

SMC™ Dialog Plus Specifications

Bulletin Number 150

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Additional Resources

These documents contain additional information concerning related products from Rockwell Automation.

Resource	Description
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation industrial system.
Product Certifications website, http://www.ab.com	Provides declarations of conformity, certificates, and other certification details.

You can view or download publications at <http://www.rockwellautomation.com/literature/>. To order paper copies of technical documentation, contact your local Allen-Bradley distributor or Rockwell Automation sales representative.





Features	SMC™ Dialog Plus 200...600V 1...1000 A
Soft Start	S
Kickstart	S
Current Limit	S
Dual Ramp Start	S
Full Voltage	S
Energy Saver	S
Soft Stop	O
Pump Control	O
Preset Slow Speed	O
SMB™ Smart Motor Braking	O
Accu-Stop™	O
Slow Speed with Braking	O
Integrated Bypass Contactor	NA▲
Integrated Motor Overload Protection	S
Metering	S
Parameter Configuration/Programming	S
Standards Compliance: CE Marked per Low Voltage Directive 73/23/EEC, 93/68/EEC CSA Certified (File No. LR 1234) UL Listed (File No. E96956)	S

S = Standard Feature

O = Optional Feature

▲ The starter is fully solid-state (no integral bypass). An external bypass contactor can be added as an option.

Standards Compliance

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

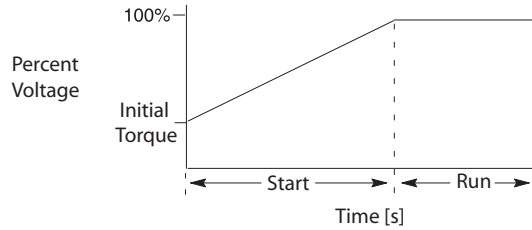
Certifications

cULus Listed (Open Type) (File No. E96956, Guides NMFT, NMFT7)
CSA Certified (File No. LR 1234)
CE Marked (Open Type) per EMC and Low Voltage Directive
CCC Certified

The SMC Dialog Plus controller provides the following modes of operation: Soft Start with selectable Kickstart, Current Limit Start, Dual Ramp Start, and Full Voltage Start.

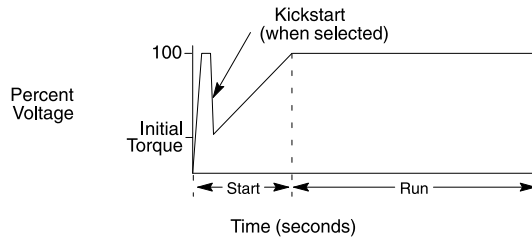
Soft Start

This method has the most general application. The motor is raised to an initial torque value which is programmable from 0...90% of locked rotor torque. The motor voltage is gradually increased during the acceleration ramp time, which can be programmed from 0...30 seconds.



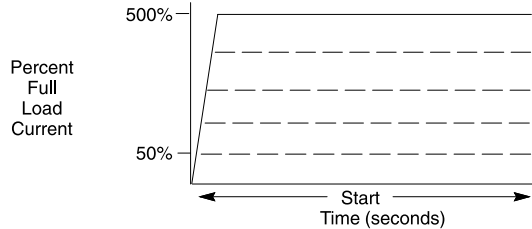
Soft Start with Selectable Kickstart

A kickstart, or boost, at the beginning of the voltage ramp is intended to provide a current pulse of 550% of full load current. The kickstart time is adjustable from 0.0...2.0 seconds. This allows the motor to develop additional torque at start for loads which may need a boost to get started.



Current Limit Start

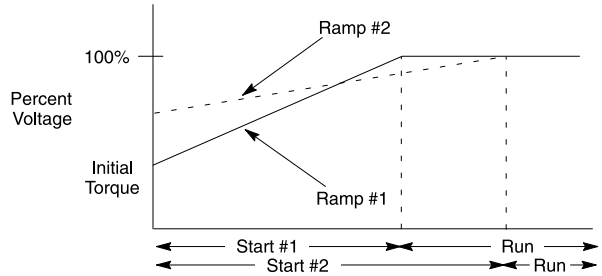
This starting mode is used when it is necessary to limit the maximum starting current. The current limit can be programmed for 50...600% of full load current.



Dual Ramp Start

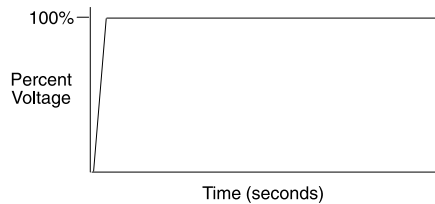
This starting mode is useful on applications that have varying loads and therefore varying starting torque requirements. The Dual Ramp Start offers the user the option to select between two separate Soft Start profiles with separately adjustable ramp times and initial torque settings.

The acceleration ramp times can be programmed from 0...30 seconds. The initial torque values can be programmed from 0...90% of locked rotor torque. **Note:** Dual Ramp is only available with the standard controller.



Full Voltage Start

This mode is used for applications requiring across-the-line starting. The ramp time is less than 1/4 second.



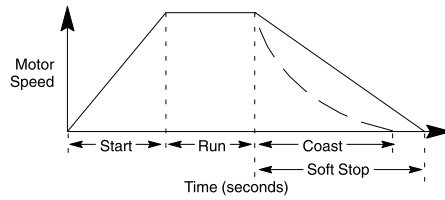
Description of Starting and Stopping Options

The following options are available in the SMC Dialog Plus controller. Only one option may be added to the standard unit.

Soft Stop ★

This option can be used on applications that require an extended coast to rest. It is designed for frictional loads that tend to stop suddenly when voltage is removed from the motor.

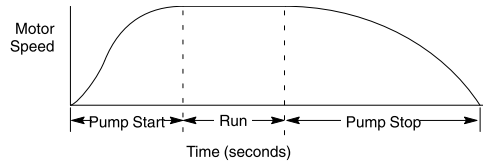
The voltage ramp down time can be programmed from 0...60 seconds. The load will stop when the motor voltage drops to a point where the load torque is greater than the motor torque.



Pump Control ★

This option is used to reduce surges during the starting and stopping of a centrifugal pump by smoothly accelerating and decelerating the motor. The microprocessor analyzes the motor variables and generates commands which control the motor and reduce the possibility of surges occurring in the system.

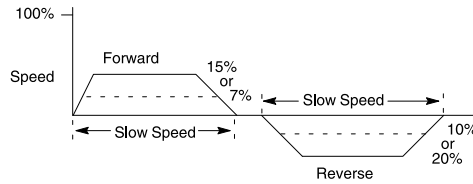
The starting time is programmable from 0...30 seconds and the stopping time is programmable from 0...120 seconds.



Preset Slow Speed

This option can be used on applications that require a slow speed (for example, moving material into position).

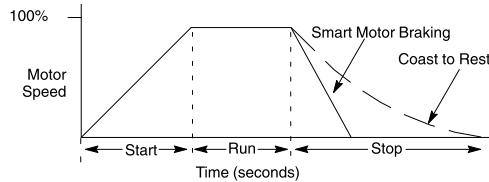
The preset slow speed can be programmed for either 7% of base speed (low) or 15% of base speed (high) in the forward direction. It can also be set for 10% of base speed (low) or 20% of base speed (high) in the reverse direction without a reversing contactor.



SMB Smart Motor Braking ★

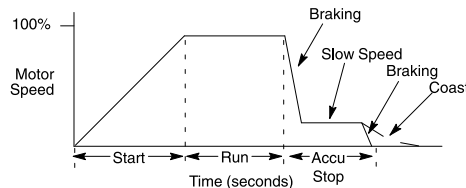
This option provides motor braking for applications that require the motor to stop faster than a coast to rest. Braking control, with automatic zero speed shut off, is fully integrated into the compact design of the SMC Dialog Plus controller. This design facilitates a clean, straightforward installation and eliminates the requirement for additional hardware such as braking contactors, resistors, timers, and speed sensors.

The microprocessor based braking system applies braking current to a standard squirrel cage induction motor. The strength of the braking current is programmable from 150...400% of full load current.



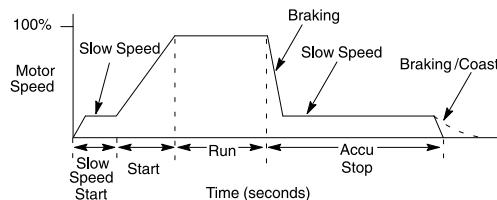
Accu-Stop ★

This option is used in applications requiring controlled position stopping. During stopping, braking torque is applied to the motor until it reaches preset slow speed (7 or 15% of rated speed) and holds the motor at this speed until a stop command is given. Braking torque is then applied until the motor reaches zero speed. Braking current is programmable from 0...400% of full load current. Slow Speed Current is programmable from 0...450% of full load current. Slow speed can be programmed for either 7% (low) or 15% (high).



Accu-Stop with Slow Speed at Start ★

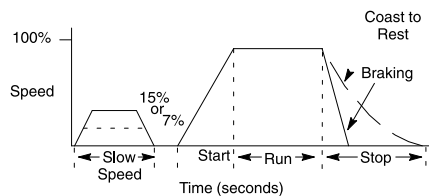
The Accu-Stop option can also allow the motor to operate at a preset slow speed when Slow Speed Start is selected. This minimizes the jogging required to position a load. The start command will ramp the voltage from the preset slow speed to full speed. The operation of Accu-Stop is the same as explained previously.



Slow Speed with Braking ★

Slow Speed with Braking is used on applications that require slow speed (in the forward direction) for positioning or alignment and also require braking control to stop.

Slow speed adjustments are 7% (low) or 15% (high) of rated speed. Slow speed acceleration current is adjustable from 0...450%. Slow speed running current is adjustable from 0...450% of full load current. Braking current is adjustable from 0...400%.



★ Not intended to be used as an emergency stop. Refer to the applicable standards for emergency stop requirements.

Description of Features

Electronic Motor Overload Protection

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

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

The controller's overload protection is programmable, providing the user with flexibility. The overload trip class can be selected for class 10, 15, 20, or 30 protection. The trip current is programmed by entering the motor full-load current rating.

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

Note: The current sensing capability of the SMC Dialog Plus controller is disabled during bypass operation. The Bulletin 825 Converter Module and 150-NFS fanning strip are required for providing current feedback in these applications. **Note:** To achieve calibration, 70% motor load or greater is required at the motor shaft for 2 s. Calibration is required when a Bulletin 825 Converter Module is not used.

Stall Protection and Jam Detection

Motors can experience locked rotor currents and develop high torque levels in the event of a stall or a jam. These conditions can result in winding insulation breakdown or mechanical damage to the connected load. The SMC Dialog Plus controller provides both stall protection and jam detection for enhanced motor and system protection. Stall protection allows the user to program a maximum stall protection delay time from 0...10 s. The stall protection delay time is in addition to the programmed start time and begins only after the start time has timed out. If the controller senses that the motor is stalled, it will shut down after the delay period has expired. Jam detection allows the user to determine the motor jam detection level as a percentage of the motor's full load current rating. To prevent nuisance tripping, a jam detection delay time, from 0.0...10.0 s, can be programmed. This allows the user to select the time delay required before the SMC Dialog Plus controller will trip on a motor jam condition. The motor current must remain above the jam detection level during the delay time. Jam detection is active only after the motor has reached full speed.

Energy Saver

This is a standard feature with the SMC Dialog Plus controller. It is used to save energy on applications where the motor is lightly loaded or unloaded for long periods of time. The Energy Saver is a built-in feature of the controller. It does not require additional panel space or external wiring. It also does not require a complicated setup procedure.

Phase Rebalance

The SMC Dialog Plus controller incorporates, as standard, a dynamic Phase Rebalance feature. The controller compensates for voltage unbalance by automatically adjusting the voltage output to balance the 3-phase currents drawn by the motor. When phase rebalance is achieved, motor life may be extended and production can continue without interruption. Phase Rebalance is a built-in feature of the controller and does not require a complicated setup procedure.

Note: Phase Rebalance requires the use of the Bulletin 825 Converter Module and the Cat. No. 150-NFS fanning strip.

Note: The performance of the Phase Rebalance feature is dependent on the motor's loading and characteristics. Severe imbalances cannot be corrected.

Underload Protection

Utilizing the underload protection of the SMC Dialog Plus controller, motor operation can be halted if a drop in current is sensed.

The SMC Dialog Plus controller provides an adjustable underload trip setting from 0...99% of the programmed motor full load current rating with an adjustable trip delay time of 0...99 s.

Undervoltage Protection

The SMC Dialog Plus controller's undervoltage protection will halt motor operation if a drop in the incoming line voltage is detected. The undervoltage trip level is adjustable as a percentage of the programmed line voltage, from 0...99%. To eliminate nuisance trips, a programmable undervoltage trip delay time of 0...99 s can also be programmed. The line voltage must remain below the undervoltage trip level during the programmed delay time.

Overvoltage Protection

If a rise in the incoming line voltage is detected, the SMC Dialog Plus controller's overvoltage protection will halt motor operation. The overvoltage trip level is adjustable as a percentage of the programmed line voltage, from 0...99%. To eliminate nuisance trips, a programmable overvoltage trip delay time of 0...99 s can also be programmed. The line voltage must remain above the overvoltage trip level during the programmed delay time.

Voltage Unbalance Protection

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

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

Excessive Starts Per Hour

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

Metering

Power monitoring parameters include:

- 3-phase current
- 3-phase voltage
- Power in kW
- Power usage in kWh
- Power factor
- Motor thermal capacity usage
- Elapsed time

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

Note: In bypass configurations, the current sensing and power factor measurement capability of the SMC Dialog Plus controller is disabled. Three-phase current measurement, kW, kWh, and motor thermal capacity usage can still be maintained with the use of the Bulletin 825 Converter Module.

Note: The usage of an SMC Controller on a generator and line power requires the use of a Bulletin 825 Converter Module.

Built-in SCANport™ Communication

A serial interface port is provided as standard, which allows connection to a Bulletin 1201 Human Interface Module or a variety of Bulletin 1203 Communication Modules. This includes Allen-Bradley Remote I/O, DeviceNet network and RS-232/422/485-DF1.

LCD Display

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

Keypad Programming

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

Auxiliary Contacts

Three hard contacts are furnished as standard with the SMC Dialog Plus controller. The first two contacts are programmable for Normal/Up-to-speed. The third is programmable for Normal/Fault.

Open Controllers

150
- B180
N
B
D
A
- 8L

a
b
c
d
e
f
g

a

Bulletin Number	
Code	Description
150	Solid-State Controller
150B 152H 153H	Solid-State Controller and Isolation Contactor (enclosed only)

b

Controller Ratings	
Code	Description
B24	24 A, 1...15 Hp @ 460V AC
B35	35 A, 1...25 Hp @ 460V AC
B54	54 A, 1...40 Hp @ 460V AC
B97	97 A, 5...75 Hp @ 460V AC
B135	135 A, 5...100 Hp @ 460V AC
B180	180 A, 5...150 Hp @ 460V AC
B240	240 A, 5...200 Hp @ 460V AC
B360	360 A, 5...300 Hp @ 460V AC
B500	500 A, 4...400 Hp @ 460V AC
B650	650 A, 5...500 Hp @ 460V AC
B720	720 A, 5...600 Hp @ 460V AC
B850	850 A, 10...700 Hp @ 460V AC
B1000	1000 A, 10...800 Hp @ 460V AC

c

Enclosure Type	
Code	Description
N	Open

d

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

e

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

f

Control Options	
Note: Select Only One	
Code	Description
Blank	Standard
A	Soft Stop
B	Pump Control
C	Preset Slow Speed
D	SMB Smart Motor Braking
E	Accu-Stop
F	Slow Speed with Braking

g

Options	
Code	Description
8L	Line-Mounted Protective Module
8M	Load-Mounted Protective Module
8B	Line- and Load-Mounted Protective Modules

Specifications

Functional Design Specifications			
Standard Features	Installation	Power Wiring	The SMC Dialog Plus Controller can be wired with or without an isolation contactor. Bypass contactors can be employed after the controller has brought the motor to full speed.
		Control Wiring	2- and 3-wire control for a wide variety of applications.
	Setup	Keypad	The SMC Dialog Plus Controller is configured with the front keypad and backlit LCD display.
		Software	Parameter values can be downloaded to the SMC Dialog Plus Controller with DriveTools programming software and the Cat. No. 1203-GD2 communication module.
	Communications	One serial port provided for connection to optional human interface and communication modules.	
	Starting Modes	Soft start with selectable kickstart, current limit, dual ramp, and full voltage in one unit.	
	Protection and Diagnostics	Power loss, line fault, voltage unbalance, excessive starts/hour, phase reversal, undervoltage, overvoltage, controller temp, stall, jam, open gate, overload, underload, communication fault.	
	Metering	Amps, volts, kW, kWh, elapsed time, power factor, motor thermal capacity usage.	
	Status Indication	Stopped, ramping, stopping, at speed, and fault.	
Auxiliary Contacts	(1) Single-pole double-throw contact programmable as normal or up-to-speed; one programmable as normal or fault.		
Optional Features	Soft Stop	Extended coast-to-rest to minimize load shifting. Ramp down time is adjustable from 0...60 s.	
	Pump Control	Helps reduce fluid surges in centrifugal pumping systems during starting and stopping period. Starting time is adjustable from 0...30 s. Stopping time is adjustable from 0...120 s.	
	Preset Slow Speed	Enables the operator to position material. The preset slow speed can be set for low (7% of base speed), high (15% of base speed), reverse low (10% of base speed) or reverse high (20% of base speed).	
	SMB Smart Motor Braking	Provides motor braking without additional equipment for applications that require the motor to stop quickly. Braking current is adjustable from 0...400% of the motor's full-load current rating.	
	Accu-Stop/Slow Speed with Braking	Combines Smart Motor Braking and Preset Slow Speed. Braking current is adjustable from 0...400% of full-load current. Slow speed can be set for either Low (7% of base speed) or High (15% of base speed).	

Electrical Ratings			
		UL/CSA/NEMA	IEC
Power Circuit	Rated Operation Voltage	200...480V AC 200...600V AC (-15%, +10%)	200...415V 200...500V
	Rated Insulation Voltage	N/A	500V
	Rated Impulse Voltage	N/A	6000V
	Dielectric Withstand	2200V AC	2500V
	Repetitive Peak Inverse Voltage Rating	200...480V AC: 1400V 200...600V AC: 1600V	200...415V: 1400V 200...500V: 1600V
	Operating Frequency	50/60 Hz	50/60 Hz
	Utilization Category	MG 1	AC-53a
	Protection Against Electrical Shock	N/A	IP00 (open device)
DV/DT Protection		RC Snubber Network	
Transient Protection		Metal Oxide Varistors: 220 Joules @ 24...360 A 220 Joules @ 480V, 500...1000 A 300 Joules @ 600V, 500...1000 A	
Short-Circuit Protection	SCPD Performance		Type 1
	SCPD List		Maximum Fuse or Circuit Breaker (A):
	Device Operational Current Rating [A]	24	80
		35	125
		54	200
		97	350
		135	500
		180	600
		240	700
		360	1000
		500	1200
		650	1600
720	2000		
850	2500		
1000	3000		
Control Circuit	Rated Operational Voltage	100...240V AC 24V AC 24V DC	100...240V 24V 24V DC
	Rated Insulation Voltage	N/A	240V
	Rated Impulse Voltage	N/A	3000V
	Dielectric Withstand	1600V AC	2000V
	Operating Frequency	50/60 Hz	50/60 Hz
	Protection Against Electric Shock	N/A	IP20
Power Requirements	Control Module		40 VA
	Heatsink Fan(s) [A] ★	24	—
		35	—
		54	—
		97	45 VA
		135	45 VA
		180	45 VA
		240	45 VA
		360	45 VA
		500	145 VA
		650	320 VA
	720	320 VA	
850	320 VA		
1000	320 VA		

★ For devices rated 24...500 A, heatsink fans can be powered by either 110/120V AC or 220/240V AC. For devices rated 650...1000 A, heatsink fans can only be powered by 110/120V AC.

Electrical Ratings, Continued			UL/CSA/NEMA	IEC
Maximum Heat Dissipation [W]	Current Rating [A]	24		110
		35		150
		54		200
		97		285
		135		490
		180		660
		240		935
		360		1170
		500		1400
		650		2025
		720		2250
850		2400		
1000		2760		
Auxiliary Contacts	Rated Operation Voltage		240V AC	240V
	Rated Insulation Voltage		N/A	240V
	Dielectric Withstand		1600V AC	2000V
	Operating Frequency		50/60 Hz	50/60 Hz
	Utilization Category		B300 (terminals 18...19) C300 (terminals 18...20) C300 (terminals 29...30)	AC-15
	SCPD Performance		Type 2	
SCPD List		Class CC 8 A @ 1000 A Available Fault Current		
Environmental				
Operating Temperature Range		0...+50 °C (32...122 °F) (open) 0...+40 °C (32...104 °F) (enclosed)		
Storage and Transportation Temperature Range		-20...+75 °C		
Humidity		2000 m (6560 ft)		
Pollution Degree		5...95% (non-condensing)		
		2		
Mechanical				
Resistance to Vibration	Operational		1.0 G Peak, 0.006 in. displacement	
	Non-Operational		2.5 G, 0.015 in. displacement	
Resistance to Shock	Operational		15 G	
	Non-Operational		30 G	
Construction	Power Poles	Thermoset Moldings Heatsink hockey puck thyristor	24...135 A 180...1000 A	
	Control Modules		Thermoset and Thermoplastic Moldings	
	Metal Parts		Anodized Aluminum, Plated Brass, Copper, or Painted Steel	
Terminals	Power Terminals	24...54 A	6.0 mm hole with clamp screw	
		97 and 135 A	One 11.5 mm (0.453 in.) diameter hole each	
		180...360 A	One 10.5 mm (0.413 in.) diameter hole each	
		500 A	Two 13.5 mm (0.531 in.) diameter holes each	
		650 and 720 A	Three 13.1 mm (0.515 in.) diameter holes each	
	850 and 1000 A	Six 13.1 mm (0.515 in.) diameter holes each		
Power Terminal Markings		NEMA, CENELEC EN50 012		
Control Terminals		M 3.5 x 0.6 Pozidriv screw with self-lifting clamp plate		
Other				
EMC Emission Levels	Conducted Radio Frequency Emissions		Class A	
	Radiated Emissions		Class A	
EMC Immunity Levels	Electrostatic Discharge		8 kV Air Discharge	
	Radio Frequency Electromagnetic Field		Per IEC 947-4-2	
	Fast Transient		Per IEC 947-4-2	
	Surge Transient		Per IEC 947-4-2	
Overload Characteristics	Current Range		1.0...999.9 A	
	Trip Classes		10, 15, 20, and 30	
	Trip Current Rating		120% of Motor FLC	
	Number of Poles		3	

Specifications, Continued

Fuse Clip Sizing and Type for Fusible Combination Controllers★‡

Horsepower @ 480V	Fuse Clip Size/Type	Fuse Size Range [A]
15	30 A/Class J	0...30
20	60 A/Class J	31...60
25	60 A/Class J	31...60
30	60 A/Class J	31...60
40	100 A/Class J	61...100
50	100 A/Class J	61...100
60	200 A/Class J	101...200
75	200 A/Class J	101...200
100	200 A/Class J	101...200
125	400 A/Class J	201...400
150	400 A/Class J	201...400
200	400 A/Class J	201...400
250	400 A/Class J	401...600
300	600 A/Class J	401...600
350	600 A/Class J	401...600
400	1200 A/Class L	601...1600
450	1200 A/Class L	601...1600
500	1200 A/Class L	601...1600
600	1200 A/Class L	601...1600
700	1200 A/Class L	601...1600
800	1200 A/Class L	601...1600

★ Consult NEC Handbook for proper fuse sizing guidelines.

‡ Optional fuse clip sizes and types are available upon request. Consult your local Rockwell Automation sales office or Allen-Bradley distributor.

Circuit Breaker Sizes and Rating Plug Sizes

Horsepower @ 480V	Circuit Breaker Size [A]/ Rating Plug Size [A]	Interrupting Rating in Symmetrical Amps @ 480V§
15	150/50	14 000
20	150/50	14 000
25	150/60	14 000
30	150/70	14 000
40	150/100	14 000
50	150/125	14 000
60	250/150	25 000
75	250/175	25 000
100	250/225	25 000
125	250/250	25 000
150	400/300	35 000
200	400/400	35 000
250	600/500	35 000
300	600/600	35 000
350	800/800	35 000
400	800/800	50 000
450	1200/1000	50 000
500	1200/1200	50 000
600	1200/1200	50 000
700	2000/1600	65 000
800	2000/2000	65 000

§ For higher interrupting ratings, consult your local Rockwell Automation sales office or Allen-Bradley distributor.

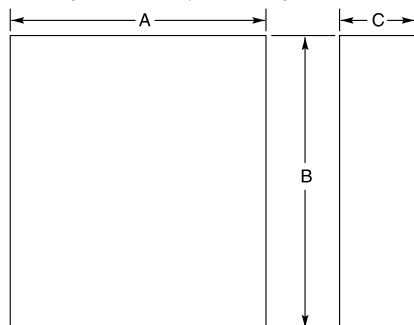
Approximate Dimensions and Shipping Weights
Open Type Controllers

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

Controller Rating [A]	Height	Width	Depth	Weight
24	180 (7.09)	154 (6.06)	185 (7.29)	4.5 kg (10 lbs)
35	240 (9.45)	214 (8.43)	195 (7.68)	6.8 kg (15 lbs)
54	290 (11.42)	244 (9.61)	225 (8.86)	11.3 kg (25 lbs)
97	336 (13.23)	248 (9.77)	256 (10.09)	10.4 kg (23 lbs)
135	336 (13.23)	248 (9.77)	256 (10.09)	11.8 kg (26 lbs)
180	560 (22.06)	273 (10.75)	294 (11.58)	25 kg (55 lbs)
240	560 (22.06)	273 (10.75)	294 (11.58)	30 kg (65 lbs)
360	560 (22.06)	273 (10.75)	294 (11.58)	30 kg (65 lbs)
500	588 (23.17)	508 (20.00)	311 (12.23)	40.8 kg (90 lbs)
650...1000	1524 (60.0)	813 (32.00)	402 (15.83)	167.8 kg (370 lbs)

Enclosed Type Controllers

Dimensions are in millimeters (inches). Dimensions are not intended for manufacturing purposes. All dimensions are subject to change. Factory-installed options may affect enclosure size requirements.



Controller Rating [A]	A			J			IP65 (Type 4)		
	IP30 (Type 1)			IP54 (Type 12)					
	B Height	A Width	C Depth	B Height	A Width	C Depth	B Height	A Width	C Depth
Non-Combination Controller									
24	610 (24)	406 (16)	229 (9)	610 (24)	406 (16)	229 (9)	610 (24)	406 (16)	229 (9)
35	762 (30)	610 (24)	305 (12)	762 (30)	610 (24)	305 (12)	762 (30)	610 (24)	305 (12)
54	762 (30)	610 (24)	305 (12)	762 (30)	610 (24)	305 (12)	762 (30)	610 (24)	305 (12)
97	762 (30)	610 (24)	305 (12)	762 (30)	610 (24)	305 (12)	762 (30)	610 (24)	305 (12)
135	965 (38)	762 (30)	356 (14)	965 (38)	762 (30)	356 (14)	965 (38)	762 (30)	356 (14)
180	965 (38)	762 (30)	356 (14)	965 (38)	762 (30)	356 (14)	965 (38)	762 (30)	356 (14)
240	965 (38)	762 (30)	356 (14)	1295 (51)	914 (36)	356 (14)	1295 (51)	914 (36)	356 (14)
360	1295 (51)	914 (36)	356 (14)	1524 (60)	914 (36)	356 (14)	1524 (60)	914 (36)	356 (14)
500	1524 (60)	914 (36)	356 (14)	2286 (90)	889 (35)	508 (20)	2134 (90)	1016 (35)	457 (20)
650	2286 (90)	889 (35)	508 (20)	2286 (90)	1778 (60)	508 (20)	2286 (90)	1778 (60)	508 (20)
720	2286 (90)	889 (35)	508 (20)	2286 (90)	1778 (60)	508 (20)	2286 (90)	1778 (60)	508 (20)
850	2286 (90)	889 (35)	508 (20)	2286 (90)	1778 (60)	508 (20)	2286 (90)	1778 (60)	508 (20)
1000	2286 (90)	889 (35)	508 (20)	2286 (90)	1778 (60)	508 (20)	2286 (90)	1778 (60)	508 (20)
Combination Controllers with Fusible Disconnect									
24	762 (30)	610 (24)	305 (12)	762 (30)	610 (24)	305 (12)	762 (30)	610 (24)	305 (12)
35	762 (30)	610 (24)	305 (12)	762 (30)	610 (24)	305 (12)	762 (30)	610 (24)	305 (12)
54 (60 A Disconnect)	762 (30)	610 (24)	305 (12)	762 (30)	610 (24)	305 (12)	762 (30)	610 (24)	305 (12)
54 (100 A Disconnect)	965 (38)	762 (30)	356 (14)	965 (38)	762 (30)	356 (14)	965 (38)	762 (30)	356 (14)
97	965 (38)	762 (30)	356 (14)	965 (38)	762 (30)	356 (14)	965 (38)	762 (30)	356 (14)
135	965 (38)	762 (30)	356 (14)	965 (38)	762 (30)	356 (14)	965 (38)	762 (30)	356 (14)
180	1295 (51)	914 (36)	356 (14)	1295 (51)	914 (36)	356 (14)	1295 (51)	914 (36)	356 (14)
240	1295 (51)	914 (36)	356 (14)	1295 (51)	914 (36)	356 (14)	1295 (51)	914 (36)	356 (14)
360	1524 (60)	965 (38)	356 (15)	1524 (60)	965 (38)	356 (15)	1524 (60)	965 (38)	356 (15)
500 (600 A Disconnect)	2134 (84)	1016 (40)	457 (18)	2134 (84)	1016 (40)	457 (18)	2134 (84)	1016 (40)	457 (18)
500 (1200 A Disconnect)	2286 (90)	1143 (55)	508 (20)	2286 (90)	1270 (55)	508 (20)	2286 (90)	1778 (55)	508 (20)
650	2286 (90)	1397 (55)	508 (20)	2286 (90)	1778 (55)	508 (20)	2286 (90)	1778 (55)	508 (20)
720	2286 (90)	1397 (55)	508 (20)	2286 (90)	1778 (55)	508 (20)	2286 (90)	1778 (55)	508 (20)
850	2286 (90)	1397 (55)	508 (20)	2286 (90)	2667 (95)	508 (20)	2286 (90)	2667 (95)	508 (20)
1000	2286 (90)	1397 (55)	508 (20)	2286 (90)	2667 (95)	508 (20)	2286 (90)	2667 (95)	508 (20)
Combination Controllers with Circuit Breaker									
24	762 (30)	610 (24)	305 (12)	762 (30)	610 (24)	305 (12)	762 (30)	610 (24)	305 (12)
35	762 (30)	610 (24)	305 (12)	762 (30)	610 (24)	305 (12)	762 (30)	610 (24)	305 (12)
54	762 (30)	610 (24)	305 (12)	762 (30)	610 (24)	305 (12)	762 (30)	610 (24)	305 (12)
97	965 (38)	762 (30)	356 (14)	965 (38)	762 (30)	356 (14)	965 (38)	762 (30)	356 (14)
135	965 (38)	762 (30)	356 (14)	965 (38)	762 (30)	356 (14)	965 (38)	762 (30)	356 (14)
180	1295 (51)	914 (36)	356 (14)	1295 (51)	914 (36)	356 (14)	1295 (51)	914 (36)	356 (14)
240	1295 (51)	914 (36)	356 (14)	1295 (51)	914 (36)	356 (14)	1295 (51)	914 (36)	356 (14)
360	1524 (60)	965 (38)	356 (14)	1524 (60)	965 (38)	356 (14)	1524 (60)	965 (38)	356 (14)
500	2134 (90)	1016 (35)	457 (20)	2134 (90)	1016 (35)	457 (20)	2134 (90)	1016 (35)	457 (20)
650	2286 (90)	1397 (55)	508 (20)	2286 (90)	1778 (50)	508 (20)	2286 (90)	1778 (50)	508 (20)
720	2286 (90)	1397 (55)	508 (20)	2286 (90)	1778 (50)	508 (20)	2286 (90)	1778 (50)	508 (20)
850	2286 (90)	1778 (55)	508 (20)	2286 (90)	2667 (65)	508 (20)	2286 (90)	2667 (65)	508 (20)
1000	2286 (90)	1778 (55)	508 (20)	2286 (90)	2667 (65)	508 (20)	2286 (90)	2667 (65)	508 (20)

Important User Information

Read this document and the documents listed in the additional resources section about installation, configuration, and operation of this equipment before you install, configure, operate, or maintain this product. Users are required to familiarize themselves with installation and wiring instructions in addition to requirements of all applicable codes, laws, and standards.

Activities including installation, adjustments, putting into service, use, assembly, disassembly, and maintenance are required to be carried out by suitably trained personnel in accordance with applicable code of practice.

If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

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Rockwell Otomasyon Ticaret A.Ş., Kar Plaza İş Merkezi E Blok Kat:6 34752 İçerenköy, İstanbul, Tel: +90 (216) 5698400

www.rockwellautomation.com

Power, Control and Information Solutions Headquarters

Americas: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204-2496 USA, Tel: (1) 414.382.2000, Fax: (1) 414.382.4444
Europe/Middle East/Africa: Rockwell Automation NV, Pegasus Park, De Kleetlaan 12a, 1831 Diegem, Belgium, Tel: (32) 2 663 0600, Fax: (32) 2 663 0640
Asia Pacific: Rockwell Automation, Level 14, Core F, Cyberport 3, 100 Cyberport Road, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846