Allen-Bradley

Selection Guide for SMC-Delta™ and SMC-3™

A New Dimension in Motor Control

Allen-Bradley
RELIANCE ELECTRIC
DODGE
ROCKWELL SOFTWARE
Rockwell Automation

Bringing Together Leading Brands in Industrial Automation

Discover a New Dimension in Motor Control: SMC-Delta and SMC-3

The Allen-Bradley SMC-Delta and SMC-3 softstarters from Complete Automation supplier Rockwell Automation provide integrated features and technology previously unavailable in a compact 45-72 mm housing. The flexibility and capabilities of both the SMC-Delta and SMC-3 make them ideal for almost any application, and with the available accessories, the functionality and application range is extended even further.

SMC-3 - A Smart and Compact Soft Starter

The SMC-3 takes soft starting to a new dimension by providing increased intelligence in a compact footprint. As standard, this true three-phase controlling device includes electronic overload protection with adjustable trip class, increased motor and system diagnostics, configurable auxiliary contacts, and multiple start and stop modes. The SMC-3 is ideal for virtually any application.

SMC-Delta - A New Dimension for Star-Delta Starting

Transitionless starting for your star-delta motor has never been smaller in size, easier to wire and set up, and easier to maintain. The SMC-Delta has packaged power wiring, overload, timers, and multiple contactors into a single, highly reliable, easy to set-up star-delta controller. The SMC-Delta is very flexible and modular, allowing one device to be configured for many applications. The SMC-Delta has the right functionality for your star-delta needs.

Why use Smart Motor Controllers (SMCs)?
SMCs provide many features to benefit your system:

- Minimize mechanical damage resulting from full voltage starting of AC induction motors, enabling longer system life
- Limit line disturbances from inrush currents, resulting in reduced downtime
- Multiple Start/Stop modes increase functionality
- Diagnostic monitoring helps prevent problems before they occur
- Satisfy electrical distribution restrictions by reducing inrush currents

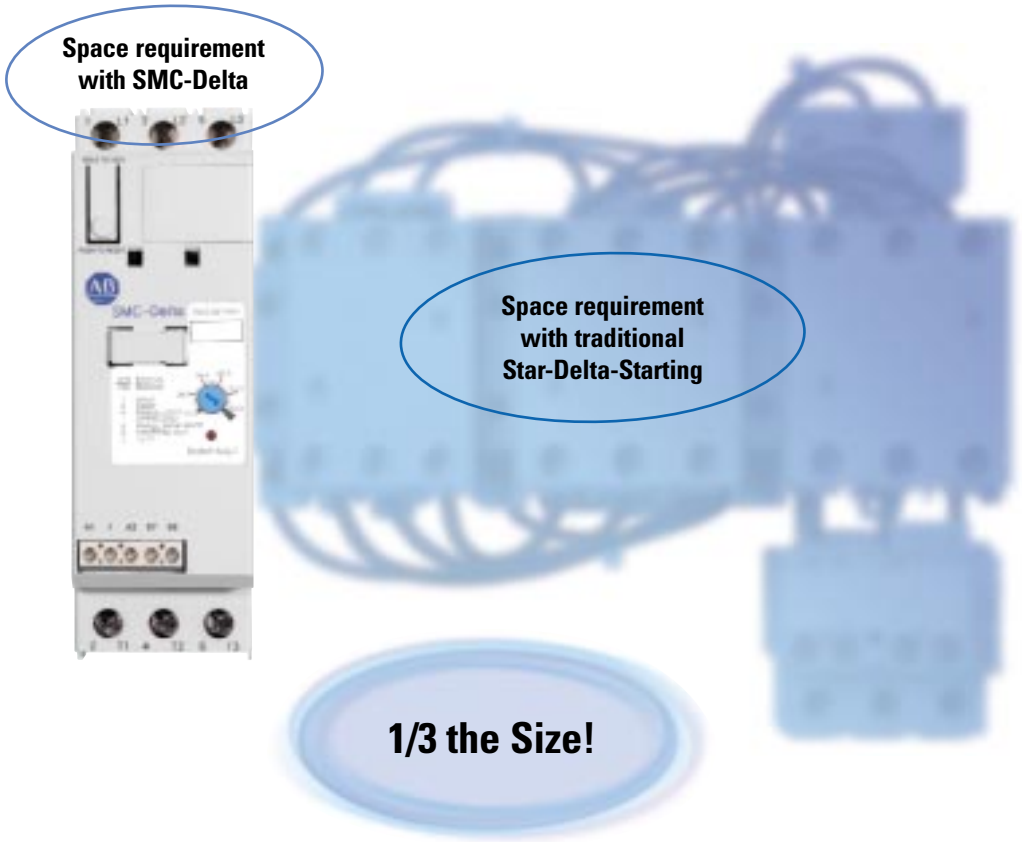
SMC Softstarters are ideal for applications where:

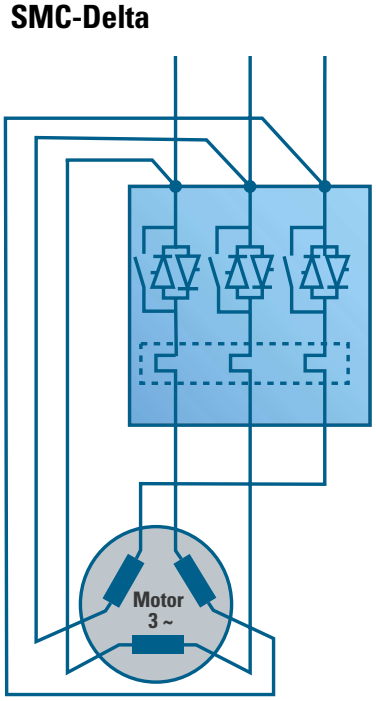
- Belts, gears, and chains can be damaged by across-the-line starting
- Materials can be damaged by sudden starts and stops
- A step change in torque can damage equipment
- Power company line current restrictions are imposed
- Space is a premium

With SMC Softstarters you benefit from:

- Advanced diagnostics, increasing system performance
- Compact, space-saving footprint
- Greater product functionality for increased system flexibility
- Decreased downtime due to advanced protection of motor winding, equipment, and materials
- Greater system operation accuracy due to improved technology
- Ease of purchasing, installation, setup and maintenance
- Modularity with other Rockwell Automation products

SMC-Delta
The Industry's First Fully Integrated Starter for Star-Delta Applications



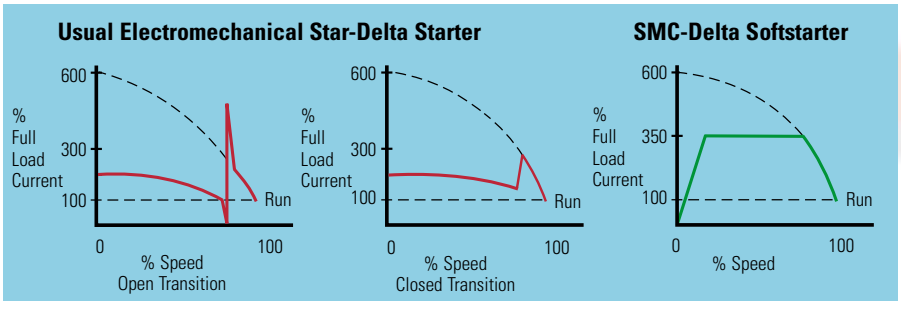


Reduced space, high functionality

The SMC-Delta is a reduced voltage starter replacement for star-delta applications incorporating a closed-transition start in only 1/3 of the panel space of an electromechanical starter. It combines contactors, overload, timers, and internal power/control wiring into a single product with a compact footprint, making installation quick and easy. Because the SMC-Delta provides six motor winding terminations, no major wiring change is required. The SMC-Delta is an ideal choice for controlling a star-delta motor or for upgrading existing electromechanical star-delta motor starters.

Highest Current Rating in Compact Design

The SMC-Delta is connected to the motor using the inside-the-delta (root 3) wiring configuration. This allows the compact design of the SMC-Delta to accommodate a higher motor Amp rating than traditional reduced voltage starters.



Transitionless Motor Starting - Eliminate switching noises and current surges

The SMC-Delta utilizes a current limit starting method to eliminate the current transition point found in star-delta applications. This greatly reduces the mechanical and electrical shock to your system and is especially important when power supplies are limited.

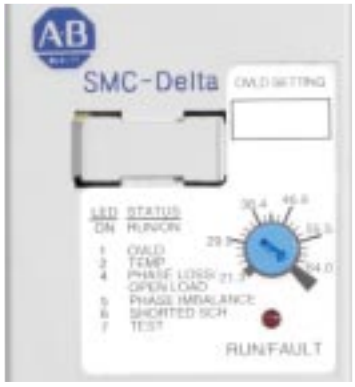
Cost-Saving Design

Benefits of the SMC-Delta over traditional electromechanical solutions:

- Compact design allows **three times** more starters in the same panel space as with one traditional electromechanical device
- Increased reliability
  - Diagnostic features help prevent downtime
  - Minimizes system mechanical and electrical stress by reducing current surges
- Simple Installation
  - Only one product to purchase and install
  - Integrated overload protection
  - Internal Timer
  - No internal wiring between contactors

Easy and secure setup

- DIP switches allow for easy, precise, and secure setting of the start/stop profile, overload trip class, and auxiliary contact characteristics.
- The overload FLC setting is easily accomplished using the rotary pot located on the front of the device.



LED Display

An LED display clearly relays device status information including RUN, FAULT diagnostics, and OFF.

Current Range	• 1...147 A
Voltage Range	• 200...600 VAC 50/60Hz
Control Voltage	• 100...240 VAC • 24 VAC/DC
Starting Modes	• Current Limit Start
Features	**Overload Protection** • Flexibility in trip class (10, 15, 20 or OFF) • Selectable overload reset (Manual or Automatic) **FAULT Diagnostics** • Overtemperature in power section • Phase loss / Open load • Phase imbalance • Shorted SCRs **Motor Control** • 6-Lead Motor • Inside-the-delta wiring
Typical Applications	• Compressors • Fans • Conveyors • Lifts • Chillers • Pumps

SMC-3
Size for Size... Best Value in the Industry

The SMC-3 provides intelligence and unmatched performance in a compact design for controlling your standard squirrel cage induction motor. It features microprocessor-controlled electronic overload with adjustable trip class, motor and system diagnostics, configurable auxiliary contacts, and multiple start and stop modes. All of these combined features provide a highly accurate, reliable, and efficient smart motor controller with the smallest footprint in the industry.

Actual Size 1...37 A

Current Range
- 1...85 A

Voltage Range
- 200...600 VAC 50/60Hz

Control Voltage
- 100...240 VAC
- 24 VAC/DC

Starting Modes
- Soft start
- Kick start
- Current limit start
- Soft stop

Features

Overload Protection
- Flexibility in trip class (10, 15, 20 or OFF)
- Selectable overload reset (Manual or Automatic)

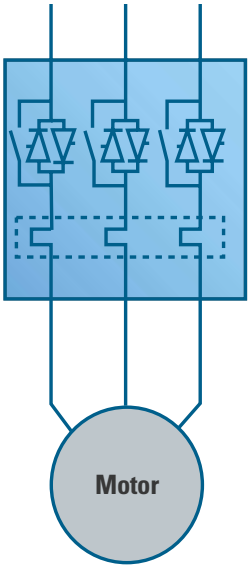
FAULT Diagnostics
- Overtemperature in power section
- Phase reversal (selectable)
- Phase loss / Open load
- Phase imbalance
- Shorted SCRs

Configurable Auxiliary Contacts

Motor Control
- Full 3-phase control
- Standard squirrel cage induction motor

Typical Applications
- Compressors
- Fans
- Conveyors
- Lifts
- Chillers
- Pumps

SMC-3



Compact Size with true 3-phase control

At a slim 45 mm or 72 mm, the SMC-3 integrates a bypass to minimize heat generation during run time. The bypass automatically closes when the motor reaches its nominal speed, resulting in a cooler-running component and reduction in enclosure size.

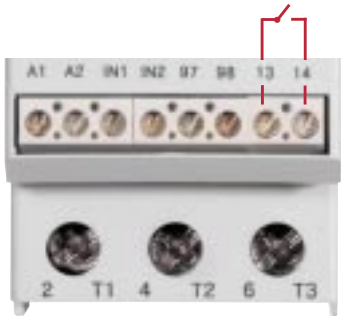
Actual Size 43...85 A

Unsurpassed Advantages

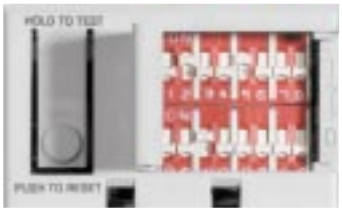
Features	SMC-3
Built-in Overload	✓
Compact Size (overload included) 1...37 A 45 mm W x 141 mm H x 100 mm D 43...85 A 72 mm W x 206 mm H x 130 mm D	✓
True 3-Phase Control	✓
Advanced Diagnostics	✓
Digital Adjustments	✓
Configurable Auxiliary Contact (Normal or Up-to-Speed)	✓
Add-on Configurable Auxiliary Contacts	✓

Configurable Auxiliary Contacts

As standard, the SMC-3 provides a configurable (Normal or Up-to-Speed) normally open (N.O.) auxiliary contact for motor run status indication.



The SMC-3 has a line of side-mount configurable (Normal or Up-to-Speed) auxiliary contacts, allowing you more flexibility than ever before in your smart motor controller application.



Easy and secure setup

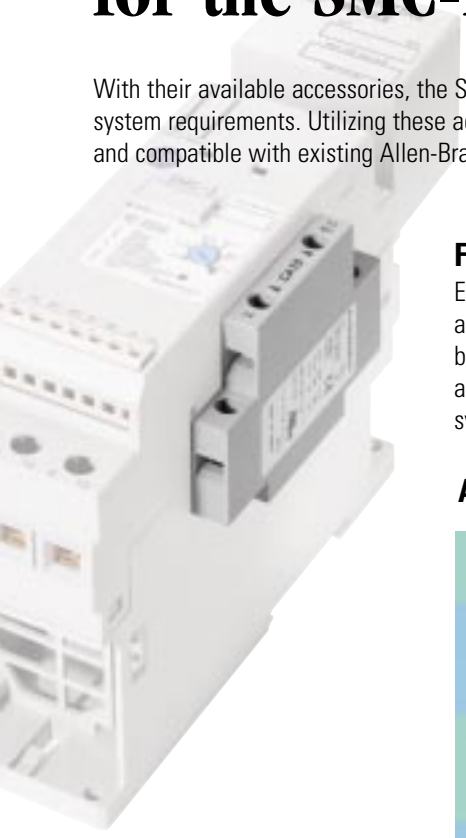
- DIP switches allow for easy, precise, and secure setting of the start/stop profile, overload trip class, and auxiliary contact characteristics.
- The overload FLC setting is easily accomplished using the rotary pot located on the front of the device.

LED Display

An LED display clearly relays device status information including RUN, FAULT diagnostics, and OFF.

Modularizing Accessories for the SMC-Delta and SMC-3

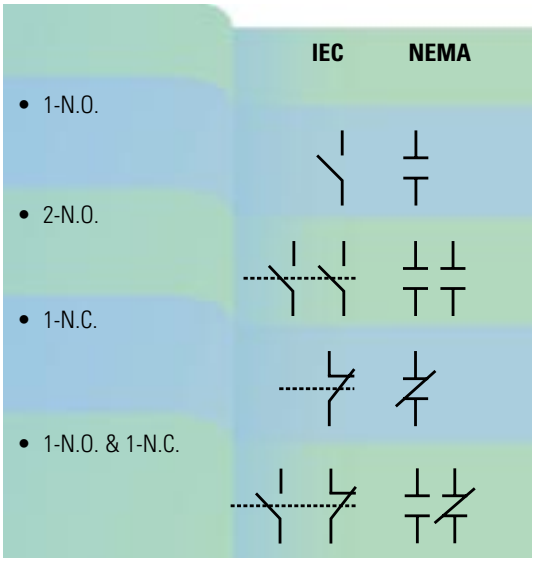
With their available accessories, the SMC-Delta and SMC-3 can be customized to fit your specific system requirements. Utilizing these accessories, the SMC-Delta and SMC-3 become very modular and compatible with existing Allen-Bradley product lines, allowing for a complete automation solution.



Flexible and Configurable Auxiliary Contacts

Easy-to-mount side-mount auxiliary contact blocks make the SMC-Delta and SMC-3 suitable for a wide range of applications. Auxiliary contact blocks are configurable for either normal or up-to-speed conditions, and are available in a variety of contact combinations, allowing for specific system requirements without additional equipment.

Available configurations



Protected for best performance

Optional MOV protective modules prevent damage from transient voltages.

Reduce Temperature, Increase Duty Cycle

Although the SMC-Delta and SMC-3 generate minimal heat, the optional fan is useful if an application requires an increased duty cycle. The snap-on fan module runs silently and is easy to install. For 43...85 A the fan is installed as standard.

Remote Reset Solenoid

The Bulletin 193 remote reset solenoid can be attached to the SMC-Delta and SMC-3, allowing you the ability to reset the overload from a remote location.

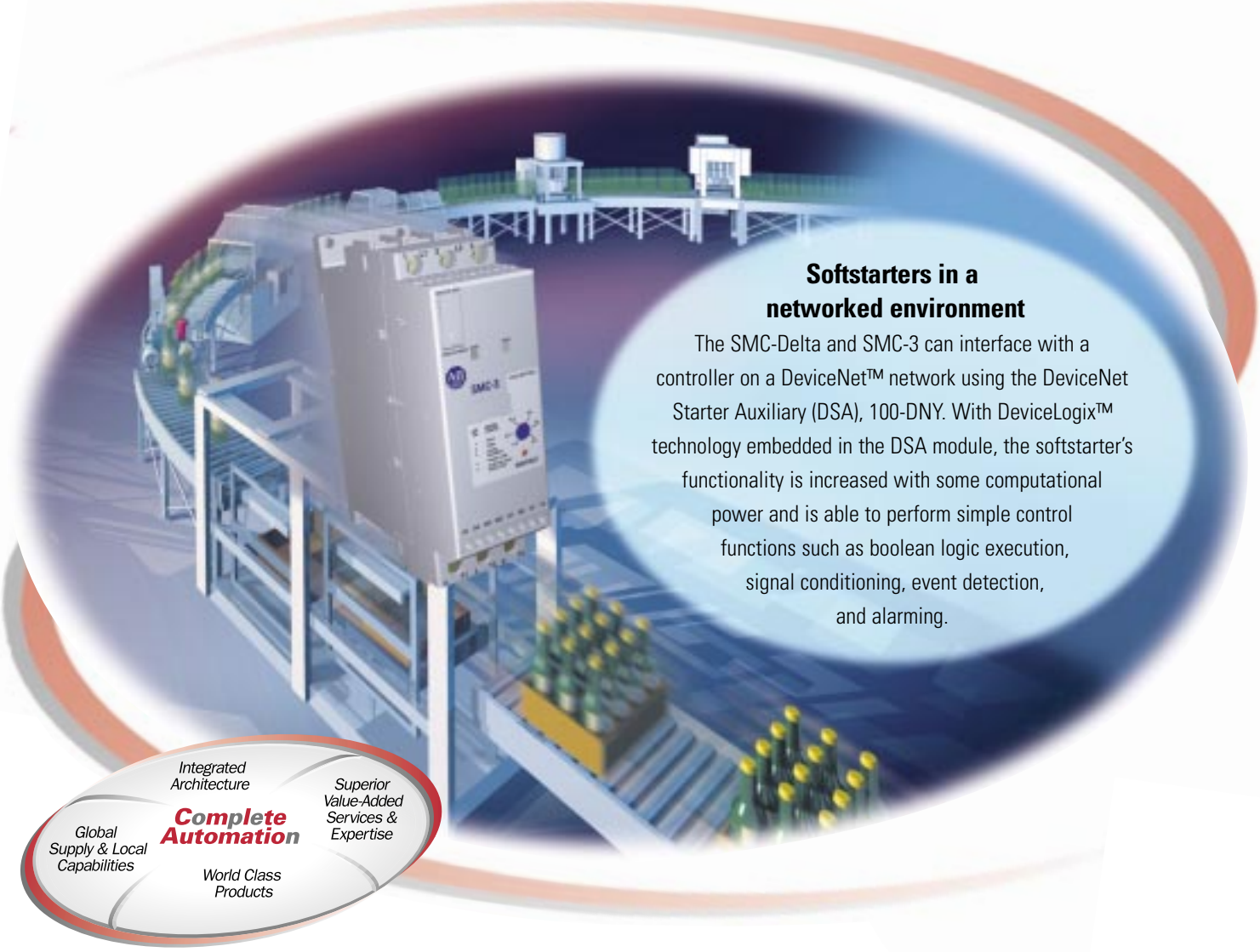
Connecting to the MCS System

It is easy to build a system with Modular Control System (MCS) Bulletin 140M and 100C product lines. With a width of only 45 mm or 72 mm, the SMC-Delta and SMC-3 fit perfectly with the compact components of the MCS. The smart motor controllers match the MCS products in performance, size, and design.

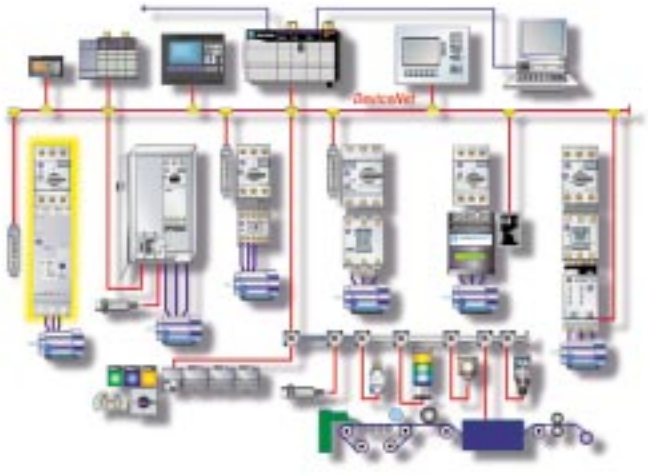
More starters on less panel space

With SMC-Delta or SMC-3, and the MCS system, you can build more starters on less panel space, providing unparalleled performance in a minimal area.

Softstarters in Networked Environment



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



Motor Management –
Total control, complete flexibility

Motors are the modern-day workhorses of today's demanding industrial automation environments. With today's multitude of applications it is important to optimise the operation and protection of the motors used within a process.

With a modular and flexible motor management program, Rockwell Automation offers you a wide range of control, switching, protection, and starting devices. The latter is now further enhanced with the addition of the SMC-Delta and SMC-3.

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

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

- Current Limit Start
- Coast to Rest

The controllers are available in 11 sizes: 3, 9, 16, 20, 25, 32, 51, 64, 74, 104, and 147 A. They offer two voltage ranges: 200…480V AC and 200…600V AC. All voltage ranges will operate at either 50 or 60 Hz.

- 1…147 A Range
- Built-In Overload
- SCR Bypass

Table of Contents

Standards Compliance

- UL 508
- CSA C22.2 No. 14
- EN/IEC 60947-4-2
- cULus Listed (Open Type) (File No. E96956)

Approvals

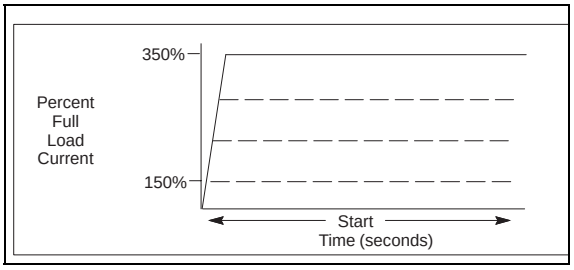
- CE Marked (Open Type) per EMC Directive and Low Voltage Directive

Your order must include 1) cat. no. of the controller selected, 2) if required, suffix code and description of any modifications, and 3) if required, cat. no. of any options or accessories.

Mode of Operation

Current Limit Start

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



Description of Protection Features

Overload Protection

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

Over-temperature

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

Phase Loss/Open Load

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

Phase Imbalance

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

Shorted SCR

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

LED Description (Number of Flashes)

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

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Cat. No. Identification

Open and Non-Combination

150 – D 32 N B D

Bulletin Number
150 Solid-State Controller

Controller Type
D Star-Delta (6-Wire)

Ampere Ratings
3 3 A
9 9 A
16 16 A
20 20 A
25 25 A
32 32 A
51 51 A
64 64 A
74 74 A
104 104 A
147 147 A

Enclosure Type
N Open

Input Line Voltage
Open Type
B 200…480V AC, 3-Phase, 50/60 Hz
C 200…600V AC, 3-Phase, 50/60 Hz

Control Voltage
D 100…240V AC
R 24V AC/DC

Product Selection

Open Type Controllers

Up to 480V AC

Current Rating (A) ❶	kW		Hp			100…240V AC 50/60 Hz Control Cat. No.	24V AC/DC Control Cat. No.
	230V AC 50 Hz	380/400/ 415V AC 50 Hz	200V AC 60 Hz	230V AC 60 Hz	460V AC 60 Hz		
1…3	0.55	1.1	0.5	0.5	0.5…1.5	150-D3NBD	150-D3NBR
3…9	2.2	4	0.75…2	0.75…2	1.5…5	150-D9NBD	150-D9NBR
5.3…16	4	7.5	1.5…3	1.5…5	5…10	150-D16NBD	150-D16NBR
6.7…20	5.5	7.5	2…5	2…5	5…10	150-D20NBD	150-D20NBR
9.2…25	5.5	11	3…7.5	3…7.5	7.5…15	150-D25NBD	150-D25NBR
10.6…32	7.5	15	3…10	5…10	7.5…20	150-D32NBD	150-D32NBR
17…51	15	22	5…15	7.5…15	15…30	150-D51NBD	150-D51NBR
21.3…64	18.5	30	7.5…20	7.5…20	20…40	150-D64NBD	150-D64NBR
24.7…74	22	37	7.5…20	7.5…25	15…50	150-D74NBD	150-D74NBR
34.7…104	30	55	15…30	15…40	25…75	150-D104NBD	150-D104NBR
49…147	45	75	15…40	20…50	40…100	150-D147NBD	150-D147NBR

Up to 600V AC

Current Rating (A) ❶	kW			Hp				100…240V AC 50/60 Hz Control Cat. No.	24V AC/DC Control Cat. No.
	230V AC 50 Hz	380/400/ 415V AC 50 Hz	500V AC 50 Hz	200V AC 60 Hz	230V AC 60 Hz	460V AC 60 Hz	575V AC 60 Hz		
1…3	0.55	1.1	1.5	0.5	0.5	0.5…1.5	0.75…2	150-D3NCD	150-D3NCR
3…9	2.2	4	5.5	0.75…2	0.75…2	1.5…5	3…7.5	150-D9NCD	150-D9NCR
5.3…16	4	7.5	7.5	1.5…3	1.5…5	5…10	5…10	150-D16NCD	150-D16NCR
6.7…20	5.5	7.5	11	2…5	2…5	5…10	7.5…15	150-D20NCD	150-D20NCR
9.2…25	5.5	11	15	3…7.5	3…7.5	7.5…15	7.5…20	150-D25NCD	150-D25NCR
10.6…32	7.5	15	18.5	3…10	5…10	7.5…20	10…30	150-D32NCD	150-D32NCR
17…51	15	22	30	5…15	7.5…15	15…30	15…40	150-D51NCD	150-D51NCR
21.3…64	18.5	30	37	7.5…20	7.5…20	20…40	20…60	150-D64NCD	150-D64NCR
24.7…74	22	37	45	7.5…20	7.5…25	15…50	20…60	150-D74NCD	150-D74NCR
34.7…104	30	55	55	15…30	15…40	25…75	40…100	150-D104NCD	150-D104NCR
49…147	45	75	90	15…40	20…50	40…100	50…150	150-D147NCD	150-D147NCR

❶ Motor FLA must fall within the current range of the device.

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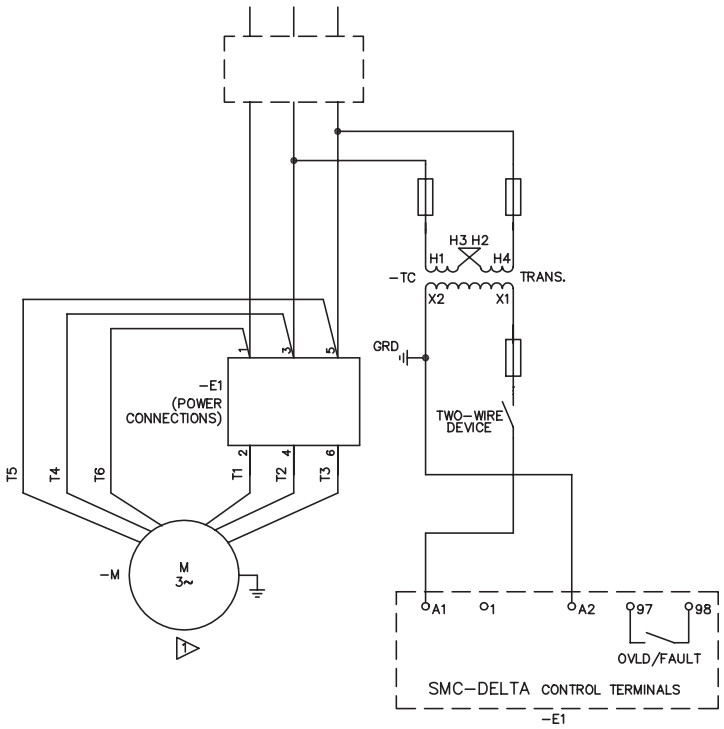
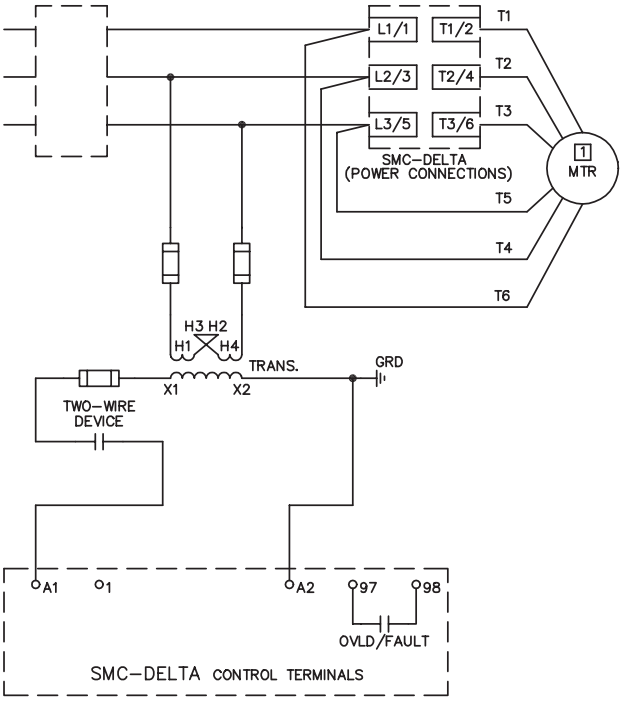
Typical Wiring Diagrams

Two-Wire Configuration

IEC



NEMA



Three-Wire Configuration

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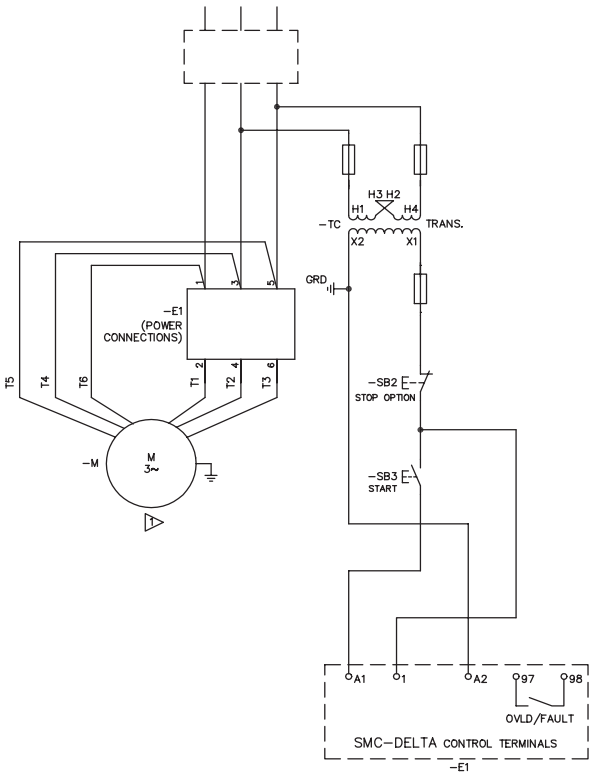

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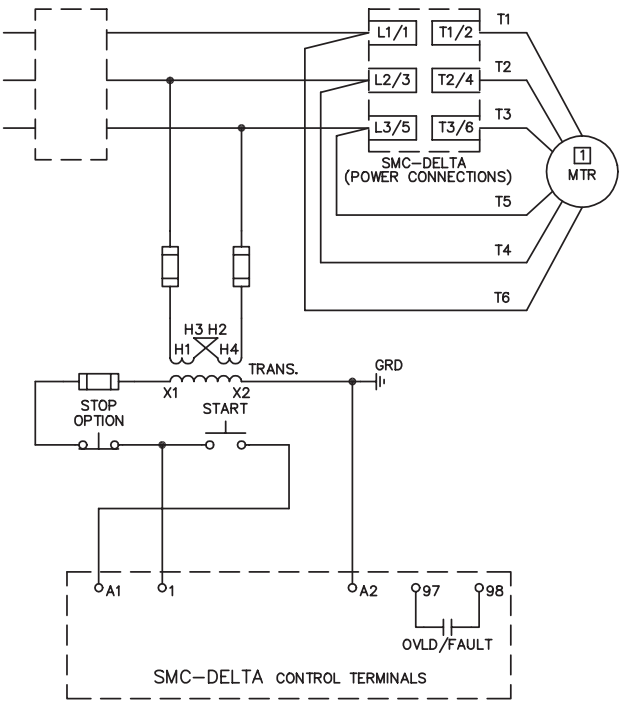

Isolation Contactor Configuration

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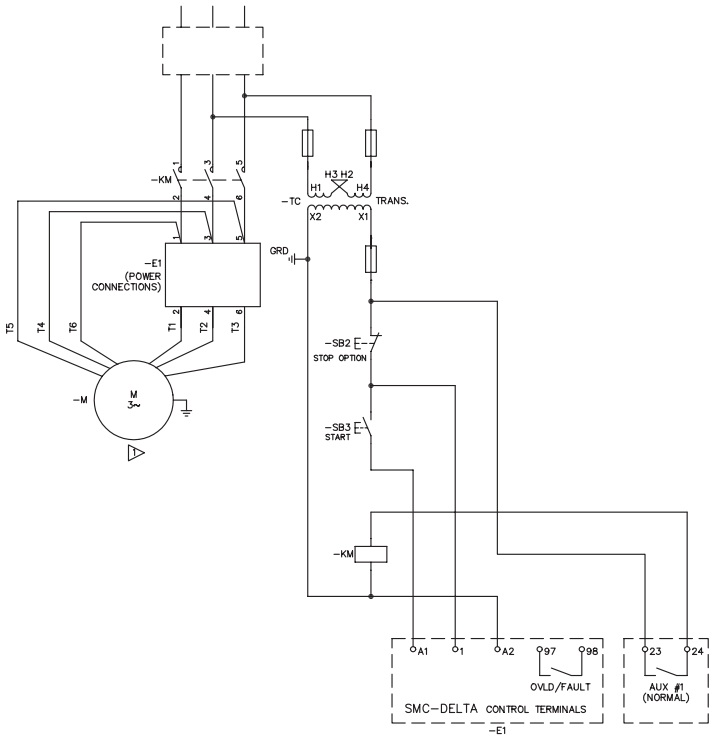

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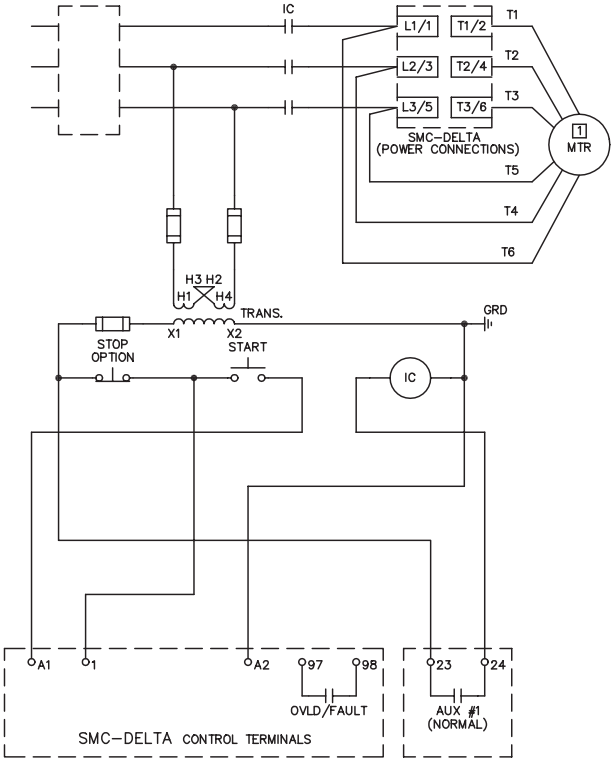

Reversing Configuration

Note: Minimum Off time equals 1.0 s.

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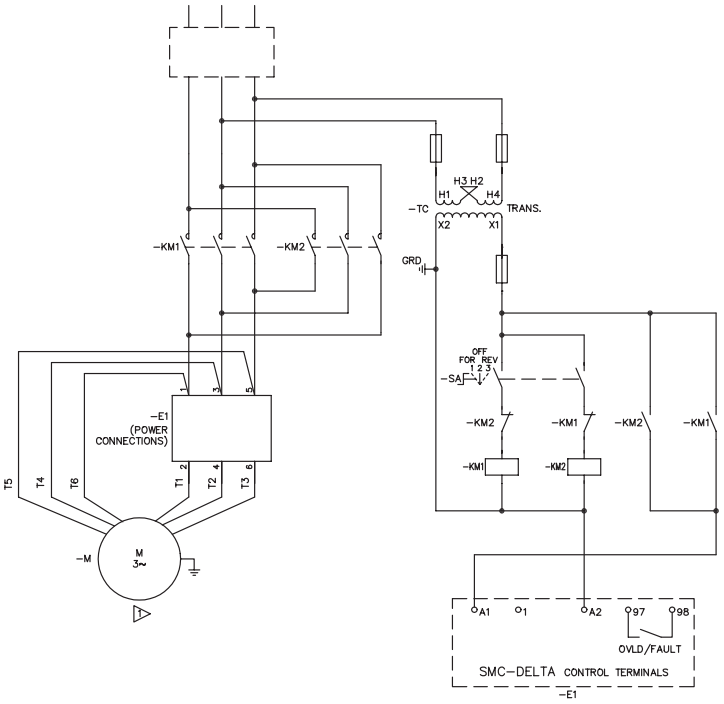

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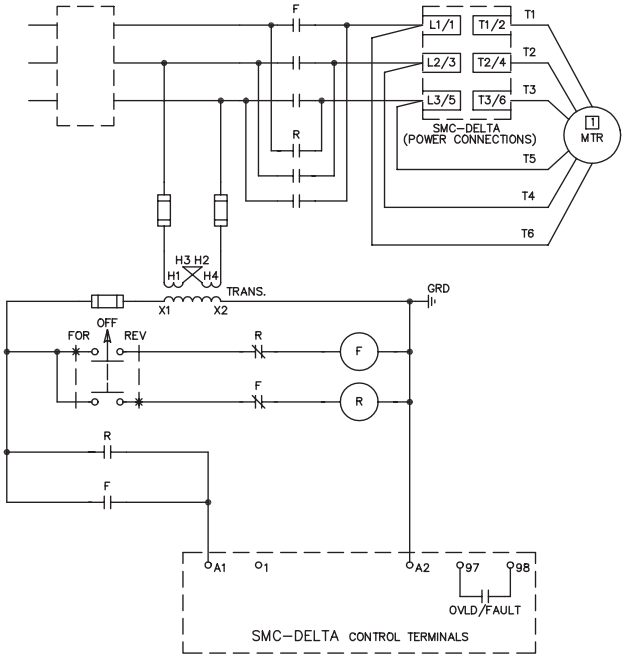


Specifications

Electrical Ratings Cat. Nos. 150-…											
Cat. No.	**D3**	**D9**	**D16**	**D20**	**D25**	**D32**	**D51**	**D64**	**D74**	**D104**	**D147**
Rated operating current I_e (A)	3	9	16	20	25	32	51	64	74	104	147
Heat dissipation (W) Continuous	7	7	7	8	8	10	14	19	27	42	74
Rated operating voltage	200…480, 500…600V AC 50/60 Hz, 3-phase (+10%, -15%)										
Line Power terminals Cable size:	2.5…25 mm² (14…4 AWG)								2.5…95 mm² (14…3/0 AWG)		
Tightening torque:	2.3…3.4 N•m (20…30 in-lbs)								11.3…12.4 N•m (100…110 in-lbs)		
Load Power terminals Cable size:	2.5…16 mm² (14…6 AWG)								2.5…50 mm² (14…1 AWG)		
Tightening torque:	2.3…3.4 N•m (20…30 in-lbs)								11.3…12.4 N•m (100…110 in-lbs)		
Control terminals Cable size:	0.2…2.5 mm² (24…14 AWG)										
Tightening torque:	0.5…0.9 N•m (4.4…8.0 in-lbs)										
Maximum continuous current	3 A	9 A	16 A	20 A	25 A	32 A	51 A	64 A	74 A	104 A	147 A
Maximum delta amps	1.74	5.2	9.3	11.6	14.5	17.4	29.6	36.5	42.8	60.1	85
Overload current range (A)	1…3	3…9	5.3…16	6.7…20	8.3…25	10.6…32	17…51	21.3…64	24.7…74	34.7…104	49…147
Control Voltage Requirements	100…240V AC or 24V AC/DC 50/60 Hz										
Short Circuit Coordination (Max Fuse or Circuit Breaker Size) Type 1											
UL Class K5 and RK5 Fuses UL Listed Combination (600V)	5 kA Available Fault Current										
	10 A	35 A	60 A	80 A	100 A	125 A	—	—	—	—	—
UL Class K5 and RK5 Fuses UL Listed Combination (600V)	10 kA Available Fault Current										
	—	—	—	—	—	—	200 A	250 A	250 A	400 A	500 A
UL Listed Thermal Magnetic Circuit Breaker UL Listed Combination (600V)	5 kA Available Fault Current										
	10 A	35 A	60 A	80 A	100 A	125 A	—	—	—	—	—
UL Listed Thermal Magnetic Circuit Breaker UL Listed Combination (600V)	10 kA Available Fault Current										
	—	—	—	—	—	—	200 A	250 A	250 A	300 A	400 A
UL Listed Bulletin 140M Motor Protection C.B. UL Listed Combination (600V)	5 kA Available Fault Current										
	C25	C25	C25	F45	F45	F45	—	—	—	—	—

Power Circuit		
	UL/cUL	**IEC**
Rated operational voltage	200…480V AC 500…600V AC	200…480V~ — 400V~ 500V~ — 500V~
Rated insulation voltage	600V AC	500V~
Dielectric withstand	2200V AC	2500V~
Repetitive peak	200…480V AC — 1400V 500…600V AC — 1600V	200…480V~ — 1400V 500V~ — 1600V
Operating frequency	50/60 Hz	50/60 Hz
Utilization category	Intermittent duty	AC-53b
Number of poles	Equipment designed for 3-phase only	
Rated impulse voltage	6 kV	
DV/DT protection	1000 V/µs	
Overvoltage Category	III	III

Environmental	
Operating temperature	0…50°C (32…122°F) (open) 0…40°C (32…104°F) (enclosed)
Storage temperature	-25…85°C (-13…185°F)
Altitude	2000 m (6560 ft)
Humidity	5…95% (non-condensing)
Pollution degree	2
Type of Protection	IP2X

Specifications — Page 15
Approximate Dimensions — Page 18

Control Circuit			
		UL/cUL	**IEC**
Rated operational voltage (+10%, –15%)		100…240V AC, 24V AC/DC	100…240V~, 24V AC/DC
Rated insulation voltage		250V	250V~
Rated impulse voltage		—	4 kV
Dielectric withstand		1500V AC	2000V~
Overvoltage category		—	III ❶
Operating frequency		50/60 Hz	50/60 Hz
Input onstate voltage minimum, during start (A1, 1)		85V AC, 19.2V DC / 13.5V AC	
Input onstate current, during start with fan (A1, 1)	3…64 A	195 mA @ 120V AC / 140 mA @ 240V AC, 790 mA @ 24V DC / 650 mA @ 24V AC	
	74…147 A	200 mA @ 120V AC / 100 mA @ 240V AC, 700 mA @ 24V AC/DC	
Input offstate voltage maximum (A1, 1)		30V AC, 17V DC / 12V AC	
Input offstate current @ input offstate voltage (A1, 1)		<2 mA	
Control power with fan, during start	3…64 A	195 mA @ 120V AC / 140 mA @ 240V AC, 790 mA @ 24V DC / 650 mA @ 24V AC	
	74…147 A	200 mA @ 120V AC / 100 mA @ 240V AC, 700 mA @ 24V AC/DC	
Control power without fan, during start		185 mA @ 120V AC / 125 mA @ 240V AC, 695 mA @ 24V DC / 570 mA @ 24V AC	

Auxiliary Contact			
		UL/cUL	**IEC**
Rated operational voltage		250V AC / 30V DC	250V~ / 30V DC
Rated insulation voltage		250V	250V~
Rated impulse voltage		—	4 kV
Dielectric withstand		1500V AC	2000V~
Overvoltage category		—	III ❶
Operating frequency		50/60 Hz	50/60 Hz
Utilization category		D300	AC15
TB-97, -98 (OVLD/Fault)	Type of control circuit	Electromagnetic relay	
	Number of contacts	1	
	Type of contacts	Normally Open (N.O.)	
	Kind of current	AC/DC	
	Rated operational current (max.)	0.6 A @ 120V~ and 0.3 A @ 240V~	
	Conventional thermal current I_{th}	1 A	
	Make VA/break VA	432/72	

Standard Features		
Start times		2, 5, 10, or 15 s
Selectable current limit		150%, 250%, 300%, and 350% of full load current
Weight — kg (lbs)	1…64 A	0.86 (1.9)
	74…147 A	2.25 (5)

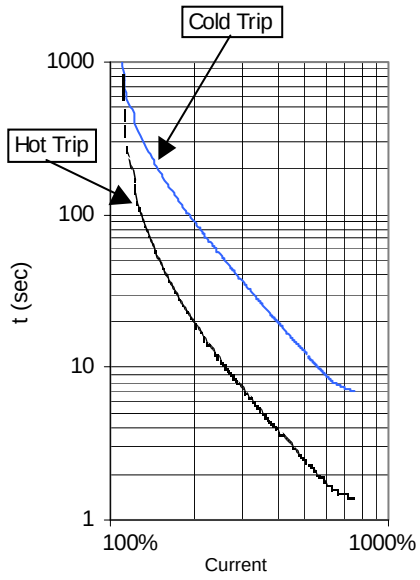
Mechanical Design Specifications/Test Requirements		
Resistance to vibration	Operational	1.0 G peak, 0.152 mm (0.006 in.) displacement
	Non-operational	2.5 G peak, 0.381 mm (0.015 in.) displacement
Resistance to shock	Operational	15 G
	Non-operational	30 G

Other			
		UL/cUL	**IEC**
EMC emission levels	Conducted radio frequency emissions	—	Class A
	Radiated emissions	—	Class A
EMC immunity levels	Electrostatic discharge	4 kV contact and 8kV air discharge	
	Radio frequency electromagnetic field	—	Per IEC 60947-4-2
	Fast transient	—	Per IEC 60947-4-2
	Surge transient	—	Per IEC 60947-4-2

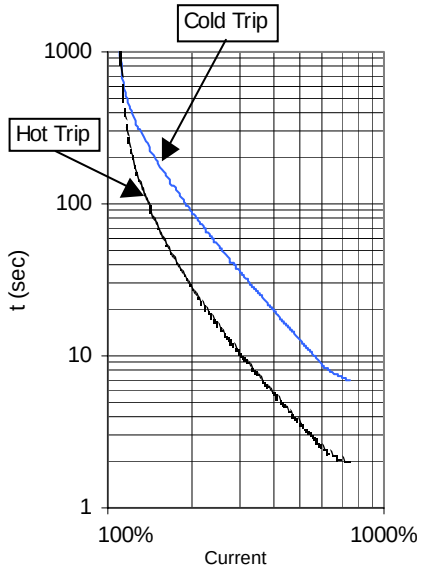
❶ Overvoltage category II, when either control or auxiliary circuit is wired to a SELV or PELV circuit.

SMC-Delta Overload Relays

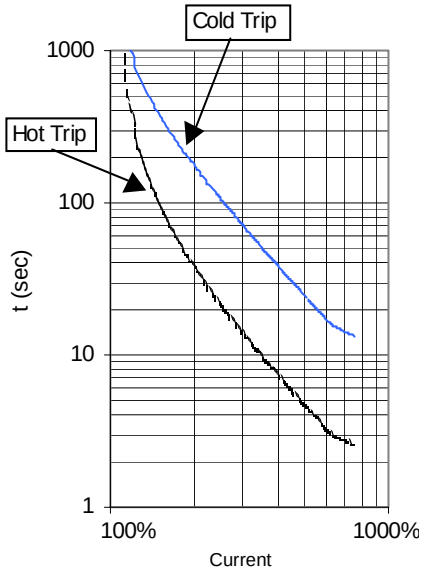
Trip Class 10



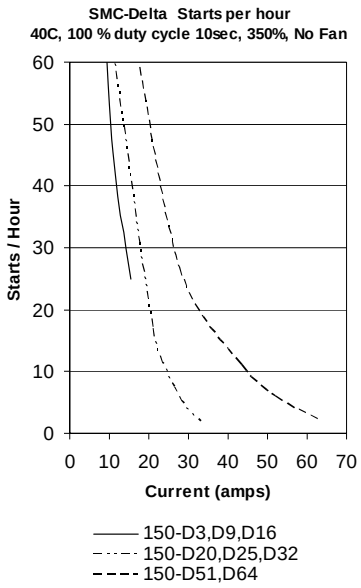
Trip Class 15

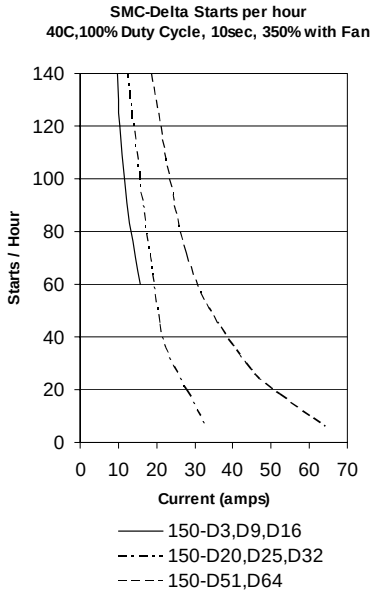


Trip Class 20



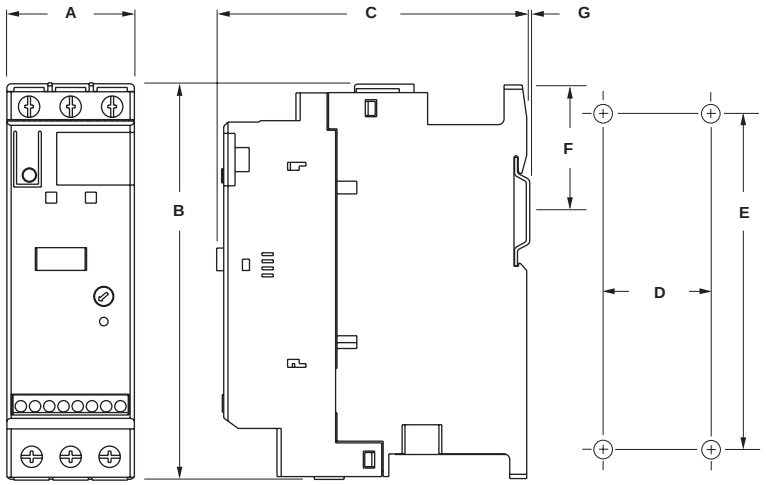
Starts per Hour Curves





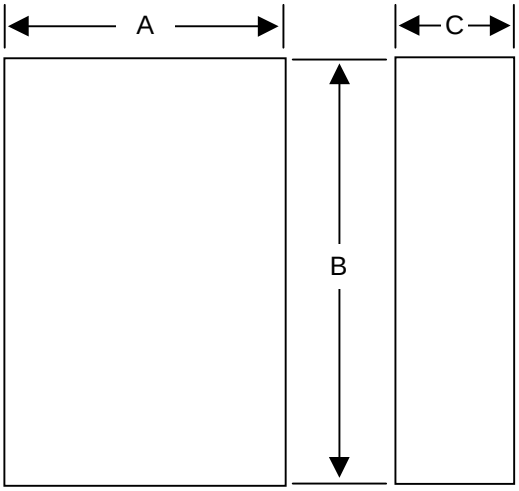
Dimensions in millimeters (inches). Dimensions are not intended to be used for manufacturing purposes. All dimensions are subject to change.
Factory-installed options may affect enclosure size requirements.
Exact dimensions can be obtained after order entry. Consult your local Allen-Bradley distributor.

Open Type



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

Minimum Enclosure Size



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

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

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

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

The controllers are available in 10 sizes: 3, 9, 16, 19, 25, 30, 37, 43, 60, and 85 A. They offer two voltage ranges: 200…480V AC and 200…600V AC. All voltage ranges will operate at either 50 or 60 Hz.

- 1…85 A Range
- Built-In Overload
- SCR Bypass

Table of Contents

Standards Compliance

- UL 508
- CSA C22.2 No. 14
- EN/IEC 60947-4-2
- cULus Listed (Open Type)
- (File No. E96956)

Approvals

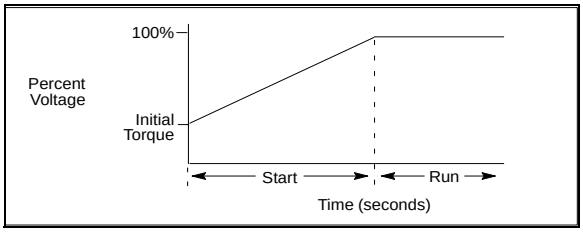
- CE Marked (Open Type) per EMC Directive and Low Voltage Directive

Your order must include 1) cat. no. of the controller selected, 2) if required, suffix code and description of any modifications, and 3) if required, cat. no. of any options or accessories.

Modes of Operation

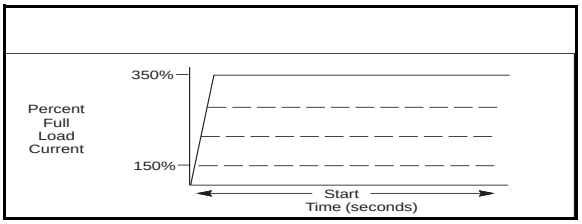
Soft Start

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



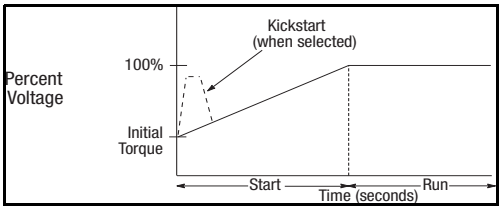
Current Limit Start

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



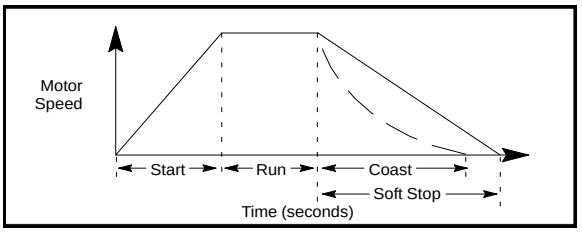
Selectable Kick Start

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



Soft Stop

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



Description of Features

Electronic Motor Overload Protection

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

Note: Trip rating is 120% of dial setting.

Over-temperature

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

Phase Reversal Protection

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

Phase Loss/Open Load

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

Phase Imbalance

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

Shorted SCR

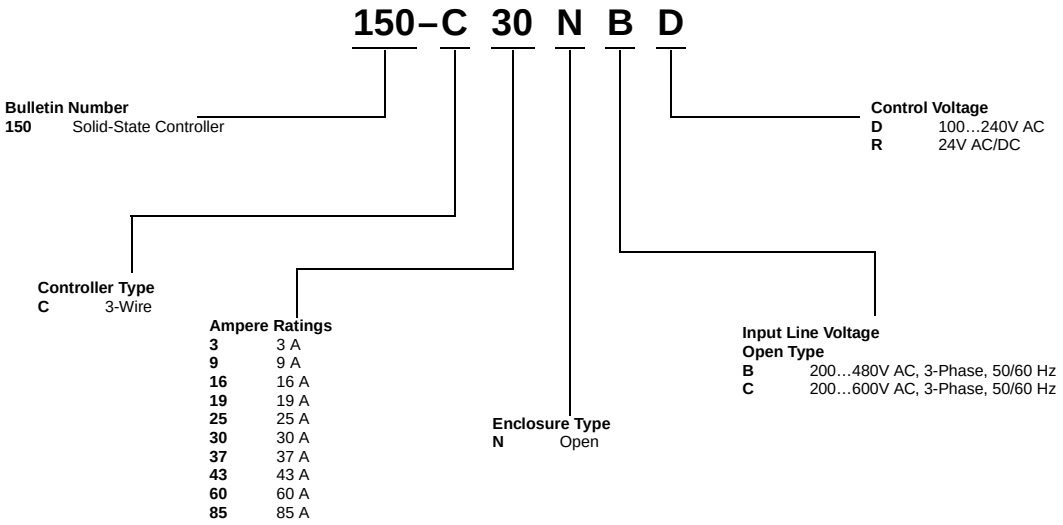
Prior to every start, the unit will check all SCRs for shorts and unit load connections to the motor. If there is a shorted SCR in the SMC-3 and/or open load, the start will be aborted and a shorted SCR/open load fault will be indicated. This prevents damage from phase imbalance.

LED Description (Number of Flashes)

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

Cat. No. Explanation

Open and Non-Combination



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Product Selection

Open Type Controllers

Up to 480V AC

Current Rating (A) ❶	kW				Hp						100…240V AC 50/60 Hz Control Cat. No.	24V AC/DC Control Cat. No.
	230V AC 50 Hz		380/400/415V AC 50 Hz		200V AC 60 Hz		230V AC 60 Hz		460V AC 60 Hz			
	Starting Duty											
	350%	450%	350%	450%	350%	450%	350%	450%	350%	450%		
1…3	0.55	0.37	1.1	0.75	0.5	0.5	0.5	0.5	0.5…1.5	0.5…1	150-C3NBD	150-C3NBR
3…9	2.2	1.5	4	3	0.75…2	0.75…1.5	0.75…2	0.75…2	1.5…5	1.5…3	150-C9NBD	150-C9NBR
5.3…16	4	3	7.5	5.5	1.5…3	1.5…3	1.5…5	1.5…3	5…10	5…7.5	150-C16NBD	150-C16NBR
6.3…19	4	4	7.5	5.5	1.5…5	1.5…3	2…5	2…3	5…10	5…10	150-C19NBD	150-C19NBR
8.3…25	5.5	4	11	9.5	3…7.5	3…5	3…7.5	3…5	7.5…15	7.5…10	150-C25NBD	150-C25NBR
10…30	7.5	5.5	15	11	3…7.5	3…5	5…10	5…7.5	7.5…20	7.5…15	150-C30NBD	150-C30NBR
12.3…37	7.5	7.5	18.5	15	5…10	5…7.5	5…10	5…10	10…25	10…20	150-C37NBD	150-C37NBR
14.3…43	11	7.5	22	15	5…10	5…7.5	5…15	5…10	10…30	10…20	150-C43NBD	150-C43NBR
20…60	15	11	30	22	7.5…15	7.5…10	7.5…20	7.5…15	15…40	15…30	150-C60NBD	150-C60NBR
28.3…85	22	18.5	45	37	10…25	10…20	15…30	15…20	25…60	25…50	150-C85NBD	150-C85NBR

Up to 600V AC

Current Rating (A) ❶	kW						Hp								100…240V AC 50/60 Hz Control Cat. No.	24V AC/DC Control Cat. No.
	230V AC 50 Hz		380/400/415V AC 50 Hz		500V AC 50 Hz		200V AC 60 Hz		230V AC 60 Hz		460V AC 60 Hz		575V AC 60 Hz			
	Starting Duty															
	350%	450%	350%	450%	350%	450%	350%	450%	350%	450%	350%	450%	350%	450%		
1…3	0.55	0.37	1.1	0.75	1.5	1.1	0.5	0.5	0.5	0.5	0.5…1.5	0.5…1	0.75…2	0.75…1	150-C3NCD	150-C3NCR
3…9	2.2	1.5	4	3	5.5	4	0.75…2	0.75…1.5	0.75…2	0.75…2	1.5…5	1.5…3	3…7.5	3…5	150-C9NCD	150-C9NCR
5.3…16	4	3	7.5	5.5	7.5	7.5	1.5…3	1.5…3	1.5…5	1.5…3	5…10	5…7.5	5…10	5…10	150-C16NCD	150-C16NCR
6.3…19	4	4	7.5	5.5	11	7.5	1.5…5	1.5…3	2…5	2…3	5…10	5…10	7.5…15	7.5…10	150-C19NCD	150-C19NCR
8.3…25	5.5	4	11	9.5	15	11	3…7.5	3…5	3…7.5	3…5	7.5…15	7.5…10	7.5…20	7.5…15	150-C25NCD	150-C25NCR
10…30	7.5	5.5	15	11	18.5	15	3…7.5	3…5	5…10	5…7.5	7.5…20	7.5…15	10…25	10…20	150-C30NCD	150-C30NCR
12.3…37	7.5	7.5	18.5	15	22	18.5	5…10	5…7.5	5…10	5…10	10…25	10…20	15…30	15…25	150-C37NCD	150-C37NCR
14.3…43	11	7.5	22	15	22	22	5…10	5…7.5	5…15	5…10	10…30	10…20	15…40	15…30	150-C43NCD	150-C43NCR
20…60	15	11	30	22	37	37	7.5…15	7.5…10	7.5…20	7.5…15	15…40	15…30	20…50	20…40	150-C60NCD	150-C60NCR
28.3…85	22	18.5	45	37	55	45	10…25	10…20	15…30	15…20	25…60	25…50	30…75	30…60	150-C85NCD	150-C85NCR

❶ Motor FLA must fall within the current range of the device.

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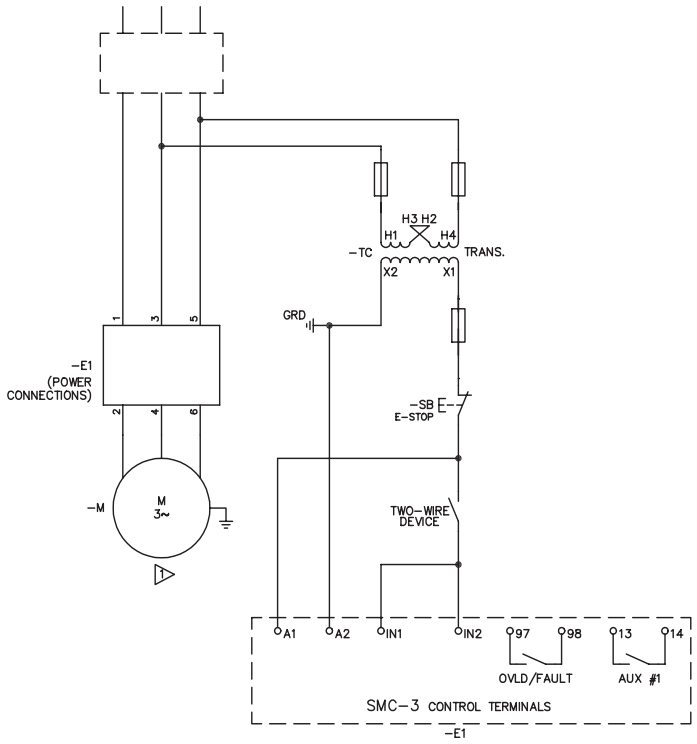
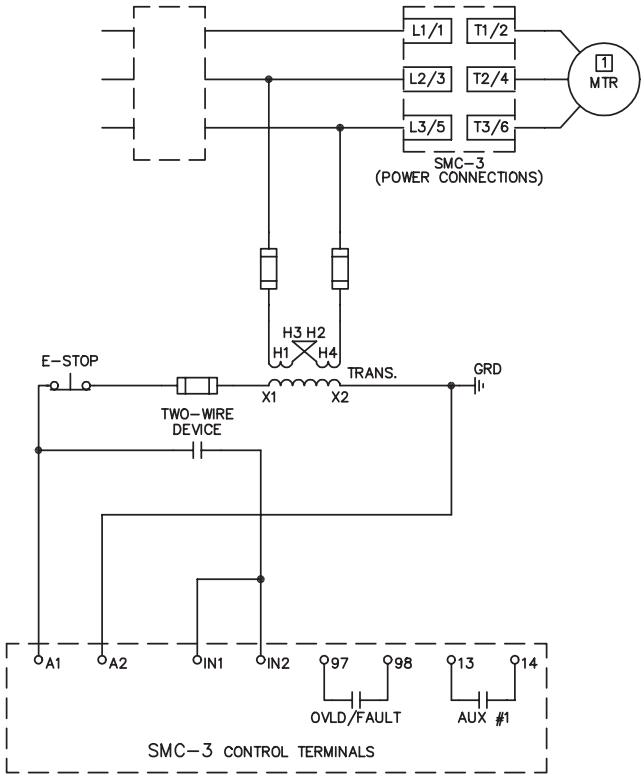
Two-Wire Configuration

IEC

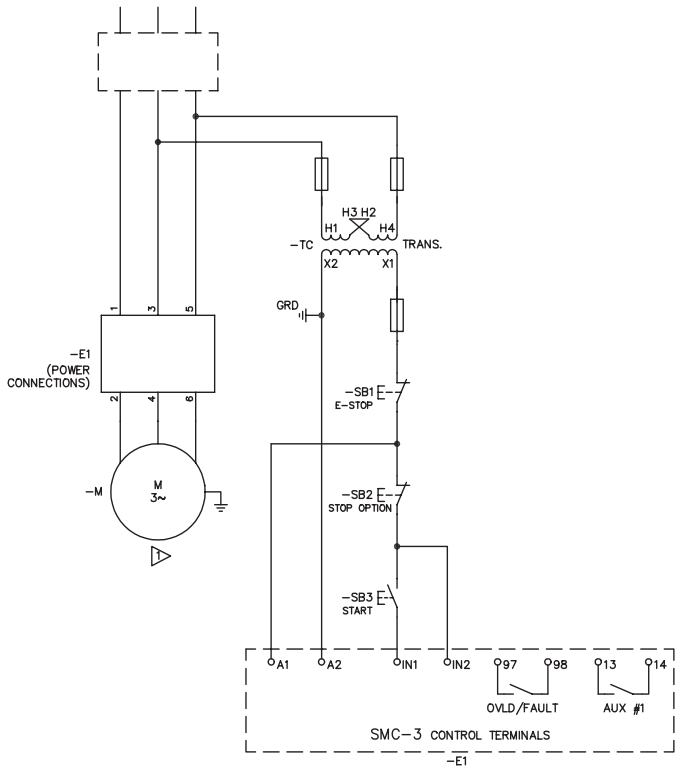


NEMA

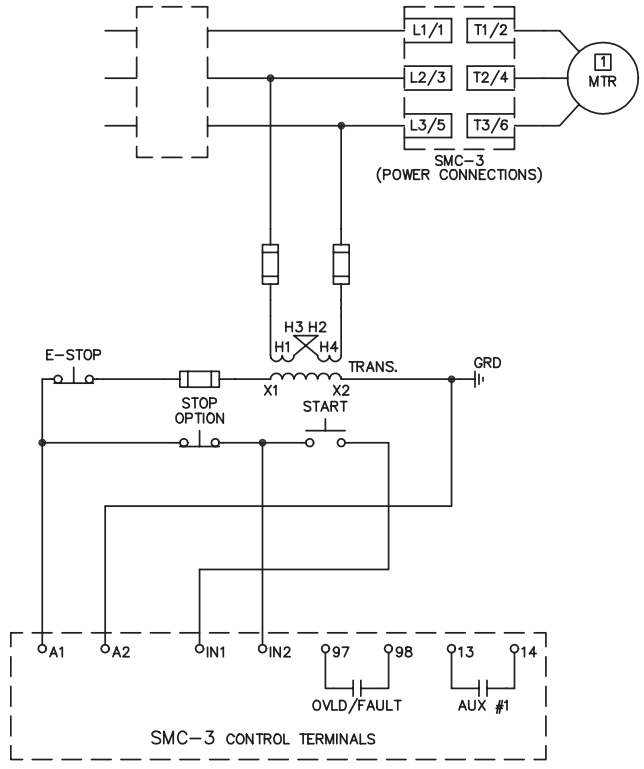


Three-Wire Configuration

IEC



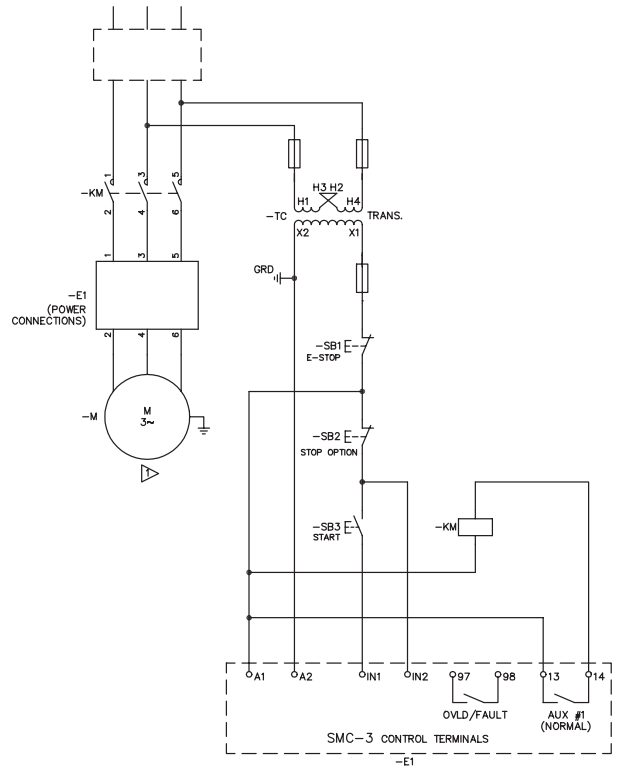
NEMA



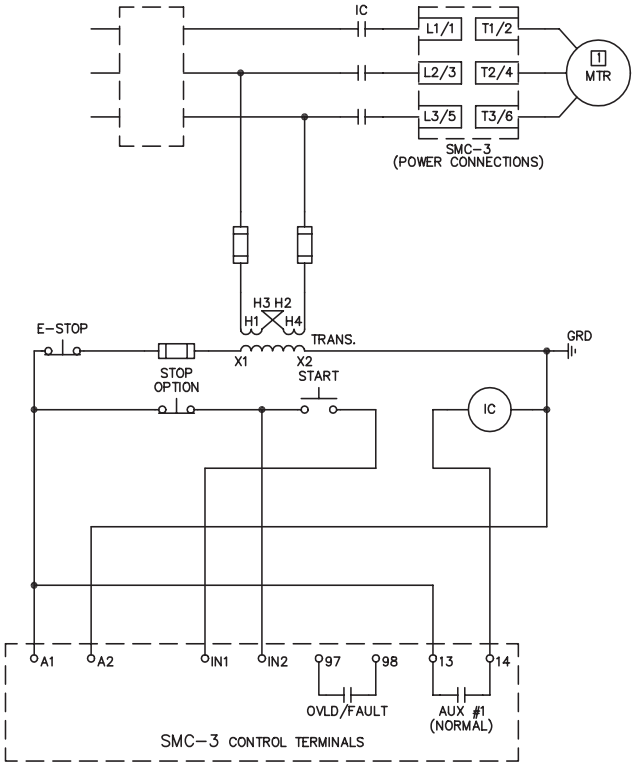
Typical Wiring Diagrams, Continued

Isolation Contactor Configuration

IEC



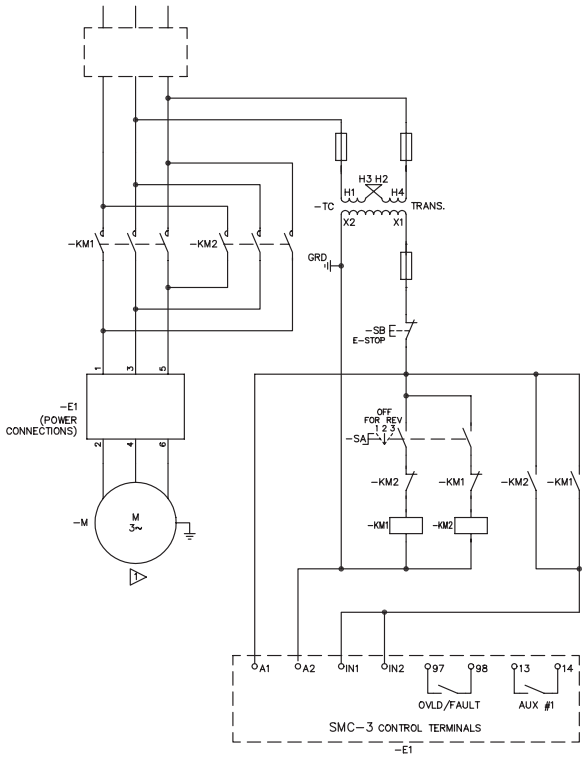
NEMA



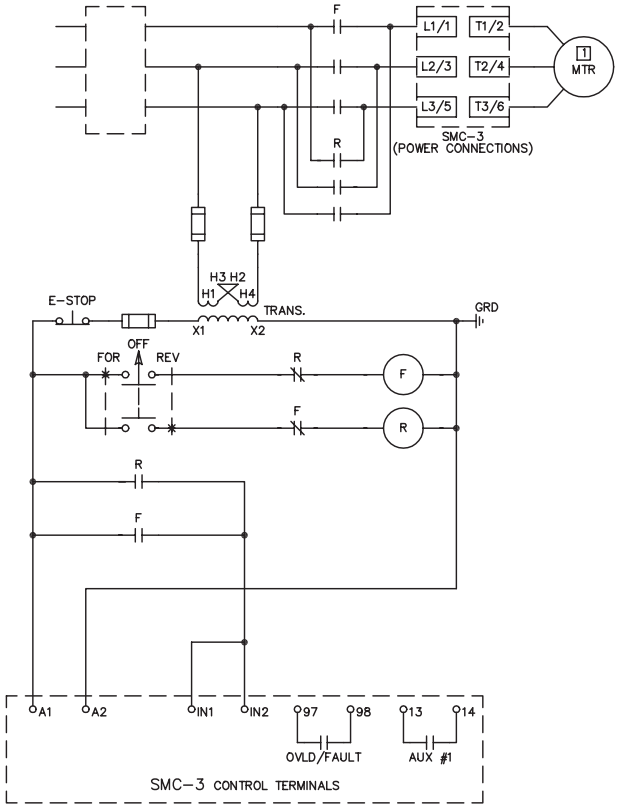
Reversing Configuration

Note: Minimum Off time equals 1.0 s.

IEC



NEMA



Electrical Ratings Cat. Nos. 150-…											
Cat. No.		**C3**	**C9**	**C16**	**C19**	**C25**	**C30**	**C37**	**C43**	**C60**	**C85**
Rated operating current I_e (A)		3	9	16	19	25	30	37	43	60	85
Heat dissipation (W)	Continuous	11	12	14	15	17	19	24	34	50	82
Rated operating voltage		200…480, 200…600V AC 50/60 Hz, 3-phase (+10%, -15%)									
Line Power terminals	Cable size: Tightening torque:	2.5…25 mm² (14…4 AWG) 2.3…3.4 N•m (20…30 in-lbs)							2.5…95 mm² (14…3/0 AWG) 11.3…12.4 N•m (100…110 in-lbs)		
Load Power terminals	Cable size: Tightening torque:	2.5…16 mm² (14…6 AWG) 2.3…3.4 N•m (20…30 in-lbs)							2.5…50 mm² (14…1 AWG) 11.3…12.4 N•m (100…110 in-lbs)		
Control terminals	Cable size: Tightening torque:	0.2…2.5 mm² (24…14 AWG) 0.5…0.9 N•m (4.4…8.0 in-lbs)									
Maximum continuous current		3 A	9 A	16 A	19 A	25 A	30 A	37 A	43 A	60 A	85 A
Overload current range (A)		1…3	3…9	5.3…16	6.3…19	8.3…25	10…30	12.3…37	14.3…43	20…60	28.3…85
Control Voltage Requirements		100…240V AC or 24V AC/DC 50/60 Hz									
Short Circuit Coordination (Max Fuse or Circuit Breaker Size) Type 1											
UL Class K5 and RK5 Fuses UL Listed Combination (600V)		5 kA Available Fault Current									
		10 A	35 A	60 A	70 A	100 A	110 A	125 A	150 A	—	—
UL Class K5 and RK5 Fuses UL Listed Combination (600V)		10 kA Available Fault Current									
		—	—	—	—	—	—	—	—	225 A	300 A
UL Listed Thermal Magnetic Circuit Breaker UL Listed Combination (600V)		5 kA Available Fault Current									
		15 A	35 A	60 A	70 A	100 A	110 A	125 A	150 A	—	—
UL Listed Thermal Magnetic Circuit Breaker UL Listed Combination (600V)		10 kA Available Fault Current									
		—	—	—	—	—	—	—	—	225 A	300 A
UL Listed Bulletin 140M Motor Protection C.B. UL Listed Combination (600V)		5 kA Available Fault Current									
		C25	C25	F45	F45	F45	F45	F45	—	—	—
Power Circuit											
		UL/cUL				**IEC**					
Rated operational voltage		200…480V AC 200…600V AC				200…480V~ — 400V~ 500V~ — 500V~					
Rated insulation voltage		600V AC				500V~					
Dielectric withstand		2200V AC				2500V~					
Repetitive peak		200…480V AC — 1400V 200…600V AC — 1600V				200…480V~ — 1400V 500V~ — 1600V					
Operating frequency		50/60 Hz				50/60 Hz					
Utilization category		Intermittent duty				AC-53b					
Number of poles		Equipment designed for 3-phase only									
Rated impulse voltage		6 kV									
DV/DT protection		1000V/µs									
Overvoltage category		III				III					

Specifications, Continued

Control Circuit			
		UL/cUL	IEC
Rated operational voltage (+10%, –15%)		100…240V AC, 24V AC/DC	100…240V~, 24V AC/DC
Rated insulation voltage		250V	250V~
Rated impulse voltage		—	4 kV
Dielectric withstand		1500V AC	2000V~
Overvoltage category		—	III ❶
Operating frequency		50/60 Hz	50/60 Hz
Input onstate voltage minimum (IN1, IN2)		85V AC, 19.2V DC / 13.5V AC	
Input onstate current (IN1, IN2)		9.8 mA @ 120V AC / 19.6mA @ 240V AC, 7.3 mA @ 24V AC/DC	
Input offstate voltage maximum (IN1, IN2)		40V AC, 17V DC / 12V AC	
Input offstate current @ input offstate voltage (IN1, IN2)		<10 mA, <12 mA	
Control power with fan, during start	3…37 A	215 mA @ 120V AC / 180 mA @ 240V AC, 800 mA @ 24V DC / 660 mA @ 24V AC	
	43…85 A	200 mA @ 120V AC / 100 mA @ 240V AC, 700 mA @ 24V AC/DC	
Control power without fan, during start	3…37 A	205 mA @ 120V AC / 145 mA @ 240V AC, 705 mA @ 24V DC / 580 mA @ 24V AC	

Auxiliary Contacts			
		UL/cUL	IEC
Rated operational voltage		250V AC / 30V DC	250V~ / 30V DC
Rated insulation voltage		250V	250V~
Rated impulse voltage		—	4 kV
Dielectric withstand		1500V AC	2000V~
Overvoltage category		—	III ❶
Operating frequency		50/60 Hz	50/60 Hz
Utilization category		D300	AC15
TB-97, -98 (OVLD/Fault)	Type of control circuit	Electromagnetic relay	
	Number of contacts	1	
	Type of contacts	Normally Open (N.O.)	
	Kind of current	AC/DC	
	Rated operational current (max.)	0.6 A @ 120V~ and 0.3 A @ 240V~	
	Conventional thermal current I_{th}	1 A	
	Make VA/break VA	432/72	
TB-13, -14 (Normal/Up-to-Speed)	Type of control circuit	Electromagnetic relay	
	Number of contacts	1	
	Type of contacts	Normally Open (N.O.)	
	Kind of current	AC/DC	
	Rated operational current (max.)	0.6 A @ 120V~ and 0.3 A @ 240V~	
	Conventional thermal current I_{th}	1 A	
	Make VA/break VA	432/72	

Standard Features		
Start times		2, 5, 10, or 15 s
Selectable soft start		15%, 25%, 35%, and 65% of locked rotor torque
Selectable current limit		150%, 250%, 350%, and 450% of full load current
Selectable soft stop		100%, 200%, or 300% of the start time setting when wired
Weight — kg (lbs)	1…37 A	0.86 (1.9)
	43…85 A	2.25 (5)

Mechanical Design Specifications/Test Requirements		
Resistance to vibration	Operational	1.0 G peak, 0.152 mm (0.006 in.) displacement
	Non-operational	2.5 G peak, 0.381 mm (0.015 in.) displacement
Resistance to shock	Operational	15 G
	Non-operational	30 G

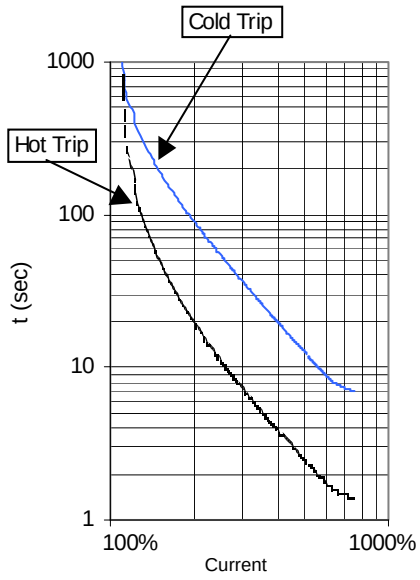
❶ Overvoltage category II, when either control or auxiliary circuit is wired to a SELV or PELV circuit.

EnviroN•mental	
Operating temperature	0…50°C (32…122°F) (open) 0…40°C (32…104°F) (enclosed)
Storage temperature	-25…85°C (-13…185°F)
Altitude	2000 m (6560 ft)
Humidity	5…95% (non-condensing)
Pollution degree	2
Type of Protection	IP2X

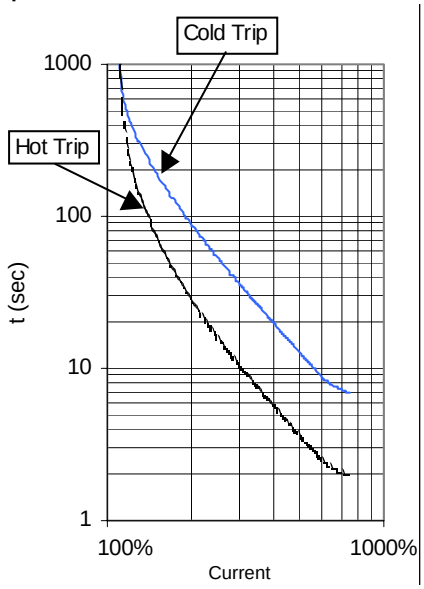
Other			
		UL/cUL	**IEC**
EMC emission levels	Conducted radio frequency emissions	—	Class A
	Radiated emissions	—	Class A
EMC immunity levels	Electrostatic discharge	4 kV contact and 8kV air discharge	
	Radio frequency electromagnetic field	—	Per IEC 60947-4-2
	Fast transient	—	Per IEC 60947-4-2
	Surge transient	—	Per IEC 60947-4-2

SMC-3 Overload Relays

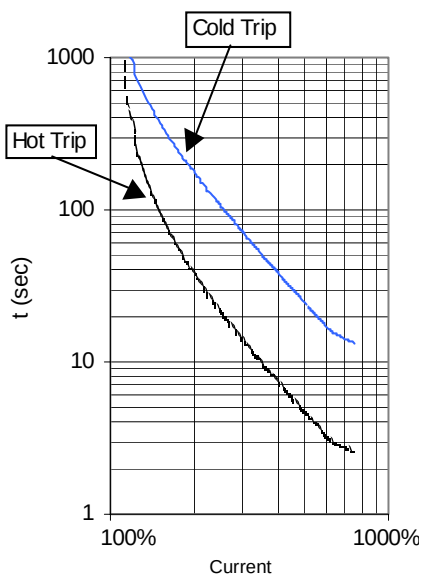
Trip Class 10



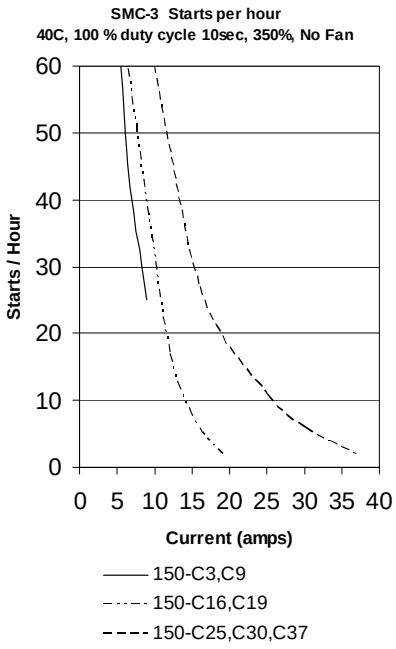
Trip Class 15

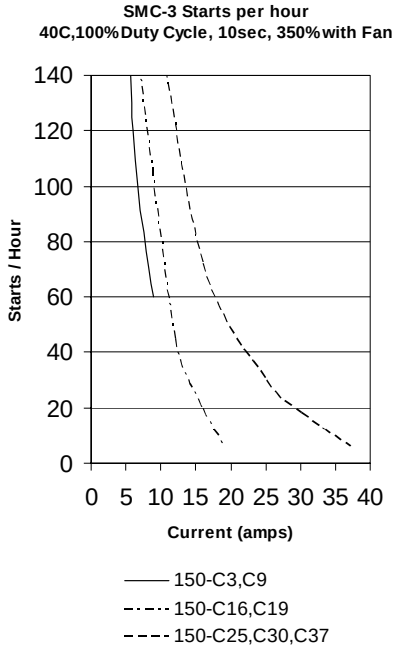


Trip Class 20



Starts per Hour Curves

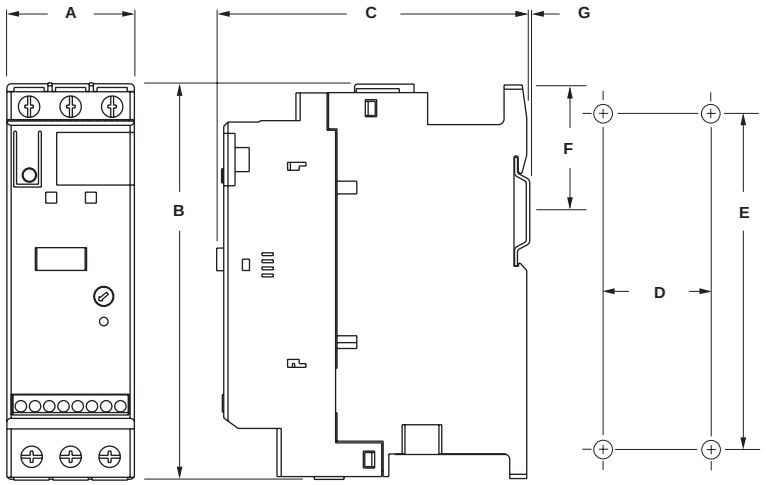




Approximate Dimensions

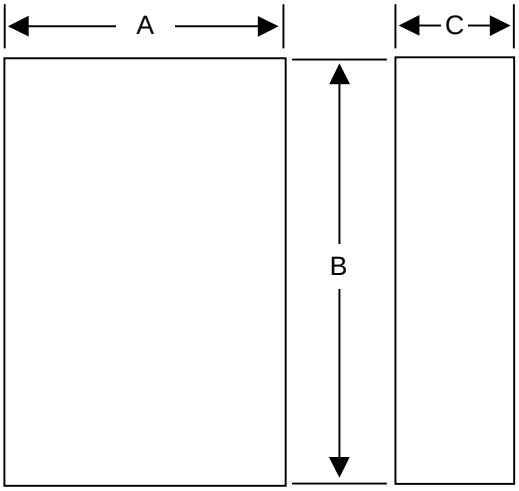
Dimensions in millimeters (inches). Dimensions are not intended to be used for manufacturing purposes. All dimensions are subject to change.
Factory-installed options may affect enclosure size requirements.
Exact dimensions can be obtained after order entry. Consult your local Allen-Bradley distributor.

Open Type



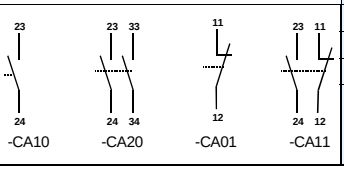
Controller	A	B	C	D	E	F	G
1…64 A	44.8 (1-49/64)	139.7 (5-1/2)	100 (4-21/64)	35 (1-3/8)	132 (5-13/64)	46.4 (1.81)	2 (1/16)
74…147 A	72 (2.83)	206 (8.11)	130 (5.12)	55 (2.17)	198 (7.8)	102 (4.02)	2 (1/16)

Minimum Enclosure Size



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

Accessories - Field Modifications

	Description	N.O.	N.C.	Connection Diagram	Cat. No.
	**Auxiliary Contact Blocks for Side Mounting without Sequence Terminal Designations** • 1- and 2-pole • Quick and easy mounting without tools	1	0		150-CA10
		2	0		150-CA20
		0	1		150-CA01
		1	1		150-CA11

	Description	For Use With	Pkg. Qty	Cat. No
	**Fan**	150-C3…37/150-D3…64	1	150-CF64
	**Connecting modules to 140M** ❶ • Electrical interconnection between SMC-Delta/SMC-3 and 140M. • Motor protector and SMC must be mounted separately.	Connects 140M-C to 150-C3…25/150-D3…25	1	150-CC25
		Connects 140M-D to 150-C3…25/150-D3…25	1	150-CD25
		Connects 140M-F to 150-C3…37/150-D3…32	1	150-CF45
	**Connecting modules to 100C** ❶ • Electrical interconnection between SMC-Delta/SMC-3 and 100C. • Contactor and SMC must be mounted separately.	Connects 100-C09…23 to 150-C3…19/ 150-D3…20	1	150-CI23
		Connects 100-C30…37 to 150-C3…37/ 150-D3…32	1	150-CI37

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

	Description	For Use With	Pkg. Qty	Cat. No
	**Marking Tag Sheet** • 10 sheets with 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 • 100 each • To be used with marking tag sheets	150-C/150-D	100	100-FMC
	**Remote Reset Solenoid** For remote reset of electronic overload	150-C/150-D	1	193-ER1⊗

⊗ Voltage Suffix Code

Available Coil Voltages 12… 600V 50 Hz/12…600V 60 Hz
Standard Coil Voltages

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

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

❶ Contact your local Allen-Bradley distributor for availability.

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