                |                | 24V AC/DC                | 150-C3NBR          |
|                      | 5.1...16                         | 1.1...4        | 1...5          | 100...240V AC, 50/60 Hz  | 150-C9NBD          |
|                      |                                  |                |                | 24V AC/DC                | 150-C9NBR          |
|                      | 9.1...27.6                       | 2.2...7.5      | 3...7.5        | 100...240V AC, 50/60 Hz  | 150-C16NBD         |
|                      |                                  |                |                | 24V AC/DC                | 150-C16NBR         |
|                      | 10.9...32.8                      | 2.2...7.5      | 3...10         | 100...240V AC, 50/60 Hz  | 150-C19NBD         |
|                      |                                  |                |                | 24V AC/DC                | 150-C19NBR         |
|                      | 14.3...43                        | 4...11         | 3...15         | 100...240V AC, 50/60 Hz  | 150-C25NBD         |
|                      |                                  |                |                | 24V AC/DC                | 150-C25NBR         |
|                      | 17.3...52                        | 4...15         | 5...15         | 100...240V AC, 50/60 Hz  | 150-C30NBD         |
|                      |                                  |                |                | 24V AC/DC                | 150-C30NBR         |
|                      | 21...64                          | 5.5...18.5     | 7.5...20       | 100...240V AC, 50/60 Hz  | 150-C37NBD         |
|                      |                                  |                |                | 24V AC/DC                | 150-C37NBR         |
|                      | 25...74                          | 5.5...22       | 7.5...25       | 100...240V AC, 50/60 Hz  | 150-C43NBD         |
|                      |                                  |                |                | 24V AC/DC                | 150-C43NBR         |
|                      | 34.6...104                       | 7.5...30       | 15...40        | 100...240V AC, 50/60 Hz  | 150-C60NBD         |
|                      |                                  |                |                | 24V AC/DC                | 150-C60NBR         |
|                      | 50...147                         | 15...45        | 20...50        | 100...240V AC, 50/60 Hz  | 150-C85NBD         |
|                      |                                  |                |                | 24V AC/DC                | 150-C85NBR         |
|                      | 47...187                         | 55             | 20...60        | 100...240V AC, 50/60 Hz  | 150-C108NBD        |
|                      |                                  |                |                | 24V AC/DC <sup>(2)</sup> | 150-C108NBR        |
|                      | 59...234                         | 75             | 25...75        | 100...240V AC, 50/60 Hz  | 150-C135NBD        |
|                      |                                  |                |                | 24V AC/DC <sup>(2)</sup> | 150-C135NBR        |
|                      | 116...348                        | 110            | 75...125       | 100...240V AC, 50/60 Hz  | 150-C201NBD        |
|                      |                                  |                |                | 24V AC/DC <sup>(2)</sup> | 150-C201NBR        |
|                      | 145...435                        | 132            | 100...150      | 100...240V AC, 50/60 Hz  | 150-C251NBD        |
|                      |                                  |                |                | 24V AC/DC <sup>(2)</sup> | 150-C251NBR        |
|                      | 183...549                        | 160            | 125...200      | 100...240V AC, 50/60 Hz  | 150-C317NBD        |
|                      |                                  |                |                | 24V AC/DC <sup>(2)</sup> | 150-C317NBR        |
|                      | 208...625                        | 200            | 150...250      | 100...240V AC, 50/60 Hz  | 150-C361NBD        |
|                      |                                  |                |                | 24V AC/DC <sup>(2)</sup> | 150-C361NBR        |
|                      | 277...831                        | 250            | 200...300      | 100...240V AC, 50/60 Hz  | 150-C480NBD        |
|                      |                                  |                |                | 24V AC/DC <sup>(2)</sup> | 150-C480NBR        |

(1) Motor FLA rating must fall within specified current range for unit to operate properly.

(2) Separate 120V or 240V single phase is required for fan operation.

Table 7 - 380/400/415/460V AC SMC-3 Controllers for Use with Delta-connected Motors

| Rated Voltage [V AC]         | Motor Current [A] <sup>(1)</sup> | Max. kW, 50 Hz | Max. Hp, 60 Hz | Control Power            | Open Type Cat. No. |
|------------------------------|----------------------------------|----------------|----------------|--------------------------|--------------------|
| 380/400/415 (kW)<br>460 (Hp) | 1.7...5.1                        | 0.55...2.2     | 0.5...2        | 100...240V AC, 50/60 Hz  | 150-C3NBD          |
|                              |                                  |                |                | 24V AC/DC                | 150-C3NBR          |
|                              | 5.1...16                         | 2.2...7.5      | 2...7.5        | 100...240V AC, 50/60 Hz  | 150-C9NBD          |
|                              |                                  |                |                | 24V AC/DC                | 150-C9NBR          |
|                              | 9.1...27.6                       | 4...11         | 5...15         | 100...240V AC, 50/60 Hz  | 150-C16NBD         |
|                              |                                  |                |                | 24V AC/DC                | 150-C16NBR         |
|                              | 10.9...32.8                      | 4...15         | 5...15         | 100...240V AC, 50/60 Hz  | 150-C19NBD         |
|                              |                                  |                |                | 24V AC/DC                | 150-C19NBR         |
|                              | 14.3...43                        | 5.5...22       | 7.5...20       | 100...240V AC, 50/60 Hz  | 150-C25NBD         |
|                              |                                  |                |                | 24V AC/DC                | 150-C25NBR         |
|                              | 17.3...52                        | 7.5...22       | 7.5...30       | 100...240V AC, 50/60 Hz  | 150-C30NBD         |
|                              |                                  |                |                | 24V AC/DC                | 150-C30NBR         |
|                              | 21...64                          | 7.5...30       | 10...40        | 100...240V AC, 50/60 Hz  | 150-C37NBD         |
|                              |                                  |                |                | 24V AC/DC                | 150-C37NBR         |
|                              | 25...74                          | 11...37        | 10...50        | 100...240V AC, 50/60 Hz  | 150-C43NBD         |
|                              |                                  |                |                | 24V AC/DC                | 150-C43NBR         |
|                              | 34.6...104                       | 15...55        | 20...75        | 100...240V AC, 50/60 Hz  | 150-C60NBD         |
|                              |                                  |                |                | 24V AC/DC                | 150-C60NBR         |
|                              | 50...147                         | 22...75        | 25...100       | 100...240V AC, 50/60 Hz  | 150-C85NBD         |
|                              |                                  |                |                | 24V AC/DC                | 150-C85NBR         |
|                              | 47...187                         | 90             | 40...125       | 100...240V AC, 50/60 Hz  | 150-C108NBD        |
|                              |                                  |                |                | 24V AC/DC <sup>(2)</sup> | 150-C108NBR        |
|                              | 59...234                         | 132            | 50...150       | 100...240V AC, 50/60 Hz  | 150-C135NBD        |
|                              |                                  |                |                | 24V AC/DC <sup>(2)</sup> | 150-C135NBR        |
|                              | 116...348                        | 160            | 150...250      | 100...240V AC, 50/60 Hz  | 150-C201NBD        |
|                              |                                  |                |                | 24V AC/DC <sup>(2)</sup> | 150-C201NBR        |
|                              | 145...435                        | 250            | 200...350      | 100...240V AC, 50/60 Hz  | 150-C251NBD        |
|                              |                                  |                |                | 24V AC/DC <sup>(2)</sup> | 150-C251NBR        |
|                              | 183...549                        | 315            | 250...450      | 100...240V AC, 50/60 Hz  | 150-C317NBD        |
|                              |                                  |                |                | 24V AC/DC <sup>(2)</sup> | 150-C317NBR        |
|                              | 208...625                        | 355            | 300...500      | 100...240V AC, 50/60 Hz  | 150-C361NBD        |
|                              |                                  |                |                | 24V AC/DC <sup>(2)</sup> | 150-C361NBR        |
|                              | 277...831                        | 450            | 350...700      | 100...240V AC, 50/60 Hz  | 150-C480NBD        |
|                              |                                  |                |                | 24V AC/DC <sup>(2)</sup> | 150-C480NBR        |

(1) Motor FLA rating must fall within specified current range for unit to operate properly.

(2) Separate 120V or 240V single phase is required for fan operation.

Table 8 - 500/575V AC SMC-3 Controllers for Use with Delta-connected Motors

| Rated Voltage [V AC] | Motor Current [A] <sup>(1)</sup> | Max. kW, 50 Hz | Max. Hp, 60 Hz | Control Power            | Open Type Cat. No. |
|----------------------|----------------------------------|----------------|----------------|--------------------------|--------------------|
| 500 (kW)<br>575 (Hp) | 1.7...5.1                        | 0.75...3       | 1...3          | 100...240V AC, 50/60 Hz  | 150-C3NCD          |
|                      |                                  |                |                | 24V AC/DC                | 150-C3NCR          |
|                      | 5.1...16                         | 3...7.5        | 3...10         | 100...240V AC, 50/60 Hz  | 150-C9NCD          |
|                      |                                  |                |                | 24V AC/DC                | 150-C9NCR          |
|                      | 9.1...27.6                       | 5.5...15       | 7.5...20       | 100...240V AC, 50/60 Hz  | 150-C16NCD         |
|                      |                                  |                |                | 24V AC/DC                | 150-C16NCR         |
|                      | 10.9...32.8                      | 5.5...22       | 7.5...30       | 100...240V AC, 50/60 Hz  | 150-C19NCD         |
|                      |                                  |                |                | 24V AC/DC                | 150-C19NCR         |
|                      | 14.3...43                        | 7.5...22       | 10...40        | 100...240V AC, 50/60 Hz  | 150-C25NCD         |
|                      |                                  |                |                | 24V AC/DC                | 150-C25NCR         |
|                      | 17.3...52                        | 11...30        | 15...50        | 100...240V AC, 50/60 Hz  | 150-C30NCD         |
|                      |                                  |                |                | 24V AC/DC                | 150-C30NCR         |
|                      | 21...64                          | 11...37        | 15...60        | 100...240V AC, 50/60 Hz  | 150-C37NCD         |
|                      |                                  |                |                | 24V AC/DC                | 150-C37NCR         |
|                      | 25...74                          | 15...45        | 20...60        | 100...240V AC, 50/60 Hz  | 150-C43NCD         |
|                      |                                  |                |                | 24V AC/DC                | 150-C43NCR         |
|                      | 34.6...104                       | 22...55        | 30...100       | 100...240V AC, 50/60 Hz  | 150-C60NCD         |
|                      |                                  |                |                | 24V AC/DC                | 150-C60NCR         |
|                      | 50...147                         | 30...90        | 40...150       | 100...240V AC, 50/60 Hz  | 150-C85NCD         |
|                      |                                  |                |                | 24V AC/DC                | 150-C85NCR         |
|                      | 47...187                         | 132            | 50...150       | 100...240V AC, 50/60 Hz  | 150-C108NCD        |
|                      |                                  |                |                | 24V AC/DC <sup>(2)</sup> | 150-C108NCR        |
|                      | 59...234                         | 160            | 60...200       | 100...240V AC, 50/60 Hz  | 150-C135NCD        |
|                      |                                  |                |                | 24V AC/DC <sup>(2)</sup> | 150-C135NCR        |
|                      | 116...348                        | 250            | 250...300      | 100...240V AC, 50/60 Hz  | 150-C201NCD        |
|                      |                                  |                |                | 24V AC/DC <sup>(2)</sup> | 150-C201NCR        |
|                      | 145...435                        | 315            | 250...400      | 100...240V AC, 50/60 Hz  | 150-C251NCD        |
|                      |                                  |                |                | 24V AC/DC <sup>(2)</sup> | 150-C251NCR        |
|                      | 183...549                        | 400            | 300...500      | 100...240V AC, 50/60 Hz  | 150-C317NCD        |
|                      |                                  |                |                | 24V AC/DC <sup>(2)</sup> | 150-C317NCR        |
|                      | 208...625                        | 450            | 350...600      | 100...240V AC, 50/60 Hz  | 150-C361NCD        |
|                      |                                  |                |                | 24V AC/DC <sup>(2)</sup> | 150-C361NCR        |
|                      | 277...831                        | 560            | 400...900      | 100...240V AC, 50/60 Hz  | 150-C480NCD        |
|                      |                                  |                |                | 24V AC/DC <sup>(2)</sup> | 150-C480NCR        |

(1) Motor FLA rating must fall within specified current range for unit to operate properly.

(2) Separate 120V or 240V single phase is required for fan operation.

# Accessories

**Table 9 - Auxiliary Contact Blocks**

| Description                                                                                                                                                                                                                                                                                                        | N.O. | N.C. | Connection Diagram                                                                      |                                                                                           |                                                                                           |                                                                                           | Cat. No.          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|-----------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|-------------------|
|  Auxiliary Contact Blocks for side mounting with sequence terminal designations <ul style="list-style-type: none"> <li>1- and 2-pole</li> <li>Quick and easy mounting without tools</li> <li>One block per device only</li> </ul> | 1    | 0    |  -CA10 |  -CA20 |  -CA01 |  -CA11 | 150-CA10          |
|                                                                                                                                                                                                                                                                                                                    | 2    | 0    |                                                                                         |                                                                                           |                                                                                           |                                                                                           | 150-CA20          |
|                                                                                                                                                                                                                                                                                                                    | 0    | 1    |                                                                                         |                                                                                           |                                                                                           |                                                                                           | 150-CA01          |
|                                                                                                                                                                                                                                                                                                                    | 1    | 1    |                                                                                         |                                                                                           |                                                                                           |                                                                                           | 150-CA11 (Form C) |

**Table 10 - Fans**

| Description                                                                                                                                             | Optional    | For Use With       | Pkg. Qty. | Cat. No.     |
|---------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|--------------------|-----------|--------------|
|  Fan <ul style="list-style-type: none"> <li>Field installed</li> </ul> | Replacement | 150-C3...37        | 1         | 150-CF64     |
|                                                                                                                                                         |             | 150-C43...85       |           | 150-CF147    |
|                                                                                                                                                         |             | 150-C108, 150-C135 |           | 41391-801-03 |
|                                                                                                                                                         |             | 150-C201, 150-C251 |           | 41391-801-01 |
|                                                                                                                                                         |             | 150-C317...C480    |           | 41391-801-02 |

**Table 11 - Connecting Modules**

| Description                                                                                                                                                                                                                                                                         | For Use With                         | Pkg. Qty. | Cat. No. |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|-----------|----------|
|  Connecting modules to 140-M <ul style="list-style-type: none"> <li>Electrical interconnection between SMC-3 and 140-M.</li> <li>Motor protector and SMC-3 must be mounted separately.</li> </ul> | Connects 140-M-C to 150-C3...25      | 1         | 150-CC25 |
|                                                                                                                                                                                                                                                                                     | Connects 140-M-D to 150-C3...25      | 1         | 150-CD25 |
|                                                                                                                                                                                                                                                                                     | Connects 140-M-F to 150-C3...37      | 1         | 150-CF45 |
|  Connecting modules to 100-C <ul style="list-style-type: none"> <li>Electrical interconnection between SMC-3 and 100-C.</li> <li>Contactor and SMC-3 must be mounted separately.</li> </ul>      | Connects 100-C09...23 to 150-C3...19 | 1         | 150-CI23 |
|                                                                                                                                                                                                                                                                                     | Connects 100-C30...37 to 150-C3...37 | 1         | 150-CI37 |



Do not place protective modules on the load side of a device when using an inside-the-delta connection.

**Table 12 - Protective Modules**

| Description                                                                                                | For Use With                        | Pkg. Qty. | Cat. No. |
|------------------------------------------------------------------------------------------------------------|-------------------------------------|-----------|----------|
|  480V Protective Module | 150-C3...37NB                       | 1         | 150-C84  |
|                                                                                                            | 150-C43...85NB                      | 1         | 150-C84P |
|                                                                                                            | 150-C108...480NB (line and/or load) | 1         | 150-F84L |
| 600V Protective Module                                                                                     | 150-C3...37NC                       | 1         | 150-C86  |
|                                                                                                            | 150-C43...85NC (line and/or load)   | 1         | 150-C86P |
|                                                                                                            | 150-C108...480NC (line and/or load) | 1         | 150-F86L |

**Table 13 - IEC Line- or Load-side Terminal Covers**

| Description <sup>(1) (2)</sup>                                                                                                                                                                                     | Current Range [A] | Pkg. Qty. | Cat. No. |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|-----------|----------|
|  <ul style="list-style-type: none"> <li>Dead front protection</li> <li>IP2X finger safe when used with 250 MCM cable</li> </ul> | 108...135         | 1         | 150-TC1  |
|                                                                                                                                                                                                                    | 201...251         | 1         | 150-TC2  |
| <ul style="list-style-type: none"> <li>Dead front protection</li> <li>IP2X finger safe when used with 500 MCM cable</li> </ul>                                                                                     | 317...480         | 1         | 150-TC3  |

(1) 3...85 A units have terminal covers as standard. No additional terminal guards are required.

(2) SMC-3 controllers that are rated from 108...480 A are shipped with one terminal cover as standard.

Table 14 - Terminal Lug Kits

|                                                                                   | Connection Type | Current Range [A] <sup>(1)</sup> | Wire Size Range                                                | Total No. of Terminal Lugs Possible Each Side |                   | Pkg. Qty. | Cat. No.  |
|-----------------------------------------------------------------------------------|-----------------|----------------------------------|----------------------------------------------------------------|-----------------------------------------------|-------------------|-----------|-----------|
|                                                                                   |                 |                                  |                                                                | Line Side                                     | Load Side         |           |           |
|  | Line            | 108...135 <sup>(2)</sup>         | #6...250 MCM AWG<br>16 mm <sup>2</sup> ...120 mm <sup>2</sup>  | 3                                             | 3                 | 3         | 199-LF1   |
|                                                                                   |                 | 201...251 <sup>(2)</sup>         |                                                                | 6                                             | 6                 | 3         |           |
|                                                                                   |                 | 317...480 <sup>(2)</sup>         | #4...500 MCM AWG<br>25 mm <sup>2</sup> ...240 mm <sup>2</sup>  | 6                                             | 6                 | 3         | 199-LG1   |
|                                                                                   | Delta           | 108...135                        | #4...500 MCM AWG<br>25 mm <sup>2</sup> ...240 mm <sup>2</sup>  | 1                                             | 6 <sup>(3)</sup>  |           | 1494R-N15 |
|                                                                                   |                 | 201...251                        | 1/0...250 MCM AWG<br>50 mm <sup>2</sup> ...120 mm <sup>2</sup> | 2                                             | 12 <sup>(3)</sup> |           | 1494R-N14 |
|                                                                                   |                 | 317...480                        | 3/0...500 MCM AWG<br>95 mm <sup>2</sup> ...240 mm <sup>2</sup> | 1                                             | 12 <sup>(4)</sup> |           | 150-LGSMC |

(1) 3...85 A units have box lugs standard. No additional lugs are required.

(2) When a multi-conductor lug is required, refer to the installation instructions for appropriate lug catalog number.

(3) When connected in an inside-the-delta configuration, use Cat. No. 199-LF1 for load-side connections (T1...T6).

(4) When connected in an inside-the-delta configuration, use Cat. No. 199-LG1 for load-side connections (T1...T6).

Table 15 - Marking Tags and Covers

|                                                                                   | Description                                                                                             | For Use With | Pkg. Qty. | Cat. No. |
|-----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|--------------|-----------|----------|
|  | Marking Tag Sheet<br>• 160 perforated paper labels each, 6 x 17 mm, to be used with a transparent cover | 150-C, 150-D | 10        | 100-FMP  |
|                                                                                   | Transparent Cover<br>• To be used with marking tag sheets                                               |              | 100       | 100-FMC  |

Table 16 - Remote Reset Solenoid

|                                                                                     | Description                                                        | For Use With     | Pkg. Qty. | Cat. No. |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------|------------------|-----------|----------|
|  | Remote Reset Solenoid<br>• for remote reset of electronic overload | 193-T all, 150-C | 1         | 193-ER1⊗ |

## ⊗ Voltage Suffix Codes

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



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

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

# Specifications

**Table 17 - Standard Features**

| Attribute                        | Description                                                   |
|----------------------------------|---------------------------------------------------------------|
| Selectable Start Times           | 2, 5, 10, 15, 20, 25, or 30 s                                 |
| 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 |
| Selectable Overload Trip Class   | Trip Class 10, 15, or 20                                      |

**Table 18 - Power Circuit Ratings**

| Attribute                |             | UL/CSA/NEMA                                              | IEC                                          |
|--------------------------|-------------|----------------------------------------------------------|----------------------------------------------|
| Rated Operation Voltage  |             | 200...480V AC (-15%, +10%)<br>200...600V AC (-15%, +10%) | 200...480V AC – 400V AC<br>500V AC – 500V AC |
| Rated Insulation Voltage |             | 600V AC                                                  | 500V AC                                      |
| Dielectric Withstand     |             | 2200V AC                                                 | 2500V AC                                     |
| Repetitive Peak          |             | 200...480V AC: 1400V<br>200...600V AC: 1600V             | 200...480V AC: 1400V<br>500V AC: 1600V       |
| Operating Frequency      |             | 50/60 Hz                                                 | 50/60 Hz                                     |
| Utilization Category     | 1...37 A    | —                                                        | AC-53b: 3.5-15:3585                          |
|                          | 43...60 A   | —                                                        | AC-53b: 4.5-30:1770                          |
|                          | 85 A        | —                                                        | AC-53b: 4.5-30:3570                          |
|                          | 108 A       | —                                                        | AC-53b: 4.5-30:1770                          |
|                          | 135 A       | —                                                        | AC-53b: 3.5-30: 1770                         |
|                          | 201...251 A | —                                                        | AC-53b: 3.5-30: 1770                         |
|                          | 317...480 A | —                                                        | AC-53b: 3.5-30: 1770                         |
| Number of Poles          |             | Equipment is designed for 3-phase only                   |                                              |
| Rated Impulse Voltage    |             | 6 kV                                                     |                                              |
| DV/DT Protection         |             | 1000V/μs                                                 |                                              |
| Overvoltage Category     |             | III                                                      |                                              |

**Table 19 - Standards Compliance and Certifications**

| Standards Compliance | Certifications                                                 |
|----------------------|----------------------------------------------------------------|
| UL 508               | cULus Listed (Open Type) (File No. E96956, Guides NMFT, NMFT7) |
| CSA C22.2 No.14      | CSA Certified (File No. LR 1234)                               |
| EN/IEC 60947-1       | CE Marked (Open Type) per EMC and Low Voltage Directive        |
| EN/IEC 60947-4-2     | CCC Certified                                                  |

Table 20 - Short-circuit Protection Ratings

| Attribute                                   |      | Description                   |                                       |                                  |                          |
|---------------------------------------------|------|-------------------------------|---------------------------------------|----------------------------------|--------------------------|
| SCPD Performance                            |      | Type 1 <sup>(1)</sup>         |                                       |                                  |                          |
|                                             |      | Non-Time Delay                |                                       | Thermal Magnetic Circuit Breaker |                          |
| SCPD List <sup>(2)</sup>                    |      | Max. Standard Available Fault | Max. Standard Fuse [A] <sup>(3)</sup> | Max. Standard Available Fault    | Max. Circuit Breaker [A] |
| Line Device Operational Current Rating [A]  | 3    | 5 kA                          | 12                                    | 5 kA                             | 15                       |
|                                             | 9    | 5 kA                          | 30                                    | 5 kA                             | 30                       |
|                                             | 16   | 5 kA                          | 60                                    | 5 kA                             | 60                       |
|                                             | 19   | 5 kA                          | 70                                    | 5 kA                             | 70                       |
|                                             | 25   | 5 kA                          | 100                                   | 5 kA                             | 100                      |
|                                             | 30   | 10 kA                         | 110                                   | 10 kA                            | 110                      |
|                                             | 37   | 10 kA                         | 125                                   | 10 kA                            | 125                      |
|                                             | 43   | 10 kA                         | 150                                   | 10 kA                            | 150                      |
|                                             | 60   | 10 kA                         | 225                                   | 10 kA                            | 225                      |
|                                             | 85   | 10 kA                         | 300                                   | 10 kA                            | 300                      |
|                                             | 108  | 10 kA                         | 400                                   | 10 kA                            | 300                      |
|                                             | 135  | 10 kA                         | 500                                   | 10 kA                            | 400                      |
|                                             | 201  | 18 kA                         | 600                                   | 18 kA                            | 600                      |
|                                             | 251  | 18 kA                         | 700                                   | 18 kA                            | 700                      |
|                                             | 317  | 30 kA                         | 800                                   | 30 kA                            | 800                      |
|                                             | 361  | 30 kA                         | 1000                                  | 30 kA                            | 1000                     |
|                                             | 480  | 42 kA                         | 1200                                  | 42 kA                            | 1200                     |
| Delta Device Operational Current Rating [A] | 5.1  | 5 kA                          | 15                                    | 5 kA                             | 15                       |
|                                             | 16   | 5 kA                          | 60                                    | 5 kA                             | 60                       |
|                                             | 27.6 | 5 kA                          | 70                                    | 5 kA                             | 70                       |
|                                             | 32.8 | 5 kA                          | 125                                   | 5 kA                             | 125                      |
|                                             | 43   | 5 kA                          | 150                                   | 5 kA                             | 150                      |
|                                             | 52   | 10 kA                         | 200                                   | 10 kA                            | 200                      |
|                                             | 64   | 10 kA                         | 250                                   | 10 kA                            | 250                      |
|                                             | 74   | 10 kA                         | 250                                   | 10 kA                            | 250                      |
|                                             | 104  | 10 kA                         | 400                                   | 10 kA                            | 300                      |
|                                             | 147  | 10 kA                         | 400                                   | 10 kA                            | 400                      |
|                                             | 187  | 10 kA                         | 600                                   | 10 kA                            | 500                      |
|                                             | 234  | 10 kA                         | 700                                   | 10 kA                            | 700                      |
|                                             | 348  | 18 kA                         | 1000                                  | 18 kA                            | 1000                     |
|                                             | 435  | 18 kA                         | 1200                                  | 18 kA                            | 1200                     |
|                                             | 549  | 30 kA                         | 1600                                  | 30 kA                            | 1600                     |
|                                             | 625  | 30 kA                         | 1600                                  | 30 kA                            | 1600                     |
|                                             | 831  | 42 kA                         | 1600                                  | 30 kA                            | 1600                     |
|                                             | 831  | 42 kA                         | 1600                                  | 42 kA                            | 1200                     |

(1) Type 1 performance/protection indicates that, under a short-circuit condition, the fused or circuit breaker-protected starter shall cause no danger to persons or installation but may not be suitable for further service without repair or replacement.

(2) Consult local codes for proper sizing of short-circuit protection.

(3) Non-time delay fuses (K5).

Table 21 - Short-circuit Protection Performance, High Fault, Type 1

| SCPD Performance <sup>(1)</sup> |              |                    | Type 1 Ratings <sup>(2)</sup>                  |                  |                                                                  |               |                      |
|---------------------------------|--------------|--------------------|------------------------------------------------|------------------|------------------------------------------------------------------|---------------|----------------------|
| Motor Connection Type           | Cat. No.     | Current Rating [A] | Class J or Class L Fuse <sup>(3)</sup>         |                  | Inverse Time (Thermal Magnetic) Circuit Breaker 480V, 65 kA Max. |               |                      |
|                                 |              |                    | Max. High Capacity Available Fault (600V) [kA] | Max. Current [A] | Max. Current [A]                                                 | Cat. No.      | Rating Plug Cat. No. |
| Line Connection                 | 150-C3N...   | 3                  | 65                                             | 6                | 15                                                               | 140G-G6C3-C15 | —                    |
|                                 | 150-C9N...   | 9                  |                                                | 15               | 30                                                               | 140G-G6C3-C30 | —                    |
|                                 | 150-C16N...  | 16                 |                                                | 30               | 60                                                               | 140G-G6C3-C60 | —                    |
|                                 | 150-C19N...  | 19                 |                                                | 40               | 70                                                               | 140G-G6C3-C70 | —                    |
|                                 | 150-C25N...  | 25                 | 70                                             | 50               | 100                                                              | 140G-J6F3-D10 | —                    |
|                                 | 150-C30N...  | 30                 |                                                | 60               | 110                                                              | 140G-J6F3-D11 | —                    |
|                                 | 150-C37N...  | 37                 |                                                | 60               | 125                                                              | 140G-J6F3-D12 | —                    |
|                                 | 150-C43N...  | 43                 |                                                | 90               | 150                                                              | 140G-J6F3-D15 | —                    |
|                                 | 150-C60N...  | 60                 |                                                | 125              | 225                                                              | 140G-J6F3-D22 | —                    |
|                                 | 150-C85N...  | 85                 |                                                | 175              | 250                                                              | 140G-J6F3-D25 | —                    |
|                                 | 150-C108N... | 108                |                                                | 200              | 300                                                              | 140G-K6F3-D30 | —                    |
|                                 | 150-C135N... | 135                |                                                | 250              | 400                                                              | 140G-K6F3-D40 | —                    |
|                                 | 150-C201N... | 201                |                                                | 350              | 600                                                              | 140G-M6F3-D60 | —                    |
|                                 | 150-C251N... | 251                |                                                | 400              | 700                                                              | 140G-M6F3-D80 | —                    |
|                                 | 150-C317N... | 317                | 69                                             | 500              | 800                                                              | 140G-N6H3-E12 | 140G-NRP-D80         |
|                                 | 150-C361N... | 361                |                                                | 600              | 1000                                                             | 140G-N6H3-E12 | 140G-NRP-E10         |
|                                 | 150-C480N... | 480                |                                                | 800              | 1200                                                             | 140G-N6H3-E12 | —                    |
|                                 | 150-C3N...   | 3                  | 69                                             | 10               | 20                                                               | 140G-G6C3-C20 | —                    |
|                                 | 150-C9N...   | 9                  |                                                | 30               | 60                                                               | 140G-G6C3-C60 | —                    |
|                                 | 150-C16N...  | 16                 |                                                | 60               | 100                                                              | 140G-G6C3-D10 | —                    |
|                                 | 150-C19N...  | 19                 |                                                | 70               | 125                                                              | 140G-G6C3-D12 | —                    |
| Inside-the-Delta Connection     | 150-C25N...  | 25                 | 70                                             | 90               | 150                                                              | 140G-J6F3-D15 | —                    |
|                                 | 150-C30N...  | 30                 |                                                | 100              | 200                                                              | 140G-J6F3-D20 | —                    |
|                                 | 150-C37N...  | 37                 |                                                | 100              | 250                                                              | 140G-J6F3-D25 | —                    |
|                                 | 150-C43N...  | 43                 |                                                | 150              | 250                                                              | 140G-J6F3-D25 | —                    |
|                                 | 150-C60N...  | 60                 |                                                | 225              | 250                                                              | 140G-J6F3-D25 | —                    |
|                                 | 150-C85N...  | 85                 |                                                | 300              | 250                                                              | 140G-J6F3-D25 | —                    |
|                                 | 150-C108N... | 108                |                                                | 400              | 400                                                              | 140G-K6F3-D40 | —                    |
|                                 | 150-C135N... | 135                |                                                | 400              | 400                                                              | 140G-K6F3-D40 | —                    |
|                                 | 150-C201N... | 201                | 69                                             | 600              | 800                                                              | 140G-M6F3-D80 | —                    |
|                                 | 150-C251N... | 251                |                                                | 800              | 800                                                              | 140G-M6F3-D80 | —                    |
|                                 | 150-C317N... | 317                |                                                | 1000             | 1200                                                             | 140G-N6H3-E12 | —                    |
|                                 | 150-C361N... | 361                |                                                | 1200             | 1200                                                             | 140G-N6H3-E12 | —                    |
|                                 | 150-C480N... | 480                |                                                | 1600             | 1200                                                             | 140G-N6H3-E12 | —                    |

(1) Consult local codes for proper sizing of short-circuit protection.

(2) Basic Requirements for Type 1 Coordination: Under the short-circuit condition, the starter shall cause no danger to persons or to the installation. The starter may not be suitable for further service without repair or replacement of parts. For further details, refer to UL 508/CSA C22.2 No. 14 and EN 60947-4-2.

(3) High Capacity fault ratings when used with time delay Class J or time delay Class L fuse.

## Electrical Ratings

**Table 22 - Control Circuits**

|                                                              | UL/CSA/NEMA                                              | IEC                      |
|--------------------------------------------------------------|----------------------------------------------------------|--------------------------|
| Rated Operational Voltage (+10%, -15%)                       | 100...240V AC, 24V AC/DC                                 | 100...240V AC, 24V AC/DC |
| Rated Insulation Voltage                                     | 250V                                                     | 250V AC                  |
| Rated Impulse Voltage                                        | 2.5 kV                                                   | 4 kV                     |
| Dielectric Withstand                                         | 1500V AC                                                 | 2000V AC                 |
| Overvoltage Category                                         | II                                                       | III <sup>(1)</sup>       |
| Operating Frequency                                          | 50/60 Hz                                                 | 50/60 Hz                 |
| Input on-state voltage minimum, during start (IN1, IN2)      | 85V AC, 19.2V DC / 19.2V AC                              |                          |
| Input on-state current (IN1, IN2)                            | 9.8 mA @ 120V AC / 19.6 mA @ 240V AC, 7.3 mA @ 24V AC/DC |                          |
| Input off-state voltage maximum (IN1, IN2)                   | 40V AC, 17V DC / 12V AC                                  |                          |
| Input off-state current @ input off-state voltage (IN1, IN2) | <10 mA, <12 mA                                           |                          |

(1) Overvoltage category II, when either control or auxiliary circuit is wired to a SELV or PELV circuit.

**Table 23 - Control Power During Start**

|             |             | UL/CSA/NEMA                                                            |                                                         | IEC |  |
|-------------|-------------|------------------------------------------------------------------------|---------------------------------------------------------|-----|--|
| With Fan    | 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                |                                                         |     |  |
|             |             | Fan Power                                                              | Control Power                                           |     |  |
|             | 108...135 A | 20VA                                                                   | 200 mA @ 120V AC / 120 mA @ 240V AC, 600 mA @ 24V AC/DC |     |  |
|             | 201...251 A | 40VA                                                                   |                                                         |     |  |
|             | 317...480 A | 60VA                                                                   |                                                         |     |  |
|             |             |                                                                        |                                                         |     |  |
| Without Fan | 3...37 A    | 205 mA @ 120V AC / 145 mA @ 240V AC, 705 mA @ 24V DC / 580 mA @ 24V AC |                                                         |     |  |

**Table 24 - Steady-state Heat Dissipation and Overload Current Range**

| Controller Rating [A] | Steady State Heat Dissipation [W] | Overload Current Range [A] |
|-----------------------|-----------------------------------|----------------------------|
| 3                     | 11                                | 1...3                      |
| 9                     | 12                                | 3...9                      |
| 16                    | 14                                | 5.3...16                   |
| 19                    | 15                                | 6.3...19                   |
| 25                    | 17                                | 8.3...25                   |
| 30                    | 19                                | 10...30                    |
| 37                    | 24                                | 12.3...37                  |
| 43                    | 34                                | 14.3...43                  |
| 60                    | 50                                | 20...60                    |
| 85                    | 82                                | 28.3...85                  |
| 108                   | 62                                | 27...108                   |
| 135                   | 75                                | 34...135                   |
| 201                   | 129                               | 67...201                   |
| 251                   | 147                               | 84...251                   |
| 317                   | 174                               | 106...317                  |
| 361                   | 194                               | 120...361                  |
| 480                   | 239                               | 160...480                  |

**Table 25 - Environmental Ratings**

| Attribute                                    |          | Rating                       |
|----------------------------------------------|----------|------------------------------|
| Operating Temperature Range                  | open     | -5...+50 °C (23...122 °F)    |
|                                              | enclosed | -5...+40 °C (23...104 °F)    |
| Storage and Transportation Temperature Range |          | -25...+85 °C (-13...+185 °F) |
| Altitude                                     |          | 2000 m (6560 ft)             |
| Humidity                                     |          | 5...95% (noncondensing)      |
| Pollution Degree                             |          | 2                            |
| Type of Protection                           |          | IP2X                         |

**Table 26 - Mechanical Ratings**

| Attribute               |                                 |                                 | Rating                                                                                                                                       |
|-------------------------|---------------------------------|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| Resistance to Vibration | Operational                     |                                 | 1.0 G Peak, 0.15 mm (0.006 in.) displacement                                                                                                 |
|                         | Non-Operational                 |                                 | 2.5 G Peak, 0.38 mm (0.015 in.) displacement                                                                                                 |
| Resistance to Shock     | Operational                     |                                 | 15 G                                                                                                                                         |
|                         | Non-Operational                 |                                 | 30 G                                                                                                                                         |
| Line Power Terminals    | Cable Size<br>Tightening Torque | 3...37 A                        | 2.5...25 mm <sup>2</sup> (14...4 AWG); 2.3...3.4 N•m (30 lb•in)<br>if 1 25 mm <sup>2</sup> (4 AWG) wire in top terminal, 4.0 N•m (35 lb•in.) |
|                         |                                 | 43...85 A                       | 2.5...95 mm <sup>2</sup> (14...3/0 AWG)<br>11.3...12.4 N•m (100...110 lb•in)                                                                 |
|                         | Power Pole Holes                | 108...135 A                     | One M10 x 1.5 diameter hole per power pole                                                                                                   |
|                         |                                 | 201...251 A                     | Two M10 x 1.5 diameter holes per power pole                                                                                                  |
|                         |                                 | 317...480 A                     | Two M12 x 1.75 diameter holes per power pole                                                                                                 |
|                         | Load Power Terminals            | Cable Size<br>Tightening Torque | 3...37 A                                                                                                                                     |
| 43...85 A               |                                 |                                 | 2.5...50 mm <sup>2</sup> (14...1 AWG)<br>11.3...12.4 N•m (100...110 lb•in)                                                                   |
| Power Pole Holes        |                                 | 108...135 A                     | One M10 x 1.5 diameter hole per power pole                                                                                                   |
|                         |                                 | 201...251 A                     | Two M10 x 1.5 diameter holes per power pole                                                                                                  |
|                         |                                 | 317...480 A                     | Two M12 x 1.75 diameter holes per power pole                                                                                                 |
| Control Terminals       |                                 | Cable Size Tightening Torque    | All                                                                                                                                          |

**Table 27 - Other Ratings**

|                     |                                       | UL/CSA/NEMA                         | IEC                  |
|---------------------|---------------------------------------|-------------------------------------|----------------------|
| EMC Emission Levels | Conducted Radio Frequency Emissions   | —                                   | Class A              |
|                     | Radiated Emissions                    | —                                   | Class A              |
| EMC Immunity Levels | Electrostatic Discharge               | 4 kV Contact and 8 kV Air Discharge | 8 kV Air Discharge   |
|                     | Radio Frequency Electromagnetic Field | —                                   | Per EN/IEC 60947-4-2 |
|                     | Fast Transient                        | —                                   | Per EN/IEC 60947-4-2 |
|                     | Surge Transient                       | —                                   | Per EN/IEC 60947-4-2 |

Table 28 - Auxiliary Contacts

|                                          |                                       | UL/CSA/NEMA                         | IEC                |
|------------------------------------------|---------------------------------------|-------------------------------------|--------------------|
| Rated Operational Voltage                |                                       | 250V AC/30V DC                      | 250V AC/30V DC     |
| Rated Insulation Voltage                 |                                       | 250V                                | 250V AC            |
| Rated Impulse Voltage                    |                                       | 2.5 kV                              | 4 kV               |
| Dielectric Withstand                     |                                       | 1500V AC                            | 2000V AC           |
| Overvoltage Category                     |                                       | II                                  | III <sup>(1)</sup> |
| Operating Frequency                      |                                       | 50/60 Hz                            | 50/60 Hz           |
| Utilization Category                     |                                       | D300/D300                           | AC-15/DC           |
| TB-97, -98<br>(OVL/D/Fault)              | Type of Control Circuit               | Electromagnetic relay               |                    |
|                                          | Number of Contacts                    | 1                                   |                    |
|                                          | Type of Contacts                      | Normally Open (N.O.)                |                    |
|                                          | Type of Current                       | AC/DC                               |                    |
|                                          | Rated Operational Current (max.)      | 0.6 A @ 120V AC and 0.3 A @ 240V AC |                    |
|                                          | Conventional Thermal Current $I_{th}$ | 1 A                                 |                    |
|                                          | Make/Break VA                         | 432/72                              |                    |
| TB-13, -14 Aux 1<br>(Normal/Up-to-Speed) | Type of Control Circuit               | Electromagnetic relay               |                    |
|                                          | Number of Contacts                    | 1                                   |                    |
|                                          | Type of Contacts                      | Normally Open (N.O.)                |                    |
|                                          | Type of Current                       | AC/DC                               |                    |
|                                          | Rated Operational Current (max.)      | 0.6 A @ 120V AC and 0.3 A @ 240V AC |                    |
|                                          | Conventional Thermal Current $I_{th}$ | 1 A                                 |                    |
|                                          | Make/Break VA                         | 432/72                              |                    |

(1) Overvoltage category II, when either control or auxiliary circuit is wired to a SELV or PELV circuit.

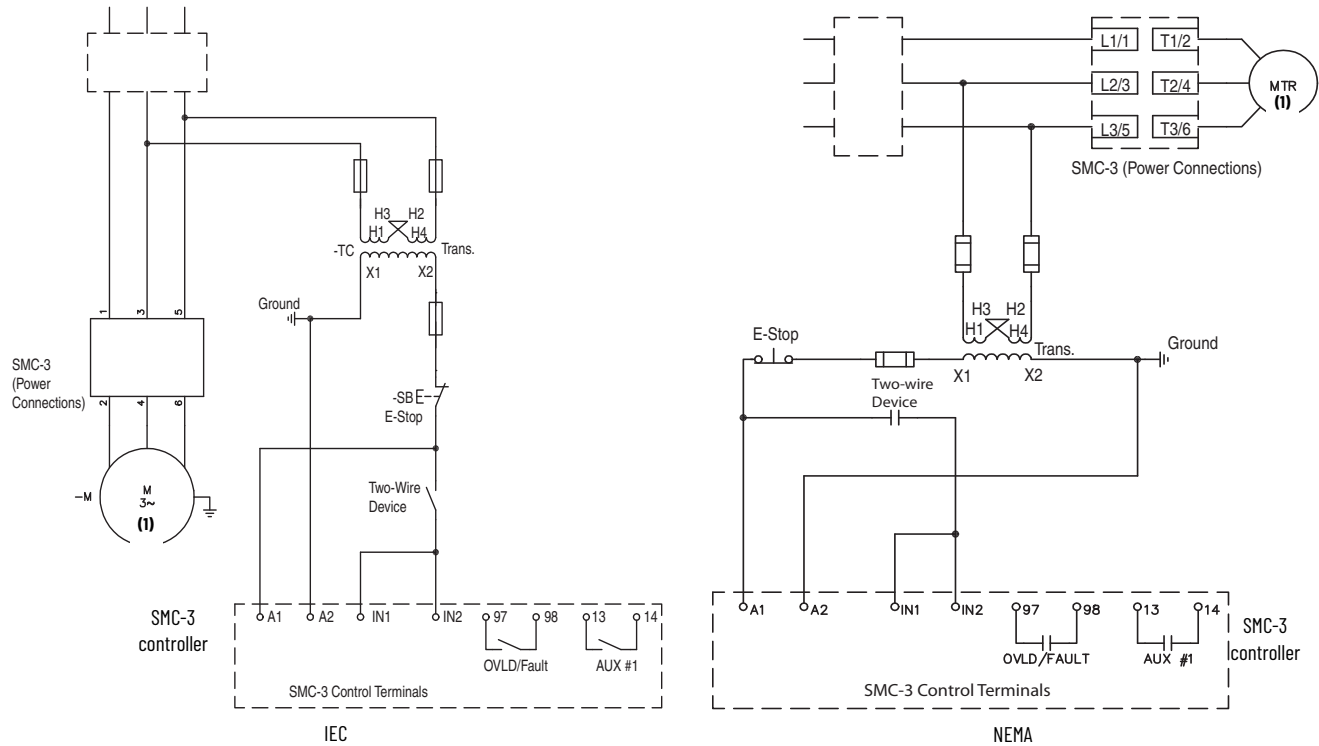
Table 29 - Side-mount Auxiliary Contacts

|                                                                          |                                       | UL/CSA/NEMA                                        | IEC                |
|--------------------------------------------------------------------------|---------------------------------------|----------------------------------------------------|--------------------|
| Rated Operational Voltage                                                |                                       | 250V AC/30V DC                                     | 250V AC/30V DC     |
| Rated Insulation Voltage                                                 |                                       | 250V                                               | 250V AC            |
| Rated Impulse Voltage                                                    |                                       | 2.5 kV                                             | 4 kV               |
| Dielectric Withstand                                                     |                                       | 1500V AC                                           | 2000V AC           |
| Overvoltage Category                                                     |                                       | II                                                 | III <sup>(1)</sup> |
| 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                              |                    |
|                                                                          | Number of Contacts                    | 1                                                  |                    |
|                                                                          | Type of Contacts                      | Normally Open (N.O.)                               |                    |
|                                                                          | Type of Current                       | AC/DC                                              |                    |
|                                                                          | Rated Operational Current (max.)      | 1.5 A @ 120V AC, 0.75 A @ 240V AC, 1.17 A @ 24V DC |                    |
|                                                                          | Conventional Thermal Current $I_{th}$ | 2.5 A                                              |                    |
| TB-11, -12<br>(Normal/Up-to-Speed)                                       | Make/Break VA                         | 1800/180V AC, 28V DC (resistive)                   |                    |
|                                                                          | Type of Control Circuit               | B300/R300                                          | AC-15/DC-13        |
|                                                                          | Type of Control Circuit               | Electromagnetic relay                              |                    |
|                                                                          | Number of Contacts                    | 1                                                  |                    |
|                                                                          | Type of Contacts                      | Normally Closed (N.C.)                             |                    |
|                                                                          | Type of Current                       | AC/DC                                              |                    |
|                                                                          | Rated Operational Current (max.)      | 3 A @ 120V AC, 1.5 A @ 240V AC, 1.17 A @ 24V DC    |                    |
|                                                                          | Conventional Thermal Current $I_{th}$ | 5 A                                                |                    |
|                                                                          | Make/Break VA                         | 3600/360VA, 28VA (DC resistive)                    |                    |

(1) Overvoltage category II, when either control or auxiliary circuit is wired to a SELV or PELV circuit.

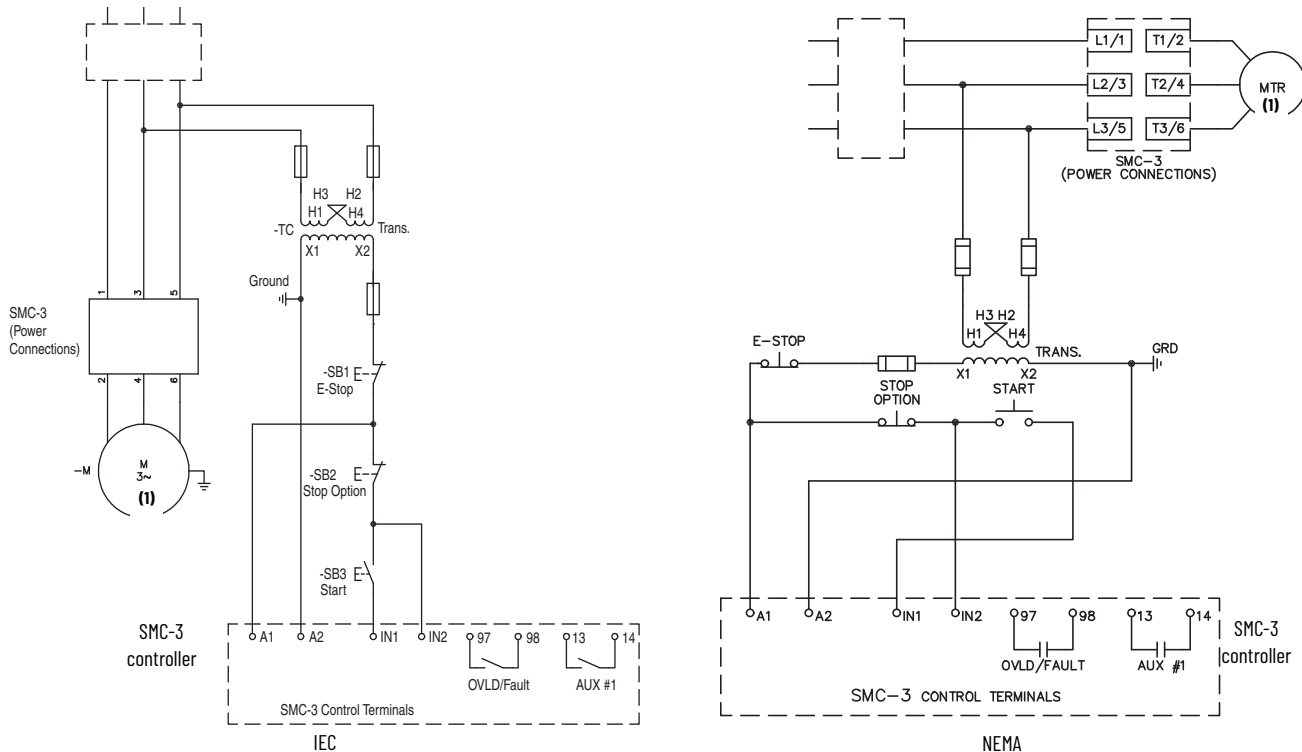
# Typical Wiring Diagrams

Figure 1 - Two-wire Configuration



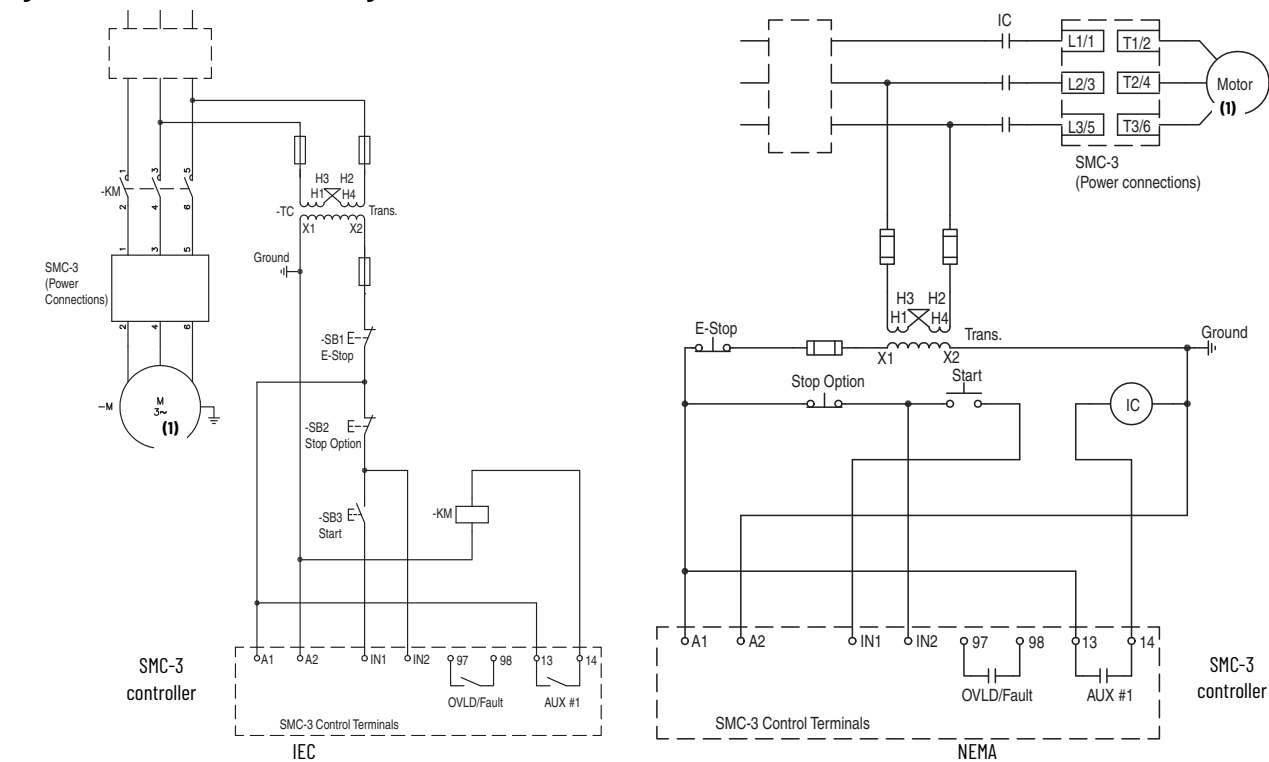
| Note | Information       |
|------|-------------------|
| 1    | Customer supplied |

Figure 2 - Three-wire Configuration



| Note | Information       |
|------|-------------------|
| 1    | Customer supplied |

Figure 3 - Isolation Contactor Configuration

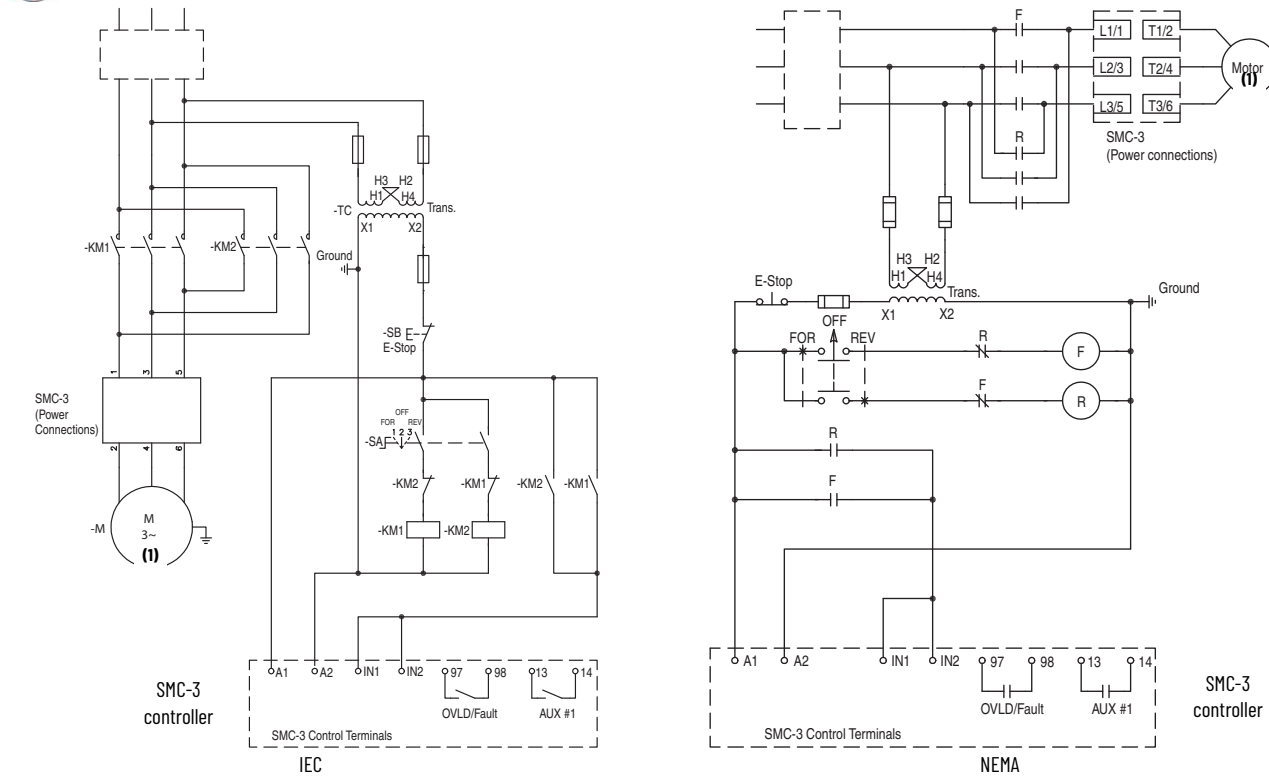


| Note | Information       |
|------|-------------------|
| 1    | Customer supplied |

Figure 4 - Reversing Configuration



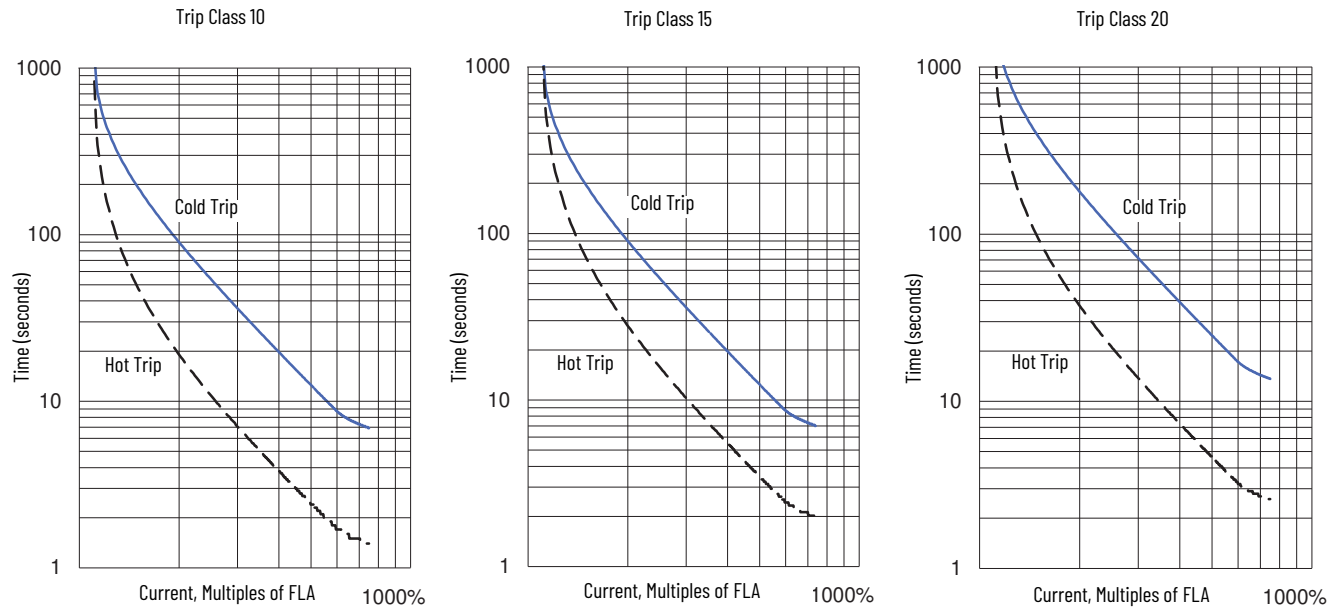
Minimum off time = 1 second



| Note | Information       |
|------|-------------------|
| 1    | Customer supplied |

## Overload Trip Curves

Figure 5 - SMC-3 Overload Trip curves—Trip Class 10, 15, and 20



## Starts per Hour Curves

Figure 6 - SMC-3 Starts per hour (3...37 A) 40 °C, 100% Duty Cycle, 10 s, 350%

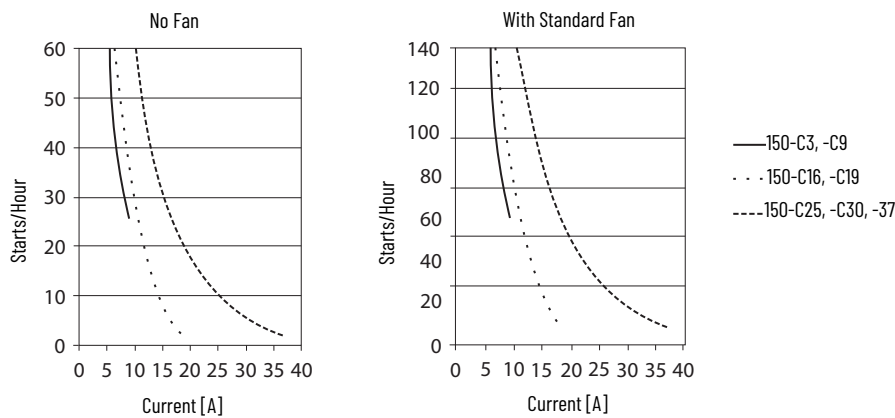


Figure 7 - SMC-3 Starts per hour (43...85 A) 40 °C, 100% Duty Cycle, 20 s, 350%

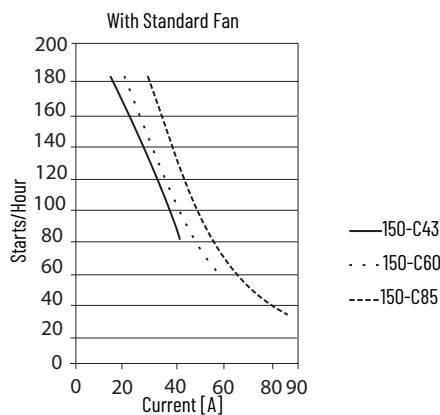


Figure 8 - SMC-3 Starts per hour (108...135 A) 40 °C, 100% Duty Cycle, 20 s, 350%

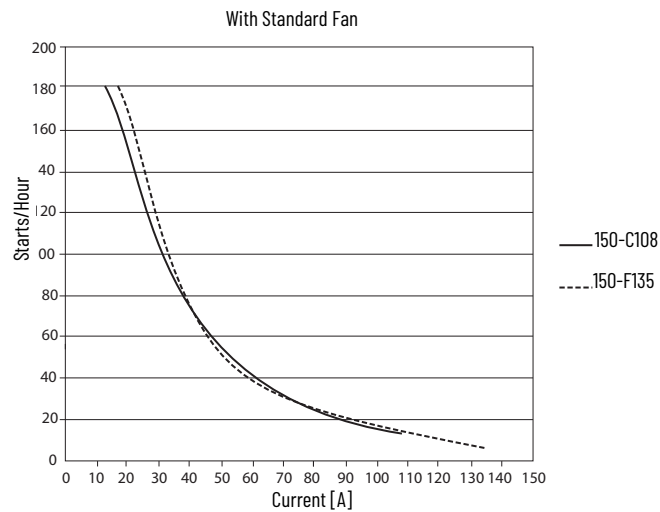
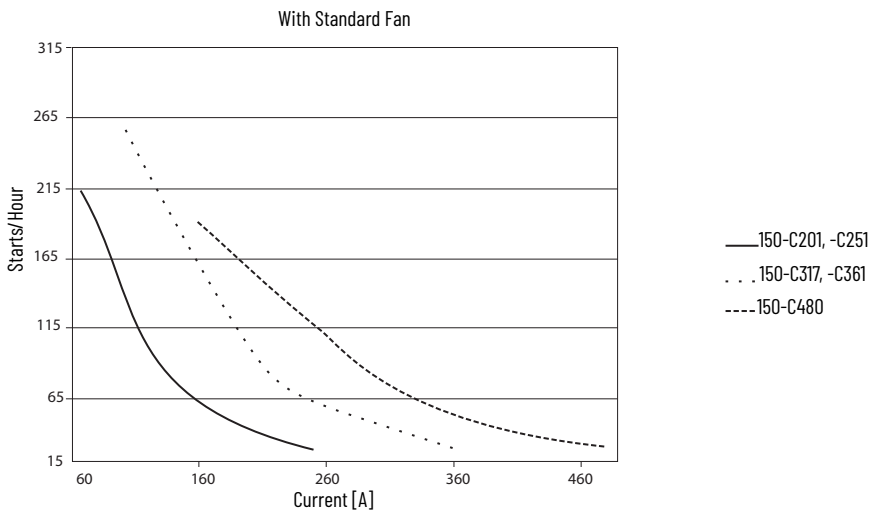


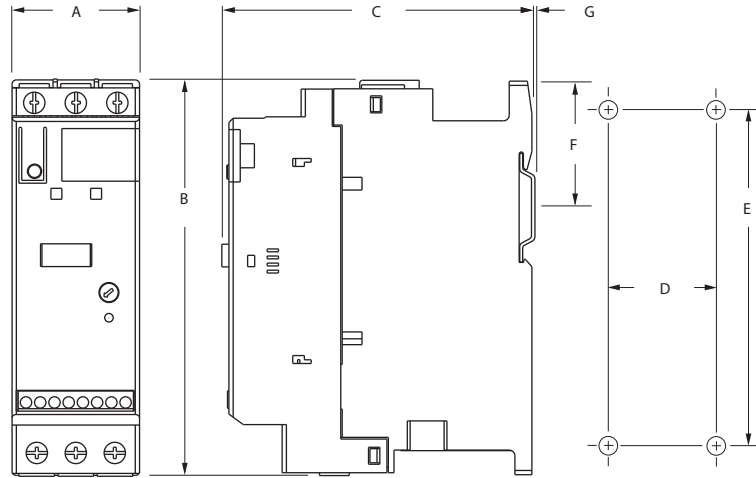
Figure 9 - SMC-3 Starts per hour (201...480 A) 40 °C, 100% Duty Cycle, 20 s, 350%



# Approximate Dimensions

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

**Figure 10 - Open Type Controllers**

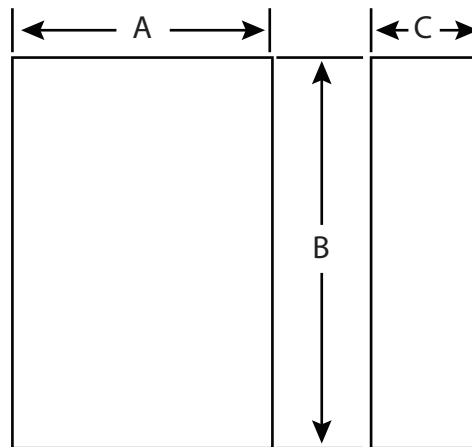


| Controller Rating [A]    | A              | B             | C             | D            | E             | F           | G        | Mounting Hole Size | Weight kg (lbs) |
|--------------------------|----------------|---------------|---------------|--------------|---------------|-------------|----------|--------------------|-----------------|
| 1...37 <sup>(1)</sup>    | 44.8 (1-49/64) | 139.7 (5-1/2) | 110 (4-21/64) | 35 (1-3/8)   | 132 (5-13/64) | 46.4 (1.81) | 2 (1/16) | 4.6 (0.18)         | 0.86 (1.9)      |
| 43...85 <sup>(2)</sup>   | 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)         | 2.25 (5.0)      |
| 108...135 <sup>(2)</sup> | 196.4 (7.74)   | 443.7 (17.47) | 205.2 (8.08)  | 166.6 (6.56) | 367 (14.45)   | —           | —        | 7.5 (0.295)        | 15 (33)         |
| 201...251 <sup>(2)</sup> | 225 (8.86)     | 560 (22.05)   | 265.3 (10.45) | 150 (5.91)   | 504.1 (19.85) | —           | —        | 11.5 (0.45)        | 30.4 (67)       |
| 317...480 <sup>(2)</sup> | 290 (11.42)    | 600 (23.62)   | 298 (11.73)   | 200 (7.87)   | 539.2 (21.23) | —           | —        | 11.5 (0.45)        | 45.8 (101)      |

(1) Optional fan does not increase dimension B.

(2) Fan is standard.

**Figure 11 - Minimum Enclosure Size**



| Controller Rating [A] | B Height  | A Width  | C Depth  | Fan Requirements |
|-----------------------|-----------|----------|----------|------------------|
| 1...37                | 305 (12)  | 224 (9)  | 152 (6)  | none             |
| 43...85               | 406 (16)  | 305 (12) | 203 (8)  | none             |
| 108...135             | 762 (30)  | 610 (24) | 305 (12) | none             |
| 201...251             | 965 (38)  | 762 (30) | 356 (14) | none             |
| 317...480             | 1295 (51) | 914 (36) | 356 (14) | none             |

The SMC Flex controller is modular so that it can help simplify installation and commissioning. A built-in LCD display, keypad, and flexible communications provide optimized configuration, advanced performance, diagnostics, and protection. Three-phase control, electronic overload, and integrated bypass along with removable control module, power modules, and fan assembly are combined in a cost-effective package for your demanding applications.

Modes of operation include the following:

- Soft Start
- Current Limit Start
- Selectable Kickstart
- Coast-to-rest
- Soft Stop
- Full Voltage Start
- Dual Ramp Start
- Pump Start
- Preset Slow Speed
- Pump Stop
- Smart Motor Braking
- Accu-Stop
- Slow Speed with Braking
- Linear Speed Acceleration (Tachometer required)

## Catalog Number Explanation

Examples that are given in this section are not intended to be used for product selection. Use ProposalWorks software to configure the SMC Flex controller. ProposalWorks software is available from [rok.auto/systemtools](http://rok.auto/systemtools).

|            |   |             |          |          |          |          |
|------------|---|-------------|----------|----------|----------|----------|
| <b>150</b> | - | <b>F135</b> | <b>N</b> | <b>B</b> | <b>D</b> | <b>B</b> |
| a          |   | b           | c        | d        | e        | f        |

| a               |                        |
|-----------------|------------------------|
| Bulletin Number |                        |
| Code            | Description            |
| 150             | Solid-state Controller |

| b                 |                           |
|-------------------|---------------------------|
| Controller Rating |                           |
| Code              | Description               |
| F5                | 5 A, 3 Hp @ 460V AC       |
| F25               | 25 A, 15 Hp @ 460V AC     |
| F43               | 43 A, 30 Hp @ 460V AC     |
| F60               | 60 A, 40 Hp @ 460V AC     |
| F85               | 85 A, 60 Hp @ 460V AC     |
| F108              | 108 A, 75 Hp @ 460V AC    |
| F135              | 135 A, 100 Hp @ 460V AC   |
| F201              | 201 A, 150 Hp @ 460V AC   |
| F251              | 251 A, 200 Hp @ 460V AC   |
| F317              | 317 A, 250 Hp @ 460V AC   |
| F361              | 361 A, 300 Hp @ 460V AC   |
| F480              | 480 A, 400 Hp @ 460V AC   |
| F625              | 625 A, 500 Hp @ 460V AC   |
| F780              | 780 A, 600 Hp @ 460V AC   |
| F970              | 970 A, 800 Hp @ 460V AC   |
| F1250             | 1250 A, 1000 Hp @ 460V AC |

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

| d                  |                                                                                                       |
|--------------------|-------------------------------------------------------------------------------------------------------|
| Input Line Voltage |                                                                                                       |
| Code               | Description                                                                                           |
| B                  | 200...460V AC, 3-Phase, 50 and 60 Hz                                                                  |
| C                  | 200...575V AC, 3-Phase, 50 and 60 Hz                                                                  |
| Z                  | 230...690V AC, 3-Phase, 50 and 60 Hz<br>(Open only, 108 A and above)<br>(690V AC line connected only) |

| e               |                                  |
|-----------------|----------------------------------|
| Control Voltage |                                  |
| Code            | Description                      |
| D               | 100...240V AC (5...480 A units)  |
| R               | 24V AC/DC (5...480 A units)      |
| E               | 110/120V AC (625...1250 A units) |
| A               | 230/240V AC (625...1250 A units) |

| f                         |                 |
|---------------------------|-----------------|
| Options - Select only one |                 |
| Code                      | Description     |
| Blank                     | Standard        |
| B                         | Pump Control    |
| D                         | Braking Control |

# Product Selection

## For use with Line-connected Motors



Use the SMC Estimation Wizard and SMC Thermal Estimation Wizard to confirm that the SMC controller selection meets the application requirements. See [Sizing and Selection Tools](#) for more information. For additional assistance, visit [rok.auto](http://rok.auto) or contact Industrial Controls Technical Support by email at [raictechsupport@ra.rockwell.com](mailto:raictechsupport@ra.rockwell.com) or by phone at +1 440-646-5800.

**Table 30 - 200/208V AC SMC Flex Controllers for Use with Line-connected Motors**

| Rated Voltage [V AC] | Motor Current [A] <sup>(1)</sup> | Max. kW, 50 Hz | Max. Hp, 60 Hz | Control Power <sup>(2)</sup> | Open Type Cat. No. <sup>(3)</sup> |
|----------------------|----------------------------------|----------------|----------------|------------------------------|-----------------------------------|
| 200/208              | 1...5                            | —              | 1              | 100...240V AC, 50/60 Hz      | 150-F5NBD                         |
|                      |                                  |                |                | 24V AC/DC                    | 150-F5NBR                         |
|                      | 5...25                           | —              | 5              | 100...240V AC, 50/60 Hz      | 150-F25NBD                        |
|                      |                                  |                |                | 24V AC/DC                    | 150-F25NBR                        |
|                      | 8.6...43                         | —              | 10             | 100...240V AC, 50/60 Hz      | 150-F43NBD                        |
|                      |                                  |                |                | 24V AC/DC                    | 150-F43NBR                        |
|                      | 12...60                          | —              | 15             | 100...240V AC, 50/60 Hz      | 150-F60NBD                        |
|                      |                                  |                |                | 24V AC/DC                    | 150-F60NBR                        |
|                      | 17...85                          | —              | 25             | 100...240V AC, 50/60 Hz      | 150-F85NBD                        |
|                      |                                  |                |                | 24V AC/DC                    | 150-F85NBR                        |
|                      | 27...108                         | —              | 30             | 100...240V AC, 50/60 Hz      | 150-F108NBD                       |
|                      |                                  |                |                | 24V AC/DC                    | 150-F108NBR                       |
|                      | 34...135                         | —              | 40             | 100...240V AC, 50/60 Hz      | 150-F135NBD                       |
|                      |                                  |                |                | 24V AC/DC                    | 150-F135NBR                       |
|                      | 67...201                         | —              | 60             | 100...240V AC, 50/60 Hz      | 150-F201NBD                       |
|                      |                                  |                |                | 24V AC/DC                    | 150-F201NBR                       |
|                      | 84...251                         | —              | 75             | 100...240V AC, 50/60 Hz      | 150-F251NBD                       |
|                      |                                  |                |                | 24V AC/DC                    | 150-F251NBR                       |
|                      | 106...317                        | —              | 100            | 100...240V AC, 50/60 Hz      | 150-F317NBD                       |
|                      |                                  |                |                | 24V AC/DC                    | 150-F317NBR                       |
|                      | 120...361                        | —              | 125            | 100...240V AC, 50/60 Hz      | 150-F361NBD                       |
|                      |                                  |                |                | 24V AC/DC                    | 150-F361NBR                       |
|                      | 160...480                        | —              | 150            | 100...240V AC, 50/60 Hz      | 150-F480NBD                       |
|                      |                                  |                |                | 24V AC/DC                    | 150-F480NBR                       |
|                      | 208...625                        | —              | 200            | 110/120V AC, 50/60 Hz        | 150-F625NBE                       |
|                      |                                  |                |                | 230/240V AC, 50/60 Hz        | 150-F625NBA                       |
|                      | 260...780                        | —              | 250            | 110/120V AC, 50/60 Hz        | 150-F780NBE                       |
|                      |                                  |                |                | 230/240V AC, 50/60 Hz        | 150-F780NBA                       |
|                      | 323...970                        | —              | 350            | 110/120V AC, 50/60 Hz        | 150-F970NBE                       |
|                      |                                  |                |                | 230/240V AC, 50/60 Hz        | 150-F970NBA                       |
|                      | 416...1250                       | —              | 400            | 110/120V AC, 50/60 Hz        | 150-F1250NBE                      |
|                      |                                  |                |                | 230/240V AC, 50/60 Hz        | 150-F1250NBA                      |

(1) Motor FLA rating must fall within specified current range for unit to operate properly. Special consideration should be given when using a motor with a potentially high starting current (greater than ten times motor FLA) with the SMC Flex controller in the Full Voltage starting mode. Contact Rockwell Automation technical support for further guidance.

(2) For controllers with 24V AC/DC control power, separate 120V or 240V single-phase power supply is required for fan operation.

(3) Devices rated 108 A and greater are not equipped with line and load terminal lugs. See [page 40](#) for terminal lug kits.

Table 31 - 230V AC SMC Flex Controllers for Use with Line-connected Motors

| Rated Voltage [V AC] | Motor Current [A] <sup>(1)</sup> | Max. kW, 50 Hz | Max. Hp, 60 Hz | Control Power <sup>(2)</sup> | Open Type Cat. No. <sup>(3)</sup> |
|----------------------|----------------------------------|----------------|----------------|------------------------------|-----------------------------------|
| 230                  | 1...5                            | 1.1            | 1              | 100...240V AC, 50/60 Hz      | 150-F5NBD                         |
|                      |                                  |                |                | 24V AC/DC                    | 150-F5NBR                         |
|                      | 5...25                           | 5.5            | 7.5            | 100...240V AC, 50/60 Hz      | 150-F25NBD                        |
|                      |                                  |                |                | 24V AC/DC                    | 150-F25NBR                        |
|                      | 8.6...43                         | 11             | 15             | 100...240V AC, 50/60 Hz      | 150-F43NBD                        |
|                      |                                  |                |                | 24V AC/DC                    | 150-F43NBR                        |
|                      | 12...60                          | 15             | 20             | 100...240V AC, 50/60 Hz      | 150-F60NBD                        |
|                      |                                  |                |                | 24V AC/DC                    | 150-F60NBR                        |
|                      | 17...85                          | 22             | 30             | 100...240V AC, 50/60 Hz      | 150-F85NBD                        |
|                      |                                  |                |                | 24V AC/DC                    | 150-F85NBR                        |
|                      | 27...108                         | 30             | 40             | 100...240V AC, 50/60 Hz      | 150-F108NBD                       |
|                      |                                  |                |                | 24V AC/DC                    | 150-F108NBR                       |
|                      | 34...135                         | 37             | 50             | 100...240V AC, 50/60 Hz      | 150-F135NBD                       |
|                      |                                  |                |                | 24V AC/DC                    | 150-F135NBR                       |
|                      | 67...201                         | 55             | 75             | 100...240V AC, 50/60 Hz      | 150-F201NBD                       |
|                      |                                  |                |                | 24V AC/DC                    | 150-F201NBR                       |
|                      | 84...251                         | 75             | 100            | 100...240V AC, 50/60 Hz      | 150-F251NBD                       |
|                      |                                  |                |                | 24V AC/DC                    | 150-F251NBR                       |
|                      | 106...317                        | 90             | 125            | 100...240V AC, 50/60 Hz      | 150-F317NBD                       |
|                      |                                  |                |                | 24V AC/DC                    | 150-F317NBR                       |
|                      | 120...361                        | 110            | 150            | 100...240V AC, 50/60 Hz      | 150-F361NBD                       |
|                      |                                  |                |                | 24V AC/DC                    | 150-F361NBR                       |
|                      | 160...480                        | 132            | 200            | 100...240V AC, 50/60 Hz      | 150-F480NBD                       |
|                      |                                  |                |                | 24V AC/DC                    | 150-F480NBR                       |
|                      | 208...625                        | 200            | 250            | 110/120V AC, 50/60 Hz        | 150-F625NBE                       |
|                      |                                  |                |                | 230/240V AC, 50/60 Hz        | 150-F625NBA                       |
|                      | 260...780                        | 250            | 300            | 110/120V AC, 50/60 Hz        | 150-F780NBE                       |
|                      |                                  |                |                | 230/240V AC, 50/60 Hz        | 150-F780NBA                       |
|                      | 323...970                        | 315            | 400            | 110/120V AC, 50/60 Hz        | 150-F970NBE                       |
|                      |                                  |                |                | 230/240V AC, 50/60 Hz        | 150-F970NBA                       |
|                      | 416...1250                       | 400            | 500            | 110/120V AC, 50/60 Hz        | 150-F1250NBE                      |
|                      |                                  |                |                | 230/240V AC, 50/60 Hz        | 150-F1250NBA                      |

(1) Motor FLA rating must fall within specified current range for unit to operate properly. Special consideration should be given when using a motor with a potentially high starting current (greater than ten times motor FLA) with the SMC Flex controller. Contact Rockwell Automation technical support for further guidance.

(2) For controllers with 24V AC/DC control power, separate 120V or 240V single-phase power supply is required for fan operation.

(3) Devices rated 108 A and greater are not equipped with line and load terminal lugs. See [page 40](#) for terminal lug kits.

Table 32 - 400/415/460V AC SMC Flex Controllers for Use with Line-connected Motors

| Rated Voltage [V AC]     | Motor Current [A] <sup>(1)</sup> | Max. kW, 50 Hz | Max. Hp, 60 Hz | Control Power <sup>(2)</sup> | Open Type Cat. No. <sup>(3)</sup> |
|--------------------------|----------------------------------|----------------|----------------|------------------------------|-----------------------------------|
| 400/415 (kW)<br>460 (Hp) | 1...5                            | 2.2            | 3              | 100...240V AC, 50/60 Hz      | 150-F5NBD                         |
|                          |                                  |                |                | 24V AC/DC                    | 150-F5NBR                         |
|                          | 5...25                           | 11             | 15             | 100...240V AC, 50/60 Hz      | 150-F25NBD                        |
|                          |                                  |                |                | 24V AC/DC                    | 150-F25NBR                        |
|                          | 8.6...43                         | 22             | 30             | 100...240V AC, 50/60 Hz      | 150-F43NBD                        |
|                          |                                  |                |                | 24V AC/DC                    | 150-F43NBR                        |
|                          | 12...60                          | 30             | 40             | 100...240V AC, 50/60 Hz      | 150-F60NBD                        |
|                          |                                  |                |                | 24V AC/DC                    | 150-F60NBR                        |
|                          | 17...85                          | 45             | 60             | 100...240V AC, 50/60 Hz      | 150-F85NBD                        |
|                          |                                  |                |                | 24V AC/DC                    | 150-F85NBR                        |
|                          | 27...108                         | 55             | 75             | 100...240V AC, 50/60 Hz      | 150-F108NBD                       |
|                          |                                  |                |                | 24V AC/DC                    | 150-F108NBR                       |
|                          | 34...135                         | 75             | 100            | 100...240V AC, 50/60 Hz      | 150-F135NBD                       |
|                          |                                  |                |                | 24V AC/DC                    | 150-F135NBR                       |
|                          | 67...201                         | 110            | 150            | 100...240V AC, 50/60 Hz      | 150-F201NBD                       |
|                          |                                  |                |                | 24V AC/DC                    | 150-F201NBR                       |
|                          | 84...251                         | 132            | 200            | 100...240V AC, 50/60 Hz      | 150-F251NBD                       |
|                          |                                  |                |                | 24V AC/DC                    | 150-F251NBR                       |
|                          | 106...317                        | 160            | 250            | 100...240V AC, 50/60 Hz      | 150-F317NBD                       |
|                          |                                  |                |                | 24V AC/DC                    | 150-F317NBR                       |
|                          | 120...361                        | 200            | 300            | 100...240V AC, 50/60 Hz      | 150-F361NBD                       |
|                          |                                  |                |                | 24V AC/DC                    | 150-F361NBR                       |
|                          | 160...480                        | 250            | 400            | 100...240V AC, 50/60 Hz      | 150-F480NBD                       |
|                          |                                  |                |                | 24V AC/DC                    | 150-F480NBR                       |
|                          | 208...625                        | 355            | 500            | 110/120V AC, 50/60 Hz        | 150-F625NBE                       |
|                          |                                  |                |                | 230/240V AC, 50/60 Hz        | 150-F625NBA                       |
|                          | 260...780                        | 450            | 600            | 110/120V AC, 50/60 Hz        | 150-F780NBE                       |
|                          |                                  |                |                | 230/240V AC, 50/60 Hz        | 150-F780NBA                       |
|                          | 323...970                        | 560            | 800            | 110/120V AC, 50/60 Hz        | 150-F970NBE                       |
|                          |                                  |                |                | 230/240V AC, 50/60 Hz        | 150-F970NBA                       |
|                          | 416...1250                       | 710            | 1000           | 110/120V AC, 50/60 Hz        | 150-F1250NBE                      |
|                          |                                  |                |                | 230/240V AC, 50/60 Hz        | 150-F1250NBA                      |

(1) Motor FLA rating must fall within specified current range for unit to operate properly. Special consideration should be given when using a motor with a potentially high starting current (greater than ten times motor FLA) with the SMC Flex controller. Contact Rockwell Automation technical support for further guidance.

(2) For controllers with 24V AC/DC control power, separate 120V or 240V single-phase power supply is required for fan operation.

(3) Devices rated 108 A and greater are not equipped with line and load terminal lugs. See [page 40](#) for terminal lug kits.

Table 33 - 500/575V AC SMC Flex Controllers for Use with Line-connected Motors

| Rated Voltage [V AC] | Motor Current [A] <sup>(1)</sup> | Max. kW, 50 Hz | Max. Hp, 60 Hz | Control Power <sup>(2)</sup> | Open Type Cat. No. <sup>(3)</sup> |
|----------------------|----------------------------------|----------------|----------------|------------------------------|-----------------------------------|
| 500 (kW)<br>575 (Hp) | 1...5                            | 2.2            | 3              | 100...240V AC, 50/60 Hz      | 150-F5NCD                         |
|                      |                                  |                |                | 24V AC/DC                    | 150-F5NCR                         |
|                      | 5...25                           | 15             | 20             | 100...240V AC, 50/60 Hz      | 150-F25NCD                        |
|                      |                                  |                |                | 24V AC/DC                    | 150-F25NCR                        |
|                      | 8.6...43                         | 22             | 40             | 100...240V AC, 50/60 Hz      | 150-F43NCD                        |
|                      |                                  |                |                | 24V AC/DC                    | 150-F43NCR                        |
|                      | 12...60                          | 37             | 50             | 100...240V AC, 50/60 Hz      | 150-F60NCD                        |
|                      |                                  |                |                | 24V AC/DC                    | 150-F60NCR                        |
|                      | 17...85                          | 55             | 75             | 100...240V AC, 50/60 Hz      | 150-F85NCD                        |
|                      |                                  |                |                | 24V AC/DC                    | 150-F85NCR                        |
|                      | 27...108                         | 75             | 100            | 100...240V AC, 50/60 Hz      | 150-F108NCD                       |
|                      |                                  |                |                | 24V AC/DC                    | 150-F108NCR                       |
|                      | 34...135                         | 90             | 125            | 100...240V AC, 50/60 Hz      | 150-F135NCD                       |
|                      |                                  |                |                | 24V AC/DC                    | 150-F135NCR                       |
|                      | 67...201                         | 132            | 200            | 100...240V AC, 50/60 Hz      | 150-F201NCD                       |
|                      |                                  |                |                | 24V AC/DC                    | 150-F201NCR                       |
|                      | 84...251                         | 160            | 250            | 100...240V AC, 50/60 Hz      | 150-F251NCD                       |
|                      |                                  |                |                | 24V AC/DC                    | 150-F251NCR                       |
|                      | 106...317                        | 200            | 300            | 100...240V AC, 50/60 Hz      | 150-F317NCD                       |
|                      |                                  |                |                | 24V AC/DC                    | 150-F317NCR                       |
|                      | 120...361                        | 250            | 350            | 100...240V AC, 50/60 Hz      | 150-F361NCD                       |
|                      |                                  |                |                | 24V AC/DC                    | 150-F361NCR                       |
|                      | 160...480                        | 315            | 500            | 100...240V AC, 50/60 Hz      | 150-F480NCD                       |
|                      |                                  |                |                | 24V AC/DC                    | 150-F480NCR                       |
|                      | 208...625                        | 450            | 600            | 110/120V AC, 50/60 Hz        | 150-F625NCE                       |
|                      |                                  |                |                | 230/240V AC, 50/60 Hz        | 150-F625NCA                       |
|                      | 260...780                        | 560            | 800            | 110/120V AC, 50/60 Hz        | 150-F780NCE                       |
|                      |                                  |                |                | 230/240V AC, 50/60 Hz        | 150-F780NCA                       |
|                      | 323...970                        | 710            | 1000           | 110/120V AC, 50/60 Hz        | 150-F970NCE                       |
|                      |                                  |                |                | 230/240V AC, 50/60 Hz        | 150-F970NCA                       |
|                      | 416...1250                       | 900            | 1300           | 110/120V AC, 50/60 Hz        | 150-F1250NCE                      |
|                      |                                  |                |                | 230/240V AC, 50/60 Hz        | 150-F1250NCA                      |

(1) Motor FLA rating must fall within specified current range for unit to operate properly. Special consideration should be given when using a motor with a potentially high starting current (greater than ten times motor FLA) with the SMC Flex controller. Contact Rockwell Automation technical support for further guidance.

(2) For controllers with 24V AC/DC control power, separate 120V or 240V single-phase power supply is required for fan operation.

(3) Devices rated 108 A and greater are not equipped with line and load terminal lugs. See [page 40](#) for terminal lug kits.

**Table 34 - 690V AC SMC Flex Controllers for Use with Line-connected Motors**

| Rated Voltage [V AC]                  | Motor Current [A] <sup>(1)</sup> | Max. kW, 50 Hz | Max. Hp, 60 Hz | Control Power           | Open Type Cat. No. <sup>(2)</sup> |
|---------------------------------------|----------------------------------|----------------|----------------|-------------------------|-----------------------------------|
| 690/Y (kW) <sup>(3)</sup><br>600 (Hp) | 27...108                         | 90             | 100            | 100...240V AC, 50/60 Hz | 150-F108NZD                       |
|                                       | 34...135                         | 132            | 125            | 100...240V AC, 50/60 Hz | 150-F135NZD                       |
|                                       | 67...201                         | 160            | 200            | 100...240V AC, 50/60 Hz | 150-F201NZD                       |
|                                       | 84...251                         | 200            | 250            | 100...240V AC, 50/60 Hz | 150-F251NZD                       |
|                                       | 106...317                        | 315            | 400            | 100...240V AC, 50/60 Hz | 150-F317NZD                       |
|                                       | 120...361                        | 355            | 450            | 100...240V AC, 50/60 Hz | 150-F361NZD                       |
|                                       | 160...480                        | 450            | 600            | 100...240V AC, 50/60 Hz | 150-F480NZD                       |
|                                       | 208...625                        | 630            | 800            | 110/120V AC, 50/60 Hz   | 150-F625NZE                       |
|                                       |                                  |                |                | 230/240V AC, 50/60 Hz   | 150-F625NZA                       |
|                                       | 260...780                        | 800            | 1000           | 110/120V AC, 50/60 Hz   | 150-F780NZE                       |
|                                       |                                  |                |                | 230/240V AC, 50/60 Hz   | 150-F780NZA                       |
|                                       | 323...970                        | 1000           | 1300           | 110/120V AC, 50/60 Hz   | 150-F970NZE                       |
|                                       |                                  |                |                | 230/240V AC, 50/60 Hz   | 150-F970NZA                       |
|                                       | 416...1250                       | 1200           | 1600           | 110/120V AC, 50/60 Hz   | 150-F1250NZE                      |
|                                       |                                  |                |                | 230/240V AC, 50/60 Hz   | 150-F1250NZA                      |

(1) Motor FLA rating must fall within specified current range for unit to operate properly. Special consideration should be given when using a motor with a potentially high starting current (greater than ten times motor FLA) with the SMC Flex controller. Contact Rockwell Automation technical support for further guidance.

(2) Devices rated 108 A and greater are not equipped with line and load terminal lugs. See [page 40](#) for terminal lug kits.

(3) To be used only in a Y-type system.

## For Use with Delta-connected Motors



Use the SMC Estimation Wizard and SMC Thermal Estimation Wizard to confirm that the SMC controller selection meets the application requirements. See [Sizing and Selection Tools](#) for more information. For additional assistance, visit [rok.auto](http://rok.auto) or contact Industrial Controls Technical Support by email at [raictechsupport@ra.rockwell.com](mailto:raictechsupport@ra.rockwell.com) or by phone at +1 440-646-5800.

**Table 35 - 200/208V AC SMC Flex Controllers for Use with Delta-connected Motors**

| Rated Voltage [V AC] | Motor Current [A] <sup>(1)</sup> | Max. kW, 50 Hz | Max. Hp, 60 Hz | Control Power <sup>(2)</sup> | Open Type Cat. No. <sup>(3)</sup> |
|----------------------|----------------------------------|----------------|----------------|------------------------------|-----------------------------------|
| 200/208              | 1.7...8.7                        | —              | 2              | 100...240V AC, 50/60 Hz      | 150-F5NBD                         |
|                      |                                  |                |                | 24V AC/DC                    | 150-F5NBR                         |
|                      | 8.7...43                         | —              | 10             | 100...240V AC, 50/60 Hz      | 150-F25NBD                        |
|                      |                                  |                |                | 24V AC/DC                    | 150-F25NBR                        |
|                      | 14.9...74                        | —              | 20             | 100...240V AC, 50/60 Hz      | 150-F43NBD                        |
|                      |                                  |                |                | 24V AC/DC                    | 150-F43NBR                        |
|                      | 20.8...104                       | —              | 30             | 100...240V AC, 50/60 Hz      | 150-F60NBD                        |
|                      |                                  |                |                | 24V AC/DC                    | 150-F60NBR                        |
|                      | 29.4...147                       | —              | 40             | 100...240V AC, 50/60 Hz      | 150-F85NBD                        |
|                      |                                  |                |                | 24V AC/DC                    | 150-F85NBR                        |
|                      | 47...187                         | —              | 60             | 100...240V AC, 50/60 Hz      | 150-F108NBD                       |
|                      |                                  |                |                | 24V AC/DC                    | 150-F108NBR                       |
|                      | 59...234                         | —              | 75             | 100...240V AC, 50/60 Hz      | 150-F135NBD                       |
|                      |                                  |                |                | 24V AC/DC                    | 150-F135NBR                       |
|                      | 116...348                        | —              | 100            | 100...240V AC, 50/60 Hz      | 150-F201NBD                       |
|                      |                                  |                |                | 24V AC/DC                    | 150-F201NBR                       |
|                      | 145...435                        | —              | 150            | 100...240V AC, 50/60 Hz      | 150-F251NBD                       |
|                      |                                  |                |                | 24V AC/DC                    | 150-F251NBR                       |
|                      | 183...549                        | —              | 200            | 100...240V AC, 50/60 Hz      | 150-F317NBD                       |
|                      |                                  |                |                | 24V AC/DC                    | 150-F317NBR                       |
|                      | 208...625                        | —              | 200            | 100...240V AC, 50/60 Hz      | 150-F361NBD                       |
|                      |                                  |                |                | 24V AC/DC                    | 150-F361NBR                       |
|                      | 277...831                        | —              | 300            | 100...240V AC, 50/60 Hz      | 150-F480NBD                       |
|                      |                                  |                |                | 24V AC/DC                    | 150-F480NBR                       |
|                      | 283...850                        | —              | 300            | 110/120V AC, 50/60 Hz        | 150-F625NBE                       |
|                      |                                  |                |                | 230/240V AC, 50/60 Hz        | 150-F625NBA                       |
|                      | 300...900                        | —              | 300            | 110/120V AC, 50/60 Hz        | 150-F780NBE                       |
|                      |                                  |                |                | 230/240V AC, 50/60 Hz        | 150-F780NBA                       |
|                      | 400...1200                       | —              | 400            | 110/120V AC, 50/60 Hz        | 150-F970NBE                       |
|                      |                                  |                |                | 230/240V AC, 50/60 Hz        | 150-F970NBA                       |
|                      | 533...1600                       | —              | 500            | 110/120V AC, 50/60 Hz        | 150-F1250NBE                      |
|                      |                                  |                |                | 230/240V AC, 50/60 Hz        | 150-F1250NBA                      |

(1) Motor FLA rating must fall within specified current range for unit to operate properly. Special consideration should be given when using a motor with a potentially high starting current (greater than ten times motor FLA) with the SMC Flex controller. Contact Rockwell Automation technical support for further guidance.

(2) For controllers with 24V AC/DC control power, separate 120V or 240V single-phase power supply is required for fan operation.

(3) Devices rated 108 A and greater are not equipped with line and load terminal lugs. See [page 40](#) for terminal lug kits.

**Table 36 - 230V AC SMC Flex Controllers for Use with Delta-connected Motors**

| Rated Voltage [V AC] | Motor Current [A] <sup>(1)</sup> | Max. kW, 50 Hz | Max. Hp, 60 Hz | Control Power <sup>(2)</sup> | Open Type Cat. No. <sup>(3)</sup> |
|----------------------|----------------------------------|----------------|----------------|------------------------------|-----------------------------------|
| 230                  | 1.7...8.7                        | 2.2            | 2              | 100...240V AC, 50/60 Hz      | 150-F5NBD                         |
|                      |                                  |                |                | 24V AC/DC                    | 150-F5NBR                         |
|                      | 8.7...43                         | 11             | 15             | 100...240V AC, 50/60 Hz      | 150-F25NBD                        |
|                      |                                  |                |                | 24V AC/DC                    | 150-F25NBR                        |
|                      | 14.9...74                        | 22             | 25             | 100...240V AC, 50/60 Hz      | 150-F43NBD                        |
|                      |                                  |                |                | 24V AC/DC                    | 150-F43NBR                        |
|                      | 20.8...104                       | 30             | 40             | 100...240V AC, 50/60 Hz      | 150-F60NBD                        |
|                      |                                  |                |                | 24V AC/DC                    | 150-F60NBR                        |
|                      | 29.4...147                       | 45             | 50             | 100...240V AC, 50/60 Hz      | 150-F85NBD                        |
|                      |                                  |                |                | 24V AC/DC                    | 150-F85NBR                        |
|                      | 47...187                         | 55             | 60             | 100...240V AC, 50/60 Hz      | 150-F108NBD                       |
|                      |                                  |                |                | 24V AC/DC                    | 150-F108NBR                       |
|                      | 59...234                         | 75             | 75             | 100...240V AC, 50/60 Hz      | 150-F135NBD                       |
|                      |                                  |                |                | 24V AC/DC                    | 150-F135NBR                       |
|                      | 116...348                        | 110            | 125            | 100...240V AC, 50/60 Hz      | 150-F201NBD                       |
|                      |                                  |                |                | 24V AC/DC                    | 150-F201NBR                       |
|                      | 145...435                        | 132            | 150            | 100...240V AC, 50/60 Hz      | 150-F251NBD                       |
|                      |                                  |                |                | 24V AC/DC                    | 150-F251NBR                       |
|                      | 183...549                        | 160            | 200            | 100...240V AC, 50/60 Hz      | 150-F317NBD                       |
|                      |                                  |                |                | 24V AC/DC                    | 150-F317NBR                       |
|                      | 208...625                        | 200            | 250            | 100...240V AC, 50/60 Hz      | 150-F361NBD                       |
|                      |                                  |                |                | 24V AC/DC                    | 150-F361NBR                       |
|                      | 277...831                        | 250            | 350            | 100...240V AC, 50/60 Hz      | 150-F480NBD                       |
|                      |                                  |                |                | 24V AC/DC                    | 150-F480NBR                       |
|                      | 283...850                        | 250            | 350            | 110/120V AC, 50/60 Hz        | 150-F625NBE                       |
|                      |                                  |                |                | 230/240V AC, 50/60 Hz        | 150-F625NBA                       |
|                      | 300...900                        | 250            | 350            | 110/120V AC, 50/60 Hz        | 150-F780NBE                       |
|                      |                                  |                |                | 230/240V AC, 50/60 Hz        | 150-F780NBA                       |
|                      | 400...1200                       | 400            | 400            | 110/120V AC, 50/60 Hz        | 150-F970NBE                       |
|                      |                                  |                |                | 230/240V AC, 50/60 Hz        | 150-F970NBA                       |
|                      | 533...1600                       | 500            | 600            | 110/120V AC, 50/60 Hz        | 150-F1250NBE                      |
|                      |                                  |                |                | 230/240V AC, 50/60 Hz        | 150-F1250NBA                      |

(1) Motor FLA rating must fall within specified current range for unit to operate properly. Special consideration should be given when using a motor with a potentially high starting current (greater than ten times motor FLA) with the SMC Flex controller. Contact Rockwell Automation technical support for further guidance.

(2) For controllers with 24V AC/DC control power, separate 120V or 240V single-phase power supply is required for fan operation.

(3) Devices rated 108 A and greater are not equipped with line and load terminal lugs. See [page 40](#) for terminal lug kits.

Table 37 - 400/415/460V AC SMC Flex Controllers for Use with Delta-connected Motors

| Rated Voltage [V AC]     | Motor Current [A] <sup>(1)</sup> | Max. kW, 50 Hz | Max. Hp, 60 Hz | Control Power <sup>(2)</sup> | Open Type Cat. No. <sup>(3)</sup> |
|--------------------------|----------------------------------|----------------|----------------|------------------------------|-----------------------------------|
| 400/415 (kW)<br>460 (Hp) | 1.7...8.7                        | 4              | 5              | 100...240V AC, 50/60 Hz      | 150-F5NBD                         |
|                          |                                  |                |                | 24V AC/DC                    | 150-F5NBR                         |
|                          | 8.7...43                         | 22             | 30             | 100...240V AC, 50/60 Hz      | 150-F25NBD                        |
|                          |                                  |                |                | 24V AC/DC                    | 150-F25NBR                        |
|                          | 14.9...74                        | 37             | 50             | 100...240V AC, 50/60 Hz      | 150-F43NBD                        |
|                          |                                  |                |                | 24V AC/DC                    | 150-F43NBR                        |
|                          | 20.8...104                       | 55             | 75             | 100...240V AC, 50/60 Hz      | 150-F60NBD                        |
|                          |                                  |                |                | 24V AC/DC                    | 150-F60NBR                        |
|                          | 29.4...147                       | 75             | 100            | 100...240V AC, 50/60 Hz      | 150-F85NBD                        |
|                          |                                  |                |                | 24V AC/DC                    | 150-F85NBR                        |
|                          | 47...187                         | 90             | 125            | 100...240V AC, 50/60 Hz      | 150-F108NBD                       |
|                          |                                  |                |                | 24V AC/DC                    | 150-F108NBR                       |
|                          | 59...234                         | 132            | 150            | 100...240V AC, 50/60 Hz      | 150-F135NBD                       |
|                          |                                  |                |                | 24V AC/DC                    | 150-F135NBR                       |
|                          | 116...348                        | 160            | 250            | 100...240V AC, 50/60 Hz      | 150-F201NBD                       |
|                          |                                  |                |                | 24V AC/DC                    | 150-F201NBR                       |
|                          | 145...435                        | 250            | 350            | 100...240V AC, 50/60 Hz      | 150-F251NBD                       |
|                          |                                  |                |                | 24V AC/DC                    | 150-F251NBR                       |
|                          | 183...549                        | 315            | 450            | 100...240V AC, 50/60 Hz      | 150-F317NBD                       |
|                          |                                  |                |                | 24V AC/DC                    | 150-F317NBR                       |
|                          | 208...625                        | 355            | 500            | 100...240V AC, 50/60 Hz      | 150-F361NBD                       |
|                          |                                  |                |                | 24V AC/DC                    | 150-F361NBR                       |
|                          | 277...831                        | 450            | 700            | 100...240V AC, 50/60 Hz      | 150-F480NBD                       |
|                          |                                  |                |                | 24V AC/DC                    | 150-F480NBR                       |
|                          | 283...850                        | 500            | 700            | 110/120V AC, 50/60 Hz        | 150-F625NBE                       |
|                          |                                  |                |                | 230/240V AC, 50/60 Hz        | 150-F625NBA                       |
|                          | 300...900                        | 500            | 700            | 110/120V AC, 50/60 Hz        | 150-F780NBE                       |
|                          |                                  |                |                | 230/240V AC, 50/60 Hz        | 150-F780NBA                       |
|                          | 400...1200                       | 710            | 1000           | 110/120V AC, 50/60 Hz        | 150-F970NBE                       |
|                          |                                  |                |                | 230/240V AC, 50/60 Hz        | 150-F970NBA                       |
|                          | 533...1600                       | 900            | 1400           | 110/120V AC, 50/60 Hz        | 150-F1250NBE                      |
|                          |                                  |                |                | 230/240V AC, 50/60 Hz        | 150-F1250NBA                      |

(1) Motor FLA rating must fall within specified current range for unit to operate properly. Special consideration should be given when using a motor with a potentially high starting current (greater than ten times motor FLA) with the SMC Flex controller. Contact Rockwell Automation technical support for further guidance.

(2) For controllers with 24V AC/DC control power, separate 120V or 240V single-phase power supply is required for fan operation.

(3) Devices rated 108 A and greater are not equipped with line and load terminal lugs. See [page 40](#) for terminal lug kits.

**Table 38 - 500/575V AC SMC Flex Controllers for Use with Delta-connected Motors**

| Rated Voltage [V AC] | Motor Current [A] <sup>(1)</sup> | Max. kW, 50 Hz | Max. Hp, 60 Hz | Control Power <sup>(2)</sup> | Open Type Cat. No. <sup>(3)</sup> |
|----------------------|----------------------------------|----------------|----------------|------------------------------|-----------------------------------|
| 500 (kW)<br>575 (Hp) | 1.7...8.7                        | 5.5            | 7.5            | 100...240V AC, 50/60 Hz      | 150-F5NCD                         |
|                      |                                  |                |                | 24V AC/DC                    | 150-F5NCR                         |
|                      | 8.7...43                         | 15             | 40             | 100...240V AC, 50/60 Hz      | 150-F25NCD                        |
|                      |                                  |                |                | 24V AC/DC                    | 150-F25NCR                        |
|                      | 14.9...74                        | 45             | 60             | 100...240V AC, 50/60 Hz      | 150-F43NCD                        |
|                      |                                  |                |                | 24V AC/DC                    | 150-F43NCR                        |
|                      | 20.8...104                       | 55             | 100            | 100...240V AC, 50/60 Hz      | 150-F60NCD                        |
|                      |                                  |                |                | 24V AC/DC                    | 150-F60NCR                        |
|                      | 29.4...147                       | 90             | 150            | 100...240V AC, 50/60 Hz      | 150-F85NCD                        |
|                      |                                  |                |                | 24V AC/DC                    | 150-F85NCR                        |
|                      | 47...187                         | 132            | 150            | 100...240V AC, 50/60 Hz      | 150-F108NCD                       |
|                      |                                  |                |                | 24V AC/DC                    | 150-F108NCR                       |
|                      | 59...234                         | 160            | 200            | 100...240V AC, 50/60 Hz      | 150-F135NCD                       |
|                      |                                  |                |                | 24V AC/DC                    | 150-F135NCR                       |
|                      | 116...348                        | 250            | 350            | 100...240V AC, 50/60 Hz      | 150-F201NCD                       |
|                      |                                  |                |                | 24V AC/DC                    | 150-F201NCR                       |
|                      | 145...435                        | 315            | 400            | 100...240V AC, 50/60 Hz      | 150-F251NCD                       |
|                      |                                  |                |                | 24V AC/DC                    | 150-F251NCR                       |
|                      | 183...549                        | 400            | 500            | 100...240V AC, 50/60 Hz      | 150-F317NCD                       |
|                      |                                  |                |                | 24V AC/DC                    | 150-F317NCR                       |
|                      | 208...625                        | 450            | 600            | 100...240V AC, 50/60 Hz      | 150-F361NCD                       |
|                      |                                  |                |                | 24V AC/DC                    | 150-F361NCR                       |
|                      | 277...831                        | 560            | 900            | 100...240V AC, 50/60 Hz      | 150-F480NCD                       |
|                      |                                  |                |                | 24V AC/DC                    | 150-F480NCR                       |
|                      | 283...850                        | 560            | 900            | 110/120V AC, 50/60 Hz        | 150-F625NCE                       |
|                      |                                  |                |                | 230/240V AC, 50/60 Hz        | 150-F625NCA                       |
|                      | 300...900                        | 630            | 900            | 110/120V AC, 50/60 Hz        | 150-F780NCE                       |
|                      |                                  |                |                | 230/240V AC, 50/60 Hz        | 150-F780NCA                       |
|                      | 400...1200                       | 800            | 1300           | 110/120V AC, 50/60 Hz        | 150-F970NCE                       |
|                      |                                  |                |                | 230/240V AC, 50/60 Hz        | 150-F970NCA                       |
|                      | 533...1600                       | 1100           | 1600           | 110/120V AC, 50/60 Hz        | 150-F1250NCE                      |
|                      |                                  |                |                | 230/240V AC, 50/60 Hz        | 150-F1250NCA                      |

(1) Motor FLA rating must fall within specified current range for unit to operate properly. Special consideration should be given when using a motor with a potentially high starting current (greater than ten times motor FLA) with the SMC Flex controller. Contact Rockwell Automation technical support for further guidance.

(2) For controllers with 24V AC/DC control power, separate 120V or 240V single-phase power supply is required for fan operation.

(3) Devices rated 108 A and greater are not equipped with line and load terminal lugs. See [page 40](#) for terminal lug kits.

# Accessories



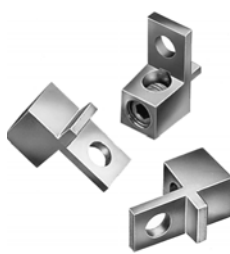
You must not place protective modules on the load (motor) side of an SMC Flex controller when using an inside-the-delta connection or with pump or braking control options.

**Table 39 - Protective Modules<sup>(1)</sup>**

|  | Current Rating [A] | Description            | Cat. No. |
|-----------------------------------------------------------------------------------|--------------------|------------------------|----------|
|                                                                                   | 5...85             | 480V Protective Module | 150-F84  |
|                                                                                   | 108...1250         |                        | 150-F84L |
|                                                                                   | 5...85             | 600V Protective Module | 150-F86  |
|                                                                                   | 108...1250         |                        | 150-F86L |

(1) The same protective module mounts on the line or load side of the SMC Flex controller. Use of protective modules is highly recommended. For applications that require both line and load side protection, you must order two protective modules.

**Table 40 - Terminal Lug Kits**

|                                                                                    | Connection Type | Current Range [A] <sup>(1)</sup> | Wire Size Range                                                | Total No. of Terminal Lugs Possible Each Side |                   | Pkg. Qty. | Cat. No.  |
|------------------------------------------------------------------------------------|-----------------|----------------------------------|----------------------------------------------------------------|-----------------------------------------------|-------------------|-----------|-----------|
|                                                                                    |                 |                                  |                                                                | Line Side                                     | Load Side         |           |           |
|  | Line            | 108...135 <sup>(2)</sup>         | #6...250 MCM AWG<br>16 mm <sup>2</sup> ...120 mm <sup>2</sup>  | 3                                             | 3                 | 3         | 199-LF1   |
|                                                                                    |                 | 201...251 <sup>(2)</sup>         |                                                                | 6                                             | 6                 | 3         |           |
|                                                                                    |                 | 317...480 <sup>(2)</sup>         | #4...500 MCM AWG<br>25 mm <sup>2</sup> ...240 mm <sup>2</sup>  | 6                                             | 6                 | 3         | 199-LG1   |
|                                                                                    |                 | 625...780                        | 2/0...500 MCM                                                  | 6                                             | 6                 | 3         | 100-DL630 |
|                                                                                    |                 | 970                              | 4/0...500 MCM                                                  | 3                                             | 3                 | 3         | 100-DL860 |
|                                                                                    |                 | 1250 <sup>(3)</sup>              | 2/0...500 MCM                                                  | 3                                             | 3                 | 3         | 100-DL630 |
|                                                                                    |                 |                                  | 4/0...500 MCM                                                  | 3                                             | 3                 | 3         | 100-DL860 |
|                                                                                    | Delta           | 108...135                        | #4...500 MCM AWG<br>25 mm <sup>2</sup> ...240 mm <sup>2</sup>  | 1                                             | 6 <sup>(4)</sup>  |           | 1494R-N15 |
|                                                                                    |                 | 201...251                        | 1/0...250 MCM AWG<br>50 mm <sup>2</sup> ...120 mm <sup>2</sup> | 2                                             | 12 <sup>(4)</sup> |           | 1494R-N14 |
|                                                                                    |                 | 317...480                        | 3/0...500 MCM AWG<br>95 mm <sup>2</sup> ...240 mm <sup>2</sup> | 1                                             | 12 <sup>(5)</sup> |           | 150-LGSMC |
|                                                                                    |                 | 625...780                        | #4...500 MCM AWG<br>25 mm <sup>2</sup> ...240 mm <sup>2</sup>  | 6 <sup>(6)</sup>                              | 6                 | 3         | 100-DL630 |
|                                                                                    |                 | 970...1250                       | #4...500 MCM AWG<br>25 mm <sup>2</sup> ...240 mm <sup>2</sup>  | 6 <sup>(6)</sup>                              | 6                 | 3         | 100-DL860 |

(1) 5...85 A units have box lugs standard. No additional lugs are required.

(2) When a multi-conductor lug is required, refer to the User Manual for appropriate lug catalog number.

(3) The 1250 A device requires (1) 100-DL630 and (1) 100-DL860 per connection.

(4) When connected in an inside-the-delta configuration, use Cat. No. 199-LF1 for load-side connections (T1...T6).

(5) When connected in an inside-the-delta configuration, use Cat. No. 199-LG1 for load-side connections (T1...T6).

(6) For 625...1250 A inside-the-delta connections, terminal blocks are required for line-side connections. For **fuse-protected** controllers, use Allen-Bradley Cat. No. 1492-BG (625...780 A devices: 2 per phase; 970...1250 A devices, 4 per phase). For **circuit breaker-protected** controllers, use Cooper Bussmann Cat. No. 16504-2 (625...780 A devices: 1 per phase; 970...1250 A devices, 2 per phase).

**Table 41 - IEC Line- or Load-side Terminal Covers**

|                                                                                     | Description <sup>(1)</sup>                                                                                                     | Current Range [A] | Pkg. Quantity | Cat. No. |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|-------------------|---------------|----------|
|  | <ul style="list-style-type: none"> <li>Dead front protection</li> <li>IP2X finger safe when used with 250 MCM cable</li> </ul> | 108...135         | 1             | 150-TC1  |
|                                                                                     |                                                                                                                                | 201...251         | 1             | 150-TC2  |
|                                                                                     | <ul style="list-style-type: none"> <li>Dead front protection</li> <li>IP2X finger safe when used with 500 MCM cable</li> </ul> | 317...480         | 1             | 150-TC3  |

(1) 5...85 A units have terminal guards as standard. No additional terminal guards are required.

Table 42 - Human Interface Modules (HIMs) and Communication Modules

| Description                                                                       |                       |                                                       | Cat. No.                |                                                                          |
|-----------------------------------------------------------------------------------|-----------------------|-------------------------------------------------------|-------------------------|--------------------------------------------------------------------------|
|  | Hand-held HIM         | LCD display, Full Numeric Keypad <sup>(1)</sup>       | 20-HIM-A3               |                                                                          |
|                                                                                   |                       | LCD display, Programmer only <sup>(1)</sup>           | 20-HIM-A5               |                                                                          |
|                                                                                   | Door-mounted HIM      | Remote (panel mount) LCD Display, Full Numeric Keypad | 20-HIM-C3S              |                                                                          |
|                                                                                   |                       | LCD Display, programmer only (includes 3 m cable)     | 20-HIM-C5S              |                                                                          |
|                                                                                   | HIM Interface Cables  | HIM Interface Cable, 1 m (39 in)                      | 20-HIM-H10              |                                                                          |
|                                                                                   |                       | Cable Kit (Male-Female) 0.33 m (1.1 ft)               | 1202-H03                |                                                                          |
|                                                                                   |                       | Cable Kit (Male-Female) 1 m (3.3 ft)                  | 1202-H10                |                                                                          |
|                                                                                   |                       | Cable Kit (Male-Female) 3 m (9.8 ft)                  | 1202-H30                |                                                                          |
|                                                                                   |                       | Cable Kit (Male-Female) 9 m (29.5 ft)                 | 1202-H90                |                                                                          |
|                                                                                   |                       | DPI/SCANport™ One to Two Port Splitter Cable          | 1203-S03                |                                                                          |
| Description                                                                       |                       | For Use With                                          | Cat. No.                |                                                                          |
|  | Communication Modules | RS-485 DF1 Communication Adapter                      | SMC Flex                | 20-COMM-S                                                                |
|                                                                                   |                       | PROFIBUS DP Communication Adapter                     |                         | 20-COMM-P                                                                |
|                                                                                   |                       | ControlNet® Communication Adapter (Coax)              |                         | 20-COMM-C                                                                |
|                                                                                   |                       | Interbus Communication Adapter                        |                         | 20-COMM-I                                                                |
|                                                                                   |                       | Modbus/TCP Communication Adapter                      |                         | 20-COMM-M                                                                |
|                                                                                   |                       | DeviceNet™ Communication Adapter                      |                         | 20-COMM-D                                                                |
|                                                                                   |                       | EtherNet/IP™ Communication Adapter                    |                         | 20-COMM-E                                                                |
|                                                                                   |                       | Dual-port EtherNet/IP Communication Adapter           |                         | 20-COMM-ER                                                               |
|                                                                                   |                       | HVAC Communication Adapter                            |                         | 20-COMM-H                                                                |
|                                                                                   |                       | ControlNet Communication Adapter (Fiber)              |                         | 20-COMM-Q                                                                |
| Connected Components Workbench™ Software                                          |                       | Programming Software                                  | Windows 7/2000/XP/Vista | Available for download at <a href="http://rok.auto/ccw">rok.auto/ccw</a> |
| DriveExecutive™                                                                   |                       |                                                       |                         | 9303-4DTE01ENE                                                           |
| DriveTools™ Sp <sup>(2)</sup>                                                     |                       |                                                       |                         | 9303-4DTS01ENE                                                           |
| AnaCANda™ RS-232 to DPI                                                           |                       | PC Interface                                          | Serial                  | 1203-SSS <sup>(3)</sup>                                                  |
| DPI to USB                                                                        |                       |                                                       | USB                     | 1203-USB <sup>(4)</sup>                                                  |

(1) Requires a 20-HIM-H10 cable to connect to the SMC Flex.

(2) Includes DriveExecutive™ and DriveObserver™

(3) Includes Cat. No. 1203-SFC and 1202-C10 cables.

(4) Includes Cat. No. 20-HIM-H10 and 22-HIM-H10 cables.

**IMPORTANT** Carefully check current range, line voltage and control input voltage when selecting an upgrade kit. Not all control voltages or current ranges can be upgraded.

**Table 43 - Upgrade Kits**

| Description                                                    | Kit Contents <sup>(1)</sup>                                                                                                                                                         | Rated Current [A] | Line Voltage [V AC] | Control Voltage <sup>(2)</sup> | Cat. No.                     |
|----------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|---------------------|--------------------------------|------------------------------|
| Frame 3 SMC Flex to SMC-50 controllers with bypass upgrade kit | <ul style="list-style-type: none"> <li>150-SCMD control module</li> <li>150-SM4 digital I/O module</li> <li>20-HIM-A6 LCD HIM</li> </ul>                                            | 108               | 200...690           | 100...240V AC                  | 150-S108UPGD                 |
|                                                                |                                                                                                                                                                                     | 135               |                     |                                | 150-S135UPGD                 |
|                                                                | <ul style="list-style-type: none"> <li>150-SCMR control module</li> <li>20-HIM-A6 LCD HIM</li> </ul>                                                                                | 108               | 200...690           | 24V DC <sup>(3)</sup>          | 150-S108UPGR <sup>(4)</sup>  |
|                                                                |                                                                                                                                                                                     | 135               |                     |                                | 150-S135UPGR <sup>(4)</sup>  |
| Frame 4 SMC Flex to SMC-50 controllers with bypass upgrade kit | <ul style="list-style-type: none"> <li>150-SCMD control module</li> <li>150-SM4 digital I/O module</li> <li>20-HIM-A6 LCD HIM</li> <li>Plastic mounting/transition cover</li> </ul> | 201               | 200...480           | 100...240V AC                  | 150-S201UPGBD                |
|                                                                |                                                                                                                                                                                     |                   | 200...575           |                                | 150-S201UPGCD                |
|                                                                |                                                                                                                                                                                     |                   | 200...690           |                                | 150-S201UPGUD                |
|                                                                |                                                                                                                                                                                     | 251               | 200...480           |                                | 150-S251UPGBD                |
|                                                                |                                                                                                                                                                                     |                   | 200...575           |                                | 150-S251UPGCD                |
|                                                                |                                                                                                                                                                                     |                   | 200...690           |                                | 150-S251UPGUD                |
|                                                                | <ul style="list-style-type: none"> <li>150-SCMR control module</li> <li>20-HIM-A6 LCD HIM</li> <li>Plastic mounting/transition cover</li> </ul>                                     | 201               | 200...480           | 24V DC <sup>(3)</sup>          | 150-S201UPGBR <sup>(4)</sup> |
|                                                                |                                                                                                                                                                                     |                   | 200...575           |                                | 150-S201UPGCR <sup>(4)</sup> |
|                                                                |                                                                                                                                                                                     |                   | 200...690           |                                | 150-S201UPGUR <sup>(4)</sup> |
|                                                                |                                                                                                                                                                                     | 251               | 200...480           |                                | 150-S251UPGBR <sup>(4)</sup> |
|                                                                |                                                                                                                                                                                     |                   | 200...575           |                                | 150-S251UPGCR <sup>(4)</sup> |
|                                                                |                                                                                                                                                                                     |                   | 200...690           |                                | 150-S251UPGUR <sup>(4)</sup> |

(1) Kit contains one of each catalog number listed.

(2) The SMC-50 control module provides two (2) 24V DC control inputs. If you need additional inputs, you must use 100...240V AC inputs (requires 150-SM4 option module).

(3) 24V DC control voltage ONLY. Not compatible with 24V AC control voltage.

(4) Consult your local Rockwell Automation sales office or Allen-Bradley distributor for availability.

# Specifications

**Table 44 - SMC Flex Feature Specifications**

| Attribute                      |                         | Description                                                                                                                                                                                                                                                                                                                                                          |
|--------------------------------|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Standard Features</b>       |                         |                                                                                                                                                                                                                                                                                                                                                                      |
| Installation                   | Power Wiring            | standard squirrel-cage induction motor or a Wye-Delta, six-lead motor                                                                                                                                                                                                                                                                                                |
|                                | Control Wiring          | 2- and 3-wire control for a wide variety of applications                                                                                                                                                                                                                                                                                                             |
| Configuration/Setup            | Keypad                  | Front keypad with backlit LCD display. Optional 20-HIM-A module can be connected using the available DPI port.                                                                                                                                                                                                                                                       |
|                                | Software                | parameter values are downloaded to the SMC Flex controller by using the Connected Components Workbench, DriveTools, and DriveExplorer programming software packages                                                                                                                                                                                                  |
| Communications                 |                         | One DPI provided for connection to optional human interface and one DPI provided for connection to communication modules.                                                                                                                                                                                                                                            |
| Starting and Stopping Modes    |                         | Soft Start<br>Current Limit Start<br>Dual Ramp<br>Full Voltage<br>Linear Speed Acceleration<br>Preset Slow Speed<br>Soft Stop                                                                                                                                                                                                                                        |
| Protection and Diagnostics     |                         | Power loss, line fault, voltage unbalance, excessive starts/hour, phase reversal, undervoltage, overvoltage, controller temp, stall, jam, open gate, overload, underload, communication fault.                                                                                                                                                                       |
| Metering                       |                         | Amps, volts, kW, kWh, MW, MWH, elapsed time, power factor, motor thermal capacity usage.                                                                                                                                                                                                                                                                             |
| Alarm Contact                  |                         | Overload, underload, undervoltage, overvoltage, unbalance, jam, stall, and ground fault                                                                                                                                                                                                                                                                              |
| Status Indication              |                         | Stopped, starting, stopping, at speed, alarm, and fault.                                                                                                                                                                                                                                                                                                             |
| Auxiliary Contacts             |                         | Four fully programmable contacts as normal/up-to-speed/fault/alarm/network (N.O./N.C.), or external bypass (N.O. only).                                                                                                                                                                                                                                              |
| <b>Optional Features</b>       |                         |                                                                                                                                                                                                                                                                                                                                                                      |
| Pump Control                   |                         | Helps reduce fluid surges in centrifugal pumping systems during starting and stopping period. Starting time is adjustable from 0...30 s. Stopping time is adjustable from 0...120 s.                                                                                                                                                                                 |
| Braking Control <sup>(1)</sup> | SMB Smart Motor Braking | Provides motor braking without additional equipment for applications that require the motor to stop quickly. Braking current is adjustable from 0...400% of the motor's full-load current rating.                                                                                                                                                                    |
|                                | Accu-Stop               | Provides controlled position stopping. During stopping, braking torque is applied to the motor until it reaches preset slow speed (7% or 15% of rated speed) and holds the motor at this speed until a stop command is given. Braking torque is then applied until the motor reaches zero speed. Braking current is programmable from 0...450% of full-load current. |
|                                | Slow Speed with Braking | Used on applications that require slow speed (in the forward direction) for positioning or alignment and also require braking control to stop.                                                                                                                                                                                                                       |

(1) Not intended to be used as an emergency stop. See the applicable standards for emergency stop requirements.

Table 45 - Power and Control Circuit Ratings

| Attribute                                         | Device Rating | UL/CSA/NEMA                                          | IEC                         |
|---------------------------------------------------|---------------|------------------------------------------------------|-----------------------------|
| Power Circuit                                     |               |                                                      |                             |
| Rated Operation Voltage                           | 480V          | 200...480V AC (-15%, +10%)                           | 200...415V                  |
|                                                   | 600V          | 200...600V AC (-15%, +10%)                           | 200...500V                  |
|                                                   | 690V          | 230...600V AC (-15%, +10%)                           | 230...690V/Y (-15%, +10%)   |
| Rated Insulation Voltage                          | 480V          | —                                                    | 500V                        |
|                                                   | 600V          |                                                      | 500V                        |
|                                                   | 690V          |                                                      | 690V                        |
| Rated Impulse Voltage                             | 480V          | —                                                    | 6000V                       |
|                                                   | 600V          |                                                      |                             |
|                                                   | 690V          |                                                      |                             |
| Dielectric Withstand                              | 480V          | 2200V AC                                             | 2500V                       |
|                                                   | 600V          |                                                      |                             |
|                                                   | 690V          |                                                      |                             |
| Repetitive Peak Inverse Voltage Rating            | 480V          | 1400V                                                | 1400V                       |
|                                                   | 600V          | 1600V                                                | 1600V                       |
|                                                   | 690V          | 1800V                                                | 1800V                       |
| Operating Frequency                               | All           | 50/60 Hz                                             |                             |
| Utilization Category                              | 5...480 A     | MG 1                                                 | AC-53b:3.0-50:1750          |
|                                                   | 625...1250 A  | MG 1                                                 | AC-53b:3.0-50:3550          |
| Protection Against Electrical Shock               | 5...85 A      | —                                                    | IP20                        |
|                                                   | 108...480 A   |                                                      | IP2X (with terminal covers) |
|                                                   | 625...1250 A  |                                                      | IP00 (open device)          |
| DV/DT Protection                                  | 480V and 600V | RC Snubber Network                                   |                             |
|                                                   | 690V          | None                                                 |                             |
| Transient Protection                              | 480V and 600V | Metal Oxide Varistors: 220 Joules (optional)         |                             |
|                                                   | 690V          | None                                                 |                             |
| Control Circuit                                   |               |                                                      |                             |
| Rated Operational Voltage <sup>(1)</sup>          | 5...480 A     | 100...240V AC or 24V AC/DC                           |                             |
|                                                   | 625...1250 A  | 110/120V AC and 230/240V AC                          |                             |
| Rated Insulation Voltage                          | All           | —                                                    | 240V                        |
| Rated Impulse Voltage                             | All           | —                                                    | 3000V                       |
| Dielectric Withstand                              | All           | 1600V AC                                             | 2000V                       |
| Operating Frequency                               | All           | 50/60 Hz                                             |                             |
| Input on-state voltage minimum                    |               | 85V AC, 19.2V DC / 20.4V AC                          |                             |
| Input on-state current                            |               | 20 mA @120V AC / 40 mA @ 240V AC, 7.6 mA @ 24V AC/DC |                             |
| Input off-state voltage maximum                   |               | 50V AC, 10V DC / 12V AC                              |                             |
| Input off-state current @ input off-state voltage |               | <10 mA AC, <3 mA DC                                  |                             |

(1) 690V power is only available with 100...240V control.

Table 46 - Short-circuit Protection Performance, 200...600V, Type 1 Coordination<sup>(1)(2)</sup>

| SCCR List <sup>(3)</sup>                    | Device Rating | Max. Standard Available Fault | Max. Standard Fuse [A] <sup>(4)</sup> | Max. Standard Available Fault | Max. Circuit Breaker [A] |
|---------------------------------------------|---------------|-------------------------------|---------------------------------------|-------------------------------|--------------------------|
| Line Device Operational Current Rating [A]  | 5             | 5 kA                          | 20                                    | 5 kA                          | 20                       |
|                                             | 25            | 5 kA                          | 100                                   | 5 kA                          | 100                      |
|                                             | 43            | 10 kA                         | 150                                   | 10 kA                         | 150                      |
|                                             | 60            | 10 kA                         | 225                                   | 10 kA                         | 225                      |
|                                             | 85            | 10 kA                         | 300                                   | 10 kA                         | 300                      |
|                                             | 108           | 10 kA                         | 400                                   | 10 kA                         | 300                      |
|                                             | 135           | 10 kA                         | 500                                   | 10 kA                         | 400                      |
|                                             | 201           | 18 kA                         | 600                                   | 18 kA                         | 600                      |
|                                             | 251           | 18 kA                         | 700                                   | 18 kA                         | 700                      |
|                                             | 317           | 30 kA                         | 800                                   | 30 kA                         | 800                      |
|                                             | 361           | 30 kA                         | 1000                                  | 30 kA                         | 1000                     |
|                                             | 480           | 42 kA                         | 1200                                  | 42 kA                         | 1200                     |
|                                             | 625           | 42 kA                         | 1600                                  | 42 kA                         | 1600                     |
|                                             | 780           | 42 kA                         | 1600                                  | 42 kA                         | 2000                     |
|                                             | 970           | 85 kA                         | 2500                                  | 85 kA                         | 2500                     |
|                                             | 1250          | 85 kA                         | 3000                                  | 85 kA                         | 3200                     |
| Delta Device Operational Current Rating [A] | 8.7           | 5 kA                          | 35                                    | 5 kA                          | 35                       |
|                                             | 43            | 5 kA                          | 150                                   | 5 kA                          | 150                      |
|                                             | 74            | 10 kA                         | 300                                   | 10 kA                         | 300                      |
|                                             | 104           | 10 kA                         | 400                                   | 10 kA                         | 400                      |
|                                             | 147           | 10 kA                         | 400                                   | 10 kA                         | 400                      |
|                                             | 187           | 10 kA                         | 600                                   | 10 kA                         | 500                      |
|                                             | 234           | 10 kA                         | 700                                   | 10 kA                         | 700                      |
|                                             | 348           | 18 kA                         | 1000                                  | 18 kA                         | 1000                     |
|                                             | 435           | 18 kA                         | 1200                                  | 18 kA                         | 1200                     |
|                                             | 549           | 30 kA                         | 1600                                  | 30 kA                         | 1600                     |
|                                             | 625           | 30 kA                         | 1600                                  | 30 kA                         | 1600                     |
|                                             | 831           | 42 kA                         | 1600                                  | 30 kA                         | 1600                     |
|                                             | 831           | 42 kA                         | 1600                                  | 42 kA                         | 1200                     |
|                                             | 850           | 42 kA                         | 1600                                  | 42 kA                         | 2000                     |
|                                             | 900           | 42 kA                         | 1600                                  | 42 kA                         | 2000                     |
|                                             | 1200          | 85 kA                         | 3000                                  | 85 kA                         | 3200                     |
|                                             | 1600          | 85 kA                         | 3000                                  | 85 kA                         | 3200                     |

(1) Type 1 performance/protection indicates that, under a short-circuit condition, the fuse- or circuit breaker-protected starter shall cause no damage to persons or the installation but it may not be suitable for further service without repair or replacement.

(2) For short-circuit current rating (SCCR) information for an enclosed panel with external bypass or isolation contactor, see [rok.auto/sccr](http://rok.auto/sccr).

(3) Consult local codes for proper sizing of short circuit protection.

(4) Non-time delay fuses (K5 – 5...480A (8.7...831 A) devices; Class L – 625...1250A (850...1600 A) devices).

Table 47 - Short-circuit Protection Performance, 200...600V, Type 1 Coordination

| SCPD Performance <sup>(1)</sup> |               |                    | Type 1 Ratings <sup>(2)</sup>                  |                  |                                                                  |               |                      |
|---------------------------------|---------------|--------------------|------------------------------------------------|------------------|------------------------------------------------------------------|---------------|----------------------|
| Motor Connection Type           | Cat. No.      | Current Rating [A] | Class J or Class L Fuse <sup>(3)</sup>         |                  | Inverse Time (Thermal Magnetic) Circuit Breaker 480V, 65 kA Max. |               |                      |
|                                 |               |                    | Max. High Capacity Available Fault (600V) [kA] | Max. Current [A] | Max. Current [A]                                                 | Cat. No.      | Rating Plug Cat. No. |
| Line Connection                 | 150-F5N...    | 5                  | 70                                             | 10               | Pending                                                          |               |                      |
|                                 | 150-F25N...   | 25                 |                                                | 50               |                                                                  |               |                      |
|                                 | 150-F43N...   | 43                 |                                                | 90               |                                                                  |               |                      |
|                                 | 150-F60N...   | 60                 |                                                | 125              |                                                                  |               |                      |
|                                 | 150-F85N...   | 85                 |                                                | 175              |                                                                  |               |                      |
|                                 | 150-F108N...  | 108                |                                                | 200              | 300                                                              | 140G-K6F3-D30 | —                    |
|                                 | 150-F135N...  | 135                |                                                | 225              | 400                                                              | 140G-K6F3-D40 | —                    |
|                                 | 150-F201N...  | 201                |                                                | 350              | 600                                                              | 140G-M6F3-D60 | —                    |
|                                 | 150-F251N...  | 251                |                                                | 400              | 700                                                              | 140G-M6F3-D80 | —                    |
|                                 | 150-F317N...  | 317                | 69                                             | 500              | 800                                                              | 140G-N6H3-E12 | 140G-NRP-D80         |
|                                 | 150-F361N...  | 361                |                                                | 600              | 1000                                                             | 140G-N6H3-E12 | 140G-NRP-E10         |
|                                 | 150-F480N...  | 480                |                                                | 800              | 1200                                                             | 140G-N6H3-E12 | —                    |
|                                 | 150-F625N...  | 625                | 74                                             | 1600             | Pending                                                          |               |                      |
|                                 | 150-F780N...  | 780                |                                                | 1600             |                                                                  |               |                      |
|                                 | 150-F970N...  | 970                | 85                                             | 2500             |                                                                  |               |                      |
|                                 | 150-F1250N... | 1250               |                                                | 3000             |                                                                  |               |                      |
| Inside-the-Delta Connection     | 150-F5N...    | 8.7                | 70                                             | 17.5             | Pending                                                          |               |                      |
|                                 | 150-F25N...   | 43                 |                                                | 90               |                                                                  |               |                      |
|                                 | 150-F43N...   | 74                 |                                                | 150              |                                                                  |               |                      |
|                                 | 150-F60N...   | 104                |                                                | 200              |                                                                  |               |                      |
|                                 | 150-F85N...   | 147                |                                                | 200              |                                                                  |               |                      |
|                                 | 150-F108N...  | 187                |                                                | 300              | 400                                                              | 140G-K6F3-D40 | —                    |
|                                 | 150-F135N...  | 234                |                                                | 400              | 400                                                              | 140G-K6F3-D40 | —                    |
|                                 | 150-F201N...  | 348                |                                                | 600              | 800                                                              | 140G-M6F3-D80 | —                    |
|                                 | 150-F251N...  | 435                |                                                | 800              | 800                                                              | 140G-M6F3-D80 | —                    |
|                                 | 150-F317N...  | 549                | 69                                             | 1000             | 1200                                                             | 140G-N6H3-E12 | —                    |
|                                 | 150-F361N...  | 625                |                                                | 1200             | 1200                                                             | 140G-N6H3-E12 | —                    |
|                                 | 150-F480N...  | 831                |                                                | 1600             | 1200                                                             | 140G-N6H3-E12 | —                    |
|                                 | 150-F625N...  | 850                | 74                                             | 1600             | Pending                                                          |               |                      |
|                                 | 150-F780N...  | 900                |                                                | 1600             |                                                                  |               |                      |
|                                 | 150-F970N...  | 1200               | 85                                             | 3000             |                                                                  |               |                      |
|                                 | 150-F1250N... | 1600               |                                                | 3000             |                                                                  |               |                      |

(1) Consult local codes for proper sizing of short-circuit protection.

(2) Basic Requirements for Type 1 Coordination: Under the short-circuit condition, the starter shall cause no danger to persons or to the installation. The starter may not be suitable for further service without repair or replacement of parts. For further details, refer to UL 508/CSA C22.2 No. 14 and EN 60947-4-2.

(3) High Capacity fault ratings when used with time delay Class J or time delay Class L fuse.

**Table 48 - Short-circuit Protection Performance, 690V, Type 1 Coordination<sup>(1)</sup>**

| SCCR List <sup>(2)</sup> | Device Rating | Max. Standard Available Fault | Max. Ampere Tested – North American Style | Max. Ampere Tested – European Style   |
|--------------------------|---------------|-------------------------------|-------------------------------------------|---------------------------------------|
| Maximum FLC              | 108           | 70 kA                         | A070URD33xxx500                           | 6,9 gRB 73xxx400<br>6,6URD33xxx500    |
|                          | 135           | 70 kA                         | A070URD33xxx500                           | 6,9 gRB 73xxx400<br>6,6URD33xxx500    |
|                          | 201           | 70 kA                         | A070URD33xxx700                           | 6,9 gRB 73xxx630<br>6,6URD33xxx700    |
|                          | 251           | 70 kA                         | A070URD33xxx700                           | 6,9 gRB 73xxx630<br>6,6URD33xxx700    |
|                          | 317           | 70 kA                         | A070URD33xxx900                           | 6,9 gRB 73xxx800<br>6,6URD33xxx900    |
|                          | 361           | 70 kA                         | A070URD33xxx900                           | 6,9 gRB 73xxx800<br>6,6URD33xxx900    |
|                          | 480           | 70 kA                         | A070D33xxx1250<br>A100URD73xxx1250        | 9 URD 73xxx1250<br>6,6URD33xxx1250    |
|                          | 625           | 70 kA                         | A070URD33xxx1400                          | 6,6URD33xxx1400                       |
|                          | 780           | 70 kA                         | A070URD33xxx1400                          | 6,6URD33xxx1400                       |
|                          | 970           | 85 kA                         | Two fuses in parallel A070URD33xxx1250    | Two fuses in parallel 6,6URD33xxx1250 |
|                          | 1250          | 85 kA                         | Two fuses in parallel A070URD33xxx1250    | Two fuses in parallel 6,6URD33xxx1250 |

(1) Type 1 performance/protection indicates that, under a short-circuit condition, the fuse- or circuit breaker-protected starter shall cause no damage to persons or the installation but it may not be suitable for further service without repair or replacement.

(2) Consult local codes for proper sizing of short circuit protection.

**Table 49 - Power Requirements**

|                                | Device Rating [A]    | Control Power               | Description                        |             |
|--------------------------------|----------------------|-----------------------------|------------------------------------|-------------|
| Control Module                 | 1...480              | 100...240V AC (-15%, +10%)  | Transformer                        | 75 VA       |
|                                |                      | 24V AC (-15%, +10%)         | Transformer                        | 130 VA      |
|                                |                      | 24V DC (-15%, +10%)         | Inrush Current                     | 5 A         |
|                                |                      |                             | Inrush Time                        | 250 ms      |
|                                |                      |                             | Transient Watts                    | 60 W        |
|                                |                      |                             | Transient Time                     | 500 ms      |
|                                |                      |                             | Steady State Watts                 | 24 W        |
|                                |                      |                             | Minimum Allen-Bradley Power Supply | 1606-XLP50E |
|                                | 625...1250           | 751 VA (recommended 800 VA) |                                    |             |
| Heatsink Fan(s) <sup>(1)</sup> | 5...135 A, 20 VA     |                             |                                    |             |
|                                | 201...251 A, 40 VA   |                             |                                    |             |
|                                | 317...480 A, 60 VA   |                             |                                    |             |
|                                | 625...1250 A, 150 VA |                             |                                    |             |

(1) Heatsink fans can be powered by either 110/120V AC or 220/240V AC.

**Table 50 - Steady-state Heat Dissipation**

| Controller Rating [A] | Steady-state Heat Dissipation with Control and Fan Power [W] | Controller Rating [A] | Steady-state Heat Dissipation with Control and Fan Power [W] |
|-----------------------|--------------------------------------------------------------|-----------------------|--------------------------------------------------------------|
| 5                     | 70                                                           | 251                   | 198                                                          |
| 25                    | 70                                                           | 317                   | 225                                                          |
| 43                    | 81                                                           | 361                   | 245                                                          |
| 60                    | 97                                                           | 480                   | 290                                                          |
| 85                    | 129                                                          | 625                   | 446                                                          |
| 108                   | 91                                                           | 780                   | 590                                                          |
| 135                   | 104                                                          | 970                   | 812                                                          |
| 201                   | 180                                                          | 1250                  | 1222                                                         |

Table 51 - Auxiliary Contact Ratings

| Contact Type                                                                                       | Attribute                                   | Value                          |
|----------------------------------------------------------------------------------------------------|---------------------------------------------|--------------------------------|
| Auxiliary Contacts<br>• 19/20 (Aux #1)<br>• 29/30 (Aux #2)<br>• 31/32 (Aux #3)<br>• 33/34 (Aux #4) | Type of Control Circuit                     | Electromagnetic relay          |
|                                                                                                    | Number of Contacts                          | 1                              |
|                                                                                                    | Type of Contacts                            | programmable N.O./N.C.         |
|                                                                                                    | Type of Current                             | AC                             |
|                                                                                                    | Rated Operational Current                   | 3 A @ 120V AC, 1.5 A @ 240V AC |
|                                                                                                    | Conventional Thermal Current $I_{th}$ AC/DC | 5 A                            |
|                                                                                                    | Make/Break VA                               | 3600/360                       |
|                                                                                                    | Utilization Category                        | AC-15/DC                       |

Table 52 - Input Ratings

| Input Type        | Attribute                                            | Value                           |
|-------------------|------------------------------------------------------|---------------------------------|
| PTC Input Ratings | Response Resistance                                  | 3400 $\Omega \pm 150 \Omega$    |
|                   | Reset Resistance                                     | 1600 $\Omega \pm 100 \Omega$    |
|                   | Short-circuit Trip Resistance                        | 25 $\Omega \pm 10 \Omega$       |
|                   | Max. Voltage at PTC Terminals (RPTC = 4 k $\Omega$ ) | < 7.5V                          |
|                   | Max. Voltage at PTC Terminals (RPTC = open)          | 30V                             |
|                   | Max. No. of Sensors.                                 | 6                               |
|                   | Max. Cold Resistance of PTC Sensor Chain             | 1500 $\Omega$                   |
|                   | Response Time                                        | 800 ms                          |
| Tachometer Input  |                                                      | 0...5V DC, 4.5V DC = 100% Speed |

Table 53 - Environmental Ratings

| Attribute                                    | Value                                                                    |
|----------------------------------------------|--------------------------------------------------------------------------|
| Operating Temperature Range                  | -5...+50 °C (23...+122 °F) (open); -5...+40 °C (23...+104 °F) (enclosed) |
| Storage and Transportation Temperature Range | -20...+75 °C (-4...+167 °F)                                              |
| Altitude                                     | 2000 m (6560 ft)                                                         |
| Humidity                                     | 5...95% (noncondensing)                                                  |
| Pollution Degree                             | 2                                                                        |

Table 54 - Mechanical Ratings

| Attribute               | Device Rating                                 | Value                                        |
|-------------------------|-----------------------------------------------|----------------------------------------------|
| Resistance to Vibration | Operational                                   | All                                          |
|                         | Non-Operational                               | 1.0 G Peak, 0.15 mm (0.006 in.) displacement |
|                         |                                               | 2.5 G Peak, 0.38 mm (0.015 in.) displacement |
| Resistance to Shock     | Operational                                   | 625...1250 A                                 |
|                         |                                               | 1.0 G Peak, 0.15 mm (0.006 in.) displacement |
|                         |                                               | 15 G                                         |
|                         | Non-Operational                               | 108...480 A                                  |
|                         |                                               | 5.5 G                                        |
|                         |                                               | 4 G                                          |
|                         |                                               | 30 G                                         |
| Construction            | Power Poles                                   | 5...85 A                                     |
|                         |                                               | 108...1250 A                                 |
|                         | Heatsink thyristor modular design             |                                              |
|                         | Heatsink hockey puck thyristor modular design |                                              |
|                         | Control Modules                               | Thermoset and Thermoplastic Moldings         |
|                         | Metal Parts                                   | Plated Brass, Copper, or Painted Steel       |

Table 55 - Power and Control Terminals

| Attribute               | Device Rating  | Value                                                                                                           |                                                                                                               |
|-------------------------|----------------|-----------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|
|                         |                | Line Side                                                                                                       | Load side                                                                                                     |
| Power Terminals         | 5...85 A       | Cable size – Upper – 2.5...95 mm <sup>2</sup> (14...3/0 AWG)<br>Lower – 0.8...2.5 mm <sup>2</sup> (18...14 AWG) | Cable size – Upper – 2.5...50 mm <sup>2</sup> (14...1 AWG)<br>Lower – 0.8...2.5 mm <sup>2</sup> (18...14 AWG) |
|                         |                | Tightening torque – 14.7 N•m (130 lb•in)<br>Wire strip length—18...20 mm (0.22...0.34 in.)                      |                                                                                                               |
|                         | 108...135 A    | One M10 x 1.5 diameter hole per power pole                                                                      |                                                                                                               |
|                         | 201...251 A    | Two M10 x 1.5 diameter holes per power pole                                                                     |                                                                                                               |
|                         | 317...480 A    | Two M12 x 1.75 diameter holes per power pole                                                                    |                                                                                                               |
|                         | 625...1250 A   | Two 13.5 mm (0.53 in.) diameter holes per power pole                                                            |                                                                                                               |
| Power Terminal Markings |                | NEMA, CENELEC EN50 012                                                                                          |                                                                                                               |
| Control Terminals       | M3 screw clamp | Clamping yoke connection                                                                                        |                                                                                                               |

Table 56 - EMC Emission Ratings

| Attribute           |                                       | Value                |
|---------------------|---------------------------------------|----------------------|
| EMC Emission Levels | Conducted Radio Frequency Emissions   | Class A              |
|                     | Radiated Emissions                    | Class A              |
| EMC Immunity Levels | Electrostatic Discharge               | 8 kV Air Discharge   |
|                     | Radio Frequency Electromagnetic Field | Per EN/IEC 60947-4-2 |
|                     | Fast Transient                        | Per EN/IEC 60947-4-2 |
|                     | Surge Transient                       | Per EN/IEC 60947-4-2 |

Table 57 - Overload Characteristics

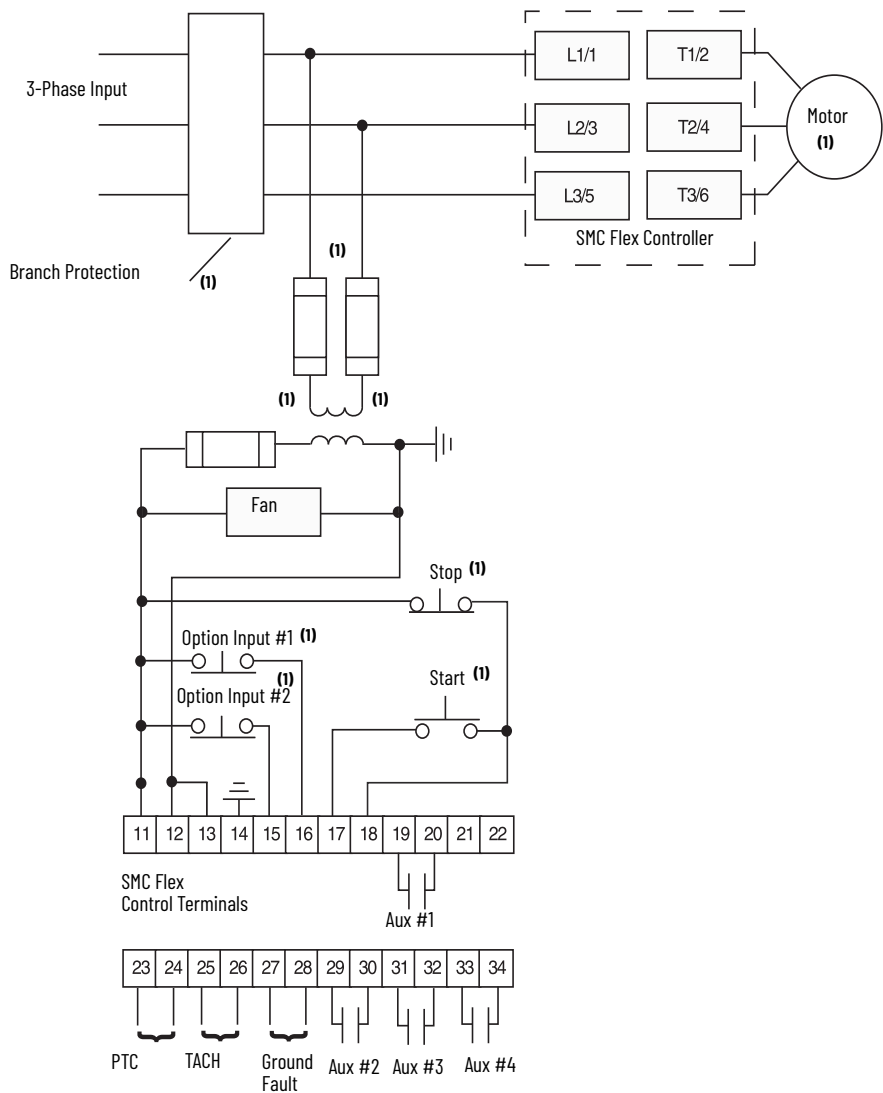
| Current Range [A]   | Line-connected Controllers | Delta-connected Controllers |
|---------------------|----------------------------|-----------------------------|
| 5                   | 1...5                      | 1.7...9                     |
| 25                  | 5...25                     | 8.6...43                    |
| 43                  | 8.6...43                   | 14.8...75                   |
| 60                  | 12...60                    | 20.8...104                  |
| 85                  | 17...85                    | 29.4...147                  |
| 108                 | 27...108                   | 47...187                    |
| 135                 | 34...135                   | 59...234                    |
| 201                 | 67...201                   | 116...348                   |
| 251                 | 84...251                   | 145...435                   |
| 317                 | 106...317                  | 183...549                   |
| 361                 | 120...361                  | 208...625                   |
| 480                 | 160...480                  | 277...831                   |
| 625                 | 208...625                  | 283...850                   |
| 780                 | 260...780                  | 300...900                   |
| 970                 | 323...970                  | 400...1200                  |
| 1250                | 416...1250                 | 533...1600                  |
| Trip Classes        | 10, 15, 20, and 30         |                             |
| Trip Current Rating | 117% of Motor FLC          |                             |
| Number of Poles     | 3                          |                             |

Table 58 - Standards Compliance and Certifications

| Standards Compliance | Certifications                                                 |
|----------------------|----------------------------------------------------------------|
| UL 508               | cULus Listed (Open Type) (File No. E96956, Guides NMFT, NMFT7) |
| CSA C22.2 No.14      | CSA Certified (File No. LR 1234)                               |
| EN/IEC 60947-1       | CE Marked                                                      |
| EN/IEC 60947-4-2     | CCC Certified                                                  |

# Typical Wiring Diagrams

Figure 12 - Wiring Diagram for SMC Flex—Line Controller

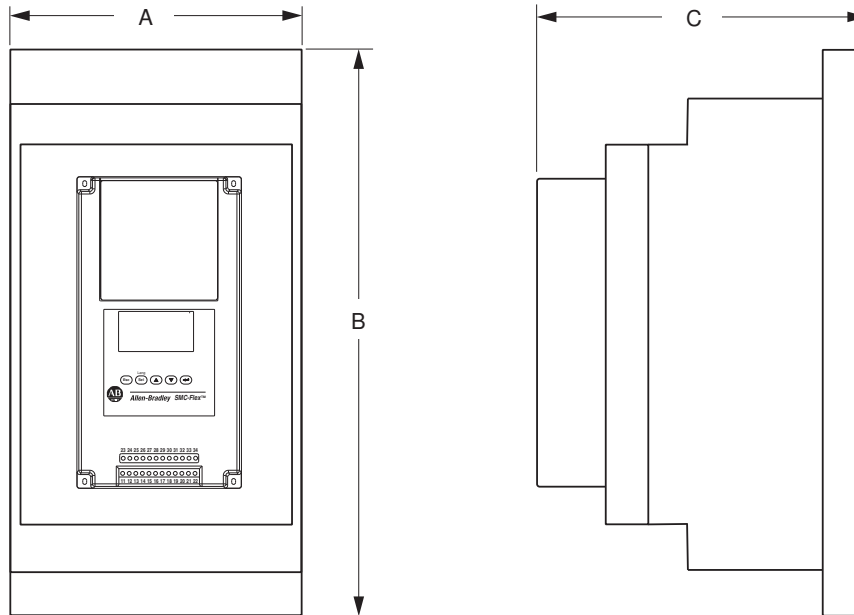


| Note | Information       |
|------|-------------------|
| 1    | Customer supplied |

# Approximate Dimensions and Shipping Weights

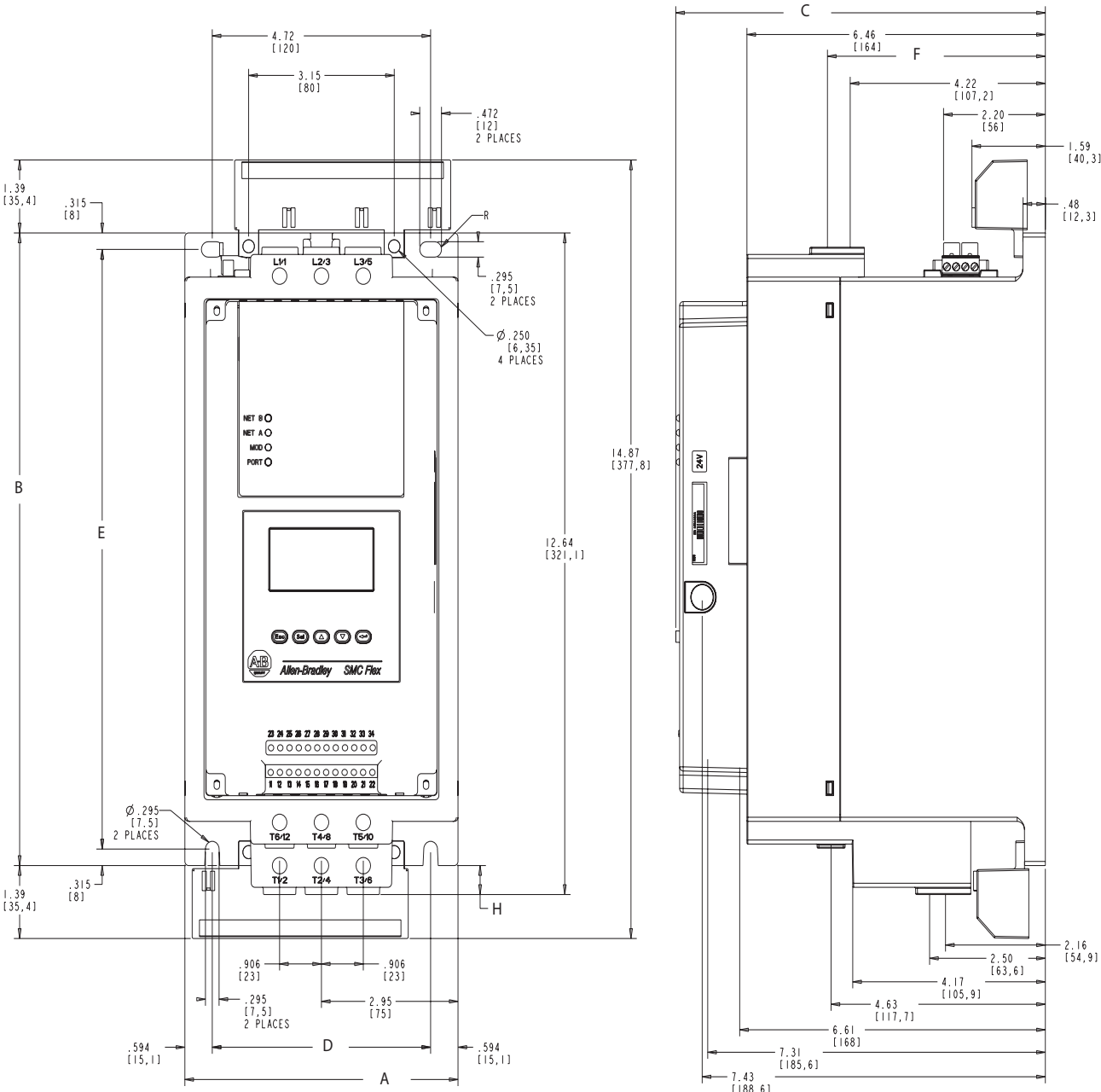
Dimensions are in millimeters (inches). Dimensions are not intended for manufacturing purposes.

## Open Controllers



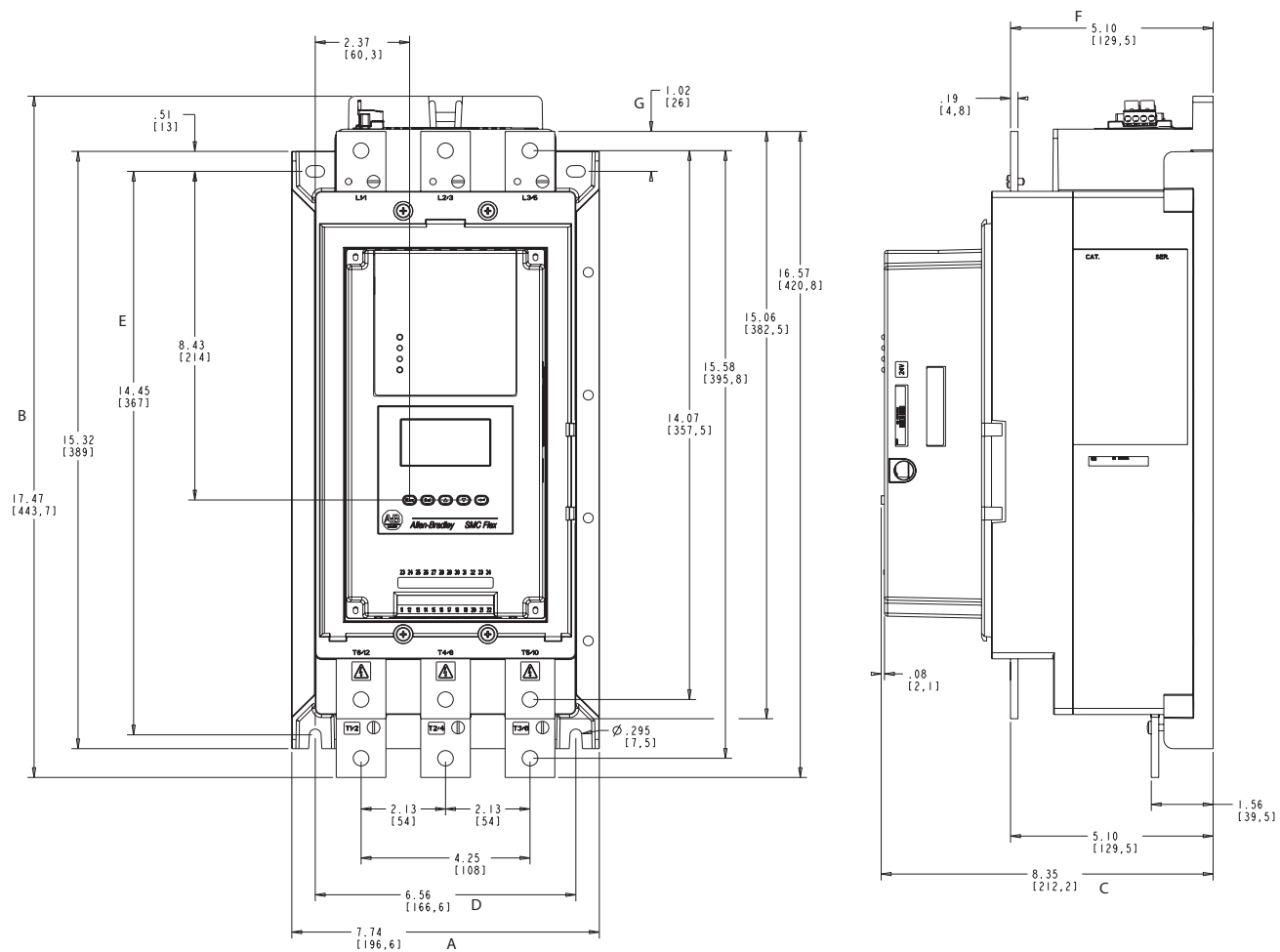
| Rated Current [A] | B Height       | A Width       | C Depth       | Weight            |
|-------------------|----------------|---------------|---------------|-------------------|
| 5...85            | 321.0 (12.60)  | 150.0 (5.90)  | 203.0 (8.00)  | 5.7 kg (12.5 lb)  |
| 108...135         | 443.7 (17.47)  | 196.4 (7.74)  | 212.2 (8.35)  | 15.0 kg (33.0 lb) |
| 201...251         | 560.0 (22.05)  | 225.0 (8.86)  | 253.8 (9.99)  | 30.4 kg (67.0 lb) |
| 317...480         | 600.0 (23.62)  | 290.0 (11.42) | 276.5 (10.89) | 45.8 kg (101 lb)  |
| 625...780         | 1041.1 (41.00) | 596.9 (23.50) | 346.2 (13.63) | 179 kg (395 lb)   |
| 970...1250        | 1041.1 (41.00) | 596.9 (23.50) | 346.2 (13.63) | 224 kg (495 lb)   |

### Figure 13 - 5...85 A Controllers



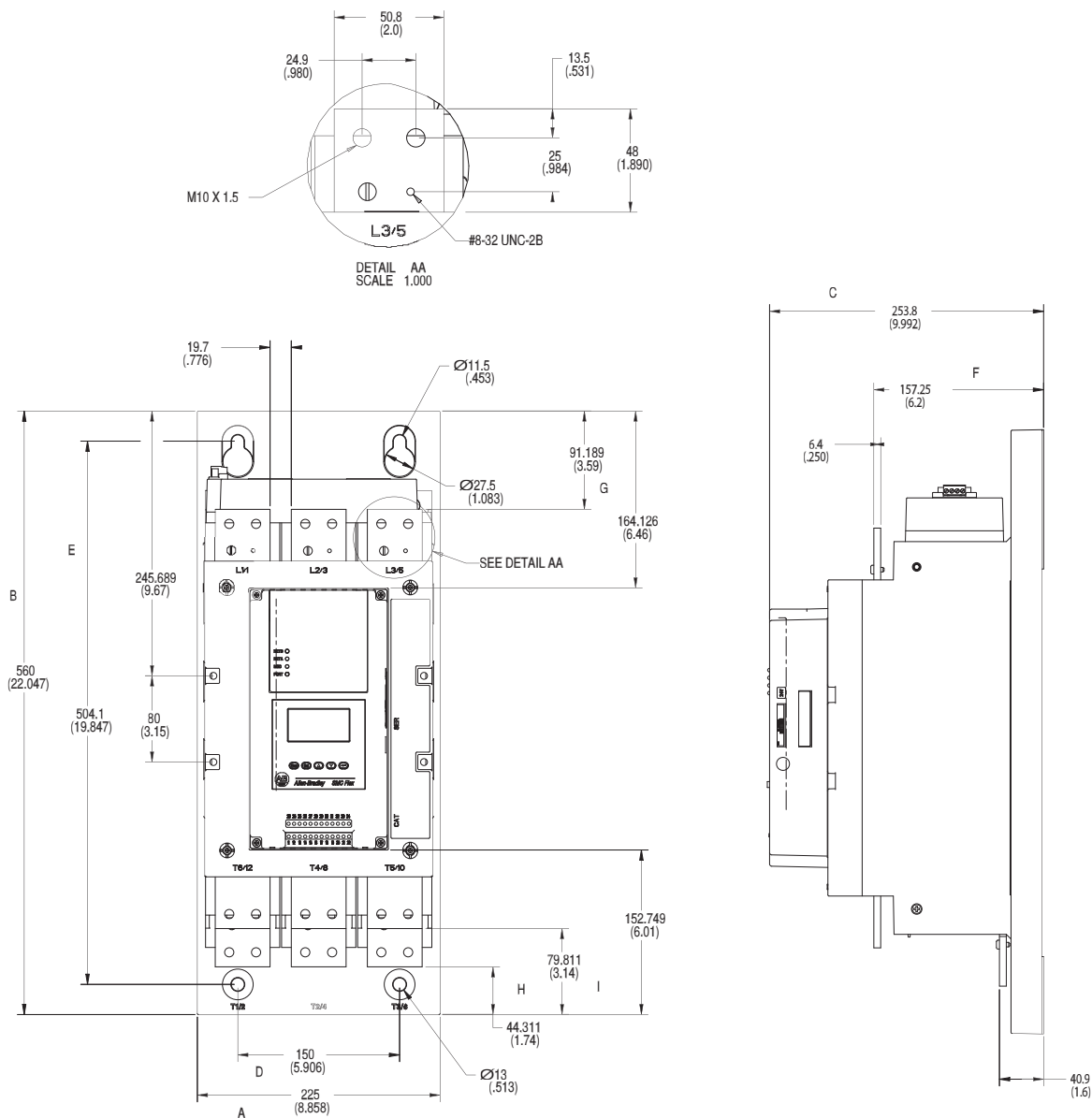
| Unit | A Width | B Height | C Depth | D    | E     | F     | H    | Approx. Ship. Wt. |
|------|---------|----------|---------|------|-------|-------|------|-------------------|
| mm   | 150.1   | 307      | 203.1   | 120  | 291   | 119.8 | 14.1 | 5.7 kg            |
| in.  | 5.91    | 12.09    | 8.00    | 4.72 | 11.46 | 4.72  | 0.56 | 12.6 lb.          |

Figure 14 - 108...135 A Controllers



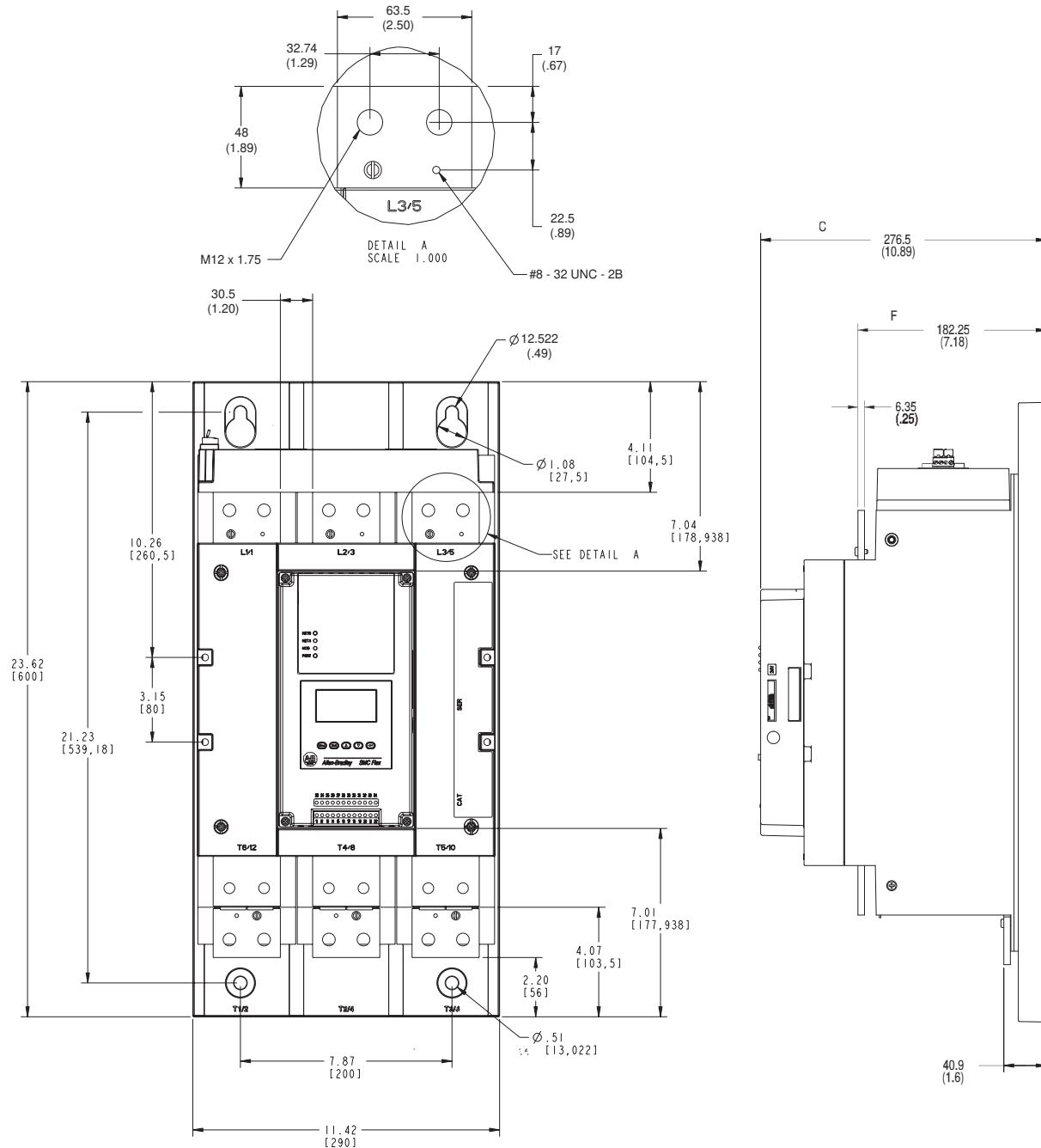
| Unit | A Width | B Height | C Depth | D     | E     | F     | G    | Approx. Ship. Wt. |
|------|---------|----------|---------|-------|-------|-------|------|-------------------|
| mm   | 196.4   | 443.7    | 212.2   | 166.6 | 367   | 129.5 | 26   | 15 kg             |
| in.  | 7.74    | 17.47    | 8.35    | 6.56  | 14.45 | 5.10  | 1.02 | 33 lb.            |

Figure 15 - 201...251 A Controllers



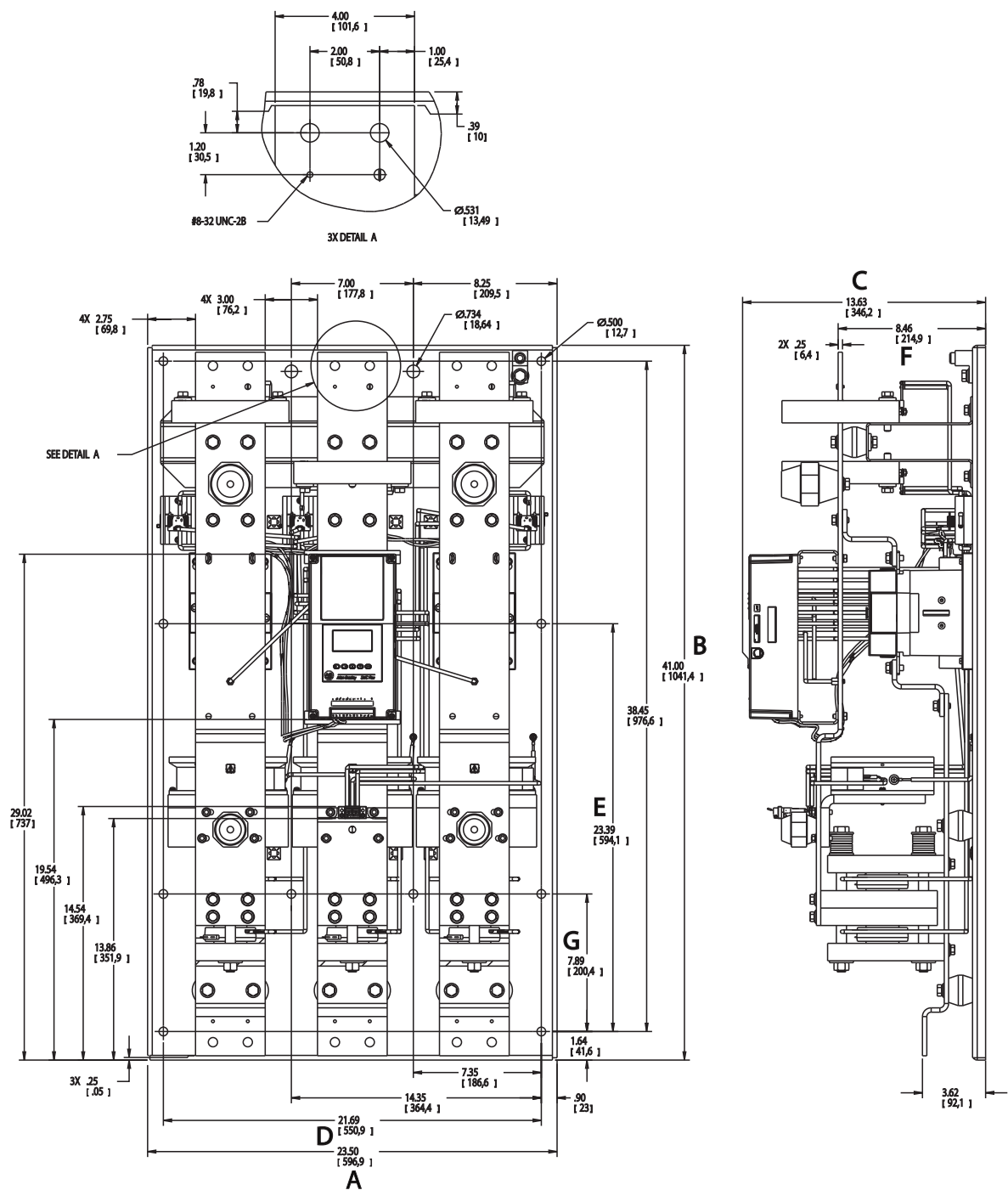
| Unit | A Width | B Height | C Depth | D     | E      | F      | G      | H      | I      | Approx. Ship. Wt. |
|------|---------|----------|---------|-------|--------|--------|--------|--------|--------|-------------------|
| mm   | 225     | 560      | 253.8   | 150   | 504.1  | 157.25 | 91.189 | 44.311 | 79.811 | 30.4 kg           |
| in.  | 8.858   | 22.047   | 9.992   | 5.906 | 19.847 | 6.2    | 3.59   | 1.74   | 3.14   | 67 lb.            |

Figure 16 - Dimensions: 317...480 A Controllers



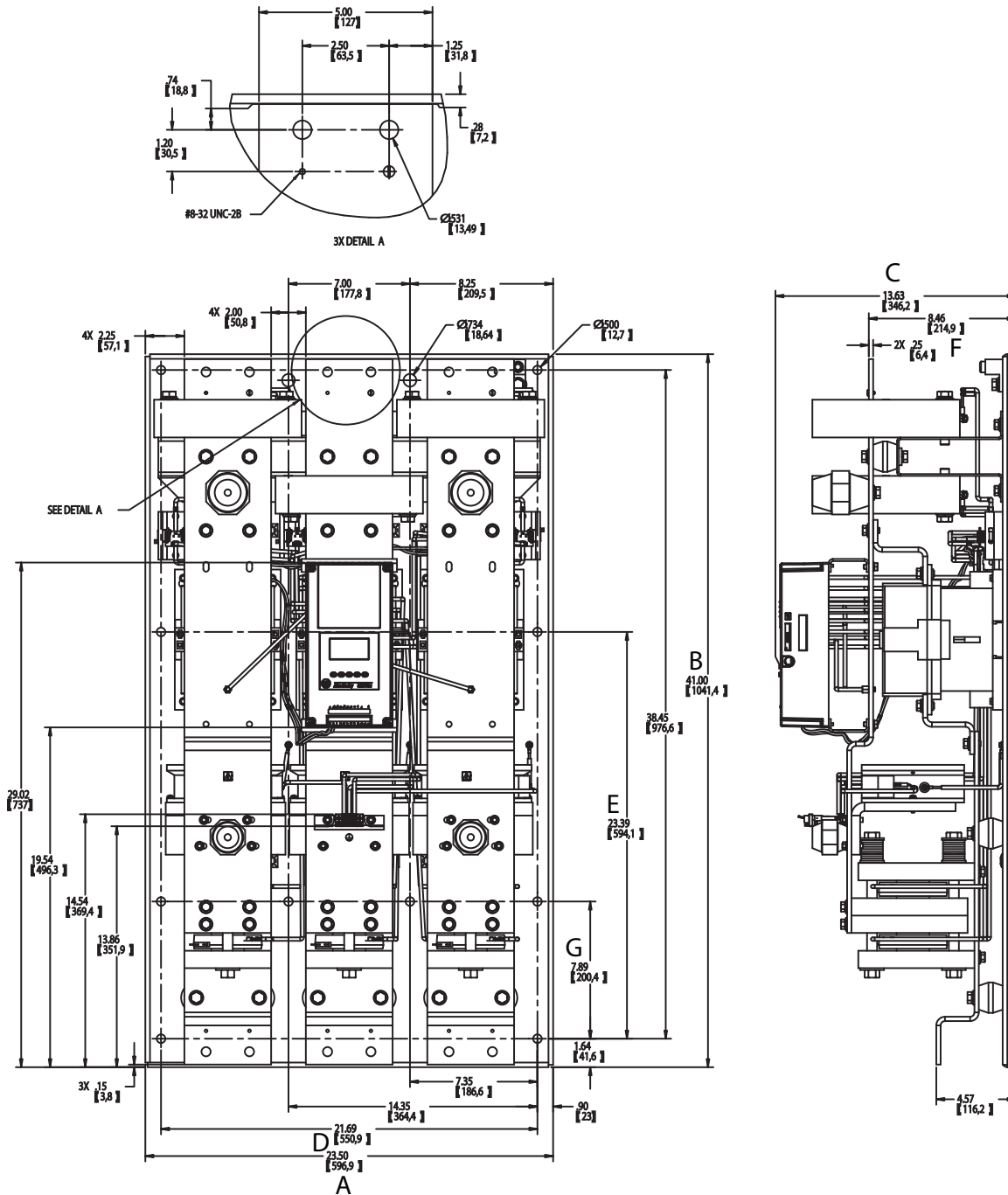
| Unit | A Width | B Height | C Depth | D    | E      | F      | G     | H    | I     | Approx. Ship. Wt. |
|------|---------|----------|---------|------|--------|--------|-------|------|-------|-------------------|
| mm   | 290     | 600      | 276.5   | 200  | 539.18 | 182.25 | 104.5 | 55.5 | 103.5 | 45.8 kg           |
| in.  | 11.42   | 23.62    | 10.89   | 7.87 | 21.23  | 7.18   | 4.11  | 2.19 | 4.07  | 101 lb.           |

Figure 17 - Dimensions: 625...780 A Controllers



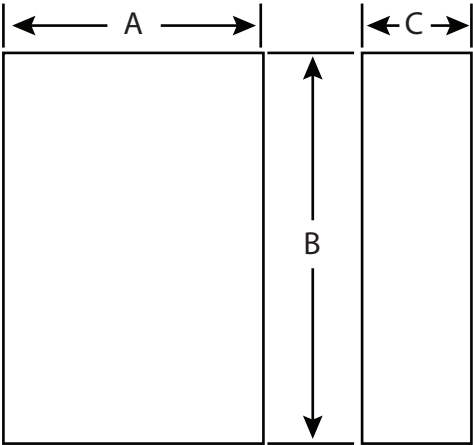
| Unit | A Width | B Height | C Depth | D     | E     | F     | G     | Approx. Ship. Wt. |
|------|---------|----------|---------|-------|-------|-------|-------|-------------------|
| mm   | 596.9   | 1041.4   | 346.2   | 550.9 | 594.1 | 214.9 | 200.4 | 179 kg            |
| in.  | 23.5    | 41.0     | 13.63   | 21.69 | 23.39 | 8.46  | 7.89  | 395 lb.           |

Figure 18 - 970...1250 A Controllers



| Unit | A Width | B Height | C Depth | D     | E     | F     | G     | Approx. Ship. Wt. |
|------|---------|----------|---------|-------|-------|-------|-------|-------------------|
| mm   | 596.9   | 1041.4   | 346.2   | 550.9 | 594.1 | 214.9 | 200.4 | 224 kg            |
| in.  | 23.5    | 41.0     | 13.63   | 21.69 | 23.39 | 8.46  | 7.89  | 495 lb.           |

Figure 19 - Minimum Enclosure Size



| Rated Current [A]   | B Height [mm (in.)] | A Width [mm (in.)] | C Depth [mm (in.)] |
|---------------------|---------------------|--------------------|--------------------|
| 5                   | 610 (24)            | 406 (16)           | 254 (10)           |
| 25                  | 610 (24)            | 406 (16)           | 254 (10)           |
| 43                  | 610 (24)            | 406 (16)           | 254 (10)           |
| 60                  | 610 (24)            | 406 (16)           | 254 (10)           |
| 85                  | 610 (24)            | 406 (16)           | 254 (10)           |
| 108                 | 762 (30)            | 610 (24)           | 305 (12)           |
| 135                 | 762 (30)            | 610 (24)           | 305 (12)           |
| 201                 | 965 (38)            | 762 (30)           | 356 (14)           |
| 251                 | 965 (38)            | 762 (30)           | 356 (14)           |
| 317                 | 1295 (51)           | 914 (36)           | 356 (14)           |
| 361                 | 1295 (51)           | 914 (36)           | 356 (14)           |
| 480                 | 1295 (51)           | 914 (36)           | 356 (14)           |
| 625                 | 2286 (90)           | 762 (30)           | 508 (20)           |
| 780                 | 2286 (90)           | 762 (30)           | 508 (20)           |
| 970 <sup>(1)</sup>  | 2286 (90)           | 762 (30)           | 508 (20)           |
| 1250 <sup>(1)</sup> | 2286 (90)           | 762 (30)           | 508 (20)           |

(1) 970 and 1250 A SMC-Flex controllers require a door-mounted fan that is capable of delivering 240 cfm. Appropriate inlet and outlet filtering is required.

The SMC-50 controller has a scalable design, allowing you the flexibility to satisfy a wide variety of control needs. Advanced monitoring and protection, superior communications capabilities, and Energy Saver mode help increase efficiency and reduce downtime. Three-phase control, built-in overload, removable control module and removable terminal blocks are combined in a cost-effective package with your choice of internal bypass or solid-state power structures. Normal- and heavy-duty ratings, expandable I/O and sensor capability, LCD screen or personal computer software setup and network integration capabilities increase application scalability.

Modes of operation include the following:

- Soft Start
- Current Limit Start
- Selectable Kickstart
- Coast-to-rest
- Soft Stop
- Full Voltage Start
- Dual Ramp Start
- Pump Start
- Preset Slow Speed
- Pump Stop
- Smart Motor Braking
- Accu-Stop
- Slow Speed with Braking
- Resistive Load
- Sensorless Linear Speed Acceleration
- Sensorless Linear Speed Deceleration
- Torque Control
- Integral Motor Winding Heater
- Energy Saver
- Emergency Run
- External Bypass

## Catalog Number Explanation

Examples that are given in this section are not intended to be used for product selection. Use ProposalWorks software to configure the SMC-50 controller. ProposalWorks software is available from [rok.auto/systemtools](http://rok.auto/systemtools).

150-S  
a
135  
b
N  
c
B  
d
D  
e

| a               |                         |
|-----------------|-------------------------|
| Bulletin Number |                         |
| Code            | Description             |
| 150-S           | SMC-50 Motor Controller |

| b                                      |                            |                               |             |
|----------------------------------------|----------------------------|-------------------------------|-------------|
| Controller Type and Rating             |                            |                               |             |
| SMC-50 Controller with Internal Bypass |                            | Solid-state SMC-50 Controller |             |
| Code                                   | Description                | Code                          | Description |
| 108                                    | 108 A with Internal Bypass | B1                            | 90 A        |
| 135                                    | 135 A with Internal Bypass | B2                            | 110 A       |
| 201                                    | 201 A with Internal Bypass | B3                            | 140 A       |
| 251                                    | 251 A with Internal Bypass | B4                            | 180 A       |
| 317                                    | 317 A with Internal Bypass | C1                            | 210 A       |
| 361                                    | 361 A with Internal Bypass | C2                            | 260 A       |
| 480                                    | 480 A with Internal Bypass | C3                            | 320 A       |
|                                        |                            | D1                            | 361 A       |
|                                        |                            | D2                            | 420 A       |
|                                        |                            | D3                            | 520 A       |

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

| d            |                                      |
|--------------|--------------------------------------|
| Line Voltage |                                      |
| Code         | Description                          |
| B            | 200...480V AC, 3-Phase, 50 and 60 Hz |
| U            | 200...690V AC, 3-Phase, 50 and 60 Hz |

| e               |                                                                  |
|-----------------|------------------------------------------------------------------|
| Control Voltage |                                                                  |
| Code            | Description                                                      |
| D               | 100...240V AC (two 24V DC inputs and two relay outputs standard) |
| R               | 24V DC (two 24V DC inputs and two relay outputs standard)        |

# Product Selection— SMC-50 Controller with Internal Bypass

## For Use with Line-connected Motors

Utilization Category: AC-53b:3.0-50:1750. Start Not to Exceed: 300% of the controller maximum current rating, 50 second start time, two starts per hour with 50 °C (122 °F) surrounding air ambient temperature.



Use the SMC Estimation Wizard and SMC Thermal Estimation Wizard to confirm that the SMC controller selection meets the application requirements. See [Sizing and Selection Tools](#) for more information. For additional assistance, visit [rok.auto](http://rok.auto) or contact Industrial Controls Technical Support by email at [raictechsupport@ra.rockwell.com](mailto:raictechsupport@ra.rockwell.com) or by phone at +1 440-646-5800.

**Table 59 - 200/208V AC and 230V AC SMC-50 Controllers with Internal Bypass for use with Line-connected Motors**

| Rated Voltage [V AC] | Motor Current [A] <sup>(1)</sup> | Max. kW, 50 Hz | Max. Hp, 60 Hz | Control Power <sup>(2)</sup> | Cat. No. <sup>(3)</sup> |
|----------------------|----------------------------------|----------------|----------------|------------------------------|-------------------------|
| 200/208              | 27...108                         | —              | 30             | 100...240V AC, 50/60 Hz      | 150-S108NBD             |
|                      |                                  |                |                | 24V DC                       | 150-S108NBR             |
|                      | 34...135                         | —              | 40             | 100...240V AC, 50/60 Hz      | 150-S135NBD             |
|                      |                                  |                |                | 24V DC                       | 150-S135NBR             |
|                      | 67...201                         | —              | 60             | 100...240V AC, 50/60 Hz      | 150-S201NBD             |
|                      |                                  |                |                | 24V DC                       | 150-S201NBR             |
|                      | 84...251                         | —              | 75             | 100...240V AC, 50/60 Hz      | 150-S251NBD             |
|                      |                                  |                |                | 24V DC                       | 150-S251NBR             |
|                      | 106...317                        | —              | 100            | 100...240V AC, 50/60 Hz      | 150-S317NBD             |
|                      |                                  |                |                | 24V DC                       | 150-S317NBR             |
|                      | 120...361                        | —              | 125            | 100...240V AC, 50/60 Hz      | 150-S361NBD             |
|                      |                                  |                |                | 24V DC                       | 150-S361NBR             |
|                      | 160...480                        | —              | 150            | 100...240V AC, 50/60 Hz      | 150-S480NBD             |
|                      |                                  |                |                | 24V DC                       | 150-S480NBR             |
| 230                  | 27...108                         | 30             | 40             | 100...240V AC, 50/60 Hz      | 150-S108NBD             |
|                      |                                  |                |                | 24V DC                       | 150-S108NBR             |
|                      | 34...135                         | 37             | 50             | 100...240V AC, 50/60 Hz      | 150-S135NBD             |
|                      |                                  |                |                | 24V DC                       | 150-S135NBR             |
|                      | 67...201                         | 55             | 75             | 100...240V AC, 50/60 Hz      | 150-S201NBD             |
|                      |                                  |                |                | 24V DC                       | 150-S201NBR             |
|                      | 84...251                         | 75             | 100            | 100...240V AC, 50/60 Hz      | 150-S251NBD             |
|                      |                                  |                |                | 24V DC                       | 150-S251NBR             |
|                      | 106...317                        | 90             | 125            | 100...240V AC, 50/60 Hz      | 150-S317NBD             |
|                      |                                  |                |                | 24V DC                       | 150-S317NBR             |
|                      | 120...361                        | 110            | 150            | 100...240V AC, 50/60 Hz      | 150-S361NBD             |
|                      |                                  |                |                | 24V DC                       | 150-S361NBR             |
|                      | 160...480                        | 132            | 200            | 100...240V AC, 50/60 Hz      | 150-S480NBD             |
|                      |                                  |                |                | 24V DC                       | 150-S480NBR             |

(1) Motor FLA rating must fall within specified current range for unit to operate properly. Special consideration should be given when using a motor with a potentially high starting current (greater than ten times motor FLA) with the SMC-50 controller. Contact Rockwell Automation technical support for further guidance.

(2) For controllers with 24V DC control power, consult your local Rockwell Automation sales office or Allen-Bradley distributor for availability.

(3) Devices are not equipped with line and load terminal lugs. See [page 75](#) for terminal lug kits.

**Table 60 - 400/415/460V AC, 500/575V AC, and 690V AC SMC-50 Controllers with Internal Bypass for use with Line-connected Motors**

| Rated Voltage [V AC]                  | Motor Current [A] <sup>(1)</sup> | Max. kW, 50 Hz | Max. Hp, 60 Hz | Control Power <sup>(2)</sup> | Cat. No. <sup>(3)</sup> |
|---------------------------------------|----------------------------------|----------------|----------------|------------------------------|-------------------------|
| 400/415 (kW)<br>460 (Hp)              | 27...108                         | 55             | 75             | 100...240V AC, 50/60 Hz      | 150-S108NBD             |
|                                       |                                  |                |                | 24V DC                       | 150-S108NBR             |
|                                       | 34...135                         | 75             | 100            | 100...240V AC, 50/60 Hz      | 150-S135NBD             |
|                                       |                                  |                |                | 24V DC                       | 150-S135NBR             |
|                                       | 67...201                         | 110            | 150            | 100...240V AC, 50/60 Hz      | 150-S201NBD             |
|                                       |                                  |                |                | 24V DC                       | 150-S201NBR             |
|                                       | 84...251                         | 132            | 200            | 100...240V AC, 50/60 Hz      | 150-S251NBD             |
|                                       |                                  |                |                | 24V DC                       | 150-S251NBR             |
|                                       | 106...317                        | 160            | 250            | 100...240V AC, 50/60 Hz      | 150-S317NBD             |
|                                       |                                  |                |                | 24V DC                       | 150-S317NBR             |
|                                       | 120...361                        | 200            | 300            | 100...240V AC, 50/60 Hz      | 150-S361NBD             |
|                                       |                                  |                |                | 24V DC                       | 150-S361NBR             |
| 500 (kW)<br>575 (Hp)                  | 27...108                         | 75             | 100            | 100...240V AC, 50/60 Hz      | 150-S108NUD             |
|                                       |                                  |                |                | 24V DC                       | 150-S108NUR             |
|                                       | 34...135                         | 90             | 125            | 100...240V AC, 50/60 Hz      | 150-S135NUD             |
|                                       |                                  |                |                | 24V DC                       | 150-S135NUR             |
|                                       | 67...201                         | 132            | 200            | 100...240V AC, 50/60 Hz      | 150-S201NUD             |
|                                       |                                  |                |                | 24V DC                       | 150-S201NUR             |
|                                       | 84...251                         | 160            | 250            | 100...240V AC, 50/60 Hz      | 150-S251NUD             |
|                                       |                                  |                |                | 24V DC                       | 150-S251NUR             |
|                                       | 106...317                        | 200            | 300            | 100...240V AC, 50/60 Hz      | 150-S317NUD             |
|                                       |                                  |                |                | 24V DC                       | 150-S317NUR             |
|                                       | 120...361                        | 250            | 350            | 100...240V AC, 50/60 Hz      | 150-S361NUD             |
|                                       |                                  |                |                | 24V DC                       | 150-S361NUR             |
| 690/Y (kW) <sup>(4)</sup><br>600 (Hp) | 27...108                         | 90             | 100            | 100...240V AC, 50/60 Hz      | 150-S108NUD             |
|                                       |                                  |                |                | 24V DC                       | 150-S108NUR             |
|                                       | 34...135                         | 132            | 175            | 100...240V AC, 50/60 Hz      | 150-S135NUD             |
|                                       |                                  |                |                | 24V DC                       | 150-S135NUR             |
|                                       | 67...201                         | 160            | 200            | 100...240V AC, 50/60 Hz      | 150-S201NUD             |
|                                       |                                  |                |                | 24V DC                       | 150-S201NUR             |
|                                       | 84...251                         | 200            | 250            | 100...240V AC, 50/60 Hz      | 150-S251NUD             |
|                                       |                                  |                |                | 24V DC                       | 150-S251NUR             |
|                                       | 106...317                        | 315            | 400            | 100...240V AC, 50/60 Hz      | 150-S317NUD             |
|                                       |                                  |                |                | 24V DC                       | 150-S317NUR             |
|                                       | 120...361                        | 355            | 450            | 100...240V AC, 50/60 Hz      | 150-S361NUD             |
|                                       |                                  |                |                | 24V DC                       | 150-S361NUR             |
| 160...480                             | 450                              | 600            |                | 100...240V AC, 50/60 Hz      | 150-S480NUD             |
|                                       |                                  |                |                | 24V DC                       | 150-S480NUR             |

(1) Motor FLA rating must fall within specified current range for unit to operate properly. Special consideration should be given when using a motor with a potentially high starting current (greater than ten times motor FLA) with the SMC-50 controller. Contact Rockwell Automation technical support for further guidance.

(2) For controllers with 24V DC control power, consult your local Rockwell Automation sales office or Allen-Bradley distributor for availability.

(3) Devices are not equipped with line and load terminal lugs. See [page 75](#) for terminal lug kits.

(4) To be used only in a Y-type system.

## For Use with Delta-connected Motors

Utilization Category: AC-53b:3.0-50:1750. Start Not to Exceed: 300% of the controller maximum current rating, 50 second start time, two starts per hour with 50 °C (122 °F) surrounding air ambient temperature.



Use the SMC Estimation Wizard and SMC Thermal Estimation Wizard to confirm that the SMC controller selection meets the application requirements. See [Sizing and Selection Tools](#) for more information. For additional assistance, visit [rok.auto](http://rok.auto) or contact Industrial Controls Technical Support by email at [raictechsupport@ra.rockwell.com](mailto:raictechsupport@ra.rockwell.com) or by phone at +1 440-646-5800.

**Table 61 - 200/208V AC and 230V AC SMC-50 Controllers with Internal Bypass for use with Delta-connected Motors**

| Rated Voltage [V AC] | Motor Current [A] <sup>(1)</sup> | Max. kW, 50 Hz | Max. Hp, 60 Hz | Control Power <sup>(2)</sup> | Cat. No. <sup>(3)</sup> |
|----------------------|----------------------------------|----------------|----------------|------------------------------|-------------------------|
| 200/208              | 47...187                         | —              | 60             | 100...240V AC, 50/60 Hz      | 150-S108NBD             |
|                      |                                  |                |                | 24V DC                       | 150-S108NBR             |
|                      | 59...234                         | —              | 75             | 100...240V AC, 50/60 Hz      | 150-S135NBD             |
|                      |                                  |                |                | 24V DC                       | 150-S135NBR             |
|                      | 116...348                        | —              | 100            | 100...240V AC, 50/60 Hz      | 150-S201NBD             |
|                      |                                  |                |                | 24V DC                       | 150-S201NBR             |
|                      | 145...435                        | —              | 150            | 100...240V AC, 50/60 Hz      | 150-S251NBD             |
|                      |                                  |                |                | 24V DC                       | 150-S251NBR             |
|                      | 183...549                        | —              | 200            | 100...240V AC, 50/60 Hz      | 150-S317NBD             |
|                      |                                  |                |                | 24V DC                       | 150-S317NBR             |
|                      | 208...625                        | —              | 200            | 100...240V AC, 50/60 Hz      | 150-S361NBD             |
|                      |                                  |                |                | 24V DC                       | 150-S361NBR             |
|                      | 277...831                        | —              | 300            | 100...240V AC, 50/60 Hz      | 150-S480NBD             |
|                      |                                  |                |                | 24V DC                       | 150-S480NBR             |
| 230                  | 47...187                         | 55             | 60             | 100...240V AC, 50/60 Hz      | 150-S108NBD             |
|                      |                                  |                |                | 24V DC                       | 150-S108NBR             |
|                      | 59...234                         | 75             | 75             | 100...240V AC, 50/60 Hz      | 150-S135NBD             |
|                      |                                  |                |                | 24V DC                       | 150-S135NBR             |
|                      | 116...348                        | 110            | 100            | 100...240V AC, 50/60 Hz      | 150-S201NBD             |
|                      |                                  |                |                | 24V DC                       | 150-S201NBR             |
|                      | 145...435                        | 132            | 150            | 100...240V AC, 50/60 Hz      | 150-S251NBD             |
|                      |                                  |                |                | 24V DC                       | 150-S251NBR             |
|                      | 183...549                        | 160            | 200            | 100...240V AC, 50/60 Hz      | 150-S317NBD             |
|                      |                                  |                |                | 24V DC                       | 150-S317NBR             |
|                      | 208...625                        | 200            | 200            | 100...240V AC, 50/60 Hz      | 150-S361NBD             |
|                      |                                  |                |                | 24V DC                       | 150-S361NBR             |
|                      | 277...831                        | 250            | 300            | 100...240V AC, 50/60 Hz      | 150-S480NBD             |
|                      |                                  |                |                | 24V DC                       | 150-S480NBR             |

(1) Motor FLA rating must fall within specified current range for unit to operate properly. Special consideration should be given when using a motor with a potentially high starting current (greater than ten times motor FLA) with the SMC-50 controller. Contact Rockwell Automation technical support for further guidance.

(2) For controllers with 24V DC control power, consult your local Rockwell Automation sales office or Allen-Bradley distributor for availability.

(3) Devices are not equipped with line and load terminal lugs. See [page 75](#) for terminal lug kits.

**Table 62 - 400/415/460V AC and 500/575V AC SMC-50 Controllers with Internal Bypass for use with Delta-connected Motors**

| Rated Voltage [V AC]     | Motor Current [A] <sup>(1)</sup> | Max. kW, 50 Hz | Max. Hp, 60 Hz | Control Power <sup>(2)</sup> | Cat. No. <sup>(3)</sup> |
|--------------------------|----------------------------------|----------------|----------------|------------------------------|-------------------------|
| 400/415 (kW)<br>460 (Hp) | 47...187                         | 90             | 125            | 100...240V AC, 50/60 Hz      | 150-S108NBD             |
|                          |                                  |                |                | 24V DC                       | 150-S108NBR             |
|                          | 59...234                         | 132            | 150            | 100...240V AC, 50/60 Hz      | 150-S135NBD             |
|                          |                                  |                |                | 24V DC                       | 150-S135NBR             |
|                          | 116...348                        | 160            | 250            | 100...240V AC, 50/60 Hz      | 150-S201NBD             |
|                          |                                  |                |                | 24V DC                       | 150-S201NBR             |
|                          | 145...435                        | 250            | 350            | 100...240V AC, 50/60 Hz      | 150-S251NBD             |
|                          |                                  |                |                | 24V DC                       | 150-S251NBR             |
|                          | 183...549                        | 315            | 450            | 100...240V AC, 50/60 Hz      | 150-S317NBD             |
|                          |                                  |                |                | 24V DC                       | 150-S317NBR             |
|                          | 208...625                        | 355            | 500            | 100...240V AC, 50/60 Hz      | 150-S361NBD             |
|                          |                                  |                |                | 24V DC                       | 150-S361NBR             |
|                          | 277...831                        | 450            | 700            | 100...240V AC, 50/60 Hz      | 150-S480NBD             |
|                          |                                  |                |                | 24V DC                       | 150-S480NBR             |
| 500 (kW)<br>575 (Hp)     | 47...187                         | 132            | 150            | 100...240V AC, 50/60 Hz      | 150-S108NUD             |
|                          |                                  |                |                | 24V DC                       | 150-S108NUR             |
|                          | 59...234                         | 160            | 200            | 100...240V AC, 50/60 Hz      | 150-S135NUD             |
|                          |                                  |                |                | 24V DC                       | 150-S135NUR             |
|                          | 116...348                        | 250            | 350            | 100...240V AC, 50/60 Hz      | 150-S201NUD             |
|                          |                                  |                |                | 24V DC                       | 150-S201NUR             |
|                          | 145...435                        | 315            | 400            | 100...240V AC, 50/60 Hz      | 150-S251NUD             |
|                          |                                  |                |                | 24V DC                       | 150-S251NUR             |
|                          | 183...549                        | 400            | 500            | 100...240V AC, 50/60 Hz      | 150-S317NUD             |
|                          |                                  |                |                | 24V DC                       | 150-S317NUR             |
|                          | 208...625                        | 450            | 600            | 100...240V AC, 50/60 Hz      | 150-S361NUD             |
|                          |                                  |                |                | 24V DC                       | 150-S361NUR             |
|                          | 277...831                        | 560            | 900            | 100...240V AC, 50/60 Hz      | 150-S480NUD             |
|                          |                                  |                |                | 24V DC                       | 150-S480NUR             |

(1) Motor FLA rating must fall within specified current range for unit to operate properly. Special consideration should be given when using a motor with a potentially high starting current (greater than ten times motor FLA) with the SMC-50 controller. Contact Rockwell Automation technical support for further guidance.

(2) For controllers with 24V DC control power, consult your local Rockwell Automation sales office or Allen-Bradley distributor for availability.

(3) Devices are not equipped with line and load terminal lugs. See [page 75](#) for terminal lug kits.

# Product Selection—SMC-50 Solid-state Controller

## For Use with Line-connected Motors

### Normal/Standard Duty Ratings (applications include pumps, compressors, elevators, and short conveyors)

Utilization Category: AC-53a:3.5-10:99-2. Start Not to Exceed: 350% of the controller maximum current rating, 10 second start time, 99% ON load factor, two starts per hour with 40 °C (104 °F) surrounding air ambient temperature.



Use the SMC Estimation Wizard and SMC Thermal Estimation Wizard to confirm that the SMC controller selection meets the application requirements. See [Sizing and Selection Tools](#) for more information. For additional assistance, visit [rok.auto](http://rok.auto) or contact Industrial Controls Technical Support by email at [raictechsupport@ra.rockwell.com](mailto:raictechsupport@ra.rockwell.com) or by phone at +1 440-646-5800.

**Table 63 - 200/208V AC SMC-50 Solid-state Controllers for Use with Line-connected Motors, Normal/Standard Duty**

| Rated Utilization Voltage [V AC] | Motor Current [A] <sup>(1)</sup> | Motor kW, 50 Hz | Motor Hp, 60 Hz | Control Power           | Cat. No. <sup>(2)</sup> |
|----------------------------------|----------------------------------|-----------------|-----------------|-------------------------|-------------------------|
| 200/208                          | 30...90                          | —               | 10...25         | 100...240V AC; 50/60 Hz | 150-SB1NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SB1NBR              |
|                                  | 37...110                         |                 | 15...30         | 100...240V AC; 50/60 Hz | 150-SB2NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SB2NBR              |
|                                  | 47...140                         |                 | 20...40         | 100...240V AC; 50/60 Hz | 150-SB3NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SB3NBR              |
|                                  | 60...180                         |                 | 25...60         | 100...240V AC; 50/60 Hz | 150-SB4NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SB4NBR              |
|                                  | 70...210                         |                 | 25...60         | 100...240V AC; 50/60 Hz | 150-SC1NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SC1NBR              |
|                                  | 87...260                         |                 | 30...75         | 100...240V AC; 50/60 Hz | 150-SC2NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SC2NBR              |
|                                  | 107...320                        |                 | 40...100        | 100...240V AC; 50/60 Hz | 150-SC3NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SC3NBR              |
|                                  | 120...361                        |                 | 50...125        | 100...240V AC; 50/60 Hz | 150-SD1NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SD1NBR              |
|                                  | 140...420                        |                 | 50...150        | 100...240V AC; 50/60 Hz | 150-SD2NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SD2NBR              |
|                                  | 174...520                        |                 | 75...150        | 100...240V AC; 50/60 Hz | 150-SD3NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SD3NBR              |

(1) Motor FLA rating must fall within specified current range for unit to operate properly. Special consideration should be given when using a motor with a potentially high starting current (greater than ten times motor FLA) with the SMC-50 controller. Contact Rockwell Automation technical support for further guidance.

(2) Devices are not equipped with line and load terminal lugs. See [page 75](#) for terminal lug kits.

**Table 64 - 230V AC and 400/415/460V AC SMC-50 Solid-state Controllers for Use with Line-connected Motors, Normal/Standard Duty**

| Rated Utilization Voltage [V AC] | Motor Current [A] <sup>(1)</sup> | Motor kW, 50 Hz | Motor Hp, 60 Hz | Control Power           | Cat. No. <sup>(2)</sup> |
|----------------------------------|----------------------------------|-----------------|-----------------|-------------------------|-------------------------|
| 230                              | 30...90                          | 10...25         | 15...30         | 100...240V AC; 50/60 Hz | 150-SB1NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SB1NBR              |
|                                  | 37...110                         | 11...32         | 15...40         | 100...240V AC; 50/60 Hz | 150-SB2NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SB2NBR              |
|                                  | 47...140                         | 15...45         | 20...50         | 100...240V AC; 50/60 Hz | 150-SB3NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SB3NBR              |
|                                  | 60...180                         | 18.5...55       | 25...60         | 100...240V AC; 50/60 Hz | 150-SB4NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SB4NBR              |
|                                  | 70...210                         | 22...63         | 30...75         | 100...240V AC; 50/60 Hz | 150-SC1NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SC1NBR              |
|                                  | 87...260                         | 30...80         | 40...100        | 100...240V AC; 50/60 Hz | 150-SC2NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SC2NBR              |
|                                  | 107...320                        | 37...100        | 50...125        | 100...240V AC; 50/60 Hz | 150-SC3NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SC3NBR              |
|                                  | 120...361                        | 40...110        | 50...150        | 100...240V AC; 50/60 Hz | 150-SD1NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SD1NBR              |
|                                  | 140...420                        | 45...132        | 60...150        | 100...240V AC; 50/60 Hz | 150-SD2NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SD2NBR              |
|                                  | 174...520                        | 63...160        | 75...200        | 100...240V AC; 50/60 Hz | 150-SD3NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SD3NBR              |
| 400/415 (kW)<br>460 (Hp)         | 30...90                          | 17...50         | 25...60         | 100...240V AC; 50/60 Hz | 150-SB1NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SB1NBR              |
|                                  | 37...110                         | 20...55         | 30...75         | 100...240V AC; 50/60 Hz | 150-SB2NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SB2NBR              |
|                                  | 47...140                         | 30...75         | 40...100        | 100...240V AC; 50/60 Hz | 150-SB3NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SB3NBR              |
|                                  | 60...180                         | 37...90         | 50...150        | 100...240V AC; 50/60 Hz | 150-SB4NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SB4NBR              |
|                                  | 70...210                         | 40...110        | 60...150        | 100...240V AC; 50/60 Hz | 150-SC1NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SC1NBR              |
|                                  | 87...260                         | 50...132        | 75...200        | 100...240V AC; 50/60 Hz | 150-SC2NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SC2NBR              |
|                                  | 107...320                        | 63...160        | 100...250       | 100...240V AC; 50/60 Hz | 150-SC3NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SC3NBR              |
|                                  | 120...361                        | 75...200        | 100...300       | 100...240V AC; 50/60 Hz | 150-SD1NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SD1NBR              |
|                                  | 140...420                        | 80...220        | 125...350       | 100...240V AC; 50/60 Hz | 150-SD2NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SD2NBR              |
|                                  | 174...520                        | 100...300       | 150...450       | 100...240V AC; 50/60 Hz | 150-SD3NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SD3NBR              |

(1) Motor FLA rating must fall within specified current range for unit to operate properly. Special consideration should be given when using a motor with a potentially high starting current (greater than ten times motor FLA) with the SMC-50 controller. Contact Rockwell Automation technical support for further guidance.

(2) Devices are not equipped with line and load terminal lugs. See [page 75](#) for terminal lug kits.

Table 65 - 500/575V AC and 690V AC SMC-50 Solid-state Controllers for Use with Line-connected Motors, Normal/Standard Duty

| Rated Utilization Voltage [V AC]      | Motor Current [A] <sup>(1)</sup> | Motor kW, 50 Hz | Motor Hp, 60 Hz | Control Power           | Cat. No. <sup>(2)</sup> |
|---------------------------------------|----------------------------------|-----------------|-----------------|-------------------------|-------------------------|
| 500 (kW)<br>575 (Hp)                  | 30...90                          | 20...63         | 30...75         | 100...240V AC; 50/60 Hz | 150-SB1NUD              |
|                                       |                                  |                 |                 | 24V DC                  | 150-SB1NUR              |
|                                       | 37...110                         | 25...75         | 40...100        | 100...240V AC; 50/60 Hz | 150-SB2NUD              |
|                                       |                                  |                 |                 | 24V DC                  | 150-SB2NUR              |
|                                       | 47...140                         | 32...90         | 50...125        | 100...240V AC; 50/60 Hz | 150-SB3NUD              |
|                                       |                                  |                 |                 | 24V DC                  | 150-SB3NUR              |
|                                       | 60...180                         | 45...125        | 60...150        | 100...240V AC; 50/60 Hz | 150-SB4NUD              |
|                                       |                                  |                 |                 | 24V DC                  | 150-SB4NUR              |
|                                       | 70...210                         | 50...150        | 75...200        | 100...240V AC; 50/60 Hz | 150-SC1NUD              |
|                                       |                                  |                 |                 | 24V DC                  | 150-SC1NUR              |
|                                       | 87...260                         | 63...185        | 100...250       | 100...240V AC; 50/60 Hz | 150-SC2NUD              |
|                                       |                                  |                 |                 | 24V DC                  | 150-SC2NUR              |
|                                       | 107...320                        | 75...220        | 125...300       | 100...240V AC; 50/60 Hz | 150-SC3NUD              |
|                                       |                                  |                 |                 | 24V DC                  | 150-SC3NUR              |
|                                       | 120...361                        | 90...250        | 125...350       | 100...240V AC; 50/60 Hz | 150-SD1NUD              |
|                                       |                                  |                 |                 | 24V DC                  | 150-SD1NUR              |
|                                       | 140...420                        | 100...300       | 150...450       | 100...240V AC; 50/60 Hz | 150-SD2NUD              |
|                                       |                                  |                 |                 | 24V DC                  | 150-SD2NUR              |
|                                       | 174...520                        | 125...375       | 200...500       | 100...240V AC; 50/60 Hz | 150-SD3NUD              |
|                                       |                                  |                 |                 | 24V DC                  | 150-SD3NUR              |
| 690/Y (kW) <sup>(3)</sup><br>600 (Hp) | 30...90                          | 30...80         | 30...75         | 100...240V AC; 50/60 Hz | 150-SB1NUD              |
|                                       |                                  |                 |                 | 24V DC                  | 150-SB1NUR              |
|                                       | 37...110                         | 37...100        | 40...100        | 100...240V AC; 50/60 Hz | 150-SB2NUD              |
|                                       |                                  |                 |                 | 24V DC                  | 150-SB2NUR              |
|                                       | 47...140                         | 45...132        | 50...125        | 100...240V AC; 50/60 Hz | 150-SB3NUD              |
|                                       |                                  |                 |                 | 24V DC                  | 150-SB3NUR              |
|                                       | 60...180                         | 63...160        | 60...150        | 100...240V AC; 50/60 Hz | 150-SB4NUD              |
|                                       |                                  |                 |                 | 24V DC                  | 150-SB4NUR              |
|                                       | 70...210                         | 75...200        | 75...200        | 100...240V AC; 50/60 Hz | 150-SC1NUD              |
|                                       |                                  |                 |                 | 24V DC                  | 150-SC1NUR              |
|                                       | 87...260                         | 90...250        | 100...250       | 100...240V AC; 50/60 Hz | 150-SC2NUD              |
|                                       |                                  |                 |                 | 24V DC                  | 150-SC2NUR              |
|                                       | 107...320                        | 110...315       | 125...300       | 100...240V AC; 50/60 Hz | 150-SC3NUD              |
|                                       |                                  |                 |                 | 24V DC                  | 150-SC3NUR              |
|                                       | 120...361                        | 125...355       | 125...350       | 100...240V AC; 50/60 Hz | 150-SD1NUD              |
|                                       |                                  |                 |                 | 24V DC                  | 150-SD1NUR              |
|                                       | 140...420                        | 160...400       | 150...450       | 100...240V AC; 50/60 Hz | 150-SD2NUD              |
|                                       |                                  |                 |                 | 24V DC                  | 150-SD2NUR              |
|                                       | 174...520                        | 185...500       | 200...500       | 100...240V AC; 50/60 Hz | 150-SD3NUD              |
|                                       |                                  |                 |                 | 24V DC                  | 150-SD3NUR              |

(1) Motor FLA rating must fall within specified current range for unit to operate properly. Special consideration should be given when using a motor with a potentially high starting current (greater than ten times motor FLA) with the SMC-50 controller. Contact Rockwell Automation technical support for further guidance.

(2) Devices are not equipped with line and load terminal lugs. See [page 75](#) for terminal lug kits.

(3) To be used only in a Y-type system.

## Heavy-duty Ratings (applications include centrifugal fans, crushers, mixers, and long conveyors)

Utilization Category: AC-53a:3.5-30:99-1. Start Not to Exceed: 350% of the controller maximum current rating, 30 second start time, 99% ON load factor, one start per hour with 50 °C (122 °F) surrounding air ambient temperature.



Use the SMC Estimation Wizard and SMC Thermal Estimation Wizard to confirm that the SMC controller selection meets the application requirements. See [Sizing and Selection Tools](#) for more information. For additional assistance, visit [rok.auto](http://rok.auto) or contact Industrial Controls Technical Support by email at [raictechsupport@ra.rockwell.com](mailto:raictechsupport@ra.rockwell.com) or by phone at +1 440-646-5800.

**Table 66 - 200/208V AC and 230V AC SMC-50 Solid-state Controllers for Use with Line-connected Motors, Heavy Duty**

| Rated Utilization Voltage [ V AC] | Motor Current [A] <sup>(1)</sup> | Motor kW, 50 Hz | Motor Hp, 60 Hz | Control Power           | Cat. No. <sup>(2)</sup> |
|-----------------------------------|----------------------------------|-----------------|-----------------|-------------------------|-------------------------|
| 200/208                           | 30...90                          | —               | 10...25         | 100...240V AC; 50/60 Hz | 150-SB2NBD              |
|                                   |                                  |                 |                 | 24V DC                  | 150-SB2NBR              |
|                                   | 37...110                         |                 | 15...30         | 100...240V AC; 50/60 Hz | 150-SB3NBD              |
|                                   |                                  |                 |                 | 24V DC                  | 150-SB3NBR              |
|                                   | 47...140                         |                 | 20...40         | 100...240V AC; 50/60 Hz | 150-SB4NBD              |
|                                   |                                  |                 |                 | 24V DC                  | 150-SB4NBR              |
|                                   | 60...180                         |                 | 25...60         | 100...240V AC; 50/60 Hz | 150-SC1NBD              |
|                                   |                                  |                 |                 | 24V DC                  | 150-SC1NBR              |
|                                   | 70...210                         |                 | 25...60         | 100...240V AC; 50/60 Hz | 150-SC2NBD              |
|                                   |                                  |                 |                 | 24V DC                  | 150-SC2NBR              |
|                                   | 87...260                         |                 | 30...75         | 100...240V AC; 50/60 Hz | 150-SC3NBD              |
|                                   |                                  |                 |                 | 24V DC                  | 150-SC3NBR              |
|                                   | 107...320                        |                 | 40...100        | 100...240V AC; 50/60 Hz | 150-SD1NBD              |
|                                   |                                  |                 |                 | 24V DC                  | 150-SD1NBR              |
|                                   | 120...361                        |                 | 50...125        | 100...240V AC; 50/60 Hz | 150-SD2NBD              |
|                                   |                                  |                 |                 | 24V DC                  | 150-SD2NBR              |
|                                   | 140...420                        |                 | 50...150        | 100...240V AC; 50/60 Hz | 150-SD3NBD              |
|                                   |                                  |                 |                 | 24V DC                  | 150-SD3NBR              |
| 230                               | 30...90                          | 10...25         | 15...30         | 100...240V AC; 50/60 Hz | 150-SB2NBD              |
|                                   |                                  |                 |                 | 24V DC                  | 150-SB2NBR              |
|                                   | 37...110                         | 11...32         | 15...40         | 100...240V AC; 50/60 Hz | 150-SB3NBD              |
|                                   |                                  |                 |                 | 24V DC                  | 150-SB3NBR              |
|                                   | 47...140                         | 15...45         | 20...50         | 100...240V AC; 50/60 Hz | 150-SB4NBD              |
|                                   |                                  |                 |                 | 24V DC                  | 150-SB4NBR              |
|                                   | 60...180                         | 18.5...55       | 25...60         | 100...240V AC; 50/60 Hz | 150-SC1NBD              |
|                                   |                                  |                 |                 | 24V DC                  | 150-SC1NBR              |
|                                   | 70...210                         | 22...63         | 30...75         | 100...240V AC; 50/60 Hz | 150-SC2NBD              |
|                                   |                                  |                 |                 | 24V DC                  | 150-SC2NBR              |
|                                   | 87...260                         | 30...80         | 40...100        | 100...240V AC; 50/60 Hz | 150-SC3NBD              |
|                                   |                                  |                 |                 | 24V DC                  | 150-SC3NBR              |
|                                   | 107...320                        | 37...100        | 50...125        | 100...240V AC; 50/60 Hz | 150-SD1NBD              |
|                                   |                                  |                 |                 | 24V DC                  | 150-SD1NBR              |
|                                   | 120...361                        | 40...110        | 50...150        | 100...240V AC; 50/60 Hz | 150-SD2NBD              |
|                                   |                                  |                 |                 | 24V DC                  | 150-SD2NBR              |
|                                   | 140...420                        | 45...132        | 60...150        | 100...240V AC; 50/60 Hz | 150-SD3NBD              |
|                                   |                                  |                 |                 | 24V DC                  | 150-SD3NBR              |

(1) Motor FLA rating must fall within specified current range for unit to operate properly. Special consideration should be given when using a motor with a potentially high starting current (greater than ten times motor FLA) with the SMC-50 controller. Contact Rockwell Automation technical support for further guidance.

(2) Devices are not equipped with line and load terminal lugs. See [page 75](#) for terminal lug kits.

Table 67 - 400/415/460V AC and 500/575V AC SMC-50 Solid-state Controllers for Use with Line-connected Motors, Heavy Duty

| Rated Utilization Voltage [V AC] | Motor Current [A] <sup>(1)</sup> | Motor kW, 50 Hz | Motor Hp, 60 Hz | Control Power           | Cat. No. <sup>(2)</sup> |
|----------------------------------|----------------------------------|-----------------|-----------------|-------------------------|-------------------------|
| 400/415 (kW)<br>460 (Hp)         | 30...90                          | 17...50         | 25...60         | 100...240V AC; 50/60 Hz | 150-SB2NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SB2NBR              |
|                                  | 37...110                         | 20...55         | 30...75         | 100...240V AC; 50/60 Hz | 150-SB3NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SB3NBR              |
|                                  | 47...140                         | 30...75         | 40...100        | 100...240V AC; 50/60 Hz | 150-SB4NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SB4NBR              |
|                                  | 60...180                         | 37...90         | 50...150        | 100...240V AC; 50/60 Hz | 150-SC1NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SC1NBR              |
|                                  | 70...210                         | 40...110        | 60...150        | 100...240V AC; 50/60 Hz | 150-SC2NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SC2NBR              |
|                                  | 87...260                         | 50...132        | 75...200        | 100...240V AC; 50/60 Hz | 150-SC3NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SC3NBR              |
|                                  | 107...320                        | 63...160        | 100...250       | 100...240V AC; 50/60 Hz | 150-SD1NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SD1NBR              |
|                                  | 120...361                        | 75...200        | 100...300       | 100...240V AC; 50/60 Hz | 150-SD2NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SD2NBR              |
|                                  | 140...420                        | 80...220        | 125...350       | 100...240V AC; 50/60 Hz | 150-SD3NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SD3NBR              |
| 500 (kW)<br>575 (Hp)             | 30...90                          | 20...63         | 30...75         | 100...240V AC; 50/60 Hz | 150-SB2NUD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SB2NUR              |
|                                  | 37...110                         | 25...75         | 40...100        | 100...240V AC; 50/60 Hz | 150-SB3NUD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SB3NUR              |
|                                  | 47...140                         | 32...90         | 50...125        | 100...240V AC; 50/60 Hz | 150-SB4NUD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SB4NUR              |
|                                  | 60...180                         | 45...125        | 60...150        | 100...240V AC; 50/60 Hz | 150-SC1NUD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SC1NUR              |
|                                  | 70...210                         | 50...150        | 75...200        | 100...240V AC; 50/60 Hz | 150-SC2NUD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SC2NUR              |
|                                  | 87...260                         | 63...185        | 100...250       | 100...240V AC; 50/60 Hz | 150-SC3NUD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SC3NUR              |
|                                  | 107...320                        | 75...220        | 125...300       | 100...240V AC; 50/60 Hz | 150-SD1NUD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SD1NUR              |
|                                  | 120...361                        | 90...250        | 125...350       | 100...240V AC; 50/60 Hz | 150-SD2NUD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SD2NUR              |
|                                  | 140...420                        | 100...300       | 150...450       | 100...240V AC; 50/60 Hz | 150-SD3NUD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SD3NUR              |

(1) Motor FLA rating must fall within specified current range for unit to operate properly. Special consideration should be given when using a motor with a potentially high starting current (greater than ten times motor FLA) with the SMC-50 controller. Contact Rockwell Automation technical support for further guidance.

(2) Devices are not equipped with line and load terminal lugs. See [page 75](#) for terminal lug kits.

**Table 68 - 690V AC SMC-50 Solid-state Controllers for Use with Line-connected Motors, Heavy Duty**

| Rated Utilization Voltage [V AC]   | Motor Current [A] <sup>(1)</sup> | Motor kW, 50 Hz | Motor Hp, 60 Hz | Control Power           | Cat. No. <sup>(2)</sup> |
|------------------------------------|----------------------------------|-----------------|-----------------|-------------------------|-------------------------|
| 690/Y (kW) <sup>(3)</sup> 600 (Hp) | 30...90                          | 30...80         | 30...75         | 100...240V AC; 50/60 Hz | 150-SB2NUD              |
|                                    |                                  |                 |                 | 24V DC                  | 150-SB2NUR              |
|                                    | 37...110                         | 37...100        | 40...100        | 100...240V AC; 50/60 Hz | 150-SB3NUD              |
|                                    |                                  |                 |                 | 24V DC                  | 150-SB3NUR              |
|                                    | 47...140                         | 45...132        | 50...125        | 100...240V AC; 50/60 Hz | 150-SB4NUD              |
|                                    |                                  |                 |                 | 24V DC                  | 150-SB4NUR              |
|                                    | 60...180                         | 63...160        | 60...150        | 100...240V AC; 50/60 Hz | 150-SC1NUD              |
|                                    |                                  |                 |                 | 24V DC                  | 150-SC1NUR              |
|                                    | 70...210                         | 75...200        | 75...200        | 100...240V AC; 50/60 Hz | 150-SC2NUD              |
|                                    |                                  |                 |                 | 24V DC                  | 150-SC2NUR              |
|                                    | 87...260                         | 90...250        | 100...250       | 100...240V AC; 50/60 Hz | 150-SC3NUD              |
|                                    |                                  |                 |                 | 24V DC                  | 150-SC3NUR              |
|                                    | 107...320                        | 110...315       | 125...300       | 100...240V AC; 50/60 Hz | 150-SD1NUD              |
|                                    |                                  |                 |                 | 24V DC                  | 150-SD1NUR              |
|                                    | 120...361                        | 125...355       | 125...350       | 100...240V AC; 50/60 Hz | 150-SD2NUD              |
|                                    |                                  |                 |                 | 24V DC                  | 150-SD2NUR              |
|                                    | 140...420                        | 160...400       | 150...450       | 100...240V AC; 50/60 Hz | 150-SD3NUD              |
|                                    |                                  |                 |                 | 24V DC                  | 150-SD3NUR              |

(1) Motor FLA rating must fall within specified current range for unit to operate properly. Special consideration should be given when using a motor with a potentially high starting current (greater than ten times motor FLA) with the SMC-50 controller. Contact Rockwell Automation technical support for further guidance.

(2) Devices are not equipped with line and load terminal lugs. See [page 75](#) for terminal lug kits.

(3) To be used only in a Y-type system.

## For Use with Delta-connected Motors

### Normal/Standard Duty Ratings (applications include pumps, compressors, elevators, and short conveyors)

Utilization Category: AC-53a:3.5-10:99-2. Start Not to Exceed: 350% of the controller maximum current rating, 10 second start time, 99% ON load factor, two starts per hour with 40 °C (104 °F) surrounding air ambient temperature.



Use the SMC Estimation Wizard and SMC Thermal Estimation Wizard to confirm that the SMC controller selection meets the application requirements. See [Sizing and Selection Tools](#) for more information. For additional assistance, visit [rok.auto](http://rok.auto) or contact Industrial Controls Technical Support by email at [raictechsupport@ra.rockwell.com](mailto:raictechsupport@ra.rockwell.com) or by phone at +1 440-646-5800.

**Table 69 - 200/208V AC and 230V AC SMC-50 Solid-state Controllers for Use with Delta-connected Motors, Normal/Standard Duty**

| Rated Utilization Voltage [V AC] | Motor Current [A] <sup>(1)</sup> | Motor kW, 50 Hz         | Motor Hp, 60 Hz         | Control Power           | Cat. No. <sup>(2)</sup> |
|----------------------------------|----------------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
| 200/208                          | 52...155                         | —                       | 20...50                 | 100...240V AC; 50/60 Hz | 150-SB1NBD              |
|                                  |                                  |                         |                         | 24V DC                  | 150-SB1NBR              |
|                                  | 65...190                         |                         | 25...60                 | 100...240V AC; 50/60 Hz | 150-SB2NBD              |
|                                  |                                  |                         |                         | 24V DC                  | 150-SB2NBR              |
|                                  | 82...242                         |                         | 30...75                 | 100...240V AC; 50/60 Hz | 150-SB3NBD              |
|                                  |                                  |                         |                         | 24V DC                  | 150-SB3NBR              |
|                                  | 104...311                        |                         | 40...100                | 100...240V AC; 50/60 Hz | 150-SB4NBD              |
|                                  |                                  |                         |                         | 24V DC                  | 150-SB4NBR              |
|                                  | 122...363                        |                         | 50...125                | 100...240V AC; 50/60 Hz | 150-SC1NBD              |
|                                  |                                  |                         |                         | 24V DC                  | 150-SC1NBR              |
|                                  | 151...450                        |                         | 60...150                | 100...240V AC; 50/60 Hz | 150-SC2NBD              |
|                                  |                                  |                         |                         | 24V DC                  | 150-SC2NBR              |
|                                  | 186...554                        |                         | 75...200                | 100...240V AC; 50/60 Hz | 150-SC3NBD              |
|                                  |                                  |                         |                         | 24V DC                  | 150-SC3NBR              |
|                                  | 210...625                        |                         | 75...200                | 100...240V AC; 50/60 Hz | 150-SD1NBD              |
|                                  |                                  |                         |                         | 24V DC                  | 150-SD1NBR              |
|                                  | 243...727                        |                         | 100...250               | 100...240V AC; 50/60 Hz | 150-SD2NBD              |
|                                  |                                  |                         |                         | 24V DC                  | 150-SD2NBR              |
| 302...900                        | 125...300                        | 100...240V AC; 50/60 Hz | 150-SD3NBD              |                         |                         |
|                                  |                                  | 24V DC                  | 150-SD3NBR              |                         |                         |
| 230                              | 52...155                         | 17...50                 | 20...60                 | 100...240V AC; 50/60 Hz | 150-SB1NBD              |
|                                  |                                  |                         |                         | 24V DC                  | 150-SB1NBR              |
|                                  | 65...190                         | 20...55                 | 25...60                 | 100...240V AC; 50/60 Hz | 150-SB2NBD              |
|                                  |                                  |                         |                         | 24V DC                  | 150-SB2NBR              |
|                                  | 82...242                         | 30...75                 | 40...75                 | 100...240V AC; 50/60 Hz | 150-SB3NBD              |
|                                  |                                  |                         |                         | 24V DC                  | 150-SB3NBR              |
|                                  | 104...311                        | 37...100                | 40...100                | 100...240V AC; 50/60 Hz | 150-SB4NBD              |
|                                  |                                  |                         |                         | 24V DC                  | 150-SB4NBR              |
|                                  | 122...363                        | 40...110                | 50...125                | 100...240V AC; 50/60 Hz | 150-SC1NBD              |
|                                  |                                  |                         |                         | 24V DC                  | 150-SC1NBR              |
|                                  | 151...450                        | 50...132                | 60...150                | 100...240V AC; 50/60 Hz | 150-SC2NBD              |
|                                  |                                  |                         |                         | 24V DC                  | 150-SC2NBR              |
|                                  | 186...554                        | 63...160                | 75...200                | 100...240V AC; 50/60 Hz | 150-SC3NBD              |
|                                  |                                  |                         |                         | 24V DC                  | 150-SC3NBR              |
|                                  | 210...625                        | 75...200                | 100...250               | 100...240V AC; 50/60 Hz | 150-SD1NBD              |
|                                  |                                  |                         |                         | 24V DC                  | 150-SD1NBR              |
|                                  | 243...727                        | 80...220                | 100...300               | 100...240V AC; 50/60 Hz | 150-SD2NBD              |
|                                  |                                  |                         |                         | 24V DC                  | 150-SD2NBR              |
| 302...900                        | 100...300                        | 125...350               | 100...240V AC; 50/60 Hz | 150-SD3NBD              |                         |
|                                  |                                  |                         | 24V DC                  | 150-SD3NBR              |                         |

(1) Motor FLA rating must fall within specified current range for unit to operate properly. Special consideration should be given when using a motor with a potentially high starting current (greater than ten times motor FLA) with the SMC-50 controller. Contact Rockwell Automation technical support for further guidance.

(2) Devices are not equipped with line and load terminal lugs. See [page 75](#) for terminal lug kits.

**Table 70 - 400/415/460V AC and 500/575V AC SMC-50 Solid-state Controllers  
for Use with Delta-connected Motors, Normal/Standard Duty**

| Rated Utilization Voltage [V AC] | Motor Current [A] <sup>(1)</sup> | Motor kW, 50 Hz | Motor Hp, 60 Hz | Control Power           | Cat. No. <sup>(2)</sup> |
|----------------------------------|----------------------------------|-----------------|-----------------|-------------------------|-------------------------|
| 400/415 (kW)<br>460 (Hp)         | 52...155                         | 30...80         | 40...100        | 100...240V AC; 50/60 Hz | 150-SB1NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SB1NBR              |
|                                  | 65...190                         | 37...100        | 50...150        | 100...240V AC; 50/60 Hz | 150-SB2NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SB2NBR              |
|                                  | 82...242                         | 50...132        | 75...200        | 100...240V AC; 50/60 Hz | 150-SB3NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SB3NBR              |
|                                  | 104...311                        | 63...160        | 100...250       | 100...240V AC; 50/60 Hz | 150-SB4NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SB4NBR              |
|                                  | 122...363                        | 75...200        | 100...300       | 100...240V AC; 50/60 Hz | 150-SC1NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SC1NBR              |
|                                  | 151...450                        | 90...250        | 125...350       | 100...240V AC; 50/60 Hz | 150-SC2NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SC2NBR              |
|                                  | 186...554                        | 110...315       | 200...450       | 100...240V AC; 50/60 Hz | 150-SC3NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SC3NBR              |
|                                  | 210...625                        | 125...355       | 200...500       | 100...240V AC; 50/60 Hz | 150-SD1NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SD1NBR              |
|                                  | 243...727                        | 150...400       | 250...600       | 100...240V AC; 50/60 Hz | 150-SD2NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SD2NBR              |
|                                  | 302...900                        | 185...530       | 250...700       | 100...240V AC; 50/60 Hz | 150-SD3NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SD3NBR              |
| 500 (kW)<br>575 (Hp)             | 52...155                         | 37...100        | 50...150        | 100...240V AC; 50/60 Hz | 150-SB1NUD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SB1NUR              |
|                                  | 65...190                         | 50...132        | 75...150        | 100...240V AC; 50/60 Hz | 150-SB2NUD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SB2NUR              |
|                                  | 82...242                         | 63...160        | 100...250       | 100...240V AC; 50/60 Hz | 150-SB3NUD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SB3NUR              |
|                                  | 104...311                        | 75...220        | 125...300       | 100...240V AC; 50/60 Hz | 150-SB4NUD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SB4NUR              |
|                                  | 122...363                        | 90...250        | 125...350       | 100...240V AC; 50/60 Hz | 150-SC1NUD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SC1NUR              |
|                                  | 151...450                        | 110...315       | 200...450       | 100...240V AC; 50/60 Hz | 150-SC2NUD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SC2NUR              |
|                                  | 186...554                        | 132...400       | 200...500       | 100...240V AC; 50/60 Hz | 150-SC3NUD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SC3NUR              |
|                                  | 210...625                        | 150...450       | 250...600       | 100...240V AC; 50/60 Hz | 150-SD1NUD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SD1NUR              |
|                                  | 243...727                        | 185...530       | 300...700       | 100...240V AC; 50/60 Hz | 150-SD2NUD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SD2NUR              |
|                                  | 302...900                        | 220...670       | 350...900       | 100...240V AC; 50/60 Hz | 150-SD3NUD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SD3NUR              |

(1) Motor FLA rating must fall within specified current range for unit to operate properly. Special consideration should be given when using a motor with a potentially high starting current (greater than ten times motor FLA) with the SMC-50 controller. Contact Rockwell Automation technical support for further guidance.

(2) Devices are not equipped with line and load terminal lugs. See [page 75](#) for terminal lug kits.

## Heavy-duty Ratings (applications include centrifugal fans, crushers, mixers, and long conveyors)

Utilization Category: AC-53a:3.5-30:99-1. Start Not to Exceed: 350% of the controller maximum current rating, 30 second start time, 99% ON load factor, one start per hour with 50 °C (122 °F) surrounding air ambient temperature.



Use the SMC Estimation Wizard and SMC Thermal Estimation Wizard to confirm that the SMC controller selection meets the application requirements. See [Sizing and Selection Tools](#) for more information. For additional assistance, visit [rok.auto](http://rok.auto) or contact Industrial Controls Technical Support by email at [raictechsupport@ra.rockwell.com](mailto:raictechsupport@ra.rockwell.com) or by phone at +1 440-646-5800.

**Table 71 - 200/208V AC and 230V AC SMC-50 Solid-state Controllers for Use with Delta-connected Motors, Heavy Duty**

| Rated Utilization Voltage [V AC] | Motor Current [A] <sup>(1)</sup> | Motor kW, 50 Hz | Motor Hp, 60 Hz | Control Power           | Cat. No. <sup>(2)</sup> |
|----------------------------------|----------------------------------|-----------------|-----------------|-------------------------|-------------------------|
| 200/208                          | 52...155                         | —               | 20...50         | 100...240V AC; 50/60 Hz | 150-SB2NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SB2NBR              |
|                                  | 65...190                         |                 | 25...60         | 100...240V AC; 50/60 Hz | 150-SB3NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SB3NBR              |
|                                  | 82...242                         |                 | 30...75         | 100...240V AC; 50/60 Hz | 150-SB4NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SB4NBR              |
|                                  | 104...311                        |                 | 40...100        | 100...240V AC; 50/60 Hz | 150-SC1NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SC1NBR              |
|                                  | 122...363                        |                 | 50...125        | 100...240V AC; 50/60 Hz | 150-SC2NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SC2NBR              |
|                                  | 151...450                        |                 | 60...150        | 100...240V AC; 50/60 Hz | 150-SC3NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SC3NBR              |
|                                  | 186...554                        |                 | 75...200        | 100...240V AC; 50/60 Hz | 150-SD1NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SD1NBR              |
|                                  | 210...625                        |                 | 75...200        | 100...240V AC; 50/60 Hz | 150-SD2NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SD2NBR              |
|                                  | 243...727                        |                 | 100...250       | 100...240V AC; 50/60 Hz | 150-SD3NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SD3NBR              |
| 230                              | 52...155                         | 17...50         | 20...60         | 100...240V AC; 50/60 Hz | 150-SB2NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SB2NBR              |
|                                  | 65...190                         | 20...55         | 25...60         | 100...240V AC; 50/60 Hz | 150-SB3NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SB3NBR              |
|                                  | 82...242                         | 30...75         | 40...75         | 100...240V AC; 50/60 Hz | 150-SB4NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SB4NBR              |
|                                  | 104...311                        | 37...100        | 40...100        | 100...240V AC; 50/60 Hz | 150-SC1NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SC1NBR              |
|                                  | 122...363                        | 40...110        | 50...125        | 100...240V AC; 50/60 Hz | 150-SC2NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SC2NBR              |
|                                  | 151...450                        | 50...132        | 60...150        | 100...240V AC; 50/60 Hz | 150-SC3NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SC3NBR              |
|                                  | 186...554                        | 63...160        | 75...200        | 100...240V AC; 50/60 Hz | 150-SD1NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SD1NBR              |
|                                  | 210...625                        | 75...200        | 100...250       | 100...240V AC; 50/60 Hz | 150-SD2NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SD2NBR              |
|                                  | 243...727                        | 80...220        | 100...300       | 100...240V AC; 50/60 Hz | 150-SD3NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SD3NBR              |

(1) Motor FLA rating must fall within specified current range for unit to operate properly. Special consideration should be given when using a motor with a potentially high starting current (greater than ten times motor FLA) with the SMC-50 controller. Contact Rockwell Automation technical support for further guidance.

(2) Devices are not equipped with line and load terminal lugs. See [page 75](#) for terminal lug kits.

**Table 72 - 400/415/460V AC and 500/575V AC SMC-50 Solid-state Controllers for Use with Delta-connected Motors, Heavy Duty**

| Rated Utilization Voltage [V AC] | Motor Current [A] <sup>(1)</sup> | Motor kW, 50 Hz | Motor Hp, 60 Hz | Control Power           | Cat. No. <sup>(2)</sup> |
|----------------------------------|----------------------------------|-----------------|-----------------|-------------------------|-------------------------|
| 400/415 (kW)<br>460 (Hp)         | 52...155                         | 30...80         | 40...100        | 100...240V AC; 50/60 Hz | 150-SB2NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SB2NBR              |
|                                  | 65...190                         | 37...100        | 50...150        | 100...240V AC; 50/60 Hz | 150-SB3NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SB3NBR              |
|                                  | 82...242                         | 50...132        | 75...200        | 100...240V AC; 50/60 Hz | 150-SB4NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SB4NBR              |
|                                  | 104...311                        | 63...160        | 100...250       | 100...240V AC; 50/60 Hz | 150-SC1NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SC1NBR              |
|                                  | 122...363                        | 75...200        | 100...300       | 100...240V AC; 50/60 Hz | 150-SC2NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SC2NBR              |
|                                  | 151...450                        | 90...250        | 125...350       | 100...240V AC; 50/60 Hz | 150-SC3NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SC3NBR              |
|                                  | 186...554                        | 110...315       | 200...450       | 100...240V AC; 50/60 Hz | 150-SD1NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SD1NBR              |
|                                  | 210...625                        | 125...355       | 200...500       | 100...240V AC; 50/60 Hz | 150-SD2NBD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SD2NBR              |
| 500 (kW)<br>575 (Hp)             | 52...155                         | 37...100        | 50...150        | 100...240V AC; 50/60 Hz | 150-SB2NUD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SB2NUR              |
|                                  | 65...190                         | 50...132        | 75...150        | 100...240V AC; 50/60 Hz | 150-SB3NUD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SB3NUR              |
|                                  | 82...242                         | 63...160        | 100...250       | 100...240V AC; 50/60 Hz | 150-SB4NUD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SB4NUR              |
|                                  | 104...311                        | 75...220        | 125...300       | 100...240V AC; 50/60 Hz | 150-SC1NUD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SC1NUR              |
|                                  | 122...363                        | 90...250        | 125...350       | 100...240V AC; 50/60 Hz | 150-SC2NUD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SC2NUR              |
|                                  | 151...450                        | 110...315       | 200...450       | 100...240V AC; 50/60 Hz | 150-SC3NUD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SC3NUR              |
|                                  | 186...554                        | 132...400       | 200...500       | 100...240V AC; 50/60 Hz | 150-SD1NUD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SD1NUR              |
|                                  | 210...625                        | 150...450       | 250...600       | 100...240V AC; 50/60 Hz | 150-SD2NUD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SD2NUR              |
|                                  | 243...727                        | 185...530       | 300...700       | 100...240V AC; 50/60 Hz | 150-SD3NUD              |
|                                  |                                  |                 |                 | 24V DC                  | 150-SD3NUR              |

(1) Motor FLA rating must fall within specified current range for unit to operate properly. Special consideration should be given when using a motor with a potentially high starting current (greater than ten times motor FLA) with the SMC-50 controller. Contact Rockwell Automation technical support for further guidance.

(2) Devices are not equipped with line and load terminal lugs. See [page 75](#) for terminal lug kits.

# Accessories

Table 73 - Option Modules

| Description                                                                       |                                                                                                                                | Compatible Control Module Ports                                                                                                                                 | Maximum No. of Option Modules of this Type Per Controller | Cat. No. |         |
|-----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|----------|---------|
|  | Option Module <ul style="list-style-type: none"><li>• Adds or expands the functionality of the SMC-50 control module</li></ul> | PTC, Ground Fault, and Current Feedback Option Module                                                                                                           | 7 and 8                                                   | 1        | 150-SM2 |
|  |                                                                                                                                | Analog I/O Option Module <ul style="list-style-type: none"><li>• 2 analog inputs (voltage or current)</li><li>• 2 analog outputs (voltage or current)</li></ul> | 7, 8, 9                                                   | 3        | 150-SM3 |
|  |                                                                                                                                | Digital I/O Option Module <ul style="list-style-type: none"><li>• 4 100...240V AC inputs</li><li>• 3 relay outputs</li></ul>                                    | 7, 8, 9                                                   | 3        | 150-SM4 |
|  |                                                                                                                                | Parameter Configuration Module <ul style="list-style-type: none"><li>• DIP and rotary dial</li></ul>                                                            | 7, 8, 9                                                   | 1        | 150-SM6 |



If the application requires network communication, a Cat. No. 20-COMM-X communication adapter must be inserted in expansion port 9.

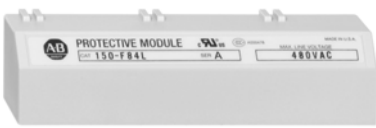
Table 74 - Converter Modules

| Description                                                                                                                                                            | For Use With                                                                                                                            | Rated Current [A]     | Cat. No.   |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|-----------------------|------------|
| <br>Three-Phase Current Monitoring Module                                           | Used with a Cat. No. 150-SM2 to provide current feedback to the SMC-50 controller when in external bypass configuration. <sup>(1)</sup> | 30...180              | 825-MCM180 |
|                                                                                                                                                                        |                                                                                                                                         | 181...520             | 825-MCM20  |
| <br>Connection Cable (replacement)<br>• Cat. No. 150-SM2 to Bul. 825-MCM connection | All                                                                                                                                     | —                     | 825-MCA    |
| <br>Core Balance Ground Fault Sensor                                                | Used with a Cat. No. 150-SM2 to provide ground current feedback. <sup>(2)</sup>                                                         | Turns Ratio:<br>100:1 | 825-CBCT   |

(1) Requires user-supplied current transformers with 5 A secondary.

(2) The ground fault sensing feature of the SMC-50 controller is intended for monitoring purposes only. It is not to be used as a ground fault circuit interrupter for personnel protection as defined by Article 100 of the NEC. The sensing feature has not been evaluated to UL 1053.

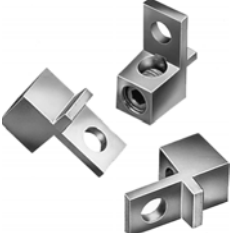
Table 75 - Protective Modules

| Description                                                                                                                               |      | Current Rating [A]    | Cat. No. |
|-------------------------------------------------------------------------------------------------------------------------------------------|------|-----------------------|----------|
| <br>Protective module<br>• Line- or load-side mounting | 480V | 90...520<br>108...480 | 150-F84L |
|                                                                                                                                           | 600V |                       | 150-F86L |



Use of protective modules is highly recommended. For applications that require both line and load side protection, you must order two protective modules.

Table 76 - Terminal Lug Kits

|                                                                                   | For Use With Controller Type                          |                                          | Current Range [A] | Wire Size Range                                                    | Total No. of Terminal Lugs Possible Each Side |                   | Pkg. Qty. | Cat. No.  |
|-----------------------------------------------------------------------------------|-------------------------------------------------------|------------------------------------------|-------------------|--------------------------------------------------------------------|-----------------------------------------------|-------------------|-----------|-----------|
|                                                                                   |                                                       |                                          |                   |                                                                    | Line Side                                     | Load Side         |           |           |
|  | Integrated bypass                                     | 150-S108..., 150-S135...                 | 108...135         | #6...250 MCM AWG<br>16 mm <sup>2</sup> ...120 mm <sup>2</sup>      | 3                                             | 3                 | 3         | 199-LF1   |
|                                                                                   |                                                       | 150-S201..., 150-S251...                 | 201...251         | #6...250 MCM AWG<br>16 mm <sup>2</sup> ...120 mm <sup>2</sup>      | 6                                             | 6                 | 3         | 199-LF1   |
|                                                                                   |                                                       | 150-S317..., 150-S361...,<br>150-S480... | 317...480         | #4...500 MCM AWG<br>25 mm <sup>2</sup> ...240 mm <sup>2</sup>      | 6                                             | 6                 | 3         | 199-LG1   |
|                                                                                   | Solid -state<br>• no external bypass                  | 150-SB...                                | 90...180          | #6...250 MCM AWG<br>16 mm <sup>2</sup> ...120 mm <sup>2</sup>      | 3                                             | 3                 | 3         | 199-LF1   |
|                                                                                   |                                                       | 150-SC...                                | 210...320         | #6...250 MCM AWG<br>16 mm <sup>2</sup> ...120 mm <sup>2</sup>      | 6                                             | 6                 | 3         | 199-LF1   |
|                                                                                   |                                                       | 150-SD...                                | 361...520         | #4...500 MCM AWG<br>25 mm <sup>2</sup> ...240 mm <sup>2</sup>      | 6                                             | 6                 | 3         | 199-LG1   |
|                                                                                   | Solid -state<br>• with external bypass                | 150-SB...                                | 90...180          | (2) 1/0...250 MCM AWG<br>50 mm <sup>2</sup> ...120 mm <sup>2</sup> | 3                                             | 3                 | 3         | 1494R-N14 |
|                                                                                   |                                                       | 150-SC...                                | 210...320         | #6...250 MCM AWG<br>16 mm <sup>2</sup> ...120 mm <sup>2</sup>      | 6 <sup>(1)</sup>                              | 6                 | 3         | 199-LF1   |
|                                                                                   |                                                       | 150-SD...                                | 361...520         | #4...500 MCM AWG<br>25 mm <sup>2</sup> ...240 mm <sup>2</sup>      | 6 <sup>(1)</sup>                              | 6                 | 3         | 199-LG1   |
|                                                                                   | Integrated bypass<br>• inside-the-delta terminal lugs | 150-S108..., 150-S135...                 | 187...234         | #4...500 MCM AWG<br>25 mm <sup>2</sup> ...240 mm <sup>2</sup>      |                                               | 6 <sup>(2)</sup>  | 3         | 1494R-N15 |
|                                                                                   |                                                       | 150-S201..., 150-S251...                 | 348...435         | (2) 1/0...250 MCM AWG<br>50 mm <sup>2</sup> ...120 mm <sup>2</sup> | 6                                             | 12 <sup>(2)</sup> | 3         | 1494R-N14 |
|                                                                                   |                                                       | 150-S317..., 150-S361...,<br>150-S480... | 549...831         | (3) 3/0...500 MCM AWG<br>95 mm <sup>2</sup> ...240 mm <sup>2</sup> | 3                                             | 12 <sup>(3)</sup> | 3         | 150-LG5MC |

(1) 6 additional terminal lugs are needed for bypass kit

(2) When connected in an inside-the-delta configuration, use terminal Cat. No. 199-LF1 for load-side connections (T1...T6).

(3) When connected in an inside-the-delta configuration, use terminals Cat. No. 199-LG1 for load-side connections (T1...T6).

Table 77 - Distribution Blocks

|                                                                                     | For Use With Controller Type      |           | Current Range [A] | Wire Size Range                                   |                                                   | Total Distribution Blocks Needed |           | Pkg. Qty. | Cat. No.                                      |
|-------------------------------------------------------------------------------------|-----------------------------------|-----------|-------------------|---------------------------------------------------|---------------------------------------------------|----------------------------------|-----------|-----------|-----------------------------------------------|
|                                                                                     |                                   |           |                   | Line Side                                         | Load Side                                         | Line Side                        | Load Side |           |                                               |
|  | Solid-state<br>• inside-the-delta | 150-SB... | 155...311         | (2) #4 AWG...500 MCM<br>25...240 mm <sup>2</sup>  | (2) #4 AWG...500 MCM<br>25...240 mm <sup>2</sup>  | 3                                | —         | 1         | 1492-BG                                       |
|                                                                                     |                                   | 150-SC... | 363...554         | (2) 1/0 AWG...750 MCM<br>54...400 mm <sup>2</sup> | (6) 6 AWG...250 MCM<br>16...120 mm <sup>2</sup>   | 1                                | —         | 1         | Marathon Special Products<br>Cat. No. 1353703 |
|                                                                                     |                                   | 150-SD... | 625...900         | (4) 1/0 AWG...750 MCM<br>54...400 mm <sup>2</sup> | (4) 1/0 AWG...750 MCM<br>54...400 mm <sup>2</sup> | 3                                | —         | 1         | Marathon Special Products<br>Cat. No. 1352702 |

Table 78 - External Bypass Kits

| For Use With Controller Type           |           | Current Range [A] | Cat. No. |
|----------------------------------------|-----------|-------------------|----------|
| Solid -state<br>• with external bypass | 150-SC... | 210...320         | 150-SCBK |
|                                        | 150-SD... | 361...520         | 150-SDBK |

Table 79 - IEC Line- or Load-side Terminal Covers

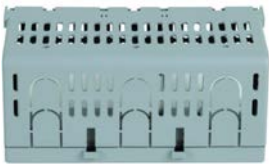
|                                                                                   | Description                                                                                                                    | For Use With                          | Pkg. Quantity | Cat. No. |
|-----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|---------------|----------|
|  | <ul style="list-style-type: none"> <li>Dead front protection</li> <li>IP2X finger safe when used with 250 MCM cable</li> </ul> | 150-S108..., 150-S135...              | 1             | 150-TC1  |
|                                                                                   | <ul style="list-style-type: none"> <li>Dead front protection</li> <li>IP2X finger safe when used with 250 MCM cable</li> </ul> | 150-S201..., 150-S251...              | 1             | 150-TC2  |
|                                                                                   | <ul style="list-style-type: none"> <li>Dead front protection</li> <li>IP2X finger safe when used with 500 MCM cable</li> </ul> | 150-S317..., 150-S361..., 150-S480... | 1             | 150-TC3  |
|  | <ul style="list-style-type: none"> <li>Dead front protection</li> <li>IP2X finger safe when used with 250 MCM cable</li> </ul> | 150-SB...<br>(90...180 A units only)  | 1             | 150-STCB |

Table 80 - Capacitor Module

|                                                                                   | Description                                         | For Use With                      | Cat. No. |
|-----------------------------------------------------------------------------------|-----------------------------------------------------|-----------------------------------|----------|
|  | Required for EMC directive compliance (EN60947-4-2) | 150-SB... (90...180 A units only) | 150-SMCA |

Table 81 - Human Interface Modules (HIMs) and Communication Modules

|                                                                                   |                                                                                                                                          | Description                                                                           | Cat. No.                                             |                                                                          |
|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|------------------------------------------------------|--------------------------------------------------------------------------|
|  | SMC-50 Controller — bezel mounted                                                                                                        | Enhanced, LCD, Full Numeric Keypad                                                    | 20-HIM-A6                                            |                                                                          |
|                                                                                   | Door-mounted HIM                                                                                                                         | Remote (panel mount) LCD Display, Full Numeric Keypad (version of Cat. No. 20-HIM-A6) | 20-HIM-C6S <sup>(1)</sup>                            |                                                                          |
|                                                                                   | HIM interface cables                                                                                                                     | HIM Interface Cable, 1 m (39 in)                                                      | 20-HIM-H10 <sup>(2)</sup>                            |                                                                          |
|                                                                                   |                                                                                                                                          | Cable Kit (Male-Female) 0.33 m (1.1 ft)                                               | 1202-H03                                             |                                                                          |
|                                                                                   |                                                                                                                                          | Cable Kit (Male-Female) 1 m (3.3 ft)                                                  | 1202-H10                                             |                                                                          |
|                                                                                   |                                                                                                                                          | Cable Kit (Male-Female) 3 m (9.8 ft)                                                  | 1202-H30                                             |                                                                          |
|                                                                                   |                                                                                                                                          | Cable Kit (Male-Female) 9 m (29.5 ft)                                                 | 1202-H90                                             |                                                                          |
|                                                                                   |                                                                                                                                          | DPI/SCANport™ One to Two Port Splitter Cable                                          | 1203-S03                                             |                                                                          |
| Description                                                                       |                                                                                                                                          | For Use With                                                                          |                                                      |                                                                          |
|  | Communication modules (installed into the physical space assigned to control module expansion port 9; connected to DPI port 4 via cable) | RS-485 DF1 Communication Adapter                                                      | Bulletin 150-Sxx                                     | 20-COMM-S                                                                |
|                                                                                   |                                                                                                                                          | PROFIBUS DP Communication Adapter                                                     |                                                      | 20-COMM-P                                                                |
|                                                                                   |                                                                                                                                          | ControlNet® Communication Adapter (Coax)                                              |                                                      | 20-COMM-C                                                                |
|                                                                                   |                                                                                                                                          | Interbus Communication Adapter                                                        |                                                      | 20-COMM-I                                                                |
|                                                                                   |                                                                                                                                          | Modbus/TCP Communication Adapter                                                      |                                                      | 20-COMM-M                                                                |
|                                                                                   |                                                                                                                                          | DeviceNet® Communication Adapter                                                      |                                                      | 20-COMM-D                                                                |
|                                                                                   |                                                                                                                                          | EtherNet/IP™ Communication Adapter                                                    |                                                      | 20-COMM-E                                                                |
|                                                                                   |                                                                                                                                          | Dual-port EtherNet/IP Communication Adapter                                           |                                                      | 20-COMM-ER                                                               |
|                                                                                   |                                                                                                                                          | HVAC Communication Adapter                                                            |                                                      | 20-COMM-H                                                                |
|                                                                                   |                                                                                                                                          | ControlNet Communication Adapter (Fiber)                                              |                                                      | 20-COMM-Q                                                                |
| Connected Components Workbench Software                                           |                                                                                                                                          | Programming Software                                                                  | Windows 7/2000/XP/Vista<br>Windows 10 <sup>(3)</sup> | Available for download at <a href="http://rok.auto/ccw">rok.auto/ccw</a> |
| DriveExecutive™                                                                   |                                                                                                                                          |                                                                                       |                                                      | 9303-4DTE01ENE                                                           |
| DriveTools™ SP <sup>(4)</sup>                                                     |                                                                                                                                          |                                                                                       |                                                      | 9303-4DTS01ENE                                                           |
| AnaCANda™ RS-232 to DPI                                                           |                                                                                                                                          | Personal computer Interface                                                           | Serial                                               | 1203-SSS <sup>(5)</sup>                                                  |
| DPI to USB                                                                        |                                                                                                                                          |                                                                                       | USB                                                  | 1203-USB <sup>(6)</sup>                                                  |

(1) A 3 m (9.8 ft.) Cat. No. 1202-C30 cable is provided.

(2) A cable is required if 20-HIM-A6 is connected to the SMC-50 DPI Port #2 and used as a hand-held device.

(3) Connected Components Workbench software only.

(4) Includes DriveExecutive™ and DriveObserver™ software.

(5) Includes Cat. No. 1203-SFC and 1202-C10 cables.

(6) Includes Cat. No. 20-HIM-H10 and 22-HIM-H10 cables.

# Replacement Parts

## For All Controller Types

Table 82 - Replacement parts for all controllers

| Description                          |                                                                   |                | Cat. No.                |
|--------------------------------------|-------------------------------------------------------------------|----------------|-------------------------|
| SMC-50 Control Module                | 100...240V AC control power; two 24V DC inputs, two relay outputs |                | 150-SCMD                |
|                                      | 24V DC control power; two 24V DC inputs, two relay outputs        |                | 150-SCMR <sup>(1)</sup> |
| Replacement Cover                    | Replacement control module front cover                            |                | 150-SCMRC               |
| Replacement Removable Terminal Block | Control module control I/O replacement removable terminal block   | Control module | 150-SCMRTB              |
|                                      | PTC module replacement removable terminal block (set of 3)        | 150-SM2        | 150-SM2RTB              |
|                                      | Analog I/O option replacement removable terminal block            | 150-SM3        | 150-SM3RTB              |
|                                      | Digital I/O module replacement removable terminal block           | 150-SM4        | 150-SM4RTB              |

(1) Consult your local Rockwell Automation sales office or Allen-Bradley distributor for availability.

## For Units with Integrated Bypass

Table 83 - Replacement Power Poles

| Description                                                                                                                                                   |                           | 100...240V AC Control Voltage | 24V DC Control Voltage      |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-------------------------------|-----------------------------|
|                                                                                                                                                               |                           | Cat. No.                      | Cat. No.                    |
| Frame 3 Power Structure Assembly<br>• Contains all three power poles in one package and includes the pole-to-control module transition cover and cooling fan. | 108 A, 200...480V AC line | 150-SPP108BD                  | 150-SPP108BR <sup>(1)</sup> |
|                                                                                                                                                               | 135 A, 200...480V AC line | 150-SPP135BD                  | 150-SPP135BR <sup>(1)</sup> |
|                                                                                                                                                               | 108 A, 200...690V AC line | 150-SPP108UD                  | 150-SPP108UR <sup>(1)</sup> |
|                                                                                                                                                               | 135 A, 200...690V AC line | 150-SPP135UD                  | 150-SPP135UR <sup>(1)</sup> |
| Frame 4 Power Pole<br>• Contains one power pole                                                                                                               | 201 A, 200...480V AC line | 150-SPP201B                   |                             |
|                                                                                                                                                               | 251 A, 200...480V AC line | 150-SPP251B                   |                             |
|                                                                                                                                                               | 201 A, 200...690V AC line | 150-SPP201U                   |                             |
|                                                                                                                                                               | 251 A, 200...690V AC line | 150-SPP251U                   |                             |
| Frame 5 Power Pole<br>• Contains one power pole                                                                                                               | 317 A, 200...480V AC line | 150-SPP317B                   |                             |
|                                                                                                                                                               | 361 A, 200...480V AC line | 150-SPP361B                   |                             |
|                                                                                                                                                               | 480 A, 200...480V AC line | 150-SPP480B                   |                             |
|                                                                                                                                                               | 317 A, 200...690V AC line | 150-SPP317U                   |                             |
|                                                                                                                                                               | 361 A, 200...690V AC line | 150-SPP361U                   |                             |
|                                                                                                                                                               | 480 A, 200...690V AC line | 150-SPP480U                   |                             |
| Base Plate<br>• for mounting power poles                                                                                                                      | 201...251 A               | 41391-803-01                  |                             |
|                                                                                                                                                               | 317...480 A               | 41391-803-02                  |                             |

(1) Consult your local Rockwell Automation sales office or Allen-Bradley distributor for availability.

Table 84 - Replacement Fan

| Description                    | Rated Control Voltage | For Use With     | Cat. No.                   |
|--------------------------------|-----------------------|------------------|----------------------------|
| for SMC-50 Frame 3 controllers | 100...240V AC         | 150-S108...-S135 | 150-SRF135D                |
|                                | 24V DC                |                  | 150-SRF135R <sup>(1)</sup> |
| for SMC-50 Frame 4 controllers | 100...240V AC         | 150-S201...-S251 | 150-SRF251D                |
|                                | 24V DC                |                  | 150-SRF251R <sup>(1)</sup> |
| for SMC-50 Frame 5 controllers | 100...240V AC         | 150-S317...-S480 | 150-SRF480D                |
|                                | 24V DC                |                  | 150-SRF480R <sup>(1)</sup> |

(1) Consult your local Rockwell Automation sales office or Allen-Bradley distributor for availability.

Table 85 - Replacement Controller Cover

| Description                       | Rated Current [A] | Line Voltage [V AC] | Control Voltage       | Cat. No.                    |
|-----------------------------------|-------------------|---------------------|-----------------------|-----------------------------|
| For SMC-50 controller with Bypass | 201               | 200...480           | 100...240V AC         | 150-S201RCBD                |
|                                   |                   |                     | 24V DC <sup>(1)</sup> | 150-S201RCBR <sup>(2)</sup> |
|                                   |                   | 200...690           | 100...240V AC         | 150-S201RCUD                |
|                                   |                   |                     | 24V DC <sup>(1)</sup> | 150-S201RCUR <sup>(2)</sup> |
|                                   | 251               | 200...480           | 100...240V AC         | 150-S251RCBD                |
|                                   |                   |                     | 24V DC <sup>(1)</sup> | 150-S251RCBR <sup>(2)</sup> |
|                                   |                   | 200...690           | 100...240V AC         | 150-S251RCUD                |
|                                   |                   |                     | 24V DC <sup>(1)</sup> | 150-S251RCUR <sup>(2)</sup> |
|                                   | 317               | 200...480           | 100...240V AC         | 150-S317RCBD                |
|                                   |                   |                     | 24V DC <sup>(1)</sup> | 150-S317RCBR <sup>(2)</sup> |
|                                   |                   | 200...690           | 100...240V AC         | 150-S317RCUD                |
|                                   |                   |                     | 24V DC <sup>(1)</sup> | 150-S317RCUR <sup>(2)</sup> |
|                                   | 361               | 200...480           | 100...240V AC         | 150-S361RCBD                |
|                                   |                   |                     | 24V DC <sup>(1)</sup> | 150-S361RCBR <sup>(2)</sup> |
|                                   |                   | 200...690           | 100...240V AC         | 150-S361RCUD                |
|                                   |                   |                     | 24V DC <sup>(1)</sup> | 150-S361RCUR <sup>(2)</sup> |
|                                   | 480               | 200...480           | 100...240V AC         | 150-S480RCBD                |
|                                   |                   |                     | 24V DC <sup>(1)</sup> | 150-S480RCBR <sup>(2)</sup> |
|                                   |                   | 200...690           | 100...240V AC         | 150-S480RCUD                |
|                                   |                   |                     | 24V DC <sup>(1)</sup> | 150-S480RCUR <sup>(2)</sup> |

(1) 24V DC Control Inputs ONLY. Not compatible with 24V AC Control Inputs.

(2) Consult your local Rockwell Automation sales office or Allen-Bradley distributor for availability.

## For Solid-state Units

**Table 86 - Replacement Power Poles**

| Description                                                                                                                                                  |                           | 100...240V AC Control Voltage | 24V DC Control Voltage |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-------------------------------|------------------------|
|                                                                                                                                                              |                           | Cat. No.                      | Cat. No.               |
| Frame B Power Structure Assembly<br>• Contains all three power poles in one package and includes the pole-to-control module transition cover and cooling fan | 90 A, 200...480V AC line  | 150-SPPB1B                    | 150-SPPB1BR            |
|                                                                                                                                                              | 110 A, 200...480V AC line | 150-SPPB2B                    | 150-SPPB2BR            |
|                                                                                                                                                              | 140 A, 200...480V AC line | 150-SPPB3B                    | 150-SPPB3BR            |
|                                                                                                                                                              | 180 A, 200...480V AC line | 150-SPPB4B                    | 150-SPPB4BR            |
|                                                                                                                                                              | 90 A, 200...690V AC line  | 150-SPPB1U                    | 150-SPPB1UR            |
|                                                                                                                                                              | 110 A, 200...690V AC line | 150-SPPB2U                    | 150-SPPB2UR            |
|                                                                                                                                                              | 140 A, 200...690V AC line | 150-SPPB3U                    | 150-SPPB3UR            |
|                                                                                                                                                              | 180 A, 200...690V AC line | 150-SPPB4U                    | 150-SPPB4UR            |
| Frame C Power Pole<br>• Contains one power pole – SCR, heatsink assembly, and cable                                                                          | 210 A, 200...480V AC line | 150-SPPC1B                    |                        |
|                                                                                                                                                              | 260 A, 200...480V AC line | 150-SPPC2B                    |                        |
|                                                                                                                                                              | 320 A, 200...480V AC line | 150-SPPC3B                    |                        |
|                                                                                                                                                              | 210 A, 200...690V AC line | 150-SPPC1U                    |                        |
|                                                                                                                                                              | 260 A, 200...690V AC line | 150-SPPC2U                    |                        |
|                                                                                                                                                              | 320 A, 200...690V AC line | 150-SPPC3U                    |                        |
| Frame D Power Pole<br>• Contains one power pole – SCR, heatsink assembly, and cable                                                                          | 361 A, 200...480V AC line | 150-SPPD1B                    |                        |
|                                                                                                                                                              | 420 A, 200...480V AC line | 150-SPPD2B                    |                        |
|                                                                                                                                                              | 520 A, 200...480V AC line | 150-SPPD3B                    |                        |
|                                                                                                                                                              | 361 A, 200...690V AC line | 150-SPPD1U                    |                        |
|                                                                                                                                                              | 420 A, 200...690V AC line | 150-SPPD2U                    |                        |
|                                                                                                                                                              | 520 A, 200...690V AC line | 150-SPPD3U                    |                        |

**Table 87 - Replacement Cover**

| Description                  |                   | Cat. No. |
|------------------------------|-------------------|----------|
| Replacement controller cover | 210...320 A units | 150-SCRC |
|                              | 361...520 A units | 150-SDRC |

**Table 88 - Replacement Fan**

| Description           |                                | Rated Control Voltage | For Use With               | Cat. No. |
|-----------------------|--------------------------------|-----------------------|----------------------------|----------|
| Replacement Fan       | for SMC-50 Frame B controllers | 100...240V AC         | 150-SB units (90...180 A)  | 150-SF1  |
|                       |                                | 24V DC                |                            | 150-SF1R |
|                       | for SMC-50 Frame C controllers | 100...240V AC         | 150-SC units (210...320 A) | 150-SF2D |
|                       |                                | 24V DC                |                            | 150-SF2R |
|                       | for SMC-50 Frame D controllers | 100...240V AC         | 150-SD units (361...520 A) | 150-SF3D |
|                       |                                | 24V DC                |                            | 150-SF3R |
| Replacement Fan Cover | for SMC-50 Frame B controllers | —                     | 150-SB units (90...180 A)  | 150-SBFC |
|                       | for SMC-50 Frame C controllers | —                     | 150-SC units (210...320 A) | 150-SCFC |
|                       | for SMC-50 Frame D controllers | —                     | 150-SD units (361...520 A) | 150-SDFC |

**IMPORTANT** Carefully check current range, line voltage and control input voltage when selecting an upgrade kit. Not all control voltages or current ranges can be upgraded.

**Table 89 - Upgrade Kits**

| Description                                                    | Kit Contents <sup>(1)</sup>                                                                                                                                                         | Rated Current [A] | Line Voltage [V AC] | Control Voltage <sup>(2)</sup> | Cat. No.                     |
|----------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|---------------------|--------------------------------|------------------------------|
| Frame 3 SMC Flex to SMC-50 controllers with bypass upgrade kit | <ul style="list-style-type: none"> <li>150-SCMD control module</li> <li>- 150-SM4 digital I/O module</li> <li>20-HIM-A6 LCD HIM</li> </ul>                                          | 108               | 200...690           | 100...240V AC                  | 150-S108UPGD                 |
|                                                                |                                                                                                                                                                                     | 135               |                     |                                | 150-S135UPGD                 |
|                                                                | <ul style="list-style-type: none"> <li>150-SCMR control module</li> <li>20-HIM-A6 LCD HIM</li> </ul>                                                                                | 108               | 200...690           | 24V DC <sup>(3)</sup>          | 150-S108UPGR <sup>(4)</sup>  |
|                                                                |                                                                                                                                                                                     | 135               |                     |                                | 150-S135UPGR <sup>(4)</sup>  |
| Frame 4 SMC Flex to SMC-50 controllers with bypass upgrade kit | <ul style="list-style-type: none"> <li>150-SCMD control module</li> <li>150-SM4 digital I/O module</li> <li>20-HIM-A6 LCD HIM</li> <li>Plastic mounting/transition cover</li> </ul> | 201               | 200...480           | 100...240V AC                  | 150-S201UPGBD                |
|                                                                |                                                                                                                                                                                     |                   | 200...575           |                                | 150-S201UPGCD                |
|                                                                |                                                                                                                                                                                     |                   | 200...690           |                                | 150-S201UPGUD                |
|                                                                |                                                                                                                                                                                     | 251               | 200...480           |                                | 150-S251UPGBD                |
|                                                                |                                                                                                                                                                                     |                   | 200...575           |                                | 150-S251UPGCD                |
|                                                                |                                                                                                                                                                                     |                   | 200...690           |                                | 150-S251UPGUD                |
|                                                                | <ul style="list-style-type: none"> <li>150-SCMR control module</li> <li>20-HIM-A6 LCD HIM</li> <li>Plastic mounting/transition cover</li> </ul>                                     | 201               | 200...480           | 24V DC <sup>(3)</sup>          | 150-S201UPGBR <sup>(4)</sup> |
|                                                                |                                                                                                                                                                                     |                   | 200...575           |                                | 150-S201UPGCR <sup>(4)</sup> |
|                                                                |                                                                                                                                                                                     |                   | 200...690           |                                | 150-S201UPGUR <sup>(4)</sup> |
|                                                                |                                                                                                                                                                                     | 251               | 200...480           |                                | 150-S251UPGBR <sup>(4)</sup> |
|                                                                |                                                                                                                                                                                     |                   | 200...575           |                                | 150-S251UPGCR <sup>(4)</sup> |
|                                                                |                                                                                                                                                                                     |                   | 200...690           |                                | 150-S251UPGUR <sup>(4)</sup> |

(1) Kit contains one of each catalog number listed.

(2) The SMC-50 control module provides two (2) 24V DC control inputs. If you need additional inputs, you must use 100...240V AC inputs (requires 150-SM4 option module).

(3) 24V DC control voltage ONLY. Not compatible with 24V AC control voltage.

(4) Consult your local Rockwell Automation sales office or Allen-Bradley distributor for availability.

# Specifications

**Table 90 - Functional Design**

| Standard Features                               |                                             | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-------------------------------------------------|---------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Installation                                    | Power Wiring                                | standard squirrel-cage induction motor or a Wye-Delta, six-lead motor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|                                                 | Control Wiring                              | 2- and 3-wire control for a wide variety of applications                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Configuration/Setup <sup>(1)</sup>              | Keypad                                      | Cat. No. 20-HIM-A6 full numeric keypad with LCD display<br>Cat. No. 20-HIM-C6S remote panel mount full numeric keypad with LCD display                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|                                                 | Software                                    | parameter values are downloaded to the SMC-50 with the Connected Components Workbench, DriveTools, and DriveExplorer programming software packages                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|                                                 | Parameter Configuration Option Module (PCM) | Cat. No. 150-SM6 provides simple and limited configuration by DIP and rotary dial switches                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Communications                                  |                                             | four DPI ports for local serial communications. Network communication supported by optional 20-COMM-X modules                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Starting and Stopping Modes                     |                                             | modes include: Soft Start, Coast-to-Stop, Soft Stop, Current Limit Start, Dual Ramp, Full Voltage, Linear Speed Acceleration (start), Linear Speed Deceleration (stop), Torque Start, and Preset Slow Speed                                                                                                                                                                                                                                                                                                                                                                                                           |
| Pump Control                                    | Start and Stop                              | helps reduce fluid surges in centrifugal pumping systems during the starting and stopping period                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Braking Control <sup>(2)</sup>                  | SMB Smart Motor Braking                     | provides motor braking without additional equipment for applications that require the motor to stop quickly                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|                                                 | Accu-Stop <sup>(3)</sup>                    | provides controlled position stopping; during stopping, brake torque is applied to the motor until the motor reaches the preset slow speed and holds the motor at this speed until a stop command is given - braking torque is then applied until the motor reaches zero speed - braking current is programmable                                                                                                                                                                                                                                                                                                      |
|                                                 | Slow Speed with Braking                     | used on applications that require slow speed (in the forward or reverse direction) for positioning or alignment and requires braking control to stop                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|                                                 | External Braking                            | activates the external braking device by using aux. relay output                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Protection and Diagnostics <sup>(4)</sup>       |                                             | displays: Power Loss, Line Fault, Voltage Unbalance, Excessive Starts/Hour, Phase Reversal, Undervoltage, Overvoltage, Controller Temperature, Stall, Jam, Open Gate, Overload, Underload, and Communication Fault                                                                                                                                                                                                                                                                                                                                                                                                    |
| Metering Indication <sup>(5)</sup>              |                                             | provides: Phase Current, Current Average, Phase-to-Phase Voltage, Voltage P-P Average, Phase-to-neutral Voltage, Calculated Torque, Real Phase Power, Real Power, Real Energy, Real Demand, Max Real Demand, Reactive Power, Reactive Energy + and -, Reactive Energy, Reactive Demand, Max Reactive Demand, Apparent Power, Apparent Energy, Apparent Demand, Number of Periods, Power Factor, Energy Savings, Elapsed Time 1 and 2, Running Time, Motor Speed, Start Time 1-5, Peak Current 1-5, Total Starts, THD V, THD I, THD V Average, THD I Average, Line Frequency, Current Imbalance, and Voltage Unbalance |
| LED Status Indication by Multi-color (standard) |                                             | displays fault and alarm codes: Running - with alarm, Running - no alarm, Ready - with alarm, Ready - no alarm, Ready - tuning enabled on next start, and Firmware Download Active - with alarm                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Auxiliary Contacts (two standard)               |                                             | two fully programmable contacts as: normal, UTS, fault, alarm, external brake, auxiliary control, network, external bypass, or fan control                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

(1) The configuration method must be ordered separately from the controller, which does not include a setup tool.

(2) Not intended to be used as an emergency stop. See the applicable standards for emergency stop requirements.

(3) Accu-Stop is not included as a parameter/function like that of the SMC Flex controller; you can accomplish the Accu-Stop function with SMB mode and Slow Speed with Braking.

(4) Diagnostic indication depends on the type of configuration tool used. The standard LED status indication displays: Inhibit (stop enabled), Fault (non- resettable), Fault (resettable). For full local access, a HIM or personal computer software is required. For network access, full access to data can also be obtained.

(5) Metering Indication depends on the type of configuration tool being used. Metering Indication requires the use of a HIM or a personal computer software configuration tool for full local access. Full access to data can also be obtained via network.

## Electrical Ratings

**Table 91 - Power Circuit Ratings**

| Description                            | Device Rating | UL/CSA/NEMA                | IEC                       |
|----------------------------------------|---------------|----------------------------|---------------------------|
| Rated Operation Voltage                | 480V          | 200...480V AC (-15%, +10%) | 200...415V (-15%, +10%)   |
|                                        | 690V          | 200...600V AC (-15%, +10%) | 200...690V/Y (-15%, +10%) |
| Rated Insulation Voltage               | 480V          | —                          | 500V                      |
|                                        | 690V          | —                          | 690V                      |
| Rated Impulse Voltage                  | 480V          | —                          | 6000V                     |
|                                        | 690V          | —                          | 6000V                     |
| Dielectric Withstand                   | 480V          | 2200V AC                   | 2500V                     |
|                                        | 690V          | 2200V AC                   | 2500V                     |
| Repetitive Peak Inverse Voltage Rating | 480V          | 1400V                      | 1400V                     |
|                                        | 690V          | 1800V                      | 1800V                     |
| Operating Frequency                    | All           | 47...63 Hz                 | 47...63 Hz                |

Table 92 - Utilization Category

| Description                         |                   | Device Rating | UL/CSA/NEMA                       | IEC                                  |
|-------------------------------------|-------------------|---------------|-----------------------------------|--------------------------------------|
| Integrated Bypass                   |                   | 108...480A    | MG 1                              | AC-53b:3.0-50:1750                   |
| Solid-state                         | Normal Duty       | 90...520 A    |                                   | AC-53a:3.5-10:99-2                   |
|                                     | Heavy Duty        |               |                                   | AC-53a:3.5-30:99-1                   |
| Protection Against Electrical Shock | Integrated Bypass | 108...480A    | —                                 | IP00 (IP20 - Control Terminals only) |
|                                     |                   | 108...480A    |                                   | IP2X (with Optional Terminal Cover)  |
|                                     | Solid-state       | 90...520 A    |                                   | IP00 (IP20 - Control Terminals only) |
|                                     |                   | 90...180 A    |                                   | IP2X (with Optional Terminal Cover)  |
| DV/DT Protection                    |                   | 480V          | RC Snubber Network                |                                      |
|                                     |                   | 690V          |                                   |                                      |
| Transient Protection                |                   | 480...600V    | Metal Oxide Varistors: 220 Joules |                                      |
|                                     |                   | 690V          | None                              |                                      |

Table 93 - Control Power Specifications

| Description                                       | UL/CSA/NEMA                                         | IEC   |
|---------------------------------------------------|-----------------------------------------------------|-------|
| Rated Operational Voltage                         | 100...240V AC (-15%...+10%) or 24V DC (-10%...+10%) |       |
| Rated Insulation Voltage                          | —                                                   | 240V  |
| Rated Impulse Voltage                             | —                                                   | 3000V |
| Dielectric Withstand                              | 1500V AC                                            | 1500V |
| Operating Frequency                               | 47...63 Hz or DC                                    |       |
| Control Power Ride Through                        | 22 ms                                               |       |
| Max. Output of 24V DC Supply (Terminals 8 and 12) | 300 mA                                              |       |
| Control Module Battery Type                       | CR 2032                                             |       |



This product contains a sealed lithium battery that may need to be replaced during the life of the product. At the end of its life, the battery contained in this product should be collected separately from any unsorted municipal waste. The collection and recycling of batteries helps protect the environment and contributes to the conservation of natural resources as valuable materials are recovered.



**ATTENTION:** There is a danger of explosion if the lithium battery or real-time clock module in this product is incorrectly replaced. Do not replace the battery or real-time clock module unless power has been removed and the area is known to be nonhazardous.

Replace the battery only with catalog number 271IP-RY2032 or an equivalent CR2032 coin-cell battery.

Do not dispose of the lithium battery or real-time clock module in a fire or incinerator. Dispose of used batteries in accordance with local regulations.

For safety information on the handling of lithium batteries, including handling and disposal of leaking batteries, see Guidelines for Handling Lithium Batteries, publication [AG 5-4](#).

Perchlorate material – special handling may apply. See [www.dtsc.ca.gov/hazardouswaste/perchlorate](http://www.dtsc.ca.gov/hazardouswaste/perchlorate).

This perchlorate warning only applies to primary Lithium Manganese Dioxide (LiMnO<sub>2</sub>) cells or batteries, and products containing these cells or batteries, sold or distributed in California, USA.

**Table 94 - Control Module Standard Inputs: Terminals 10 and 11**

| Description                 |               | UL/CSA/NEMA                        | IEC      |
|-----------------------------|---------------|------------------------------------|----------|
| Nominal Operating Voltage   |               | 24V DC                             |          |
| Operating Voltage Range     |               | 15...30V DC                        |          |
| On State                    | Current, min. | 2.8 mA                             |          |
|                             | Voltage, min. | 10V DC                             |          |
| Off State                   | Current, max. | 3 mA                               |          |
|                             | Voltage, max. | 10.9V DC                           |          |
| Inrush Current Maximum      |               | 7 mA                               |          |
| Input Delay Time            |               | On-to-Off: 30 ms, Off-to-On: 20 ms |          |
| Reverse Polarity Protection |               | Yes                                |          |
| Rated Insulation Voltage    |               | —                                  | 60V      |
| Rated Impulse Voltage       |               | —                                  | 500V     |
| Dielectric Withstand        |               | 500V AC                            | 1000V AC |

**Table 95 - Control Module Standard Outputs: Terminals 4/5 and 6/7**

| Description                                 | UL/CSA/NEMA                                       | IEC   |
|---------------------------------------------|---------------------------------------------------|-------|
| Outputs                                     | Aux 1, Aux 2                                      |       |
| Type of Control Circuit                     | Electromagnetic Relay                             |       |
| Number of Contacts per Relay                | 1                                                 |       |
| Type of Contacts                            | Programmable N.O./N.C. (electrically held closed) |       |
| Type of Current                             | AC                                                |       |
| Rated Operational Current                   | 3 A @ 120V AC, 1.5 A @ 240V AC                    |       |
| Conventional Thermal Current $I_{th}$ AC/DC | 5 A                                               |       |
| Make/Break VA                               | 3600/360                                          |       |
| Utilization Category                        | B300                                              | AC-15 |
| Off-State Leakage Current                   | 0.024 mA @ 24V                                    |       |
| Off-State Leakage Current                   | 0.12 mA @ 120V                                    |       |
| Off-State Leakage Current                   | 0.24 mA @ 240V                                    |       |

**Table 96 - Wiring Terminals (applies to Control Module Standard I/O and Expansion Module Terminals 150-SM2, 150-SM3, 150-SM4)**

| Description           | Device Rating                          |
|-----------------------|----------------------------------------|
| Terminal Style        | M3 Screw Clamp                         |
| Terminal Type         | Removable                              |
| Screw Terminal Torque | 0.8 N•m (7.0 lb•in)                    |
| Terminal Wire Size    | 0.2...2.5mm <sup>2</sup> (24...14 AWG) |
| Wire Strip Length     | 7.0 mm (0.27 in.)                      |

**Table 97 - Cat. No. 150-SM4 Optional Digital Control Inputs: Terminals A1, A2**

| Description               | UL/CSA/NEMA                   | IEC                                  |
|---------------------------|-------------------------------|--------------------------------------|
| Nominal Operating Voltage | 100...240V AC                 |                                      |
| Operating Voltage Range   | 85V...264V AC @ 47 Hz...63 Hz |                                      |
| On State                  | Current, min.                 | 9.7 mA @ 47 Hz, 9.7 mA @ 62.4 Hz     |
|                           | Voltage, min.                 | 74.5V AC @ 47 Hz, 55.9V AC @ 62.4 Hz |
| Off State                 | Current, max.                 | 9.0 mA @ 47 Hz, 9.3 mA @ 62.4 Hz     |
|                           | Voltage, max.                 | 68.8V AC @ 47 Hz, 53.6V AC @ 62.4 Hz |
| Inrush Current Maximum    |                               | 3.64 A                               |
| Input Delay Time          |                               | On-to-Off: 30 ms, Off-to-On: 25 ms   |
| Rated Insulation Voltage  |                               | — 240V                               |
| Rated Impulse Voltage     |                               | — 3000V                              |
| Dielectric Withstand      |                               | 1600V AC 2000V AC                    |

**Table 98 - Cat. No. 150-SM4 Optional Digital Control Inputs: Terminals A3 and A4**

| Description               | UL/CSA/NEMA                   | IEC <sup>(1)</sup>                   |
|---------------------------|-------------------------------|--------------------------------------|
| Nominal Operating Voltage | 100...240V AC                 |                                      |
| Operating Voltage Range   | 85V...264V AC @ 47 Hz...63 Hz |                                      |
| On State                  | Current, min.                 | 5.1 mA @ 47 Hz, 5.0 mA @ 62.4 Hz     |
|                           | Voltage, min.                 | 74.5V AC @ 47 Hz, 55.8V AC @ 62.4 Hz |
| Off State                 | Current, max.                 | 4.7 mA @ 47 Hz, 4.8 mA @ 62.4 Hz     |
|                           | Voltage, max.                 | 68.6V AC @ 47 Hz, 53.5V AC @ 62.4 Hz |
| Inrush Current Maximum    |                               | 3.64 A                               |
| Input Delay Time          |                               | On-to-Off: 30 ms, Off-to-On: 25 ms   |
| Rated Insulation Voltage  |                               | — 240V                               |
| Rated Impulse Voltage     |                               | — 3000V                              |
| Dielectric Withstand      |                               | 1600V AC 2000V AC                    |

(1) Meets IEC Type 2 specifications for inputs per IEC 60947-1 for 240V AC only.

**Table 99 - Cat. No. 150-SM4 Optional Outputs: Terminals A6/A7, A8/A9, A10/A11**

| Description                                 | UL/CSA/NEMA                                       | IEC   |
|---------------------------------------------|---------------------------------------------------|-------|
| Outputs                                     | Aux 1, Aux 2, Aux 3                               |       |
| Type of Control Circuit                     | Electromagnetic Relay                             |       |
| Number of Contacts per Relay                | 1                                                 |       |
| Type of Contacts                            | Programmable N.O./N.C. (electrically held closed) |       |
| Type of Current                             | AC                                                |       |
| Rated Operational Current                   | 3 A @ 120V AC, 1.5 A @ 240V AC                    |       |
| Conventional Thermal Current $I_{th}$ AC/DC | 5 A                                               |       |
| Make/Break VA                               | 3600/360                                          |       |
| Utilization Category                        | B300                                              | AC-15 |
| Off-State Leakage Current                   | 0.024 mA @ 24V                                    |       |
|                                             | 0.12 mA @ 120V                                    |       |
|                                             | 0.24 mA @ 240V                                    |       |

**Table 100 - Cat. No. 150-SM3 Optional Analog Control Inputs: Terminals B5...B10**

| Description                         | Rating                                                                                     |
|-------------------------------------|--------------------------------------------------------------------------------------------|
| Number of Inputs                    | 2 differential inputs                                                                      |
| Normal Operating Input Ranges       | ±10V, 0...10V, 0...5V, 1...5V, 0...20 mA, 4...20 mA                                        |
| Full-scale Operating Input Ranges   | ±10.5V, 0...10.5V, -0.5...5.25V, 0.5...5.25V, 0...21 mA, 3.5...21 mA                       |
| Input Resolution                    | 16 bit (sample rate = 60 Hz)/13 bit (sample rate = 250 Hz)                                 |
| Data Refresh Rate                   | Filter dependent: 100 ms (sample rate = 60 Hz); 24 ms (sample rate = 250 Hz)               |
| Rated Working Voltage               | 24V DC / 17V AC                                                                            |
| Common Mode Voltage Range           | ±10V DC / channel                                                                          |
| Input Impedance                     | 220 kΩ: voltage mode                                                                       |
|                                     | 249 Ω: current mode                                                                        |
| Input Channel Diagnostics           | Over and Under Range and Open Circuit                                                      |
| Open Circuit Detection Time         | Positive Full Scale Reading: within 3 seconds (max)                                        |
| Maximum Overload at Input Terminals | Voltage: ±24V DC continuous at 0.1 mA                                                      |
|                                     | Current: ±30 mA continuous at 7V DC                                                        |
| External Calibration                | Not required: auto-calibration performed by the module if required to meet specs.          |
| Module Isolation to Control Board   | Yes (1000V AC)                                                                             |
| Removable Terminal Block            | Yes (Cat. No.150-SM3RTB as a spare replacement part)                                       |
| Cable Type                          | Belden 8760 (or equiv.) 0.750 mm <sup>2</sup> (18 AWG twisted pair 100% shield with drain) |

**Table 101 - Cat. No. 150-SM3 Optional Analog Control Outputs: Terminals B1...B4**

| Description                            | Rating                                                  |
|----------------------------------------|---------------------------------------------------------|
| Number of Outputs                      | 2 Single-ended                                          |
| Normal Operating Ranges                | ±10V, 0...10V, 0...5V, 0...20 mA, 4...20 mA             |
| Full Scale Operating Ranges            | ±10.5V, 0...10.5V, -0.5...5.25V, 0...21 mA, 3.5...21 mA |
| Output Resolution                      | 16 bit (15 plus sign bipolar)                           |
| Resistive Load on Current Output       | 0...750 Ω                                               |
| Load Range on Voltage Output           | 1 kΩ at 10V DC                                          |
| Max. Inductive Load (Current Outputs)  | 15 mH                                                   |
| Max. Capacitive Load (Voltage Outputs) | 100 μF                                                  |
| Overall Accuracy                       | Voltage Terminal                                        |
|                                        | Current Terminal                                        |
| Accuracy Drift with Temperature        |                                                         |
| Output Impedance                       |                                                         |
| Open and Short-circuit Protection      |                                                         |
| Maximum Short-circuit Current          |                                                         |
| Output Overvoltage Protection          |                                                         |

**Table 102 - PTC Input Ratings (Cat. No. 150-SM2 required)**

| Description                                 | Rating         |
|---------------------------------------------|----------------|
| Response Resistance                         | 3400 Ω ± 150 Ω |
| Reset Resistance                            | 1600 Ω ± 100 Ω |
| Short-circuit Trip Resistance               | 25 Ω ± 10 Ω    |
| Max. Voltage at PTC Terminals (RPTC = 4 kΩ) | < 7.5 V        |
| Max. Voltage at PTC Terminals (RPTC = open) | 30V            |
| Max. No. of Sensors (wired in series)       | 6              |
| Max. Cold Resistance of PTC Sensor Chain    | 1500 Ω         |
| Response Time                               | 800 ms         |

**Table 103 - Control Power Requirements (Maximum Control Circuit Consumption)**

| Description                                                                                             |                              | Current Range [A] | Control Voltage |        |
|---------------------------------------------------------------------------------------------------------|------------------------------|-------------------|-----------------|--------|
|                                                                                                         |                              |                   | 100...240V AC   | 24V DC |
| Base Power Draw: Control Module with Heat Sink Fan                                                      | Integrated Bypass            | 108...135         | 150 VA          | 75 W   |
|                                                                                                         |                              | 201...251         | 175 VA          | 75 W   |
|                                                                                                         |                              | 317...480         | 225 VA          | 180 W  |
|                                                                                                         | Solid-state                  | 90...180          | 150 VA          | 75 W   |
|                                                                                                         |                              | 210...260         | 150 VA          | 75 W   |
|                                                                                                         |                              | 361...520         | 300 VA          | 300 W  |
| Option Power Adder<br>• for each option installed, add to base power to obtain total power requirement) | Human Interface Module (HIM) | —                 | 10 VA           | 2 W    |
|                                                                                                         | 150-SM2 <sup>(1)</sup>       | —                 | 30 VA           | 4 W    |
|                                                                                                         | 150-SM3                      | —                 | 30 VA           | 4 W    |
|                                                                                                         | 150-SM4                      | —                 | 50 VA           | 2 W    |
|                                                                                                         | 150-SM6 <sup>(1)</sup>       | —                 | 5 VA            | 1 W    |
|                                                                                                         | 20-COMM-X <sup>(1)</sup>     | —                 | 25 VA           | 4 W    |

(1) Max. one of each option type per control module.

**Table 104 - Continuous Duty Power Structure Heat Dissipation at Rated Current (Watts)**

| Description |                   | Current Range [A] | Heat Dissipation [W] |
|-------------|-------------------|-------------------|----------------------|
| Controller  | Integrated Bypass | 108               | 27                   |
|             |                   | 135               | 40                   |
|             |                   | 201               | 75                   |
|             |                   | 251               | 93                   |
|             |                   | 317               | 100                  |
|             |                   | 361               | 120                  |
|             |                   | 480               | 165                  |
|             | Solid-state       | 90                | 270                  |
|             |                   | 110               | 330                  |
|             |                   | 140               | 420                  |
|             |                   | 180               | 540                  |
|             |                   | 210               | 630                  |
|             |                   | 260               | 780                  |
|             |                   | 320               | 960                  |
|             |                   | 361               | 1083                 |
|             |                   | 420               | 1260                 |
|             |                   | 520               | 1560                 |

*Power Calculation:*

$$\text{Max. Total Power Dissipation} = \frac{\text{Base Power}}{\text{Base Power}} + \frac{\text{Options}}{\text{Options}} + \frac{\text{Power Structure}}{\text{Power Structure}} \text{ Watts}$$

Example: Solid-state 361 A device with a 20-COMM-X, HIM, and Cat. No. 150-SM4

$$\text{Max. Total Power Dissipation} = \frac{300}{\text{Base Power}} + \frac{(25+10+50)}{\text{Options}} + \frac{1083}{\text{Power Structure}} \text{ Watts}$$

Max. Total Power Dissipation = 1468 W

## Performance Ratings

### Integrated Bypass Devices

Table 105 - Integrated Bypass SCPD Performance, 600V Maximum, Type 1

| SCPD Performance <sup>(1)</sup> |              |                    | Type 1 Ratings <sup>(2)</sup>      |                  |                                                 |                  |
|---------------------------------|--------------|--------------------|------------------------------------|------------------|-------------------------------------------------|------------------|
| Motor Connection Type           | Cat. No      | Current Rating [A] | Non-time Delay Fuse <sup>(3)</sup> |                  | Inverse Time (Thermal Magnetic) Circuit Breaker |                  |
|                                 |              |                    | Max. Standard Available Fault [kA] | Max. Current [A] | Max. Standard Available Fault [kA]              | Max. Current [A] |
| Line                            | 150-S108N... | 108                | 10                                 | 400              | 10                                              | 300              |
|                                 | 150-S135N... | 135                |                                    | 500              |                                                 | 400              |
|                                 | 150-S201N... | 201                | 18                                 | 600              | 18                                              | 600              |
|                                 | 150-S251N... | 251                |                                    | 700              |                                                 | 700              |
|                                 | 150-S317N... | 317                | 30                                 | 800              | 30                                              | 800              |
|                                 | 150-S361N... | 361                |                                    | 1000             |                                                 | 1000             |
|                                 | 150-S480N... | 480                | 42                                 | 1200             | 42                                              | 1200             |
| Inside Delta                    | 150-S108N... | 187                | 10                                 | 600              | 10                                              | 500              |
|                                 | 150-S135N... | 234                |                                    | 700              |                                                 | 700              |
|                                 | 150-S201N... | 348                | 18                                 | 1000             | 18                                              | 1000             |
|                                 | 150-S251N... | 435                |                                    | 1200             |                                                 | 1200             |
|                                 | 150-S317N... | 549                | 30                                 | 1600             | 30                                              | 1600             |
|                                 | 150-S361N... | 625                |                                    | 1600             |                                                 | 1600             |
|                                 | 150-S480N... | 831                | 42                                 | 1600             | 42                                              | 1200             |

(1) Consult local codes for proper sizing of short-circuit protection.

(2) Basic Requirements for Type 1 Coordination: Under the short-circuit condition, the starter shall cause no danger to persons or to the installation. The starter may not be suitable for further service without repair or replacement of parts. For further details, refer to UL 508/CSA C22.2 No. 14 and EN 60947-4-2.

(3) Non-Time Delay Fuses: Class K5 up to 600 A, Class L above 600 A.

Table 106 - Integrated Bypass SCPD Performance, 690V Maximum, Type 1, Line Connected Motors Only

| SCPD Performance <sup>(1)</sup> |              |                    | Type 1 Ratings <sup>(2)</sup>      |                                           |                                     |
|---------------------------------|--------------|--------------------|------------------------------------|-------------------------------------------|-------------------------------------|
| Motor Connection Type           | Cat. No      | Current Rating [A] | Max. Standard Available Fault [kA] | Max. Ampere Tested – North American Style | Max. Ampere Tested – European Style |
| Line                            | 150-S108N... | 108                | 70                                 | A070URD33xxx500                           | 6,9 gRB 73xxx400<br>6,6URD33xxx500  |
|                                 | 150-S135N... | 135                |                                    | A070URD33xxx500                           | 6,9 gRB 73xxx400<br>6,6URD33xxx500  |
|                                 | 150-S201N... | 201                |                                    | A070URD33xxx700                           | 6,9 gRB 73xxx630<br>6,6URD33xxx700  |
|                                 | 150-S251N... | 251                |                                    | A070URD33xxx700                           | 6,9 gRB 73xxx630<br>6,6URD33xxx700  |
|                                 | 150-S317N... | 317                |                                    | A070URD33xxx900                           | 6,9 gRB 73xxx800<br>6,6URD33xxx900  |
|                                 | 150-S361N... | 361                |                                    | A070URD33xxx900                           | 6,9 gRB 73xxx800<br>6,6URD33xxx900  |
|                                 | 150-S480N... | 480                |                                    | A070D33xxx1250<br>A100URD73xxx1250        | 9 URD 73xxx1250<br>6,6URD33xxx1250  |

(1) Consult local codes for proper sizing of short-circuit protection.

(2) Basic Requirements for Type 1 Coordination: Under the short-circuit condition, the starter shall cause no danger to persons or to the installation. The starter may not be suitable for further service without repair or replacement of parts. For further details, see UL 508/CSA C22.2 No. 14 and EN 60947-4-2.

Table 107 - Integrated Bypass SCPD Performance, High Fault, Type 1

| SCPD Performance <sup>(1)</sup> |              |                    | Type 1 Ratings <sup>(2)</sup>                  |                  |                                                                                   |               |                      |
|---------------------------------|--------------|--------------------|------------------------------------------------|------------------|-----------------------------------------------------------------------------------|---------------|----------------------|
| Motor Connection Type           | Cat. No      | Current Rating [A] | Class J or Class L Fuse <sup>(3)</sup>         |                  | Inverse Time (Thermal Magnetic) Circuit Breaker <sup>(4)</sup> 480V, 65kA Maximum |               |                      |
|                                 |              |                    | Max. High Capacity Available Fault (600V) [kA] | Max. Current [A] | Max. Current [A]                                                                  | Cat. No.      | Rating Plug Cat. No. |
| Line                            | 150-S108N... | 108                | 70                                             | 200              | 300                                                                               | 140G-K6F3-D30 | —                    |
|                                 | 150-S135N... | 135                |                                                | 225              | 400                                                                               | 140G-K6F3-D40 | —                    |
|                                 | 150-S201N... | 201                |                                                | 350              | 600                                                                               | 140G-M6F3-D60 | —                    |
|                                 | 150-S251N... | 251                |                                                | 400              | 700                                                                               | 140G-M6F3-D80 | —                    |
|                                 | 150-S317N... | 317                | 69                                             | 500              | 800                                                                               | 140G-N6H3-E12 | 140G-NRP-D80         |
|                                 | 150-S361N... | 361                |                                                | 600              | 1000                                                                              | 140G-N6H3-E12 | 140G-NRP-E10         |
|                                 | 150-S480N... | 480                |                                                | 800              | 1200                                                                              | 140G-N6H3-E12 | —                    |
| Inside Delta                    | 150-S108N... | 187                | 70                                             | 300              | 400                                                                               | 140G-K6F3-D40 | —                    |
|                                 | 150-S135N... | 234                |                                                | 400              | 400                                                                               | 140G-K6F3-D40 | —                    |
|                                 | 150-S201N... | 348                |                                                | 600              | 800                                                                               | 140G-M6F3-D80 | —                    |
|                                 | 150-S251N... | 435                |                                                | 800              | 800                                                                               | 140G-M6F3-D80 | —                    |
|                                 | 150-S317N... | 549                | 69                                             | 1000             | 1200                                                                              | 140G-N6H3-E12 | —                    |
|                                 | 150-S361N... | 625                |                                                | 1200             | 1200                                                                              | 140G-N6H3-E12 | —                    |
|                                 | 150-S480N... | 831                |                                                | 1600             | 1200                                                                              | 140G-N6H3-E12 | —                    |

(1) Consult local codes for proper sizing of short-circuit protection.

(2) Basic Requirements for Type 1 Coordination: Under the short-circuit condition, the starter shall cause no danger to persons or to the installation. The starter may not be suitable for further service without repair or replacement of parts. For further details, refer to UL 508/CSA C22.2 No. 14 and EN 60947-4-2.

(3) High Capacity fault ratings when used with time delay Class J or time delay Class L fuse.

(4) Circuit Breaker must be of the designated 140G Frame.

Table 108 - Integrated Bypass Semiconductor Fusing Recommendations

| Semiconductor (SCR) Fusing <sup>(1)</sup> |                     |                             |                                                     |                                  |                              |                                                       |                              |
|-------------------------------------------|---------------------|-----------------------------|-----------------------------------------------------|----------------------------------|------------------------------|-------------------------------------------------------|------------------------------|
| Cat. No.                                  | Current Rating [A]  |                             | $I^2t$ Reference (10 <sup>3</sup> A <sup>2</sup> s) | North America <sup>(2) (3)</sup> |                              | Type 2 Coordination per EN 60947-2 <sup>(3) (4)</sup> |                              |
|                                           | Line <sup>(5)</sup> | Inside Delta <sup>(6)</sup> |                                                     | Max. Available Fault (480V) [kA] | Ferraz-shawmut Fuse Part No. | Max. Available Fault (500V) [kA]                      | Ferraz-shawmut Fuse Part No. |
| 150-S108N...                              | 108                 | 187                         | 87                                                  | 65                               | A70QS200                     | 65                                                    | 6,9URD30*0250                |
| 150-S135N...                              | 135                 | 234                         | 90                                                  |                                  | A70QS200                     |                                                       | 6,9URD30*0250                |
| 150-S201N...                              | 201                 | 348                         | 200                                                 |                                  | A70QS400                     |                                                       | 6,9URD31*0450                |
| 150-S251N...                              | 251                 | 435                         | 238                                                 |                                  | A70QS400                     |                                                       | 6,9URD31*0450                |
| 150-S317N...                              | 317                 | 549                         | 300                                                 |                                  | A70QS450                     |                                                       | 6,9URD33*0550                |
| 150-S361N...                              | 361                 | 625                         | 320                                                 |                                  | A70QS450                     |                                                       | 6,9URD33*0550                |
| 150-S480N...                              | 480                 | 831                         | 1200                                                |                                  | A70QS700                     | 45                                                    | 6,9URD33*0550                |

(1) Consult local codes for proper sizing of short-circuit protection.

(2) Calculated only, NOT tested.

(3) Fuse size based on a start profile of 300% of the controller maximum current rating for 50 seconds. Contact Industrial Controls Technical Support by email at [raictechsupport@ra.rockwell.com](mailto:raictechsupport@ra.rockwell.com) or by phone at +1 440-646-5800 for applications with a longer start time or higher starting current.

(4) Basic requirements for Type 2 Coordination per EN60947-4-2: under short-circuit conditions, the device shall cause no danger to persons or installation and shall be suitable for further use.

(5) For line-connected motors, connect fuses to the SMC-50 in line with three-phase power terminals L1, L2, and L3.

(6) For delta-connected motors, connect fuses to the SMC-50 inside the delta after terminals L1-T6, L2-T4, and L3-T5.

## Solid-state Devices

Table 109 - Solid-state SCPD Performance, 600V Maximum, Type 1

| SCPD Performance <sup>(1)</sup> |             |                    | Type 1 Ratings <sup>(2)</sup>      |                     |                  |                                    |                     |                  |                                                 |                     |                  |
|---------------------------------|-------------|--------------------|------------------------------------|---------------------|------------------|------------------------------------|---------------------|------------------|-------------------------------------------------|---------------------|------------------|
| Motor Connection Type           | Cat. No     | Current Rating [A] | Non-time Delay Fuse <sup>(3)</sup> |                     |                  | Time Delay Fuse <sup>(4)</sup>     |                     |                  | Inverse Time (Thermal Magnetic) Circuit Breaker |                     |                  |
|                                 |             |                    | Max. Standard Available Fault [kA] | Typical Current [A] | Max. Current [A] | Max. Standard Available Fault [kA] | Typical Current [A] | Max. Current [A] | Max. Standard Available Fault [kA]              | Typical Current [A] | Max. Current [A] |
| Line <sup>(5)</sup>             | 150-SB1N... | 90                 | 10                                 | 250                 | 350              | 10                                 | 150                 | 200              | 10                                              | 225                 | 350              |
|                                 | 150-SB2N... | 110                |                                    | 300                 | 400              |                                    | 175                 | 225              |                                                 | 250                 | 300              |
|                                 | 150-SB3N... | 140                |                                    | 400                 | 500              |                                    | 225                 | 300              |                                                 | 350                 | 400              |
|                                 | 150-SB4N... | 180                |                                    | 500                 | 500              |                                    | 300                 | 400              |                                                 | 450                 | 500              |
|                                 | 150-SC1N... | 210                | 18                                 | 600                 | 600              | 18                                 | 350                 | 450              | 18                                              | 500                 | 600              |
|                                 | 150-SC2N... | 260                |                                    | 700                 | 700              |                                    | 450                 | 500              |                                                 | 600                 | 700              |
|                                 | 150-SC3N... | 320                |                                    | 800                 | 800              |                                    | 500                 | 700              |                                                 | 800                 | 800              |
|                                 | 150-SD1N... | 361                | 30/18 <sup>(6)</sup>               | 1000                | 1000             | 30/18 <sup>(6)</sup>               | 600                 | 800              | 30/18 <sup>(6)</sup>                            | 800                 | 1000             |
|                                 | 150-SD2N... | 420                |                                    | 1200                | 1200             |                                    | 700                 | 800              |                                                 | 1000                | 1200             |
|                                 | 150-SD3N... | 520                |                                    | 1200                | 1200             |                                    | 800                 | 1000             |                                                 | 1200                | 1200             |
| Inside Delta <sup>(7)</sup>     | 150-SB1N... | 155                | 18                                 | 450                 | 450              | 18                                 | 250                 | 300              | 18                                              | 350                 | 450              |
|                                 | 150-SB2N... | 190                |                                    | 500                 | 500              |                                    | 300                 | 400              |                                                 | 450                 | 500              |
|                                 | 150-SB3N... | 242                |                                    | 700                 | 700              |                                    | 400                 | 500              |                                                 | 600                 | 700              |
|                                 | 150-SB4N... | 311                |                                    | 800                 | 800              |                                    | 500                 | 600              |                                                 | 700                 | 800              |
|                                 | 150-SC1N... | 363                | 30                                 | 1000                | 1000             | 30                                 | 600                 | 800              | 30                                              | 800                 | 1000             |
|                                 | 150-SC2N... | 450                |                                    | 1200                | 1200             |                                    | 700                 | 1000             |                                                 | 1000                | 1200             |
|                                 | 150-SC3N... | 554                |                                    | 1600                | 1600             |                                    | 800                 | 1200             |                                                 | 1200                | 1600             |
|                                 | 150-SD1N... | 625                | 42                                 | 1600                | 1600             | 42                                 | 1000                | 1200             | 42                                              | 1200                | 1600             |
|                                 | 150-SD2N... | 727                |                                    | 2000                | 2000             |                                    | 1200                | 1600             |                                                 | 1600                | 2000             |
|                                 | 150-SD3N... | 900                |                                    | 2500                | 2500             |                                    | 1200                | 2000             |                                                 | 2000                | 2500             |

(1) Consult local codes for proper sizing of short-circuit protection.

(2) Basic Requirements for Type 1 Coordination: Under the short-circuit condition, the starter shall cause no danger to persons or to the installation. The starter may not be suitable for further service without repair or replacement of parts. For further details, refer to UL 508/CSA C22.2 No. 14 and EN 60947-4-2.

(3) Non-Time Delay Fuses: Class K5 up to 600 A, Class L above 600 A.

(4) Time Delay Fuse: Devices rated 90...180 A (155...311 A): Class RK5. Devices rated 210...520 A (363...900 A): Class RK5 or Class J up to 600 A, Class L above 600 A.

(5) UL/CSA (Type 1) and EN 60947-4-2 (Type 1) for Line-Connected Motors: Suitable for use on a circuit capable of delivering not more than the listed max. RMS symmetrical amperes (UL: 600V maximum, IEC: 690V max.).

(6) UL/CSA applications = 30 kA, 600V maximum. IEC applications = 18 kA, 690V maximum.

(7) UL/CSA (Type 1) and EN 60947-4-2 (Type 1) for Inside-the-Delta Connected Motors: Suitable for use on a circuit capable of delivering not more than the listed max. RMS symmetrical amperes (UL and IEC: 600V maximum).

Table 110 - Solid-state SCPD Performance, High Fault, Type 1

| SCPD Performance <sup>(1)</sup> |             |                    | Type 1 Ratings <sup>(2)</sup>                  |                     |                  |                                                                     |               |                      |
|---------------------------------|-------------|--------------------|------------------------------------------------|---------------------|------------------|---------------------------------------------------------------------|---------------|----------------------|
| Motor Connection Type           | Cat. No     | Current Rating [A] | Class J or Class L Fuse <sup>(3)</sup>         |                     |                  | Inverse Time (Thermal Magnetic) Circuit Breaker 480V, 65 kA Maximum |               |                      |
|                                 |             |                    | Max. High Capacity Available Fault (600V) [kA] | Typical Current [A] | Max. Current [A] | Max. Current [A]                                                    | Cat. No.      | Rating Plug Cat. No. |
| Line                            | 150-SB1N... | 90                 | 100                                            | 150                 | 200              | 350                                                                 | 140G-K6F3-D40 | —                    |
|                                 | 150-SB2N... | 110                |                                                | 175                 | 225              | 300                                                                 | 140G-K6F3-D30 | —                    |
|                                 | 150-SB3N... | 140                |                                                | 225                 | 300              | 400                                                                 | 140G-K6F3-D40 | —                    |
|                                 | 150-SB4N... | 180                |                                                | 300                 | 400              | 400                                                                 | 140G-K6F3-D40 | —                    |
|                                 | 150-SC1N... | 210                |                                                | 350                 | 450              | 600                                                                 | 140G-M6F3-D60 | —                    |
|                                 | 150-SC2N... | 260                |                                                | 450                 | 500              | 700                                                                 | 140G-M6F3-D80 | —                    |
|                                 | 150-SC3N... | 320                |                                                | 500                 | 700              | 800                                                                 | 140G-M6F3-D80 | —                    |
|                                 | 150-SD1N... | 361                |                                                | 601                 | 800              | 1000                                                                | 140G-N6H3-E12 | 140G-NRP3-E10        |
|                                 | 150-SD2N... | 420                |                                                | 700                 | 800              | 1200                                                                | 140G-N6H3-E12 | —                    |
|                                 | 150-SD3N... | 520                |                                                | 800                 | 1000             | 1200                                                                | 140G-N6H3-E12 | —                    |
| Inside Delta                    | 150-SB1N... | 155                | 65                                             | 250                 | 300              | 450                                                                 | 140G-M6F3-D60 | —                    |
|                                 | 150-SB2N... | 190                |                                                | 300                 | 400              | 500                                                                 | 140G-M6F3-D60 | —                    |
|                                 | 150-SB3N... | 242                |                                                | 400                 | 500              | 700                                                                 | 140G-M6F3-D80 | —                    |
|                                 | 150-SB4N... | 311                |                                                | 500                 | 600              | 700                                                                 | 140G-M6F3-D80 | —                    |
|                                 | 150-SC1N... | 363                |                                                | 601                 | 800              | 1000                                                                | 140G-N6H3-E12 | 140G-NRP3-E10        |
|                                 | 150-SC2N... | 450                |                                                | 700                 | 1000             | 1200                                                                | 140G-N6H3-E12 | —                    |
|                                 | 150-SC3N... | 554                |                                                | 800                 | 1200             | 1200                                                                | 140G-N6H3-E12 | —                    |
|                                 | 150-SD1N... | 625                |                                                | 1000                | 1200             | Pending <sup>(4)</sup>                                              |               |                      |
|                                 | 150-SD2N... | 727                |                                                | 1200                | 1600             |                                                                     |               |                      |
|                                 | 150-SD3N... | 900                |                                                | 1200                | 2000             |                                                                     |               |                      |

(1) Consult local codes for proper sizing of short-circuit protection.

(2) Basic Requirements for Type 1 Coordination: Under the short-circuit condition, the starter shall cause no danger to persons or to the installation. The starter may not be suitable for further service without repair or replacement of parts. For further details, refer to UL 508/CSA C22.2 No. 14 and EN 60947-4-2.

(3) High Capacity fault ratings when used with time delay Class J or time delay Class L fuse.

(4) Other circuit breakers pending.

Table 111 - Solid-state Semiconductor Fusing Recommendations

| Semiconductor (SCR) Fusing <sup>(1)</sup> |                     |                             |                                  |                                  |                              |                                                         |                              |
|-------------------------------------------|---------------------|-----------------------------|----------------------------------|----------------------------------|------------------------------|---------------------------------------------------------|------------------------------|
| Cat. No.                                  | Current Rating [A]  |                             | $I^2t$ Reference ( $10^3 A^2s$ ) | North America <sup>(2) (3)</sup> |                              | Type 2 Coordination Per EN 60947-4-2 <sup>(3) (4)</sup> |                              |
|                                           | Line <sup>(5)</sup> | Inside Delta <sup>(6)</sup> |                                  | Max. Available Fault (480V) [kA] | Ferraz-shawmut Fuse Part No. | Max. Available Fault (500V) [kA]                        | Ferraz-shawmut Fuse Part No. |
| 150-SB1N...                               | 90                  | 155                         | 92                               | 65                               | A70QS150                     | 65                                                      | 6,9URD30*0200                |
| 150-SB2N...                               | 110                 | 190                         | 95                               |                                  | A70QS175                     |                                                         | 6,9URD30*0200                |
| 150-SB3N...                               | 140                 | 242                         | 100                              |                                  | A70QS200                     |                                                         | 6,9URD30*0250                |
| 150-SB4N...                               | 180                 | 311                         | 106                              |                                  | A70QS250                     |                                                         | 6,9URD31*0315                |
| 150-SC1N...                               | 210                 | 363                         | 200                              |                                  | A70QS350                     |                                                         | 6,9URD30*0315                |
| 150-SC2N...                               | 260                 | 450                         | 238                              |                                  | A70QS400                     |                                                         | 6,9URD31*0400                |
| 150-SC3N...                               | 320                 | 554                         | 320                              |                                  | A70QS450                     |                                                         | 6,9URD31*0450                |
| 150-SD1N...                               | 361                 | 625                         | 1000                             |                                  | A70QS500                     |                                                         | 6,9URD31*0500                |
| 150-SD2N...                               | 420                 | 727                         | 1100                             |                                  | A70QS600                     |                                                         | 6,9URD31*0630                |
| 150-SD3N...                               | 520                 | 900                         | 1200                             |                                  | A70QS700                     |                                                         | 6,9URD31*0700                |

(1) Consult local codes for proper sizing of short-circuit protection.

(2) Calculated only, NOT tested.

(3) Fuse size based on a start profile of 350% of the controller maximum current rating for 10 seconds. Contact Industrial Controls Technical Support by email at [raictechsupport@ra.rockwell.com](mailto:raictechsupport@ra.rockwell.com) or by phone at +1 440-646-5800 for applications with a longer start time or higher starting current.

(4) Basic Requirements for Type 2 Coordination: Per EN 60947-4-2 under short-circuit conditions, the device shall cause no danger to persons or installation and shall be suitable for further use.

(5) For line-connected motors, connect fuses to the SMC-50 in line with three-phase power terminals T6, T4, and T5.

(6) For delta-connected motors, connect fuses to the SMC-50 inside the delta after terminals L1-T6, L2-T4, and L3-T5.

## Environmental, Mechanical, and Other Ratings

**Table 112 - Environmental Ratings**

| Attribute                                                     |                           | Rating                                                                                                                                                    |
|---------------------------------------------------------------|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| Operating Ambient Temperature Range (surrounding air ambient) | Integrated Bypass Devices | -20...+50 °C (-4...+122 °F) (no derating) –<br>For operation 50...65 °C (122...149 °F), refer to Thermal Wizard.<br>-20...+40 °C (-4...104 °F) (Enclosed) |
|                                                               | Solid-state Devices       | -20...+40 °C (-4...+104 °F) (no derating) –<br>For operation 40...65 °C (104...149 °F), see Thermal Wizard.<br>-20...+40 °C (-4...104 °F) (Enclosed)      |
| Storage and Transportation Temperature Range                  |                           | -25...+75 °C (-13...+167 °F)                                                                                                                              |
| Altitude                                                      |                           | 2000 m (6560 ft) without derating;<br>for operation above 2000...7000 m (6560...22965 ft) maximum, refer to Thermal Wizard                                |
| Humidity                                                      |                           | 5...95% (noncondensing)                                                                                                                                   |
| Pollution Degree                                              |                           | 2                                                                                                                                                         |
| Mounting Orientation                                          |                           | Vertical                                                                                                                                                  |
| Atmospheric Protection                                        |                           | ANSI/ISA - 71.04-2013; Class G3 Environment                                                                                                               |

**Table 113 - Mechanical Ratings**

| Attribute               |                         |                   |                | Rating                                               |
|-------------------------|-------------------------|-------------------|----------------|------------------------------------------------------|
| Resistance to Vibration |                         | Operational       | All Devices    | 1.0 G Peak, 0.15 mm (0.006 in.) Displacement         |
|                         |                         | Non-Operational   |                | 2.5 G Peak, 0.38 mm (0.015 in.) Displacement         |
| Resistance to Shock     | Integrated Bypass       | Operational       | 108...480 A    | 5.5 G                                                |
|                         |                         | Non-Operational   |                | 25 G                                                 |
|                         | Solid-state             | Operational       | 90...520 A     | 15 G                                                 |
|                         |                         | Non-Operational   |                | 30 G                                                 |
| Construction            |                         | Power Poles       |                | Heatsink Hockey Puck Thyristor Modular Design        |
|                         |                         | Control Modules   |                | Thermoset and Thermoplastic Moldings                 |
|                         |                         | Metal Parts       |                | Plated Brass, Copper, or Steel                       |
| Terminals               | Power Terminal Lugs     | Integrated Bypass | 108...135 A    | One M10 x 1.5 diameter hole per power pole           |
|                         |                         |                   | 201...251 A    | Two M10 x 1.5 diameter hole per power pole           |
|                         |                         |                   | 317...480 A    | Two M12 x 1.75 diameter hole per power pole          |
|                         |                         | Solid-state       | 90...180 A     | One 10.5 mm (0.41 in.) diameter hole per power pole  |
|                         |                         |                   | 210...320 A    | Two 10.5 mm (0.41 in.) diameter holes per power pole |
|                         |                         |                   | 361...520 A    | Two 13.5 mm (0.53 in.) diameter holes per power pole |
|                         | Power Terminal Markings |                   |                | NEMA, CENELEC EN50 012                               |
|                         | Control Terminals       |                   | M3 Screw Clamp | Clamping Yoke Connection                             |

**Table 114 - Electromagnetic Compatibility (EMC) Ratings**

| Attribute           |                                       | Rating                              |
|---------------------|---------------------------------------|-------------------------------------|
| EMC Emission Levels | Conducted Radio Frequency Emissions   | Class A (per EN 60947-4-2)          |
|                     | Radiated Emissions                    | Class A (per EN 60947-4-2)          |
| EMC Immunity Levels | Electrostatic Discharge               | 8 kV Air Discharge Per EN 60947-4-2 |
|                     | Radio Frequency Electromagnetic Field | Per EN 60947-4-2                    |
|                     | Fast Transient                        | Per EN 60947-4-2                    |
|                     | Surge Transient                       | Per EN 60947-4-2                    |

Table 115 - Overload Characteristics

| Overload Characteristics | Device Type               | Rated Current [A] | Line-connected Devices              | Delta-connected Devices |
|--------------------------|---------------------------|-------------------|-------------------------------------|-------------------------|
| Current Range            | Integrated Bypass Devices | 108               | 27...108                            | 47...187                |
|                          |                           | 135               | 34...135                            | 59...234                |
|                          |                           | 201               | 67...201                            | 116...348               |
|                          |                           | 251               | 84...251                            | 145...435               |
|                          |                           | 317               | 106...317                           | 183...549               |
|                          |                           | 361               | 120...361                           | 208...625               |
|                          |                           | 480               | 160...480                           | 277...831               |
|                          | Solid-state Devices       | 90                | 30...90                             | 52...155                |
|                          |                           | 110               | 37...110                            | 65...190                |
|                          |                           | 140               | 47...140                            | 82...242                |
|                          |                           | 180               | 60...180                            | 104...311               |
|                          |                           | 210               | 70...210                            | 122...363               |
|                          |                           | 260               | 87...260                            | 151...450               |
|                          |                           | 320               | 107...320                           | 186...554               |
|                          |                           | 361               | 120...361                           | 210...625               |
|                          |                           | 420               | 140...420                           | 243...727               |
|                          |                           | 520               | 174...520                           | 302...900               |
| Overload Type            |                           |                   | Electronic - using $I^2t$ algorithm |                         |
| Trip Classes             |                           |                   | 5 to 30                             |                         |
| Trip Current Rating      |                           |                   | 118% of Motor FLC                   |                         |
| Number of Poles          |                           |                   | 3                                   |                         |

Table 116 - Standards Compliance and Certifications

| Standards Compliance | Certifications                                        |
|----------------------|-------------------------------------------------------|
| UL 508               | cULus Listed (Open Type) (File No. E96956)            |
| EN 60947-4-2         | CE Marked per EMC Directive and Low Voltage Directive |
|                      | CCC <sup>(1)</sup>                                    |
|                      | C-Tick <sup>(1)</sup>                                 |
|                      | EAC <sup>(1)</sup>                                    |
|                      | KCC <sup>(1)</sup>                                    |
|                      | ABS <sup>(1)</sup>                                    |

(1) For updated certification status of controllers with 24V DC control power, consult your local Rockwell Automation sales office or Allen-Bradley distributor, or [rok.auto/productcertifications](http://rok.auto/productcertifications).

**Table 117 - Integrated Bypass Devices: Protection Device and Bypass Component Selection—Line-connected Motor**

| Description                                                    | SMC-50 Cat. No. <sup>(1)</sup> |                 |                 |                 |                 |                                |                |
|----------------------------------------------------------------|--------------------------------|-----------------|-----------------|-----------------|-----------------|--------------------------------|----------------|
|                                                                | 150-S108N                      | 150-S135N       | 150-S201N       | 150-S251N       | 150-S317N       | 150-S361N                      | 150-S480N      |
| Rated Current [A]                                              | 108                            | 135             | 201             | 251             | 317             | 361                            | 480            |
| Voltage                                                        | 230...600V AC                  | 230...600V AC   | 230...600V AC   | 230...600V AC   | 230...600V AC   | 230...600V AC                  | 230...600V AC  |
| Short-circuit Current Ratings (SCCR) <sup>(2)</sup>            |                                |                 |                 |                 |                 |                                |                |
| Standard Fault SCCR at 600V                                    |                                |                 |                 |                 |                 |                                |                |
| Std. Available Fault [kA]                                      | 10                             |                 | 18              |                 | 30              |                                | 42             |
| Max. Non-Time Delay Fuse                                       | 400                            | 500             | 600             | 700             | 800             | 1000                           | 1200           |
| Max. Inverse Time Circuit Breaker (CB)                         | 300                            | 400             | 600             | 700             | 800             | 1000                           | 1200           |
| High Fault SCCR                                                |                                |                 |                 |                 |                 |                                |                |
| High Available Fault with Fuses at 600V [kA]                   | 70                             |                 |                 |                 | 69              |                                |                |
| Max. Class J or L Time Delay Fuse                              | 200                            | 225             | 350             | 400             | 500             | 600                            | 800            |
| High Available Fault with Circuit Breaker at 480V [kA]         | Pending                        |                 |                 |                 |                 |                                |                |
| Max. Inverse Time CB (Bul. 140G required) <sup>(3)</sup>       |                                |                 |                 |                 |                 |                                |                |
| Bul. 140G MCCB Frame Size                                      |                                |                 |                 |                 |                 |                                |                |
| Branch Protection Reference <sup>(2)</sup>                     |                                |                 |                 |                 |                 |                                |                |
| Inverse Time Circuit Breaker Selections <sup>(1)</sup>         |                                |                 |                 |                 |                 |                                |                |
| 35 kA at 600V Maximum                                          | 140G- K6F3-D...                | 140G- K6F3-D... | 140G- M6F3-D... | 140G- M6F3-D... | 140G- M6F3-D... | —                              | —              |
| 50 kA at 600V Maximum                                          | —                              | —               | —               | —               | —               | 140G- N6H3-E... <sup>(4)</sup> | 140G- N6H3-E12 |
| 65 kA at 480V Maximum <sup>(3)</sup>                           | Pending                        |                 |                 |                 |                 |                                |                |
| Fused Disconnect Selections, For Use With Non-Time Delay Fuses | 194R-J400-1753                 | 194R-J600-1753  | 194R-J600-1753  | 194R-L800-1753  | 194R-L800-1753  | —                              | —              |

(1) For complete catalog numbers, see the product directory: [rok.auto](http://rok.auto).

(2) Always refer to local codes for proper selection of branch circuit components.

(3) Circuit Breaker must be of the designated 140G Frame size for high fault short circuit ratings.

(4) Requires rating plug selection based on application; see the product directory: [rok.auto](http://rok.auto).

**Table 118 - Solid-state Devices: Protection Device and Bypass Component Selection Overview—Line-connected Motor**

| Description                                                    |        | SMC-50 Cat. No. <sup>(1)</sup> |                |                |                |                |                |                |                              |               |               |
|----------------------------------------------------------------|--------|--------------------------------|----------------|----------------|----------------|----------------|----------------|----------------|------------------------------|---------------|---------------|
|                                                                |        | 150-SB1N                       | 150-SB2N       | 150-SB3N       | 150-SB4N       | 150-SC1N       | 150-SC2N       | 150-SC3N       | 150-SD1N                     | 150-SD2N      | 150-SD3N      |
| Rated Current                                                  | [A]    | 90                             | 110            | 140            | 180            | 210            | 260            | 320            | 361                          | 420           | 520           |
| Voltage                                                        | [V AC] | 230...600                      | 230...600      | 230...600      | 230...600      | 230...600      | 230...600      | 230...600      | 230...600                    | 230...600     | 230...600     |
| Short-circuit Current Ratings (SCCR) <sup>(2)</sup>            |        |                                |                |                |                |                |                |                |                              |               |               |
| Standard Fault SCCR at 600V                                    |        |                                |                |                |                |                |                |                |                              |               |               |
| Std. Available Fault                                           | [kA]   | 10                             |                |                |                | 18             |                |                | 30                           |               |               |
| Max. Non-Time Delay Fuse                                       | [A]    | 350                            | 400            | 500            | 500            | 600            | 700            | 800            | 1000                         | 1200          | 1200          |
| Max. Time Delay Fuse                                           | [A]    | 200                            | 225            | 300            | 400            | 450            | 500            | 700            | 800                          | 800           | 1000          |
| Max. Inverse Time Circuit Breaker (CB)                         | [A]    | 350                            | 300            | 400            | 500            | 600            | 700            | 800            | 1000                         | 1200          | 1200          |
| High Fault SCCR                                                |        |                                |                |                |                |                |                |                |                              |               |               |
| High Available Fault with Fuses at 600V                        | [kA]   | 100                            |                |                |                |                |                |                |                              |               |               |
| Max. Class J or L Time Delay Fuse                              | [A]    | 200                            | 225            | 300            | 400            | 450            | 500            | 700            | 800                          | 800           | 1000          |
| High Available Fault with Circuit Breaker at 480V              | [kA]   | 65                             |                |                |                |                |                |                |                              |               |               |
| Max. Inverse Time CB (Bul. 140G required) <sup>(3)</sup>       | [A]    | 350                            | 300            | 400            | 400            | 600            | 700            | 800            | 1000                         | 1200          | 1200          |
| Bul. 140G MCCB Frame Size                                      |        | K                              |                |                |                | M              |                |                | N                            |               |               |
| Branch Protection Reference <sup>(2)</sup>                     |        |                                |                |                |                |                |                |                |                              |               |               |
| Inverse Time Circuit Breaker Selections <sup>(1)</sup>         |        |                                |                |                |                |                |                |                |                              |               |               |
| 35 kA at 600V Maximum                                          |        | 140G-K6F3-D                    | 140G-K6F3-D    | 140G-K6F3-D    | 140G-M6F3-D    | 140G-M6F3-D    | 140G-M6F3-D    | 140G-M6F3-D    | —                            | —             | —             |
| 50 kA at 600V Maximum                                          |        | —                              | —              | —              | —              | —              | —              | —              | 140G-N6H3-E <sup>(4)</sup>   | 140G-N6H3-E12 | 140G-N6H3-E12 |
| 65 kA at 480V Maximum <sup>(3)</sup>                           |        | 140G-K6F3-D                    | 140G-K6F3-D    | 140G-K6F3-D    | 140G-K6F3-D    | 140G-M6F3-D    | 140G-M6F3-D    | 140G-M6F3-D    | 140G-N6H3-E12 <sup>(4)</sup> | 140G-N6H3-E12 | 140G-N6H3-E12 |
| Fused Disconnect Selections, For Use With Non-Time Delay Fuses |        | 194R-J200-1753                 | 194R-J400-1753 | 194R-J400-1753 | 194R-J400-1753 | 194R-J600-1753 | 194R-J600-1753 | 194R-L800-1753 | —                            | —             | —             |
| Bypass Contactor Reference <sup>(3) (5)</sup>                  |        |                                |                |                |                |                |                |                |                              |               |               |
| AC-3 Rated per UL/CSA <sup>(6)</sup> , Standard Fault SCCR     |        |                                |                |                |                |                |                |                |                              |               |               |
| Short-circuit current ratings @ 600V with: <sup>(1)</sup>      |        | 100-C97                        | 100-D115       | 100-D140       | 100-D180       | 100-D250       | 100-D250       | 100-D300       | 100-D630                     | 100-D630      | 100-D630      |
| Standard Available Fault                                       | [kA]   | 10                             |                |                |                | 18             |                |                | 30                           |               |               |
| Max. Non-Time Delay Fuse                                       | [A]    | 350 A                          | 250 A          | 350 A          | 450 A          | 600 A          | 700 A          | 700 A          | 1000 A                       | 1200 A        | 1200 A        |
| High Fault SCCR                                                |        |                                |                |                |                |                |                |                |                              |               |               |
| Short-circuit current ratings with: <sup>(1)</sup>             |        | 100-C97                        | 100-D115       | 100-D140       | 100-D180       | 100-D210       | 100-D250       | 100-D300       | 100-D420                     | 100-D630      | 100-D630      |
| High Available Fault with Fuses at 600V                        | [kA]   | 100                            |                |                |                | 100            |                |                | 100                          | 42            |               |
| Max. Class J or Class L Time Delay Fuse                        | [A]    | 120                            | 150            | 200            | 225            | 300            | 350            | 450            | 500 A                        | 600 A         | 700 A         |

(1) For complete catalog numbers, see the product directory: [rok.auto](http://rok.auto).

(2) Always refer to local codes for proper selection of branch circuit components.

(3) Circuit Breaker must be of the designated 140G Frame size for high fault short circuit ratings.

(4) Requires rating plug selection based on application; see the product directory: [rok.auto](http://rok.auto).(5) For the most up-to-date information, including voltage ratings other than 600V, see [rok.auto/scrr](http://rok.auto/scrr).

(6) In IEC regulated regions when sizing the bypass contactor per AC-1 or AC-3 ratings, the short circuit rating of the bypass contactor must be similar to that of the SMC-50 controller.

**Table 119 - Integrated Bypass Devices: Protection Device and Bypass Component Selection—Delta-connected Motor**

| Description                                                    | SMC-50 Cat. No. <sup>(1)</sup> |                 |                                |                |                             |                             |               |
|----------------------------------------------------------------|--------------------------------|-----------------|--------------------------------|----------------|-----------------------------|-----------------------------|---------------|
|                                                                | 150-S108N                      | 150-S135N       | 150-S201N                      | 150-S251N      | 150-S317N                   | 150-S361N                   | 150-S480N     |
| Rated Current [A]                                              | 187                            | 234             | 348                            | 435            | 549                         | 625                         | 831           |
| Voltage                                                        | 230...600V AC                  | 230...600V AC   | 230...600V AC                  | 230...600V AC  | 230...600V AC               | 230...600V AC               | 230...600V AC |
| Short-circuit Current Ratings (SCCR) <sup>(2)</sup>            |                                |                 |                                |                |                             |                             |               |
| Standard Fault SCCR at 600V                                    |                                |                 |                                |                |                             |                             |               |
| Std. Available Fault [kA]                                      | 10                             |                 | 18                             |                | 30                          |                             | 42            |
| Max. Non-Time Delay Fuse                                       | 600                            | 700             | 1000                           | 1200           | 1600                        | 1600                        | 1600          |
| Max. Inverse Time Circuit Breaker (CB)                         | 500                            | 700             | 1000                           | 1200           | 1600                        | 1600                        | 1200          |
| High Fault SCCR                                                |                                |                 |                                |                |                             |                             |               |
| High Available Fault with Fuses at 600V [kA]                   | 70                             |                 |                                |                | 69                          |                             |               |
| Max. Class J or L Time Delay Fuse                              | 300                            | 400             | 600                            | 800            | 1000                        | 1200                        | 1600          |
| High Available Fault with Circuit Breaker at 480V [kA]         | Pending                        |                 |                                |                |                             |                             |               |
| Max. Inverse Time CB (Bul. 140G required) <sup>(3)</sup>       |                                |                 |                                |                |                             |                             |               |
| Bul. 140G MCCB Frame Size                                      |                                |                 |                                |                |                             |                             |               |
| Branch Protection Reference <sup>(2)</sup>                     |                                |                 |                                |                |                             |                             |               |
| Inverse Time Circuit Breaker Selections <sup>(1)</sup>         |                                |                 |                                |                |                             |                             |               |
| 35 kA at 600V Maximum                                          | 140G- M6F3-D...                | 140G- M6F3-D... | —                              | —              | —                           | —                           | —             |
| 50 kA at 600V Maximum                                          | —                              | —               | 140G- N6H3-E... <sup>(4)</sup> | 140G- N6H3-E12 | 140G-R1213-E <sup>(4)</sup> | 140G-R1213-E <sup>(4)</sup> | 140G-N6H3-E12 |
| 65 kA at 480V Maximum <sup>(3)</sup>                           | Pending                        |                 |                                |                |                             |                             |               |
| Fused Disconnect Selections, For Use With Non-Time Delay Fuses | 194R-J600-1753                 | 194R-L800-1753  | —                              | —              | —                           | —                           | —             |

(1) For complete catalog numbers, see the product directory: [rok.auto](http://rok.auto).

(2) Always refer to local codes for proper selection of branch circuit components.

(3) Circuit Breaker must be of the designated 140G Frame size for high fault short circuit ratings.

(4) Requires rating plug selection based on application; see the product directory: [rok.auto](http://rok.auto).

**Table 120 - Solid-state Devices: Protection Device and Bypass Component Selection—Delta-connected Motor**

| Description                                                    |        | SMC-50 Cat. No. <sup>(1)</sup> |                |                |                |                             |                |                             |                             |                 |                 |
|----------------------------------------------------------------|--------|--------------------------------|----------------|----------------|----------------|-----------------------------|----------------|-----------------------------|-----------------------------|-----------------|-----------------|
|                                                                |        | 150-SB1N                       | 150-SB2N       | 150-SB3N       | 150-SB4N       | 150-SC1N                    | 150-SC2N       | 150-SC3N                    | 150-SD1N                    | 150-SD2N        | 150-SD3N        |
| Rated Current                                                  | [A]    | 155                            | 190            | 242            | 311            | 363                         | 450            | 554                         | 625                         | 727             | 900             |
| Voltage                                                        | [V AC] | 230...600                      | 230...600      | 230...600      | 230...600      | 230...600                   | 230...600      | 230...600                   | 230...600                   | 230...600       | 230...600       |
| Short-circuit Current Ratings (SCCR) <sup>(2)</sup>            |        |                                |                |                |                |                             |                |                             |                             |                 |                 |
| Standard Fault SCCR at 600V                                    |        |                                |                |                |                |                             |                |                             |                             |                 |                 |
| Std. Available Fault                                           | [kA]   | 18                             |                |                |                | 30                          |                |                             | 42                          |                 |                 |
| Max. Non-Time Delay Fuse                                       | [A]    | 450                            | 500            | 700            | 800            | 1000                        | 1200           | 1600                        | 1600                        | 2000            | 2500            |
| Max. Time Delay Fuse                                           | [A]    | 300                            | 400            | 500            | 600            | 800                         | 1000           | 1200                        | 1200                        | 1600            | 2000            |
| Max. Inverse Time Circuit Breaker (CB)                         | [A]    | 450                            | 500            | 700            | 800            | 1000                        | 1200           | 1600                        | 1600                        | 2000            | 2500            |
| High Fault SCCR                                                |        |                                |                |                |                |                             |                |                             |                             |                 |                 |
| High Available Fault with Fuses at 600V                        | [kA]   | 65                             |                |                |                |                             |                |                             |                             |                 |                 |
| Max. Class J or L Time Delay Fuse                              | [A]    | 300                            | 400            | 500            | 600            | 800                         | 1000           | 1200                        | 1200                        | 1600            | 2000            |
| High Available Fault with Circuit Breaker at 480V              | [kA]   | 65                             |                |                |                |                             |                |                             |                             |                 |                 |
| Max. Inverse Time CB (Bul. 140G required) <sup>(3)</sup>       | [A]    | 450                            | 500            | 700            | 700            | 1000                        | 1200           | 1200                        | —                           | —               | —               |
| Bul. 140G MCCB Frame Size                                      |        | M                              |                |                |                | N                           |                |                             | Pending                     |                 |                 |
| Branch Protection Reference <sup>(2)</sup>                     |        |                                |                |                |                |                             |                |                             |                             |                 |                 |
| Inverse Time Circuit Breaker Selections <sup>(1)</sup>         |        |                                |                |                |                |                             |                |                             |                             |                 |                 |
| 35 kA at 600V Maximum                                          |        | 140G- K6F3-D                   | 140G- M6F3-D   | 140G- M6F3-D   | 140G- M6F3-D   | —                           | —              | —                           | —                           | —               | —               |
| 50 kA at 600V Maximum                                          |        | —                              | —              | —              | —              | 140G- N6H3-E <sup>(4)</sup> | 140G- N6H3-E12 | 140G-R12I3-E <sup>(4)</sup> | 140G-R12I3-E <sup>(4)</sup> | 140G- R12I3-E20 | 140G- R12I3-E25 |
| 65 kA at 480V Maximum <sup>(3)</sup>                           |        | 140G-M6F3-D                    | 140G-M6F3-D    | 140G-M6F3-D    | 140G-M6F3-D    | 140G- N6H3-E <sup>(4)</sup> | 140G- N6H3-E12 | 140G- N6H3-E12              | Pending                     |                 |                 |
| Fused Disconnect Selections, For Use With Non-Time Delay Fuses |        | 194R-J400-1753                 | 194R-J400-1753 | 194R-J600-1753 | 194R-J600-1753 | 194R-L800-1753              | —              | —                           | —                           | —               | —               |
| Bypass Contactor Reference <sup>(2) (5)</sup>                  |        |                                |                |                |                |                             |                |                             |                             |                 |                 |
| AC-3 Rated per UL/CSA <sup>(6)</sup> , Standard Fault SCCR     |        |                                |                |                |                |                             |                |                             |                             |                 |                 |
| Short-circuit current ratings @ 600V with: <sup>(1)</sup>      |        | 100-D250                       | 100-D250       | 100-D250       | 100-D300       | 100-D630                    | 100-D630       | 100-D630                    | 100-D860                    | 100-D860        | —               |
| Standard Available Fault                                       | [kA]   | 18                             |                |                |                | 30                          |                |                             | 42                          |                 |                 |
| Max. Non-Time Delay Fuse                                       | [A]    | 450                            | 500            | 700            | 700            | 1000                        | 1200           | 1600                        | 1600                        | 2000            | —               |
| High Fault SCCR                                                |        |                                |                |                |                |                             |                |                             |                             |                 |                 |
| Short-circuit current ratings with: <sup>(1)</sup>             |        | 100-D180                       | 100-D180       | 100-D250       | 100-D300       | 100-D420                    | 100-D630       | 100-D630                    | 100-D630                    | 100-D860        | 100-G1200       |
| High Available Fault with Fuses at 600V                        | [kA]   | 65                             |                |                |                | 65                          | 42             |                             | 42                          |                 | 65              |
| Max. Class J or Class L Time Delay Fuse                        | [A]    | 225                            | 225            | 350            | 450            | 500                         | 600            | 700                         | 800                         | 1000            | 1300            |

(1) For complete catalog numbers, see the product directory: [rok.auto](http://rok.auto).

(2) Always refer to local codes for proper selection of branch circuit components.

(3) Circuit Breaker must be of the designated 140G Frame size for high fault short circuit ratings. Other circuit breakers pending.

(4) Requires rating plug selection based on application; see the product directory: [rok.auto](http://rok.auto).(5) For the most up-to-date information, including voltage ratings other than 600V, see [rok.auto/scrr](http://rok.auto/scrr).

(6) In IEC regulated regions when sizing the bypass contactor per AC-1 or AC-3 ratings, the short circuit rating of the bypass contactor must be similar to that of the SMC-50 controller.

**Table 121 - SMC-50 Controller Enclosure Requirements**

| Enclosure Ratings                                                                              |                 |                             |
|------------------------------------------------------------------------------------------------|-----------------|-----------------------------|
| Standard Device Rating:                                                                        |                 | IP00 (NEMA Open Type)       |
| Minimum Required Enclosure:                                                                    |                 | IP23 (NEMA Type 1)          |
| Recommended Enclosure: <sup>(1)</sup>                                                          |                 | IP54 (NEMA Type 12)         |
| Ambient temperature range (open air) or internal enclosure temperature range without derating: | Internal Bypass | -20...+50 °C (-4...+122 °F) |
|                                                                                                | Solid-state     | -20...+40 °C (-4...+104 °F) |
| Orientation and Clearance                                                                      |                 |                             |
| Mounting Orientation:                                                                          |                 | Vertical ONLY               |
| Minimum Clearance:                                                                             | Horizontal      | 0 cm (0 in.)                |
|                                                                                                | Vertical        | 15 cm (6 in.)               |

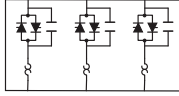
(1) See [Table 122](#) for minimum enclosure size.

# Typical Wiring Diagrams

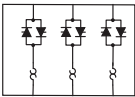
Figure 20 - Typical Power Wiring Diagrams

## Diagrams per NEMA Symbolology

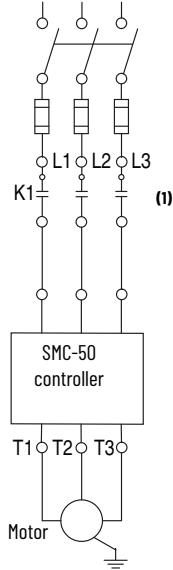
SMC-50 controller with internal bypass



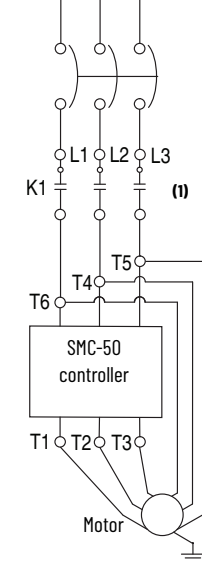
SMC-50 solid-state controller



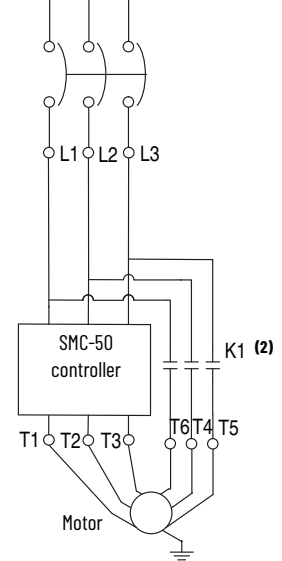
Line connection with isolation contactor (default mode)



Inside-the-Delta connection with isolation contactor (optional mode)

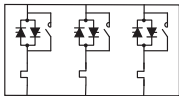


Delta connection with shorted SCR protection (optional mode)

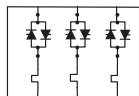


## Diagrams per IEC Symbolology

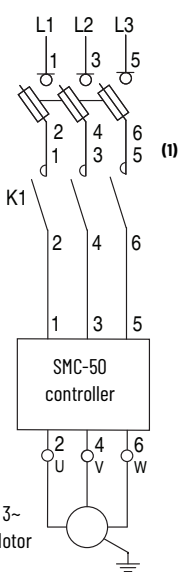
SMC-50 controller with internal bypass



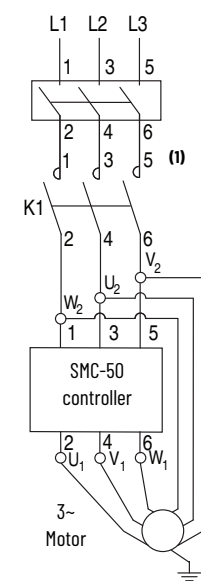
SMC-50 solid-state controller



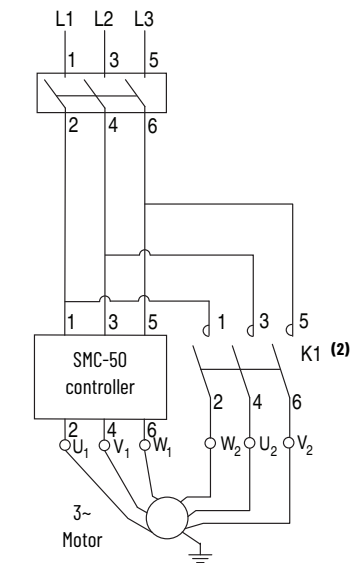
Line connection with isolation contactor (default mode)



Inside-the-Delta connection with isolation contactor (optional mode)



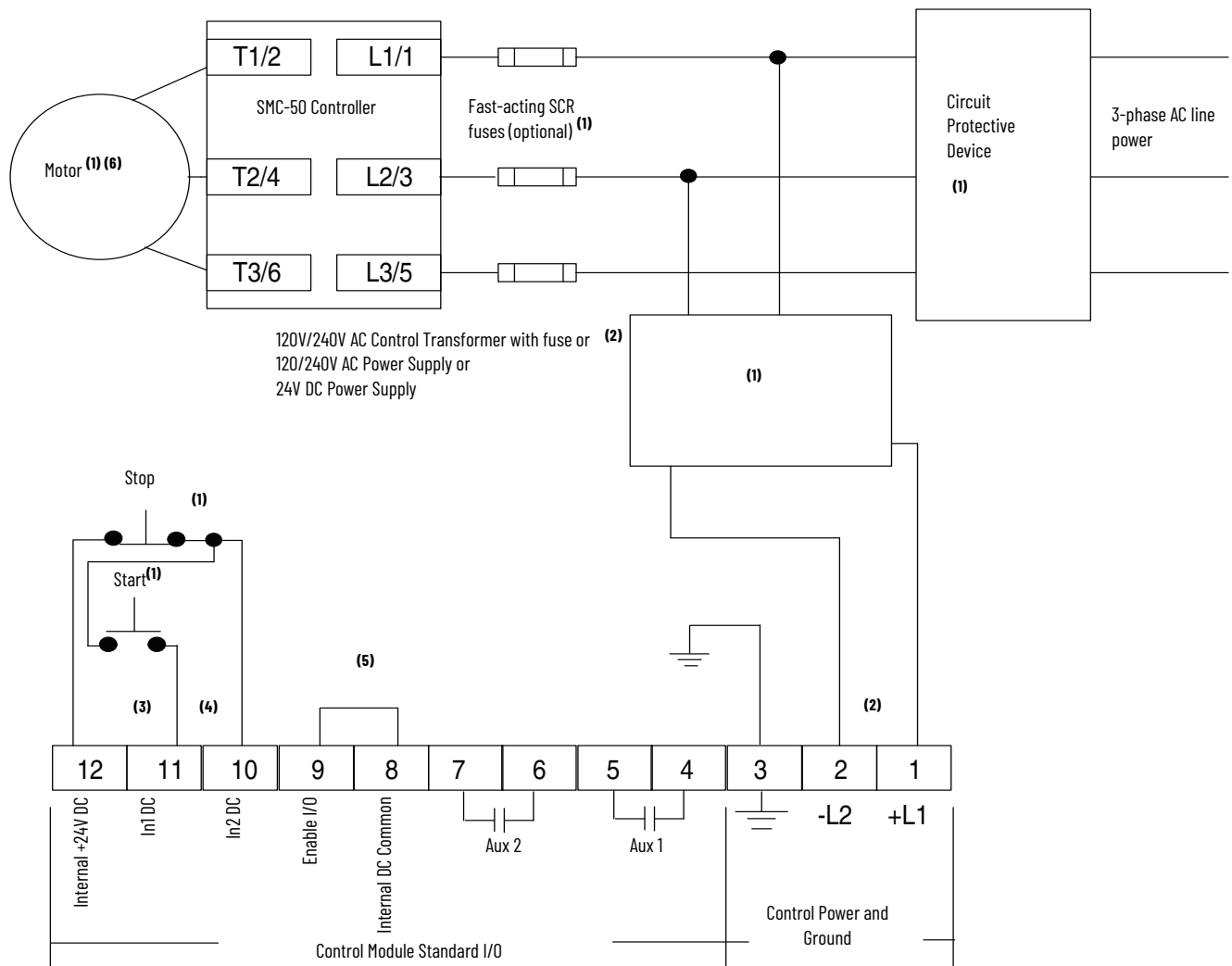
Delta connection with shorted SCR protection (optional mode)



| Note | Information                                                                                                                                                                                                                                                                     |
|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1    | Contactors must be fully rated for motor Hp/kW and FLA.                                                                                                                                                                                                                         |
| 2    | For North American applications, size the contactor according to the motor Hp and FLA. For IEC applications, size the contactor according to the motor AC-1 or AC-3 rating. The short-circuit current rating of the contactor must be similar to that of the SMC-50 controller. |

## Typical Control Wiring Diagrams

Figure 21 - Typical Control Wiring for Standard 3-Wire Control—DC Inputs, No DPI Control



| Note | Information                                                                                                                                                                                                                 |
|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1    | Customer supplied                                                                                                                                                                                                           |
| 2    | See the controller nameplate to verify control power input ratings (100...240V AC or 24V DC)                                                                                                                                |
| 3    | Terminal T1 (In 1 DC) 24V DC input configured for START input using Parameter 56                                                                                                                                            |
| 4    | Terminal T2 (In 2 DC) 24V DC input configured for COAST, STOP option, etc. using Parameter 57                                                                                                                               |
| 5    | A customer-supplied jumper is required to enable standard I/O operation.                                                                                                                                                    |
| 6    | Due to current leakage through an SCR in the OFF state (controller stopped), some form of off-stream line power isolation is recommended if maintenance is required on the motor. See <a href="#">Figure 20</a> for details |

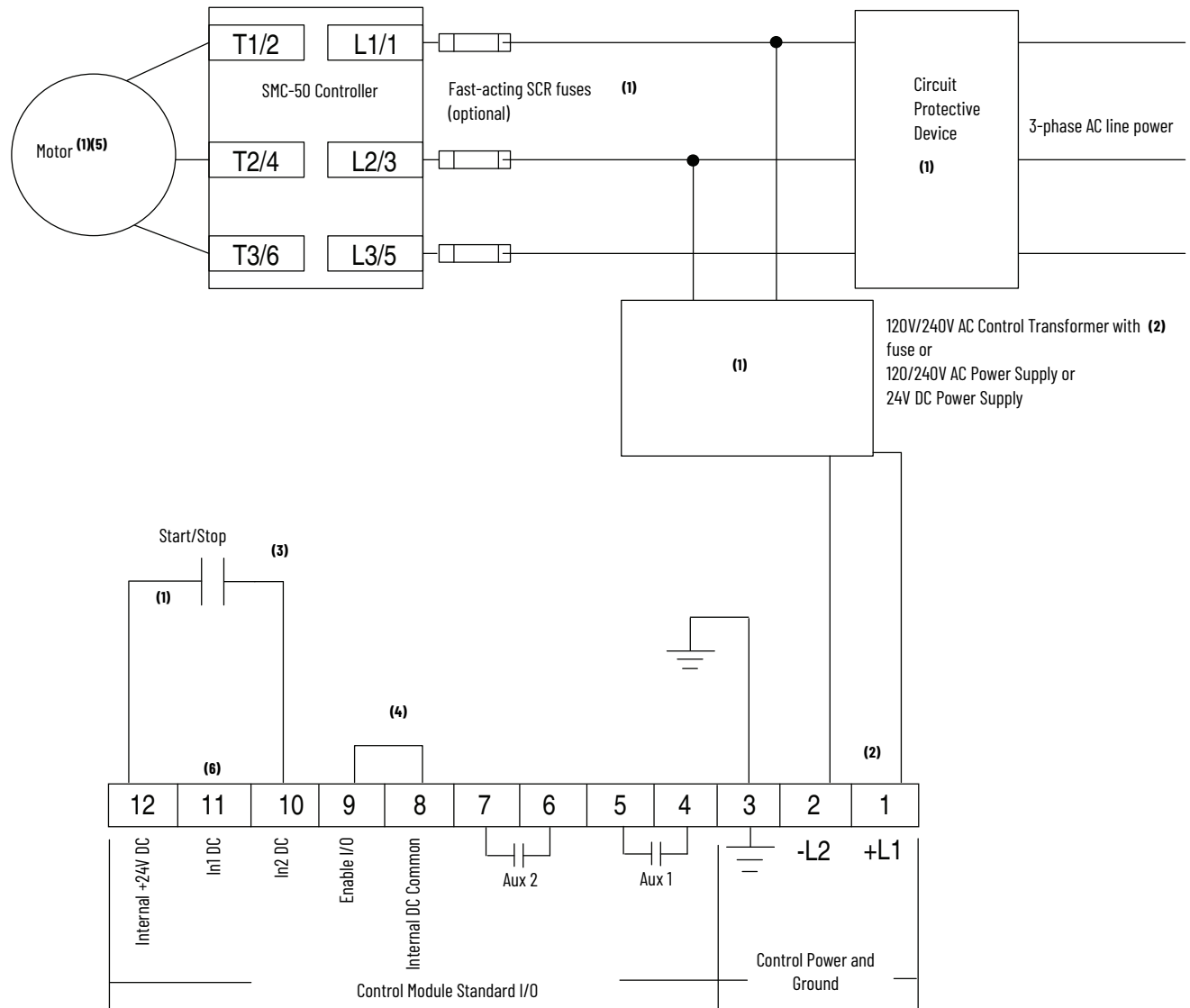


The controller generates an I/O configuration fault if any input is configured for START or SLOW speed and no input is selected for COAST or STOP.



In addition to a small amount of leakage current flowing through an SCR in the off-state, failure of one or more solid-state power switching components allows uncontrolled current to flow to the motor winding(s). This could potentially result in overheating or damage to the motor. To help prevent potential personal injury or equipment damage, we recommend that you install an isolation contactor or shunt trip-type circuit breaker capable of interrupting the motor locked rotor current on the line side of the SMC-50 controller. Coordinate operation of the isolation device by configuring using one of the SMC-50 controller auxiliary contacts configured to NORMAL.

Figure 22 - Typical Control Wiring for 2-Wire Control with Stopping Capability—DC Inputs, No DPI Control



| Note | Information                                                                                                                                                                                                                                           |
|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1    | Customer supplied                                                                                                                                                                                                                                     |
| 2    | See the controller nameplate to verify control power input ratings (100...240V AC or 24V DC)                                                                                                                                                          |
| 3    | Terminal 10 (In 2 DC) 24V DC N.O. input is configured for start/stop or start/coast using Parameter 57 (contact closed start initiated, contact open, stop initiated). When using start/stop or start/coast, you <b>must</b> use a N.O. input contact |
| 4    | A customer-supplied jumper is required to enable controller standard I/O operation                                                                                                                                                                    |
| 5    | Due to current leakage through an SCR in the OFF state (controller stopped), some form of upstream line power isolation is recommended if maintenance is required on the motor. See <a href="#">Figure 20</a> for details                             |
| 6    | Configure In1 (Input 1—Parameter 56) to "Disable"                                                                                                                                                                                                     |



The controller generates an I/O configuration fault if any input is configured for START or SLOW speed and no input is selected for COAST or STOP.



In addition to a small amount of leakage current flowing through an SCR in the off-state, failure of one or more solid-state power switching components allows uncontrolled current to flow to the motor winding(s). This could potentially result in overheating or damage to the motor. To help prevent potential personal injury or equipment damage, the installation of an isolation contactor or shunt trip-type circuit breaker capable of interrupting the motor's locked rotor current on the line side of the SMC-50 controller is recommended. Operation of the isolation device should be coordinated using one of the SMC-50 controller Aux contacts configured to NORMAL.

# Approximate Dimensions

Dimensions are in inches (mm) unless otherwise noted. Dimensions are not to be used for manufacturing purposes.

The guidelines in [Table 122](#) result from the open design of the SMC-50 controller and the minimum clearance requirements of 150 mm (6 in.) above and below the controller.

**Table 122 - SMC-50 Controller Minimum Enclosure Size**

| SMC-50 Controller with Internal Bypass  |                         |               |              | Solid-state SMC-50 Controller |                  |                         |               |              |
|-----------------------------------------|-------------------------|---------------|--------------|-------------------------------|------------------|-------------------------|---------------|--------------|
| Catalog Number                          | mm (in.) <sup>(1)</sup> |               |              | Catalog Number                | Configuration    | mm (in.) <sup>(1)</sup> |               |              |
|                                         | Width                   | Height        | Depth        |                               |                  | Width                   | Height        | Depth        |
| 150-S108... / 150-S135...               | 609.6 (24.0)            | 762.0 (30.0)  | 304.8 (12.0) | 150-SB...                     | Line/Wye         | 609.6 (24.0)            | 762.0 (30.0)  | 304.8 (12.0) |
| 150-S201... / 150-S251...               | 762.0 (30.0)            | 965.2 (38.0)  | 355.6 (14.0) |                               | Inside-the-Delta | 762.0 (30.0)            | 965.2 (38.0)  | 355.6 (14.0) |
| 150-S317... / 150-S361... / 150-S480... | 914.4 (36.0)            | 1295.4 (51.0) | 355.6 (14.0) | 150-SC...                     | All              | 762.0 (30.0)            | 965.2 (38.0)  | 355.6 (14.0) |
|                                         |                         |               |              | 150-SD...                     | All              | 914.4 (36.0)            | 1295.4 (51.0) | 355.6 (14.0) |

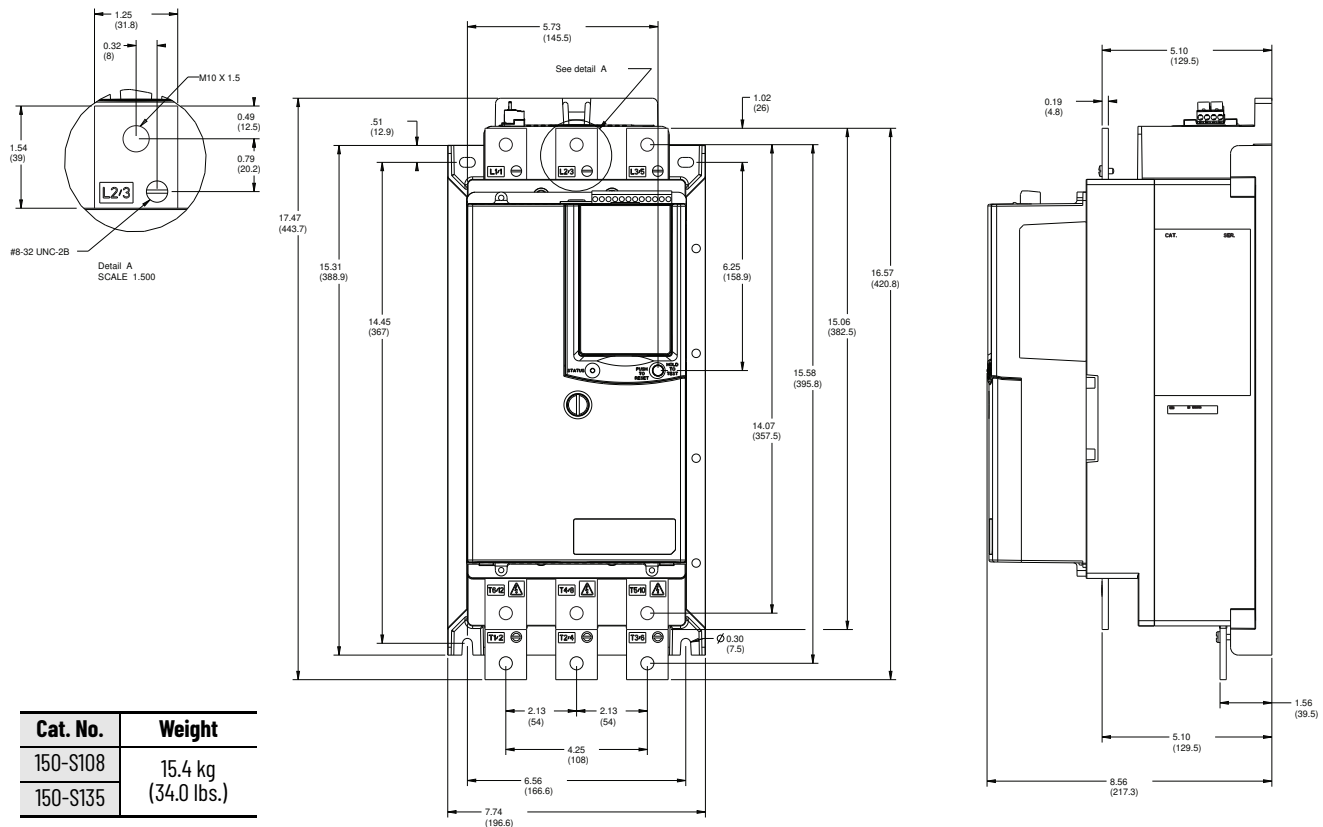
(1) Actual enclosure size changes based on heat dissipation, duty cycle, ambient temperature, and external cooling. See the user manual, publication [150-UM001](#), for more information.

## Controllers with Internal Bypass



When mounted in an enclosure, maintain a minimum of 6.0 inches (152.4 mm) clearance above and below the SMC-50 controller. Side-to-side clearance is not required.

**Figure 23 - 108/135 A Controller with Internal Bypass: Without Terminal Covers**





When mounted in an enclosure, maintain a minimum of 6.0 inches (152.4 mm) clearance above and below the SMC-50 controller. Side-to-side clearance is not required.

**Figure 24 - 108/135 A Controller with Internal Bypass: With Terminal Covers and MOV Options**

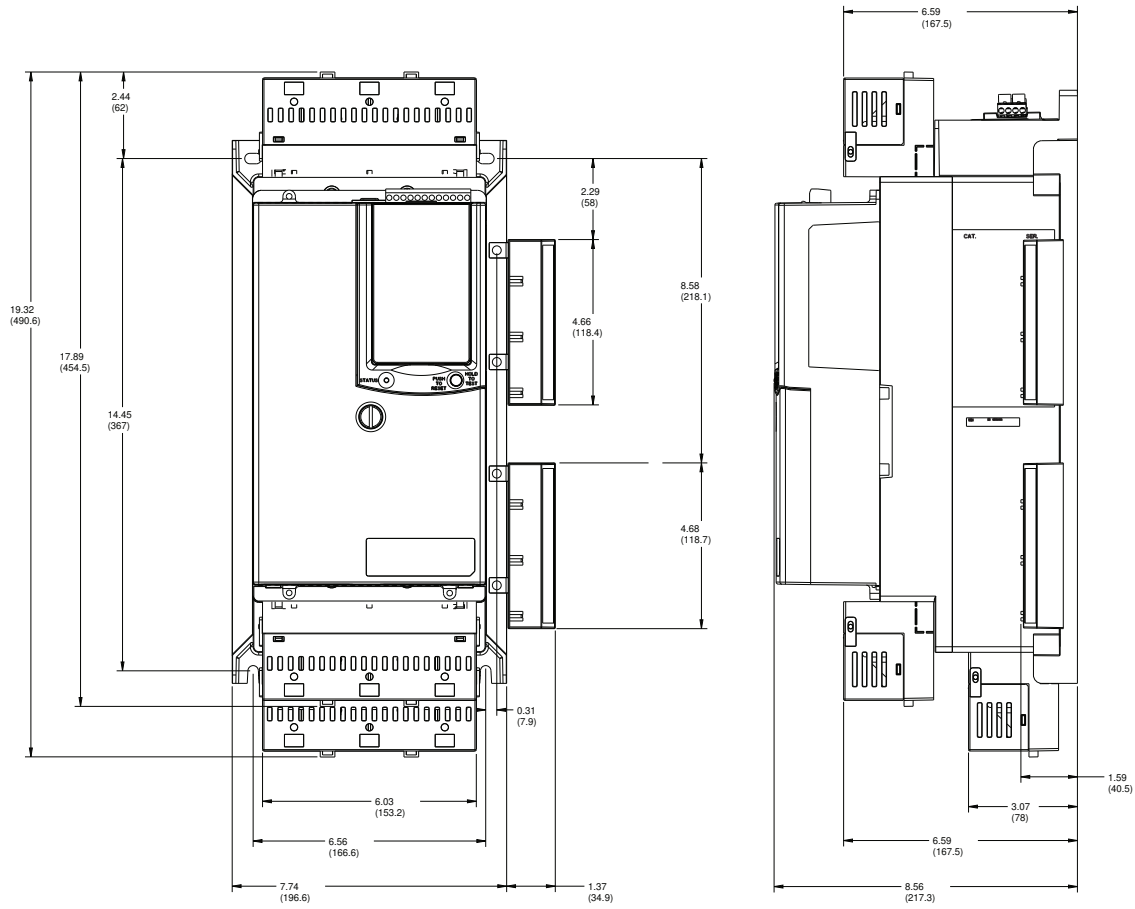
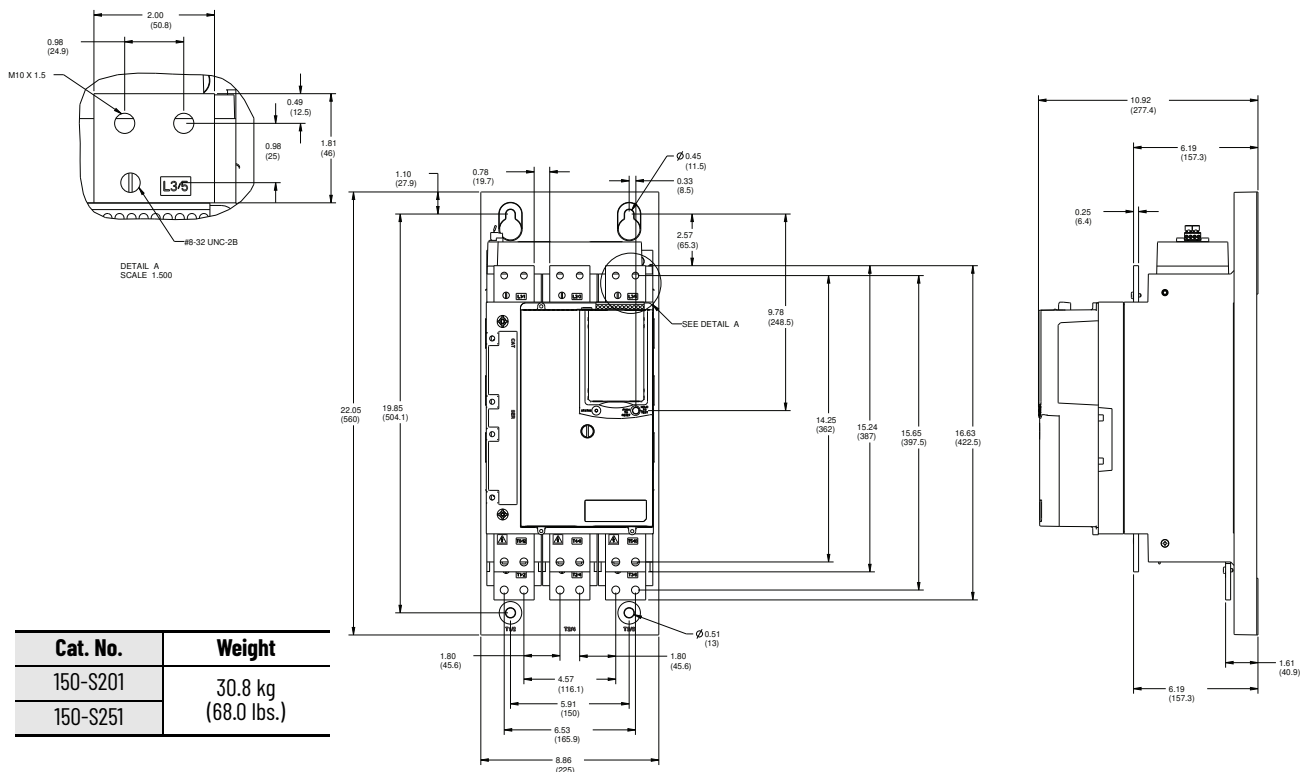
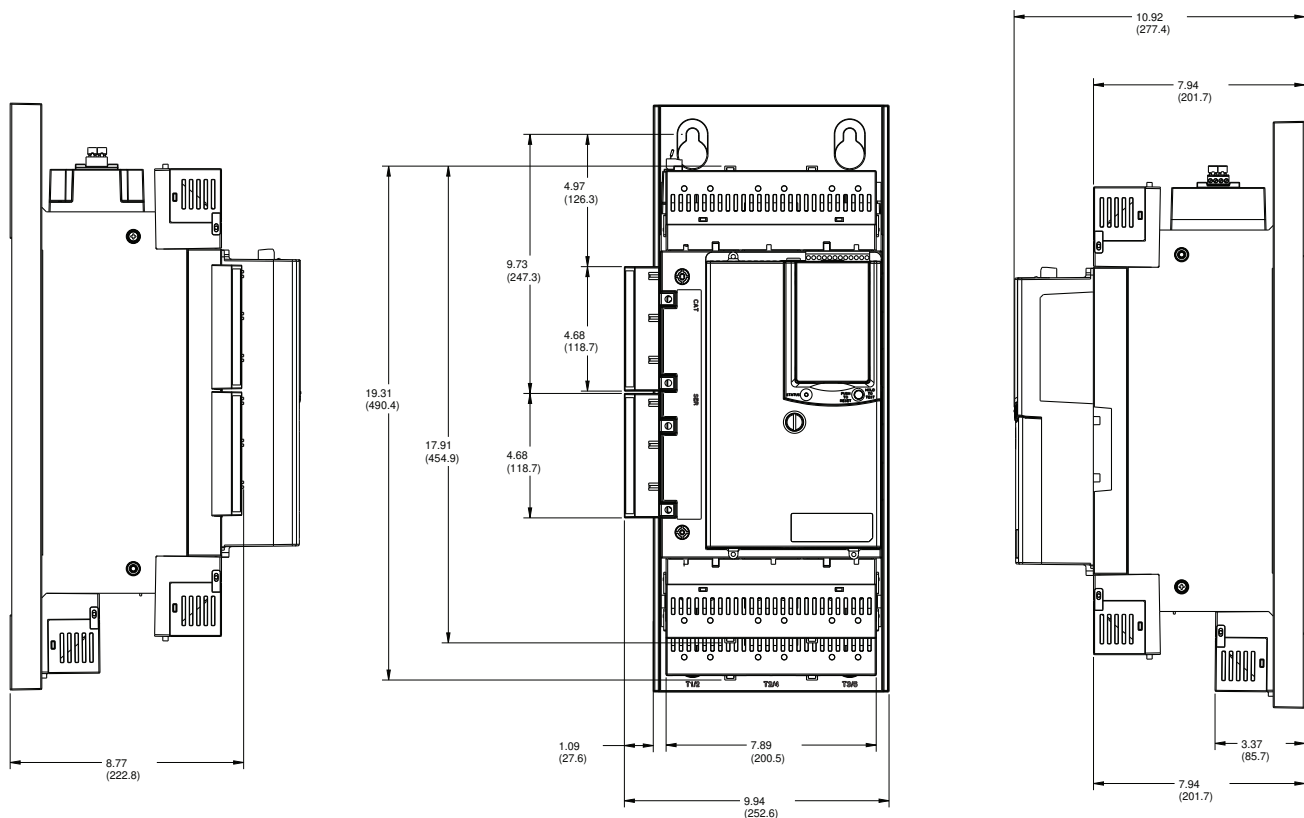


Figure 25 - 201/251 A Controller with Internal Bypass: Without Terminal Covers

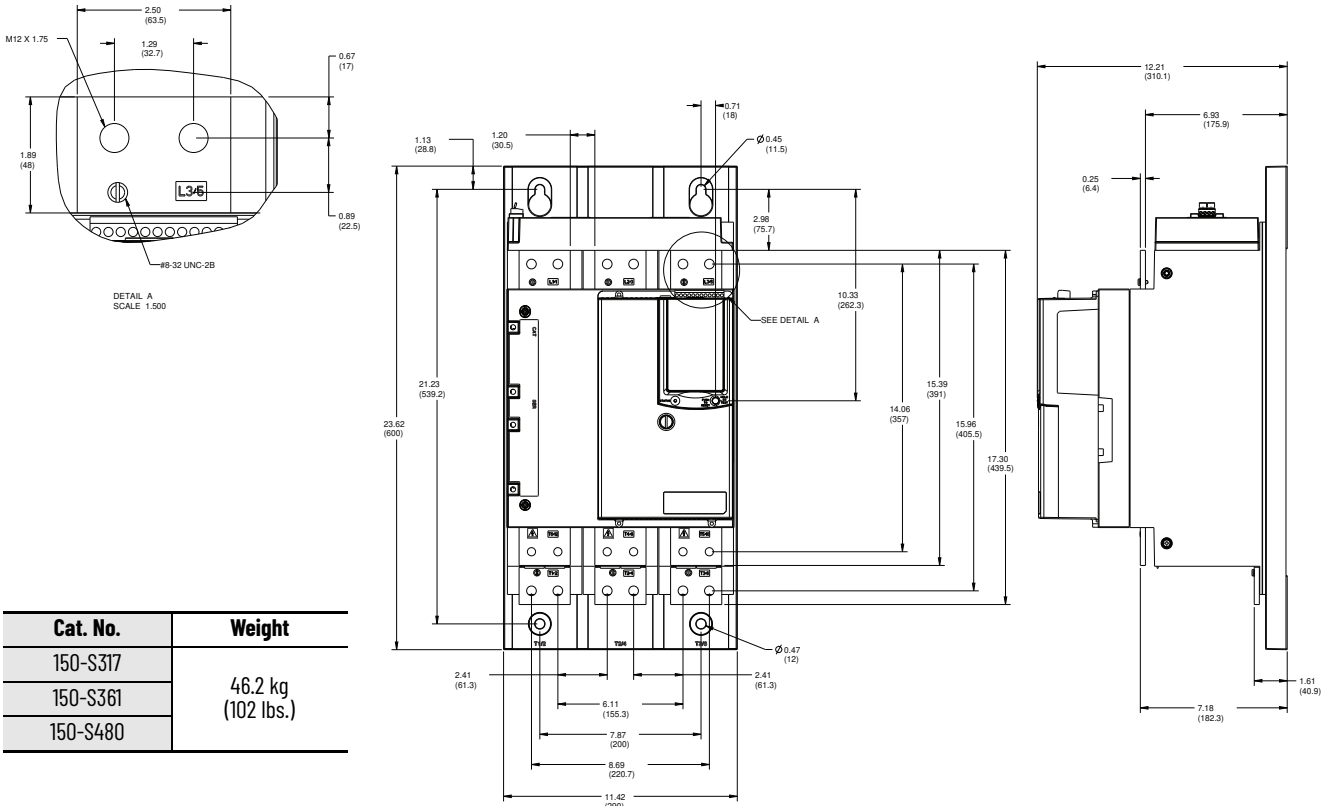


When mounted in an enclosure, maintain a minimum of 6.0 inches (152.4 mm) clearance above and below the SMC-50 controller. Side-to-side clearance is not required.

Figure 26 - 201/251 A Controller with Internal Bypass: With Terminal Covers and MOV Options

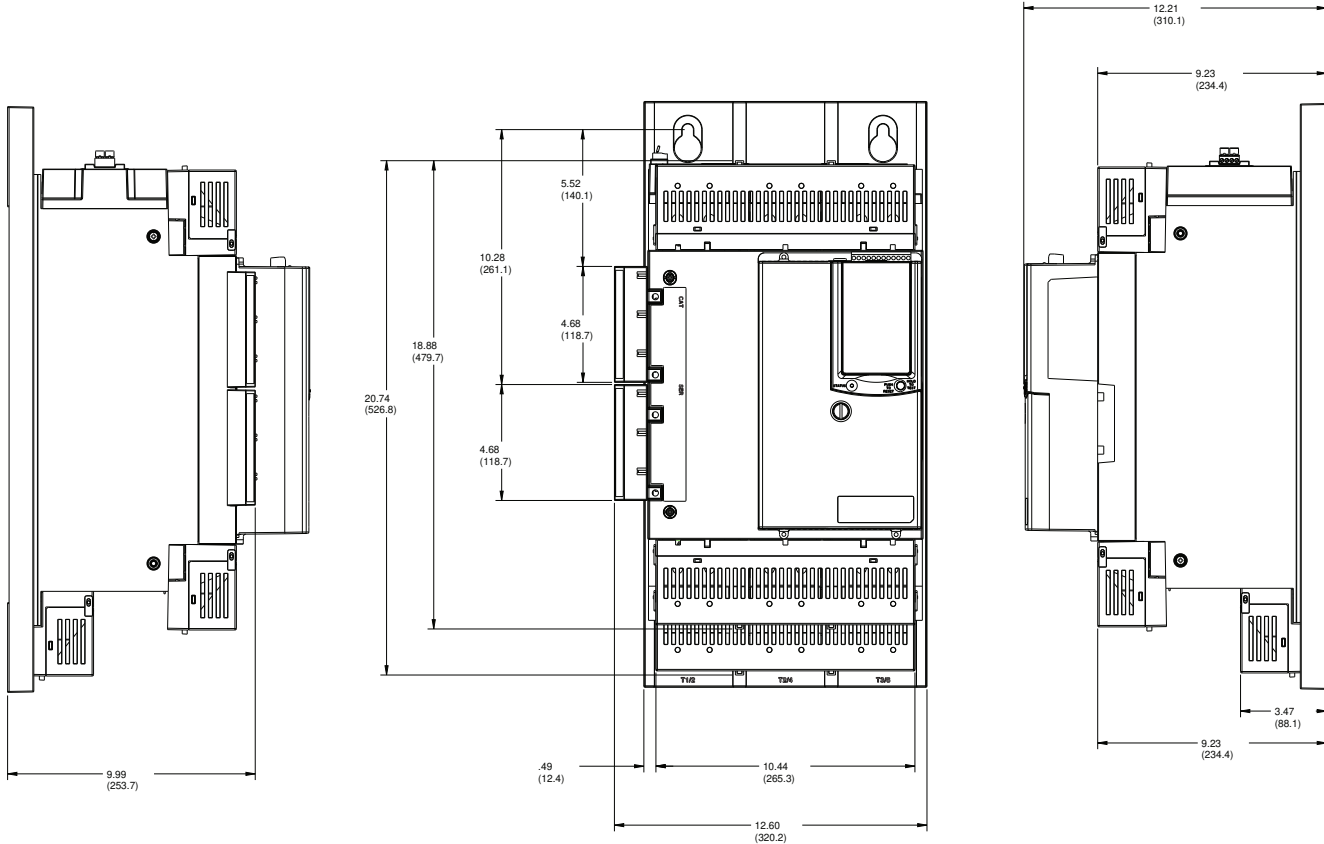


**Figure 27 - 317/361/480 A Controller with Internal Bypass: Without Terminal Covers**



When mounted in an enclosure, maintain a minimum of 6.0 inches (152.4 mm) clearance above and below the SMC-50 controller. Side-to-side clearance is not required.

**Figure 28 - 317/361/480 A Controller with Internal Bypass: With Terminal Covers and MOV Options**

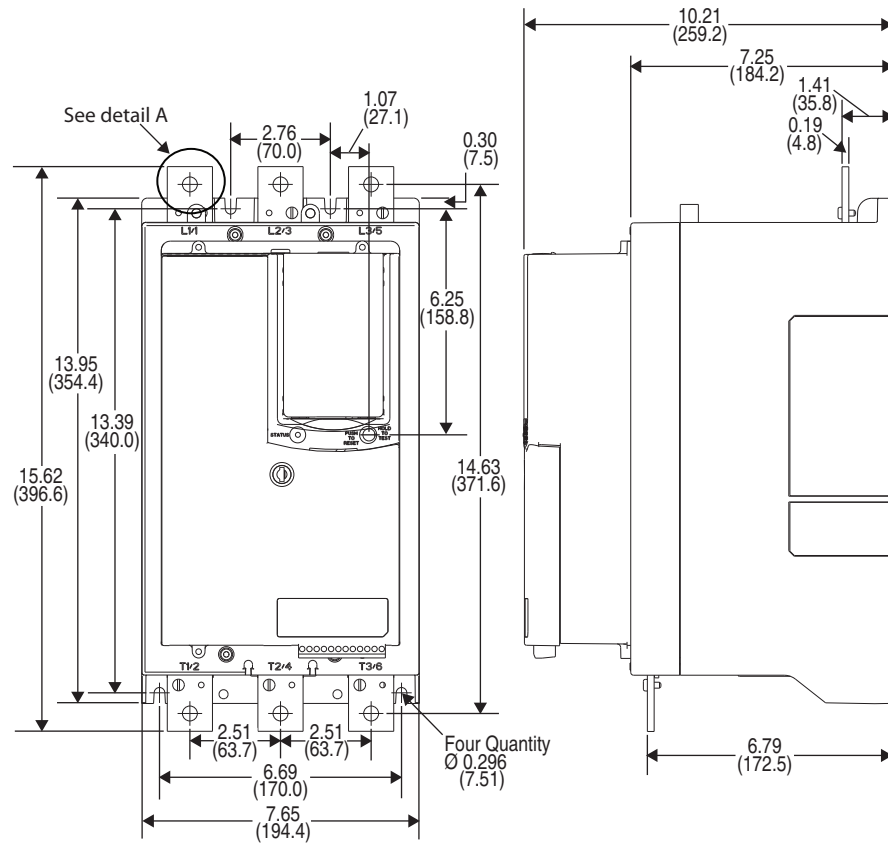
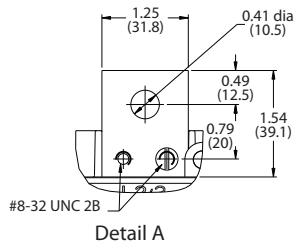


## Solid-state Controllers



When mounted in an enclosure, maintain a minimum of 6.0 inches (152.4 mm) clearance above and below the SMC-50 controller. Side-to-side clearance is not required.

**Figure 29 - Cat. Nos. 150-SB1...SB4 Solid-state Controller: Without Terminal Covers**

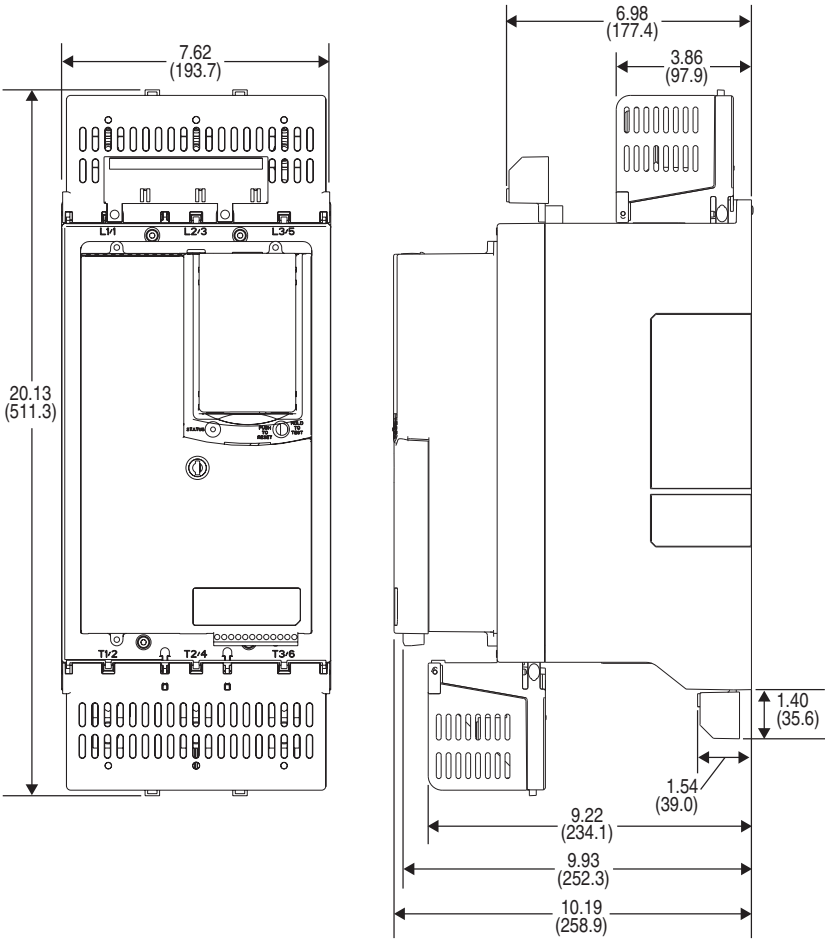


| Cat. No. | Weight                 |
|----------|------------------------|
| 150-SB1  | 15.7 kg<br>(34.6 lbs.) |
| 150-SB2  |                        |
| 150-SB3  |                        |
| 150-SB4  |                        |



When mounted in an enclosure, maintain a minimum of 6.0 inches (152.4 mm) clearance above and below the SMC-50 controller. Side-to-side clearance is not required.

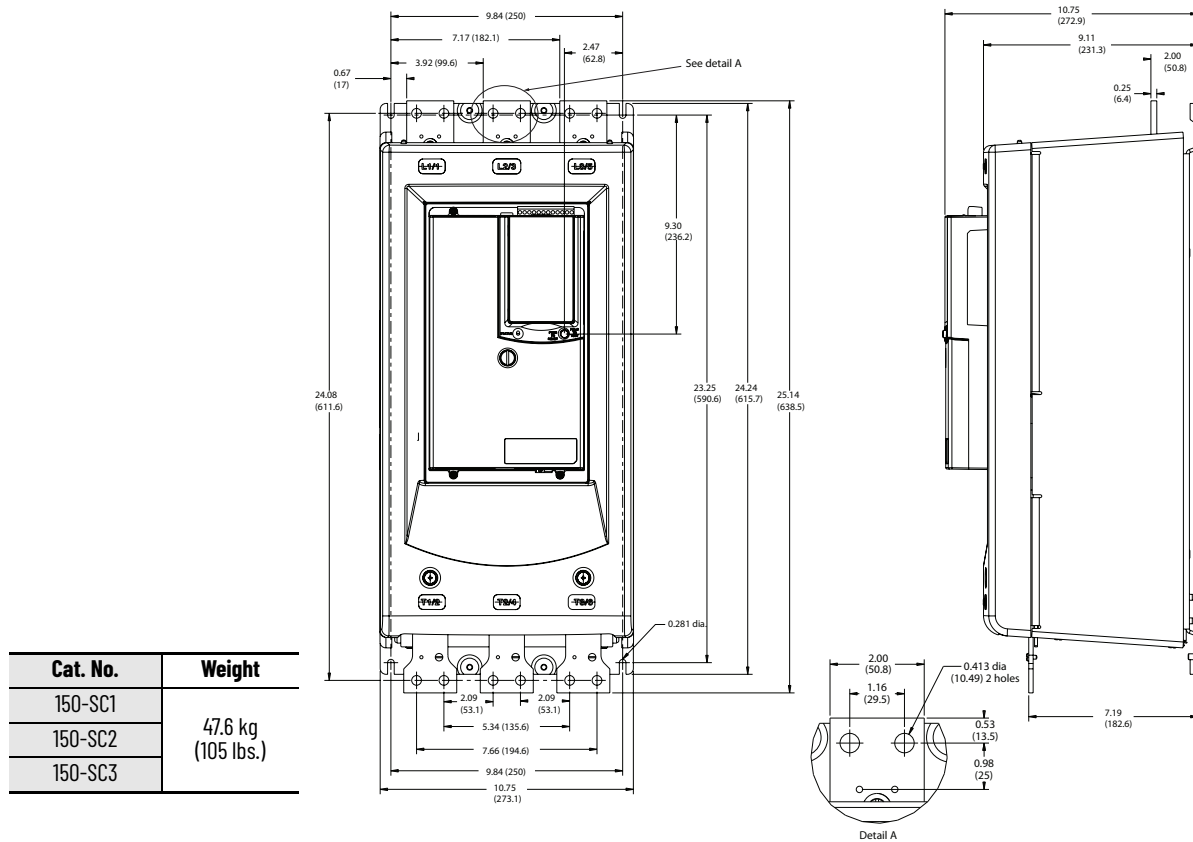
**Figure 30 - Cat. Nos. 150-SB1...SB4 Solid-state Controller: With Terminal Covers and MOV Options**





When mounted in an enclosure, maintain a minimum of 6.0 inches (152.4 mm) clearance above and below the SMC-50 controller. Side-to-side clearance is not required.

**Figure 31 – Cat. Nos. 150-SC1...SC3 Solid-state Controller**





When mounted in an enclosure, maintain a minimum of 6.0 inches (152.4 mm) clearance above and below the SMC-50 controller. Side-to-side clearance is not required.

Figure 32 - Cat. Nos. 150-SC1...SC3 Solid-state Controller: With Lugs, Bypass Kit, and MOV Options

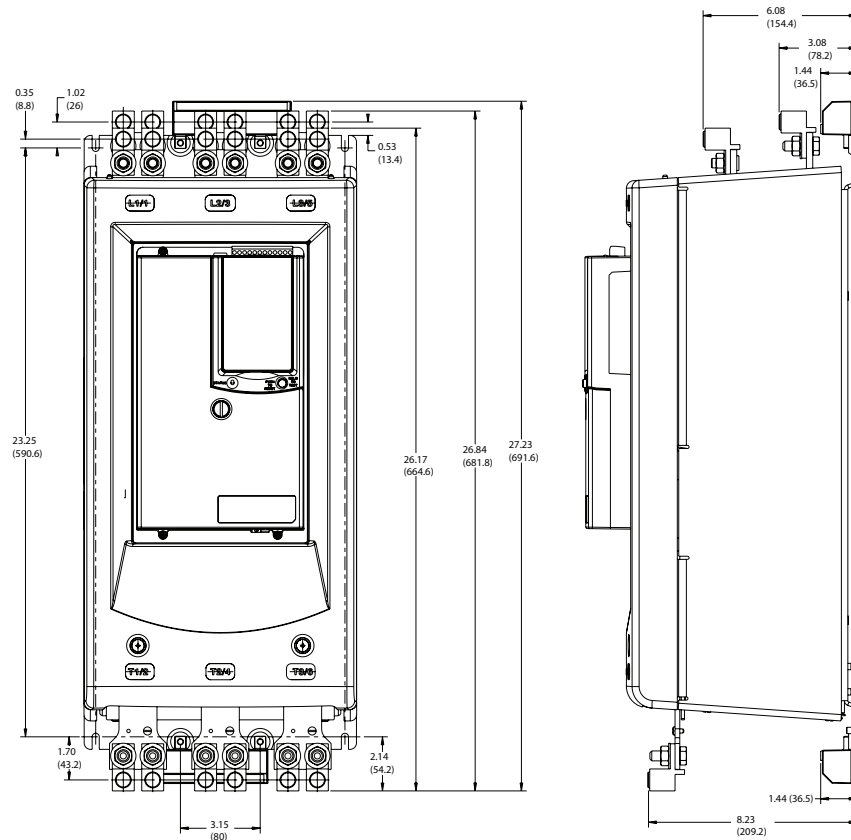
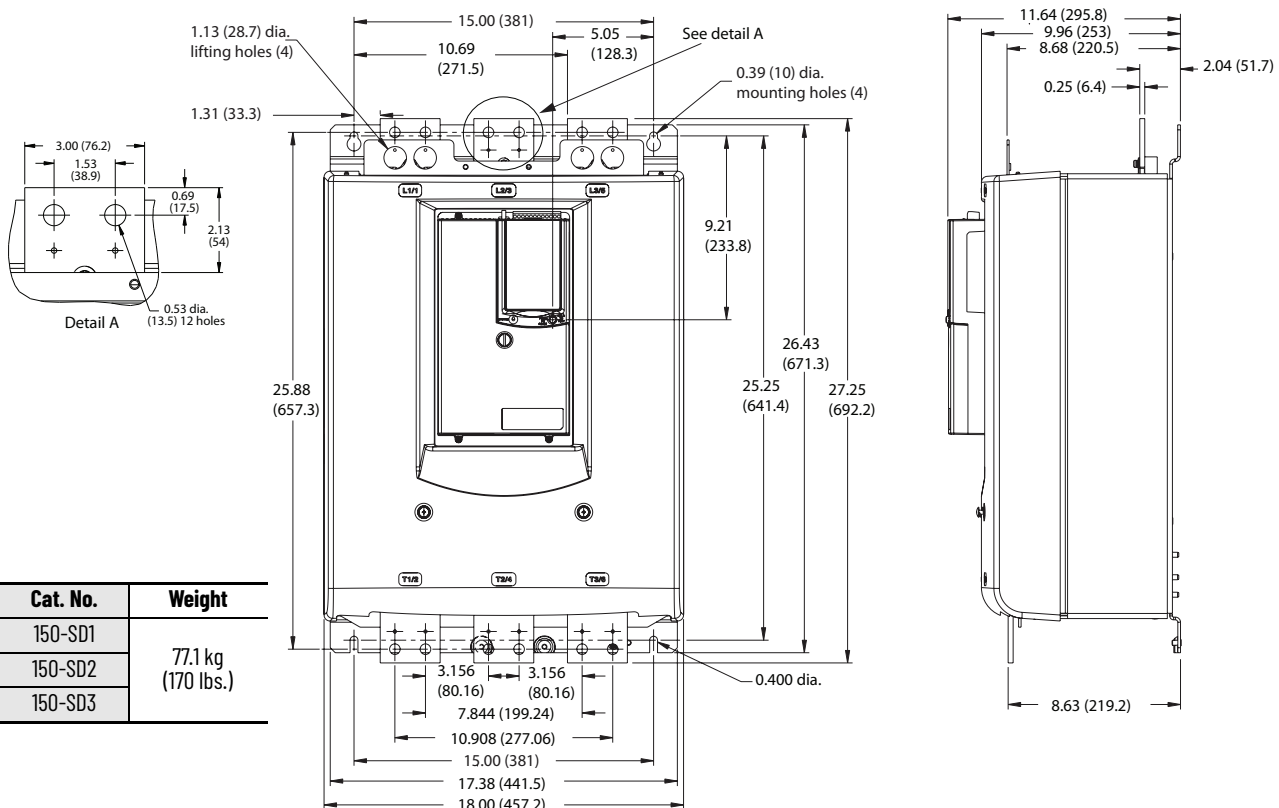


Figure 33 - Cat. Nos. 150-SD1...SD3 Solid-state Controller

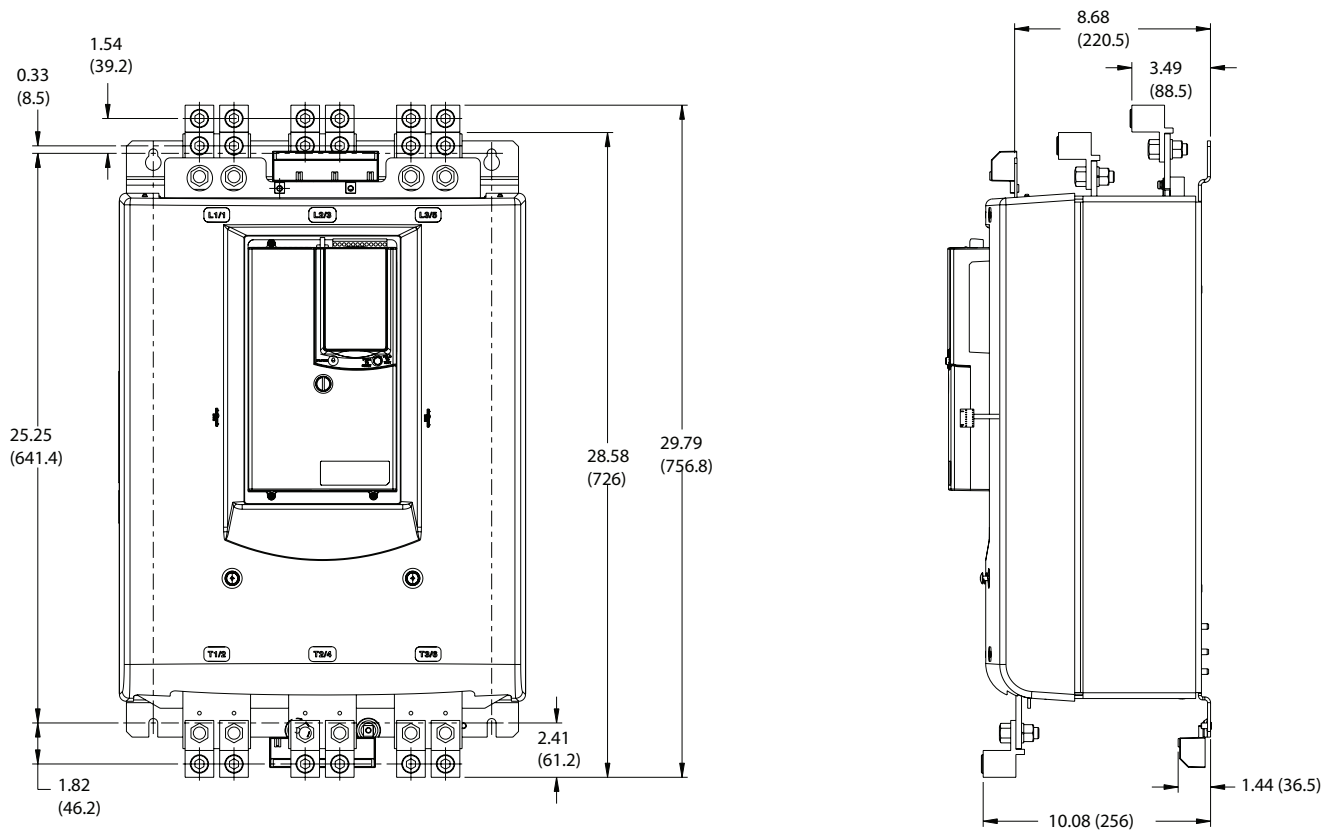


| Cat. No. | Weight                |
|----------|-----------------------|
| 150-SD1  | 77.1 kg<br>(170 lbs.) |
| 150-SD2  |                       |
| 150-SD3  |                       |



When mounted in an enclosure, maintain a minimum of 6.0 inches (152.4 mm) clearance above and below the SMC-50 controller. Side-to-side clearance is not required.

**Figure 34 - Cat. Nos. 150-SD1...SD3 Solid-state Controller: With Lugs, Bypass Kit, and MOV Options**



This section describes several of the myriad applications for SMC controllers. It also details the basis for selecting a control method. Illustrations are included to help identify the application. Motor ratings are specified, but the ratings may vary in other typical applications.

Applications and starting methods that are ideal for the SMC controllers include the following.

- Fans
  - Soft start
  - Linear acceleration
- Pumps
  - Soft start
  - Pump control
  - Linear acceleration
  - Pump cavitation
- Conveyors
  - Soft start
  - Linear acceleration
- Centrifuges
  - Smart motor braking
  - Current limit
- Shock loads
  - Rock crushers
  - Hammer Mills
  - Bark Hogs
- High-inertia loads
  - Hammer mill with current limit
  - Shredder with soft start
  - Bandsaw with soft start
  - Ball mill with current limit
- Smart Motor Braking
  - Bandsaw
  - Centrifuge
  - Hammermill
  - Ball mill
- Compressors
  - Soft start
- Tumblers
  - Linear acceleration
  - Soft start
- Short-term slow speed
- Resistive loads

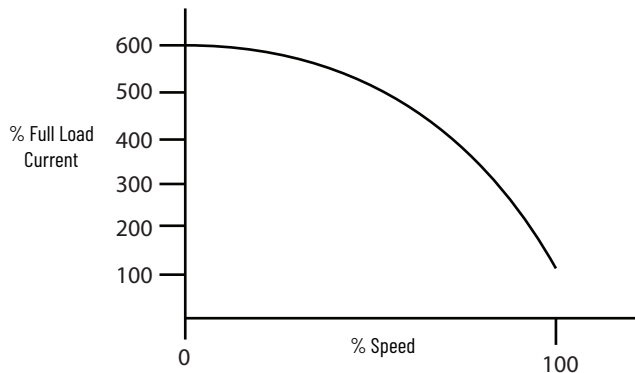
# Reduced Voltage Starting

There are two primary reasons for using reduced voltage when starting a motor:

- Limit line disturbances
- Reduce excessive torque to the driven equipment

When starting a motor at full voltage, the current drawn from the power line is typically 600% of normal full load current. This high current flows until the motor is almost up to speed and then decreases, as shown in [Figure 35](#). This could cause line voltage dips and brown-outs.

**Figure 35 - Full-load Current vs. Speed**



In addition to high starting currents, the motor also produces starting torques that are higher than full-load torque. The magnitude of the starting torque depends on the motor design. NEMA publishes standards for torques and currents for motor manufacturers to follow. Typically, a NEMA Design B motor has a locked rotor or starting torque that is approximately 180% of full-load torque.

In many applications, this starting torque can cause excessive mechanical damage such as belt, chain, or coupling breakage.

All forms of reduced voltage starting affect the motor current and torque characteristics. When you apply a reduced voltage to a motor at rest, the current drawn by the motor is reduced. The torque produced by the motor is a factor of approximately the square of the percentage of voltage applied.

For example, if 50% voltage is applied to the motor, a starting torque of approximately 25% of the normal starting torque is produced. In the previous full voltage example, the NEMA Design B motor had a starting torque of 180% of full load torque. With only 50% voltage applied, this equates to approximately 45% of full load torque. [Table 123](#) shows the typical relationship of voltage, current, and torque for a NEMA Design B motor.

**Table 123 - Typical Voltage, Current and Torque Characteristics for NEMA Design B Motors**

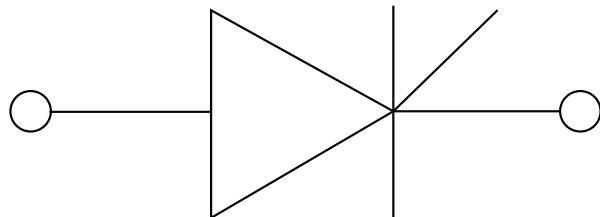
| Starting Method | % Voltage at Motor Terminals | Motor Starting Current as % of: |                   | Line Current as % of: |                   | Motor Starting Torque as % of: |                  |
|-----------------|------------------------------|---------------------------------|-------------------|-----------------------|-------------------|--------------------------------|------------------|
|                 |                              | Locked Rotor Current            | Full Load Current | Locked Rotor Current  | Full Load Current | Locked Rotor Torque            | Full Load Torque |
| Full Voltage    | 100                          | 100                             | 600               | 100                   | 600               | 100                            | 180              |
| Autotransformer |                              |                                 |                   |                       |                   |                                |                  |
| 80% tap         | 80                           | 80                              | 480               | 64                    | 384               | 64                             | 115              |
| 65% tap         | 65                           | 65                              | 390               | 42                    | 252               | 42                             | 76               |
| 50% tap         | 50                           | 50                              | 300               | 25                    | 150               | 25                             | 45               |
| Part Winding    | 100                          | 65                              | 390               | 65                    | 390               | 50                             | 90               |
| Wye-Delta       | 100                          | 33                              | 198               | 33                    | 198               | 33                             | 60               |
| Solid-state     | 0...100                      | 0...100                         | 0...100           | 0...100               | 0...100           | 0...100                        | 0...100          |

With the wide range of torque characteristics for the various starting methods, selecting an electromechanical reduced voltage starter becomes more application dependent. In many instances, available torque becomes the key factor in the selection processes.

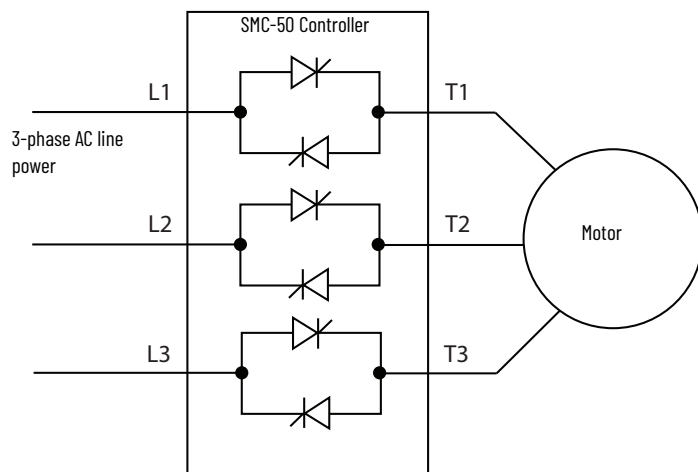
## Solid-state Starters with SCRs

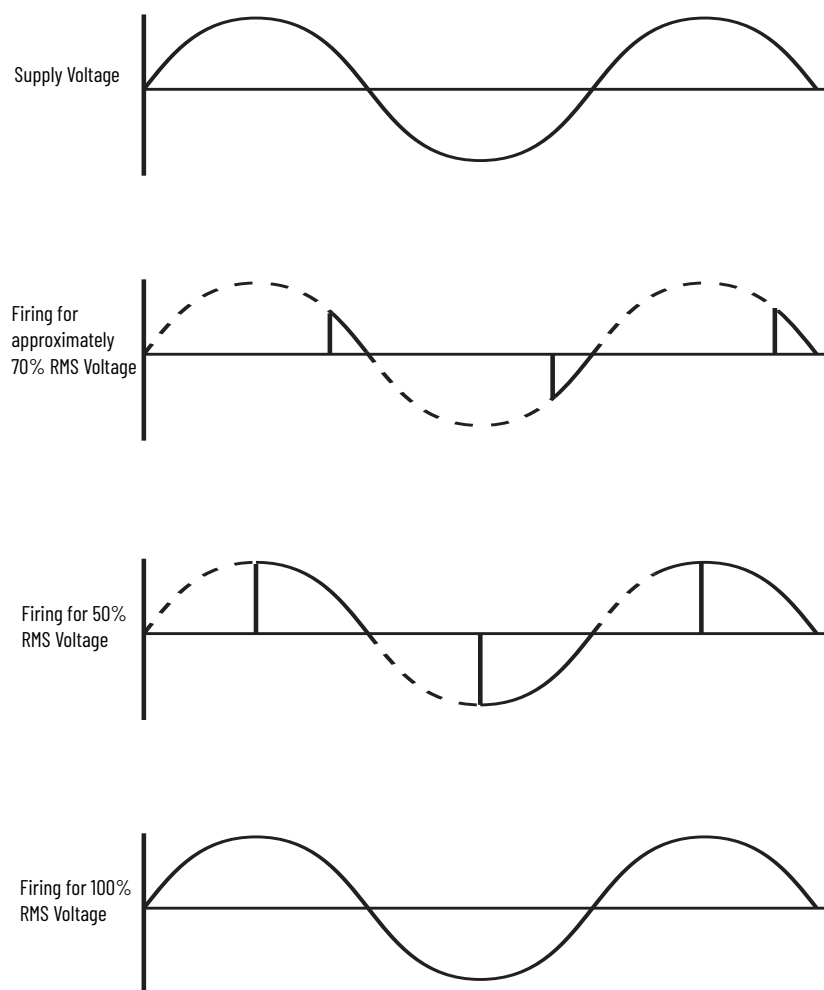
In solid-state starters, silicon-controlled rectifiers (SCRs) (see [Figure 36](#)) are used to control the voltage output to the motor. An SCR allows current to flow in one direction only. The amount of conduction of an SCR is controlled by the pulses received at the gate of the SCR. When two SCRs are connected back to back (see [Figure 37](#)), the AC power to a load can be controlled by changing the firing angle of the line voltage (see [Figure 38](#)) during each half cycle. By changing the angle, it is possible to increase or decrease the voltage and current to the motor. The SMC-50 controller incorporates a microprocessor to control the firing of the SCRs. Six SCRs are used in the power section to provide full cycle control of the voltage and current. The voltage and current can be slowly and steplessly increased to the motor.

**Figure 36 - Silicon-controlled Rectifier**



**Figure 37 - Typical Wiring Diagram for SCRs**



**Figure 38 - Different Firing Angles (Single-phase Simplification)**

# Industry Applications Matrix

Use this section to identify possible SMC controller applications. This section contains an application matrix that identifies starting characteristics and typical stopping features that may be used in various applications.

**Table 124 - Mining and Metals<sup>(1)</sup>**

| Application       | Soft Start |   |    | Current Limit |   |    | Kickstart |   |    | Soft Stop |   |    | Pump Control |   |    | Accu- Stop |   |    | Smart Motor Brake |   |    | Preset Slow Speed |   |    | Slow Speed with Brake |   |    | Linear Speed Acceleration |   |    | Torque Control Start |   |   |
|-------------------|------------|---|----|---------------|---|----|-----------|---|----|-----------|---|----|--------------|---|----|------------|---|----|-------------------|---|----|-------------------|---|----|-----------------------|---|----|---------------------------|---|----|----------------------|---|---|
|                   | 3          | F | 50 | 3             | F | 50 | 3         | F | 50 | 3         | F | 50 | 3            | F | 50 | 3          | F | 50 | 3                 | F | 50 | 3                 | F | 50 | 3                     | F | 50 | 3                         | F | 50 |                      |   |   |
| Roller Mills      | —          | X | X  | —             | X | X  | —         | — | —  | —         | — | —  | —            | — | —  | —          | — | —  | —                 | X | X  | —                 | — | —  | —                     | X | X  | —                         | — | X  | —                    | — | X |
| Hammermills       | —          | X | X  | —             | X | X  | —         | — | —  | —         | — | —  | —            | — | —  | —          | — | —  | —                 | X | X  | —                 | — | —  | —                     | X | X  | —                         | — | X  | —                    | — | X |
| Roller Conveyors  | —          | X | X  | —             | — | —  | —         | — | —  | —         | X | X  | —            | — | —  | —          | — | —  | —                 | — | —  | —                 | — | —  | —                     | — | —  | X                         | — | —  | X                    |   |   |
| Centrifugal Pumps | —          | X | X  | —             | X | X  | —         | — | —  | —         | — | —  | —            | X | X  | —          | — | —  | —                 | — | —  | —                 | — | —  | —                     | — | —  | X                         | — | —  | X                    |   |   |
| Fans              | X          | X | X  | X             | X | X  | X         | X | X  | —         | — | —  | —            | — | —  | —          | — | —  | —                 | — | —  | —                 | — | —  | —                     | — | —  | X                         | — | —  | X                    |   |   |
| Tumbler           | —          | X | X  | —             | X | X  | —         | — | —  | —         | — | —  | —            | — | —  | —          | X | X  | —                 | X | X  | —                 | X | X  | —                     | X | X  | —                         | — | X  | —                    | — | X |
| Rock Crusher      | —          | X | X  | —             | X | X  | —         | — | —  | —         | — | —  | —            | — | —  | —          | — | —  | —                 | — | —  | —                 | — | —  | —                     | — | —  | X                         | — | —  | X                    |   |   |
| Dust Collector    | —          | X | X  | —             | X | X  | —         | — | —  | —         | — | —  | —            | — | —  | —          | — | —  | —                 | — | —  | —                 | — | —  | —                     | — | —  | X                         | — | —  | X                    |   |   |
| Chillers          | —          | X | X  | —             | X | X  | —         | — | —  | —         | — | —  | —            | — | —  | —          | — | —  | —                 | — | —  | —                 | — | —  | —                     | — | —  | X                         | — | —  | X                    |   |   |
| Compressor        | X          | X | X  | X             | X | X  | —         | — | —  | —         | — | —  | —            | — | —  | —          | — | —  | —                 | — | —  | —                 | — | —  | —                     | — | —  | X                         | — | —  | X                    |   |   |
| Wire Draw Machine | —          | X | X  | —             | X | X  | —         | X | X  | —         | — | —  | —            | — | —  | —          | — | —  | —                 | — | —  | —                 | — | —  | —                     | — | —  | X                         | — | —  | X                    |   |   |
| Belt Conveyors    | X          | X | X  | X             | X | X  | X         | X | X  | —         | X | X  | —            | — | —  | —          | X | X  | —                 | — | —  | —                 | X | X  | —                     | — | —  | —                         | X | —  | —                    | X |   |
| Shredder          | —          | X | X  | —             | X | X  | —         | — | —  | —         | — | —  | —            | — | —  | —          | — | —  | —                 | — | —  | —                 | — | —  | —                     | — | —  | X                         | — | —  | X                    |   |   |
| Grinder           | —          | X | X  | —             | X | X  | —         | — | —  | —         | — | —  | —            | — | —  | —          | — | —  | —                 | X | X  | —                 | — | —  | —                     | X | X  | —                         | — | X  | —                    | — | X |
| Slicer            | —          | X | X  | —             | X | X  | —         | X | X  | —         | — | —  | —            | — | —  | —          | — | —  | —                 | — | —  | —                 | — | —  | —                     | — | —  | X                         | — | —  | X                    |   |   |
| Overload Conveyor | —          | X | X  | —             | — | —  | —         | X | X  | —         | X | X  | —            | — | —  | —          | X | X  | —                 | — | —  | —                 | — | —  | —                     | — | —  | X                         | X | —  | —                    | X |   |

(1) Table Legend: 3= SMC-3 controller; F = SMC Flex controller; 50 = SMC-50 controller

**Table 125 - Food Processing<sup>(1)</sup>**

| Application       | Soft Start |   |    | Current Limit |   |    | Kickstart |   |    | Soft Stop |   |    | Pump Control |   |    | Accu- Stop |   |    | Smart Motor Brake |   |    | Preset Slow Speed |   |    | Slow Speed with Brake |   |    | Linear Speed Acceleration |   |    | Torque Control Start |   |   |
|-------------------|------------|---|----|---------------|---|----|-----------|---|----|-----------|---|----|--------------|---|----|------------|---|----|-------------------|---|----|-------------------|---|----|-----------------------|---|----|---------------------------|---|----|----------------------|---|---|
|                   | 3          | F | 50 | 3             | F | 50 | 3         | F | 50 | 3         | F | 50 | 3            | F | 50 | 3          | F | 50 | 3                 | F | 50 | 3                 | F | 50 | 3                     | F | 50 | 3                         | F | 50 |                      |   |   |
| Centrifugal Pumps | —          | X | X  | —             | X | X  | —         | — | —  | —         | — | —  | —            | X | X  | —          | — | —  | —                 | — | —  | —                 | — | —  | —                     | — | —  | X                         | — | —  | X                    |   |   |
| Palletizers       | —          | X | X  | —             | — | —  | —         | — | —  | —         | X | X  | —            | — | —  | —          | — | —  | —                 | — | —  | —                 | — | —  | —                     | — | —  | X                         | — | —  | X                    |   |   |
| Mixers            | —          | X | X  | —             | X | X  | —         | X | X  | —         | — | —  | —            | — | —  | —          | — | —  | —                 | — | X  | X                 | — | —  | —                     | — | —  | X                         | — | —  | X                    |   |   |
| Agitators         | —          | X | X  |               |   |    | —         | — | —  | —         | — | —  | —            | — | —  | —          | — | —  | —                 | — | —  | —                 | — | —  | —                     | — | —  | X                         | — | —  | X                    |   |   |
| Centrifuges       | —          | — | —  | —             | X | X  | —         | — | —  | —         | — | —  | —            | — | —  | —          | — | —  | —                 | X | X  | —                 | — | —  | —                     | X | X  | —                         | — | X  | —                    | — | X |
| Conveyors         | X          | X | X  | X             | X | X  | X         | X | X  | —         | X | X  | —            | — | —  | —          | X | X  | —                 | — | —  | —                 | — | —  | —                     | — | —  | X                         | — | —  | X                    |   |   |
| Fans              | X          | X | X  | X             | X | X  | —         | — | —  | —         | — | —  | —            | — | —  | —          | — | —  | —                 | — | —  | —                 | — | —  | —                     | — | —  | X                         | — | —  | X                    |   |   |
| Bottle Washers    | —          | X | X  | —             | — | —  | —         | — | —  | —         | X | X  | —            | — | —  | —          | — | —  | —                 | — | —  | —                 | — | —  | —                     | — | —  | X                         | — | —  | X                    |   |   |
| Compressors       | —          | X | X  | —             | X | X  | —         | — | —  | —         | — | —  | —            | — | —  | —          | — | —  | —                 | — | —  | —                 | — | —  | —                     | — | —  | X                         | — | —  | X                    |   |   |
| Hammermill        | —          | X | X  | —             | X | X  | —         | — | —  | —         | — | —  | —            | — | —  | —          | — | —  | —                 | — | —  | —                 | — | —  | —                     | — | —  | X                         | — | —  | X                    |   |   |
| Separators        | —          | X | X  | —             | X | X  | —         | — | —  | —         | — | —  | —            | — | —  | —          | — | —  | —                 | — | —  | —                 | — | —  | —                     | — | —  | X                         | — | —  | X                    |   |   |
| Dryers            | —          | X | X  | —             | X | X  | —         | — | —  | —         | — | —  | —            | — | —  | —          | — | —  | —                 | — | —  | —                 | — | —  | —                     | — | —  | X                         | — | —  | X                    |   |   |
| Slicers           | —          | X | X  | —             | X | X  | —         | X | X  | —         | — | —  | —            | — | —  | —          | — | —  | —                 | — | —  | —                 | — | —  | —                     | — | —  | X                         | — | —  | X                    |   |   |

(1) Table Legend: 3= SMC-3 controller; F = SMC Flex controller; 50 = SMC-50 controller

Table 126 - Pulp and Paper<sup>(1)</sup>

| Application       | Soft Start |   |    | Current Limit |   |    | Kickstart |   |    | Soft Stop |   |    | Pump Control |   |    | Accu- Stop |   |    | Smart Motor Brake |   |    | Preset Slow Speed |   |    | Slow Speed with Brake |   |    | Linear Speed Acceleration |                  |    | Torque Control Start |   |   |
|-------------------|------------|---|----|---------------|---|----|-----------|---|----|-----------|---|----|--------------|---|----|------------|---|----|-------------------|---|----|-------------------|---|----|-----------------------|---|----|---------------------------|------------------|----|----------------------|---|---|
|                   | 3          | F | 50 | 3             | F | 50 | 3         | F | 50 | 3         | F | 50 | 3            | F | 50 | 3          | F | 50 | 3                 | F | 50 | 3                 | F | 50 | 3                     | F | 50 | 3                         | F                | 50 |                      |   |   |
| Compressors       | X          | X | X  | X             | X | X  | —         | — | —  | —         | — | —  | —            | — | —  | —          | — | —  | —                 | — | —  | —                 | — | —  | —                     | — | X  | —                         | —                | X  |                      |   |   |
| Conveyors         | X          | X | X  | X             | X | X  | X         | X | X  | X         | X | X  | —            | — | —  | —          | X | X  | —                 | — | —  | —                 | X | X  | —                     | — | —  | —                         | —                | X  | —                    | — | X |
| Trolleys          | —          | X | X  | —             | — | —  | —         | — | —  | —         | X | X  | —            | — | —  | —          | X | X  | —                 | — | —  | —                 | X | X  | —                     | — | —  | —                         | —                | X  | —                    | — | X |
| Dryers            | X          | X | X  | X             | X | X  | —         | — | —  | —         | — | —  | —            | — | —  | —          | — | —  | —                 | — | —  | —                 | — | —  | —                     | — | —  | —                         | X                | —  | —                    | X |   |
| Agitators         | —          | X | X  | —             | X | X  | —         | — | —  | —         | — | —  | —            | — | —  | —          | — | —  | —                 | — | —  | —                 | — | —  | —                     | — | —  | —                         | X                | —  | —                    | X |   |
| Centrifugal Pumps | —          | X | X  | —             | X | X  | —         | — | —  | —         | — | —  | —            | X | X  | —          | — | —  | —                 | — | —  | —                 | — | —  | —                     | — | —  | —                         | X                | —  | —                    | X |   |
| Mixers            | —          | X | X  | —             | X | X  | —         | — | —  | —         | — | —  | —            | — | —  | —          | — | —  | —                 | — | —  | —                 | — | —  | —                     | — | —  | —                         | X <sup>(2)</sup> | —  | —                    | X |   |
| Fans              | X          | X | X  | X             | X | X  | —         | X | X  | —         | — | —  | —            | — | —  | —          | — | —  | —                 | — | —  | —                 | — | —  | —                     | — | —  | —                         | X                | —  | —                    | X |   |
| Re-Pulper         | —          | X | X  | —             | X | X  | —         | X | X  | —         | — | —  | —            | — | —  | —          | — | —  | —                 | — | —  | —                 | — | —  | —                     | — | —  | —                         | X                | —  | —                    | X |   |
| Shredder          | —          | X | X  | —             | X | X  | —         | — | —  | —         | — | —  | —            | — | —  | —          | — | —  | —                 | — | —  | —                 | — | —  | —                     | — | —  | X                         | X                | —  | —                    | X |   |

(1) Table Legend: 3= SMC-3 controller; F = SMC Flex controller; 50 = SMC-50 controller

(2) Unloaded

Table 127 - Petrochemical<sup>(1)</sup>

| Application       | Soft Start |   |    | Current Limit |   |    | Kickstart |   |    | Soft Stop |   |    | Pump Control |   |    | Accu- Stop |   |    | Smart Motor Brake |   |    | Preset Slow Speed |   |    | Slow Speed with Brake |   |    | Linear Speed Acceleration |   |    | Torque Control Start |   |    |
|-------------------|------------|---|----|---------------|---|----|-----------|---|----|-----------|---|----|--------------|---|----|------------|---|----|-------------------|---|----|-------------------|---|----|-----------------------|---|----|---------------------------|---|----|----------------------|---|----|
|                   | 3          | F | 50 | 3             | F | 50 | 3         | F | 50 | 3         | F | 50 | 3            | F | 50 | 3          | F | 50 | 3                 | F | 50 | 3                 | F | 50 | 3                     | F | 50 | 3                         | F | 50 | 3                    | F | 50 |
| Centrifugal Pumps | —          | X | X  | —             | X | X  | —         | — | —  | —         | — | —  | —            | X | X  | —          | — | —  | —                 | — | —  | —                 | — | —  | —                     | — | —  | —                         | — | X  | —                    | — | X  |
| Extruders         | —          | X | X  | —             | X | X  | —         | — | —  | —         | — | —  | —            | — | —  | —          | — | —  | —                 | — | —  | —                 | — | —  | —                     | — | —  | —                         | — | X  | —                    | — | X  |
| Screw Conveyors   | —          | X | X  | —             | X | X  | —         | X | X  | —         | — | —  | —            | — | —  | —          | — | —  | —                 | — | —  | —                 | — | —  | —                     | — | —  | —                         | — | X  | —                    | — | X  |
| Mixers            | —          | X | X  | —             | X | X  | —         | — | —  | —         | — | —  | —            | — | —  | —          | — | —  | —                 | — | —  | X                 | X | —  | —                     | — | —  | —                         | — | X  | —                    | — | X  |
| Agitators         | —          | X | X  | —             | X | X  | —         | — | —  | —         | — | —  | —            | — | —  | —          | — | —  | —                 | — | —  | —                 | — | —  | —                     | — | —  | —                         | — | X  | —                    | — | X  |
| Compressors       | —          | X | X  | —             | X | X  | —         | — | —  | —         | — | —  | —            | — | —  | —          | — | —  | —                 | — | —  | —                 | — | —  | —                     | — | —  | —                         | — | X  | —                    | — | X  |
| Fans              | X          | X | X  | X             | X | X  | X         | X | X  | —         | — | —  | —            | — | —  | —          | — | —  | —                 | — | —  | —                 | — | —  | —                     | — | —  | —                         | — | X  | —                    | — | X  |
| Ball Mills        | —          | X | X  | —             | X | X  | —         | — | —  | —         | — | —  | —            | — | —  | —          | X | X  | —                 | X | X  | —                 | — | —  | —                     | X | X  | —                         | — | X  | —                    | — | X  |
| Centrifuge        | —          | X | X  | —             | X | X  | —         | — | —  | —         | — | —  | —            | — | —  | —          | — | —  | —                 | X | X  | —                 | — | —  | —                     | X | X  | —                         | — | X  | —                    | — | X  |

(1) Table Legend: 3= SMC-3 controller; F = SMC Flex controller; 50 = SMC-50 controller

Table 128 - Transportation and Machine Tool<sup>(1)</sup>

| Application                 | Soft Start |   |    | Current Limit |   |    | Kickstart |   |    | Soft Stop |   |    | Pump Control |   |    | Accu- Stop |   |    | Smart Motor Brake |   |    | Preset Slow Speed |   |    | Slow Speed with Brake |   |    | Linear Speed Acceleration |   |    | Torque Control Start |   |    |
|-----------------------------|------------|---|----|---------------|---|----|-----------|---|----|-----------|---|----|--------------|---|----|------------|---|----|-------------------|---|----|-------------------|---|----|-----------------------|---|----|---------------------------|---|----|----------------------|---|----|
|                             | 3          | F | 50 | 3             | F | 50 | 3         | F | 50 | 3         | F | 50 | 3            | F | 50 | 3          | F | 50 | 3                 | F | 50 | 3                 | F | 50 | 3                     | F | 50 | 3                         | F | 50 | 3                    | F | 50 |
| Material Handling Conveyors | X          | X | X  | X             | X | X  | X         | X | X  | —         | X | X  | —            | — | —  | —          | X | X  | —                 | — | —  | —                 | X | X  | —                     | — | —  | —                         | — | X  | —                    | — | X  |
| Ball Mills                  | —          | X | X  | —             | X | X  | —         | — | —  | —         | — | —  | —            | — | —  | —          | X | X  | —                 | X | X  | —                 | X | X  | —                     | X | X  | —                         | — | X  | —                    | — | X  |
| Grinders                    | —          | X | X  | —             | X | X  | —         | — | —  | —         | — | —  | —            | — | —  | —          | — | —  | —                 | X | X  | —                 | — | —  | —                     | X | X  | —                         | — | X  | —                    | — | X  |
| Centrifugal Pumps           | —          | X | X  | —             | X | X  | —         | — | —  | —         | — | —  | —            | X | X  | —          | — | —  | —                 | — | —  | —                 | — | —  | —                     | — | —  | —                         | — | X  | —                    | — | X  |
| Trolleys                    | —          | X | X  | —             | — | —  | —         | — | —  | —         | X | X  | —            | — | —  | —          | X | X  | —                 | — | —  | —                 | X | X  | —                     | — | —  | —                         | — | X  | —                    | — | X  |
| Presses                     | —          | X | X  | —             | X | X  | —         | — | —  | —         | — | —  | —            | — | —  | —          | — | —  | —                 | X | X  | —                 | — | —  | —                     | X | X  | —                         | — | X  | —                    | — | X  |
| Fans                        | X          | X | X  | X             | X | X  | X         | X | X  | —         | — | —  | —            | — | —  | —          | — | —  | —                 | — | —  | —                 | — | —  | —                     | — | —  | —                         | — | X  | —                    | — | X  |
| Palletizers                 | —          | X | X  | —             | X | X  | —         | — | —  | —         | X | X  | —            | — | —  | —          | X | X  | —                 | — | —  | —                 | X | X  | —                     | — | —  | —                         | — | X  | —                    | — | X  |
| Compressors                 | —          | X | X  | —             | X | X  | —         | — | —  | —         | — | —  | —            | — | —  | —          | — | —  | —                 | — | —  | —                 | — | —  | —                     | — | —  | —                         | — | X  | —                    | — | X  |
| Roller Mill                 | —          | X | X  | —             | X | X  | —         | — | —  | —         | — | —  | —            | — | —  | —          | — | —  | —                 | X | X  | —                 | — | —  | —                     | X | X  | —                         | — | X  | —                    | — | X  |
| Die Charger                 | —          | X | X  | —             | — | —  | —         | — | —  | —         | — | —  | —            | — | —  | —          | X | X  | —                 | — | —  | —                 | — | —  | —                     | — | —  | —                         | — | X  | —                    | — | X  |
| Rotary Table                | —          | X | X  | —             | — | —  | —         | — | —  | —         | — | —  | —            | — | —  | —          | X | X  | —                 | — | —  | —                 | X | X  | —                     | — | —  | —                         | — | X  | —                    | — | X  |

(1) Table Legend: 3= SMC-3 controller; F = SMC Flex controller; 50 = SMC-50 controller

Table 129 - OEM Specialty Machine<sup>(1)</sup>

| Application                   | Soft Start |   |    | Current Limit |   |    | Kickstart |   |    | Soft Stop |   |    | Pump Control |   |    | Accu- Stop |   |    | Smart Motor Brake |   |    | Preset Slow Speed |   |    | Slow Speed with Brake |   |    | Linear Speed Acceleration |   |    | Torque Control Start |   |   |
|-------------------------------|------------|---|----|---------------|---|----|-----------|---|----|-----------|---|----|--------------|---|----|------------|---|----|-------------------|---|----|-------------------|---|----|-----------------------|---|----|---------------------------|---|----|----------------------|---|---|
|                               | 3          | F | 50 | 3             | F | 50 | 3         | F | 50 | 3         | F | 50 | 3            | F | 50 | 3          | F | 50 | 3                 | F | 50 | 3                 | F | 50 | 3                     | F | 50 | 3                         | F | 50 |                      |   |   |
| Centrifugal Pumps             | X          | X | X  | X             | X | X  | —         | — | —  | —         | — | —  | —            | X | X  | —          | — | —  | —                 | — | —  | —                 | — | —  | —                     | — | —  | —                         | — | X  | —                    | — | X |
| Washers                       | —          | X | X  | —             | X | X  | —         | — | —  | —         | — | —  | —            | — | —  | —          | X | X  | —                 | X | X  | —                 | X | X  | —                     | X | X  | —                         | — | X  | —                    | — | X |
| Conveyors                     | X          | X | X  | X             | X | X  | X         | X | X  | X         | X | X  | —            | — | —  | —          | X | X  | —                 | X | X  | —                 | X | X  | —                     | X | X  | —                         | — | X  | —                    | — | X |
| Power Walks                   | —          | X | X  | —             | X | X  | —         | — | —  | —         | X | X  | —            | — | —  | —          | — | —  | —                 | — | —  | —                 | — | —  | —                     | — | —  | —                         | — | X  | —                    | — | X |
| Fans                          | X          | X | X  | X             | X | X  | X         | X | X  | —         | — | —  | —            | — | —  | —          | — | —  | —                 | — | —  | —                 | — | —  | —                     | — | —  | —                         | — | X  | —                    | — | X |
| Twisting/<br>Spinning Machine | —          | X | X  | —             | X | X  | —         | — | —  | —         | — | —  | —            | — | —  | —          | — | —  | —                 | — | —  | —                 | — | —  | —                     | — | —  | —                         | — | X  | —                    | — | X |

(1) Table Legend: 3= SMC-3 controller; F = SMC Flex controller; 50 = SMC-50 controller

Table 130 - Lumber and Wood Products<sup>(1)</sup>

| Application       | Soft Start |   |    | Current Limit |   |    | Kickstart |   |    | Soft Stop |   |    | Pump Control |   |    | Accu- Stop |   |    | Smart Motor Brake |   |    | Preset Slow Speed |   |    | Slow Speed with Brake |   |    | Linear Speed Acceleration |   |    | Torque Control Start |   |   |
|-------------------|------------|---|----|---------------|---|----|-----------|---|----|-----------|---|----|--------------|---|----|------------|---|----|-------------------|---|----|-------------------|---|----|-----------------------|---|----|---------------------------|---|----|----------------------|---|---|
|                   | 3          | F | 50 | 3             | F | 50 | 3         | F | 50 | 3         | F | 50 | 3            | F | 50 | 3          | F | 50 | 3                 | F | 50 | 3                 | F | 50 | 3                     | F | 50 | 3                         | F | 50 |                      |   |   |
| Chipper           | —          | X | X  | —             | X | X  | —         | — | —  | —         | — | —  | —            | — | —  | —          | — | —  | X                 | X | —  | —                 | — | —  | X                     | X | —  | —                         | X | —  | —                    | X |   |
| Circular Saw      | —          | X | X  | —             | X | X  | —         | — | —  | —         | — | —  | —            | — | —  | —          | — | —  | X                 | X | —  | —                 | — | —  | X                     | X | —  | —                         | X | —  | —                    | X |   |
| Bandsaw           | —          | X | X  | —             | X | X  | —         | — | —  | —         | — | —  | —            | — | —  | —          | — | —  | X                 | X | —  | X                 | X | —  | X                     | X | —  | —                         | X | —  | —                    | X |   |
| Edger             | —          | X | X  | —             | X | X  | —         | — | —  | —         | — | —  | —            | — | —  | —          | — | —  | —                 | — | —  | —                 | — | —  | —                     | — | —  | —                         | X | —  | —                    | X |   |
| Conveyors         | X          | X | X  | X             | X | X  | X         | X | X  | X         | X | X  | —            | — | —  | —          | X | X  | —                 | — | —  | —                 | X | X  | —                     | — | —  | —                         | — | X  | —                    | — | X |
| Centrifugal Pumps | —          | X | X  | —             | X | X  | —         | — | —  | —         | — | —  | —            | X | X  | —          | — | —  | —                 | — | —  | —                 | — | —  | —                     | — | —  | —                         | X | —  | —                    | X |   |
| Compressors       | —          | X | X  | —             | X | X  | —         | — | —  | —         | — | —  | —            | — | —  | —          | — | —  | —                 | — | —  | —                 | — | —  | —                     | — | —  | —                         | X | —  | —                    | X |   |
| Fans              | X          | X | X  | X             | X | X  | X         | X | X  | —         | — | —  | —            | — | —  | —          | — | —  | —                 | — | —  | —                 | — | —  | —                     | — | —  | —                         | X | —  | —                    | X |   |
| Planers           | —          | X | X  | —             | X | X  | —         | — | —  | —         | — | —  | —            | — | —  | —          | — | —  | —                 | — | —  | —                 | — | —  | —                     | — | —  | —                         | X | —  | —                    | X |   |
| Sander            | —          | X | X  | —             | X | X  | —         | — | —  | —         | — | —  | —            | — | —  | —          | X | X  | —                 | X | X  | —                 | X | X  | —                     | X | X  | —                         | — | X  | —                    | — | X |
| Debarker          | —          | X | X  | —             | X | X  | —         | — | —  | —         | — | —  | —            | — | —  | —          | — | —  | —                 | X | X  | —                 | — | —  | —                     | X | X  | —                         | — | X  | —                    | — | X |

(1) Table Legend: 3= SMC-3 controller; F = SMC Flex controller; 50 = SMC-50 controller

Table 131 - Water/Wastewater Treatment and Municipalities<sup>(1)</sup>

| Application       | Soft Start |   |    | Current Limit |   |    | Kickstart |   |    | Soft Stop |   |    | Pump Control |   |    | Accu- Stop |   |    | Smart Motor Brake |   |    | Preset Slow Speed |   |    | Slow Speed with Brake |   |    | Linear Speed Acceleration |   |    | Torque Control Start |  |  |
|-------------------|------------|---|----|---------------|---|----|-----------|---|----|-----------|---|----|--------------|---|----|------------|---|----|-------------------|---|----|-------------------|---|----|-----------------------|---|----|---------------------------|---|----|----------------------|--|--|
|                   | 3          | F | 50 | 3             | F | 50 | 3         | F | 50 | 3         | F | 50 | 3            | F | 50 | 3          | F | 50 | 3                 | F | 50 | 3                 | F | 50 | 3                     | F | 50 | 3                         | F | 50 |                      |  |  |
| Centrifugal Pumps | X          | X | X  | X             | X | X  | —         | — | —  | X         | X | X  | —            | X | X  | —          | — | —  | —                 | — | —  | —                 | — | —  | —                     | — | X  | —                         | — | X  |                      |  |  |
| Centrifuge, heavy | —          | X | X  | —             | X | X  | —         | — | —  | —         | — | —  | —            | — | —  | —          | X | X  | —                 | — | —  | —                 | X | X  | —                     | — | X  | —                         | — | X  |                      |  |  |
| Fans              | X          | X | X  | X             | X | X  | —         | — | —  | X         | X | X  | —            | — | —  | —          | — | —  | —                 | — | —  | —                 | — | —  | —                     | — | X  | —                         | — | X  |                      |  |  |
| Compressors       | X          | X | X  | X             | X | X  | —         | — | —  | —         | — | —  | —            | — | —  | —          | — | —  | —                 | — | —  | —                 | — | —  | —                     | — | X  | —                         | — | X  |                      |  |  |

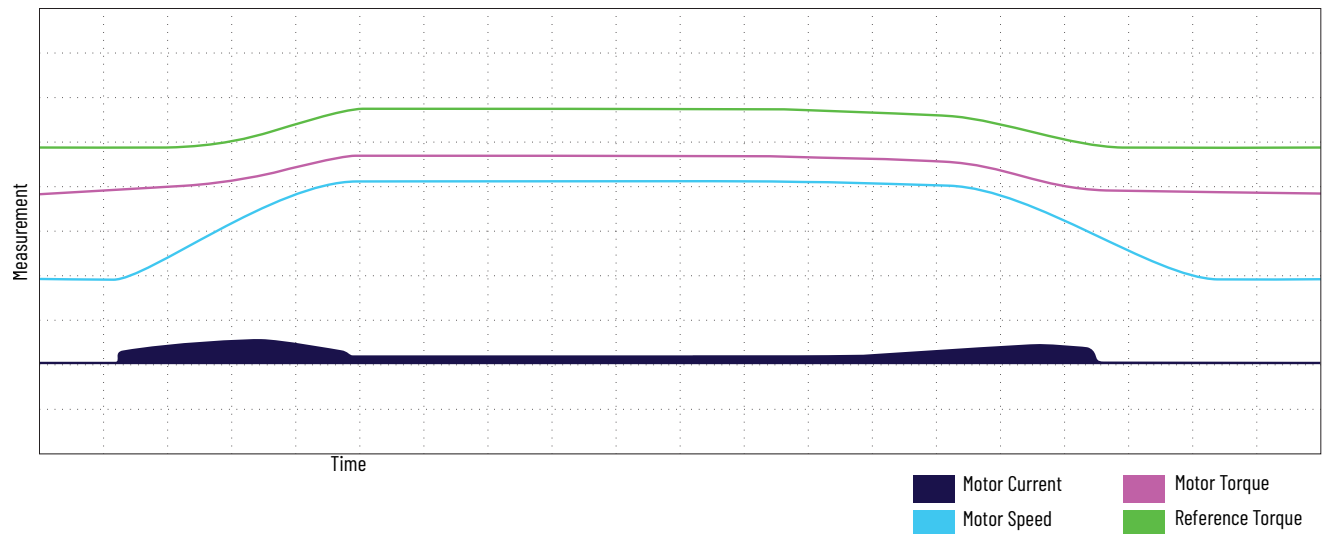
(1) Table Legend: 3= SMC-3 controller; F = SMC Flex controller; 50 = SMC-50 controller

# Fans

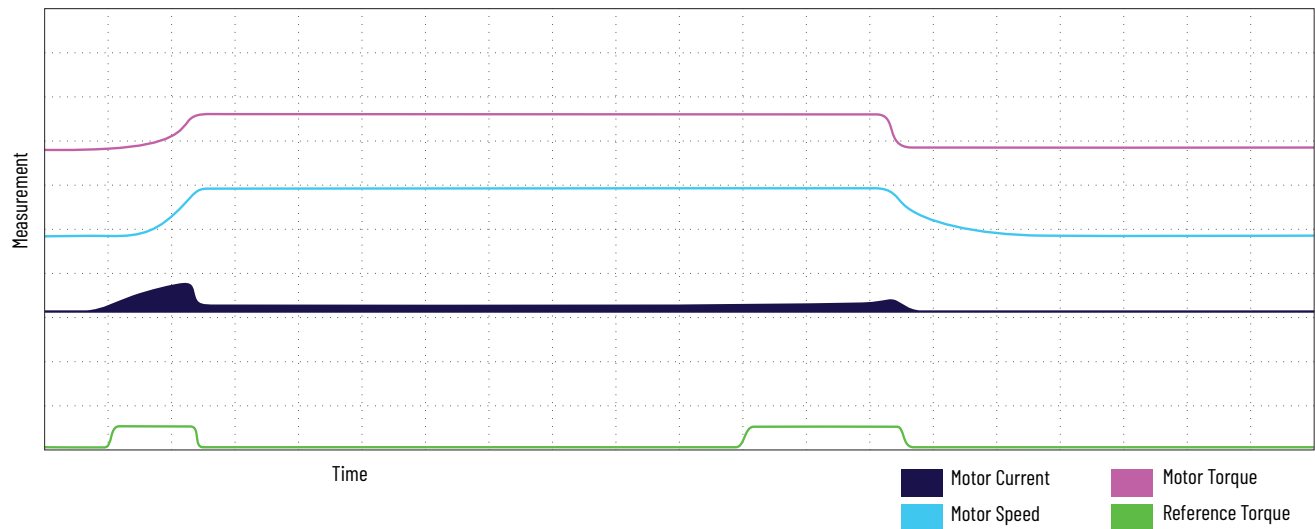
Soft starters are commonly used to start fans. Fans are typically variable torque type loads. The amount of torque that is required increases with the starting speed of the fan.

The best way to start a fan load is with the dampers closed to reduce the amount of resistance to airflow. [Figure 39](#) and [Figure 40](#) illustrate methods the SMC-50 uses for successful fan starting. Note the smooth start of the sensorless linear acceleration, keeping smooth control of the motor current.

**Figure 39 - Sensorless Linear Acceleration and Sensorless Linear Deceleration**



**Figure 40 - Soft Start and Soft Stop**

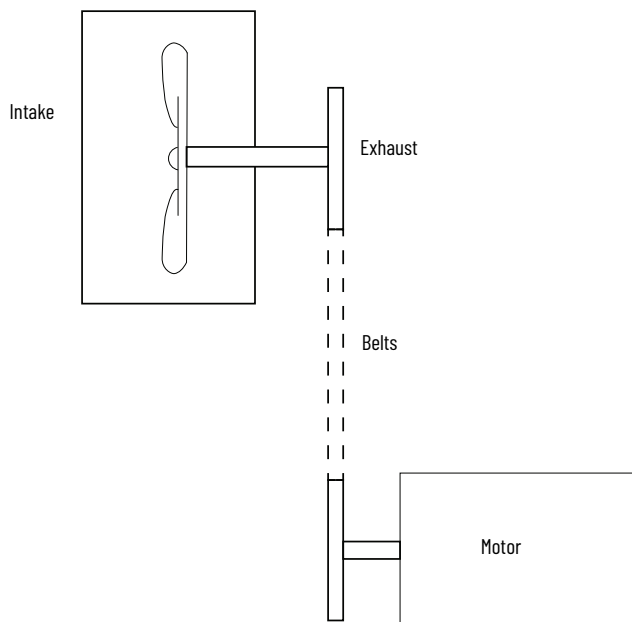


## Exhaust Fan with Soft Start

### Problem

The belts on an exhaust fan frequently break, which causes maintenance problems. In addition to the high cost of the belts, the fan belt guard is cumbersome to remove. The high starting torque from the motor is a major contributor to the belt wear. The customer wants to remotely stop and start the fan from a PLC. Panel space is limited, which requires a compact device. [Figure 41](#) illustrates this scenario.

**Figure 41 - Exhaust Fan with Soft Start**



### Solution

The SMC-50 controller is installed as a retrofit to the existing starter. The ramp time is set for 28 seconds, which facilitates a smooth acceleration while reducing the starting torque of the motor and minimizing the mechanical shock to the belts. The SMC-50 controller has optional communication capabilities, allowing it to be controlled remotely via a PLC. It also has built-in overload protection, which saves panel space by not requiring a separate overload protection device.

SMC Flex controllers also have the flexibility of setting the ramp time and the adjustability required for this application.

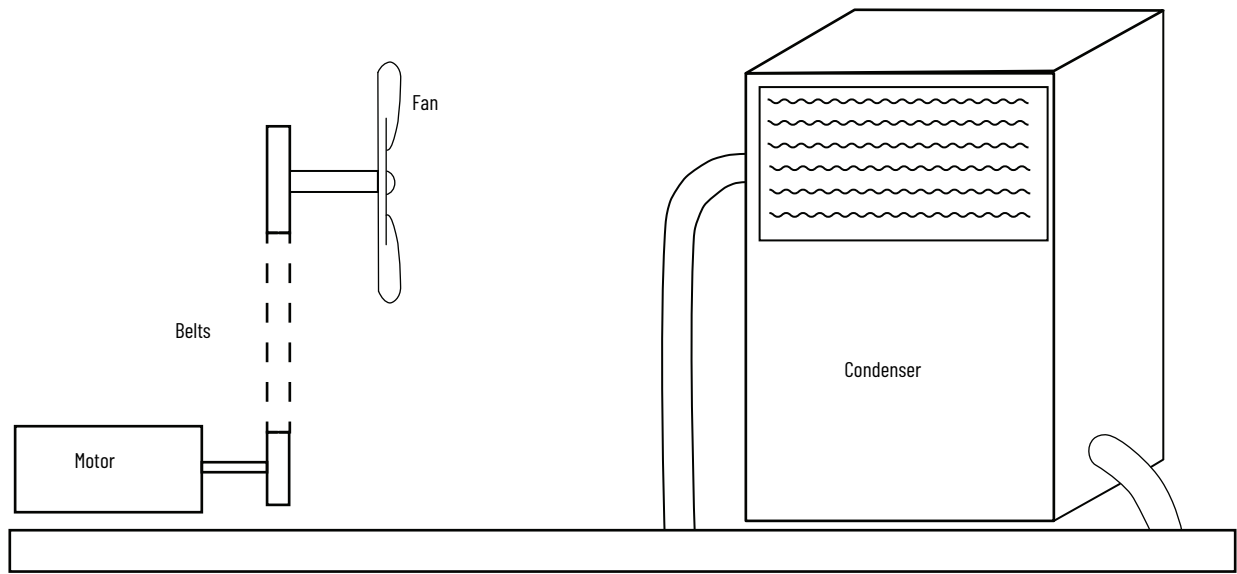
SMC-3 controllers have fixed selectable ramp times and selectable starting torques.

## Chiller with Soft Start

### Problem

A belt-driven fan on a chiller frequently breaks the belt because of high starting torque. The customer incurs excessive downtime because the housing has to be removed to replace the belt. A combination across-the-line starter is used to control the motor. Control panel space is limited. A device that uses same control and line voltage is required because there is no room in the panel for a control circuit transformer. [Figure 42](#) illustrates this scenario.

**Figure 42 - Chiller with Soft Start**



### Solution

The SMC-50 controller is installed as a retrofit to the chiller. It is set for an 18-second soft start to reduce the snap to the belts as a result of the high starting torque. It also reduces belt "squealing" that had been occurring at startup. Because the SMC-50 controller can operate with 240V control voltage and line voltage, a control circuit transformer is not required. The built-in overload protection on the SMC-50 controller further reduces the required panel space. The customer is able to retrofit the controller into the existing panel space.

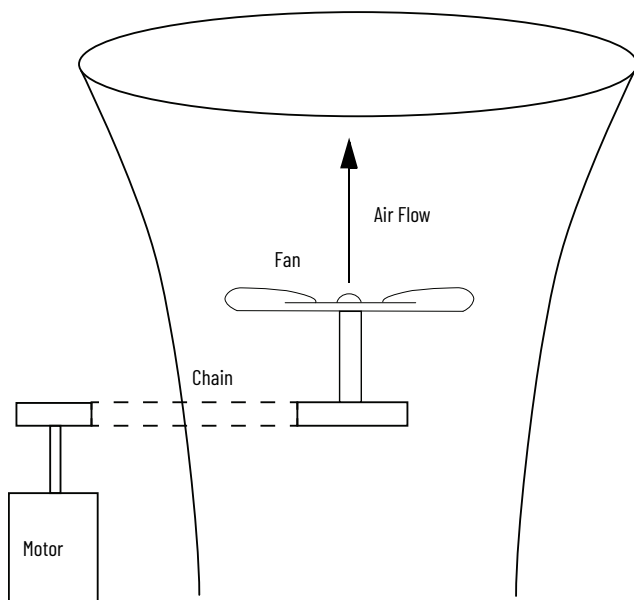
Both the SMC Flex and the SMC-3 controllers can operate at 240 control and line voltage, removing the requirement for a control circuit transformer.

## Cooling Tower Fan with Linear Acceleration

### Problem

A chain-driven fan that moderates the temperature of water in a chemical process is started across-the-line. The system requires frequent inspection and maintenance because of problems with the chain drive. Ice forms on the blades in winter. The air density is affected by seasonal temperature variations, which affects the starting time. The application requires a controlled start. [Figure 43](#) illustrates this scenario.

**Figure 43 - Cooling Tower Fan with Linear Acceleration**



### Solution

The SMC-50 controller is installed to provide a controlled acceleration to minimize the mechanical shock that is encountered during an across-the-line start. Maintenance inspection is also reduced. In the winter, when a longer start is required, linear acceleration is used to start the motor in the same time frame.

The SMC Flex controller offers soft start mode and linear acceleration with the use of an external tachometer.

The SMC-3 controller only offers soft start or current limit mode for this application.

# Pumps

System dynamics play a big part in pumping applications. The motor, valving, elbows, head (static and dynamic) pressure and power source of the system are all factors. Each system requires different ways to start and stop the pump to reduce water hammer. The two main pumping systems are positive displacement and centrifugal.

SMC controllers work best when they start lightly loaded centrifugal pumps. These pumps increase pressure from the impellers, which creates the pumping action. Motor torque increases during the starting process.

In contrast, positive displacement pumps have a constant torque characteristic and need more-specific calculations to correctly estimate requirements. One tool to use is the SMC controller estimation wizard. The issue is the potential for high torque demand while starting this type of pump. The SMC controller requires full voltage at start to provide full torque.

Because each system is different, the SMC-50 controller offers multiple ways to control the pump, simply by changing parameters.

You can use soft start, pump start, and linear acceleration starting methods. Stopping methods for pump applications include soft stop, pump stop, and linear deceleration.

[Figure 44](#) through [Figure 46](#) compare starting methods using a 10-second start time, 0% initial torque, and 65% load on a centrifugal pump.

**Figure 44 - Soft Start and Soft Stop in Pump Application**

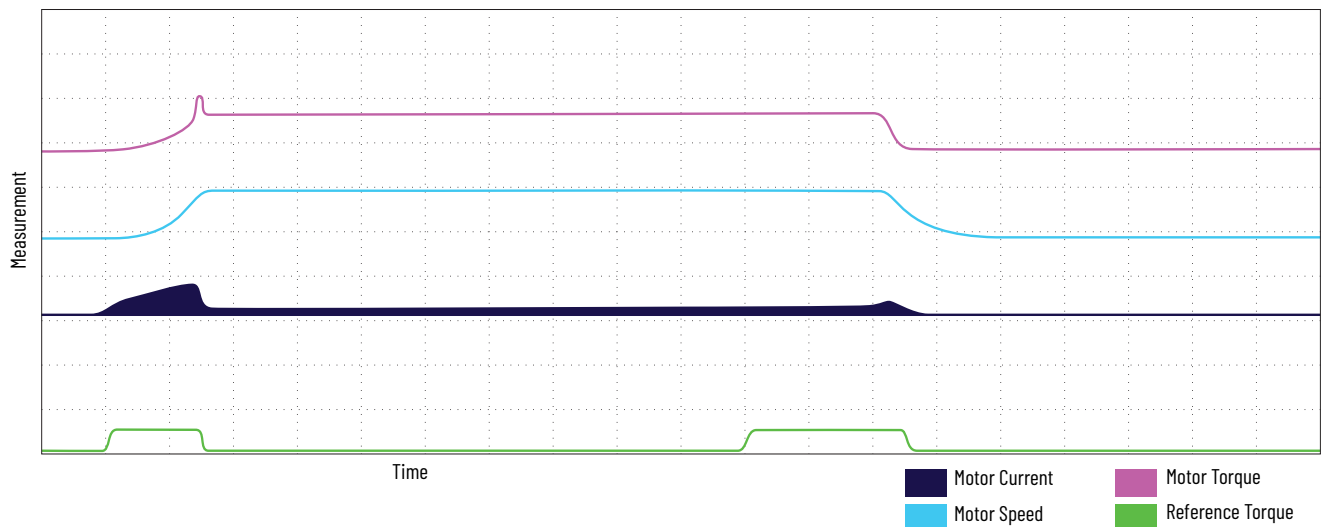


Figure 45 - Pump Control in Pump Application

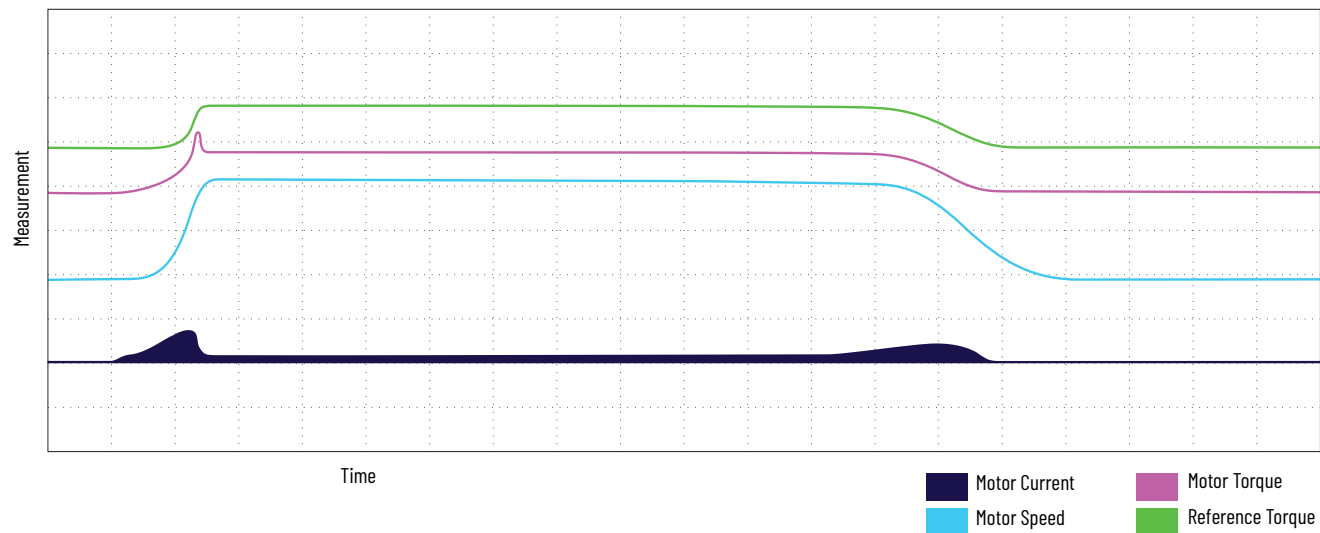
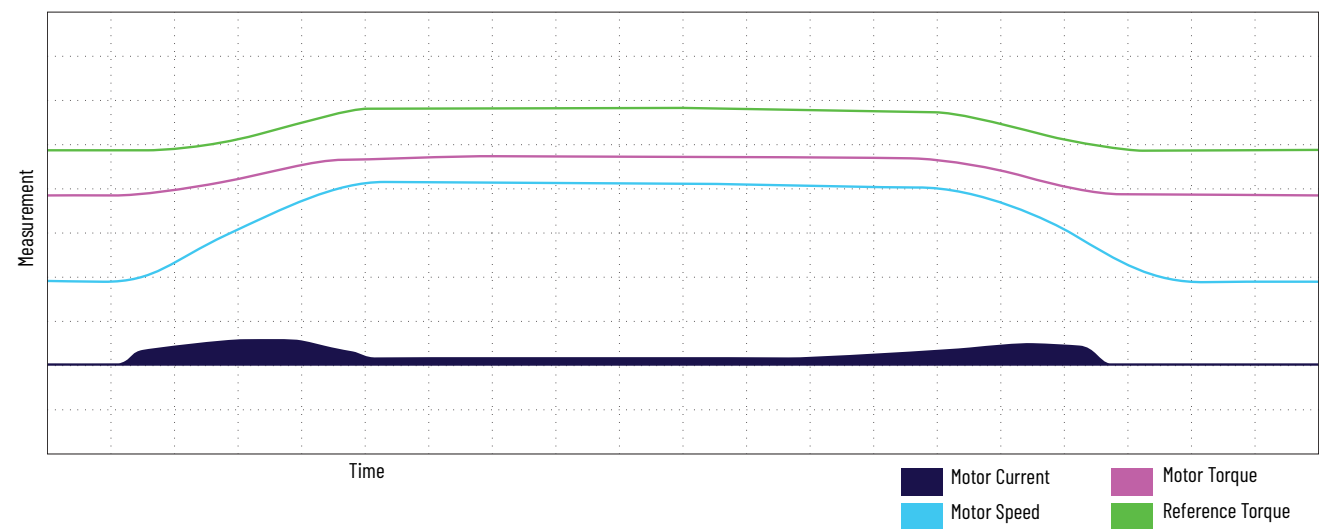


Figure 46 - Linear Acceleration and Linear Deceleration in Pump Application



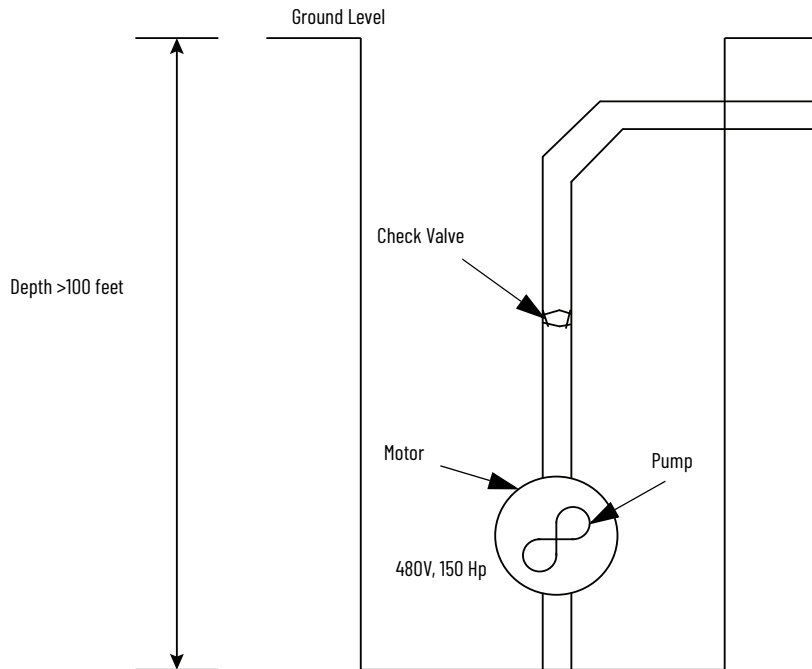
Notice the lower current consumption that is used by using the linear acceleration mode on startup. This mode is not as load dependent as the other two methods. In addition to the starting and stopping methods offered by the SMC-50 controller, it also offers the ability to monitor and control pumping applications that are not available in other soft starters

## Pump with Soft Start

### Problem

A municipal water company is experiencing problems with damaged pump impellers. The damage occurs during frequent motor starting while the load below the check valve drains from the system. A timing relay is installed to help prevent restart under load, but it needs to be adjusted frequently. The pumping station motor is over 100 feet below ground, which makes repair costly. For maintenance scheduling purposes, an elapsed time meter that measures motor running time needs to be installed in the enclosure. [Figure 47](#) illustrates this scenario.

**Figure 47 - Pump with Soft Start**



### Solution

The SMC-50 controller is installed, and it provides a controlled motor acceleration. It can reduce the shock to the impeller by decreasing the torque during startup. The SMC-50 controller backspin timer feature can be implemented to help prevent the motor from starting while it turns in a reverse direction. By using the built-in elapsed time meter, panel space is saved. The SMC-50 controller line diagnostics protect the motor by detecting faults such as a shorted SCR condition at pre-start and shuts off the motor, protecting it against damage. Soft start is a good method to use with soft power sources to reduce current spikes.

The SMC Flex controller can also perform control with the backspin timer feature only with the pump control module.

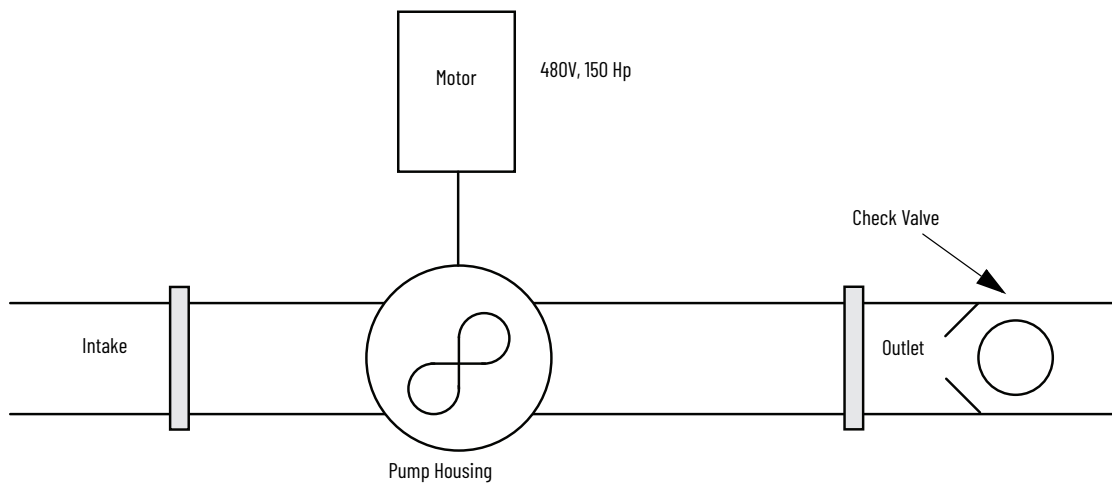
The SMC-3 controller offers soft start control but not a backspin timer.

## Pump with Pump Control

### Problem

A municipal pump uses a soft start controller with soft stop to control the pump motor. The soft stop controls the motor in an open-loop fashion by reducing the voltage to the motor. Because there is not enough motor torque to drive the load, the motor quickly reaches its stall point. Severe surges cause pipe vibration and breakage during the stop mode. [Figure 48](#) illustrates this scenario.

**Figure 48 - Pump with Pump Control**



### Solution

The SMC-50 controller is installed and configured to the Pump Control setting. The Pump Control option removes the surges by controlling the speed of the motor during starting and stopping. The microprocessor inside the SMC-50 controller analyzes the motor variables and generates control commands to reduce the surges in the system.

You could also use the pump control option on the on the SMC Flex controller.

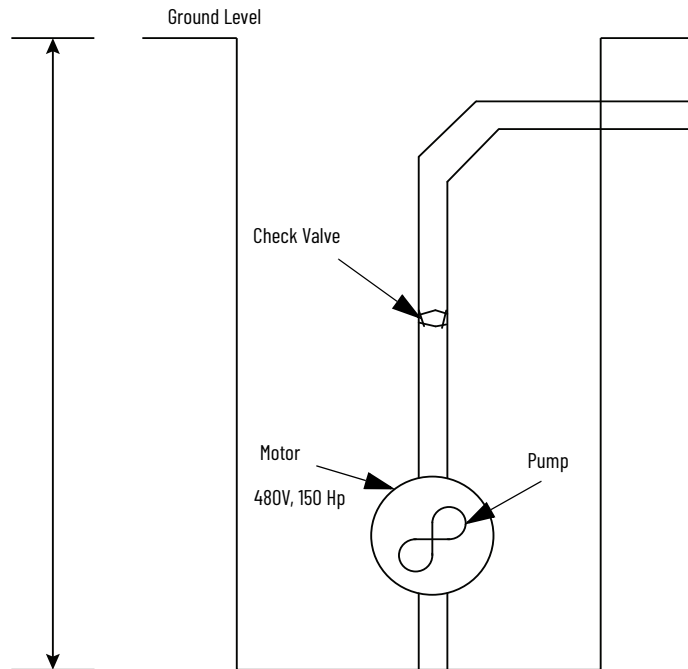
The SMC-3 controller does not offer pure pump control option.

## Pump Control with Sensorless Linear Acceleration and Deceleration

### Problem

A municipality has a pumping station where there is water hammer taking place even when using pump stop. The water hammer causes vibration alarms to go off at a bank several miles away. Fire and police are automatically notified and called to the bank. Once the source of the issue is identified, the municipality needs to adjust the stopping procedure. The pump stop profile of the SMC Flex controller is verified with an oscilloscope, but does not solve the issue. [Figure 49](#) illustrates this scenario.

**Figure 49 - Pump Control with Sensorless Linear Acceleration and Deceleration**



### Solution

Linear deceleration using the patented sensorless linear deceleration is the answer. The SMC-50 controller is connected to the SMC Flex power structure using the proper upgrade kit for the 108...251 A units. This method controls the SMC-50, but removes the need to remove the entire SMC Flex controller. This lets the personnel leave the 3-phase power wiring connected. (Three-phase power is turned off when the controllers are swapped.) Once the addition of the SMC-50 control module is complete, using the linear deceleration instead of pump stop removes the water hammer and provides a smooth closing of the valves.

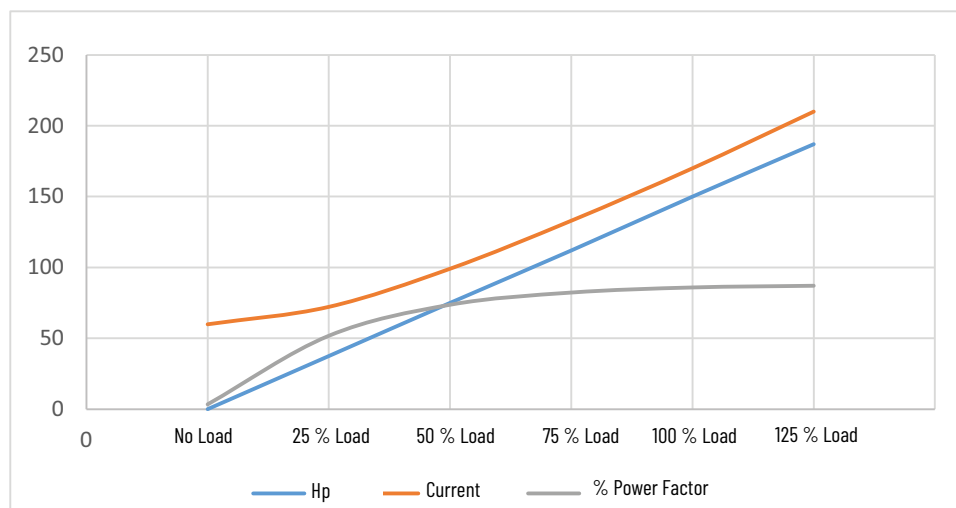
You cannot place the SMC-3 controller on an SMC Flex power structure, and the SMC-3 controller does not have linear acceleration or deceleration capabilities.

## Pump Cavitation and Blockage

### Problem

A customer is unable to detect pump cavitation quickly enough to help prevent damage to the system, including the pump impellers and valves. The traditional way to detect pump cavitation is to use a current-monitoring device to detect an issue. These devices are added separately from the starter. However, even at no load, there is still magnetizing current. [Figure 50](#) illustrates this scenario.

**Figure 50 - Pump Cavitation and Blockage (for 150 Hp Motor)**



### Solution

In addition to starting and stopping the motor for the pumping application, the SMC-50 controller can also monitor and trigger alarms or faults based on current, real power, and power factor. At no load, power factor is at a near zero value, real power is at zero value, and motor current is at another value due to the magnetizing current of the motor. The combination of the three values can help determine whether pump cavitation is taking place. For example, if real power decreases, this could indicate a clogged suction line, which can result in the pump running dry. It could also be an indication of pump cavitation. If real power increases, this can indicate overload or a rupture in the discharge line. You can set real power fault and alarm functions with a time delay and select for both under and over values.

The SMC Flex controller can monitor real power and power factor, but it does not have the ability to enunciate an alarm or fault based only on those values.

The SMC-3 controller does not have real power enunciation capability.

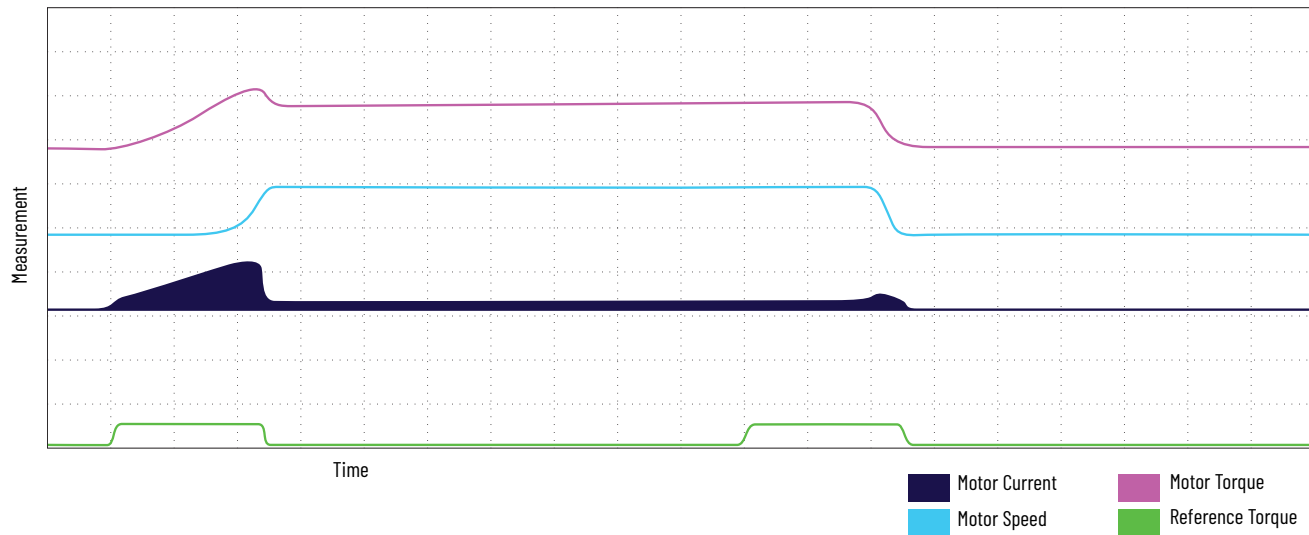
# Conveyors

Conveyors are one of the easiest systems to control using the SMC-50 controller. The SMC-50 controller offers linear acceleration and soft start for controlling a smooth start and stop of conveyors. The primary use of the soft starter in this application is to reduce mechanical stress and dynamic shifts in product.

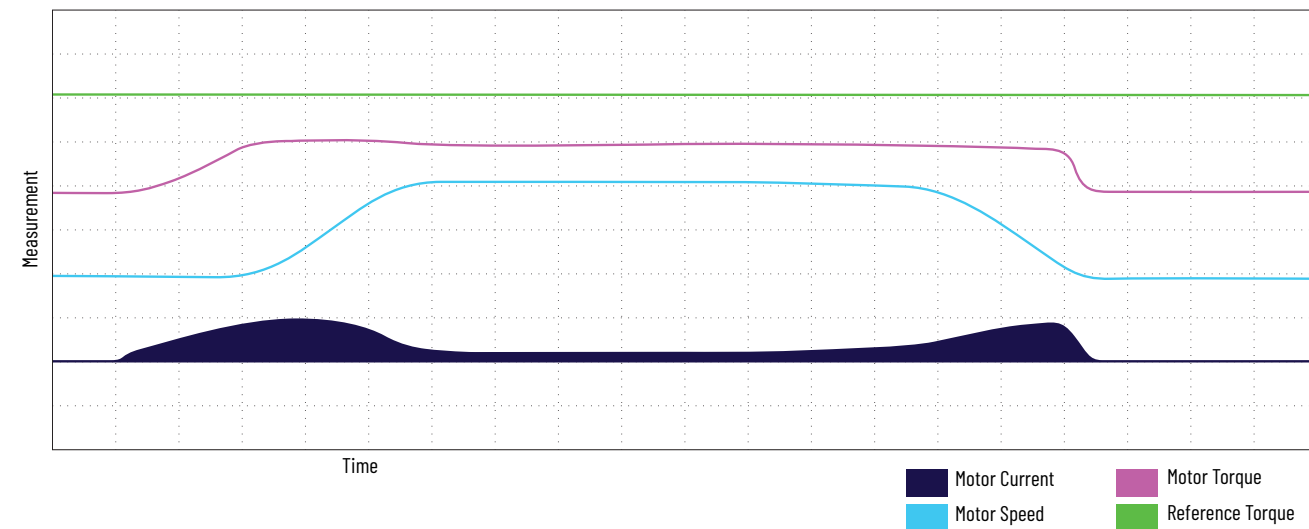
Soft start is the typical way of starting a conveyor that is lightly loaded. If you need to restart the conveyor with a heavier load, linear acceleration may be a more effective option. Linear acceleration is not as load-dependent as soft start is, so it is more flexible under varying load conditions. It is also more flexible than soft starting when it must function in varying thermal conditions, such as running a cold motor in the morning, and a hotter motor as the day progresses.

[Figure 51](#) and [Figure 52](#) illustrate plots of starting and stopping constant loads, such as conveyors.

**Figure 51 - Soft Start and Soft Stop on Conveyor**



**Figure 52 - Linear Acceleration and Linear Deceleration on Conveyor**



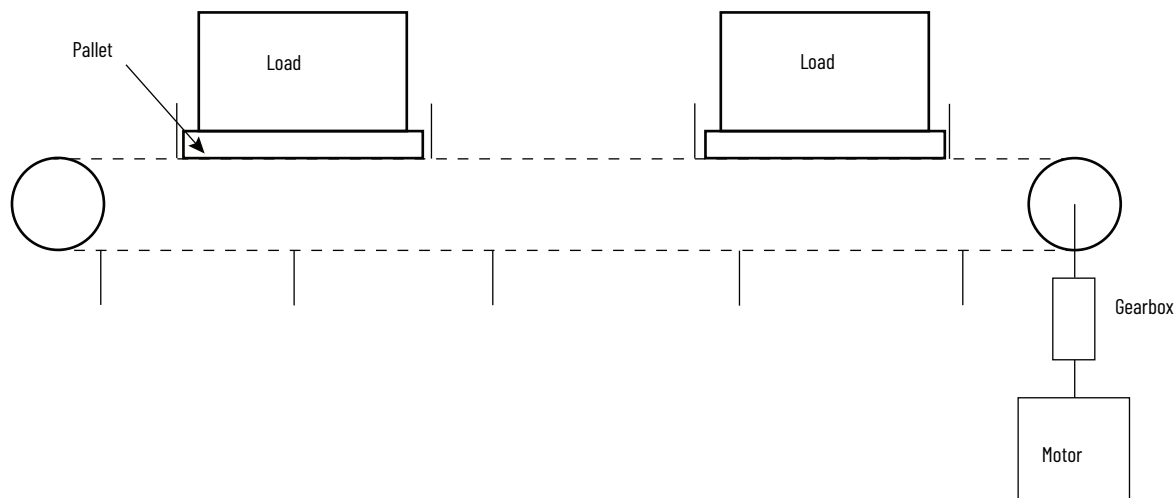
These two scenarios use identical motors and starting parameters. Note the difference between the two starts. The sensorless linear acceleration provides smoother motor torque over the soft starting method. Unlike soft start, which is load dependent, linear acceleration can produce a more accurate starting time. Sensorless linear acceleration also produces a smoother motor current, torque, and speed.

## Towline Conveyor with Soft Start and Soft Stop Options

### Problem

A towline conveyor at the end of a production line has frequent damage to the gearbox caused by the starting torque from across-the-line motor starting. There are also frequent spills during starting and stopping. The conveyor occasionally needs to be started under heavy load. This towline application has a variety of starting requirements that other soft starters could not satisfy. Investing in a variable speed drive was not cost effective. [Figure 53](#) illustrates this scenario.

**Figure 53 - Towline Conveyor with Soft Start and Stop**



### Solution

The SMC-50 controller with the Soft Stop option is installed as a retrofit to the existing across the-line starter. The starting and stopping times are programmed for 13 seconds. The reduced starting torque decreases the shock to the gearbox and keeps the load from shifting on startup. The Soft Stop option protects against loads shifting while stopping. The kickstart feature is used to provide a pulse of current to break the load away when higher starting torque is required. The SMC-50 controller meets the starting requirements and is a cost-effective solution.

SMC Flex controllers also have a full range of adjusting the initial torque value for starting the soft starting application, including full voltage if needed.

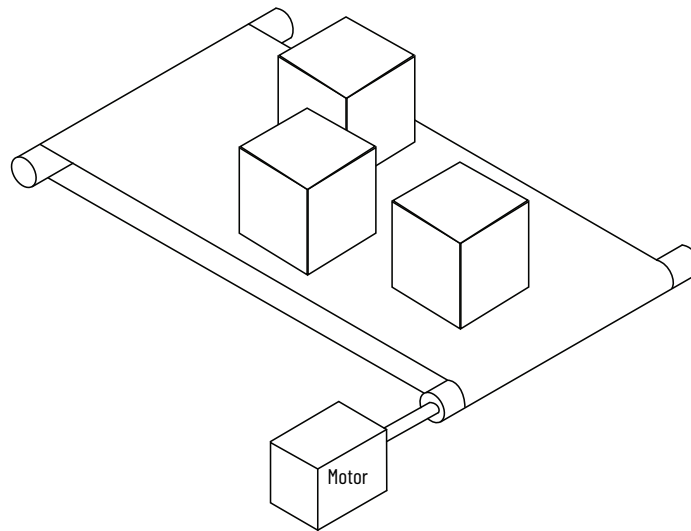
SMC-3 controllers have limited adjustability on initial torque value. They offer soft stop and kickstart options.

## Palletizer with Sensorless Linear Acceleration

### Problem

A palletizer moves boxes of product through a packaging process to a shrink wrap machine. Across-the-line starting causes unwanted product spillage, and an interruption of production due to the uncontrolled torque from the motor on startup. Because several types of product, in different size boxes, are produced on the same line, the system needs the ability to match the acceleration ramp to the product. [Figure 54](#) illustrates this scenario.

**Figure 54 - Palletizer with Sensorless Linear Acceleration**



### Solution

The SMC-50 controller was installed. It is now able to furnish a controlled acceleration, reduce the shock to the load, and eliminate product spillage. The Linear Acceleration feature allows the controller to be programmed to more closely match the motor acceleration with the product produced.

You could also use an SMC Flex controller in soft start mode. With an external tachometer attached, you could also use linear acceleration.

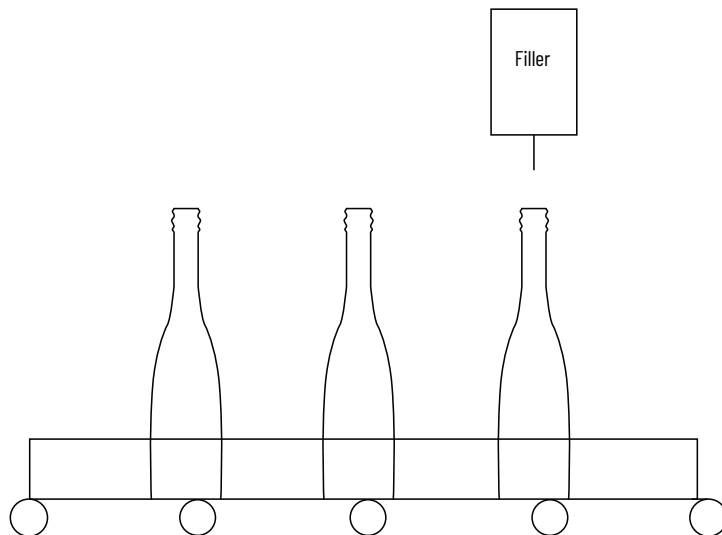
In this application, you could use the SMC-3 controller in soft start mode.

## Bottle Filler with Soft Start and Soft Stop

### Problem

A bottle filler line has product spillage during starting and stopping. An across-the-line starter is used to start the motor. The application also requires an auxiliary contact that energizes when the motor is up to speed. [Figure 55](#) illustrates this scenario.

**Figure 55 - Bottle Filler with Soft Start and Soft Stop**



### Solution

The SMC-50 controller is installed and programmed for a 13-second soft start with an 18-second soft stop. The controlled start reduces the starting torque and the product spillage. The soft stop option extends the stopping time and smooths load shift while stopping. The auxiliary contacts are configured to change state when the motor is up to speed.

You could also use either the SMC Flex or SMC-3 controllers for this application.

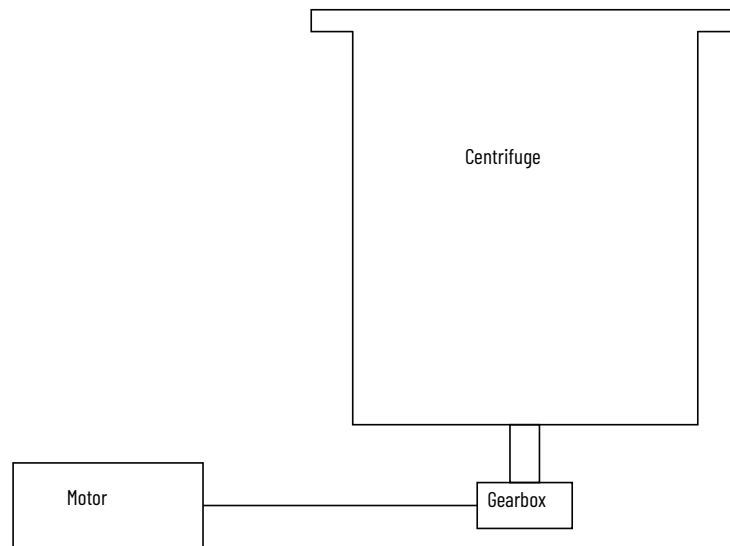
# Centrifuge

## Centrifuge with Current Limit Start and SMB Smart Motor Braking

### Problem

A centrifuge requires a reduced voltage start because of power company restrictions. The high torque during starting damages the gearbox. The customer wants a shorter stop time than the present 15-minute coast-to-rest. The long stop time causes delays in the production process. A Wye-Delta starter with a mechanical brake is currently in use. A zero-speed switch is used to release the brake. The mechanical brake requires frequent maintenance and replacement, which is costly and time consuming. Both the mechanical brake and zero speed switches are worn out and require replacement. [Figure 56](#) illustrates this scenario.

**Figure 56 - Centrifuge with Current Limit Start and SMB Smart Motor Braking**



### Solution

The SMC-50 controller using the SMB option is installed. The controller is set for a 28-second, 340% current limit start, which meets the power company requirements and reduces the starting torque stress to the gearbox. The SMB option allows the centrifuge to stop in approximately one minute. The SMC-50 controller with SMB option does not require additional mounting space or panel wiring. The controller is mounted in a panel that is much smaller than the previous controller. Additionally, the new controller does not require frequent maintenance and can sense zero speed without a feedback device.

You can also use the SMC Flex controller with SMB in this application.

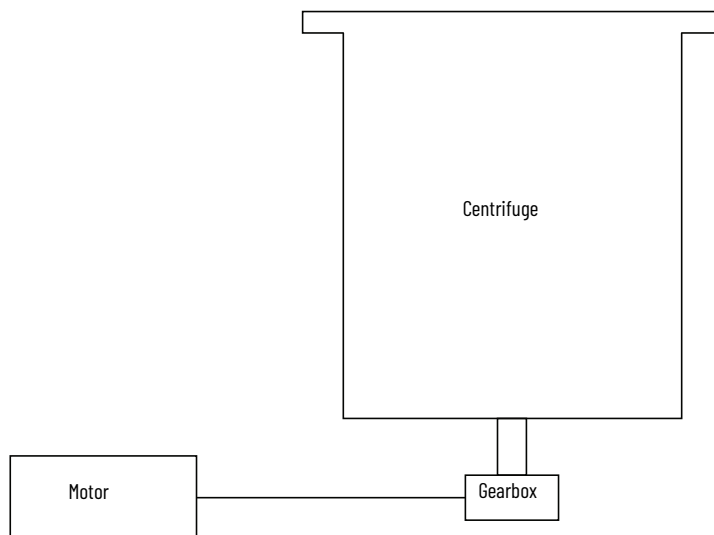
You should not use an SMC-3 controller in this instance because it does not have the braking option.

## Centrifuge with Current Limit Start

### Problem

High starting torque damages the gearbox to a centrifuge. A reduced-voltage starter is desired because this motor is near the end of the distribution line. In addition, the incoming power is unbalanced. The application needs a controller with a circuit breaker combination enclosure. When the enclosure door is open, the controller's circuit boards can not be exposed. [Figure 57](#) illustrates this scenario.

**Figure 57 - Centrifuge with Current Limit Start**



### Solution

The SMC-50 controller is installed. It is programmed for a 27-second, 300% current limit start, which limits the starting torque of the motor and the shock to the gearbox on startup. The Energy Saver feature reduces the voltage to the motor when it runs under a light load. The SMC-50 controller is ordered as a combination controller with a circuit breaker. The SMC-50 controller has no exposed circuit boards, which fulfills the packaging requirements.

The SMC Flex controller could also be used, but it does not offer energy saver mode.

The SMC-3 controller could be used, but it is not recommended because starting methods may need to take longer and this controller has limited adjustability.

# Shock Loads

A load that quickly accelerates or decelerates is called a shock load. Shock loads are typically associated with a lot of vibration, dust, and current spikes because product (such as rock) gets stuck in the hopper. The SMC-50 controller electrically monitors what happens when running; there are current spikes from the application during acceleration and deceleration.

The SMC-50 controller is available in two versions, one version with solid-state control, and the other with an integrated bypass. You will need to apply these versions differently in some applications, including shock load.

## For Controllers with Integrated Bypass Power Structures

The SCRs and the integrated bypass are not fully rated and need more awareness in this type of application. The internal bypass contactor is used after the SCRs of the soft starter have brought the motor up to speed. The algorithm of the soft starter determines when the motor is up to speed and then transitions from SCR control to the bypass contactor. The SMC-3 and the SMC Flex controllers are both hybrid soft starters; they have the power structure of a solid-state starter and an internal bypass contactor. The SMC-50 controller is available with an internal bypass contactor or as a purely solid-state version with no internal bypass contactor.

Attributes of an internal bypass contactor allow the soft starter to operate at a lower temperature with the motor at speed than a fully solid-state starter. A hybrid soft starter is typically smaller than that of fully rated SCRs with no bypass. This is because smaller components are used to start and carry the load current. The SCRs are rated for intermittent duty (AC-53b). The internal bypass contactors are not fully rated (AC-3), because they are not designed to make or break load current.

With an internal bypass soft starter, you only need power and control wiring. You do not need to purchase any additional devices. Internal bypass on a soft starter is appropriate for conveyors, fans, pumps and other applications in which the current and speed do not change while at running speed.

In a rock crushing application, there is a high chance of jamming material in a hopper, causing spikes in current. A soft starter with an internal bypass contactor monitors current and typically drops out of bypass around 120% over the SMC frame rating to protect the contactor and return to SCR control. Once the current returns to normal, the bypass contactor is pulled back in. This cycling on and off could shorten the life of the internal electromechanical contactor.

Not having all protective features of the soft starter during the run mode may be a benefit to keep an application like rock crushing working. In that application, using an external bypass contactor that is fully rated to handle the current surges keeps the contactor pulled in until a stop command is given or an overload is tripped. External overloads may be needed to protect the motor because some soft starters may not be able to read motor data while in external bypass mode.

An external bypass contactor can also be used on a AC-53a-rated fully solid-state SMC-50 controller. Depending on both the soft starter and the mounting and wiring of the bypass contactor, you might not need external overload devices. The mounting features from the soft start to the bypass contactor dictate whether the soft starter will be able to read data (current and voltage readings) while in bypass mode.

In UL/CSA regulated regions, size the bypass contactor according to the motor Hp and FLA. In IEC regulated regions, size the bypass conductor according to the AC-1 rated bypass contactor rating.

The Hp ratings of the AC-3 rated bypass contactor must match the Hp ratings of the SMC soft starter. The short-circuit ratings of the bypass contactor must be similar to those of the SMC soft starter. This is particularly important for the AC-1 rated bypass contactor selection.

## For Controllers with Fully Solid-state Power Structures

The SMC-50 fully solid-state version of the controller lets you keep the machine running when current spikes. The SCRs are fully rated to handle the shock of the current spikes. Fully rated means they have the AC-53a rating, indicating the ability to operate at full duty. Overload and other protection of the motor and the SMC controller still applies.

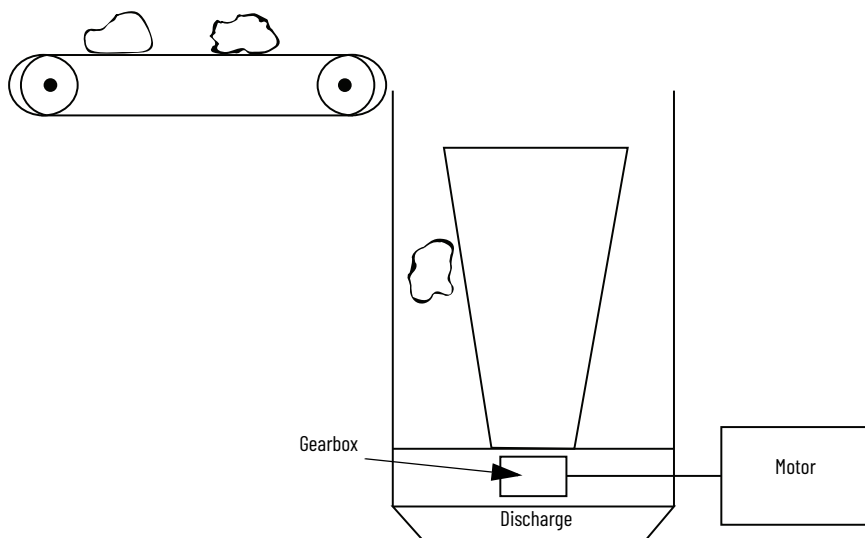
Fully solid-state devices are advantageous in harsh applications when there is a lot of vibration, dust, and dirt. Conformal coated circuit boards on the SMC-50 controller help protect component damage from conductive or corrosive dust in those types of environments. Vibration is not a concern as it would be for an electromechanical bypass contactor, where it could potentially cause contact bounce.

## Rock Crusher with Current Limit and External Bypass Kit

### Problem

Because of the remote location of a rock quarry, the utility power is weak and requires the use of current limit to start the crusher. The 350 Hp motor that drives the crusher has used hybrid soft starters in the past, but had to replace power structures too often because of the current spikes when product is stuck in the hopper. [Figure 58](#) illustrates this scenario.

**Figure 58 - Rock Crusher with Current Limit and External Bypass Kit**



### Solution

The solid-state SMC-50 controller is installed with an external bypass by using the bypass kit. The bypass kit allows the SMC-50 controller to still provide protection to the motor, including current overload, without the need for external protection to the externally connected bypass. When rock spikes the current, the system still runs because the fully AC-3 rated contactor does not drop out unless there is an overload condition that is based on the thermal curve and trip class that is set. The conformal coating of the SMC-50 controller circuit board keeps any dust from interfering with the operation of the soft starter. If the SMC-50 solid-state unit is used, the unit will continue to run until the thermal overload, or other parameter is exceeded. The SMC-50 controller can operate in solid-state mode without an optional external bypass by changing one parameter.

The SMC Flex controller can also perform current limit with the external bypass by setting the bypass parameter to external.

The SMC-3 controller can not run an external bypass.

# High-inertia Loads

Loads that take longer than 30 seconds to start are typically considered to be high-inertia loads. In these applications, the inertia of the load is typically a significant factor in how long the motor will take to start without damaging the equipment. Heat generation is a byproduct of these long starting times. Too much heat can damage the motor, wiring, and other system components.

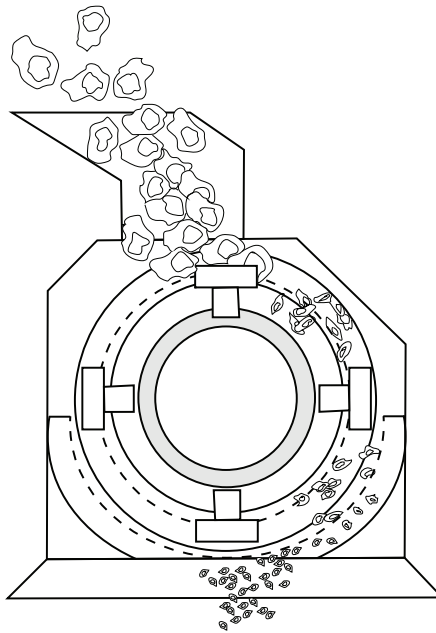
It is important to estimate how long it will take to start the motor for a given process that takes over 30 seconds to start. The SMC estimation tool can assist with this. See [page 159](#).

## Hammer Mill with Current Limit Start

### Problem

A hammer mill with a high inertia load requires a reduced-voltage start because of power company restrictions. High torque on startup causes belt wear. Panel space is very limited. Traditional reduced voltage starters do not fit in the available space. [Figure 59](#) illustrates this scenario.

**Figure 59 - Hammer Mill with Current Limit Start**



### Solution

The SMC-50 controller is installed. It is set for a 23-second, 425% current limit start, which meets the power company's requirement for a reduced-voltage start. A current limit start is selected to quickly break away the high-inertia load and still provide a reduced-voltage start. The belt life is extended because the lower starting torque causes less wear. The Energy Saver feature is used when the mill is running lightly loaded. The compact size of the SMC-50 controller, along with the built-in overload feature, lets the controller fit into the available panel space.

The SMC Flex controller is also a good candidate for this application because it can adjust the start time and current limit. The SMC Flex controller does not have energy saver mode.

The SMC-3 is not appropriate for this application.

## Bark Hogs

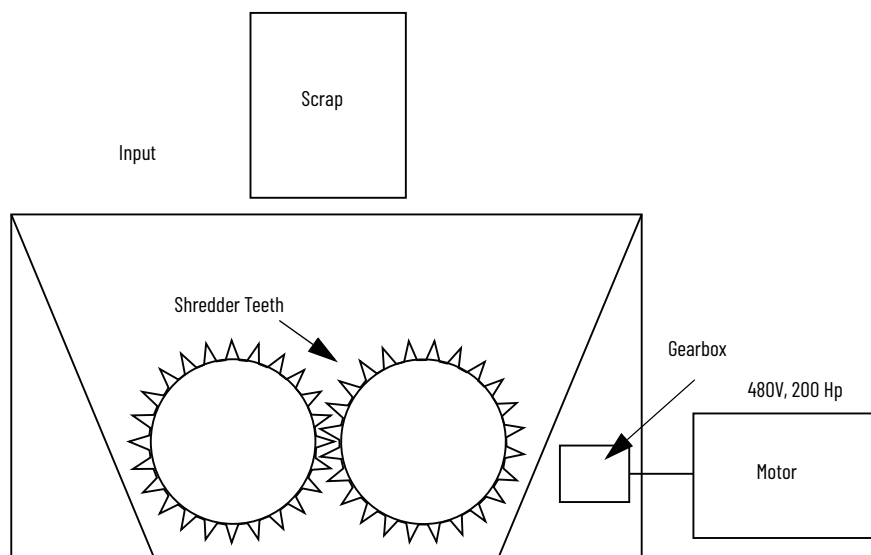
Challenges with bark hogs are very similar to those associated with hammer mill applications.

### Shredder with Soft Start

#### Problem

Because of power company restrictions, a metal shredder requires a reduced-voltage start. Occasionally, a jam occurs during the shredding process. Additionally, the equipment runs unloaded for long periods. An autotransformer-type starter was used previously. [Figure 60](#) illustrates this scenario.

**Figure 60 - Shredder with Soft Start**



#### Solution

The SMC-50 controller is installed, facilitating a reduced-voltage start. The controller also provides jam detection, which helps protect against excessive motor heating when a jam condition occurs. The Energy Saver feature of the SMC-50 controller reduces the voltage to the motor when the motor is running lightly loaded. The built-in overload feature of the controller saves panel space. A jam alarm is also set. This allows the operator to use the slow speed in reverse feature to try and unjam the product without needing to send someone out to clear the jam. Once the jam is cleared, the process continues normally.

The SMC Flex controller is also a good candidate for this application because it has current limit functions. The SMC Flex controller does not have energy saver mode.

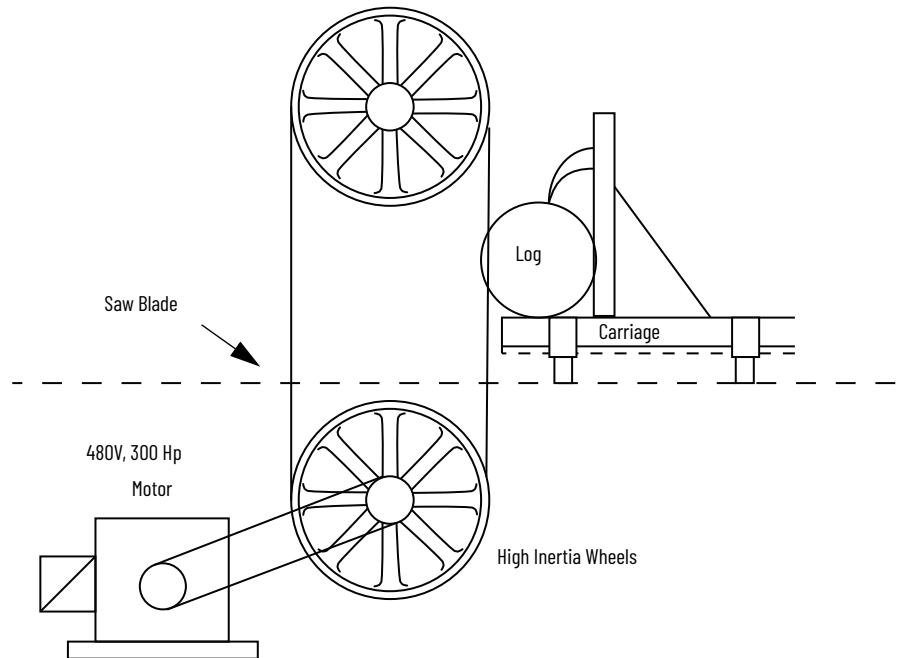
The SMC-3 is not appropriate for this application.

## Bandsaw with Soft Start

### Problem

Because of the remote location of the facility and power distribution limitations, a reduced voltage starter is needed on a bandsaw application. The saw is turned off only during shift changes. When the saw blade becomes dull, the motor draws more current. Therefore, an ammeter is required to meter the application for jam conditions. Single phasing of the motor is also a problem because of distribution limitations. [Figure 61](#) illustrates this scenario.

**Figure 61 - Bandsaw with Soft Start**



### Solution

The SMC-50 controller is installed to provide a reduced-voltage start, which minimizes the starting torque shock to the system. The Energy Saver feature activates whenever the bandsaw runs lightly loaded. The current monitoring and jam detection features of the SMC-50 controller are implemented, saving panel space and the cost of purchasing dedicated monitoring devices. The controller's built-in programmable overload protection eliminates the need for separate overload protection. The SMC-50 controller's diagnostic capabilities can help to detect single phasing and use current imbalance data to shut the motor off accordingly.

The SMC Flex controller does not have energy saver mode but has some alarm and fault imbalance capabilities.

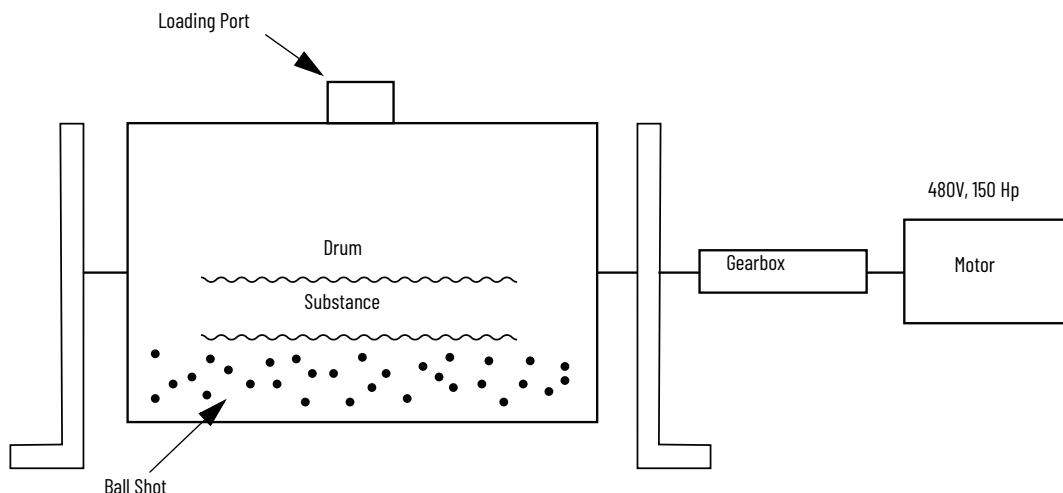
The SMC-3 is not appropriate for this application.

## Ball Mill with Current Limit Start

### Problem

An across-the-line starter starts the motor in a ball mill application. The uncontrolled start damages the gearbox, resulting in maintenance downtime, and the potential for the loss of the product (paint) being mixed. Line failures are a frequent problem. The application requires prestart and running protection and an elapsed time meter to monitor the process time. Communication capability is desired, and panel space is limited. [Figure 62](#) illustrates this scenario.

**Figure 62 - Ball Mill with Current Limit Start**



### Solution

The SMC-50 controller is installed. It is programmed for a 26-second current limit start, which reduces the starting torque and the damage to the gearbox. The metering feature of the SMC-50 controller contains an elapsed-time meter, which could monitor the process time of the ball mill. The optional communications capabilities of the controller allow it to communicate the process time to the PLC, which could remotely stop the ball mill. The line diagnostics required in the application are standard in the SMC-50 controller, and the built-in overload protection saves panel space.

The SMC Flex controller would also do well in this application.

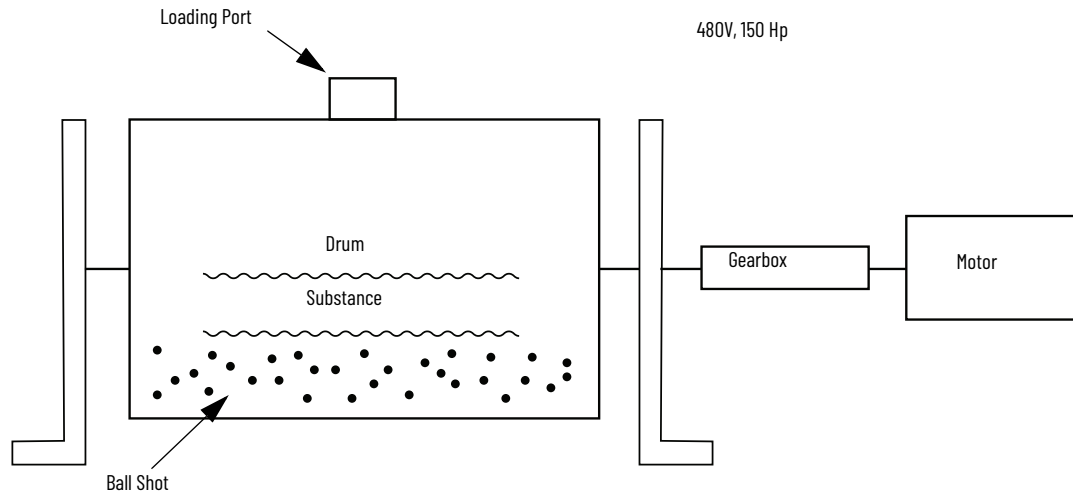
The SMC-3 controller is not appropriate for this application because of its limited diagnostics and lack of communication capability.

## Ball Mill Soft Start with Accu-Stop

### Problem

An across-the-line starter is used in a ball mill application. An electronic braking package stops the mill. The mill has to be jogged excessively to position the port for loading. The starting torque surges are causing gearbox problems. The application requires a cost-effective method to position the mill and control the stopping. [Figure 63](#) illustrates this scenario.

**Figure 63 - Ball Mill with Accu-Stop**



### Solution

The SMC-50 controller is installed on the mill. The Accu-Stop feature allows the drum to brake down to 15% slow speed and rotate the loading port into position before stopping. The SMC-50 requires less space and power wiring than the across-the-line starter and braking package.

The SMC Flex controller has fixed slow speed capabilities along with the ability to use Accu-Stop.

The SMC-3 controller does not have slow speed capabilities and is therefore not appropriate for this application.

## Smart Motor Braking

The forest products industry is one of the most dangerous industrial environments. Very sharp and fast-turning saw blades and moving products are common. Many of these saw blades are large and have a lot of mass. It is not uncommon for it to take 15 to 30 minutes or longer for the blade to coast to a complete stop.

Smart Motor Braking (SMB) is an effective way to stop a motor much faster than coast-to-rest methods. The average time to stop using SMB is 1.5...4 times the motor starting time. Stopping a large mass faster than coast uses more some energy, so you will need to consider the following points.

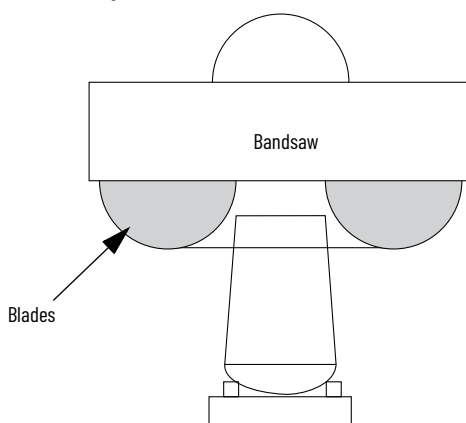
1. Braking is hard on the motor windings because more current is used to stop a load that generally takes many minutes to stop on its own.
2. You can hear noise, such as moans and groans of all kinds, during the braking process.
3. SMB produces some harmonic distortion during stopping, but the levels are somewhat insignificant as compared to the fundamental (typically < 10%) frequency.
4. SMB is not intended to be used as an emergency stop. Many factors go into using a safety function. The purpose of SMB is for routine use of stopping a mass for maintenance or other similar application.
5. Braking is hard on motors, but cannot create more energy than the motor demands.
6. Settings above 300% FLA can play havoc with power systems and cause nuisance overload trips or other issues.
7. A solid power supply is critical for consistent braking. Generators should be sized for minimum 3x motor FLA to work effectively in braking.

## Bandsaw with Soft Start and SMB Option

### Problem

A bandsaw application requires a reduced-voltage start because of power company restrictions. A brake package is required to reduce the stopping time of the saw. An autotransformer was previously used to start the saw. The saw is now stopped by sawing down. Sawing down is a process of running logs through the saw after the motor has been de-energized, which results in large amount of scrap lumber. Other stopping methods using dedicated braking devices have been investigated, but were unacceptable because of overly complex installation. Other stopping methods require panel space for the brake module, brake contactors and timers, and they offer no zero-speed detection. [Figure 64](#) illustrates this scenario.

**Figure 64 - Bandsaw with Soft Start and SMB Option**



### Solution

The SMC-50 controller installed and it is configured to use the SMB option. The controller provides the reduced-voltage start needed to meet the power company restrictions. The SMB operation does not require DC braking contactors. The starting and stopping control is furnished in a single modular design, providing ease of installation.

The SMC Flex controller using the SMB option control module is also a possible solution.

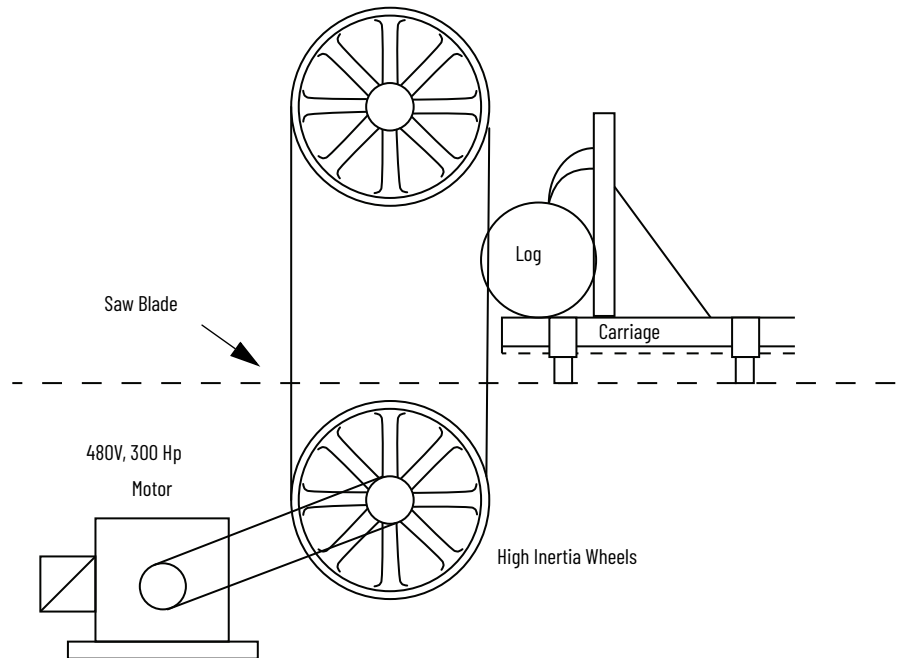
The SMC-3 controller is not appropriate for this application.

## Bandsaw with Soft Start and Slow Speed with SMB

### Problem

To change the saw blade, a bandsaw requires 25 minutes to coast to a stop. It requires a braking package to reduce the stopping time. Other methods using dedicated braking devices were investigated but were unacceptable because of overly complex installation. These methods require additional panel space for the brake module, brake contactors, and timers. Because of potential alignment problems, it is dangerous to bring the saw up to full speed after installing a new blade. [Figure 65](#) illustrates this scenario.

**Figure 65 - Bandsaw with Soft Start and slow speed with SMB**



### Solution

The SMC-50 controller, which has a selectable slow speed with braking option as standard, is installed. It provides a user-selected slow speed, allowing the user to inspect the saw blade tracking before the motor is brought to full speed. The braking option of the SMC-50 controller does not require additional panel space or DC braking contactors. Starting and stopping control is furnished in a single modular unit, providing ease of installation.

The SMC Flex controller using the SMB option control module is also a possible solution, but with fixed slow speed operation.

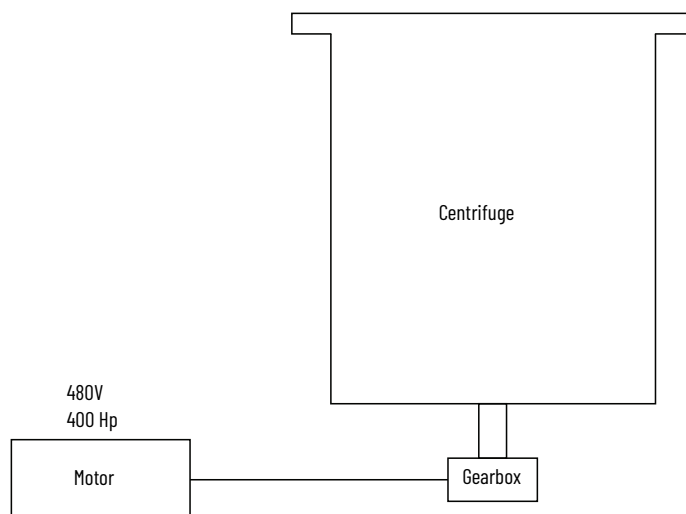
The SMC-3 controller is not appropriate for this application.

## Centrifuge with Current Limit Start and SMB

### Problem

A centrifuge requires a reduced-voltage start because of power company restrictions. The high torque during starting is damaging the gearbox. A shorter stopping time than the present 15 minute coast-to rest is desired. The long stop time causes delays in the production process. A Wye-Delta starter with a mechanical brake is currently in use. A zero-speed switch is used to release the brake. The mechanical brake requires frequent maintenance and replacement, which is costly and time consuming. Both the mechanical brake and zero-speed switches are worn out and require replacement. [Figure 66](#) illustrates this scenario.

**Figure 66 - Centrifuge with Current Limit Start and SMB**



### Solution

The SMC-50 controller is installed and wired inside-the-delta to the wye-delta motor and programmed to smart motor braking. The controller is set for a 28-second, 340% current limit start, meeting the power company requirements and reducing the starting torque stress to the gearbox. SMB allows the centrifuge to stop in approximately 1 minute. The SMC-50 controller with SMB programmed does not require additional mounting space or panel wiring. The controller is mounted in a panel that is considerably smaller than the previous controller. As an added benefit, the controller does not require frequent maintenance and can sense zero speed without using a feedback device.

The SMC Flex controller is also a good fit for this application.

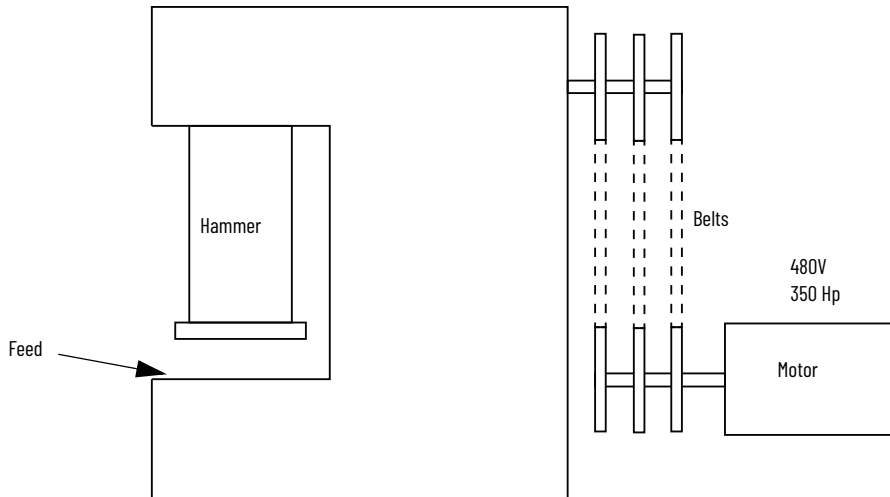
The SMC-3 controller is not appropriate for this application because of the extended ramp time and its lack of SMB capability.

## Hammermill with Current Limit Start and SMB

### Problem

A hammermill requires a reduced-voltage start because of power company restrictions. A stopping time less than the present 5 minute coast-to-rest is desired. To save panel space, the customer wants to incorporate both starting and stopping control in the same device. [Figure 67](#) illustrates this scenario.

**Figure 67 - Hammermill with Current Limit Start and SMB**



### Solution

The SMC-50 controller configured with SMB is installed. A 23-second, 450% current limit acceleration is programmed, meeting the power company requirements and reducing the mechanical stress on the belts during startup. The braking function is accomplished without additional power wiring, panel space, or contactors. The controller detects zero speed without additional sensors or timers. The current limit start, braking, and overload protection are all contained in the same modular package.

The SMC Flex controller is also a good fit for this application.

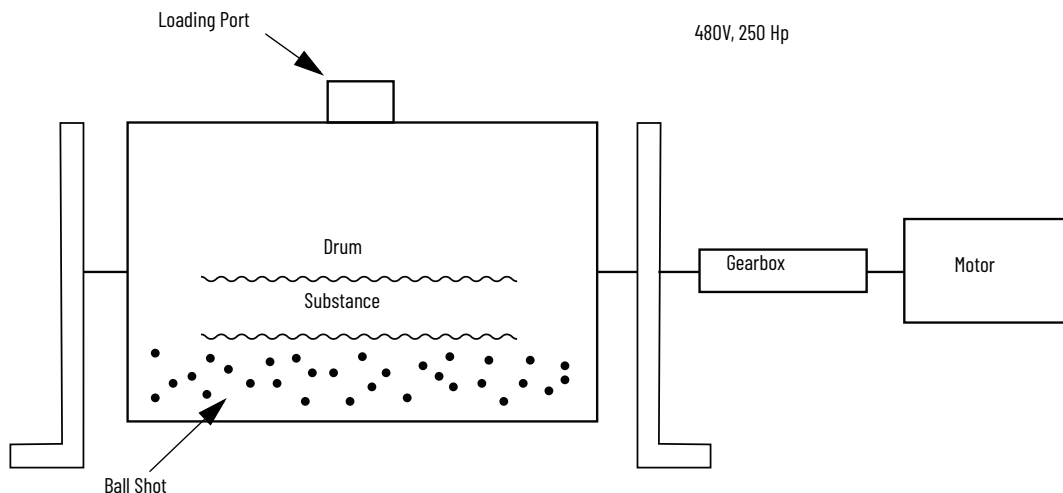
The SMC-3 controller is not appropriate for this application because of its lack of SMB capability.

## Ball Mill with Soft Start and SMB

### Problem

Across-the-line starts are damaging the gearbox on a ball mill, resulting in extra maintenance time to keep the mill operating. Due to the high inertia of the load, the coast-to-stop time is approximately five minutes. The application requires a soft start and braking package in a single controller because panel space is at a premium. [Figure 68](#) illustrates this scenario.

**Figure 68 - Ball Mill with Soft Start and SMB**



### Solution

The SMC-50 controller is installed on the ball mill and set to use the SMB setting. The soft start reduces the shock to the gearbox on startup. The SMB option reduces the stopping time and increases the productivity of the mill. The SMC-50 controller is installed in the same space in which the previous contactor had been mounted. No additional power wiring is required.

The SMC Flex controller is also a good fit for this application.

The SMC-3 controller is not appropriate for this application because of its lack of SMB capability.

# Compressor

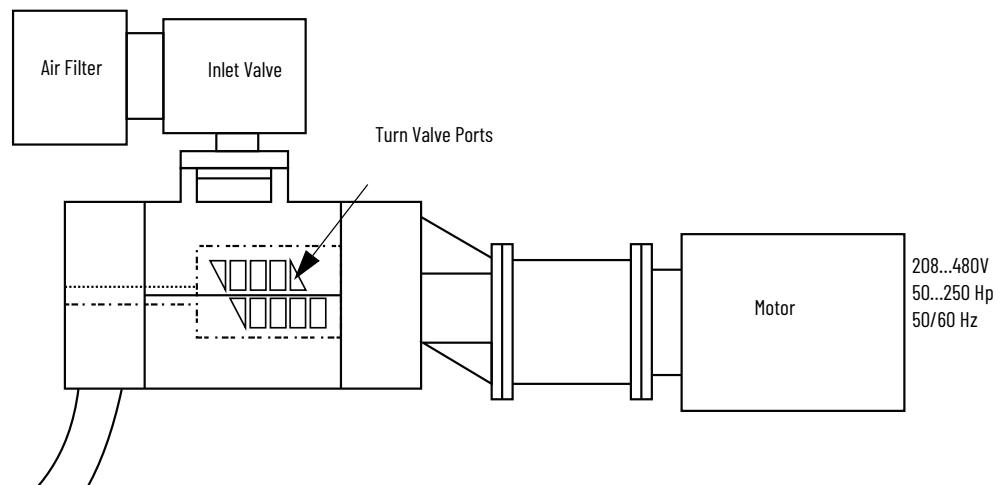
Compressor applications vary depending on the types of motors and loading when starting. Air and ammonia compressors are examples of good fits for a soft starter that runs efficiently at 100% voltage while using a voltage ramp, such as soft start or linear acceleration mode, during the starting process.

## Compressor with Soft Start

### Problem

A compressor OEM exports its equipment into foreign markets. Based on the final destination of the product, the compressors have to be able to meet many different voltage and frequency requirements. Due to power company requirements and mechanical stress on the compressor, reduced voltage starting is required. This makes ordering and stocking spare parts difficult. Customers want to save energy because this is typically one of the larger motors in the plant and it frequently runs lightly loaded. Because of the size of the motor, the incoming line voltage unbalance causes excessive heating in the motor. [Figure 69](#) illustrates this scenario.

**Figure 69 - Compressor with Soft Start**



### Solution

The SMC-50 controller is installed and set for an 18-second Soft Start, which reduces the voltage to the motor during starting and meets the power company requirements. Reducing the voltage reduces the starting torque, minimizing the shock to the compressor. Panel space is saved because the SMC-50 controller has a built-in overload feature. The Phase Rebalance feature automatically adjusts the voltage output to balance the three-phase currents drawn by the motor. The Energy Saver feature optimizes the voltage to the motor while it is running unloaded.

Neither the SMC-Flex or the SMC-3 controller have phase rebalance or have energy saver, and are therefore not suitable for this application.

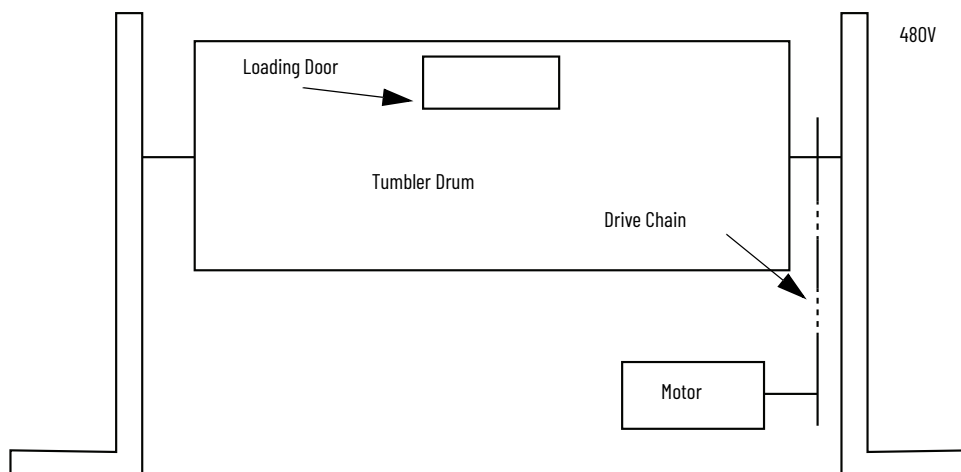
# Tumbler

## Tumbler with Linear Acceleration and Slow Speed

### Problem

A tumbler used in a nail finishing process breaks the drive chain because of uncontrolled acceleration from the across-the-line starting. A reversing starter is needed to position the drum to the top position for loading the product. Because of the lack of controlled acceleration, numerous jogs are used to position the drum. Stopping time is not a concern in this application. When in maintenance mode, the tumble starts unloaded, reaching full speed very quickly. A second starting ramp, for unloaded conditions, is desired. Single phasing of the motor that causes premature motor failure is a frequent problem. [Figure 70](#) illustrates this scenario.

**Figure 70 - Tumbler with Linear Acceleration and Slow Speed**



### Solution

The SMC-50 is installed and linear acceleration is used to provide a controlled start when the tumbler runs both loaded and unloaded. Because the linear acceleration is not as load dependent as other starting methods, there is no need to have two different start profiles. The implementation of the slow speed function enables forward and reverse  $\pm 15\%$  full speed. This function enables the drum to move forward and reverse directions at slow speed without using reversing contactors. Along with the starting, stopping, and slow speed features, the SMC-50 controller also has fault indicators for a 'line fault' that helps prevent the motor from restarting if it is detected.

The SMC Flex controller has fixed slow speed but does not have energy saver mode.

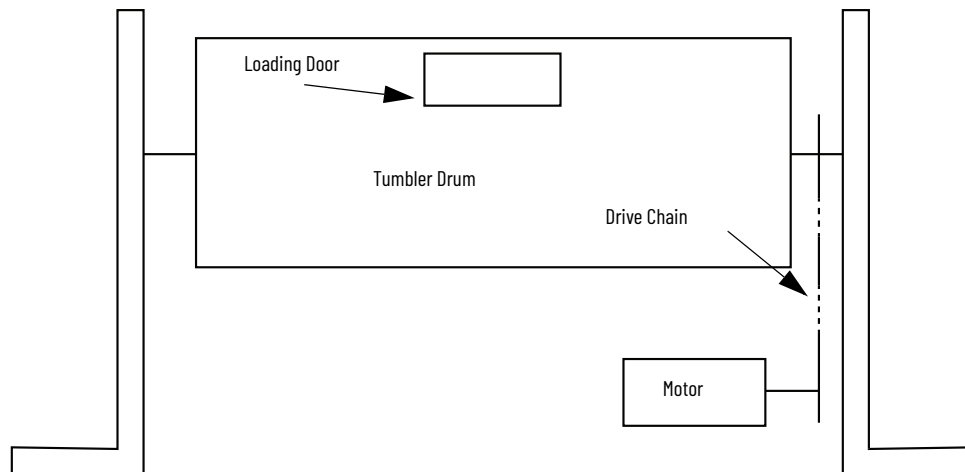
The SMC-3 controller is not appropriate for this application.

## Tumbler with Soft Start and SMB

### Problem

A tumbler used in the de-burring process breaks the drive chain because of uncontrolled acceleration from the across-the-line starting. To increase production on the drum, the coasting time on stop must be reduced. Previous solutions used a separate soft start package plus a motor brake, which required additional panel space and power wiring. The new solution needs a small enclosure size and simplified power wiring to reduce the cost of the controls. Because a PLC is controlling several other processes in the facility, communication capabilities are desired. [Figure 71](#) illustrates this scenario.

**Figure 71 - Tumbler with Soft Start and SMB**



### Solution

The SMC-50 controller is installed and set to use the SMB setting. The Soft Start feature provides a smooth acceleration of the drive chain, which reduces downtime. The controlled acceleration simplifies positioning for loading/unloading. The SMB feature allows the operators to stop the system quickly, improving productivity. The SMB feature does not require additional panel space or wiring. The built-in overload protection on the SMC-50 controller eliminates the need to mount an external overload relay in the enclosure, saving more panel space. The communication option of the SMC-50 controller allows remote starting and stopping of the process from a PLC using multiple communication protocols.

You can also use the SMC Flex controller with the SMB control module for this application. A communication module can also be mounted on board.

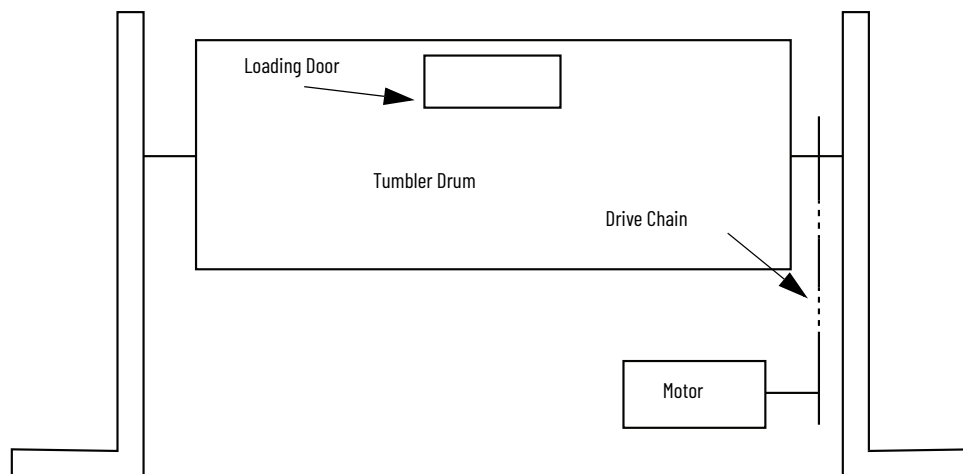
The SMC-3 controller is not appropriate for this application because it lacks communication capabilities and SMB functionality.

## Tumbler with Accu-Stop Function

### Problem

A tumbler drum used in a hide processing plant requires a controlled acceleration to help prevent the drive chain from breaking. The customer also wants to minimize the loading and unloading time. The drum coasts for a long period of time before stopping for unloading. A soft starter with electronic brake is currently being used. This method requires excessive jogging for loading and unloading, which results in extended production times. It also requires additional panel space and wiring for the brake. Consequently, higher installation costs are incurred. [Figure 72](#) illustrates this scenario.

**Figure 72 - Tumbler with Accu-Stop Function**



### Solution

The SMC-50 controller using the Accu-Stop feature is installed. This allows the drum to be positioned for loading using the Preset Slow Speed. For unloading, the drum is rotated at programmed Slow Speed and then accurately stopped. This increases the productivity of the loading/unloading cycle. The SMC-50 controller requires no additional panel space or power wiring, facilitating a smooth retrofit and reducing the installation costs.

The SMC Flex controller also uses the Accu-Stop function with fixed slow speed settings and can be applied in this scenario.

The SMC-3 controller is not appropriate for this application.

## Slow Speed

The SMC Flex controller uses cycle skipping, which is typical of many soft starts where the current pulses are controlled by the silicon-controlled rectifier (SCR) and fired for portions of every few line cycles, allowing for slow speed control. Torque during slow speed with this method is limited.

Another way to control slow speed is by using an SMC-50 soft starter. The SMC-50 soft starter has an adjustable forward and reverse capability from 1...15% of full speed. In other words, if the motor is running at full speed at 1800 rpm, the SMC-50 soft starter can be selected to run from -270...+270 rpm.

Instead of skipping cycles and then firing the thyristors (SCRs), the magnitude and duration of the current pulse is controlled approximately every cycle. The produced pseudo sine wave provides more stable control and programmable slow speed. A patented algorithm allows torque to be more controlled and developed in this method than in the cycle skipping method.

Unlike the typical soft starting methods in which percent resultant torque is approximately the square of the voltage that is applied, the torque at slow speed is higher. The slow speed resultant torque is higher due to firing approximately every cycle. This method provides a stable method of slowly rotating a motor shaft forward or in reverse without using a reversing contactor. The firing consistency translates to less wear and tear on windings.

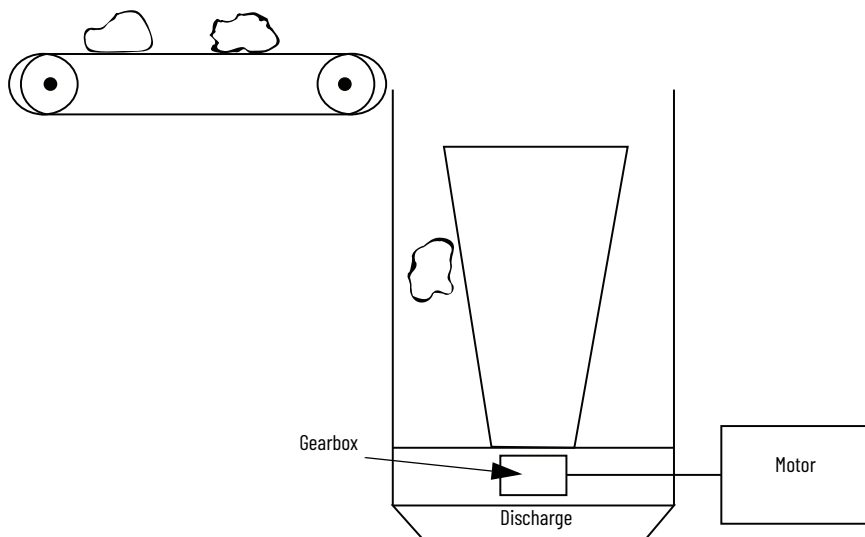
Typically, for soft starters, the longer the time in slow speed, the more current is being drawn from the motor, and the hotter the SCRs get. Running slow speed on soft starters can only be done for short periods of time due to heat buildup in the motor and the SCRs.

## Rock Crusher with Soft Start and Reverse Slow Speed

### Problem

Because of the remote location of a rock quarry, the power company requires a reduced-voltage start on all motors over 150 Hp. The starting current on these large motors causes severe voltage dips when it strains the capacity of the power system. When the rock crusher is overloaded, the current draw by the Wye-Delta-connected motor increases, which requires current monitoring capabilities within the starter. Because the conveyor that feeds the rock crusher is controlled by a PLC, communication between the starter and a PLC is necessary. When the rock crusher runs, it occasionally stalls or jams. [Figure 73](#) illustrates this scenario.

**Figure 73 - Rock Crusher with Soft Start and Reverse Slow Speed**



### Solution

The solid-state SMC-50 controller is installed, meeting the power company requirements for a reduced-voltage start. The motor is wired inside-the-delta, which saves panel space and lets you use the same wires to the motor. The metering capabilities of the SMC-50 controller allow the motor current draw to be monitored. With the optional communication capabilities, the motor current is communicated to the PLC. When the motor current reaches a specified limit, the conveyor that feeds the rock crusher can be slowed by configured alarms on the SMC-50 controller. By slowing the conveyor, a jam condition in the rock crusher is avoided. The stall and jam detection capabilities of the SMC-50 controller shut off the motor when a stall or jam condition occurs. By using the jam alarm, reverse slow speed is also used to change the rotation direction to unplug the jam in the crusher.

The SMC Flex controller can also be used inside the delta and uses one of two fixed slow speeds forward, or two in reverse.

The SMC-3 controller does not have slow speed capabilities.

## Resistive Loads

Solid-state contactors have been used for a long time, typically at zero cross, meaning that they turn on and off at zero cross for resistive load applications. You need an external control method to control the solid-state contactors, in order to control the resistive heating. Zero cross typically cycles on and off for so many cycles to achieve the desired temperature. The SMC-50 controller can directly control three-phase connected resistive loads by using SCR phase angle firing, which uses a PLC via communication, analog input, or DeviceLogix. By using a reference source, the controller can have the output remain on from 1...100% full voltage until commanded off. You can change the value of the reference source while the SMC-50 controller is in a run state. The output voltage varies in response to the reference source (Output V Ref, Analog Input or DeviceLogix™).



You cannot use the resistive load feature on motor loads.

In resistive control mode, the tuning process still takes place, but is different than that of being connected to a motor. Current limit levels are still active.

When you use the resistive load feature, the output voltage to the resistive load is similar to the Full Voltage starting mode when using Output V Ref. Any type of ramping created is accomplished by using logic code, analog signal, or DeviceLogix.

Because there is a wide variety of possible resistive loads, the most universal control method is phase angle control, which is the method used by the SMC-50 controller. High hot-to-cold ratios of heaters are well suited for phase angle firing. You can use the SMC-50 controller to dry out heating resistors before full working voltage is applied, helping to prevent damage to the element.

When you use the SMC-50 controller on heater loads, it provides all of the running protections that are available with induction motors. Unlike using a standard solid-state contactor that needs external overload and protection, protection is built into the SMC-50 controller in a compact package.

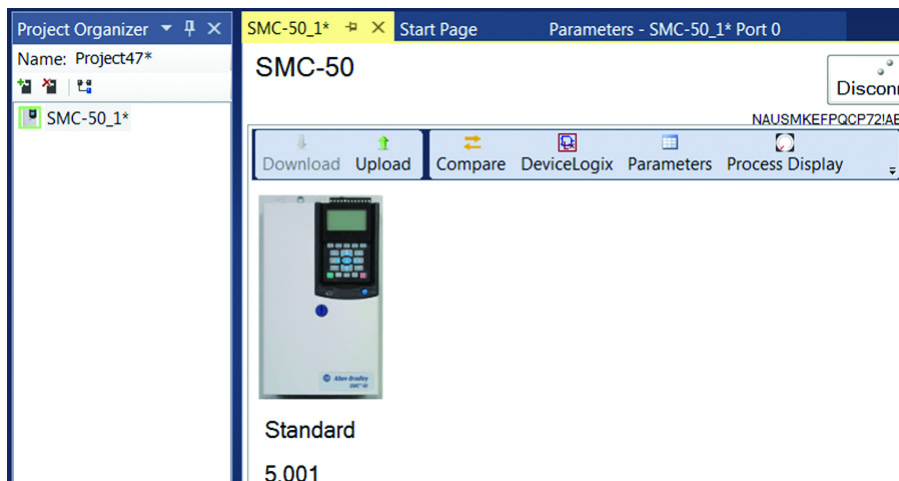


Using this mode with the integrated bypass version is not recommended as unit will quickly trip on an SCR overtemperature fault.

## Programming

You can have direct control from most analog signals via the 150-SM3 optional analog card. You can control the SMC-50 controller with or without the aid of a programmable logic controller (PLC). For example, you can use the free Connected Components Workbench Software or a 20-HIM-A6 module.

**Figure 74 - Connected Components Workbench Software and 20-HIM-A6 Interface Module**



You are required to set the following parameters.

- Parameter 46, Line Voltage
  - Set this value to the actual voltage of the line, not in general terms. For example, if the voltage measures 460V, enter 460V, not 480V. The accuracy of the voltage output (parameter 349) depends on the value that you enter.
- Parameter 53, Current Limit
  - This parameter limits the current to a percentage of the value of parameter 78. For example, if parameter 78 is set to 150 A, and parameter 53 is set to 100%, the output (parameter 349) of the SMC-50 controller is limited to 150 A.
- Parameter 78, Motor FLC
  - Set this value to line current
- Parameter 347, Load Type
  - Set this value to resistive load

|     |              |           |
|-----|--------------|-----------|
| 346 | DLX Status   | Disable   |
| 347 | Load Type    | Motor     |
| 348 | Ref Source   | Motor     |
| 349 | Output V Ref | Resistive |
| 350 | Slow Speed 2 | 10        |

- Parameter 348 Reference Source
  - Use this parameter to select the reference source: Output V Ref, Analog Input (Port 7 – 9, Input 1 or 2), or DeviceLogix Output 1 and 2.

|     |                |              |
|-----|----------------|--------------|
| 340 | DLX DL Input 4 | Output V Ref |
| 341 | DLX DL Input 5 | P7 In1       |
| 342 | DLX DL Input 6 | P7 In2       |
| 343 | DLX Output 1   | P8 In1       |
| 344 | DLX Output 2   | P8 In2       |
| 345 | DLX Command    | P9 In1       |
| 346 | DLX Status     | P9 In2       |
| 347 | Load Type      | DLX Output 1 |
| 348 | Ref Source     | DLX Output 2 |
| 349 | Output V Ref   | 1            |

- Parameter 349 Output Voltage Reference
  - This parameter allows direct control of output if the output is controlled via communication.
- Parameter 148 Logic Mask
  - Logic Mask enables control (start – stop function) via communication port or HIM to control the SMC-50 controller.

| Parameter |                | Bit Number               | DPI Assignment                               | Access | Units [default]                                               |
|-----------|----------------|--------------------------|----------------------------------------------|--------|---------------------------------------------------------------|
| Number    | Name           |                          |                                              |        |                                                               |
| 148       | Logic Mask     | 0 - NA<br>1              | Port 0 - NA<br>Port 1                        | R/W    | Bit = 0 [disabled]<br>Bit = 1 enabled                         |
| 149       | Logic Mask Act | 2<br>3<br>4<br>5 - 15 NA | Port 2<br>Port 3<br>Port 4<br>Port 5 - 15 NA | R      | Bit = 0 [disabled]<br>Bit = 1 enabled<br>[Follows Logic Mask] |

## Resistive Control Via Communication

You can have direct control from a PLC to the SMC-50 controller via communication such as Ethernet, by setting parameter 348, Reference Source, to Output V Ref and parameter 349 to the value that you want (1...100%). Whatever is sent from the PLC program to the SMC-50 controller will be put on the output of the SMC. You need to select the logic mask for DPI port 4 for control.

### EXAMPLE:

- Parameter 46: line voltage
- Parameter 78: motor FLC set to line current
- Parameter 148: logic mask set to port 4 (bit 4)
- Parameter 347: load type set to RESISTIVE
- Parameter 348: reference source set to OUTPUT V REF
- Parameter 349: output voltage reference programmed to 50%

|     |              |            |   |    |              |   |     |
|-----|--------------|------------|---|----|--------------|---|-----|
| 347 | Load Type    | Resistive  | ▼ | 1  | Motor        | 0 | 1   |
| 348 | Ref Source   | Output ... | ▼ | 0  | Output V Ref | 0 | 8   |
| 349 | Output V Ref | 50         | % | 50 | 1            | 1 | 100 |

- The output of the SMC-50 controller is 50% voltage (entered in parameter 46) until you change it or turn it off.

In this scenario, a PLC command on parameter 349 dictates the controller output. In the PLC rack, a thermocouple or RTD card feeds data to the PLC processor, which scales that information to the SMC-50 controller. Using a PID loop in the PLC controller program allows you to control temperature changes. The output is 1...100% output for this application. The PLC can also use the data from the PLC and directly control the output parameter 349, replicating the result you get from using a 150-SM3 analog card.

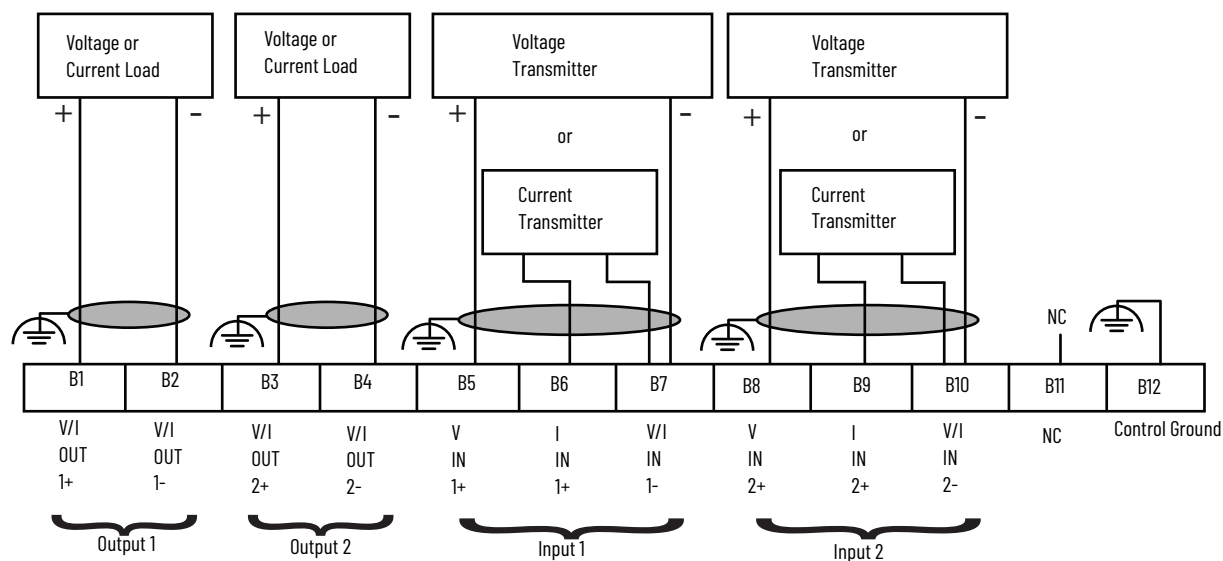
[Table 132](#) lists the communication protocols and corresponding option cards that are available.

**Table 132 - Communication Card Selection by Protocol Type**

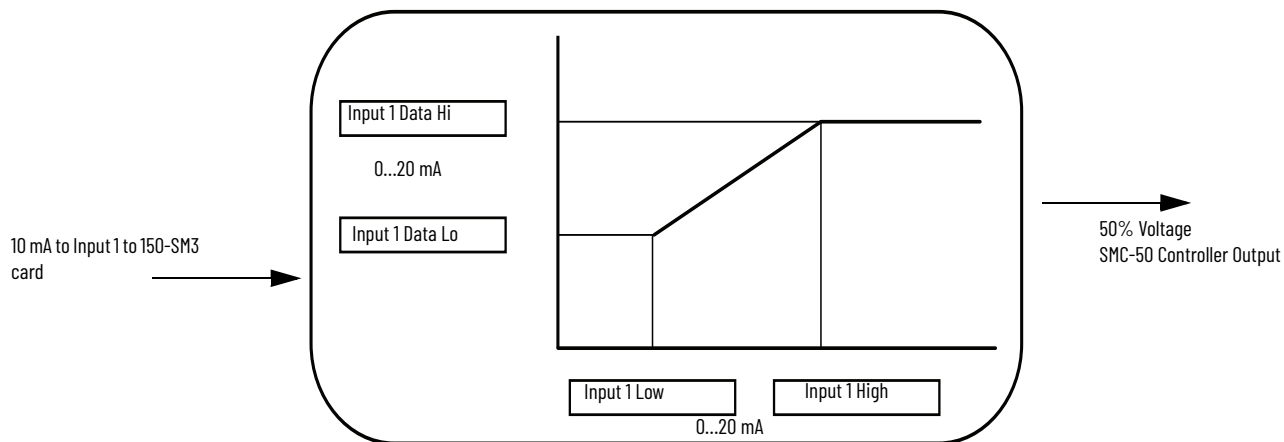
| Protocol Type         | Cat. No.   |
|-----------------------|------------|
| DeviceNet             | 20-COMM-D  |
| ControlNet            | 20-COMM-C  |
| PROFIBUS®             | 20-COMM-P  |
| RS-485                | 20-COMM-S  |
| InterBus              | 20-COMM-I  |
| EtherNet/IP           | 20-COMM-E  |
| Dual Port EtherNet/IP | 20-COMM-ER |
| RS485 HVAC            | 20-COMM-H  |
| ControlNet (Fiber)    | 20-COMM-Q  |
| CANopen               | 20-COMM-K  |

## Analog Control

You can have direct analog control when you use the optional 150-SM3 analog card. The 150-SM3 card offers selectability of  $\pm 10\text{V}$ ,  $0\text{...}10\text{V}$ ,  $0\text{...}5\text{V}$ ,  $0\text{...}20\text{mA}$ , and  $4\text{...}20\text{mA}$ . Once you have programmed the controller, it can produce the range of 1...100% output. You can place the analog card in one of three ports (7, 8 or 9) on the SMC-50 controller. [Figure 75](#) illustrates the analog input wiring.

**Figure 75 - Analog Input Wiring****Example:**

- Parameter 347: load type set to RESISTIVE
- Parameter 348: reference source set to P7 In1 (Port 7, input 1)
- Program the 150-SM3 card.
- Select X(Port).7 input range to 0...20 mA
- The 150-SM3 card reads 10 mA
- The output of the SMC-50 controller is 50% voltage (entered in parameter 46) until you change it or turn it off.

**Figure 76 - Analog Input Scaling**

## DeviceLogix

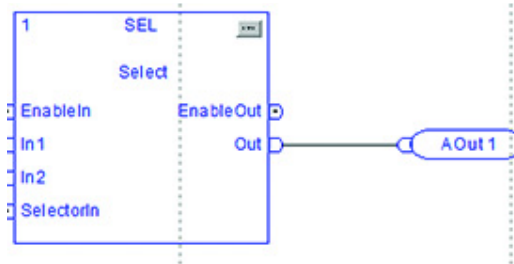
You can also use DeviceLogix with the SMC-50 controller on resistive loads. You can use one of two outputs on the DeviceLogix communication card to control the output of the SMC-50 controller. You can only program the DeviceLogix communication card on the SMC-50 controller within the free Connected Components Workbench Software. Resistive load functionality is only available on FRN 5.001 and later.

**Example:**

- Parameter 347: load type set to RESISTIVE
- Parameter 348: reference source set to DLX Output 1

|     |            |              |   |              |   |   |
|-----|------------|--------------|---|--------------|---|---|
| 347 | Load Type  | Resistive    | 1 | Motor        | 0 | 1 |
| 348 | Ref Source | DLX Output 1 | 0 | Output V Ref | 0 | 8 |

- Create the DeviceLogix program with A Out 1 (DeviceLogix Analog Out 1)



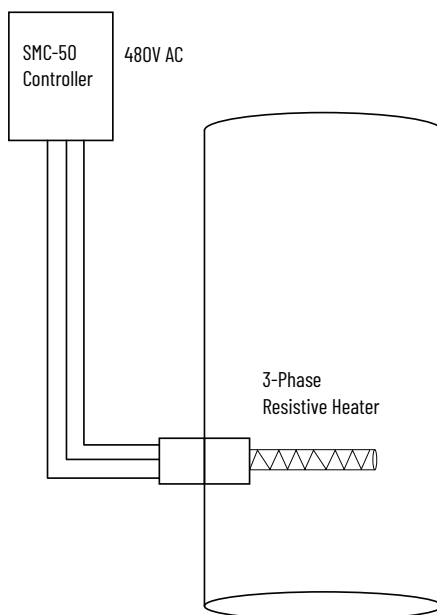
- The output of the SMC-50 controller is set from 1...100% of the value of A Out 1.

## Tank Heater with Resistive Load

### Problem

A customer is burning up standard contactors while cycling power on and off to achieve heater control for a tank of water that will be used to mix with chemicals at a certain temperature. Solid-state contactors are the best fit for high duty cycle. However the customer also wants to have communication and overload protection. The customer is planning to use a controller reading thermocouples and feeding information to an analog card on a ControlLogix rack. That signal will be used to turn on and off contactors through PLC outputs. This process leaves unaddressed concerns about duty cycle and overshoot (hysteresis), and so it requires more programming. The application also requires that no excessive current is applied to the cabling. [Figure 77](#) illustrates this scenario.

**Figure 77 – Tank Heater with Resistive Load**



### Solution

The SMC-50 replaces all standard and solid-state contactors in the application. The SMC-50 controller takes the feedback that the thermocouples send to the signal conditioner and sends it to the 150-SM3 analog card. This method allows direct control of the SMC-50 controller output to the resistive heaters by simply programming the reference source. By utilizing the current limit feature, the current is not allowed to exceed the level that is prescribed by the customer. The SMC-50 controller output increases or decreases depending on the input signal, without the need to turn the signal on and off.

# Sizing and Selection Tools

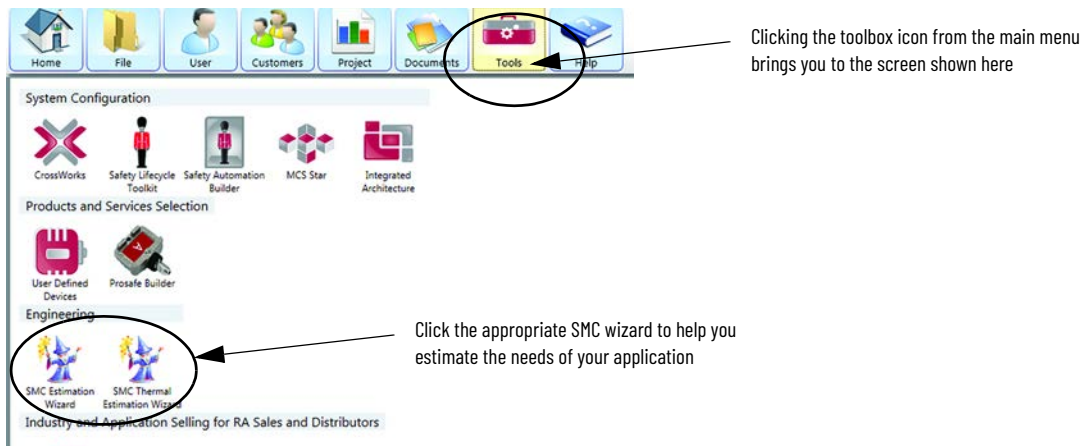
Properly sizing an SMC controller provides the best chance of starting a motor in the smoothest and most efficient way possible. Both thermal and estimation wizards are available to help assist you with this process.

Several types of applications need closer scrutiny to confirm that you have sized your controller properly.

- Starts longer than 30 seconds
- High inertia loads
- Frequent starts in a short period of time (high duty cycle)
- Predicting start and stop times of an application
- Elevation above 2000 meters
- High ambient temperature

You can access the SMC Estimation Wizard and SMC Thermal Estimation Wizard at [rok.auto/pcdc](http://rok.auto/pcdc). You can also access these wizards from within ProposalWorks software by clicking the toolbox icon, as shown in [Figure 78](#). ProposalWorks software is available from [rok.auto/systemtools](http://rok.auto/systemtools).

**Figure 78 - SMC Controller Wizards in ProposalWorks Software**



## Thermal Wizard

The thermal wizard is designed to help you to estimate the thermal capacity of the SCRs on the SMC controller for the estimated start, stop, and off time. Together, these times comprise the duty cycle.

The SMC Thermal Wizard is intended to provide an estimation of the applicability of the SMC products to a given set of operating requirements. The results of this tool are intended to be used as reference only.

To find out whether an SMC controller can perform the task from a thermal perspective, or if you need the next size up, you must set the following tool parameters.

- Unit Rating
  - The rating refers to the maximum current rating for the device, connected as a line controller. For example a 150-F85NBD is capable of 85 A.
- Starting Current
  - This determines the level of current that is allowed during starting. You can use a nominal value of 300 % or 350 % for modeling purposes for most applications.
- Starting Time
  - The starting time represents how long it takes for the motor to reach full speed. This is not always the same as the start time, because the motor getting to full speed is heavily dependent on the load.
- Motor Full Load Amps (FLA)
  - The value in this field is the motor's full load current. You can find this value on the motor nameplate.
- Typical Running Time
  - This represents the actual running time (time the motor runs at full speed without starting or stopping). If normal operation requires many starts and stops, set this time to represent the worst-case condition (shortest time).
- Typical Off Time
  - This represents the actual off time for the application. If normal operation requires many starts and stops, this time represents the worst-case condition (shortest time). In some cases where there is a high duty cycle, you can set this time to 1 second.
- Ambient Temperature
  - The standard maximum temperature is 50 °C for SMC-3 and SMC Flex controllers, and 40 °C for SMC-50 controllers. The thermal wizard can estimate derating up to 60 °C for the SMC-3 and SMC Flex controllers and up to 65 °C for the SMC-50 controller.
- Altitude
  - The value that is used in this field is the altitude in meters. The standard maximum for all SMC controllers is 2000m. The tool provides derating information for altitudes up to 7000 m.

The thermal wizard does not consider system dynamics; it only shows the thermal capacity of the SMC-50 controller. To look at the application itself, including the load and motor data, use the estimation wizard.

## Estimation Wizard

Use the estimation wizard to determine how long the motor will take to start using different starting methods, such as a current limit and soft start. The tool also calculates the estimated stopping time using smart motor braking. Using the tool helps to determine whether the size SMC controller that you selected is appropriate for the given application. Unlike the thermal wizard, this wizard considers the inertia of the motor and the load.

SMC Estimation Wizard

> Instructions

General

> Product

Est. Starting Time

Est. Stopping Time

Motor

> Motor Type

> Rated Power

> Rated Speed

Load

> Load Type

You need to supply values for the following parameters to use the estimation wizard.

- Motor Type
  - This parameter defines the characteristic of the motor torque speed curve; you can usually find the motor type on the motor nameplate. The most common types are NEMA B and IEC N. You can enter a custom curve by selecting the custom type and entering data in the next section
- Rated Motor Power
  - This represents the nominal Hp or kW rating of the motor
- Motor Rated Speed
  - This value represents the motor's nominal speed, not its rated speed. Nominal speed factors in % slip speed. For example, a motor that is rated 1800 rpm typically runs at a slightly lower speed, typically around 1750 rpm. This is the nominal speed. You can usually find this value on the motor nameplate
- Load Type
  - Select the load type that best fits the application that you wish to model. The high-inertia profile uses all the available input parameters. When selecting the other loads, only the % load factor, load inertia, and motor inertia parameters are used.
- Load Inertia
  - This value represents the actual total inertia of the load. Under most conditions, it can be difficult to approximate or obtain the true inertia of the system. In some cases, you may need to get this information from the machine or system designer. In these cases, you need to make some assumptions. The model is a good approximation but should not be considered absolute.
- Load Speed
  - The load speed is the actual running speed of the end mover. For instance, the load speed for a typical bandsaw (bandmill) is the actual speed of the blade (or wheels), which is typically between 500 and 700 rpm. With the load speed entered, the tool automatically calculates the gearing ratio and uses it in other calculations. Variations in the load speed have a large impact on reflected inertia, because it involves a square function. For applications with direct coupling or no change in speed, use the rated speed of the motor.
- Load Factor %
  - This factor represents the ratio of the load torque demand to the capabilities of the motor (for example, a load requires 525 kW, motor is rated 630 kW, load factor is 83.3%). This variable provides the ability to compensate for applications where the motor has been oversized for the load when running at rated speed. For instance, a value of 50% means that the motor has twice as much torque as required while at speed. Common values range from 50% to 90%.

- **Motor Inertia**
  - This value represents the inertia of the motor. In most high-inertia applications, this value is insignificant. However, it can play an important role in the overall calculation of the total system inertia for large motors. You can usually get this value from the nameplate or motor data sheet.
- **% Inefficiency**
  - This value equals the dynamic friction factor of the system. Dynamic friction is the amount of energy that is consumed by system components, such as bearings and windage, that helps prevent the load from running forever. This value is only active for high-inertia loads and plays a more important role in estimating braking times. It is often impossible to determine the exact value. However, you can try to determine the coast down time. By setting the braking model for “coast” and then dialing in the % load efficiency so that the stopping time is approximately the time predicted, it will give you a good estimate of the value. If you are unable to estimate this value, use a value of 100%, which represents a worst case condition.
- **Starting Type**
  - This represents the desired starting mode. This program allows you to select soft start, current limit, and, in some cases, full voltage. The soft start allows the voltage to increase over the start time, while the current limit holds the voltage constant during the start time. Most traditional electro-mechanical methods (that is, Star Delta) are variations of current limit. If you are unsure where to start, choose the default setting of most SMC controllers, which is Soft Start with an initial torque setting of 65 or 70%.
- **Torque/Current %**
  - Initial current %: this represents the level of current that is allowed during the start. This is only active when you have selected a current limit mode and it is programmable as allowed by the product selected. Because most designs are based in historical references, the best place to start an analysis is with 350% current limit. This produces a torque equivalent to a star-delta type reduced voltage starting method.
  - Initial Torque %: this represents the initial level of torque that will be applied to the motor at zero speed. This value will increase as the voltage is ramped during the start time. This value is only active when a soft start mode is selected and is programmable as allowed by the product selected. A default setting of around 70% is a good place to start with the estimation.
- **Braking Type**
  - This selection only becomes active when you select a stopping estimation. The selection includes coast to rest or SMB. At this time pump stop and soft stop are not modeled. When you select SMB, you can estimate how long it will take to stop the motor using a specified braking current level.
- **Braking Current %**
  - This value indicates the level of current that will be applied during SMB. The typical value is between 150% and 300%. It is generally not practical to use more than 300% braking current unless the system and motor have been properly designed to handle the potential impact of increased heating and electrical distribution demands.

The results of this tool do not change the ratings of the device or imply that you can use a device outside of its designed ratings as defined by all applicable electrical codes and standards. The tool is not a substitute for a formal determination by the SMC product engineering staff, nor should it be solely relied on for critical or safety-related applications. It is not designed to replace the engineering responsibility associated with the design or manufacturing of a machine or any of the components.

## Wizard Hints

While getting the load information might be impossible to obtain, it may be possible to model the motor characteristics by using the motor's across the line starting characteristics. This is also true for braking when taking the information on how long it takes to coast. You can then adjust settings to match the time of the starting and stopping method; this creates the start/stop profile using the SMC Wizard methods.

You can get most motor data from the motor nameplate. Common rotor inertia values are listed in [Table 133](#) and [Table 134](#).

Table 133 – Rotor Line Inertia—NEMA Ratings

| Rated Hp | TEFC                  |                       |                       |                       | OPD                   |                       |                       |                       |
|----------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
|          | 2-Pole                | 4-Pole                | 6-Pole                | 8-Pole                | 2-Pole                | 4-Pole                | 6-Pole                | 8-Pole                |
|          | [lb/ft <sup>2</sup> ] | [lb/ft <sup>2</sup> ] | [lb/ft <sup>2</sup> ] | [lb/ft <sup>2</sup> ] | [lb/ft <sup>2</sup> ] | [lb/ft <sup>2</sup> ] | [lb/ft <sup>2</sup> ] | [lb/ft <sup>2</sup> ] |
| 0.5      | 0.015                 | 0.017                 | 0.017                 | 0.04                  | 0.018                 | 0.17                  | 0.18                  | 0.18                  |
| 0.75     | 0.03                  | 0.05                  | 0.04                  | 0.06                  | 0.035                 | 0.21                  | 0.21                  | 0.21                  |
| 1        | 0.05                  | 0.05                  | 0.19                  | 0.13                  | 0.15                  | 0.21                  | 0.21                  | 0.55                  |
| 1.5      | 0.06                  | 0.07                  | 0.22                  | 0.18                  | 0.21                  | 0.23                  | 0.55                  | 0.62                  |
| 2        | 0.08                  | 0.1                   | 0.52                  | 0.37                  | 0.21                  | 0.25                  | 0.6                   | 0.76                  |
| 3        | 0.1                   | 0.47                  | 0.65                  | 0.51                  | 0.23                  | 0.62                  | 0.76                  | 0.91                  |
| 5        | 0.16                  | 0.57                  | 0.76                  | 1.3                   | 0.25                  | 0.7                   | 0.91                  | 1.8                   |
| 7.5      | 0.41                  | 0.68                  | 2.3                   | 1.6                   | 0.62                  | 0.84                  | 1.8                   | 2.1                   |
| 10       | 0.46                  | 2.2                   | 2.8                   | 2.6                   | 0.7                   | 0.99                  | 2.1                   | 3.6                   |
| 15       | 0.93                  | 2.2                   | 3.9                   | 3.8                   | 0.84                  | 1.9                   | 3.6                   | 4.4                   |
| 20       | 1.2                   | 3                     | 4.5                   | 5                     | 0.99                  | 2.3                   | 4.4                   | 7.3                   |
| 25       | 2                     | 4                     | 11                    | 6.4                   | 1.9                   | 3.6                   | 7.3                   | 9                     |
| 30       | 2.3                   | 4.5                   | 12.5                  | 11                    | 2.3                   | 4.4                   | 9                     | 17                    |
| 40       | 3.3                   | 9                     | 20                    | 14                    | 3.6                   | 6.3                   | 13                    | 20                    |
| 50       | 4.2                   | 10                    | 23.5                  | 24                    | 4.4                   | 7.6                   | 15                    | 22                    |
| 60       | 4.9                   | 14.5                  | 35                    | 28                    | 6.3                   | 11                    | 24                    | 25                    |
| 75       | 6.1                   | 17                    | 40.5                  | 39                    | 7.6                   | 13                    | 27                    | 28                    |
| 100      | 12                    | 27                    | 61.5                  | 51                    | 11                    | 16                    | 45                    | 47                    |
| 125      | 20                    | 33                    | 57.5                  | 62                    | 13                    | 20                    | 56                    | 59                    |
| 150      | 24                    | 44.5                  | 85                    | 68                    | 16                    | 33                    | 56                    | 68                    |
| 200      | 31                    | 56                    | 111                   | 85                    | 20                    | 39                    | 68                    | 85                    |
| 250      | 40                    | 74.5                  | 136                   | 82                    | 33                    | 43                    | 85                    | 106                   |
| 300      | 40                    | 86                    | 136                   | 86                    | 39                    | 54                    | 98                    | 129                   |
| 350      | 44.5                  | 95                    |                       | 92                    | 43                    | 60                    | 112                   | 158                   |
| 400      | 56                    | 109                   |                       | 101                   | 54                    | 82                    | 130                   | 181                   |
| 500      | 74.5                  | 114                   |                       | 101                   | 60                    | 122                   | 149                   | 200                   |

**Table 134 - Rotor Line Inertia—IEC Ratings**

| Rated kW | 2-Pole               | 4-Pole               | 6-Pole               | 8-Pole               |
|----------|----------------------|----------------------|----------------------|----------------------|
|          | [kg/m <sup>2</sup> ] | [kg/m <sup>2</sup> ] | [kg/m <sup>2</sup> ] | [kg/m <sup>2</sup> ] |
| 0.37     | 0.00035              | 0.0008               | 0.0015               | 0.0025               |
| 0.55     | 0.00045              | 0.0015               | 0.0018               | 0.0035               |
| 0.75     | 0.00085              | 0.0018               | 0.0028               | 0.0053               |
| 1.1      | 0.0011               | 0.0028               | 0.0035               | 0.007                |
| 1.5      | 0.0015               | 0.0035               | 0.0063               | 0.013                |
| 2.2      | 0.002                | 0.0048               | 0.011                | 0.025                |
| 3        | 0.0038               | 0.0058               | 0.02                 | 0.033                |
| 4        | 0.0055               | 0.011                | 0.028                | 0.05                 |
| 5.5      | 0.014                | 0.023                | 0.035                | 0.065                |
| 7.5      | 0.019                | 0.028                | 0.055                | 0.088                |
| 11       | 0.033                | 0.05                 | 0.08                 | 0.21                 |
| 15       | 0.04                 | 0.07                 | 0.2                  | 0.37                 |
| 18.5     | 0.05                 | 0.13                 | 0.29                 | 0.58                 |
| 22       | 0.077                | 0.15                 | 0.33                 | 0.66                 |
| 30       | 0.14                 | 0.24                 | 0.57                 | 1.1                  |
| 37       | 0.16                 | 0.44                 | 0.89                 | 1.4                  |
| 45       | 0.24                 | 0.52                 | 1.3                  | 1.6                  |
| 55       | 0.45                 | 0.79                 | 1.5                  | 2.3                  |
| 75       | 0.79                 | 1.4                  | 2.4                  | 3                    |
| 90       | 0.92                 | 1.6                  | 2.9                  | 3.6                  |
| 110      | 1.3                  | 2.2                  | 3.5                  | 4.4                  |
| 132      | 1.5                  | 2.7                  | 4.3                  | 6.2                  |
| 150      | 1.65                 | 3.09                 | 5.2                  | 6.4                  |
| 160      | 1.8                  | 3.2                  | 6                    | 7.5                  |
| 200      | 2.3                  | 4.2                  | 7.5                  | 9.3                  |
| 225      | 2.8                  | 5.2                  | 7.9                  | 13.9                 |
| 250      | 3.3                  | 6                    | 9.1                  | 16                   |
| 280      | 3.9                  | 6.8                  | 12.4                 | 20                   |
| 315      | 4                    | 7.4                  | 17                   | 24                   |
| 355      | 6.2                  | 12                   | 24                   | 30                   |
| 373      | 7.5                  | 12.44                | 30                   | 36                   |

For motor type selection, entering in the data points of a speed torque curve on the custom motor is more accurate than taking the normal curve of a NEMA or IEC standard provided by the tool. While standards have a criteria to meet for the motors, there is still a window of variance. Motors vary in the speed torque curve even within the same type. The wizard uses the average range. [Table 135](#), reproduced from NEMA publication NEMA MG 10-2013, shows the variance within the chart.

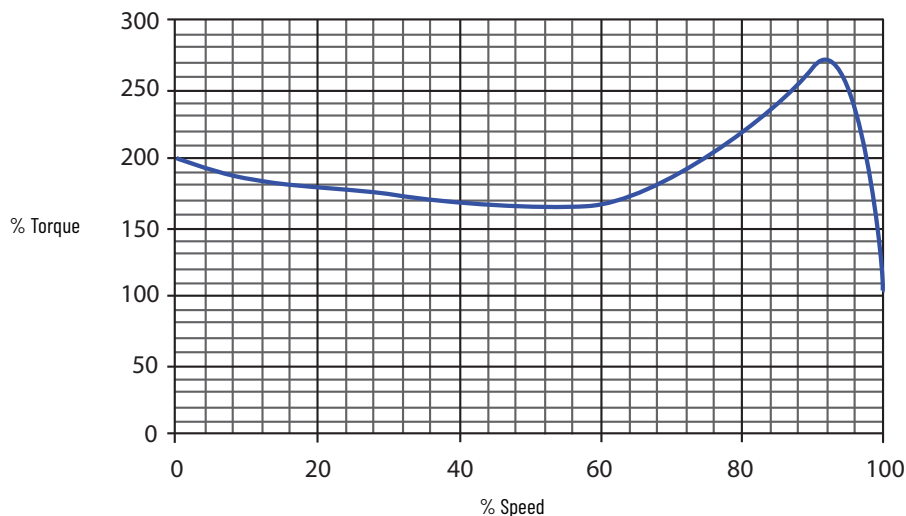
**Table 135 - Typical Characteristics and Applications of Fixed Frequency Medium AC Squirrel-cage Induction Motors**

| Polyphase Characteristics <sup>(1)</sup>                                   | Torque [% Rated Load Torque] |                          |                          | Locked Rotor Current [% Rated Load Current] | Slip      | Typical Applications                                                                                                                                         | Relative Efficiency |
|----------------------------------------------------------------------------|------------------------------|--------------------------|--------------------------|---------------------------------------------|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
|                                                                            | Locked Rotor Torque          | Pull-up Torque           | Breakdown Torque         |                                             |           |                                                                                                                                                              |                     |
| Design A<br>• Normal locked rotor torque and high locked rotor current     | 70...275 <sup>(2)</sup>      | 65...190 <sup>(2)</sup>  | 175...300 <sup>(2)</sup> | Not Defined                                 | 0.5...5 % | Fans, blowers, centrifugal pumps and compressors, motor-generator sets, etc., where starting torque requirements are relatively low.                         | Medium or high      |
| Design B<br>• Normal locked rotor torque and normal locked rotor current   | 70...275 <sup>(2)</sup>      | 65...190 <sup>(2)</sup>  | 175...300 <sup>(2)</sup> | 600...800                                   | 0.5...5 % | Fans, blowers, centrifugal pumps and compressors, motor-generator sets, etc., where starting torque requirements are relatively low.                         | Medium or high      |
| Design C<br>• High locked rotor torque and high locked rotor current       | 200...285 <sup>(2)</sup>     | 140...195 <sup>(2)</sup> | 190...225 <sup>(2)</sup> | 600...800                                   | 1...5 %   | Conveyors, crushers, stirring machines, agitators, reciprocating pumps and compressors, etc., where starting under load is required.                         | Medium              |
| Design D<br>• High locked rotor torque and high slip                       | 275                          | Not Defined              | 275                      | 600...800                                   | ≥5 %      | High peak loads with or without flywheels such as punch presses, shears, elevators, extractors, winches, hoists, oil-well pumping and wire-drawing machines. | Medium              |
| IEC Design H<br>• High locked rotor torque and high locked rotor current   | 200...285 <sup>(2)</sup>     | 140...195 <sup>(2)</sup> | 190...225 <sup>(2)</sup> | 800...1000                                  | 1...5 %   | Conveyors, crushers, stirring machines, agitators, reciprocating pumps and compressors, etc., where starting under load is required.                         | Medium              |
| IEC Design N<br>• Normal locked rotor torque and high locked rotor current | 75...190 <sup>(2)</sup>      | 60...140 <sup>(2)</sup>  | 160...200 <sup>(2)</sup> | 800...1000                                  | 0.5...3 % | Fans, blowers, centrifugal pumps and compressors, motor-generator sets, etc., where starting torque requirements are relatively low.                         | Medium or high      |

(1) These characteristics represent common usage of the motors—for further details, consult the specific performance standards for the complete requirements.

(2) Higher values are for motors having lower horsepower ratings.

[Figure 79](#) shows an example of a customer-supplied speed torque curve and the entries into the custom motor data.

**Figure 79 - Custom Motor Speed vs. Torque Curve**

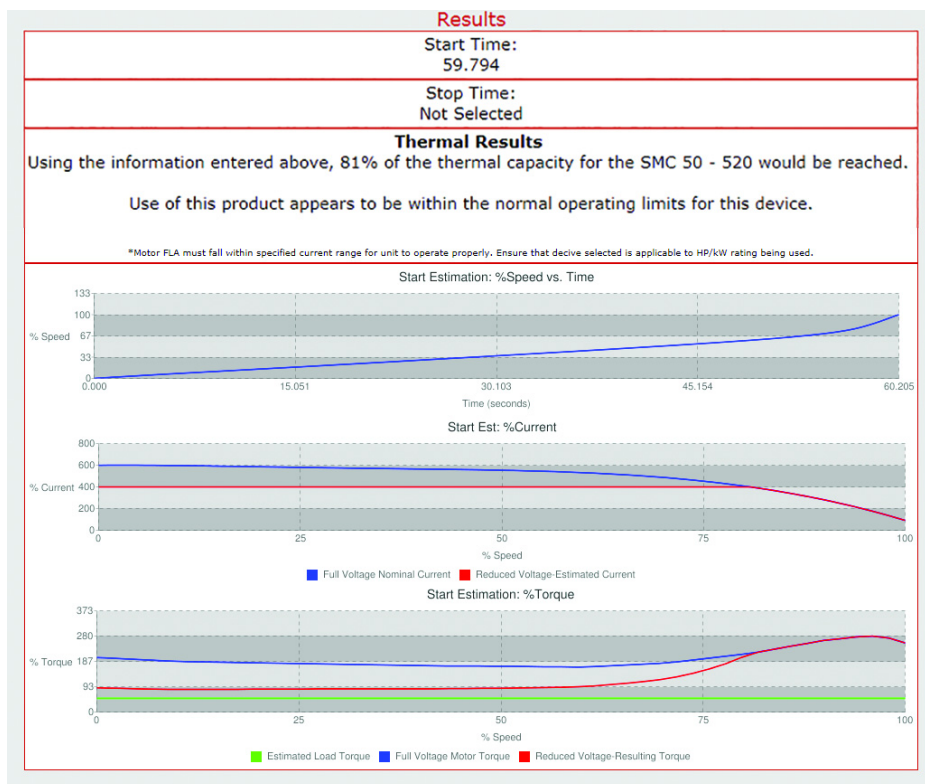
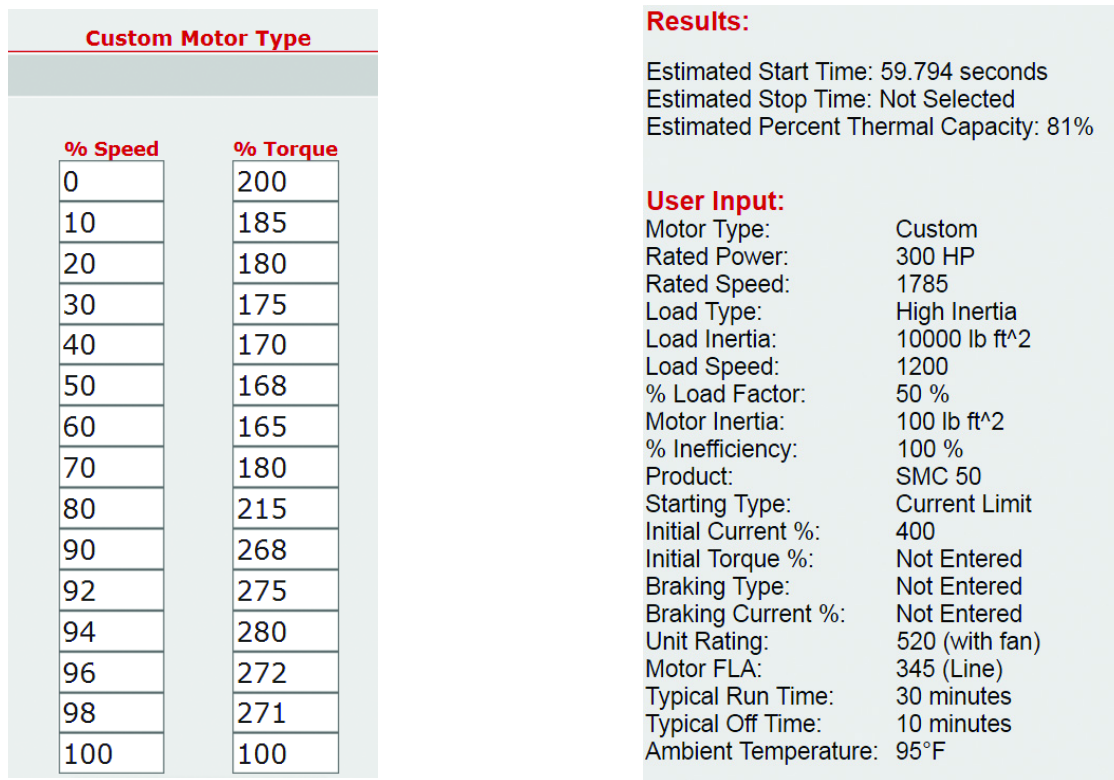
The customer-supplied curve provides a much more accurate method of using the estimation wizard than that of NEMA design average.

A customer calls in and wants to know if they can use an SMC-50 with their motor to start a load in approximately 60 s. You are able to find out the following information:

The load is a flywheel for a large mill. The motor is 300 Hp NEMA Type B motor with a rated speed of 1785 rpm (information from the motor nameplate). The load speed is about 1200 rpm according to the customer. The load inertia was provided by the machine OEM as approximately 10,000 lb•ft<sup>2</sup>. There is a 50% load factor (which means the motor is twice the size needed for the actual load). The customer does not know the system inefficiency. They would like to use an SMC-50 with a current limit start. Motor is a 3 lead motor type with a 345 A

FLA. Running time is 30 minutes and off time is 10 minutes. Ambient temperature can get up to 95 °F (35 °C) during the summer. Motor inertia is 100 lb•ft<sup>2</sup> according to the motor specification sheet.

With this scenario, and using the custom motor speed torque from [Figure 79](#), the results look like this.



Remember, the tool is an estimate and is not a guarantee.

[Table 136](#) shows the torque capabilities of the SMC-50 controller when it uses reduced voltage or current limit starting. Notice that using an SMC controller at 350% current limit produces approximately the same amount of torque as an electro-mechanical starter. The % applied voltage of the two starting methods is the same.

**Table 136 - Motor Torque Capabilities with SMC-50 Controller Options**

| Starting Type                 | % Voltage Applied During Start | % Full Load Starting Torque | % Full Load Rated Current |
|-------------------------------|--------------------------------|-----------------------------|---------------------------|
| Full Voltage                  | 100                            | 100                         | 600                       |
| Wye-Delta                     | 58                             | 33                          | 200                       |
| Soft Start with current limit |                                |                             |                           |
| 150 %                         | 25                             | 6                           | 150                       |
| 200 %                         | 33                             | 11                          | 200                       |
| 250 %                         | 42                             | 18                          | 250                       |
| 300 %                         | 50                             | 25                          | 300                       |
| 350 %                         | 58                             | 34                          | 350                       |
| 400 %                         | 67                             | 49                          | 400                       |

**Notes:**

## Additional Resources

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

| Resource                                                                                                                           | Description                                                                                                                                                                                                                                                                     |
|------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SMC-50 User Manual, publication <a href="#">150-UM011</a>                                                                          | Provides complete user information for SMC-50 controllers.                                                                                                                                                                                                                      |
| SMC-50 Smart Motor Controller Quick Start, publication <a href="#">150-OS003</a>                                                   | Provides you with the basic information that is required to install, start up, and program your SMC-50 Soft Starter.                                                                                                                                                            |
| SMC Flex User Manual, publication <a href="#">150-UM008</a>                                                                        | Provides complete user information for SMC Flex controllers.                                                                                                                                                                                                                    |
| SMC-3 Installation Instructions, publication <a href="#">150-IN044</a>                                                             | Provides installation instructions for SMC-3 controllers.                                                                                                                                                                                                                       |
| SMC-50 - New Control Advances; Sensorless Linear Acceleration White Paper, publication <a href="#">150-WP005</a>                   | Explains the benefits of different start and stop options of the SMC-50 controllers, with an emphasis on sensorless linear acceleration.                                                                                                                                        |
| Soft Starter Bypass Technology in Smart Motor Controllers, publication <a href="#">150-WP006</a>                                   | Discusses the differences between the internal and external and options for the bypass contactor in SMC controllers.                                                                                                                                                            |
| When to Use a Soft Starter or AC Variable Frequency Drive White Paper, publication <a href="#">150-WP007</a>                       | Shows similarities and differences between the soft starters and variable frequency drives.                                                                                                                                                                                     |
| SMC-50 Solid-state Smart Motor Controller for Managing Resistive Loads, publication <a href="#">150-WP008</a>                      | Explains the benefits of using an SMC-50 controller to manage resistive loads.                                                                                                                                                                                                  |
| Slow Speed Applications Using a Soft Starter, publication <a href="#">150-WP009</a>                                                | Explains the benefits of using an SMC controller in slow speed applications.                                                                                                                                                                                                    |
| How Do You Control an Electric Motor When the Communication Network Fails?, publication <a href="#">CMPNTS-AT001</a>               | Provides an overview about using DeviceLogix technology to program an orderly shutdown.                                                                                                                                                                                         |
| Using an SMC-50 Solid-State Smart Motor Controller for Pump Protection, publication <a href="#">150-AT003</a>                      | Discusses the use of technology in pumping applications to warn of damage or to stop a process from damage.                                                                                                                                                                     |
| Wye-delta and Solid-state Starters Application Guide, publication <a href="#">150-AT005</a>                                        | Explanation and assistance for applying solid-state soft starters in traditional reduced-voltage applications.                                                                                                                                                                  |
| DeviceLogix Technology for Industrial Applications, publication <a href="#">193-AT001</a>                                          | Discusses DeviceLogix technology in control system architecture.                                                                                                                                                                                                                |
| Short-circuit Current Ratings and Your Industrial Control Panel, publication <a href="#">SCCR-AT002</a>                            | Provides examples for short-circuit current ratings of panels based on the methods stated in UL 508A Supplement B.                                                                                                                                                              |
| Global Short-circuit Rating Tool, <a href="http://rok.auto/sccr">rok.auto/sccr</a>                                                 | Provides coordinated high-fault branch circuit solutions for motor starters, soft starters, and component drives.                                                                                                                                                               |
| EtherNet/IP Network Devices User Manual, <a href="#">ENET-UM006</a>                                                                | Describes how to configure and use EtherNet/IP devices to communicate on the EtherNet/IP network.                                                                                                                                                                               |
| Ethernet Reference Manual, <a href="#">ENET-RM002</a>                                                                              | Describes basic Ethernet concepts, infrastructure components, and infrastructure features.                                                                                                                                                                                      |
| Industrial Components Preventive Maintenance, Enclosures, and Contact Ratings Specifications, publication <a href="#">IC-TD002</a> | Provides a quick reference tool for Allen-Bradley industrial automation controls and assemblies.                                                                                                                                                                                |
| Safety Guidelines for the Application, Installation, and Maintenance of Solid-state Control, publication <a href="#">SGI-1.1</a>   | Designed to harmonize with NEMA Standards Publication No. ICS 1.1-1987 and provides general guidelines for the application, installation, and maintenance of solid-state control in the form of individual devices or packaged assemblies incorporating solid-state components. |
| Industrial Automation Wiring and Grounding Guidelines, publication <a href="#">1770-4.1</a>                                        | Provides general guidelines for installing a Rockwell Automation industrial system.                                                                                                                                                                                             |
| Product Certifications website, <a href="http://rok.auto/certifications">rok.auto/certifications</a>                               | Provides declarations of conformity, certificates, and other certification details.                                                                                                                                                                                             |

You can view or download publications at [rok.auto/literature](http://rok.auto/literature).

# Rockwell Automation Support

Use these resources to access support information.

|                                                         |                                                                                                    |                                                                    |
|---------------------------------------------------------|----------------------------------------------------------------------------------------------------|--------------------------------------------------------------------|
| <b>Technical Support Center</b>                         | Find help with how-to videos, FAQs, chat, user forums, and product notification updates.           | <a href="http://rok.auto/support">rok.auto/support</a>             |
| <b>Knowledgebase</b>                                    | Access Knowledgebase articles.                                                                     | <a href="http://rok.auto/knowledgebase">rok.auto/knowledgebase</a> |
| <b>Local Technical Support Phone Numbers</b>            | Locate the telephone number for your country.                                                      | <a href="http://rok.auto/phonesupport">rok.auto/phonesupport</a>   |
| <b>Literature Library</b>                               | Find installation instructions, manuals, brochures, and technical data publications.               | <a href="http://rok.auto/literature">rok.auto/literature</a>       |
| <b>Product Compatibility and Download Center (PCDC)</b> | Download firmware, associated files (such as AOP, EDS, and DTM), and access product release notes. | <a href="http://rok.auto/pcdc">rok.auto/pcdc</a>                   |

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