



**Bulletin 150 — SMC™ Flex Smart Motor Controller**

The SMC Flex controller provides microprocessor controlled starting for standard 3-phase squirrel-cage induction or Wye-Delta (6-lead) motors. Seven standard modes of operation are available within a single controller.

- 1...1250 A Range
- Seven Standard Start Modes
- Options Include Pump Control and Braking Control

**Features**

- Built in SCR Bypass/Run Contactor
- Built in Electronic Motor Overload Protection
- CT on each Phase
- Metering
- DPI Communication
- LCD Display
- Keypad Programming
- Four Programmable Auxiliary Contacts

The SMC Flex controller is available for motors rated 1...1250 A; 200...480V AC, 200...600V AC, or 230...690V AC, 50/60 Hz. In addition to motors, the SMC Flex controller can be used to control resistive loads.

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This catalog product information is based on the **minimum** information needed to select an SMC soft starter for applications with low starting torque requirements. For product selection involving loads with high starting torque requirements (large fan, rock crusher, chipper, etc.), use of the free tools available from the Rockwell Automation Website is recommended:

[http://www.ab.com/industrialcontrols/products/solid-state\\_motor\\_control/software/](http://www.ab.com/industrialcontrols/products/solid-state_motor_control/software/)

**Standards Compliance**

- UL 508
- CSA C22.2 No.14
- EN/IEC 60947-1
- EN/IEC 60947-4-2

**Modes of Operation**

The SMC Flex controller provides the following modes of operation as standard:

- Soft Start
- Selectable Kickstart
- Current Limit Start
- Dual Ramp Start
- Full Voltage Start
- Linear Speed Acceleration
- Preset Slow Speed
- Soft Stop

**Note:** For detailed information about the different modes of operation, see page 4-109.

**Certifications**

- cULus Listed (Open Type) (File No. E96956, Guides NMFT, NMFT7)
- CSA Certified (File No. LR 1234)
- CE Marked
- CCC Certified

**Optional Modes of Operation**

**Pump Control**

- Start and Stop

**Braking Control**

- SMB — Smart Motor Braking
- Accu-Stop
- Slow Speed with Braking

**Description of Features**

**Electronic Motor Overload Protection**

The SMC Flex controller incorporates, as standard, electronic motor overload protection. This overload protection is accomplished electronically with an  $I^2t$  algorithm.

When coordinated with the proper short-circuit protection, overload protection is intended to protect the motor, motor controller, and power wiring against overheating caused by excessive overcurrent. The SMC Flex controller meets applicable requirements as a motor overload protective device.

The controller's overload protection is programmable, providing the user with flexibility. The overload trip class consists of either OFF, 10, 15, 20, or 30 protection. The trip current is programmed by entering the motor full-load current rating, service factor, and selecting the trip class.

Thermal memory is included to accurately model motor operating temperature. Ambient temperature insensitivity is inherent in the electronic design of the overload.

**Undervoltage Protection**

The SMC Flex controller's undervoltage protection will halt motor operation if a drop in the incoming line voltage is detected.

The undervoltage trip level is adjustable as a percentage of the programmed line voltage, from 0...99%. To eliminate nuisance trips, a programmable undervoltage trip delay time of 0...99 seconds can also be programmed. The line voltage must remain below the undervoltage trip level during the programmed delay time.

**Overvoltage Protection**

If a rise in the incoming line voltage is detected, the SMC Flex controller's overvoltage protection will halt motor operation.

The overvoltage trip level is adjustable as a percentage of the programmed line voltage, from 0...199%. To eliminate nuisance trips, a programmable overvoltage trip delay time of 0...99 seconds can also be programmed. The line voltage must remain above the overvoltage trip level during the programmed delay time.



**Stall Protection and Jam Detection**

Motors can experience locked-rotor currents and develop high torque levels in the event of a stall or a jam. These conditions can result in winding insulation breakdown or mechanical damage to the connected load. The SMC Flex controller provides both stall protection and jam detection for enhanced motor and system protection. Stall protection allows the user to program a maximum stall protection delay time from 0...10 seconds. The stall protection delay time is in addition to the programmed start time and begins only after the start time has timed out. If the controller senses that the motor is stalled, it will shut down after the delay period has expired. Jam detection allows the user to determine the motor jam detection level as a percentage of the motor's full-load current rating. To prevent nuisance tripping, a jam detection delay time, from 0.0...99.0 seconds, can be programmed. This allows the user to select the time delay required before the SMC Flex controller will trip on a motor jam condition. The motor current must remain above the jam detection level during the delay time. Jam detection is active only after the motor has reached full speed.

**Underload Protection**

Utilizing the underload protection of the SMC Flex controller, motor operation can be halted if a drop in current is sensed. The SMC Flex controller provides an adjustable underload trip setting from 0...99% of the programmed motor full-load current rating with an adjustable trip delay time of 0...99 seconds.

**Voltage Unbalance Protection**

Voltage unbalance is detected by monitoring the 3-phase supply voltage magnitudes in conjunction with the rotational relationship of the three phases. The controller will halt motor operation when the calculated voltage unbalance reaches the user-programmed trip level.

The voltage unbalance trip level is programmable from 0...25% unbalance.

**Excessive Starts Per Hour**

The SMC Flex controller allows the user to program the allowed number of starts per hour (up to 99). This helps eliminate motor stress caused by repeated starting during a short time period.

**Metering**

Power monitoring parameters include:

- 3-phase current
- 3-phase voltage
- Power in kW or mW
- Power usage in kWh or mWh
- Power Factor
- Motor thermal capacity usage
- Elapsed time

**Note:** The motor thermal capacity usage allows the user to monitor the amount of overload thermal capacity usage before the SMC Flex controller's built-in electronic overload trips.

**Built-in DPI Communication Capabilities**

A serial interface port is provided as standard, which allows connection to a Bulletin 20 Human Interface Module and a variety of Bulletin 20-COMM Communication Modules. This includes Allen-Bradley Remote I/O, DeviceNet, ControlNet, Ethernet, ProfiBUS, Interbus, and RS485-DF1.

**LCD Display**

The SMC Flex controller's three-line 16-character backlit LCD display provides parameter identification using clear, informative text. Controller set up can be performed quickly and easily without the use of a reference manual. Parameters are arranged in an organized four-level menu structure for ease of programming and fast access to parameters.

**Network I/O**

The SMC Flex can have up to two inputs and four outputs controlled via a communication network. The output contacts use the auxiliary contacts.

**Keypad Programming**

Programming of parameters is accomplished through a five-button keypad on the front of the SMC Flex controller. The five buttons include up and down arrows, an Enter button, a Select button, and an Escape button. The user needs only to enter the correct sequence of keystrokes for programming the SMC Flex controller.

**Auxiliary Contacts**

Four fully programmable hard contacts are furnished as standard with the SMC Flex controller:

Aux #1, Aux #2, Aux #3, Aux #4

- N.O./N.C.
- Normal/Up-to-Speed/External Bypass/Fault/Alarm/Network

**Ground Fault Input**

The SMC Flex can monitor for ground fault conditions. An external core balance current transformer is required for this function. See SMC Flex User Manual for additional information.

**Tach Input**

A motor tachometer is required for the Linear Speed Start mode. Please see the Specifications section on page 4-127 for tachometer characteristics.

**PTC Input**

A motor PTC input can be monitored by the SMC Flex. In the event of a fault, the SMC Flex will shut down and indicate a motor PTC fault.



Open and Non-Combination

150 – F135    F    B    D    B – 8L  
 a    b    c    d    e    f    g

**a**

| Bulletin Number |  |
|-----------------|--|
| Code            | Description  |
| 150             | Solid-State Controller                                   |
| 150B            | Enclosed Solid-State Controller with Isolation Contactor |

**c**

| Enclosure Type |  |
|----------------|--|
| Code           | Description                                  |
| F              | NEMA Type 4/12 (IP65) (Non-Combination Only) |
| J              | NEMA Type 12 (IP54)                          |
| N              | Open   |

**e**

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

**b**

| Controller Ratings |                           |
|--------------------|---------------------------|
| 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 |

**d**

| Input Line Voltage            |   |
|-------------------------------|---|
| Open Type                     |   |
| 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 (Open Only, 108 A and above) |
| Non-Combination Enclosed Only |   |
| H                             | 200...208V AC, 3-phase, 50 and 60 Hz                              |
| A                             | 230V AC, 3-phase, 50 and 60 Hz                                    |
| B                             | 400...460V AC, 3-phase, 50 and 60 Hz                              |
| C                             | 500...575V AC, 3-phase, 50 and 60 Hz                              |

**f**

| Options (Select Only One) |                 |
|---------------------------|-----------------|
| Code                      | Description     |
| Blank                     | Standard        |
| B                         | Pump Control    |
| D                         | Braking Control |

**g**

| Options (Non-Combination only) (see page 4-125 for a full listing) |   |
|--|---|
| Code   | Description   |
| 8L   | Line-Mounted Protective Module (enclosed only)            |
| 8M   | Load-Mounted Protective Module (enclosed only)            |
| 8B   | Line- and Load-Mounted Protective Modules (enclosed only) |

Load-side MOVs are not available with Pump and Braking options, or on delta-connected motors. MOVs can be field installed for open type units.

4

Combination

152H – F480    F    BD    B – 59 – 8B  
 a    b    c    d    e    f    g

**a**

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

**c**

| Enclosure Type |                       |
|----------------|-----------------------|
| Code           | Description           |
| F              | NEMA Type 4/12 (IP65) |
| J              | NEMA Type 12 (IP54)   |

**e**

| Control Options |                 |
|-----------------|-----------------|
| Code            | Description     |
| Blank           | Standard        |
| B               | Pump Control    |
| D               | Braking Control |

**b**

| Controller Ratings |                         |
|--------------------|-------------------------|
| 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 |

**d**

| Line Voltage, 120V AC Control Voltage |                                      |
|---------------------------------------|--------------------------------------|
| Code                                  | Description                          |
| HD                                    | 200...208V AC, 3-phase, 50 and 60 Hz |
| AD                                    | 230V AC, 3-phase, 50 and 60 Hz       |
| BD                                    | 400...460V AC, 3-phase, 50 and 60 Hz |
| CD                                    | 500...575V AC, 3-phase, 50 and 60 Hz |

**g**

| Options (see page 4-125 for a full listing) |   |
|---|---|
| Code  | Description                               |
| 8L  | Line-Mounted Protective Module            |
| 8M  | Load-Mounted Protective Module            |
| 8B  | Line- and Load-Mounted Protective Modules |

Load-side MOVs are not available with Pump and Braking options, or when used with inside-the-delta connections.

**f**

| Horsepower |           |          |           |          |           |          |           |          |           |
|------------|-----------|----------|-----------|----------|-----------|----------|-----------|----------|-----------|
| Cat. No.   | Hp Rating | Cat. No. | Hp Rating | Cat. No. | Hp Rating | Cat. No. | Hp Rating | Cat. No. | Hp Rating |
| 33         | 0.5       | 39       | 5         | 46       | 40        | 52       | 150       | 60       | 450       |
| 34         | 0.75      | 40       | 7.5       | 47       | 50        | 54       | 200       | 61       | 500       |
| 35         | 1         | 41       | 10        | 48       | 60        | 56       | 250       | 62       | 600       |
| 36         | 1.5       | 42       | 15        | 49       | 75        | 57       | 300       | 63       | 700       |
| 37         | 2         | 43       | 20        | 50       | 100       | 58       | 350       | 65       | 800       |
| 38         | 3         | 44       | 25        | 51       | 125       | 59       | 400       | 67       | 1000      |
| —          | —         | 45       | 30        | —        | —         | —        | —         | —        | —         |

## Open Type and Non-Combination Enclosed (IP65, Type 4/12) Controllers — For use with Line-Connected Motors

Enclosures other than those listed are available; consult your local Rockwell Automation sales office or Allen-Bradley distributor.

| Rated Voltage<br>[V AC] | Motor Current<br>[A]⊛ | Max. kW,<br>50 Hz | Max. Hp,<br>60 Hz       | Control Power           | Open Type — Line-Connected<br>Motors* | IP65 (Type 4/12) Enclosed<br>Non-Combination Controllers§➤ |
|-------------------------|-----------------------|-------------------|-------------------------|-------------------------|---------------------------------------|--|
|                         |                       |                   |                         |                         | Cat. No.                              | Cat. No.   |
| 200/208                 | 1...5                 | —                 | 1                       | 100...240V AC, 50/60 Hz | <b>150-F5NBD</b>                      | 150-F5FHD  |
|                         |                       |                   |                         | 24V AC/DC♣              | <b>150-F5NBR</b>                      | —  |
|                         | 5...25                | —                 | 5                       | 100...240V AC, 50/60 Hz | <b>150-F25NBD</b>                     | 150-F25FHD   |
|                         |                       |                   |                         | 24V AC/DC♣              | <b>150-F25NBR</b>                     | —  |
|                         | 8.6...43              | —                 | 10                      | 100...240V AC, 50/60 Hz | <b>150-F43NBD</b>                     | 150-F43FHD   |
|                         |                       |                   |                         | 24V AC/DC♣              | <b>150-F43NBR</b>                     | —  |
|                         | 12...60               | —                 | 15                      | 100...240V AC, 50/60 Hz | <b>150-F60NBD</b>                     | 150-F60FHD   |
|                         |                       |                   |                         | 24V AC/DC♣              | <b>150-F60NBR</b>                     | —  |
|                         | 17...85               | —                 | 25                      | 100...240V AC, 50/60 Hz | <b>150-F85NBD</b>                     | 150-F85FHD   |
|                         |                       |                   |                         | 24V AC/DC♣              | <b>150-F85NBR</b>                     | —  |
|                         | 27...108              | —                 | 30                      | 100...240V AC, 50/60 Hz | <b>150-F108NBD</b>                    | 150-F108FHD  |
|                         |                       |                   |                         | 24V AC/DC♣              | <b>150-F108NBR</b>                    | —  |
|                         | 34...135              | —                 | 40                      | 100...240V AC, 50/60 Hz | <b>150-F135NBD</b>                    | 150-F135FHD  |
|                         |                       |                   |                         | 24V AC/DC♣              | <b>150-F135NBR</b>                    | —  |
|                         | 67...201              | —                 | 60                      | 100...240V AC, 50/60 Hz | <b>150-F201NBD</b>                    | 150-F201FHD  |
|                         |                       |                   |                         | 24V AC/DC♣              | <b>150-F201NBR</b>                    | —  |
|                         | 84...251              | —                 | 75                      | 100...240V AC, 50/60 Hz | <b>150-F251NBD</b>                    | 150-F251FHD  |
|                         |                       |                   |                         | 24V AC/DC♣              | <b>150-F251NBR</b>                    | —  |
|                         | 106...317             | —                 | 100                     | 100...240V AC, 50/60 Hz | <b>150-F317NBD</b>                    | 150-F317FHD  |
|                         |                       |                   |                         | 24V AC/DC♣              | <b>150-F317NBR</b>                    | —  |
| 120...361               | —                     | 125               | 100...240V AC, 50/60 Hz | <b>150-F361NBD</b>      | 150-F361FHD                           |  |
|                         |                       |                   | 24V AC/DC♣              | <b>150-F361NBR</b>      | —                                     |  |
| 160...480               | —                     | 150               | 100...240V AC, 50/60 Hz | <b>150-F480NBD</b>      | 150-F480FHD                           |  |
|                         |                       |                   | 24V AC/DC♣              | <b>150-F480NBR</b>      | —                                     |  |
| 208...625               | —                     | 200               | 110/120V AC, 50/60 Hz   | <b>150-F625NBE</b>      | ⊛ 150-F625JHE                         |  |
|                         |                       |                   | 230/240V AC, 50/60 Hz   | 150-F625NBA             | ⊛ 150-F625JHA                         |  |
| 260...780               | —                     | 250               | 110/120V AC, 50/60 Hz   | 150-F780NBE             | ⊛ 150-F780JHE                         |  |
|                         |                       |                   | 230/240V AC, 50/60 Hz   | 150-F780NBA             | ⊛ 150-F780JHA                         |  |
| 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            | —                                     |  |

\* Controllers rated 108 A and greater are not equipped with line and load terminal lugs. See page 4-126 for terminal lug kits.

⊛ Motor FLA rating should 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 in the "Full Voltage" starting mode. Contact Rockwell Automation technical support for further guidance.

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

♣ Separate 120V or 240V single-phase power supply is required for fan operation.

➤ Line and load termination are provided as standard.

⊛ Available in IP54 (Type 12) enclosure only.

**Control Options (open and enclosed)**

| Option          | Description   | Cat. No. Modification |
|-----------------|---|-----------------------|
| Pump Control    | Provides smooth motor acceleration and deceleration, reducing surges caused by the starting and stopping of centrifugal pumps. Starting time is adjustable from 0...30 s, and stopping time is adjustable from 0...120 s. | <b>B*</b>             |
| Braking Control | Provides Smart Motor Braking (SMB), Accu-Stop, and Slow Speed with Braking.   | <b>D*</b>             |

**Enclosed Options**

| Option                      | Description  | Cat. No. Modification |
|-----------------------------|--|-----------------------|
| Push Buttons                | Start-Stop Push Button   | -1                    |
|                             | Start-Stop Push Button with H-O-A Selector Switch                          | -1F                   |
|                             | Soft Stop Push Button*   | 1XA                   |
|                             | Pump Stop Push Button*   | 1XB                   |
|                             | Slow Speed Push Button*  | 1XC                   |
|                             | Brake Push Button*   | 1XD                   |
|                             | Accu-Stop/Slow Speed Push Button*  | 1XE                   |
| Selector Switch             | Hand-Off-Auto Selector Switch  | -3                    |
|                             | SMC-Off-Bypass Selector Switch   | -3B +                 |
| Pilot Lights                | Transformer Pilot Light - Green Power On Indicator                         | -4G                   |
|                             | Transformer Pilot Light - Red Run Indicator                                | -4R                   |
|                             | Push-to-Test Pilot Light - Red Run Indicator                               | -5R                   |
| Control Circuit Transformer | Control Circuit Transformer (fused primary and secondary)                  | -6P                   |
|                             | Additional 100VA Control Circuit Transformer (fused primary and secondary) | -6PX                  |
|                             | 1000VA Control Circuit Transformer (fused primary and secondary)           | -6PK                  |
|                             | 1600VA Control Circuit Transformer (fused primary and secondary)           | -6PL                  |
|                             | 2000VA Control Circuit Transformer (fused primary and secondary)           | -6PM                  |
| Protective Modules          | 480V Line Side Protective Module   | -8L                   |
|                             | 600V Line Side Protective Module   |                       |
|                             | 480V Load Side Protective Module   | -8M                   |
|                             | 600V Load Side Protective Module   |                       |
|                             | 480V Both Line and Load Side Protective Modules                            | -8B                   |
|                             | 600V Both Line and Load Side Protective Modules                            |                       |
| Human Interface Module      | Door-mounted, Full Numeric (Type 4/12)                                     | -HC3                  |
| Communication Module        | RS-485   | -20S                  |
|                             | DeviceNet  | -20D                  |
|                             | Ethernet/IP  | -20E                  |
|                             | Control Net  | -20C                  |
|                             | ProfiBUS   | -20P                  |
| Disconnect Auxiliary        | N.O. disconnect auxiliary mounted on operating mechanism                   | -98                   |
|                             | N.C. disconnect auxiliary mounted on operating mechanism                   | -99                   |
| Circuit Breaker Auxiliary   | Internal N.O. circuit breaker auxiliary                                    | -98X                  |
|                             | Internal N.C. circuit breaker auxiliary                                    | -99X                  |
| Service Entrance Label      | Service Entrance Label   | -SEL                  |
| Oil Pump Starter            | Bulletin 509 NEMA Size 1 starter and Bulletin 592 solid-state overload     | -OPS                  |

\* Add the designated letter to the end of the cat. no. Example: To add the Pump Control option: **Cat. No. 150-F361NBDB** or **Cat. No. 152H-F361FBDB-57**.  
 \* Option push buttons are available only when the corresponding option module is selected. Example: **Cat. No. 150-F108FBDB-1XB**.  
 + Bypass contactor and overload are not included with this option. A **-NB** or **-BP** needs to be added to the catalog string to add these devices.



## Enclosed Options, Continued

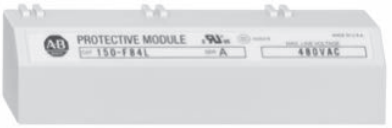
| Option                                   | Description | Cat. No. Modification |
|--|-------------|-----------------------|
| NEMA Bypass Contactor and Overload Relay | 5...43 A    | -NB                   |
|  | 60...85 A   |                       |
|  | 108...135 A |                       |
|  | 201...251 A |                       |
|  | 317...361 A |                       |
|  | 480 A       |                       |
| NEMA Isolation Contactor                 | 5...43 A    | -NI                   |
|  | 60...85 A   |                       |
|  | 108...135 A |                       |
|  | 201...251 A |                       |
|  | 317...361 A |                       |
|  | 480 A       |                       |
| MCS Bypass Contactor and Overload Relay  | 5...43 A    | -BP                   |
|  | 60...85 A   |                       |
|  | 108...135 A |                       |
|  | 201...251 A |                       |
|  | 317...361 A |                       |
|  | 480 A       |                       |

4

## Accessories

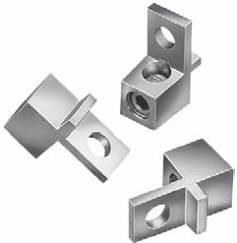
## Protective Modules\*

Protective modules must not be placed on the load side of a device when using an inside-the-delta connection or with Pump, Braking, or Linear Speed control.

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

\* The same protective module mounts on the line or load side of the SMC Flex. For applications requiring both line and load side protection, two protective modules must be ordered.

## Terminal Lug Kits (108...1250 A)

|  | Current Rating [A] * | Wire Size   | Total No. of Line Controller Terminal Lugs Possible Each Side |           | Pkg. Qty. | Cat. No.  |
|---|----------------------|---|---|-----------|-----------|-----------|
|   |                      |   | Line Side   | Load Side |           |           |
|   | 108...135♣           | #6...250 MCM AWG  | 3   | 3         | 3         | 199-LF1   |
|   | 201...251♣           | 16 mm <sup>2</sup> ...120 mm <sup>2</sup>                     | 6   | 6         |           |           |
|   | 317...480♣           | #4...500 MCM AWG<br>25 mm <sup>2</sup> ...240 mm <sup>2</sup> | 6   | 6         |           | 199-LG1   |
|   | 625...780            | 2/0...500 MCM AWG   | 6   | 6         |           | 100-DL630 |
|   | 970                  | 4/0...500 MCM AWG   | 3   | 3         |           | 100-DL860 |
|   | 1250§                | 2/0...500 MCM AWG   | 3   | 3         |           | 100-DL630 |
|   |                      | 4/0...500 MCM AWG   | 3   | 3         |           | 100-DL860 |


Line and Load terminals are provided as standard on enclosed SMCs.

♣ 5...85 A units have box lugs standard. No additional lugs are required.

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



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

**IEC Terminal Covers**

|  | Description†  | Package Quantity | Field Modification Cat. No. |
|---|---|------------------|-----------------------------|
|   | IEC line or load terminal covers for 108 and 135 A devices. Dead front protection | 1                | <b>150-TC1</b>              |
|   | IEC line or load terminal covers for 201...251 A devices. Dead front protection   | 1                | <b>150-TC2</b>              |
|   | IEC line or load terminal covers for 317...480 A devices. Dead front protection   | 1                | <b>150-TC3</b>              |

† 5...85 A units have terminal guards standard. No additional terminal guards are required.

**Human Interface and Communication Modules**

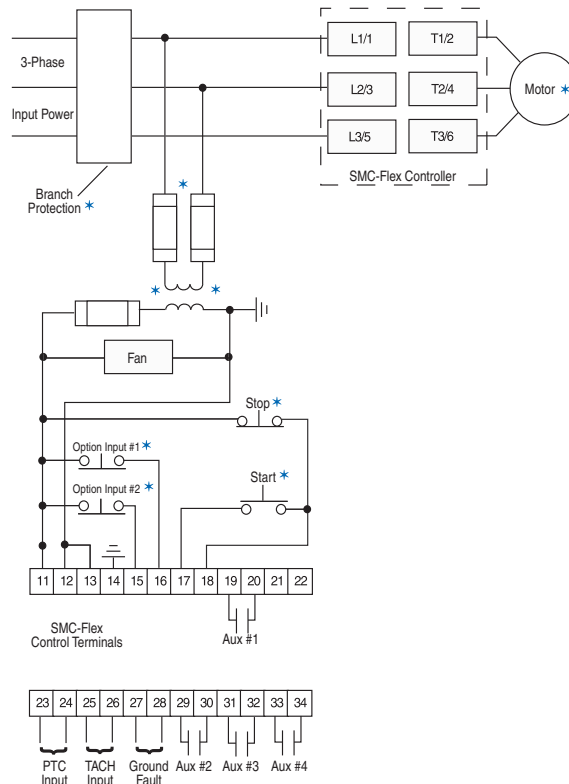
| Description  |   | Cat. No.  |                       |
|--|---|---|-----------------------|
|   | Hand-Held Human Interface Modules       | LCD Display, Full Numeric Keypad*                     | <b>20-HIM-A3</b>      |
|  |   | LCD Display, Programmer Only*                         | 20-HIM-A5             |
|  | Door-Mounted Human Interface Modules    | Remote (Panel Mount) LCD Display, Full Numeric Keypad | <b>20-HIM-C3S</b>     |
|  |   | LCD Display, Programmer Only HIM (includes 3 m cable) | <b>20-HIM-C5S</b>     |
|  | Human Interface Module Interface Cables | PowerFlex 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)                  | <b>1202-H10</b>       |
|  |   | Cable Kit (Male-Female) 3 m (9.8 ft)                  | <b>1202-H30</b>       |
|  |   | Cable Kit (Male-Female) 9 m (29.5 ft)                 | <b>1202-H90</b>       |
|  |   | DPI/SCANport™ One to Two Port Splitter Cable          | <b>1203-S03</b>       |
| Description (IP30/Type 1)  |   | For Use With  |                       |
|  | Communication Modules                   | RS485 DF1 Communication Adapter                       | 20-COMM-S             |
|  |   | PROFIBUS™ DP Communication Adapter                    | <b>20-COMM-P</b>      |
|  |   | ControlNet™ Communication Adapter (Coax)              | 20-COMM-C             |
|  |   | Interbus™ Communication Adapter                       | 20-COMM-I             |
|  |   | Modbus/TCP Communication Adapter                      | <b>20-COMM-M</b>      |
|  |   | DeviceNet™ Communication Adapter                      | <b>20-COMM-D</b>      |
|  |   | EtherNet/IP™ Communication Adapter                    | 20-COMM-E             |
|  |   | HVAC Communication Adapter                            | 20-COMM-H             |
|  |   | ControlNet™ Communication Adapter (Fiber)             | 20-COMM-Q             |
| DriveTools™  | Programming Software                    | WIN NT/2000/XP  | <b>9303-4DTE01ENE</b> |
|  | DriveTools™ Sp                          | WIN NT/2000/XP  | <b>9303-4DTS01ENE</b> |
|  | AnaCANda™ RS-232 to DPI                 | Serial  | <b>1203-SSS</b>       |
|  | DPI to USB                              | USB   | <b>1203-USB</b>       |

\* Requires a 20-HIM-H10 cable to connect to the SMC Flex.

Functional Design Specifications

|                    |                             |   |  |
|--------------------|-----------------------------|---|--|
| Standard Features  | 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.  |
|                    | Setup                       | Keypad  | Front keypad and backlit LCD display.  |
|                    |                             | Software  | Parameter values can be downloaded to the SMC-Flex Controller with DriveTools programming software and the Cat. No. 20-COMM... DPI communication module.   |
|                    | Communications              |   | One DPI provided for connection to optional human interface and 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). |  |
| Optional Features  | 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             | 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.   |

Wiring Diagram — Line Controller



\* Customer supplied.



| Electrical Ratings                  |   |  |                             |                           |
|-------------------------------------|---|--|-----------------------------|---------------------------|
|                                     | Device Rating                                   | UL/CSA/NEMA  | IEC                         |                           |
| <b>Power Circuit</b>                | 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   | N/A                         | 500V                      |
|                                     |   | 600V   |                             | 500V                      |
|                                     |   | 690V   |                             | 690V                      |
|                                     | Rated Impulse Voltage                           | 480V   | N/A                         | 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  | N/A  | IP20                        |                           |
|                                     | 108...480 A                                     |  | IP2X (with terminal covers) |                           |
|                                     | 625...1250 A                                    |  | IP00 (open device)          |                           |
| DV/DT Protection                    | 480V & 600V                                     | RC Snubber Network                                   |                             |                           |
|                                     | 690V  | None   |                             |                           |
| Transient Protection                | 480V & 600V                                     | Metal Oxide Varistors: 220 Joules                    |                             |                           |
|                                     | 690V  | None   |                             |                           |
| <b>Control Circuit</b>              | Rated Operational Voltage§                      | 5...480 A  | 100...240V AC or 24V AC/DC  |                           |
|                                     |   | 625...1250 A   | 110/120V AC and 230/240V AC |                           |
|                                     | Rated Insulation Voltage                        | All  | N/A                         | 240V                      |
|                                     | Rated Impulse Voltage                           | All  | N/A                         | 3000V                     |
|                                     | Dielectric Withstand                            | All  | 1600V AC                    | 2000V                     |
|                                     | Operating Frequency                             | All  | 50/60 Hz                    |                           |
|                                     | Input onstate voltage minimum                   | 85V AC, 19.2V DC / 20.4V AC                          |                             |                           |
|                                     | Input onstate current                           | 20 mA @120V AC / 40 mA @ 240V AC, 7.6 mA @ 24V AC/DC |                             |                           |
|                                     | Input offstate voltage maximum                  | 50V AC, 10V DC / 12V AC                              |                             |                           |
|                                     | Input offstate current @ input offstate voltage | <10 mA AC, <3 mA DC                                  |                             |                           |



§ 690V power is only available with 100...240V control.

Electrical Ratings

| SCPD Performance 200...600V                 |               | Type 1§*                                  |   |  |  |                 |                 |
|---|---------------|---|---|--|--|-----------------|-----------------|
| SCCR List*                                  |               | Max. Standard Available Fault             | Max. Standard Fuse [A]*                   | Max. Standard Available Fault            | Max. Circuit Breaker [A]                 | Max. High Fault | Max. Fuse [A] ‡ |
| Line Device Operational Current Rating [A]  | 5             | 5 kA                                      | 20  | 5 kA                                     | 20                                       | 70 kA           | 10              |
|   | 25            | 5 kA                                      | 100                                       | 5 kA                                     | 100                                      | 70 kA           | 50              |
|   | 43            | 10 kA                                     | 150                                       | 10 kA                                    | 150                                      | 70 kA           | 90              |
|   | 60            | 10 kA                                     | 225                                       | 10 kA                                    | 225                                      | 70 kA           | 125             |
|   | 85            | 10 kA                                     | 300                                       | 10 kA                                    | 300                                      | 70 kA           | 175             |
|   | 108           | 10 kA                                     | 400                                       | 10 kA                                    | 300                                      | 70 kA           | 200             |
|   | 135           | 10 kA                                     | 500                                       | 10 kA                                    | 400                                      | 70 kA           | 225             |
|   | 201           | 18 kA                                     | 600                                       | 18 kA                                    | 600                                      | 70 kA           | 350             |
|   | 251           | 18 kA                                     | 700                                       | 18 kA                                    | 700                                      | 70 kA           | 400             |
|   | 317           | 30 kA                                     | 800                                       | 30 kA                                    | 800                                      | 69 kA           | 500             |
|   | 361           | 30 kA                                     | 1000                                      | 30 kA                                    | 1000                                     | 69 kA           | 600             |
|   | 480           | 42 kA                                     | 1200                                      | 42 kA                                    | 1200                                     | 69 kA           | 800             |
|   | 625           | 42 kA                                     | 1600                                      | 42 kA                                    | 1600                                     | 74 kA           | 1600            |
|   | 780           | 42 kA                                     | 1600                                      | 42 kA                                    | 2000                                     | 74 kA           | 1600            |
|   | 970           | 85 kA                                     | 2500                                      | 85 kA                                    | 2500                                     | 85 kA           | 2500            |
| 1250  | 85 kA         | 3000                                      | 85 kA                                     | 3200                                     | 85 kA                                    | 3000            |                 |
| Delta Device Operational Current Rating [A] | 8.7           | 5 kA                                      | 35  | 5 kA                                     | 35                                       | 70 kA           | 17.5            |
|   | 43            | 5 kA                                      | 150                                       | 5 kA                                     | 150                                      | 70 kA           | 90              |
|   | 74            | 10 kA                                     | 300                                       | 10 kA                                    | 300                                      | 70 kA           | 150             |
|   | 104           | 10 kA                                     | 400                                       | 10 kA                                    | 400                                      | 70 kA           | 200             |
|   | 147           | 10 kA                                     | 400                                       | 10 kA                                    | 400                                      | 70 kA           | 200             |
|   | 187           | 10 kA                                     | 600                                       | 10 kA                                    | 500                                      | 70 kA           | 300             |
|   | 234           | 10 kA                                     | 700                                       | 10 kA                                    | 700                                      | 70 kA           | 400             |
|   | 348           | 18 kA                                     | 1000                                      | 18 kA                                    | 1000                                     | 70 kA           | 600             |
|   | 435           | 18 kA                                     | 1200                                      | 18 kA                                    | 1200                                     | 70 kA           | 800             |
|   | 549           | 30 kA                                     | 1600                                      | 30 kA                                    | 1600                                     | 69 kA           | 1000            |
|   | 625           | 30 kA                                     | 1600                                      | 30 kA                                    | 1600                                     | 69 kA           | 1200            |
|   | 831           | 42 kA                                     | 1600                                      | 30 kA                                    | 1600                                     | 69 kA           | 1600            |
|   | 850           | 42 kA                                     | 1600                                      | 42 kA                                    | 2000                                     | 74 kA           | 1600            |
|   | 900           | 42 kA                                     | 1600                                      | 42 kA                                    | 2000                                     | 74 kA           | 1600            |
|   | 1200          | 85 kA                                     | 3000                                      | 85 kA                                    | 3200                                     | 85 kA           | 3000            |
| 1600  | 85 kA         | 3000                                      | 85 kA                                     | 3200                                     | 85 kA                                    | 3000            |                 |
| SCPD Performance 690V                       |               | Type 1§                                   |   |  |  |                 |                 |
| SCCR List*                                  | 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<br>A070URD33xxx1250 |  | Two fuses in parallel<br>6,6URD33xxx1250 |                 |                 |
| 1250  | 85 kA         | Two fuses in parallel<br>A070URD33xxx1250 |   | Two fuses in parallel<br>6,6URD33xxx1250 |  |                 |                 |

\* Consult local codes for proper sizing of short circuit protection.

\* Non-time delay fuses (K5 — 5...480V (8.7...831 A) devices; Class L — 625...1250V (850...1600 A) devices).

‡ High capacity fault rating when used with time delay class CC, J, or L fuses.

§ 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.

\* For short-circuit current rating (SCCR) for enclosed panel with external bypass or isolation contactor, see the Industrial Controls catalog website: [www.ab.com/catalogs](http://www.ab.com/catalogs).

Short-Circuit Protection



| Electrical Ratings   |  |                                 |                                  |                                    |             |  |  |
|--|--|---------------------------------|----------------------------------|------------------------------------|-------------|--|--|
| Power Requirements   | Control Module   | 1...480 A                       | 120...240V AC                    | Transformer                        | 75 VA       |  |  |
|  |  |                                 | 24V AC                           | Transformer                        | 130 VA      |  |  |
|  |  |                                 | 24V DC                           | 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 A                     | 751 VA (recommended 800 VA)        |             |  |  |
|  |  |                                 | Heatsink Fan(s)✦                 | 5...135 A, 20 VA                   |             |  |  |
| 201...251 A, 40 VA   |  |                                 |                                  |                                    |             |  |  |
| 317...480 A, 60 VA   |  |                                 |                                  |                                    |             |  |  |
| 625...1250 A, 150 VA   |  |                                 |                                  |                                    |             |  |  |
| Steady State Heat Dissipation with Control and Fan Power (Watts)                           | Controller Rating [A]                                      | 5                               | 70                               |                                    |             |  |  |
|  |  | 25                              | 70                               |                                    |             |  |  |
|  |  | 43                              | 81                               |                                    |             |  |  |
|  |  | 60                              | 97                               |                                    |             |  |  |
|  |  | 85                              | 129                              |                                    |             |  |  |
|  |  | 108                             | 91                               |                                    |             |  |  |
|  |  | 135                             | 104                              |                                    |             |  |  |
|  |  | 201                             | 180                              |                                    |             |  |  |
|  |  | 251                             | 198                              |                                    |             |  |  |
|  |  | 317                             | 225                              |                                    |             |  |  |
|  |  | 361                             | 245                              |                                    |             |  |  |
|  |  | 480                             | 290                              |                                    |             |  |  |
|  |  | 625                             | 446                              |                                    |             |  |  |
|  |  | 780                             | 590                              |                                    |             |  |  |
| 970  | 812  |                                 |                                  |                                    |             |  |  |
| 1250   | 1222   |                                 |                                  |                                    |             |  |  |
| 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                         |                                    |             |  |  |
| 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 ( $R_{PTC} = 4$ k $\Omega$ ) |                                 | < 7.5V                           |                                    |             |  |  |
|  | Max. Voltage at PTC Terminals ( $R_{PTC} =$ open)          |                                 | 30V                              |                                    |             |  |  |
|  | Max. No. of Sensors.                                       |                                 | 6                                |                                    |             |  |  |
|  | Max. Cold Resistance of PTC Sensor Chain                   |                                 | 1500 $\Omega$                    |                                    |             |  |  |
| Response Time  |  | 800 ms                          |                                  |                                    |             |  |  |
| Tach Input   |  | 0...5V DC, 4.5V DC = 100% Speed |                                  |                                    |             |  |  |

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

Bulletin 150  
**SMC™ Flex Smart Motor Controllers**  
 Specifications

**Environmental**

|  |  |
|--|--|
| Operating Temperature Range                  | -5...+50 °C (23...+122 °F) (open)<br>-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% (non-condensing)   |
| Pollution Degree                             | 2  |

**Mechanical**

|                         |                         |                          |   |
|-------------------------|-------------------------|--------------------------|---|
| Resistance to Vibration | Operational             | All                      | 1.0 G Peak, 0.15 mm (0.006 in.) displacement  |
|                         | Non-Operational         | 5...480 A                | 2.5 G Peak, 0.38 mm (0.015 in.) displacement  |
|                         |                         | 625...1250 A             | 1.0 G Peak, 0.15 mm (0.006 in.) displacement  |
| Resistance to Shock     | Operational             | 5...85 A                 | 15 G  |
|                         |                         | 108...480 A              | 5.5 G   |
|                         |                         | 625...1250 A             | 4 G   |
|                         | Non-Operational         | 5...85 A                 | 30 G  |
|                         |                         | 108...480 A              | 25 G  |
|                         |                         | 625...1250 A             | 12 G  |
| Construction            | Power Poles             | 5...85 A                 | Heatsink thyristor modular design   |
|                         | Power Poles             | 108...1250 A             | Heatsink hockey puck thyristor modular design   |
|                         | Control Modules         |                          | Thermoset and Thermoplastic Moldings  |
|                         | Metal Parts             |                          | Plated Brass, Copper, or Painted Steel  |
| Terminals               | Power Terminals         | 5...85 A                 | Cable size — Line Upper — 2.5...95 mm <sup>2</sup> (14...3/0 AWG)<br>Line Lower — 0.8...2.5 mm <sup>2</sup> (18...14 AWG)<br>Load Upper — 2.5...50 mm <sup>2</sup> (14...1 AWG)<br>Load Lower — 0.8...2.5 mm <sup>2</sup> (18...14 AWG)<br>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 |   |

**Other**

|                          |   |  |           |            |
|--------------------------|---|--|-----------|------------|
| EMC Emission Levels      | Conducted Radio Frequency Emissions<br>Radiated Emissions   | Class A<br>Class A   |           |            |
| EMC Immunity Levels      | Electrostatic Discharge<br>Radio Frequency Electromagnetic Field<br>Fast Transient<br>Surge Transient | 8 kV Air Discharge<br>Per EN/IEC 60947-4-2<br>Per EN/IEC 60947-4-2<br>Per EN/IEC 60947-4-2 |           |            |
| Overload Characteristics | Current Range [A]   | Line   | Delta     |            |
|                          |   | 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<br>Trip Current Rating<br>Number of Poles  | 10, 15, 20, and 30<br>117% of Motor FLC<br>3   |           |            |
| Certifications           | Open-Type Controllers   | CE Marked Per Low Voltage Directive 73/23/EEC, 93/68/EEC<br>UL Listed (File No. E96956)    |           |            |

4

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

### Approximate Dimensions and Shipping Weights

#### Open Type Controllers

| Rating [A] | Height           | Width           | Depth            | Weight               |
|------------|------------------|-----------------|------------------|----------------------|
| 5...85     | 321<br>(12.6)    | 150<br>(5.9)    | 203<br>(8.0)     | 5.7 kg<br>(12.6 lbs) |
| 108...135  | 443.7<br>(17.47) | 196.4<br>(7.74) | 205.2<br>(8.08)  | 15.0 kg<br>(33 lbs)  |
| 201...251  | 560<br>(22.05)   | 225<br>(8.86)   | 253.8<br>(9.99)  | 30.4 kg<br>(67 lbs)  |
| 317...480  | 600<br>(23.62)   | 290<br>(11.42)  | 276.5<br>(10.89) | 45.8 kg<br>(101 lbs) |
| 625...780  | 1041.1<br>(41.0) | 596.9<br>(23.5) | 346.2<br>(13.63) | 179 kg<br>(395 lbs)  |
| 970...1250 | 1041.1<br>(41.0) | 596.9<br>(23.5) | 346.2<br>(13.63) | 224 kg<br>(495 lbs)  |

#### Enclosed-Type Line-Connected Controllers

Factory-installed options may affect enclosure size requirements.

Exact dimensions can be obtained after order entry. Please consult your local Rockwell Automation sales office or Allen-Bradley distributor.

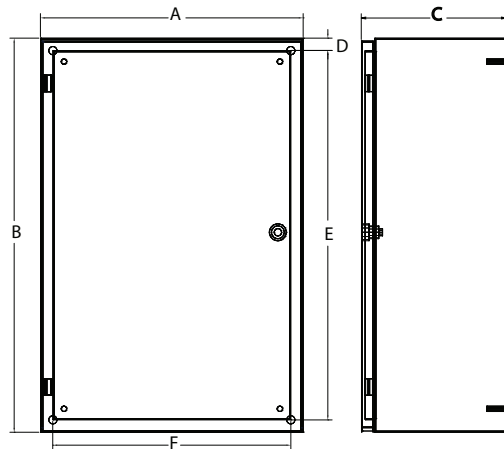


Figure 1 — Wall-Mount

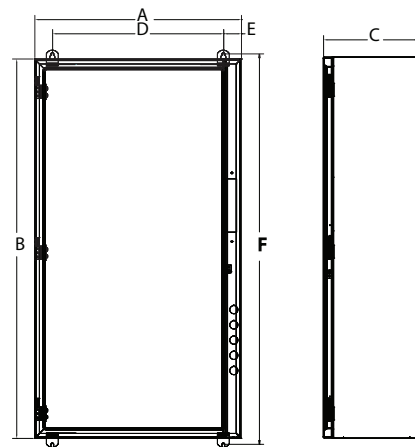


Figure 2 — Wall-Mount

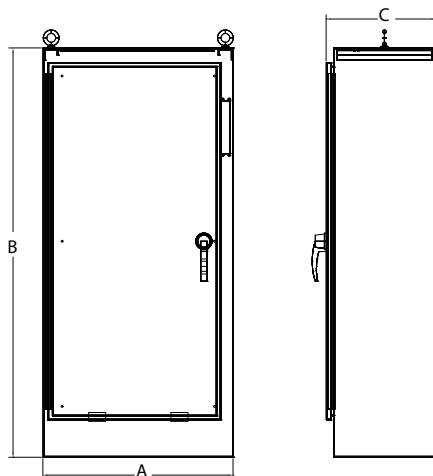


Figure 3 — Floor-Mount

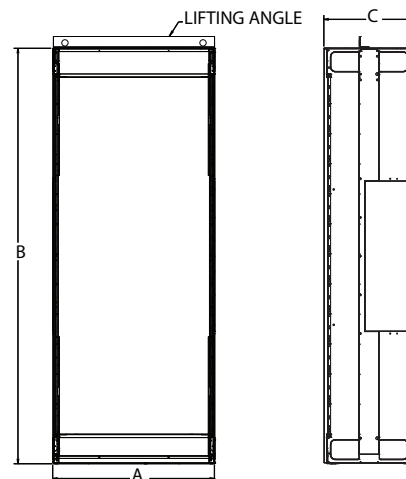


Figure 4 — Floor-Mount

| Controller Rating [A]                  | Bulletin             | With Option | Dimension Figure No. | Dimensions in inches (mm) |             |             |               |               |               |
|--|----------------------|-------------|----------------------|---------------------------|-------------|-------------|---------------|---------------|---------------|
|  |                      |             |                      | A (Width)                 | B (Height)  | C (Depth)   | D (Mtg. Dim.) | E (Mtg. Dim.) | F (Mtg. Dim.) |
| <b>SMC-Flex Combination Controller</b> |                      |             |                      |                           |             |             |               |               |               |
| 5...25                                 | 152H,153H,152B,153B  | —           | 1                    | 16 (406)                  | 24 (610)    | 10 (254)    | 0.75 (19)     | 22.5 (572)    | 14.5 (368)    |
|  |                      | BP,NB,NI,6_ |                      | 24 (610)                  | 30 (762)    | 12 (305)    |               | 28.5 (724)    | 22.5 (572)    |
| 43                                     | 152H,153H,152B,153B  | —           | 1                    | 16 (406)                  | 24 (610)    | 10 (254)    | 0.75 (19)     | 22.5 (572)    | 14.5 (368)    |
|  |                      | BP, 6_      |                      | 24 (610)                  | 30 (762)    | 12 (305)    |               | 28.5 (724)    | 22.5 (572)    |
|  |                      | NI, NB      |                      | 30 (762)                  | 38 (965)    | 14 (356)    |               | 36.5 (927)    | 28.5 (724)    |
| 60                                     | 153H, 153B           | —           | 1                    | 16 (406)                  | 24 (610)    | 10 (254)    | 0.75 (19)     | 22.5 (572)    | 14.5 (368)    |
|  | 152H, 153H,153B      | 6_          |                      | 24 (610)                  | 30 (762)    | 12 (305)    |               | 28.5 (724)    | 22.5 (572)    |
|  | 152H,152B            | —           |                      | 24 (610)                  | 30 (762)    | 12 (305)    |               | 28.5 (724)    | 22.5 (572)    |
|  | 152H,152B, 153B,153H | NI, NB      |                      | 30 (762)                  | 38 (965)    | 14 (356)    |               | 36.5 (927)    | 28.5 (724)    |
| 85                                     | 153B, 153H           | —           | 1                    | 16 (406)                  | 24 (610)    | 10 (254)    | 0.75 (19)     | 22.5 (572)    | 14.5 (368)    |
|  | 152B,152H            | —           |                      | 24 (610)                  | 30 (762)    | 12 (305)    |               | 28.5 (724)    | 22.5 (572)    |
|  | 152H, 153H,153B      | 6_          |                      | 24 (610)                  | 30 (762)    | 12 (305)    |               | 28.5 (724)    | 22.5 (572)    |
|  | 153H                 | BP          |                      | 24 (610)                  | 30 (762)    | 12 (305)    |               | 28.5 (724)    | 22.5 (572)    |
|  | 152B, 152H,153B      | BP, 6_      |                      | 30 (762)                  | 38 (965)    | 14 (356)    |               | 36.5 (927)    | 28.5 (724)    |
| 108                                    | 152H,153H            | —           | 1                    | 30 (762)                  | 38 (965)    | 14 (356)    | 0.75 (19)     | 36.5 (927)    | 28.5 (724)    |
|  | 153H,153B,152H,152B  | 6_          |                      | 30 (762)                  | 38 (965)    | 14 (356)    |               | 36.5 (927)    | 28.5 (724)    |
| 135                                    | 152H,153H            | —           | 1                    | 30 (762)                  | 38 (965)    | 14 (356)    | 0.75 (19)     | 36.5 (927)    | 28.5 (724)    |
|  | 152H,152B,153H,153B  | BP, NB,NI   |                      | 36 (914)                  | 51 (1295)   | 14 (356)    |               | 49.5 (1257)   | 34.5 (876)    |
| 201                                    | 152H,153H            | —           | 1                    | 30 (762)                  | 38 (965)    | 14 (356)    | 0.75 (19)     | 36.5 (927)    | 28.5 (724)    |
|  | 152B,153B,153H,152H  | 6_          |                      | 30 (762)                  | 38 (965)    | 14 (356)    |               | 36.5 (927)    | 28.5 (724)    |
| 251                                    | 152H,153H            | —           | 1                    | 30 (762)                  | 38 (965)    | 14 (356)    | 0.75 (19)     | 36.5 (927)    | 28.5 (724)    |
|  | 152B,153B,153H,152H  | 6_          |                      | 30 (762)                  | 38 (965)    | 14 (356)    |               | 36.5 (927)    | 28.5 (724)    |
| 317                                    | 153H                 | —           | 1                    | 36 (914)                  | 51 (1295)   | 14 (356)    | 0.75 (19)     | 49.5 (1257)   | 34.5 (876)    |
|  | 153H                 | 6_          |                      | 36 (914)                  | 51 (1295)   | 14 (356)    |               | 49.5 (1257)   | 34.5 (876)    |
|  | 153H                 | BP,NB       |                      | 36 (914)                  | 60 (1524)   | 14 (356)    |               | 58.5 (1486)   | 34.5 (876)    |
|  | 153B                 | —           | 2                    | 36 (914)                  | 60 (1524)   | 14 (356)    | 33.88 (861)   | 58.5 (1486)   | 34.5 (876)    |
|  | 152H,152B            | 6_          |                      | 38 (965)                  | 60 (1524)   | 17 (431)    |               | 1.75 (45)     | 61.69 (1567)  |
| 152B,153B,152H                         | NB,NI                | 3           | 40 (1016)            | 84 (2134)                 | 18 (457)    | —           | —             | —             |               |
| 361                                    | 153H                 | —           | 1                    | 36 (914)                  | 51 (1295)   | 14 (356)    | 0.75 (19)     | 49.5 (1257)   | 34.5 (876)    |
|  | 153H                 | 6_          |                      | 36 (914)                  | 51 (1295)   | 14 (356)    |               | 49.5 (1257)   | 34.5 (876)    |
|  | 153H                 | BP          |                      | 36 (914)                  | 60 (1524)   | 14 (356)    |               | 58.5 (1486)   | 34.5 (876)    |
|  | 153B                 | —           | 2                    | 36 (914)                  | 60 (1524)   | 14 (356)    | 33.88 (861)   | 58.5 (1486)   | 34.5 (876)    |
|  | 152H, 152B           | —           |                      | 38 (965)                  | 60 (1524)   | 17 (431)    |               | 1.75 (45)     | 61.69 (1567)  |
|  | 152H                 | 6_          |                      | 38 (965)                  | 60 (1524)   | 17 (431)    |               | 1.75 (45)     | 61.69 (1567)  |
| 153H,152B,153B,152H                    | NB,NI                | 3           | 40 (1016)            | 84 (2134)                 | 18 (457)    | —           | —             | —             |               |
| 480                                    | 153H                 | —           | 1                    | 36 (914)                  | 51 (1295)   | 14 (356)    | 0.75 (19)     | 49.5 (1257)   | 34.5 (876)    |
|  | 153H                 | 6_          |                      | 36 (914)                  | 51 (1295)   | 14 (356)    |               | 49.5 (1257)   | 34.5 (876)    |
|  | 153H,153B            | BP,NI       | 1*                   | 36 (914)                  | 60 (1524)   | 14 (356)    | —             | 58.5 (1486)   | 34.5 (876)    |
|  | 152H                 | —           | 2*‡                  | 38 (965)                  | 60 (1524)   | 17 (431)    | 33.88 (861)   | 1.75 (45)     | 61.69 (1567)  |
|  |                      | BP          |                      | 38 (965)                  | 60 (1524)   | 17 (431)    |               | 1.75 (45)     | 61.69 (1567)  |
|  |                      | —           | 3*‡                  | 40 (1016)                 | 84 (2134)   | 18 (457)    | —             | —             | —             |
|  |                      | NB          |                      | 4*§                       | 20 (508)    | 91.5 (2324) | 20 (508)      | —             | —             |
|  | 153H,153B            | BP,NB,NI    | 3*§                  | 40 (1016)                 | 84 (2134)   | 18 (457)    | —             | —             | —             |
| 152B                                   | BP,NB,NI,6_          | 3*          | 40 (1016)            | 84 (2134)                 | 18 (457)    | —           | —             | —             |               |
| 152H,152B                              | BP,NB,NI             | 4           | 35 (889)             | 91.5 (2324)               | 20 (508)    | —           | —             | —             |               |
| 625                                    | 152B                 | —           | 4                    | 55 (1397)                 | 91.5 (2324) | 20 (508)    | —             | —             | —             |
|  | 152B,152H,153B,153H  | NB          |                      | 105 (2664)                | 91.5 (2324) | 20 (508)    |               |               |               |
|  | 152H                 | —           |                      | 55 (1397)                 | 91.5 (2324) | 20 (508)    |               |               |               |
|  | 152H                 | BP          |                      | 70 (1778)                 | 91.5 (2324) | 20 (508)    |               |               |               |
| 153B,153H                              | —                    | 65 (1651)   | 91.5 (2324)          | 20 (508)                  | —           | —           | —             |               |               |
| 780                                    | 152B                 | —           | 4                    | 55 (1397)                 | 91.5 (2324) | 20 (508)    | —             | —             | —             |
|  | 152B,152H            | BP,NI       |                      | 70 (1778)                 | 91.5 (2324) | 20 (508)    |               |               |               |
|  | 152B,152H,153B,153H  | NB          |                      | 105 (2664)                | 91.5 (2324) | 20 (508)    |               |               |               |
|  | 153B,153H            | —           |                      | 65 (1651)                 | 91.5 (2324) | 20 (508)    |               |               |               |

\* Assumed line voltage to be 480V AC. Different voltage may necessitate a bigger enclosure size. Consult your local Rockwell Automation sales office or Allen-Bradley distributor.

‡ 350 Hp max.

‡ 150 Hp @ 208V AC, 350 Hp @480V, 400...4500 Hp @ 600V

§ 200 Hp @ 240V AC, 400 Hp @480V, 5000 Hp @ 600V



| Controller Rating [A]             | Bulletin  | With Option | Dimension Figure No. | Dimensions in inches (mm) |             |            |               |               |               |
|-----------------------------------|-----------|-------------|----------------------|---------------------------|-------------|------------|---------------|---------------|---------------|
|                                   |           |             |                      | A (Width)                 | B (Height)  | C (Depth)  | D (Mtg. Dim.) | E (Mtg. Dim.) | F (Mtg. Dim.) |
| <b>Non-Combination Controller</b> |           |             |                      |                           |             |            |               |               |               |
| 5...43                            | 150       | —           | 1                    | 16 (406)                  | 24 (610)    | 10 (254)   | 0.75 (19)     | 22.5 (572)    | 14.5 (368)    |
|                                   |           | 6_          | 1*                   | 16 (406)                  | 24 (610)    | 10 (254)   |               | 22.5 (572)    | 14.5 (368)    |
|                                   |           | BP          | 1                    | 24 (610)                  | 30 (762)    | 12 (305)   |               | 28.5 (724)    | 22.5 (572)    |
|                                   | 150, 150B | NB,NI       | 1                    | 24 (610)                  | 30 (762)    | 305(12)    |               | 28.5 (724)    | 22.5 (572)    |
|                                   | 150       | NB,6P_      | 1*                   | 30 (762)                  | 38 (965)    | 14 (356)   |               | 36.5 (927)    | 28.5 (724)    |
| 60                                | 150       | —           | 1                    | 16 (406)                  | 24 (610)    | 10 (254)   | 0.75 (19)     | 22.5 (572)    | 14.5 (368)    |
|                                   | 150B      | —           |                      | 24 (610)                  | 30 (762)    | 12 (305)   |               | 28.5 (724)    | 22.5 (572)    |
|                                   |           | BP          |                      | 24 (610)                  | 30 (762)    | 12 (305)   |               | 28.5 (724)    | 22.5 (572)    |
|                                   | 150       | 6_          | 1*                   | 24 (610)                  | 30 (762)    | 12 (305)   |               | 28.5 (724)    | 22.5 (572)    |
|                                   | 150, 150B | NB          | 1                    | 24 (610)                  | 30 (762)    | 12 (305)   |               | 28.5 (724)    | 22.5 (572)    |
|                                   |           | NI          |                      | 30 (762)                  | 38 (965)    | 14 (356)   |               | 36.5 (927)    | 28.5 (724)    |
| 85                                | 150       | —           | 1                    | 16 (406)                  | 24 (610)    | 10 (254)   | 0.75 (19)     | 22.5 (572)    | 14.5 (368)    |
|                                   | 150B      | —           |                      | 24 (610)                  | 30 (762)    | 12 (305)   |               | 28.5 (724)    | 22.5 (572)    |
|                                   |           | BP          |                      | 24 (610)                  | 30 (762)    | 12 (305)   |               | 28.5 (724)    | 22.5 (572)    |
|                                   | 150       | NB          | 24 (610)             | 30 (762)                  | 12 (305)    | 28.5 (724) |               | 22.5 (572)    |               |
|                                   | 150, 150B | 6_          | 1*                   | 24 (610)                  | 30 (762)    | 12 (305)   |               | 28.5 (724)    | 22.5 (572)    |
|                                   |           | NB,NI,6P_   | 1*                   | 30 (762)                  | 38 (965)    | 14 (356)   |               | 36.5 (927)    | 28.5 (724)    |
| 108                               | 150       | —           | 1                    | 24 (610)                  | 30 (762)    | 12 (305)   | 0.75 (19)     | 28.5 (724)    | 22.5 (572)    |
|                                   |           | BP          |                      | 30 (762)                  | 38 (965)    | 14 (356)   |               | 36.5 (927)    | 28.5 (724)    |
|                                   |           | NB          |                      | 30 (762)                  | 38 (965)    | 14 (356)   |               | 36.5 (927)    | 28.5 (724)    |
|                                   | 150B      | —           |                      | 30 (762)                  | 38 (965)    | 14 (356)   |               | 36.5 (927)    | 28.5 (724)    |
|                                   |           | NB,NI       |                      | 36 (914)                  | 51 (1295)   | 14 (356)   |               | 49.5 (1257)   | 34.5 (876)    |
|                                   |           | —           |                      | 24 (610)                  | 30 (762)    | 12 (305)   |               | 28.5 (724)    | 22.5 (572)    |
| 135                               | 150       | —           | 1                    | 30 (762)                  | 38 (965)    | 14 (356)   | 0.75 (19)     | 36.5 (927)    | 28.5 (724)    |
|                                   | 150B      | —           |                      | 30 (762)                  | 38 (965)    | 14 (356)   |               | 36.5 (927)    | 28.5 (724)    |
|                                   |           | NB          |                      | 30 (762)                  | 38 (965)    | 14 (356)   |               | 36.5 (927)    | 28.5 (724)    |
|                                   | 150       | —           |                      | 36 (914)                  | 51 (1295)   | 14 (356)   |               | 49.5 (1257)   | 34.5 (876)    |
|                                   | 150B      | NB,NI       |                      | 36 (914)                  | 51 (1295)   | 14 (356)   |               | 49.5 (1257)   | 34.5 (876)    |
| 201                               | 150       | —           | 1                    | 30 (762)                  | 38 (965)    | 14 (356)   | 0.75 (19)     | 36.5 (927)    | 28.5 (724)    |
|                                   | 150, 150B | NB,NI,BP,6_ |                      | 36 (914)                  | 51 (1295)   | 14 (356)   |               | 49.5 (1257)   | 34.5 (876)    |
| 251                               | 150       | —           | 1                    | 30 (762)                  | 38 (965)    | 14 (356)   | 0.75 (19)     | 36.5 (927)    | 28.5 (724)    |
|                                   | 150, 150B | NB,NI,BP,6_ |                      | 36 (914)                  | 51 (1295)   | 14 (356)   |               | 49.5 (1257)   | 34.5 (876)    |
| 317                               | 150       | NB,NI,BP,6_ | 1                    | 36 (914)                  | 51 (1295)   | 14 (356)   | 0.75 (19)     | 49.5 (1257)   | 34.5 (876)    |
|                                   | 150B      | NB,NI,BP,6_ |                      | 36 (914)                  | 60 (1524)   | 14 (356)   |               | 58.5 (1486)   | 34.5 (876)    |
| 361                               | 150       | NB,NI,BP,6_ | 1                    | 36 (914)                  | 51 (1295)   | 14 (356)   | 0.75 (19)     | 49.5 (1257)   | 34.5 (876)    |
|                                   | 150B      | NB,NI,BP,6_ |                      | 36 (914)                  | 60 (1524)   | 14 (356)   |               | 58.5 (1486)   | 34.5 (876)    |
| 480                               | 150       | —           | 1                    | 36 (914)                  | 51 (1295)   | 14 (356)   | 0.75 (19)     | 49.5 (1257)   | 34.5 (876)    |
|                                   | 150, 150B | BP,NB,NI    |                      | 36 (914)                  | 60 (1524)   | 14 (356)   |               | 58.5 (1486)   | 34.5 (876)    |
| 625                               | 150       | —           | 4                    | 35 (889)                  | 91.5 (2324) | 20 (508)   | —             | —             | —             |
|                                   |           | BP,NB       |                      | 60 (1524)                 | 91.5 (2324) | 20 (508)   |               |               |               |
|                                   | 150B      | —           |                      | 60 (1524)                 | 91.5 (2324) | 20 (508)   |               |               |               |
|                                   |           | NB          |                      | 90 (2286)                 | 91.5 (2324) | 20 (508)   |               |               |               |
| 780                               | 150       | —           | 4                    | 35 (889)                  | 91.5 (2324) | 20 (508)   | —             | —             | —             |
|                                   |           | BP,NB       |                      | 60 (1524)                 | 91.5 (2324) | 20 (508)   |               |               |               |
|                                   | 150B      | —           |                      | 60 (1524)                 | 91.5 (2324) | 20 (508)   |               |               |               |
|                                   |           | NB          |                      | 90 (2286)                 | 91.5 (2324) | 20 (508)   |               |               |               |

\* Extra capacity transformer may require a larger enclosure; consult your local Rockwell Automation sales office or Allen-Bradley distributor.

\* 1 kVA control transformers or larger extra capacity transformers may require a larger enclosure; consult your local Rockwell Automation sales office or Allen-Bradley distributor.