Quick Start

Original Instructions

Allen-Bradley

SMC-50 Smart Motor Controller

Bulletin150

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.

In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

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Throughout this manual, when necessary, we use notes to make you aware of safety considerations.

	**WARNING:** Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.
	**ATTENTION:** Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequence.
IMPORTANT	Identifies information that is critical for successful application and understanding of the product.

Labels may also be on or inside the equipment to provide specific precautions.

	**SHOCK HAZARD:** Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.
	**BURN HAZARD:** Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.
	**ARC FLASH HAZARD:** Labels may be on or inside the equipment, for example, a motor control center, to alert people to potential Arc Flash. Arc Flash will cause severe injury or death. Wear proper Personal Protective Equipment (PPE). Follow ALL Regulatory requirements for safe work practices and for Personal Protective Equipment (PPE).

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About This Publication

This quick start guide provides you with the basic information that is required to install, start up, and program your SMC™-50 Soft Starter.

The SMC-50 soft starter is a reduced voltage soft starter that uses a state-of-the-art microprocessor- based control module. By using six back-to-back silicon-controlled rectifiers (SCRs) (two per phase), the SMC-50 soft starter provides controlled acceleration, operation/run, and deceleration of standard asynchronous induction motors. Power structures are available with an integral bypass contactor or without (solid-state).

The information that is provided in this quick start guide does not replace the user manual. The quick start guide assumes that the installer is a qualified person with previous experience and basic understanding of electrical terminology, configuration procedures, required equipment, and safety precautions.

For safety of maintenance personnel and others who might be exposed to electrical hazards associated with maintenance activities, follow all local safety-related work practices (such as NFPA 70E, Part II in the United States). Maintenance personnel must be trained in the safety practices, procedures, and requirements that pertain to their respective job assignments.

Additional Resources

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

Resource	Description
SMC-50 Controller User Manual, publication 150-UM011	Provides comprehensive user information for the SMC-50 controller.
SMC-50 Controller Selection Guide, publication 150-SG010	Provides comprehensive selection information for SMC-50 controller and accessories.
PowerFlex™ 20-HIM-A6 and 20-HIM-C6S HIM (Human Interface Module), publication 20HIM-UM001.	Provides comprehensive user information for 20-HIM human interface modules.
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.rockwellautomation.com/global/certification/overview.page	Provides declarations of conformity, certificates, and other certification details.

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

Terminology

Throughout this publication, we also refer to the SMC-50 soft starter as the SMC-50 controller. These terms are interchangeable.

General Precautions

WARNING:

- Only personnel familiar with the controller and associated machinery should plan or implement the installation, startup, and subsequent maintenance of the system. Failure to do this may result in personal injury and/or equipment damage.
- Hazardous voltage is present in the motor circuit even when the SMC-50 controller is off. To avoid shock hazard, disconnect the main power before working on the controller, motor, and control devices such as Start-Stop push buttons. Procedures that require parts of the equipment to be energized during troubleshooting, testing, etc., must be performed by properly qualified personnel, using appropriate local safety work practices and precautionary measures.
- Failure of solid-state power switching components can cause overheating due to a single-phase condition in the motor. To prevent injury or equipment damage, the use of an isolation contactor or shunt trip-type circuit breaker on the line side of the SMC controller is recommended. This device should be capable of interrupting the motor's locked-rotor current.
- Hazardous voltages that can cause shock, burn, or death are present on L1, L2, L3, T1, T2, and T3. For Internal bypass units, hazardous voltages are also present on T4, T5, and T6. Power terminal covers for units rated 90…180 A (solid state) and 108…480 A (integrated bypass) can be installed to prevent inadvertent contact with terminals. Disconnect the main power before servicing the motor controller, motor, or associated wiring.

ATTENTION:

- Static control precautions are required when you install, test, service, or repair the assembly. The controller contains electrostatic discharge (ESD) sensitive parts and assemblies. Component damage may result if ESD control procedures are not followed. If you are not familiar with static control procedures, See applicable ESD protection handbooks.
- Stopping modes, such as braking, are not intended to be used as an emergency stop. You are responsible for determining which stopping mode is best suited to the application. See the applicable standards for emergency stop requirements.
- Pump and linear deceleration stopping modes may cause motor heating. Depending upon the mechanical dynamics of the system, select the lowest stopping time setting that satisfactorily stops the motor.
- Slow speed running is not intended for continuous operation. This is due to reduced motor cooling.
- Two peripheral devices can be connected to the direct programming interface (DPI™) port that is located in the control module. The maximum output current through the DPI port is 560 mA.
  NOTE: A Human Interface Module (HIM) located in the control module HIM port/bezel (See Figure 9) also draws power from the DPI port.
- Disconnect the controller from the power source when installing or inspecting protective or capacitor modules. These modules should be inspected periodically for damage or discoloration. Replace module if it is damaged or the clear sealant or components are discolored.
- Additional considerations may be required for EMC compliance. See SMC-50 Controller User Manual, publication 150-UM011.

ATTENTION:

- The controller must be correctly applied and installed. If applied or installed incorrectly, damage to the components or the reduction in product life may occur. The system may malfunction if the following wiring or application errors occur: undersizing the motor, using an improperly sized controller, using an incorrect or inadequate AC supply, excessive ambient temperatures, or power quality.
- You must program the Motor Overload parameter to provide proper protection. Overload configuration must be properly coordinated with the motor.
- This product has been designed and tested as Class A equipment for electromagnetic compatibility (EMC). Use of this product in domestic environments may cause radio interference, in which case, the installer may need to employ additional mitigation methods.
- Disconnect the controller from the motor before you measure insulation resistance (IR) of the motor windings. Voltages used for insulation resistance testing can cause silicone-controlled rectifier (SCR) failure. Do not make any measurements on the controller with an insulation resistance (IR) or Megger tester.
- To protect the Smart Motor Controller (SMC) and/or motor from line voltage surges, protective modules may be placed on the line, load, or both sides of the SMC controller. **Do not place protective modules on the load side of the SMC controller** when using an inside-the-delta motor connection or with pump, linear deceleration, or braking control.
- The controller can be installed on a system with power factor correction capacitors (PFCC). **The PFCCs must only be on the line side of the SMC controller**. Installing PFCCs on the load side results in SCR damage and failure.
- The ground fault sensing feature of the SMC-50 controller is intended for monitoring purposes only and not as a ground fault circuit interrupter for personnel protection as defined in Article 100 of the NEC. The ground fault sensing feature has not been evaluated to UL 1053.
- After a short circuit occurs, you **must** verify device functionality.

This product contains a sealed lithium battery that may need to be replaced during the life of the product.

At the end of its life, the battery that is contained in this product should be collected separately from any unsorted municipal waste.

The collection and recycling of batteries helps to protect the environment and contributes to the conservation of natural resources as valuable materials are recovered.

Perchlorate material – special handling may apply. See www.dtsc.ca.gov/hazardouswaste/perchlorate.

This perchlorate warning only applies to primary Lithium Manganese Dioxide ($LiMnO_2$) cells or batteries, and products containing these cells or batteries, sold or distributed in California, USA.

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

Replace the battery only with an equivalent CR2032 coin-cell battery.

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

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

Summary of Changes

This manual includes new information about the SMC-50 controller with internal bypass option. It also updates and corrects information from previous revisions.

Notes:

Installation

Enclosures

The open-style design of the SMC-50 controller requires that you install it in an enclosure.

IMPORTANT The ambient temperature (open air) or internal enclosure temperature without derating must be kept within the specified range. See Table 1.

Table 1 - SMC-50 Controller Enclosure Requirements

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

(1) See Table 2 for minimum enclosure size

The guidelines in Table 2 result from the open design of the SMC-50 controller and the requirements of minimum clearance of 150 mm (6 in.) above and below the controller.

Table 2 - SMC-50 Controller Minimum Enclosure Size

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

(1) Actual enclosure size changes dependent on heat dissipation, duty cycle, ambient temperature, and external cooling.See the user manual, publication 150-UM011, for more information.

Mounting Requirements

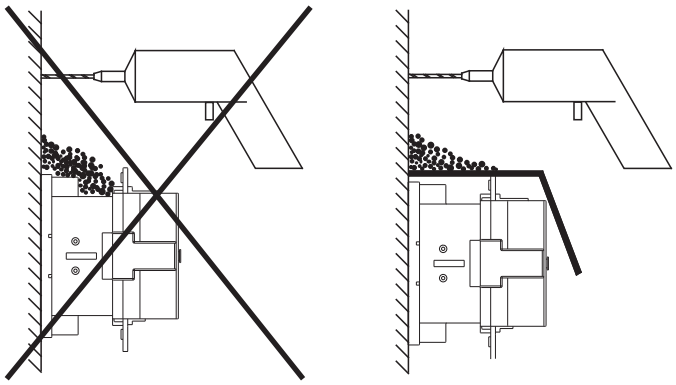
All units are fan cooled. It is important to locate the controller in a position that allows air to flow vertically through the power module.

IMPORTANT The controller must be mounted in a vertical plane and have a minimum of 6 in. (150 mm) free space above and below the controller. Horizontal mounting of the SMC-50 controller is not allowed. Enclosure must be sized such that the enclosure's internal temperature remains within specified controller ratings.

See Table 2 for minimum enclosure dimensions.

When you drill or install near the soft starter, make sure that you take adequate measures to protect the device from dust and debris, as shown in Figure 1.

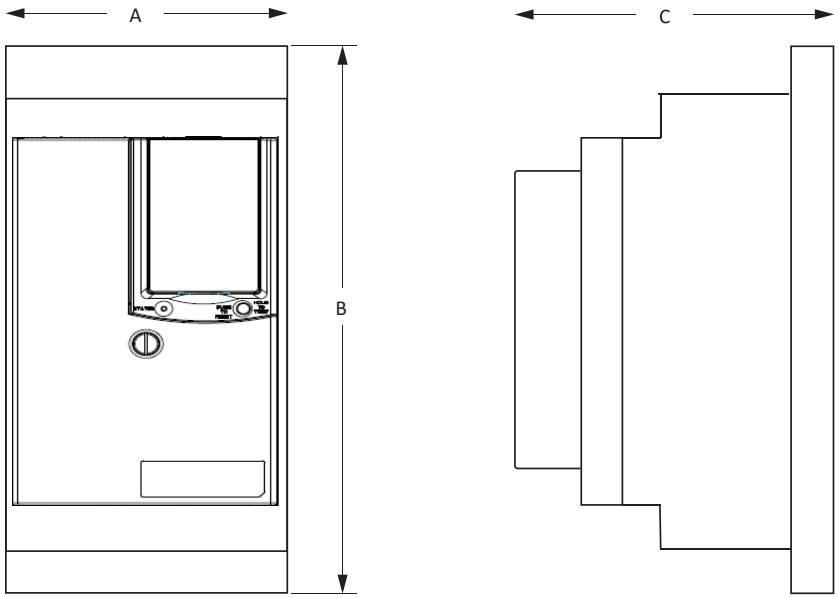
Figure 1 - SMC-50 Controller Mounting Protection



Dimensions

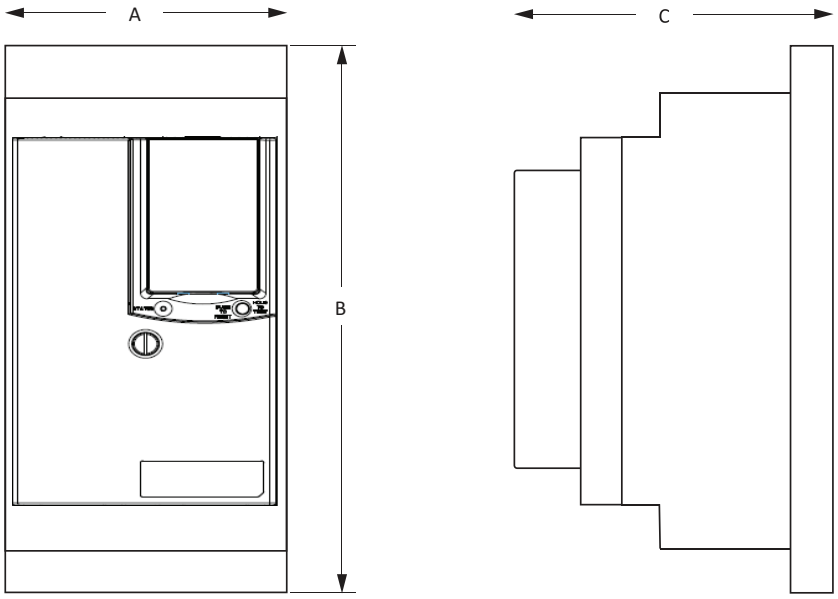
Dimensions are in millimeters (inches). All dimensions are approximate and are not intended for manufacturing purposes. For complete dimension drawings, see the user manual, publication 150-UM011, or consult your local Rockwell Automation sales office or Allen-Bradley distributor.

Figure 2 - SMC-50 Soft Starter with Integral Bypass



Cat. No.	Height (B)	Width (A)	Depth (C)	Approximate Shipping Weight
150-S108… / 150-S135…	443.7 (17.47)	196.4 (7.74)	217.3 (8.56)	15.4 kg (34.0 lb)
150-S201… / 150-S251…	560.0 (22.05)	225.0 (8.86)	277.4 (10.92)	30.8 kg (68.0 lb)
150-S317… / 150-S361… / 150-S480…	600.0 (23.62)	290.0 (11.42)	310.1 (12.21)	46.2 kg (102 lb)

Figure 3 - Solid-state SMC-50 Soft Starter



Cat. No.	Height (B)	Width (A)	Depth (C)	Approximate Shipping Weight
150-SB…	396.6 (15.62)	194.4 (7.65)	259.2 (10.21)	15.7 kg (34.6 lb)
150-SC…	638.5 (25.14)	273.1 (10.75)	272.9 (10.75)	47.6 kg (105 lb)
150-SD…	692.2 (27.25)	457.2 (18.00)	295.8 (11.64)	77.1 kg (170 lb)

Power Wiring

See the product nameplate or the SMC-50 controller user manual, publication 150-UM011, for device-specific information.

SMC-50 controller power structures use solid-state SCR designs that are capable of interfacing with 200...480V AC or 200...690V AC (690V line and 600V inside-the-delta) motors. Both the internally bypassed and solid-state power structures are available. Verify ratings of unit before application.

The power structure incorporates three-phase true current-sensing and overtemperature protection. You can use an external bypass contactor if it is required for your application.

Conductor range, torque, lug, and delta distribution block lug kit information is provided in Table 3 through Table 6. Figure 4 supplies typical power wiring diagrams.

ATTENTION: SMC-50 controllers can be installed in a system with power factor correction capacitors (PFCCs). The PFCCs must only be on the line side of the controller. Placing the PFCCs on the load side of the SMC results in damage to the SCRs in the SMC-50 controller. For additional details, see the user manual, publication 150-UM011.

Power Lugs

Power lugs are required for devices rated 108...480 A (internal bypass) and 90...520 A (solid-state). These lugs are sold in kits. Each kit contains three lugs. Table 3 through Table 6 list the number and type of lugs required.

Table 3 - SMC-50 Integrated Bypass Devices Connection Lug Information for Line/Wye Connected Motors

Cat. No.	Rating [A]	Lug Kit Cat. No.	Wire Strip Length [mm]	Conductor Range	Max No. Lugs/Pole		Tightening Torque	
					Line Side	Load Side	Wire - Lug	Lug - Busbar
150-S108…, 150-S135…	108…135	199-LF1	18…20	16…120 mm^2 (#6…250 MCM)	1	1	31 N•m (275 lb•in)	17 N•m (150 lb•in)
150-S201…, 150-S251…	201…251	199-LF1	18…20	16…120 mm^2 (#6…250 MCM)	2	2	31 N•m (275 lb•in)	23 N•m (200 lb•in)
150-S317…, 150-S361…, 150-S480…	317…480	199-LG1	18…25	25…240 mm^2 (#4…500 MCM)	2	2	42 N•m (375 lb•in)	28 N•m (250 lb•in)

Table 4 - SMC-50 Integrated Bypass Devices Connection Lug Information for Inside-the-Delta Connected Motors

Cat. No.	Rating [A]	Lug Kit Cat. No.	Conductor Range	Max No. Lugs/Pole	Tightening Torque	
				Line Side	Wire - Lug	Lug - Busbar
150-S108…, 150-S135…	187…234	1494R-N15	25…240 mm^2 (#4…500 MCM)	1	42 N•m (375 lb•in)	17 N•m (150 lb•in)
150-S201…, 150-S251…	348…435	1494R-N14	50…120 mm^2 (1/0…250 MCM)	2	31 N•m (275 lb•in)	23 N•m (200 lb•in)
150-S317…, 150-S361…, 150-S480…	549…831	150-LG5MC	95…240 mm^2 (3/0…500 MCM)	1	34 N•m (300 lb•in)	28 N•m (250 lb•in)

Table 5 - Solid-state SMC-50 Controller Power Wiring Information, Line/Wye and Inside-the-Delta Configurations

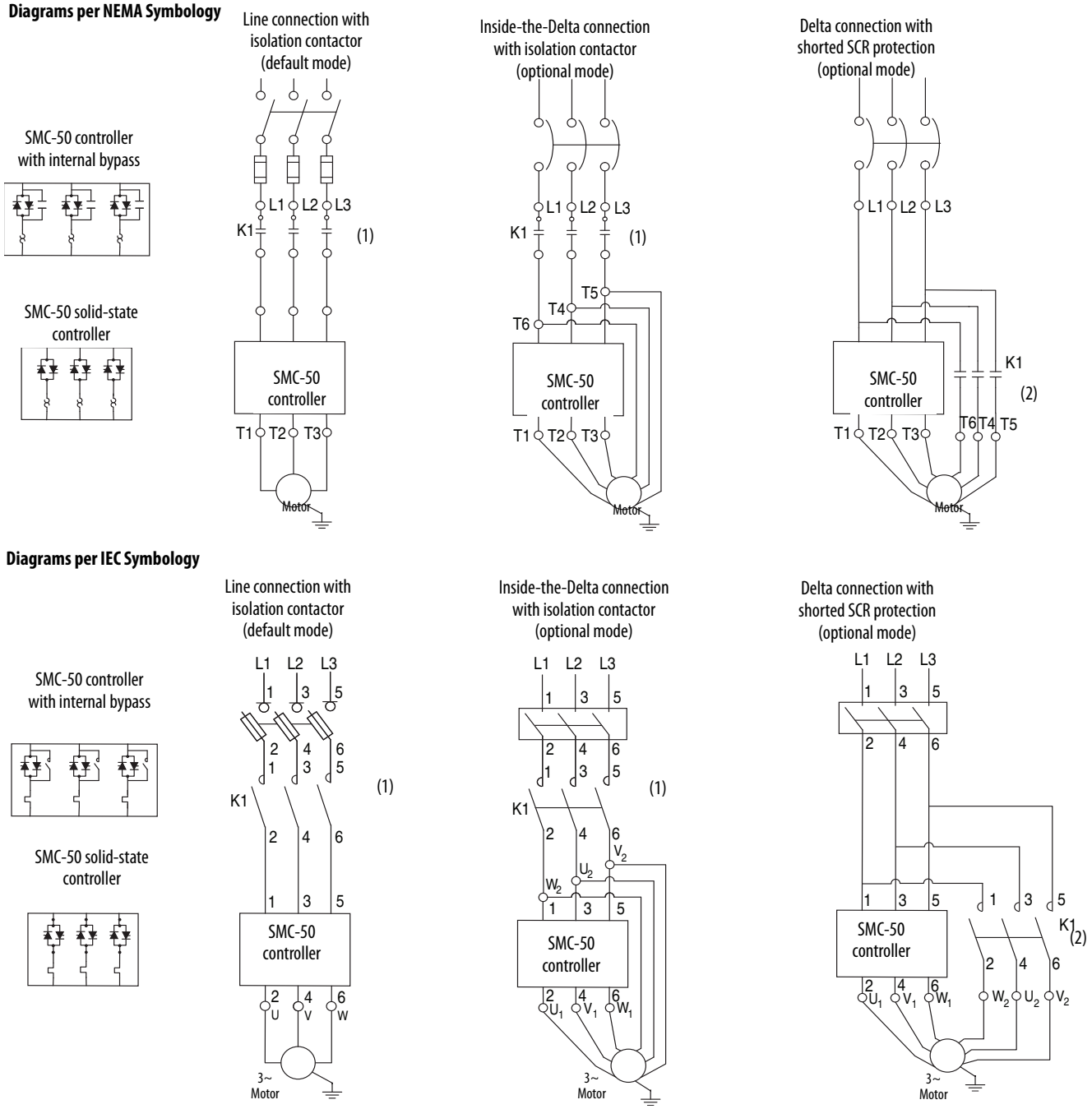
Cat. No.	Rating [A]	Lug Kit Cat. No.	Wire Strip Length [mm]	Conductor Range	Max No. Lugs/Pole		Tightening Torque	
					Line Side	Load Side	Wire - Lug	Lug - Busbar
150-SB…	90…180 (Line/Wye) 155…311 (Delta)	199-LF1	18…20	16…120 mm^2 (#6…250 MCM)	1	1	31 N•m (275 lb•in)	23 N•m (200 lb•in)
150-SC…	210…320 (Line/Wye) 363…554 (Delta)	199-LF1	18…20	16…120 mm^2 (#6…250 MCM)	2	2	31 N•m (275 lb•in)	23 N•m (200 lb•in)
150-SD…	361…520 (Line/Wye) 625…900 (Delta)	199-LG1	18…25	25…240 mm^2 (#4…500 MCM)	2	2	42 N•m (375 lb•in)	28 N•m (250 lb•in)

Table 6 - Solid-state SMC-50 Controller Delta Distribution Block Wiring Information

Cat. No.	Tightening Torque		Quantity	Conductor Range		Wire Strip Length [mm]		Lug Kit Cat. No.
	Line	Load		Line	Load	Line	Load	
150-SB…	42 N•m (375 lb•in.)		3	25…240 mm^2 (#4…500 MCM)		35	35	Allen-Bradley 1492-BG
150-SC…	67.8 N•m (600 lb•in.)	31 N•m (275 lb•in.)	1	54…400 mm^2 (1/0…750 MCM)	16…120 mm^2 (#6…250 MCM)	45	Top Row = 23 Bottom Row = 48	Marathon Special Products 1353703
150-SD…	67.8 N•m (600 lb•in.)	67.8 N•m (600 lb•in.)	3	54…400 mm^2 (1/0…750 MCM)	54…400 mm2 (1/0…750 MCM)	45	45	Marathon Special Products 1352702

Typical Power Diagrams

Figure 4 - Power Wiring Diagrams



(1) Contactor must be fully rated for motor Hp/kW and FLA.

(2) For North American applications, size the contactor per the motor Hp and FLA. For IEC applications, size the contactor per the motor AC-1 or AC-3 rating. The short-circuit rating of the contactor must be similar to that of the SMC-50.

Control Wiring

Standard Control Terminal Block

SMC-50 controllers come standard with two 24V DC digital on/off inputs and two relay outputs for auxiliary control functions. The standard digital I/O wiring terminal block is on the upper right portion of the SMC-50 controller. The terminal block is removable.

Control Wiring Specifications

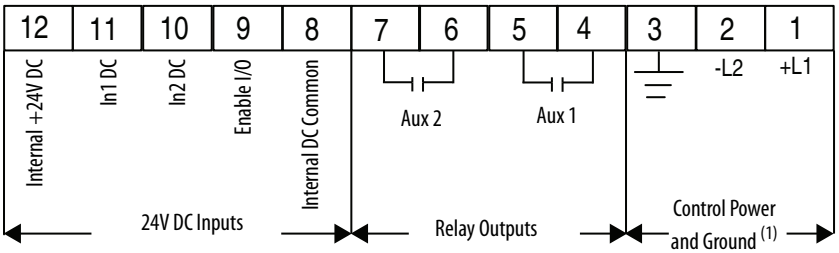
The following table provides the specifications for all SMC-50 controller control wiring and option module terminal blocks. Each wiring terminal accepts a maximum of two wires.

Table 7 - Control Wiring Specifications

Wire Size	0.2...2.5 mm^2 (#24...14 AWG)
Maximum Torque	0.8 N•m (7 lb•in.)
Maximum Wire Strip Length	7 mm (0.27 in.)
Screw Type	M3 Slotted

SHOCK HAZARD: To prevent the risk of electrical shock, disconnect all power sources from the controller and option module before you install or service it. Install the controller and option module in a suitable enclosure and keep it free of contaminants.

Figure 5 - Standard Control Terminal Block Identification



(1) See the controller nameplate to verify the control power ratings (120/240V AC or 24V DC).

ATTENTION: IN1 DC (terminal 11) and IN2 DC (terminal 10) are 24V DC inputs on controllers rated 120/240V AC and on controllers rated 24V DC. Voltages that exceed the specified input range may cause damage to the controller.

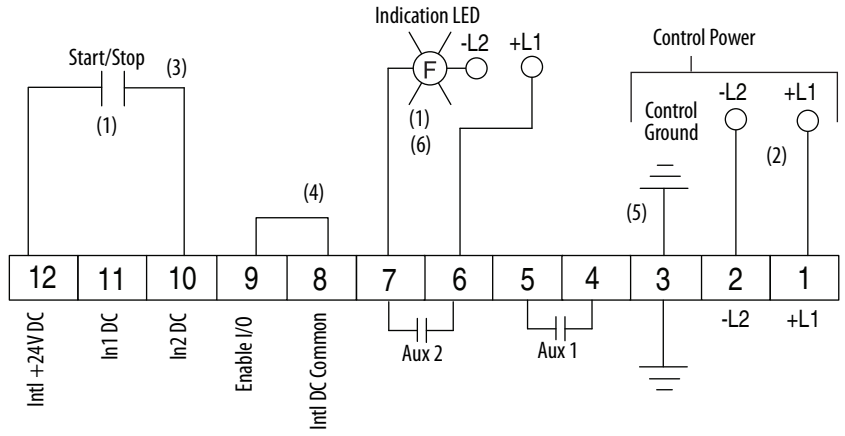
Terminal Number	Description
1 (1) (2)	Control Power +L1
2 (1)(2)	Control Power Common -L2
3	Ground — To connect to the system/control ground point.
4 (1)(3)	Auxiliary Relay Contact #1—rated 3 A @ 120V AC, 1.5 A @ 240V AC
5 (1)(3)	Auxiliary Relay Contact #1—rated 3 A @ 120V AC, 1.5 A @ 240V AC
6 (1)(3)	Auxiliary Relay Contact #2—rated 3 A @ 120V AC, 1.5 A @ 240V AC
7 (1)(3)	Auxiliary Relay Contact #2—rated 3 A @ 120V AC, 1.5 A @ 240V AC
8	DC Internal I/O Power, DC Common
9	Enable I/O
10 (1)(4)	Input #2 (24V DC) (range 15…30V DC)
11 (1)(4)	Input #1 (24V DC) (range 15…30V DC)
12	+24V DC Internal I/O Power

(1) RC snubbers are required when inductive loads are connected to terminal.
(2) See the controller nameplate to verify the control power ratings (120/240V AC or 24V DC)
(3) When set to external bypass mode, the auxiliary contact is used to control a properly sized external contactor and overload once the motor is at full speed.
(4) Do not connect any additional loads to this terminal. Parasitic loads may cause problems with operation.

Typical Control Wiring Examples

Figure 6 and Figure 7 are control wiring diagram examples using the controller standard I/O. For additional wiring examples, see the SMC-50 controller user manual, publication 150-UM011.

Figure 6 - Two-wire Control (No DPI) with Fault Indication



(1) Customer supplied.

(2) See the controller nameplate to verify the control power input ratings (120V/240V AC or 24V DC).

(3) Terminal 10 (IN2) 24V DC normally open (N.O.) input is configured for Start/Stop or Start/Coast using Parameter 57. When using the Start/Stop or Start/Coast, the N.O. contact must be used.

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

(4) A customer-supplied jumper is required to enable the controller's standard I/O operation.

(5) The terminal must be wired to the control ground to maintain reliable operation.

(6) The Aux2 output contact is configured for Fault using Parameter 176.

NOTE: Due to current leakage through an SCR in the OFF state (controller stopped), some form of upstream line power isolation is recommended if maintenance is required on the motor. See the typical wiring diagram for Isolation Contactor Application in the user manual.

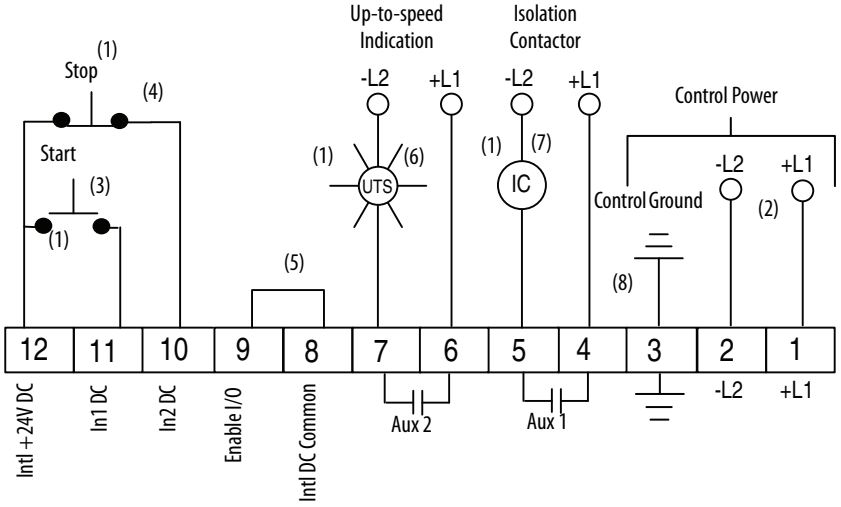
TIP When you are using two-wire control with IN1 and/or IN2 set for either Start/Stop or Start/Coast, you cannot start the SMC-50 controller via a HIM.

If you want to start and stop the motor in test mode via a HIM, use the following steps:

- Set IN1 (Parameter 56) and IN2 (Parameter 57) to "Disable".
- Clear the I/O Config Fault, if it appears.
- Set the Logic Mask (Parameter 148) to the appropriate bit, based on which device port the HIM is using.

Motor should now start and coast via HIM commands.

Figure 7 - Three-wire Control (with or without DPI) with Up-to-speed Indication and Isolation Contactor



(1) Customer supplied.

(2) See the controller nameplate to verify the control power input ratings (120V/240V AC or 24V DC).

(3) Terminal 11 (IN1) 24V DC is configured for START input using Parameter 56.

(4) Terminal 10 (IN2) 24V DC is configured for Coast, Stop Option, etc. using Parameter 57.

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

(5) A customer-supplied jumper is required to enable the controller's standard I/O operation.

(6) The Aux2 output contact is configured for motor UTS using Parameter 176.

(7) The Aux1 output contact is configured for Normal (closed with Start command, Open with stop command) using Parameter 172.

(8) The terminal must be wired to the control ground to maintain reliable operation.

NOTE: Due to current leakage through an SCR in the OFF state (controller stopped), some form of upstream line power isolation is recommended if maintenance is required on the motor. See the typical wiring diagrams for Isolation Contactor Application in the user manual.

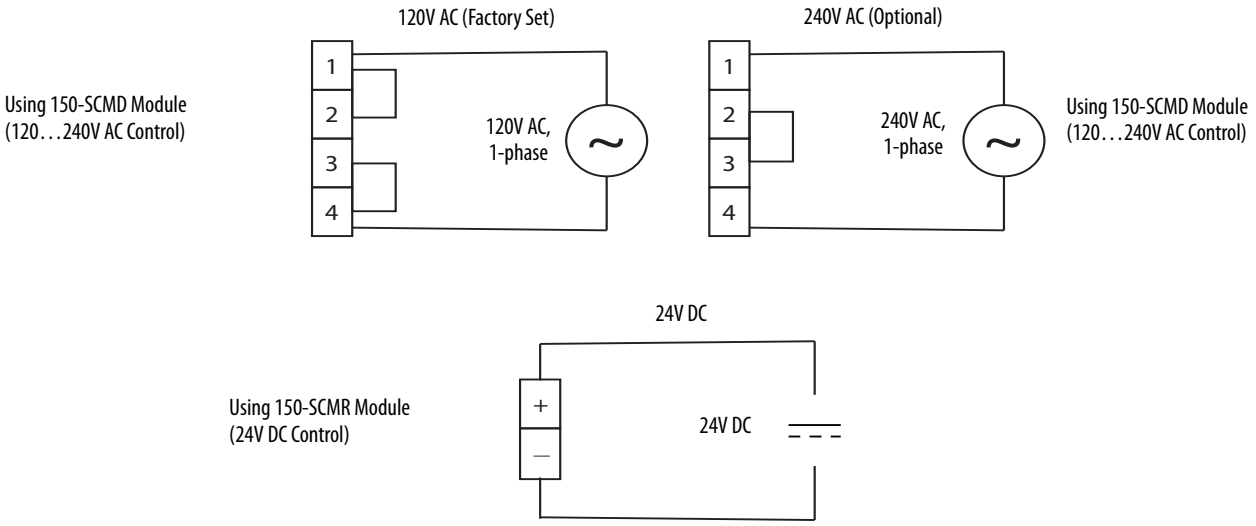
Fan Wiring

Fans for the SMC-50 controllers should be wired according to the instructions in this section.

Integrated Bypass Units

For units with integrated bypass, you should wire the fans as shown in Figure 8.

Figure 8 - Fan Wiring—Integrated Bypass Units



Solid-state Units

Solid-state units do not require any additional wiring. The fans are connected internally.

Upgraded Units

For SMC Flex controller-to-SMC-50 controller control upgrades, the fans remain connected as they were in the SMC Flex controller. You do not need to change any wiring.

Option Modules

SMC-50 controllers have three expansion ports. These ports provide the capability to add optional modules (additional inputs and outputs (I/O), simple start/stop parameter configuration capability, ground fault, etc.).

- Note: the 20-COMM-X communication modules can only reside in Port 9.

ATTENTION: There is the potential to have voltage values above 220V AC on the option modules. Before removing the control module cover to access option modules, disconnect **ALL** power to the SMC-50 controller. Do not remove or add option modules while power is applied.

Figure 9 - Port Number Identification

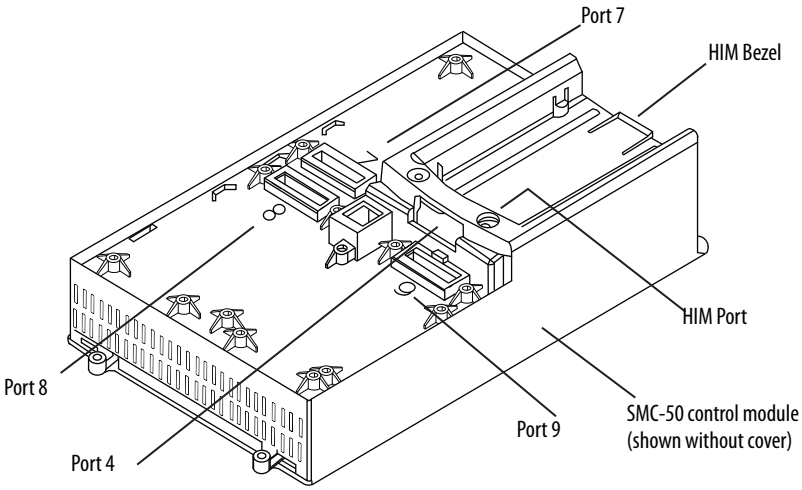


Table 8 - Port Location for Compatible Option Modules

Option Module Cat. No.	Module Name	Description	Compatible Control Module Port			Max. No of this Type of Option Module per Control Module
			Port 7	Port 8	Port 9	
150-SM2	PTC, Ground Fault(1) and Current Transformer Interface	• Connectivity to motor PTC sensors • Connectivity to external ground fault sensors(2) • Connectivity to external current sensors(2)	Yes	Yes	No	1
150-SM3	Analog I/O	• 2 analog inputs • 2 analog outputs	Yes	Yes	Yes	3
150-SM4	Digital I/O	• 4 digital inputs • 3 relay outputs	Yes	Yes	Yes	3
150-SM6	Parameter Configuration Module	• Three sets of 8-position DIP switches and five sets of 16-position rotary switches use for simple programming.	Yes	Yes	Yes	1
20-COMM-X(3)(4)	Communication Modules	• Various communication modules are available	No	No	Yes	1
20-HIM-A6	Enhanced, LCD display, full numeric keypad	• Can be installed on control module in bezel/cradle (DPI Port 1) or connected with cable to DPI Port 2.	—	—	—	1(5)
20-HIM-C6S	Remote (panel mount), LCD display, full numeric keypad	• Typically door- or panel mounted and connected with cable to DPI Port 2.	—	—	—	1(5)

(1) The ground fault sensing feature of the SMC-50 controller is intended for monitoring purposes only.

(2) External components may be needed. See the SMC-50 controller user manual, publication 150-UM011, for additional information.

(3) See the SMC-50 Controller selection guide, publication 150-SG010, or SMC-50 controller user manual, publication 150-UM011, for a list of compatible 20-COMM-X communication modules.

(4) When installed in an SMC-50 controller, 20-COMM-X modules physically reside in the space assigned to Port 9, but connect to DPI Port 4 with a ribbon cable that is supplied with the communications module.

(5) For most systems, a single HIM device is used. You can use multiple HIMs by using DPI Port 2 and a DPI Port-Splitter See the SMC-50 controller user manual, publication 150-UM011, for additional information.

ATTENTION: The ground fault sensing feature of the SMC-50 controller is intended for monitoring purposes only and not as a ground fault circuit interrupter for personnel protection as defined in Article 100 of the NEC. The ground fault sensing feature has not been evaluated for conformance to UL 1053.

Bypass Operation and Diagrams

Bypass operation varies between the SMC-50 controller with internal bypass and the solid-state controller.

SMC-50 Controllers with Internal Bypass

SMC-50 controllers with internal bypass have one or more built-in contactors that close when the motor is up to speed. This reduces heat because the motor current is now flowing though the internal bypass contactor(s) and not through the SCRs.

SMC-50 Controllers with External Bypass

For external bypass operation, you must supply a bypass contactor. An auxiliary relay contact that is programmed for external bypass is used to control a properly sized external contactor once the motor is at full speed.

You can accomplish overload protection in several ways. Table 9 provides a summary of motor overload protection options.

Table 9 - Motor Overload Protection Options

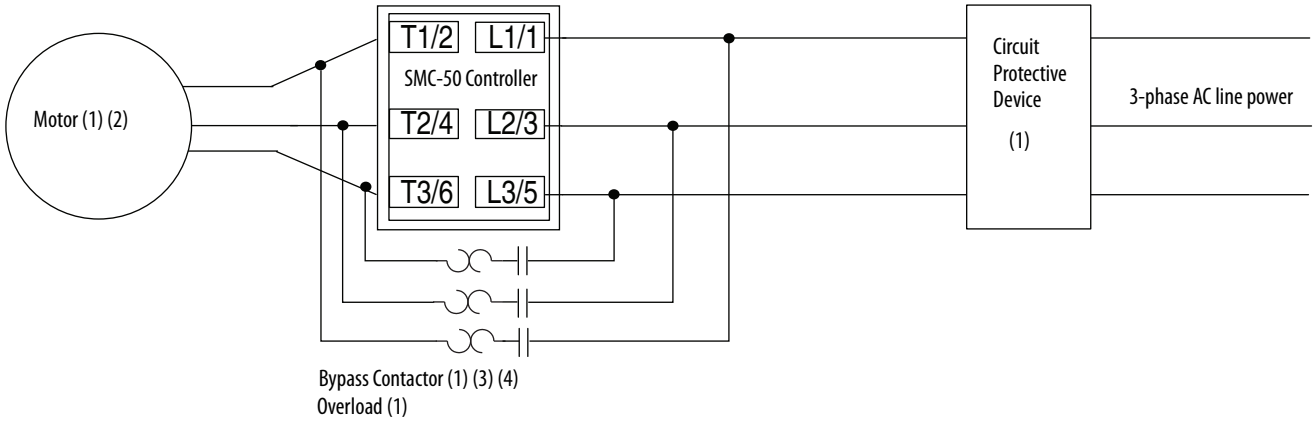
Power Structure Type	Catalog Number	Overload Protection Option			
		150-SM2 and 825-MCM180	150-SM2, 825-MCM20, and External CTs	Bypass Kit	External Overload
Internal Bypass	150-S108…	X(1)	—	—	X
	150-S135…				
	150-S201…	—	X(1)	—	X
	150-S251…				
	150-S317…	—	X(1)	—	X
	150-S361…				
	150-S480…				
Solid-State	150-SB…	X	—	—	X
	150-SC…	—	X	X	X
	150-SD…	—	X	X	X

(1) Not available for inside-the-delta applications.

Bypass Contactor with External Overload Protection

All SMC-50 controllers, regardless of power structure, can use an external bypass contactor with an external overload protection device.

Figure 10 - Wiring Diagram with Bypass Contactor and External Overload



(1) Customer supplied.

(2) Due to current leakage through an SCR in the OFF state (controller stopped), some form of upstream line power isolation is recommended if maintenance is required on the motor. See the Isolation Contactor Applications for details.

(3) Bypass must be controlled by an auxiliary contact of the SMC-50 controller that is configured for external bypass.

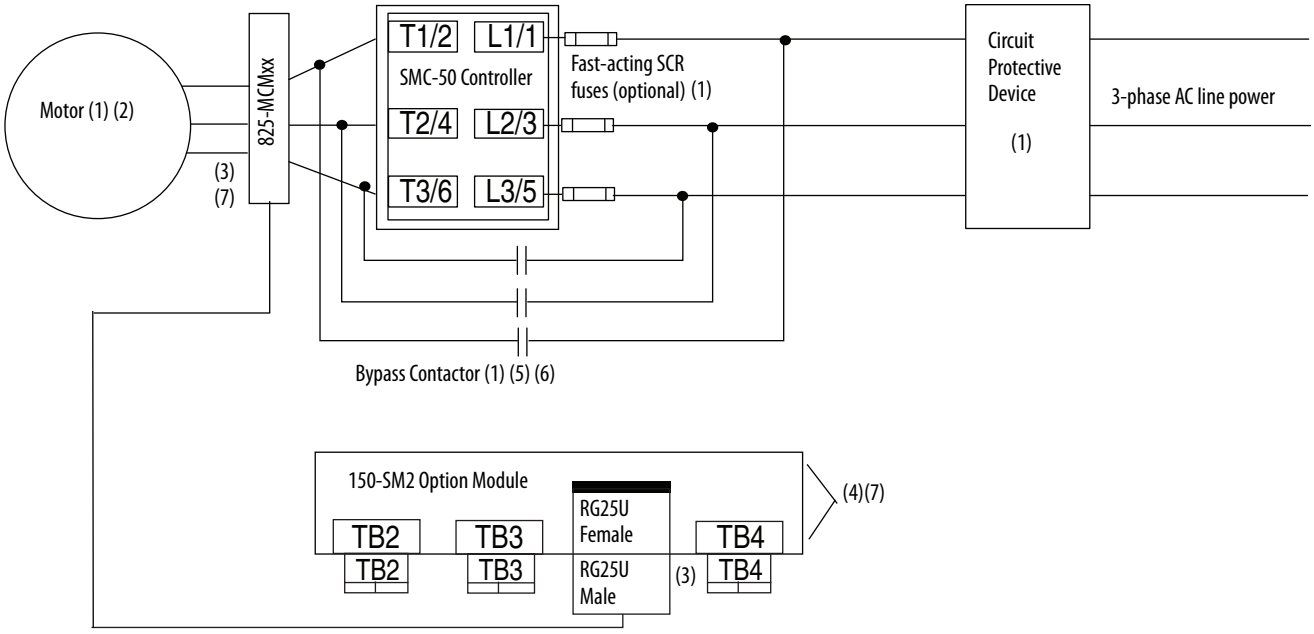
(4) Bypass contactor must be fully rated to motor Hp/kW and FLA.

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

Bypass Contactor with Converter Module and Cat. No. 150-SM2 Option Module

All SMC-50 controllers, regardless of power structure, can use an external bypass contactor with a Bulletin 825 converter module and cat. no. 150-SM2 option module. These components allow the SMC-50 controller to perform the overload function.

Figure 11 - Wiring Diagram using 825 Converter Module and 150-SM2 Devices with Bypass Contactor



(1) Customer supplied.

(2) Due to current leakage through an SCR in the OFF state (controller stopped), some form of upstream line power isolation is recommended if maintenance is required on the motor. See the Isolation Contactor Applications for details.

(3) In Bypass Contactor RUN operation, the 825-MCM and the 150-SM2 module provide current-based protective feedback features including overload. Only the cable that is provided with the 825-MCM converter can be used in this configuration. The maximum cable length is 4 m, thus the 825-MCM must be located within 4 m of the SMC-50 controller.

(4) The order of the terminal numbers for the 150-SM2 module can be reversed depending on which expansion slot it is located in the control module. However, the function that is associated with the terminal number remains the same.

(5) Bypass must be controlled by an auxiliary contact of SMC-50 controller configured to external bypass.

(6) In North America, size the bypass contactor per the motor Hp and FLA. In IEC, size the bypass contactor per the motor AC-1 rating. The short-circuit rating of the bypass contactor must be similar to that of the SMC-50 controller.

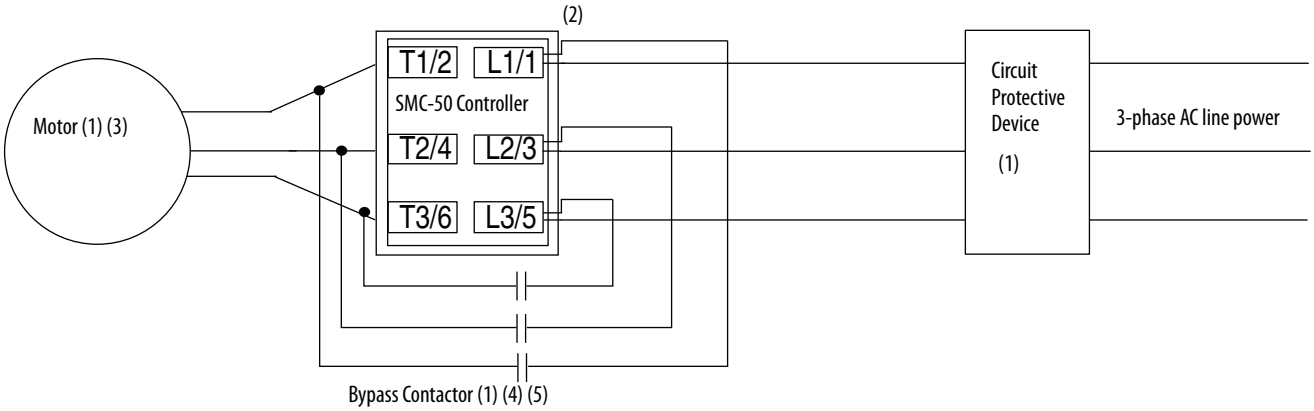
(7) Depending on the current rating of the controller, external current transformers may be required.

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

Bypass Contactor with SMC-50 Bypass Kit (Solid-state Controllers ONLY)

C- and D-Frame SMC-50 controllers with solid-state power structure (cat. nos. 150-SC... and 150-SD...) can use an optional bypass kit. This bypass kit allows the SMC-50 controller to perform the overload function and eliminates the need for the Bulletin 825 converter module and 150-SM2 option module.

Figure 12 - Wiring Diagram for Frame C (Cat. No. 150-SC…) or Frame D (Cat. No. 150-SD…) Devices with Bypass Contactor and Bypass Bus Kit



(1) Customer supplied.

(2) SMC-50 controller Bypass bus kit Cat. No. 150-SCBK (Frame C; Cat. No. 150-SC…) or 150-SDBK (Frame D; Cat. No. 150-SD…).

NOTE: Controller FRN 3.001 or higher is required.

(3) Due to current leakage through an SCR in the OFF state (controller stopped), some form of upstream line power isolation is recommended if maintenance is required on the motor. See the Isolation Contactor Applications for details.

(4) Bypass must be controlled by an auxiliary contact of the SMC-50 controller that is configured for external bypass.

(5) In North America, size the bypass contactor per the motor Hp and FLA. In IEC applications, size the bypass contactor per the motor AC-1 rating. The short-circuit rating of the bypass contactor must be similar to that of the SMC-50 controller.

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

Programming

Parameter Configuration

Parameter Configuration Using a 20-HIM-A6 (FRN1.006 or Later)

You can configure all SMC-50 controller parameters using the 20-HIM-A6 (NEMA Type 1) or the 20-HIM-C6S (remote-mount NEMA Type 4X/12) module. The Cat. No. 20-HIM-A6 module is typically installed in the HIM bezel/port that is located in the upper right corner of the SMC-50 controller (See Figure 9). For temporary hand-held operation, you can plug the HIM into DPI Port #2, at the top of the control module. You will need a Cat. No. 20-HIM-H10 cable for this temporary operation.

The following text describes basic screen and keypad functions of the Cat. No. 20-HIM-A6 module. For additional detail on the installation and use of the 20-HIM-A6 or the 20-HIM-C6S modules, see the user manual, publication 20HIM-UM001.

HIM Single-function Keys

The four single-function keys only perform their dedicated functions, no matter which screen or data entry mode is being used.

Figure 13 - HIM Single-function Keys

Key	Function
Start	Starts the controller if the SMC-50 Logic Mask is enabled for the port the HIM is connected to.(1)
Folders	Accesses folders for parameters, diagnostics, memory functions, preferences, and other tests.
Controls	Accesses jog, auto/manual, and other control functions.
Stop	Stops the SMC-50 controller or clears a fault. The Stop key is always active.

(1) If the device (port) is enabled and removed under power or an expansion device is removed, a fault is generated. The bit location (such as 0, 1, 2, etc.) corresponds to the DPI port numbers.

Basic Parameter Access and Category/File Structure

Parameter Access

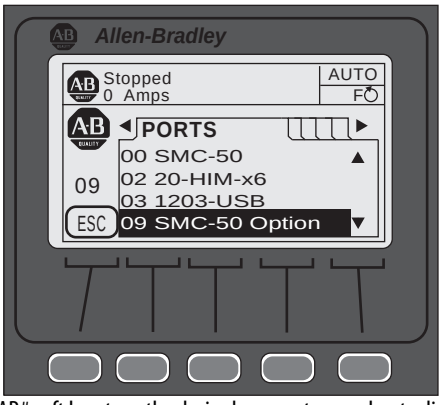
The parameters of the SMC-50 are structured into five categories:

1. Monitoring
2. Setup
3. Motor Protection
4. Communications
5. Utility

The Cat. No. 20-HIM-A6 can access any or all parameters that reside in any category. The following examples show how to access the SMC-50 parameters with the 20-HIM-A6.

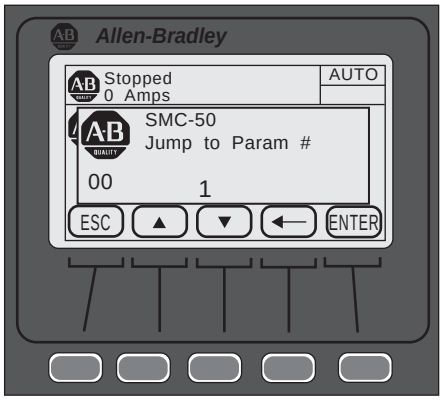
EXAMPLE To perform a parameter number search and modification, perform the following procedure.

1. and that the HIM SMC-50 power-up screen appears as shown:



2. Using the PAR# soft key, type the desired parameter number to display, then press ENTER, then press EDIT. The following screen appears.

NOTE: To access the next/previous PAR# from the one currently displayed, use the UP/DOWN arrow soft keys to display the desired parameter for modification.



3. Press ENTER to load the changed value into memory.

For additional details on these procedures, see the 20-HIM-A6 or 20-HIM-C6S module user manual, publication 20HIM-UM001.

Category/File Structure

Table 10 - Category/File Structure of the SMC-50 Controller

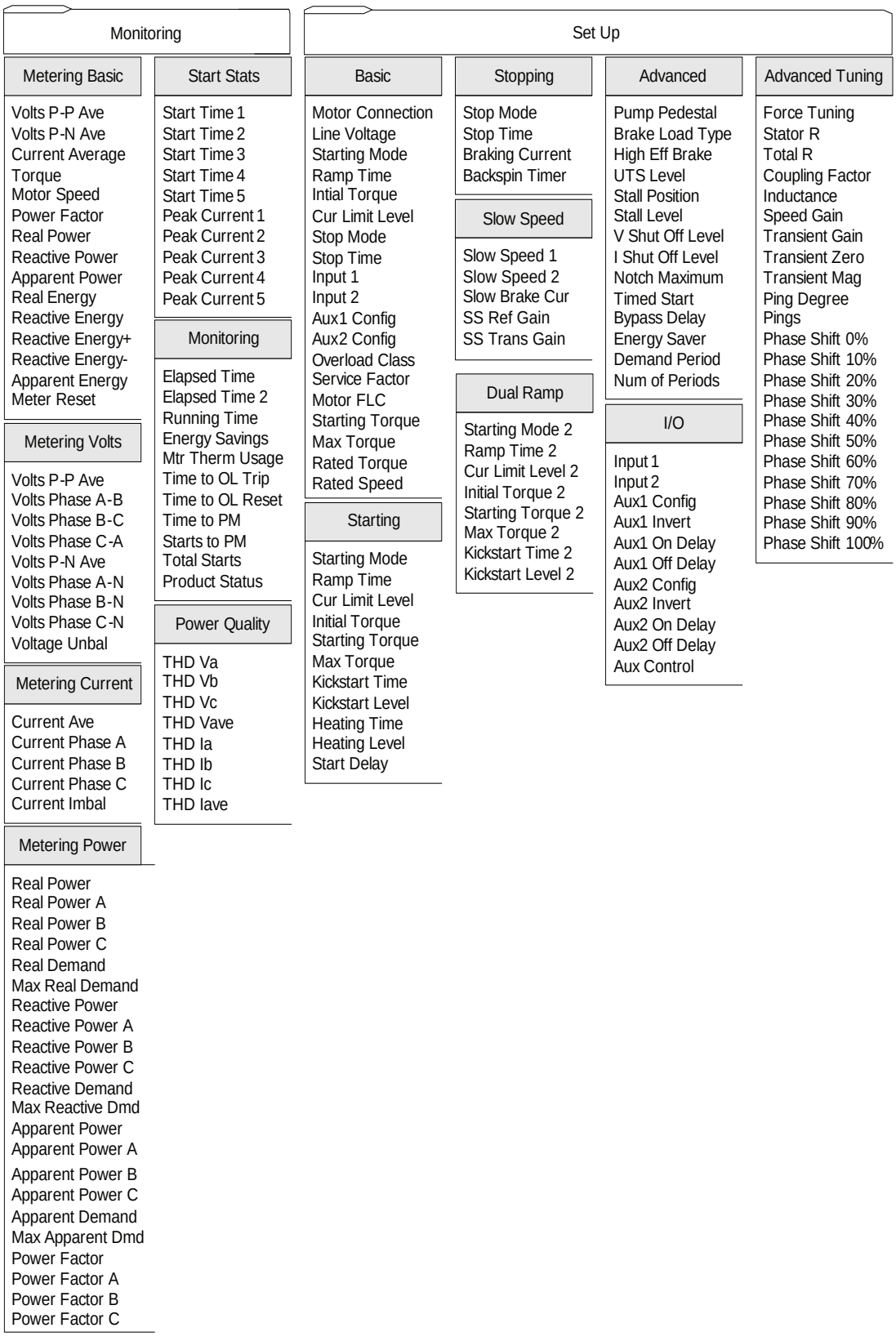
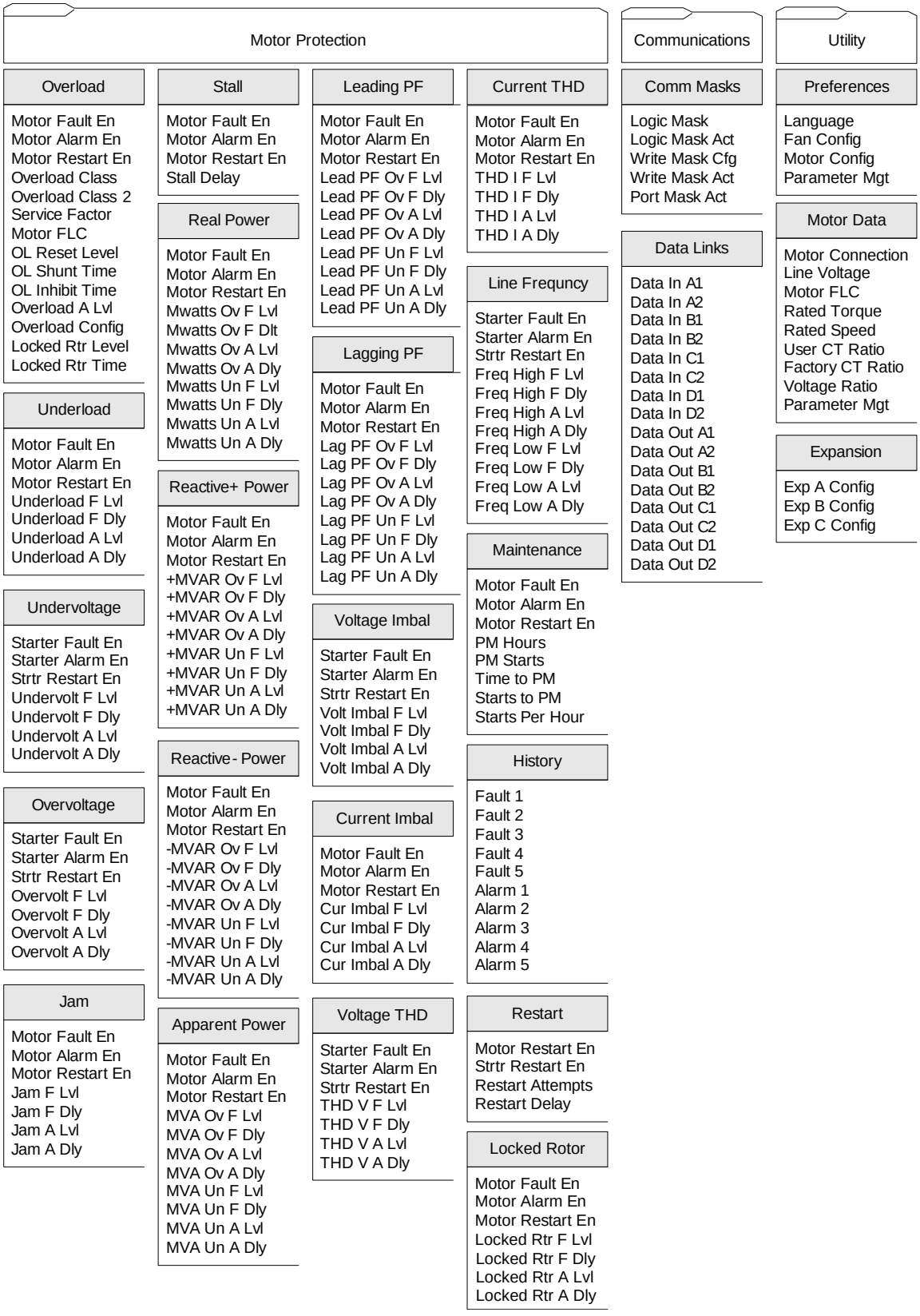


Table 11 - Category/File Structure (Continued)



Quick Setup

Access the basic programming configuration group in the Setup category. This group provides a limited parameter set, which allows quick startup with minimal adjustments.

Table 12 - Quick Start Parameters

Parameter Number	Parameter Name	Description/Function	Value(s)	Default
46	Line Voltage	Enter the system 3-phase line voltage value. A value must be entered for the voltage protection functions to work properly.	0…700V	480
47	Rated Torque	Use for Torque Ramp Rating Starting Mode. Enter the maximum motor rating in Newton meters.	1…1000 N•m	10
48	Rated Speed	Use for Torque Ramp Rating Starting Mode. Enter the rated speed of the motor.	750, 900, 1500, 1800, 3500, 3600 RPM	1800
49	Starting Mode	Enter the desired starting mode for the application. ***Related Parameters for the Starting Mode:*** *Full Voltage:* None *Current Limit:* Current Limit Level, Ramp Time, Kickstart Time, Kickstart Level *Soft Start:* Initial Torque, Ramp Time, Current Limit, Kickstart Time, Kickstart Level *Linear Speed:* Initial Torque, Ramp Time, Current Limit *Torque Ramp:* Starting Torque, Maximum Torque, Ramp Time, Current Limit, Kickstart Time, Kickstart Level *Pump Start:* Initial Torque, Ramp Time	Full Voltage, Current Limit, Soft Start, Linear Speed, Torque Ramp, Pump Start	Soft Start
50	Ramp Time	Enter the amount of desired time for the motor starting ramp to take.	0.0…1000 seconds	10
51	Initial Torque	Motor torque level at which the start ramp begins.	0...90%LRT	70
52	Maximum Torque	Use the Torque Ramp Starting mode. Enter the maximum motor torque at the end of the required start ramp for the application.	0…300%	250
53	Current Limit Level	Enter the value of the maximum current that is allowed during the ramp time.	50…600% FLC	350
56	Input 1	Allows the selection of how input 1 (CM terminal #11) affects the function of the SMC-50 controller.	Disable, Start, Coast, Stop Option, Start/Coast, Start/Stop, Slow Speed, Dual Ramp, OL Select, Fault, Fault NC, Clear Fault, Emergency Run, Motor Heater	Start/Coast
57	Input 2	Allows the selection of how input 2 (CM terminal #10) affects the function of the SMC-50 controller.		Disable
65	Stop Mode	Enter the desired stopping mode for the application. Related Parameters to the Stopping Mode: *Coast:* None *Soft Stop:* Stop Time *Linear Speed:* Stop Time, Current Limit *Pump Stop:* Stop Time *SMB:* Braking Current *Ext. Brake:* Stop Time	Coast, Soft Stop, Linear Speed, Pump Stop, SMB, Ext. Brake	Coast
66	Stop Time	Defines the desired time to ramp from run to stop for a specific stop mode. For Ext Brake mode, the Stop Time = the time the Aux contact is closed to energize an external brake.	0…999 seconds	0
75	Overload Class	Enter the desired motor overload trip class.	5…30	10
77	Service Factor	Enter the Service Factor of the motor.	0.01…1.99	1.15
78	Motor FLC	Enter the motor specified Full Load Current (FLC) value. This value must be entered to and the controller can provide proper motor current (such as overload) protection.	1.0…2200.0 A	1.0
172	Aux1 Configuration	Allows selection of the operation for Auxiliary relay output contact #1 (control module terminals #4 and #5).(1)	Normal, UTS, Fault, Alarm, External Bypass, External Brake, Auxiliary Control, Network 1, Network 2, Network 3, Network 4, Fan Control	Normal
176	Aux 2 Configuration	Allows selection of the operation for Auxiliary relay output contact #1 (control module terminals #6 and #7).(1)		Normal

(1) Normal = The contact is closed when the Start command is initiated and remains closed during a stop maneuver. After the stop is complete, the contact opens.

Notes:

Operation and Troubleshooting

Operation

SMC-50 controllers with integrated bypass can operate standard line-connected induction motors rated 27...480 A or star-delta (wye-delta) type motors rated 47...831 A that are operated inside-the-delta.

The SMC-50 solid-state controller can operate line-connected induction motors rated 30...520 A or star-delta (wye-delta) type motors rated 52...900 A operated inside-the-delta.

IMPORTANT Verify line and control voltage values on the product before you apply power.

Motor Configuration

Line-connected wye, line-connected delta, and inside-the-delta motor configurations are possible with the SMC-50 controller. The motor-tuning feature of the SMC-50 controller automatically determines the motor connection. Motor tuning is done automatically by the controller on initial motor start or forced to occur by the user. You can also enter the configuration of the Motor Connection, Parameter 44, into the SMC-50 controller. You must enter the Motor Line Voltage rating, Parameter 46, to enable the motor protection features to function (default 480V).

Motor Tuning

The SMC-50 controller performs the motor-tuning process on the initial start sequence of the motor. Motor tuning includes the identification of the motor parameters and the detection of the motor connection type (line or delta). The SMC-50 controller uses the motor-tuning data in its control algorithm.

During the tuning process, the motor makes some audible noise, including pulsing and buzzing. The time to complete the tuning process is approximately 10...20 seconds, but varies based on the size and characteristics of the individual motor being used. After successful completion of the tuning process, the motor starts based on the user-programmed start profile. If you interrupt the tuning process by giving a stop command or removing power from the unit, the tuning process repeats on the next start command. Subsequent starts of the motor after a successful tuning do not perform the auto-tuning process.

After the initial successful tuning of the motor the process, you can reinitiate it via one of the following methods:

1. Change the status of the Force Tuning, Parameter 194, to TRUE by using a configuration tool (such as a HIM) with the motor stopped. During the next start cycle, the tuning process occurs and Parameter 194 changes back to FALSE.
2. Press the "HOLD TO TEST / PUSH TO RESET" push button, on the front of the controller, for ten seconds with the motor stopped. The tuning process occurs during the next start cycle. The status LED flashes amber, which indicates that tuning occurs on the next start cycle.
3. When the controller processes a "Load Factory Defaults" command via Parameter Management, Parameter 229.

NOTE: If you use a motor that is smaller or larger than normal for the initial system test, you must perform a motor tuning cycle on the motor that is used in the final installation.

Resistive Load Control

The SMC-50 controller can control directly connected resistive loads by using phase angle control that is based on a reference value. Select this control method via a new Load Type parameter. Selecting a resistive load type modifies the standard motor tuning procedure and allows the SMC-50 controller to vary the output voltage in response to the reference source (Output V Ref, Analog Input, or DeviceLogix™) as a percentage of the full voltage range. You can change the value of the reference source while the SMC-50 controller is in a run state.

NOTE: Using resistive load control is not recommended for internal bypass units because of possible overtemperature trips.

For additional information regarding this operating mode, see the SMC-50 controller user manual, publication 150-UM011.

Troubleshooting with Diagnostic LEDs

Controller LED Status Indicator

The SMC-50 controller's multi-color LED Status Indicator and HOLD TO TEST, PUSH TO RESET button are located below the HIM bezel port. The Status LED indicates the status and fault conditions of the SMC-50 controller.

Table 13 - Corresponding LED Color and Fault Conditions

Status LED Color	Device Mode	SMC Status
Green	Running	Running without an alarm
Green/Amber	Running	Running with an alarm
Green Flashing	Ready	Ready (no inhibit and no fault) without an alarm
Amber Flashing	Ready	Ready (no inhibit and no fault) with tuning enabled on the next start
Amber	Ready	Ready with alarm (no tuning enabled)
Red/Amber	Inhibit	Inhibited; cannot start due to a Stop command
Red	Faulted	A non-resettable fault has occurred
Red Flashing	Faulted	A resettable fault has occurred
Red/Green	Download	Firmware is being downloaded

The HOLD TO TEST, PUSH TO RESET button lets you reset an alarm/fault, test for a fault condition, and initiate the tuning mode.

Table 14 - Function Initiation of the HOLD TO TEST, PUSH TO RESET Button

Function	Time Required to Press Button
Fault Reset	Momentary (less than 2 seconds)
Test Fault	Greater than 3 seconds, but less than 10 seconds
Initiate Tuning Mode	Greater than 10 seconds(1)

(1) The motor must be stopped.

Troubleshooting with Monitoring Equipment

The SMC-50 controller has built-in detailed diagnostics fault codes and metering functions. You can access these fault codes and metering functions through a local 20-HIM-A6 or remote 20-HIM-C6S module or by using a Rockwell Automation Drive Software package such as Connected Components Workbench™ software.

Troubleshooting By Fault Code — Abbreviated Listing

The following table contains an abbreviated listing of fault codes available. For a complete troubleshooting list, fault codes, descriptions, and tips, see the SMC-50 controller user manual, publication 150-UM011.

Table 15 - SMC-50 Controller Fault Codes

Display Fault	HIM or Software Fault Code	Enabled	Possible Causes	Possible Solutions
Line Fault with Phase Indication	1, 2, 3	Prestart and Running	• Missing supply phase • Motor not connected properly • Incoming 3-phase voltage instability	• Check for open line (blown fuse) • Check for open load lead • Verify power quality
Shorted SCR with Phase Indication	4, 5, 6	All	• Shorted power module	• Check for shorted SCR, replace power module if necessary
Open Gate with Phase Indication	7, 8, 9	Start or Stop	• Open gate circuitry • Loose gate lead	• Perform resistance check; replace power module if necessary • Check gate lead connections to the control module
PTC Power Pole and SCR Overtemp	10 or 60		• Controller ventilation blocked • Controller duty cycle exceeded • Fan failure • Ambient temperature limit exceeded • Failed thermistor	• Check for proper ventilation • Check application duty cycle • Wait for motor to cool or provide external cooling • Replace power module or control module as needed • Replace fan
Open Bypass	11, 12, 13	Running	• Control voltage is low • Inoperable power module bypass	• Check control voltage power supply • Check control module TB2…TB4 and TB5…TB7 for secureness • Make sure that AUX1 or AUX2 are not set to external bypass • Replace power module
No Load Fault	14, 15, 16, 17	Prestart Only	• Loss of load side power wiring with phase indication (15=A, 17=C) • Start command cycled unexpectedly with motor rotating	• Check all load side power connections • Check motor windings
Voltage Unbalance and/or Current Imbalance	18 and/or 42	Running	• Supply unbalance is greater than the user-programmed value • The delay time is too short for the application	• Check power system and correct if necessary, then correct the user-programmed value • Extend the delay time to match the application requirements
Overvoltage	19	Running	• Supply voltage is greater than the user-programmed value • The delay time is too short for the application	• Check power system and correct if necessary, otherwise correct the user-programmed value • Extend the delay time to match the application requirements
Undervoltage	20	Running	• Supply voltage is less than the user-programmed value • The delay time is too short for the application	• Check power system and correct if necessary, otherwise correct the user-programmed value • Extend the delay time to match the application requirements
Overload	21	Running	• Motor overloaded • Overload parameters are not matched to the motor	• Check motor overload condition • Check values for overload class and motor FLC and verify current draw of the motor
Underload	22	Running	• Broken motor shaft, belts, tool bits, etc. • Pump cavitation • Incorrect user setting	• Check pump system, machine drive components, and loading • Check settings • Repair or replace motor
Jam	23	Running	• Motor current has exceeded the user-programmed jam level	• Correct source of jam or excessive loading and check programmed time value
Stall	24	Running	• Motor did not reach full speed by the end of the programmed ramp time • Incorrect user setting	• Check pump system, machine drive components, and loading. Repair or replace motor, if necessary. • Check settings
Phase Reversal	25	Prestart only	• Incoming supply voltage is not the expected ABC sequence	• Check power wiring and correct if necessary
Network and Comm's Loss	x026, x027, x028 (See Table 16)	All	• DPI network loss • Communication disconnect at the serial port	• Check communication adapters and verify connection to the SMC. • Reconnect each DPI connected device
Internal 24V and System Faults	36, 37	All	• Low line condition • Excessive load on internal 24V supply	• Check the control power and verify it is within the specification; check the connections and grounding to the SMC control terminals • Replace the control module

Display Fault	HIM or Software Fault Code	Enabled	Possible Causes	Possible Solutions
Line Power Quality with Phase Indication	52, 53, 54	Start or Stop	• Incoming 3-phase voltage instability or distortion • High impedance connection	• Check supply voltage for capability to start/stop motor; check for loose connections on the line side or motor side of the power wires • Verify and correct the input power quality
Ground Fault	x058 (See Table 16)	Running	• Ground fault current level has exceeded programmed value • The delay time is too short for the application	• Check power system and motor; correct if necessary. Check programmed ground fault levels to match application requirements • Extend the delay time to match the application requirements
Motor PTC	59	Running	• Motor ventilation blocked • Motor duty cycle exceeded • PTC open or shorted	• Check for proper ventilation • Check application duty cycle • Wait for motor to cool or provide external cooling then check resistance of PTC

In Table 15, HIM or software fault codes that begin with “x” are based on values that are automatically entered by the controller. The letter “x” denotes the individual port assignment values, as shown in Table 16.

Table 16 - Port Assignment

Port Number	Source
0	Control Module
1	HIM Located in Controller Bezel (optional)
2 or 3	Remote DPI
4	20-COMM-X (optional)
7, 8, 9	Expansion Port 7, 8, 9 (option module)

Notes:

SCCR Ratings

SCCR Ratings

Table 17 - SCCR (High Capacity Fault) Electrical Ratings for Integrated Bypass Units

Type 1 Coordination[1]								
SCPD Performance[2]			Class J or Class L Fuse[3]		Inverse Time (Thermal Magnetic) Circuit Breaker[4]			
					480V, 65 kA Maximum			
Motor Connection Type	Cat. No.	Current Rating [A]	Maximum Available Fault (600V) [kA]	Max. Current [A]	Bul. 140G Frame Size	Max. Current [A]	Cat. No.	Rating Plug
Line	150-S108N…	108	70	200	Pending[5]			
	150-S135N…	135		225				
	150-S201N…	201		350				
	150-S251N…	251		400				
	150-S317N.…	317	69	500				
	150-S361N…	361		600				
	150-S480N…	480		800				
Inside-the-Delta	150-S108N…	187	70	300				
	150-S135N…	234		400				
	150-S201N…	348		600				
	150-S251N…	435		800				
	150-S317N…	549	69	1000				
	150-S361N…	625		1200				
	150-S480N…	831		1600				

(1) Basic Requirements for Type 1 Coordination: Under the short-circuit condition, the starter shall cause no danger to persons or the installation. The starter may not be suitable for further service without repair or replacement of parts. For further details, See UL508/CSA C22.2 No. 14 and EN 60947-4-2.

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

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

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

(5) Other circuit breakers pending.

Table 18 - SCCR (High Capacity Fault) Electrical Ratings for Solid-state Units

Type 1 Coordination[1]									
SCPD Performance[2]			Class J or Class L Fuse[3]			Inverse Time (Thermal Magnetic) Circuit Breaker[4]			
Motor Connection Type	Cat. No.	Current Rating [A]	Maximum Available Fault (600V) [kA]	Current [A]		480V, 65 kA Maximum			
				Typical	Max.	Bul. 140G Frame Size	Max. Current [A]	Cat. No.	Rating Plug
Line	150-SB1N…	90	100	150	200	K	350	140G-K6F3-D40	—
	150-SB2N…	110		175	225		300	140G-K6F3-D30	—
	150-SB3N…	140		225	300		400	140G-K6F3-D40	—
	150-SB4N…	180		300	400		400	140G-K6F3-D40	—
	150-SC1N…	210		350	450	M	600	140G-M6F3-D60	—
	150-SC2N…	260		450	500		700	140G-M6F3-D80	—
	150-SC3N…	320		500	700		800	140G-M6F3-D80	—
	150-SD1N…	361		601	800	N	1000	140G-N6HE-E12	140G-NRP3-E10
	150-SD2N…	420		700	800		1200	140G-N6HE-E12	—
	150-SD3N…	520		800	1000		1200	140G-N6HE-E12	—
Inside Delta	150-SB1N…	155	65	250	300	M	450	140G-M6F3-D60	—
	150-SB2N…	190		300	400		500	140G-M6F3-D60	—
	150-SB3N…	242		400	500		700	140G-M6F3-D80	—
	150-SB4N…	311		500	600		700	140G-M6F3-D80	—
	150-SC1N…	363		601	800	N	1000	140G-N6HE-E12	140G-NRP3-E10
	150-SC2N…	450		700	1000		1200	140G-N6HE-E12	—
	150-SC3N…	554		800	1200		1200	140G-N6HE-E12	—
	150-SD1N…	625		1000	1200	Pending[5]			
	150-SD2N…	727		1200	1600				
	150-SD3N…	900		1200	2000				

(1) Basic Requirements for Type 1 Coordination: Under the short-circuit condition, the starter shall cause no danger to persons or the installation. The starter may not be suitable for further service without repair or replacement of parts. For further details, See UL508/CSA C22.2 No. 14 and EN 60947-4-2.

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

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

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

(5) Other circuit breakers pending.

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Direct Dial Codes	Find the Direct Dial Code for your product. Use the code to route your call directly to a technical support engineer.	http://www.rockwellautomation.com/global/support/direct-dial.page
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