



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

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

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

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

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

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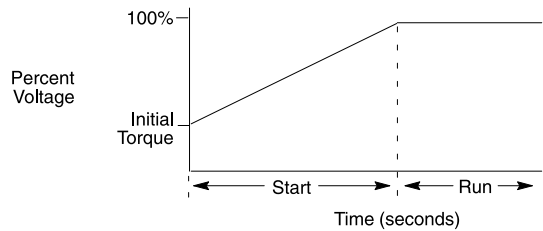
Standards Compliance/Approvals

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

Modes of Operation

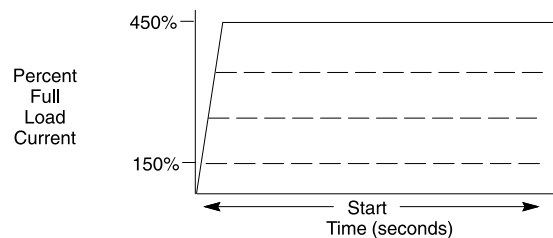
Soft Start

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



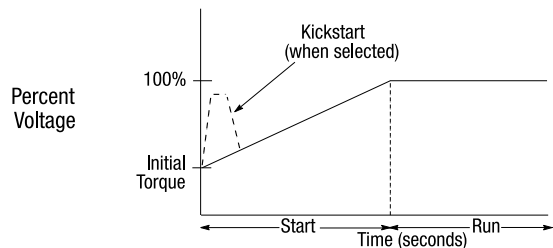
Current Limit Start

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



Selectable Kick Start

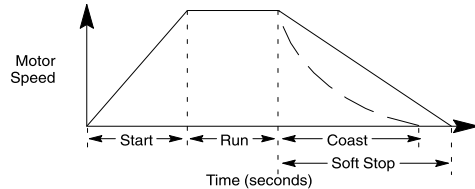
A kickstart, or boost, at the beginning of the start mode is intended to provide a current pulse of 450% of full load current. The kickstart time is adjustable from 0.5...1.5 seconds. This allows the motor to develop additional torque during starting for loads which may need a boost to get initial shaft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



Modes of Operation, Continued

Soft Stop

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



Description of Features

Electronic Motor Overload Protection

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

Note: Trip rating is 120% of dial setting.

Over-temperature

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

Phase Reversal Protection

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

Phase Loss/Open Load

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

Phase Imbalance

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

Push to Test

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

Shorted SCR

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

LED Description (Number of Flashes)

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

Cat. No. Explanation

Open and Non-Combination

150 – C 30 F B D – 8L
a b c d e f g

a

Bulletin Number	
Code	Description
150	Solid-State Controller

b

Controller Type	
Code	Description
C	SMC-3

c

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

d

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

e

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

f

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

g

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

Combination

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

a

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

b

Controller Type	
Code	Description
C	SMC-3

c

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

d

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

e

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

f

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

g

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

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

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

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

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

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

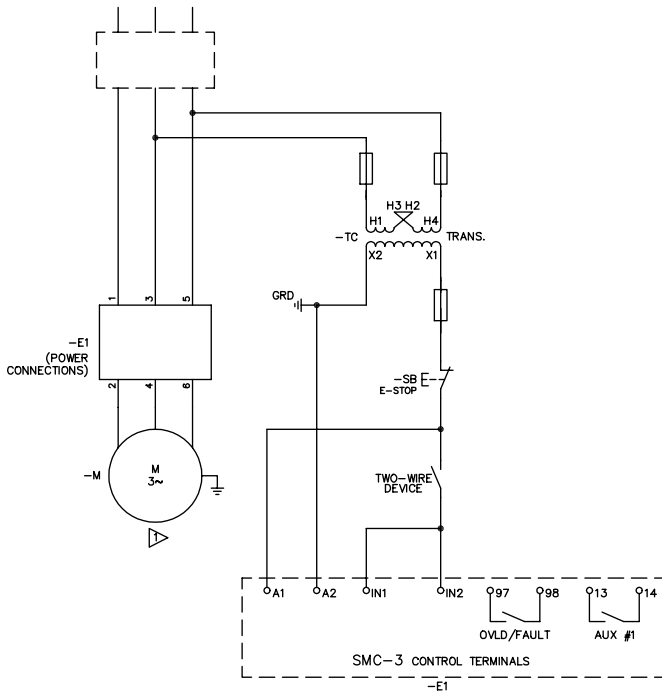
Combination Enclosed (IP65, NEMA 4/12) Controllers with Fusible Disconnect or Circuit Breaker

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

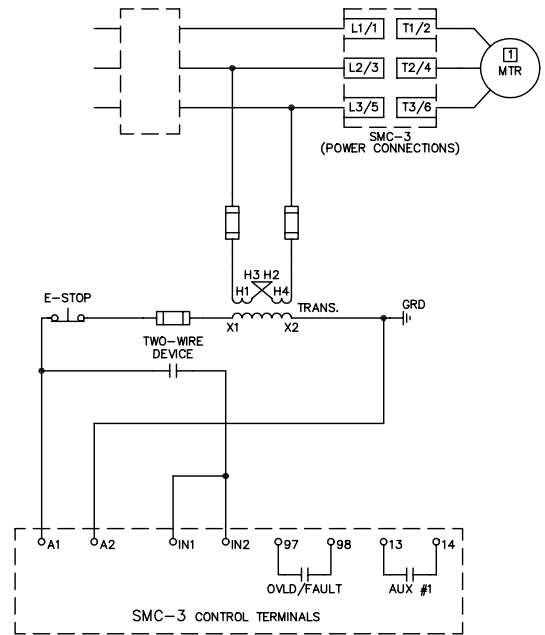
* These controllers require a separate 100...240V, 50/60 Hz single-phase control source. To add a control circuit transformer to the enclosure, add the appropriate option code to the catalog string.

Two-Wire Configuration

IEC

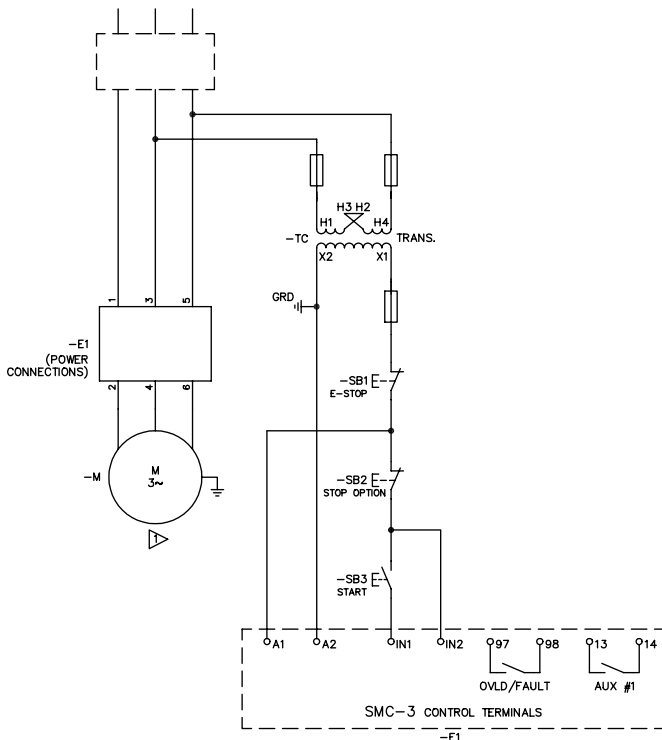


NEMA

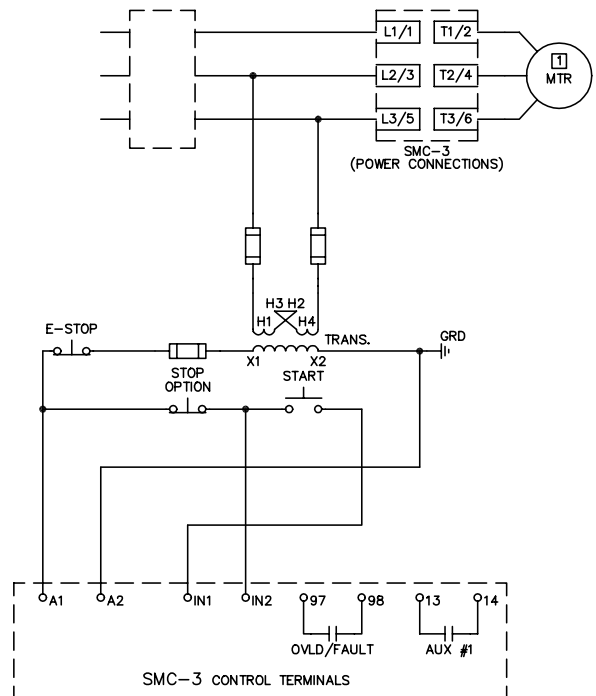


Three-Wire Configuration

IEC

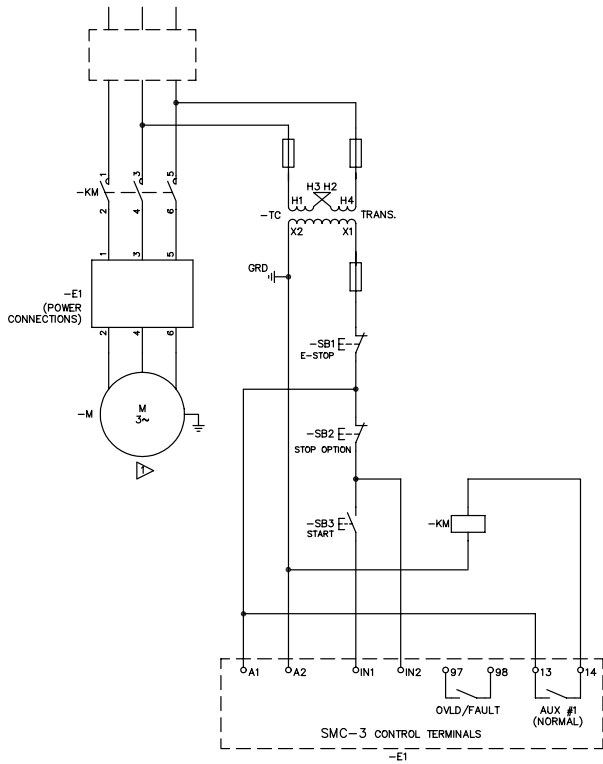


NEMA

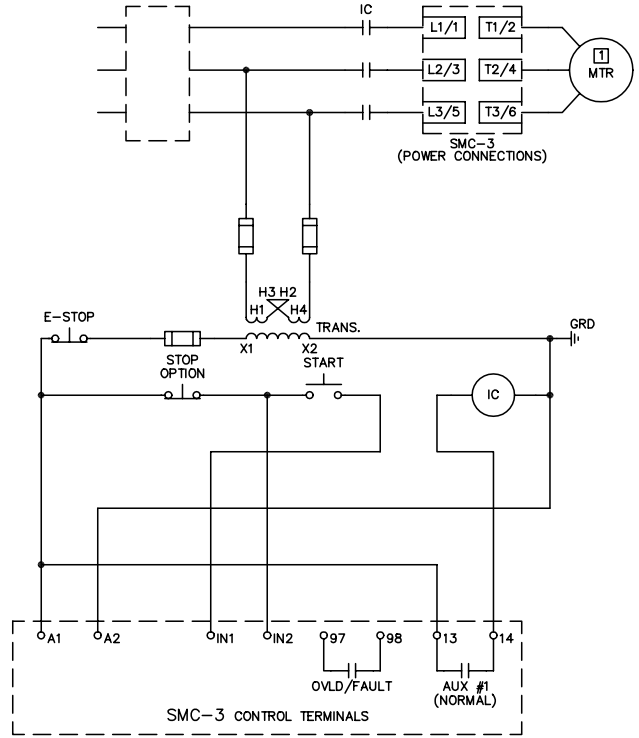


Isolation Contactor Configuration

IEC



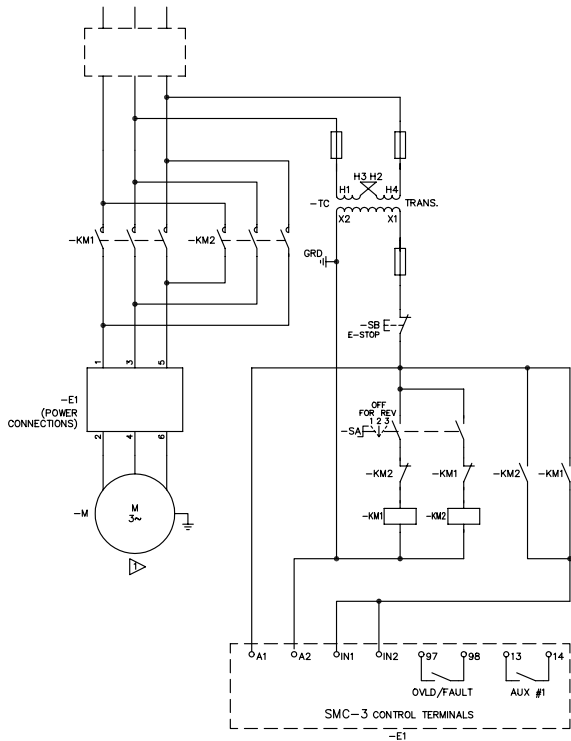
NEMA



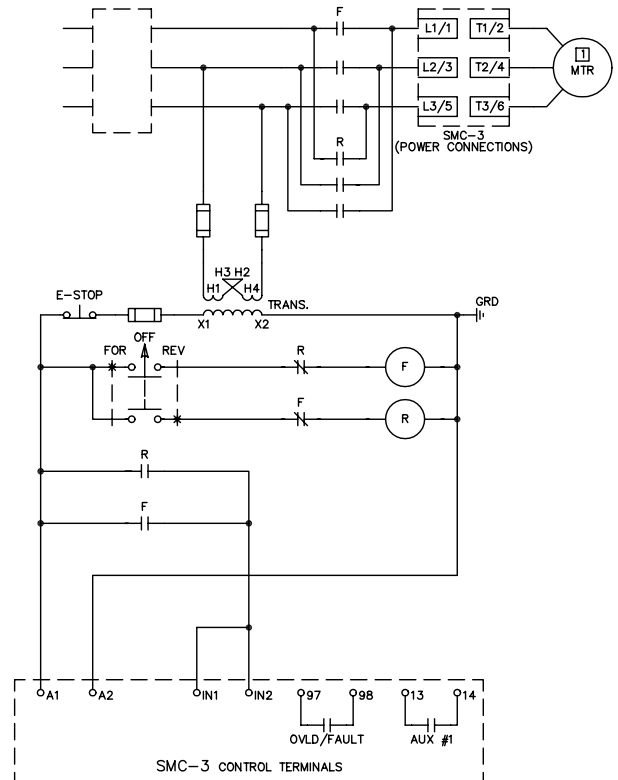
Reversing Configuration

Note: Minimum Off time equals 1.0 s.

IEC



NEMA



Bulletin 150
Smart Motor Controllers — SMC-3™
Specifications

Electrical Ratings Cat. Nos. 150-...												
Cat. No.		C3	C9	C16	C19	C25	C30	C37	C43	C60	C85	
Rated operating current I_e (A)		3	9	16	19	25	30	37	43	60	85	
Heat dissipation (W)		Continuous		11	12	14	15	17	19	24	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 mm ² (14...4 AWG) 2.3...3.4 N•m (20...30 in-lbs)					2.5...95 mm ² (14...3/0 AWG) 11.3...12.4 N•m (100...110 in-lbs)			
Load Power terminals		Cable size: Tightening torque:		2.5...16 mm ² (14...6 AWG) 2.3...3.4 N•m (20...30 in-lbs)					2.5...50 mm ² (14...1 AWG) 11.3...12.4 N•m (100...110 in-lbs)			
Control terminals		Cable size: Tightening torque:		0.2...2.5 mm ² (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	9.2...27.7	10...30	12.3...37	14.3...43	20...60	28.3...85	
Control Voltage Requirements		100...240V AC or 24V AC/DC 50/60 Hz										
Short Circuit Coordination (Max Fuse or Circuit Breaker Size) Type 1												
UL Class K5 Fuses UL Listed Combination (600V)		5 kA Available Fault Current										
		10 A	35 A	60 A	70 A	100 A	110 A	125 A	150 A	—	—	
UL Class K5 Fuses UL Listed Combination (600V)		10 kA Available Fault Current										
		—	—	—	—	—	—	—	—	225 A	300 A	
UL Class 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 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		1...37 A 43...85 A		Intermittent duty		AC-53b: 3.5-15:3585 AC-53b: 4.5-30:3570						
Number of poles		Equipment designed for 3-phase only										
Rated impulse voltage		6 kV										
DV/DT protection		1000V/μs										
Overvoltage category		III				III						
Control Circuit												
		UL/cUL				IEC						
Rated operational voltage (+10%, -15%)		100...240V AC, 24V AC/DC				100...240V~, 24V AC/DC						
Rated insulation voltage		250V				250V~						
Rated impulse voltage		—				4 kV						
Dielectric withstand		1500V AC				2000V~						
Overvoltage category		—				III *						
Operating frequency		50/60 Hz				50/60 Hz						
Input onstate voltage minimum, during start (IN1, IN2)		85V AC, 19.2V DC / 13.5V AC										
Input onstate current (IN1, IN2)		9.8 mA @120V AC/19.6 mA @ 240V AC, 7.3 mA @ 24V AC/DC										
Input offstate voltage maximum (IN1, IN2)		40V AC, 17V DC / 12V AC										
Input offstate current @ input offstate voltage (IN1, IN2)		<10 mA, <12 mA										
Control power with fan, during start		3...37 A 43...85 A		215 mA @ 120V AC / 180 mA @ 240V AC, 800 mA @ 24V DC / 660 mA @ 24V AC 200 mA @ 120V AC / 100 mA @ 240V AC, 700 mA @ 24V AC/DC								
Control power without fan, during start		3...37 A		205 mA @ 120V AC / 145 mA @ 240V AC, 705 mA @ 24V DC / 580 mA @ 24V AC								

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

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

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

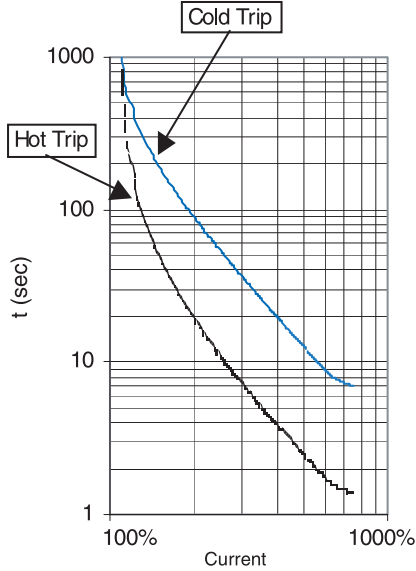
Bulletin 150
Smart Motor Controllers — SMC-3™
 Specifications, Continued

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

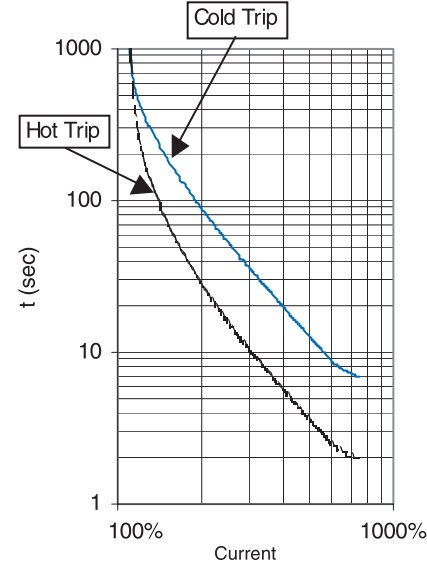
* Overvoltage category II when either control or auxiliary circuit is wired to a SELV or PELV circuit.

SMC-3 Overload Trip Curves

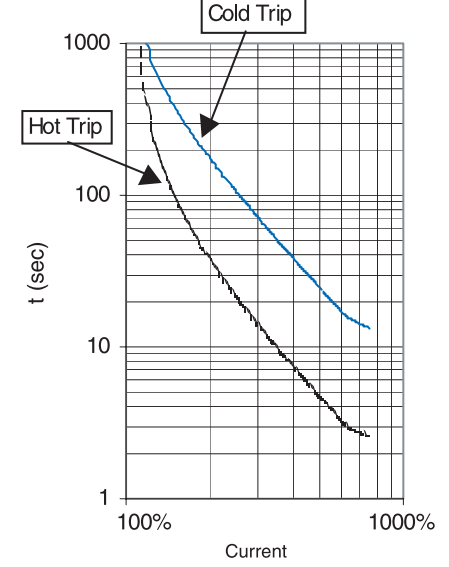
Trip Class 10



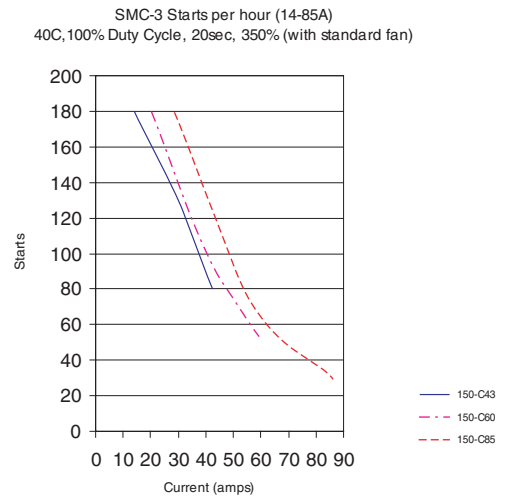
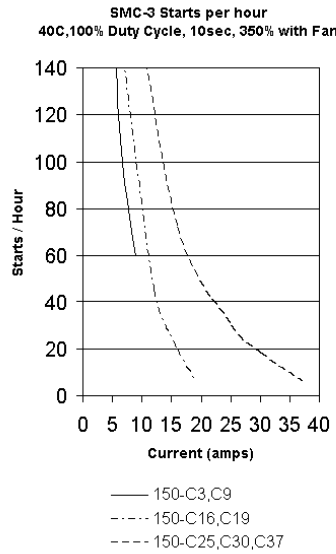
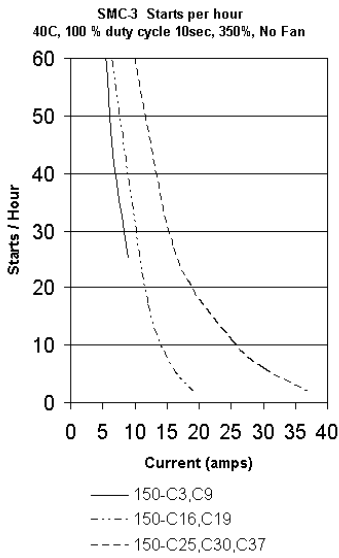
Trip Class 15



Trip Class 20



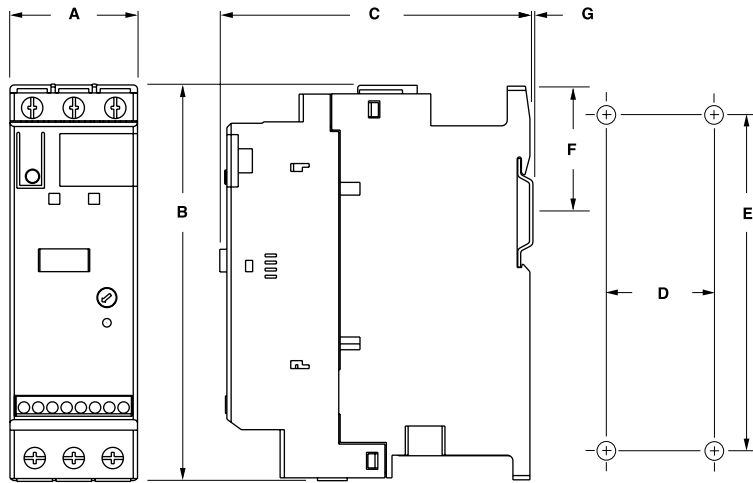
Starts per Hour Curves



Bulletin 150
Smart Motor Controllers — SMC-3™
 Approximate Dimensions

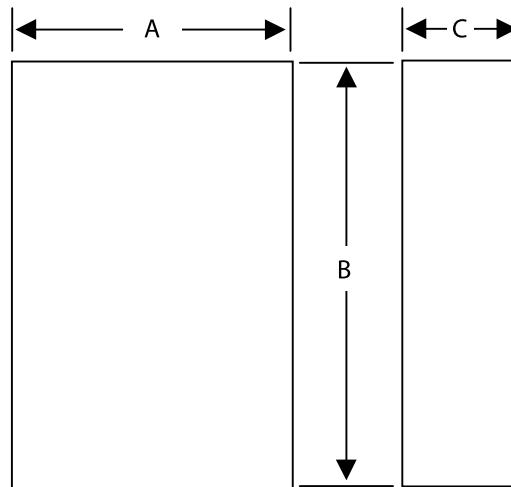
Dimensions in millimeters (inches). Dimensions are not intended to be used for manufacturing purposes. All dimensions are subject to change.

Open Type



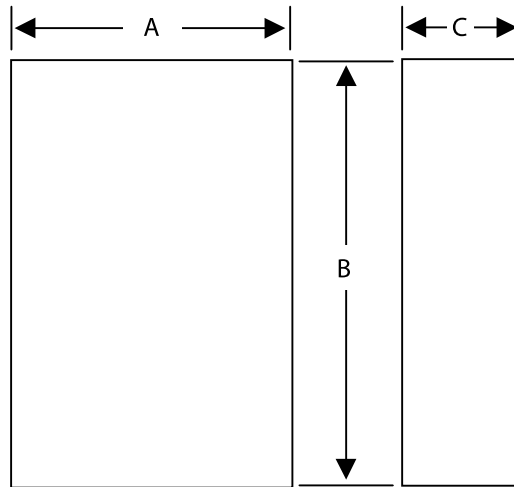
Controller	A	B	C	D	E	F	G	Mounting Hole Size
1...37 A	44.8 (1-49/64)	139.7 (5-1/2)	100 (4-21/64)	35 (1-3/8)	132 (5-13/64)	46.4 (1.81)	2 (1/16)	4.6 (0.18)
43...85 A	72 (2.83)	206 (8.11)	130 (5.12)	55 (2.17)	198 (7.8)	102 (4.02)	2 (1/16)	5.3 (0.21)

Minimum Enclosure Size



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

Enclosed Type Controllers



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

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






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




Bulletin 150
Smart Motor Controllers — SMC-3™
 Enclosed Options


Enclosed Options



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

Accessories (SMC-3 and SMC-Delta)

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

Description	For Use With	Pkg. Qty.	Cat. No.
 Fan Field installed.	150-C3...37/150-D3...64	1	150-CF64
	150-C43...85/150-D74...147		150-CF147
 Connecting modules to 140M 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 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...64NB	150-C84	
	150-C43...85NB or 150-D74...147NB	150-C84P	
	600V Protective Module	150-C3...37NC or 150-D3...64NC	150-C86
		150-C43...85NC or 150-D74...147NC	150-C86P

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

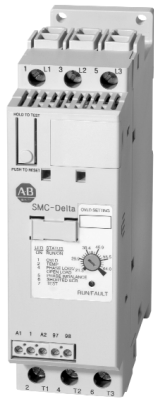
⊗ Voltage Suffix Code

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.)



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

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

- Current Limit Start
- Coast to Rest

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

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

Table of Contents

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 Product Selection 28
 Typical Wiring Diagrams 29
 Specifications 31
 Approximate Dimensions 34
 Accessories (SMC-3 and SMC-Delta) 25

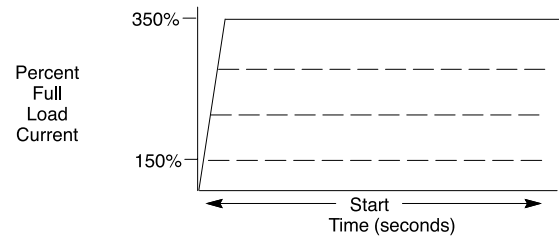
Standards Compliance/Approvals

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

Mode of Operation

Current Limit Start

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



Description of Protection Features

Overload Protection

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

Over-temperature

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

Phase Loss/Open Load

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

Phase Imbalance

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

Shorted SCR

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

Push to Test

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

LED Description (Number of Flashes)

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

Open Type

150 – D 32 N B D
a b c d e f

a

Bulletin Number	
Code	Description
150	Solid-State Controller

b

Controller Type	
Code	Description
D	SMC-Delta

c

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

d

Enclosure Type	
Code	Description
N	Open

e

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

f

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

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

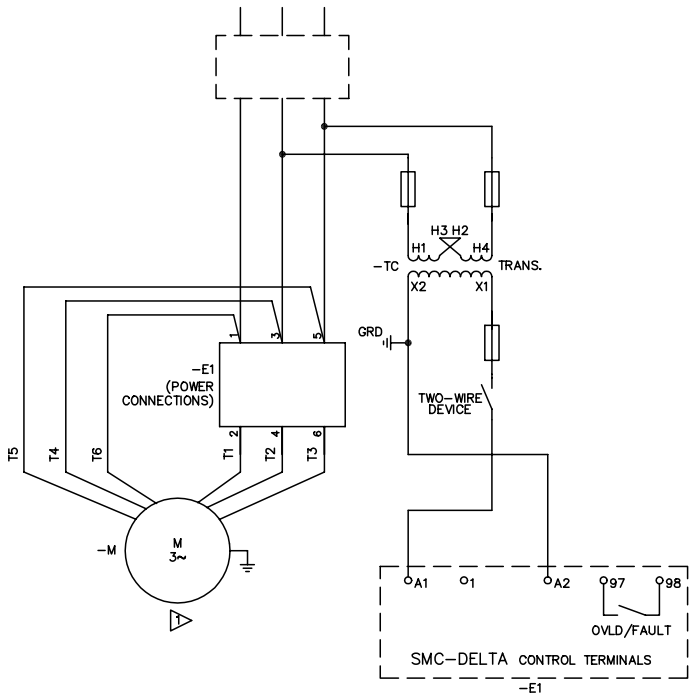
Product Selection
 Open Type Controllers

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

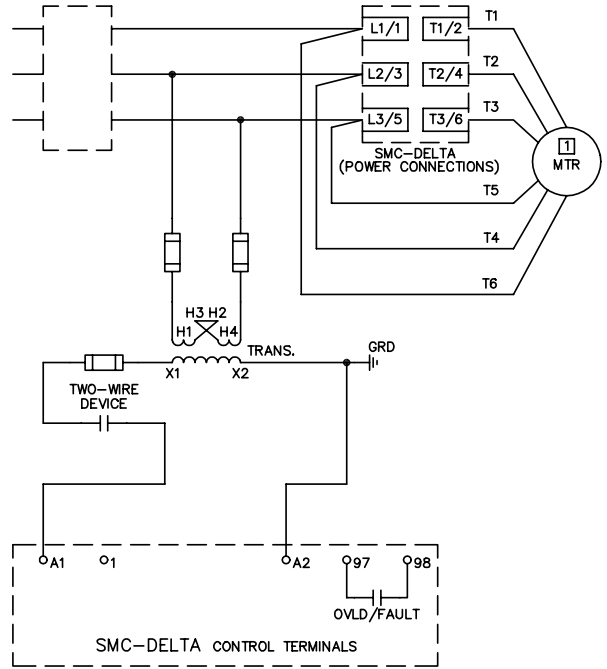
* Motor FLA must fall within the current range of the device.

Two-Wire Configuration

IEC

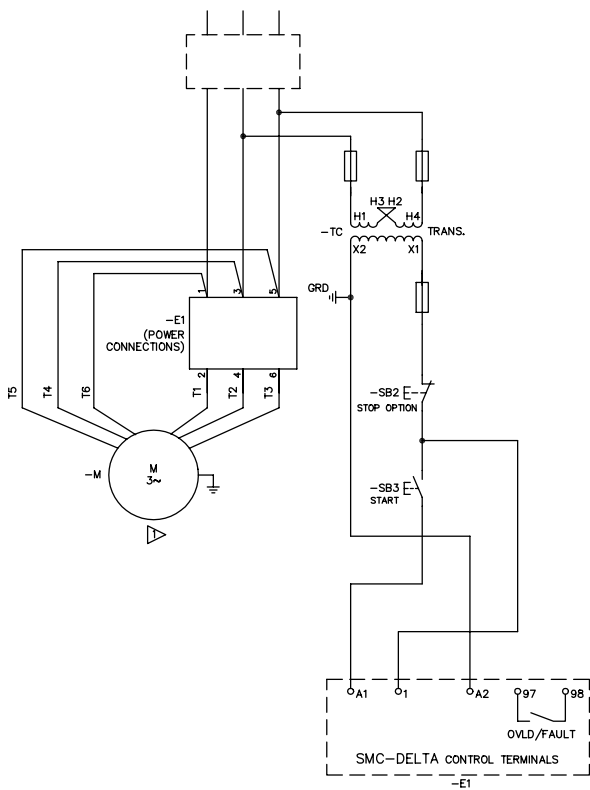


NEMA

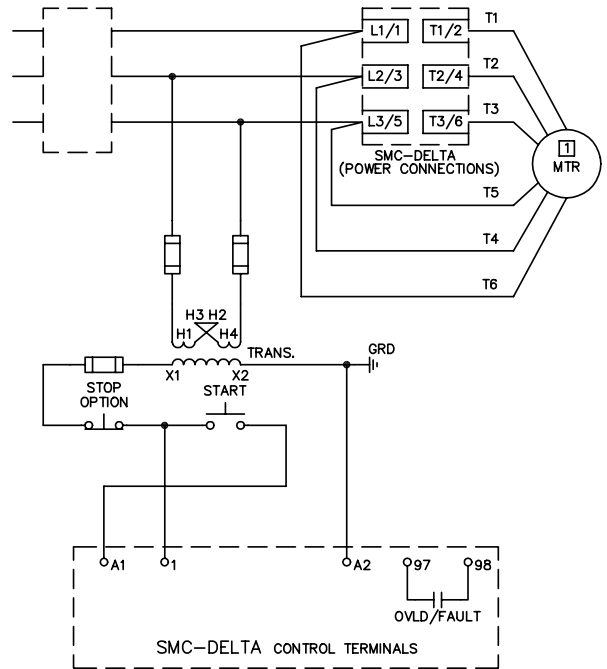


Three-Wire Configuration

IEC

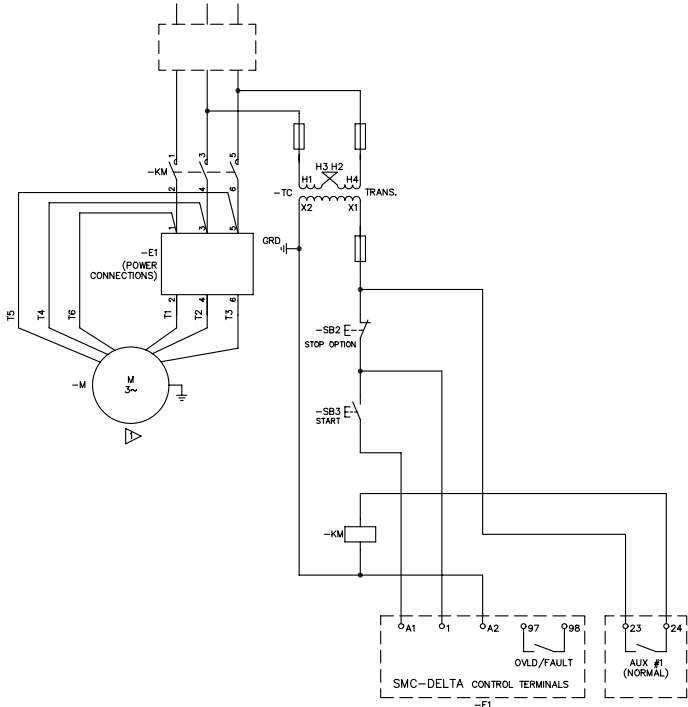


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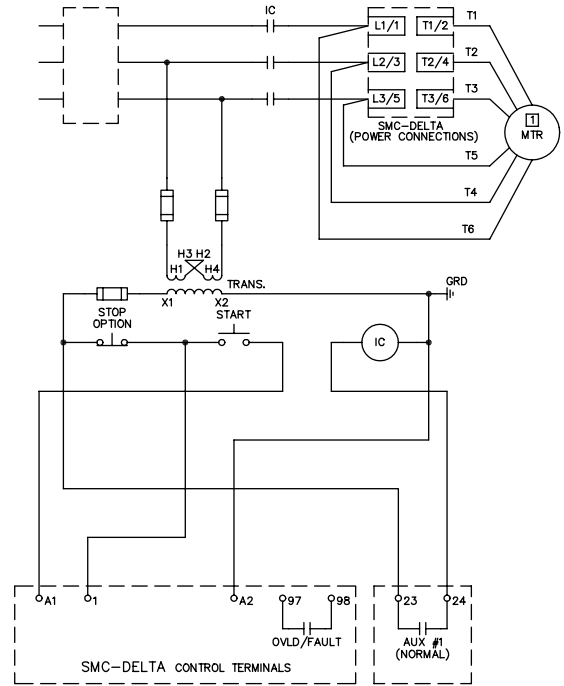


Isolation Contactor Configuration

IEC



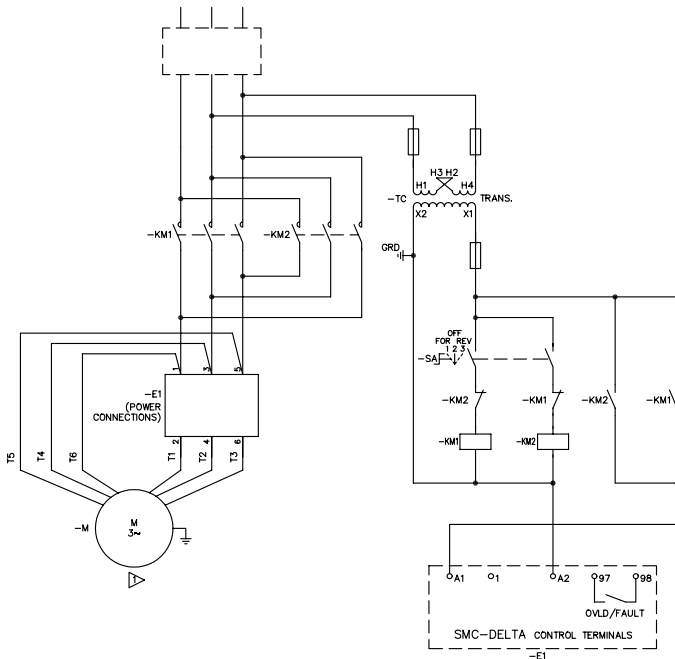
NEMA



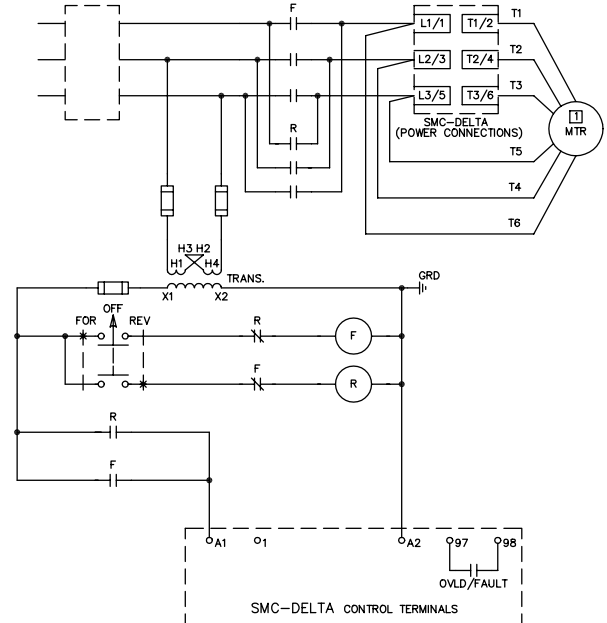
Reversing Configuration

Note: Minimum Off time equals 1.0 s.

IEC



NEMA



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

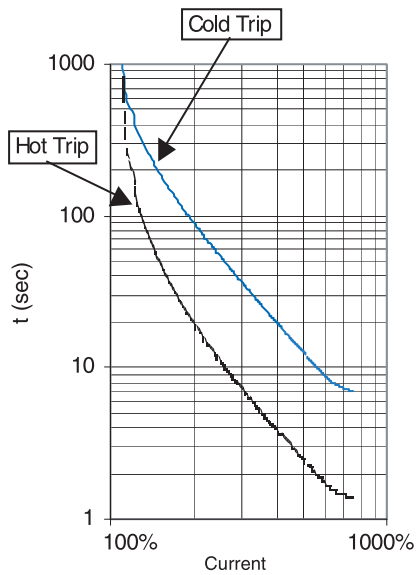
Bulletin 150
Smart Motor Controllers - SMC-Delta™
Specifications, Continued

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

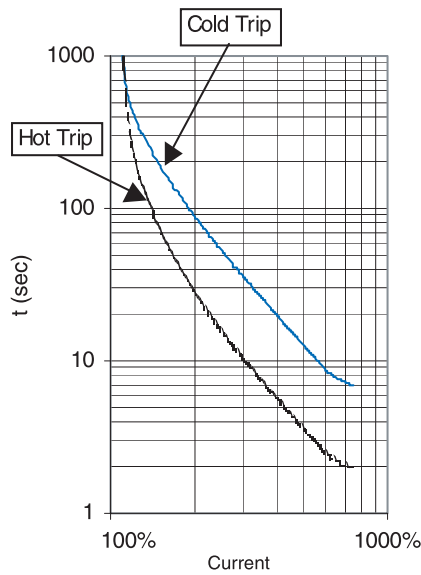
* Overtoltage category II, when either control or auxiliary circuit is wired to a SELV or PELV circuit.

SMC-Delta Overload Trip Curves

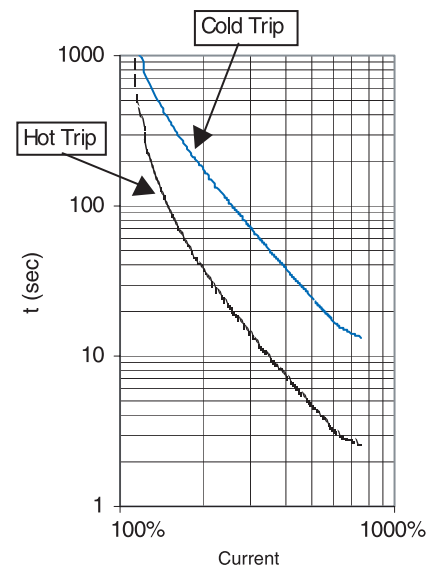
Trip Class 10



Trip Class 15

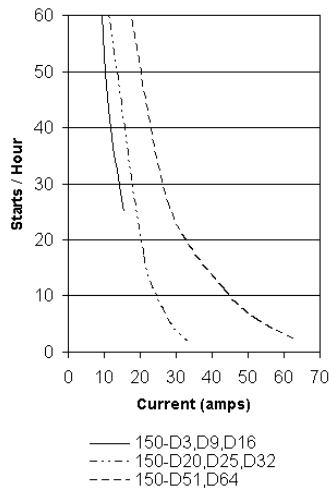


Trip Class 20

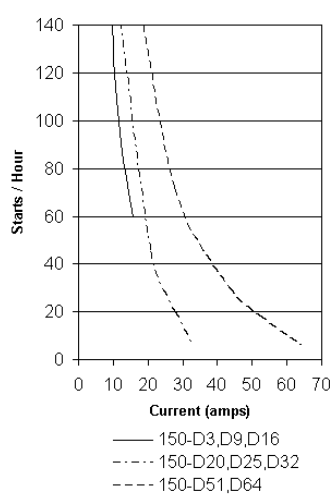


Starts per Hour Curves

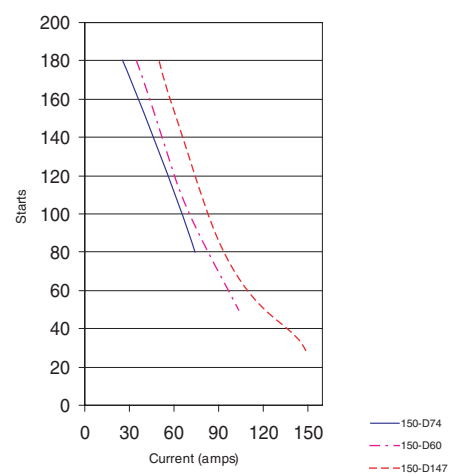
SMC-Delta Starts per hour
 40C, 100% duty cycle 10sec, 350%, No Fan



SMC-Delta Starts per hour
 40C, 100% Duty Cycle, 10sec, 350% with Fan



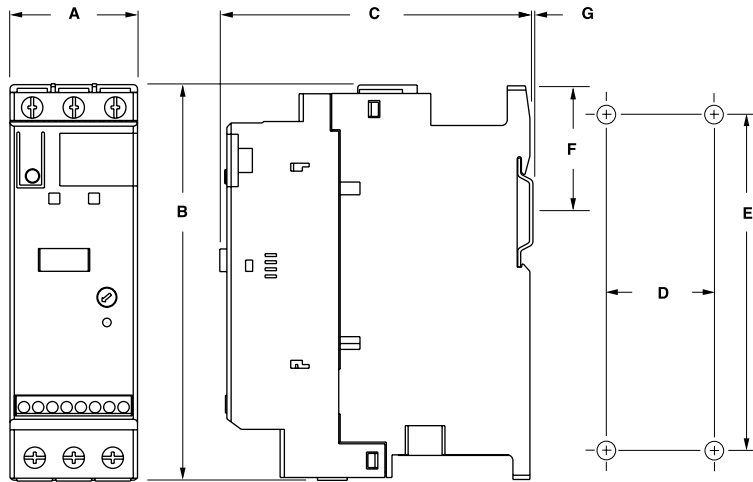
SMC-Delta Starts per hour (24-147A)
 40C, 100% Duty Cycle, 20sec, 350% with fan



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 Approximate Dimensions

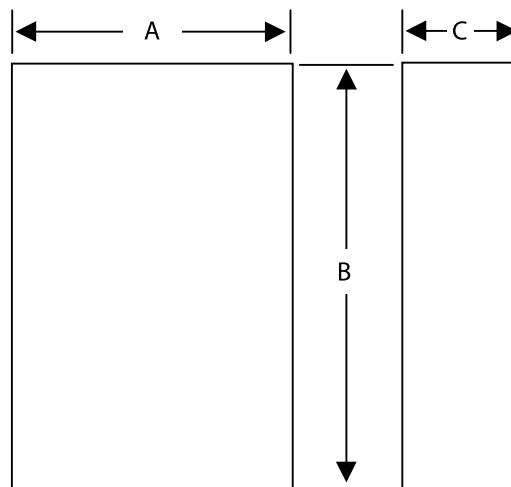
Dimensions in millimeters (inches). Dimensions are not intended to be used for manufacturing purposes. All dimensions are subject to change.

Open Type



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

Minimum Enclosure Size



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