User Manual

Allen-Bradley

SMC™-50 Solid-State Smart Motor Controller

Bulletin 150

Allen-Bradley • Rockwell Software

Rockwell Automation

Important User Information

Solid-state equipment has operational characteristics differing from those of electromechanical equipment. Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls (publication SGI-1.1 available from your local Rockwell Automation sales office or online at http://www.rockwellautomation.com/literature/) describes some important differences between solid-state equipment and hard-wired electromechanical devices. Because of this difference, and also because of the wide variety of uses for solid-state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

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.

No patent liability is assumed by Rockwell Automation, Inc. with respect to use of information, circuits, equipment, or software described in this manual.

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.
	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.
IMPORTANT	Identifies information that is critical for successful application and understanding of the product.

Chapter 3

Operating Modes

Chapter 4

Protection & Diagnostic Functions

Chapter 5
Programming

Chapter 6

Metering

Product Overview

Other Related Documents

- Quick Start — Publication 150-QS003
- Option Module Instructions:
  - Analog and Digital I/O Options: Publication 150-IN052
  - Parameter Configuration: Publication 150-IN053
  - PTC, Ground Fault, Current Feedback: Publication 150-IN051
- Accessory Component Instructions:
  - Protection Modules: Publication 150-IN036
  - IEC Terminal Covers (Frame B): Publication 10000152881
  - External Bypass (Frames C and D): Publication 150-IN071
- Selection Guide—Publication 150-SG010
- DeviceLogix™ User Manual—Publication RA-UM003

Description

Starting Modes/Features

The SMC™-50 is a reduced voltage soft starter that utilizes a a state-of-the-art microprocessor- based control module and solid-state (without an integral bypass contactor) power structure. Using six back-to-back SCRs (two per phase), the SMC-50 provides controlled acceleration, operation/run, and deceleration of standard asynchronous induction motors.

The SMC-50 offers a full range of starting modes as standard:

- Linear Speed Acceleration
- Soft Start with selectable kickstart
- Current Limit with selectable kickstart
- Dual Ramp Start with selectable kickstart
- Full Voltage Start
- Preset Slow Speed from 1 to 15%, forward and reverse
- Torque Control
- Pump Control — Pump Start with selectable Kickstart

Running Modes/Features

The SMC-50 offers three operational/run modes:

- solid-state run mode
- solid-state with energy saver run mode
- external bypass run mode (option)

Stopping Modes/Features

The SMC-50 offers a full range of stopping modes as standard:

- Linear Speed Deceleration
- Coast
- Soft Stop
- Pump Control
- Braking Control
  - — Smart Motor Braking (SMB™)
  - — Slow Speed with Braking

Metering

The SMC-50 allows the user to monitor the following power parameters:

- RMS current for each phase and average of all three phases
- Line-to-line voltage for each phase and average of all three phases
- Line-to-neutral voltage for each phase and average of all three phases
- Line frequency
- Voltage unbalance.
- Current imbalance.
- Torque ❶
- Real, reactive and apparent power for each phase
- Real, reactive and apparent power maximum demand
- Real, reactive and apparent energy
- Power factor for each phase and total
- Energy savings (when energy saving mode is selected)
- Motor operation elapsed time total
- Motor operation elapsed time since start command
- Motor speed ❷
- Motor start time duration ❸
- Peak RMS motor starting current ❸
- Total motor starts since purchased from Rockwell Automation
- Total Harmonic Distortion (THD) for voltage of each phase and the average
- THD for current of each phase and the average

❶ During braking and slow speed, torque will be zero.
❷ Estimated speed during starting and stopping when Linear Speed acceleration and deceleration is used. Displays 100 when the motor is at its full steady state (running) speed.
❸ Data available for most recent five starts.

I/O

Inputs

The SMC-50 has two 24V DC inputs available as standard. The operation of each input can be configured from a select group of functions by the user. See Figure 1 for the location of the removable standard I/O terminal block.

The status of these two 24V DC inputs is available to networked devices using any of the standard SMC-50 communication networks through the product logic status word (Chapter 8, Communications).

NOTE: Four additional 120…240V AC inputs can be added using a single Cat. No. 150-SM4 Digital I/O Option Module. See Chapter 2, page 38.

The available configuration functions for each input are as follows:

- Disable — Input **not** activated
- Start — used in a 3-wire configuration
- Coast — used in a 3-wire configuration
- Stop Option — initiates a stop option stopping mode selected through the Stop Mode, Parameter 65, used in a 3-wire configuration
- Start/Coast — 2-wire operation with Coast stopping method
- Start/Stop Option — 2-wire start/stop control with Stop Option stopping mode
- Slow Speed
- Overload Select — select between Motor Overload Class 1 and Motor Overload Class 2
- Fault — active high fault input
- Fault N.C. — active low fault input
- Clear Fault — active high clears fault
- Emergency Run — active high disables all faults
- Dual Ramp — select between Starting Profile #1 and #2
- Motor Winding Heater — active high, enables heating feature when the start command is present

The SMC-50 will generate an I/O configuration fault if:

1. any input is configured as a start or slow speed input and no input is configured as a coast or stop, or
2. any input configuration is changed from a start input (Start, Start/Coast, Start/Stop, or Slow Speed) to a non-start input, or
3. any input configuration is changed from a stop (Coast, Stop, Start/Coast, Start/Stop) to a non-stop input.

In cases 2 and 3, the fault is generated when the parameter changes.

NOTE: Two analog inputs (voltage or current) can be added using a single Cat. No. 150-SM3 Analog I/O Option Module. See Chapter 2, page 39.

Outputs

The SMC-50 has two relay outputs provided as standard. These relay outputs can be configured to follow a number of functions (see the relay output parameters list below) and operate normally open (N.O.) or electrically held normally closed (N.C.). In addition to the configured function, each relay can be individually configured with an ON and OFF delay time.

See Figure 1 for the locations of the removable standard I/O terminal block.

Relay output parameters include:

- Normal — active when the start command is initiated, inactive with stop command
- Up-to-Speed (UTS)
- Fault
- Alarm
- External Bypass
- External Brake
- DeviceLogix
- Aux Control
- Network 1
- Network 2
- Network 3
- Network 4

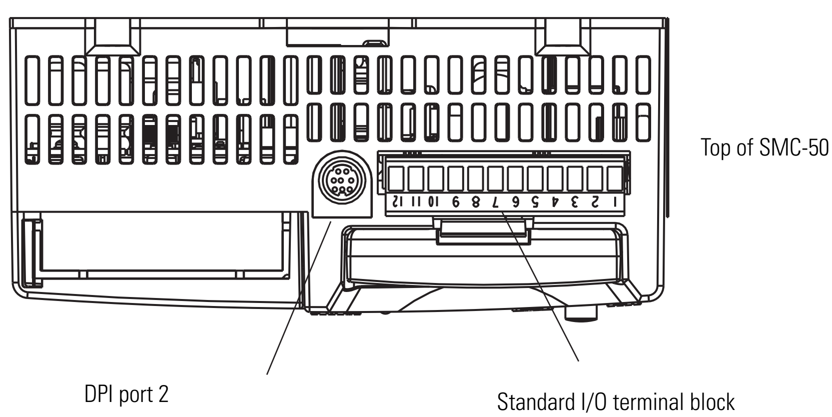
NOTE: Three additional relay outputs can be added using a single 150-SM4 Digital I/O Option Module. See page 38.

Two analog outputs (voltage or current) can be added using a single Cat. No. 150-SM3 Analog I/O Option Module. See page 39.

Communication

A Drives Programming Interface (DPI) communications port is provided as standard (see Figure 1). This communications port enables the SMC-50 to interface with other DPI communication devices (e.g., a 20-HIM-A6, a 1203-SSS, or a 1203-USB AnaCANda cable for PC interface software such as DriveExplorer™) and software that is PC based and network compatible (e.g., Connected Components Workbench).

Figure 1 - DPI Location & Standard Terminal Block



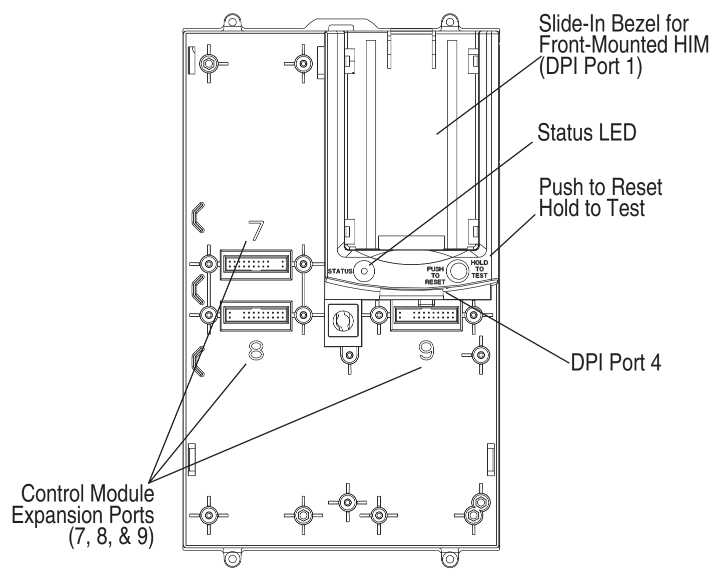
The SMC-50 Controller supports DPI communication port numbers 1, 2, 3, and 4. Port 1 is assigned to support the optional slide-in front-mounted HIM (see Figure 2). Port 2 is assigned to the DPI port located on the top of the control module (see Figure 1). Communication port 4 is assigned to a 20-COMM-X network module hardware expansion slot 9 (see Figure 2).

NOTE: When the DPI splitter is placed into port 2, it is assigned communication port numbers 2 and 3.

The front of the controller also contains a multi-color diagnostic STATUS LED to provide simple operational and fault information. A PUSH TO RESET and HOLD TO TEST push button provides the ability to reset a fault without additional hardware. More detailed information about these tools can be found in Chapter 10, Troubleshooting.

The SMC-50 has three hardware expansion ports (7, 8, and 9) which are used to house optional expansion modules. These expansion modules provide additional features/functions (e.g., I/O expansion, basic parameter configuration, ground fault detection, etc.) to be added as necessary.

Figure 2 - SMC-50 - Front View



ATTENTION: Two peripheral devices can be connected to the DPI port on top of the SMC-50. The maximum output current through the DPI port is 280 mA.

Programming

The SMC-50 parameters can be programmed/configured using a Bulletin 20-HIM-A6 LCD configuration device, PC-based software (e.g., DriveExecutive™ or DriveExplorer™), or a Cat. No. 150-SM6 Parameter Configuration Module. Each configuration device must be ordered separately. The SMC-50 does not include a configuration device.

The Cat. No. 150-SM2, -SM3, and -SM4 option modules can be programmed/configured using a Cat. No. 20-HIM-A6 or -C6S LCD configuration device or PC-based software.

DeviceLogix

DeviceLogix is an embedded component of SMC-50 Smart Motor Controllers. It is used to control outputs and manage status information locally within the soft starter. It can function stand-alone or complimentary to supervisory control. See Appendix F, Using DeviceLogix for additional information and programming examples.

Installation & Wiring

Overview

The SMC-50 Soft Starters can be used to start three-phase, line-type (up to 690V), or delta-type (up to 600V) motors. Line voltage and motor type are automatically detected by the SMC-50 or can be configured by the user.

Degree of Protection

The line and load power terminals of the SMC-50 Soft Starters have an IP00 rating. Units rated 90…180 A can have an IP2X rating with the addition of optional 150-STCB terminal covers. Taking into account the ambient conditions, the device must be installed in a suitable enclosure. Make sure that no dust, liquids, or conductive parts can enter the soft starter. Soft starter operation produces waste heat (i.e., heat loss). For details, see Table 1 in this chapter or Appendix A, Specifications.

Receiving

It is the user's responsibility to thoroughly inspect the equipment before accepting the shipment from the freight company. Check the item(s) received against the purchase order. If any items are damaged, it is the responsibility of the user not to accept delivery until the freight agent has noted the damage on the freight bill. Should any concealed damage be found during unpacking, it is again the responsibility of the user to notify the freight agent. The shipping container must be left intact and the freight agent should be requested to make a visual inspection of the equipment.

Unpacking

Remove all packing material, wedges, or braces from within and around the controller.

Inspecting

After unpacking, check the item(s) nameplate catalog number against the purchase order.

Storing

The controller should remain in its shipping container prior to installation. If the equipment is not to be used for a period of time, it must be stored according to the following instructions in order to maintain warranty coverage:

- Store in a clean, dry location.
- Store within an ambient temperature range of –25 °C to +75 °C (–13 °F to +167 °F).

- Store within a relative humidity range of 0% to 95%, noncondensing.
- Do not store equipment where it could be exposed to a corrosive atmosphere.
- Do not store equipment in a construction area.

General Precautions

In addition to the precautions listed throughout this manual, the following statements, which are general to the system, must be read and understood.

ATTENTION: The controller contains ESD- (electrostatic discharge) sensitive parts and assemblies. Static control precautions are required when installing, testing, servicing, or repairing the assembly. 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.

ATTENTION: An incorrectly applied or installed controller can damage components or reduce product life. Wiring or application errors (e.g. undersizing the motor, incorrect or inadequate AC supply, or excessive ambient temperatures) may result in malfunction of the system.

ATTENTION: Only personnel familiar with the controller and associated machinery should plan or implement the installation, start-up, and subsequent maintenance of the system. Failure to do this may result in personal injury and/or equipment damage.

ATTENTION: Hazardous voltages that can cause shock, burn, or death are present on L1, L2, L3, T1, T2, and T3.

Power terminal covers can be installed on devices rated 90…180 A to prevent inadvertent contact with terminals. Disconnect the main power before servicing the motor controller or associated wiring.

Heat Dissipation

The following table provides the maximum heat dissipation at the maximum rated current for the controllers. For currents lower than the rated value, heat dissipation will be reduced.

Table 1 - Control Power Requirements (Max. Control Circuit Consumption)

Description	Current Range [A]	Control Voltage 100…240V AC	Control Voltage 24V DC
Base Power Draw: Control Module with Heat Sink Fan	90…180	150 VA	75 W
	210…320	150 VA	75 W
	361…520	300 VA	300 W
Optional Power Adder (for each option installed, add to base power) ❶	Human Interface Module (HIM)	10 VA	2 W
	150-SM2❷	30 VA	4 W
	150-SM3	30 VA	4 W
	150-SM4	50 VA	2 W
	150-SM6❷	5 VA	1 W
	20-COMM-X❷	25 VA	4 W

❶ Add to Base power using the formula below to obtain total power requirements.

❷ Max. 1 of each option type per control module

Table 2 - Continuous Duty Power Structure Heat Dissipation at Rated Current

Description	Current Range [A]	Heat Dissipation [W]
Controller Rating [A]	90	270
	110	330
	140	420
	180	540
	210	630
	260	780
	320	960
	361	1083
	420	1260
	520	1560

Power Calculation

Max. total power dissipation = ______ Base Power + ______ Options + ______ Power Structure Watts

Example: 361 A device with a 20-COMM-X module, HIM, and Cat. No. 150-SM4

Max. total power dissipation = $\underset{\text{Base Power}}{300}$ + $\underset{\text{Options}}{(25 + 10 + 50)}$ + $\underset{\text{Power Structure}}{1083}$ Watts

Max. total power dissipation = 1468 Watts

Enclosures

The open-style design of the SMC-50 requires an enclosure with at least 150 mm (6 in.) of clearance above and below the controller. The enclosure will allow air to flow through the heat sink, keeping the surrounding air ambient temperature within the required range of -20...40 °C (-4...104 °F). See Table 3 for the minimum enclosure size.

Table 3 - Minimum Enclosure Size (SMC-50 only)

	Configuration	mm (in.)		
		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)

IMPORTANT	The internal ambient temperature of the enclosure must be kept within the range of -20...40 °C (-4…104 °F).

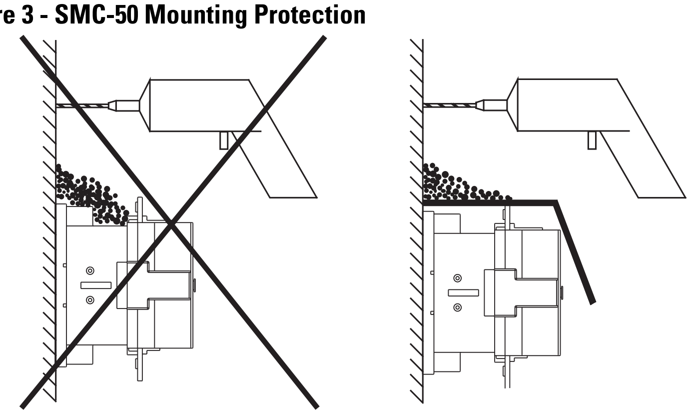
Mounting

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. Side-to-side spacing in **not** required. Horizontal mounting of the SMC-50 is **not** allowed. Enclosure **must** be sized such that the enclosure's internal temperature remains within specified controller ratings.

When drilling or installing near the Soft Starter, make sure that adequate measures are taken to protect the device from dust and debris, as illustrated below.

Figure 3 - SMC-50 Mounting Protection

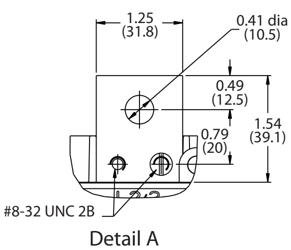


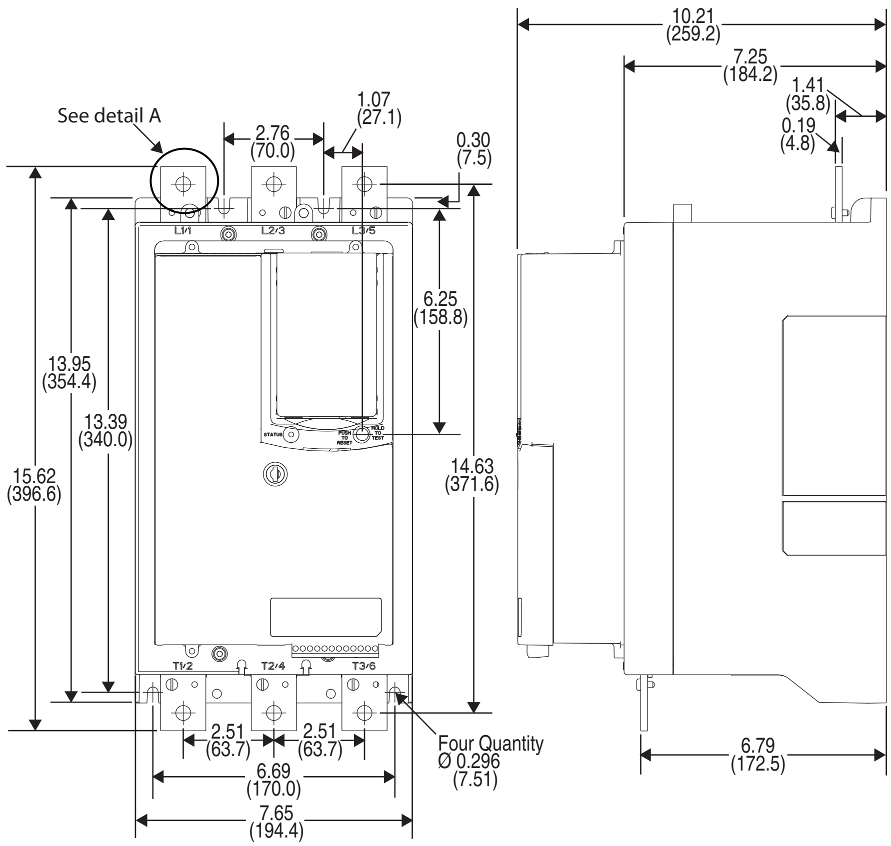
Dimensions

NOTE: Dimensions are in inches (millimeters). All dimensions are approximate and are not intended for manufacturing purposes. Consult your local Rockwell Automation sales office or Allen-Bradley distributor for complete dimension drawings.

Cat. No. 150-SB… Controllers

Figure 4 - Dimensions of Cat. No. 150-SB1…SB4 Controller without Terminal Covers

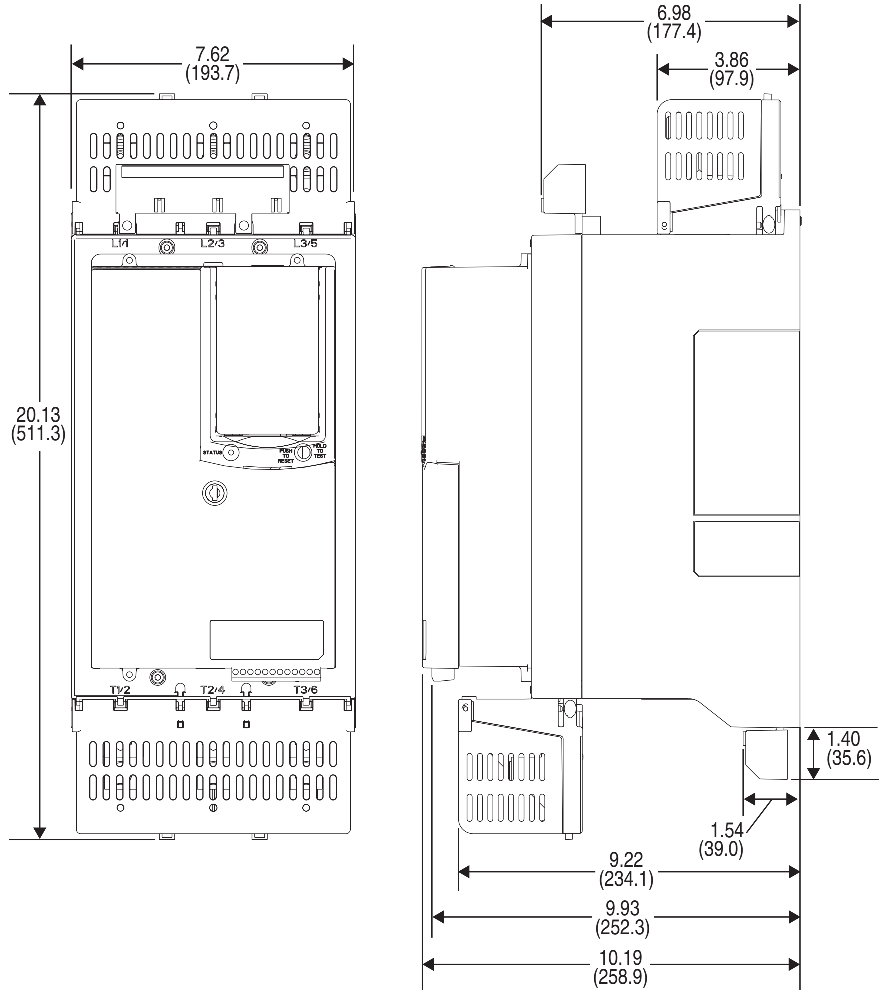




Note: When mounted in an enclosure, maintain a minimum of 6.0 inches (152.4 millimeters) clearance above or below the SMC-50. Side-to-side clearance is not required.

Catalog Number	Approximate Shipping Weight
150-SB1…	15.7 kg 34.6 lb
150-SB2…	
150-SB3…	
150-SB4…	

Figure 5 - Dimension of Cat. No. 150-SB1…SB4 Controller with Terminal Covers

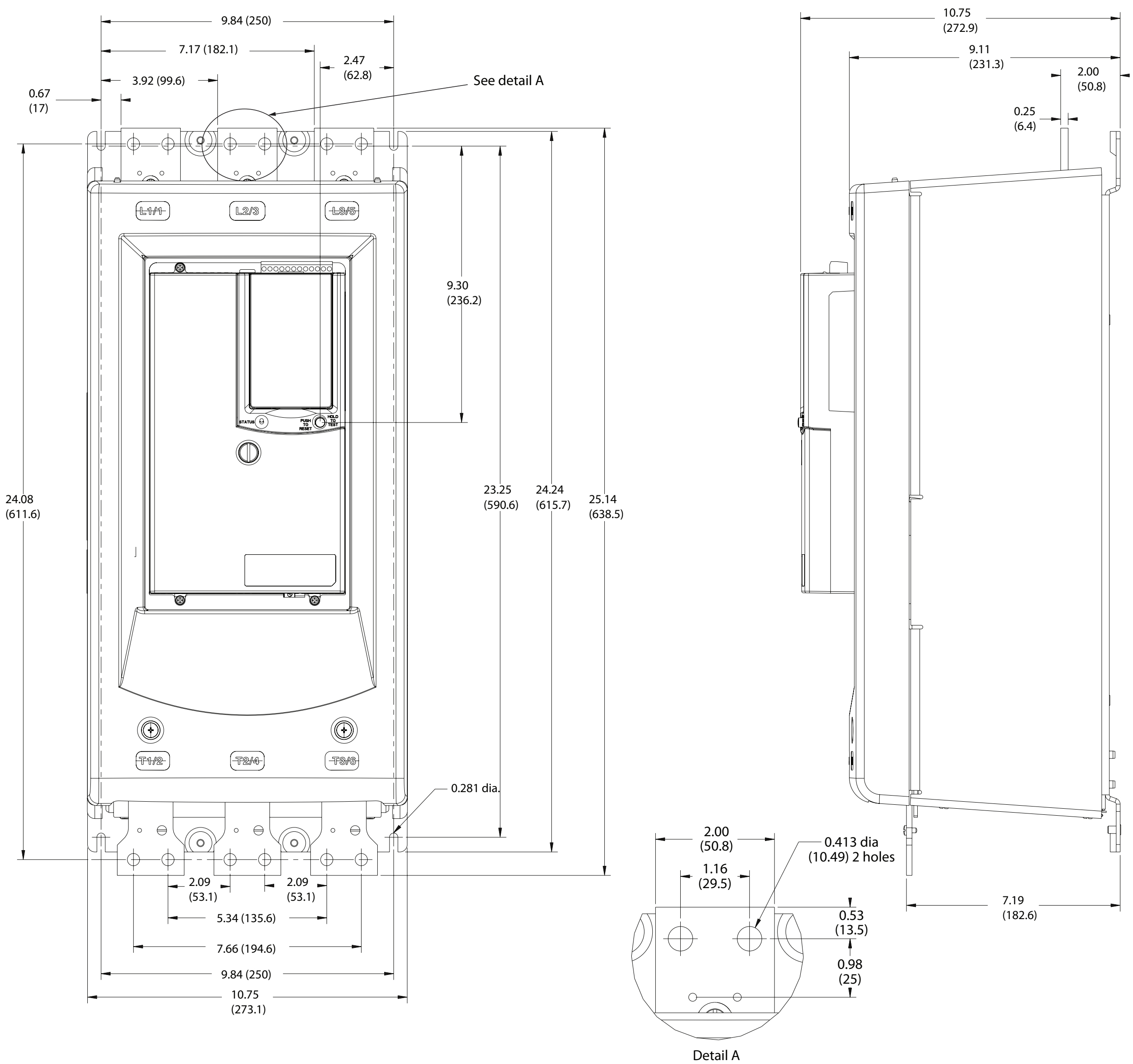


Note: When mounted in an enclosure, maintain a minimum of 6.0 inches (152.4 millimeters) clearance above or below the SMC-50. Side-to-side clearance is not required.

Catalog Number	Approximate Shipping Weight
150-SB1…	15.92 kg 35.1 lb
150-SB2…	
150-SB3…	
150-SB4…	

Cat. No. 150-SC… Controllers

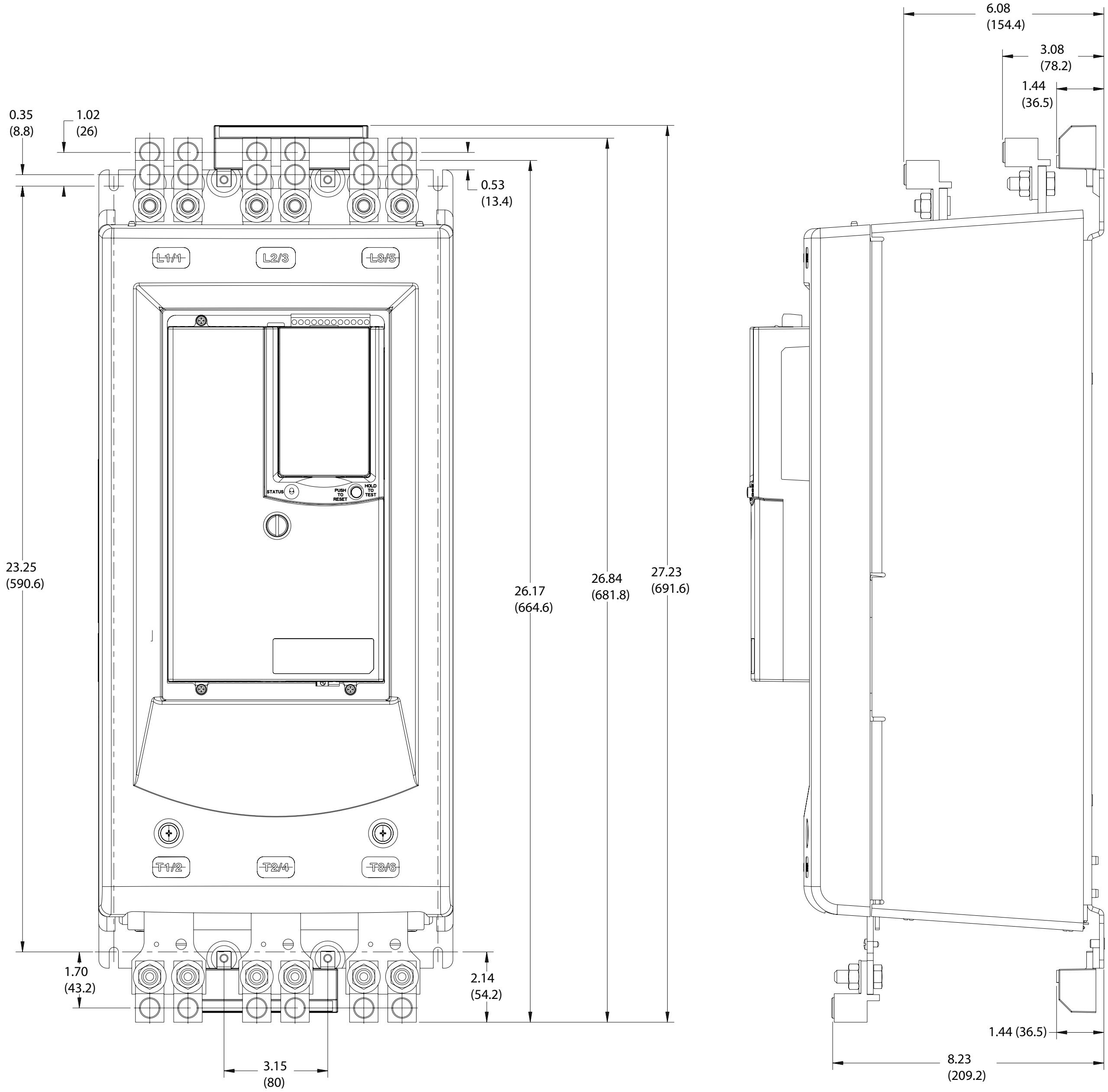
Figure 6 - Dimensions of Cat. No. 150-SC1…SC3 Controller



Note: When mounted in an enclosure, maintain a minimum of 6.0 inches (152.4 millimeters) clearance above or below the SMC-50. Side-to-side clearance is not required.

Catalog Number	Approximate Shipping Weight
150-SC1…	47.6 kg 105 lb
150-SC2…	
150-SC3…	

Figure 7 - Dimensions of Cat. No. 150-SC1…SC3 Controller with Lugs, Bypass Kit, and MOV options

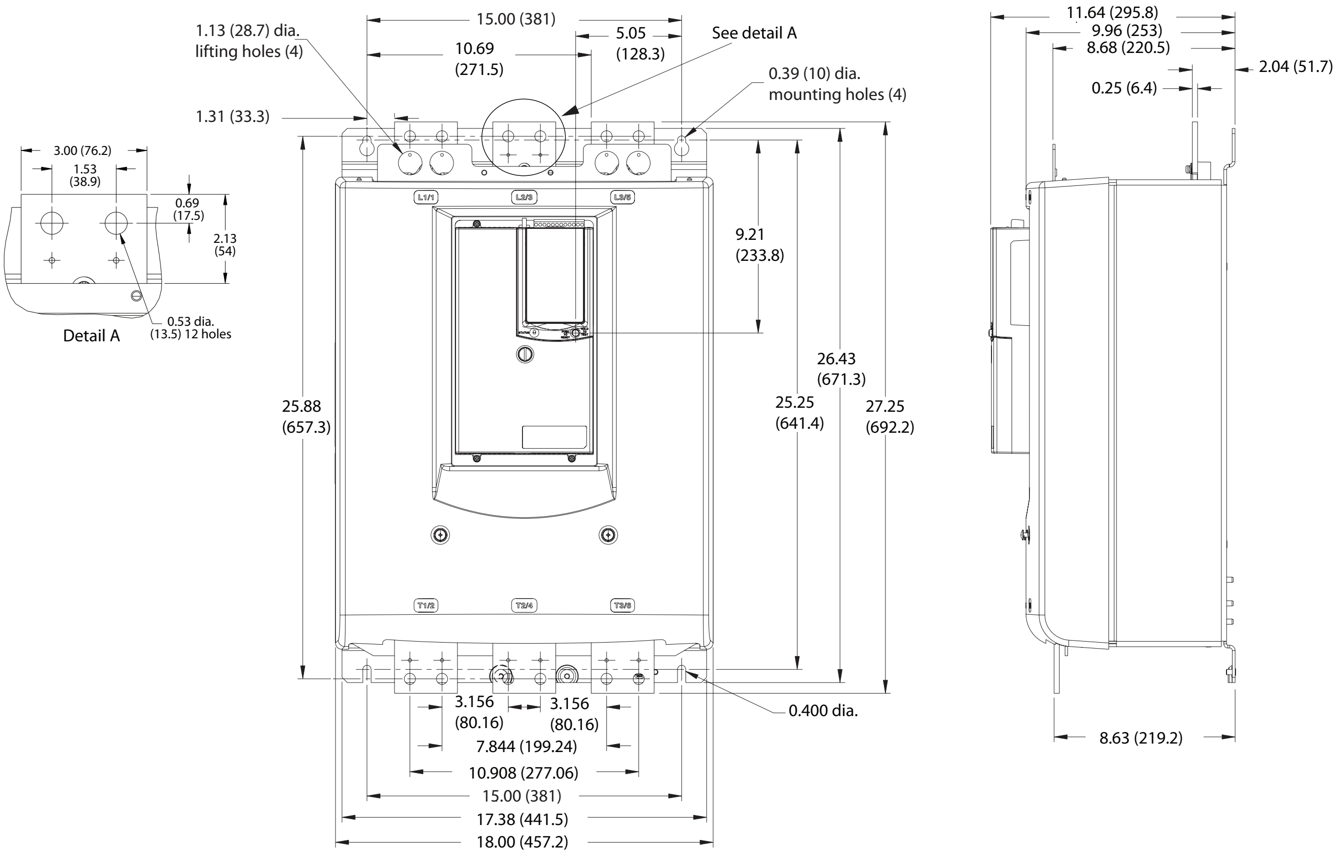


Note: When mounted in an enclosure, maintain a minimum of 6.0 inches (152.4 millimeters) clearance above or below the SMC-50. Side-to-side clearance is not required.

Catalog Number	Approximate Shipping Weight
150-SC1…	47.6 kg 105 lb
150-SC2…	
150-SC3…	

Cat. No. 150-SD… Controllers

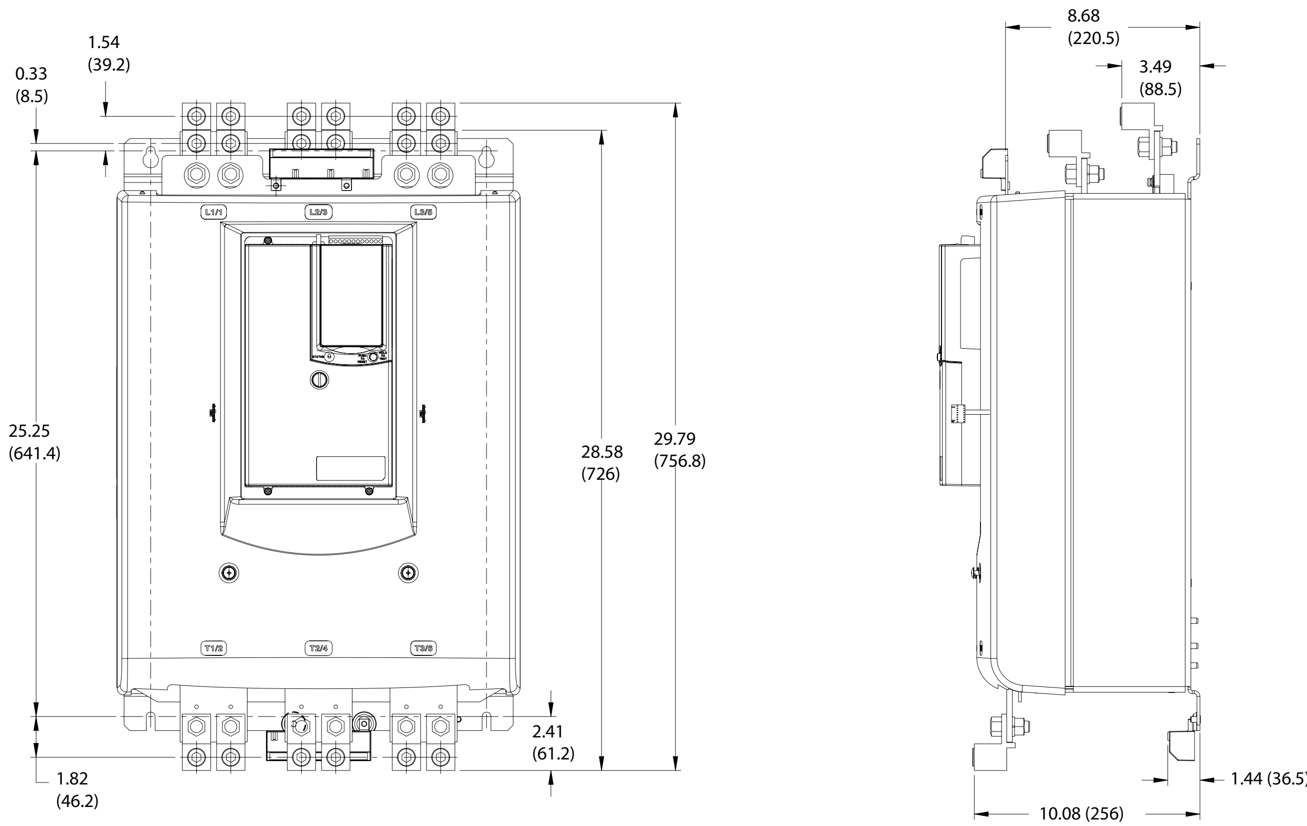
Figure 8 - Dimensions of Cat. No. 150-SD1…SD3 Controller



Note: When mounted in an enclosure, maintain a minimum of 6.0 inches (152.4 millimeters) clearance above or below the SMC-50. Side-to-side clearance is not required.

Catalog Number	Approximate Shipping Weight
150-SD1…	77.1 kg 170 lb
150-SD2…	
150-SD3…	

Figure 9 - Dimensions of Cat. No. 150-SD1…SD3 Controller with Lugs, Bypass Kit, and MOV options



Note: When mounted in an enclosure, maintain a minimum of 6.0 inches (152.4 millimeters) clearance above or below the SMC-50. Side-to-side clearance is not required.

Catalog Number	Approximate Shipping Weight
150-SD1…	77.1 kg 170 lb
150-SD2…	
150-SD3…	

Power Factor Correction Capacitors (PFCC)

The SMC-50 controller can be installed on a system with PFCCs. **The PFCCs must be located on the line side of the controller**. This must be done to prevent damage to the silicon-controlled rectifiers (SCRs) in the controller power section.

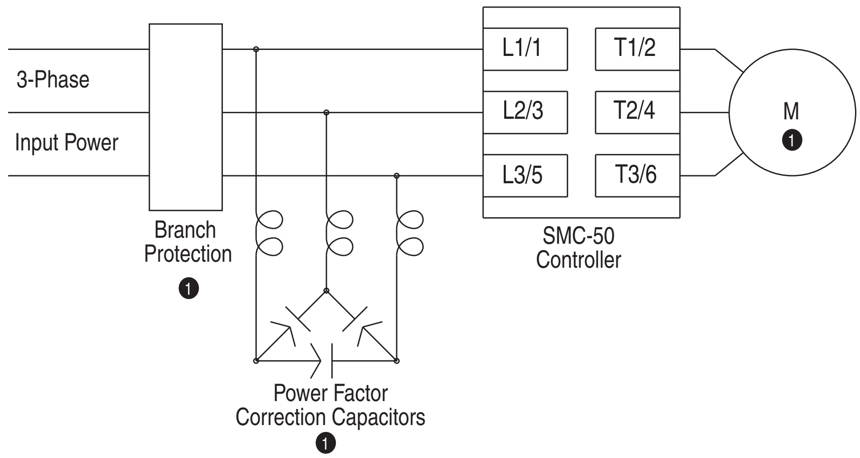
When discharged, a capacitor essentially has zero impedance. For switching, sufficient impedance should be connected in series with the capacitor bank to limit the inrush current. One method for limiting the surge current is to add inductance in the capacitor's conductors. This can be accomplished by creating turns or coils in the power connections to the capacitors.

- 250V — 150 mm (6 in.) diameter coil, 6 loops
- 480…690V — 150 mm (6 in.) diameter coil, 8 loops

Figure 10 and Figure 11 show a typical system wiring diagram using PFCCs.

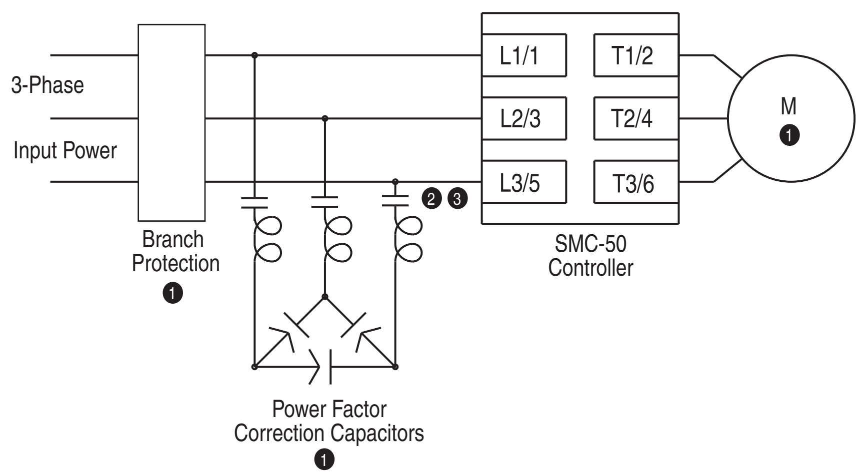
IMPORTANT	**DO NOT** mount the coils directly on top of one another. Doing so will cause a cancelling effect. To avoid parts acting as induction heaters, **DO** mount the coils on insulated supports away from metal parts. If an isolation contactor is used, **DO** place the capacitors in front of the contactor. For further instructions, consult the PFC capacitor vendor.

Figure 10 - PFCC



❶Customer Supplied.

Figure 11 - PFC Capacitors & Contactor



❶Customer Supplied.
❷ Energize for 1/2 of a second before starting command to SMC-50.
❸ Open contactor after the stopping method is complete.
Alternate:
The alternate method can be accomplished with an Aux Output configured for UTS (up-to-speed).
❷ Energize the contactor after motor is up to speed.
❸ Open the contactor before initiating a stop.

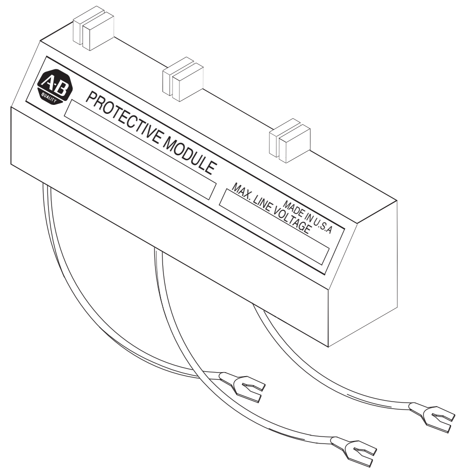
Protective Modules

A protective module (see Figure 12) containing MOVs (Metal Oxide Varistors) should be installed to protect the SMC-50 power components from electrical transients and/or electrical noise.

Protective modules can be installed on controllers rated from 200…600V to protect the power components from electrical transients. The protective modules clip voltage transients generated on the lines to prevent such surges from damaging the SCRs. The use of MOVs are highly recommended, as 480V and 600V MOVs offer maximum protection of 1400V and 1600V respectively.

NOTE: Protective modules are not available for 690V applications.

Figure 12 - Protective Module



IMPORTANT	Protective modules may be placed on the line, load, or both sides of the SMC-50. **However, protective modules must not be placed on the load side of the SMC-50 when using inside-the-delta motor connections or with pump, linear speed, or braking control.**

There are two general situations that may occur which would indicate the need for using the protective modules.

1. **Transient Spikes —** Transient spikes will typically occur on the lines feeding the SMC-50 or feeding the load from the SMC-50. Transient spikes are created on the line when devices are attached with current-carrying inductances that are open-circuited. The energy stored in the magnetic field is released when the contacts open the circuit. Examples of these are: lightly loaded motors, transformers, solenoids, full voltage starters, and electromechanical brakes.

2. **Fast-rising Wavefronts** — If the SMC-50 is installed on a system that has fast-rising wavefronts present, although not necessarily high peak voltages, protective modules may be needed. Additionally, if the SMC-50 is on the same bus as other SCR devices (e.g. AC/DC drives, induction heating equipment, or welding equipment), the firing of the SCRs in those devices can cause noise.

ATTENTION: When installing or inspecting the protective module, make sure that the controller has been disconnected from the power source. The protective module should be inspected periodically for damage or discoloration. Replace if necessary.

Motor Overload Protection

Thermal motor overload protection is provided as standard with the SMC-50. If the overload trip class is less than the acceleration time of the motor, nuisance tripping may occur.

ATTENTION: Overload protection should be properly coordinated with the motor.

Two applications require special consideration: two-speed motors and multi-motor protection.

Two-Speed Motors

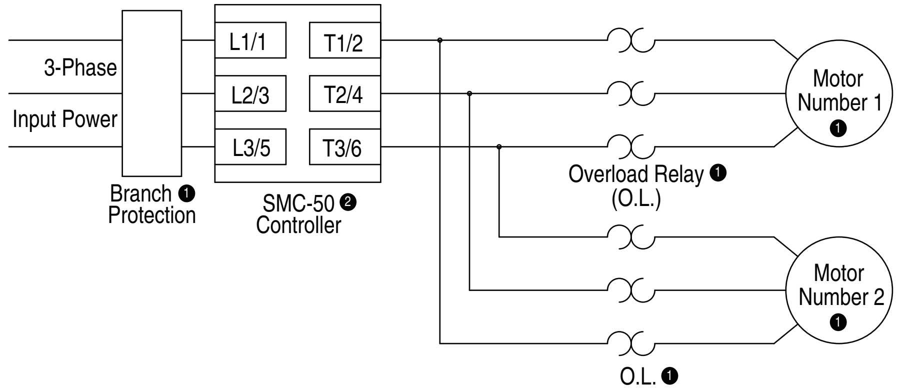
The SMC-50 has overload protection available for single-speed motors. When the SMC-50 is applied to a two-speed motor, the Overload function must be disabled via Parameter #230—Motor Fault En and separate overload relays must be provided for each speed.

Multi-Motor Applications

The SMC-50 will operate with more than one motor connected to it. Motors should be mechanically coupled. To size the controller, add the total nameplate amperes of all of the connected loads. The stall and jam features should be turned off. Separate overloads are still required to meet the National Electric Code (NEC) requirements.

IMPORTANT	The SMC-50's built-in overload protection cannot be used in multi-motor applications. Disable the SMC-50 Overload function using Parameter #230—Motor Fault En

Figure 13 - Multi-Motor Application



❶ Customer supplied.

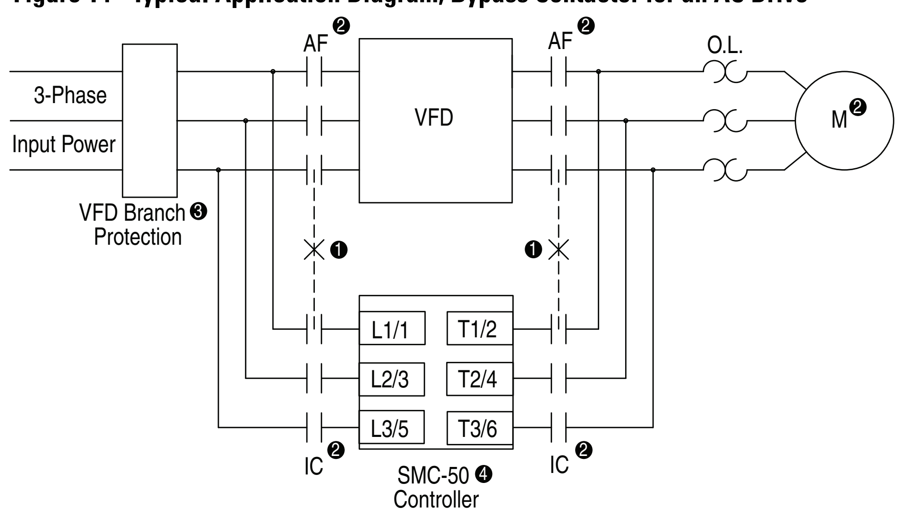
❷ Disable the SMC-50 Overload function using Parameter #230—Motor Fault En.

SMC-50 Controller as a Bypass to an AC Drive

By using the SMC-50 controller in a typical application, as shown in Figure 14, a soft start characteristic can be provided in the event that an AC drive is non-operational.

IMPORTANT	A controlled acceleration can be achieved with this scheme.

Figure 14 - Typical Application Diagram, Bypass Contactor for an AC Drive



❶ Mechanical interlock required.

❷ Customer supplied.

❸ Many variable speed drives (VFDs) are rated 150% full load amperes (FLA). Since the SMC-50 can be used for 600% FLA starting, separate branch circuit protection may be required.

❹ Overload protection is included as a standard feature of the SMC-50.

Motor Winding Heater Capability

SMC-50 Internal Motor Winding Heater Function

The SMC-50 motor winding heater function provides low levels of current to each of the motor windings to preheat a cold motor before starting. To avoid stressing a single motor winding, the SMC-50 cycles the current to the three motor phases. This feature provides a programmable heating level, heating time, and terminal block input.

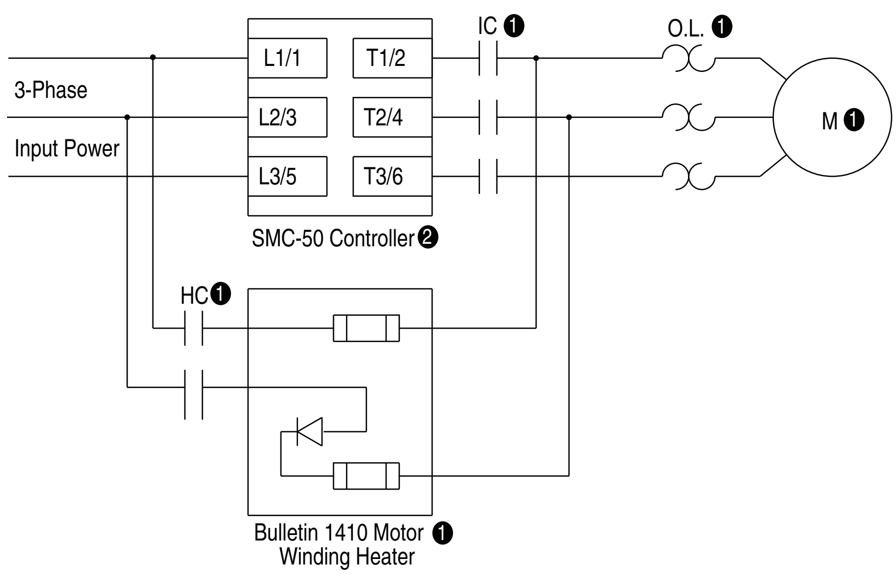
The motor winding heater can be activated after a valid start command is received. After a valid start, the activation of the heating function can be performed by programming the Heating Time parameter to a non-zero value or by configuring a terminal block input to "Motor Heater" and activating that input prior to the start command. The heater function will continue for the specified time or until the input is deactivated, at which time the motor will start.

The heater function will be disabled if the parameter Heater Level is set to zero or the parameter Heater Time is set to zero and the input is inactive (or not configured) at the time of the start command.

SMC-50 with an External Bulletin 1410 Motor Winding Heater

In addition to using the SMC-50 internal motor heater feature, an external Bulletin 1410 motor winding heater can be used. A typical application diagram is shown below in Figure 15.

Figure 15 - SMC-50 with an External Bulletin 1410 Motor Winding Heater



❶ Customer supplied.

❷ Overload protection is included as a standard feature of the SMC-50.

Electromagnetic Compatibility (EMC)

ATTENTION: This product has been designed for Class A equipment. Use of the product in domestic environments may cause radio interference, in which case the installer may need to employ additional mitigation methods.

The following guidelines are provided for EMC installation compliance.

Enclosure

Install the product in a grounded metal enclosure.

Wiring

Wire in an industrial control application can be divided into three groups: power, control, and signal. The following recommendations for physical separation between these groups is provided to reduce the coupling effect:

- Different wire groups should cross at 90° inside an enclosure.
- Minimum spacing between different wire groups in the same tray should be 16 cm (6 in.).
- Wire runs outside of an enclosure should be run in conduit or have shielding/armor with equivalent attenuation.
- Different wire groups should be run in separate conduits.
- Minimum spacing between conduits containing different wire groups should be 8 cm (3 in.).
- For additional guidelines, please see the installation instructions, Wiring and Ground Guidelines, publication DRIVES-IN001*.

Additional Requirements

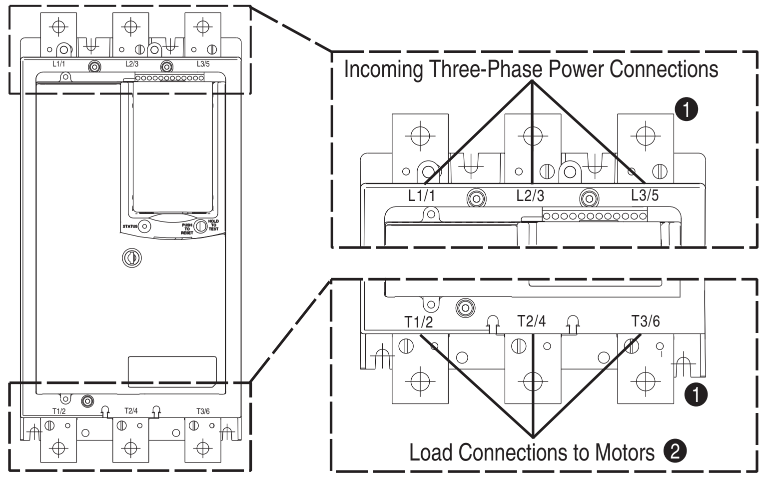
- Wire earth ground to control terminal #3 control ground.
- Use shielded wire for PTC and ground fault input.
- Terminate shielded wires to the control module terminal #3 control ground.
- Ground fault CT must be inside or within 3 m (9.84 ft.) of metal enclosure.
- When an external HIM is used, a ferrite core must be placed around the HIM cable. The recommended core is Fair-Rite Products, Corp. part no. 0461164181 or equivalent.

For additional PTC, external CT, and ground fault requirements, see footnote ❺ of Figure 28 on page 46.

Wiring Terminal Locations

The SMC-50 wiring terminal locations are shown in Figure 16. Incoming three-phase power connections are made to terminals L1/1, L2/3, and L3/5. Load connections to motors are made to T1/2, T2/4, and T3/6.

Figure 16 - Wiring Terminal Locations



❶ See Table 4 for lug information.

❷ Inside-the-delta connected motors require an additional delta distribution block. See Table 4.

For controllers rated 210…520 A, a grounding nut (size 1/4-20) is provided for grounding per applicable local codes.

Power Structure

The SMC-50 power structure is a solid-state SCR (silicon-controlled rectifier) design capable of interfacing with 200…480V AC or 200…690V AC (690V line and 600V inside-the-delta) motors. Released product will handle motor current from 90…520 A. The power structure incorporates true current-sensing and over temperature protection. If the application requires, an external bypass contactor may be utilized. See page 91.

Power Wiring

See the product nameplate or Table 4 for power lug termination information including:

- lug wire capacity
- tightening torque requirement
- lug kit

ATTENTION: 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 following is recommended:

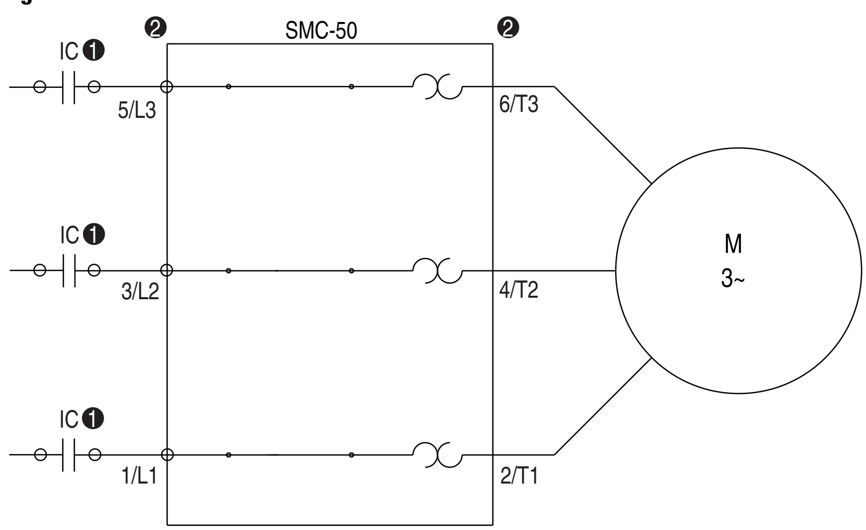
Use an isolation contactor or shunt trip type circuit breaker on the line side of the SMC-50. This device should be capable of interrupting the motor's lock rotor current.

Wire the isolation contactor's control relay to an auxiliary relay output contact on the SMC-50. This will achieve coordinated operation with the SMC-50. The auxiliary relay contact should be programmed for the "normal" condition. See Chapter 5, Programming, for additional information.

Line Connected Motors

The SMC-50 can be connected to a line-controlled motor (see Figure 17). This type of motor typically has three leads. The SMC-50 automatically detects the motor wiring configuration during the tuning process. Since there is a small amount of leakage current passing through a non-conducting SCR, it is recommended that an Isolation Contactor (IC) be added to the circuit to provide galvanic isolation of the motor and final electromechanical removal of power.

Figure 17 - SMC-50 Connected to a Line-Controlled Motor



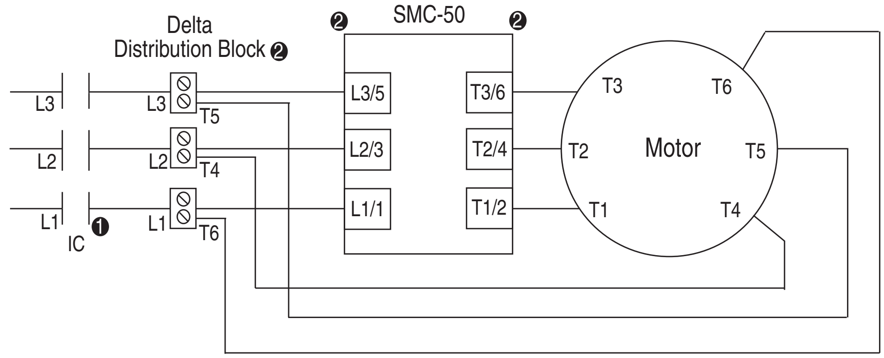
❶ Recommended.

❷ See Table 4 for lug information.

Delta Connected Motors

The SMC-50 has the ability to run Wye-Delta motors in an inside-the-delta configuration. These motors typically have 6 or 12 leads. The SMC-50 automatically detects the motor wiring configuration during the tuning process. In a delta configuration, it is required that an isolation contactor (IC) be added to the circuit to provide galvanic isolation of the motor and final electromechanical removal of power.

Figure 18 - SMC-50 Connected to a Delta Connected Motor



❶ Required.

❷ See Table 4 for lug and delta distribution block information.

Grounding Provision

Provision for connecting a field-installed grounding conductor is provided on controllers rated 210…520 A. The grounding location is identified by the green grounding nut (size 1/4-20) near the controller's bottom mounting holes.

Power Lugs

Power lugs are required for devices rated 90…520 A. These lugs are sold in kits. Each kit contains three lugs. The number and type of lugs required is listed in Table 4.

ATTENTION: Line and load terminal covers that can give units rated 90…180 A deadfront protection (IP2X with 250-MCM cable) are available. See Appendix E for the appropriate catalog numbers for ordering.

Table 4 - Power Wiring Information

Cat. No.			150-SB…		150-SC…		150-SD…	
Rating [A]			90…180	155…311	210…320	363…554	361…520	625…900
Configuration			Line/Wye	Inside-the-Delta	Line/Wye	Inside-the-Delta	Line/Wye	Inside-the-Delta
SMC Lugs	**Torque**	**Lug-Bus**	23 N•m (200 lb•in.)	23 N•m (200 lb•in.)	23 N•m (200 lb•in.)	23 N•m (200 lb•in.)	28 N•m (250 lb•in.)	28 N•m (250 lb•in.)
		Wire-Lug	31 N•m (275 lb•in.)	31 N•m (275 lb•in.)	31 N•m (275 lb•in.)	31 N•m (275 lb•in.)	42 N•m (375 lb•in.)	42 N•m (375 lb•in.)
	Max No. Lugs/Pole	**Line Side**	1	1	2	2	2	2
		Load Side	1	1	2	2	2	2
	Conductor Range		16…120 mm^2 (#6…250 MCM)	16…120 mm^2 (#6…250 MCM)	16…120 mm^2 (#6…250 MCM)	16…120 mm^2 (#6…250 MCM)	25…240 mm^2 (#4…500 MCM)	25…240 mm^2 (#4…500 MCM)
	Wire Strip Length [mm]		18…20	18…20	18…20	18…20	18…25	18…25
	Lug Kit Cat. No.		199-LF1	199-LF1	199-LF1	199-LF1	199-LG1	199-LG1
Delta Distribution Block	**Torque**	**Line**		42 N•m (375 lb•in.)		67.8 N•m (600 lb•in.)		67.8 N•m (600 lb•in.)
		Load		42 N•m (375 lb•in.)		31 N•m (275 lb•in.)		67.8 N•m (600 lb•in.)
	Qty			3		1		3
	Conductor Range	**Line**		25…240 mm^2 (#4…500 MCM)		54…400 mm^2 (1/0…750 MCM)		54…400 mm^2 (1/0…750 MCM)
		Load		25…240 mm^2 (#4…500 MCM)		16…120 mm^2 (#6…250 MCM)		54…400 mm^2 (1/0…750 MCM)
	Wire Strip Length [mm]	**Line**		35		45		45
		Load		35		Top Row = 23 Bottom Row = 48		45
	Lug Kit No.			Allen-Bradley 1492-BG		Marathon Special Products 1353703		Marathon Special Products 1352702

Control Power

Control Power Ratings

The SMC-50 can accept control power input of 100…240V AC (-15%…+10%) or 24V DC (-10%…+10%). A minimum control power source is required. See Table 5. This base control power requirement is for the control module with fan. The control power requirement for the fan is supplied by the control module and auto-configured. The control module and option module control power requirements are shown in Table 5.

Table 5 - Control Power Requirements (Max. Control Circuit Consumption)

Description	Current Range [A]	Control Voltage	
		100…240V AC	24V DC
Base Power Draw: Control Module with Heat Sink Fan	90…180	150 VA	75 W
	210…320	150 VA	75 W
	361…520	300 VA	300 W
Optional Power Adder (for each option installed, add to base power) ❶	Human Interface Module (HIM)	10 VA	2 W
	150-SM2❷	30 VA	4 W
	150-SM3	30 VA	4 W
	150-SM4	50 VA	2 W
	150-SM6❷	5 VA	1 W
	20-COMM-X❷	25 VA	4 W

❶ Add to Base power to obtain total power requirements.
❷ Max. 1 of each option type per control module

Each control terminal is removable and will accept a 14 AWG maximum and 24 AWG minimum wire size. The terminals are UL Recognized to accept a maximum of two 16 AWG wires per terminal. See the product nameplate prior to applying control power.

Table 6 provides the terminal wire capacity, the tightening torque requirements, and the wire strip length for all SMC-50 control wiring and option module wiring.

Table 6 - Control and Option Module 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

Fan Power

The SCR heat sink fan of the SMC-50 is located at the bottom of the power assembly. The fan is designed to cycle ON/OFF as necessary to cool the assembly SCRs. The fan and fan cover are field replaceable. See Appendix C.

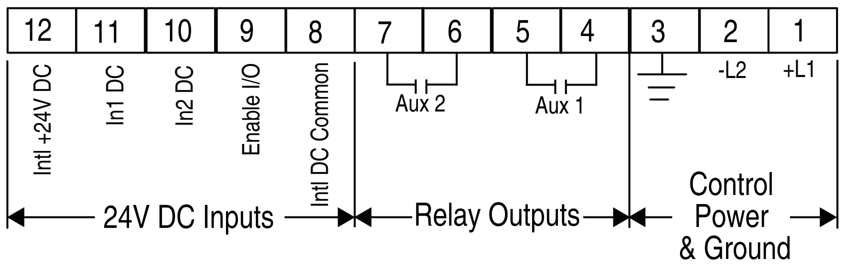
Fan Terminations

The fan is self powered from the power applied to Control Terminals 1 and 2 on the control module. Fan power is automatically configured based on control power. No user connections or configuration is required.

Control Terminal Designations

As shown in Figure 19, the SMC-50 contains 12 control terminals and is equipped as standard with two digital 24V DC on/off inputs and two relay outputs for auxiliary control function.

Figure 19 - Standard Digital I/O Wiring Terminal Block Identification



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

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

❶ Do not connect any additional loads to this terminal. Parasitic loads may cause problems with operation.
❷ 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.
❸ RC snubbers are required when inductive loads are connected to terminal.

SMC-50 Option Modules

The SMC-50 has three expansion ports to place optional modules (see Figure 20). These ports provide the capability to add control modules (e.g., additional inputs and outputs (I/O), simple start/stop parameter configuration capability, ground fault, etc.). Brief functional explanations are provided here with the wiring termination identifications. See Chapter 5, Programming, for more detailed functional and configuration information. See Figure 20 for compatible port locations of the selected module.

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.

Figure 20 - Port Number Identification

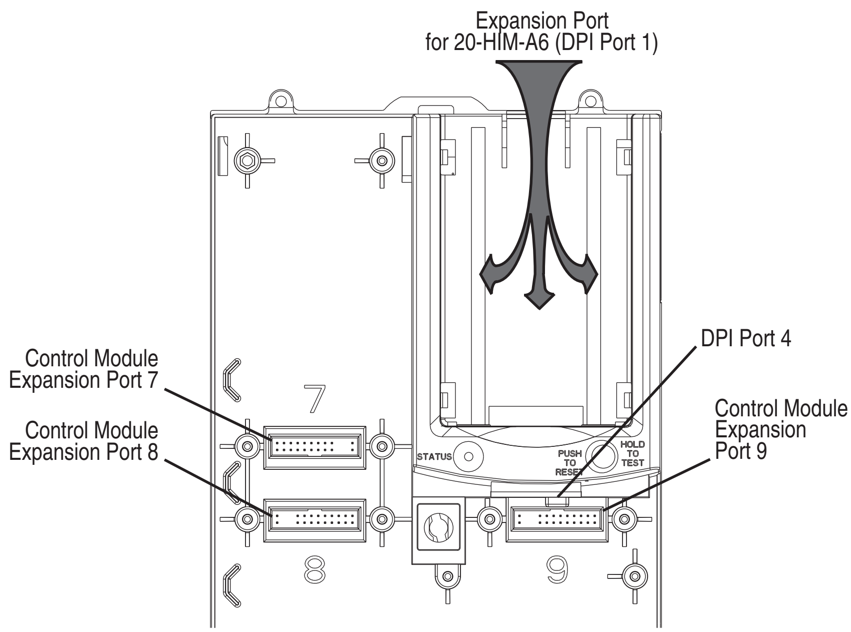


Table 7 - Port Location for Compatible Option Modules

SMC-50 Control Module Compatible Option Modules Cat. Nos.	Compatible Control Module Port			Maximum Number of this Type of Option Module per Control Module
	Port 7	Port 8	Port 9	
150-SM2: Ground Fault/PTC/External CT	Yes	Yes	No	1
150-SM3: Analog I/O	Yes	Yes	Yes	3
150-SM4: Digital I/O	Yes	Yes	Yes	3
150-SM6: Parameter Configuration	Yes	Yes	Yes	1
20-COMM-X ❶❷: Communications	No	No	Yes	1

❶ See Chapter 8, Communications on page 205 for a list of compatible 20-COMM-X modules.

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

Optional Cat. No. 150-SM4 Digital I/O Module

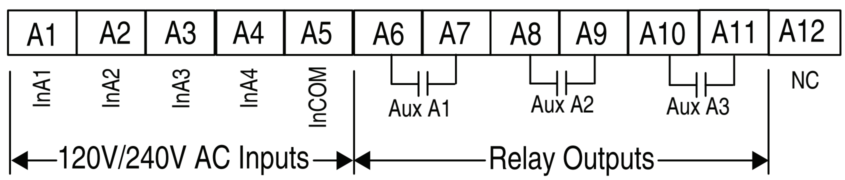
A Cat. No. 150-SM4 Digital I/O Option Module provides four 120…240V AC digital on/off inputs and three relay outputs to provide additional auxiliary control or indications (e.g., up-to-speed (UTS), alarm, etc.) functions. The 150-SM4 module can be located in any of the three control module option ports (See Figure 20). Up to three 150-SM4 modules can be used with a single control module. The 150-SM4 module terminal block used to wire the I/O is removable.

NOTE:

1 When installed in Control Module Port 7, the orientation of the module terminal block is rotated 180° along with its terminals.

2 The Cat. No. 150-SM4 Digital I/O Module can NOT be configured using a 150-SM6 PCM. This module can be configured using a 20-HIM-A6, network card, or communications software (e.g., Connected Components Workbench).

Figure 21 - Optional Digital I/O Module Terminal Id



Terminal Number	Description
A1 ❶	Optional Input #1 (120/240V AC)
A2 ❶	Optional Input #2 (120/240V AC)
A3 ❶	Optional Input #3 (120/240V AC)
A4 ❶	Optional Input #4 (120/240V AC)
A5 ❸	Input Common
A6 ❷❸	Optional Auxiliary Relay Contact #1
A7 ❷❸	Optional Auxiliary Relay Contact #1
A8 ❷❸	Optional Auxiliary Relay Contact #2
A9 ❷❸	Optional Auxiliary Relay Contact #2
A10 ❷❸	Optional Auxiliary Relay Contact #3
A11 ❷❸	Optional Auxiliary Relay Contact #3
A12	NO CONNECT

❶ Do not connect additional loads to this terminal. Parasitic loads may cause problems with operation.
❷ 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.
❸ RC snubbers are required when inductive loads are connected to terminal.

Optional Cat. No. 150-SM3 Analog I/O Module

An optional Cat. No. 150-SM3 Analog I/O Module provides two analog inputs (voltage or current) and two analog outputs (voltage or current), seeTable 8 for specifications.

The 150-SM3 module can be located in any of the three control module option ports (See Figure 20). Up to three 150-SM3 modules can be used with a single control module. The 150-SM3 module terminal block used to wire the I/O is removable.

NOTE:

1 When installed in Control Module Port 7, the orientation of the module terminal block is rotated 180° along with its terminals.

2 The Cat. No. 150-SM3 Analog I/O Module can NOT be configured using a 150-SM6 PCM. This module can be configured using a 20-HIM-A6, network card, or communications software (e.g., Connected Components Workbench).

Figure 22 - Analog I/O Module Wiring Diagram

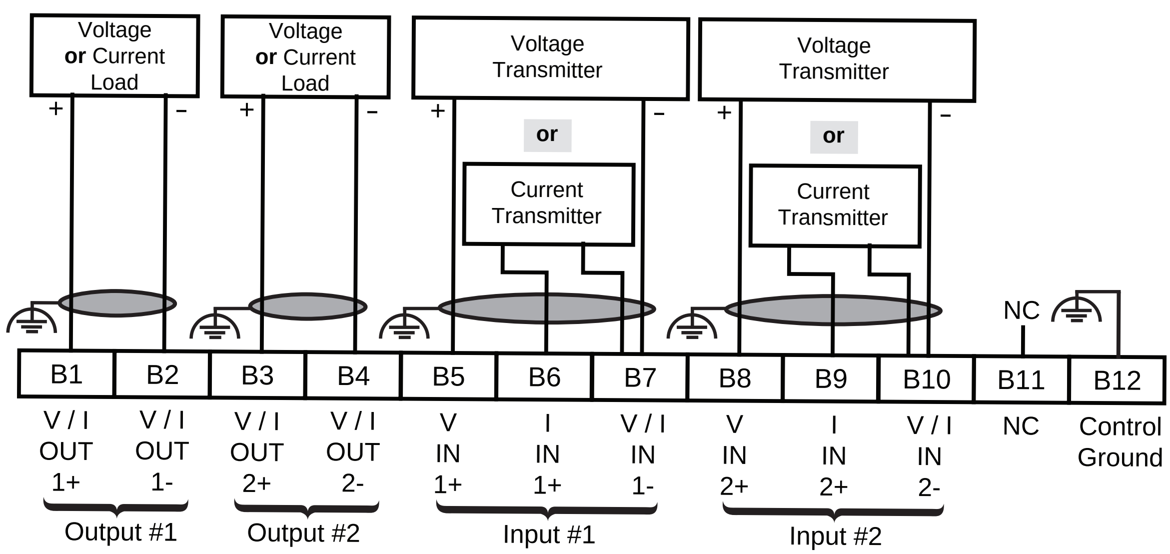


Table 8 - Cat. No. 150-SM3 Input and Output Specifications

Control Circuit	Specification	
150-SM3 Optional inputs: Terminals B5…B10	Number of Inputs	2 differential inputs
	Normal Operating Input Ranges	±10V, 0…10V, 0…5V, 1…5V, 0…20 mA, 4…20 mA
	Full Scale Operating Input Ranges	±10.5V, 0…10.5V, -0.5…5.25V, 0.5…5.25V, 0…21 mA, 3.5…21 mA
	Input Resolution	16 bit (sample rate = 60 Hz)/13 bit (sample rate = 250 Hz)
	Data Refresh Rate:	Filter dependent: 100 ms (sample rate = 60Hz);24 ms (sample rate = 250Hz)
	Rated Working Voltage	24V DC / 17V AC
	Common Mode Voltage Range	±10V DC / channel
	Input Impedance	220 kΩ: voltage mode 249 Ω: current mode
	Input Channel Diagnostics	Over and Under Range and Open Circuit
	Open Circuit Detection Time	Positive Full Scale Reading: within 3 seconds (max)
	Maximum Overload at Input Terminals	Voltage: ±24V DC continuous at 0.1 mA Current: ±30 mA continuous at 7V DC
	External Calibration	Not required: auto-calibration performed by the module if required to meet specs.
	Module Isolation to Control Board	Yes (1000V AC)
	Removable Terminal Block	Yes (Cat. No.150-SM3RTB as a spare replacement part)
	Cable Type	Belden 8760 (or equiv.) 0.750 mm^2 (18 AWG twisted pair 100% shield with drain)
150-SM3 Optional outputs: Terminals B1…B4	Number of Outputs	2 Single-ended
	Normal Operating Ranges	±10V, 0…10V, 0…5V, 0…20 mA, 4…20 mA
	Full Scale Operating Ranges	±10.5V, 0…10.5V, -0.5…5.25V, 0…21 mA, 3.5…21 mA
	Output Resolution ±10.5V, 0 …10.5V, -0.5…5.25V,, 0…21 mA, 3.5 …21 mA	16 bit (15 plus sign bipolar)
	Resistive Load on Current Output	0…750 Ω
	Load Range on Voltage Output	1 kΩ at 10V DC
	Max. Inductive Load (Current Outputs)	15 mH
	Max. Capacitive Load (Voltage Outputs)	100 μF
	Overall Accuracy	Voltage Terminal: ±0.5% full scale at 25° C Current Terminal: ±0.35% full scale at 25° C
	Accuracy Drift with Temperature	±5 PPM / ° C
	Output Impedance	15 Ω (typical)
	Open and Short-Circuit Protection	Yes
	Maximum Short-Circuit Current	45 mA
	Output Overvoltage Protection	Yes

Optional Cat. No. 150-SM2 Positive Temperature Coefficient (PTC), Ground-Fault, & External Current Transformer Option Module

An optional Cat. No. 150-SM2 module provides connectivity to external PTC motor winding temperature sensors, ground-fault, and current transformer sensors.

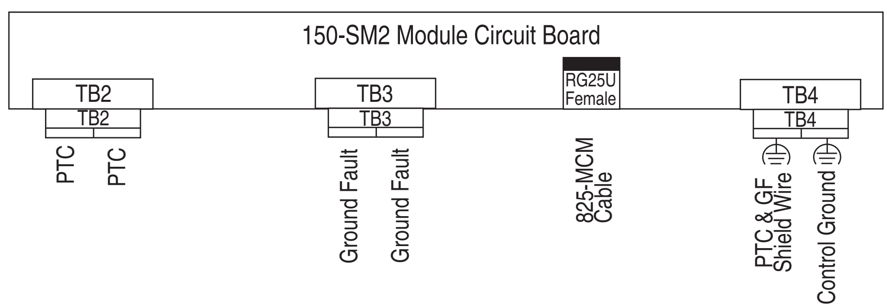
The 150-SM2 module can be located in control module Port 7 or 8. Only one 150-SM2 module is allowed to be used with the control module (See Figure 20). All of the individual terminal blocks (TB2, TB3, and TB4) are removable. The RG25U female connector provides a connection point for the male-to-male cable provided with the 825-MCM current sensor/converter module.

NOTE:

1 When installed in Control Module Port 7, the orientation of the module terminals is rotated 180° along with its terminals.

2 The Cat. No. 150-SM2 Option Module can NOT be configured using a 150-SM6 PCM. This module can be configured using a 20-HIM-A6, network card, or communications software (e.g., Connected Components Workbench).

Figure 23 - Circuit Board



Positive Temperature Coefficient (PTC) Sensor — Motor Temperature Sensing:

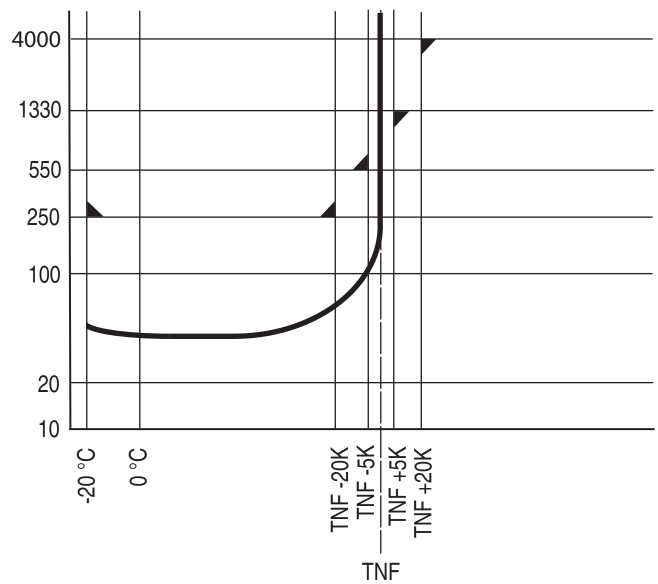
The optional 150-SM2 module provides the ability for the SMC-50 to interface with motor PTC sensors. PTC thermistor sensors are commonly embedded in motor stator windings by the motor manufacturer to provide temperature monitoring of the motor windings. Since PTC thermistor sensors react to the actual motor winding temperature, enhanced motor protection can be provided to address such conditions as obstructed motor cooling and high ambient temperature. The following table defines the required PTC thermistor input and response ratings for operation with the 150-SM2.

Table 9 - PTC Thermistor Input & Response Ratings

Thermistor Input	Response Ratings
Response Resistance:	3400 Ω ± 150 Ω
Reset Resistance:	1600 Ω ± 100 Ω
Short-circuit Trip Resistance:	25 Ω ± 10 Ω
Maximum Voltage at PTC Terminals: (RPTC = 4 K ohms):	< 7.5V
Maximum Voltage at PTC Terminals: (RPTC = open):	30V
Maximum Number of Sensors Connected in Series:	6
Maximum Cold Resistance of PTC Sensor Chain:	1500 Ω
Response Time:	800 ms

The following figure shows the required PTC sensor characteristics for operation with the 150-SM2 Option Module, per IEC-34-11-2.

Figure 24 - PTC Sensor Characteristics per IEC-34-11-2



For additional information concerning the configuration and diagnostic information provided by the PTC part of the 150-SM2 Option Module, see Chapter 5, Programming.

Ground Fault Sensing

In isolated or high impedance-grounded systems, core balanced current sensors are typically used to detect low-level ground faults which could be due to motor insulation breakdown or entry of foreign objects. Detection of ground faults can be used to prevent further damage or alert personnel to perform maintenance.

The SMC-50 can provide ground fault indication when used with the 150-SM2 Option Module and the 825-CBCT External Ground Fault (Core Balance) Current Sensor. The ground fault current sensor mounts separately from the

SMC-50 and must be placed within three meters of the SMC-50. A customer-supplied cable for wiring the ground fault sensor to the 150-SM2 module must meet the requirements outlined in Table 10.

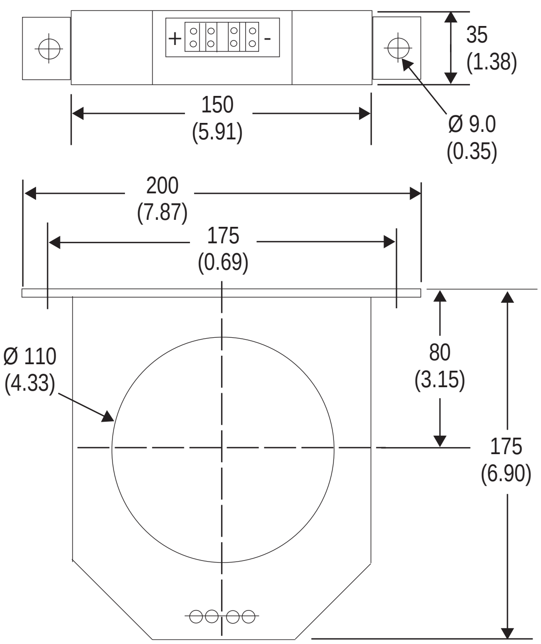
WARNING: The ground fault sensing feature of the SMC-50 is intended for monitoring purposes **only**. **It is not** intended as a ground fault circuit interrupter for personnel protection as defined in Article 100 of the National Electric Code (NEC) and has **not** been evaluated to UL 1053.

Table 10 - Ground Fault Sensor Cable Requirements❶

Wire Type:	Shielded, twisted pair
Wire Size:	0.2…2.5 mm^2 (#24…14 AWG)
Terminal Torque:	0.8 N•m (7.0 lb•in.)

❶ See Figure 28 on page 46 for wiring details.

Figure 25 - 825-CBCT Dimensions



External Current Transformer — Current Sensing in Bypass Mode

The 150-SM2 Option Module and an external current sensing device (e.g., 825-MCM) can be used to provide current feedback to the SMC-50 when it is used with an external bypass contactor. The external current feedback device provides all current measurement and current protection functions while the controller is in external bypass mode (running). A single 825-MCM Converter provides external current feedback from all three motor phases. In all other modes (e.g., starting, stopping, slow speed), the SMC-50's internal current feedback signals are used.

NOTE: External CTs can be used and enabled even without an external bypass.

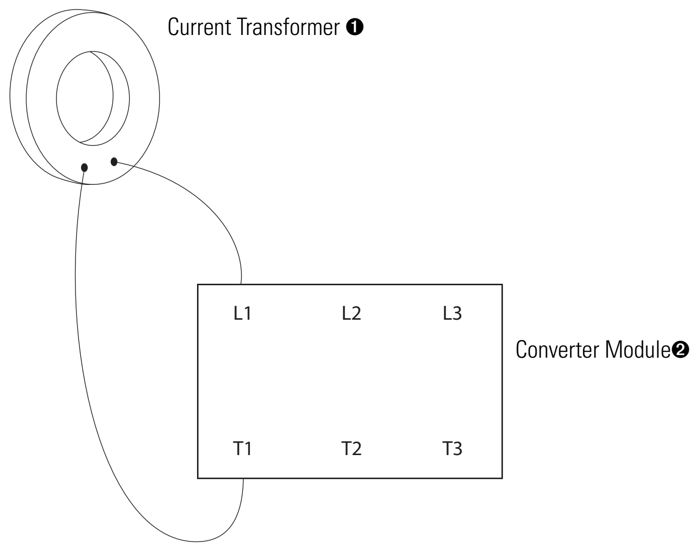
The following table provides the 825 converter to use based on the motor FLC range.

Table 11 - 825 Converter Selection

Motor FLC Range	Catalog Number
30…180 A	825-MCM180
181…520 A	825-MCM20 ❶

❶ User-supplied current transformers with 5 A secondary are required. See Figure 26.

Figure 26 - Current Transformer Connection to Converter Module

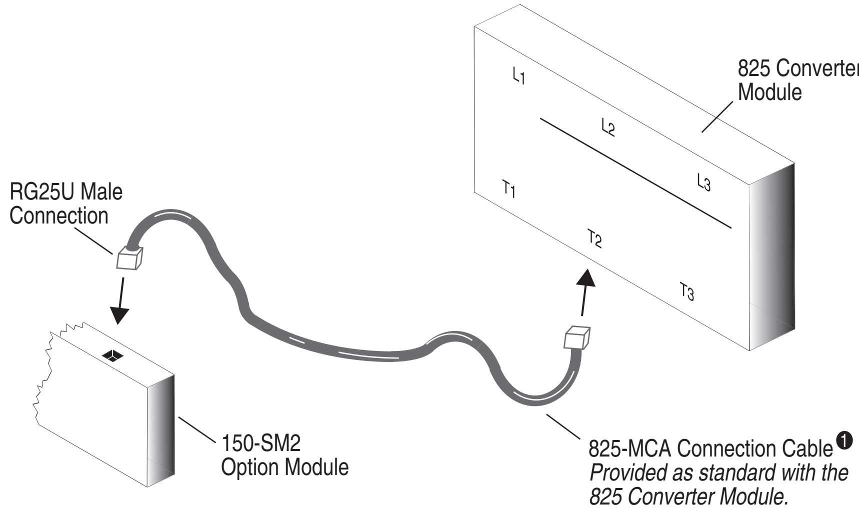


❶ Another current transformer connects L2 and T2, and another connects L3 and T3.
❷ The converter module, Cat No. 825-MCM20, must be used in these applications.

To enable the 150-SM2 External CT function, the CT Enable parameter in the 150-SM2 must be set to "Enable" and the 825-MCM hardware must be correctly configured. When the 150-SM2 External CT function is enabled, the external CT is calibrated by the SMC-50 for scaling, phase shift, and inversion during the SMC-50 tuning cycle. The tuning cycle will automatically occur before the first start after the controller installation, after a "Load Default" parameter occurs, or when the user forces tuning of the SMC-50 through the Force Tuning parameter or the control module's Hold to Reset button. The scaling is displayed relative to the unit's rating where 1.00 indicates that the external CTs and the internal CTs are scaled the same.

Figure 27 shows the connection of the 825-MCM Converter to the SMC-50's 150-SM2 Option Module.

Figure 27 - Converter to Option Module Connection



❶ The cable length is fixed at 4 meters. Only the cable provided with the converter can be used. The use of any other cable will result in incorrect data from the converter and incorrect controller operation.

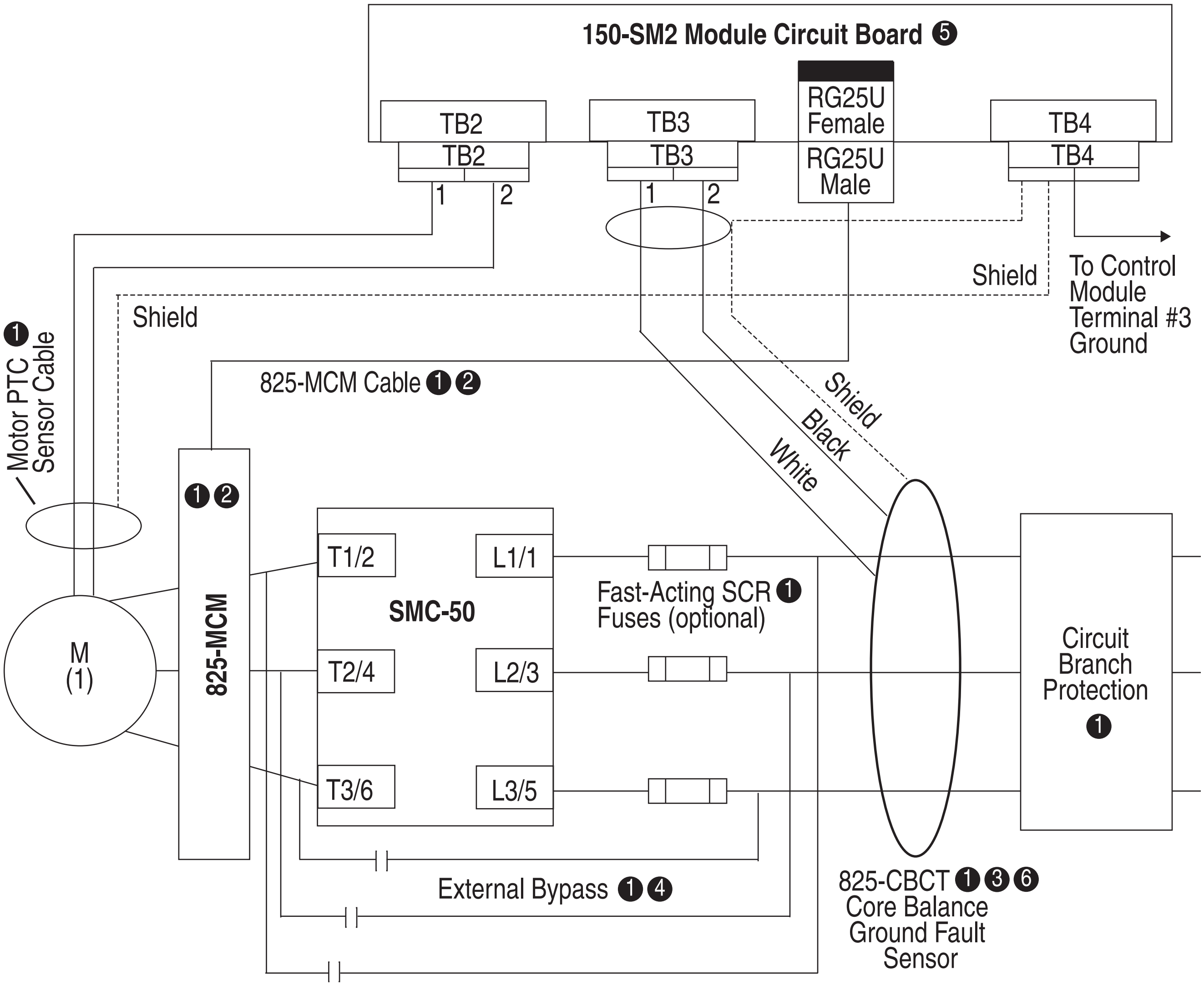
The following table provides the terminal and wire specifications for the 150-SM2 (terminals TB2, TB3, and TB4).

Table 12 - Control and Option Module 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

Figure 28 provides information for wiring all sensors to the 150-SM2 module.

Figure 28 - Combined Wiring Diagram of all 150-SM2 Sensors



❶ Customer-supplied.

❷ The 825-MCM can be used with or without an external bypass contactor. If an external bypass contactor is used then the 825-MCM must be installed in order to use current-based motor protective features including the motor overload feature. Cable length is 4 meters. Only the cable provided with the 825-MCM is compatible with the 150-SM2. See Figure 29 for 825-MCM dimensions.

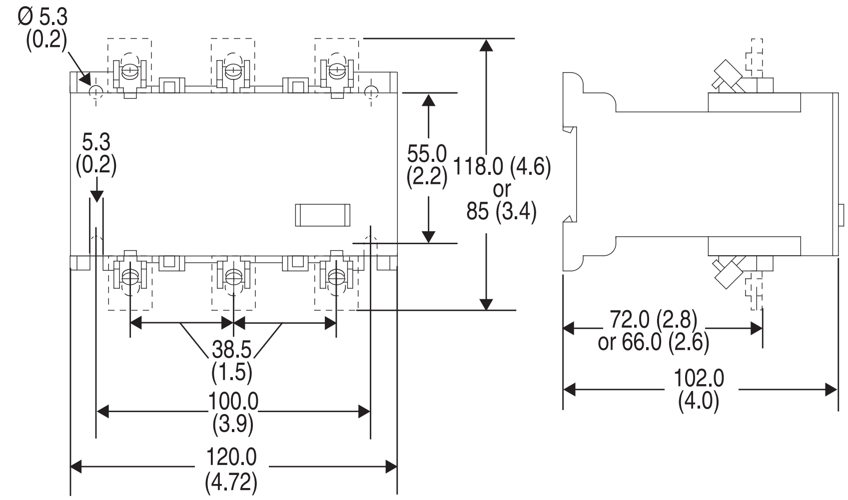
❸ The 825-CBCT Core Balance Sensor mounts separately from the SMC-50 and must be placed within 3 meters of the SMC-50. When connecting the 825-CBCT ground-fault sensor, the secondary of the CT must be shorted until connection to the 150-SM2 module is complete.

❹ See Figure 44 on page 63 for additional bypass configurations (e.g., emergency run-off bypass) and application considerations.

❺ To meet product susceptibility requirements, a single ferrite core must be placed around any or all sensor (e.g., PTC, ground fault, etc.) wires connected to the 150-SM2 Option Module. The recommended core is a Fair-Rite Products Corp Part Number 0431167281 or equivalent.

❻ Ensure the 150-SM2 Turns Ratio, Parameter X.5, is configured to match the 825-CBCT Turns Ratio 100:1 (X.5=100).

Figure 29 - 825-MCM180 and -MCM20 Dimensions



Optional Cat. No. 150-SM6 Parameter Configuration Module (PCM)

The Cat. No. 150-SM6 PCM provides simple and limited configuration of the SMC-50. This PCM can be inserted into any control module option port (7, 8, or 9).

This module contains five rotary dials and three banks of two-position, eight-switch DIP switches.

Parameters that **are** configured by the PCM will appear as read-write parameters to other configuration devices whose values represent the switch settings. The parameter values set by the PCM are stored in the control module memory. If any of these parameters are changed by an external device, the value will revert to the PCM setting.

Parameters that **are not** defined and therefore are not configurable by the PCM can be configured through other means (e.g., Human Interface Module (HIM), DriveExplorer or DriveExecutive software), if necessary.

Only one (1) 150-SM6 Option Module can be installed in the control module. Any of the three control module expansion ports can be used. A fault will be generated if an attempt is made to install more than one 150-SM6 into the control module.

A single PCM can be used to configure multiple SMC-50 controllers. After setup of the initial SMC-50 is complete, remove all power and move the PCM to the next SMC-50 that needs to be programmed. Upon powerup of the initial SMC-50, the parameters set by the PCM are retained.

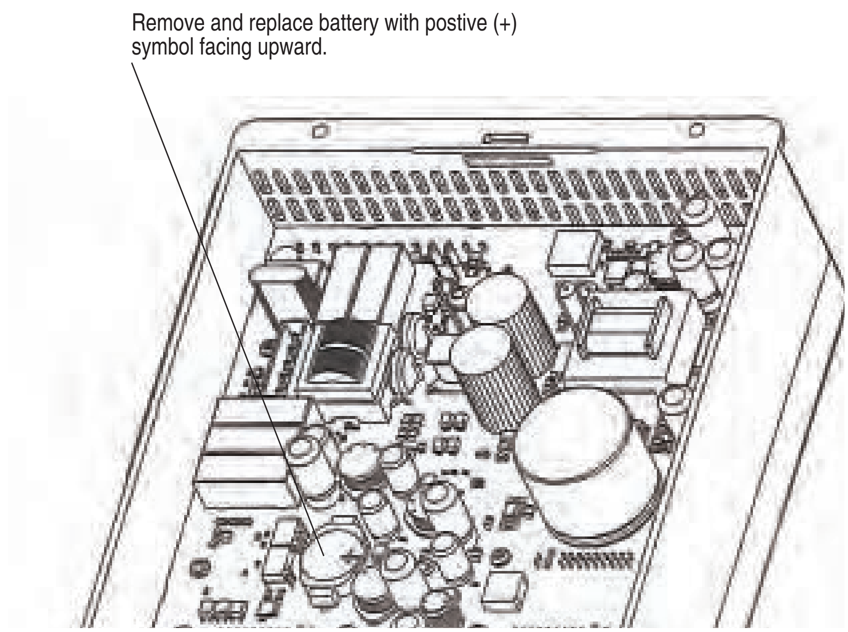
Real Time Clock (RTC) Battery Replacement

The SMC-50 Control Module comes standard with a RTC used to time and date stamp Faults and Alarms. When the control power is not applied to the SMC-50, the operation of the RTC is maintained by an off-the-shelf Lithium™ CR2032 coin cell battery. The battery must be replaced if the SMC-50's low battery alarm is activated.

To replace the battery:

1. Perform the steps in Figure 97 on page 291 to remove the control module.
2. Locate the battery on the circuit board. Note the positive symbol is facing upward.

Bottom Side of SMC-50

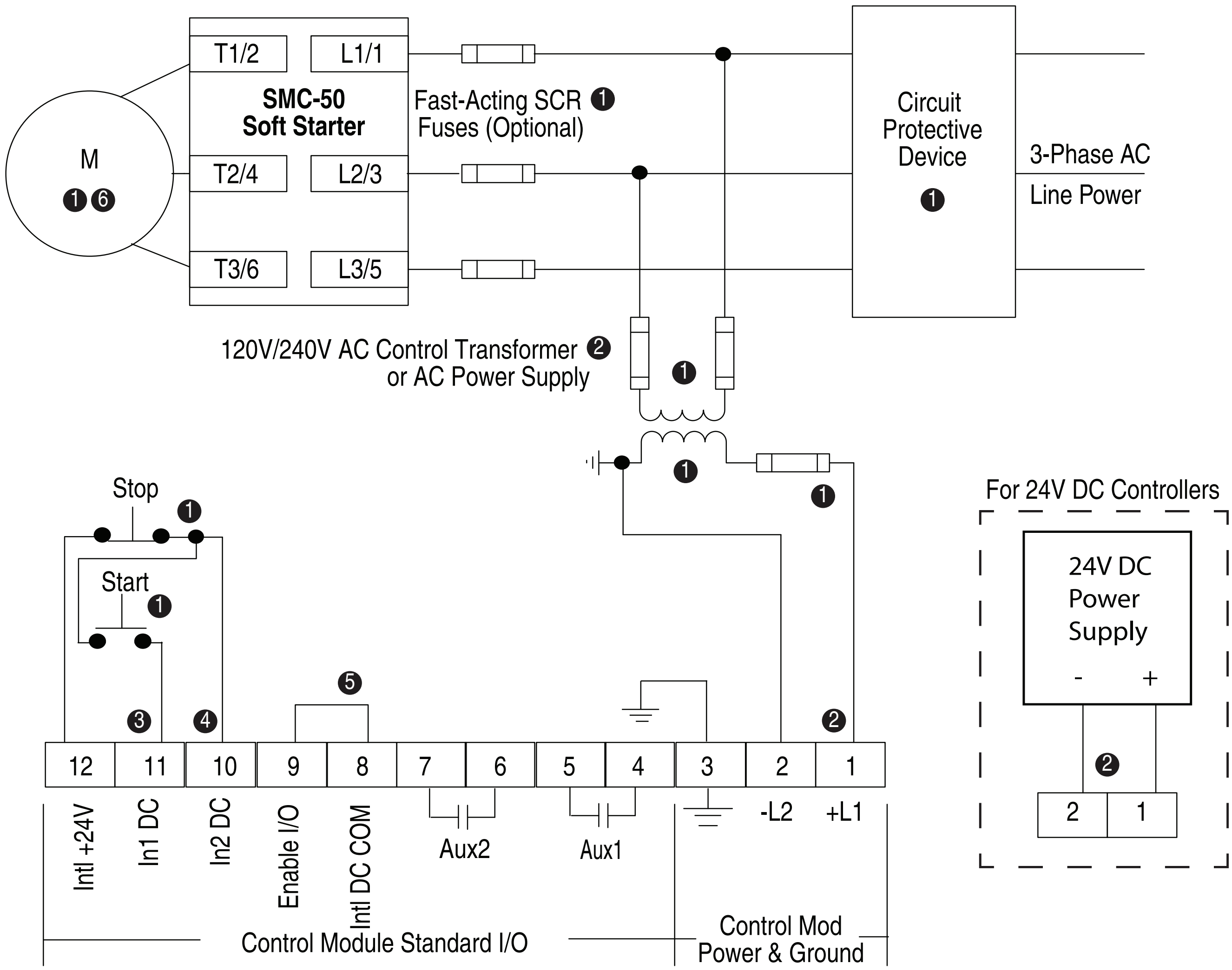


3. Remove the existing battery, disposing of it according to local environmental codes.
4. With the positive symbol of the new battery facing upward, properly seat the battery into place.
5. Perform the steps in Figure 98 on page 292 to replace the control module.
6. Reprogram/reset the clock.

Standard Controller Wiring Diagrams

Figure 30 through Figure 42 show typical wiring diagrams for the SMC-50.

Figure 30 - For Standard 3-Wire Control — DC Inputs, No DPI Control



❶ Customer supplied.

❷ See the controller nameplate to verify control power input ratings (100…240V AC or 24V DC).

❸ Terminal 11 (In 1 DC) 24V DC input configured for START input using Parameter 56.

❹ Terminal 10 (In 2 DC) 24V DC input configured for COAST, STOP option, etc. using Parameter 57.

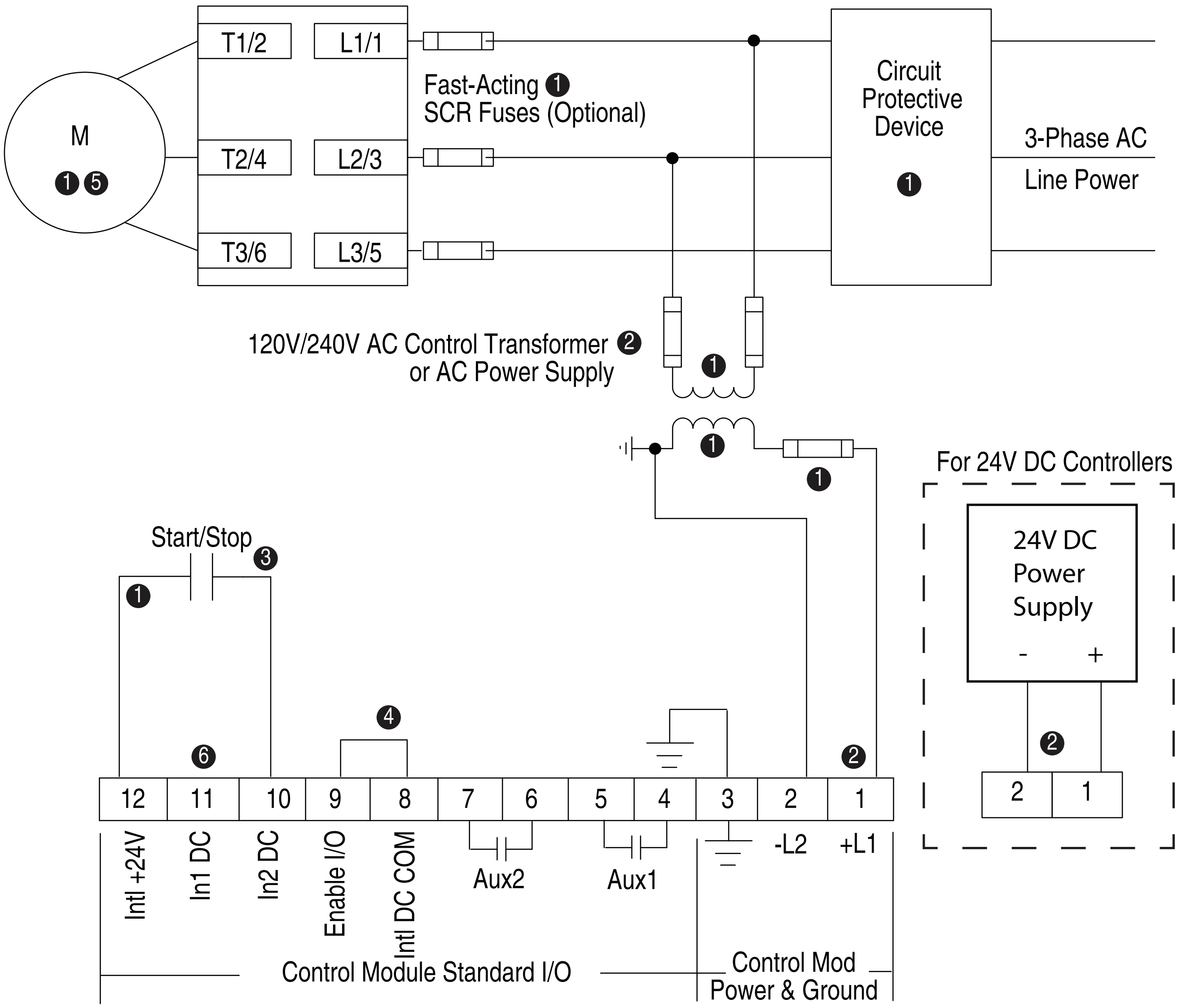
NOTE: The controller will generate an I/O configuration fault if any input is configured for START or SLOW speed and no input is selected for COAST or STOP.

❺ A customer supplied jumper is required to enable standard I/O operation.

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

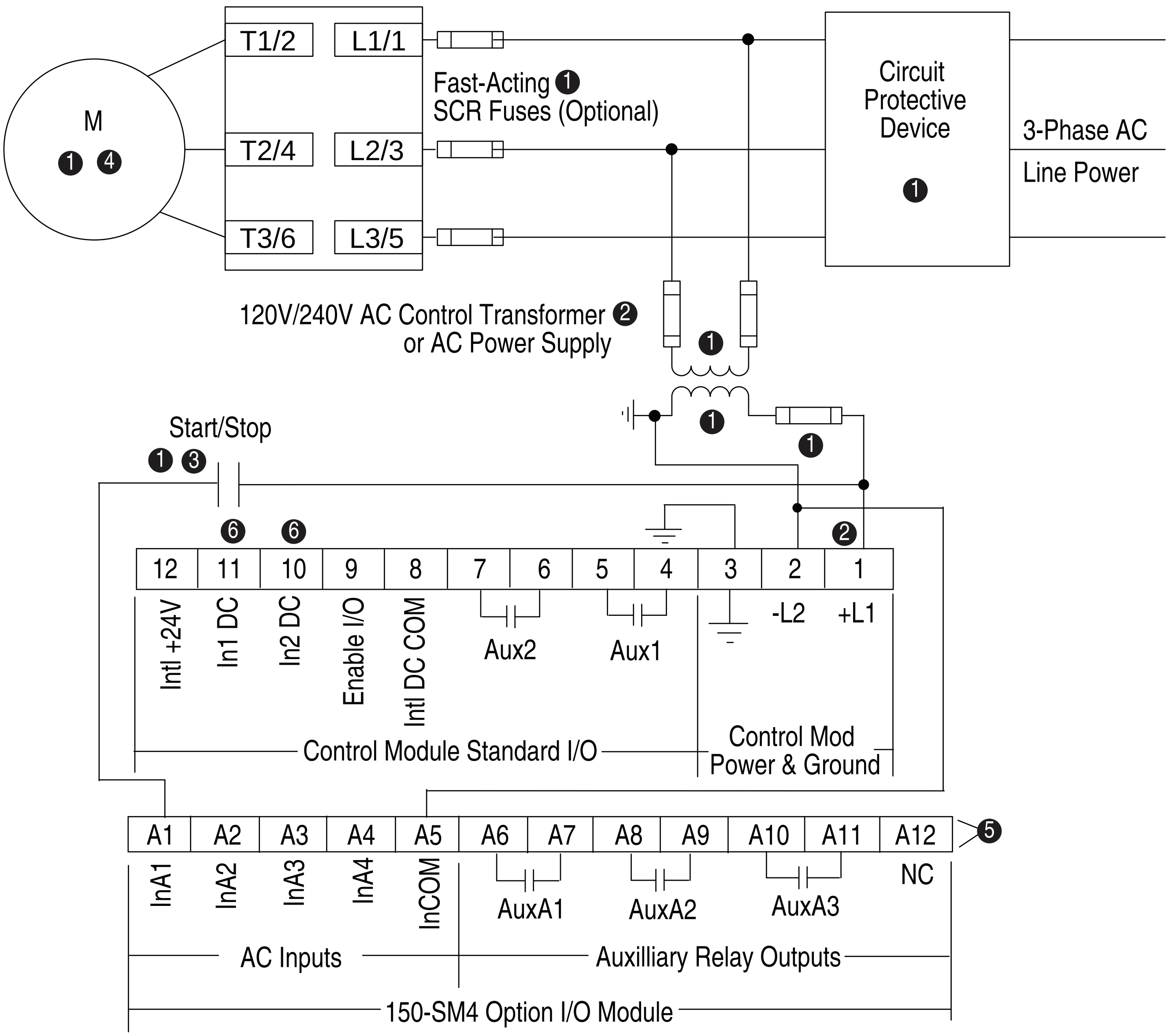
NOTE: In addition to a small amount of leakage current flowing through an SCR in the off-state, failure of one or more solid-state power switching components allows uncontrolled current to flow to the winding(s) of the motor. This could potentially result in overheating or damage to the motor. To prevent 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 is recommended. Operation of the isolation device should be coordinated using one of the SMC-50 Aux contacts configured to NORMAL.

Figure 31 - For 2-Wire Control with Stopping Capability — DC Inputs, No DPI Control



❶ Customer supplied.
❷ See the controller nameplate to verify control power input ratings (100...240V AC or 24V DC).
❸ Terminal 10 (In 2 DC) 24V DC N.O. input is configured for start/stop or start/coast using Parameter 57 (contact closed start initiated, contact open, stop initiated). When using start/stop or start/coast, a N.O. input contact **must** be used.
NOTE: The controller will generate an I/O configuration fault if any input is configured for START or SLOW speed and no input is selected for COAST or STOP.
❹ A customer-supplied jumper is required to enable controller standard I/O operation.
❺ 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 diagram for details.
❻ Configure In1 (Input 1 — Parameter 56) to "Disable".
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 is recommended. Operation of the isolation device should be coordinated using one of the SMC-50 Aux contacts configured to NORMAL.

Figure 32 - For 2-Wire Control with Stopping Capability — AC Inputs, No DPI Control



❶ Customer supplied.

❷ See the controller nameplate to verify control power input ratings (100...240V AC).

❸ Terminal A1 (InA1) 100...240V AC N.O. input is configured for start/stop or start/coast using Parameter 7-2 (control module port number 7) (contact closed, start initiated, contact open, stop initiated). When using start/stop or start/coast, a N.O. input contact **must** be used.

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

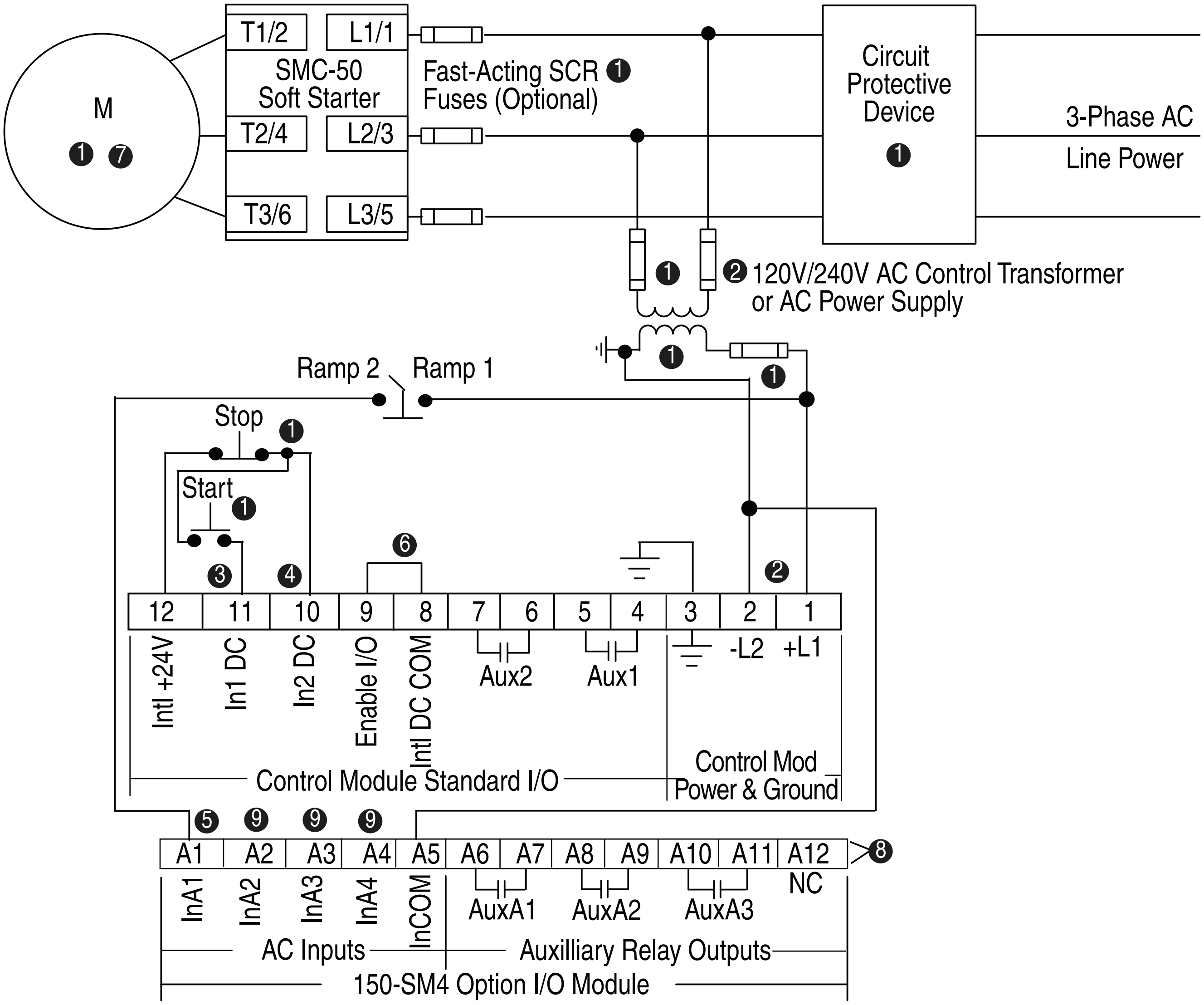
❹ Due to current leakage through an SCR in the OFF state (controller stopped), some form of upstream line power isolation is recommended if maintenance is required on the motor. See the Isolation Contactor Applications diagram for details.

❺ The order of the terminal numbers for the option I/O module can be reversed depending on which expansion slot option I/O module is located in on the control module. However, the function associated with the terminal number remains the same.

❻ Configure both In1 (Input 1 — Parameter 56) and In2 (Input 2 — Parameter 57) to "Disable".

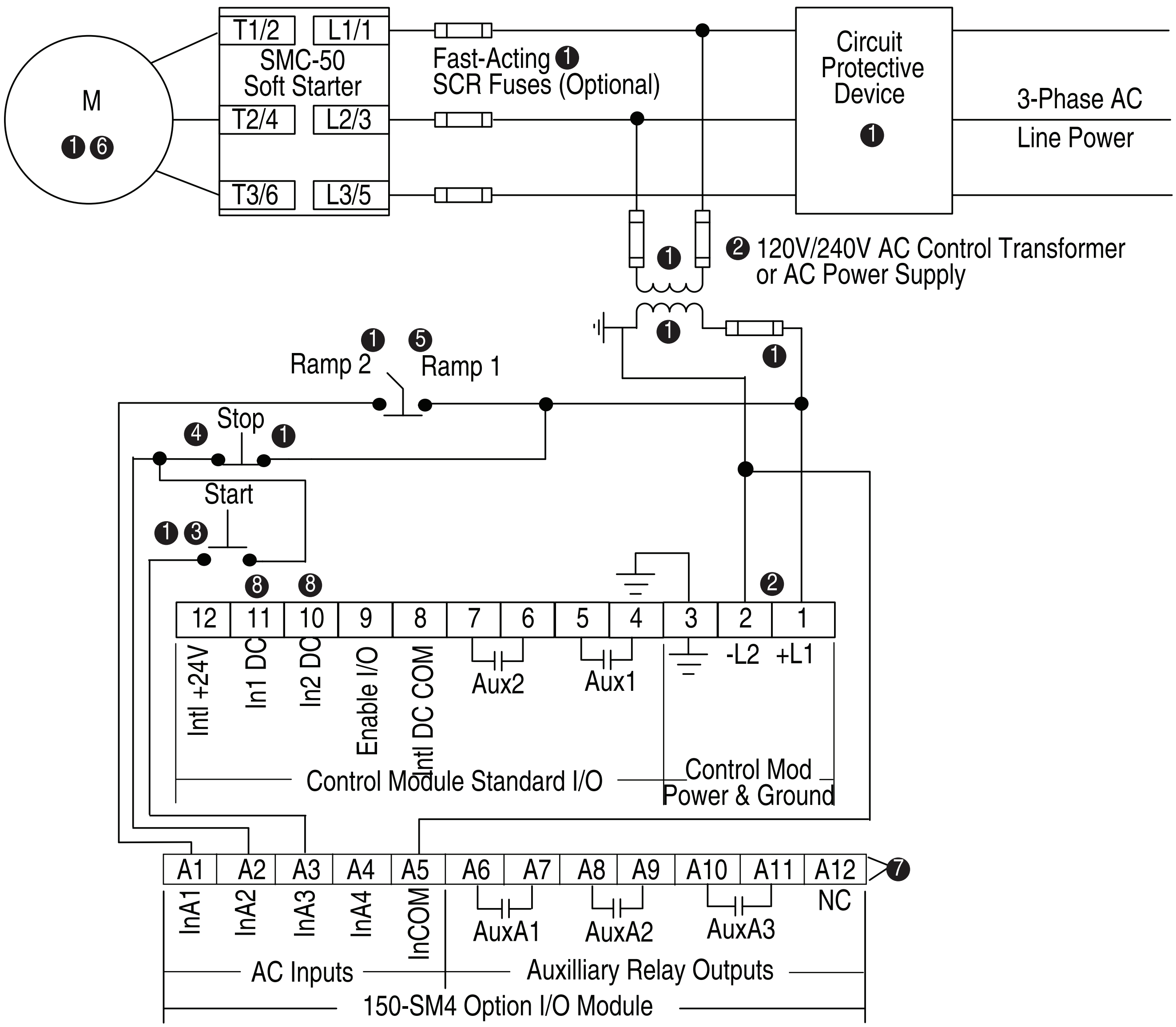
NOTE: In addition to a small amount of leakage current flowing through an SCR in the off-state, failure of one or more solid-state power switching components allows uncontrolled current to flow to the winding(s) of the motor. This could potentially result in overheating or damage to the motor. To prevent 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 is recommended. Operation of the isolation device should be coordinated using one of the SMC-50 Aux contacts configured to NORMAL.

Figure 33 - For Dual Ramp Applications — AC & DC Inputs



❶ Customer supplied.
❷ See the controller nameplate to verify control power input ratings (100…240V AC).
❸ Terminal 11 (In 1 DC) 24V DC input configured for START input using Parameter 56.
❹ Terminal 10 (In 2 DC) 24V DC input configured for COAST, STOP option, etc. using Parameter 57.
NOTE: The controller will generate an I/O configuration fault if any input is configured for START or SLOW speed and no input is selected for COAST or STOP.
❺ Terminal A1 (INA1) 100…240V AC input is configured for Dual Ramp using Parameter 7-2 (control module port 7).
❻ A customer supplied jumper is required to enable controller I/O operation.
❼ Due to current leakage through an SCR in the OFF state (controller stopped), some form of off-stream line power isolation is recommended if maintenance is required on the motor. See the Isolation Contactor Applications diagram for details.
❽ The order of the terminal numbers for the option I/O module can be reversed depending on which expansion slot option I/O module is located in on the control module. However, the function associated with the terminal number remains the same.
❾ Ensure that InA2, InA3, and InA4 are configured to "Disable" [Default].
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 is recommended. Operation of the isolation device should be coordinated using one of the SMC-50 Aux contacts configured to NORMAL.

Figure 34 - For Dual Ramp — AC Inputs



❶ Customer supplied.

❷ See the controller nameplate to verify control power input ratings (100...240V AC).

❸ Terminal A3 (InA3) 100...240V AC input configured for START input using Parameter 7-4 (control module port 7).

❹ Terminal A2 (InA2) 100...240V AC input configured for COAST, STOP option, etc. using Parameter 7-3 (control module port 7).

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

❺ Terminal A1 (InA1) 100...240V AC input is configured for Dual Ramp using Parameter 7-2 (control module port 7).

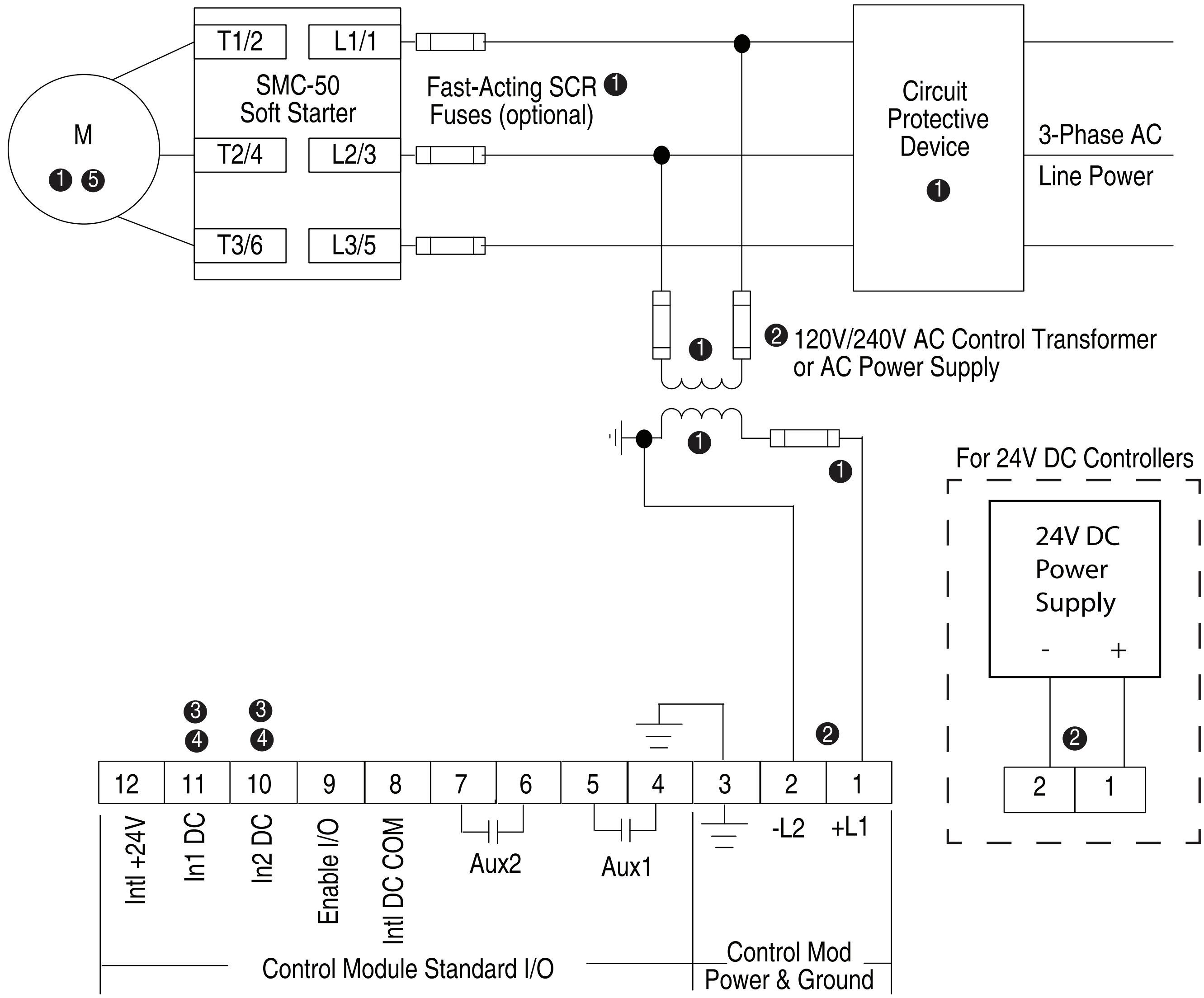
❻ Due to current leakage through an SCR in the OFF state (controller stopped), some form of off-stream line power isolation is recommended if maintenance is required on the motor. See the Isolation Contactor Applications diagram for details.

❼ The order of the terminal numbers for the option I/O module can be reversed depending on which expansion slot the option I/O module is located on the control in the control module. However, the function associated with the terminal number remains the same.

❽ Configure both In1 (Input 1 — Parameter 56) and In2 (Input 2 — Parameter 57) to "Disable".

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 is recommended. Operation of the isolation device should be coordinated using one of the SMC-50 Aux contacts configured to NORMAL.

Figure 35 - For Start/Stop Control via HIM or Communications



❶ Customer supplied.

❷ See the controller nameplate to verify the control power input ratings (100...240V AC or 24V DC).

❸ Configure both In1 (Input 1 — Parameter 56) and In2 (Input 2 — Parameter 57) to "Disable".

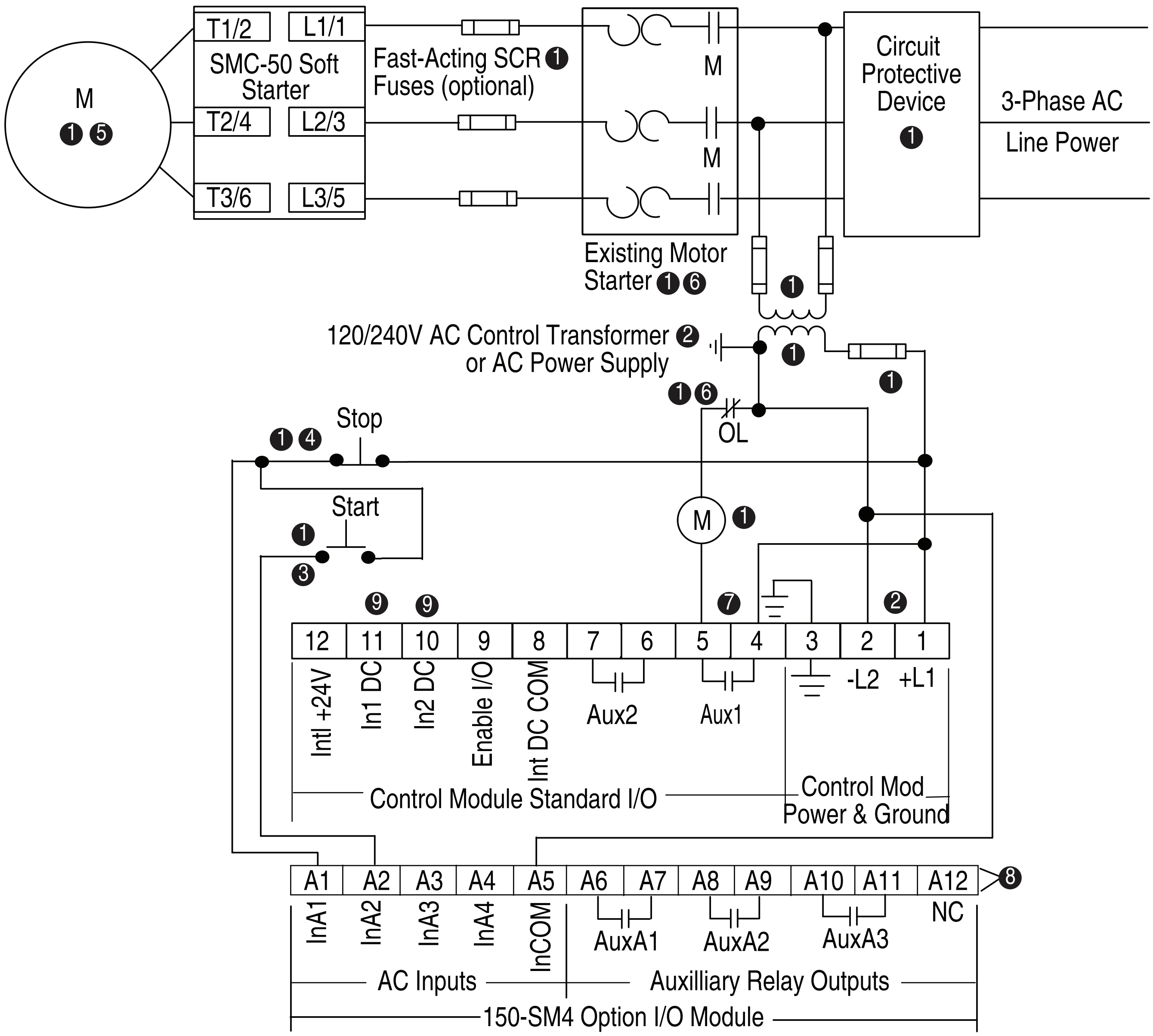
NOTE: If terminal 10 and 11 are required for a non Stop/Start function (e.g. slow speed), see Parameter 56 and Parameter 57 Communication Control word bits 0-5 for options.

❹ For DPI operation, if the start/stop operation is done via communications (DPI port, 20-COMM module, or HIM) the appropriate bit (0...4) in the Logic Mask, Parameter 148, must be set. See Chapter 8, Communications for additional details.

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

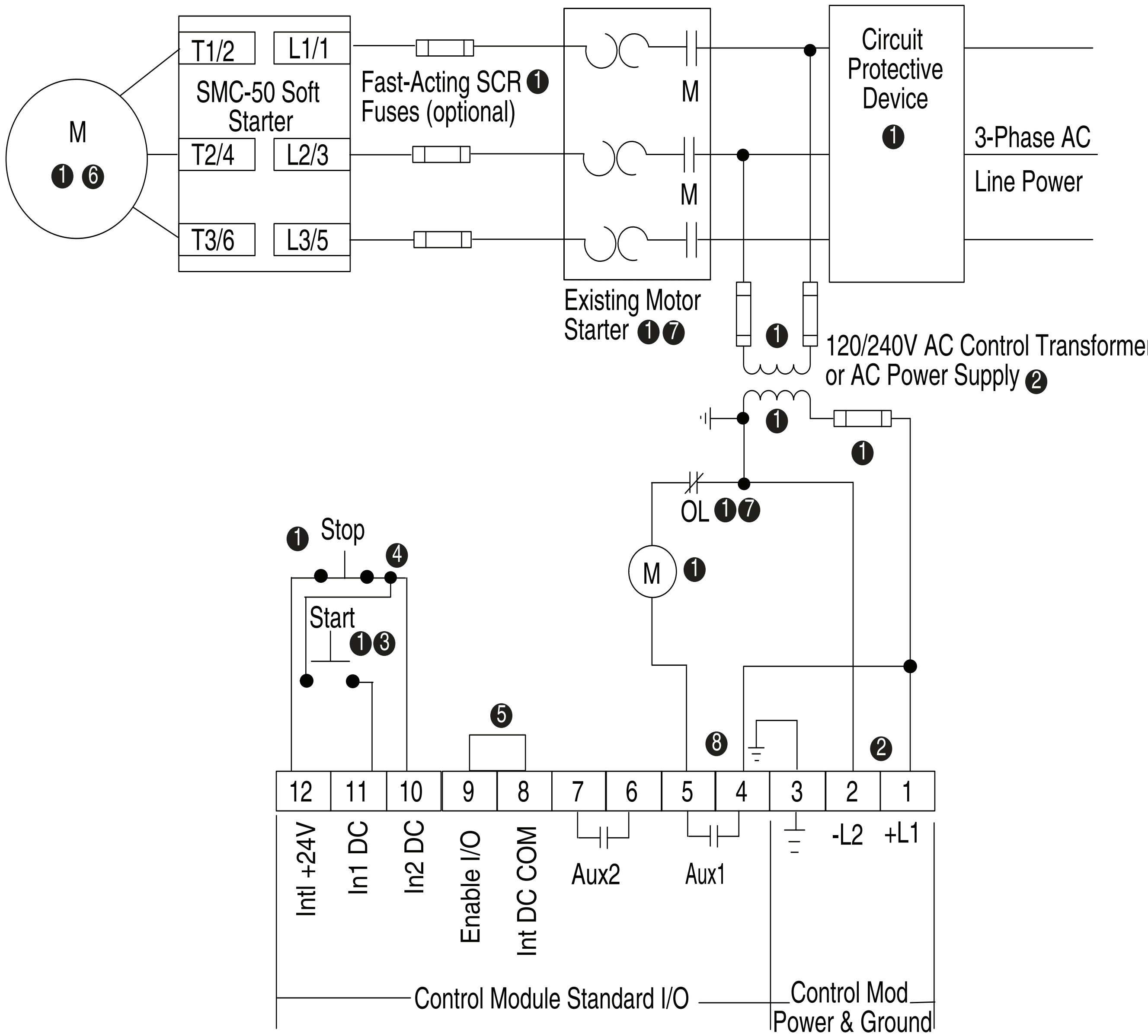
NOTE: In addition to a small amount of leakage current flowing through an SCR in the off-state, failure of one or more solid-state power switching components allows uncontrolled current to flow to the winding(s) of the motor. This could potentially result in overheating or damage to the motor. To prevent 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 is recommended. Operation of the isolation device should be coordinated using one of the SMC-50 Aux contacts configured to NORMAL.

Figure 36 - For Retrofit Applications — AC Inputs, No DPI Control



❶ Customer supplied.
❷ See the controller nameplate to verify the control power input ratings (100...240V AC).
❸ Terminal A2 (InA2) 100...240V AC input configured for START input using Parameter 7-3 (control module port 7).
❹ Terminal A1 (InA1) 100...240V AC input configured for Coast, Stop Option, etc, using Parameter 7-2 (control module port 7).
NOTE: The controller will generate an I/O configuration fault if any input is configured for START or SLOW speed and no input is configured for COAST or STOP.
❺ 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. In this example, the Existing Motor Starter fulfills that requirement.
❻ Due to existing motor starter overload protection, the overload protection should be disabled in the SMC-50 controller.
❼ Set Aux 1 to NORMAL using Parameter 172. NORMAL = Aux 1 contact will close to energize the M coil with the START push button and will open to de-energize it when the stop maneuver, initiated by the stop push button, is complete.
❽ The order of the terminal numbers for the option I/O module cam be reversed depending on which expansion slot it is located in on the control module. However, the function associated with the terminal number remains the same.
❾ Configure both In1 (Input 1 — Parameter 56) and In2 (Input 2 — Parameter 57) to "Disable".

Figure 37 - For Retrofit Applications – DC Inputs, No DPI Control



❶ Customer supplied.

❷ See the controller nameplate to verify the control power input ratings (100...240V AC).

❸ Terminal 11 (In1 DC) 24V DC input is configured for START input using Parameter 56.

❹ Terminal 10 (In2 DC) 24V DC input configured for COAST, STOP OPTION, etc. using Parameter 57.

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

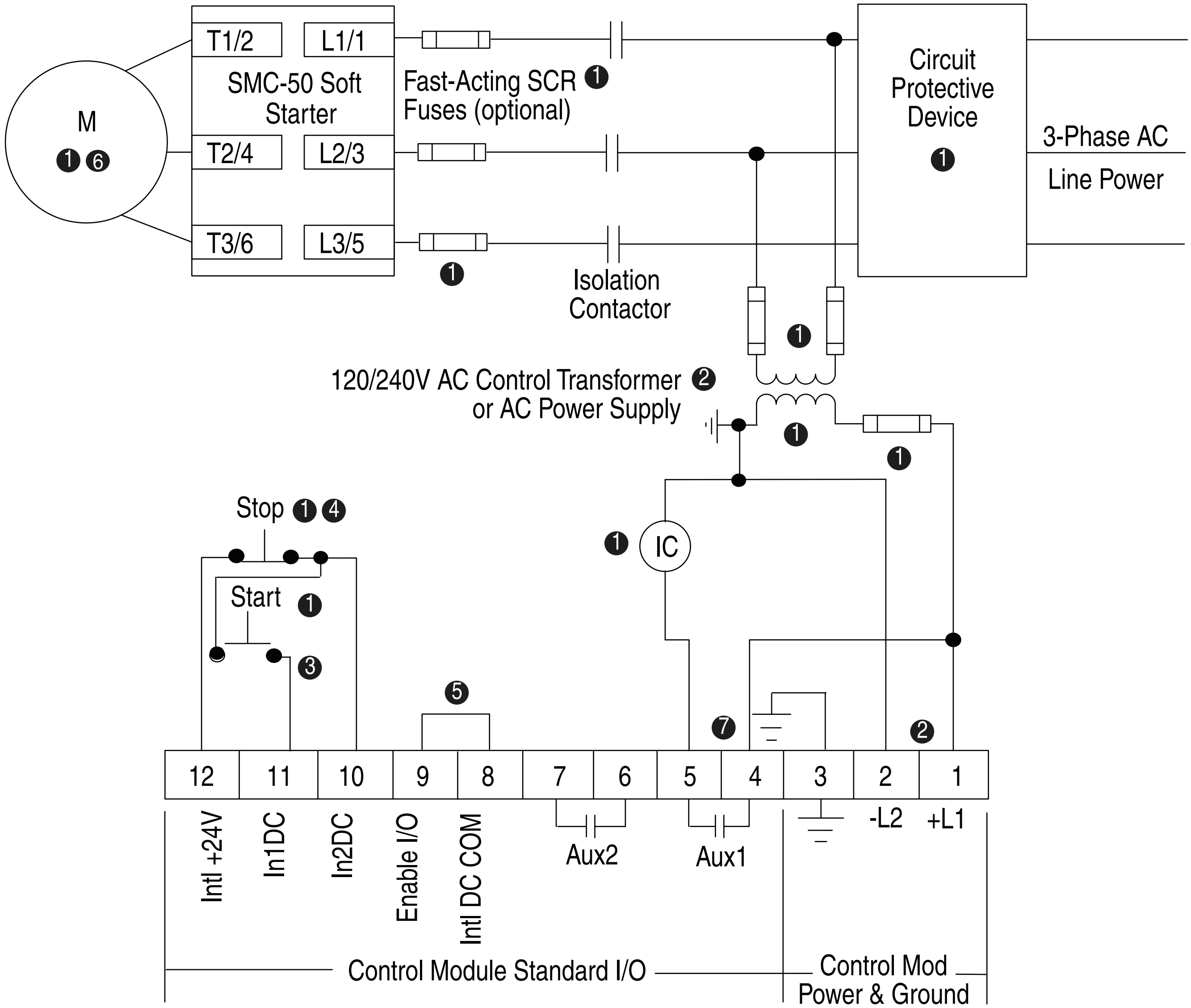
❺ A customer-supplied jumper is required to enable the controller I/O operation.

❻ 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. In this example, the existing Motor Starter fulfills that requirement.

❼ Due to existing motor starter overload protection, the overload protection should be disabled in the SMC-50 controller.

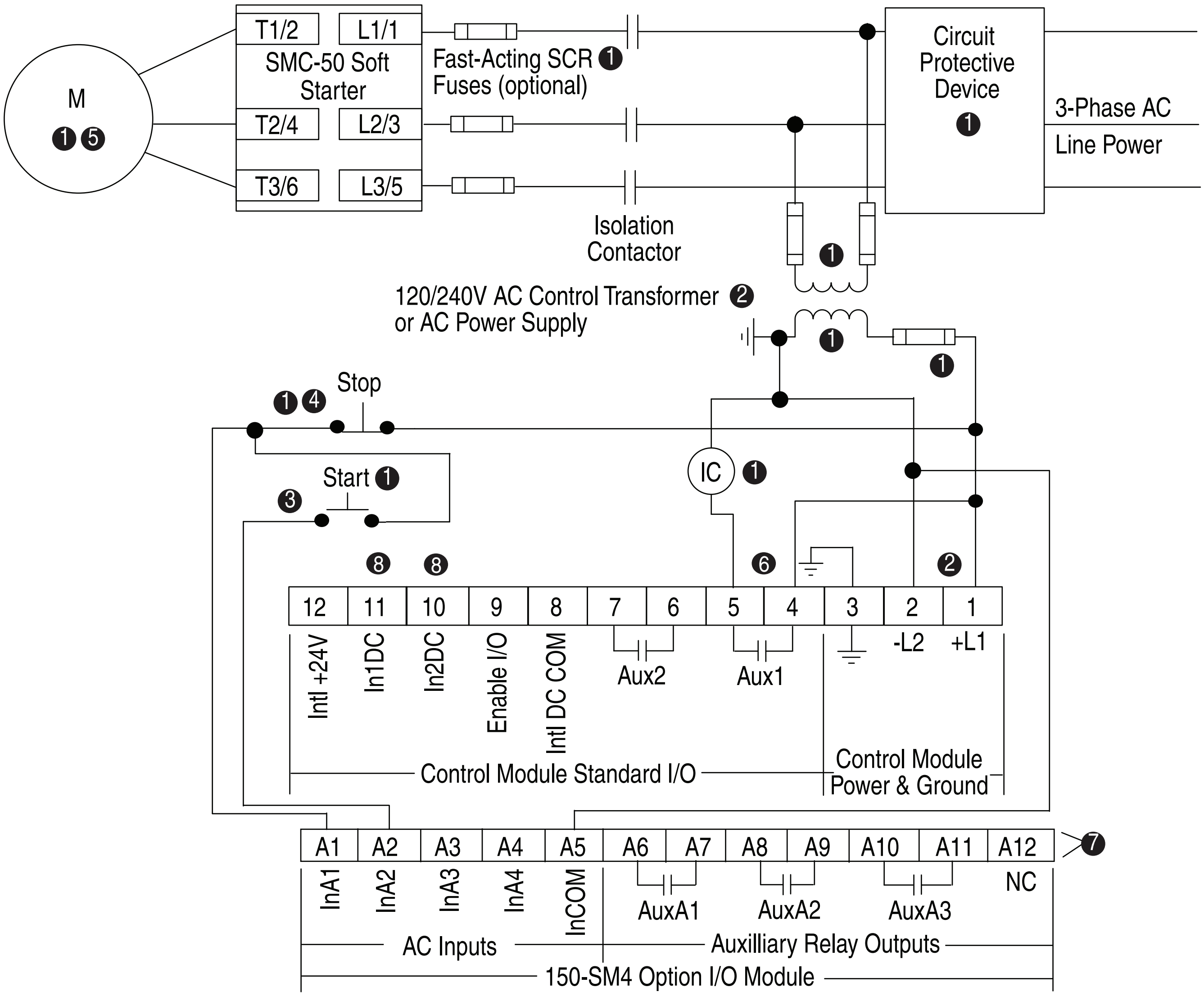
❽ Set Aux 1 to NORMAL using Parameter 172. NORMAL = Aux 1 contact will close to energize the M coil with the START push button and will open to de-energize it when the stop maneuver, initiated by the stop push button, is complete.

Figure 38 - For Isolation Contactor Applications — DC Inputs



❶ Customer supplied.
❷ See the controller nameplate to verify the control power input ratings (100…240V AC).
❸ Terminal 11 (In1 DC) 24V DC input is configured for START input using Parameter 56.
❹ Terminal 10 (In2 DC) 24V DC input configured for COAST, STOP OPTION, etc. using Parameter 57.
NOTE: The controller will generate an I/O configuration fault if any input is configured for START or SLOW speed and no input is configured for COAST or STOP.
❺ A customer-supplied jumper is required to enable the controller I/O operation.
❻ Due to current leakage through an SCR in the OFF state (controller stopped), some form of upstream line power isolation (e.g., the Isolation Contactor used in this diagram) is recommended if maintenance is required on the motor.
❼ Configure Aux 1 to NORMAL using Parameter 172. NORMAL = Aux 1 contact will close to energize the IC coil with the START push button and will open to de-energize it when the stop maneuver, initiated by the stop push button, is complete.
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 (as shown in this diagram) or shunt trip-type circuit breaker capable of interrupting the motor's locked rotor current on the line side of the SMC-50 is recommended. Operation of the isolation device should be coordinated using one of the SMC-50 Aux contacts configured to NORMAL.

Figure 39 - For Isolation Contactor Applications — AC Inputs



❶ Customer supplied.

❷ See the controller nameplate to verify the control power input ratings (100...240V AC).

❸ Terminal A2 (InA2) 100...240V AC input is configured for START input using Parameter 7-3 (control module port 7).

❹ Terminal A1 (InA1) 100...240V AC input configured for COAST, STOP OPTION, etc. using Parameter 7-2 (control module port 7).

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

❺ Due to current leakage through an SCR in the OFF state (controller stopped), some form of upstream line power isolation (e.g., the isolation contactor used in this diagram) is recommended if maintenance is required on the motor.

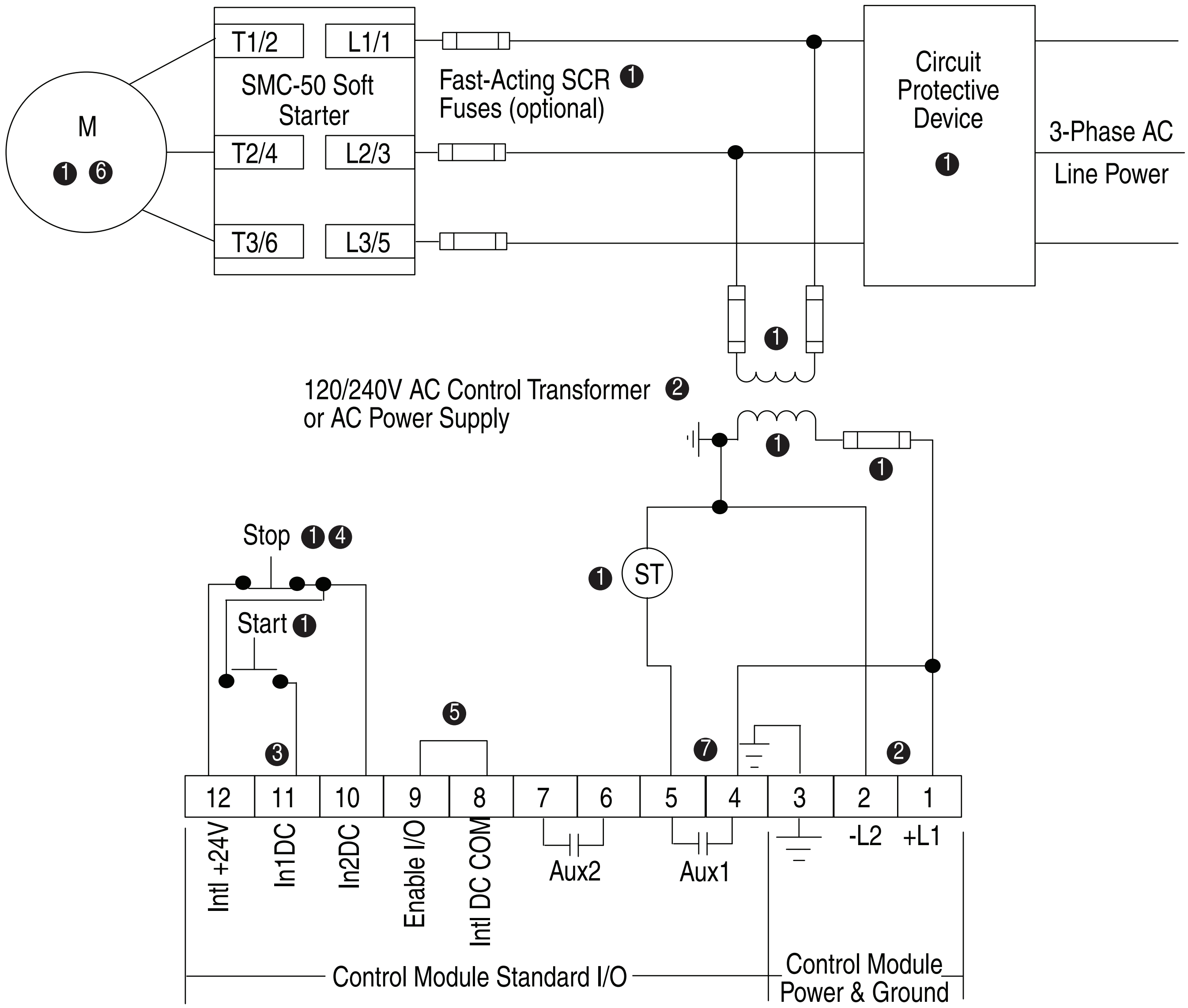
❻ Configure Aux 1 to NORMAL using Parameter 172. NORMAL = Aux 1 contact will close to energize the IC coil with the START push button and will open to de-energize it when the stop maneuver, initiated by the stop push button, is complete.

❼ The order of the terminal numbers for the option I/O module can be reversed depending on which expansion slot it is located in on the control module. However, the function associated with the terminal number remains the same.

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 (as shown in this diagram) or shunt trip-type circuit breaker capable of interrupting the motor's locked rotor current on the line side of the SMC-50 is recommended. Operation of the isolation device should be coordinated using one of the SMC-50 Aux contacts configured to NORMAL.

❽ Configure both In1 (Input 1 — Parameter 56) and In2 (Input 2 — Parameter 57) to "Disable".

Figure 40 - For Shunt Trip Applications — DC Inputs



❶ Customer supplied.

❷ See the controller nameplate to verify the control power input ratings (100...240V AC).

❸ Terminal 11 (In1 DC) 24V DC input is configured for START input using Parameter 56.

❹ Terminal 10 (In2 DC) 24V DC input configured for COAST, STOP OPTION, etc. using Parameter 57.

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

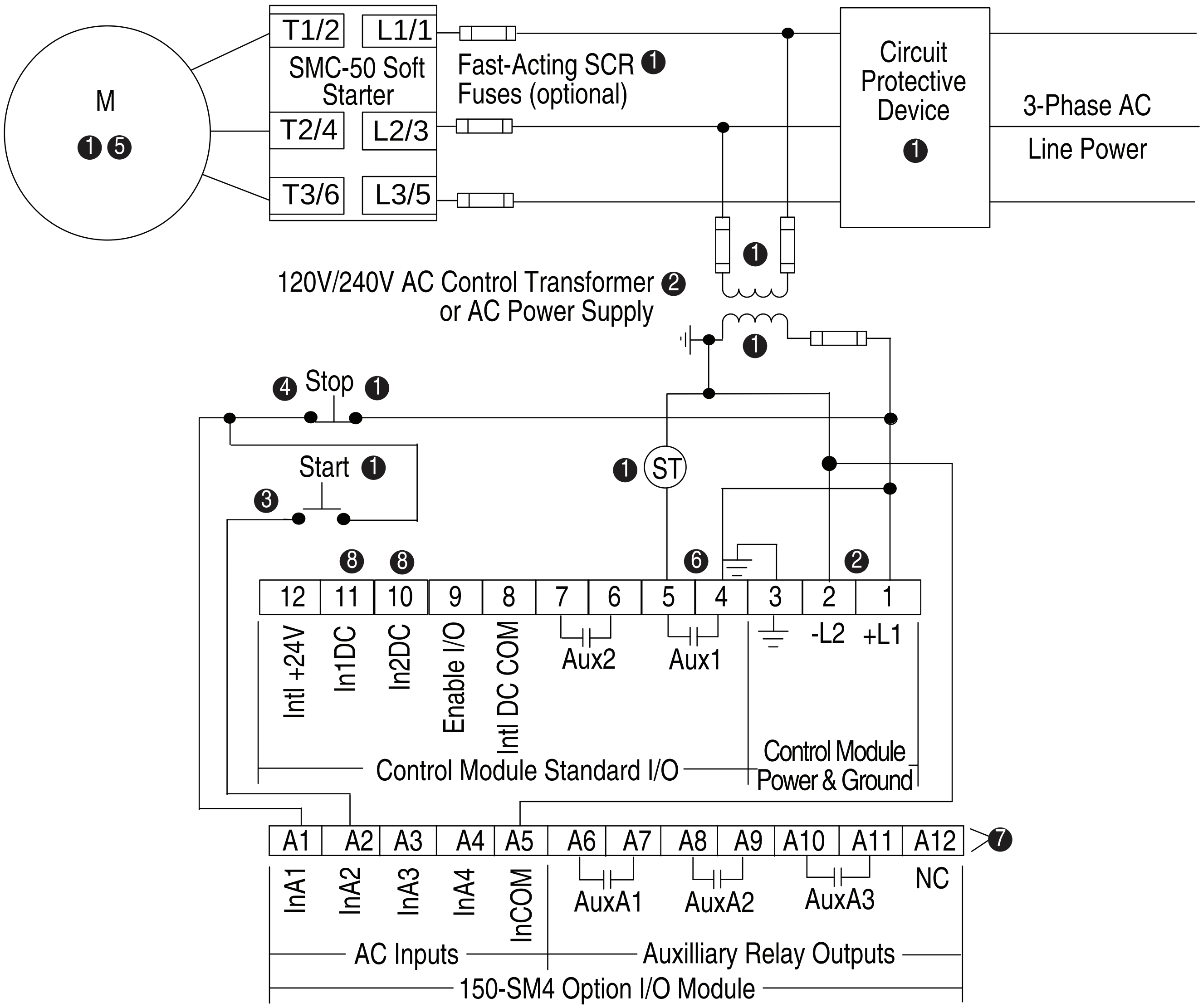
❺ A customer-supplied jumper is required to enable the controller I/O operation.

❻ 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 Application for details.

❼ Configure Aux 1 to FAULT using Parameter 172. During a controller fault condition, the Aux 1 contact will close to energize the Shunt Trip (ST) coil.

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 is recommended. Operation of the isolation device should be coordinated using one of the SMC-50 Aux contacts configured to NORMAL.

Figure 41 - For Shunt Trip Applications — AC Inputs



❶ Customer supplied.

❷ See the controller nameplate to verify the control power input ratings (100...240V AC or 24V DC).

❸ Terminal A2 (InA2) 100...240V AC input is configured for START input using Parameter 7-3 (control module port 7).

❹ Terminal A1 (InA1) 100...240V AC input configured for COAST, STOP OPTION, etc. using Parameter 7-2 (control module port 7).

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

❺ 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 Application for details.

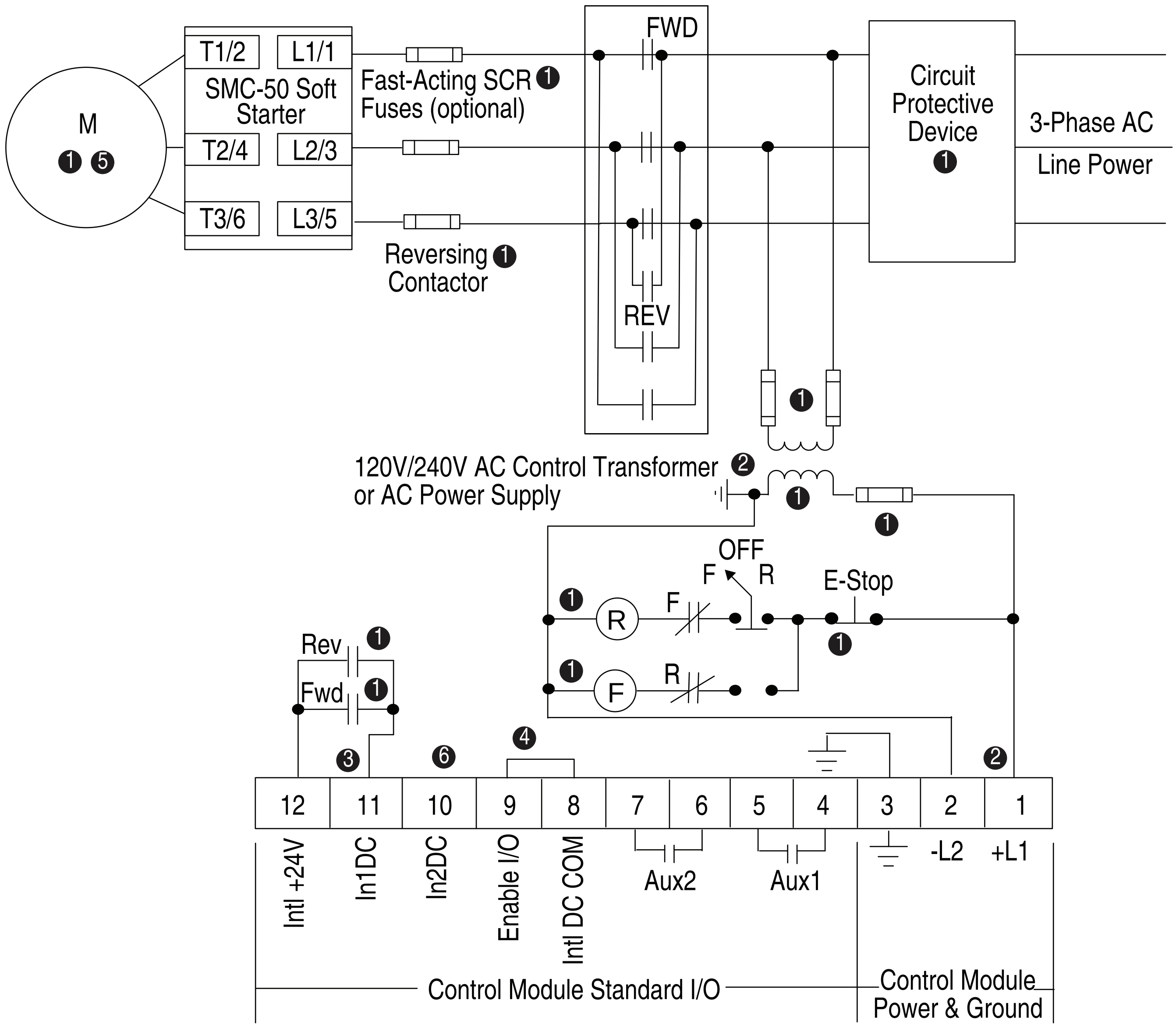
❻ Configure Aux 1 to FAULT using Parameter 172. During a controlled fault condition the Aux 1 contact will close to energize the Shunt Trip (ST) coil.

❼ The order of the terminal numbers for the option I/O module can be reversed depending on which expansion slot it is located in on the control module. However, the function associated with the terminal number remains the same.

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 is recommended. Operation of the isolation device should be coordinated using one of the SMC-50 Aux contacts configured to NORMAL.

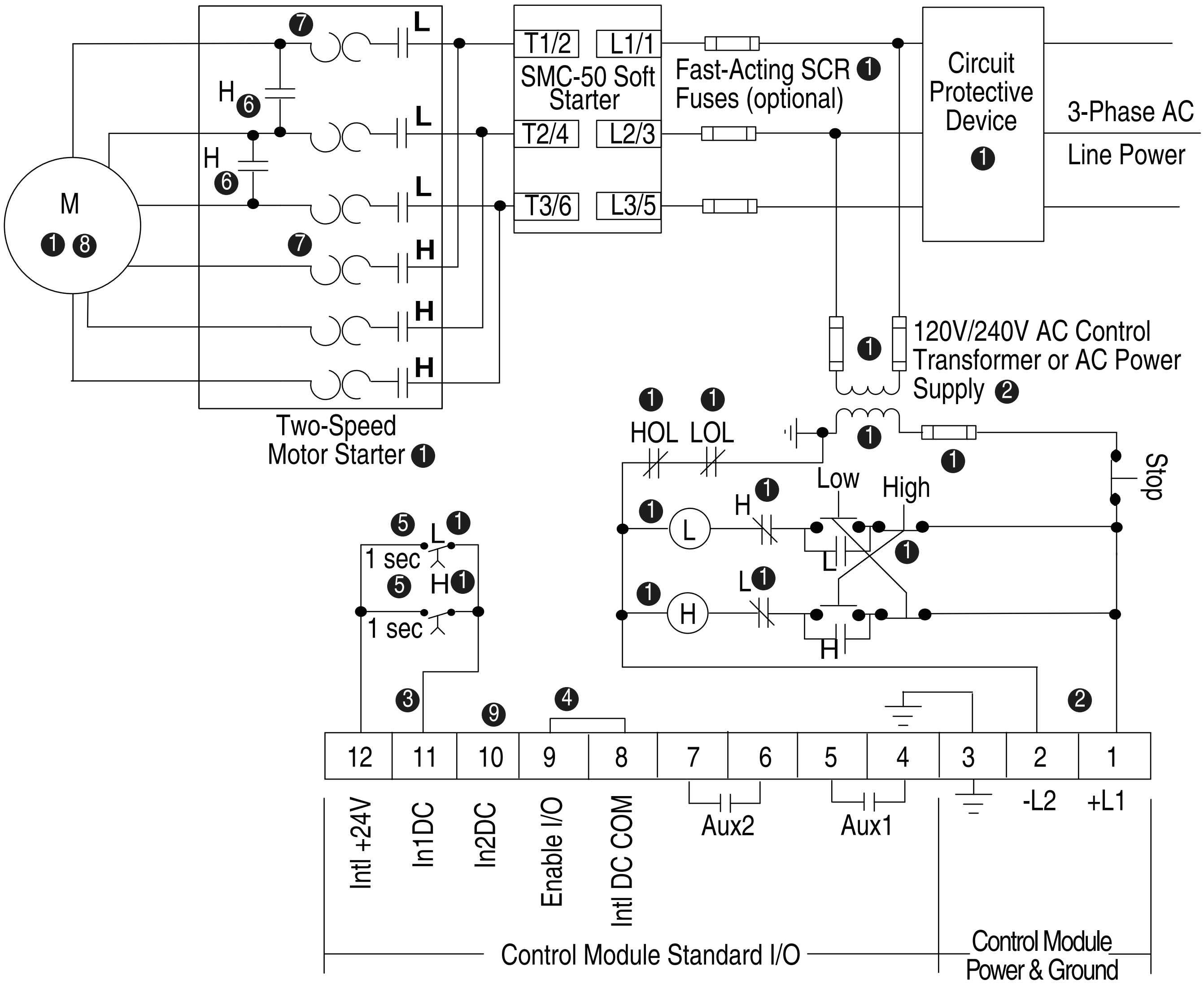
❽ Configure both In1 (Input 1 — Parameter 56) and In2 (Input 2 — Parameter 57) to "Disable".

Figure 42 - For Single-Speed Reversing Applications — DC Control



❶ Customer supplied.
❷ See the controller nameplate to verify the control power input ratings (100...240V AC).
❸ Terminal 11 (In1 DC) 24V DC input is configured for START/COAST using Parameter 56.
NOTE: The controller will generate an I/O configuration fault if any input is configured for START or SLOW speed and no input is configured for COAST or STOP.
❹ A customer-supplied jumper is required to enable the controller I/O operation.
❺ 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. In this example, the reversing contactor provides isolation.
❻ Configure In2DC (Input 2 - Parameter 57) to "Disable".
NOTE: The SMC-50 minimum transition time for reversing is 0.5 s. The SMC-50 phase reversal must be disabled in reversing applications.

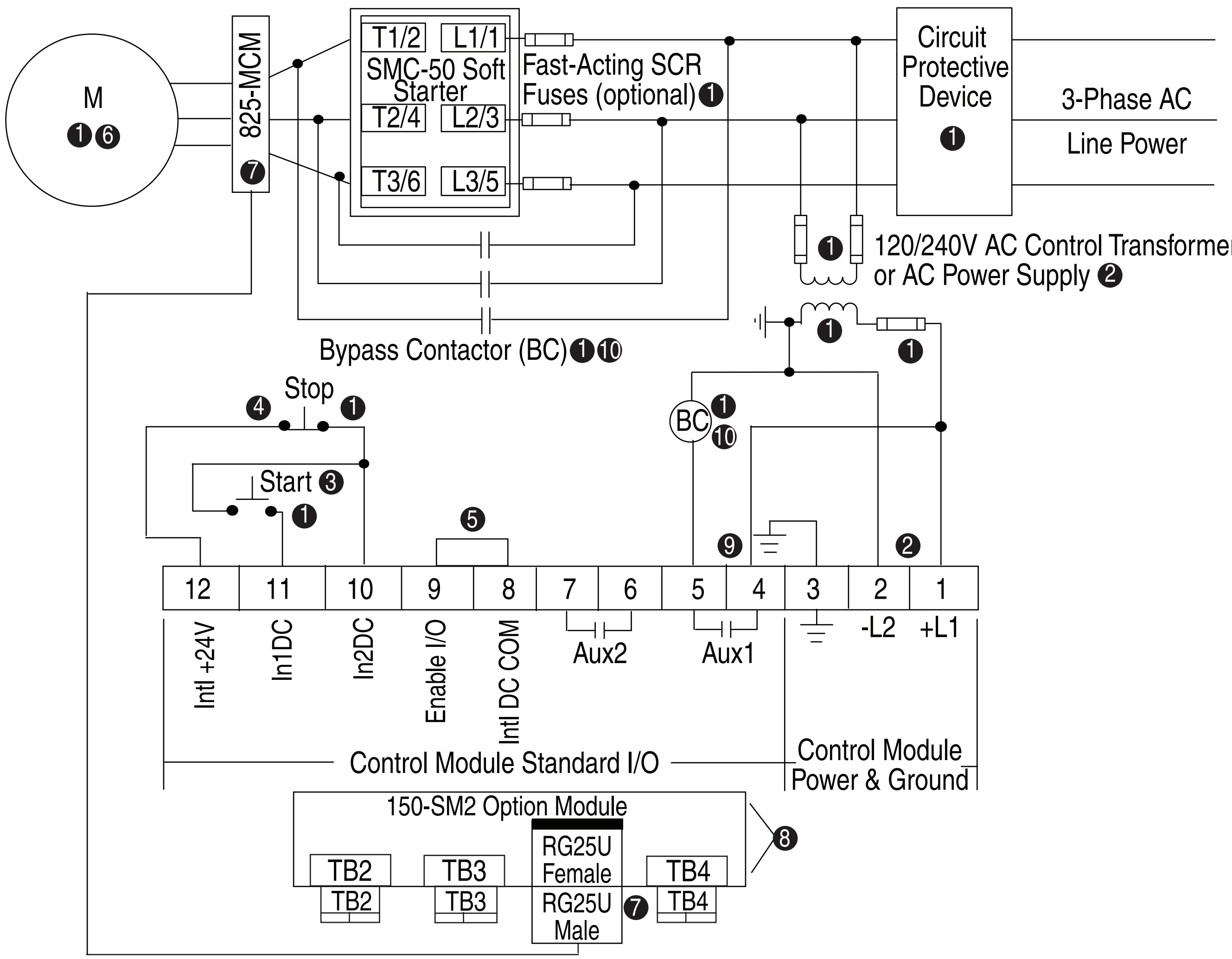
Figure 43 - For Two-Speed Applications — DC Control



❶ Customer supplied.
❷ See the controller nameplate to verify the control power input ratings (100...240V AC).
❸ Terminal 11 (In1 DC) 24V DC input is configured for START/COAST using Parameter 56.
NOTE: The controller will generate an I/O configuration fault if any input is configured for START or SLOW speed and no input is configured for COAST or STOP.
❹ A customer-supplied jumper is required to enable the controller I/O operation.
❺ Customer-supplied timers with hard contact are required to accept DC power.
❻ Two-speed consequent pole operations.
❼ The SMC-50 overload must be disabled.
❽ 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 Application for details.
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 is recommended. Operation of the isolation device should be coordinated using one of the SMC-50 Aux contacts configured to NORMAL.
❾ Configure In2DC (Input 2 - Parameter 57) to "Disable".

Figure 44 - For SMC Start, Run On Bypass — DC Inputs

See *External Bypass Control Mode* on page 91 for additional configurations



❶ Customer supplied.

❷ See the controller nameplate to verify the control power input ratings (100...240V AC).

❸ Terminal 11 (In1 DC) 24V DC input is configured for START input using Parameter 56.

❹ Terminal 10 (In2 DC) 24V DC input configured for COAST, STOP OPTION, etc. using Parameter 57.

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

❺ A customer-supplied jumper is required to enable the controller I/O operation.

❻ 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.

❼ In Bypass Contactor RUN operation, the 825-MCM and the 150-SM2 provide current-based protective feedback features including overload. Only the cable 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.

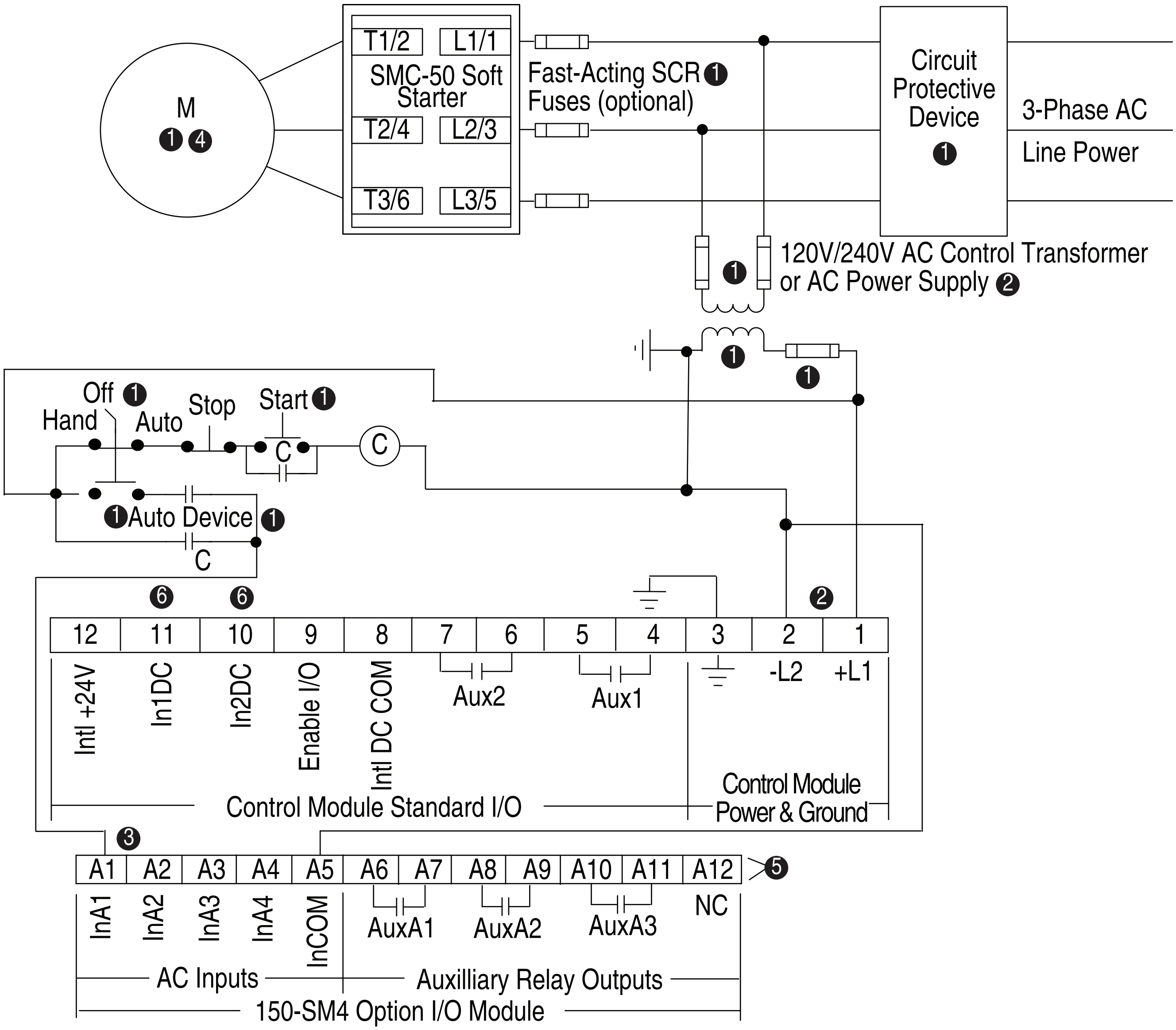
❽ The order of the terminal numbers for the 150-SM2 module can be reversed depending on which expansion slot it is located in the control module. However, the function associated with the terminal number remains the same.

❾ The Aux 1 relay output is configured for external bypass using Parameter 172.

❿ 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 the SMC-50.

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 is recommended. Operation of the isolation device should be coordinated using one of the SMC-50 Aux contacts configured to NORMAL.

Figure 45 - Hand-OFF-Auto Control with Start/Stop Push Buttons — AC Control



❶ Customer supplied.

❷ See the controller nameplate to verify the control power input ratings (100...240V AC).

❸ Terminal A1 (InA1) 100...240V AC input is configured for START/STOP or START/COAST using Parameter 7-2 (control module port 7, Start = Input High, Coast/Stop = Input Low).

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

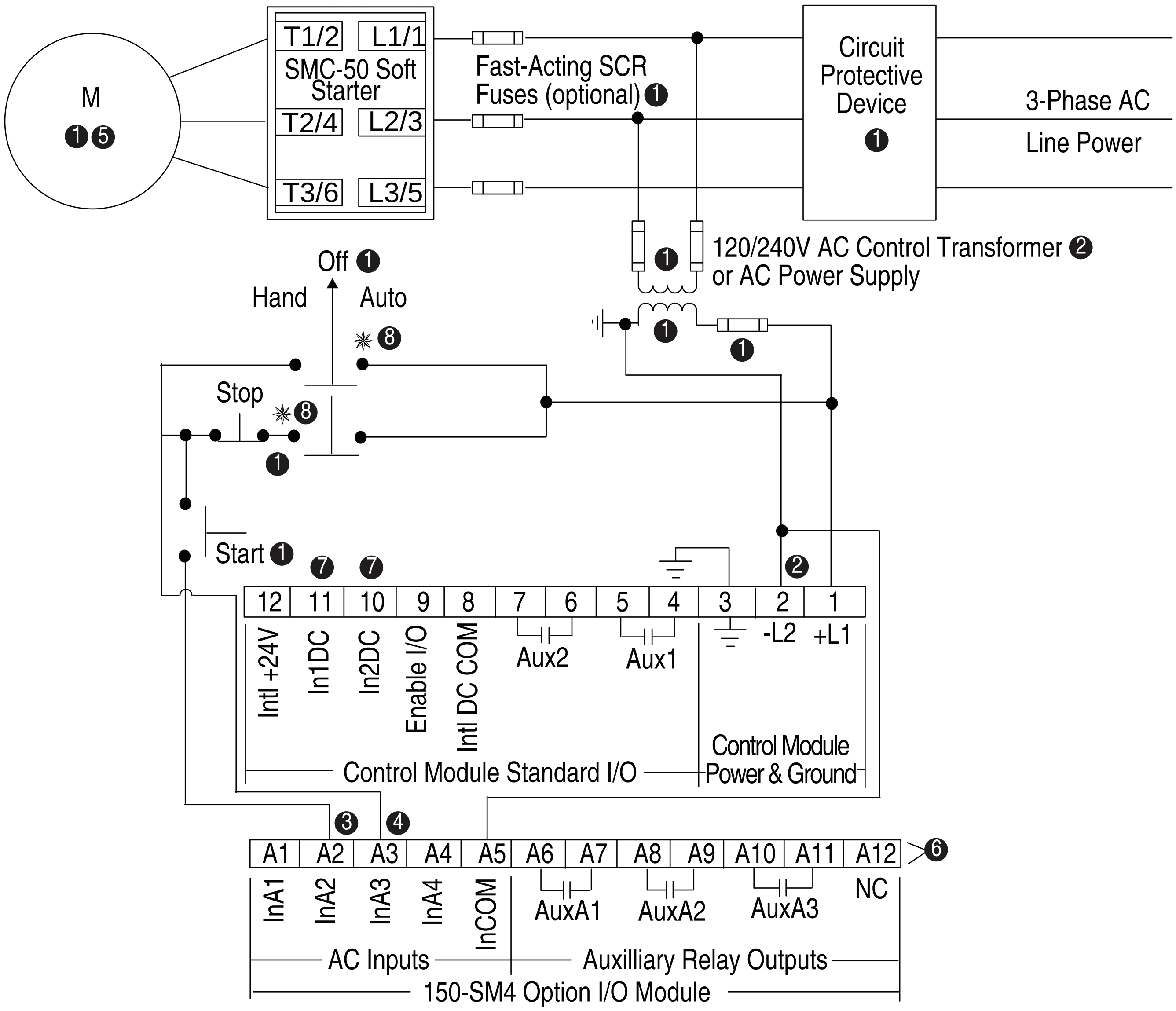
❹ Due to current leakage through an SCR in the OFF state (controller stopped), some form of upstream line power isolation is recommended if maintenance is required on the motor. See the Isolation Contactor Applications diagram for details.

❺ The order of the terminal numbers for the option I/O module can be reversed depending on which expansion port it is located in on the control module. However, the function associated with the terminal number remains the same.

❻ Configure both In1 (Input 1 — Parameter 56) and In2 (Input 2 — Parameter 57) to "Disable".

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 is recommended. Operation of the isolation device should be coordinated using one of the SMC-50 Aux contacts configured to NORMAL.

Figure 46 - For Hand-OFF-Auto (DPI) with Start/Stop Push Buttons — AC I/O

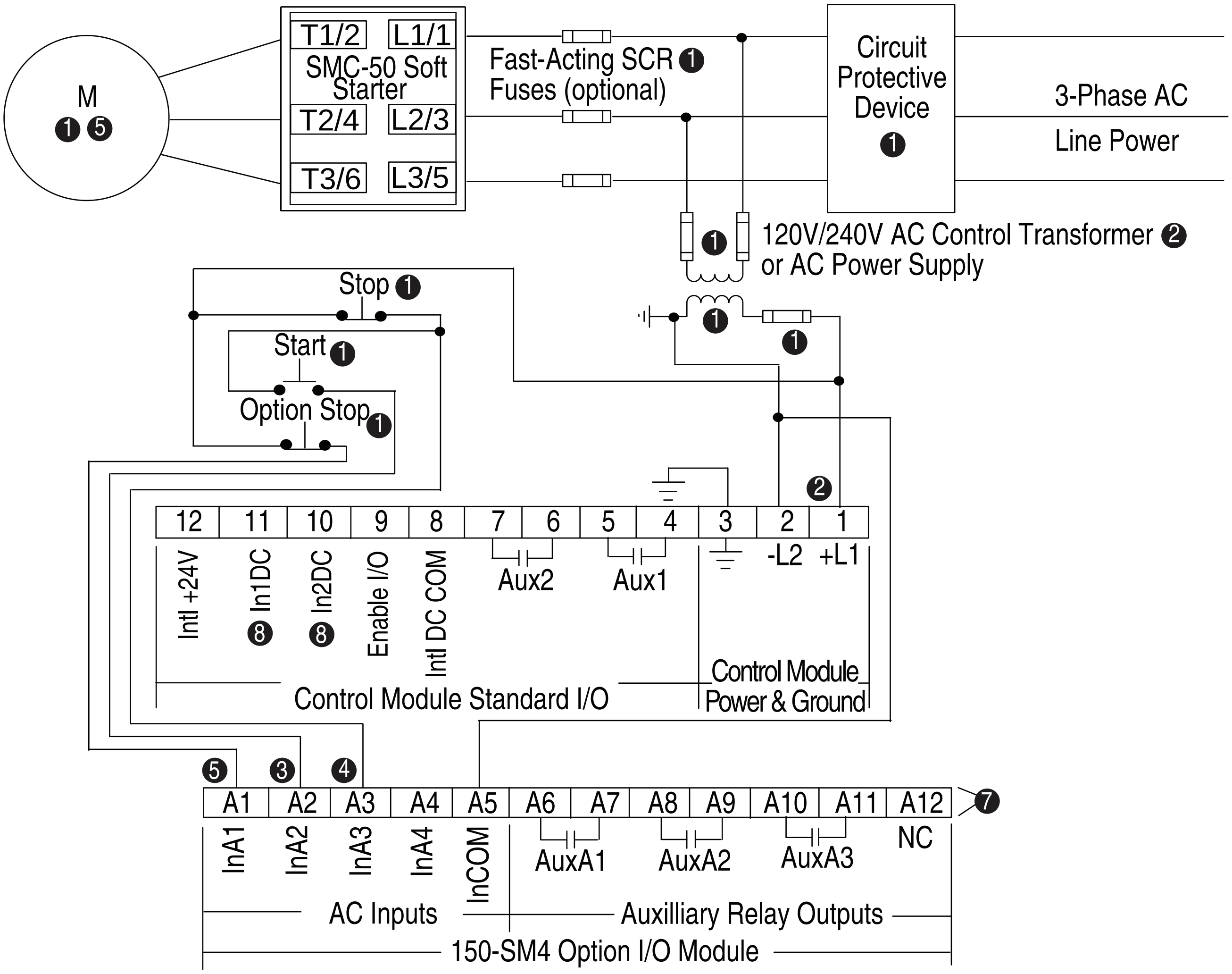


❶ Customer supplied.
❷ See the controller nameplate to verify the control power input ratings (100...240V AC).
❸ Option I/O Terminal A2 (InA2) 100...240V AC input is configured for START input using Parameter 7-4 (control module port 7).
❹ Option I/O Terminal A3 (InA3) 100...240V AC input configured for COAST, STOP OPTION, etc. using Parameter 7-3 (control module port 7).
NOTE: The controller will generate an I/O configuration fault if any input is configured for START or SLOW speed and no input is configured for COAST or STOP.
❺ 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 diagram for details.
❻ The order of the terminal numbers for the option I/O module can be reversed depending on which expansion port it is located in on the control module. However, the function associated with the terminal number remains the same.
❼ Configure both In1 (Input 1 — Parameter 56) and In2 (Input 2 — Parameter 57) to "Disable".
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 is recommended. Operation of the isolation device should be coordinated using one of the SMC-50 Aux contacts configured to NORMAL.
❽ ✳ indicates that the switch is closed in this position.

Soft Stop, Pump Control, & Smart Motor Braking (SMB)

The following figure shows the typical wiring diagrams for the Soft Stop, Pump Control, and SMB options.

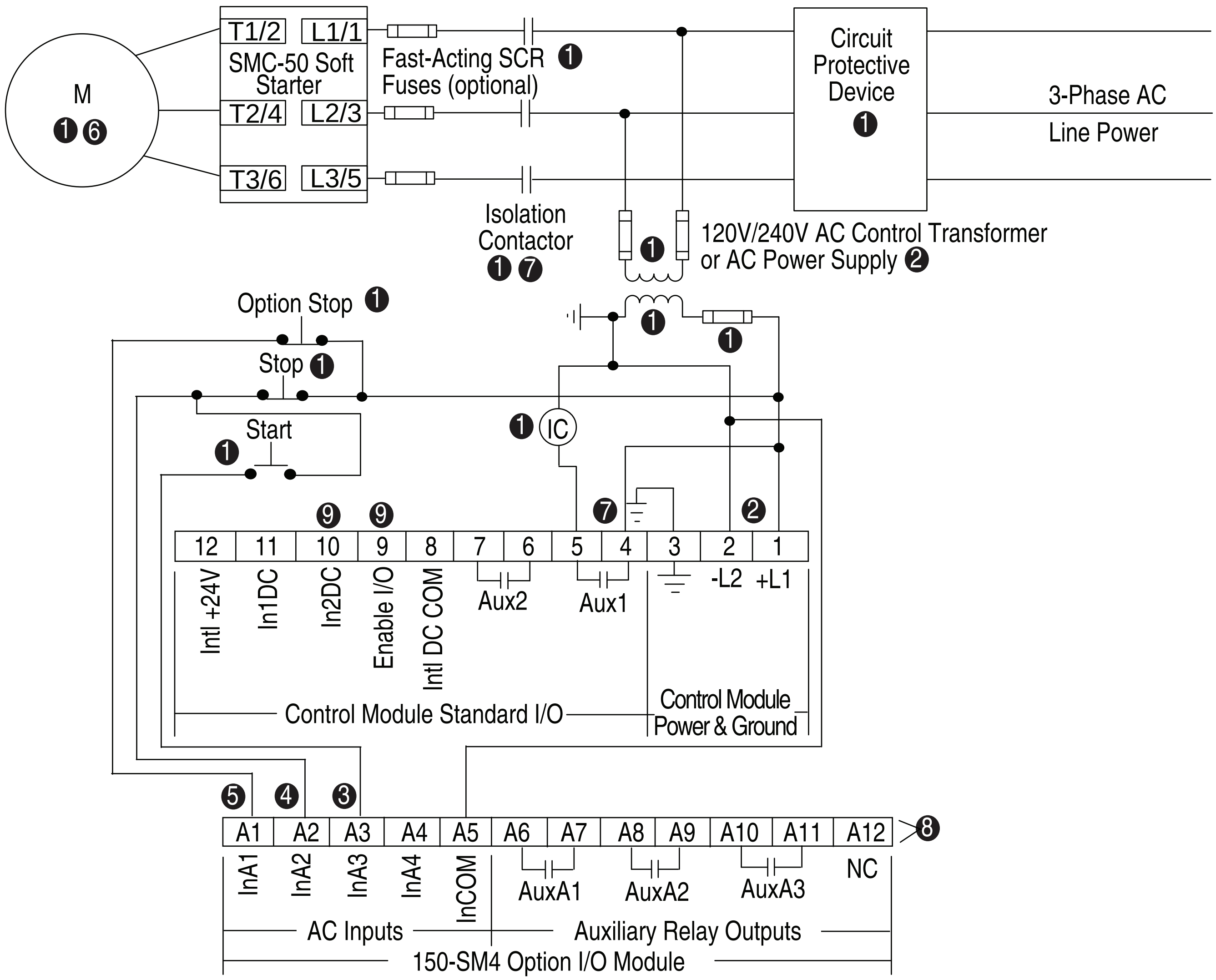
Figure 47 - Soft Stop, Pump Stop, or Braking Control Option, AC Control



❶ Customer supplied.
❷ See the controller nameplate to verify the control power input ratings (100...240V AC).
❸ Option I/O Terminal A2 (InA2) 100...240V AC input is configured for START input using Parameter 7-3 (contact module port 7).
❹ Option I/O Terminal A3 (InA3) 100...240V AC input configured for COAST using Parameter 7-4 (contact module port 7).
NOTE: The controller will generate an I/O configuration fault if any input is configured for START or SLOW speed and no input is configured for COAST or STOP.
❺ Option I/O module Terminal A1 (InA1) 120/240V AC input is configured for STOP OPTION using Parameter 7-2 (contact module port 7).
❻ 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 diagram for details.
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 is recommended. Operation of the isolation device should be coordinated using one of the SMC-50 Aux contacts configured to NORMAL.
❼ The order of the terminal numbers for the option I/O module can be reversed depending on which expansion port it is located in on the control module. However, the function associated with the terminal number remains the same.
❽ Configure both In1 (Input 1 — Parameter 56) and In2 (Input 2 — Parameter 57) to "Disable".

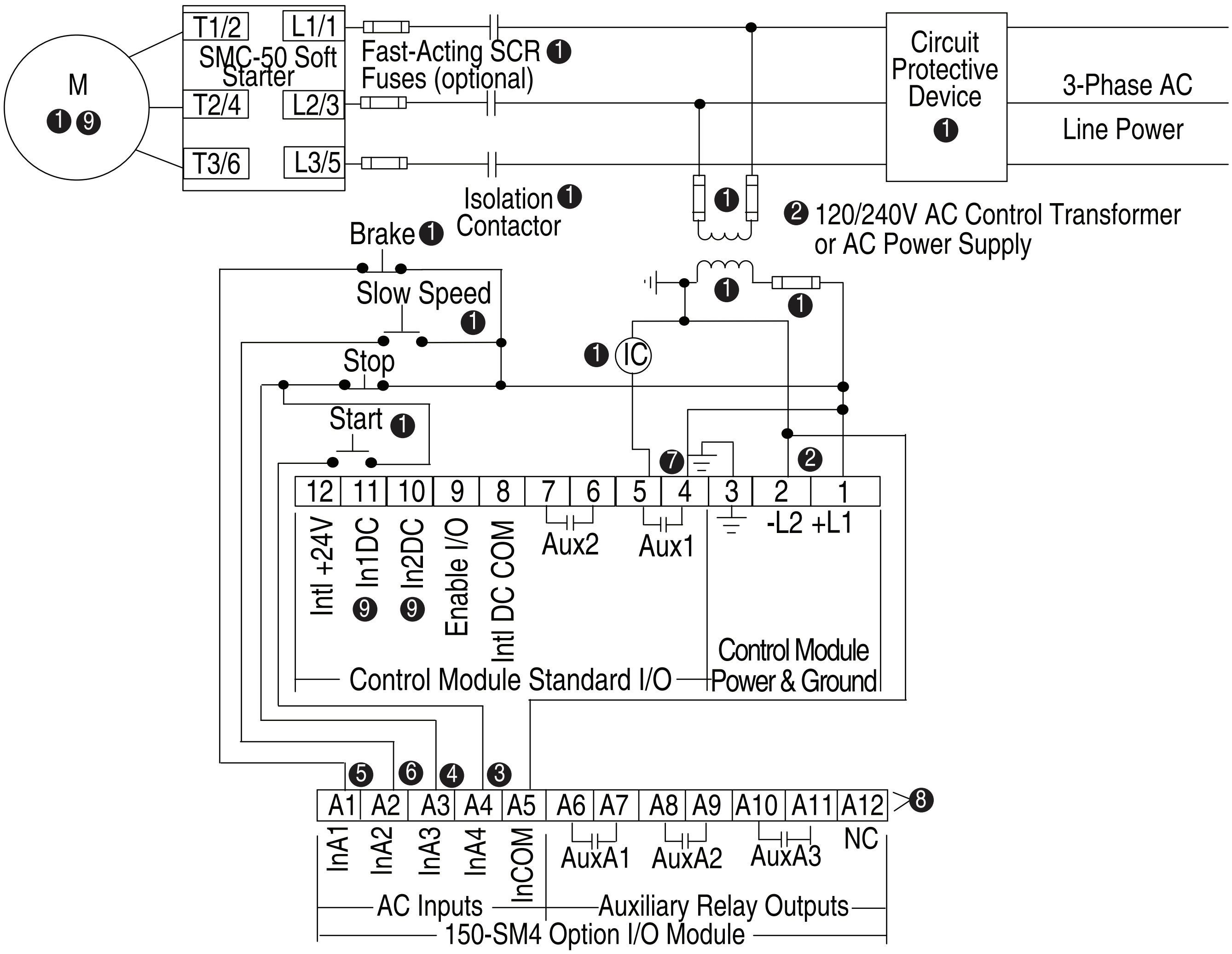
Slow Speed with Braking

Figure 48 - For Isolation Contactor with STOP Option Applications, AC Inputs



❶ Customer supplied.
❷ See the controller nameplate to verify the control power input ratings (100...240V AC).
❸ Option I/O Terminal A3 (InA3) 100...240V AC input is configured for START input using Parameter 7-4 (control module port 7).
❹ Option I/O Terminal A2 (InA2) 100...240V AC input configured for COAST using Parameter 7-3 (control module port 7).
NOTE: The controller will generate an I/O configuration fault if any input is configured for START or SLOW speed and no input is configured for COAST or STOP.
❺ Option I/O module Terminal A1 (InA1) 100...240V AC input is configured for STOP OPTION using Parameter 7-2 (control module port 7).
❻ Due to current leakage through an SCR in the OFF state (controller stopped), some form of upstream line power isolation (e.g., the one shown in this diagram) is recommended if maintenance is required on the motor.
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 is recommended. Operation of the isolation device should be coordinated using one of the SMC-50 Aux contacts configured to NORMAL.
❼ Configure Aux1 to NORMAL using Parameter 172. NORMAL = Aux1 contact will close to energize the IC coil with the START push button and open to de-energize when the stop maneuver, initiated by the STOP push button, is complete.
❽ The order of the terminal numbers for the option I/O module can be reversed depending on which expansion port it is located in on the control module. However, the function associated with the terminal number remains the same.
❾ Configure both In1 (Input 1 — Parameter 56) and In2 (Input 2 — Parameter 57) to "Disable".

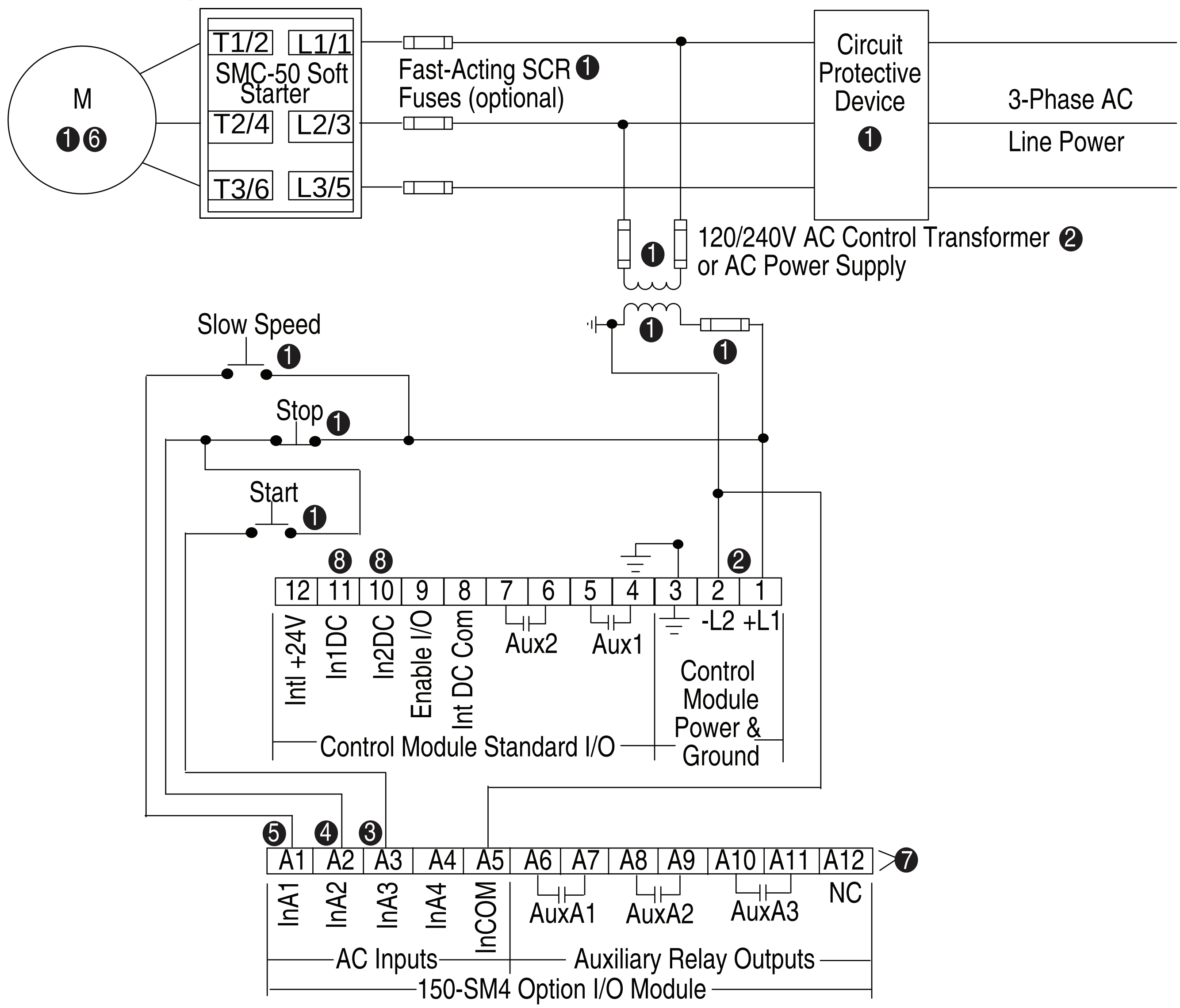
Figure 49 - For Isolation Contactor & Slow-Speed with Braking Application – AC Control



❶ Customer supplied.
❷ See the controller nameplate to verify the control power input ratings (100...240V AC).
❸ Option I/O Terminal A4 (InA4) 100...240V AC input is configured for START input using Parameter 7-5 (control module port 7).
❹ Option I/O Terminal A3 (InA3) 100...240V AC input configured for COAST, etc. using Parameter 7-4 (control module port 7).
NOTE: The controller will generate an I/O configuration fault if any input is configured for START or SLOW speed and no input is configured for COAST or STOP.
❺ Option I/O module Terminal A1 (InA1) 100...240V AC input is configured for STOP OPTION using Parameter 7-2 (control module port 7). Set STOP MODE, Parameter 65, to SMB.
❻ Option I/O module Terminal A2 (InA2) 100...240V AC input is configured for SLOW SPEED using Parameter 7-3 (control module port 7).
❼ Configure Aux1 to NORMAL using Parameter 172. NORMAL = Aux1 contact will close to energize the IC coil with the START push button and open to de-energize when the stop maneuver, initiated by the STOP push button, is complete.
❽ The order of the terminal numbers for the option I/O module can be reversed depending on which expansion port it is located in on the control module. However, the function associated with the terminal number remains the same.
❾ Configure both In1 (Input 1 — Parameter 56) and In2 (Input 2 — Parameter 57) to "Disable".
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 (as shown in this diagram) or shunt trip-type circuit breaker capable of interrupting the motor's locked rotor current on the line side of the SMC-50 is recommended. Operation of the isolation device should be coordinated using one of the SMC-50 Aux contacts configured to NORMAL.

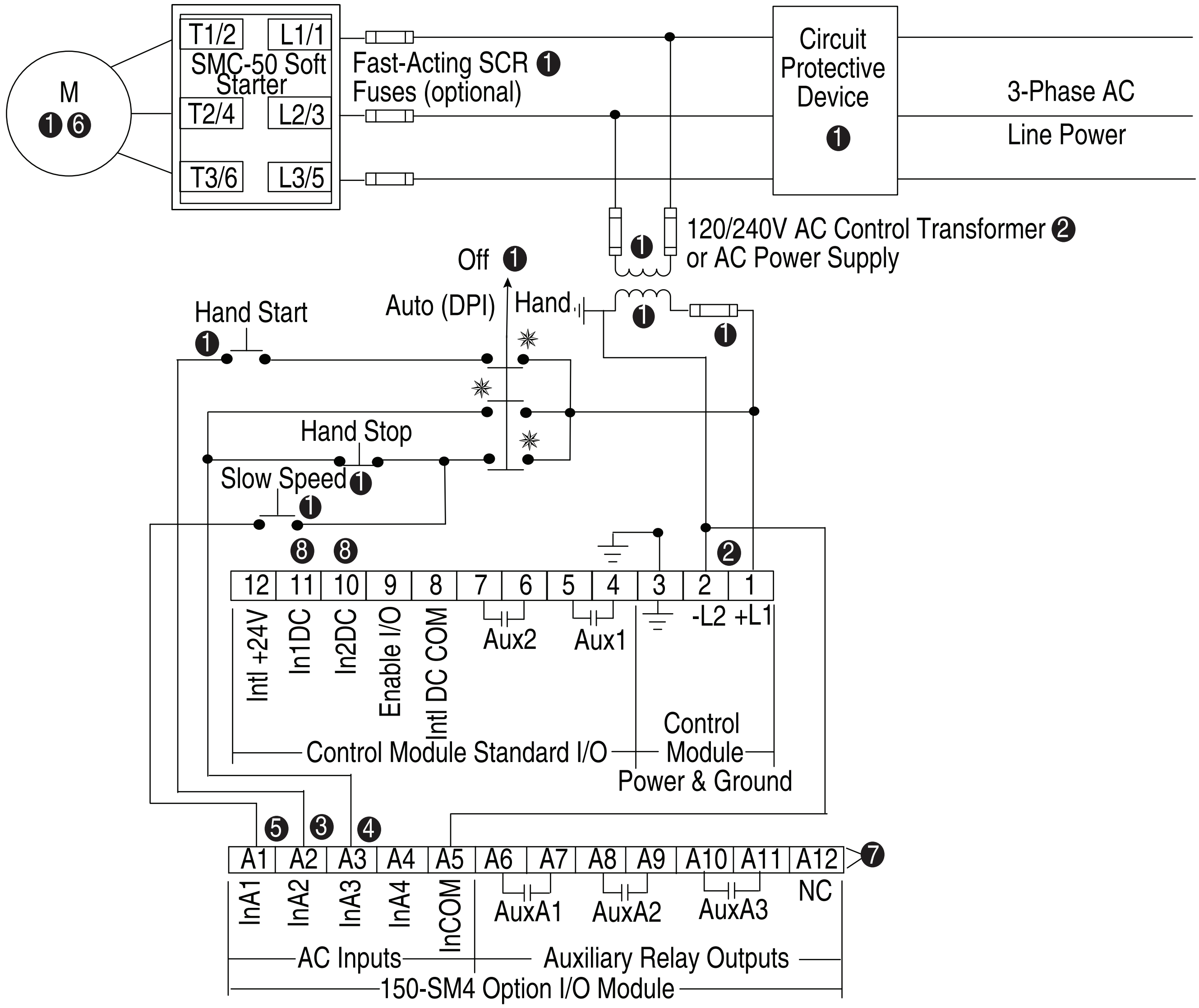
Preset Slow Speed

Figure 50 - For Preset Slow Speed Control — AC I/O



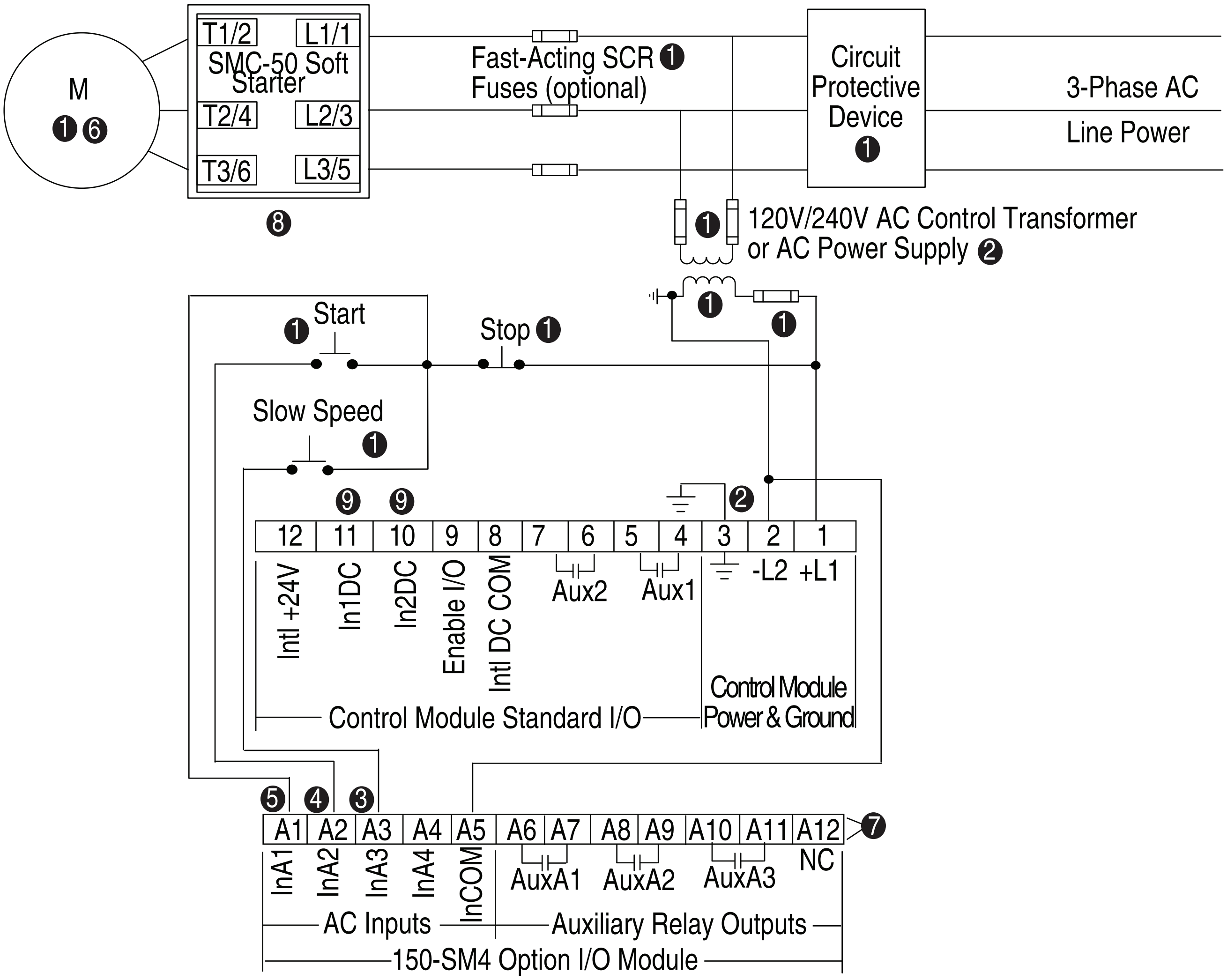
❶ Customer supplied.
❷ See the controller nameplate to verify the control power input ratings (100...240V AC).
❸ Option I/O Terminal A3 (InA3) 100...240V AC input is configured for START input using Parameter 7-4 (control module port 7).
NOTE: The controller will generate an I/O configuration fault if any input is configured for START or SLOW speed and no input is configured for COAST or STOP.
❹ Option I/O Terminal A2 (InA2) 100...240V AC input configured for COAST, Stop Option, etc. using Parameter 7-3 (control module port 7).
❺ Option I/O terminal A1 (InA1) 120/240V AC input configured for SLOW SPEED using Parameter 7-2 (control module port 7)
❻ 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 diagram for details.
❼ The order of the terminal numbers for the option I/O module can be reversed depending on which expansion port it is located in on the control module. However, the function associated with the terminal number remains the same.
❽ Configure both In1 (Input 1 — Parameter 56) and In2 (Input 2 — Parameter 57) to "Disable".
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 is recommended. Operation of the isolation device should be coordinated using one of the SMC-50 Aux contacts configured to NORMAL.

Figure 51 - For Preset Slow Speed Control for Hand-OFF-Auto (DPI) —AC I/O



❶ Customer supplied.
❷ See the controller nameplate to verify the control power input ratings (100...240V AC).
❸ Option I/O Terminal A2 (InA2) 100...240V AC input is configured for START input using Parameter 7-3 (control module port 7).
NOTE: The controller will generate an I/O configuration fault if any input is configured for START or SLOW speed and no input is configured for COAST or STOP.
❹ Option I/O Terminal A3 (InA3) 100...240V AC input configured for COAST, Stop Option, etc. using Parameter 7-4 (control module port 7).
❺ Option I/O Terminal A1 (InA1) 120/240V input configured for SLOW SPEED using Parameter 7-2 (control module port 7).
❻ Due to current leakage through an SCR in the OFF state (controller stopped), some form of upstream line power isolation os recommended if maintenance is required on the motor. See the Isolation Contactor Application diagram for details.
❼ The order of the terminal numbers for the option I/O module can be reversed depending on which expansion port it is located in on the control module. However, the function associated with the terminal number remains the same.
❽ Configure both In1 (Input 1 — Parameter 56) and In2 (Input 2 — Parameter 57) to "Disable".
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 is recommended. Operation of the isolation device should be coordinated using one of the SMC-50 Aux contacts configured to NORMAL.

Figure 52 - Accu-Stop — AC I/O



❶ Customer supplied.
❷ See the controller nameplate to verify the control power input ratings (100...240V AC).
❸ Option I/O Terminal A3 (InA3) 100...240V AC input configured for SLOW SPEED, Stop Option, etc. using Parameter 7-4 (control module port 7).
NOTE: The controller will generate an I/O configuration fault if any input is configured for START or SLOW speed and no input is configured for COAST or STOP.
❹ Option I/O Terminal A2 (InA2) 100...240V AC input is configured for SART input using Parameter 7-3 (control module port 7).
❺ Option I/O Terminal A1 (InA1) 120/240V Input configured for COAST using Parameter 7-2 (control module port 7).
❻ 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 diagram for details.
❼ The order of the terminal numbers for the option I/O module can be reversed depending on which expansion port it is located in on the control module. However, the function associated with the terminal number remains the same.
❽ Configure Stop Mode to SMB using Parameter 65; Braking Current using Parameter 69; Slow Speed using Parameter 72; and Slow Brake using Parameter 73 (Parameter 73 = 0 results in Coast).
❾ Configure both In1(Input 1 - Parameter 56) and In2 (Input 2 - Parameter 57) to DISABLE.
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 is recommended. Operation of the isolation device should be coordinated using one of the SMC-50 Aux contacts configured to NORMAL.

Notes:

Operating Modes

Operation

The SMC-50 can operate standard squirrel-cage 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 as the voltage values on the product before applying power.

Motor Configuration

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

Motor Tuning

The SMC-50 will perform 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 uses the motor tuning data in its control algorithm.

During the tuning process the motor will not turn and will make some audible noise including pulsing and buzzing. The time to complete the tuning process is approximately 10 to 20 seconds but may vary based on the size and characteristics of the individual motor being used. After successful completion of the tuning process the motor will start based on the user programmed start profile. If the tuning process is interrupted by the user giving a stop command or removing power from the unit the tuning process will be repeated on the next start command. Subsequent starts of the motor after a successful tuning will not perform the tuning process.

After the initial successful tuning of the motor the process may be re-initiated by the user via one of the following methods:

1. Change the status of Force Tuning, Parameter 194, to TRUE by using a configuration tool (e.g., a HIM) with the motor stopped. During the next start cycle, the tuning process will occur and Parameter 194 will change back to FALSE. **OR**

2. Press the "HOLD TO TEST/PUSH TO RESET" push button, located on the front of the controller, for ten seconds with the motor stopped. During the next start cycle, the tuning process will occur. The controller's status LED will flash amber indicating that Tuning will occur on the next start cycle. **OR**
3. When the controller processes a "Load Factory Defaults" command via Parameter Management, Parameter 229.

NOTE: If a motor that is smaller or larger than normal is used for initial system testing, a motor tuning cycle **must** be performed on the motor used in the final installation.

The following table lists Parameter 194 Force Tuning along with the key motor parameters checked by the SMC-50 controller during a motor tuning cycle.

Table 13 - Key Motor Parameters Checked During a Motor Tuning Cycle

Parameter Number	Parameter Name	Minimum/Maximum [Default]	Access	Units
194	Force Tuning	FALSE [TRUE]	R/W	—
195	Stator R	0.00-50.00	R	Ohms
196	Total R	0.00-50.00		Ohms
197	Coupling Factor	0.00-10.00		
198	Inductance	0.00-1000.00		mH
45	Motor Connection	[Line] Delta		—

Modes of Operation—Starting

Overview

The SMC-50 starting mode is configured using Starting Mode, Parameter 49. The available starting modes are: Soft Start [default], Current Limit, Torque Ramp, Linear Speed, Pump Start, and Full Voltage.

Soft Start

This mode has the most general application. The motor is given an initial torque setting using Parameter 51, which is user-adjustable from 0…90% of locked rotor torque. From the initial torque level, the output voltage to the motor is linearly increased during the acceleration ramp time. The acceleration ramp time is adjustable from 0…1000 seconds using Parameter 50.

During soft start, a current limit override (50…600% FLC) is also available to limit current throughout the start cycle using Parameter 53. The controller has Up-to-Speed (UTS) detection to determine when the motor is at full speed. If the motor reaches UTS before the end of the ramp time, the SMC-50 applies full voltage to the motor and the soft start is ended. The UTS level can be configured in percent of the SMC-50's applied motor voltage using Parameter 186. The full Soft Start parameter list can be found in Table 14.

NOTE: If the controller is detecting UTS too soon, the UTS level should be increased. This typically occurs in very high efficiency motors. If the controller is detecting UTS too late or not at all, the UTS level should be lowered. This typically occurs in very low efficiency motors. See Timed Start on page 83 for additional details.

Figure 53 - Soft Start

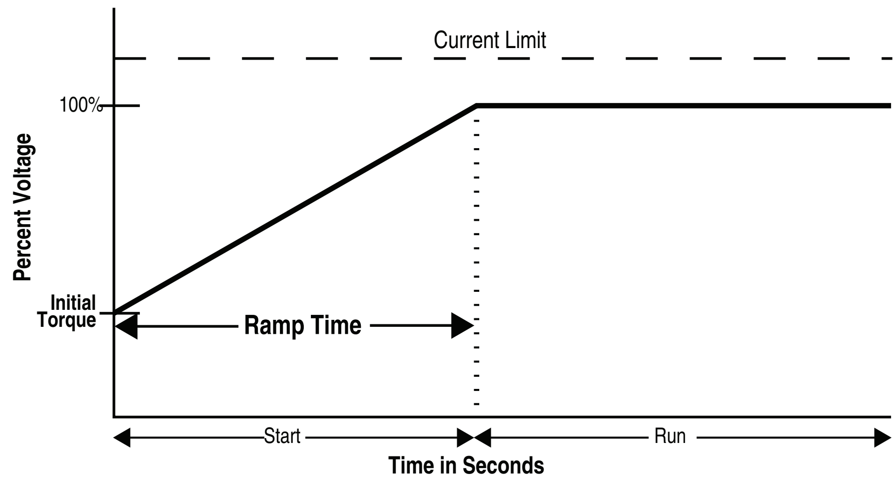


Table 14 - Soft Start Mode Parameter List

Parameter Number	Parameter Name	Minimum/Maximum [Default]	Access	Units
49	Starting Mode	[Soft Start]	R/W	—
50	Ramp Time	0.0-1000.0 [10.0]		SEC
51	Initial Torque	0-90 [70]		%LRT
53	Cur Limit Level	50-600 [350]		%FLC
54	Kickstart Time	[0.0]-2.0		SEC
55	Kickstart Level	[0.0]-90		%LRT
182	Start Delay	[0.0]-30		SEC
186	UTS Level	0-100 [75]		%
78	Motor FLC	[1.0]-2200.0		Amps

Selectable Kickstart

This feature provides a torque (current) boost at startup to break away loads that require a pulse of high torque to get started. The amount of torque pulse is selectable from 0…90% of locked rotor torque using Kickstart Level, Parameter 55. The time duration for the selectable kickstart is user-adjustable from 0.0…2.0 seconds using Kickstart Time, Parameter 54.

Kickstart is available in Soft Start, Current Limit, Pump, and Torque Control starting modes.

Figure 54 provides a graphical representation of Kickstart. Table 15 provides the Kickstart Mode Parameter List.

Figure 54 - Selectable Kickstart

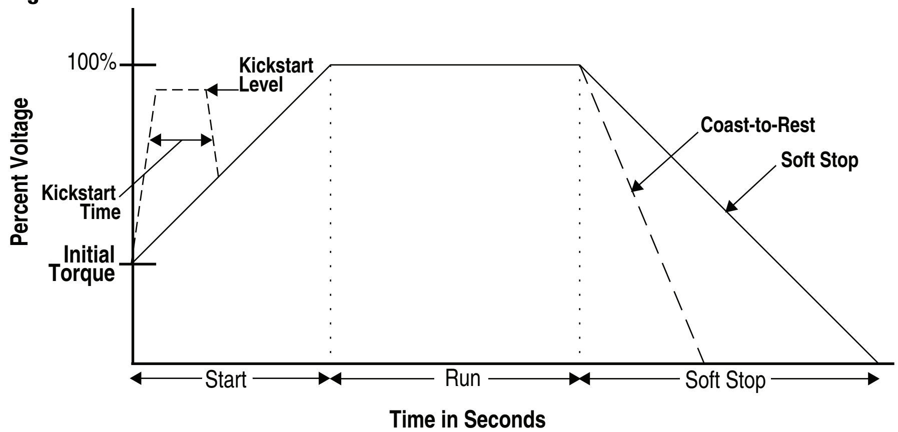


Table 15 - Kickstart Mode Parameter List

Parameter Number	Parameter Name	Minimum/Maximum [Default]	Access	Units
54	Kickstart Time	[0.0]-2.0	R/W	SEC
55	Kickstart Level	[0.0]-90		%LRT

Current Limit Start

This starting mode provides a true current limit start, and is used when it is required to limit the maximum starting current to the load. This is accomplished using Current Limit Level, Parameter 53, which is user-adjustable from 50…600% of the motor full load current rating (FLC) and Ramp Time, Parameter 50, which is user-adjustable from 0.0…1000.0 seconds. For current limit, the Ramp Time is the time the controller will hold the current limit level until switching to full voltage. If the controller senses that the motor has reached the UTS condition during the current limit starting mode, the current limit ramp will end. As with Soft Start, the UTS level can be modified to account for load or motor characteristics. If Ramp Time has expired and UTS is not achieved, the SMC-50 will hold the current limit until UTS is reached, a Motor Overload Trip, or Starter Overtemp Fault occurs. Kickstart is also available with current limit.

Figure 55 provides a graphical depiction of a Current Limit Start. Table 16 provides a list of Current Limit Start parameters.

Figure 55 - Current Limit Start

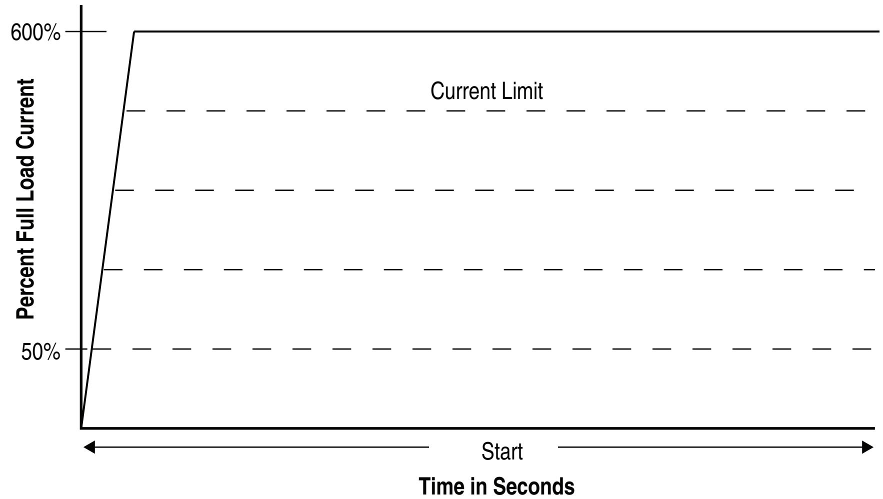


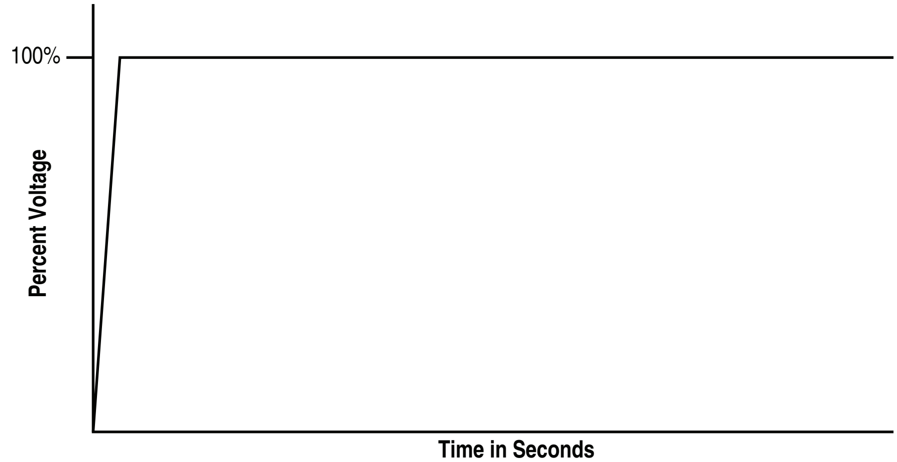
Table 16 - Current Limit Start Parameter List

Parameter Number	Parameter Name	Minimum/Maximum [Default]	Access	Units
50	Ramp Time	0.0-1000.0 [10.0]	R/W	SEC
53	Cur Limit Level	50-600 [350]		%FLC
54	Kickstart Time	[0.0]-2.0		SEC
55	Kickstart Level	[0.0]-90		%LRT
182	Start Delay	[0.0]-30		SEC
186	UTS Level	0-100 [75]		%
78	Motor FLC	[1.0]-2200.0		Amps

Full Voltage Start

This starting mode is used for applications requiring across-the-line starting. The controller supplied voltage to the motor will reach full voltage within five AC line cycles (0.08 s at 60 Hz and 0.1 s at 50 Hz). To enable Full Voltage Start, set Parameter 49 to Full Voltage.

Figure 56 - Full Voltage Start



Linear Acceleration

The SMC-50 has the ability to start the motor following a timed linear ramp. The Ramp Time, Parameter 50, is selectable from 0.0…1000.0 seconds and determines the time the motor will ramp from a zero speed to full speed condition. An Initial Torque, Parameter 51, value sets the starting torque supplied to the motor from the controller. A current limit setting (50…600% selectable of motor FLC) is also available. If the controller reaches the current limit setpoint, the acceleration ramp will stop. When the unit comes out of current limit, the linear ramp will resume.

NOTE: Kickstart is not available with this starting mode.

Figure 57 provides a graphical example of a linear acceleration and Table 17 provides a list of linear acceleration parameters.

Figure 57 - Linear Acceleration

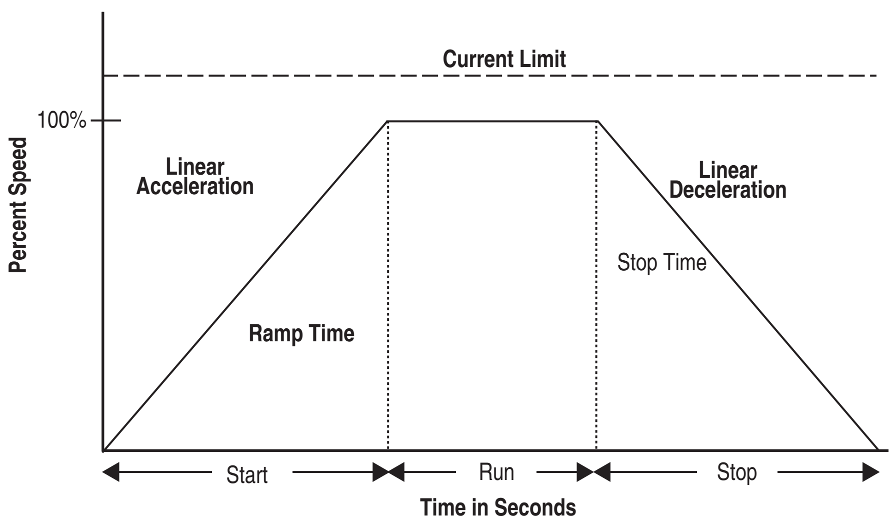


Table 17 - Linear Acceleration Mode Parameter List

Parameter Number	Parameter Name	Minimum/Maximum [Default]	Access	Units
49	Starting Mode	Linear Speed	R/W	—
50	Ramp Time	0.0-1000.0 [10.0]		SEC
51	Initial Torque	0-90 [70]		%LRT
53	Cur Limit Level	50-600 [350]		%FLC
78	Motor FLC	[1.0]-2200.0		Amps
199	Speed PGain	0-10000 [1000]		—

Torque Control Start

This motor starting method provides a torque ramp from an initial starting torque level to a maximum torque level over the start time. The torque levels are entered in percent of rated motor torque. This requires that the Rated Torque parameter be configured to the motor's rated torque. The torque start operating mode requires motor tuning to function properly. Tuning can be forced manually or it will otherwise be performed automatically the first time the motor is started. See Motor Tuning on page 73.

Figure 58 - Torque Start

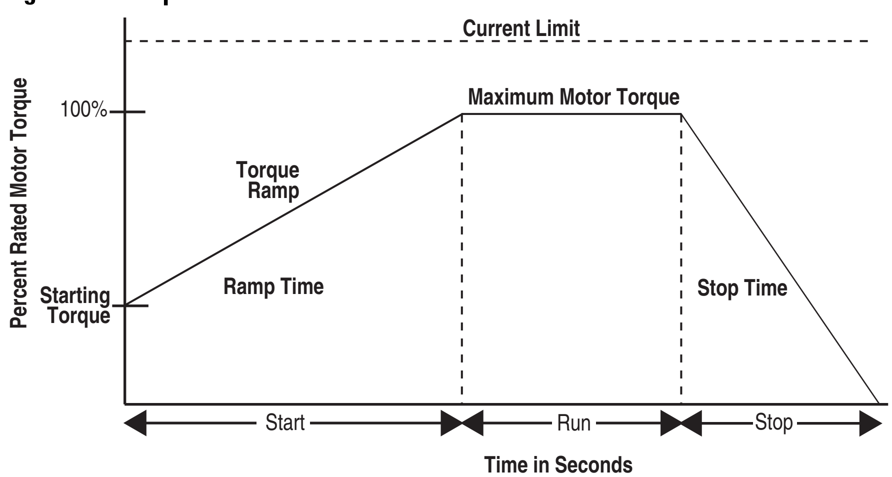


Table 18 provides a list of Torque Control Start parameters.

Table 18 - Torque Start Mode Parameter List

Parameter Number	Parameter Name	Minimum/Maximum [Default]	Access	Units
49	Starting Mode	Torque Ramp	R/W	
305	Starting Torque	0-300 [100]		%
52	Max Torque	0-300 [250]		%
50	Ramp Time	0.0-1000.0 [10.0]		SEC
47	Rated Torque	0-10000 [10]		N·m
48	Rated Speed	750, 900, 1500, [1800], 3600		RPM
53	Cur Limit Level	50-600 [350]		%FLC
54	Kickstart Time	[0.0]-2.0		SEC
55	Kickstart Level	[0.0]-90		%LRT
78	Motor FLC	[1.0]-2200.0		Amps

Pump Control Start & Stop

The pump control reduces surges (water hammer) during the starting and stopping of a centrifugal pump by smoothly accelerating and decelerating the motor. As such, starting and stopping parameters are typically configured together. The microprocessor analyzes the motor variables and generates commands that control the motor and reduce the possibility of surges occurring in the system.

The starting time (Ramp Time, Parameter 50) is programmable from 0.0…1000.0 seconds and the stopping time (Stop Time, Parameter 66) is programmable from 0…999 seconds when the Pump Stop mode is selected from Parameter 65.

Figure 59 - Pump Control

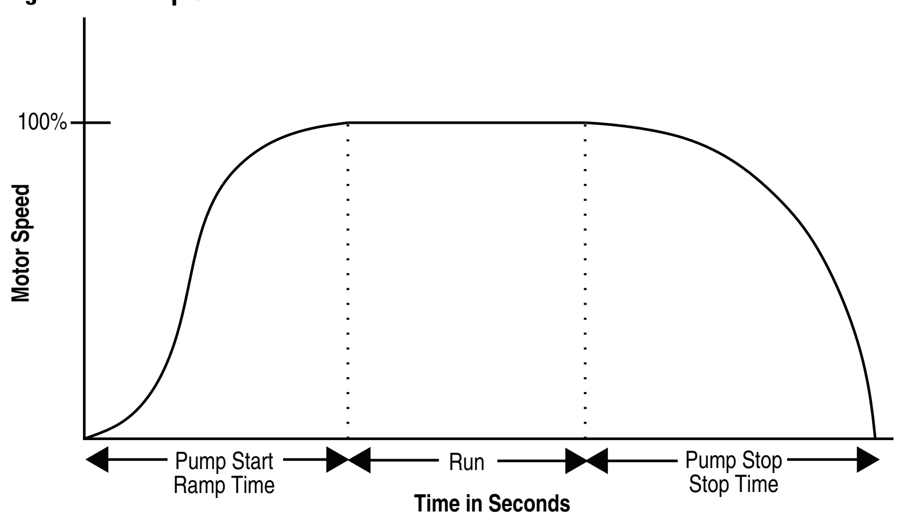


Table 19 - Pump Start Control Mode Parameter List

Parameter Number	Parameter Name	Minimum/Maximum [Default]	Access	Units
49	Starting Mode	Pump Start	R/W	
50	Ramp Time	0.0-1000.0 [10.0]		SEC
51	Initial Torque	0-90 [70]		%LRT
67	Backspin Timer	[0]-999		SEC
54	Kickstart Time	[0.0]-2.0		SEC
55	Kickstart Level	[0.0]-90		%LRT
78	Motor FLC	[1.0]-2200.0		Amps

Table 20 - Pump Stop Mode Parameter List

Parameter Number	Parameter Name	Minimum/Maximum [Default]	Access	Units
65	Stop Mode	Pump Stop	R/W	—
66	Stop Time	[0.0]-999.0		SEC
68	Pump Pedestal	[0.0]-50.0		%

NOTE: Pump Pedestal, Parameter 68, provides the ability to modify the internal pump control algorithm for special application conditions.
For example, if overload trips persist during stopping, either reduce the Stop Time, Parameter 66, or increase the Pump Pedestal in 5% increments. Try not to exceed 40%

ATTENTION: Pump stopping is not intended to be used as an emergency stop. See the applicable standard for emergency stop requirements.

ATTENTION: Pump stopping may cause motor heating depending on the mechanical dynamics of the pumping system. Therefore, select the lowest stopping time setting that will satisfactorily stop the pump.

Additional Start Features—Functions

Dual Ramp Start

This feature is useful for applications that have varying loads (and therefore varying starting feature requirements). Dual Ramp allows the user to select between two separate start profiles with separately adjustable ramp times, initial torque settings, etc. to best meet the application needs.

The second start profile is enabled by configuring one of the controller auxiliary inputs to Dual Ramp and activating that input. When the Start command is then activated, the second start profile will begin.

Figure 60 - Dual Ramp Start

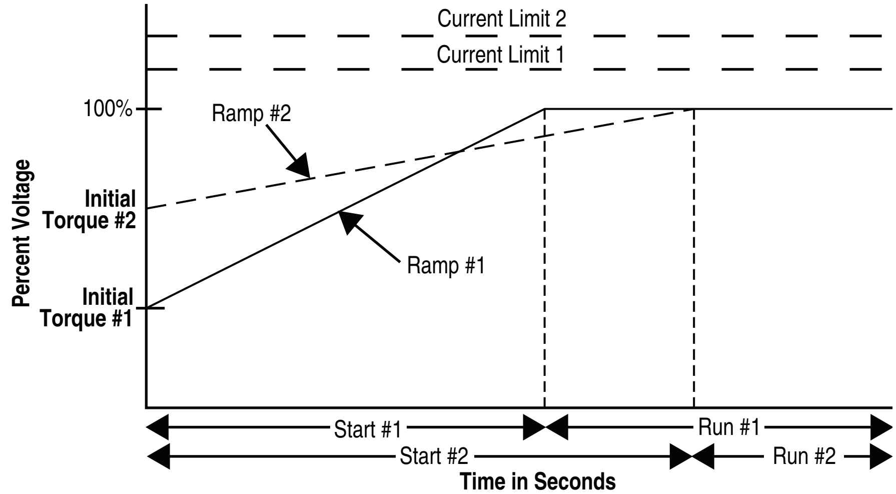


Table 21 - Dual Ramp Start Mode Parameter List

Parameter Number	Parameter Name	Minimum/Maximum [Default]	Access	Units
49	Starting Mode	Full Voltage, Current Limit, [Soft Start], Linear Speed, Torque Ramp, Pump Start	R/W	
50	Ramp Time	0.0-1000.0 [10.0]		SEC
51	Initial Torque	0-90 [70]		%LRT
52	Max Torque	0-300 [250]		
53	Cur Limit Level	50-600 [350]		%FLC
54	Kickstart Time	[0.0]-2.0		SEC
55	Kickstart Level	[0.0]-90		%LRT
305	Starting Torque	0-300 [100]		%
58	Starting Mode 2	Full Voltage, Current Limit, [Soft Start], Linear Speed, Torque Ramp, Pump Start		
59	Ramp Time 2	0.0-1000.0 [10.0]		SEC
60	Initial Torque 2	0-90 [70]		%LRT
61	Max Torque 2	0-300 [250]		%
62	Cur Limit Level 2	50-600 [350]		%FLC
63	Kickstart Time 2	[0.0]-2.0		SEC
64	Kickstart Level 2	[0]-90		%LRT
306	Starting Torque 2	0-300 [100]		%
182	Start Delay	[0]-30		SEC

Start Timer (Start Delay)

This feature provides the ability to set a user-configurable start (0…30 s) delay from the point when the start command is enabled until the start sequence actually occurs. This feature applies to any start mode.

Timed Start

Timed Start, Parameter 183, forces the starting profile to complete the entire user-configured ramp time before applying full voltage. In some starting modes (e.g., soft start) and with certain loads (e.g., lightly loaded motor), an early UTS condition can be generated placing the SMC-50 in full-voltage start, which might cause excessive current. Setting Timed Start to "Enable" forces all starts to complete the configured Ramp Time, Parameter 50.

Backspin Timer

A Backspin Timer, Parameter 67, is provided in order to avoid starting a motor into a backspin condition, which may result in motor shaft damage. The user-configured time begins to count down after a stop maneuver is complete. All start inputs are ignored until the backspin timer has timed out.

Motor Winding Heater Function

The Motor Winding Heater function provides low levels of current to each of the motor windings to preheat a cold motor before starting. To avoid thermally stressing a single motor winding, the SMC-50 cycles the heating current to each of the phases. This feature provides a programmable heating level, heating time, and a control (terminal block) input which can be used to start the process.

NOTE: Configuration of control module inputs is done via Input 1, Parameter 56, or Input 2, Parameter 57. If a 150-SM4 Optional Digital I/O Module is configured, its inputs can also be used for the motor winding heater function.

Table 22 - Motor Winding Heater Parameter List

Parameter Number	Parameter Name	Minimum/Maximum [Default]	Access	Units
220	Heating Time	[0]-1000	R/W	SEC
221	Heating Level	[0]-100		%

The motor winding heater function can be activated after a valid start command is received. After a valid start, the activation of the heating function can be performed by:

- programming the Heating Time, Parameter 220, to a non-zero value or

- configuring an input to "Motor Heater" and activating that input prior to the start command.

The heater function will continue for the specified time or until the input is deactivated, at which time the motor will start. The heater function will be disabled if the:

- Heating Level, Parameter 221, is set to zero, or
- Heating Time, Parameter 220, is set to zero, or
- input is inactive (or not configured) at the time of the start command.

Modes of Operation—Stopping Modes

Overview

Stop Mode, Parameter 65, defines the type of stop maneuver performed by the SMC-50 when a stop command is issued. The STOP command can be initiated through any input ❶, a network command, or the JOG key on the A6 HIM.

NOTE: The STOP Key on a Cat. no. 20-HIM-A6 or 20-HIM-C6S device initiates a Coast-to-Stop.

The available stopping modes are:

- Coast-to-Stop
- Soft Stop
- Linear Speed Deceleration
- SMB Smart Motor Braking
- Pump Stop
- External Brake

❶ To utilize terminal block inputs to initiate a Stop Mode, the respective input should be configured for Start/Stop or Stop Option.

Coast-to-Stop

When Stop Mode, Parameter 65, is set to Coast-to-Stop and the STOP command is initiated, the starter will not perform any other function and the motor coasts to a stop. No other Stop parameters need to be configured if Coast-to-Stop is enabled.

The Coast-to-Stop command overrides all other commands that could result in motor operation. When this command is initiated, it is latched into the controller's logic so that no other motor command can occur until it is cleared. It will be cleared when all terminal block Start inputs are opened and any other Soft Stop (Inhibits a Start) input is removed. Note that in a 2-wire control scheme, this involves placing the Start/Stop input in the Stop position; in a 3-wire control scheme, this involves opening the Start input.

Table 23 - Stop Mode Parameter List

Parameter Number	Parameter Name	Minimum/Maximum [Default]	Access	Units
65	Stop Mode	[Coast]	R/W	—

Soft Stop

The Soft Stop feature can be used in applications that require an extended stop time. The voltage ramp down time is user-adjustable from 0…999 seconds using Stop Time, Parameter 66. The load will stop when the SMC-50 output voltage drops to a point where the load torque is greater than the developed motor torque.

ATTENTION: Soft Stop is not intended to be used as an emergency stop. See the applicable standards for emergency stop requirements.

Figure 61 - Soft Stop

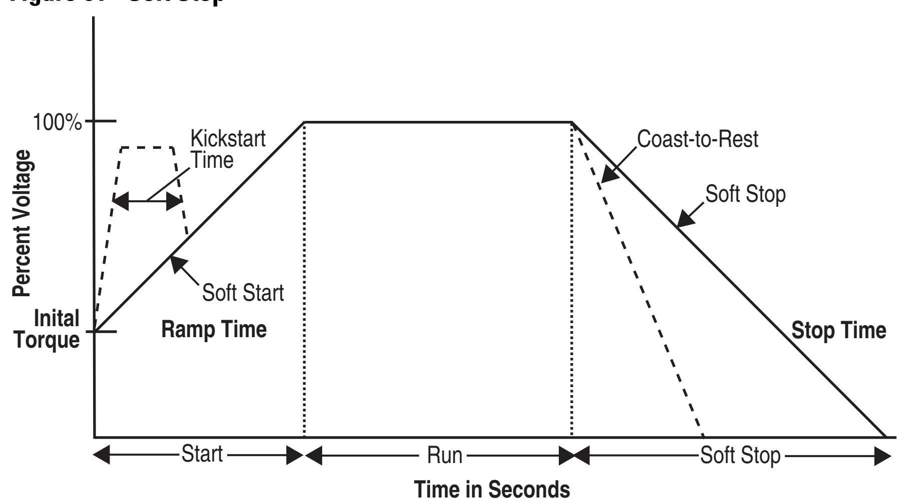


Table 24 - Soft Stop Mode Parameter List

Parameter Number	Parameter Name	Minimum/Maximum [Default]	Access	Units
65	Stop Mode	Soft Stop	R/W	—
66	Stop Time	[0]-999		SECS

NOTE: For additional details, see Figure 68 on page 95.

Linear Deceleration

When Stop Mode, Parameter 65, is configured for Linear Speed, the SMC-50 will stop the motor following a timed linear speed ramp configured in Stop Time, Parameter 66. A current limit setting is also available to limit the current while stopping. If the current limit level is reached, the motor will decelerate faster than the defined ramp. If motor current falls below the current limit, the ramp is resumed.

ATTENTION: Linear Stop is not intended to be used as an emergency stop. See the applicable standards for emergency stop requirements.

Figure 62 - Linear Deceleration

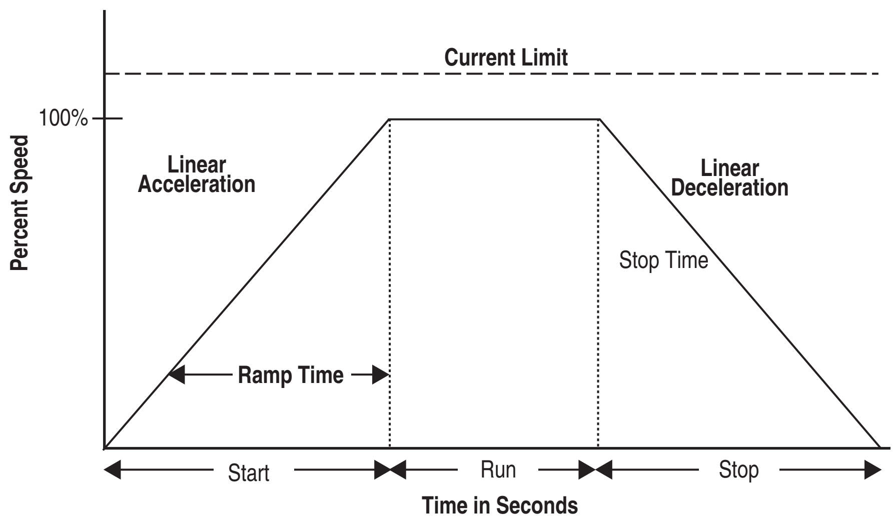


Table 25 - Linear Deceleration Mode Parameter List

Parameter Number	Parameter Name	Minimum/Maximum [Default]	Access	Units
65	Stop Mode	Linear Speed	R/W	—
66	Stop Time	[0.0]-999		SEC
53	Cur Limit Level	50-600 [350]		%FLC

For additional details, see Figure 68 on page 95.

Smart Motor Braking (SMB)

When Stop Mode, Parameter 65, is configured for SMB and the Stop Maneuver is commanded, the SMC-50 will apply the configured braking current and brake the motor to a stop. This function can be used in applications that require reduced stopping times. The SMC-50 incorporates a microprocessor-based system that applies braking current to the motor without any additional equipment. This option offers a user-adjustable braking current setting from 0%

to 400% of the motor's full load current rating using Braking Current, Parameter 69. Further, it provides automatic brake current shut-off at zero speed detection.

ATTENTION: Smart Motor Braking is not intended to be used as an emergency stop. See applicable standards for emergency stop requirements.

Figure 63 - SMB

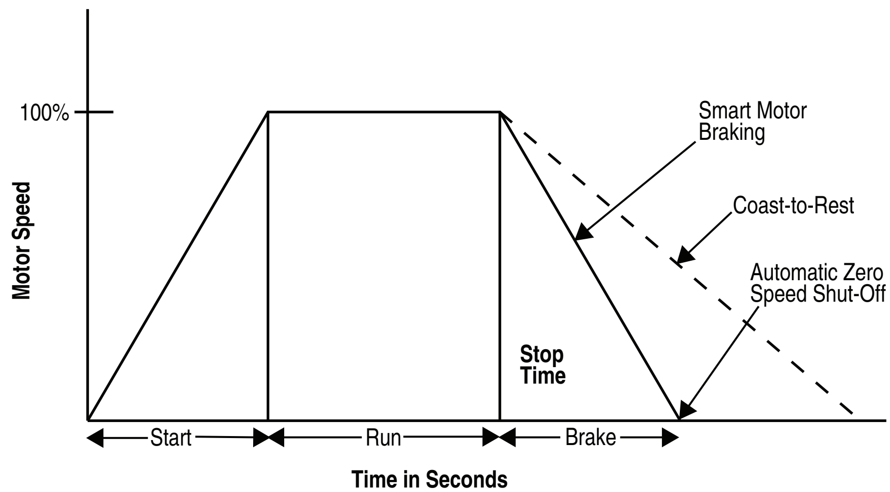


Table 26 - SMB Mode Parameter List

Parameter Number	Parameter Name	Minimum/Maximum [Default]	Access	Units
65	Stop Mode	SMB	R/W	
66	Stop Time ❶❷	[0]-999		SECS
69	Braking Current	[0]-400		%FLC

❶ Programming a Stop Time is not required when SMB is used. SMB automatically controls the duration (Stop Time) of the braking current to the motor from the Running at Speed condition until a zero speed condition (Zero Speed Braking Shut Off feature/function). Programming a Stop Time will override the SMB Zero Speed Braking Shutoff feature/function. This could result in current being applied to a stopped motor, which will cause the motor to overheat. See Figure 71 on page 98 and Chapter 5, Programming, for additional details.

❷ With Stop Time, Parameter 66, set to some time value other than zero, the user-selected "Braking Current", Parameter 69, is applied for the user-configured "Stop Time" regardless of the motor speed (e.g., Automatic Zero Speed Detection disabled). This braking method can be used in applications where detecting zero speed is ineffective or when braking the motor to a complete stop results in random overload trips. Note that an ideal Stop Time setting can be accomplished by trial and error, but should always allow for some coast time. Setting the Stop Time for too long of a time period can result in braking current to be applied to a stopped motor and will likely result in overload trips.

Preset Slow Speed & Slow Speed with Braking

The Slow Speed Mode can be used in applications that require a jog for general purpose positioning. Preset Slow Speed, Parameter 72, provides operation from +1…+15% forward or -1…-15% reverse of the motor base speed.

An SMC-50 control input must be configured for Slow Speed to initiate a slow speed operation. A second input must be configured for Coast or Stop Option.

The Slow Speed operating mode requires motor tuning to function properly. Tuning can be forced manually or it will otherwise be performed automatically the first time the motor is started. See Motor Tuning on page 73.

To provide more precise stopping from a slow speed operation, braking from slow speed can also be configured using Slow Brake Current, Parameter 73. The maximum allowable brake current is 350% FLC. A value of 0 (default) applies no braking and a motor coast-to-stop results and slow speed is terminated.

ATTENTION: Slow speed running is not intended for continuous operation due to reduced motor cooling.

Figure 64 - Preset Slow Speed

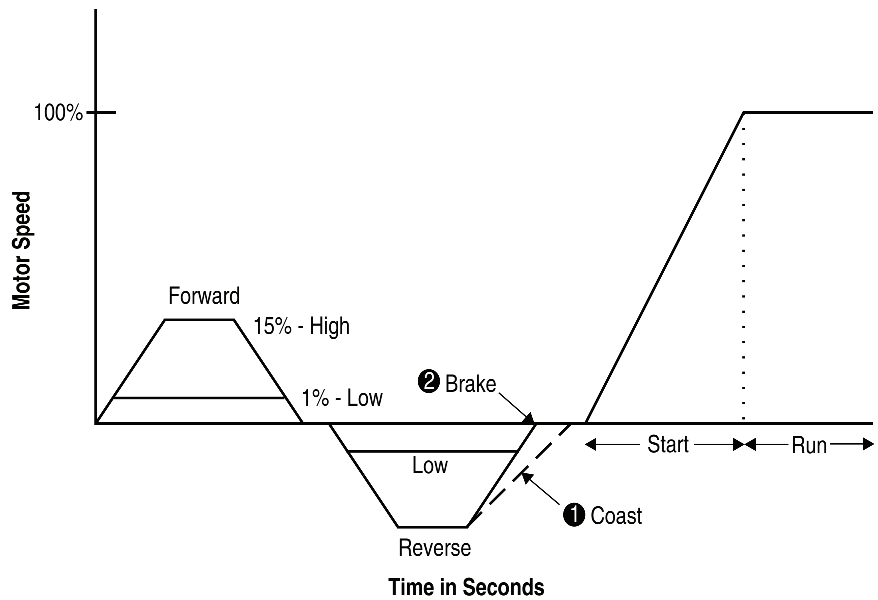


Table 27 - Preset Slow Speed & Slow Speed with Braking Parameter List

Parameter Number	Parameter Name	Minimum/Maximum [Default]	Access	Units
72	Slow Speed	-15 to +15 [10] ❶	R/W	%
73	Slow Brake Cur	[0]-350 ❷		%FLC

❶ Direction of the motor rotation is dependent on the sign (±) of Slow Speed %.

❷ Brake if Slow Brake Cur Parameter >0 and <350; coast if 0.

Accu-Stop™

This function combines the benefits of the SMB and Preset Slow Speed features. For general-purpose positioning, the Accu-Stop function provides a brake from full speed to the preset slow speed setting, then a brake or coast-to-stop.

The Accu-Stop function is enabled whenever the Stop Mode, Parameter 65, is configured for SMB and:

- a control input is configured for Stop
- a control input is configured for Start
- a control input is configured for Slow Speed.

With the above SMC-50 control configuration and with the motor running, enabling the Slow Speed input will initiate a SMB to the configured Slow Speed percent value, Parameter 72. The SMC-50 will continue to run the motor in slow speed until the Slow Speed input is disabled, At that point, the motor will either Brake-to-Stop or Coast-to-Stop depending on the value of the Slow Brake Cur, Parameter 73. If the value of Slow Brake Cur is zero (0), the motor will Coast-to-Stop from Slow Speed. If the value of Slow Brake Cur is a value other than zero, the SMC-50 will use braking to stop the motor using that value as a percent of the Motor FLC. See Figure 65, Figure 72 and Table 28.

The Accu-Stop operating mode requires motor tuning to function properly. Tuning can be forced manually or it will otherwise be performed automatically the first time the motor is started. See Motor Tuning on page 73.

ATTENTION: Accu-Stop is not intended to be used as an Emergency Stop. See applicable standards for emergency stop requirements.

Figure 65 - Accu-Stop

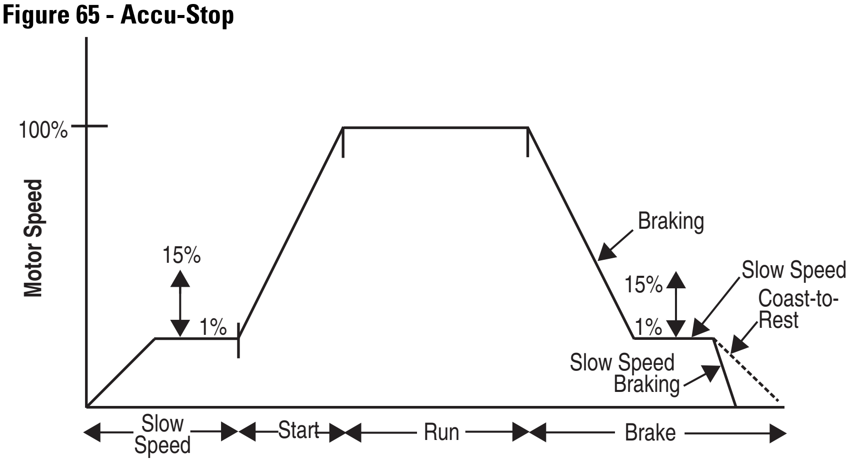


Table 28 - Accu-Stop Mode Parameter List

Parameter Number	Parameter Name	Minimum/Maximum [Default]	Access	Units
65	Stop Mode	SMB	R/W	
66	Stop Time ❶❷	[0]-999		SECS
69	Braking Current	[0]-400		%FLC
72	Slow Speed ❸	-15 to +15 [10]		%
73	Slow Brake Cur ❹	[0]-350		%FLC

❶ Programming a Stop Time is not required when SMB is used. SMB automatically controls the duration (Stop Time) of the braking current to the motor from the Running at Speed condition until a zero speed condition (Zero Speed Braking Shut Off feature/function). Programming a Stop Time will override the SMB Zero Speed Braking Shutoff feature/function. This could result in current being applied to a stopped motor, which will cause the motor to overheat. See Figure 71 on page 98 and Chapter 5, Programming, for additional details.

❷ With Stop Time, Parameter 66, set to some time value other than zero, the user-selected "Braking Current", Parameter 69, is applied for the user-configured "Stop Time" regardless of the motor speed (e.g., Automatic Zero Speed Detection disabled). This braking method can be used in applications where detecting zero speed is ineffective or when braking the motor to a complete stop results in random overload trips. Note that an ideal Stop Time setting can be accomplished by trial and error, but should always allow for some coast time. Setting the Stop Time for too long of a time period can result in braking current to be applied to a stopped motor and will likely result in overload trips.

❸ The direction of motor rotation is determined by the sign (+ or -) of Slow Speed, Parameter 72.

❹ With Slow Brake Cur, Parameter 73, set to 0 (default), the motor will coast-to-stop from Slow Speed. When the value is between 1...350 braking current is applied from Slow Speed.

External Braking Control

The external braking control feature enables an external mechanical motor brake to function in concert with the SMC-50 stop parameter. When the Stop Mode, Parameter 65, is set to Ext Brake and the stop maneuver is commanded, the starter will remove power to the motor and close any auxiliary output configured for External Brake. The auxiliary output relay configured for External Brake ❶ will remain active for the user-configured Stop Time, Parameter 66. Once the Stop Time is complete, the unit will open the auxiliary output and switch to the stopped state. While in the External Brake stopped mode, all relays and status functions will operate as they would in any other mode.

❶ The appropriate auxiliary relay must be configured for the Ext. Brake stopping function using the Aux X relay configuration parameter (e.g., Aux 1:Parameter 172, Aux 2: Parameter 176, etc.).

Table 29 - External Braking Control Mode Parameter List

Parameter Number	Parameter Name	Minimum/Maximum [Default]	Access	Units
65	Stop Mode	Ext Brake	R/W	—
66	Stop Time	[0]-999		SECS

Running Modes

Solid-State (SCR) Control Mode

The unit will run at full voltage under SCR control mode when the unit is at full speed and when no external bypass contactor is provided. All SMC-50 diagnostic and power monitoring features are available in this running mode.

External Bypass Control Mode

An external bypass contactor may be configured to operate the motor while running at full voltage and speed. The SMC-50 controls the external bypass contactor by using one of the auxiliary relay outputs configured to Ext. Bypass using that output's configuration parameter.

Devices rated 90…180 A

In external bypass control mode on devices rated 90…180 A, the controller's integral current sensors are out of the control circuit. If all the current sensing features (including motor overload) are desired while running in external bypass control mode, then the optional PTC/Ground Fault/External Current Transformer Expansion Module (150-SM2) and an 825-MCM180 current sensor are required. See Figure 28 on page 46 and Figure 44 on page 63.

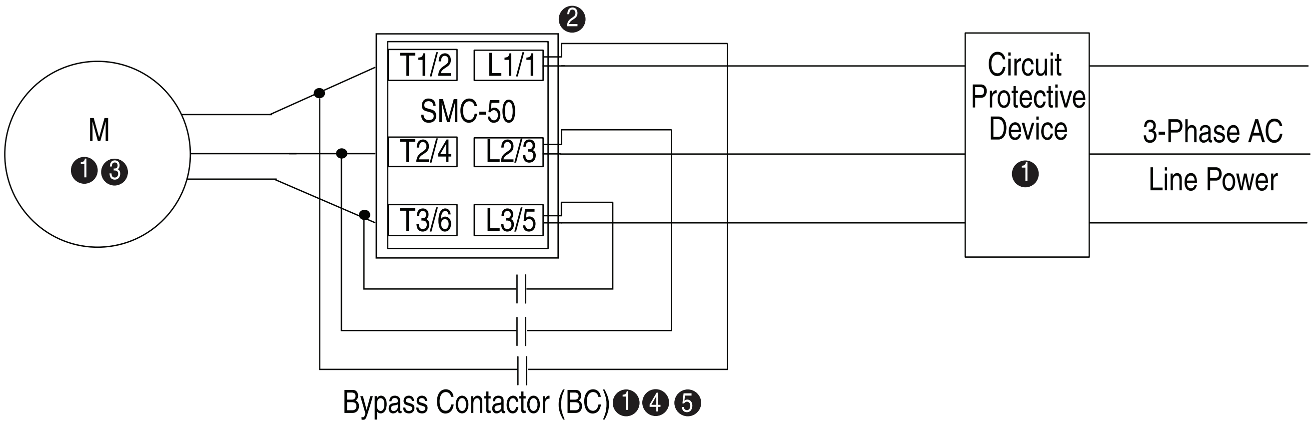
Devices rated 210…520 A

In external bypass control mode on devices rated 210…520 A, the controller's integral current sensors remain in the control circuit by using Cat. No. 150-SCBK (devices rated 210…320 A) or Cat. No. 150-SDBK (devices rated 361…520 A) Bypass Kits. See Figure 66 on page 92. The optional PTC/Ground Fault/External Current Transformer Expansion Module (150-SM2) and an 825-MCM20 with user supplied CTs with 5 A secondary can be used in place of the bypass kits. See Figure 26 on page 44 and Figure 44 on page 63.

NOTE: When using the Cat. No. 150-SCBK or 150-SDBK bypass kit, the controller firmware must be FRN 3.001 or higher.

The Cat. No. 150-SM2 Expansion Module can only be inserted into control module expansion port 7 or 8. In addition, only one 150-SM2 Expansion Module can be used per control module. Once the 150-SM2 Expansion Module is installed in the control module and power is applied, it must be configured using the 20-HIM-A6, the 20-HIM-C6S, or PC software (e.g. DriveExplorer). For additional configuration details refer to Chapter 2, Installation & Wiring, and Chapter 5, Programming.

Figure 66 - Wiring Diagram for Cat. No. 150-SC… or Cat. No. 150-SD… Devices with Bypass Contactor and Bypass Bus Kit



❶ Customer supplied.

❷ SMC-50 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.

❸ 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.

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

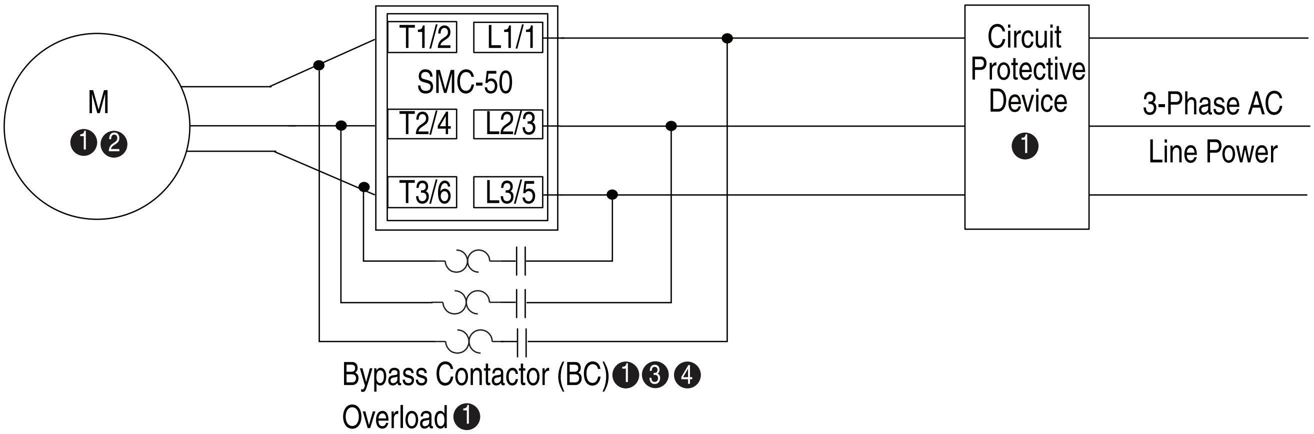
❺ In North America, size the bypass contactor per the motor Hp and FLA. In IEC applications, size the bypass contactor per the motor AC-1 rating.The short-circuit rating of the bypass contactor must be similar to the SMC-50.

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 is recommended. Operation of the isolation device should be coordinated using one of the SMC-50 auxiliary contacts configured to NORMAL.

External Overload (all devices)

The SMC-50 can also be used with an external overload in conjunction with the external bypass. In this configuration the external bypass contactor must be fully rated to the motor Hp/kW and FLA. See Figure 67 on page 93.

Figure 67 - Wiring Diagram for all Cat. No. 150-S… Devices with Bypass and External Overload



❶ Customer supplied.

❷ 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.

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

❹ 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 is recommended. Operation of the isolation device should be coordinated using one of the SMC-50 auxiliary contacts configured to NORMAL.

Energy Saver Mode

The energy saver function only applies during light motor load situations at which time the SMC-50 reduces current to the motor and thereby saves energy.

When in energy saver operation, the Energy Savings status bit is set. In addition, Energy Savings, Parameter 15, indicates the percentage energy savings.

Parameter 17 - [Power Factor] should be monitored and recorded when the motor is running at no/light load and at full/heavy load. The power factor value where the controller enters Energy Saver mode is determined by setting **Parameter 193 - [Energy Saver]** to a value between the no/light load and full/heavy load recorded values.

Table 30 - Energy Saver Mode Parameter List

Parameter Number	Parameter Name	Minimum/Maximum [Default]	Access	Units
15	Energy Savings	0…100	R	%
17	Power Factor	-1.00…1.00	R	—
193	Energy Saver	[0.00]-1.00	R/W	—

NOTE: Set Parameter 193=0 to diable Energy Saver mode.

Emergency RUN

With the SMC-50, a control terminal or network (via Comm Control Word) input can be configured as the Emergency Run command input. When this input is active all faults are disabled.

NOTE: The Emergency Run command input does not actually start the unit, but causes the unit to run in the Emergency Run mode. The Emergency Run command can be initiated at any time. This command is not latched allowing the Emergency Run mode to be cancelled while the unit is still running.

Sequence of Operation

Figure 68 through Figure 73 show the different operation sequences for the Soft Stop, Preset Slow Speed, Pump Control, SMB Smart Motor Braking, Accu-Stop, and Slow Speed with Braking options.

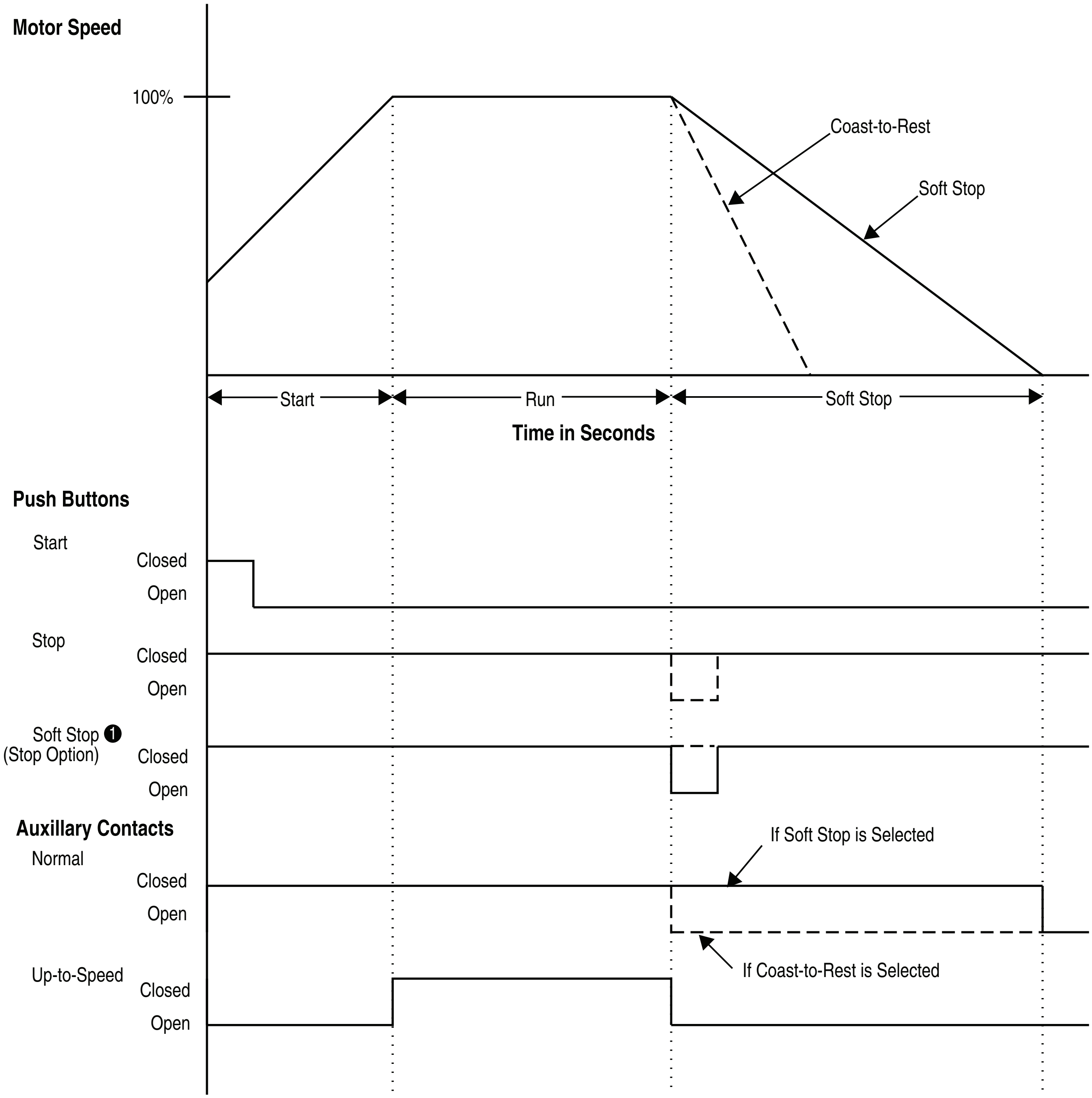
When control power is present but 3-phase line power is not applied, a valid START command causes AUX contacts configured for "Normal" to close. While waiting for 3-phase line power, the SMC-50 controller will indicate "Starting". When 3-phase line power is applied, the start sequence will be initiated.

ATTENTION: The user is responsible for determining which stopping mode is best suited to the application and will meet applicable standards for operator safety on a particular machine.

ATTENTION: Stopping modes are NOT intended to be used as an emergency stop. See applicable standards for emergency stop requirements.

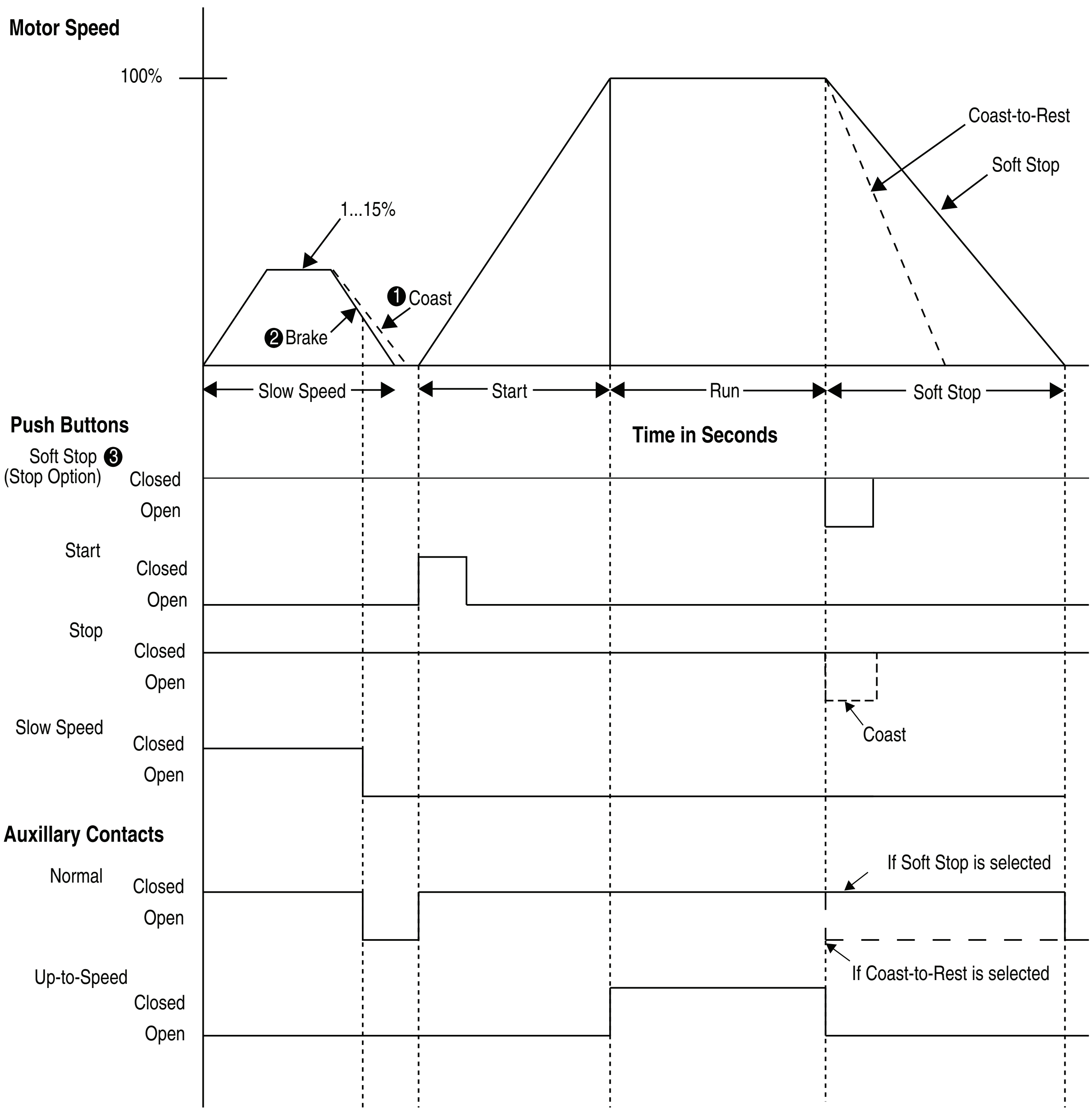
ATTENTION: The Energy Savings setting is motor and load dependent. Setting this to high may cause the unit to enter energy savings to soon and increase current.

Figure 68 - Soft Stop



❶ When the Stop Mode, Parameter 65, configured for Soft Stop and with the Input push button configured for the Stop Option.

Figure 69 - Preset Slow Speed

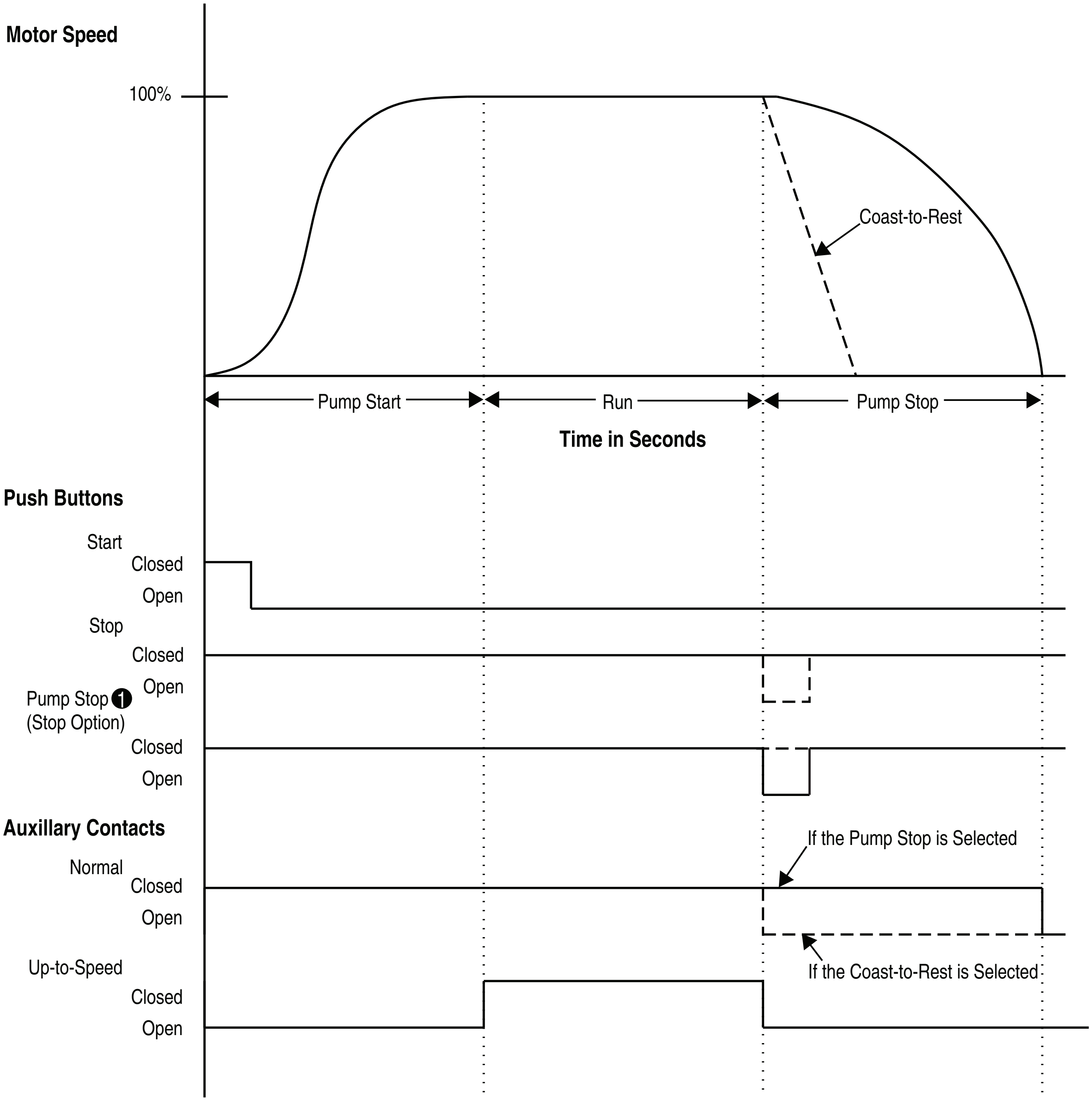


❶ Coast if Slow Brake Cur Parameter = 0.

❷ Brake if Slow Brake Cur Parameter >0 and <350.

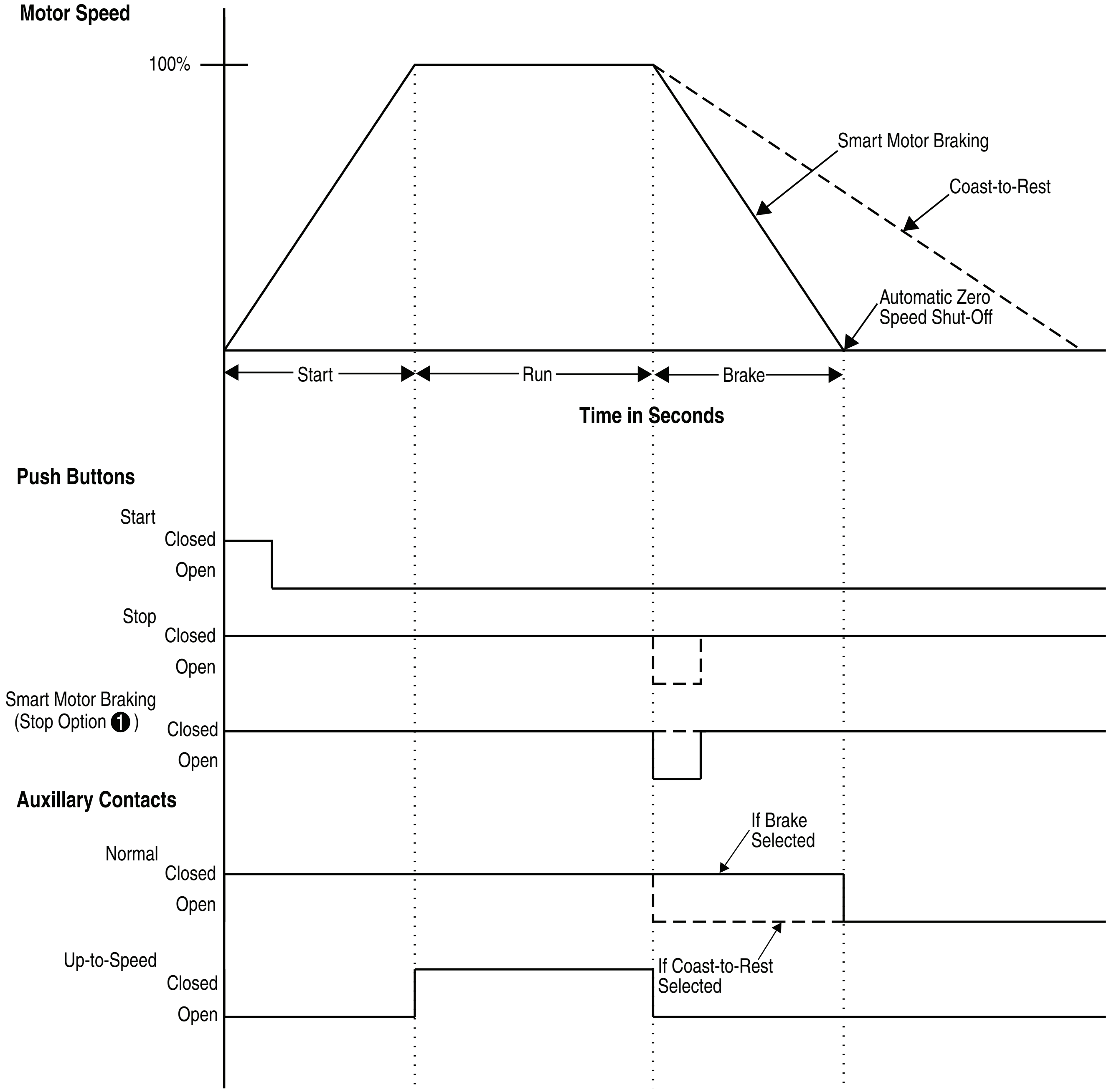
❸ When the Stop Mode, Parameter 65, configured for Soft Stop and with the Input push button configured for the Stop Option.

Figure 70 - Pump Control



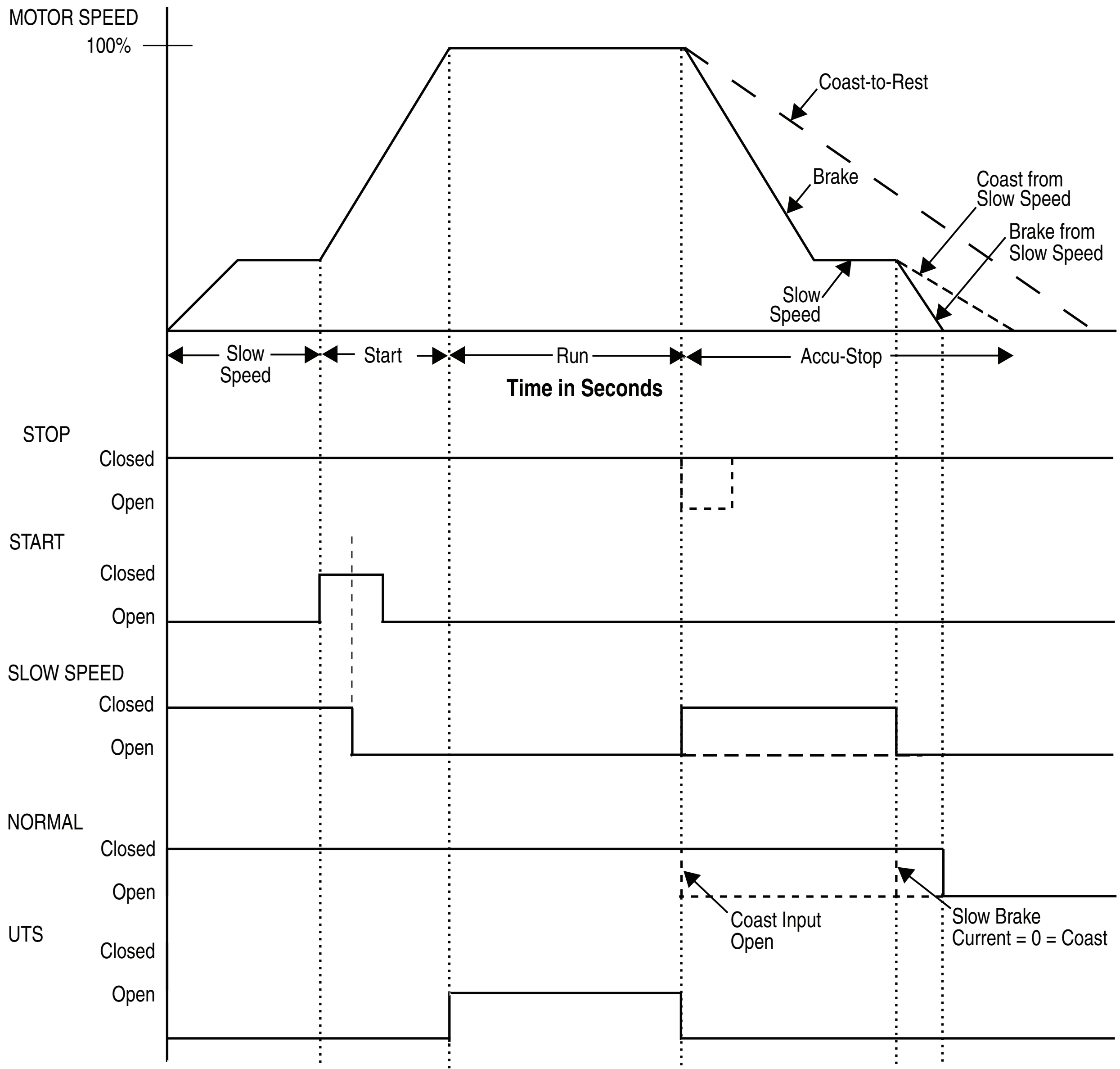
❶ When Stop Mode, Parameter 65, is configured for Pump Stop and the Input push button is configured for Stop Option.

Figure 71 - Smart Motor Braking (SMB)



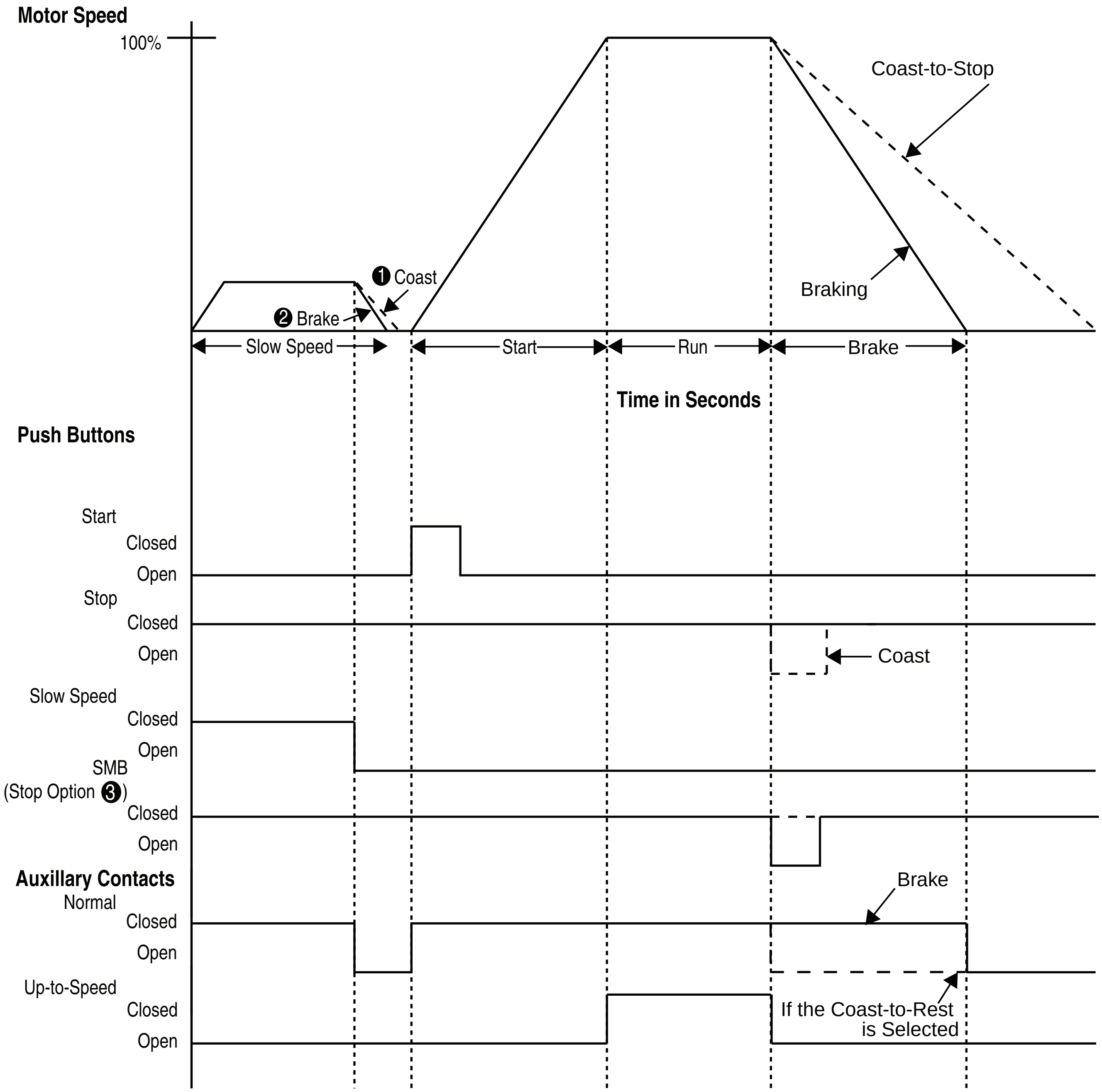
❶ When Stop Mode, Parameter 65, is configured for SMB and the Input push button is configured for Stop Option.

Figure 72 - Accu-Stop



NOTE: Parameter Selections:
1. Parameter 65: Stop Mode = SMB
2. Parameter 69: Braking Current = User Defined Value
3. Parameter 72: Slow Speed = User Defined Value/Selection
4. Parameter 73: Slow Brake Cur = User Defined Value (0 selected enables Coast-to-Rest)

Figure 73 - Slow Speed with Braking

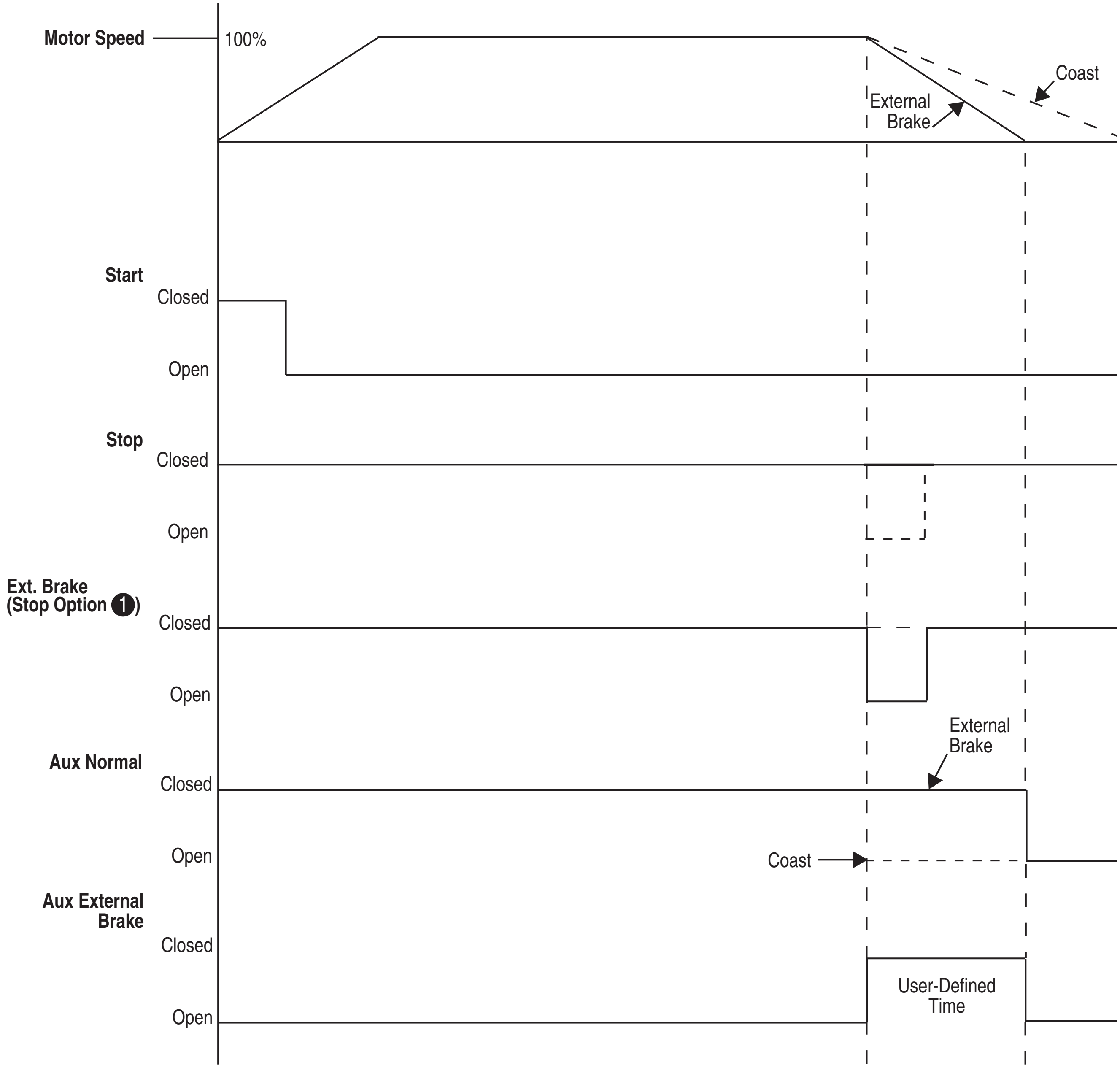


❶ Coast if Slow Brake Cur Parameter = 0.

❷ Brake if Slow Brake Cur Parameter >0 and <350.

❸ When the Stop Mode, Parameter 65, is configured for SMB and the Input push button is configured for Stop Option.

Figure 74 - External Braking



❶ When the Stop Mode, Parameter 65, is configured for Ext. Brake, (Eternal Brake) and the input push button is configured for STOP option.

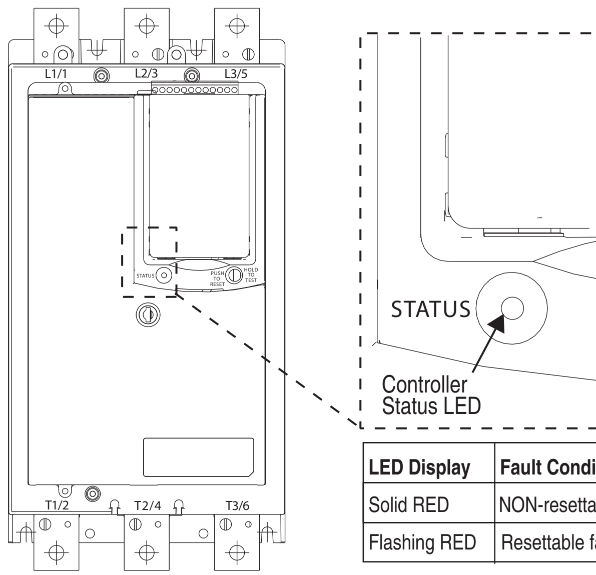
Protection & Diagnostic Functions

Overview

The SMC-50 provides both diagnostic and protection functions. These functions are in the form of user-configured parameters which provide motor and starter Alarms and Faults. Each configurable Alarm and Fault can be individually enabled or disabled. In addition, many Alarms and Faults have a user defined time delay available to help limit nuisance tripping. A Fault condition results in a controller shutdown. An alarm can be used to alert an operator to a pending fault. Motor and starter faults can be individually configured for automatic reset/restart after configuring the number of restart attempts and restart time delay. Restart attempts and restart delay are universal to all faults. See the Auto Restart from Fault section in this chapter for additional details.

A multi-colored (red, green, amber) STATUS LED is located on the front of the SMC-50 directly below the bezel/pocket for the 20-HIM-A6.

Figure 75 - Controller Status LED



LED Display	Fault Condition
Solid RED	NON-resettable fault has occurred
Flashing RED	Resettable fault has occured

Additional diagnostic LEDs are located on the optional Bulletin 150-SM6 Parameter Configuration Module (PCM). This module provides simple and limited parameter configurations. For additional diagnostic LED information, see Chapter 9, Diagnostics.

20-HIM-A6, 20-HIM-C6 & Configuration Software (e.g., DriveExplorer™)

The 20-HIM-A6, 20-HIM-C6, and PC configuration/monitoring software (e.g., DriveExplorer™) provide detailed Fault and Alarm information. When an SMC-50 Fault occurs, the HIM display indicates FAULTED along with the Fault Code, a simple fault description, and the elapsed time since the fault occurred. Other HIM screens provide more detailed data along with the ability to reset the Fault/Alarm from the keypad. For more details regarding the diagnostic use of these tools, see Chapter 9, Diagnostics.

To simplify identifying the source of a DPI port related Fault or Alarm, the SMC-50 displays the DPI port number when posting the Fault or Alarm number.

EXAMPLE	If a 150-SM4 Digital I/O Option Module is located in the SMC-50 DPI Port 7 and is the source of a Fault, port number 7 will be displayed with the Fault Code (e.g.,Port 7, Fault 26 is displayed as 7026).

Table 31 - SMC-50 DPI-Assigned Port Numbers & Source

DPI Port Number	Source	DPI Port Number	Source
0	SMC-50 Controller	6	Reserved
1	Front-Mounted HIM	7	Control Module Port 7
2	Remote DPI (top of SMC-50)	8	Control Module Port 8
3 ❷	Remote DPI	9 ❶	Control Module Port 9
4 ❶	20-COMM-X Module	10-15	Reserved
5	Reserved		

❶ When using a 20-COMM-X network communication module, it must physically be located in Control Module Port 9. However, its DPI Port Number assignment is 4 because of the cable connection to the DPI Port 4 located below the front-mounted HIM.

❷ To access Port 3, the use of a 1203-S03 splitter inserted into Port 2 is required.

Enabling Starter & Motor Faults & Alarms

Motor and starter Faults and Alarms can be individually configured, enabled, and disabled by the user. The parameters Motor Fault En, Starter Fault En, Motor Alarm En, and Starter Alarm En are numbered bit fields for configuration to enable (bit=1) or disable (bit =0) specific motor and/or starter Faults and Alarms. This can be done by configuration tools (e.g., HIM or PC software) or network communications.

Due to the number of Faults and Alarms being greater than 32, the configuration bits are located in the lower and upper 16-bit fields (numbered 0-31) of the associated SMC-50 parameters. The bits are broken up into the starter Faults and motor Faults.

These parameters do not enable or disable Faults that may be generated by expansion modules (e.g., 150-SM2, -SM4, etc.). When an expansion module is plugged into a control module port (7, 8, or 9), a set of configuration parameters appear to enable configuration of that specific module.

The following tables provide an overview of the motor and starter Fault and Alarm Enable parameters. All bits are read (R) and write (W) enabled.

Table 32 - Enable/Disable Starter Fault/Alarm Matrix

Parameter Number	Function/ Description❶	Fault/Alarm Name❶	Bit Assignment	Bit Access	Units [Default]
Starter Fault					
136	Starter Fault En	Volt Unbal Overvoltage Undervoltage Phase Rev [Line Loss] [Open Gate] Config Change Freq THD V	0 1 2 3 4 5 6 7 8	R/W	Bit = 0 Disabled Bit = 1 Enabled [Enabled]
Starter Alarm					
137	Starter Alarm En	Volt Unbal Overvoltage Undervoltage Phase Rev Line Loss Open Gate Config Change Freq THD V	0 1 2 3 4 5 6 7 8	R/W	Bit = 0 Disabled Bit = 1 Enabled [All Disabled as Default]

❶ As displayed on the HIM or DriveExplorer configuration tools.

Table 33 - Enable/Disable Motor Fault/Alarm Matrix

Parameter Number	Function/ Description❶	Fault/Alarm Name❶	Bit Assignment	Bit Access	Units [Default]
Motor Fault					
230	Motor Fault En	[Overload]	0	R/W	Bit = 0 Disabled
		Underload	1		Bit = 1 Enabled
		MWatts Over	2		[Enabled]
		MWatts Under	3		
		+MVAR Over	4		
		+MVAR Under	5		
		-MVAR Over	6		
		-MVAR Under	7		
		MVA Under	8		
		MVA Over	9		
		Curr Imbal	10		
		Jam	11		
		Stall	12		
		Starts/Hr	13		
		PM Hours	14		
		PM Starts	15		
		[Power Qual]	16		
		[Open Load]	27		
		THD1	18		
		Lead PF Un	19		
		Lead PF Ov	20		
		Lag PF Un	21		
		Lag PF Ov	22		
		Locked Rotor	23		
Motor Alarm					
231	Motor Alarm En	Overload	0	R/W	Bit = 0 Disabled
		Underload	1		Bit = 1 Enabled
		MWatts Over	2		[All Disabled as Default]
		MWatts Under	3		
		+MVAR Over	4		
		+MVAR Under	5		
		-MVAR Over	6		
		-MVAR Under	7		
		MVA Under	8		
		MVA Over	9		
		Curr Imbal	10		
		Jam	11		
		Stall	12		
		Starts/Hr	13		
		PM Hours	14		
		PM Starts	15		
		Power Qual	16		
		Open Load	27		
		THD1	18		
		Lead PF Un	19		
		Lead PF Ov	20		
		Lag PF Un	21		
		Lag PF Ov	22		
		Locked Rotor	23		

❶ As displayed on the HIM or DriveExplorer configuration tools.

Enabling Option Module Functional Faults & Alarm

Not all option modules have faults and alarms associated with their specific function(s). For example, the 150-SM4 Option I/O and 150-SM6 Parameter Configuration Modules **do not** have functional faults or alarms. However, when an option module has functional faults and alarms, it also has the ability to individually configure, enable, and disable them like faults and alarms for the controller and motor.

150-SM2 Option Module

The 150-SM2 Option Module has individually enabled faults and alarms associated with the Ground Fault and Motor PTC functions. The following table provides an overview.

Table 34 - 150-SM2 Faults & Alarms

Parameter Number	Function/ Description❶	Fault/Alarm Name❶	Bit Assignment	Bit Access	Units [Default]
X02 ❷	Fault En	PTC Gnd Flt	0 1	R/W	**NOTE:** Bit=0 Disabled Bit=1 Enabled [All Disabled]
X03 ❷	Alarm En	PTC Gnd Flt	0 1	R/W	

❶ As displayed on the HIM or DriveExplorer™ configuration tools.

❷ X = the control module port number (7 or 8) in which the 150-SM2 resides.

150-SM3 Option Module

The 150-SM3 Option Module has individually enabled faults and alarms associated with the analog inputs and outputs. The following table provides an overview.

Table 35 - 150-SM3 Faults & Alarms

Parameter Number	Function/ Description❶	Fault/Alarm Name❶	Bit Assignment	Bit Access	Units [Default]
X37 ❷	Fault En	IN1 Over IN1 Under IN2 Over IN2 Under OUT1 Shorted OUT1 Open OUT2 Shorted OUT2 Open	0 1 2 3 4 5 6 7	R/W	**NOTE:** Bit=0 Disabled Bit=1 Enabled [All Disabled]
X38 ❷	Alarm En	IN1 Over IN1 Under IN2 Over IN2 Under OUT1 Shorted OUT1 Open OUT2 Shorted OUT2 Open	0 1 2 3 4 5 6 7	R/W	

❶ As displayed on the HIM or DriveExplorer™ configuration tools.
❷ X = the control module port number (7 or 8) in which the 150-SM2 resides.

Protection & Diagnostics

The following describes the SMC-50 protection and diagnostic functions.

Overload — Fault & Alarm

Overload Fault (Code 21)

The SMC-50 meets applicable requirements as a motor overload protective device. Thermal memory provides added protection and maintains motor thermal data when control power is removed.

The SMC-50 provides overload protection through true RMS current measurement of the individual phase currents of the connected motor. A thermal model that simulates the actual heating of the motor is calculated based on the following:

- measured maximum motor current value,
- Motor FLC Setting, Parameter 78,
- Overload (Trip) Class❶ Setting, Parameter 75, and
- Motor Service Factor, Parameter 77, (obtained from the motor nameplate)

❶ Trip Class is defined as the maximum time in seconds for an overload trip to occur when the motor's operating current is six times its rated current. The SMC-50 overload function offers an adjustable Trip Class range of 5…30, which can be programmed in increments of one via Overload Class, Parameter 75, and Overload Class 2, Parameter 76 (configuration for a second OL Class).

The Motor Thermal Usage (MTU), Parameter 18, displays the percentage of the motor overload currently utilized. The SMC-50 overload fault will trip the motor when (1) the motor overload fault is enabled **and** (2) the MTU reaches 100%.

The overload function calculates and provides motor overload data through:

- MTU, Parameter 18,
- Time to OL Trip, Parameter 19, and
- Time to OL Reset, Parameter 20.

NOTE: Trip rating is 118% of the programmed motor FLC.

The SMC-50 continues to calculate the reduction in MTU (decay rate) when the motor is powered down (cooling). This is enabled using the SMC-50's real time clock (RTC) function. When control power is lost, the SMC-50 saves the power down thermal level and time. Then, when power is reapplied, the SMC-50 reads the current time, power down time, and power down thermal level. From this data, the SMC-50 calculates the new thermal information for the overload.

Overload Alarm

In addition to the Overload Fault, an Overload Alarm is also available. The desired value or level of the alarm is set up with Overload Alarm Level, (Overload A Lvl), Parameter 83, which can be set from 0% to 100%. When the MTU value reaches the set percentage of the thermal trip level, then the alarm becomes active. When the MTU value falls below the set percentage of the thermal trip level, the alarm becomes inactive.

Motor Thermal Usage (Mtr Therm Usage), Parameter 18, provides the current motor thermal usage value. This parameter reads from 0% to 200%, where 100% corresponds to a fault condition.

Figure 76 - Overload Trip Curves

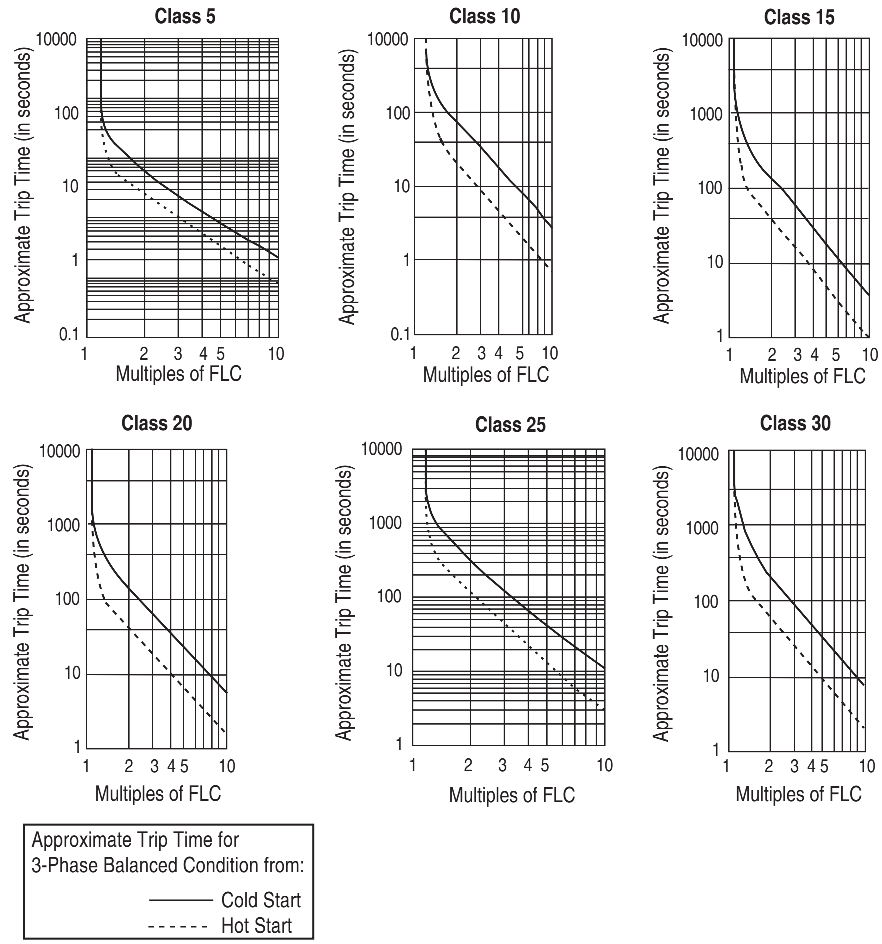
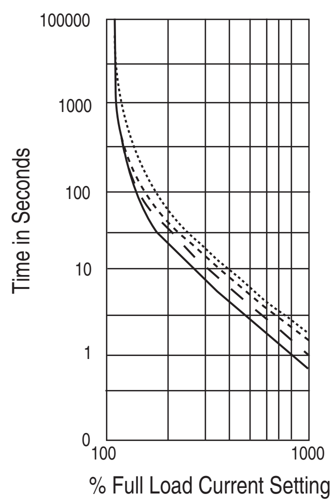


Figure 77 - Restart Trip Curves after Auto Reset



	Class	Auto Reset Time in Seconds
———	10	90
— — —	15	135
- - - - - - - -	20	180
················	30	270

Overload Shunt Time, Parameter 81, allows disabling (shunt) the overload at the beginning of the start cycle. The length of time that the overload is disabled (shunted) is defined by this parameter. The motor overload is not accumulating data (MTU) during this period.

The SMC-50 can be configured to automatically reset the overload fault when it has cooled to the set Overload Reset Level, Parameter 80. The Motor Restart Enabled (Motor Restart En), Parameter 264, must be enabled (Overload = Set) to allow the Overload Reset Level parameter to function.

The Time to Overload Trip (Time to OL Trip), Parameter 19, provides indication of how much time is left before an overload trip will occur given the current operating conditions. If the overload fault is disabled, this parameter will read its maximum value.

The Time to OL Reset, Parameter 20, provides indication of how much time is left before an overload fault will clear based on the cooling (decay) algorithm. If the overload parameter is disabled or has not tripped, then this parameter will be zero.

Table 36 - Overload Parameter List

Parameter Number	Parameter Name❶	Minimum/Maximum [Default]	Access	Units
75	Overload Class	5-30 [10]		—
76	Overload Class 2 ❷	5-30 [10]	R/W	—
77	Service Factor	0.01-1.99 [1.15]		—
78	Motor FLC	[1.0]-2200.0		Amps
80	OL Reset Level	1-99 [75]		%MTU
18	Motor Therm Usage	0-200	R	%MTU
81	OL Shunt Time	[0]-999		SECS
82	OL Inhibit Time	[0]-999	R/W	SECS
83	Overload A Lvl	[0]-100		%MTU
19	Time to OL Trip	0-10000	R	SECS
20	Time to OL Reset	0-10000		SECS
84	Locked Rtr Level	400-1000 [600]	R/W	%FLC
85	Locked Rtr Time	[1]-1000	R/W	SECS

❶ As displayed on the HIM or DriveExplorer™ configuration tools. ❷ Configuration for a second OL Class.

Underload — Fault & Alarm

The SMC-50 provides the ability to trip on underload when the motor current falls below a user-defined level for a user-defined time.

Underload Fault (Code 22)

Motor current less than a specific level may indicate a mechanical malfunction in the installation (e.g., a torn conveyor belt, damaged fan blade, broken shaft, or worn tool). Such conditions may not harm the motor, but can lead to loss of production. Rapid Underload Fault detection helps to minimize damage and loss of production.

Underload Fault current protection, Fault Code 22, is enabled or disabled via the motor Underload Enable/Disable bit in the Motor Fault Enable, Parameter 230. The value or level of the Fault current is configured using Underload Fault Level (Underload F Lvl), Parameter 86. A configurable Fault Delay Time using Underload Fault Delay (Underload F Dly), Parameter 87, is also available to help eliminate nuisance faults.

Underload Alarm

A motor Underload Alarm is also available. This is configured exactly as the Underload Fault using Underload Alarm Level (Underload A Lvl), Parameter 88, and Underload Alarm Delay (Underload A Dly), Parameter 89. The Alarm can be enabled or disabled using the Underload bit in the Motor Alarm Enabled, Parameter 231.

The SMC-50 checks for a motor Underload condition approximately every 0.025 seconds.

NOTE: Underload protection is active when the motor is at speed.

Table 37 - Underload Parameter List

Parameter Number	Parameter Name ❶	Minimum/Maximum [Default]	Access	Units
86	Underload F Lvl	[0]-99	R/W	%FLC
87	Underload F Dly	[0.1]-99.0		SECS
88	Underload A Lvl	[0]-99		%FLC
89	Underload A Dly	[0.1]-99.0		SECS

❶ As displayed on the HIM or DriveExplorer™ configuration tools.

Line Power Undervoltage Protection

Undervoltage Fault (Code 20)

The SMC-50 has the ability to protect against low line power voltage. The Undervoltage Fault, Code 20, provides protection from a line power undervoltage condition. An undervoltage fault condition exists if the average of the three-phase Line Voltage (Line Voltage), Parameter 46, falls below the user-defined voltage level (Undervolt F Lvl), Parameter 98, for a user-defined time Undervolt Fault Delay. See Table 38

Undervoltage Fault protection is enabled or disabled via the Undervoltage Enable/Disable bit in the Starter Fault Enable, Parameter 136.

Undervoltage Alarm

In addition to the Fault, an Undervoltage Alarm is also available. This is set up exactly like the Fault using the "Undervolt A Lvl", Parameter 100, and the "Undervolt A Dly", Parameter 101. The Undervoltage Alarm is enabled or disabled via the Undervoltage Enable/Disable bit in the Starter Alarm Enable, Parameter 137.

Table 38 - Undervoltage Protection Parameter List

Parameter Number	Parameter Name❶	Minimum/Maximum [Default]	Access	Units
46	Line Voltage	0-700 [400]	R/W	Volts
98	Undervolt F Lvl	0-100 [90]		%V
99	Undervolt F Dly	0.1-99.0 [3.0]		SECS
100	Undervolt A Lvl	0-100 [90]		%V
101	Undervolt A Dly	0.1-99.0 [3.0]		SECS

❶ As displayed on the HIM or DriveExplorer™ configuration tools.

Line Power Overvoltage Protection — Fault & Alarm

Overvoltage Fault (Code 19)

The SMC-50 has the ability to protect against high line power voltage. The Overvoltage Fault, Code 19, provides protection from a line power Overvoltage condition. An overvoltage condition exists if the average of the three-phase line voltage exceeds a user-defined percent above that level (Overvolt F Lvl) for a user-defined time, "Overvolt F Dly". See Table 39 on page 114.

Overvoltage protection is enabled or disabled via the Overvoltage Enable/Disable bit in the Starter Fault Enable, Parameter 136.

Overvoltage Alarm

In addition to the Fault, an Overvoltage Alarm is also available. This is set up exactly as like the Overvoltage Fault using the Overvoltage Alarm Level and Overvoltage Alarm Delay parameters.

The Overvoltage Alarm is enabled or disabled via the Overvoltage Enable/Disable bit in the Starer Alarm Enable, Parameter 137.

Table 39 - Overvoltage Protection Parameter List

Parameter Number	Parameter Name❶	Minimum/Maximum [Default]	Access	Units
46	Line Voltage	0-700 [400]	R/W	Volts
102	Overvolt F Lvl	100-199 [110]		%
103	Overvolt F Dly	0.1-.99.0 [3.0]		SECS
104	Overvolt A Lvl	100-199 [110]		%
105	Overvolt A Dly	0.1-.99.0 [3.0]		SECS

❶ As displayed on the HIM or DriveExplorer™ configuration tools.

Current Imbalance Protection — Fault & Alarm

A current imbalance condition can be caused by an unbalance in the voltage supply, unequal motor winding impedance, or long and varying wire lengths. When a current imbalance condition exists, the motor can experience an additional temperature rise, resulting in degradation of the motor insulation and reduction in life expectancy. Rapid current imbalance fault detection helps extend the motor's life expectancy and minimize potential damage and loss of production.

The current imbalance calculation is equal to the largest deviation of the three current signals (RMS phase current) from the average phase current, divided by the average phase current. Note that the power pole current is used for the current imbalance calculation.

Current Imbalance Fault (Code 42)

A Current Imbalance Fault condition, Fault Code 42, occurs when the calculated imbalance level rises above a user-defined level, Current Imbalance Fault Level, for a user-defined time, Current Imbalance Fault Delay. See Table 40 on page 115.

Current imbalance protection is enabled or disabled using the Current Imbalance bit in the Motor Fault Enable, Parameter 230.

Current Imbalance Alarm

In addition to the Current Imbalance Fault, a Current Imbalance Alarm is also available. This is set up exactly like the Current Imbalance Fault using the Current Imbalance Alarm Level and Current Imbalance Alarm Delay parameters. The Current Imbalance Alarm can be enabled or disabled using the Current Imbalance bit in the Motor Alarm Enable, Parameter 231.

Table 40 - Current Imbalance Parameter List

Parameter Number	Parameter Name❶	Minimum/Maximum [Default]	Access	Units
110	Cur Imbal F Lvl	1-25 [15]	R/W	%
111	Cur Imbal F Dly	0.1-.99.0 [3.0]		SECS
112	Cur Imbal A Lvl	1-25 [10]		%
113	Cur Imbal A Dly	0.1-.99.0 [3.0]		SECS

❶ As displayed on the HIM or DriveExplorer™ configuration tools.

Voltage Unbalance Protection — Fault & Alarm

An unbalance in the voltage supply results in a current imbalance. This causes the motor to experience an additional temperature rise, resulting in degradation of the motor insulation and reducing its life expectancy. Voltage unbalance detection helps extend the motor life expectancy and minimize potential damage and loss of production.

The voltage unbalance (Vu) calculation is equal to the largest deviation (Vd) of the three-phase voltage signals (RMS phase voltage) from the average of the RMS phase voltage (Vave), divided by the average voltage. In other words:

$$Vu\% = 100\left(\frac{V_d}{V_{ave}}\right)$$

Note that the phase-to-phase voltage is used in the calculation for voltage unbalance.

Voltage Unbalance Fault (Code 18)

A Voltage Unbalance Fault condition, Fault Code 18, occurs when the calculated unbalance level rises above a user-defined level, Voltage Unbalance Fault Level, for a user-defined time, Voltage Unbalance Fault Delay. See Table 41 on page 116.

Voltage unbalance protection is enabled or disabled using the Voltage Unbalance bit in the Starter Fault Enable, Parameter 136.

Voltage Unbalance Alarm

In addition to the Voltage Unbalance Fault, a Voltage Unbalance Alarm is also available. This is set up exactly like that of the Voltage Unbalance Fault using the Voltage Unbalance Alarm Level and Voltage Unbalance Alarm Delay parameters. This Voltage Unbalance Alarm is enabled or disabled using the Voltage Unbalance bit in the Starter Alarm Enable, Parameter 137.

Table 41 - Voltage Unbalance Protection Parameter List

Parameter Number	Parameter Name❶	Minimum/Maximum [Default]	Access	Units
106	Volt Unbal F Lvl	1-25 [15]	R/W	%
107	Volt Unbal F Dly	0.1-.99.0 [3.0]		SECS
108	Volt Unbal A Lvl	1-25 [10]		%
109	Volt Unbal A Dly	0.1-.99.0 [3.0]		SECS

❶ As displayed on the HIM or DriveExplorer™ configuration tools.

Phase Reversal Protection

Phase Reversal Fault (Code 25)

The SMC-50 provides Fault Protection, Fault Code 25, against reverse connection (CBA) of line power phases.

Phase Reversal protection is enabled or disabled via the "Phase Rev" bit in the Starter Fault Enable, Parameter 136. There are no phase reversal fault parameters to configure.

A phase reversal Alarm is also available and enabled via the "Phase Rev" bit in the Starter Alarm Enable, Parameter 137. There are no Alarm parameters to configure.

High & Low Line Power Frequency Protection — Fault & Alarm

The SMC-50 has the ability to protect against poor line power quality by offering programmable frequency-based protection. The user can fault the starter if the line power frequency is either too high or too low.

High and low frequency limits for both Faults and Alarms are configured through the parameters listed in Table 42. Note that each also has a programmable delay to limit nuisance trips.

Frequency Fault (Code 49)

The high/low Frequency Fault, Code 49, is enabled or disabled using the Frequency bit "Freq" in the Starter Fault Enable, Parameter 136.

Frequency Alarm

In addition to the Fault, a Frequency Alarm is also available. The Frequency Alarm is enabled or disabled using the Frequency bit in the Starter Alarm Enable, Parameter 137.

NOTE: Regardless of the user-defined high or low frequency Fault or Alarm levels, if the line power frequency falls below 45 Hz or above 66 Hz, the SMC-50 will enter a wait state (stop and will not start, or will not start if already stopped) until the frequency returns within the 45 Hz to 66 Hz range.

Table 42 - High & Low Line Power Frequency Parameter List

Parameter Number	Parameter Name❶	Minimum/Maximum [Default]	Access	Units
129	Freq High F Lvl	45-66 [63]	R/W	Hz
225	Freq High F Dly	[0.1]-.99.0		SECS
130	Freq Low F Lvl	45-66 [47]		Hz
227	Freq Low F Dly	[0.1]-.99.0		SECS
131	Freq High A Lvl	45-66 [63]		Hz
226	Freq High A Dly	[0.1]-.99.0		SECS
132	Freq Low A Lvl	45-66 [47]		Hz
228	Freq Low A Dly	[0.1]-.99.0		SECS

❶ As displayed on the HIM or DriveExplorer™ configuration tools.

Stall Protection — Fault & Alarm

When a motor stalls (stops) during its starting sequence, the motor heats up very rapidly; after some permissible stall time, the motor reaches the temperature limit of its insulation. Rapid stall detection during the starting sequence can extend the motor's life as well as minimize the potential damage and loss of production.

Stall Fault (Code 24)

When the SMC-50 is instructed to start a motor and the programmed start Ramp Time has completed before the motor is Up-to-Speed (UTS), the start sequence will continue until one of the following occurs:

- motor reaches full speed,
- Stall Fault, Code 24, occurs,
- indefinitely if the stall fault is disabled, or
- until a motor overload or SCR overtemperature condition

When the stall feature is enabled, the SMC-50 will start an internal timer when the programmed Ramp Time expires. When this timer reaches the time value programmed in the Stall Delay, Parameter 188, a Stall Fault is generated. If the

Stall Delay parameter is set to zero, then the Fault will occur immediately if the motor is not UTS at the completion of the programmed Ramp Time. If the SMC-50 detects that the motor is UTS before the Stall Delay, it will consider the start sequence complete, switch to full voltage, and not generate a Stall Fault/Alarm.

NOTE: Due to the beginning of the Linear Speed Starting mode being an open loop voltage control, the actual starting time may vary depending on the motor load. For this reason (and to avoid nuisance faults), the SMC-50 automatically adds a time to the configured starting ramp time before the stall timer begins to count. The time factor is 50% of the configured start ramp time.

Stall Fault protection is enabled or disabled via the "Stall" bit in the Motor Fault Enable, Parameter 230.

Stall Alarm

In addition to the Stall Fault, a Stall Alarm can also be enabled, which will activate under the same condition as the Stall Fault. In this case, the Alarm will be cleared once the motor leaves the starting state (e.g., is UTS, is stopped, faulted, etc.).

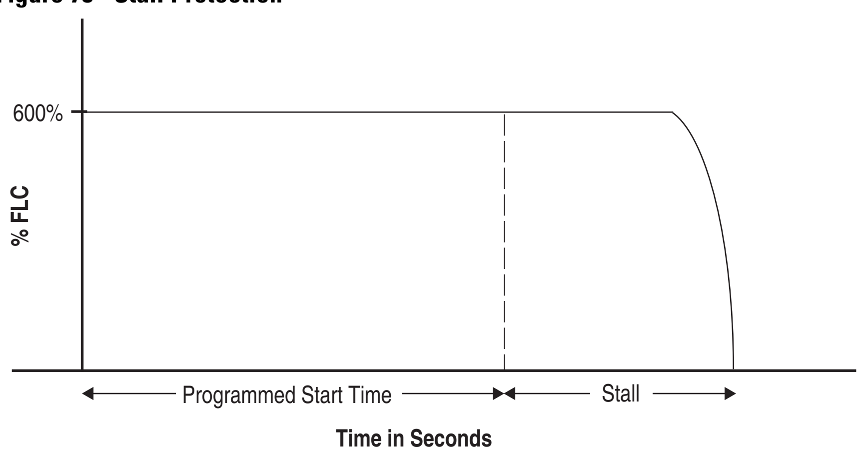
The Stall Alarm is enabled or disabled via the "Stall" bit in the Motor Alarm Enable, Parameter 231.

Table 43 - Stall Protection Parameter List

Parameter Number	Parameter Name❶	Minimum/Maximum [Default]	Access	Units
188	Stall Delay	0.0-30.0 [10.0]	R/W	SECS

❶ As displayed on the HIM or DriveExplorer™ configuration tools.

Figure 78 - Stall Protection



Jam Detection — Fault & Alarm

Motor operational (run) current greater than the motor nameplate rating may indicate a jam condition due to a conveyor jam or jammed drive gear. These conditions can result in overheating of the motor and equipment damage. Rapid Jam detection helps to minimize damage and loss of production.

NOTE: The SMC-50 starter SCR Overtemperature Fault (see SCR Overtemperature) may occur before the jam trip in the case of high current situations.

Jam Fault (Code 23)

The SMC-50 Jam Fault, Fault Code 23, provides detection of a motor jam. A jam condition exists if the motor current rises above a user-defined level for a user-defined time while in the run mode.

NOTE: This fault is not active during starting or stopping.

The Jam Level, Parameter 114, is a percentage of the motor's Full Load Current Parameter 78. If the actual motor current rises above the Jam Fault Level (Jam F Lvl) for a time equal to the Jam Fault Delay (Jam F Dly) then a Fault will be generated. See Table 44 and Figure 79. Jam protection is enabled or disabled using the Jam bit in the Motor Fault Enable, Parameter 230.

Jam Alarm

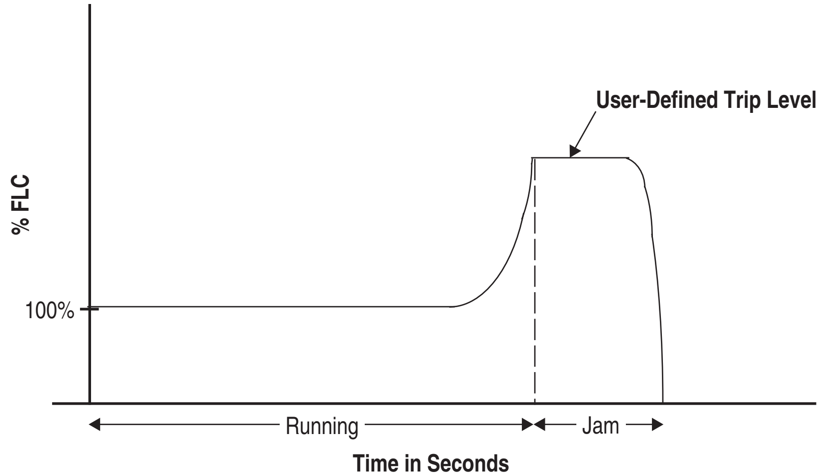
In addition to the Fault, a Jam Alarm is also available. This is set up exactly like the Fault Jam, using Jam Alarm Level and Jam Alarm Delay. This Alarm is enabled or disabled using the Jam bit in the Motor Alarm Enable, Parameter 231.

Table 44 - Jam Detection Parameter List

Parameter Number	Parameter Name❶	Minimum/Maximum [Default]	Access	Units
78	Motor FLC	[1.0]-2200.0	R/W	Amps
114	Jam F Lvl	0-[1000]		%FLC
115	Jam F Dly	[0.1]-99.0		SECS
116	Jam A Lvl	0-[1000]		%FLC
117	Jam A Dly	[0.1]-99.0		SECS

❶ As displayed on the HIM or DriveExplorer™ configuration tools.

Figure 79 - Jam Detection



Real Power Protection (MWatts)

Motor Over Power Real — Fault & Alarm

Motor Over Power Real Fault (Code 44)

A Motor Over Power Real Fault, Code 44, condition occurs when the real power being consumed by the motor has risen above a user-defined level MWatts Ov F Lvl, Parameter 90, for the user-defined time MWatts Ov F Dly, Parameter 91.

This over power real Fault is enabled or disabled using the MWatts Over bit in the Motor Fault Enable, Parameter 230.

Motor Over Power Real Alarm

A motor overpower real Alarm is also available. This is set up exactly like the motor Fault using Parameter MWatts Ov A Lvl and MWatts Ov A Dly. This alarm is enabled or disabled using the MWatts Over bit in the Motor Alarm Enable, Parameter 231.

Table 45 - Motor Overpower Real Parameter List

Parameter Number	Parameter Name❶	Minimum/Maximum [Default]	Access	Units
90	MWatts Ov F Lvl	[0.000]-1000.00	R/W	MW
91	MWatts Ov F Dly	[0.1]-99.0		SECS
92	MWatts Ov A Lvl	[0.000]-1000.00		MW
93	MWatts Ov A Dly	[0.1]-99.0		SECS

❶ As displayed on the HIM or DriveExplorer™ configuration tools.

Motor Under Power Real — Fault & Alarm

Motor Under Power Real Fault (Code 43)

A Motor Under Power Real Fault, Fault Code 43, condition occurs when the real power being consumed by the motor falls below a user-defined level MWatts Un F Lvl, Parameter 94, for the user-defined time MWatts Un F Dly, Parameter 95.

This Fault is enabled or disabled using the MWatts Under bit in the Motor Fault En, Parameter 230.

Motor Under Power Real Alarm

In addition to the Fault, an Alarm is also available. This is set up exactly like the motor Fault using Parameter MWatts Un A Lvl and MWatts Un A Dly. This alarm is enabled or disabled using the MWatts Under bit in the Motor Alarm En, Parameter 231.

Table 46 - Motor Over Power Real Parameter List

Parameter Number	Parameter Name❶	Minimum/Maximum [Default]	Access	Units
94	MWatts Un F Lvl	[0.000]-1000.000	R/W	MW
95	MWatts Un F Dly	[0.1]-99.0		SECS
96	MWatts Un A Lvl	[0.000]-1000.000		MW
97	MWatts Un A Dly	[0.1]-99.0		SECS

❶ As displayed on the HIM or DriveExplorer™ configuration tools.

Reactive Power Protection (MVAR)

The SMC-50 has the ability to protect against excessive reactive power (MVAR). The user can protect (Fault) or issue a warning (Alarm) in the event that the motor reactive power (MVAR) consumption (+) or generation (-) is too high. This protection can be used with synchronous motors or motors that have active Power Factor correction capacitors.

Motor Over Power Reactive Positive (Motor Consumed) — Fault & Alarm

Motor Over Power Reactive Positive Fault (Code 46)

A Motor Over Power Reactive Positive Fault condition, Fault Code 46, occurs when the reactive power being consumed by the motor rises above a user-defined level +MVAR Ov F Lvl, Parameter 232, for the user-defined delay time +MVAR Ov F Dly, Parameter 233.

This Fault is enabled or disabled using the +MVAR Over bit in the Motor Fault Enable, Parameter 230.

Motor Over Power Reactive Positive Alarm

In addition to the Fault, a Motor Over Power Reactive Alarm is also available. This is set up exactly like the Fault using parameters +MVAR Ov A Lvl and +MVAR Ov A Dly, as shown in Table 47. The Alarm is enabled or disabled using the +MVAR Over bit in the Motor Alarm Enable, Parameter 231.

Table 47 - Motor Over Power Reactive Positive Parameter List

Parameter Number	Parameter Name❶	Minimum/Maximum [Default]	Access	Units
232	+MVAR Ov F Lvl	[0.000]-1000.000	R/W	MVAR
233	+MVAR Ov F Dly	[0.1]-99.0		SECS
234	+MVAR Ov A Lvl	[0.000]-1000.000		MVAR
235	+MVAR Ov A Dly	[0.1]-99.0		SECS

❶ As displayed on the HIM or DriveExplorer™ configuration tools.

Motor Under Power Reactive Positive (Motor Consumed) — Fault & Alarm

Motor Under Power Reactive Positive Fault (Code 45)

A Motor Under Power Reactive Positive Fault condition, Fault Code 45, occurs when the reactive power being consumed by the motor falls below the user-defined level +MVAR Un F Lvl, Parameter 236, for the user-defined delay time +MVAR Un F Dly, Parameter 237.

This Fault is enabled or disabled using the +MVAR Under bit in the Motor Fault Enable, Parameter 230.

Motor Under Power Reactive Positive Alarm

In addition to the Fault, an Under Power Reactive Alarm is also available. This is set up exactly like the Fault using parameters +MVAR Un A Lvl and +MVAR Un A Dly, as shown in Table 48. The Alarm is enabled or disabled using the +MVAR Under bit in the Motor Alarm Enable, Parameter 231.

Table 48 - Motor Underpower Reactive Positive Parameter List

Parameter Number	Parameter Name❶	Minimum/Maximum [Default]	Access	Units
236	+MVAR Un F Lvl	[0.000]-1000.000	R/W	MVAR
237	+MVAR Un F Dly	[0.1]-99.0		SECS
238	+MVAR Un A Lvl	[0.000]-1000.000		MVAR
239	+MVAR Un A Dly	[0.1]-99.0		SECS

❶ As displayed on the HIM or DriveExplorer™ configuration tools.

Motor Over Power Reactive Negative (Motor Generated) — Fault & Alarm

Motor Over Power Reactive Negative Fault (Code 67)

A Motor Over Power Reactive Negative Fault, Fault Code 67, condition occurs when the Reactive Power being generated by the motor rises above a user-defined level -MVAR Ov F Lvl, Parameter 297, for a user-defined time -MVAR Ov F Dly, Parameter 298. This only occurs when the Reactive Power is negative.

The Over Power Reactive Negative Fault is enabled or disabled using the -MVAR Over bit in the Motor Fault Enable, Parameter 230.

Motor Over Power Reactive Negative Alarm

In addition to the Over Power Reactive Negative Fault, an Over Power Reactive Negative Alarm is also available. This is set up exactly like the Fault, using -MVAR Ov A Lvl, Parameter 299, and -MVAR Ov A Dly, Parameter 300. This Alarm is enabled or disabled using the -MVAR Over bit in the Motor Alarm Enable, Parameter 231.

Table 49 - Motor Over Power Reactive Negative Parameter List

Parameter Number	Parameter Name❶	Minimum/Maximum [Default]	Access	Units
297	-MVAR Ov F Lvl	-1000.000-[0.000]	R/W	MVAR
298	-MVAR Ov F Dly	[0.1]-99.0		SECS
299	-MVAR Ov A Lvl	-1000.000-[0.000]		MVAR
300	-MVAR Ov A Dly	[0.1]-99.0		SECS

❶ As displayed on the HIM or DriveExplorer™ configuration tools.

Motor Under Power Reactive Negative (Motor Generated) — Fault & Alarm

Motor Under Power Reactive Negative Fault (Code 68)

A Motor Under Power Reactive Negative Fault, Fault Code 68, condition occurs when the Reactive Power being generated by the motor falls below a user-defined level -MVAR Un F Lvl, Parameter 301, for the user-defined time -MVAR Un F Dly, Parameter 302. This only occurs when the Reactive Power is negative.

The Motor Under Power Reactive Negative Fault is enabled or disabled using the -MVAR Under bit in the Motor Fault Enable, Parameter 230.

Motor Under Power Reactive Negative Alarm

In addition to the Motor Under Power Reactive Negative Fault, a Motor Underpower Reactive Negative Alarm is also available. This is set up exactly like the Fault, using -MVAR Un A Lvl, Parameter 303, and -MVAR Un A Dly, Parameter 304. This Alarm is enabled or disabled using the -MVAR Under bit in the Motor Alarm Enable, Parameter 231.

Table 50 - Motor Underpower Reactive Negative Parameter List

Parameter Number	Parameter Name❶	Minimum/Maximum [Default]	Access	Units
301	-MVAR Un F Lvl	-1000.000- [0.000]	R/W	MVAR
302	-MVAR Un F Dly	[0.1]-99.0		SECS
303	-MVAR Un ALvl	-1000.000- [0.000]		MVAR
304	-MVAR Un A Dly	[0.1]-99.0		SECS

❶ As displayed on the HIM or DriveExplorer™ configuration tools.

Apparent Power Protection (MVA)

The SMC-50 has the ability to protect against excessive apparent power. The user can protect (Fault) or issue a warning (Alarm) in the event that the apparent power (MVA) consumption of the motor being controlled is too high or too low.

Motor Over Power Apparent — Fault & Alarm

Motor Over Power Apparent Fault (Code 48)

A Motor Over Power Apparent Fault, Fault Code 48, condition occurs when the Apparent Power being consumed by the motor rises above a user-defined level (MVA Ov F Lvl), Parameter 240, for a user-defined time, MVA Ov F Dly, Parameter 241. This Fault is enabled or disabled using the MVA Over Power bit in the Motor Fault Enable, Parameter 230.

Motor Over Power Apparent Alarm

In addition to the Motor Over Power Apparent Fault, a Motor Over Power Apparent Alarm is also available. This is set up exactly like the Fault using MVA Over Alarm Level, Parameter 242, and MVA Over Alarm Delay, Parameter 243. This Alarm is enabled or disabled using the MVA Over Power bit in the Motor Alarm Enable, Parameter 231.

Table 51 - Motor Over Power Apparent Parameter List

Parameter Number	Parameter Name❶	Minimum/Maximum [Default]	Access	Units
240	MVA Ov F Lvl	[0.000] - 1000.000	R/W	MVA
241	MVA Ov F Dly	[0.1]-99.0		SECS
242	MVA Ov A Lvl	[0.000] - 1000.000		MVA
243	MVA Ov A Dly	[0.1]-99.0		SECS

❶ As displayed on the HIM or DriveExplorer™ configuration tools.

Motor Under Power Apparent — Fault & Alarm

Motor Under Power Apparent Fault (Code 47)

A Motor Under Power Apparent Fault, Fault Code 47, condition occurs when the Apparent Power being consumed by the motor falls below a user-defined time, MVA Un F Lvl, Parameter 244, for a user-defined time, MVA Un F Dly, Parameter 245. This Fault is enabled or disabled using the MVA Under Power bit in the Motor Fault Enable, Parameter 230.

Motor Under Power Apparent Alarm

In addition to the Motor Under Power Apparent Fault, a Motor Under Power Apparent Alarm is also available. This is set up exactly like the Fault using MVA Under Alarm Level, Parameter 246, and MVA Over Alarm Delay, Parameter 242. This Alarm is enabled or disabled using the MVA Under Power bit in the Motor Alarm Enable, Parameter 231.

Table 52 - Motor Under Power Apparent Parameter List

Parameter Number	Parameter Name❶	Minimum/Maximum [Default]	Access	Units
244	MVA Un F Lvl	[0.000] - 1000.000	R/W	MVA
245	MVA Un F Dly	[0.1]-99.0		SECS
246	MVA Un A Lvl	[0.000] - 1000.000		MVA
247	MVA Un A Dly	[0.1]-99.0		SECS

❶ As displayed on the HIM or DriveExplorer™ configuration tools.

Power Factor (PF) Protection

Motor Power Factor (PF) — Fault & Alarm

Lagging Power Factor Under Fault (Code 63)
Leading Power Factor Under Fault (Code 64)
Lagging Power Factor Over Fault (Code 65)
Leading Power Factor Over Fault (Code 66)
Lagging Power Factor Under Alarm
Leading Power Factor Under Alarm
Lagging Power Factor Over Alarm
Leading Power Factor Over Alarm

The SMC-50 has the ability to protect against an excessive PF for specific applications that require monitoring the phase angle difference between voltage and current. The user can protect the motor by using the Fault function or issue a warning using the Alarm function in the event that the PF for an electric motor is either too high or too low for both Leading, Fault Code 64 and 66, and Lagging, Fault Code 63 and 65, conditions.

In addition to the configurable Fault and Alarm levels, both Motor Leading and Motor Lagging Fault and Alarm functions provide a configurable delay time to limit nuisance trips. PF Faults and PF Alarms are individually enabled and disabled through the Motor Fault Enable, Parameter 230, and Motor Alarm Enable, Parameter 231.

Table 53 - PF Parameter List

Parameter Number	Parameter Name❶	Minimum/Maximum [Default]	Access	Units
248	Lead PF Ov F Lvl	[0] -1.00	R/W	—
249	Lead PF Ov F Dly	[0.1]-99.0		SECS
250	Lead PF Ov A Lvl	[0] -1.00		—
251	Lead PF Ov A Dly	[0.1]-99.0		SECS
252	Lead PF Un F Lvl	[0] -1.00		—
253	Lead PF Un F Dly	[0.1]-99.0		SECS
254	Lead PF Un A Lvl	[0] -1.00		—
255	Lead PF Un A Dly	[0.1]-99.0		SECS
256	Lag PF Ov F Lvl	[0] -1.00		—
257	Lag PF Ov F Dly	[0.1]-99.0		SECS
258	Lag PF Ov A Lvl	[0] -1.00		—
259	Lag PF Ov A Dly	[0.1]-99.0		SECS
260	Lag PF Un F Lvl	[0] -1.00		—
261	Lag PF Un F Dly	[0.1]-99.0		SECS
262	Lag PF Un A Lvl	[0] -1.00		—
263	Lag PF Un A Dly	[0.1]-99.0		SECS

❶ As displayed on the HIM or DriveExplorer™ configuration tools.

Excessive Starts/Hour Protection

Motor Starts/Hour — Fault & Alarm

Starts per Hour Fault (Code 29)

The SMC-50 can be programmed to limit the maximum number of starter/motor starts within a sliding one-hour time window. Once the number of starts per hour is reached as configured by the user in Starts Per Hour, Parameter 128, any additional starts will cause an Excessive Starts Fault, Fault Code 29. This fault is enabled or disabled using the Starts/Hr bit in the Motor Fault Enable, Parameter 230.

Starts per Hour Alarm

A Starts Per Hour Alarm is also available. This Alarm is enabled or disabled using the Starts/Hr bit in the Motor Alarm Enable, Parameter 231. The Starts per Hour Faults and Alarm is activated when the starts within the last hour exceed the value configured in Starts Per Hour, Parameter 128. The starts count value is cleared when the starts in the previous hour are less than or equal to the Starts Per Hour parameter.

Table 54 - Starts per Hour Parameter List

Parameter Number	Parameter Name❶	Minimum/Maximum [Default]	Access	Units
128	Starts Per Hour	1-[99]	R/W	—

❶ As displayed on the HIM or DriveExplorer™ configuration tools.

Preventive Maintenance (PM) Protection

PM Hours Protection — Fault & Alarm

PM Hours Fault (Code 50) and Alarm

The SMC-50 can be configured to provide a Fault and/or Alarm to indicate that PM should be performed after a programmed number of hours have elapsed, Fault Code 50. This is done by setting a value in the Time to PM, Parameter 21, to indicate the amount of running time before PM needs to be done.

The programmed Time to PM value counts down while the motor is starting, stopping, operating in slow speed, and running. When the Time to PM parameter value reaches zero, the configured Fault and/or Alarm condition is activated and the parameter counter stops decrementing.

After the preventative maintenance is complete, the user can reset the Fault and/or Alarm. The user must reload the Time to PM to the value configured and stored in the PM Hours, Parameter 126, through the Meter Reset, Parameter 16, via the HIM or network connection.

The PM Hours Fault is enabled using the PM Hours bit in the Motor Fault Enable, Parameter 230. The PM Hours Alarm is enabled using the PM Hours bit in the Motor Alarm Enable, Parameter 231.

Table 55 - PM Hours Protection Parameter List

Parameter Number	Parameter Name❶	Minimum/Maximum [Default]	Access	Units
126	PM Hours	1-[10000]	R/W	HRS
21	Time to PM	[0.0-10000.00	R	HRS
16	Meter Reset	[Ready], Elapsed Time, Energy, Time to PM, Starts to PM	R/W	—

❶ As displayed on the HIM or DriveExplorer™ configuration tools.

PM Starts Protection — Fault & Alarm

PM Starts Fault (Code 51) & Alarm

The SMC-50 can be configured to provide a Fault and/or Alarm to indicate that PM should be performed after a pre-defined number of starts have occurred, Fault Code 51. This is done by using the PM Starts, Parameter 127, Starts to PM, Parameter 22, and Meter Reset, Parameter 16.

The Starts to PM parameter indicates the number of starts before preventative maintenance needs to be performed. This value counts down by one for each start initiated, even if the start is not completed. When the Starts to PM value reaches zero, the configured Fault and/or Alarm condition is activated and the counter stops counting.

After the preventative maintenance is complete, the user can reset the Fault and/or Alarm. The user must reload the Starts to PM to the value configured and stored in the PM Starts parameter through the Meter Reset, Parameter 16 via a HIM or network communications.

The PM Starts Alarm function is enabled using the PM Starts bit in the Motor Fault Enable, Parameter 230. The Alarm is enabled using the PM Starts bit in the Motor Alarm Enable, Parameter 231.

Table 56 - Starts Protection Parameter List

Parameter Number	Parameter Name❶	Minimum/Maximum [Default]	Access	Units
127	PM Starts	1-50000 [100]	R/W	
22	Starts to PM	[0]-50000	R	
16	Meter Reset	[Ready], Elapsed Time, Energy, Time to PM, Starts to PM	R/W	

❶ As displayed on the HIM or DriveExplorer™ configuration tools.

Line Loss Protection

Line Loss Fault Phase A (Code1)
Line Loss Fault Phase B (Code 2)
Line Loss Fault Phase C (Code 3)

The SMC-50 is able to individually identify and provide a Fault and or Alarm if a power line loss occurs on any phase.

NOTE: Phase A, B, or C loss = Fault Code 1, 2, or 3 respectively. There are no line loss Fault Parameters to configure.

The Line Loss Fault is enabled or disabled using the Line Loss bit in the Starter Fault Enable, Parameter 136. In addition, a Line Loss Alarm can be enabled or disabled using the Line Loss bit in the Starter Alarm Enable, Parameter 137.

NOTE: If Line Loss is disabled, consider enabling the Undervoltage Fault to limit potential motor damage caused by phase loss.

Silicon-Controlled Rectifier (SCR) Protection

Shorted SCR Fault — Phase A, B, or C

Shorted SCR Fault Phase A (Code 4)
Shorted SCR Fault Phase B (Code 5)
Shorted SCR Fault Phase C (Code 6)

The SMC-50 is able to detect if any one of its SCRs are shorted in any phase. The shorted SCR Fault is always enabled (user cannot disable). No user intervention or parameter configuration is required and no shorted SCR Alarm exists.

NOTE: Shorted SCR detection is performed as part of a prestart check.

SCR Overtemperature — Fault

SCR Overtemperature Fault (Code 10)

The SMC-50 is able to detect if any one of its SCRs has reached an over temperature condition, which could indicate excessive current draw or excessive number of starts. This function is accomplished using an I^2t calculation. There are no SCR overtemperature parameters for the user to configure. The SCR Overtemperature Fault is always enabled. There is no SCR Overtemperature Alarm.

The SCR temperature calculation/algorithm also controls the cyclic operation of the SMC-50's fan(s) in the power section. The SMC-50 internal fan is turned on whenever the motor it is controlling is running **or** the estimated SCR temperature is above 50 °C. The fan is turned off when the motor is **not** energized **and** the estimated SCR temperature is below 49 °C.

Open SCR Gate Fault & Alarm — Phase A, B, or C

Open SCR Phase A (Code 7)
Open SCR Phase B (Code 8)
Open SCR Phase C (Code 8)

The SMC-50 is able to detect if an SCR control gate in any power phase has malfunctioned and initiate a Fault or Alarm. There are no user-configurable Open Gate parameters.

The Open SCR Gate Fault is enabled and disabled using the Open Gate bit in the Starter Fault Enable, Parameter 136. The Open SCR Gate Alarm is enabled and disabled in the Starter Alarm Enable, Parameter 137.

Power Quality

Power Quality Fault & Alarm — Phase A, B, or C

Power Quality Phase A (Code 52)
Power Quality Phase B (Code 53)
Power Quality Phase C (Code 54)

A power quality Fault or Alarm will occur when the starter is not properly firing its phase A, B, or C SCRs. This condition is generally attributed to power line problems that are not detected by other line monitoring functions. There are no user-configurable Power Quality Fault or Alarm parameters to configure.

Phase A, B, and C Power Quality equates to Fault Code 52, 53, or 54 respectively. This can be enabled or disabled using the Power Quality bit in the Motor Fault Enable, Parameter 230.

In addition, a Power Quality Alarm can be enabled or disabled using the Power Quality bit in the Motor Alarm Enable, Parameter 231.

Total Harmonic Distortion (THD) Fault & Alarm

Power Quality THDV (Fault Code 55) & Power Quality THDI (Fault Code 56) — Fault & Alarm

The SMC-50 provides the ability to read power line THD which is the average of 32 line frequency harmonics. The calculation for THDI and THDV (THDx) is:

$$THDx = \sqrt{\frac{(THD_2^2 + THD_3^2 ... + THD_{31}^2)}{THD_1}}$$

Excessive THD indicates a problem in the power source and/or the application. This can have an adverse effect on the performance of the overall system. THD Fault and Alarm parameters are available for both voltage THDV and current THD I. A Fault and Alarm delay time and a level are also available to configure each of these parameters.

Table 57 - THD Parameter List

Parameter Number	Parameter Name❶	Minimum/Maximum [Default]	Access	Units
118	THD V F Lvl	0.0-[1000.0]	R/W	%
119	THD V F Dly	[0.1]-99.0		SECS
120	THD V A Lvl	0.0-[1000.0]		%
121	THD V A Dly	[0.1]-99.0		SECS
122	THD I F Lvl	0.0-[1000.0]		%
123	THD I F Dly	[0.1]-99.0		SECS
124	THD I A Lvl	0.0-[1000.0]		%
125	THD I A Dly	[0.1]-99.0		SECS

❶ As displayed on the HIM or DriveExplorer™ configuration tools.

Power Pole Overtemperature — Fault

PTC Power Pole Overtemperature Fault (Code 60)

A built-in PTC is used to measure the SMC-50's power pole temperature. The SMC-50 will generate a Power Pole PTC Fault, Fault Code 60, when the temperature in the power pole rises above the PTC trip temperature.

NOTE: There are no user-configurable Power Pole Overtemperature Fault parameter and it cannot be disabled. The Fault cannot be reset until the unit cools.

Open Load — Fault & Alarm

No Load Motor Fault (Code 14)
Open Motor Phase A Loss Fault (Code 15)
Open Motor Phase B Loss Fault (Code 16)
Open Motor Phase C Loss Fault (Code 17)

The SMC-50 can detect and report a No Load Motor Fault (no motor detected), Fault Code 14, condition and Open Motor Phase Loss Fault condition for each individual motor phase A, B, or C, Fault Code 15, 16, & 17. A check for No Load and Open Motor Phase is done as an SMC-50 pre-start activity and is checked immediately after the motor start command and before the first SCR gating pulse. There are no user configurable parameters associated with this Fault.

The No Load and Open Motor Phase Loss Fault can be enabled or disabled using the Open Load bit in the Motor Fault Enable, Parameter 230.

In addition to the Open Load Fault, an Open Load Alarm can be enabled or disabled using the Open Load bit in the Motor Alarm Enable, Parameter 231.

Current Transformers (CT) Loss — Fault

CT Loss Phase A Fault (Code 30)
CT Loss Phase B Fault (Code 31)
CT Loss Phase C Fault (Code 32)

The CT Loss Fault is provided on a per phase basis (phase A, B, & C; Fault Code 30, 31, & 32) and occurs when the current feedback signal from one of the SMC-50's internal CTs is invalid. Indication of an invalid CT feedback signal is when the SMC-50 remains at the minimum negative current or maximum positive current for its current range. This Fault cannot be disabled and no parameters need to be configured.

Locked Rotor — Fault & Alarm

Locked Rotor Fault (Code 70)

The Locked Rotor Fault, Fault Code 70, provides indication that the rotor of the motor under SMC-50 control and operating in **any** running mode (e.g., Slow Speed) has become frozen or locked.

NOTE: The Locked Rotor Fault is similar to the Jam Fault **except** it is active during **all** running modes, not just at full speed.

The value or level of the Locked Rotor Fault is configured as a percentage of the motor FLC using Locked Rotor F Lvl, Parameter 84. A configurable delay time using Locked Rtr F Dly, Parameter 85, is also available to help eliminate nuisance Faults.

Locked Rotor protection is enabled or disabled via the Locked Rotor bit in the Motor Fault Enable, Parameter 230.

In addition to the Locked Rotor Fault, a Locked Rotor Alarm can also be enabled, which will activate under the same condition as the Locked Rotor Fault. The Locked Rotor Alarm is enabled or disabled via the Locked Rotor bit in the Motor Alarm Enable, Parameter 231,

Table 58 - Locked Rotor Parameter List

Parameter Number	Parameter Name❶	Minimum/Maximum [Default]	Access	Units
84	Locked Rtr F Lvl	400-1000 [600]	R/W	% FLC
85	Locked Rtr F Dly	[0.1]-100.0		SECS
310	Locked Rtr A Lvl	400-1000 [600]		% FLC
311	Locked Rtr A Dly	[0.1]-100.0		SECS

❶ As displayed on the HIM or DriveExplorer™ configuration tools.

Expansion Module Functions

Expansion Device Removed Fault

Expansion Module Removed Fault (Code x026)

When an expansion module (e.g., 150-SM...) is removed from a powered down control module and power is reapplied, Expansion Removed, Fault Code 26, is generated. For SMC-50 expansion modules, the Fault code includes the control module port number (7, 8, or 9) to distinguish which expansion module caused the Fault (e.g., an expansion module located in port 8 would display the Fault Code 8026).

For physical DPI devices that support this function, the Fault will be generated only when the associated bit is set in the Logic Mask Act, Parameter 149.

IMPORTANT	Ensure **all** line and control power is removed from the SMC-50 **before** removing or installing any expansion or communication module.

Expansion Device Fault

Expansion Module Fault (Code x028)

This fault code is generated directly by any option module or DPI device and is separate from the Expansion Device Removed fault (control module generated). This fault is always enabled (user cannot disable) in the control module. Individual option modules or DPI devices may enable or disable these faults as needed.

NOTE: Not all devices use this fault.

Expansion Module Incompatible Fault

Incompatible Expansion Module Fault (Code x027)

If an expansion module (e.g., 150-SM…) is plugged into an incompatible expansion port or the expansion module is not supported by the control module firmware revision (FRN), an Expansion Incompatible, Fault Code 27, will be generated. The SMC-50 port number (7, 8, or 9) of the expansion module generating the Fault is also displayed (e.g., an expansion module located in port 7 would display the Fault Code 7027). This fault cannot be disabled.

Real Time Clock (RTC)

Battery Low

RTC Battery Low Fault (Code 69)

An RTC Battery Low, Fault Code 69, provides indication of a control module battery low condition. This condition is checked upon power up of the control module. The battery maintains the operation of the control module's RTC when the control power is removed. Once the Alarm is posted, the battery should be replaced as soon as possible. This alarm cannot be disabled.

To clear this alarm, the battery must be replaced and the time/date set with a HIM or applicable PC software (e.g., DriveExplorer).

Configuration Functions

Configuration Change — Fault & Alarm

Configuration Change Fault (Code 57)

By setting the Configuration Change bit in the Starter Fault Enable, Parameter 136, any change to the controller configuration will result in a Configuration Change Fault, Fault Code 57. An Alarm can also be initiated by setting the

"Config Change" bit in the Starter Alarm Enable, Parameter 137. The Fault can be cleared immediately and the Alarm will clear upon the next motor start command.

I/O Configuration — Fault

I/O Configuration Fault (Code 61)

The SMC-50 will generate an I/O Configuration Fault, Fault Code 61, if any control input is programmed as a Start or Slow Speed command and no input is configured for Coast or Stop. The Fault occurs when the Start or operational maneuver is attempted (the motor will not start). This Fault is also generated when an input configuration changes from:

1. one that cannot start the motor to one that can start the motor **OR**
2. an input that can stop the motor to one that cannot.

This Fault is always enabled; no parameter adjustments are required and no alarm is available.

Buffers & Storage Functions

Non-volatile Storage (NVS) Fault

NVS Fault (Code 34)

The NVS Error Fault, Fault Code 34, is posted if a read/write checksum error occurs within the user data portion of the SMC-50's non-volatile memory. This Fault can only be cleared by the user modifying/storing a parameter value (requires changing any parameter). It is recommended that the user perform a Load Defaults command to make sure that all controller parameters are within range. This error cannot be cleared by cycling the SMC-50 controller power.

Fault Buffer & Fault Storage Parameters

The Fault Buffer is used to store the last five system Faults. The Fault Buffer is accessed via the Diagnostic screen of a 20-HIM-A6, 20-HIM-C6S, or from the Device Properties screen, which is accessed using the DriveExplorer's Explore>Device Properties pull-down menu. The most recent Fault is located at the top of the buffer (number 1 for the HIM or number 1.1 for the software configuration tool. The Fault Buffer also stores the date and time that the Fault occurred.

NOTE: The date and time information is obtained from the SMC-50's RTC. Ensure the RTC is set correctly.

The five most recent Faults are stored in Parameter 138 through Parameter 142. This stored Fault history in the parameter list can be accessed by any networked device. The Fault date and time are not available from the parameters list.

Table 59 - Fault Buffer & Fault Storage Parameter List

Parameter Number	Parameter Name❶	Fault Code	Access	Units
138	Fault 1	0-10000	R	—
139	Fault 2			
140	Fault 3			
141	Fault 4			
142	Fault 5			

❶ As displayed on the HIM or DriveExplorer™ configuration tools.

Alarm/Event Buffer & Alarm/Event Storage Parameters

In addition to storing (buffering) Alarm Data, the Alarm Buffer is used to store several key controller events. The type of events stored includes:

Event	Alarm Code
Start	71
Slow Speed	72
Stop Option	73
Coast	74
Clear Fault	75 — a Fault has been cleared
Fault	76
Parameter Change	77 — change to any Parameter occurred

The Alarm Buffer can be accessed via the Diagnostic screen of a 20-HIM-A6, 20-HIM-C6S, or from the Device Fault/Alarm button of Connected Components Workbench. The last 100 events are stored in the Alarm Buffer with the most recent event numbered as 1 (HIM) or 1.1 (software) in the list. Along with the Alarm Code, the date and time that the event occurred is also listed.

NOTE: The date and time information is obtained from the SMC-50's RTC. Ensure the RTC is set correctly.

In addition to the Alarm Buffer, the last five Alarm Events are available via Parameter 143 through Parameter 147. Storing this Alarm history in the parameter list provides access by any networked device. The Alarm/Event date and time are not available from the parameter list.

Table 60 - Alarm/Event Parameter List

Parameter Number	Parameter Name❶	Alarm Code	Access	Units
143	Alarm 1	0-10000	R	—
144	Alarm 2			
145	Alarm 3			
146	Alarm 4			
147	Alarm 5			

❶ As displayed on the HIM or DriveExplorer™ configuration tools.

Auto Restart from Fault Function

This function allows the SMC-50 to automatically restart from various Starter or Motor Fault conditions. Auto Restart from Fault is individually bit enabled or disabled using Starter Restart Enable, Parameter 135, or Motor Restart Enable, Parameter 264. See Table 61 on page 138.

Parameter 133, Restart Attempts, allows the user to define the allowable number of restart attempts from the fault before ending the retry process. The Retry Counter is cleared whenever the controller receives a valid Stop command.

In addition, Restart Delay Time, Parameter 134, allows the user to define a time delay from when the Fault event occurred until a Restart Attempt can be effective.

NOTE: This delay is not used with an Overload Fault. Instead, the restart attempt will occur when the Mtr Therm Usage, Parameter 18, falls below the OL Reset Level, Parameter 80.

Table 61 - Auto Restart from Fault Parameter List

Parameter Number	Parameter Name❶	Fault Name	Bit Assignment	Bit Access	Units
135	Strtr Restart En	Volt Umbal Overvoltage Undervoltage Phase Rev Line Loss Open Gate Config Change Freq THD V	0 1 2 3 7 5 6 7 8	R/W	Bit = 0, Disabled Bit = 1, Enabled [All Disabled as Default]
264	Motor Restart En	Overload Underload MWatts Over MWatts Under +MVAR Over +MVAR Under -MVAR Over -MVAR Under MVA Under MVA Over Curr Imbal Jam Stall Starts/Hr PM Hours PM Starts Power Qual Open Load THD I Lead PF Un Lead PF Ov Lag PF Un Lag PF Ov Locked Rotor	0 1 2 3 7 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22. 23	R/W	Bit = 0, Disabled Bit = 1, Enabled [All Disabled as Default]

❶ As displayed on the HIM or DriveExplorer™ configuration tools.

Table 62 - Auto Restart Parameter List

Parameter Number	Parameter Name❶	Minimum/Maximum [Default]	Access	Units
133	Restart Attempts	[0] -5	R/W	
134	Restart Dly	[0]-60		SECS

❶ As displayed on the HIM or DriveExplorer™ configuration tools.

Programming

Overview

This chapter provides a basic understanding of the programming/configuration tools available to modify the SMC-50's parameters. Unlike previous SMC products (e.g., SMC-3 and SMC Flex), the SMC -50 comes without a built-in programming tool. This allows the user to select from several programming tools to best suit their application.

Parameter Configuration Module (PCM)

Using the PCM (150-SM6)

The Cat. No. 150-SM6 PCM provides simple and limited configuration of the SMC-50. This PCM can be inserted into any control module option port (7, 8, or 9). Only one PCM is allowed per control module.

Parameters that **are** configured by the PCM will appear as read-write parameters to other configuration devices and whose values represent the switch settings. The parameter values set by the PCM are stored in the control module memory. Therefore, using the appropriate removal procedure (remove all power to Control Module and Power Module), the PCM can be removed from the control module with its parameter settings retained.

Parameters that **are not** defined and therefore are not configurable by the Cat. No. 150-SM6 PCM can be configured through other means (e.g., Human Interface Module (HIM), Connected Components Workbench, or DriveExecutive software), if necessary.

Application considerations for the 150-SM6 PCM are listed below.

- If another configuration tool attempts to configure a parameter setup by an installed 150-SM6, that parameter will revert back to the 150-SM6 configuration. The PCM overrides other configuration tools.
- The 150-SM6 can only configure the onboard control I/O of the Control Module. If additional I/O are added by using a 150-SM4 Digital I/O Option Module, those I/O must be configured by another programming tool.

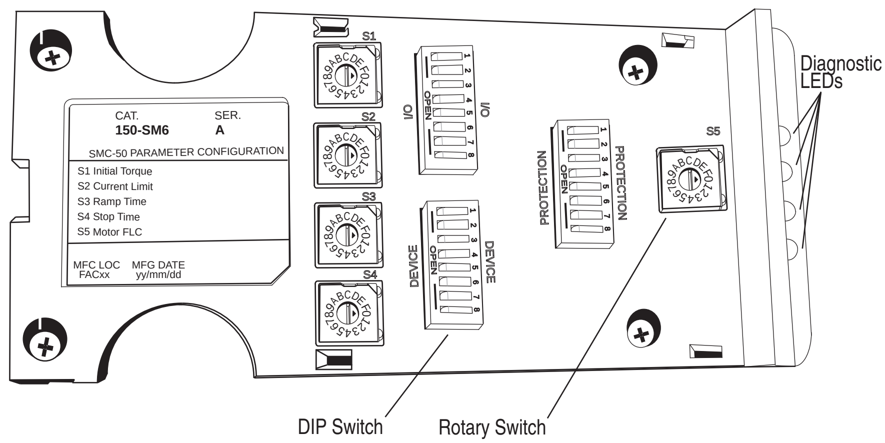
When using a Cat. No. 150-SM6 PCM to configure the SMC-50, it should be noted that the following features, functions, and modes are not configurable:

- Full voltage start
- Torque ramp start
- External brake stop

- Option card I/O configuration (Cat. No. 150-SM… option modules)
- External bypass
- Specialized output relay configuration (e.g., network control, DeviceLogix, auxiliary control)
- Specialized operation modes/features
  - Dual ramp, motor winding heater, emergency run
  - Overload select (Class)
  - Adjustment of slow speed set point

NOTE: If the PCM is removed, another configuration tool (e.g., a HIM) can change a parameter that was previously altered by an installed PCM.

Figure 80 - DIP Switch & Rotary Switch Locations



The 150-SM6 PCM contains five rotary switches, S1 through S5, each with designations 0-F and three banks of ON/OFF 8-switch DIP switches.

The following tables show the resulting values of the position setting functions for each of the five rotary switches and the associated controller parameter numbers. For details on the functions of these parameters, see Chapter 3, 4, 6, and Appendix B.

Table 63 - S1 = Initial Torque Configuration — Controller Parameter 51

Position Setting	Resulting Initial Torque Value (% motor torque)	Position Setting	Resulting Initial Torque Value (% motor torque)
0	10	8	58
1	16	9	64
2	22	A	70 (default)
3	28	B	76
4	34	C	82
5	40	D	88
6	46	E	94
7	52	F	100

Table 64 - S2 = Current Limit Level Configuration — Controller Parameter 53

Position Setting	Resulting Current Limit Value (% (FLC)	Position Setting	Resulting Current Limit Value (% FLC)
0	200	8	360 (default)
1	220	9	380
2	240	A	400
3	260	B	420
4	280	C	440
5	300	D	460
6	320	E	480
7	340	F	500

Table 65 - S3 = Ramp Time Configuration — Starting — Controller Parameter 50

Position Setting	Starting Ramp Time (seconds)	Position Setting	Starting Ramp Time (seconds)
0	0.1	8	16
1	2	9	18
2	4	A	20
3	6	B	22
4	8	C	24
5	10 (default)	D	26
6	12	E	28
7	14	F	30

Table 66 - S4 = Stop Time Configuration — Controller Parameter 66

Position Setting	Stop Time (seconds) ❶	Position Setting	Stop Time (seconds)❶
0	Coast -to-Stop (default)	8	16
1	2	9	18
2	4	A	20
3	6	B	22
4	8	C	24
5	10	D	26
6	12	E	28
7	14	F	30

❶ When the braking STOP MODE is selected (device configuration bank switch #3 and #4), the controller multiplies the selected stop time by ten.

Table 67 - S5 = Motor FLC Configuration — Controller Parameter 78

Position Setting	FLC ❶❷ (% of controller's max)	Position Setting	FLC ❶❷ (% of controller's max)
0	40 (default))	8	72
1	44	9	76
2	48	A	80
3	52	B	84
4	56	C	88
5	60	D	92
6	64	E	96
7	68	F	100

❶ Since a set of switches do not provide the resolution to enter all possible FLC combinations like a keypad, switch S5 allows you to configure the motor's FLC in the SMC-50 by using a percent (%) of the controller's rated FLC (e.g., 90 A, 110 A, 180 A, etc.).

EXAMPLE

For a 60 A motor and a 90 A controller:

% of controller's max FLC for a 60 A motor = 64% of 90 A (57.6 A), or Switch Position 6

❷ To determine the S5 switch setting for an inside-the-delta motor configuration, use the following equations:

Step 1

$$\frac{\text{Motor Nameplate FLC}}{1.73} = X$$

Step 2

$$\frac{X}{\text{SMC-50 Controller Rating}} \times 100 = \text{S5 Switch Setting}$$

EXAMPLE

Step 1

$$\frac{100\text{ A}}{1.73} = 57.8\text{ A}$$

Step 2

$$\frac{57.8\text{ A}}{90\text{ A}} \times 100 = \mathbf{64\%}$$

Result From the result of 64%, the S5 switch setting is position 6.

NOTE:

1 If the calculated value does not match a switch position, use the previous (lower percent) switch setting.

2 The inside-the-delta motor configuration can be selected using Motor Connection, Parameter 44, or automatically during a controller tuning process. The tuning process is done during the initial system start after changing any of the tuning parameters and initializing a start or by pressing and holding the SMC-50 reset push button for at least 10 seconds with the motor stopped and then initializing a start. If another configuration device is available (e.g., a 20-HIM-A6 or PC software such as DriveExplorer), changing Force Tuning, Parameter 194, to TRUE or resetting the controller to "Default" will also result in tuning to occur.

The following tables define the functions for the three banks of ON/OFF 8-switch DIP switches. Each of the three banks is defined by a high level, functional name with each switch having a unique function.

Table 68 - ON/OFF 8-Switch DIP Switch Definitions — Device

DEVICE Configuration Bank (O = Switch OPEN)		Switch Number							
		#1	#2	#3	#4	#5	#6	#7	#8
Starting Mode— Controller Parameter 49	Linear Speed Acceleration (default)	0	0						
	Current Limit	0	1						
	Soft Start	1	0						
	Pump Start	1	1						
Stop Mode ❶❷ — Controller Parameter 65	Linear Speed Deceleration (default)			0	0				
	Soft Stop			0	1				
	Braking			1	0				
	Pump Stop			1	1				
Energy Saver ❸ — Controller Parameter 193	Enable					1			
	Disable (default)					0			
Braking Current — Controller Parameter 69	50%						0	0	0
	100%						0	0	1
	150%						0	1	0
	200% (default)						0	1	1
	250%						1	0	0
	300%						1	0	1
	350%						1	1	0
	400%						1	1	1

❶ When the "Stop Mode" is configured as (a) "Linear Speed Decel", (b) " Soft Stop", (c) "Pump Stop", and the "Stop Time" (rotary switch S4) is set to zero, a "Coast" stop will result. A non-zero "Stop Time" value for the three previously listed "Stop Modes" defines the time to stop period which is based on that specific configuration.

❷ If the "Stop Mode" is configured as "Braking", then the "Stop Time" setting (Rotary Switch S4) is used to select either the "Automatic Zero Speed Detection" method ("Stop Time" is set to zero) or the "Timed Brake" method ("Stop Time" is not set to zero).

❸ With the Energy Saver switch (#5) set to Enable, the Energy Saver Level, Parameter 193, is automatically configured by the PCM to 0.25.

NOTE: **1** With the "Automatic Zero Speed Detection" method, the controller applies the user-selected "Braking Current" defined by the Device Configuration Switch Bank. Switch #6, #7, and #8 senses a motor "Zero Speed" condition and automatically stops the braking process (brake current OFF).

2 With the "Timed Brake" method, the user-selected "Braking Current" is applied for the user-configured "Stop Time" regardless of the motor speed (e.g., "Automatic Zero Speed Detection" disabled). The "Timed Brake" method can be used in applications where detecting zero speed is ineffective or when braking the motor to a complete stop results in random overload trips. With this method, braking is applied for a fixed time equal to the "Stop Time" setting (Rotary Switch S4) and multiplied by ten. An ideal "Stop Time" setting can be accomplished by trial and error, but should always allow for some coast time. Setting the "Stop Time" for too long of a time period can result in braking current to be applied to a stopped motor and will likely result in overload trips.

Table 69 - ON/OFF 8-Switch DIP Switch Definitions — Protection

PROTECTION Configuration Bank (O = Switch OPEN)		Switch Number							
		#1	**#2**	**#3**	**#4**	**#5**	**#6**	**#7**	**#8**
Preset Protection Level Parameter ❶	Enabled (default)	1							
	Disabled	0							
Stall Fault Parameter 230	Enabled (default)		1						
	Disable		0						
Phase Reversal Fault Parameter 136	Enable			1					
	Disable (default)			0					
OL Restart Parameter 264	Enable				1				
	Disable (default)				0				
OL Enable Parameter 230	Enabled (default)					1			
	Disable					0			
OL Class Parameter 75	10 (default)						0	0	
	15						0	1	
	20						1	0	
	30						1	1	

❶ The Preset Production Level DIP switch allows the following Faults to be enabled (1) or disabled (0) as a group.

- Current Imbalance Fault — Parameter Number: 110 [default value: 15]
- Voltage Unbalance Fault — Parameter Number: 106 [default value: 15]
- Line Loss Fault — Parameter Number: NA [default value: no value required - see Chapter 4, Line Loss Protection on page 129]
- Open Gate Fault — Parameter Number: NA [default value: no value required - see Chapter 4, Open SCR Gate Fault & Alarm — Phase A, B, or C on page 130]
- No/Open Load Fault — Parameter Number: NA [default value: no value required - see Chapter 4, Open Load — Fault & Alarm on page 132]

The PCM configuration setting for each of these Faults follows the currently entered/loaded parameter value for each Fault. This will typically be the default setting unless a 20-HIM-A6 or other configuration tool (e.g., PC software or network device) is used to change a parameter setting. The switch setting also overrides the Motor Fault Enable, Parameter 230, and Starter Fault Enable, Parameter 136, function to enable or disable these Faults.

Note that with the Preset Protection Level switch set to Disable, all Starter and Motor Faults are disabled (as defaults except the Power Quality Fault).

Table 70 - ON/OFF 8-Switch DIP Switch Definitions — Configuration

I/O Configuration ❶ Bank (O = Switch OPEN)		Switch Number							
		#1	**#2**	**#3**	**#4**	**#5**	**#6**	**#7**	**#8**
Aux #1 Configuration Parameter 172	Normal (default)	0	0						
	Up-to-Speed (UTS)	0	1						
	Fault	1	0						
	Alarm	1	1						
Aux #2 Configuration Parameter 176	Normal			0	0				
	UTS [default]			0	1				
	Fault			1	0				
	Alarm			1	1				
Input #1 Parameter 56	Start/Coast (default)					0			
	Start/Stop Option					1			
Input #2 Parameter 57	Stop Option (default)						0	0	
	Clear Fault						0	1	
	Slow Speed						1	0	
	Fault						1	1	

❶ The I/O Configuration ability of the 150-SM6 is limited to the Control Module's standard I/O.

Human Interface Module (HIM) (Cat. No. 20-HIM-A6 or 20-HIM-C6S)

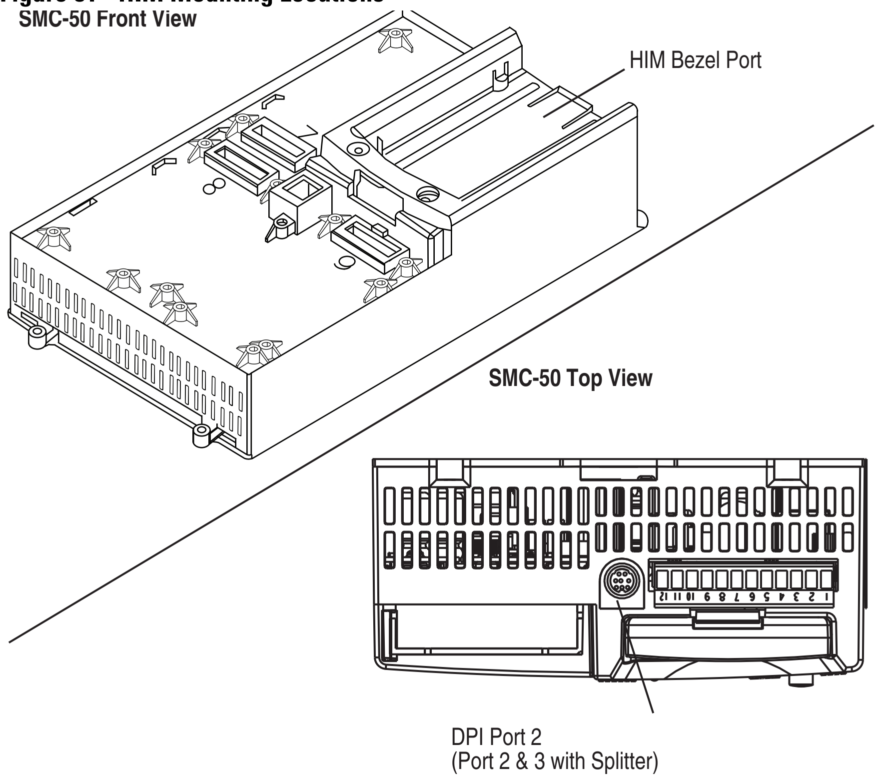
The 20-HIM-A6 provides the ability to:

- configure/monitor all controller parameters,
- configure/monitor all option modules (e.g., 150-SM4, digital I/O, 150-SM6 PCM, etc.), and
- use the SMC-50's general startup configuration wizard.

NOTE: The 20-HIM-A3 cannot configure the option modules or use the general startup configuration wizard. Therefore, the 20-HIM-A3 is **not** recommended for use with the SMC-50 and is not mentioned in this document.

The 20-HIM-A6 is typically inserted into the HIM bezel port located on the upper right of the control module. Inserting the HIM into the bezel provides operation in a NEMA Type 1 environment. The 20-HIM-C6S, a remote (door-mount) version of the 20-HIM-A6, provides operation in a NEMA 4X/12 environment and includes a 1202-C30 interface cable to the SMC-50 DPI Port 2 on the top of the controller. For additional information on mounting the 20-HIM-A6 or the 20-HIM-C6S, see the HIM User Manual, publication 20HIM-UM001.

Figure 81 - HIM Mounting Locations



The following information describes some of the basic screens and keypad functions of the 20-HIM-A6 or 20-HIM-C6S. Additional details concerning all HIM functions can be found in 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.

Table 71 - HIM Single-Function Keys

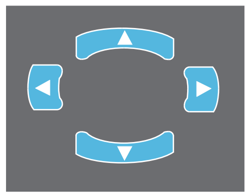
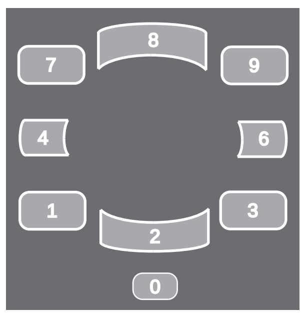
Key	Function
Start	Starts the controller if the SMC-50 Logic Mask is enabled for the port the HIM is connected to. ❶
Folders	Accesses folders for parameters, diagnostics, memory functions, preferences, and other tests.
Controls	Accesses jog, direction, auto/manual, and other control functions.
Stop	Stops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

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

HIM Soft Keys

Up to five dynamic soft keys can be shown at the bottom of the HIM screen. Based on the specific screen or the data entry mode being used, a soft key name and its function may change. When a soft key is active, its presentation function and corresponding soft key label are shown at the bottom of the HIM screen.

Table 72 - HIM Soft Key Functions

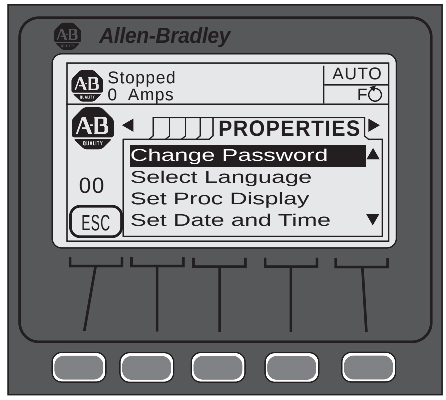
Soft Key	Description	Function
	Multi-Function — Blue	• Scrolls through menus and screens as directed by each arrow • Performs corresponding functions displayed in the data area
	Numeric Keys — Grey	• Enters their respective numeric values
	5/Enter	• Enters the numeric value, 5 • Displays the next level of a selected menu item • Enters new values • Performs intended actions

Password Modification Using the HIM

The SMC-50 provides password protection by numeric code (0 to 65,535) to prevent unwanted modification of parameters. Data and parameter values can be viewed/monitored without entering the password, but modification requires password entry.

The password can be modified from the PROPERTIES folder screen of the 20-HIM-A6 or 20-HIM-C6S, as shown in Figure 82 on page 149.

Figure 82 - PROPERTIES Folder Screen



NOTE: If the default password (0=default) is modified, ensure the modified password is written down in a secure place. There is no way to reset the password if it is forgotten. For additional information on password modification, see the 20-HIM-A6 User Manual, publication 20HIM-UM001.

To modify the default password, perform the following steps using the 20-HIM-A6 or 20-HIM-C6S:

1. From the initial power-up screen, press the FOLDERS single function key.
2. Use the forward or back arrow key until the PROPERTIES folder screen is displayed, as shown in Figure 82.
3. Select the CHANGE PASSWORD option, then press the Enter (#5) key.
4. Enter a numeric password, then press the Enter (#5) key. This will load the password into the SMC-50's memory.

Parameter Access Level Modification Using the HIM

The SMC-50 provides three different parameter access levels: Monitor, Basic, and Advanced. These access levels provide the ability to limit user access and/or speed viewing or changing of certain parameters.

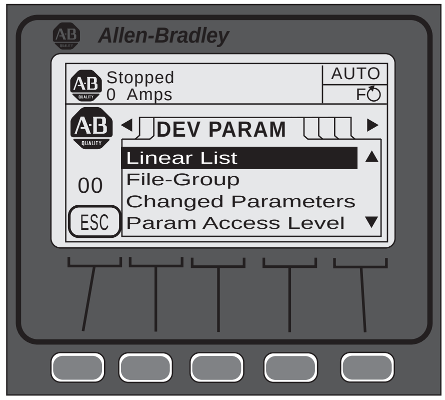
NOTE:

- The access level is **not** maintained if power to the controller is cycled.
- The default access level is Basic.
- The advanced level provides access to all parameters.
- Individual parameter access levels are shown in Figure 87 through Figure 91 beginning on page 174 and is also contained in the Parameter Linear List, Table 73 through Table 77 beginning on page 177.

To view/modify the current access level, perform the following steps using the 20-HIM-A6:

1. From the initial power-up screen, press the FOLDERS single function key.
2. Use the forward or back arrow key until the DEV PARAM folder screen is displayed.

3. Select the PARAM ACCESS LEVEL option, then press the Enter (#5) key. The Dev Parameter screen appears.

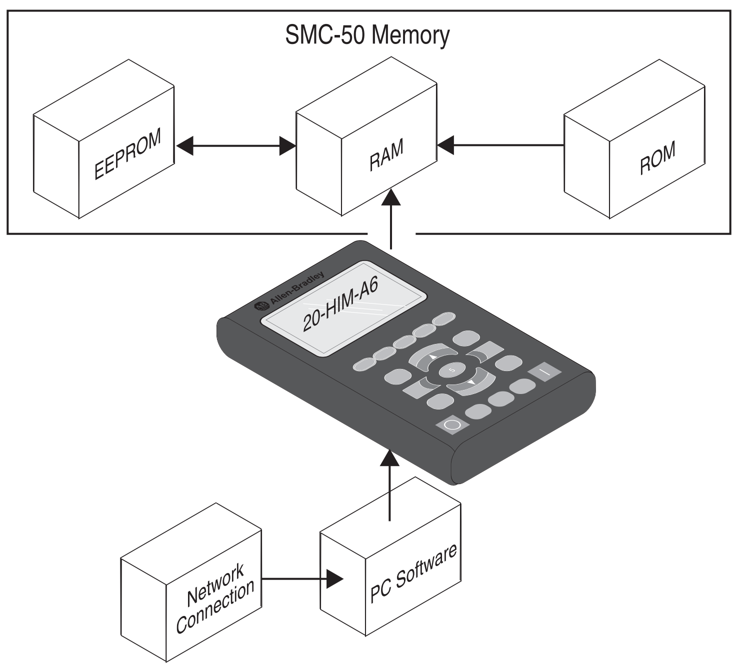


4. Use the up or down arrow to scroll up or down to until the desired access level is reached, then press Enter (#5) to view that access level.

Parameter Management

Before you begin programming, it is important to understand how the memory is structured within the SMC-50 **and** used on power-up and during normal operation.

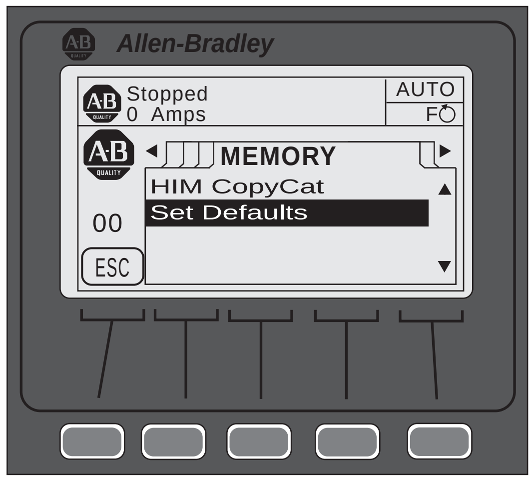
Figure 83 - Memory Block Diagram



RAM (Random Access Memory)

RAM is the work area of the controller after it is powered up. The SMC-50 uses an Auto Store feature when programming parameters. When parameters are modified in the program mode, the new values are stored immediately in RAM and then in EEPROM (Electrically Erasable Programmable Read-Only Memory), once the enter key has been pressed. If control power is lost prior to the enter key being pressed, these values will be lost. When the device first powers up, the values from the EEPROM area of memory are copied into RAM.

ROM (Read-only Memory) — Set Defaults



The SMC-50 comes with factory default parameter values. These settings are stored in non-volatile ROM and are displayed the first time you enter the Program mode via the Linear List or File-Group mode using the HIM. To restore factory parameter defaults:

1. Navigate to the Memory folders screen with Port <00> displayed.

NOTE: Option modules can also be restored to defaults using this method. Ensure its respective port number is displayed.

2. Select/highlight the Set Defaults line, then press ENTER (#5). The following text will be displayed: WARNING: Sets all Parameters to factory defaults. Continue?
3. Press the ENTER soft key to change defaults or the ESC soft key to return to the previous screen.

NOTE: Factory defaults can also be restored using the Parameter Management, Parameter 229, available in the Utility File-Group (see Figure 91 on page 176).

EEPROM

The SMC-50 provides a non-volatile area for storing user-modified parameter values in the EEPROM.

Parameter Configuration

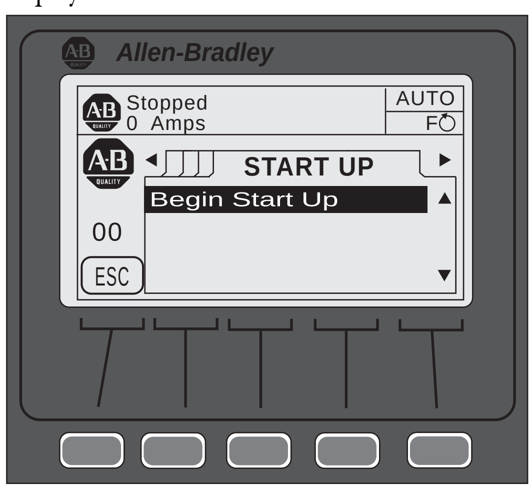
Using the START UP Configuration Tool (20-HIM-A6 or 20-HIM-C6S)

The general START UP configuration tool provides the ability to rapidly configure an SMC-50. Enabled by the SMC-50 and the 20-HIM-A6 or 20-HIM-C6S, a series of questions required to configure starting (e.g., Soft, Linear, Pump, etc.) and stopping (e.g., Coast, Pump, etc.) modes are displayed on the HIM via this tool.

Not all parameters are configured with this tool. Non-configured START-UP parameters can be configured using the parameter number or File — Group search method. See the Basic Configuration using the HIM on page 182.

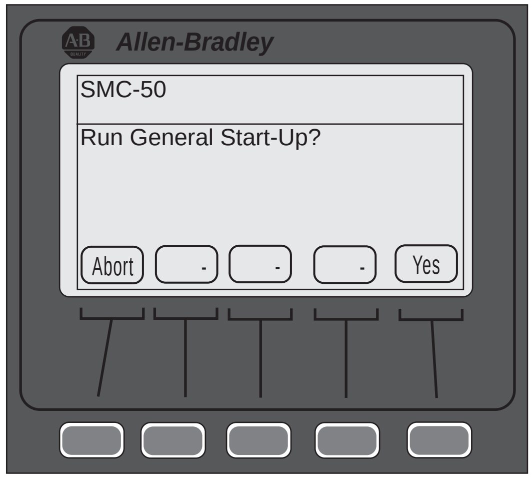
Accessing the General START UP Tool

1. Select the FOLDERS single-function key located on the lower left portion of the keypad.
2. Use the left or right arrow key until the START UP folders screen is displayed.



3. Press the ENTER (#5) key to begin the configuration process. The HIM will display "Run General Start-up?".

4. Press the Yes soft key to begin the process or Abort soft key to return to the START UP folders screen.



The HIM will display a series of questions pertaining to the Motor, Start, and Stop processes.

NOTE:

Depending on the answers to the Start and Stop processes, some screens may not be displayed.

EXAMPLE

If: Soft Start, Linear Speed, or Pump Start is selected:

Then: Starting Torque, Max Torque, Rated Torque, and Rated Speed will **not** be displayed.

Reason: These parameters are specific to the Torque Start parameter group.

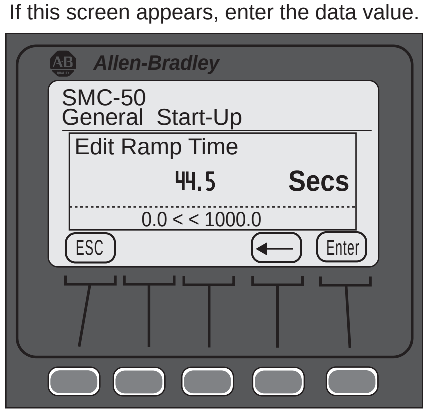
See Figure 84 on page 155 which shows the flow of the General Start-up, and the parameters used with the Starting and Stopping modes.

Entering Data into General Startup

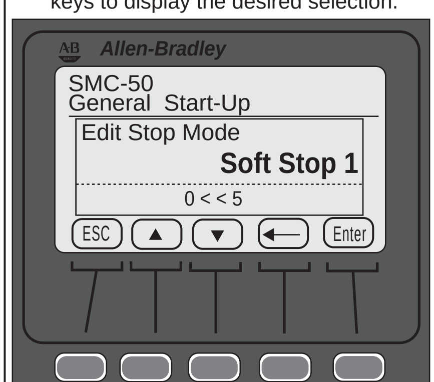
1. Display the parameter.

   If the HIM provides the allowable range (e.g., 1.0 << 2200.0) at the bottom of the screen, enter the data value. If an up or down arrow soft key is displayed, use the soft key to display the desired selection.

If this screen appears, enter the data value.



If this screen appears, use the ▲ or ▼ soft keys to display the desired selection.



2. Enter the desired value, then press the ENTER soft key.

TIP If an incorrect value was entered: Press the ESC soft key to return to the previous screen, then enter the desired value. Use the left arrow soft key to delete a single digit at a time from the data field to enter the correct digit. If a group of selections is displayed, the left arrow soft key moves to the lowest numbered selection.

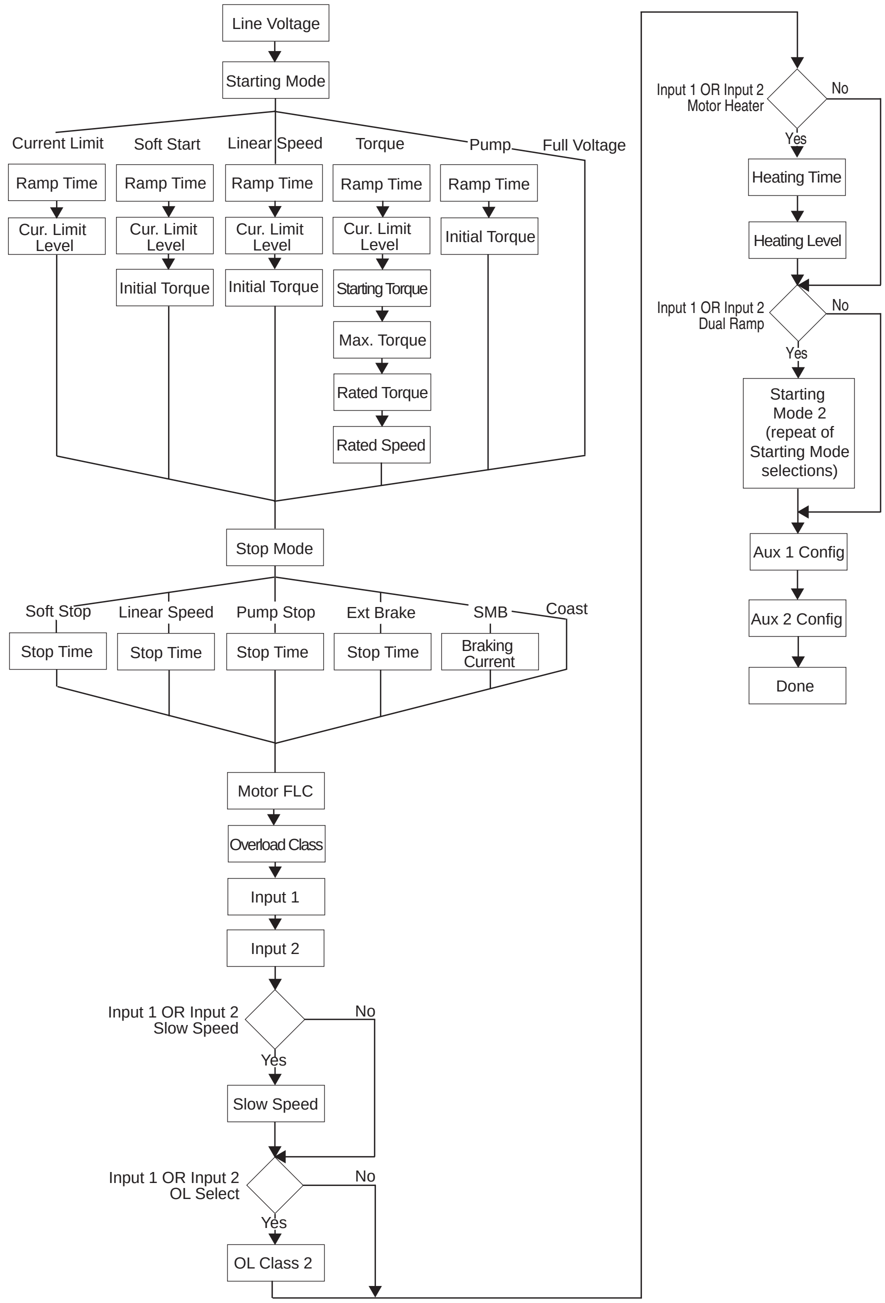
Once all parameters are entered, the START-UP folders screen will appear.

Review/Modify Parameter Data

1. Display the START UP folder screen.
2. Press the ENTER (#5) key.
3. Select the "Yes" soft key when "Run General Start-Up?" is displayed.
4. Individually review each parameter (required), pressing the ENTER soft key to move onto the next parameter. If necessary, press the ESC soft key to review the previous parameter.

NOTE: To modify parameter data, use the procedure outlined in Entering Data into General Startup above.

Figure 84 - Flow Chart — General Start-Up Parameters



Parameter Search & Configuration

The 20-HIM-A6 or 20-HIM-C6S can access all of the SMC-50 parameters. It provides two basic ways to search for and modify a specific parameter or group of parameters by: (1) parameter number or (2) File-Group. The following example explains how to search by parameter number using the 20-HIM-A6.

Parameter Search & Configuration by Parameter Number

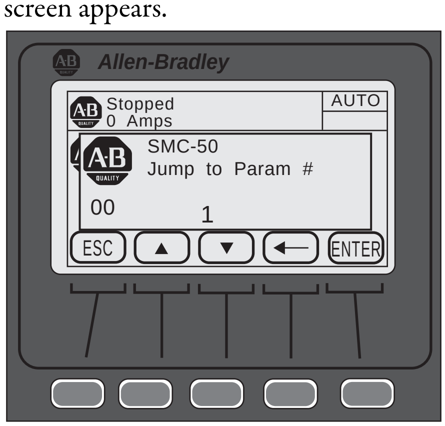
To perform a parameter number search and modification, perform the following steps.

EXAMPLE

Parameter Search & Configuration by Parameter Number

1. Ensure the initial SMC-50 Power Up screen appears on the HIM as shown below.

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

NOTE: For a complete SMC-50 linear list, see Table 73 through Table 77 beginning on page 177.

For additional details on these procedures, see the 20-HIM-A6 or 20-HIM-C6S User Manual, publication 20HIM-UM001.

Parameter Search & Configuration by File—Group Structure

Parameter Structure

The parameters of the SMC-50 are structured into five parameter File-Groups:

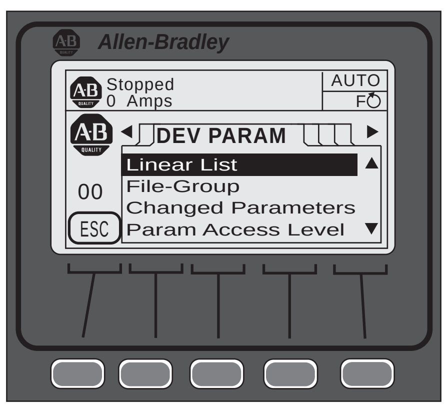
1. Monitoring
2. Setup
3. Motor Protection
4. Communications
5. Utility

The parameters associated with each of these five File — Groups are shown in Figure 87 through Figure 91 beginning on page 174 of this chapter.

Parameter Search & Configuration by File-Group (SMC-50 Category Search)

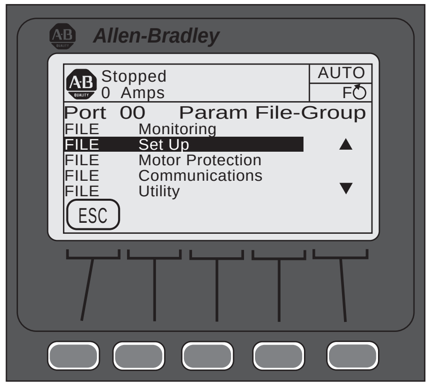
EXAMPLE

1. From the HIM Power-Up screen, press the FOLDERS single-function key.
2. Press the LEFT or RIGHT arrow key until the screen displays DEV PARAM. Ensure Port 00 SMC-50 is selected from the PORTS screen.



3. Using the DOWN arrow key, scroll to the File-Group selection, then press ENTER (#5 keypad). The screen will display Port 00 Param File-Group at the top of the screen.

4. Using the DOWN arrow key, scroll to the Set Up selection, then press ENTER. The screen will display the Set Up categories (e.g., Basic, Starting, etc.).



5. With Basic highlighted, press ENTER (number 5 on the keypad).
6. Scroll to the desired parameter (e.g., Line Voltage) to modify it, then press ENTER (number 5 on the keypad).
7. With the parameter displayed, press the EDIT soft key.
8. Enter the desired value, then press the ENTER soft key to save the value.
9. Press the ESC key to return to the Basic category.
10. To modify another parameter in the Basic category, follow step 5 though 7 above. To back out to a higher level category, press the BACK arrow key.

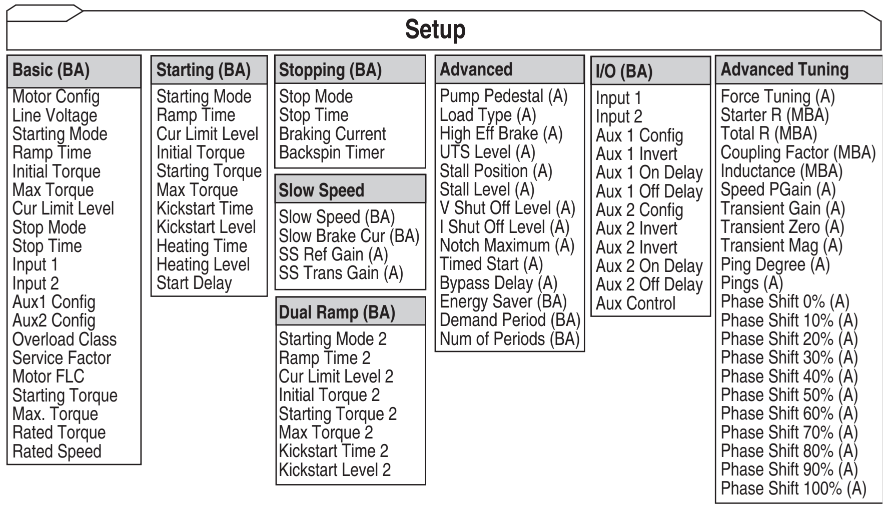
NOTE: Using the DEV PARAM folder screen and the File-Group selection, SMC-50 parameters can be selected and configured by functional category. See the SMC-50 Category/File Structure parameters, Figure 87 through Figure 91 beginning on page 174.

Parameter Configuration - Using the Setup File Group

Overview

The following figure shows the parameter sets available within the Basic Setup group.

Figure 85 - Setup File Group



NOTE: For a complete parameter set listing within each parameter File — Group, see Figure 87 through Figure 91 beginning on page 174.

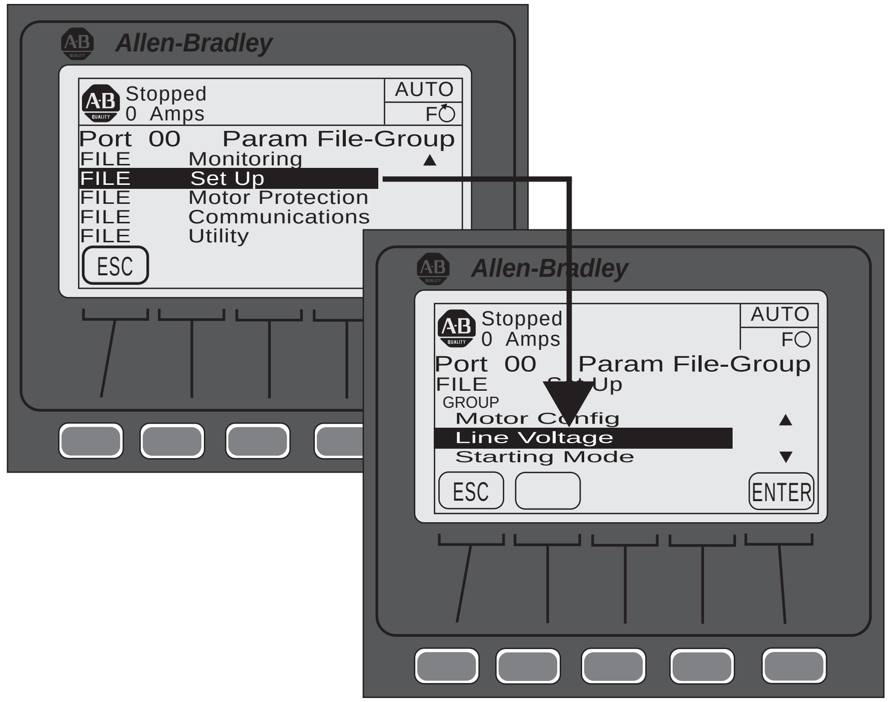
The Basic parameter set in the Setup group is limited, yet powerful. It allows for quick system startup with minimal adjustments and provides quick access to parameters required for standard motor connection and overload protection. If advanced controller features (e.g., Dual Ramp, Braking, etc.) will be used, however, the parameter set associated with those features must also be utilized. The Setup group will be used throughout this section as a baseline for system configuration.

IMPORTANT	Parameter values that are modified while the motor is operating are **not** valid until the next time the operation for that parameter occurs.

ATTENTION: For Overload Protection, it is critical that the data be entered into the SMC-50 as it appears on the motor nameplate.

The following figure shows the initial FILE Setup screens using the HIM.

Figure 86 - Initial FILE Setup Screens



Soft Start & Stop

To program a Soft Start with simple Stop Mode operation, the following parameters are provided for user adjustment. The Basic parameter set can be accessed with the HIM from the Port <00> DEV PARAM folder under the File-Group, File: Setup, Group: Basic Selection sequence.

Parameter	Option [default]
Motor Configuration Setting for the motor configuration Line Connected Wye or Inside-the-Delta. **NOTE:** In the AUTO Detect [default] selection, the controller will automatically check the motor configuration.	Line, Delta, [Auto Detect]
Line Voltage Select the value of line voltage being used in the system. The correct line voltage value must be entered for the voltage protection functions to work properly.	0…700V [480V]
Starting Mode This mode must be programmed for Soft Start.	Soft Start ❶❷
Ramp Time Programs the time period that the SMC-50 will ramp the output voltage up to full voltage and to full speed form the Initial Torque level.	0…1000 [10] seconds
Initial Torque The initial reduced output voltage (torque) level for the voltage ramp to the motor is established and adjusted with this parameter — the torque level at which the ramp begins.	0…90% [70%] LRT
Current Limit Level Limits the current supplied to the motor throughout the Soft Start cycle. NOTE: Enter a value so as to limit the current but not so low as to inhibit the start cycle.	50...600% [350%] FLC
Stop Mode Programs the desired Stop Mode. NOTE: The mode of stopping does not need to match the starting mode (e.g., a Soft Start can have a stop mode programmed for [Coast], Linear Stop, or SMB — there is no Current Limit Stop or Torque Stop mode).	[Coast], Soft Stop, Linear Speed, Pump Stop, SMB ❸, Ext Brake ❹

Parameter	Option [default]
Stop Time Programs the amount of time desired to ramp from full to zero voltage for Soft, Linear, and Pump Stop mode. The actual ramp stop time will depend on the stopping mode selected and load inertia.	[0]…999 seconds
Input 1 Programs the desired operation of the Control Module to a change in status of Input #1 wired to control terminal #11 (24V DC). [Default: Start/Coast]	Disable, Start, Coast, Stop Option, Start/ Coast, Start/Stop, Slow Speed, Dual Ramp, OL Select, Fault, Fault NC, Clear Fault, Emerg Run, Motor Heater
Input 2 Programs the desired operation of the Control Module to a change in status of Input #2 wired to control terminal #10 (24V DC). [Default: Disable]	
Aux 1 Config Programs the control function of the Auxiliary Output Contact #1, wired across control terminal #4 and #5. **NOTE:** Relay Operational Options (e.g., ON and OFF delay, etc.) are provided in the File: Setup, Group: I/O selection sequence. See Figure 85 on page 159.	[Normal], UTS, Fault, Alarm, Ext Bypass, Ext Brake, Aux Control ❺, Network 1, Network 2, Network 3, Network 4.
Aux 2 Config Programs the control function of the Auxiliary Output Contact #2, wired across control terminal #6 and #7. **NOTE:** Relay Operational Options (e.g., ON and OFF delay, etc.) are provided in the File: Setup, Group: I/O selection sequence. See Figure 85 on page 159.	
Overload Class Required for motor protection. Allows the user to select the time-to-trip for the built-in Motor Overload. This selection is based on the type of motor being used and the application it is being applied to.	5…30 [10]
Service Factor Required for motor protection. This value is taken directly from the nameplate and used by the controller to determine the ultimate Overload Trip Current.	0.01...1.99 [1.15]
Motor FLC Required for motor protection. This programmed value is taken directly from the motor nameplate.	1.0...2200.0 [1.0] Amps
Starting Torque NOT used for a Soft Start.	0...300% [100%] RMT
Max Torque NOT used for a Soft Start.	0...300% [250%] RMT
Rated Torque NOT used for a Soft Start.	0...10000 [10] N•m
Rated Speed NOT used for a Soft Start.	750, 900, 1500, [1800], 3500, 3600 RPM

❶ Kickstart is available when using Soft Start. A Kickstart Level and Time must be configured if this mode is used. Access these parameters via the Starting Setup Group. The Starting Setup Group can be accessed with the HIM from the Port <00> DEV PARAM folder under the File-Group, File: Setup, Group: Starting selection sequence (see Figure 85 on page 159). Setting either parameter to zero disables Kickstart.

❷ A Start Delay Time can also be programmed to delay starting for a period of time after the initiation of the START command. The Start Delay parameter can be accessed from the Group Starting selection as noted in ❶ above.

❸ In addition to Stop Mode for SMB, a Braking Current value must be configured from the Group Stopping selection (see Figure 85 on page 159).

❹ To use Ext. Braking, one of the Auxiliary Outputs must be programmed to Ext Brake. When programmed for Ext Brake, the function of this Auxiliary is to energize the external brake device to stop the motor. The relay stays ON from the beginning of the STOP command until the STOP time parameter has timed out.

❺ Any auxiliary output configured for Aux Control using the AuxX Config parameter will be under control of its associated bit from the Aux Control, Parameter 180. See Parameter 180 information for bit assignments.

NOTE: This function enables forcing an output, ON or OFF.

ATTENTION: For Overload Protection, it is critical that the data be entered into the SMC-50 as it appears on the motor nameplate.

Current Limit Start with Simple Stop Mode

To program a Current Limit Start with simple Stop Mode operation, the following parameters are provided for user adjustment. The basic parameter set can be accessed with the HIM (see Figure 88 on page 175).

Parameter	Option [default]
Motor Config Setting for the motor configuration Line Connected Wye or Inside-the-Delta. **NOTE:** In the AUTO Detect [default] selection, the controller will automatically check the motor configuration.	Line, Delta, [Auto Detect]
Line Voltage Select the value of line voltage being used in the system. The correct line voltage value must be entered for the voltage protection functions to work properly.	0…700V [480V]
Starting Mode This mode must be programmed for Current Limit.	Current Limit ❶❷
Ramp Time Programs the time period that the SMC-50 will HOLD the fixed reduced voltage/current before switching to full voltage.	0…1000 [10] seconds
Initial Torque NOT used for a Current Limit Start.	0…90% [70%] LRT
Current Limit Level Limits the current supplied to the motor throughout the Start cycle. NOTE: Enter a value so as to limit the current but not so low as to inhibit the start cycle.	50...600% [350%] FLC
Stop Mode Programs the desired Stop Mode. NOTE: The mode of stopping does not need to match the starting mode (e.g., a Soft Start can have a stop mode programmed for [Coast], Linear Stop, or SMB — there is no Current Limit Stop or Torque Stop mode).	[Coast], Soft Stop, Linear Speed, Pump Stop, SMB ❸, Ext Brake ❹
Stop Time Programs the amount of time desired to ramp from full to zero voltage for Soft, Linear, and Pump Stop mode. The actual ramp stop time will depend on the stopping mode selected and load inertia.	[0]…999 seconds
Input 1 Programs the desired operation of the Control Module to a change in status of Input #1 wired to control terminal #11 (24V DC). [Default: Start/Coast]	Disable, Start, Coast, Stop Option, Start/Coast, Start/Stop, Slow Speed, Dual Ramp, OL Select, Fault, Fault NC, Clear Fault, Emerg Run, Motor Heater❶
Input 2 Programs the desired operation of the Control Module to a change in status of Input #2 wired to control terminal #10 (24V DC). [Default: Disable]	
Aux 1 Config Programs the control function of the Auxiliary Output Contact #1, wired across control terminal #4 and #5. **NOTE:** Relay Operational Options (e.g., ON and OFF delay, etc.) are provided in the File: Setup, Group: I/O selection sequence. See Figure 85 on page 159.	[Normal], UTS, Fault, Alarm, Ext Bypass, Ext Brake, Aux Control ❺, Network 1, Network 2, Network 3, Network 4.
Aux 2 Config Programs the control function of the Auxiliary Output Contact #2, wired across control terminal #6 and #7. **NOTE:** Relay Operational Options (e.g., ON and OFF delay, etc.) are provided in the File: Setup, Group: I/O selection sequence. See Figure 85 on page 159.	
Overload Class Required for motor protection. Allows the user to select the time-to-trip for the built-in Motor Overload. This selection is based on the type of motor being used and the application it is being applied to.	5-30 [10]
Service Factor Required for motor protection. This programmed value is taken directly from the nameplate and used by the controller to determine the ultimate Overload Trip Current.	0.01...1.99 [1.15]
Motor FLC Required for motor protection. This programmed value is taken directly from the motor nameplate.	1.0...2200.0 [1.0] Amps
Starting Torque NOT used for a Current Limit Start.	0...300% [100%] RMT
Max Torque NOT used for a Current Limit Start.	0...300% [250%] RMT

Parameter	Option [default]
Rated Torque NOT used for a Current Limit Start.	0...10000 [10] N·m
Rated Speed NOT used for a Current Limit Start.	750, 900, 1500, [1800], 3500, 3600 rpm

❶ Kickstart is available when using Current Limit Start. A Kickstart Level and Time must be configured if this mode is used. Access these parameters via the Starting Setup Group. The Starting Setup Group can be accessed with the HIM from the Port <00> DEV PARAM folder under the File-Group, File: Setup, Group: Starting selection sequence (see Figure 85 on page 159). Setting either parameter to zero disables Kickstart.

❷ A Start Delay Time can also be programmed to delay starting for a period of time after the initiation of the START command. The Start Delay parameter can be accessed from the Group Starting selection as noted in ❶ above.

❸ In addition to Stop Mode for SMB, a Braking Current value must be configured from the Group Stopping selection (see Figure 85 on page 159).

❹ To use Ext. Braking, one of the Auxiliary Outputs must be programmed to Ext Brake. When programmed for Ext Brake, the function of this Auxiliary is to energize the external brake device to stop the motor. The relay stays ON from the beginning of the STOP command until the STOP time parameter has timed out.

❺ Any auxiliary output configured for Aux Control using the AuxX Config parameter will be under control of its associated bit from the Aux Control, Parameter 180. See Parameter 180 information for bit assignments.
NOTE: This function enables forcing an output, ON or OFF.

ATTENTION: For Overload Protection, it is critical that the data be entered into the SMC-50 as it appears on the motor nameplate.

Linear Acceleration (Speed Sense) Start with Stop

To use the Basic Setup Group to program a Linear Acceleration Start and Simple Stop Mode operation, the following parameters are provided for user adjustment. The Basic parameter set can be accessed with the HIM (see Figure 88).

Parameter	Option [default]
Motor Config Setting for the motor configuration Line Connected Wye or Inside-the-Delta. **NOTE:** In the AUTO Detect [default] selection, the controller will automatically check the motor configuration.	Line, Delta, [Auto Detect]
Line Voltage Select the value of line voltage being used in the system. The correct line voltage value must be entered for the voltage protection functions to work properly.	0…700V [480V]
Starting Mode This mode must be programmed for Linear Speed.	Linear Speed ❶❷
Ramp Time Programs the time period that the SMC-50 will ramp the output voltage up to full voltage and to full speed from Stop. With the Linear Speed Starting mode, the time to ramp to full speed will closed to this value depending on load characteristics.	0…1000 [10] seconds
Initial Torque The initial reduced output (torque) level for the voltage ramp to the motor is established and adjusted to this parameter. Torque level at which the ramp begins.	0…90% [70%] LRT
Current Limit Level Limits the current supplied to the motor throughout the Linear Start and Stop cycle. NOTE: Enter a value so as to limit the current but not so low as to inhibit the start cycle.	50...600% [350%] FLC
Stop Mode Programs the desired Stop Mode. NOTE: The mode of stopping does not need to match the starting mode (e.g., a Soft Start can have a stop mode programmed for [Coast], Linear Stop, or SMB — there is no Current Limit Stop or Torque Stop mode).	[Coast], Soft Stop, Linear Speed, Pump Stop, SMB ❸, Ext Brake ❹
Stop Time Programs the amount of time desired to ramp from full to zero voltage for Soft, Linear, and Pump Stop mode. The actual ramp stop time will depend on the stopping mode selected and load inertia.	[0]…999 seconds

Parameter	Option [default]
Input 1 Programs the desired operation of the Control Module to a change in status of Input #1 wired to control terminal #11 (24V DC). [Default: Start/Coast]	Disable, Start, Coast, Stop Option, Start/Coast, Start/Stop, Slow Speed, Dual Ramp, OL Select, Fault, Fault NC, Clear Fault, Emerg Run, Motor Heater
Input 2 Programs the desired operation of the Control Module to a change in status of Input #2 wired to control terminal #10 (24V DC). [Default: Disable]	
Aux 1 Config Programs the control function of the Auxiliary Output Contact #1, wired across control terminal #4 and #5. **NOTE:** Relay Operational Options (e.g., ON and OFF delay, etc.) are provided in the File: Setup, Group: I/O selection sequence. See Figure 85 on page 159.	[Normal], UTS, Fault, Alarm, Ext Bypass, Ext Brake, Aux Control ❺, Network 1, Network 2, Network 3, Network 4
Aux 2 Config Programs the control function of the Auxiliary Output Contact #2, wired across control terminal #6 and #7. **NOTE:** Relay Operational Options (e.g., ON and OFF delay, etc.) are provided in the File: Setup, Group: I/O selection sequence. See Figure 85 on page 159.	
Overload Class Required for motor protection. Allows the user to select the time-to-trip for the built-in Motor Overload. This selection is based on the type of motor being used and the application it is being applied to.	5-30 [10]
Service Factor Required for motor protection. This programmed value is taken directly from the nameplate and used by the controller to determine the ultimate Overload Trip Current.	0.01...1.99 [1.15]
Motor FLC Required for motor protection. This programmed value is taken directly from the motor nameplate.	1.0...2200.0 [1.0] Amps
Starting Torque NOT used for a Linear Speed Start.	0...300% [100] RMT
Max Torque NOT used for a Linear Speed Start.	0...300% [250] RMT
Rated Torque NOT used for a Linear Speed Start.	0...10000 [10] N·m
Rated Speed NOT used for a Linear Speed Start.	750, 900, 1500, [1800], 3500, 3600 RPM

❶ For best results with Linear Acceleration, Motor Tuning Cycle should be performed. The SMC-50 will do this automatically the first time the motor is run. The user can also force this manually by setting the Force Tuning parameter to true (=1), which is accessed from the File Setup, Group Adv. Tuning or by pressing and holding the SMC-50's Reset button for 10 seconds with the motor stopped.

❷ A Start Delay Time can also be programmed to delay starting for a period of time after the initiation of the START command. The Start Delay parameter can be accessed from the Group Starting selection (see Figure 85 on page 159).

❸ In addition to Stop Mode for SMB, a Braking Current value must be configured from the Group Stopping selection (see Figure 85 on page 159).

❹ To use Ext. Braking, one of the Auxiliary Outputs must be programmed to Ext Brake. When programmed for Ext Brake, the function of this Auxiliary is to energize the external brake device to stop the motor. The relay stays ON from the beginning of the STOP command until the STOP time parameter has timed out.

❺ Any auxiliary output configured for Aux Control using the AuxX Config parameter will be under control of its associated bit from the Aux Control, Parameter 180. See Parameter 180 information for bit assignments.
NOTE: This function enables forcing an output, ON or OFF.

ATTENTION: For Overload Protection, it is critical that the data be entered into the SMC-50 as it appears on the motor nameplate.

Torque Start with Stop

To program a Torque Start with simple Stop operation, the following parameters are provided for user adjustment. The Basic parameter set can be accessed with the HIM (see Figure 88 on page 175).

Parameter	Option [default]
Motor Config Setting for the motor configuration Line Connected Wye or Inside-the-Delta. **NOTE:** In the AUTO Detect [default] selection, the controller will automatically check the motor configuration.	Line, Delta, [Auto Detect]
Line Voltage Select the value of line voltage being used in the system. The correct line voltage value must be entered for the voltage protection functions to work properly.	0…700V [480V]
Starting Mode This mode must be programmed for Torque Ramp.	Torque Ramp ❶❷❸
Ramp Time Programs the time period that the SMC-50 will ramp the output voltage from the Starting Torque Value to the Programmed Max Torque Value.	0…1000 [10] seconds
Initial Torque NOT used for a Torque Ramp Start.	0…90% [70%] LRT
Current Limit Level Limits the current supplied to the motor throughout the Torque Ramp Start cycle. NOTE: Enter a value so as to limit the current but not so low as to inhibit the start cycle.	50...600% [350%] FLC
Stop Mode Programs the desired Stop Mode. NOTE: The mode of stopping does not need to match the starting mode (e.g., a Soft Start can have a stop mode programmed for [Coast], Linear Stop, or SMB — there is no Current Limit Stop or Torque Stop mode).	[Coast], Soft Stop, Linear Speed, Pump Stop, SMB ❹, Ext Brake ❺
Stop Time Programs the amount of time desired to ramp from full to zero voltage for Soft, Linear, and Pump Stop mode. The actual ramp stop time will depend on the stopping mode selected and load inertia.	0…999 seconds
Input 1 Programs the desired operation of the Control Module to a change in status of Input #1 wired to control terminal #11 (24V DC). [Default: Start/Coast]	Disable, Start, Coast, Stop Option, Start/Coast, Start/Stop, Slow Speed, Dual Ramp, OL Select, Fault, Fault NC, Clear Fault, Emerg Run, Motor Heater
Input 2 Programs the desired operation of the Control Module to a change in status of Input #2 wired to control terminal #10 (24V DC). [Default: Disable]	
Aux 1 Config Programs the control function of the Auxiliary Output Contact #1, wired across control terminal #4 and #5. **NOTE:** Relay Operational Options (e.g., ON and OFF delay, etc.) are provided in the File: Setup, Group: I/O selection sequence. See Figure 85 on page 159.	[Normal], UTS, Fault, Alarm, Ext Bypass, Ext Brake, Aux Control ❻, Network 1, Network 2, Network 3, Network 4
Aux 2 Config Programs the control function of the Auxiliary Output Contact #2, wired across control terminal #6 and #7. **NOTE:** Relay Operational Options (e.g., ON and OFF delay, etc.) are provided in the File: Setup, Group: I/O selection sequence. See Figure 85 on page 159.	
Overload Class Required for motor protection. Allows the user to select the time-to-trip for the built-in Motor Overload. This selection is based on the type of motor being used and the application it is being applied to.	5-30 [10]
Service Factor Required for motor protection. This programmed value is taken directly from the nameplate and used by the controller to determine the ultimate Overload Trip Current.	0.01...1.99 [1.15]
Motor FLC Required for motor protection. This programmed value is taken directly from the motor nameplate.	1...2200 [1.0] Amps
Starting Torque Programmed initial or starting point for a Torque Ramp Start.	0...300% [100] RMT
Max Torque Programmed end point for a Torque Ramp Start.	0...300% [250] RMT

Parameter	Option [default]
Rated Torque The actual rated torque of the motor being used in a Torque Ramp Start.	0...10000 [10] N·m
Rated Speed The actual rated speed of the motor used in the Torque Ramp Start.	750, 900, 1500, [1800], 3500, 3600 RPM

❶ Torque Ramp Starting requires that a Motor Tuning Cycle be performed. The SMC-50 will do this automatically the first time the motor is run. The user can also force this manually by setting the Force Tuning, Parameter 194, to TRUE (=1), which is accessed from the File Setup, Group Adv. Tuning or by pressing and holding the SMC-50's Reset button for 10 seconds with the motor stopped.

❷ A Start Delay Time can also be programmed to delay starting for a period of time after the initiation of the START command. The Start Delay parameter can be accessed from the Group Starting selection (see Figure 85 on page 159).

❸ Kickstart is available when using Torque Start. A Kickstart Level and Time must be configured if this mode is used. Access these parameters via the Starting Setup Group. The Starting Setup Group can be accessed with the HIM from the Port <00> DEV PARAM folder under the File-Group, File: Setup, Group: Starting selection sequence (see Figure 85 on page 159). Setting either parameter to zero disables Kickstart.

❹ In addition to Stop Mode for SMB, a Braking Current value must be configured from the Group Stopping selection (see Figure 85 on page 159).

❺ To use Ext. Braking, one of the Auxiliary Outputs must be programmed to Ext Brake. When programmed for Ext Brake, the function of this Auxiliary is to energize the external brake device to stop the motor. The relay stays ON from the beginning of the STOP command until the STOP time parameter has timed out.

❻ Any auxiliary output configured for Aux Control using the AuxX Config parameter will be under control of its associated bit from the Aux Control, Parameter 180. See Parameter 180 information for bit assignments.
NOTE: This function enables forcing an output, ON or OFF.

ATTENTION: For Overload Protection, it is critical that the data be entered into the SMC-50 as it appears on the motor nameplate.

Pump Start with Stop

To program a Pump Start with simple Stop operation, the following parameters are provided for user adjustment. The Basic Setup parameter set can be accessed with the HIM (see Figure 88 on page 175).

Parameter	Option [default]
Motor Config Setting for the motor configuration Line Connected Wye or Inside-the-Delta. **NOTE:** In the AUTO Detect [default] selection, the controller will automatically check the motor configuration.	Line, Delta, [Auto Detect]
Line Voltage Select the value of line voltage being used in the system. The correct line voltage value must be entered for the voltage protection functions to work properly.	0…700V [480V]
Starting Mode This mode must be programmed for Pump Start.	Pump Start ❶❷
Ramp Time Programs the time period that the SMC-50 will ramp the output voltage to full voltage and motor speed from the programmed Initial Torque value.	0…1000 [10] seconds
Initial Torque The initial reduced output voltage (torque) level for the voltage ramp to the motor is established and adjusted with this parameter. The torque level at which the ramp begins.	0…90% [70%] LRT
Current Limit Level Limits the current supplied to the motor throughout the Torque Ramp Start cycle. NOTE: Enter a value so as to limit the current but not so low as to inhibit the start cycle.	50...600% [350%] FLC
Stop Mode Programs the desired Stop Mode. NOTE: The mode of stopping does not need to match the starting mode (e.g., a Soft Start can have a stop mode programmed for [Coast], Linear Stop, or SMB — there is no Current Limit Stop or Torque Stop mode).	[Coast], Soft Stop, Linear Speed, Pump Stop, SMB ❸, Ext Brake ❹
Stop Time Programs the amount of time desired to ramp from full to zero voltage for Soft, Linear, and Pump Stop mode. The actual ramp stop time will depend on the stopping mode selected and load inertia.	[0]…999 seconds

Parameter	Option [default]
Input 1 Programs the desired operation of the Control Module to a change in status of Input #1 wired to control terminal #11 (24V DC). [Default: Start/Coast]	Disable, Start, Coast, Stop Option, Start/Coast, Start/Stop, Slow Speed, Dual Ramp, OL Select, Fault, Fault NC, Clear Fault, Emerg Run, Motor Heater
Input 2 Programs the desired operation of the Control Module to a change in status of Input #2 wired to control terminal #10 (24V DC). [Default: Disable]	
Aux 1 Config Programs the control function of the Auxiliary Output Contact #1, wired across control terminal #4 and #5. **NOTE:** Relay Operational Options (e.g., ON and OFF delay, etc.) are provided in the File: Setup, Group: I/O selection sequence. See Figure 85 on page 159.	[Normal], UTS, Fault, Alarm, Ext Bypass, Ext Brake, Aux Control ❺, Network 1, Network 2 Network 3, Network 4
Aux 2 Config Programs the control function of the Auxiliary Output Contact #2, wired across control terminal #6 and #7. **NOTE:** Relay Operational Options (e.g., ON and OFF delay, etc.) are provided in the File: Setup, Group: I/O selection sequence. See Figure 85 on page 159.	
Overload Class Required for motor protection. Allows the user to select the time-to-trip for the built-in Motor Overload. This selection is based on the type of motor being used and the application it is being applied to.	5-30 [10]
Service Factor Required for motor protection. This programmed value is taken directly from the nameplate and used by the controller to determine the ultimate Overload Trip Current.	0.01…1.99 [1.15]
Motor FLC Required for motor protection. This programmed value is taken directly from the motor nameplate.	[1]…2200 Amps
Starting Torque NOT used for Pump Start.	0…300% [100%] RMT
Max Torque NOT used for Pump Start.	0…300% [250%] RMT
Rated Torque NOT used for Pump Start.	0…10000 [10] N·m
Rated Speed NOT used for Pump Start.	750, 900, 1500, [1800], 3500, 3600 RPM

❶ For best results with a Pump Start, it is recommended that the tuning cycle be run. The SMC-50 will automatically perform the tuning cycle the first time the motor is run. The user can also force this manually by setting the Force Tuning parameter to TRUE (=1), which is accessed from the File Setup, Group Adv. Tuning or by pressing and holding the SMC-50's Reset button for 10 seconds with the motor stopped.

❷ A Start Delay Time can also be programmed to delay starting for a period of time after the initiation of the START command. The Start Delay parameter can be accessed from the Group Starting selection (see Figure 85 on page 159).

❸ In addition to Stop Mode for SMB, a Braking Current value must be configured from the Group Stopping selection (see Figure 85 on page 159).

❹ To use Ext. Braking, one of the Auxiliary Outputs must be programmed to Ext Brake. When programmed for Ext Brake, the function of this Auxiliary is to energize the external brake device to stop the motor. The relay stays ON from the beginning of the STOP command until the STOP time parameter has timed out.

❺ Any auxiliary output configured for Aux Control using the AuxX Config parameter will be under control of its associated bit from the Aux Control, Parameter 180. See Parameter 180 information for bit assignments.
NOTE: This function enables forcing an output, ON or OFF.

ATTENTION: For Overload Protection, it is critical that the data be entered into the SMC-50 as it appears on the motor nameplate.

Full Voltage Start with Stop

The SMC-50 may be programmed to provide a full voltage start (output voltage to the motor reaches full voltage within five line power cycles).

To provide a Full Voltage Start to the motor, the only start parameter that requires adjustment is the Starting Mode. The Basic parameter set should be used to program Full Voltage Start to ensure configuration of other motor configuration and basic protection parameters. To use the Basic parameter set to program a Full Voltage Start and Simple or Stop Mode operation, the following parameters are provided for user adjustment. The Basic Setup parameter set can be accessed with the HIM (see Figure 88 on page 175).

Parameter	Option [default]
Motor Config Setting for the motor configuration Line Connected Wye or Inside-the-Delta. **NOTE:** In the AUTO Detect [default] selection, the controller will automatically check the motor configuration.	Line, Delta, [Auto Detect]
Line Voltage Select the value of line voltage being used in the system. The correct line voltage value must be entered for the voltage protection functions to work properly.	0…700V [480V]
Starting Mode This mode must be programmed for Full Voltage Start.	Full Voltage ❶
Ramp Time NOT used for Full Voltage Start.	0…1000 [10] seconds
Initial Torque NOT used for Full Voltage Start.	0…90% [70%] LRT
Current Limit Level NOT used for Full Voltage Start.	50...600% [350%] FLC
Stop Mode Programs the desired Stop Mode. NOTE: The mode of stopping does not need to match the starting mode (e.g., a Soft Start can have a stop mode programmed for [Coast], Linear Stop, or SMB — there is no Current Limit Stop or Torque Stop mode).	[Coast], Soft Stop, Linear Speed, Pump Stop, SMB ❷, Ext Brake ❸
Stop Time Programs the amount of time desired to ramp from full to zero voltage for Soft, Linear, and Pump Stop mode. The actual ramp stop time will depend on the stopping mode selected and load inertia.	[0]…999 seconds
Input 1 Programs the desired operation of the Control Module to a change in status of Input #1 wired to control terminal #11 (24V DC). [Default: Start/Coast]	Disable, Start, Coast, Stop Option, Start/Coast, Start/Stop, Slow Speed, Dual Ramp, OL Select, Fault, Fault NC, Clear Fault, Emerg Run, Motor Heater
Input 2 Programs the desired operation of the Control Module to a change in status of Input #2 wired to control terminal #10 (24V DC). [Default: Disable]	
Aux 1 Config Programs the control function of the Auxiliary Output Contact #1, wired across control terminal #4 and #5. **NOTE:** Relay Operational Options (e.g., ON and OFF delay, etc.) are provided in the File: Setup, Group: I/O selection sequence. See Figure 85 on page 159.	[Normal], UTS, Fault, Alarm, Ext Bypass, Ext Brake, Aux Control ❹, Network 1, Network 2, Network 3, Network 4
Aux 2 Config Programs the control function of the Auxiliary Output Contact #2, wired across control terminal #6 and #7. **NOTE:** Relay Operational Options (e.g., ON and OFF delay, etc.) are provided in the File: Setup, Group: I/O selection sequence. See Figure 85 on page 159.	
Overload Class Required for motor protection. Allows the user to select the time-to-trip for the built-in Motor Overload. This selection is based on the type of motor being used and the application it is being applied to.	5-30 [10]
Service Factor Required for motor protection. This programmed value is taken directly from the nameplate and used by the controller to determine the ultimate Overload Trip Current.	0.01...1.99 [1.15]
Motor FLC Required for motor protection. This programmed value is taken directly from the motor nameplate.	[1]...2200 Amps
Starting Torque NOT used for Full Voltage Start.	0...300% [100%] RMT
Max Torque NOT used for Full Voltage Start.	0...300% [250%] RMT

Parameter	Option [default]
Rated Torque NOT used for Full Voltage Start.	0…10000 [10] N·m
Rated Speed NOT used for Full Voltage Start.	750, 900, 1500, [1800], 3500, 3600 RPM

❶ A Start Delay Time can also be programmed to delay starting for a period of time after the initiation of the START command. The Start Delay parameter can be accessed from the Group Starting selection.

❷ In addition to Stop Mode for SMB, a Braking Current value must be configured from the Group Stopping selection (see Figure 85 on page 159).

❸ To use Ext. Braking, one of the Auxiliary Outputs must be programmed to Ext Brake. When programmed for Ext Brake, the function of this Auxiliary is to energize the external brake device to stop the motor. The relay stays ON from the beginning of the STOP command until the STOP time parameter has timed out.

❹ Any auxiliary output configured for Aux Control using the AuxX Config parameter will be under control of its associated bit from the Aux Control, Parameter 180. See Parameter 180 information for bit assignments.
NOTE: This function enables forcing an output, ON or OFF.

ATTENTION: For Overload Protection, it is critical that the data be entered into the SMC-50 as it appears on the motor nameplate.

Dual Ramp Start with Stop

The SMC-50 provides the ability to select between two start profiles. Start Profile 1 can be configured using the Basic parameter set as explained in the previous sections. The Basic Setup parameter set can be accessed with the HIM (see Figure 88 on page 175).

NOTE: The Stop mode selected in the Basic parameter set will apply to both start profiles.
The Basic parameter set provides the method to select between the operation of Start Profile 1 and Start Profile 2 by configuration of Input 1 or Input 2 to the Dual Ramp. If the input configured for Dual Ramp is open (low), Start Profile 1 is selected. If the input is closed (high), Profile 2 is selected.

Setup of Start Profile 2 is accomplished using the Dual Ramp parameter set. Dual Ramp can be accessed with the HIM from the <Port 00> DEV PARAM folder (see Setup on page 175). The following parameters are provided for user Dual Ramp adjustment.

Parameter	Option [default]
Starting Mode 2 Select the desired starting mode for Profile 2 (Soft Start, Full Voltage, Linear Speed, Torque Start, Current Limit, Pump Start).	Soft Start, Linear, etc. ❶❷
Ramp Time 2 Programs the Profile 2 time period that the SMC-50 will ramp the output voltage to full voltage and motor speed from the programmed Initial Torque value.	0…1000 [10] seconds
Current Limit Level 2 The Profile 2 setting limits the current supplied in the motor throughout the Soft Start, Linear Speed, or Torque Ramp cycle. NOTE: Enter a value so as to limit current but not so low as to inhibit the start cycle.	50…600% [350%] FLC
Initial Torque 2 The initial reduced output voltage (torque) level for the Profile 2 Voltage Ramp to the motor is established and adjusted with this parameter. The torque level at which the ramp begins for Profile 2. NOTE: Not used for Torque Ramp.	0…90% [70%]
Starting Torque 2 For a Torque Ramp Start, the programmed initial or start torque point for Profile 2. This parameter is not used for other starting modes.	0…300% [100%] RMT

Parameter	Option [default]
Max Torque 2 For Start Profile 2, the programmed torque end point for a Torque Ramp start. This parameter is not used for other starting modes.	0…300% [250%] RMT
Kickstart Time 2 For Start Profile 2, if required, a boost of current (torque) is provided to motor for this programmed time period. NOTE: Available for Soft Start, Current Limit, and Torque Start modes. Set to zero to disable Kickstart.	[0]…2 seconds
Kickstart Level 2 For Start Profile 2, if required, this parameter programs the amount of current (torque) applied to the motor during Kickstart time. NOTE: Available for Soft Start, Current Limit, and Torque Start modes. Set to zero to disable Kickstart.	750, 900, 1500, [1800], 3500, 3600 RPM

❶ Torque Ramp and Linear Speed Starting modes require that a Motor Tuning Cycle be performed. The SMC-50 will automatically perform the tuning cycle the first time the motor is run. The user can also force this manually by setting the Force Tuning, Parameter 194, to TRUE (=1), which is accessed from the File Setup, Group Adv. Tuning or by pressing and holding the SMC-50 Reset button for 10 seconds with the motor stopped.

❷ A Start Delay Time can also be programmed and will apply to both Start Profile 1 and Start Profile 2. The Start Delay parameter can be accessed from the Group Starting selection (see Figure 85 on page 159).

Start Options

Motor Winding Heater Function

The motor winding heater can be activated after a valid Start command is received. After a valid Start command is received, the activation of the heating function can be performed by either programming the Heating Time parameter to a non-zero value **or** by configuring a terminal block input to Motor Heater and activating that input prior to the Start command. The Motor Winding Heater function will continue for the specified time **or** until the Motor Heater Input is deactivated, at which time the motor will start based on the prior Start command signal. The Motor Winding Heater function will be disabled if the Heater Level parameter is set to zero, the Heater Time is set to zero, **or** the Input is inactive (or not configured) at the time of the Start command.

To program the Motor Winding Heater function, use the File Setup, Group Basic parameter list to configure the motor and the majority of the Start/Stop functions. See any of the previous programming sections for details based on the selected Start mode. The two key parameters (Heating Time and Heating Level), however, are in the File Setup Group Starting parameter list. See Figure 88 on page 175 for a basic understanding of accessing the Starting group. See the table below for details concerning the Heating Time and Heating Level parameters.

Parameter	Option [default]
Heating Time The amount of time the Motor Winding Heater function will remain engaged after receiving a valid Start command.	[0]…1000 seconds ❶
Heating Level The percent Heating Level is sequentially applied to each winding.	[0]…100%

❶ If the Terminal Block Input, configured to Motor Heater, is used to initiate the Motor Winding Heater function, Heating Time can be zero (0), The heater function will be active after the terminal input is active and a start command.

Stop Options

SMB — Smart Motor Breaking

To use the SMB function, the Stopping file group parameter set must be selected from FILE Setup group using the HIM (see Figure 88 on page 175).

Parameter	Option [default]
Stop Mode Allows selection of the desired Stop mode. The mode must be programmed for SMB.	SMB
Stop Time NOT used for SMB. SMB automatically controls the duration (stop time) of the braking current to the motor from the "running at speed" condition until a zero speed condition is reached (zero speed braking shutoff feature/function). ❶	[0]…999 seconds
Braking Current The amount of braking current to be applied to the motor.	[0]…400% FLC
Backspin Timer The amount of time which much expire before another Start cycle can occur. The timer begins after the Stop maneuver is completed. All Start commands are ignored until the timer has expired. If the Start command is momentary and ends before the timer has expired, the motor will not start. This is used to prevent starting a motor that is still cycling.	[0]…999 seconds

❶ Programming a non-zero value for Stop Time will override the SMB zero-speed detection feature/function and use the exact time programmed for Stop Time to apply the programmed Braking Current to the motor. Doing this is useful in applications where detecting zero-speed is difficult (e.g., a specific motor type or when the purpose is to reduce the number of overload trips associated with driving the motor to a complete stop). Setting the Stop Time to a specific value will turn off braking current at a set time and each time a stopping maneuver is performed. To achieve an ideal Stop Time setting, use trial and error and always allow for some small coast time.
NOTE: Setting the Stop Time to a longer duration will cause braking current to be applied to a stopped motor and likely result in overload trips.

Slow Speed with Braking

The SMC-50 Slow Speed feature provides a slow speed jog capability for general purpose positioning which is typically used for system setup. Slow Speed can drive the motor within a range of 1 to 15% of normal speed in the forward or reverse direction without a reversing contactor. Braking from Slow Speed is also provided.

To use the Slow Speed with Braking feature, use the HIM. Navigate from the Port 00 DEV PARAM folder: File-Group, File: Setup, Group: Slow Speed. See Figure 88 on page 175 for detailed information.

Parameter	Option [default]
Slow Speed Allow selection of the best Slow Speed value for the application. NOTE: The plus (+) or minus (-) sign determines the motor direction.	-15…+15 [+10]
Slow Brake Current The desired brake current to be applied from the programmed Slow Speed. **NOTE:** A value of zero results in Coast-to-Stop.	[0]…350% FLC
Slow Speed Reference Gain Provides the ability to adjust the flux reference while the motor is running.	0.1…2.00 [1.00]
Slow Speed Transient Gain Provides the ability to adjust the control reference when transitioning between slow speed and any starting mode.	0.1…2.0 [1.00]

Accu-Stop

This function combines the benefits of SMB and Preset Slow Speed features. For general purpose positioning, the Accu-Stop function provides a brake from full speed to the preset slow speed setting, then a brake from Slow Speed or a Coast-to-Stop.

The Accu-Stop function is enabled whenever a control input is configured for Stop and another control input is configured for Slow Speed; the Stop Mode is configured for SMB and Slow Speed is configured. When the Slow Speed Input is enabled in this configuration, a SMB-to-Slow Speed occurs and Slow Speed continues until the Slow Speed Input is enabled.

To program Accu-Stop with the HIM, Setup Group Slow Speed and Setup Group Stopping must be used. See the two previous programming sections, SMB — Smart Motor Breaking and Slow Speed with Braking.

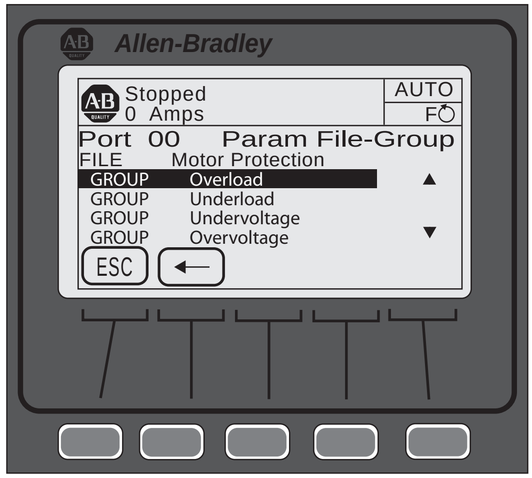
Motor Protection

The Motor Protection Group (see Figure 89 on page 175) is used to program motor and starter protection functions. The Motor Protection Group is accessed from the HIM using the Port 00 DEV PARAM folder under the File-Group, File: Motor Protection selection sequence. By using this file group, the SMC-50 provides the ability to individually enable, disable, or restart the motor and starter Faults and Alarms. Each of the 21 different Motor/Starter Protection Setup groups (e.g., Overload, Underload, Jam, Stall, Voltage Unbal, etc.) has at least one selection for Fault Enable, Alarm Enable, and Restart Enable. For bit assignment definitions for the related Faults and Alarms, see Table 32 and Table 33 on page 105 in Chapter 4.

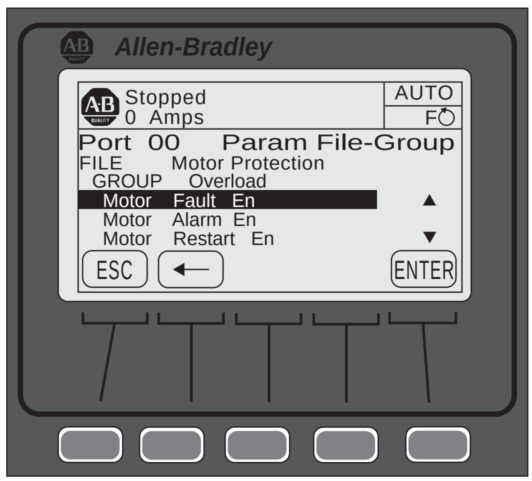
IMPORTANT	The majority of parameters have a Fault and an Alarm setting.

To modify any Fault or Alarm bit for enable/disable functionality, perform the following steps.

1. From the Motor Protection Group, select the desired group.



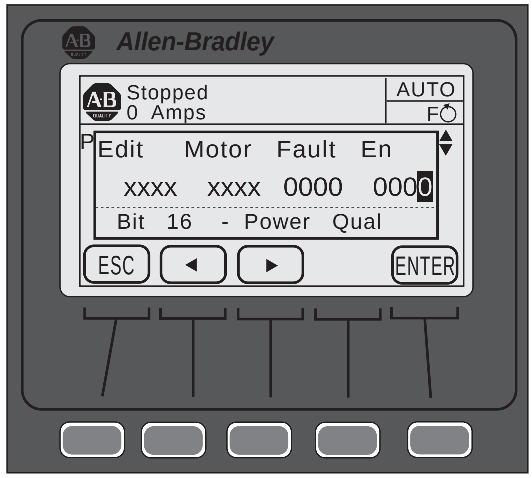
2. Press ENTER (number 5 from keypad) to display the associated bit parameters.



3. Select the desired 16 bit field, then press EDIT.

NOTE: The UPPER and LOWER soft key allows for switching between the upper (16 to 31) and lower (0 to 16) bits.

4. Use the right or left arrow to move the cursor to the desired bit. The bit function is displayed at the bottom of the screen.
5. Enter a 1 to enable or 0 to disable, then press ENTER to load the change into the controller.



For details concerning mot or and controller (Fault and Alarm) protection parameters, see Chapter 4, Protection & Diagnostic Functions.

Parameter File-Group Structure

The five parameter File-Groups are structured as shown below. The access levels for each parameter are abbreviated as follows:

- M — Monitoring,
- B — Basic,
- A — Advanced, and
- MBA — Monitoring, Basic, and Advanced.

Figure 87 - Monitoring

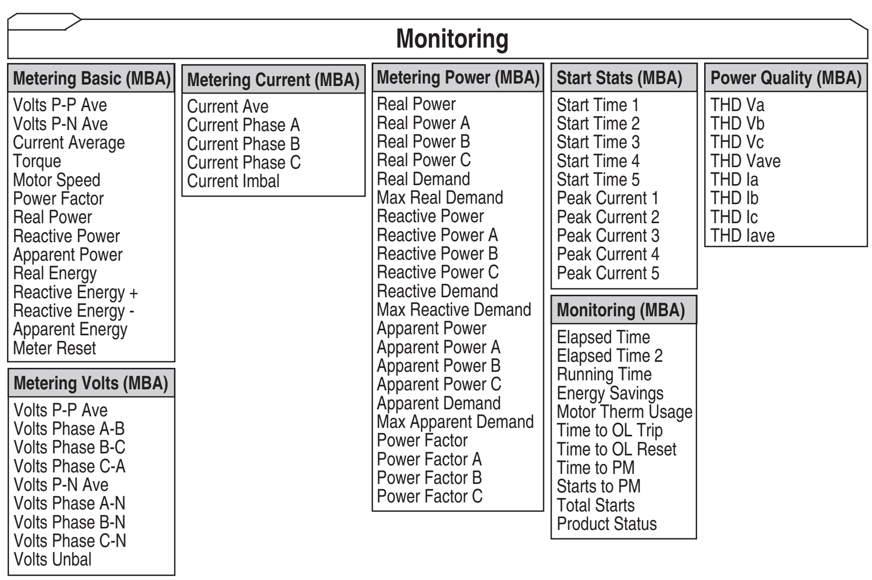


Figure 88 - Setup

Setup

Basic (BA)
- Motor Config
- Line Voltage
- Starting Mode
- Ramp Time
- Initial Torque
- Max Torque
- Cur Limit Level
- Stop Mode
- Stop Time
- Input 1
- Input 2
- Aux1 Config
- Aux2 Config
- Overload Class
- Service Factor
- Motor FLC
- Starting Torque
- Max. Torque
- Rated Torque
- Rated Speed

Starting (BA)
- Starting Mode
- Ramp Time
- Cur Limit Level
- Initial Torque
- Starting Torque
- Max Torque
- Kickstart Time
- Kickstart Level
- Heating Time
- Heating Level
- Start Delay

Stopping (BA)
- Stop Mode
- Stop Time
- Braking Current
- Backspin Timer

Slow Speed
- Slow Speed (BA)
- Slow Brake Cur (BA)
- SS Ref Gain (A)
- SS Trans Gain (A)

Dual Ramp (BA)
- Starting Mode 2
- Ramp Time 2
- Cur Limit Level 2
- Initial Torque 2
- Starting Torque 2
- Max Torque 2
- Kickstart Time 2
- Kickstart Level 2

Advanced
- Pump Pedestal (A)
- Load Type (A)
- High Eff Brake (A)
- UTS Level (A)
- Stall Position (A)
- Stall Level (A)
- V Shut Off Level (A)
- I Shut Off Level (A)
- Notch Maximum (A)
- Timed Start (A)
- Bypass Delay (A)
- Energy Saver (BA)
- Demand Period (BA)
- Num of Periods (BA)

I/O (BA)
- Input 1
- Input 2
- Aux 1 Config
- Aux 1 Invert
- Aux 1 On Delay
- Aux 1 Off Delay
- Aux 2 Config
- Aux 2 Invert
- Aux 2 Invert
- Aux 2 On Delay
- Aux 2 Off Delay
- Aux Control

Advanced Tuning
- Force Tuning (A)
- Starter R (MBA)
- Total R (MBA)
- Coupling Factor (MBA)
- Inductance (MBA)
- Speed PGain (A)
- Transient Gain (A)
- Transient Zero (A)
- Transient Mag (A)
- Ping Degree (A)
- Pings (A)
- Phase Shift 0% (A)
- Phase Shift 10% (A)
- Phase Shift 20% (A)
- Phase Shift 30% (A)
- Phase Shift 40% (A)
- Phase Shift 50% (A)
- Phase Shift 60% (A)
- Phase Shift 70% (A)
- Phase Shift 80% (A)
- Phase Shift 90% (A)
- Phase Shift 100% (A)

Figure 89 - Motor Protection

Motor Protection

Overload (BA)
- Motor Fault Enable
- Motor Alarm Enable
- Motor Restart Enable
- Overload Class
- Overload Class 2
- Service Factor
- Motor FLC
- OL Reset Level
- OL Shunt Time
- OL Inhibit Time
- Overload A Lvel

Underload (BA)
- Motor Fault Enable
- Motor Alarm Enable
- Motor Restart Enable
- Underload F Level
- Underload F Delay
- Underload A Level
- Underload A Delay

Undervoltage (BA)
- Starter Fault Enable
- Starter Alarm Enable
- Starter Restart Enable
- Undervolt F Level
- Undervolt F Delay
- Undervolt A Level
- Undervolt A Delay

Overvoltage (BA)
- Starter Fault Enable
- Starter Alarm Enable
- Starter Restart Enable
- Overvolt F Level
- Overvolt F Delay
- Overvolt A Level
- Overvolt A Delay

Jam (BA)
- Motor Fault Enable
- Motor Alarm Enable
- Motor Restart Enable
- Jam F Level
- Jam F Delay
- Jam A Level
- Jam A Delay

Stall (BA)
- Motor Fault Enable
- Motor Alarm Enable
- Motor Restart Enable
- Stall Delay

Real Power (BA)
- Motor Fault Enable
- Motor Alarm Enable
- Motor Restart Enable
- Mwatts Ov F Level
- Mwatts OV F Delay
- Mwatts Ov A Level
- Mwatts OV A Delay
- Mwatts Un F Level
- Mwatts Un F Delay
- Mwatts Un A Level
- Mwatts Un A Delay

Reactive+ Power (BA)
- Motor Fault Enable
- Motor Alarm Enable
- Motor Restart Enable
- +MVAR Ov F Level
- +MVAR OV F Delay
- +MVAR Ov A Level
- +MVAR OV A Delay
- +MVAR Un F Level
- +MVAR Un F Delay
- +MVAR Un A Level
- +MVAR Un A Delay

Reactive- Power (BA)
- Motor Fault Enable
- Motor Alarm Enable
- Motor Restart Enable
- -MVAR Ov F Level
- -MVAR OV F Delay
- -MVAR Ov A Level
- -MVAR OV A Delay
- -MVAR Un F Level
- -MVAR Un F Delay
- -MVAR Un A Level
- -MVAR Un A Delay

Apparent Power (BA)
- Motor Fault Enable
- Motor Alarm Enable
- Motor Restart Enable
- MVA Ov F Level
- MVA OV F Delay
- MVA Ov A Level
- MVA OV A Delay
- MVA Un F Level
- MVA Un F Delay
- MVA Un A Level
- MVA Un A Delay

Leading PF (BA)
- Motor Fault Enable
- Motor Alarm Enable
- Motor Restart Enable
- Lead PF F Level
- Lead PF F Delay
- Lead PF A Level
- Lead PF A Delay
- Lead PF F Level
- Lead PF F Delay
- Lead PF A Level
- Lead PF A Delay

Lagging PF (BA)
- Motor Fault Enable
- Motor Alarm Enable
- Motor Restart Enable
- Lag PF F Level
- Lag PF F Delay
- Lag PF A Level
- Lag PF A Delay
- Lag PF F Level
- Lag PF F Delay
- Lag PF A Level
- Lag PF A Delay

Voltage Unbal (BA)
- Starter Fault Enable
- Starter Alarm Enable
- Starter Restart Enable
- Voltage Unbal F Level
- Voltage Unbal F Delay
- Voltage Unbal A Level
- Voltage Unbal A Delay

Current Imbal (BA)
- Motor Fault Enable
- Motor Alarm Enable
- Motor Restart Enable
- Current Imbal F Level
- Current Imbal F Delay
- Current Imbal A Level
- Current Imbal A Delay

Voltage THD (BA)
- Starter Fault Enable
- Starter Alarm Enable
- Starter Restart Enable
- THD V F Level
- THD V F Delay
- THD V A Level
- THD V A Delay

Current THD (BA)
- Motor Fault Enable
- Motor Alarm Enable
- Motor Restart Enable
- THD I F Level
- THD I F Delay
- THD I A Level
- THD I A Delay

Line Frequency (BA)
- Starter Fault Enable
- Starter Alarm Enable
- Starter Restart Enable
- Frequency High F Level
- Frequency High F Delay
- Frequency High A Level
- Frequency High A Delay
- Frequency Low F Level
- Frequency Low F Delay
- Frequency Low A Level
- Frequency Low A Delay

Maintenance
- Motor Fault Enable (BA)
- Motor Alarm Enable (BA)
- Motor Restart Enable (BA)
- PM Hours (BA)
- PM Starts (BA)
- Time to PM (MBA)
- Starts to PM (MBA)
- Starts per Hour (BA)

History (MBA)
- Fault 1
- Fault 2
- Fault 3
- Fault 4
- Fault 5
- Alarm 1
- Alarm 2
- Alarm 3
- Alarm 4
- Alarm 5

Restart (BA)
- Motor Restart Enable
- Starter Restart Enable
- Restart Attempts
- Restart Delay

Locked Rotor (BA)
- Motor Fault Enable
- Motor Alarm Enable
- Motor Restart Enable
- Locked Rotor F Level
- Locked Rotor F Delay
- Locked Rotor A Level
- Locked Rotor A Delay

Figure 90 - Communications

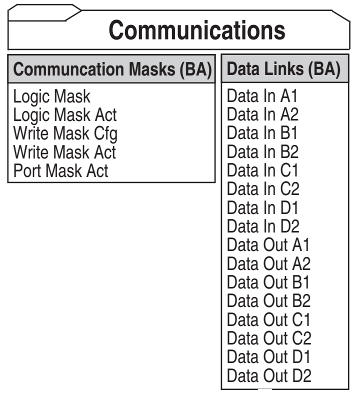
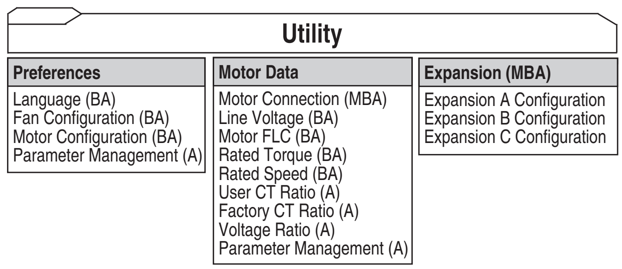


Figure 91 - Utility



DeviceLogix parameters are Parameters 335…346, located in the parameter linear list. See Appendix F for additional information and programming examples.

Table 73 - SMC-50 Parameter Linear List — Parameter 1-67

Number ❶	Name		Number ❶	Name	
1 (M, B, A)	Voltage	P-P Ave	35 (M, B, A)	THD	V_a
2 (M, B, A)	VoltsPhase	A-B	36 (M, B, A)		V_b
3 (M, B, A)		B-C	37 (M, B, A)		V_c
4 (M, B, A)		C-A	38 (M, B, A)		V_{ave}
5 (M, B, A)	Current Average		39 (M, B, A)		I_a
6 (M, B, A)	Current Phase	A	40 (M, B, A)		I_b
7 (M, B, A)		B	41 (M, B, A)		I_c
8 (M, B, A)		C	42 (M, B, A)		I_{ave}
9 (M, B, A)	Torque		43 (M, B, A)	Product Status	
10 (M, B, A)	Real Power		44 (B, A)	Motor Config	
11 (M, B, A)	Real Energy		45 (M, B, A)	Motor Connection	
12 (M, B, A)	Elapsed Time		46 (B, A)	Line Voltage	
13 (M, B, A)	Elapsed Time 2		47 (B, A)	Rated	Torque
14 (M, B, A)	Running Time		48 (B, A)		Speed
15 (M, B, A)	Energy Savings		49 (B, A)	Starting Mode	
16 (M, B, A)	Meter Reset		50 (B, A)	Ramp Time	
17 (M, B, A)	Power Factor		51 (B, A)	Initial Torque	
18 (M, B, A)	Motor Therm Usage		52 (B, A)	Maximum Torque	
19 (M, B, A)	Time to OL	Trip	53 (B, A)	Current Limit Level	
20 (M, B, A)		Reset	54 (B, A)	Kickstart	Time
21 (M, B, A)	Time to PM		55 (B, A)		Level
22 (M, B, A)	Starts to PM		56 (B, A)	Input	1
23 (M, B, A)	Total Starts		57 (B, A)		2
24 (M, B, A)	Start Time	1	58 (B, A)	Starting Mode 2	
25 (M, B, A)		2	59 (B, A)	Ramp Time 2	
26 (M, B, A)		3	60 (B, A)	Initial Torque 2	
27 (M, B, A)		4	61 (B, A)	Maximum Torque 2	
28 (M, B, A)		5	62 (B, A)	Current Limit Level 2	
29 (M, B, A)	Peak Current	1	63 (B, A)	Kickstart	Time 2
30 (M, B, A)		2	64 (B, A)		Level 2
31 (M, B, A)		3	65 (B, A)	Stop	Mode
32 (M, B, A)		4	66 (B, A)		Time
33 (M, B, A)		5	67 (B, A)	Backspin Timer	
34 (M, B, A)	Motor Speed		❶ M, B, A = Access Level; see Parameter Access Level using the HIM.		

Table 74 - SMC-50 Parameter Linear List — Parameter 68-135

Number ❶	Name		Number ❶	Name	
68 (A)	Pump Pedestal		102 (B, A)	Overvolt	F Lvl
69 (B, A)	Braking Current		103 (B, A)		F Dly
70 (B, A)	Load Type		104 (B, A)		A Lvl
71 (B, A)	High Eff Brake		105 (B, A)		A Dly
72 (B, A)	Slow Speed		106 (B, A)	Volt Unbal	F Lvl
73 (B, A)	Slow Brake Current		107 (B, A)		F Dly
74 (—)	Reserved		108 (B, A)		A Lvl
75 (B, A)	Overload Class		109 (B, A)		A Dly
76 (B, A)	Overload Class 2		110 (B, A)	Cur Imbal	F Lvl
77 (B, A)	Service Factor		111 (B, A)		F Dly
78 (B, A)	Motor FLC		112 (B, A)		A Lvl
79 (B, A)	Motor FLC 2		113 (B, A)		A Dly
80 (B, A)	OL Reset Level		114 (B, A)	Jam	F Lvl
81 (B, A)	OL Shunt Time		115 (B, A)		F Dly
82 (B, A)	OL Inhibit Time		116 (B, A)		A Lvl
83 (B, A)	Overload A Lvl		117 (B, A)		A Dly
84 (B, A)	Locked Rotor	F Lvl	118 (B, A)	THD V	F Lvl
85 (B, A)		F Dly	119 (B, A)		F Dly
86 (B, A)	Underload	F Lvl	120 (B, A)		A Lvl
87 (B, A)		F Dly	121 (B, A)		A Dly
88 (B, A)		A Lvl	122 (B, A)	THD I	F Lvl
89 (B, A)		A Dly	123 (B, A)		F Dly
90 (B, A)	MWatts Ov	F Lvl	124 (B, A)		A Lvl
91 (B, A)		F Dly	125 (B, A)		A Dly
92 (B, A)		A Lvl	126 (B, A)	PM Hours	
93 (B, A)		A Dly	127 (B, A)	PM Starts	
94 (B, A)	MWatts Un	F Lvl	128 (B, A)	Starts Per Hour	
95 (B, A)		F Dly	129 (B, A)	Frequency High F Lvl	
96 (B, A)		A Lvl	130 (B, A)	Frequency Low F Lvl	
97 (B, A)		A Dly	131 (B, A)	Frequency High A Lvl	
98 (B, A)	Undervolt	F Lvl	132 (B, A)	Frequency Low A Lvl	
99 (B, A)		F Dly	133 (B, A)	Restart Attempts	
100 (B, A)		A Lvl	134 (B, A)	Restart Delay	
101 (B, A)		A Dly	135 (B, A)	Starter Restart Enable	

❶ M, B, A = Access Level; see Parameter Access Level using the HIM.

Table 75 - SMC-50 Parameter Linear List — Parameter 136 - 205

Number ❶	Name		Number ❶	Name	
136 (B, A)	Starter Fault Enable		171 (A)	Factory CT Ratio	
137 (B, A)	Starter Alarm Enable		172 (B, A)		Config
138 (M, B, A)		1	173 (B, A)	Aux 1	Invert
139 (M, B, A)		2	174 (B, A)		On Delay
140 (M, B, A)	Fault	3	175 (B, A)		Off Delay
141 (M, B, A)		4	176 (B, A)		Config
142 (M, B, A)		5	177 (B, A)	Aux 2	Invert
143 (M, B, A)		1	178 (B, A)		On Delay
144 (M, B, A)		2	179 (B, A)		Off Delay
145 (M, B, A)	Alarm	3	180 (B, A)	Aux Control	
146 (M, B, A)		4	181 (B, A)	Language	
147 (M, B, A)		5	182 (B, A)	Start Delay	
148 (B, A)	Logic Mask		183 (A)	Timed Start	
149 (B, A)	Logic Mask Act		184 (A)	V Shut Off Level	
150 (B, A)	Write Mask Cfg		185 (A)	I Shut Off Level	
151 (B, A)	Write Mask Act		186 (A)	UTS Level	
152 (B, A)	Port Mask Act		187 (A)		Level
153 (B, A)		A1	188 (B, A)	Stall	Delay
154 (B, A)		A2	189 (A)		Position
155 (B, A)		B1	190 (A)	Notch Maximum	
156 (B, A)	Data In	B2	191 (A)	Notch Position	
157 (B, A)		C1	192 (A)	Bypass Delay	
158 (B, A)		C2	193 (B, A)	Energy Saver	
159 (B, A)		D1	194 (A)	Force Tuning	
160 (B, A)		D2	195 (M, B, A)	Stator R	
161 (B, A)		A1	196 (M, B, A)	Total R	
162 (B, A)		A2	197 (M, B, A)	Coupling Factor	
163 (B, A)		B1	198 (M, B, A)	Inductance	
164 (B, A)	Data Out	B2	199 (A)	Speed PGain	
165 (B, A)		C1	200 (A)		Gain
166 (B, A)		C2	201 (A)	Transient	Zero
167 (B, A)		D1	202 (A)		Mag
168 (B, A)		D2	203 (A)	Ping Degree	
169 (A)	Voltage Ratio		204 (A)	Pings	
170 (A)	User CT Ratio		205 (A)	Phase Shift 0	

❶ M, B, A = Access Level; see Parameter Access Level using the HIM.

Table 76 - SMC-50 Parameter Linear List — Parameter 206 - 277

Number ❶	Name		Number ❶	Name	
206 (A)	Phase Shift	10	242 (B, A)	MVA	Ov A Lvl
207 (A)		20	243 (B, A)		Ov A Dly
208 (A)		30	244 (B, A)		Un F Lvl
209 (A)		40	245 (B, A)		Un F Dly
210 (A)		50	246 (B, A)		Un A Lvl
211 (A)	Phase Shift	60	247 (B, A)		Un A Dly
212 (A)		70	248 (B, A)	Lead PF	Ov F Lvl
213 (A)		80	249 (B, A)		Ov F Dly
214 (A)		90	250 (B, A)		Ov A Lvl
215 (A)		100	251 (B, A)		Ov A Dly
216 (M, B, A)	Board Temp		252 (B, A)		Un F Lvl
217 (B, A)	Exp 7 Config		253 (B, A)		Un F Dly
218 (B, A)	Exp 8 Config		254 (B, A)		Un A Lvl
219 (B, A)	Exp 9 Config		255 (B, A)		Un A Dly
220 (B, A)	Heating	Time	256 (B, A)	Lag PF	Ov F Lvl
221 (B, A)		Level	257 (B, A)		Ov F Dly
222 (B, A)	Fan	Config	258 (B, A)		Ov A Lvl
223 (M, B, A)		Connection	259 (B, A)		Ov A Dly
224 (M, B, A)	Line Frequency		260 (B, A)		Un F Lvl
225 (B, A)	Freq High	F Dly	261 (B, A)		Un F Dly
226 (B, A)		A Dly	262 (B, A)		Un A Lvl
227 (B, A)	Freq Low	F Dly	263 (B, A)		Un A Dly
228 (B, A)		A Dly	264 (B, A)	Motor Restart En	
229 (A)	Parameter Management		265 (M, B, A)	Voltage	P-N Ave
230 (B, A)	Motor	Fault En	266 (M, B, A)	Volts Phase	A-N
231 (B, A)		Alarm En	267 (M, B, A)		B-N
232 (B, A)	+MVAR ❷	Ov F Lvl	268 (M, B, A)		C-N
233 (B, A)		Ov F Dly	269 (M, B, A)	Real Power	A
234 (B, A)		Ov A Lvl	270 (M, B, A)		B
235 (B, A)		Ov A Dly	271 (M, B, A)		C
236 (B, A)		Un F Lvl	272 (M, B, A)	Real Demand	
237 (B, A)		Un F Dly	273 (M, B, A)	Max Real Demand	
238 (B, A)		Un A Lvl	274 (M, B, A)	Reactive Power	A
239 (B, A)		Un A Dly	275 (M, B, A)		B
240 (B, A)	MVA	Ov F Lvl	276 (M, B, A)		C
241 (B, A)		Ov F Dly	277 (M, B, A)	Reactive Power	

❶ M, B, A = Access Level; see Parameter Access Level using the HIM. ❷ The "+" for MVAR indicates power consumed.

Table 77 - SMC-50 Parameter Linear List — Parameter 278 - 333

Number ❶	Name		Number ❶	Name	
278 (M, B, A)	Reactive Energy	C ❸	307 (A)	SS Ref Gain	
279 (M, B, A)		P ❹	308 (A)	SS Trans Gain	
280 (B, A)	Reactive Energy		309 (M, B, A)	Input Status	
281 (M, B, A)	Reactive Demand		310 (B, A)	Locked Rotor	A Lvl
282 (M, B, A)	Max Reactive Demand		311 (B, A)		A Dly
283 (M, B, A)	Apparent Power	A	312 (A)	Product Command	
284 (M, B, A)		B			
285 (M, B, A)		C	313 (B, A)	Rebalance Level	
286 (M, B, A)	Apparent Power		314 (M, B, A)	Peak Voltage	A
287 (M, B, A)	Apparent Energy		315 (M, B, A)		B
288 (M, B, A)	Apparent Demand		316 (M, B, A)		C
289 (M, B, A)	Max Apparent Demand		317 (M, B, A)	Peak Current	A
290 (B, A)	Demand Period		318 (M, B, A)		B
291 (B, A)	Number of Periods		319 (M, B, A)		C
292 (M, B, A)	Power Factor	A	320 (M, B, A)	Snap Shot	Phase A-B Voltage
293 (M, B, A)		B	321 (M, B, A)		Phase B-C Voltage
294 (M, B, A)		C	322 (M, B, A)		Phase C-A Voltage
295 (M, B, A)	Current Imbal		323 (M, B, A)		Phase A Current
296 (M, B, A)	Voltage Unbal		324 (M, B, A)		Phase B Current
297 (B, A)	-MVAR ❷	Ov F Lvl	325 (M, B, A)		Phase C Current
298 (B, A)		Ov F Dly	326 (M, B, A)		Power Factor
299 (B, A)		Ov A Lvl	327 (M, B, A)		Motor Thermal Usage
300 (B, A)		Ov A Dly	328 (M, B, A)		Motor Speed
301 (B, A)		Un F Lvl	329 (M, B, A)		THD Voltage Average
302 (B, A)		Un F Dly	330 (M, B, A)		THD Current Average
303 (B, A)		Un A Lvl	331 (M, B, A)		Product Status
304 (B, A)		Un A Dly	332 (M, B, A)		Board Temp
305 (B, A)	Starting Torque		333 (M, B, A)		Line Frequency
306 (B, A)	Starting Torque 2		334 (M, B, A)	Restart Auto	
307 (A)	SS Ref Gain				

❶ M, B, A = Access Level; see Parameter Access Level using the HIM. ❷ The "-" for MVAR indicates power generated.
❸ C=Consumed. ❹ P=Produced

Table 78 - SMC-50 Parameter Linear List — Parameter 334 - 346

Number ❶	Name	
335 (M, B, A)	DeviceLogix	DLX Input 1
336 (M, B, A)		DLX Input 2
337 (M, B, A)		DLX DL Input 1
338(M, B, A)		DLX DL Input 2
339 (M, B, A)		DLX DL Input 3
340 (M, B, A)		DLX DL Input 4
341 (M, B, A)		DLX DL Input 5
342 (M, B, A)		DLX DL Input 6
343 (M, B, A)		DLX Output 1
344 (M, B, A)		DLX Output 2
345 (M, B, A)		DLX Command
346 (M, B, A)		DLX Status

❶ M, B, A = Access Level; see Parameter Access Level using the HIM.

SMC-50 Option Module Configuration

Basic Configuration using the HIM

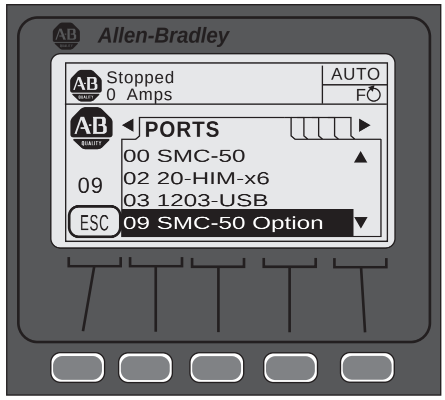
When an SMC-50 Option Module is plugged into one of the three available ports (07, 08, or 09), the option module may require parameter configuration. The option module parameters are resident in the option module through one of the controller ports (07, 08, or 09) and are not included in the SMC-50 Controller (Port <00>) parameter list.

Perform the following steps to access the option module parameters using the HIM.

NOTE: **Before proceeding with these steps:** Take note of the SMC-50 port number (07, 08, or 09) that the option module is connected to.

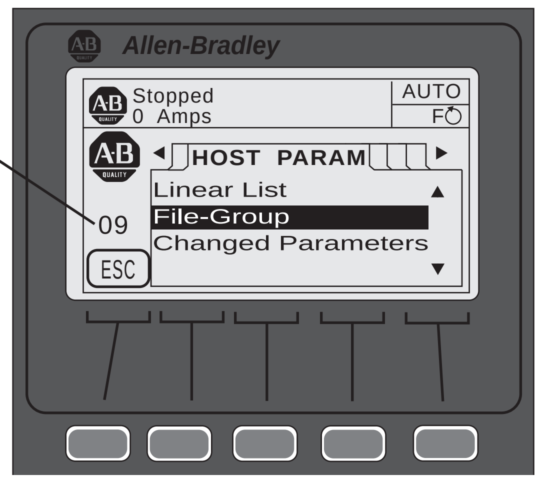
1. Press the FOLDERS single function key.

2. Use the forward or back arrow until the PORTS folder screen is displayed.



3. Use the up or down arrow until the noted port number of the option module is displayed. The HIM will display the HOST PARM file screen and indicate the option module port controller number below the AB logo.

Ensure the correct port number is displayed **before** modifying the option module parameter.



4. Ensure the correct port number is displayed, then configure the parameters using either the Linear List or File-Group selection.

NOTE: Parameters can be restored to factory defaults using its respective Parameter Management parameter or the Set Defaults function from the HIM's memory screen. Ensure the correct port number of the device to be restored is displayed **before** restoring.

For additional information using the FOLDERS function of the HIM, see the 20-HIM-A6 User Manual, publication 20HIM-UM001.

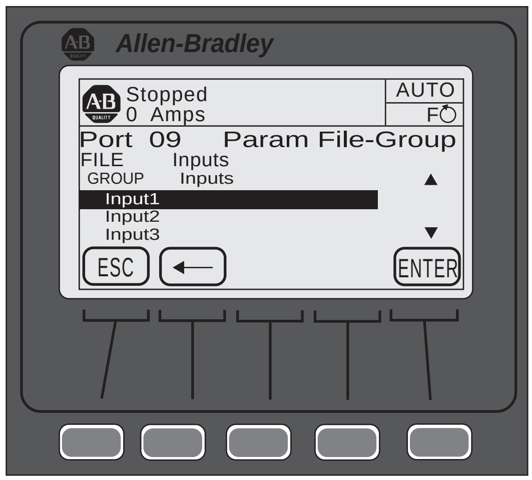
150-SM4 Digital I/O Option Module

In addition to the SMC-50 two on-board 24V DC input and two auxiliary relay outputs, the 150-SM4 Digital I/O Option Module has four 120...240V AC inputs and three auxiliary relay outputs. These inputs and outputs can be used for control functions.

Configure 120...240V AC Inputs

NOTE: **Before** proceeding with the following steps, perform the steps 1 through 4 in Basic Configuration using the HIM on page 182.

1. From the File-Group screen, press ENTER (number 5 on the keypad). The four inputs are displayed.



2. Use the up or down arrow to select the input, then press ENTER (number 5 on the keypad). The display will show the current setting of the input.
3. Press the EDIT soft key to change the selected input function.
4. Use the up or down arrow to select the desired function (e.g., Start, Stop, Coast, Slow Speed, etc.), then press the ENTER soft key to load the selection. If necessary, use the back arrow to return to the previous selection.

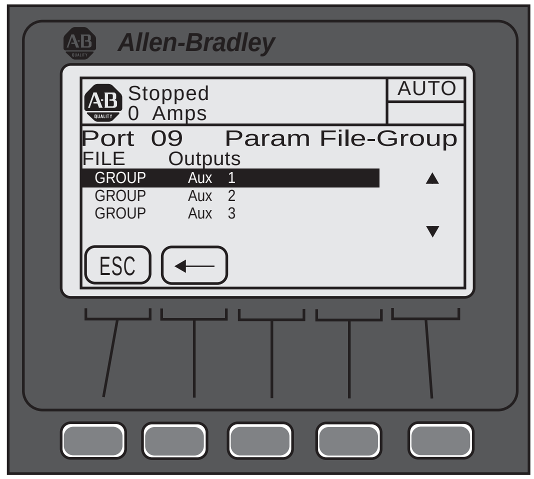
NOTE: For a complete list of 150-SM4 parameters, see the Digital I/O Option Module Parameter List on page 186.

For additional information using the FILE GROUP function of the HIM, see the 20-HIM-A6 User Manual, publication 20HIM-UM001.

Configure Auxiliary Relay Outputs

NOTE: **Before** proceeding with the following steps, perform the steps 1 through 4 in Basic Configuration using the HIM on page 182.

1. Use the up or down arrow to select the one of the Aux Outputs, then press ENTER (number 5 on the keypad).



2. Select one of the four configuration options (Aux X Config, Aux X Invert, Aux X On Delay, or Aux X Off Delay), then press ENTER (keypad or soft key).
3. Modify the auxiliary relay output as desired. If necessary, use the back arrow to return to the previous selection.

Digital I/O Option Module Parameter List

The allowable selections for the 150-SM4 are listed below.

Parameter		Min/Max			
Number ❶	**Name**	**[default]**		**Access**	**Units**
X.1	Module Status	Bit 0 = Module Ready/Disabled Bit 1 = Input 1 Status Bit 2 = Input 2 Status Bit 3 = Input 3 Status	Bit 4 = Input 4 Status Bit 5 = Aux 1 Status Bit 6 = Aux 2 Status Bit 7 = Aux 3 Status	R	0 = Disabled OFF 1 = Enabled ON
X.2	Input 1	[Disable] Start Coast Stop Option Start/Coast Start/Stop Slow Speed	Dual Ramp OL Select Fault Fault NC Clear Fault Emerg Run Motor Heater	R/W	NA
X.3	Input 2				
X.4	Input 3				
X.5	Input 4				
X.6	Aux 1 Config	[Normal] UTS (Up-to-Speed) Fault Alarm Ext Bypass Ext Brake	DeviceLogix Aux Control ❷ Network 1 Network 2 Network 3 Network 4	R/W	NA
X.7	Aux 1 Invert	[Disable] Enable		R/W	
X.8	Aux 1 On Delay	[0.0]-10.0		R/W	seconds
X.9	Aux 1 Off Delay	[0.0]-10.0		R/W	seconds
X.10	Aux 2 Config	[Normal] UTS (Up-to-Speed) Fault Alarm Ext Bypass Ext Brake	DeviceLogix Aux Control ❷ Network 1 Network 2 Network 3 Network 4	R/W	NA
X.11	Aux 2 Invert	[Disable] Enable		R/W	NA
X.12	Aux 2 On Delay	[0.0]-10.0		R/W	seconds
X.13	Aux 2 Off Delay	[0.0]-10.0		R/W	seconds
X.14	Aux 3 Config	[Normal] UTS (Up-to-Speed) Fault Alarm Ext Bypass Ext Brake	DeviceLogix Aux Control ❷ Network 1 Network 2 Network 3 Network 4	R/W	NA
X.15	Aux 3 Invert	[Disable]	Enable	R/W	NA
X.16	Aux 3 On Delay	[0.0]-10.0		R/W	seconds
X.17	Aux 3 Off Delay	[0.0]-10.0		R/W	seconds
X.18	Parameter Mgmt	[Ready] Factory Default		R/W	NA

❶ "X" indicates the port number (07, 08, or 09) the 150-SM4 is connected to the SMC-50. This port number is displayed on the HIM screen below the AB brand logo.

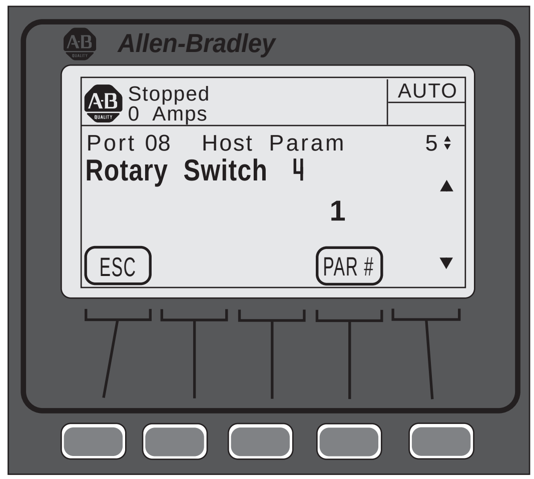
❷ An auxiliary output configured for Aux Control using the AuxX Config parameter will be under control of its associated bit form the AuxControl, Parameter 180. See 150-SM6 PCM Information on page 276 in Appendix B for bit assignments. This function enables forcing an output, ON or OFF.

150-SM6 Parameter Configuration Option Module

The 150-SM6 Parameter Configuration Option Module is used to configure a select group of parameters. The option module itself requires no user configuration. The option module status and switch positions that configure its select parameters can be read using the HIM or PC software.

NOTE: Only one 150-SM6 is allowed per SMC-50.

To read the 150-SM6 switch positions, follow the steps in Basic Configuration using the HIM on page 182. When Linear List is selected, use the up or down arrow to view the module switch positions.



The following table provides the parameter detail of the 150-SM6.

Parameter		Min./Max. [Default]	Access	Units
Number ❶	Name			
X.1	Module Status	Ready	R	1=Ready 0=Disabled
X.2	Rotary Switch 1 ❷ (Initial Torque)	0.0…15.0	R	0…1.5=0…F
X.3	Rotary Switch 2 ❷ (Current Limit)			
X.4	Rotary Switch 3 ❷ (Ramp Time)			
X.5	Rotary Switch 4 ❷ (Stop Time)			
X.6	Rotary Switch 5 ❷ (Motor FLC)			
X.7	Device Config	0.0…255.0	R/W	Bit Numbered ❸
X.8	Protect Config			
X.9	I/O Config			

❶ "X" indicates the SMC-50's port number (07, 08, or 09) that the 150-SM6 is connected to. This port number is displayed on the HIM screen below the AB brand logo.

❷ For 150-SM6: Rotary Switch 1 = S1, Rotary Switch 2 = S2, etc. Rotary switch positions equal 1 to F. As displayed on the HIM, A=10, B=11, C=12, etc.

❸ Bit 0 and 1 values represent the ON/OFF switch positions within the associated switch bank (e.g., Device Config) where 0=OFF and 1=ON.

NOTE: Switch #1=Bit 0, Switch #2=Bit 1, etc. as displayed on the HIM.

For switch setting details, see Table 63 through Table 67 beginning on page 140.

150-SM2 PTC, Ground Fault, & External Current Transformer Module

The 150-SM2 Option Module provides simultaneous interface capability to three different types of external sensing devices which can be used by the SMC-50 for certain application conditions. When installing the 150-SM2 into the SMC-50, the following installation requirements **must** be followed:

- Only one 150-SM2 can be installed in one SMC-50.
- The 150-SM2 **must** reside in port 7 or 8 only. **DO NOT** use port 9 with the 150-SM2.
- When the external CT function is enabled through the 150-SM2 CT Enable Bit, the external CT is calibrated by the SMC-50 for scaling, phase shift, and inversion. The calibration cycle will automatically occur:
  - before the first START occurs after the 150-SM2 installation and when the CT Enable, Parameter X.12, = Enable,
  - after a Load Defaults occurs, and
  - when the user forces tuning of the SMC-50 through the Force Tuning, Parameter 194, or the HOLD TO TEST button on the SMC-50 is held for > 10 seconds when stopped.

To configure the 150-SM2, follow the steps in Basic Configuration using the HIM on page 182 then proceed with the steps below.

1. Using the File-Group selection, press ENTER (number 5 on the keypad) until the Group Linear List is displayed.
2. Use the up or down arrow to scroll to the desired parameter, then press ENTER.

   If the parameter **is** bit configured (e.g., Fault Enable):

   a. Use the left or right arrow to move to the bit location that needs to be modified. The bit function is displayed at the bottom of the screen.

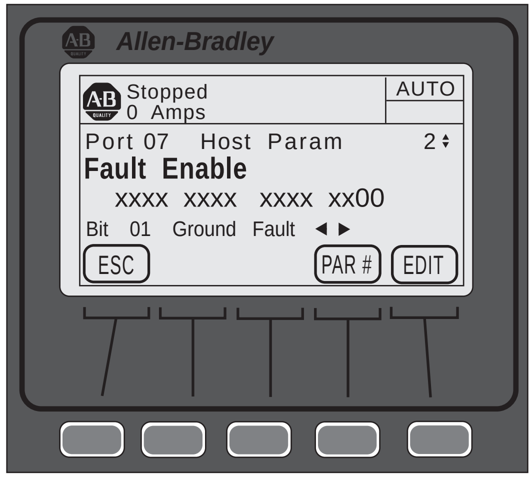
   b. Press EDIT to move to the edit screen.

c. Change the bit assignment, then press EDIT.

If the parameter **is not** bit configured (e.g., Turns Ratio):

a. Press the EDIT.

b. Change the value within the displayed limits, then press ENTER to load the parameter contents into memory.



The following table provides the parameter detail of the 150-SM2.

Parameter		Min/Max		
Number ❶	**Name**	**[default]**	**Access**	**Units**
X.1	Module Status	Bit 0 = Module Ready Bit 1 = PTC Bit 2 = CT Loss	R	Bit = 0 Disable Bit = 1 Enable
X.2	Fault Enable	Bit 0 = PTC Bit 1 = Ground Fault	R/W	Bit = 0 Disable Bit = 1 Enable
X.3	Alarm Enable			
X.4	Restart Enable			
X.5	Turns Ratio ❹	100-2000 [1000]	R/W	NA
X.6	Ground Fault Level ❷	0.00–5.00 [2.5]	R/W	Amps
X.7	Ground Fault Delay	0.1–250.0 [0.5]	R/W	Seconds
X.8	Ground Fault A Level	0.00–5.00 [2.5]	R/W	Amps
X.9	Ground Fault A Delay	0.1–250.0 [0.5]	R/W	Seconds
X.10	Ground Fault Inh Time ❸	0.0–250.0 [10.0]	R/W	Seconds
X.11	Ground Current	[0.00]–5.00	R	Amps
X.12	CT Enable	[Disable] Enable	R/W	NA
X.13	CT Scaling A	0.10–5.00 [1.00]	R	NA
X.14	CT Scaling B			
X.15	CT Scaling C			

Parameter		Min/Max		
Number ❶	**Name**	**[default]**	**Access**	**Units**
X.16	Phase Shift A	-12.50–12.50 [0.00]	R	Degree
X.17	Phase Shift B			
X.18	Phase Shift C			
X.19	Parameter Mgmt	[Ready] Factory Default	R/W	NA

❶ "X" indicates the port number (07, 08, or 09) the 150-SM4 is connected to the SMC-50. This port number is displayed on the HIM screen below the AB brand logo.

❷ The sensing range of the module.

❸ Inhibit Time provides the ability to inhibit (disable) ground fault protection for the time selected during starting.

❹ Configure Turns Ratio to the value of the Ground Fault sensor CT Turns Ratio (e.g., 825-CBCT=100:1 Set X.5 to 100.

Metering

Overview

While the SMC-50 operates a motor, it is also monitoring several different parameters to provide a full-function metering package.

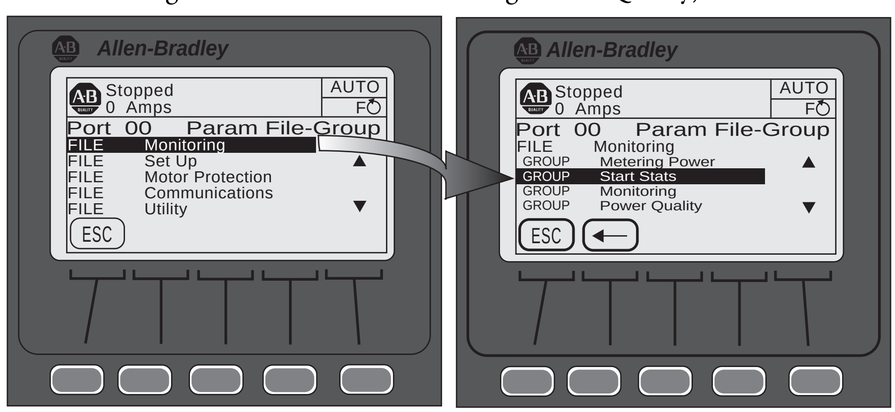
Viewing Metering Data

To access the metering information using the 20-HIM-A6, follow the procedure below using the keypad.

1. From the SMC-50 standard power-up screen, select **FOLDERS**.
2. Use the right or left arrow until the **Port 00 DEV PARAM** screen is displayed.

NOTE: Ensure the Advanced Access Level is selected, located at the bottom of the DEV PARAM screen. For additional configuration details, see Parameter Access Level Modification Using the HIM on page 149 in Chapter 5.

3. From the **Port 00 DEV PARAM** screen, select File-Group, then press the ENTER key (number 5 on the keypad). The **Port 00 Param File-Group** screen will appear.
4. Use the up or down Arrow key to select File Monitoring. The Port 00 Param File-Group File Monitoring screen will appear with seven GROUP metering selections (Metering Basics, Metering Volts, Metering Current, Metering Power, Start Stats. Monitoring, Power Quality).



5. Use the up or down arrow key to select the desired GROUP, then press the ENTER key (number 5 on the keypad).

6. Select the desired parameter from the previous group selected, then press the ENTER key to monitor the metering parameter.

NOTE: With the exception of the Meter Reset, Parameter 16, the metering parameters contained in the Monitoring File-Group are Read (R) only. See Metering on page 10 in Chapter 1 and Metering Parameters on page 192 in this chapter for a detailed list of metering parameters.

Resetting Metering Parameters

Meter Reset, Parameter 16, is used to clear (reset to 0) the contents of metering parameters Elapsed Time, Energy, Time to PM (Preventative Maintenance), and Starts to PM. To clear the contents of any one of these parameters, configure Meter Reset to the specific parameter you wish to clear.

EXAMPLE To clear (reset to 0) the Elapsed Time, configure Meter Reset to Elapsed Time. The controller will then clear the Elapsed Time and the value of Meter Reset will return to Ready 0.

To access Meter Reset using the 20-HIM-A6, perform steps 1 through 4, Viewing Metering Data, beginning on page 191.

1. From Step 4, select the **Metering Basic Group**, then press ENTER (number 5 on the keypad).
2. Use the down arrow on the keypad to select/highlight **Meter Reset**.
3. With Meter Reset highlighted, press the ENTER key (number 5 on the keypad) or the ENTER soft key.
4. Press the EDIT soft key.
5. Use the up or down arrow to select the desired parameter (Elapsed Time, Energy, Time to PM, or Starts to PM) to be reset, then press the soft ENTER soft key. The selected parameter will be reset to zero with the exception of the Starts to PM.

NOTE: When the ENTER key is pressed and Starts to PM is selected, its contents will be set to the value contained in PM Starts, Parameter 127.

Metering Parameters

Current

The SMC-50 calculates true RMS current based on Current Transformer (CT) feedback for all three phases. In addition, an average value of the three phase currents is calculated. During Braking and Slow Speed operation, the calculated current is estimated based on time and current settings.

The accuracy of the current calculation is +/-5% of the true RMS current.

Table 79 - Metering Parameters Associated with Current

Parameter Number	Name/Description	Min/Max [Default]	Access	Units
5	Current Average	[0]…15,000	R	Amps
6	Current Phase A			
7	Current Phase B			
8	Current Phase C			

Voltage

Line-to-Line and Line-to-Neutral RMS voltage is calculated for all three phases with the average of the three voltages also provided. The data is provided whenever 3-phase power is applied.

The accuracy of the voltage calculations will be +/-2% of the true RMS voltage.

Table 80 - Metering Parameters Associated with Voltage

Parameter Number	Name/Description	Min/Max [Default]	Access	Units
1	Voltage P-P Average	[0]…700	R	Volts
2	Volts Phase A-B			
3	Volts Phase B-C			
4	Volts Phase C-A			
265	Voltage P-N Average	[0]….450	R	Volts
266	Volts Phase A-N			
267	Volts Phase B-N			
268	Volts Phase C-N			

Torque

The SMC-50 calculates true electromechanical torque based on the existing motor voltage and current feedback data.

NOTE: **1** During Braking and Slow Speed operations, Torque will read 0.
2 In order for the Torque parameter to display correctly, the motor value for Rated Torque, Parameter 47, and Rated Speed, Parameter 48, must be correctly configured.

The accuracy of the torque calculations is +/-10% of the true electromechanical torque.

Table 81 - Metering Parameters Associated with Torque

Parameter Number	Name/Description	Min/Max [Default]	Access	Units
9	Torque	-50…300 [0]	R	%

Power

Real, Reactive, and Apparent power calculations (along with demand and maximum demand) are made on each line power phase along with a total for all three phases.

The Energy parameters can be cleared using the Meter Reset parameter. See Resetting Metering Parameters on page 192 for further details.

NOTE: For Reactive Energy, Parameter 278 and 279, the system will keep a:
- positive energy, which only integrates power when it is positive,
- negative energy, which only integrates power when it is negative, and
- net energy, which always integrates.

The demand numbers are calculated as follows:
- Energy is calculated over a period of time defined by "Demand Period", Parameter 290.
- The previous "n" period values are averaged and the result is written to the Demand, Parameter 272, 281 and 288, which is used in calculating the Max Demand values. This averaging uses a rolling window algorithm where the previous "n" periods are averaged.

Table 82 - Metering Parameters Associated with Power

Parameter Number	Name/Description	Min/Max [Default]	Access	Units ❶
269	Real Power A	+/- 1000.000 [0.000]	R	MW
270	Real Power B			
271	Real Power C			
10	Real Power			
11	Real Energy	+/- 1000.000 [0.000]	R	MWH
272	Real Demand	+/- 1000.000 [0.000]	R	MW
273	Max Real Demand			
274	Reactive Power A	+/- 1000.000 [0.000]	R	MVAR
275	Reactive Power B			
276	Reactive Power C			
277	Reactive Power			
278	Reactive Energy C	1000.000 [0.000]	R	MVRH
279	Reactive Energy P			
280	Reactive Energy	+/- 1000.000 [0.000]	R	MVRH
281	Reactive Demand	+/- 1000.000 [0.000]	R	MVAR
282	Max. Reactive Dmd			
283	Apparent Power A	+/- 1000.000 [0.000]	R	MVA
284	Apparent Power B			
285	Apparent Power C			
286	Apparent Power			
287	Apparent Energy			MVAH
288	Apparent Demand			MVA
289	Max. Apparent Demand			MVA

Parameter Number	Name/Description	Min/Max [Default]	Access	Units ❶
290	Demand Period	[1]...255	R/W	min
291	Number of Periods	[1]...15	R/W	—

❶ M = Mega

Power Factor

Power Factor is calculated for each phase along with a total power factor value. The power factor calculation does not apply during Slow Speed and Braking operations.

Table 83 - Metering Parameters Associated with Power Factor

Parameter Number	Name/Description	Min/Max [Default]	Access	Units
292	Power Factor A	-1.00...1.00 [0.00]	R	NA
293	Power Factor B			
294	Power Factor C			
17	Power Factor			

Energy Savings

The energy saver function only applies during light motor load situations at which time the SMC-50 reduces current to the motor and thereby saves energy.

When in energy saver operation, the Energy Savings status bit is set. In addition, Energy Savings, Parameter 15, indicates the percentage energy savings.

Parameter 17 - [Power Factor] should be monitored and recorded when the motor is running at no/light load and at full/heavy load. The power factor value where the controller enters Energy Saver mode is determined by setting **Parameter 193 - [Energy Saver]** to a value between the no/light load and full/heavy load recorded values.

Table 84 - Energy Saver Mode Parameter List

Parameter Number	Parameter Name	Minimum/Maximum [Default]	Access	Units
15	Energy Savings	0…100	R	%
17	Power Factor	-1.00…1.00	R	—
193	Energy Saver	[0.00]-1.00	R/W	—

NOTE: Set Parameter 193 = 0 to disable Energy Saver mode.

Elapsed Time

The SMC-50 keeps a log of the total accumulated hours the controlled motor has been running via the Elapsed Time metering parameter. The Elapsed Time meter value is updated every 10 minutes and stored at power down (accurate to 1/6 of an hour). The Elapsed Time meter accumulates to 50,000 hours of operation and can be reset to zero via the Meter Reset parameter (see Resetting Metering Parameters on page 192).

Elapsed Time 2 is similar to Elapsed Time. Elapsed Time 2 differs in that it cannot be reset by the user and will count up to 50,000 hours and then hold that value (it will not roll over).

Table 85 - Metering Parameters Associated with Elapsed Time

Parameter Number	Name/Description	Min/Max [Default]	Access	Units
12	Elapsed Time	[0.0]...50000.0	R/W	Hours
13	Elapsed Time 2		R	

Running Time

The Running Time meter parameter logs the amount of time the motor has been operating. The timer resets to zero and begins counting as each start command is received.

NOTE: When the SMC-50 is stopped, the parameter displays the length of time the motor was previously operating.

Table 86 - Metering Parameters Associated with Running Time

Parameter Number	Name/Description	Min/Max [Default]	Access	Units
14	Running Time	[0.0]...5000.0	R	Hours

Motor Speed

The Motor Speed meter parameter is only valid when using the Linear Speed Starting or Linear Speed Stopping modes. It provides the estimated motor speed during either the starting or stopping maneuver. When the SMC-50 is not in these modes, the Motor Speed meter parameter reads zero except when the unit is at speed. In this case, the parameter displays 100%.

Table 87 - Metering Parameters Associated with Motor Speed

Parameter Number	Name/Description	Min/Max [Default]	Access	Units
34	Motor Speed	[0]...100	R	%

Actual Start Time

The SMC-50 logs the start time of the last five motor starts and stores that information in Parameters 24 through 28. The start time data is stored in a first-in, first-out method so the record of the last five starts is always maintained.

Table 88 - Metering Parameters Associated with Actual Start Time

Parameter Number	Name/Description	Min/Max [Default]	Access	Units
24	Start Time 1	[0]…1000	R	Seconds
25	Start Time 2			
26	Start Time 3			
27	Start Time 4			
28	Start Time 5			

Peak Start Current

The SMC-50 logs the peak average RMS current during each start and stores that information in Parameters 29 through 33. The Peak Start Current data is stored in a first-in, first-out method so the record of the last five starts is always maintained.

Table 89 - Metering Parameters Associated with Peak Start Current

Parameter Number	Name/Description	Min/Max [Default]	Access	Units
29	Peak Current 1	[0]…15,000	R	Amps
30	Peak Current 2			
31	Peak Current 3			
32	Peak Current 4			
33	Peak Current 5			

Total Starts

The SMC-50 maintains a Total Start counter which is incremented each time the controller is started. As shipped, the counter value is zero. It cannot be reset by the user.

NOTE: The Total Starts counter is not incremented if the controller faults on a pre-start fault. It is incremented once SCR gating begins.

Table 90 - Metering Parameters Associated with Total Starts

Parameter Number	Name/Description	Min/Max [Default]	Access	Units
23	Total Starts	[0]…30,000	R	NA

Total Harmonic Distortion (THD)

The SMC-50 provides the IEEE calculated THD value for the three Line Voltages (Line-to-Neutral) and the three Motor Phase Currents (current through SMC-50 Power Pole ❶). In addition, the average THD is calculated for both Line Voltage and Phase Current.

The controller algorithm uses a round-robin approach to gather the six signals by sampling one signal and then calculating the THD value for that signal. In other words, each power cycle current and voltage THD are calculated for a phase, then for the next phase and so on.

NOTE: When the motor is not running, the Current-Based THD values will read 0.

❶ When in external bypass running mode/configuration, an external CT (825-MCM) and a 150-SM2 Option Module can be used to read current-based (THD I_x) values.

Table 91 - Metering Parameters Associated with THD

Parameter Number	Name/Description	Min/Max [Default]	Access	Units
35	THD V_a	[0.0]…1000.0	R	%
36	THD V_b			
37	THD V_c			
38	THD V_{ave}			
39	THD I_a	[0.0]…1000.0	R	%
40	THD I_b			
41	THD I_c			
42	THD I_{ave}			

Line Frequency

The SMC-50 measures and displays the system 3-phase AC Line Frequency. Upon power up, the Line Frequency parameter displays zero until a valid AC Line Frequency is measured. When three-phase power is removed from the SMC-50, the parameter maintains the value of the previous frequency reading.

Table 92 - Metering Parameters Associated with Line Frequency

Parameter Number	Name/Description	Min/Max [Default]	Access	Units
224	Line Frequency	[0]…100	R	Hz

Current Imbalance

The SMC-50 provides a calculated Current Imbalance value. The Current Imbalance calculation is equal to the largest deviation of the three RMS phase current signals from the average RMS phase current, divided by the average. Note that the SMC-50 Power Pole Current is used for the Current Imbalance calculation.

Table 93 - Metering Parameters Associated with Current Imbalance

Parameter Number	Name/Description	Min/Max [Default]	Access	Units
295	Current Imbalance	[0]…100	R	%

Voltage Unbalance

The SMC-50 provides a calculated Voltage Unbalance value. The Voltage Unbalance calculation is equal to the largest deviation of the three RMS phase voltage signals from the average RMS phase voltage divided by the average. Note that the phase-to-neutral voltage is used in the calculation for voltage unbalance.

Table 94 - Metering Parameters Associated with Voltage Unbalance

Parameter Number	Name/Description	Min/Max [Default]	Access	Units
296	Voltage Unbalance	[0]…100	R	%

Optional HIM Operation

Overview

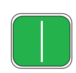
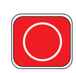
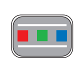
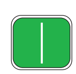
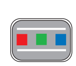
The SMC-50 offers a variety of unique control options that provide enhanced motor starting and stopping capabilities.

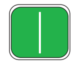
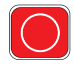
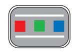
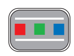
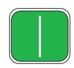
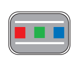
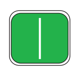
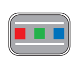
HIM Control Buttons

The control buttons available with the Bulletin 20-HIM-A6 LCD modules are compatible with the SMC-50's control options. The following table details the functionality of each control button with regards to each option.

IMPORTANT	The logic mask port must be enabled prior to initiating control commands except for Stop, which will always initiate a Coast-to-Stop to the SMC-50. See Chapter 8, Control Enable on page 207 for instructions. The control terminals must be wired according to Figure 35 on page 54 or Figure 46 on page 65 in Chapter 2, Installation & Wiring.

Figure 92 - 20-HIM-A6 Control Button Functionality

Option	Action	Operation When Pressed
Standard		
Soft Stop Current Limit Full Voltage Linear Speed		The green start button will commence motor acceleration to full speed.
		The red stop button will provide a coast stop, and/or reset a fault.
		This button will bring up the Control Screen to enable the stop option maneuver. See the HIM Control Screen section on page 203.
Preset Slow Speed		The green start button, when pressed, will commence motor acceleration to full speed.
		The red stop button, when pressed, will provide a coast stop and/or reset a fault.
		This button will display the Control screen. * Slow Speed cannot be operated via the HIM.

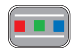
Option	Action	Operation When Pressed
Pump Control		
Pump Control		The green start button will commence motor acceleration to full speed.
		The red stop button will provide a coast stop, and/or reset a fault.
		Displays the Control Screen with the Jog button. The jog button will initiate a pump stop maneuver.
Braking Control		
Smart Motor Braking		The green start button will commence motor acceleration to full speed.
		The red stop button will provide a coast stop, and/or reset a fault.
		Displays the Control Screen with the Jog button. The jog button will initiate a brake stop.
Accu-Stop ❶		The green start button will commence motor acceleration to full speed.
		The red stop button will provide a coast stop, and/or reset a fault.
		Displays the Control Screen with the Jog button. The jog button will initiate braking to slow speed operation. The controller will maintain slow speed operation as long as the jog button is pressed.
Slow Speed with Braking		The green start button will commence motor acceleration to full speed.
		The red stop button will provide a coast stop, and/or reset a fault.
		Displays the Control Screen with the Jog button. The jog button will initiate a brake stop from slow speed. * Slow Speed cannot be operated via the HIM.

❶ Accu-Stop is not included as a parameter/function as the SMC-Flex was. However, Accu-Stop is accomplished with the Stop option and the Slow Speed with Braking.

NOTE: For additional details on using the 20-HIM-A6, see the 20-HIM-A6 User Manual, publication 20HIM-UM001.

ATTENTION: The Bulletin 20-HIM-A6 LCD module's stop push button is not intended to be used as an emergency stop. See applicable standards for emergency stop requirements.

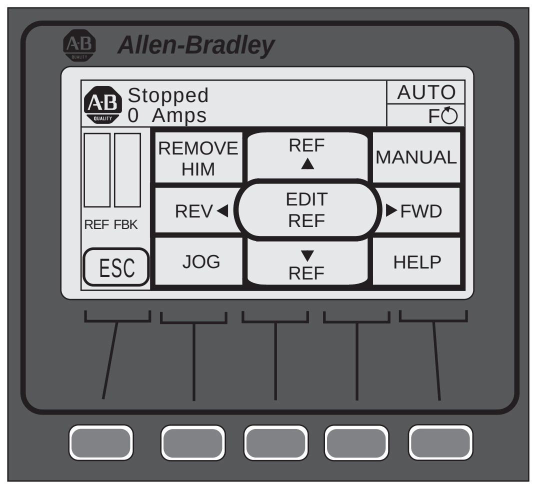
HIM Control Screen

The HIM Control Screen is typically used to directly control a drive. Press the  (controls) key to display the Control Screen.

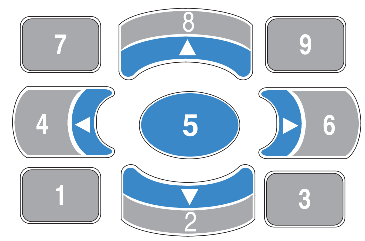
IMPORTANT	To navigate from the Control Screen to another HIM menu screen, the ESC soft key **must** be pressed. This deactivates the Control Screen and displays the previous screen.

Figure 93 - HIM Control Screen

Control Screen's Key Function



Control Screen Navigation Number Keys



NOTE: The Control Screen's Key Function map coorespond with the Control Screen Navigation/Number keys on the HIM.

Table 95 - Control Screen Soft Key Functionality

Label	Name	Function
ESC	Escape	Reverts back to the previous screen.

Table 96 - Control Screen Navigation/Number Keys

Label	Name	Function
JOG	1	Stop Option for SMC-50
REF ▼	2	NA
HELP	3	Displays Rockwell Automation Drive's Technical Support direct phone number, website address, and email address. ❶
REV ◀	4	NA
EDIT REF	5	NA
FWD ▶	6	NA
REMOVE HIM	7	Allows HIM removal without causing a fault if the HIM is not the last controlling device. The REMOVE HIM label is not available when the HIM has a manual control of the host SMC-50. In this case, a fault will occur if the HIM is removed.
REF ▲	8	NA
MANUAL	9	NA

❶ Technical Support is not applicable to the SMC-50. Technical Support for the SMC-50 may be reached at: 440-646-5800 (option 2 and option 4) or raictechsupport@ra.rockwell.com.

CopyCat Function of the 20-HIM-A6

The SMC-50 supports the CopyCat function of the 20-HIM-A6. For details on using the CopyCat function, see the 20-HIM-A6 User Manual, 20HIM-UM001_EN-P.

Chapter 8

Communications

Overview

The SMC-50 provides advanced communications capabilities that allow it to be started and stopped from multiple sources as well as provide diagnostic information through the use of communication interfaces. The SMC-50 uses DPI as an internal method of communication bus, therefore all standard DPI communication interfaces used by other devices (e.g., PowerFlex™ Drives) can be used in the SMC-50. ScanPort devices are not supported by the SMC-50.

Standard DPI communications cards are available for various protocols including DeviceNet, ControlNet, ModBus™, and Profibus® DP. Other modules may be available in the future. For specific programming examples, configuration, or programming information, see the user manual for the communication module being used. A list of available modules is shown below.

Table 97 - Communication Card Selection by Protocol Type

Protocol Type	Cat. No.	User Manual
DeviceNet	20-COMM-D	20COMM-UM002
ControlNet	20-COMM-C	20COMM-UM003
Profibus®	20-COMM-P	20COMM-UM006
RS-485	20-COMM-S	20COMM-UM005
InterBus	20-COMM-I	20COMM-UM007
EtherNet/IP	20-COMM-E	20COMM-UM010
Dual Port EtherNet/IP	20-COMM-ER	20COMM-UM015
RS485 HVAC	20-COMM-H	20COMM-UM009
ControlNet (Fiber)	20-COMM-Q	20COMM-UM003
CANopen	20-COMM-K	20COMM-UM012

Communication Ports

The SMC-50 supports four DPI ports for communication. Port 1 is for the front mounted (bezel) Human Interface Module (HIM). Ports 2 and 3 are supported through the serial connection on the top of the device and are typically used to interface with a door mounted HIM or a PC. Port 2 is the default connection with port 3 available by installing a splitter on port 2. DPI Port 4 is supported by connecting one of the communication cards listed above in Table 97 to the internal DPI communication card connection (SMC-50 hardware controller port 9).

HIM Keypad & Displays

The SMC-50 can be programmed with the optional Bulletin 20-HIM-A6 LCD display. Parameters are organized in a multi-level menu structure and divided into programming groups.

Connecting the HIM to the Controller

Figure 94 shows how to connect a HIM and DPI device to the SMC-50. Table 98 on page 206 provides a description of each port.

TIP The SMC-50 only supports the use of DPI communication modules and DPI 20-HIM-A6 Modules.

See the control wiring diagram that enables start-stop control from a HIM.

Figure 94 - SMC-50 with a HIM

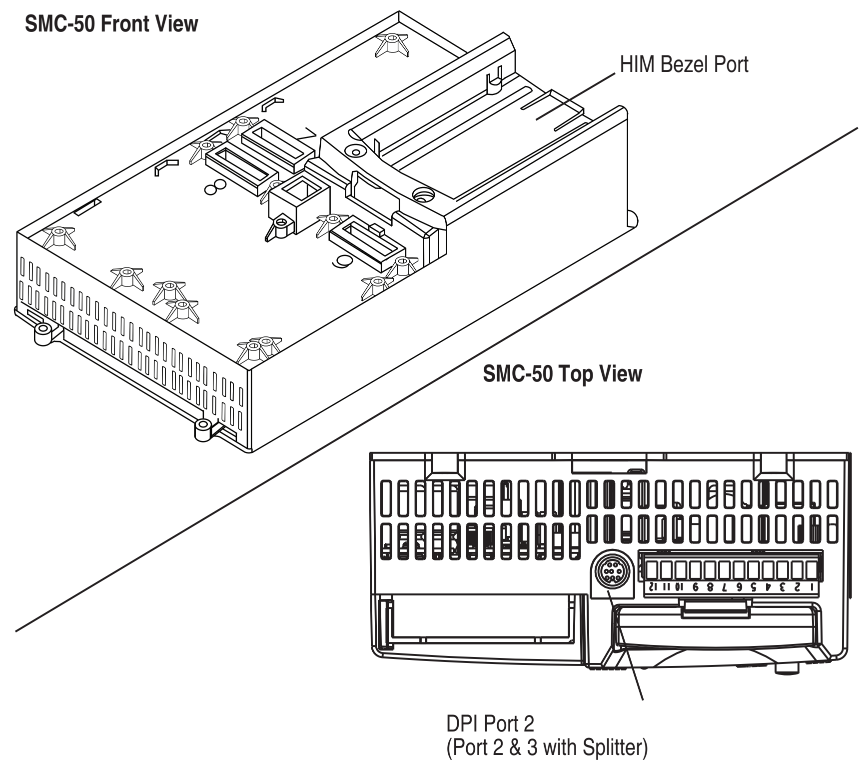


Table 98 - Description of Ports

DPI Port Number	Source
1	Front-Mounted HIM (HIM Bezel)
2	Remote DPI (top of SMC-50)
3	Remote DPI (top of SMC-50 with splitter)
4 ❶	20-COMM-x Module

❶ When using a 20-COMM-x network communication module, it must physically be located in control module hardware port 9. However, its DPI Port Number assignment is 4. The cable connection for the DPI Port 4 is located below the HIM bezel (see Figure 94).

Control Enable

Logic Mask, Parameter 148, allows the user to configure whether a communication device (HIM or network connection) can perform motor control commands such as starting. Each communication port (1 through 4) can be enabled (bit= 1) or disabled (bit = 0) as required. When a given device is enabled through the logic mask that device is allowed to execute control commands. In addition, disconnecting any device with the logic mask enabled will result in an Exp Removed (X026)❶ communication fault. A device that is disabled through the logic mask can be disconnected without causing a fault❷.

❶ When a given device is disabled through the logic mask that device cannot execute control commands, but can still be used for configuration and monitoring. X = DPI port number of the device causing the Fault.

❷ If a 20-HIM-A6 is enabled for control via the Logic Mask, it can still be removed using the HIM control screen. See Chapter 7, Optional HIM Operation.

IMPORTANT	Stop commands override all start commands and can be initiated from the hardwired inputs or any DPI port regardless of the logic mask.

Logic Mask Enable/Disable using a HIM

To enable motor control using a connected HIM, follow the procedure below with the connected HIM's programming keys.

The Bulletin 20-HIM-A6 provides start and stop control of the SMC-50. However, the Logic Mask factory default settings disable control commands other than Stop through the controller's DPI ports 1, 2, 3, or 4.

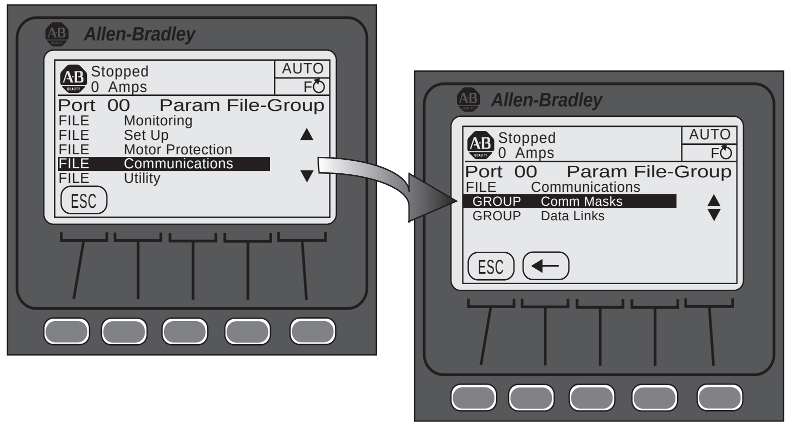
To enable motor control from either of the four ports using a connected 20-HIM-A6, the following steps must be performed from the SMC-50 standard power-up screen.

1. Press the  key. Use the right or left arrow key on the keypad to display the <00> DEV PARAM folder screen.
2. Select/highlight the File-Group.
3. Press the 

(enter) key. The Port 00 Param File-Group screen will appear.

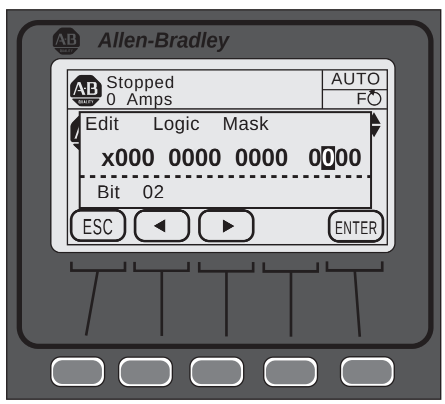
NOTE: Ensure the Advanced Access Level is selected, located at the bottom of the DEV PARAM screen. For additional configuration details, see Parameter Access Level Modification Using the HIM on page 149 in Chapter 5.

4. Press the to select FILE Communications, then press 5 . The GROUP Comm Masks and Data Links screen will appear.



5. With Comm Mask selected/highlighted, press the 5 key. The GROUP Comm Masks screen will appear with the associated Logic Mask Action selected.

6. Select/highlight Logic Mask, then press the 5 key. The Edit Logic Mask screen with bit field will appear.



7. Press the EDIT key to modify the settings, then use the left or right arrow to select the desired bit, 1 through 4, then press the 5 key.

To enable motor control, press 1 or press 0 to disable motor control from the selected DPI port, then press EDIT.

Table 99 - Logic Mask & Logic Mask Active Parameter Specifications

Parameter		Bit Number	DPI Assignment	Access	Units [default]
Number	Name				
148	Logic Mask	0 - NA 1	Port 0 - NA Port 1	R/W	Bit = 0 [disabled] Bit = 1 enabled
149	Logic Mask Act	2 3 4 5 - 15 NA	Port 2 Port 3 Port 4 Port 5 - 15 NA	R	Bit = 0 [disabled] Bit = 1 enabled [Follows Logic Mask]

IMPORTANT

- The Logic Mask must be set to 0 or the "REMOVE HIM" key is depressed via the HIM controller screen (see Chapter 7) prior to disconnecting the HIM from the SMC-50 controller. If not, the unit will fault on a "Exp. Removed".
- The Logic Mask Active, Parameter 149, is a read-only parameter that shows the logic mask actually in use at any given time. It typically follows the Logic Mask, Parameter 148, **except** in some application environments where network communication is in use.

Loss of Communication with DPI Device

An "Exp. Removed" fault indicates a device was improperly removed. There is a Fault code determined by port number.

DPI provides a separate Exp. fault for each port. This fault can be generated directly by the peripheral and is separate from the Exp. Removed fault (device specific).

Default Input/Output Communication Configuration

The default configuration for I/O communication is 4 bytes in and 4 bytes out (TX = 4 bytes, RX = 4 bytes). The total size may very when used with a communication card. The default configuration is arranged according to the following table.

Table 100 - Default Configuration

Word	Produced Data (Status)	Consumed Data (Control)
0	Logic Status	Logic Command
1	Feedback ❶	Reference ❷

❶ The feedback word is always Ave Current.
❷ The reference word is not used with the SMC-50, however the space must be reserved.

Variable Input/Output Configuration

TIP The total data size produced or consumed may vary, depending on the communication card being used. For more information, see the User Manual of the specific communication card being used with the SMC-50.

The SMC-50 supports 32-bit Data Links. Therefore, the device can be configured to return additional information. The I/O message size depends on how many DataLinks are enabled. The following table summarizes the I/O data sizes.

Table 101 - I/O Data Sizes

Rx Size	Tx Size	Logic Status/Command (16-bit)	Reference/FeedBack (16-bit)	DataLinks			
				A	B	C	D
4	4	x	x				
12	12	x	x	x			
20	20	x	x	x	x		
28	28	x	x	x	x	x	
36	36	x	x	x	x	x	x

To configure DataLinks, see Configuring DataLink™ on page 212.

SMC-50 — Bit Identification

Product Functional (Logic) Status, Parameter 43, is used to provide SMC-50 functional (logic) status to communication devices. The following table details Parameter 43, which is a read-only parameter.

Table 102 - Logic Status

Bit Number	Status/Function	Description	
		1	0
0	Enabled/Ready	Control Power Applied	Control Power NOT applied
1	Running	Power applied to motor (gating SCRs or bypass closed)	Power NOT applied to motor
2	Phasing	ABC phasing	CBA phasing
3	Phasing Active	Three-phase is valid	No valid three-phase detected
4	Starting (Accel)	Performing a start maneuver (slow speed not included)	Not performing a start maneuver
5	Stopping (Decel)	Performing a stop maneuver (coast to stop not included)	Not performing a stop maneuver
6	Alarm	Alarm present	No alarm present
7	Fault	Fault condition exists and has not been cleared	No fault condition
8	At Speed	Full voltage applied (bypass or full SCR conduction)	No full voltage applied
9	Start/Isolation	Start/Isolation contactor enabled	Start/Isolation contactor disabled
10	Bypass	Bypass contactor enabled	Bypass contactor disabled
11	Ready	Ready to Run	Control Inhibit Active (do not run)
12-13	Reserved	Always 0	
14	Input #1	Control Module Input #1 Status	
15	Input #2	Control Module Input #2 Status	

Table 103 - Logic Command Word (Control)

Bit Number	Control	Description 1	0
0	Stop	Coast/Inhibit	No action
1	Start	Start	No action
2	Jog	Stop/Maneuver	No action
3	Clear Fault	Clear fault	No action
4	Slow Speed	Run at slow speed	No action
5	Emergency Run	Enable emergency run mode	Disable emergency run mode
6	Motor Winding Heater	Enable motor winding heater	Disable motor winding heater
7-10	Reserved	These bits must always be set to 0	
11	Aux Enable	Use the Network #1 - #4 bits	Ignore the Network #1 - #4 bits
12	Network #1	Closes any output configured for Network #1	Opens any output configured for Network #1
13	Network #2	Closes any output configured for Network #2	Opens any output configured for Network #2
14	Network #3	Closes any output configured for Network #3	Opens any output configured for Network #3
15	Network #4	Closes any output configured for Network #4	Opens any output configured for Network #4

Reference/Feedback

The SMC-50 does not offer the analog **Reference** feature. The analog **Feedback** feature is supported and will provide Current Average, Parameter 5, automatically as the feedback word.

Parameter Information

A complete listing of the SMC-50 parameters is located in Appendix B.

Scale Factors for PLC Communication

The parameter values stored and produced by the SMC-50 through communication are unscaled numbers. When reading or writing values from a PLC image table, it is important to apply the proper scaling factor, which is based on the number of decimal places.

Read Example

Power Factor, Parameter 17 — The stored value is 85. Since this value has two decimal places, the value should be divided by 100. The correctly read value is 0.85.

Write Example

Motor FLC, Parameter 78 — The example value, which is to be written to the SMC-50, is 75 A. Since this value has one decimal place, the value should be multiplied by 10. The correctly written value is 750.

Display Text Unit Equivalents

Some parameters have text descriptions when viewed from a HIM or through a communication software program such as RSNetworx™. When receiving or sending information from a PLC each text description has a numerical equivalent. The table below shows an example of Meter Reset, Parameter 16, and the appropriate relationship between the text descriptor and the equivalent value. This relationship is identical for other similar parameters located in Appendix B.

EXAMPLE

Text Descriptor	Numerical Equivalent
Ready	0
Elapsed Time	1
Energy	2
Time to PM	3
Starts to PM	4

Configuring DataLink™

DataLink is supported in the SMC-50. DataLink is a mechanism used by most drives to transfer data to and from the controller without using an explicit message. The SMC-50 supports a 32-bit DataLink, therefore the device can be configured to return up to eight additional pieces of information without the need for an explicit message.

Criteria for Using DataLink

- Each set of DataLink parameters in an SMC-50 can be used by only one adapter. If more than one adapter is connected, multiple adapters must not try to use the same DataLink.
- Parameter settings (contents) in the SMC-50 determine the data passed through the DataLink mechanism.
- When DataLink is used to change a value in the SMC-50, the value is not written to the Non-Volatile Storage (NVS). However, if the SMC-50 is powered down, the current value is written to NVS.

To configure DataLink, Parameters 153…168 of the SMC-50 **must** be used. See Table 104 below for a detailed listing of these parameters. For additional information regarding DataLink, see the communication interface's user manual.

Table 104 - Parameter 153 - 168 DataLinks Detail

Parameter Number	Description		Min/Max [Default]	Access	Units
153	Data In	A1	[0]-Max Parameter Number ❶	R/W	
154		A2			
155		B1			
156		B2			
157		C1			
158		C2			
159		D1			
160		D2			
161	Data Out	A1			
162		A2			
163		B1			
164		B2			
165		C1			
166		C2			
167		D1			
168		D2			

❶ The data transferred via the DataLink function is the setting (content(s)) of the parameter number as entered by the user here.

Updating Firmware

The latest version of firmware and instructions for the SMC-50 can be obtained from www.ab.com.

Diagnostics

Overview

This chapter describes the fault diagnostics of the SMC-50. Further, this section describes the conditions that cause various faults to occur.

Protection Programming

Many of the protective features available with the SMC-50 can be enabled and adjusted through the programming parameters provided. For further details on programming, see Motor Protection on page 172 in Chapter 5, Programming.

Diagnostic LEDs

The SMC-50 multi-color Diagnostic 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.

Table 105 - 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 provides the ability to reset an alarm/fault, test for a fault condition, and initiate the tuning mode.

Table 106 - 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 ❶

❶ The motor must be stopped.

Using the Controller Status LED & Parameter Configuration Module (150-SM6) LEDs

When a 150-SM6 is installed in one of the three control module ports (7, 8, or 9) of the SMC-50, additional LED diagnostic information is provided beyond that of the Status LED.

The 150-SM6 has four diagnostic/status LEDs to display an LED code for each fault/alarm. When the SMC-50's Status LED indicates the control module has faulted, the 150-SM6 displays a specific fault code. If the unit is not faulted but in an alarm condition, the 150-SM6 displays the alarm code. If the unit is neither faulted or in an alarm condition, all 150-SM6 LEDs will not be illuminated.

The 150-SM6 > (<) LED indicates whether the fault/alarm is a SMC-50 device fault/alarm or a motor fault/alarm. The on/off status of the other three LEDs indicate the actual fault/alarm codes.

Depending on which SMC-50 port the 150-SM6 is installed into, the position of the LEDs (e.g., >, III, II, and I versus I, II, III, and <) change. The table below displays the LED order when the 150-SM6 is installed in port 7. When the 150-SM6 is installed in port 8 or 9, the order is reversed, but the LED diagnostic code is the same.

Table 107 - LED Order When 150-SM6 is Installed in Port 7 of the SMC-50

	LED On/Off State			
LED Error Code	>	III	II	I
0		Off	Off	Off
1		Off	Off	On
2		Off	On	Off
3	Red = SMC Yellow = Motor Off = No Fault or Alarm	Off	On	On
4		On	Off	Off
5		On	Off	On
6		On	On	Off
7		On	On	On

The displayed LED error code is either a fault or an alarm code depending on the cause. For example, if the LED code is 1, Line Loss A is either a fault or an alarm.

If a more detailed display of the error code source is desired, a human interface module (HIM) or configuration software is recommended.

The following table provides a list of faults with LED fault/alarm codes for the 150-SM6 Parameter Configuration Module.

Table 108 - LED Error Code with Respective Fault/Alarm Source

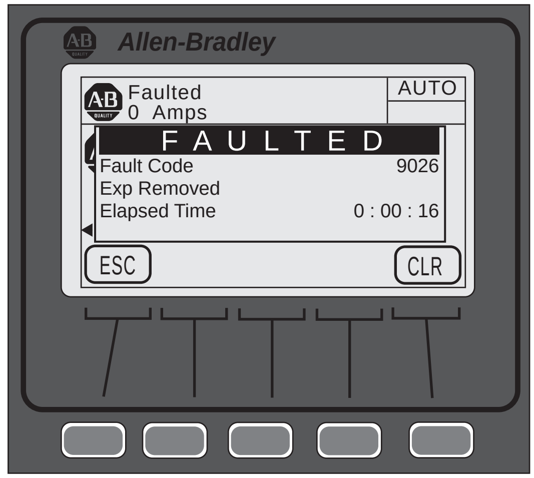
LED Error Code	Fault/Alarm Source		Referenced HIM/ Configuration Software Code ❶	LED Error Code	Fault/Alarm Source		Referenced HIM/ Configuration Software Code ❶
Red = SMC							
1	Line Loss	A	1	**5**	HAL ID		33
		B	2		NVS Error		34
		C	3		V24 Recovery		35
	Shorted SCR	A	4		V24 Loss		36
		B	5		V Control Loss		37
		C	6		RTC Battery Low		69
2	Open Gate	A	7		System Faults		100-199
		B	8	**6**	Terminal Block Input	1	38
		C	9			2	39
3	SCR Overtemp		10			3	40
	Pwr Pole PTC		60			4	41
4	CT Loss	A	30		Test Fault		62
		B	31	**7**	Open Bypass	A	11
		C	32			B	12
						C	13
Yellow = Motor							
2	No Load		14	**4**	Overload		21
	Open Load	A	15	**5**	Stall		24
		B	16	**6**	Phase Reversal		25
		C	17	**7**	Current Imbalance		42
3	Volt Imbalance		18				

❶ The Fault/Alarm code, available from a HIM or configuration software, provides more detailed information concerning the source of the fault/alarm. Fault and Alarm codes for the same event (e.g., Line Loss) are the same.

Fault Display (20-HIM-A6)

When the SMC-50 is used with a 20-HIM-A6, the HIM displays the fault information.

Figure 95 - Fault Display



IMPORTANT	Resetting a fault will not correct the cause of the fault condition. Corrective action must be taken before resetting the fault. The fault display will remain active as long as control power is applied. If control power is cycled, the fault will be cleared, the controller will re-initialize, and the display will show a status of Stopped unless the Fault condition still exists. You can press Esc to get to another programming/diagnostic list, but the SMC-50 will still be in a faulted state.

Clear Fault

A fault can be cleared using any of the following methods:

- Program the SMC-50 to automatically clear a fault using Restart Enable, Parameter 135 or 264.
- Press the SMC-50 HOLD TO TEST, PUSH TO RESET button.
- Connect a N.O. push button to Option Input #1 (terminal 11) or # 2 (terminal 10). Option Input #1 or #2 must be programmed for Clear Fault using Parameter 56 or 57.

NOTE: This can also be done with an Input from a 150-SM4 Option I/O Module.

- Cycle the control power to the SMC-50.

IMPORTANT	An overload fault cannot be reset until the value of the Motor Thermal Usage, Parameter 18, is below the value programmed in OL Reset, Parameter 80. See Enabling Option Module Functional Faults & Alarm on page 107 for further details.

Fault & Alarm Buffer - Parameter List

The SMC-50 stores the five most recent Fault and Alarm codes (Fault Parameter List 138 to 142, Alarm Parameter List 143 to 147) in parameter memory from newest to oldest.

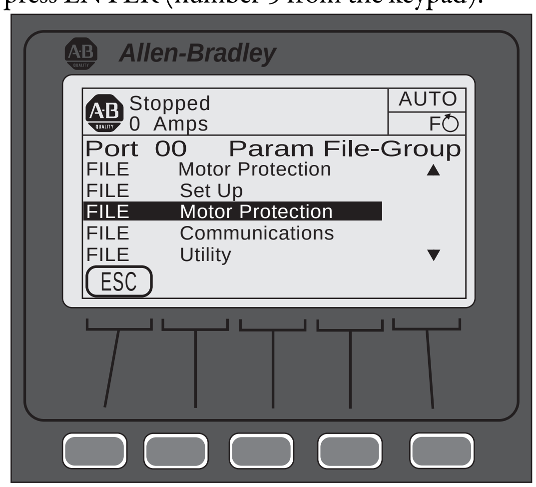
Accessing the Fault & Alarm Parameters

Using the 20-HIM-A6, the fault and alarm parameter lists can be displayed in the Motor Protection File Group or Linear List parameter number search (Fault Parameter List 138 to 142, Alarm Parameter List 143 to 147). To use the File-Group method, perform the following steps:

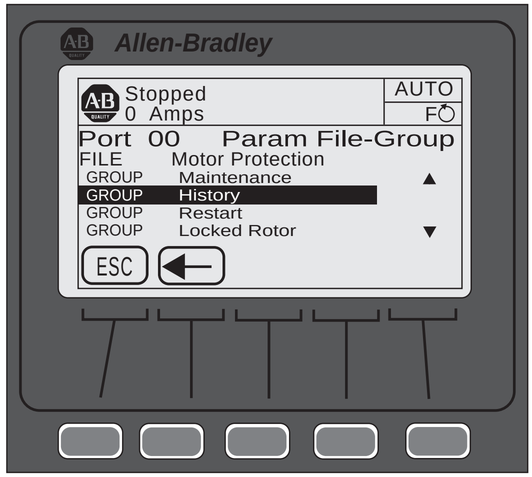
1. From the SMC-50 standard power up screen, press the Folders keypad key at the lower left of the display.

   NOTE: Ensure the Advanced access level (located at the bottom of the <00> DEV PARAM screen) is selected **before** pressing ENTER. See Program Access Level Configuration in Chapter 5 for additional details.

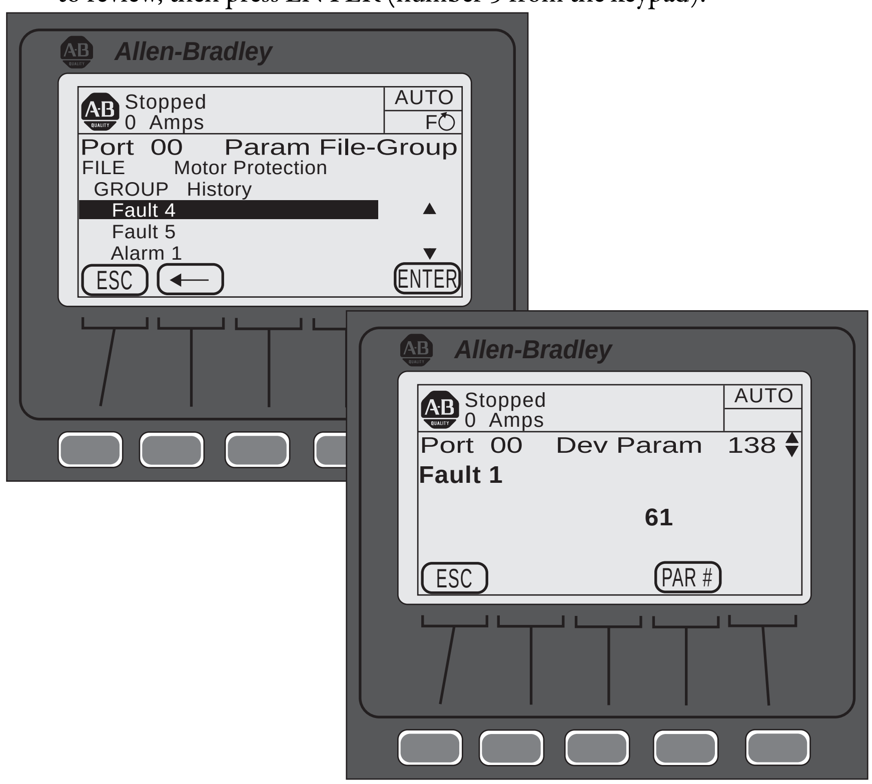
2. From the <00> DEV PARAM folder screen select File-Group, then press ENTER (number 5 from the keypad). The Port 00 Param File Group screen will appear.
3. Use the down arrow key to select (highlight) FILE Motor Protection, then press ENTER (number 5 from the keypad).



4. Use the down arrow key to select GROUP History, then press ENTER (number from the keypad).



5. Use the arrow keys on the keypad to navigate to the Fault or Alarm number to review, then press ENTER (number 5 from the keypad).

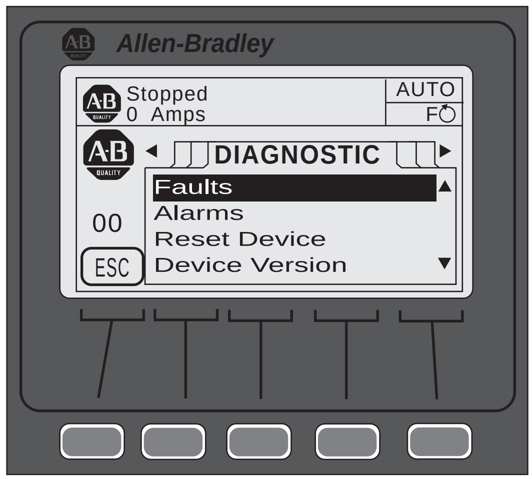


NOTE: In the example above, Fault 61 is displayed. For Fault/Alarm code data, see Table 110 on page 224.

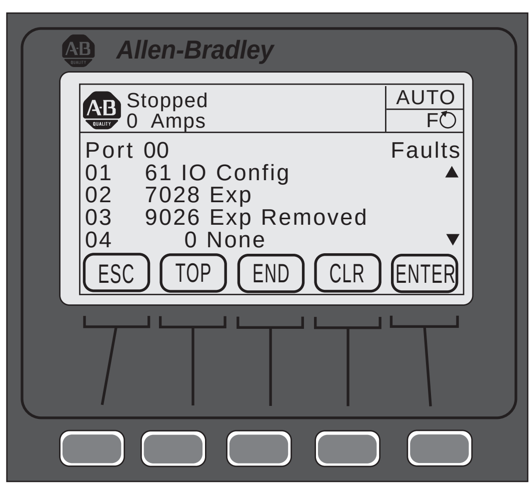
Accessing the Fault & Alarm Buffers

In addition to the SMC-50 storing the most recent Alarm and Fault codes as parameters, the date and time the Fault or Alarm occurred is stored in the Fault Buffer (last five faults) and Alarm Buffer (last 100 alarms). To access Fault buffers and Alarm Buffers using the 20-HIM-A6, the Diagnostic folder must be accessed. To do so, perform the following steps.

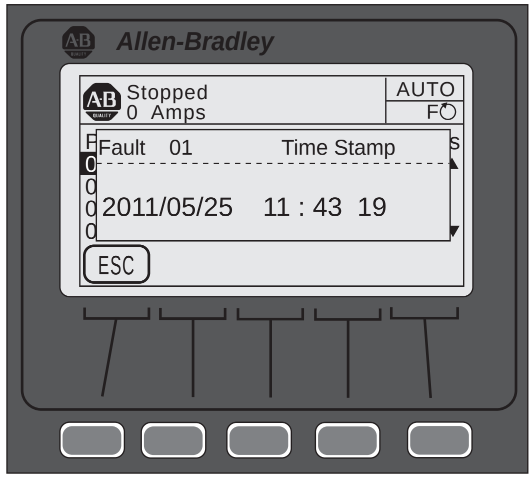
1. From the SMC-50 standard power up screen, press the Folders key at the lower left of the display.
2. Using the right or left arrow key, display the DIAGNOSTIC folder.
3. Using the up or down arrow key, select either Faults or Alarms, then press ENTER. In this example, Faults will be used.



The HIM will display the five most recent Fault codes if Faults was selected. The HIM will display the 100 most recent Alarm codes with an abbreviated description if Alarm codes were selected. The most recent code will be listed as 01 with the second most recent code as 02, and so on.



4. Select the Fault or Alarm in question, then press ENTER. The date and time that the Fault or Alarm occurred will be displayed.



NOTE: The Fault/Alarm buffers are available using DriveExplorer via the Explore and Device properties drop-down menu. Ensure 0-SMC-50 is selected from the list of Devices.

Fault Codes

The following table provides a complete cross-reference of the available fault codes and corresponding fault descriptions.

Table 109 - Fault/Alarm Code Cross-Reference

Fault/Alarm Name		Code	LED Code	Category ❶	Host	DPI/HIM/COMM	Exp 7, 8, 9	Fault/Alarm Name		Code	LED Code	Category ❶	Host	DPI/HIM/COMM	Exp 7, 8, 9
	A	1				—	—	Under Power Real		43	—	M	X	—	—
Line Loss	B	2	1	D	X	—	—	Over Power Real		44	—	M	X	—	—
	C	3				—	—	Un Power Reac +		45	—	M	—	—	—
	A	4				—	—	Ov Power Reac +		46	—	M	—	—	—
Shorted SCR	B	5	1	D	X	—	—	Und Power App		47	—	M	—	—	—
	C	6				—	—	Ov Power App		48	—	M	—	—	—
	A	7				—	—	Frequency		49	—	M	X	—	—
Open Gate	B	8	2	D	X	—	—	PM Hours		50	—	M	X	—	—
	C	9				—	—	PM Starts		51	—	M	X	—	—
SCR Overtemp		10	3	D	X	—	—		A	52	—	M	X	—	—
No Load		14	2	M	X	—	—	Power Quality	B	53	—	M	X	—	—
	A	15				—	—		C	54	—	M	X	—	—
Open Load	B	16	2	M	X	—	—	Power Quality THD V		55	—	M	X	—	—
	C	17				—	—	Power Quality THD I		56	—	M	X	—	—
Voltage Unbal		18	3	M	X	—	—	Config Change		57	—	D	X	—	—
Overvoltage		19	—	M	X	—	—	Ground Fault		58	—	M	—	—	X
Undervoltage		20	—	M	X	—	—	Motor PTC		59	—	M	—	—	X
Overload		21	4	M	X	—	—	Power Pole PTC		60	3	D	X	—	—
Underload		22	—	M	X	—	—	I/O Config		61	—	D	X	—	—
Jam		23	—	M	X	—	—	Test Fault		62	6	D	X	—	
Stall		24	5	M	X	—	—							—	
Phase Reversal		25	6	M	X	—	—	Und PF Lag		63	—	M	—	—	—
Exp Removed		26	—	D	—	X	X	Und PF Lead		64	—	M	X	—	—
Exp Incompat		27	—	D	—	—	X	Ovr PF Lag		65	—	M	X	—	—
Expansion		28	—	D	—	X	X	Ovr PF Lead		66	—	M	X	—	—
Excess Starts		29	—	M	X	—	—	–MVAR Over		67	—	M	X	—	—
	A	30				—	—	–MVAR Under		68	—	M	X	—	—
CT Loss	B	31	4	D	X	—	—	RTC Battery Low		69	5	D	X	—	—
	C	32				—	—	Locked Rotor		70	—	M	X	—	—
HAL ID		33	5	D	X	—	—	Start ❸		71	—	—	—	—	—
NVS Error		34	5	D	—	—	—	Slow Speed ❸		72	—	—	—	—	—
V24 Recovery		35	5	D	X	—	—	Stop Option ❸		73	—	—	—	—	—
V24 Loss		36	5	D	X	—	—	Coast ❸		74	—	—	—	—	—
VControl Loss		37	5	D	X	—	—	Clear Fault ❸		75	—	—	—	—	—
	1	38			X	—	X	Fault ❸		76	—	—	—	—	—
TB Input ❷	2	39	6	D	X	—	X	Param Change ❸		77	—	—	—	—	—
	3	40			—	—	X	Reserved		78-99	—	—	—	—	—
	4	41			—	—	X	System Faults		100-199	5	D	X	—	—
Current Imbal		42	7	M	X	—	—								

❶ For Category, M= Motor; D=Device ❷ TB = Terminal Block Input ❸ Codes 71…77 are Event codes.

The following table provides an overview of the Fault and Alarm codes with Time Delay and Restart options plus a basic description of what causes each Fault or Alarm to occur.

NOTE: Most Faults and Alarms are individually bit enabled and disabled (F/A Bit Enab) and can have a user configurable delay time to help avoid nuisance trips (Time Delay Aval). In addition, many have the ability to automatically restart once the condition is cleared (Restart En). See Chapter 4 for additional information on Faults and Alarms.

Table 110 - Linear Listing — Fault & Alarm Code Overview

Fault/Alarm Code Name		F/A Code	Time Delay Avail.	F/A Bit Enable	Restart Enable	Description F/A= Fault & Alarm, A= Alarm, F= Fault
Line Loss	A	1	N	Y	Y	**F/A** Loss of line power for Phase A, B, or C
	B	2				
	C	3				
Shorted SCR	A	4	N	N	NA	**A** During prestart checks (motor stopped not running), the SMC-50 monitors for current flow in each individual phase. **NOTE:** In Wye configurations, a single Phase A, B, or C shorted SCR will not be detected until the unit is started. This fault is always enabled.
	B	5				
	C	6				
Open Gate	A	7	N	Y	Y	**F/A** Indicates that an abnormal condition that causes faulty firing (e.g., open SCR Gate) has been sensed during the starting sequence.
	B	8				
	C	9				
SCR Overtemp		10	N	N	NA	**F T**he SMC-50 protects the SCRs from damage caused by overtemperature operation using an internally configured I^2T. **NOTE:** This fault is always enabled.
No Load		14	N	Y	Y	**F/A** The SMC-50 can determine if a load connection exists (total load lost or all load leads lost) and a No Load Fault and/or Alarm can be indicated.
Open Load	A	15	N	Y	Y	**F/A** An Open Load A — Fault/Alarm indicates that the Phase X load lead connection is OFF/Open.
	B	16				**F/A** An Open Load B
	C	17				**F/A** An Open Load C
Voltage Unbalance		18	Y	Y	Y	**F/A** Indicates that when the calculated unbalance level is greater than the user-defined Fault and/or Alarm level. See Chapter 4 for calculated value details.
Overvoltage		19	Y	Y	Y	**F/A** Indicates that if the average line voltage is greater than the user-defined Fault and/or Alarm level.
Undervoltage		20	Y	Y	Y	**F/A** Indicates that if the average line voltage is less than the user-defined Fault and/or Alarm level.
Overload		21	Y [1]	Y	Y	**F/A** Enabled in the Motor Protection Group by programming the: Overload Class, Overload Reset, Motor FLC, and Service Factor.
Underload		22	Y	Y	Y	**F/A** Motor operation will halt (Fault only) if the value of the motor's average RMS current is less than the user-defined value.

<table>
<thead>
<tr><th colspan="2">Fault/Alarm Code Name</th><th>F/A Code</th><th>Time Delay Avail.</th><th>F/A Bit Enable</th><th>Restart Enable</th><th colspan="2">Description
F/A= Fault & Alarm, A= Alarm, F= Fault</th></tr>
</thead>
<tbody>
<tr><td colspan="2">Jam</td><td>23</td><td>Y</td><td>Y</td><td>Y</td><td colspan="2">F/A Indicates that the motor current increases above the user-defined Fault and or Alarm level while the motor is running at speed. This F/A condition is not active during starting or stopping.</td></tr>
<tr><td colspan="2">Stall</td><td>24</td><td>Y</td><td>Y</td><td>Y</td><td colspan="2">F/A Condition exists and a Fault/Alarm is generated if the SMC-50 senses that the motor is NOT Up-to-Speed (UTS) at the end of the programmed starting ramp time plus the time programmed in the Stall Delay time.</td></tr>
<tr><td colspan="2">Phase Reversal</td><td>25</td><td>N</td><td>Y</td><td>Y</td><td colspan="2">F/A Fault/Alarm is indicated when the incoming power to the SMC-50 is in any sequence other than ABC.</td></tr>
<tr><td colspan="2">Exp Removed</td><td>26</td><td>N</td><td>N</td><td>NA</td><td colspan="2">F Removing an expansion module (device) (e.g., a 150-SM4) from a SMC-50 will result in a x026 fault, where "x" is the SMC-50 port number (7, 8, or 9) the expansion module was installed. DPI devices (e.g., 20-HIM-A6 or 20-COMM-X) will only generate this fault if its associated bit in Logix Mask parameter is set.
NOTE: If an expansion module (device) (e.g., a 150-SM4 is removed from a SMC-50), the message "Device Conflicts Port xy Not Found" will be displayed on the HIM or PC software) when power returns.</td></tr>
<tr><td colspan="2">Exp Incompat</td><td>27</td><td>N</td><td>N</td><td>NA</td><td colspan="2">F Inserting an expansion module or DPI device into an incompatible controller port number or inserting an expansion module into a controller with incompatible version of firmware will result in this Fault. The port number of the offending device is included as the first digit of this Fault code.</td></tr>
<tr><td colspan="2">Expansion</td><td>28</td><td>N</td><td>N</td><td>NA</td><td colspan="2">F General Fault that can be generated by an expansion or peripheral device. The port number of the offending device is included as the first digit of this Fault code.</td></tr>
<tr><td colspan="2">Starts per Hour</td><td>29</td><td>N</td><td>Y</td><td>Y</td><td colspan="2">F/A Starts per Hour is the maximum number of starts (user configured) within a sliding one hour window. Once the number of starts per hour is reached, any additional starts will cause a Fault/Alarm Code 29.</td></tr>
<tr><td rowspan="3">CT Loss</td><td>A</td><td>30</td><td rowspan="3">N</td><td rowspan="3">N</td><td rowspan="3">NA</td><td>F CT Loss A
(Phase A)</td><td rowspan="3">fault will occur when current feedback is invalid. This Fault is always enabled.</td></tr>
<tr><td>B</td><td>31</td><td>F CT Loss B
(Phase B)</td></tr>
<tr><td>C</td><td>32</td><td>F CT Loss B
(Phase B)</td></tr>
<tr><td colspan="2">HAL ID</td><td>33</td><td>N</td><td>N</td><td>NA</td><td colspan="2">F HAL ID Fault is generated if the controller determines that an incorrect (incompatible) power pole is installed. This Fault is always enabled.</td></tr>
<tr><td colspan="2">NVS Error</td><td>34</td><td>N</td><td>N</td><td>NA</td><td colspan="2">F Indicates an error in the SMC-50's nonvolatile memory storage. Clearing the Fault requires a change to the parameter or loading defaults (preferred). It is not cleared by cycling power. This Fault is always enabled.</td></tr>
<tr><td colspan="2">Future Use</td><td>35</td><td></td><td></td><td></td><td colspan="2">Future use.</td></tr>
<tr><td colspan="2">V24 Loss</td><td>36</td><td>N</td><td>N</td><td>NA</td><td colspan="2">F Indicates that the voltage level of the SMC-50's internal 24V DC supply which provides power to the controller logic and on-board 24V DC I/O has fallen outside of the allowable range. This Fault is always enabled.</td></tr>
</tbody>
</table>

Fault/Alarm Code Name		F/A Code	Time Delay Avail.	F/A Bit Enable	Restart Enable	Description F/A= Fault & Alarm, A= Alarm, F= Fault	
VControl Loss		37	N	N	NA	**F** Indicates that the control voltage level of the user applied control voltage has fallen outside the allowable upper or lower limit. This Fault is always enabled.	
TB Input	1	38	N	N	NA	**F** Occurs when the Control Input is configured to generate a Fault and the input condition (N.O. or N.C.) is satisfied.	
	2	39					
	3	40					
	4	41					
Current Imbal		42	Y	Y	Y	**F/A** Exists when the calculated imbalance level is equal to or greater than the user-defined Fault/Alarm level. See Chapter 4 for calculated value details.	
Under Power Real		43	Y	Y	Y	**F/A** Occurs when the Real Power:	falls below the user-defined fault/alarm level.
Over Power Real		44	Y	Y	Y		rises above the user-defined fault/alarm level.
Un Power Reac +		45	Y	Y	Y	**F/A** Occurs when the Reactive Power +:	falls below the user-defined fault/alarm level.
Ov Power Reac +		46	Y	Y	Y		rises above the user-defined fault/alarm level.
Under Power App		47	Y	Y	Y	**F/A** Occurs when the Apparent Power+:	falls below the user-defined fault/alarm level.
Over Power App		48	Y	Y	Y		rises above the user-defined fault/alarm level.
Frequency		49	Y	Y	Y	**F/A** Occurs if the line frequency goes above or below the user-defined frequency high or frequency low Fault/Alarm level.	
PM Hours		50	N	Y	Y	**F/A** User-defined value which sets the number of elapsed hours (actual operating hours of the motor) before a fault/alarm is signaled indicating that preventative maintenance should be performed.	
PM Starts		51	N	Y	Y	**F/A** User-defined value which sets the number of starts before a fault/alarm is signaled indicating that preventative maintenance should be performed.	
Power Quality	A	52	N	Y	Y	**F/A** Fault condition which indicates that the starter is not properly firing its:	A Phase SCR.
	B	53					B Phase SCR.
	C	54					C Phase SCR.
Power Quality THD V		55	Y	Y	Y	**F/A** Indicates a high, voltage based total harmonic distortion level.	
Power Quality THD I		56	Y	Y	Y	**F/A** Indicates a high, current based total harmonic distortion level.	
Config Change		57	N	Y	Y	**F/A** Indicates any change to the SMC-50 parameter configuration.	
Ground Fault		58	Y	Y	Y	**F/A** Indicates the value of Ground Fault Current goes above the user-defined fault/alarm level. **NOTE:** A 150-SM2 Ground Fault PTC Feedback Module and 825-CBCT Core Balanced Ground Fault Sensor are required to configure this Fault/Alarm.	
Motor PTC		59	N	Y	Y	**F/A** Indicates the embedded motor PTC sensing device is tripped/closed due to a motor overtemperature condition. **NOTE:** A 150-SM2 Ground Fault PTC Feedback Module is required to configure this Fault/Alarm.	

<table>
<tr><th>Fault/Alarm Code Name</th><th>F/A Code</th><th>Time Delay Avail.</th><th>F/A Bit Enable</th><th>Restart Enable</th><th colspan="2">Description
F/A= Fault & Alarm, A= Alarm, F= Fault</th></tr>
<tr><td>Power Pole PTC</td><td>60</td><td>N</td><td>N</td><td>NA</td><td colspan="2">F Built-in Power Pole PTC Temperature Sensor is used to measure power pole temperature. A fault will occur when the temperature rises above a predetermined level. This fault is always enabled.</td></tr>
<tr><td>I/O Config</td><td>61</td><td>N</td><td>N</td><td>NA</td><td colspan="2">F Occurs when any input is programmed as a start or slow speed and no input is configured as a coast or stop. The fault will occur when the start or maneuver is attempted (the motor will not start). This fault is also generated when the input configuration changes from one that cannot start the motor to one that can. It will also be generated when a parameter is changed from an input that can stop the motor to one that cannot. This fault is always enabled.</td></tr>
<tr><td>Test Fault</td><td>62</td><td>N</td><td>N</td><td>NA</td><td colspan="2">F Occurs when the Push-to-Test, Hold-to-Reset push button on the SMC-50 is pushed for ≥ 3 seconds but < 10 seconds.</td></tr>
<tr><td>Under PF Lag</td><td>63</td><td>Y</td><td>Y</td><td>Y</td><td colspan="2">F/A Occurs when the lagging Power Factor goes below the user-defined fault/alarm level.</td></tr>
<tr><td>Under PF Lead</td><td>64</td><td>Y</td><td>Y</td><td>Y</td><td colspan="2">F/A Occurs when the leading Power Factor goes below the user-defined fault/alarm level.</td></tr>
<tr><td>Over PF Lag</td><td>65</td><td>Y</td><td>Y</td><td>Y</td><td colspan="2">F/A Occurs when the lagging Power Factor goes above the user-defined fault/alarm level.</td></tr>
<tr><td>Over PF Lead</td><td>66</td><td>Y</td><td>Y</td><td>Y</td><td colspan="2">F/A Occurs when the leading Power Factor goes above the user-defined fault/alarm level.</td></tr>
<tr><td>-MVAR Over</td><td>67</td><td>Y</td><td>Y</td><td>Y</td><td colspan="2">F/A Occurs when the magnitude of the Reactive Power rises above the user-defined level.</td></tr>
<tr><td>-MVAR Under</td><td>68</td><td>Y</td><td>Y</td><td>Y</td><td colspan="2">F/A Occurs when the magnitude of the Reactive Power falls below the user-defined level.</td></tr>
<tr><td>RTC Battery Low</td><td>69</td><td>N</td><td>N</td><td>NA</td><td colspan="2">A Occurs when the SMC-50 battery that maintains the value of the Real Time Clock (RTC) is low and needs to be replaced immediately. Alarm is always enabled.</td></tr>
<tr><td>Locked Rotor</td><td>70</td><td>Y</td><td>Y</td><td>Y</td><td colspan="2">F/A Occurs when the motor current increases above the user-defined fault/alarm level while the motor is in any running mode. This F/A condition is not active during starting or stopping.</td></tr>
<tr><td>Start</td><td>71</td><td>NA</td><td>NA</td><td>NA</td><td rowspan="7">This is an Event Code and is stored in the Alarm Buffer for:</td><td>Start Event tracking.</td></tr>
<tr><td>Slow Speed</td><td>72</td><td>NA</td><td>NA</td><td>NA</td><td>Slow Speed Event tracking.</td></tr>
<tr><td>Stop Option</td><td>73</td><td>NA</td><td>NA</td><td>NA</td><td>Stop Option Event tracking.</td></tr>
<tr><td>Coast</td><td>74</td><td>NA</td><td>NA</td><td>NA</td><td>Coast Event tracking.</td></tr>
<tr><td>Clear Fault</td><td>75</td><td>NA</td><td>NA</td><td>NA</td><td>Clear Fault Event tracking.</td></tr>
<tr><td>Fault</td><td>76</td><td>NA</td><td>NA</td><td>NA</td><td>Fault Event tracking.</td></tr>
<tr><td>Parm Change</td><td>77</td><td>NA</td><td>NA</td><td>NA</td><td>Parameter Change Event tracking.</td></tr>
<tr><td>Reserved</td><td>78-99</td><td>N</td><td>N</td><td>N</td><td colspan="2">Future Use.</td></tr>
<tr><td>System Faults</td><td>100-199</td><td>N</td><td>N</td><td>NA</td><td colspan="2">A general Fault/Alarm typically associated with the SMC-50 hardware (e.g., system Watchdog Time failure).</td></tr>
</table>

❶ Overload is inherently a time-based fault.

Auxiliary Relay Output Fault or Alarm Indication

Auxiliary Relay Output contacts can be programmed for Fault or Alarm, N.O. or N.C. indication. In addition, an ON or OFF Delay Time can also be configured. Basic parameter setup (without N.C. or timed functions) can be found in the Setup / I/O Parameter Group. Alternatively, full configuration is available from the Setup / I/O Parameter Group.

Troubleshooting

Introduction

For safety of maintenance personnel as well as others who might be exposed to electrical hazards associated with maintenance activities, follow the local safety related work practices (e.g., 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.

SHOCK HAZARD: Hazardous voltage is present in the motor circuit even when the SMC-50 is off. To avoid shock hazard, disconnect main power **before** working on the controller, motor, and control devices (e.g., 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.

ATTENTION: Disconnect the controller from the motor **before** measuring insulation resistance (IR) of the motor windings. Voltages used for insulation resistance testing can cause SCR failure. **Do not** make any measurements on the controller with an IR tester (megger).

The following flowchart is provided to aid in quick troubleshooting.

NOTE: The time it takes for the motor to come up to speed may be more or less than the time programmed. This depends upon the motor and load characteristics.

NOTE: Depending upon the application, the braking options (SMB Smart Motor Braking and Slow Speed) may cause some vibration or noise during the stopping cycle. To minimize vibration or noise, lower the braking current adjustment. If this is a concern in your application, please consult the factory before implementing the braking options.

Figure 96 - Troubleshooting Flowchart

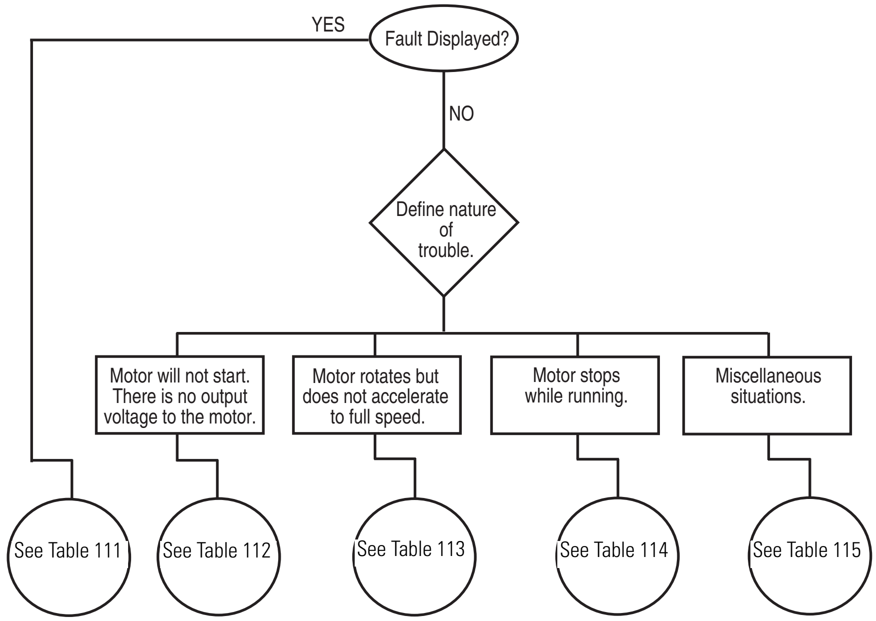


Table 111 - Fault Display Explanation

Display	Fault Code	Fault Enabled	Possible Causes	Possible Solutions
Line Loss (with phase indication)	1, 2, 3	Prestart & Running	• High impedance line connection • Missing supply phase • Motor not connected properly • Incoming 3-phase voltage instability	• Check for line and load loose connections. • Check for open line (e.g., blown fuse). • Check for open line lead(s). • Verify power quality. • Disable this fault/alarm feature.
Shorted SCR (with phase Indication)	4, 5, 6	In All Modes	• Shorted power module.	• Check for shorted SCR, perform a resistance check (see Power Module Check section), or replace power module if necessary.
Open Gate (with phase indication)	7, 8, 9	Start or Stop	• Open gate circuitry • Loose gate lead	• Perform a resistance check (see Power Module Check section), replace power module if necessary. • Remove control module from the power section and check gate lead connections (TB5, TB6, and TB 7) are firmly seated to the control module. • Disable this fault/alarm feature.
SCR Overtemp or PTC Power Pole	10 or 60	In All Modes	• Controller ventilation blocked • Controller duty cycle exceeded • Fan failure • Ambient temperature limit exceeded • Failed thermistor	• Check for proper controller ventilation. • Check application-appropriate duty cycle. • Wait for controller to cool or provide external cooling if ambient temperature is high. • Check for fan operation. Replace fan, if necessary. • Replace power module or control module as needed.
No Load or Open Load (with Phase Indication)	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 (megger).
Voltage Unbalance or Current Imbalance	18 or 42	Running	• Power line unbalance is greater than the programmed value • The delay time programmed is too short for the application	• Check the power system and correct if necessary or change the programmed value. • Extend the delay time to match the application requirements. • Disable this fault/alarm feature.

Table 111 - Fault Display Explanation

Display	Fault Code	Fault Enabled	Possible Causes	Possible Solutions
Overvoltage	19	Running	• Power line grid voltage is greater than the programmed value • Abnormal voltage regulation • The parameter settings &/or delay time programmed are not suited for the application	• Check the power system and correct if necessary. **NOTE:** If the power source is a backup generator, check the stability of the generator voltage regulator. Replace if necessary. • Modify the parameter &/or extend the delay time to match the application requirements. • Disable this fault/alarm feature.
Undervoltage	20	Running	• Power line grid voltage is less than the programmed value • Abnormal voltage regulation • The parameter settings & or delay time programmed are not suited for the application	• Check the power system and correct if necessary. **NOTE:** If the power source is a backup generator, check the stability of the generator voltage regulator. Replace if necessary. • Modify the parameter &/or extend the delay time to match the application requirements. • Disable this fault/alarm feature.
Overload	21	Running	• Motor overloaded • Overload parameters are not matched to the motor	• Check motor overload condition. • Check programmed values for overload class and motor FLC; verify current draw of the motor. • Disable this fault/alarm feature. ❸
Underload	22	Running	• Broken motor shaft, belt, grating, etc. • Pump cavitation • Programmed setting incorrect for application	• Check machine drive components and loading. • Check pump system. • Repair or replace motor. • Check programmed settings. • Disable this fault/alarm feature.
Jam	23	Running	• Motor current has exceeded the user programmed jam level for the programmed time	• Correct source of jam or excessive loading. • Check programmed time value. • Disable this fault/alarm feature.
Stall	24	Running	• The motor did not reach full speed by the end of the programmed ramp time • Incorrect programmed setting	• Check pump system, machine drive components, and loading; repair or replace motor, if necessary. • Check programmed settings. • Disable this fault/alarm feature.
Phase Reversal	25	Prestart Only	• The controller is not detecting incoming supply voltage in the expected ABC sequence	• Check power wiring and correct, if necessary. • Disable this fault/alarm feature.
Exp Removed	x026 ❶	In All Modes	• Expansion module is loose or removed • Expansion module is defective	• Reseat or replace the expansion module connector to the control module and tighten module screws. • Replace defective module.
Exp Incompat	x027 ❶	In All Modes	• Expansion module is inserted into an incompatible control module port number • Controller firmware is not compatible with the expansion module • Expansion module is defective	• Insert the expansion module into a compatible control module port. • Update the control module firmware • Replace defective module.
Expansion	x028 ❶	In All Modes	• Expansion module is loose or removed • Expansion module is defective • Expansion module is inserted into an incompatible control module port number • Controller firmware is not compatible with the expansion module	• Reseat and/or replace loose/removed module and tighten module screws. • Replace defective expansion module. • Update control module firmware.
Starts per Hour	29	Starting	• The number of starts within the last hour has exceeded the programmed value • Programmed setting is incorrect for the application	• Wait for the hour to expire, then restart the motor. • Reduce the actual number of starts per hour or increase the programmed start time (if allowed by the application) and controller thermal limits. • Turn off this fault/alarm feature.

Table 111 - Fault Display Explanation

Display	Fault Code	Fault Enabled	Possible Causes	Possible Solutions
CT Loss A, B, or C	30, 31, or 32	In All Modes	• Loose CT cable connection between the power section and the control module • Phase A (F30), B (F31), or C (F32) current transformer feedback circuit has failed • Option Module 150-SM2 with external CT operation (Fault Code 7030, 8030)	• Remove the control module from the power section; verify connectors TB2 (A), TB3 (B), and TB4 (C) are firmly seated to the control module. • Replace the control module and/or the power section. • Inspect the CT sensor cables for loose connections; check CTs for damage; repair/replace CTs if necessary; replace 150-SM2 option module if necessary.
Hall ID	33	In All Modes	• Loose cables between the controller and power section. • Incompatible power section installed with the controller	• Remove the control module from the power section; verify connectors TB2 (A), TB3 (B), and TB4 (C) are firmly seated to the control module. • Check the power section and replace, if necessary.
NVS Error	34	In All Modes	• Controller memory corrupted • Option module error (Fault Code 7034, 8034, or 9034)	• Modify a parameter or load parameter defaults (preferred) and reload the customer-specific parameters. • Check the option module sensor cables. • Replace the option module.
Future Use	35	NA	NA	NA
V24 Loss	36	In All Modes	• Loose connection at Control Terminals 1 (+L1) and 2 (-L2) • Excessive load on internal 24V supply • Low line voltage condition	• Check the control power and verify it is within the specification; check the line connections and grounding to the SMC-50 control terminals. • Replace the control module.
V Control Loss	37	In All Modes	• Loose connection at Control Terminals 1 (+L1) and 2 (-L2) • Low line voltage condition	• Check the control power and verify it is within the specification; check the connections and grounding to the SMC-50 control terminals. • Replace the control module.
TB Input 1, 2, 3 & 4	38, 39, 40, & 41	In All Modes	• The condition to generate the TB Input fault is satisfied • Terminal wiring configuration or fault N.O./N.C. configuration of input is incorrect	• Clear the fault condition. • Rewire and/or reconfigure the input.
Voltage Unbalance or Current Imbalance	42 or 18	Running	• Power line unbalance is greater than the programmed value • The delay time programmed is too short for the application	• Check the power system and correct if necessary or change the programmed value. • Extend the delay time to match the application requirements. • Disable this fault/alarm feature.
Und Pwr Real ❷	43	Running	• Abnormally reduced real (MW) power draw by the motor possibly due to broken mechanical connection (belt, gears, etc.) between motor and load • Pump cavitation • Programmed setting is incorrect for the application	• Repair/replace the condition causing the reduced real power load. • Modify the programmed fault/alarm parameters to better suit the application. • Disable the fault/alarm feature.
Ovr Pwr Real ❷	44	Running	• Abnormally high real (KW) power draw by the motor • Programmed setting is incorrect for the application	• Repair/replace the condition causing the high KW power draw. • Modify the programmed fault/alarm parameters to better suit the application. • Disable the fault/alarm feature.
Un Pwr Reac+ ❷	45	Running	• Abnormally reduced reactive (+MVAR) power produced by the motor • Programmed setting is incorrect for the application	• Repair/replace the condition causing the reduced +MVAR power draw. • Modify the programmed fault/alarm parameters to better suit the application. • Disable the fault/alarm feature.

Table 111 - Fault Display Explanation

Display	Fault Code	Fault Enabled	Possible Causes	Possible Solutions
Ov Pwr Reac+ ❷	46	Running	• Abnormally high reactive (+MVAR) power produced by the motor • Programmed settings are incorrect for the application	• Repair/replace the condition causing the high +MVAR power draw. • Modify the programmed fault/alarm parameters to better suit the application. • Disable the fault/alarm feature.
Und Pwr App ❷	47	Running	• Abnormally reduced apparent (MVA) power draw by the motor • Programmed settings are incorrect for the application	• Repair/replace the condition causing the reduced +MVA power draw. • Modify the programmed fault/alarm parameters to better suit the application. • Disable the fault/alarm feature.
Ovr Pwr App ❷	48	Running	• Abnormally high apparent (MVA) power draw by the motor • Programmed settings are incorrect for the application	• Repair/replace the condition causing the high +MVA power draw. • Modify the programmed fault/alarm parameters to better suit the application. • Disable the fault/alarm feature.
Frequency	49	Running	• Speed control regulation system of the generator prime mover (e.g., diesel engine) is unable to adjust to current load conditions or is defective • Abnormal power grid connections; power generation source is operating outside its normal frequency limits or range	• Reduce the generator load, increase generator output, replace the speed control system, or generator. **NOTE:** For a diesel generator system, Rockwell Automation recommends it be oversized by a factor of three for Soft Start applications. • Contact the power company for additional information. • Modify the programmed fault/alarm parameters to better suit the application.
PM Hours	50	In All Modes	• The number of hours programmed in the PM Hours Parameter has been reached	• Perform required maintenance and reset the PM Hours parameter. • Disable this fault/alarm feature.
PM Starts	51	Pre-Start	• The number of Starts programmed in the PM Start Parameter has been reached	• Perform required maintenance and reset the PM Hours parameter. • Disable this fault/alarm feature.
Power Quality A, B, or C	52, 53, or 54	Start or Stop	• Incoming 3-phase voltage instability or distortion • High impedance line or load connection	• Check supply voltage for capability to start/stop the motor; check for loose connections on the line side or motor side of the power wires. • Verify and correct the input power quality issue • Disable this fault/alarm feature.
Power Quality THD V	55	Running	• The current mix of loads on the power line contributing to the THD V has exceeded the programmed THD V level &/or time	• Check the mix of loads (what was added, what was changed); modify the load mix if necessary. • Change the programmed THD V level &/or delay time. • Disable this fault/alarm feature.
Power Quality THD I	56	Running	• The current mix of loads on the power line contributing to the THD I has exceeded the programmed THD I level &/or time	• Check the mix of loads (what was added, what was changed); modify the load mix if necessary. • Change the programmed THD I level &/or delay time. • Disable this fault/alarm feature.
Config Change	57	In All Modes	• A controller parameter has been modified	• Disable this fault/alarm feature.
Ground Fault	X058 ❶	Running	• The ground fault current level has exceeded the programmed value • The delay time is too short for the application **NOTE:** An optional 150-SM2 Ground Fault PTC Module is required for this fault.	• Check the power system and motor; correct if necessary. • Check the programmed ground fault levels to match application requirements; modify if necessary. • Extend the delay time to match the application requirements. • Disable this fault/alarm feature.

Table 111 - Fault Display Explanation

Display	Fault Code	Fault Enabled	Possible Causes	Possible Solutions
Motor PTC	X059 ❶	In All Modes	• Motor ventilation is blocked. • Motor duty cycle is exceeded • PTC open or shorted **NOTE:** An optional 150-SM2 Ground Fault PTC Module is required for this fault.	• Check for proper ventilation. • Check application duty cycle. • Wait for motor to cool or provide external cooling, then check resistance of PTC. • Disable this fault/alarm feature.
SCR Overtemp or PTC Power Pole	60 or 10	In All Modes	• Controller ventilation blocked • Controller duty cycle exceeded • Fan failure • Ambient temperature limit exceeded • Failed thermistor	• Check for proper controller ventilation. • Check application-appropriate duty cycle. • Wait for controller to cool or provide external cooling if ambient temperature is high. • Check for fan operation. Replace fan, if necessary. • Replace power module or control module as needed.
I/O Config	61	Pre-Start	• The configuration of the control I/O does not meet the system rules as defined in Chapter 4, Configuration Functions on page 134	• Modify the control I/O configuration to meet the established rules.
Test Fault	62	In All Modes	• The SMC-50's Push to Reset/Hold to Test push button was pressed for more than three seconds, but less than ten • The SMC-50's Push to Reset/Hold to Test push button is stuck or damaged	• To reset the Test fault, press the Push to Reset/Hold to Test push button for less than two seconds. **NOTE:** Only use the Push to Reset push button when absolutely necessary. • Attempt to dislodge the push button or replace the control module if necessary.
Und PF Lag	63	In All Modes	• A lagging PF is abnormally under the typical value; less inductance or more capacitance has been introduced to the power line • A programmed setting or time value is incorrect for the application	• Determine the cause of the reduced Lagging PF. • Modify the programmed fault/alarm parameters to better suit the application. • Disable the fault/alarm feature.
Und PF Lead	64	Running	• A leading PF is abnormally under the typical value; less inductance or more capacitance has been introduced to the power line • A programmed setting or time value is incorrect for the application	• Determine the cause of the reduced Leading PF • Modify the programmed fault/alarm parameters to better suit the application. • Disable the fault/alarm feature.
Ovr PF Lag	65	Running	• A lagging PF is abnormally over the typical value; more inductance or less capacitance has been introduced to the power line • A programmed setting or time value is incorrect for the application	• Determine the cause of the Over PF Lagging • Modify the programmed fault/alarm parameters to better suit the application. • Disable the fault/alarm feature.
Ovr PF Lead	66	Running	• A leading PF is abnormally under the typical value; less inductance or more capacitance has been introduced to the power line • A programmed setting or time value is incorrect for the application	• Determine the cause of the Over PF Leading. • Modify the programmed fault/alarm parameters to better suit the application. • Disable the fault/alarm feature.
-MVAR Over ❷	67	Running	• Abnormally high reactive (-MVAR) power consumed by the motor • Programmed settings are incorrect for the application	• Repair/replace the condition causing the high -MVAR. • Modify the programmed fault/alarm parameters to better suit the application. • Disable the fault/alarm feature.
-MVAR Under ❷	68	Running	• Abnormally reduced reactive (-MVAR) power consumed by the motor • Programmed settings are incorrect for the application	• Repair/replace the condition causing the reduced -MVAR. • Modify the programmed fault/alarm parameters to better suit the application. • Disable the fault/alarm feature.

Table 111 - Fault Display Explanation

Display	Fault Code	Fault Enabled	Possible Causes	Possible Solutions
RTC Battery Low	69	Pre-Start	• Battery reading is below the acceptable level to potentially maintain the real time clock and calendar	• Replace battery (CR2032) as soon as possible.
Locked Rotor	70	In All Modes	• Motor has stalled; rotor is not turning	• Check motor and load for binding or jammed conditions • Parameters are not adequately configured for the application. Review and adjust. • Disable the fault/alarm feature.
Start	71	Starting	• A start event (command) has occurred. This is not a fault.	• NA
Slow Speed	72	Slow Speed	• A slow speed event (command) has occurred. This is not a fault.	• NA
Stop Option	73	Stop Option	• A stop option event (command) has occurred. This is not a fault.	• NA
Coast	74	Coast	• A coast-to-stop event (command) has occurred. This is not a fault.	• NA
Clear Fault	75	Faulted	• A clear fault event (command) has occurred. This does not generate a fault.	• NA
Fault	76	Faulted	• A fault event (command) has occurred. This is not a fault.	• NA
Param Change	77	Stopped	• A change to one of the controller parameters has occurred. This is not a fault.	• NA
Reserved	78-99	NA	NA	NA
System Faults	100-199	In All Modes	• There is an issue with the control module wiring • The control module is defective	• Review the control module wiring. Ensure the ground terminal is secure and connected to the system's earth ground. Ensure an RC snubber/suppressor is connected to all inductive loads in the control circuit. See input wiring. • Replace the control module.

❶ "X" indicates a port number in which the expansion module resides in the SMC-50.

❷ The Real, Reactive, and Apparent Power faults/alarms are best suited to provide indication of an abnormal running operation of the motor or system which another parameter (e.g., Underload, Overload, Jam, Stall, etc.) does not provide. To understand what is an abnormal running operation, a "normal" or "typical" value, usually established during system startup, needs to be determined by the user.

❸ If controller based motor overload is disabled, external motor overload protection should be used.

Table 112 - Motor Will Not Start — No Output Voltage to the Motor

Display	Possible Cause	Possible Solutions
Fault displayed	• See fault description	• See Table 111 addressing fault conditions
HIM display is blank	• Failed HIM • Control voltage is absent • Failed control module • HIM connection is loose	• Check control wiring and correct if necessary • Check HIM connection • Cycle control power • Replace HIM only • Replace control module only
Stopped 0.0 Amps	• Pilot devices • SMC Enable input is open at terminal 9 • Configured or wired input terminals are not wired correctly • Start-Stop control has not been enabled for the human interface module • Control voltage • Failed control module	• Check wiring; follow the instructions on page 209 to enable control capability. • Check control voltage • Replace control module
Starting	• One or more power phases are missing • Isolation contactor (if used) is not picking up	• Check power system • Check that the SMC-50 Aux. relay output controlling the Isolation Contactor is configured to "Normal". • Check the Isolation Contactor for proper operation

Table 113 - Motor Rotates but Does Not Accelerate to Full Speed

Display	Possible Cause	Possible Solutions
Fault displayed	• See fault description	• See Table 111 addressing fault conditions
Starting	• Mechanical problems Inadequate Current Limit setting • Failed control module	• Check for binding or external loading and correct • Check motor • Adjust the Current Limit Level to a higher setting • Replace control module

Table 114 - Motor Stops While Running

Display	Possible Cause	Possible Solutions
Fault displayed	• See fault description	• See addressing fault conditions
HIM display is blank	• Failed HIM • Control voltage is absent • Failed control module • HIM connection is loose	• Replace HIM • Check control wiring and correct if necessary • Replace control module • Check HIM connection
Stopped 0.0 Amps	• Pilot devices • Failed control module	• Check control wiring and correct if necessary • Replace control module
Starting	• One or more power phases are missing • Failed control module	• Check power system • Replace control module

Table 115 - Miscellaneous Situations

Situation	Possible Cause	Possible Solutions
Motor current and voltage fluctuates	• Motor • Erratic Load	• Verify type of motor as a standard squirrel cage induction motor • Check load conditions
Erratic operation	• Loose connections	• Shut off **all** power to controller and check for loose connections
Accelerates too fast	• Starting time • Initial torque • Current limit setting • Kickstart	• Increase starting time • Lower initial torque setting • Decrease current limit setting • Lower kickstart time or turn off
Accelerates too slow	• Starting time • Initial torque • Current limit setting • Kickstart	• Decrease starting time • Increase initial torque setting • Increase current limit setting • Increase kickstart time or turn off
Fan does not operate ❶	• Control wiring • Failed fan(s)	• Check control wiring and correct if necessary • Replace fan module
Motor stops too quickly with Soft Stop option	• Time setting	• Verify the programmed stopping time and correct if necessary
Motor stops too slowly with Soft Stop option	• Stopping time setting • Misapplication	• Verify the programmed stopping time and correct if necessary • The Soft Stop option is intended to **extend** the stopping time for loads that stop suddenly when power is removed from the motor.
Fluid surges with pumps still occur with the Soft Stop option	• Misapplication	• Soft Stop ramps voltage down over a set period of time. In the case of pumps, the voltage may drop too rapidly to prevent surges. A closed loop system such as Pump Control would be more appropriately suited.
Motor overheats	• Duty cycle	• Preset Slow Speed and SMB options: Extended operation at slow speeds reduces motor cooling efficiency. Consult motor manufacturer for motor limitations. • Smart Motor Braking option: Check duty cycle. Consult motor manufacturer for motor limitations.
Motor short circuit	• Winding fault	• Identify fault and correct. • Check for shorted SCR; replace if necessary. • Ensure power terminals are secure.

❶ Fan operation is controlled by the SMC-50 Control Module. The fan may not run in low ambient temperature conditions. See Chapter 2, Fan Power on page 35 for additional details.

Power Module Check

If a power module needs to be checked, use the applicable procedure that follows.

ATTENTION: To avoid shock hazard, disconnect main power before working on the controller, motor, or control devices such as Start/Stop push buttons.

ATTENTION: Make sure that wires are properly marked and programmed parameter values are recorded.

Shorted SCR Test

1. Using an ohm meter, measure the resistance between the line and load terminals of each phase on the controller. (L1-T1, L2-T2, & L3-T3)

The resistance should be greater than 5,000 ohms. Replace the power assembly if this reading is not reached. See Appendix C for the list of Spare/Replacement SMC-50 parts.

Notes:

Specifications

Standard Features

Table 116 - Functional Design Specifications

Standard Features		Description
Installation	Power Wiring	standard squirrel-cage induction motor or Wye-Delta, six-lead motor
	Control Wiring	two- and three- wire control for a wide variety of applications
Configuration/ Setup ❶	Keypad	Cat. No. 20-HIM-A6 full numeric keypad with LCD display Cat. No. 20-HIM-C6S remote panel mount full numeric keypad with LCD display
	Software	parameter values are downloaded to the SMC-50 with the Connected Components Workbench and DriveTools programming software
	Parameter Configuration Option Module	Cat. No. 150-SM6 provides limited configuration by DIP and rotary switches
Communications		four DPI ports for local serial communications, network communication is supported by optional 20-COMM-X modules
Basic Starting & Stopping Modes		modes include: Soft Start, Current Limit Start, Dual Ramp, Full Voltage, Linear Speed Acceleration (start), Linear Speed Deceleration (stop), Torque Start, Preset Slow Speed, and Soft Stop
Pump Control	Start & Stop	helps reduce fluid surges in centrifugal pumping systems during the starting and stopping period
Braking Control❺	SMB Smart Motor Braking	provides motor braking without additional equipment for applications that require the motor to stop quickly
	Accu-Stop ❷	provides controlled position stopping; during stopping, brake torque is applied to the motor until the motor reaches the preset slow 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
	Slow Speed with Braking	used on applications that require slow speed in the forward or reverse position for positioning or alignment and requires braking control to stop.
	External Braking	activates an external braking device by using an auxiliary relay output
Protection & Diagnostics ❸		displays: Power Loss, Line Fault, Voltage Unbalance, Excessive Starts/Hour, Phase Reversal, Undervoltage, Overvoltage, Controller Temperature, Stall, Jam, Open Gate, Overload, Underload, and Communication Fault
Metering Indication ❹		provides: Phase Current, Current Average, Phase-to-Phase Voltage, Voltage P-P Average, Phase-to-Neutral Voltage, Calculated Torque, Real Phase Power, Real Power, Real Energy, Real Demand, Max Real Demand, Reactive Power, Reactive Energy + & -, Reactive Energy, Reactive Demand, Max Reactive Demand, Apparent Power, Apparent Energy, Apparent Demand, Number of Periods, Power Factor, Energy Savings, Elapsed Time 1 & 2, Running Time, Motor Speed, Start Time 1-5, Peak Current 1-5, Total Starts, THD V, THD I, THD V Average, THD I Average, Line Frequency, Current Imbalance, and Voltage Unbalance
LED Status Indication by Multi-Color (standard)		displays status, fault, and alarm codes: Running - with alarm, Running - no alarm, Ready - with alarm, Ready - no alarm, Ready - tuning enabled on next start, and Firmware Download Active - with alarm
Auxiliary Contacts (two standard)		two fully programmable contacts as: normal, UTS, fault, alarm, external brake, auxiliary control, network, or external bypass

❶ The configuration option **must** be ordered separately from the controller, which **does not** include a setup tool.
❷ Accu-Stop is accomplished using the SMB Mode and Slow Speed with Braking.
❸ Diagnostic indication depends on the type of configuration tool used, The standard LED status indication displays: Inhibit (stop enabled), Fault (non-resettable), Fault (resettable). For full local access, a HIM or PC software is required. Remote full access to data can also be obtained using a 20-COMM-XX communication module.
❹ Metering Indication depends on the type of configuration tool being used. Metering Indication requires the use of a HIM or PC software configuration tool for full local access. Full access to data can also be obtained via network using a 20-COMM-XX communication module.
❺ Not intended to be used as an emergency stop. See applicable standards for emergency stop requirements.

Electrical Ratings

Table 117 - Power Circuit & Utilization Category Ratings

Type	Device Rating	UL/CSA/NEMA	IEC
Power Circuit			
# of Controlled Poles	3	—	—
Rated Operation Voltage	480V	200...480V AC (-15%, +10%)	200...415V (-15%, +10%)
	690V	200...600V AC (-15%, +10%)	200...690V /Y (-15%, +10%)
Rated Isolation Voltage	480V	N/A	500V
	690V		690V
Rated Impulse Voltage	480V	N/A	6000V
	690V		
Dielectric Withstand	480V	2200V AC	2500V
	690V		
Repetitive Peak Inverse Voltage Rating	480V	1400V	1400V
	690V	1800V	1800V
Operating Frequency	All	47...63 Hz	47...63 Hz
Utilization Category			
Normal Duty	90...520 A	MG1	AC-53a: 3.5-10:99-2
Heavy Duty			AC-53a: 3.5-30:99-1
Protection Against Electrical Shock	90...520 A	N/A	IP00 (IP20 - Control Terminals only)
	90...180 A		IP2X (with 150-STCB Terminal Cover)
DV/DT Protection	480V	RC Snubber Network	
	690V		
Transient Protection	480...600V	Metal Oxide Varistors: 220 Joules	
	690V	None	
Control Power Specifications			
Rated Operation Voltage		100...240V AC (-15...+10%) or 24V DC (-10...+10%)	
Rated Insulation Voltage		NA	240V
Rated Impulse Voltage		NA	3000V
Dielectric Withstand		1500V AC	1500V
Operating Frequency		47...63 Hz	
Control Power Ride Through		22 mS	
Max Output of 24V DC Internal Supply (Terminals 8 & 12)		300mA	
Control Module Battery Type		CR 2032	

Table 118 - Control Module Standard Input/Output Ratings

Type		UL/CSA/NEMA	IEC
Control Module Standard Control Inputs: Terminals 10 & 11			
Normal Operating Voltage		24V DC	
Operating Voltage Range		15...30V DC	
On-State	Current Minimum	2.8 mA	
	Voltage Minimum	10V DC	
Off State	Current Maximum	3 mA	
	Voltage Maximum	10.9V DC	
Inrush Current Maximum		7 mA	
Input Delay Time		On-to-Off: 30 mS; Off-to-On: 20 mS	
Reverse Polarity Protection		Yes	
Rated Insulation Voltage		NA	60V
Rated Impulse Voltage		NA	500V
Dielectric Withstand		500V AC	1000V AC
Control Module Standard Outputs: Terminals 4/5 and 6/7			
Type of Control Circuit		Electromagnetic Relay	
Number of Contacts per Relay		1	
Type of Contacts		Programmable N.O./N.C. ❶	
Type of Current		AC	
Rated Operational Current		3 A @ 120V AC, 1.5 A @ 240V AC	
Conventional Thermal Current I_{th} AC/DC		5 A	
Make/Brake VA		3600/360	
Utilization Category		B300/AC-15	
Off-State Leakage Current		0.024 mA @ 24V	
		0.12 mA @ 120V	
		0.24 mA @240V	

❶ Electrically held closed

Table 119 - Control I/O Wiring Terminals ❶

Terminal Style	M3 Screw Clamp	**Terminal Wire Size**	0.2...2.5 mm^2 (24...14 AWG)
Terminal Type	Removable	**Wire Strip Length**	7.0 mm (0.27 in.)
Screw Terminal Torque	0.8 N•m (7.0 lb•in)	**Maximum Torque**	0.8 N•m (7.0 lb•in)

❶ Applies to Control Module Standard I/O and 150-SM Expansion Module Terminals (150-SM2, 150-SM3, 150-SM4 Terminals).

Table 120 - Cat. No. 150-SM4 Optional Digital Control Input/Output Ratings

Type		UL/CSA/NEMA	IEC
150-SM4 Optional Digital Control Inputs: Terminals A1 & A2			
Normal Operating Voltage		100...240V AC	
Operating Voltage Range		85V...264V AC @ 47 Hz…63 Hz	
On-State	Current Minimum	9.7 mA @ 47 Hz; 9.7 mA @ 62.4 Hz	
	Voltage Minimum	74.5 V AC @ 47 Hz; 55.9 V AC @ 62.4 Hz	
Off State	Current Maximum	9.0 mA @ 47 Hz; 9.3 mA @ 62.4 Hz	
	Voltage Maximum	68.8 V AC @ 47 Hz; 53.6 V AC @ 62.4 Hz	
Inrush Current Maximum		3.64 A	
Input Delay Time		On-to-Off: 30 mS; Off-to-On: 25 mS	
Rated Insulation Voltage		NA	240V
Rated Impulse Voltage		NA	3000V
Dielectric Withstand		1600V AC	2000V
150-SM4 Optional Digital Control Inputs: Terminals A3 & A4 ❶			
Normal Operating Voltage		100...240V AC	
Operating Voltage Range		85V...264V AC @ 47...63 Hz	
On-State	Current Minimum	5.1 mA @ 47 Hz; 5.0 mA @ 62.4 Hz	
	Voltage Minimum	74.5 V AC @ 47 Hz; 55.8 V AC @ 62.4 Hz	
Off State	Current Maximum	4.7 mA @ 47 Hz; 4.8 mA @ 62.4 Hz	
	Voltage Maximum	68.6 V AC@ 47 Hz; 53.5 V AC @ 62.4 Hz	
Inrush Current Maximum		3.64 A	
Input Delay Time		On-to-Off: 30 mS; Off-to-On: 25 mS	
Rated Insulation Voltage		NA	240V
Rated Impulse Voltage		NA	3000V
Dielectric Withstand		1600V AC	2000V
150-SM4 Optional Digital Outputs: Terminals A6/A7, A8/A9, A10/A11			
Type of Control Circuit		Electromagnetic Relay	
Number of Contacts per Relay		1	
Type of Contacts		Programmable N.O./N.C. ❷	
Type of Current		AC	
Rated Operational Current		3 A @ 120V AC, 1.5 A @ 240V AC	
Conventional Thermal Current I_{th} AC/DC		5 A	
Make/Brake VA		3600/360	
Utilization Category		B300/AC-15	
Off-State Leakage Current		0.024 mA @ 24V	
		0.12 mA @ 120V	
		0.24 mA @240V	

❶ Meets IEC Type 2 Specifications for Inputs per EN 60947-1 for 240V AC only.
❷ Electrically held closed.

Table 121 - Cat. No. 150-SM3 Optional Analog Control Input/Output Ratings

Cat. No. 150-SM3 Optional Analog Control Inputs: Terminals B5…B10	
Number of Inputs	2 differential inputs
Normal Operating Input Ranges	±10V, 0…10V, 0…5V, 1…5V, 0…20 mA, 4…20 mA
Full Scale Operating Input Ranges	±10.5V, 0…10.5V, -0.5…5.25V, 0.5…5.25V, 0…21 mA, 3.5…21 mA
Input Resolution	16 bit (sample rate = 60 Hz)/13 bit (sample rate = 250 Hz)
Data Refresh Rate	Filter dependent: 100 ms (sample rate = 60Hz);24 ms (sample rate = 250 Hz)
Rated Working Voltage	24V DC / 17V AC
Common Mode Voltage Range	±10V DC / channel
Input Impedance	220 kΩ: voltage mode
	249 Ω: current mode
Input Channel Diagnostics	Over and Under Range and Open Circuit
Open Circuit Detection Time	Positive Full Scale Reading: within 3 seconds (max)
Maximum Overload at Input Terminals	Voltage: ±24V DC continuous at 0.1 mA
	Current: ±30 mA continuous at 7V DC
External Calibration	Not required: auto-calibration performed by the module if required to meet specs.
Module Isolation to Control Board	Yes (1000V AC)
Removable Terminal Block	Yes (Cat. No.150-SM3RTB as a spare replacement part)
Cable Type	Belden 8760 (or equiv.) 0.750 mm^2 (18 AWG twisted pair 100% shield with drain)
Cat. No. 150-SM3 Optional Analog Control Outputs: Terminals B1…B4	
Number of Outputs	2 Single-ended
Normal Operating Ranges	±10V, 0…10V, 0…5V, 0…20 mA, 4…20 mA
Full Scale Operating Ranges	±10.5V, 0…10.5V, -0.5…5.25V, 0…21 mA, 3.5…21 mA
Output Resolution ±10.5V, 0 …10.5V, -0.5…5.25V, 0…21 mA, 3.5 …21 mA	16 bit (15 plus sign bipolar)
Resistive Load on Current Output	0…750 Ω
Load Range on Voltage Output	1 kΩ at 10V DC
Max. Inductive Load (Current Outputs)	15 mH
Max. Capacitive Load (Voltage Outputs)	100 µF
Overall Accuracy	Voltage Terminal: ±0.5% full scale at 25° C
	Current Terminal: ±0.35% full scale at 25° C
Accuracy Drift with Temperature	±5 PPM / ° C
Output Impedance	15 Ω (typical)
Open and Short-Circuit Protection	Yes
Maximum Short-Circuit Current	45 mA
Output Overvoltage Protection	Yes

SCPD Performance ❶, Type 1 ❷

Table 122 - SCCR List Standard Capacity Fault

SCPD Performance ❶			Type 1 ❷								
Motor Connection Type	**Catalog Number**	**Current Rating [A]**	**Non-Time Delay Fuse ❸**			**Time Delay Fuse ❹**			**Inverse Time (Thermal Magnetic) Circuit Breaker**		
			Max. Standard Available Fault (kA)	**Amps Typical**	**Amps Max.**	**Max. Standard Available Fault (kA)**	**Amps Typical**	**Amps Max.**	**Max. Standard Available Fault (kA)**	**Amps Typical**	**Amps Max.**
Line ❺	150-SB1N*	90	10	250	350	10	150	200	10	225	350
	150-SB2N*	110		300	400		175	225		250	300
	150-SB3N*	140		400	500		225	300		350	400
	150-SB4N*	180		500			300	400		450	500
	150-SC1N*	210	18	600		18	350	450	18	500	600
	150-SC2N*	260		700			450	500		600	700
	150-SC3N*	320		800			500	700		800	800
	150-SD1N*	361	30 / 18 ❻	1000		30 / 18 ❻	600	800	30 / 18 ❻	800	1000
	150-SD2N*	420		1200			700	800		1000	1200
	150-SD3N*	520		1200			800	1000		1200	1200
Inside Delta ❼	150-SB1N*	155	18	450		18	250	300	18	350	450
	150-SB2N*	190		500			300	400		450	500
	150-SB3N*	242		700			400	500		600	700
	150-SB4N*	311		800			500	600		700	800
	150-SC1N*	363	30	1000		30	600	800	30	800	1000
	150-SC2N*	450		1200			700	1000		1000	1200
	150-SC3N*	554		1600			800	1200		1200	1600
	150-SD1N*	625	42	1600		42	1000	1200	42	1200	1600
	150-SD2N*	727		2000			1200	1600		1600	2000
	150-SD3N*	900		2500			1200	2000		2000	2500

❶ Consult local codes for proper sizing of short-circuit protection.

❷ **Basic Requirements for Type 1 Coordination:** Under the short-circuit condition, the starter shall cause no danger to persons or to the installation. The starter may not be suitable for further service without repair or replacement of parts. For further details, see UL 508/CSA C22.2 No. 14 and EN 60947-4-2.

❸ **Non-time Delay Fuses:** Class K5 up to 600 A, Class L above 600 A.

❹ **Time Delay Fuses:** Devices rated 90…180 A (155 …311 A): Class RK5. Devices rated 210…520 A (363…900 A): Class RK5 or Class J up to 600 A, Class L above 600 A

❺ **UL/CSA (Type 1) & EN 60947-4-2 (Type 1) for Line-Connected Motors:** Suitable for use on a circuit capable of delivering not more than the listed maximum RMS symmetrical amperes (UL: 600V maximum, IEC: 690V maximum).

❻ **UL/CSA applications** = 30kA, 600V maximum. **IEC applications** = 18kA, 690V maximum

❼ **UL/CSA (Type 1) & EN 60947-4-2 (Type 1) for Inside-the-Delta Connected Motors:** Suitable for use on a circuit capable of delivering not more than the listed maximum RMS symmetrical amperes (UL: 600V maximum, IEC: 600V maximum)

Table 123 - SCCR List High Capacity Fault

SCPD Performance ❶			Type 1 Coordination ❷						
			Class J or Class L Fuse ❸			Inverse Time (Thermal Magnetic) Circuit Breaker ❹			
				Amps		480V, 65kA Maximum			
Motor Connection Type	Catalog Number	Current Rating [A]	Max. High Capacity Available Fault (600V) [kA]	Typical	Max.	140U Frame ❺	Max. Amps	Catalog Number ❺	Rating Plug
Line	150-SB1N*	90	100	150	200	M	350	140U-M6D3-D35	N/A
	150-SB2N*	110		175	225		300	140U-M6D3-D30	N/A
	150-SB3N*	140		225	300		400	140U-M6D3-D40	N/A
	150-SB4N*	180		300	400		400	140U-M6D3-D40	N/A
	150-SC1N*	210		350	450	M	600	140U-M6D3-D60	N/A
	150-SC2N*	260		450	500		700	140U-M6D3-D70	N/A
	150-SC3N*	320		500	700		800	140U-M6D3-D80	N/A
	150-SD1N*	361		601	800	N	1000	140U-N6L3-E12	140U-NRP3-E10
	150-SD2N*	420		700	800		1200	140U-N6L3-E12	140U-NRP3-E12
	150-SD3N*	520		800	1000		1200	140U-N6L3-E12	140U-NRP3-E12
Inside Delta	150-SB1N*	155	65	250	300	M	450	140U-M6D3-D45	N/A
	150-SB2N*	190		300	400		500	140U-M6D3-D50	N/A
	150-SB3N*	242		400	500		700	140U-M6D3-D70	N/A
	150-SB4N*	311		500	600		700	140U-M6D3-D70	N/A
	150-SC1N*	363		601	800	N	1000	140U-N6L3-E12	140U-NRP3-E10
	150-SC2N*	450		700	1000		1200	140U-N6L3-E12	140U-NRP3-E12
	150-SC3N*	554		800	1200		1200	140U-N6L3-E12	140U-NRP3-E12
	150-SD1N*	625		1000	1200	R	1600	140U-R6L3-E20	140U-R20RP3-E16
	150-SD2N*	727		1200	1600		2000	140U-R6L3-E20	140U-R20RP3-E20
	150-SD3N*	900		1200	2000		2000	140U-R6L3-E20	140U-R20RP3-E20

❶ Consult local codes for proper sizing of short-circuit protection

❷ **Basic Requirements for Type 1 Coordination:** Under the short-circuit condition, the starter shall cause no danger to persons or to the installation. The starter may not be suitable for further service without repair or replacement of parts. For further details, refer to UL 508/CSA C22.2 No. 14 and EN 60947-4-2

❸ High Capacity fault ratings when used with time delay Class J or time delay Class L fuse

❹ Circuit breaker must be of the designated 140U Frame

❺ Other circuit breakers pending

Table 124 - Semiconductor Fusing and Type 2 Coordination Ratings

Catalog Number	Current Rating		I^2t Reference (10^3 A^2s)	Semiconductor (SCR) Fusing ❶ North America ❷❸		Type 2 Coordination Per EN 60947-4-2 ❸❹	
	Line ❺	Inside Delta ❻		Max. Available Fault (480V) [kA]	Fuse Part Number ❼	Max. Available Fault (500V) [kA]	Fuse Part Number ❼
150-SB1N*	90	155	92	65	A70QS150	65	6,9URD30*0200
150-SB2N*	110	190	95		A70QS175		6,9URD30*0200
150-SB3N*	140	242	100		A70QS200		6,9URD30*0250
150-SB4N*	180	311	106		A70QS250		6,9URD31*0315
150-SC1N*	210	363	200		A70QS350		6,9URD30*0315
150-SC2N*	260	450	238		A70QS400		6,9URD31*0400
150-SC3N*	320	554	320		A70QS450		6,9URD31*0450
150-SD1N*	361	625	1000		A70QS500		6,9URD31*0500
150-SD2N*	420	727	1100		A70QS600		6,9URD31*0630
150-SD3N*	520	900	1200		A70QS700		6,9URD31*0700

❶ Consult local codes for proper sizing of short-circuit protection

❷ Calculated only, NOT tested.

❸ Fuse size based on a start profile of 350% of the controller maximum current rating for 10 seconds. Contact Technical Support at raictechsupport@ra.rockwell.com or 440-646-5800 for applications with a longer start time or higher starting current.

❹ **Basic Requirements for Type 2 Coordination:** Per EN 60947-4-2 under short-circuit conditions, the device shall cause no danger to persons or installation and shall be suitable for further use.

❺ For Line Connected Motors, connect fuses to the SMC-50 in line with three-phase power terminals L1, L2, and L3

❻ For Delta Connected Motors, connect fuses to the SMC-50 inside the delta after terminals L1-T6, L2-T4, and L3-T5.

❼ Ferraz Shawmut - Mersen part number

Additional Specifications

Table 125 - Control Power Requirements (Max. Control Circuit Consumption)

Description	Current Range [A]	Control Voltage	
		100…240V AC	24V DC
Base Power Draw: Control Module with Heat Sink Fan ❶	90…180	150 VA	75 W
	210…320	150 VA	75 W
	361…520	300 VA	300 W
Option Power Adder ❷	Human Interface Module (HIM)	10 VA	2 W
	150-SM2❸	30 VA	4 W
	150-SM3	30 VA	4 W
	150-SM4	50 VA	2 W
	150-SM6❸	5 VA	1 W
	20-COMM-X❸	25 VA	4 W

❶ Heatsink fans are powered from the same source as the control module. The 100…240V AC fans can be either 110/120V AC or 220/240V AC (auto-configured).
❷ Add to Base power using the formula below to obtain total power requirements.
❸ Max. 1 of each option type per control module

Table 126 - Continuous Duty Power Structure Heat Dissipation at Rated Current

Description	Current Range [A]	Heat Dissipation [W]
Controller Rating [A]	90	270
	110	330
	140	420
	180	540
	210	630
	260	780
	320	960
	361	1083
	420	1260
	520	1560

Power Calculation

$$\text{Max. total power dissipation} = \underset{\text{Base Power}}{\underline{\qquad}} + \underset{\text{Options}}{\underline{\qquad}} + \underset{\text{Power Structure}}{\underline{\qquad}} \text{ Watts}$$

Example: 361 A device with a 20-COMM-X module, HIM, and Cat. No. 150-SM4

$$\text{Max. total power dissipation} = \underset{\text{Base Power}}{\underline{300}} + \underset{\text{Options}}{\underline{(25 + 10 + 50)}} + \underset{\text{Power Structure}}{\underline{1083}} \text{ Watts}$$

Max. total power dissipation = 1468 Watts

Table 127 - Additional Electrical Ratings

PTC Input Ratings (150-SM2 Required)	
Response Resistance	3400 Ω ± 150 Ω
Reset Resistance	1600 Ω ± 100 Ω
Short-Circuit Trip Resistance	25 Ω ± 10 Ω
Max. Voltage at PTC Terminals (R_{PTC} = 4 kΩ)	< 7.5V
Max. Voltage at PTC Terminals (R_{PTC} = open)	30V
Max. Number of Sensors (wired in series)	6
Max. Cold Resistance of PTC Sensor Chain	1500 Ω
Response TIme	800 mS

Table 128 - Environmental and Mechanical Specifications

Environmental			
Operating Ambient Temperature Range (surrounding air ambient)			-20...+40 °C (-4...+104 °F) (no derating) — For operation at 40 °C...65 °C (104...149 °F); see Thermal Wizard.
Storage & Transportation Temperature Range			-25...+75 °C (-13...+167 °F)
Altitude			2000 m (6560 ft.) without derating — For operation at 2000...7000 m (6560...22965 ft.), see Thermal Wizard.
Humidity			5...95% (non-condensing)
Pollution Degree			2
Mounting Position			Vertical
Atmospheric Protection			ANSI/ISA - 71.04-2013; Class G3 Environment
Mechanical			
Resistance to Vibration	Operational	90...520 A	1.0 G Peak, 0.15 mm (0.006 in.) displacement
	Non-Operational		2.5 G Peak, 0.38 mm (0.015 in.) displacement
Resistance to Shock	Operational	90...520 A	15 G
	Non-Operational		30 G
Construction	Power Poles		Heatsink Hockey Puck Thyristor Modular Design
	Control Modules		Thermoset & Thermoplastic moldings
	Metal Parts		plated brass, copper, or steel
Terminals	Power Terminal Lugs	90...180 A	one ∅10.5 mm (0.41 in.) hole per power pole
		210…320 A	two ∅10.5 mm (0.41 in.) holes per power pole
		361…520 A	two ∅13.5 mm (0.53 in.) holes per power pole
	Power Terminal Markings		NEMA, CENELEC EN50 012
	Control Terminals	M3 screw clamp	clamping yoking connection

Table 129 - Other Specifications

Other — EN/IEC			
EMC Emission Levels	Conducted Radio Frequency Emissions	Class A (per EN 60947-4-2)	
	Radiated Emissions		
EMC Immunity Levels	Electrostatic Discharge	8 kV air discharge	
	Radio Frequency Electromagnetic Field	per EN 60947-4-2	
	Fast Transient		
	Surge Transient		
Overload Characteristics		Line	Delta
Current Range	90	30...90	52...155
	110	37...110	65...180
	140	47...140	82...242
	180	60...180	104...311
	210	70…210	122…363
	260	87…260	151…450
	320	107…320	186…554
	361	120…361	210…625
	420	140…420	243…727
	520	174…520	302…900
Overload Type		electronic — using an I^2t algorithm	
Trip Classes		5 to 30	
Trip Current Rating		118% of motor FLC	
Number of Poles		3	
Certifications	Open-Type Controllers	CE marked for low voltage directive 73/23/EEC, 93, 68, EEC UL Listed (File No. E96956)	

Parameter Information

SMC-50 Information

Table 130 - Parameter 1…18

Number	Name		Units	Min./Max. [Default]	Enum Text	Description	Read/Write Access
1	Volts Phase	PP Ave	Volt	0/700 [0]	NA	Displays the calculated average voltage of the applied three phase to phase line voltages being measured by the SMC-50.	R
2		A-B				Displays the Phase A to Phase B voltage applied to the SMC at the supply terminals.	
3		B-C				Displays the Phase B to Phase C voltage applied to the SMC at the supply terminals.	
4		C-A				Displays the Phase C to Phase A voltage applied to the SMC at the supply terminals.	
5	Current Phase	Ave	Amps	0/15000 [0]	NA	Displays the average of the three phase currents flowing through the SMC Power section to the load.	R
6		A				Displays the Current flowing through the Phase A power pole of the SMC Power section to the load.	
7		B				Displays the Current flowing through the Phase B power pole of the SMC Power section to the load.	
8		C				Displays the Current flowing through the Phase C power pole of the SMC Power section to the load.	
9	Torque		%	-5.0/30.0 [0.0]	NA	Displays the true electromechanical torque calculated based on current and voltage feedback. In order for this reading to display correctly the value for Rated Torque parameter must be set.	R
10	Real Power		MW	-1000.000/1000.00 [0.000]	NA	Displays the total Real Power.	R
11	Real Energy		MWH	-1000.000/1000.00 [0.000]	NA	Displays the Real Energy, where Real Energy equal to Real Power X Time. This parameter is updated every 1/10 of an hour (6 minutes).	R
12	Elapsed Time		Hours	0.0/50000.0 [0.0]	NA	Displays the elapsed motor running time since the last reset of the Elapsed timer by the user.	R
13	Elapsed Time 2		Hours	0.0/50000.0 [0.0]	NA	Displays the elapsed motor running time since the control module was manufactured.	R
14	Running Time		Hours	0.0/50000.0 [0.0]	NA	Displays the time the motor has been running since the last start command. This value will go to zero when a motor is restarted after a stop command or fault.	R
15	Energy Savings		%	0/100 [0]	NA	Displays the energy saving when the energy saving mode is enabled.	R
16	Meter Reset		—	0/4 [0]	—	Provides the user the ability to reset various timers and counters by selecting the appropriate reset option.	R/W
					Ready	Ready state of parameter, waiting for selection.	
					Elapsed Timer	Zero the elapsed timer.	
					Time to PM	Resets the Time to PM timer to the value set in parameter PM Hours (126).	
					Starts to PM	Reset the Starts to PM counter to the value set in parameter PM Starts (127).	
17	Power Factor		—	-1.00/1.00 [0.00]	NA	Displays the Cosine of the phase angle between the voltage and current. A positive values is leading and negative value is lagging.	R
18	Motor Therm Usage		%MTU	0/200 [0]	NA	Displays the thermal capacity utilized in the motor overload algorithm. A value of 100% will result in a motor overload fault. This value can go over 100% depending on the rate at which the motor is heating before an overload trip.	R

Table 131 - Parameter 19…42

Number	Name		Units	Min./Max. [Default]	Enum Text	Description	Read/Write Access
19	Time to OL Trip		Secs	0/1000 [0]	NA	Displays the estimated time before an overload trip will occur if the present operating conditions persist. If operating below ultimate trip current the value will display the max value.	R
20	Time to OL Reset		Secs	0/1000 [0]	NA	Displays the estimated time until the motor overload fault can be reset. The MTU reset level is set by the OL reset parameter (80).	R
21	Time to PM		Hrs	0/1000 [0]	NA	Displays the estimated time to a preventive maintenance event if enabled. The scheduled time for a PM event is set by the user via the PM Hours parameter (126).This value can be reset by the user after an event via the meter reset parameter (16).	R
22	Starts to PM		—	0/50000 [0]	NA	Displays the estimated number of starts to a PM event if enabled. The scheduled number of starts for a PM event is set by the user via the PM Starts parameter (127).This value can be reset by the user after an event via the meter reset parameter (16).	R
23	Total Starts		—	0/30000 [0]	NA	Displays the total number of SMC starts. The SMC keeps a Start Counter which will be incremented each time the SMC is started. This parameter cannot be reset by the customer and leaves the factory with a value of 0.	R
24	Start Time	1	Secs	0/1000 [0]	NA	Displays the measured start time of the previous start.	R
25		2				Displays the measured start time of the 2nd previous start.	
26		3				Displays the measured start time of the 3rd previous start.	
27		4				Displays the measured start time of the 4th previous start.	
28		5				Displays the measured start time of the 5th previous start.	
29	Peak Current	1	Amps	0/150000 [0]	NA	Displays the measured peak current of the previous start.	R
30		2				Displays the measured peak current of the 2nd previous start.	
31		3				Displays the measured peak current of the 3rd previous start.	
32		4				Displays the measured peak current of the 4th previous start.	
33		5				Displays the measured peak current of the 5th previous start.	
34	Motor Speed		%	0/100 [0]	NA	Displays the estimated motor speed during starting and stopping. This parameter is only valid when using the linear speed starting or linear speed stopping modes.	R
35	THD ❶ Va		%	0/1000.0 [0]	NA	Measures the THD of the applied Phase A line voltage.	R
36	THD Vb					Measures the THD of the applied Phase B line voltage.	
37	THD Vc					Measures the THD of the applied Phase C line voltage.	
38	THD Vave					Displays the calculated average of the three voltage THD measurements.	
39	THD ❶ Ia		%	0/1000.0 [0]	NA	Measures the THD of the applied Phase A current.	R
40	THD Ib					Measures the THD of the applied Phase B current.	
41	THD Ic					Measures the THD of the applied Phase C current.	
42	THD Iave					Displays the calculated average of the three current THD measurements.	

❶ THD = A Power Quality measurement that provides the ability to measure total harmonic distortion levels.

Table 132 - Parameter 43…51

Number	Name	Units	Min./Max. [Default]	Enum Text	Description	Read/Write Access
43	Product Status	—	0/65535 [0]	—	The product Logic Status is made available to all DPI devices and is also available as a bit enumerated parameter "Product Status". The bits in this parameter correspond with the bits in the Product Logic Status defined for DPI.	R
				bit 0 = Enabled/Ready	1 – Ready 0 – Not Ready	
				bit 1 = Running	1 – Power Applied to Motor (Gating SCRs or Bypass closed) 0 – Power NOT Applied to Motor	
				bit 2 = Phasing	1 – ABC Phasing 0 – CBA Phasing	
				bit 3 = Phasing Active	1 – 3-phase is valid 0 – No valid 3-phase detected	
				bit 4 = Starting (Accel)	1 – Performing a Start Maneuver (slow speed not included) 0 – Not Performing a Start Maneuver	
				bit 5 = Stopping (Decel)	1 – Performing a Stop Maneuver (coast to stop not included) 0 – Not Performing a Stop Maneuver	
				bit 6 = Alarm	1 – Alarm Present 0 – No Alarm Present	
				bit 7 = Fault	1 – Fault Condition Exists and hasn't been cleared 0 – No Fault Condition	
				bit 8 = At Speed	1 – Full Voltage Applied (Bypass or full SCR conduction) 0 – Not Full Voltage Applied	
				bit 9 = Start/Isolate	1 – Start/Isolate Contactor Enabled 0 – Start/Isolate Contactor Disabled	
				bit 10 = Bypass	1 – Bypass Contactor Enabled 0 – Bypass Contactor Disabled	
				bit 11 = Ready	1 indicates that the SMC is ready to accept a Start command. The device is not faulted or in the process of stopping, starting or jogging.	
				bit 12 - 13 = Reserved	Always 0.	
				bit 14 = Input #1	Control Module Input #1 Status. 1 = Input Closed.	
				bit 15 = Input #2	Control Module Input #2 Status. 1 = Input Closed.	
44	Motor Config	—	0/2 [2]	Line Delta [Auto]	Provides the user the ability to select the type of motor connection the SMC is being applied to, 'Line' or 'Delta'. It can also be set to 'Auto Config' and the SMC will determine the motor connection.	R/W
45	Motor Connection	—	0/1 [0]	[Line] Delta	Displays the type of motor connection the SMC is configured to operate with.	R
46	Line Voltage	Volt	0/700 [480]	NA	The Line voltage applied to the SMC L1, L2, L3 terminals.	R/W
47	Rated Torque	Nm	0/10000 [10]	NA	Enables the user the ability to enter the rated torque of the motor as read from the motor specifications (typically nameplate). This is required for proper torque mode starts and stops.	R/W
48	Rated Speed	RPM	0/5 [3]	750, 900, 1500, [1800], 3500, 3600	Enables the user the ability to enter the rated motor speed as read from the motor specifications (typically nameplate). This is required for proper torque mode starts and stops.	R/W
49	Starting Mode	—	0/5 [2]		Used to program the SMC controller for the type of starting mode that best fits the application.	R/W
				Full Voltage	Apply full voltage to the motor at start.	
				Current Limit	Apply limited current for a programmed period of time.	
				[Soft Start]	Slowly increase current to load over a programmed period of time.	
				Linear Speed	Increase current to cause a linear acceleration of the motor.	
				Torque Ramp	Slowly increase torque generated by motor over fixed period of time.	
				Pump Start	Special starting algorithm for pump applications.	
50	Ramp Time	Sec	0.0/1000.0 [10.0]	NA	Enables the user the ability to configure the time period during which the controller will ramp the output voltage.	R/W
51	Initial Torque	%LRT	0/90 [70]	NA	The initial reduced voltage output level for the voltage ramp is established and adjusted with this parameter.	R/W

Table 133 - Parameter 52…57

Number	Name	Units	Min./Max. [Default]	Enum Text	Description	Read/Write Access
52	Max. Torque	%	0/300 [250]	NA	Gives the user ability to configure the maximum torque limit of a torque ramp during a torque start operation.	R/W
53	Cur Limit Level	%FLC	50/600 [350]	NA	The current limit level that is applied for the ramp time selected.	R/W
54	Kickstart Time	SEC	0.0/2.0 [0.0]	NA	A boost of current is applied to the motor for this programmed time.	R/W
55	Kickstart Level	%LRT	0/90 [0]	NA	Gives the user the ability to adjust the amount of current boost applied to the motor during the kickstart period.	R/W
56	Input 1	—	0/13 [4]	—	Allows the user to select the operation of Terminal 11, Input 1 on the control module.	R/W
				Disable	Disable the input - ignores any assertion to Input 1, Terminal 11.	
				Start	Initiates a start as set up by the start parameters at Input 1, Terminal 11 (High).	
				Coast	Initiates a coast stop.- no current to motor at Input 1, Terminal 11 (Low).	
				Stop Option	Initiates a stop maneuver as set up by the stopping parameters at Input 1 (Low).	
				[Start/Coast]	if Input 1 = 0 - Stops motor 1- Initiates a start as set up by the start parameters	
				Start/Stop	if Input 1 = 0- Initiates a stop maneuver as set up by stopping parameters 1- Initiates a start as set up by the start parameters	
				Slow Speed	Runs motor in slow speed mode as set up by slow speed parameters (High).	
				Dual Ramp	if Input 1 = 0 - Use starting mode 1 1 - Use starting mode 2	
				OL Select	if Input 1 = 0 - Use Motor Overload Class 1 1 - Use Motor Overload Class 2	
				Fault	A fault condition forced if Input 1= 1.	
				Fault NC	A fault condition forced if Input 1 = 0.	
				Clear Fault	Clear a fault from input 1 Terminal 11 (High).	
				Emerg Run	Allow motor to run in emergency run mode if asserted from Input 1, Terminal 11 - does not start motor (High).	
				Motor Heater	Run motor heating algorithm if asserted from Input 1, Terminal 11 (High).	
57	Input 2	—	0/13 [0]	—	Allows the user to select the operation of Terminal 10, Option Input 2, on the control module.	R/W
				[Disable]	Disable the input - ignores any assertion to Input 2 Terminal 10.	
				Start	Initiate a start as set up by the start parameters at Input 2 Terminal 10 (High).	
				Coast	Initiates a coast stop.- no current to motor at Input 2 Terminal 10 (Low).	
				Stop Option	Initiates a stop maneuver as set up by the stopping parameters at Input 2 (Low).	
				Start/Coast	If Input 2= 0 - Stops motor 1- Initiate a start as set up by the start parameters	
				Start/Stop	If Input 2 = 0- Initiate a stop maneuver as set up by stopping parameters 1- Initiate a start as set up by the start parameters	
				Slow Speed	Runs motor in slow speed mode as set up by slow speed parameters (High).	
				Dual Ramp	If Input 2= 0 - Use Starting Mode 1 1 - Use Starting Mode 2	
				OL Select	If Input 2 = 0 - User Motor Overload Class 1 1 - Use Motor Overload Class 2	
				Fault	A fault condition is forced if Input 2= 1.	
				Fault NC	A fault condition is forced if Input 2 = 0.	
				Clear Fault	Clear a fault from Input 2 (High).	
				Emerg Run	Allow motor to run in emergency run mode if asserted on Input 2 - does not start motor (High).	
				Motor Heater	Run motor heating algorithm if asserted at Input 2 (High).	

Table 134 - Parameter 58…71

Number	Name	Units	Min./Max. [Default]	Enum Text	Description	Read/Write Access
58	Starting Mode 2	—	0/5 [2]	—	Allows the user to program an alternate starting mode for the SMC-50 that suits the application.	R/W
				Full Voltage	Apply full voltage to the motor at start.	
				Current Limit	Apply limited current for a programmed period of time.	
				[Soft Start]	Slowly increase current to load over a programmed period of time.	
				Linear Speed	Increase current to cause a linear acceleration of the motor.	
				Torque Ramp	Slowly increase torque generated by the motor over a fixed period of time.	
				Pump Start	Special starting algorithm for pump applications.	
59	Ramp Time 2	Sec	0.0/1000.0 [10.0]	NA	Allows the user to set an alternate time period during which the controller will ramp the output voltage.	R/W
60	Initial Torque 2	%LRT	0/90 [70]	NA	Allows the user to set an alternate initial reduced voltage output level for the voltage ramp.	R/W
61	Max. Torque 2	%	0/300 [250]	NA	Allows the user to set a alternate maximum torque limit of a torque ramp during a torque start operation.	R/W
62	Cur Limit Level 2	%FLC	50/600 [350]	NA	Allows the user to set an alternate current limit level that is applied for the ramp time selected.	R/W
63	Kickstart Time 2	Sec	0/2 [0]	NA	Allows the user to set an alternate boost current to be applied to the motor for the programmed time.	R/W
64	Kickstart Level 2	%LRT	0/90 [0]	NA	Allows the user to set an alternate adjustment of the amount of current applied to the motor during the kickstart period.	R/W
65	Stop Mode	—	0/5 [0]	—	Allows the user to program the SMC-50 for the type of stopping that best suits the application.	R/W
				[Coast]	Coast-to-Rest	
				Soft Stop	Slowly reduces current by reducing voltage applied to the motor over a programmed period of time.	
				Linear Speed	Stops the motor following a linear speed ramp over a programmed period of time.	
				Pump Stop	Slowly reduces current by reducing voltage applied to the motor using the pump stop algorithm over a programmed period of time.	
				SMB	Brakes the motor to a stop using an SCR firing pattern to create current flow to brake the motor per the configuration of the braking parameters.	
				External Brake	Closes an external contactor to apply braking current to the motor.	
66	Stop Time	Sec	0/999 [0]	NA	Sets the time period which the controller will ramp the voltage during a stopping maneuver.	R/W
67	Backspin Timer	Sec	0/999 [0]	NA	Avoids starting into a backspin condition. The timer begins counting after a stop is completed (coast, stop maneuver, fault etc). All start inputs will be ignored until the backspin timer has timed out.	R/W
68	Pump Pedestal	%	0/50 [0]	NA	Provides the ability to adjust the pump algorithm slightly for different applications. Typically, this is used to shorten the ramp time before the SMC-50 starts to get aggressive in its pump stopping maneuver.	R/W
69	Braking Current	%FLC	0/400 [0]	NA	Provides the ability to program the intensity of the braking current applied to the motor.	R/W
70	Load Type	—	0/3 [0]		Identifies the load type to enable appropriate braking algorithms.	R/W
				Standard	—	
				High Inertia	—	
				High Friction	—	
				Ramp 89	Special braking mode that reduces braking torques.	
71	High Eff Brake	%	0/99 [0]	NA	Adds additional time to a braking sequence after the SMC-50 detects a zero speed condition that indicates the end of the braking sequence. Can adjust if additional time is needed to stop the load.	R/W

Table 135 - Parameter 72…94

Number	Name	Units	Min./Max. [Default]	Enum Text	Description	Read/Write Access
72	Slow Speed	%	-15/15 [10]	NA	Allows the user to program the slow speed that best suits the application.	R/W
73	Slow Brake Cur	%FLC	0/350 [0]	NA	Provides braking from slow speed. If set to 0, no braking will be provided. Any other setting will result in motor braking when the slow speed operation is terminated.	R/W
75	Overload Class	—	5/30 [10]	NA	Sets the desired trip class of internal solid state overload. Overload fault and alarms are enabled and disabled in the Starter Fault En and Starter Alarm parameters.	R/W
76	Overload Class 2	—	5/30 [10]	NA	Allows user to set the internal solid state overload to an alternate trip class. This Trip Class is used when an input (configured as overload select) is asserted.	R/W
77	Service Factor	—	0.01/1.990 [1.15]	NA	Parameter to enter the value of the motor's service factor from the nameplate.	R/W
78	Motor FLC	Amps	1.0/2200.0 [1.0]	NA	Parameter to enter the Full Load Current (FLC) value from the motor's nameplate.	R/W
79	Motor FLC 2	Amps	1.0…2200.0 [1.0]	N/A	Second motor FLC setting to be used when Overload #2 is selected using the "Overload 2" input.	R/W
80	OL Reset Level	%MTU	1/99 [75]	NA	When the level of Motor Thermal Usage (MTU) drops below this limit after an OL fault, an overload reset can occur. If restart is enabled, the motor overload will automatically reset when the MTU drops below this level	R/W
81	OL Shunt Time	Secs	0/999 [0]	NA	Disables the overload from incrementing MTU for the selected time period after a start or stop command is initiated.	R/W
82	OL Inhibit Time	Secs	0/999 [0]	NA	Disables the overload from tripping during slow speed and stopping maneuvers. The MTU. Therm Usage continues to increment during these maneuvers.	R/W
83	Overload A Level	%MTU	0/100 [90]	NA	The MTU level that will set off an alarm when exceeded. The Overload bit the Motor Alarm En parameter must be set to signal an alarm.	R/W
84	Locked Rtr F Lvl	%FLC	400/1000 [600]	NA	The peak phase current to the load that, if exceeded for the time period defined in Locked Rtr Delay, will signal a fault. The Locked Rotor bit in the Motor Fault En parameter must be set to signal a fault.	R/W
85	Locked Rtr F Dly	Secs	0.1/100.0 [0.1]	NA	The time period that the peak phase current exceeds the Locked Rtr F Level to signal a fault. The Locked Rotor bit in the Motor Fault En parameter must be set to signal a fault.	R/W
86	Underload F Lvl	%FLC	0/99 [0]	NA	If phase current drops below this level for the period of time set in Underload F Dly parameter, an Underload Fault will be signaled. The Underload bit in the Motor Fault En parameter must be set to signal a fault.	R/W
87	Underload F Dly	Secs	0.1/99.0 [0.1]	NA	The time period that the phase current must be below the level set in the Underload F Level parameter before a underload fault is signaled. The Underload bit in the Motor Fault En parameter must be set to signal a fault.	R/W
88	Underload A Lvl	%FLC	0/99 [0]	NA	If phase current drops below this level for the period of time set in Underload A Dly parameter, an Underload Alarm will be signaled. The Underload bit in the Motor Alarm En parameter must be set to signal a alarm.	R/W
89	Underload A Dly	Secs	0.1/99.0 [0.1]	NA	The time period that the phase current must be below the level set in the Underload A Level parameter before an Underload Alarm is signaled. The Underload bit in the Motor Alarm En parameter must be set to signal a alarm.	R/W
90	MWatts Ov F Lvl	MW	0.000/1000.00 [0.000]	NA	If the Real Power exceeds this level for the time period set in MWatts Ov F Dly parameter, an MWatts Ov fault will be signaled. The MWatts Ov bit in the Motor Fault En parameter must be set to signal a fault.	R/W
91	MWatts Ov F Dly	Secs	0.1/99.0 [0.1]	NA	The time period that Real Power must exceed MWatts Ov F Lvl to signal a fault. The MWatts Ov bit in the Motor Fault En parameter must be set to signal fault.	R/W
92	MWatts Ov A Lvl	MW	0.000/1000.00 [0.000]	NA	If the Real Power exceeds this level for the time period set in MWatts Ov A Dly parameter, a MWatts Ov Alarm will be signaled. The MWatts Ov bit in the Motor Alarm En parameter must be set to signal an alarm.	R/W
93	MWatts Ov A Dly	Secs	0.1/99.0 [0.1]	NA	The time period that Real Power must exceed MWatts Ov A Lvl to signal an alarm. The MWatts Ov bit in the Motor alarm En parameter must be set to signal an alarm.	R/W
94	MWatts Un F Lvl	MW	0.000/1000.00 [0.000]	NA	If the Real Power drops below this level for the time period set in MWatts Un F Dly parameter, an MWatts Un Fault will be signalled. The MWatts Un bit in the Motor Fault En parameter must be set to signal a fault.	R/W

Table 136 - Parameter 95…113

Number	Name	Units	Min./Max. [Default]	Enum Text	Description	Read/Write Access
95	MWatts Un F Dly	Secs	0.1/99.0 [0.1]	NA	The time period that Real Power must drop below MWatts Un F Lvl to signal a fault. The MWatts Un bit in the Motor Fault En parameter must be set to signal a fault.	R/W
96	MWatts Un A Lvl	MW	0.000/1000.00 [0.000]	NA	If the Real Power drops below this level for the time period set in MWatts Un A Dly parameter, an MWatts Un Alarm will be signaled. The MWatts Un bit in the Motor Alarm En parameter must be set to signal an alarm.	R/W
97	MWatts Un A Dly	Secs	0.1/99.0 [0.1]	NA	The time period that Real Power must drop below MWatts Un A Level to signal an alarm. The MWatts Un bit in the Motor Alarm En parameter must be set to signal an alarm.	R/W
98	Undervolt F Lvl	%V	0/100 [90]	NA	If the average three phase line voltage drops below this level for the time period set in the Undervolt F Dly parameter, an Undervolt fault will be signaled. The Undervolt bit in the Starter Fault En parameter must be set to signal a fault.	R/W
99	Undervolt F Dly	Secs	0.1/99.0 [3.0]	NA	The time period that the average three phase voltage must remain below Undervolt F Level to signal a fault. The Undervolt bit in the Starter Fault En parameter must be set to signal a fault.	R/W
100	Undervolt A Lvl	%V	0/100 [90]	NA	If the average three phase line voltage drops below this level for the time period set in the Undervolt A Dly parameter, an Undervolt Alarm will be signaled. The Undervolt bit in the Starter Alarm En parameter must be set to signal an Alarm.	R/W
101	Undervolt A Dly	Secs	0.1/99.0 [3.0]	NA	The time period that the average three phase voltage must remain below Undervolt A Lvl to signal an Alarm. The Undervolt bit in the Starter Alarm parameter must be set to signal an Alarm.	R/W
102	Overvolt F Lvl	%V	100/199 [110]	NA	If the average three phase line voltage exceed this level for the time period set in the Overvolt F Dly parameter, an Overvolt fault will be signaled. The Overvolt bit in the Starter Fault En parameter must be set to signal a fault.	R/W
103	Overvolt F Dly	Secs	0.1/99.0 [3.0]	NA	The time period that the average three phase voltage must exceed the Overvolt F Level to signal a fault. The Overvolt bit in the Starter Fault En parameter must be set to signal a fault.	R/W
104	Overvolt A Lvl	%V	100/199 [110]	NA	If the average three phase line voltage exceed this level for the time period set in the Overvolt A Dly parameter, an Overvolt alarm will be signaled. The Overvolt bit in the Starter Alarm parameter must be set to signal an alarm.	R/W
105	Overvolt A Dly	Secs	0.1/99.0 [3.0]	NA	The time period that the average three phase voltage must exceed the Overvolt A Level to signal an alarm The Overvolt bit in the Starter alarm En parameter must be set to signal a alarm.	R/W
106	Volt Unbal F Lvl	%	1/25 [15]	NA	If the line-to-line voltage imbalance condition exceeds the Volt Unbal F Lvl for the period set in Volt Unbal F Dly, a fault will be signalled. The Volt Unbal bit must be set in the Starter Fault En parameter to signal a fault. See manual for details on imbalance calculations.	R/W
107	Volt Unbal F Dly	Secs	0.1/99.0 [3.0]	NA	The time period that the voltage imbalance exceeds the Volt Unbal F Lvl to signal a fault. The Volt Unbal bit in the Starter Fault En parameter must be set to signal a fault.	R/W
108	Volt Unbal A Lvl	%	1/25 [15]	NA	If the line-to-line voltage imbalance condition exceeds the Volt Unbal A Lvl for the time period set in Volt Unbal A Dly, an alarm will be signalled. The Volt Unbal bit must be set in the Starter Alarm parameter to signal a alarm. See manual for details on imbalance calculations.	R/W
109	Volt Unbal A Dly	Secs	0.1/99.0 [3.0]	NA	The time period that the voltage imbalance exceeds the Volt Unbal A Level to signal a alarm. The Volt Unbal bit in the Starter Alarm parameter must be set to signal a alarm.	R/W
110	Cur Imbal F Lvl	%	1/25 [15]	NA	If the line-to-line current imbalance condition exceeds the Cur Imbal F Lvl for the time period set in Cur Imbal F Dly, a fault will be signalled. The Cur Imbal bit must be set in the Motor Fault En parameter to signal a fault.	R/W
111	Cur Imbal F Dly	Secs	0.1/99.0 [3.0]	NA	The time period that the current imbalance exceeds the Cur Imbal F Lvl to signal a fault. The Cur Imbal bit in the Motor Fault En parameter must be set to signal a fault.	R/W
112	Cur Imbal A Lvl	%	1/25 [15]	NA	If the line-to-line current imbalance condition exceeds the Cur Imbal A Lvl for the time period set in Cur Imbal A Dly, an alarm will be signalled. The Cur Imbal bit must be set in the Motor Alarm En parameter to signal a Alarm.	R/W
113	Cur Imbal A Dly	Secs	0.1/99.0 [3.0]	NA	The time period that the current imbalance exceeds the Cur Imbal A Lvl to signal an alarm. The Cur Imbal bit in the Motor Alarm En parameter must be set to signal an alarm.	R/W

Table 137 - Parameter 114…134

Number	Name	Units	Min./Max. [Default]	Enum Text	Description	Read/Write Access
114	Jam F Lvl	%FLC	0/1000 [1000]	NA	If the peak phase current exceeds the Jam F Lvl for the time period set in Jam F Dly, a fault will be signaled. The Jam bit must be set in the Motor Fault En parameter to signal a fault.	R/W
115	Jam F Dly	Secs	0.1/99.0 [0.1]	NA	The time period that the peak phase current exceeds the Jam F Lvl to signal a fault. The Jam bit in the Motor fault En parameter must be set to signal a fault.	R/W
116	Jam A Lvl	%FLC	0/1000 [1000]	NA	If the peak phase current exceeds the Jam A Lvl for the time period set in Jam A Dly, an alarm will be signaled. The Jam bit must be set in the Motor Alarm En parameter to signal a alarm.	R/W
117	Jam A Dly	Secs	0.1/99.0 [0.1]	NA	The time period that the peak phase current exceeds the Jam A level to signal an alarm. The Jam bit in the Motor Alarm En parameter must be set to signal a alarm.	R/W
118	THD V F Lvl	%	0/1000 [1000]	NA	If the average total harmonic distortion (THD) on the line voltage exceeds the THD V F Lvl for the time period set in THD V F Dly, a fault will be signaled. The THD V bit must be set in the Starter Fault En parameter to signal a fault.	R/W
119	THD V F Dly	Secs	0.1/99.0 [0.1]	NA	The time period that the average THD on the line voltage exceeds the THD V F Lvl to signal a fault. The THD V bit in the Starter Fault En parameter must be set to signal a fault.	R/W
120	THD V A Lvl	%	0/1000 [1000]	NA	If the average THD on the line voltage exceeds the THD V A Lvl for the time period set in THD V Dly, an alarm will be signaled. The THD V bit must be set in the Starter Alarm parameter to signal a alarm.	R/W
121	THD V A Dly	Secs	0.1/99.0 [0.1]	NA	The time period that the average THD on the line voltage exceeds the THD V A Lvl to signal a alarm. The THD V bit in the Starter Alarm parameter must be set to signal an alarm.	R/W
122	THD I F Lvl	%	0/1000 [1000]	NA	If the average THD on the phase current exceeds the THD I F Lvl for the period set in THD I F Dly, a fault will be signalled. The THD I bit must be set in the Motor Fault En parameter to signal a fault.	R/W
123	THD I F Dly	Secs	0.1/99.0 [0.1]	NA	The time period that the average THD on the phase current exceeds the THD I F Lvl to signal a fault. The THD I bit in the Motor Fault En parameter must be set to signal a fault.	R/W
124	THD I A Lvl	%	0/1000 [1000]	NA	If the average THD on the phase current exceeds the THD I A Lvl for the time period set in THD I A Dly, an alarm will be signaled. The THD I bit must be set in the Motor Alarm En parameter to signal an alarm.	R/W
125	THD I A Dly	Secs	0.1/99.0 [0.1]	NA	The time period that the average THD on the phase current exceeds the THD I A Lvl to signal an alarm. The THD I bit in the Motor Alarm En parameter must be set to signal an alarm.	R/W
126	PM Hours	Hrs	1/100 [1000]	NA	This is a counter the user can set to generate an alarm or fault to signal a need for preventive maintenance. The Hours to PM parameter is initialized to this value and counts down when the motor is running.	R/W
127	PM Starts	—	1/50000 [100]	NA	This is a counter the user can set to generate an alarm or fault to signal a need for preventive maintenance. The Starts to PM parameter is initialized to this value and counts down each time the motor is started.	R/W
128	Starts per Hour	—	1/99 [99]	NA	The user can program the maximum number of starts within a sliding one-hour window. Once the number of starts per hour is reached any additional starts will cause a fault.	R/W
129	Freq High F Lvl	Hz	45/66 [63]	NA	The highest line voltage frequency that can be applied to the SMC-50 before causing a Freq High F Lvl fault. The Freq High bit in the Starter Fault En parameter must be set to signal a fault.	R/W
130	Freq Low F Lvl	Hz	45/66 [47]	NA	The lowest line voltage frequency that can be applied to the SMC-50 before causing a Freq Low F Lvl fault.The Freq Low bit in the Starter Fault En parameter must be set to signal a fault.	R/W
131	Freq High A Lvl	Hz	45/66 [63]	NA	The highest line voltage frequency that can be applied to the SMC-50 before causing a Freq High F Lvl alarm. The Freq High bit in the Starter Alarm parameter must be set to signal an alarm.	R/W
132	Freq Low A Lvl	Hz	45/66 [47]	NA	The lowest line voltage frequency that can be applied to the SMC-50 before causing a Freq Low F Lvl alarm. The Freq Low bit in the Starter Alarm parameter must be set to signal an alarm.	R/W
133	Restart Attempts	—	0/5 [0]	NA	Allows the user to enable the SMC-50 to auto-restart for up-to five attempts after a thyristor has failed to fire and results in an open gate fault trip.	R/W
134	Restart Dly	Secs	0/60 [0]	NA	Provides a delay time prior to the SMC-50's attempt to restart the motor after a fault.	R/W

Table 138 - Parameter 135…148

Number	Name		Units	Min./Max. [Default]	Enum Text	Description	Read/Write Access
135	Strtr Restart En		—	0	Volt Unbal	Allows the user to select which type of fault that the SMC-50 can try to restart from once the restart delay period has expired. To enable a restart from a fault, the function must be selected (1). Restart Attempts, Parameter 133, and Restart Delay, Parameter 134, must be configured.	R/W
					Overvoltage		
					Undervoltage		
					Phase Rev		
					Line Loss		
					Open Gate		
					Config Change		
					Freq		
					THD V		
				Future	Future		
136	Starter Fault En		—	0	Volt Unbal	Allows the user to enable faults associated with the control module. The bit for a fault must be set (1) for the fault to be asserted.	R/W
				0	Overvoltage		
				0	Undervoltage		
				0	Phase Rev		
				[1]	Line Loss		
				[1]	Open Gate		
				0	Config Change		
				0	Freq		
				0	THD V		
137	Starter Alarm En		—	0	Volt Unbal	Allows the user to enable alarms associated with the control module. The bit for an alarm must be set (1) for the alarm to be asserted.	R/W
					Overvoltage		
					Undervoltage		
					Phase Rev		
					Line Loss		
					Open Gate		
					Config Change		
					Freq		
					THD V		
138	Fault	1	—	0/1000 [0]	NA	First entry in the fault buffer and is the most recent fault to have occurred.	R/W
139		2				Second entry in the fault buffer.	
140		3				Third entry in the fault buffer.	
141		4				Fourth entry in the fault buffer.	
142		5				Fifth entry in the fault buffer. The oldest fault displayed in the fault buffer.	
143	Alarm	1	—	0/1000 [0]	NA	First entry in the alarm buffer and is the most recent alarm to have occurred.	R/W
144		2				Second entry in the alarm buffer.	
145		3				Third entry in the alarm buffer.	
146		4				Fourth entry in the alarm buffer.	
147		5				Fifth entry in the alarm buffer. There can be up to 100 events stored in the alarm buffer. To see the whole buffer, go the diagnostics tab on the HIM or DriveExplorer.	
148	Logic Mask		—	0/65535 [0]	NA	The bits in this parameter allow the user to enable (bit=1) or disable (bit=0) which DPI ports the SMC-50 will accept Start and Maneuver commands from. Coast Stop commands are always accepted from any port. bit 1 = port 1 (On board HIM) [Default=0] bit 2 = port 2(DPI port on control module) [Default=0] bit 3 = port 3(DPI port on control module with splitter) [Default=0] bit 4 = port 4(Internal Comm module) [Default=0] bit 5-13 = unused bit 14 = port 14 [DeviceLogix engine] bit 15 = unused	R/W

Table 139 - Parameter 149…171

Number	Name		Units	Min./Max. [Default]	Enum Text	Description			Read/Write Access
149	Logic Mask Act		—	0/65535 [0]	NA	Displays which DPI port the SMC-50 will accept a start command from. It may be different from the Logic Mask set by the local user if someone changes it over the network. bit 1 = port 1 (on board HIM) bit 2 = port 2 (DPI port on control module) bit 3 = port 3 (DPI port on control module with splitter) bit 4 = port 4 (Internal Comm module) bit 5-15 = reserved			R
150	Write Mask Cfg		—	0/65535 [7FFF]	NA	This bits in this parameter allow the user to enable (bit=1) or disable (Bit=0) which DPI ports the SMC-50 will accept write commands from. Only selected ports can modify parameters. bit 1 = port 1 (on board HIM) [Default=1] bit 2 = port 2 (DPI port on control module) [Default=1] bit 3 = port 3 (DPI port on control module with splitter) [Default=1] bit 4 = port 4 (Internal Comm module) [Default=1] bit 5-15 = reserved [Default=0]			R/W
151	Write Mask Act		—	0/65535 [0]	NA	Displays which DPI ports the SMC will accept write commands from that can change parameters. It may be different from the Write Mask Cfg parameter setup by the local user if someone changes it over the network. bit 1 = port 1 (on board HIM) bit 2 = port 2 (DPI port on control module) bit 3 = port 3 (DPI port on control module with splitter) bit 4 = port 4 (Internal Comm module) bit 5-15 = reserved			R
152	Port Mask Act		—	0/65535 [0]	NA	Displays which DPI ports are active on the control module and will accept operational commands from. bit 1 = port 1 (on board HIM) bit 2 = port 2 (DPI port on control module) bit 3 = port 3 (DPI port on control module with splitter) bit 4 = port 4 (Internal Comm module) bit 5-15 = reserved			R
153	Data In	A1	—	0/159999 [0]	NA	This is the channel	A1	In Datalink index, holding the parameter number of the parameter that will be written to during Datalink communications. A value of 0 indicates that it is disabled.	R/W
154		A2					A2		
155		B1					B1		
156		B2					B2		
157		C1					C1		
158		C2					C2		
159		D1					D1		
160		D2					D2		
161	Data Out	A1	—	0/159999 [0]	NA	This is the channel	A1	Out Datalink index, holding the parameter number of the parameter that will be read from during Datalink communications. A value of 0 indicates that it is disabled.	R/W
162		A2					A2		
163		B1					B1		
164		B2					B2		
165		C1					C1		
166		C2					C2		
167		D1					D1		
168		D2					D2		
169	Voltage Ratio		—	1/32767 [3079]	NA	Allow OEM's to fine-tune their voltage dividers.This is a Medium Voltage specific parameter and has no function at 690 volts and below.			R/W
170	User CT Ratio		—	10/500 [100]	NA	Allows the user to achieve proper current ratio for FLC ratings when using external CTs. This is a MV specific parameter and has no function at 690 volts and below.			R/W
171	Factory CT Ratio		—	1/15000 [50]	NA	Set at the factory to achieve proper current ratio for FLC ratings when using external CTs. This is a MV specific parameter and has no function at 690 volts and below.			R/W

Table 140 - Parameter 172…177

Number	Name	Units	Min./Max. [Default]	Enum Text	Description	Read/Write Access
172	Aux1 Config	—	0/11 [0]	—	Allows the user to configure the functionality of the Aux1 relay output on the control module based on the following selections.	R/W
				[Normal]	Aux 1 closes when start command asserted and opens when motor stops [Default].	
				UTS (Up-To -Speed)	Aux 1 closes when motor reaches up to speed and opens when motor is not at speed.	
				Fault	Aux1 closes when the SMC-50 enters a fault state and opens when the fault is cleared.	
				Alarm	Aux1 closes when the SMC-50 detects an alarm condition and opens when alarm is cleared.	
				Ext Bypass	Aux1 closes when the SMC-50 enters the external bypass mode and opens when it leaves that mode.	
				Ext Brake	Aux1 closes when Ext Braking command is active and opens when it is not active.	
				DeviceLogix	Aux1 is controlled by DeviceLogix program	
				Aux Control	When an auxiliary is configured for Aux Control, a bit within the parameter Aux Control controls the state of that auxiliary.	
				Network 1	With an auxiliary configured as Network 1, it is controlled over the Local Area Network (LAN) as Relay 1.	
				Network 2	With an auxiliary configured as Network 2 it is controlled over the LAN as Relay 2.	
				Network 3	With an auxiliary configured as Network 3 it is controlled over the LAN as Relay 3.	
				Network 4	With an auxiliary configured as Network 4 it is controlled over the LAN as Relay 4.	
173	Aux 1 Invert	—	0/1 [0]	—	Enables the user to invert the logic of the Aux 1 output. When disabled, it is a normally open relay output contact when de-energized. By enabling the invert function, the relay contact becomes a normally closed contact when de-energized.	R/W
				Disable	Aux 1 relay output not inverted [Default] (N.O.).	
				Enable	Aux 1 relay output inverted (N.C.) ❶.	
174	Aux1 On Delay	Secs	0.0/10.0 [0.0]	NA	A time delay in activating the Aux1 relay contact can be programmed.	R/W
175	Aux1 Off Delay	Secs	0.0/10.0 [0.0]	NA	A time delay in de-activating the Aux1 relay contact can be programmed.	R/W
176	Aux2 Config	—	0/11 [0]	—	Allows the user to configure the functionality of the Aux1 relay output on the control module based on the following selections.	R/W
				[Normal]	Aux 2 closes when start command asserted and opens when motor stops [Default].	
				UTS	Aux 2 closes when motor reaches up to speed and opens when motor is not at speed.	
				Fault	Aux2 closes when the SMC-50 enters a fault state and opens when the fault is cleared.	
				Alarm	Aux2 closes when the SMC-50 detects an alarm condition and opens when alarm is cleared.	
				Ext Bypass	Aux2 closes when the SMC-50 enters the external bypass mode and opens when it leaves that mode.	
				Ext Brake	Aux2 closes when Ext Braking command is active and opens when it is not active.	
				DeviceLogix	Aux2 is controlled by DeviceLogix program	
				Aux Control	When an auxiliary is configured for Aux Control, a bit within the parameter Aux Control controls the state of that auxiliary.	
				Network 1	With an auxiliary configured as Network 1, it is controlled over the Local Area Network (LAN) as Relay 1.	
				Network 2	With an auxiliary configured as Network 2 it is controlled over the LAN as Relay 2.	
				Network 3	With an auxiliary configured as Network 3 it is controlled over the LAN as Relay 3.	
				Network 4	With an auxiliary configured as Network 4 it is controlled over the LAN as Relay 4.	
177	Aux 2 Invert	—	0/1 [0]	—	Enables the user to invert the logic of the Aux2 output. When disabled, it is a normally open relay output contact when de-energized. By enabling the invert function, the relay contact becomes a normally closed contact when de-energized.	R/W
				Disable	Aux2 relay output not inverted [Default] (N.O.).	
				Enable	Aux2 relay output inverted (N.C.) ❶.	

❶ N.C. is electrically held.

Table 141 - Parameter 178…185

Number	Name	Units	Min./Max. [Default]	Enum Text	Description	Read/Write Access
178	Aux2 On Delay	Secs	0.0/10.0 [0.0]	NA	A time delay in activating the Aux2 relay contact can be programmed.	R/W
179	Aux2 Off Delay	Secs	0.0/10.0 [0.0]	NA	A time delay in de-activating the Aux2 relay contact can be programmed.	R/W
180	Aux Control	—	[0]	—	When an Auxiliary Relay output is configured for "Aux Control" a bit within this parameter will control the state of the auxiliary.	R/W
				Aux 1	Bit 0 - Control Module Aux Relay 1	
				Aux 2	Bit 1 - Control Module Aux Relay 2	
				Aux 7-1	Bit 2 - Expansion Port 7 Aux Relay 1	
				Aux 7-2	Bit 3- Expansion Port 7 Aux Relay 2	
				Aux 7-3	Bit 4- Expansion Port 7 Aux Relay 3	
				Aux 7-4	Bit 5- Expansion Port 7 Aux Relay 4	
				Aux 8-1	Bit 6 - Expansion Port 8 Aux Relay 1	
				Aux 8-2	Bit 7- Expansion Port 8 Aux Relay 2	
				Aux 8-3	Bit 8- Expansion Port 8 Aux Relay 3	
				Aux 8-4	Bit 9- Expansion Port 8 Aux Relay 4	
				Aux 9-1	Bit 10 - Expansion Port 9 Aux Relay 1	
				Aux 9-2	Bit 11 - Expansion Port 9 Aux Relay 2	
				Aux 9-3	Bit 12 - Expansion Port 9 Aux Relay 3	
				Aux 9-4	Bit 13 - Expansion Port 9 Aux Relay 4	
					Bit 14 - Reserved Bit 15 - Reserved	
181	Language	—	[0]	[English]	Provides the ability to configure the language that is displayed for any interface device. The selected language will be the same for all devices connected to the SMC-50.	R/W
				French		
				Spanish		
				Italian		
				German		
				Portuguese		
				Mandrin		
182	Start Delay	Secs	0/30 [0]	NA	The time between asserting a start command with valid 3-phase applied and the SMC-50 starting the motor can be delayed by setting the "Start Delay". If a stop is asserted during the delay period, the start is cancelled.	R/W
183	Timed Start	—	0/1 [0]	—	This parameter is used to force the starting profile to complete its entire time ramp period. This ability can help to avoid conditions where an up-to-speed is sensed before the motor is actually up to speed.	R/W
				Disable	Complete starting mode when up-to-speed detected.	
				Enable	Complete starting mode when ramp time expires.	
184	V Shutoff Level	%	0/100 [25]	NA	Provides the ability to manually adjust the threshold for the controller's voltage (notch) shutoff detection level. Since this parameter has the potential to modify the SCR operational control scheme, it is important that any change made be in small (several percent) increments. Do NOT disable (0) this parameter and Parameter 185 (I Shutoff Level) at the same time or SCR firing (motor control) instability can occur. Contact RA Technical Support for assistance. When running high-efficiency motors with Energy Saver, this value may need to be adjusted downward.	R/W
185	I Shutoff Level	%	0/37 [0]	NA	Provides the ability to adjust the level at which the SMC-50 expects to see current or the level of current which the SMC-50 determines the SCR has turned off. A common reason for increasing this value would be to compensate for the inability of the control to sense a voltage notch due to significant LINE voltage noise or LINE distortion. Since this parameter has the potential to modify the SCR operational control scheme, it is important that any change made be in small (several percent) increments.Do NOT disable (0) this parameter and Parameter 184 (V Shutoff Level) at the same time or SCR firing (motor control) instability can occur. Contact Rockwell Automation Technical Support for assistance.	R/W

Table 142 - Parameter 186…204

Number	Name	Units	Min./Max. [Default]	Enum Text	Description	Read/Write Access
186	UTS Level	%	0/100 [75]	NA	The SMC-50 has the ability to determine if the motor is up-to-speed (UTS). If the SMC-50 encounters a problem detecting motor UTS, this parameter can be modified by the user to compensate. If the SMC-50 is detecting the UTS condition to soon (e.g., abrupt speed change), this number should be increased (this typically occurs on high efficiency motors). If the SMC-50 is detecting the UTS condition to late or not at all (display does not indicate At Speed), this number should be lowered. Contact RA Technical Support for assistance.	R/W
187	Stall Level	%	0/100 [75]	NA	Allows the user to set the motor winding voltage level (as a percentage of line voltage) at which the SMC-50 will consider the motor stalled.	R/W
188	Stall Delay	Secs	0.0/30.0 [10.0]	NA	Allows the user to configure the time period after the start maneuver start time that the motor has to reach UTS, or else a stall fault will occur.	R/W
189	Stall Position	%	0/100 [75]	NA	Allows the user to set the change in the notch position at which the SMC-50 will consider the motor stalled.	R/W
190	Notch Maximum (Pump Control)	—	50.0/70.0 [60.0]	NA	Allows the user to change the maximum notch value during pump stop. This parameter is not typically modified and it is recommended that RA Technical Support be contacted for assistance before attempting to do so.	R/W
191	Notch Position	%	40.0/100.0 [87.5]	NA	Enables the user to make a manual adjustment to an internal value used for notch control gain, which impacts the SMC-50 starting control algorithm. This parameter is not typically modified and it is recommended that RA Technical Support be contacted for assistance before attempting to do so.	R/W
192	Bypass Delay	Secs	1/15 [1]	NA	For possible future use with internal bypass contactor operation: Not applicable for use with an external bypass contactor system. Allows a time delay upon closing an internal bypass.	R/W
193	Energy Saver	—	0.00/1.00 [0.00]	—	Allows the user to enable the controller’s energy saving control scheme, which opens the "notch" (reduces power applied) to lightly loaded motors thereby reducing the motor terminal voltage and winding losses. This value should be set between the no/light load value and the full/heavy load value of Parameter 17. Set Parameter 193=0 to disable Energy Saver mode.	R/W
194	Forced Tuning	—	0/1 [1]	—	Enables the controller's tuning algorithms to analyze the load and supply and adjust parameters for easy set up and optimum performance.	R/W
				FALSE	Do not run tuning algorithm (was already run or disabled by user).	
				TRUE	Run tuning algorithm at next start command [Default].	
195	Stator R	Ohms	0.00/50.00 [0.00]	NA	Enables the user to read/view the motor stator resistance value that was measured during the tuning process.	R
196	Total R	Ohms	0.00/50.00 [0.00]	NA	Enables the user to read/view the motor total load resistance that was measured during the tuning process.	R
197	Coupling Factor	—	0.00/10.00 [0.00]	NA	This is a coefficient inserted by the controller during the tuning process and viewable by the user.	R
198	Inductance	mH	0.00/1000.00 [0.00]	NA	Enables the user to read/view the motor inductance that was measured during the tuning process.	R
199	Speed PGain	—	1/10000 [1000]	NA	Provides the ability to adjust the gain factor used in speed measurement algorithms. These parameters are not typically modified and it is recommended that RA Technical Support be contacted for assistance before attempting to do so.	R/W
200	Transient Mag	—	0.00/2.00 [0.90]			
201	Transient Zero	—	0.00/10.00 [5.00]			
202	Transient Gain	—	0.00/4.00 [1.00]			
203	Ping Degree	—	0.0/180.0 [50.0]	NA	Timing parameter used in speed measurement algorithms. These parameters are not typically modified and it is recommended that RA Technical Support be contacted for assistance before attempting to do so.	R/W
204	Pings	—	0/20 [2]	NA		R/W

Table 143 - Parameter 205…226

Number	Name		Units	Min./Max. [Default]	Enum Text	Description	Read/Write Access
205	Phase Shift	0	—	-360/360 [0]	NA	Timing parameters used in speed measurement algorithms. These parameters are not typically modified and it is recommended that RA Technical Support be contacted for assistance before attempting to do so.	R/W
206		10					
207		20					
208		30					
209		40					
210		50					
211		60					
212		70					
213		80					
214		90					
215		100					
216	Board Temp		°C	-25/100 [20]	NA	Displays the internal temperature of the SMC control module.	R
217	Exp 7 Config		—	0/5 [0]	None Input/Output Analog I/O (future) GndF/PTC/CT DIP Switch Seq Start (future)	Displays the type of expansion board plugged into Expansion Port 7.	R
218	Exp 8 Config		—	0/5 [0]	None Input/Output Analog I/O (future) GndF/PTC/CT DIP Switch Seq Start (future)	Displays the type of expansion board plugged into Expansion Port 8.	R
219	Exp 9 Config		—	0/5 [0]	None Input/Output Analog I/O (future) GndF/PTC/CT DIP Switch Seq Start (future)	Displays the type of expansion board plugged into Expansion Port 9.	R
220	Heating Time		Secs	0/1000 [0]	NA	Provides the ability to configure the time period the motor winding heating algorithm is active after asserting the motor heating command.	R/W
221	Heating Level		%	0/100 [0]	NA	Provides the ability to configure the amount of current applied during the motor winding heating process.	R/W
222	Fan Config		—	0/2 [0]	120V 240V [Auto Detect]	Allows the user to configure the voltage applied to the internal SMC-50 cooling fans. If configured for Auto Detect [Default], the SMC-50 will use the control voltage applied to the SMC-50 as the level and configure the fans to work at that level.	R/W
223	Fan Connection		—	0/1 [0]	[120V] 240V	Displays the voltage configuration of the fans. If Auto Detect was selected in the Fan Config parameter, this will display the result of the Auto Detect process.	R
224	Line Frequency		Hz	0/100 [0]	NA	Displays the line frequency of the three phase voltage applied to the SMC-50 at terminals L1, L2, and L3.	R
225	Freq High F Dly		Secs	0.1/99.0 [0.1]	NA	Allows the user to configure the time period that the supplied line voltage frequency must exceed Freq High F Lvl parameter value before causing a Freq High fault. The Freq High bit must be set in the Starter Fault En parameter for the fault to activate.	R
226	Freq High A Dly		Secs	0.1/99.0 [0.1]	NA	Allows the user to configure the time period that the supplied line voltage frequency must exceed Freq High A Lvl parameter value before causing a Freq High alarm. The Freq High bit must be set in the Starter Alarm parameter for the fault to activate.	R

Table 144 - Parameter 227…230

Number	Name	Units	Min./Max. [Default]	Enum Text	Description	Read/Write Access
227	Freq Low F Dly	Secs	0.1/99.0 [0.1]	NA	Allows the user to configure the time period that the supplied line voltage frequency must drop below Freq Low F Lvl parameter value before causing a Freq Low fault. The Freq Low bit must be set in the Starter Fault En parameter for the fault to activate.	R
228	Freq Low A Dly	Secs	0.1/99.0 [0.1]	NA	Allows the user to configure the time period that the supplied line voltage frequency must drop below Freq Low A Lvl parameter value before causing a Freq Low alarm. The Freq Low bit must be set in the Starter Alarm parameter for the fault to activate.	R
229	Parameter Mgmt	—	0/1 [0]	—	Allows the user to force all the Control Module parameters to default values. This has no impact on any option module(s) installed. Each Option module has its own associated Parameter Mgmt parameter	R/W
				[Ready]	Waiting for command to set factory defaults	
				Factory Default	Command for SMC to set all Control Module Writable Parameters to factory default values. This command does not impact Option Module parameters.	
230	Motor Fault En	—	1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 0 0 0 0 0 0	[Overload] Underload MWatts Over MWatts Under +MVAR Over +MVAR Under -MVAR Over -MVAR Under MVA Under MVA Over Curr Imbal Jam Stall Starts/Hr PM Hours PM Starts [Power Qual] [Open Load] THD I Lead PF Un Lead PF Ov Lag PF Un Lag PF Ov Locked Rotor	Allows the user to enable Motor related faults that can be detected by the SMC-50. 0 = Fault Disabled 1 = Fault Enabled [Default]	R/W

Table 145 - Parameter 231…240

Number	Name	Units	Min./Max. [Default]	Enum Text	Description	Read/Write Access
231	Motor Alarm En	—	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Overload Underload MWatts Over MWatts Under +MVAR Over +MVAR Under -MVAR Over -MVAR Under MVA Under MVA Over Curr Imbal Jam Stall Starts/Hr PM Hours PM Starts Power Qual Open Load THD I Lead PF Un Lead PF Ov Lag PF Un Lag PF Ov Locked Rotor	Allows the user to enable Motor related alarms that can be detected by the SMC-50. 0 = Fault Disabled 1 = Fault Enabled [All Disabled as Default]	R/W
232	+MVAR Ov F Lvl	MVAR	0.000/1000.000 [0.000]	NA	Allows the user to enter a value for the Consumed Reactive Power Over Fault Level (+MVAR Ov F Lvl). If the current actual +MVAR value is greater than the +MVAR OV F Lvl for a time period greater than that defined by +MVAR Ov F Dly, a +MVAR Ov Fault will be signaled. ❶	R/W
233	+MVAR Ov F Dly	Secs	0.1/99.0 [0.1]	NA	Allows the user to enter a time value for the +MVAR Over Fault delay. If the current actual value of Consumed Reactive Power (+MVAR) is greater than the +MVAR OV F Lvl for a time period greater than that defined by +MVAR Ov F Dly, a +MVAR Ov Fault will be signaled. ❶	R/W
234	+MVAR Ov A Lvl	MVAR	0.000/1000.000 [0.000]	NA	Allows the user to enter a value for the Consumed Reactive Power Over Alarm Level (+MVAR OV A Lvl). If the current actual +MVAR value is greater than the +MVAR OV A Lvl for a time period greater than that defined by +MVAR Ov A Dly, a +MVAR Ov Alarm will be signaled. ❶	R/W
235	+MVAR Ov A Dly	Secs	0.1/99.0 [0.1]	NA	Allows the user to enter a time value for the +MVAR Over Alarm Delay (+MVAR Ov A Dly). If the current actual value of Consumed Reactive Power (+MVAR) is greater than the +MVAR Ov A Level for a time period greater than that defined by +MVAR Ov A Dly, a +MVAR Ov Alarm will be signaled. ❶	R/W
236	+MVAR Un F Lvl	MVAR	0.000/1000.000 [0.000]	NA	Allows the user to enter a value for the Consumed Reactive Power Under Fault Level (+MVAR Un F Lvl). If the current actual +MVAR value is less than the +MVAR Un F Level for a time period greater than that defined by +MVAR Un F Dly, a +MVAR Un Fault will be signaled. ❶	R/W
237	+MVAR Un F Dly	Secs	0.1/99.0 [0.1]	NA	Allows the user to enter a time value for the +MVAR Under Fault delay. If the Consumed Reactive Power (+MVAR) is less than the +MVAR Un F Level for a time period greater than that defined by +MVAR Un F Dly, a +MVAR Un Fault will be signaled. ❶	R/W
238	+MVAR Un A Lvl	MVAR	0.000/1000.000 [0.000]	NA	Allows the user to enter a value for the Consumed Reactive Power Under Alarm Level (+MVAR Un A Lvl). If the current actual value of Consumed Reactive Power (+MVAR) is less than the +MVAR Un A Level for a time period greater than that defined by +MVAR Un A Dly a +MVAR Un Alarm will be signaled. ❶	R/W
239	+MVAR Un A Dly	Secs	0.1/99.0 [0.1]	NA	Allows the user to enter a time value for the +MVAR Under Alarm Delay (+MVAR Un A Dly). If the current actual value of Consumed Reactive Power (+MVAR) is less than the +MVAR Un A Level for a time period greater than that defined by +MVAR Un A Dly, a +MVAR Un Alarm will be signaled. ❶	R/W
240	MVA Ov F Lvl	MVA	0.000/1000.000 [0.000]	NA	Allows the user to enter a value for the MVA Over Fault Level (MVA Ov F Lvl). If the current actual value of Apparent Power (MVA) is greater than the MVA Ov F Lvl for a time period greater than that defined by MVA Ov F Dly, a MVA Ov Fault will be signaled. ❶	R/W

❶ To implement an Alarm or Fault, the appropriate bit in the Motor Fault En, Parameter 230, or Motor Alarm En, Parameter 231, must also be set.

Table 146 - Parameter 241…253

Number	Name	Units	Min./Max. [Default]	Enum Text	Description	Read/Write Access
241	MVA Ov F Dly	Secs	0.1/99.0 [0.1]	NA	Allows the user to enter a time value for the Apparent Power Over Fault Delay (MVA Ov F Dly). If the current actual value of Apparent Power (MVA) is greater than the MVA Ov F Lvl for a time period greater than that defined by MVA Ov F Dly, a MVA Ov Fault will be signaled. ❶	R/W
242	MVA Ov A Lvl	MVA	0.000/1000.000 [0.000]	NA	Allows the user to enter a value for the MVA Over Alarm Level (MVA Ov A Lvl). If the current actual value of the Apparent Power (MVA) is greater than the MVA Ov A Lvl for a time period greater than that defined by MVA Ov A Dly, a MVA Ov Alarm will be signaled. ❶	R/W
243	MVA Ov A Dly	Secs	0.1/99.0 [0.1]	NA	Allows the user to enter a time value for the Apparent Power Over Alarm Delay (MVA Ov A Dly). If the current actual value of the Apparent Power (MVA) is greater than the MVA Ov A Lvl for a time period greater than that defined by MVA Ov A Dly, a MVA Ov Alarm will be signaled. ❶	R/W
244	MVA Un F Lvl	MVA	0.000/1000.000 [0.000]	NA	Allows the user to enter a value for the MVA Under Fault Level (MVA Un F Lvl). If the current actual value of the Apparent Power (MVA) is less than the MVA Un F Lvl for a time period greater than that defined by MVA Un F Dly, a MVA Un Fault will be signaled. ❶	R/W
245	MVA Un F Dly	Secs	0.1/99.0 [0.1]	NA	Allows the user to enter a time value for the Apparent Power Under Fault Delay (MVA Un F Dly). If the current actual value of the Apparent Power (MVA) is less than the MVA Un F Lvl for a time period greater than that defined by MVA Un F Dly, a MVA Un Fault will be signaled.	R/W
246	MVA Un A Lvl	MVA	0.000/1000.000 [0.000]	NA	Allows the user to enter a value for the MVA Under Alarm Level (MVA Un A Lvl). If the current actual value of the Apparent Power (MVA) is less than the MVA Un A Lvl for a time period greater than that defined by MVA Un A Dly, a MVA Un Alarm will be signaled. ❶	R/W
247	MVA Un A Dly	Secs	0.1/99.0 [0.1]	NA	Allows the user to enter a time value for the Apparent Power Under Alarm Delay (MVA Un A Dly). If the current actual value of the Apparent Power (MVA) is less than the MVA Un A Lvl for a time period greater than that defined by MVA Un A Dly, a MVA Un Alarm will be signaled. ❶	R/W
248	Lead PF Ov F Lvl	—	0.00/1.00 [0.00]	NA	Allows the user to enter a value for the Leading Power Factor Over Fault Level (Lead PF Ov F Lvl). If the current actual Power Factor value is leading more than the Lead PF Ov F Lvl for a time period greater than that defined by Lead PF Ov F Dly, a Lead PD Ov Fault will be signaled. ❶	R/W
249	Lead PF Ov F Dly	Secs	0.1/99.0 [0.1]	NA	Allows the user to enter a time value for the Leading Power Factor Over Fault Delay (Lead PF Ov F Dly). If the current actual Power Factor value is leading more than the Lead PF Ov F Lvl for a period greater than that defined by Lead PF Ov F Dly, a Lead PD Ov fault will be signaled. ❶	R/W
250	Lead PF Ov A Lvl	—	0.00/1.00 [0.00]	NA	Allows the user to enter a value for the Leading Power Factor Over Alarm Level (Lead PF Ov A Lvl). If the current actual Power Factor value is leading more than the Lead PF Ov A Lvl for a period greater than that defined by Lead PF Ov A Dly, a Lead PD Ov alarm will be signaled. ❶	R/W
251	Lead PF Ov A Dly	Secs	0.1/99.0 [0.1]	NA	Allows the user to enter a time value for the Leading Power Factor Over Alarm Delay (Lead PF Ov A Dly). If the current actual Power Factor value is leading more than the Lead PF Ov A Lvl for a period greater than that defined by Lead PF Ov A Dly, a Lead PD Ov alarm will be signaled. ❶	R/W
252	Lead PF Un F Lvl	—	0.00/1.00 [0.00]	NA	Allows the user to enter a value for the Leading Power Factor Under Fault Level (Lead PF Un F Lvl). If the current actual Power Factor value is leading less than the Lead PF Un A Lvl for a time period greater than that defined by Lead PF Un A Dly, a Lead PD Un Fault will be signaled. ❶	R/W
253	Lead PF Un F Dly	Secs	0.1/99.0 [0.1]	NA	Allows the user to enter a time value for the Leading Power Factor Under Fault Delay (Lead PF Un F Dly). If the current actual Power Factor value is leading less than the Lead PF Un A Lvl for a time period greater than that defined by Lead PF Un A Dly, a Lead PD Un Fault will be signaled. ❶	R/W

❶ To implement an Alarm or Fault, the appropriate bit in the Motor Fault En, Parameter 230, or Motor Alarm En, Parameter 231, must also be set.

Table 147 - Parameter 254…263

Number	Name	Units	Min./Max. [Default]	Enum Text	Description	Read/Write Access
254	Lead PF Un A Lvl	—	0.00/1.00 [0.00]	NA	Allows the user to enter a value for the Leading Power Factor Under Alarm Level (Lead PF Un A Lvl). If the current actual Power Factor value is leading less than the Lead PF Un A Lvl for a time period greater than that defined by Lead PF Un A Dly, a Lead PD Un Alarm will be signaled. ❶	R/W
255	Lead PF Un A Dly	Secs	0.1/99.0 [0.1]	NA	Allows the user to enter a time value for the Leading Power Factor Under Alarm Delay (Lead PF Un A Dly). If the current actual Power Factor value is leading less than the Lead PF Un A Lvl for a time period greater than that defined by Lead PF Un A Dly, a Lead PD Un Alarm will be signaled. ❶	R/W
256	Lag PF Ov F Lvl	—	-1.00/0.00 [0.00]	NA	Allows the user to enter a value for the Lagging Power Factor Over Fault Level (Lag PF Ov F Lvl). If the current actual Power Factor value lags more than the Lag PF Ov F Lvl for a time period greater than that defined by Lag PF Ov F Dly, a Lag PF Ov Fault will be signaled. ❶	R/W
257	Lag PF Ov F Dly	Secs	0.1/99.0 [0.1]	NA	Allows the user to enter a time value for the Lagging Power Factor Over Fault Delay (Lag PF Ov F Dly). If the current actual Power Factor value lags more than the Lag PF Ov F Lvl for a time period greater than that defined by Lag PF Ov F Dly, a Lag PF Ov Fault will be signaled. ❶	R/W
258	Lag PF Ov A Lvl	—	-1.00/0.00 [0.00]	NA	Allows the user to enter a value for the Lagging Power Factor Over Alarm Level (Lag PF Ov A Lvl). If the current actual Power Factor value lags more than the Lag PF Ov A Lvl for a time period greater than that defined by Lag PF Ov A Dly, a Lag PF Ov Alarm will be signaled. ❶	R/W
259	Lag PF Ov A Dly	Secs	0.1/99.0 [0.1]	NA	Allows the user to enter a time value for the Lagging Power Factor Over Alarm Delay (Lag PF Ov A Dly). If the current actual Power Factor value lags more than the Lag PF Ov A Lvl for a time period greater than that defined by Lag PF Ov A Dly, a Lag PF Ov Alarm will be signaled. ❶	R/W
260	Lag PF Un F Lvl	—	-1.00/0.00 [0.00]	NA	Allows the user to enter a value for the Lagging Power Factor Under Fault Level (Lag PF Un F Lvl). If the current actual Power Factor value lags less than the Lag PF Un F Lvl for a time period greater than that defined by Lag PF Un F Dly, a Lag PF Un Fault will be signaled. ❶	R/W
261	Lag PF Un F Dly	Secs	0.1/99.0 [0.1]	NA	Allows the user to enter a time value for the Lagging Power Factor Under Fault Delay (Lag PF Un F Dly). If the current actual Power Factor value lags less than the Lag PF Un F Lvl for a time period greater than that defined by Lag PF Un F Dly, a Lag PF Un Fault will be signaled. ❶	R/W
262	Lag PF Un A Lvl	—	-1.00/0.00 [0.00]	NA	Allows the user to enter a value for the Lagging Power Factor Under Alarm Level (Lag PF Un A Lvl). If the current actual Power Factor value lags less than the Lag PF Un A Lvl for a time period greater than that defined by Lag PF Un A Dly, a Lag PF Un Alarm will be signaled. ❶	R/W
263	Lag PF Un A Dly	Secs	0.1/99.0 [0.1]	NA	Allows the user to enter a time value for the Lagging Power Factor Under Alarm Delay (Lag PF Un A Dly). If the current actual Power Factor value lags less than the Lag PF Un A Lvl for a period greater than that defined by Lag PF Un A Dly, a Lag PF Un alarm will be signalled. ❶	R/W

❶ To implement an Alarm or Fault, the appropriate bit in the Motor Fault En, Parameter 230, or Motor Alarm En, Parameter 231, must also be set.

Table 148 - Parameter 264…281

Number	Name	Units	Min./Max. [Default]	Enum Text	Description	Read/Write Access
264	Motor Restart En	—	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Overload Underload MWatts Over MWatts Under +MVAR Over +MVAR Under -MVAR Over -MVAR Under MVA Over MVA Under Curr Imbal Jam Stall Starts/Hr PM Hours PM Starts Power Qual Open Load THD I Lead PF Un Lead PF Ov Lag PF Un Lag PF Ov Locked Rotor	Enables the user to adjust the Motor Restart Enable conditions. Setting (=1) a bit causes the motor to attempt a restart after the selected event is detected. A limit to the number of starts attempted before a fault is signalled can be set in the Restart Attempts parameter. 0 = Do not attempt a restart after fault is cleared 1 = Attempt a restart after this fault is cleared **NOTE:** Restart attempts, Parameter 133, and Restart Delay, Parameter 134, must also be configured. [All Disabled as Default]	R/W
265	Voltage Pn Ave	Volts	0/450 [0]	NA	Displays the average of the sum of the three phase voltages to neutral.	R
266	Voltage Phase A-N				Displays Phase A (L1) to neutral voltage.	
267	Voltage Phase B-N				Displays Phase B (L2) to neutral voltage.	
268	Voltage Phase C-N				Displays Phase C (L3) to neutral voltage.	
269	Real Power A	MW	-1000.000/1000.000 [0.000]	NA	Displays the Real Power of the Phase A branch which is equal to Phase A Voltage x Phase A Current x PF.	R
270	Real Power B				Displays the Real Power of the Phase B branch which is equal to Phase B Voltage x Phase B Current x PF.	
271	Real Power C				Displays the real power of the Phase C branch which is equal to Phase C Voltage x Phase C Current x PF.	
272	Real Demand	MW	-1000.000/1000.000 [0.000]	NA	Displays Real Energy (MWH) averaged over a period of time defined by Demand Period.	R
273	Max. Real Demand	MW	-1000.000/1000.000 [0.000]	NA	Displays the Maximum energy demand recorded since the last energy meter reset.	R
274	Reactive Power A	MVAR	-1000.000/1000.000 [0.000]	NA	Displays the reactive power of the Phase A branch.	R
275	Reactive Power B				Displays the reactive power of the Phase B branch.	
276	Reactive Power C				Displays the reactive power of the Phase C branch.	
277	Reactive Power	MVAR	-1000.000/1000.000 [0.000]	NA	Displays the total reactive power.	R
278	Reactive Energy C	MVRH	-1000.000/1000.000 [0.000]	NA	Displays the reactive energy being consumed by the load.	R
279	Reactive Energy P				Displays the reactive energy being produced by the load.	
280	Reactive Energy				Displays the total reactive energy which is equal to Reactive Power X time.	
281	Reactive Demand	MVAR	-1000.000/1000.000 [0.000]	NA	Displays the Reactive Energy consumed or generated by the system over the Demand Time Period.	R

Table 149 - Parameter 282…302

Number	Name	Units	Min./Max. [Default]	Enum Text	Description	Read/Write Access
282	Max. Reactive Dmd	MVAR	-1000.000/1000.000 [0.000]	NA	Displays the maximum reactive energy demand recorded since the energy meters were reset	R
283	Apparent Power A	MVA	-1000.000/1000.000 [0.000]	NA	Displays the Apparent Power (VA) measured in the phase A branch.	R
284	Apparent Power B				Displays the VA measured in the phase B branch.	
285	Apparent Power C				Displays the VA measured in the phase C branch.	
286	Apparent Power	MVA	-1000.000/1000.000 [0.000]	NA	Displays the total apparent power consumed (-) or produced (+) by the load.	R
287	Apparent Energy	MVAH	-1000.000/1000.000 [0.000]	NA	Displays the Apparent Energy which is equal to Apparent Power x Time.	R
288	Apparent Demand	MVA	-1000.000/1000.000 [0.000]	NA	Displays the total amount of Apparent Energy which is equal to MVAH x demand period produced or consumed by the load.	R
289	Max. Apparent Dmd	MVA	-1000.000/1000.000 [0.000]	NA	Displays the maximum apparent demand recorded since energy meters were reset.	R
290	Demand Period	Mins	1/255 [1]	NA	Enables the user to enter the time period that energy samples are taken to calculate demand.	R/W
291	Num of Periods	—	1/15 [1]	NA	Enables the user to enter the number of periods that energy measurements are taken in calculating demand.	R/W
292	Power Factor A	—	-1.00/1.00 [0.00]	NA	Displays the power factor in the Phase A branch of the load circuit.	R
293	Power Factor B				Displays the power factor in the Phase B branch of the load circuit.	
294	Power Factor C				Displays the power factor in the Phase C branch of the load circuit.	
295	Current Imbal	%	0/100 [0.00]	NA	Displays the percent current imbalance measured in the load circuit (max deviation of current from the average of three currents / average current of three currents).	R
296	Voltage Imbal	%	0/100 [0.00]	NA	Displays the percent voltage imbalance measured in the load circuit (max deviation of voltage from the average of three voltages / average current of three voltages).	R
297	-MVAR Ov F Lvl	MVAR	-1000.000/0.000 [0.000]	NA	Enables the user to enter a value for the Generated Reactive Power Over Fault Level (-MVAR Ov F Lvl). If the current actual value for Generated Reactive Power is more than the -MVAR Ov F Lvl for a period greater than that defined by -MVAR Ov F Dly, a -MVAR Ov fault will be signaled. ➊	R/W
298	-MVAR Ov F Dly	Secs	0.1/99.0 [0.1]	NA	Enables the user to enter a time value for the Generated Reactive Power Over Fault Delay (-MVAR Ov F Dly). If the current actual value for the Generated Reactive Power is more than the -MVAR Ov F Lvl for a time period greater than that defined by -MVAR Ov F Dly, a -MVAR Ov fault will be signaled. ➊	R/W
299	-MVAR Ov A Lvl	MVAR	-1000.000/0.000 [0.000]	NA	Enables the user to enter a value for the Generated Reactive Power Over Alarm Level (-MVAR Ov A Lvl). If the current actual value for Generated Reactive Power is more than the -MVAR Ov A Lvl for a period greater than that defined by -MVAR Ov A Dly, a -MVAR Ov Alarm will be signaled. ➊	R/W
300	-MVAR Ov A Dly	Secs	0.1/99.0 [0.1]	NA	Enables the user to enter a time value for the Generated Reactive Power Over Alarm Delay (-MVAR Ov A Dly). If the current actual value for the Generated Reactive Power is more than the -MVAR Ov A Lvl for a period greater than that defined by -MVAR Ov A Dly, a -MVAR Ov alarm will be signaled. ➊	R/W
301	-MVAR Un F Lvl	MVAR	-1000.000/0.000 [0.000]	NA	Enables the user to enter a value for the Generated Reactive Power Under Fault Level (-MVAR Un F Lvl). If the current actual value for Generated Reactive Power is less than the -MVAR Un F Lvl for a period greater than that defined by -MVAR Un F Dly, a -MVAR Un Fault will be signaled. ➊	R/W
302	-MVAR Un F Dly	Secs	0.1/99.0 [0.1]	NA	Enables the user to enter a time value for the Generated Reactive Power Under Fault Delay (-MVAR Un F Dly). If the current actual value for Generated Reactive Power is less than the -MVAR Un F Lvl for a period greater than that defined by -MVAR Un F Dly, a -MVAR Un Fault will be signaled. ➊	R/W

➊ To implement an Alarm or Fault, the appropriate bit in the Motor Fault En, Parameter 230, or Motor Alarm En, Parameter 231, must also be set.

Table 150 - Parameter 303…311

Number	Name	Units	Min./Max. [Default]	Enum Text	Description	Read/Write Access
303	-MVAR Un A Lvl	MVAR	-1000.000/0.000 [0.000]	NA	Enables the user to enter a value for the Generated Reactive Power Under Alarm Level (-MVAR Un A Lvl). If the current actual value for Generated Reactive Power is less than the -MVAR Un A Lvl for a period greater than that defined by -MVAR Un A Dly, a MVAR Un Alarm will be signaled. ❶	R/W
304	-MVAR Un A Dly	Secs	0.1/99.0 [0.1]	NA	Enables the user to enter a time value for the Generated Reactive Power Under Alarm Delay (-MVAR Un A Dly). If the current actual value for Generated Reactive Power is less than the -MVAR Un A Lvl for a period greater than that defined by -MVAR Un A Dly, a -MVAR Un Alarm will be signaled. ❶	R/W
305	Starting Torque	%	0/300 [100]	NA	Enables the user to enter Starting Torque value required for a torque start operation.	R/W
306	Starting Torque 2				Enables the user to enter an alternate Starting Torque required for a torque start operation.	
307	SS Ref Gain	—	0.10/2.00 [1.00]	NA	Enables the user to enter Slow Speed Reference Gain value (SS Ref Gain) used to adjust slow speed operation. This parameter is rarely adjusted. Contact RA Technical Support for further information.	R/W
308	SS Trans Gain				Enables the user to enter Slow Speed Transfer Gain value (SS Trans Gain) used to adjust slow speed operation. This parameter is rarely adjusted. Contact RA Technical Support for further information.	
309	Input Status	—	0/65535 [0]		Displays the status of all the digital inputs for the SMC-50.	R
				Input 1	Bit 0 - Displays status of Control Module Input #1.	
				Input 2	Bit 1 - Displays status of Control Module Input #2.	
				Input 7-1	Bit 2 - Displays status of Control Module Port 7, 150-SM4 Option Module Input #1.	
				Input 7-2	Bit 3 - Displays status of Control Module Port 7, 150-SM4 Option Module Input #2.	
				Input 7-3	Bit 4- Displays status of Control Module Port 7, 150-SM4 Option Module Input #3.	
				Input 7-4	Bit 5- Displays status of Control Module Port 7, 150-SM4 Option Module Input #4.	
				Input 8-1	Bit 6 - Displays status of Control Module Port 8, 150-SM4 Option Module Input #1.	
				Input 8-2	Bit 7- Displays status of Control Module Port 8, 150-SM4 Option Module Input #2.	
				Input 8-3	Bit 8- Displays status of Control Module Port 8, 150-SM4 Option Module Input #3.	
				Input 8-4	Bit 9- Displays status of Control Module Port 8, 150-SM4 Option Module Input #4.	
				Input 9-1	Bit 10 - Displays status of Control Module Port 9, 150-SM4 Option Module Input #1.	
				Input 9-2	Bit 11 - Displays status of Control Module Port 9, 150-SM4 Option Module Input #2.	
				Input 9-3	Bit 12 - Displays status of Control Module Port 9, 150-SM4 Option Module Input #3.	
				Input 9-4	Bit 13 - Displays status of Control Module Port 9, 150-SM4 Option Module Input #4.	
					Bit 14 & 15 - Reserved.	
310	Locked Rotor A Lvl	%FLC	400/1000 [600]	NA	Enables the user to enter a value for the Locked Rotor Alarm Level (Locked Rtr A Lvl). The locked rotor value represents the motor peak phase current to the load that if exceeded for the period defined in Locked Rtr A Delay will signal a fault. The Locked Rotor bit in the Motor Alarm En parameter must be set to signal a alarm. ❶	R/W
311	Locked Rotor A Dly	Secs	0.1/100.0 [0.1]	NA	The time period that the peak phase current exceeds the Locked Rtr F Level to signal a fault. The Locked Rotor bit in the Motor Fault En parameter must be set to enable a fault. ❶	R/W

❶ To implement an Alarm or Fault, the appropriate bit in the Motor Fault En, Parameter 230, or Motor Alarm En, Parameter 231, must also be set.

Table 151 - Parameters 312…325

Number	Name	Units	Min./Max. [Default]	Enum Text	Description	Read/Write Access
312	Product Command	—	0/65535 [0]		Displays an image of the DPI product command required for DPI communications.	R
				Stop	1 – Coast / Inhibit 0 – No Action	
				Start	1 – Start 0 – No Action	
				Jog	1 – Stop Maneuver / Inhibit 0 – No Action	
				Clear Fault	1 – Clear Faults 0 – No Action	
				Slow Speed	1 – Run at Slow Speed 0 – No Action	
				Emer Run	1 – Enable Emergency Run Mode 0 – Disable Emergency Run Mode	
				Motor Heater	1 – Enable Motor Winding Heater 0 – Disable Motor Winding Heater	
				Reserved	0	
				Reserved	0	
				Reserved	0	
				Reserved	0	
				Aux Enable	1 – Use the Network #1 - #4 bits 0 – Ignore the Network #1 - #4 bits	
				Network_1	1 – Closes any Output Configured for "Network 1" 0 – Opens any Output Configured for "Network 1"	
				Network_2	1 – Closes any Output Configured for "Network 2" 0 – Opens any Output Configured for "Network 2"	
				Network_3	1 – Closes any Output Configured for "Network 3" 0 – Opens any Output Configured for "Network 3"	
				Network_4	1 – Closes any Output Configured for "Network 4" 0 – Opens any Output Configured for "Network 4"	
313	Rebalance Level	%	0/100 [0]	NA	The percentage of motor current imbalance above which the SMC-50 will rebalance the motor current	R/W
314	Va Peak	Volt	0/15000 [0]	NA	The peak value of the Phase A line to neutral voltage during the motor start, run, and stop cycle. The value resets to 0 when the motor starts.	R
315	Vb Peak	Volt	0/15000 [0]	NA	The peak value of the Phase B line to neutral voltage during the motor start, run, and stop cycle.The value resets to 0 when the motor starts.	R
316	Vc Peak	Volt	0/15000 [0]	NA	The peak value of the Phase C line to neutral voltage during the motor start, run, and stop cycle. The value resets to 0 when the motor starts.	R
317	Ia Peak	Amps	0/15000 [0]	NA	The peak value of the Phase A current during the motor start, run, and stop cycle. The value resets to 0 when the motor starts.	R
318	Ib Peak	Amps	0/15000 [0]	NA	The peak value of the Phase B current during the motor start, run, and stop cycle. The value resets to 0 when the motor starts.	R
319	Ic Peak	Amps	0/15000 [0]	NA	The peak value of the Phase C current during the motor start, run, and stop cycle. The value resets to 0 when the motor starts.	R
320	SSVolts Phas A-B	Volt	0/700 [0]	NA	Snapshot of the Phase A-B voltage when a fault occurs. The value is overwritten if a subsequent fault occurs	R
321	SSVolts Phas B-C	Volt	0/700 [0]	NA	Snapshot of the Phase B-C voltage when a fault occurs. The value is overwritten if a subsequent fault occurs.	R
322	SSVolts Phas C-A	Volt	0/700 [0]	NA	Snapshot of the Phase C-A voltage when a fault occurs. The value is overwritten if a subsequent fault occurs.	R
323	SSCurrent Phas A	Amps	0/15000 [0]	NA	Snapshot of the Phase A current when a fault occurs. The value is overwritten if a subsequent fault occurs.	R
324	SSCurrent Phas B	Amps	0/15000 [0]	NA	Snapshot of the Phase B current when a fault occurs. The value is overwritten if a subsequent fault occurs.	R
325	SSCurrent Phas C	Amps	0/15000 [0]	NA	Snapshot of the Phase C current when a fault occurs. The value is overwritten if a subsequent fault occurs.	R

Table 152 - Parameter 326…333

Number	Name	Units	Min./Max. [Default]	Enum Text	Description	Read/Write Access
326	SSPower Factor	—	-1.00/1.00 [0]	NA	Snapshot of the Motor Power Factor when a fault occurs. The value is overwritten if a subsequent fault occurs.	R
327	SSMtr Thrm Usage	%MTU	0/200 [0]	NA	Snapshot of the Motor Thermal Usage when a fault occurs. The value is overwritten if a subsequent fault occurs.	R
328	SSMotor Speed	%	0/100 [0]	NA	Snapshot of the Motor Speed when a fault occurs. The value is overwritten if a subsequent fault occurs.	R
329	SSTHD Vave	%	0.0/1000.0 [0]	NA	Snapshot of the average voltage Total Harmonic Distortion (THD) when a fault occurs. The value is overwritten if a subsequent fault occurs,	R
330	SSTHD Iave	%	0.0/1000.0 [0]	NA	Snapshot of the average current Total Harmonic Distortion (THD) when a fault occurs. The value is overwritten if a subsequent fault occurs.	R
331	SSProduct Status	—	0/65535 [0]	—	Snapshot of the product status when a fault occurs. The value is overwritten if a subsequent fault occurs.	R
				bit 0 = Enabled/ Ready	1 – Ready	
					0 – Not Ready	
				bit 1 = Running	1 – Power Applied to Motor (Gating SCRs or Bypass closed)	
					0 – Power NOT Applied to Motor	
				bit 2 = Phasing	1 – ABC Phasing	
					0 – CBA Phasing	
				bit 3 = Phasing Active	1 – 3-phase is valid	
					0 – No valid 3-phase detected	
				bit 4 = Starting (Accel)	1 – Performing a Start Maneuver (slow speed not included)	
					0 – Not Performing a Start Maneuver	
				bit 5 = Stopping (Decel)	1 – Performing a Stop Maneuver (coast to stop not included)	
					0 – Not Performing a Stop Maneuver	
				bit 6 = Alarm	1 – Alarm Present	
					0 – No Alarm Present	
				bit 7 = Fault	1 – Fault Condition Exists and hasn't been cleared	
					0 – No Fault Condition	
				bit 8 = At Speed	1 – Full Voltage Applied (Bypass or full SCR conduction)	
					0 – Not Full Voltage Applied	
				bit 9 = Start/Isolate	1 – Start/Isolate Contactor Enabled	
					0 – Start/Isolate Contactor Disabled	
				bit 10 = Bypass	1 – Bypass Contactor Enabled	
					0 – Bypass Contactor Disabled	
				bit 11 = Ready	1 indicates that the SMC is ready to accept a Start command. The device is not faulted or in the process of stopping, starting or jogging.	
				bit 12 - 13 = Reserved	Always 0	
				bit 14 = Input #1	Control Module Input #1 Status. 1 = Input Closed	
				bit 15 = Input #2	Control Module Input #2 Status. 1 = Input Closed	
332	SSBoard Temp	degC	-25/100 [20]	NA	Snapshot of the internal temperature of the SMC control module when a fault occurs. The value is overwritten if a subsequent fault occurs	R
333	SSLine Frequency	HZ	0/100 [0]	NA	Snapshot of the line frequency of the three phase voltage when a fault occurs. The value is overwritten if a subsequent fault occurs	R

Table 153 - Parameter 334…346

Number	Name	Units	Min./Max. [Default]	Enum Text	Description	Read/Write Access
334	Restart Auto	—	— [all disabled]	Volt Unbal Overvoltage Undervoltage Line Loss	Modifies the Auto Restarting of the selected faults so that the restart is attempted when the fault condition is removed rather than after a fixed time delay.	R/W
335	DLX Input 1	—	-2147483648… 2147483647 [0]	NA	General purpose parameter used as an input to the DeviceLogix Engine.	R/W
336	DLX Input 2	—	-2147483648… 2147483647 [0]	NA	General purpose parameter used as an input to the DeviceLogix Engine.	R/W
337	DLX DL Input 1	—	0 / 159999 [1]	NA	General purpose datalink used to select another parameter within the SMC-50 as an input to the DeviceLogix Engine.	R/W
338	DLX DL Input 2	—	0 / 159999 [1]	NA	General purpose datalink used to select another parameter within the SMC-50 as an input to the DeviceLogix Engine.	R/W
339	DLX DL Input 3	—	0 / 159999 [1]	NA	General purpose datalink used to select another parameter within the SMC-50 as an input to the DeviceLogix Engine.	R/W
340	DLX DL Input 4	—	0 / 159999 [1]	NA	General purpose datalink used to select another parameter within the SMC-50 as an input to the DeviceLogix Engine.	R/W
341	DLX DL Input 5	—	0 / 159999 [1]	NA	General purpose datalink used to select another parameter within the SMC-50 as an input to the DeviceLogix Engine.	R/W
342	DLX DL Input 6	—	0 / 159999 [1]	NA	General purpose datalink used to select another parameter within the SMC-50 as an input to the DeviceLogix Engine.	R/W
343	DLX Output 1	—	-2147483648… 2147483647 [0]	NA	General purpose parameter that can be written by the DeviceLogix engine and monitored from a HIM or network device.	R
344	DLX Output 2	—	-2147483648… 2147483647 [0]	NA	General purpose parameter that can be written by the DeviceLogix engine and monitored from a HIM or network device.	R
345	DLX Command	—		Ready Enable Disable	Allows the user to enable or disable the DeviceLogix engine. Once the "Enable" or "Disable" command has been executed the parameter will automatically revert back to "Ready".	R/W
346	DLX Status	—		Enable Disable	Indicates the current state of the DeviceLogix engine.	R

150-SM6 PCM Information

Table 154 - Parameter X.1…X.9

Number	Name	Min./Max. [Default]	Units	Enum Text	Description	Read/Write Access
X.1	Module Status	0/1 [1]	NA	—	Displays information about the operational status of the 150-SMB Parameter Configuration Option I/O Module.	R
				Ready	Bit 0 - Ready; Bit Set = 1 indicates the module is ready for operation.	R
X.2	Rotary Switch 1	0/15 [0]	NA	NA	Displays the numeric position of Rotary Switch 1 = Initial Torque	R
X.3	Rotary Switch 2	0/15 [0]	NA	NA	Displays the numeric position of Rotary Switch 2 = Current Limit.	R
X.4	Rotary Switch 3	0/15 [0]	NA	NA	Displays the numeric position of Rotary Switch 3 = Ramp Time.	R
X.5	Rotary Switch 4	0/15 [0]	NA	NA	Displays the numeric position of Rotary Switch 4 = Stop Time.	R
X.6	Rotary Switch 5	0/15 [0]	NA	NA	Displays the numeric position of Rotary Switch 5 = Motor FLC.	R
X.7	Device Config	0/255 [0]	NA	NA	Displays the Device Config DIP switch bit status (1=Sw ON & 2=Sw OFF).	R
X.8	Protect Config	0/255 [0]	NA	NA	Displays the Protect Config DIP switch bit status (1=Sw ON & 2=Sw OFF).	R
X.9	IO Config	0/255 [0]	NA	NA	Displays the IO Config DIP switch bit status (1=Sw ON & 2=Sw OFF).	R

❶ X indicates the Control Module port number in which the 150-SM6 Option Module is installed. Allowable ports = 7, 8, or 9.

150-SM4 Digital I/O Module Information

Table 155 - Parameter X.1…X.18

Number	Name	Min./Max. [Default]	Units	Enum Text	Description	Read/Write Access
X.1	Module Status	0/256 [0]	NA	—	Displays information about the operational status of the 150-SM4 Digital I/O Option Module.	R
				Ready	Bit 0 = Ready; Bit Set = indicates the module is ready for operation.	
				Input 1	Bit 1 = Input 1; Bit Set (1) indicates the input is ON.	
				Input 2	Bit 2 = Input 2; Bit Set (1) indicates the input is ON.	
				Input 3	Bit 3 = Input 3; Bit Set (1) indicates the input is ON.	
				Input 4	Bit 4 = Input 4; Bit Set (1) indicates the input is ON.	
				Aux 1	Bit 5 = Aux 1; Bit Set (1) indicates the auxiliary relay output is ON.	
				Aux 2	Bit 6 = Aux 2; Bit Set (1) indicates the auxiliary relay output is ON.	
				Aux 3	Bit 7 = Aux 3; Bit Set (1) indicates the auxiliary relay output is ON.	
				Bit 8-15 Spare	Bit 8-15 Spare	
X.2	Input 1	0/13 [0]	NA	—	Allows the user to select the operation of Input Terminal A1, Option Input 1 on the 150-SM4 Digital I/O Option Module.	R/W
				[Disable]	Disable the input; ignores any assertion to Input A1Terminal (High).	
				Start	Initiate a start as set up by the start parameters at Input Terminal A1.	
				Coast	Initiates a coast stop; no current to motor at Input Terminal A1 (Low).	
				Stop Option	Initiates a stop maneuver as set up by the stopping parameters at Input Terminal A1 (Low).	
				Start/Coast	If Input Terminal A1 = 0 stops motor, 1 initiates a start as set up by the start parameters.	
				Start/Stop	If Input Terminal A1 = 0 initiates a stop maneuver as set up by stopping parameters, 1 initiates a start as set up b the start parameters.	
				Slow Speed	Runs motor in slow speed mode as set up by slow speed parameters (High).	
				Dual Ramp	If Input Terminal A1 = 0, use starting mode 1; 1, use starting mode 2.	
				OL Select	If Input Terminal A1 = 0, use Motor Overload Class 1; 1, use Motor Overload Class 2.	
				Fault	A fault condition is forced if Input Terminal A1 = 1.	
				Fault NC	A fault condition is forced if Input Terminal A1 = 0.	
				Clear Fault	Clear a fault from Input Terminal A1 (High).	
				Emerg Run	Allows motor to run in emergency run mode if asserted from Input Terminal A1; does not start motor (High).	
				Motor Heater	Runs motor heating algorithm if asserted at Input Terminal A1 (High).	

Number	Name	Min./Max. [Default]	Units	Enum Text	Description	Read/Write Access
X.3	Input 2	0/13 [0]	NA	—	Allows the user to select the operation of Input Terminal A2, Option Input 2 on the 150-SM4 Digital I/O Option Module.	R/W
				[Disable]	Disable the input; ignores any assertion to Input A2 Terminal.	
				Start	Initiate a start as set up by the start parameters at Input Terminal A2 (High).	
				Coast	Initiates a coast stop; no current to motor at Input Terminal A2 (Low).	
				Stop Option	Initiates a stop maneuver as set up by the stopping parameters at Input Terminal A2 (High).	
				Start/Coast	If Input Terminal A2 = 0 stops motor, 1 initiates a start as set up by the start parameters.	
				Start/Stop	If Input Terminal A2 = 0 initiates a stop maneuver as set up by stopping parameters, 1 initiates a start as set up b the start parameters.	
				Slow Speed	Runs motor in slow speed mode as set up by slow speed parameters (High).	
				Dual Ramp	If Input Terminal A2 = 0, use starting mode 1; 1, use starting mode 2.	
				OL Select	If Input Terminal A2 = 0, use Motor Overload Class 1; 1, use Motor Overload Class 2.	
				Fault	A fault condition is forced if Input Terminal A2 = 1.	
				Fault NC	A fault condition is forced if Input Terminal A2 = 0.	
				Clear Fault	Clear a fault from Input Terminal A2 (High).	
				Emerg Run	Allows motor to run in emergency run mode if asserted from Input Terminal A2; does not start motor (High).	
				Motor Heater	Runs motor heating algorithm if asserted at Input Terminal A2 (High).	
X.4	Input 3	0/13 [0]	NA	—	Allows the user to select the operation of Input Terminal A3, Option Input 3 on the 150-SM4 Digital I/O Option Module.	R/W
				[Disable]	Disable the input; ignores any assertion to Input A3 Terminal.	
				Start	Initiate a start as set up by the start parameters at Input Terminal A3 (High).	
				Coast	Initiates a coast stop; no current to motor at Input Terminal A3 (Low).	
				Stop Option	Initiates a stop maneuver as set up by the stopping parameters at Input Terminal A3 (Low).	
				Start/Coast	If Input Terminal A3 = 0 stops motor, 1 initiates a start as set up by the start parameters.	
				Start/Stop	If Input Terminal A3 = 0 initiates a stop maneuver as set up by stopping parameters, 1 initiates a start as set up b the start parameters.	
				Slow Speed	Runs motor in slow speed mode as set up by slow speed parameters (High).	
				Dual Ramp	If Input Terminal A3 = 0, use starting mode 1; 1, use starting mode 2.	
				OL Select	If Input Terminal A3 = 0, use Motor Overload Class 1; 1, use Motor Overload Class 2.	
				Fault	A fault condition is forced if Input Terminal A3 = 1.	
				Fault NC	A fault condition is forced if Input Terminal A3 = 0.	
				Clear Fault	Clear a fault from Input Terminal A3 (High).	
				Emerg Run	Allows motor to run in emergency run mode if asserted from Input Terminal A3; does not start motor (High).	
				Motor Heater	Runs motor heating algorithm if asserted at Input Terminal A3 (High).	

Number	Name	Min./Max. [Default]	Units	Enum Text	Description	Read/Write Access
X.5	Input 4	0/13 [0]	NA	—	Allows the user to select the operation of Input Terminal A4, Option Input 4 on the 150-SM4 Digital I/O Option Module.	R/W
				[Disable]	Disable the input; ignores any assertion to Input A4 Terminal.	
				Start	Initiate a start as set up by the start parameters at Input Terminal A4 (High).	
				Coast	Initiates a coast stop; no current to motor at Input Terminal A4 (Low).	
				Stop Option	Initiates a stop maneuver as set up by the stopping parameters at Input Terminal A4.	
				Start/Coast	If Input Terminal A4 = 0 stops motor, 1 initiates a start as set up by the start parameters.	
				Start/Stop	If Input Terminal A4 = 0 initiates a stop maneuver as set up by stopping parameters, 1 initiates a start as set up b the start parameters.	
				Slow Speed	Runs motor in slow speed mode as set up by slow speed parameters (High).	
				Dual Ramp	If Input Terminal A4 = 0, use starting mode 1; 1, use starting mode 2.	
				OL Select	If Input Terminal A4 = 0, use Motor Overload Class 1; 1, use Motor Overload Class 2.	
				Fault	A fault condition is forced if Input Terminal A4 = 1.	
				Fault NC	A fault condition is forced if Input Terminal A4 = 0.	
				Clear Fault	Clear a fault from Input Terminal A4 (High).	
				Emerg Run	Allows motor to run in emergency run mode if asserted from Input Terminal A4; does not start motor (High).	
				Motor Heater	Runs motor heating algorithm if asserted at Input Terminal A4 (Low).	
X.6	Aux1 Config	0/11 [0]	NA	—	Allows the user to configure the functionality of the Aux1 Relay Output on the 150-SM4 Digital I/O Option Module.	R/W
				[Normal]	Aux1 closes when start asserted, opens when motor stops.	
				Up-to-Speed	Aux1 closes when motor reaches up-to-speed and opens when the motor is not at speed.	
				Fault	Aux1 closes when the SMC-50 enters a fault state and opens when the fault is cleared.	
				Alarm	Aux1 closes when the SMC-50 detects an alarm condition and opens when the alarm is cleared.	
				Ext Bypass	Aux1 closes when the SMC-50 enters the external bypass mode and opens when it leaves that mode (SCR Control).	
				Ext Brake	Aux1 closes when the external braking command is active and opens when it is not active.	
				Device Logix	Aux1 is controlled by the Device Logix program.	
				Aux Control	When an auxiliary output is configured for Aux Control, a bit within the parameter Aux Control will control the state of the auxiliary.	
				Network 1	With an auxiliary configured as Network 1, it is controlled over the LAN as Relay 1.	
				Network 2	With an auxiliary configured as Network 2, it is controlled over the LAN as Relay 2.	
				Network 3	With an auxiliary configured as Network 3, it is controlled over the LAN as Relay 3.	
				Network 4	With an auxiliary configured as Network 4, it is controlled over the LAN as Relay 4.	
X.7	Aux1 Invert	0/1 [0]	NA	—	Enables the user to invert the logic of the Aux1 output. When disabled, it is a normally open relay output contact when de-energized. By enabling the invert function, the relay contact becomes a normally closed contact when de-energized.	R/W
				[Disable]	Aux1 Relay Output is not inverted (N.O.).	
				Enable	Aux1 Relay Output is inverted (N.C.) ❷.	
X.8	Aux1 On Delay	0.0/10.0 [0.0]	sec	NA	A user-selected time delay in activating the Aux1 Relay Contact can be programmed.	R/W
X.9	Aux1 Off Delay	0.0/10.0 [0.0]	sec	NA	A user-selected time delay in de-activating the Aux1 Relay Contact can be programmed.	R/W

Number	Name	Min./Max. [Default]	Units	Enum Text	Description	Read/Write Access
X.10	Aux2 Config	0/11 [0]	NA	—	Allows the user to configure the functionality of the Aux2 Relay Output on the 150-SM4 Digital I/O Option Module.	R/W
				[Normal]	Aux2 closes when start asserted, opens when motor stops.	
				Up-to-Speed	Aux2 closes when motor reaches up-to-speed and opens when the motor is not at speed.	
				Fault	Aux2 closes when the SMC-50 enters a fault state and opens when the fault is cleared.	
				Alarm	Aux2 closes when the SMC-50 detects an alarm condition and opens when the alarm is cleared.	
				Ext Bypass	Aux2 closes when the SMC-50 enters the external bypass mode and opens when it leaves that mode (SCR Control).	
				Ext Brake	Aux2 closes when the external braking command is active and opens when it is not active.	
				Device Logix	Aux2 is controlled by the Device Logix program	
				Aux Control	When an auxiliary output is configured for Aux Control, a bit within the parameter Aux Control will control the state of the auxiliary.	
				Network 1	With an auxiliary configured as Network 1, it is controlled over the LAN as Relay 1.	
				Network 2	With an auxiliary configured as Network 2, it is controlled over the LAN as Relay 2.	
				Network 3	With an auxiliary configured as Network 3, it is controlled over the LAN as Relay 3.	
				Network 4	With an auxiliary configured as Network 4, it is controlled over the LAN as Relay 4.	
X.11	Aux2 Invert	0/1 [0]	NA	—	Enables the user to invert the logic of the Aux2 output. When disabled, it is a normally open relay output contact when de-energized. By enabling the invert function, the relay contact becomes a normally closed contact when de-energized.	R/W
				[Disable]	Aux2 Relay Output is not inverted (N.O.).	
				Enable	Aux2 Relay Output is inverted (N.C.) ❷.	
X.12	Aux2 On Delay	0.0/10.0 [0.0]	sec	NA	A user-selected time delay in activating the Aux2 Relay Contact can be programmed.	R/W
X.13	Aux2 Off Delay	0.0/10.0 [0.0]	sec	NA	A user-selected time delay in de-activating the Aux2 Relay Contact can be programmed.	R/W
X.14	Aux3 Config	0/11 [0]	NA	—	Allows the user to configure the functionality of the Aux3 Relay Output on the 150-SM4 Digital I/O Option Module.	R/W
				[Normal]	Aux3 closes when start asserted, opens when motor stops.	
				Up-to-Speed	Aux3 closes when motor reaches Up-to-Speed and opens when the motor is not at speed.	
				Fault	Aux3 closes when the SMC-50 enters a fault state and opens when the fault is cleared.	
				Alarm	Aux3 closes when the SMC-50 detects an alarm condition and opens when the alarm is cleared.	
				Ext Bypass	Aux3 closes when the SMC-50 enters the external bypass mode and opens when it leaves that mode (SCR Control).	
				Ext Brake	Aux3 closes when the external braking command is active and opens when it is not active.	
				Device Logix	Aux3 is controlled by the Device Logix program	
				Aux Control	When an auxiliary output is configured for Aux Control, a bit within the parameter Aux Control will control the state of the auxiliary.	
				Network 1	With an auxiliary configured as Network 1, it is controlled over the LAN as Relay 1.	
				Network 2	With an auxiliary configured as Network 2, it is controlled over the LAN as Relay 2.	
				Network 3	With an auxiliary configured as Network 3, it is controlled over the LAN as Relay 3.	
				Network 4	With an auxiliary configured as Network 4, it is controlled over the LAN as Relay 4.	

Number	Name	Min./Max. [Default]	Units	Enum Text	Description	Read/Write Access
X.15	Aux3 Invert	0/1 [0]	NA	—	Enables the user to invert the logic of the Aux3 output. When disabled, it is a normally open relay output contact when de-energized. By enabling the invert function, the relay contact becomes a normally closed contact when de-energized.	R/W
				[Disable]	Aux3 Relay Output is not inverted (N.O.).	
				Enable	Aux3 Relay Output is inverted (N.C.) ❷.	
X.16	Aux3 On Delay	0.0/10.0 [0.0]	sec	NA	A user-selected time delay in activating the Aux3 Relay Contact can be programmed.	R/W
X.17	Aux3 Off Delay	0.0/10.0 [0.0]	sec	NA	A user-selected time delay in de-activating the Aux3 Relay Contact can be programmed.	R/W
X.18	Parameter Management	0/1 [0]	NA	—	Allows the user to set all 150-SM4 Digital I/O Option Module parameters to default values.	R/W
				[Ready]	Waiting for command to set defaults.	
				Factory Default	Set all writable parameters to factory default values.	

❶ X indicates the Control Module port number in which the 150-SM4 Option Module is installed. Allowable ports = 7, 8, or 9.

❷ N.C. is electrically held closed.

150-SM2 Ground Fault Module Information

Table 156 - Parameter X.1…X.19

Number	Name	Min./Max. [Default]	Units	Enum Text	Description	Read/Write Access
X.1	Module Status	0/7 [7]	NA	—	Displays information about the operational status of the 150-SM2 PTC, Ground Fault, and External Current Transformer (CT) Option Module.	R
				Ready	Bit 0 = Ready; Bit Set =1 indicates the module is ready for operation.	
				PTC	Bit 1 = PTC; 1 = PTC Indicating Fault 0; = No fault	
				CT Loss	Bit 2 = CT Loss; 1 = CT disconnected; 0 = CT Connected	
X.2	Fault Enable	0/3 [0]	NA	—		R/W
				PTC	0 = PTC Fault Disabled; 1 = PTC Fault Enabled	
				Ground Fault	0 = Ground Fault Disabled; 1 = Ground Fault Enabled	
x.3	Alarm Enable	0/3 [0]	NA	—		R/W
				PTC	0 = PTC Alarm Disabled; 1 = PTC Alarm Enabled	
				Ground Fault	0 = Ground Fault Alarm Disabled; 1 = Ground Fault Alarm Enabled	
X.4	Restart Enable	0/3 [0]	NA	—		R/W
				PTC	0 = does not restart after PTC Fault is cleared; 1 = restart after PTC Fault is cleared	
				Ground Fault	0 = does not restart after the Ground Fault is cleared; 1 = restart after the Ground Fault is cleared	
X.5	Turns Ratio	100/2000 [1000]	:1	NA	Enables user to configure the turns ratio for the CT being used.	R/W
X.6	Gnd Flt Level	0.00/5.00 [2.50]	Amps	NA	Enables the user to configure the level (value) of ground current that determines a ground fault condition.	R/W
X.7	Gnd Flt Delay	0.1/250.0 [0.5]	Secs	NA	Sets the time limit that the ground fault level must be exceeded before signalling a fault.	R/W
X.8	Gnd Flt A Level	0.00/5.00 [2.50]	Amps	NA	Sets the level of ground current that determines a ground fault alarm condition.	R/W
X.9	Gnd Flt A Delay	0.1/250.0 [0.5]	Secs	NA	Sets the time limit that the ground fault level must be exceeded before signalling an alarm.	R/W
X.10	Gnd Flt Inh Time	0.0/250.0 [10.0]	Secs	NA	User configurable time delay to inhibit ground fault after a start.	R/W
X.11	Ground Current	0.00/5.00 [0.00]	Amps	NA	Measured ground current.	R/W

Number	Name	Min./Max. [Default]	Units	Enum Text	Description	Read/Write Access
X.12	CT Enable	0/1 [0]	NA	—		R/W
				Disable	Disables the CT function.	
				Enable	Enables the CT function.	
X.13	CT Scaling A	0.00/5.00 [0.01]	NA	NA	Displayed result of the SMC-50 tuning feature determination of the scaling between external CT and the internal current measuring circuitry.	R
X.14	CT Scaling B					
X.15	CT Scaling C					
X.16	Phase Shift A	-12.5/12.5 [0.00]	Deg	NA	Displayed result of the SMC-50 tuning feature determination of the phase shift between external CT and the internal current measuring circuitry.	R
X.17	Phase Shift B					
X.18	Phase Shift C					
X.19	Parameter Mgmt	0/1 [0]	NA	—		R/W
				Ready	Waiting for command to set defaults.	
				Factory Default	Set all writable parameters to factory default values.	

❶ X indicates the Control Module port number in which the 150-SM2 PTC, Ground Fault, and External CT Option Module is installed. Allowable ports = 7 or 8.

150-SM3 Analog I/O Module Information

Table 157 - Parameter X.1…X.56

Number ❶	Name	Min./Max. [Default]	Units	Enum Text	Description	Read/Write Access
X.1	Module Status	0/4096 [0]	NA	—	Displays information about the operational status of the 150-SM3 Analog I/O Option Module	R
				Ready	Bit 0 = Ready Bit Set = indicates the module is ready for operation	
				In1 Over Flt	Bit 1 = Input 1 Over Fault Bit Set = Input 1 Overrange fault	
				In1 Over Alm	Bit 2 = Input 1 Over Alarm Bit Set = Input 1 Overrange alarm	
				In1 Undr Flt	Bit 3 = Input 1 Under Fault Bit Set = Input 1 Underrange fault	
				In1 Undr Alm	Bit 4 = Input 1 Under Alarm Bit Set = Input 1 Underrange Alarm	
				In2 Over Flt	Bit 5 = Input 2 Over Fault Bit Set = Input 2 Overrange fault	
				In2 Over Alm	Bit 6 = Input 2 Over Alarm Bit Set = Input 2 Overrange alarm	
				In2 Undr Flt	Bit 7 = Input 2 Under Fault Bit Set = Input 2 Underrange fault	
				In2 Undr Alm	Bit 8 = Input 2 Under Alarm Bit Set = Input 2 Underrange Alarm	
				Out 1 Shorted	Bit 9 = Output 1 Shorted Bit Set = indicates Output 1 is shorted	
				Out 1 Open	Bit 10 = Output 1 Open Bit Set = indicates Output 1 is an open circuit	
				Out 2 Shorted	Bit 11 = Output 2 Shorted Bit Set = indicates Output 2 is shorted	
				Out 2 Open	Bit 12 = Output 2 Open Bit Set = indicates Output 2 is an open circuit	
				Bits 13-15	Reserved	
X.2	Sample Rate	0/1[0]	NA	60 Hz	Selects a 60 Hz filter on Input 1 and Input 2	R/W
				250 Hz	Selects a 250 Hz filter on Input 1 and Input 2	
X.3	Input 1 Scaled	-3000.0/ 3000.0 [0.0]	NA	NA	Input 1 scaled to user units	R
X.4	Input 1 Analog	-21.000/ 21.000 [0.000]	V or mA	NA	Input 1 in electrical units (volts or milliamps)	R

Number ❶	Name	Min./Max. [Default]	Units	Enum Text	Description	Read/Write Access
X.5	Input 1 Percent	-105.00/105.00 [0.00]	NA	NA	Input 1 as a percentage of configured range	R
X.6	Input 1 Raw	-32768/32768 [0]	NA	NA	Input 1 unscaled	R
X.7	Input 1 Range	0/5 [1]	NA	+/- 10V	Input 1 set to voltage mode with range of -10V to +10V	R/W
				10V	Input 1 set to voltage mode with range of 0V to 10V	
				5V	Input 1 set to voltage mode with range of 0V to 5V	
				1-5V	Input 1 set to voltage mode with range of 1V to 5V	
				0-20mA	Input 1 set to current mode with range of 0mA to 20mA	
				4-20mA	Input 1 set to current mode with range of 4mA to 20mA	
X.8	Input 1 Offset	-10000/10000 [0]	NA	NA	Offset value of Input 1 subtracted from the Input 1 Raw value (positive offset lowers the resulting value)	R/W
X.9	Input 1 Data Hi	-3000.0/3000.0 [1000.0]	NA	NA	User defined maximum value of Input 1 custom value range	R/W
X.10	Input 1 Data Lo	-3000.0/3000.0 [0.0]	NA	NA	User defined minimum value of Input 1 custom value range	R/W
X.11	Input 1 High	-21.000/21.000 [10.000]	V or mA	NA	Correlates Input 1 Data Hi to the Input 1 Raw value	R/W
X.12	Input 1 Low	-21.000/21.000 [0.000]	V or mA	NA	Correlates Input 1 Data Low to the Input 1 Raw value	R/W
X.13	Input 2 Scaled	-3000.0/3000.0 [0.0]	NA	NA	Input 2 scaled to user units	R
X.14	Input 2 Analog	-21.000/21.000 [0.000]	V or mA	NA	Input 2 in electrical units (volts or milliamps)	R
X.15	Input 2 Percent	-105.00/105.00 [0.00]	NA	NA	Input 2 as a percentage of configured range	R
X.16	Input 2 Raw	-32768/32768 [0]	NA	NA	Input 2 unscaled	R
X.17	Input 2 Range	0/5 [1]	NA	+/- 10V	Input 2 set to voltage mode with range of -10V to +10V	R/W
				10V	Input 2 set to voltage mode with range of 0V to 10V	
				5V	Input 2 set to voltage mode with range of 0V to 5V	
				1-5V	Input 2 set to voltage mode with range of 1V to 5V	
				0-20mA	Input 2 set to current mode with range of 0mA to 20mA	
				4-20mA	Input 2 set to current mode with range of 4mA to 20mA	
X.18	Input 2 Offset	-10000/10000 [0]	NA	NA	Offset value of Input 2 subtracted from the Input 2 Raw value. (positive offset lowers the resulting value)	R/W
X.19	Input 2 Data Hi	-3000.0/3000.0 [1000.0]	NA	NA	User defined maximum value of Input 2 custom value range	R/W
X.20	Input 2 Data Lo	-3000.0/3000.0 [0.0]	NA	NA	User defined minimum value of Input 2 custom value range	R/W
X.21	Input 2 High	-21.000/21.000 [10.000]	V or mA	NA	Correlates Input 2 Data Hi to the Input 2 Raw value	R/W
X.22	Input 2 Low	-21.000/21.000 [0.000]	V or mA	NA	Correlates Input 2 Data Low to the Input 2 Raw value	R/W
X.23	Output 1 Range	0/4 [1]	NA	+/- 10V	Output 1 set to voltage mode with range of -10V to +10V	R/W
				10V	Output 1 set to voltage mode with range of 0V to 10V	
				5V	Output 1 set to voltage mode with range of 0V to 5V	
				0-20mA	Output 1 set to current mode with range of 0mA to 20mA	
				4-20mA	Output 1 set to current mode with range of 4mA to 20mA	
X.24	Output 1 Select	0/15999 [1]	NA	NA	Selects the parameter used to drive Output 1	R/W
X.25	Output 1 High	-20.000/20.000 [10.000]	V or mA	NA	Output level when the selected parameter (Output 1 Select) reaches "Output 1 Data Hi"	R/W
X.26	Output 1 Low	-20.000/20.000 [0.000]	V or mA	NA	Output level when the selected parameter (Output 1 Select) reaches "Output 1 Data Lo"	R/W
X.27	Output 1 Data Hi	-300000000/300000000 [480]	V or mA	NA	Level of the selected parameter (Output 1 Select) corresponding to an output of "Output 1 High"	R/W
X.28	Output 1 Data Lo	-300000000/300000000 [0]	V or mA	NA	Level of the selected parameter (Output 1 Select) corresponding to an output of "Output 1 High"	R/W
X.29	Output1 Setpoint	0/65535 [0]	NA	NA	Raw value sent to Output 1 when "Output 1 Select" is set to "Disabled"	R/W

Number ❶	Name	Min./Max. [Default]	Units	Enum Text	Description	Read/Write Access
X.30	Output 2 Range	0/4 [1]	NA	+/- 10V	Output 2 set to voltage mode with range of -10V to +10V	R/W
				10V	Output 2 set to voltage mode with range of 0V to 10V	
				5V	Output 2 set to voltage mode with range of 0V to 5V	
				0-20mA	Output 2 set to current mode with range of 0mA to 20mA	
				4-20mA	Output 2 set to current mode with range of 4mA to 20mA	
X.31	Output 2 Select	0/15999 [1]	NA	NA	Selects the parameter used to drive Output 2	R/W
X.32	Output 2 High	-20.000/20.000 [10.000]	V or mA	NA	Output level when the selected parameter (Output 2 Select) reaches "Output 2 Data Hi"	R/W
X.33	Output 2 Low	-20.000/20.000 [0.000]	V or mA	NA	Output level when the selected parameter (Output 2 Select) reaches "Output 2 Data Lo"	R/W
X.34	Output 2 Data Hi	-300000000/ 300000000 [480]	V or mA	NA	Level of the selected parameter (Output 2 Select) corresponding to an output of "Output 2 High"	R/W
X.35	Output 2 Data Lo	-300000000/ 300000000 [0]	V or mA	NA	Level of the selected parameter (Output 2 Select) corresponding to an output of "Output 2 High"	R/W
X.36	Output2 Setpoint	0/65535 [0]	NA	NA	Raw value sent to Output 2 when "Output 2 Select" is set to "Disabled"	R/W
X.37	Fault Enable	0/255 [0]	NA	In1 Over	Allows the user to enable the Input/Output faults 0 = Fault Disabled 1 = Fault Enabled	R/W
				In1 Under		
				In2 Over		
				In2 Under		
				Out1 Shorted		
				Out1 Open		
				Out2 Shorted		
				Out2 Open		
X.38	Alarm Enable	0/255 [0]	NA	In1 Over	Allows the user to enable the Input/Output alarms 0 = Alarm Disabled 1 = Alarm Enabled	R/W
				In1 Under		
				In2 Over		
				In2 Under		
				Out1 Shorted		
				Out1 Open		
				Out2 Shorted		
				Out2 Open		
X.39	Restart Enable	0/255 [0]	NA	In1 Over	0 = Do not attempt a restart after fault is cleared 1 = Attempt a restart after fault is cleared Note: Restart Attempts, Parameter 133 and Restart Delay, Parameter 134 must also be configured	R/W
				In1 Under		
				In2 Over		
				In2 Under		
				Out1 Shorted		
				Out1 Open		
				Out2 Shorted		
				Out2 Open		
X.40	In1 Over F Lvl	-3000.0/3000.0 [1050.0]	NA	NA	If Input 1 exceeds this level for the time period set in the In1 Over F Dly parameter, an In1 Over fault will be signaled. The In1 Over bit must be set in the Fault Enable Parameter	R/W
X.41	In1 Over F Dly	0.1/99.0 [3.0]	sec	NA	The time period that Input 1 must exceed the In1 Over F Lvl to signal a fault. The In1 Over bit must be set in the Fault Enable Parameter	R/W
X.42	In1 Over A Lvl	-3000.0/3000.0 [1000.0]	NA	NA	If Input 1 exceeds this level for the time period set in the In1 Over A Dly parameter, an In1 Over alarm will be signaled. The In1 Over bit must be set in the Alarm Enable Parameter	R/W
X.43	In1 Over A Dly	0.1/99.0 [3.0]	sec	NA	The time period that Input 1 must exceed the In1 Over F Lvl to signal a fault. The In1 Over bit must be set in the Fault Enable Parameter.	R/W
X.44	In1 Under F Lvl	-3000.0/3000.0 [-50.0]	NA	NA	If Input 1 remains below this level for the time period set in the In1 Under F Dly parameter, an In1 Under fault will be signaled. The In1 Under bit must be set in the Fault Enable Parameter	R/W
X.45	In1 Under F Dly	0.1/99.0 [3.0]	sec	NA	The time period that Input 1 must remain below the In1 Under F Lvl to signal a fault. The In1 Under bit must be set in the Fault Enable Parameter	R/W

Number ❶	Name	Min./Max. [Default]	Units	Enum Text	Description	Read/Write Access
X.46	In1 Under A Lvl	-3000.0/3000.0 [0.0]	NA	NA	If Input 1 remains below this level for the time period set in the In1 Under A Dly parameter, an In1 Under alarm will be signaled. The In1 Under bit must be set in the Alarm Enable Parameter	R/W
X.47	In1 Under A Dly	0.1/99.0 [3.0]	sec	NA	The time period that Input 1 must remain below the In1 Under F Lvl to signal a fault. The In1 Under bit must be set in the Fault Enable Parameter.	R/W
X.48	In2 Over F Lvl	-3000.0/3000.0 [1050.0]	NA	NA	If Input 2 exceeds this level for the time period set in the In2 Over F Dly parameter, an In2 Over fault will be signaled. The In2 Over bit must be set in the Fault Enable Parameter	R/W
X.49	In2 Over F Dly	0.1/99.0 [3.0]	sec	NA	The time period that Input 2 must exceed the In2 Over F Lvl to signal a fault. The In2 Over bit must be set in the Fault Enable Parameter	R/W
X.50	In2 Over A Lvl	-3000.0/3000.0 [1000.0]	NA	NA	If Input 2 exceeds this level for the time period set in the In2 Over A Dly parameter, an In2 Over alarm will be signaled. The In2 Over bit must be set in the Alarm Enable Parameter	R/W
X.51	In2 Over A Dly	0.1/99.0 [3.0]	sec	NA	The time period that Input 2 must exceed the In2 Over F Lvl to signal a fault. The In2 Over bit must be set in the Fault Enable Parameter	R/W
X.52	In2 Under F Lvl	-3000.0/3000.0 [-50.0]	NA	NA	If Input 2 remains below this level for the time period set in the In2 Under F Dly parameter, an In2 Under fault will be signaled. The In2 Under bit must be set in the Fault Enable Parameter	R/W
X.53	In2 Under F Dly	0.1/99.0 [3.0]	sec	NA	The time period that Input 2 must remain below the In2 Under F Lvl to signal a fault. The In2 Under bit must be set in the Fault Enable Parameter	R/W
X.54	In2 Under A Lvl	-3000.0/3000.0 [0.0]	NA	NA	If Input 2 remains below this level for the time period set in the In2 Under A Dly parameter, an In2 Under alarm will be signaled. The In2 Under bit must be set in the Alarm Enable Parameter	R/W
X.55	In2 Under A Dly	0.1/99.0 [3.0]	sec	NA	The time period that Input 2 must remain below the In2 Under F Lvl to signal a fault. The In2 Under bit must be set in the Fault Enable Parameter	R/W
X.56	Parameter Mgmt	0/1 [0]	NA	Ready	Waiting for command to set defaults	R/W
				Set Defaults	Set all writable parameters to factory default values	

❶ X indicates the Control module Port number in which the Cat. No. 150-SM3 Analog I/O option module is installed. Allowable ports = 7, 8, or 9.

Spare/Replacement Parts

SMC-50 Power Poles and Assemblies

Table 158 - Power Poles and Assemblies Cat. Nos.

Description	Rating	Cat. No.	Cat. No.
Frame B Power Structure Assembly (Contains all three power poles in a single package and includes the pole-to-control module transition cover and cooling fan.)	90 A, 200…480V AC line	150-SPPB1B	150-SPPB1BR
	110 A, 200…480V AC line	150-SPPB2B	150-SPPB2BR
	140 A, 200…480V AC line	150-SPPB3B	150-SPPB3BR
	180 A, 200…480V AC line	150-SPPB4B	150-SPPB4BR
	90 A, 200…690V AC line	150-SPPB1U	150-SPPB1UR
	110 A, 200…690V AC line	150-SPPB2U	150-SPPB2UR
	140 A, 200…690V AC line	150-SPPB3U	150-SPPB3UR
	180 A, 200…690V AC line	150-SPPB4U	150-SPPB4UR
Frame C Power Pole (Contains one power pole — SCR and heatsink assembly and cable.)	210 A, 200…480V AC line	150-SPPC1B	
	260 A, 200…480V AC line	150-SPPC2B	
	320 A, 200…480V AC line	150-SPPC3B	
	210 A, 200…690V AC line	150-SPPC1U	
	260 A, 200…690V AC line	150-SPPC2U	
	320 A, 200…690V AC line	150-SPPC3U	
Frame D Power Pole (Contains one power pole — SCR and heatsink assembly and cable.)	361 A, 200…480V AC line	150-SPPD1B	
	420 A, 200…480V AC line	150-SPPD2B	
	520 A, 200…480V AC line	150-SPPD3B	
	361 A, 200…690V AC line	150-SPPD1U	
	420 A, 200…690V AC line	150-SPPD2U	
	520 A, 200…690V AC line	150-SPPD3U	

SMC-50 Control Modules

Table 159 - SMC-50 Replacement Control Module Cat. Nos.

Description	Cat. No.
Replacement Control Module 100...240V AC Control Power (Two 24V DC Inputs, Two Relay Outputs)	150-SCMD ❶
Replacement Control Module 24V DC Control Power (Two 24V DC Inputs, Two Relay Outputs)	150-SCMR ❶
❶ Control module includes cover.	

Option Modules

Table 160 - Option Module Cat. Nos.

Description	Rating	Cat. No.
PTC, Ground Fault, & Current Feedback	—	150-SM2
Analog I/O Module	Two analog inputs (voltage or current) and two analog outputs (voltage or current)	150-SM3
Digital I/O Module	Four inputs (120/240V AC) — 3 relay outputs	150-SM4
Parameter Configuration Module	DIP & Rotary Switch Configuration	150-SM6

Removable Terminal Blocks for Control Wiring

Table 161 - Replacement Terminal Block(s) Cat. Nos.

Description	Where Used	Cat. No.
Control Module Control I/O replacement removable terminal block	Control Module	150-SCMRTB
PTC Module replacement removable terminal block (set of 3)	150-SM2	150-SM2RTB
Analog I/O Option replacement removable terminal block	150-SM3	150-SM3RTB
Digital I/O Option replacement removable terminal block	150-SM4	150-SM4RTB

Fan

Table 162 - Replacement Fan Cat. Nos.

Description	Rating	Control Power	Cat. No.
Replacement Fan for Cat. No. 150-SB… Controller	90…180 A	100…240V AC	150-SF1
		24V DC	150-SF1R
Replacement Fan for Cat. No. 150-SC… Controller	210…320 A	100…240V AC	150-SF2D
		24V DC	150-SF2R
Replacement Fan for Cat. No. 150-SD… Controller	361…520 A	100…240V AC	150-SF3D
		24V DC	150-SF3R

Covers

Table 163 - Replacement Cover Cat. Nos.

Description	Rating	Cat. No.
Replacement Fan Cover for Cat. No. 150-SB… Controller	90…180 A	150-SBFC
Replacement Fan Cover for Cat. No. 150-SC… Controller	210…320 A	150-SCFC
Replacement Fan Cover for Cat. No. 150-SD… Controller	361…520 A	150-SDFC
Replacement Control Module Front Cover	90…520 A	150-SCMRC
Replacement Controller Cover	210…320 A	150-SCRC
Replacement Controller Cover	361…520 A	150-SDRC

Battery

Table 164 - Replacement Battery for RTC

Description	Rating	Cat. No.
Manganese Dioxide Lithium Coin Cell Battery	Normal Capacity: 220 m A h Nominal Voltage: 3V	Not a RA Listed Cat. No. ❶

❶ Commercially available as CR2032.

Renewal Part Instructions:

- Fan: Publication 150-IN054
- Fan Cover: Publication 150-IN057
- Control Module Cover: Publication 10000152882
- I/O Module RTB: Publication 150-IN058
- PTC Option Module RTB: Publication 10000152885
- Control Module RTB: Publication 10000152887
- Power Section, Frame B: Publication 10000152876
- Power Pole, Frame C: Publication 150-IN069
- Power Pole, Frame D: Publication 150-IN070
- Control Module, Frame B: Publication 10000152876
- Control Module, Frames C and D: Publication 150-IN067
- Shroud, Frames C and D: Publication 150-IN068

Control Module/Power Pole Assembly Replacement

SHOCK HAZARD: To prevent electrical shock, disconnect the control module and power pole assembly from all power sources **before** installing or servicing. Install in a suitable enclosure. Keep free from contaminants.

Removal & Replacement

Figure 97 - Control Module Removal

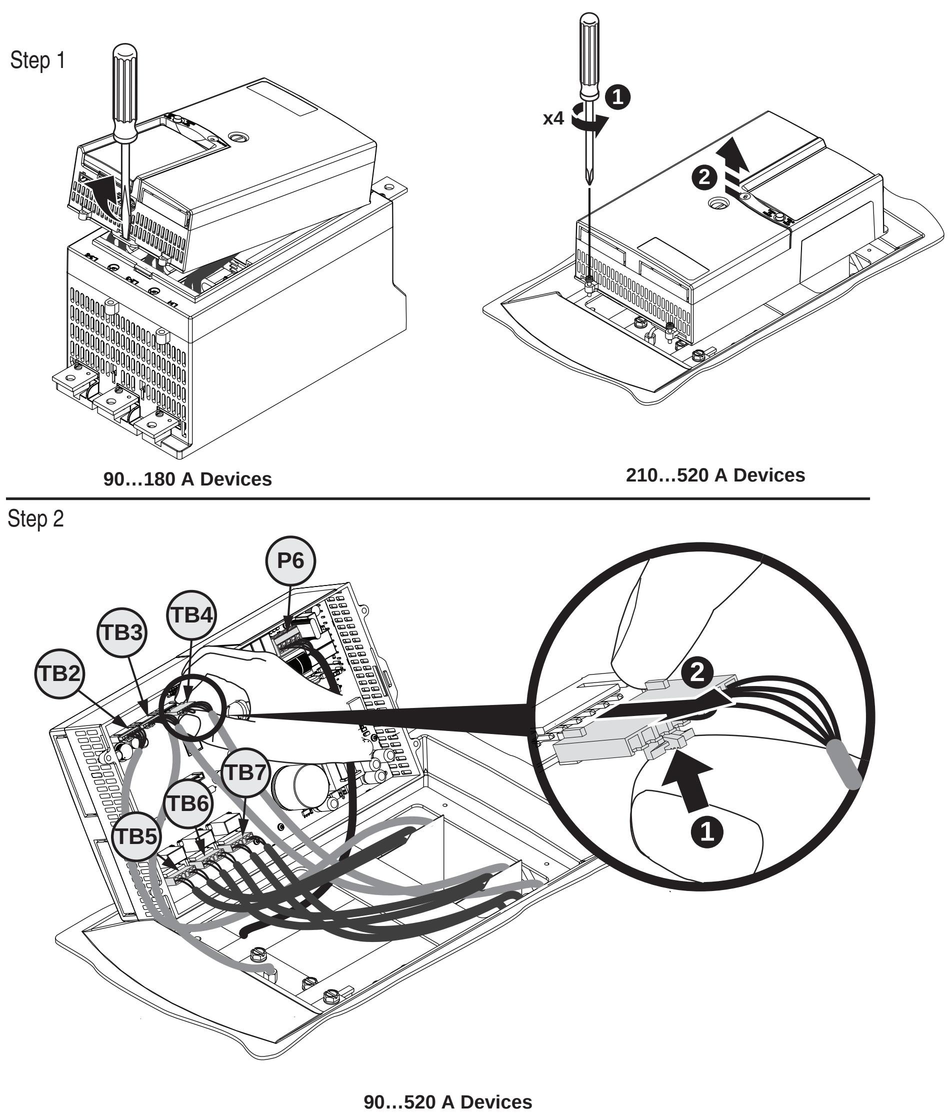
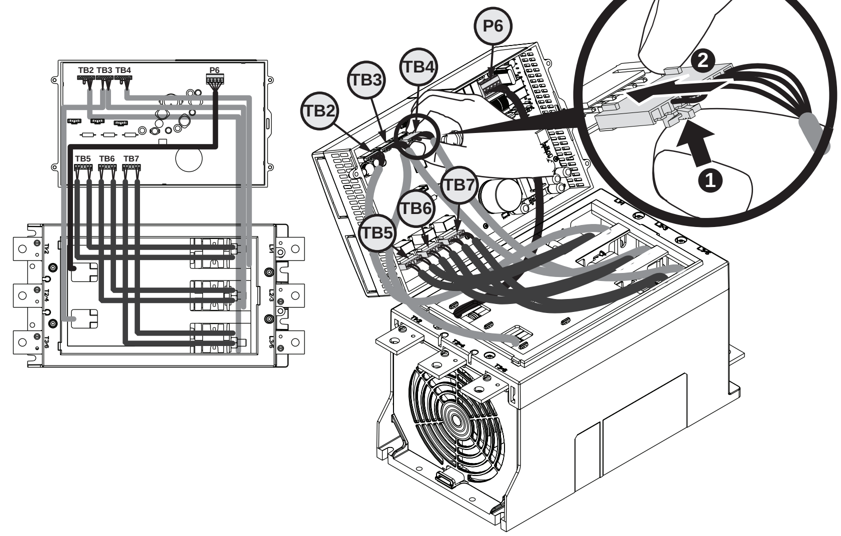


Figure 98 - Control Module Replacement

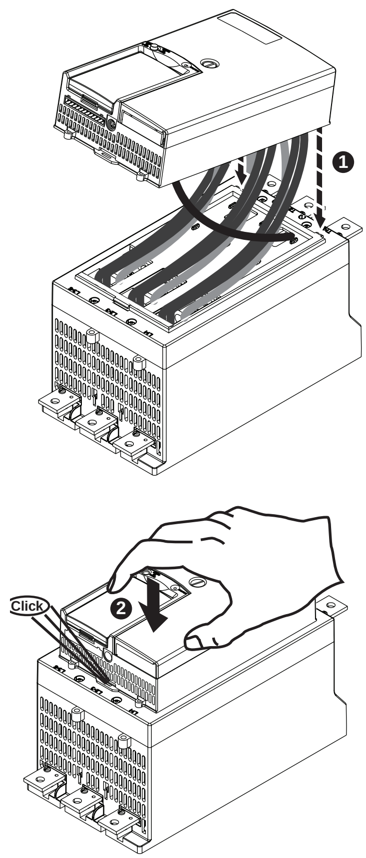
Step 1

90…520 A Devices

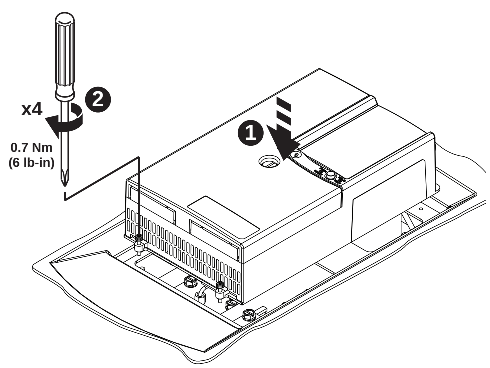


Step 2

90…180 A Devices



210…520 A Devices



Accessories

Catalog Numbers

Table 165 - Accessories Cat. Nos.

Description	Cat. No.
Option Modules	
PTC, Ground Fault, & Current Feedback	150-SM2
Analog I/O	150-SM3
Digital I/O	150-SM4
Parameter Configuration Module	150-SM6
Converter Modules❶	
30…180 A Three-Phase Current Monitoring	825-MCM180
181…520 A Three-Phase Current Monitoring ❷	825-MCM20
90…520 A Core Balance Ground Fault Sensor	825-CBCT
Protective Modules	
90…520 A, 480V AC	150-F84L
90…520 A, 600V AC	150-F86L
Terminal Lugs	
90…320 A	199-LF1
361…520 A	199-LG1
155…311 A Inside-the-Delta Connection Distribution Block	1492-BG
363…554 A Inside-the-Delta Connection Distribution Block	Marathon Special Products 1353703
625…900 A Inside-the-Delta Connection Distribution Block	Marathon Special Products 1352702
90…180 A Bypass Connection	1494R-N14
210…320 A Bypass Kits	150-SCBK❸
361…520 A Bypass Kits	150-SDBK❹
IEC Terminal Covers	
90…180 A Line or Load Terminal Cover	150-STCB

HIM❺			
SMC-50 Bezel Mount or Hand-Held❻			20-HIM-A6
Door-Mounted (includes cable) NEMA Type 4X/1A❼			20-HIM-C6S
Remote Mount Bezel❼			20-HIM-B1
Extension Cables		0.3 m (0.98 ft)	1202-H03
		1.0 m (3.28 ft)	1202-H10
		3.0 m (9.8 ft)	1202-H30
		9.0 m (29.5 ft)	1202-H90
Splitter Cable			1203-S03
Communication Modules			
DeviceNet			20-COMM-D
ControlNet			20-COMM-C
Profibus			20-COMM-P
RS 485 DF1			20-COMM-S
InterBus			20-COMM-I
Modbus/TCP			20-COMM-M
EtherNet			20-COMM-E
Dual-Port EtherNet			20-COMM-ER
RS 485 HVAC			20-COMM-H
ControlNet (Fiber)			20-COMM-Q
Programming Software for Windows 7/2000/XP/Vista	DriveExecutive™		9303-4DTE01ENE
	DriveTools™ SP❽		9303-4DTS01ENE
	Connected Components Workbench		download from www.rockwellautomation.com
PC Interface	AnaCANda™ RS232 to DPI	Serial	1203-SSS ❾
	AnaCANda USB to DPI	USB	1203-USB❿

❶ Used with a Cat. No. 150-SM2 to provide current feedback to the SMC-50 when in external bypass configuration.
❷ Requires user-supplied current transformers with 5 A secondary.
❸ Requires Cat. No. 199-LF1 lugs.
❹ Requires Cat. No. 199-LG1 lugs.
❺ For remote mounting details, see the HIM User Manual, 20HIM-UM001.
❻ The hand-held HIM requires a Cat. No. 20-HIM-H10 cable
❼ Includes a Cat. No. 1202-C30 cable that is 3.0 m (9.8 ft) in length.
❽ Includes DriveExecutive and DriveObserver™.
❾ Includes Cat. No. 1203-SFC and 1202-C10 cables.
❿ Includes Cat. No. 20-HIM-H10 and 22-HIM-H10 cables.

Using DeviceLogix

Introduction

DeviceLogix (DLX) is a standard feature in the SMC-50 (firmware 4.002 and higher). DeviceLogix can be used to control and monitor the SMC-50. DeviceLogix programming for the SMC-50 is accomplished through a DeviceLogix Editor component ( icon), available in Connected Components Workbench version 6 and later. Other DeviceLogix Editors, such as RSNetWorx for DeviceNet, cannot be used.

Table 166 - Basic features:

	SMC-50 4.002 and later
DeviceLogix Library	Version 5
Maximum number of function blocks	32
Program update time per number of blocks used	20 ms (fixed): 1…10 blocks 30 ms (fixed): 11…21 blocks 40 ms (fixed): 22…32 blocks

The SMC-50 DeviceLogix implementation provides basic logic capability for applications. A 20…40 ms scan time is provided depending on program size. DeviceLogix can be used in both networked and stand- alone environments. DeviceLogix continues execution independent of the SMC-50's state (starting, running, fault, etc.)

There is no data retention in DeviceLogix during a power cycle. Timer and counter accumulators, calculation results, latched bits, etc. will be cleared.

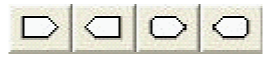
Controlling the SMC-50 operating modes (starting, stopping, slow speed etc.) through DeviceLogix requires that bit #14 of the "Logic Mask" (parameter #148) be set.

Parameters

See Parameter 334…346 on page 276 for DeviceLogix parameter descriptions.

Function Block Elements

The following function block elements are available:

Bit and Analog I/O[1]	
Process	ALM TDG
Select/Limit	SEL HLL
Timer/Counter	TONR TOFR PULR CTU CTD CTUD
Compare	MEQ EQU NEQ LES GRT LEQ GEQ
Compute/Math	ADD SUB MUL DIV MOD NEG ABS
Move/Logical	BAND BOR BXOR BNOT BNAND BNOR BXNOR SETD RSTD
Macro Block	

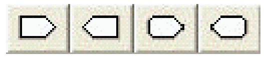
[1] Bit and Analog I/O do not count against the Function Block total. All other elements count, with each instance counting as one Function Block.

The DeviceLogix Editor provides a graphical interface for configuring Function Blocks to provide local control within the drive. DeviceLogix Editor navigation and programming basics are not covered in this manual. Refer to the DeviceLogix User Manual, publication RA-UM003A for additional information. It can be found on the RA Literature Library web site at: http://www.rockwellautomation.com/literature.

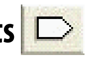
Macro Blocks 

Up to five Macro Blocks can be created by the user and each can be used five times. The selections will be empty until a Macro Block gets created. The icon text associated with each Macro Block is also created by the user.

Bit and Analog I/O Points



The DeviceLogix controller in Port 14 uses (32) bit inputs, (18) bit outputs, (24) analog inputs, and (2) analog outputs.

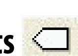
Bit Inputs 

Available bit inputs to the DeviceLogix program include:

Bit Inputs	Name	Description
(17) Hardware Boolean Inputs	Input 1, Input 2	State of the 2 inputs on the control module.
	P7 Ready, P8 Ready, P9 Ready	Status indicating that the expansion card installed into the corresponding expansion port is functioning and Ready
	PX input 1 – PX input 4	Status of the Boolean inputs from the expansion cards – See the Expansion Card Mapping table below
(15) Network Boolean Inputs	Running Phase Rotation Phase Detection Starting Stopping Alarm Fault At Speed Start Bypass Ready	These Boolean inputs correspond to the statuses listed in Table 102 - Logic Status on page 210
	Network Bit 1 Network Bit 2 Network Bit 3 Network Bit 4	These Boolean inputs correspond to the statuses listed in Table 103 - Logic Command Word (Control) on page 211

The function of the expansion port inputs depends on the card installed in the given port. The following table shows how the bit inputs are mapped for each card type:

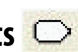
Bit Input	Digital I/O (150-SM4)	Analog I/O (150-SM3)	PTC / Grd Fault (150-SM2)	Parameter Config (150-SM6)
PX Input 1	Input #1	DAC #1 Open Status	PTC Status	None (always 0)
PX Input 2	Input #2	DAC #1 Shorted Status	CT Loss Status	None (always 0)
PX Input 3	Input #3	DAC #2 Open Status	None (always 0)	None (always 0)
PX Input 4	Input #4	DAC #1 Shorted Status	None (always 0)	None (always 0)

Bit Outputs 

Bit Outputs are used to connect to real-world output devices (pilot lights, relays, etc.) that are wired to an Auxiliary Relay in the SMC-50. Available bit outputs from the DeviceLogix program include:

Bit Outputs	Name	Description
(11) Hardware Boolean Outputs	Aux 1, Aux2	Auxiliary Relays available on the control board. ❶
	PX Aux1 – PX Aux3	Auxiliary Relays #1 - #3 available on the Digital I/O (150-SM4) Expansion Card❶
(7) Network Boolean Outputs	Coast Start Stop CLR Fault Slow Speed Emergency Run Motor Heater	These outputs can be used to control the SMC-50 in the same way a PLC can control the SMC-50. See Table 103 - Logic Command Word (Control) on page 211 for a definition of these control bits.

❶The Auxiliary Relays must be programmed to “Device Logix” to allow the DeviceLogix program to control each specific relay. For example, if you want to control Aux 1 on the control module you must configure “Aux1 Config” (parameter #172) to “Device Logix”. Similarly, to control Aux 1 in a Digital I/O (150-SM4) expansion card you must configure “Aux 1 Config” (parameter #6 in the expansion card) to “Device Logix”.

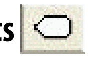
Analog Inputs 

Available analog inputs to the DeviceLogix program are all 32-bit integers and include the following data points:

Analog Inputs	Name	Description
(22) Network Analog Inputs	Volt PP Ave	Average Phase to Phase Voltage (Param #1 - Volts)
	I Ave	Average Current (Param #5 – Amps)
	Torque	Average Torque (Param #9 - %)
	Real Power	Total Real Power (Param #10 – Kwatts)
	Power Factor	Average Power Factor (Param #17 – in hundredths)
	Volt PN Ave	Average Phase to Neutral Voltage (Param #265 – Volts)
	Reactive Power	Total Reactive Power (Param #277 – Kwatts)
	Apparent Power	Total Apparent Power (Param #286 – Kwatts)
	DLX In 1, DLX In 2	DLX General Purpose Input parameters (Param #335, #336)
	DLX DL1 – DLX DL6	DLX Datalink Input Parameters (Param #337-342)
	PX In 1 – PX In 2	Analog inputs from the expansion cards – See the Expansion Card Mapping table below

The function of the expansion port inputs depends on the card installed in the given port. The following table shows how the analog inputs are mapped for each card type:

Bit Input	Digital I/O (150-SM4)	Analog I/O (150-SM3)	PTC / Grd Fault (150-SM2)	Parameter Config (150-SM6)
PX In 1	None (always 0)	Analog In #1 (Param X.6)	Ground Current (Param #11)	None (always 0)
PX In 2	None (always 0)	Analog In #2 (Param X.16)	None (always 0)	None (always 0)

Analog Outputs 

Available analog outputs from the DeviceLogix program are all 32-bit integers and include the following data points:

Analog Outputs	Name	Description
(2) Network Analog Outputs	A Out 1 – A Out 2	General Purpose Output parameters (Param #343, #344)

Tips

Data types

The SMC-50 DeviceLogix implementation supports 32-bit integers only.

DeviceLogix scratchpad registers

The SMC-50 provides 2 input (parameter #335, #336) and 2 output (parameter #343, #344) scratchpad registers. The input parameters can be written by any configuration or network device and used as an input to DeviceLogix. The output parameters can be written by DeviceLogix and displayed on configuration devices or read using network devices.

SMC-50 DeviceLogix Input Datalinks (P337…P342)

The SMC-50 provides parameters directly to DeviceLogix as analog inputs. Additional parameters from the host and expansion cards can be made available through the DeviceLogix Datalink inputs. The value of the parameter linked to by the datalink will be made available to DeviceLogix. For example, configuring a datalink to "Mtr Therm Usage" (parameter #18) would make the motor thermal usage value available to DeviceLogix.

Program Examples

Example 1: Selector Switch Operation

This example demonstrates how a selector switch could be used to select 1 or 4 parameters to write to one of the scratchpad output parameters.

The truth table below represents the inputs and outputs for a 4 position selector switch.

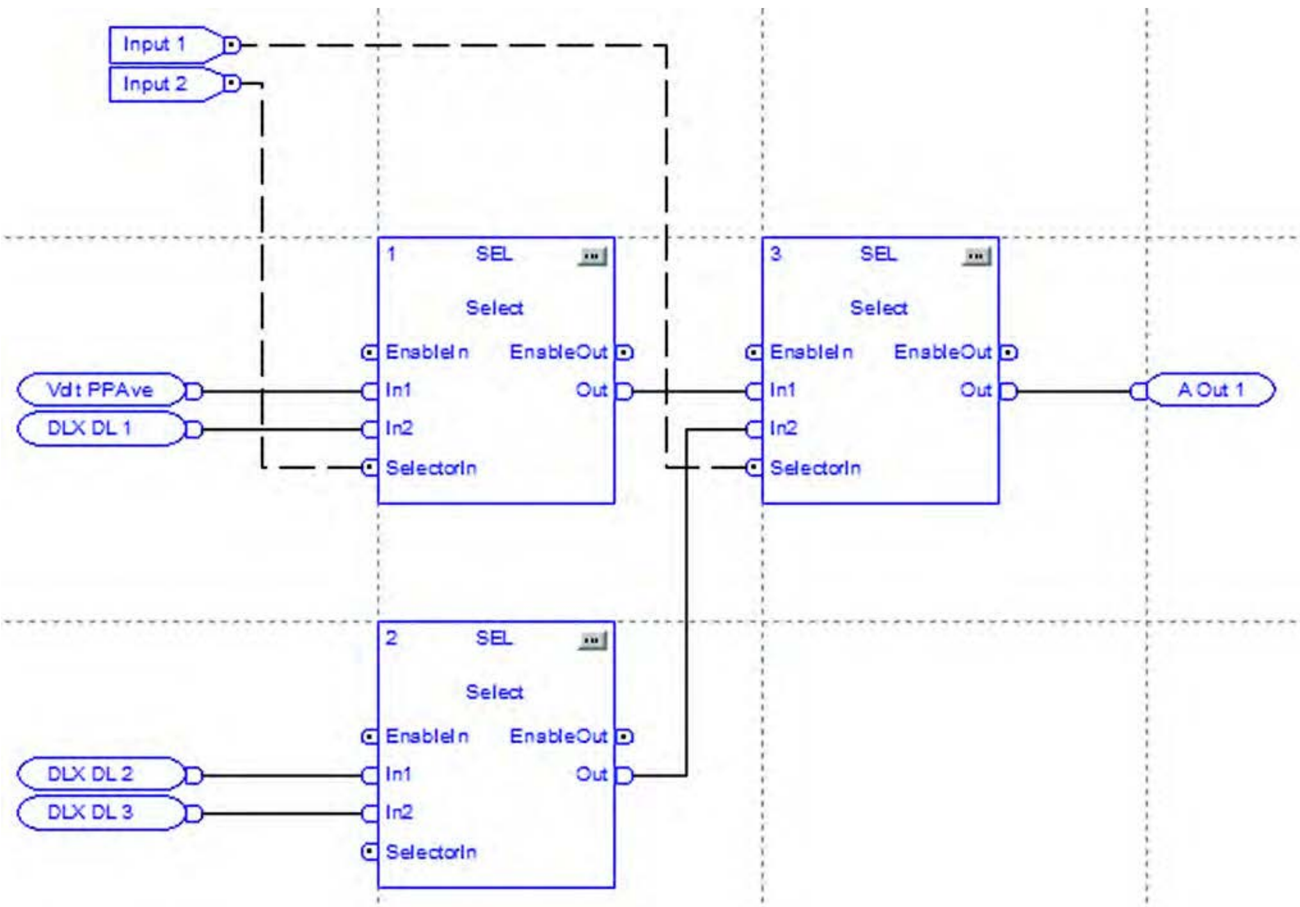
Inputs		Outputs	
Input 1	Input 2	Output Selection	Selector Switch Output
0	0	0	Volt PP Ave
0	1	1	Volt Phase A-B
1	0	2	Volt Phase B-C
1	1	3	Volt Phase C-A

Parameter Configuration

Since the individual phase voltage parameters are not directly available in DeviceLogix (only the average voltage – Volt PP Ave is) we will use three of the DeviceLogix Datalink parameters to make those values available to DeviceLogix as follows:

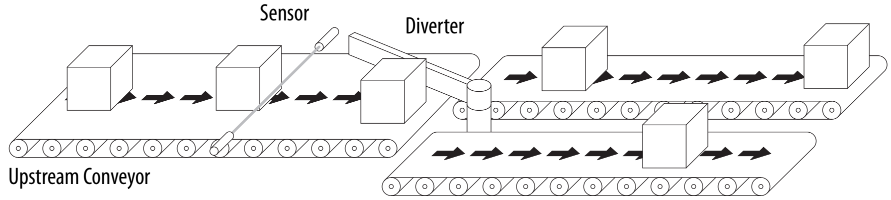
Parameter No.	Parameter	Value	Description
337	DLX DL Input 1	Port 0: Volts Phase A-B	Value for Selection 01
338	DLX DL Input 2	Port 0: Volts Phase B-C	Value for selection 10
339	DLX DL Input 3	Port 0: Volts Phase C-A	Value for selection 11

Figure 99 - Function Block Programming



Example 2: Diverter Operation

This example demonstrates basic control logic to operate a diverter in a conveyor system using a in Digital I/O (150-SM4) option module card installed in Port #8. The diverter directs parts from an upstream conveyor to one of two downstream conveyors. The parameter “DLX Input 1” (parameter # 335) defines the total number of boxes diverted to conveyer “A” (when the diverter control signal is off). The parameter “DLX Input 2” (parameter # 336) defines the total number of boxes diverted to conveyer “B” (when the diverter control signal is on).



The application consists of the following discrete I/O:

Type	Name	Description
Inputs	Part Present Sensor	Identifies that a part is present – Connected to Input #1 on an Digital I/O (150-SM4) card installed in Port #8
Outputs	Diverter Actuator	Controls the diverter actuator to direct the flow of parts – Connected to Aux #1 on an Digital I/O (150-SM4) card installed in Port #8

Example logic requirements:

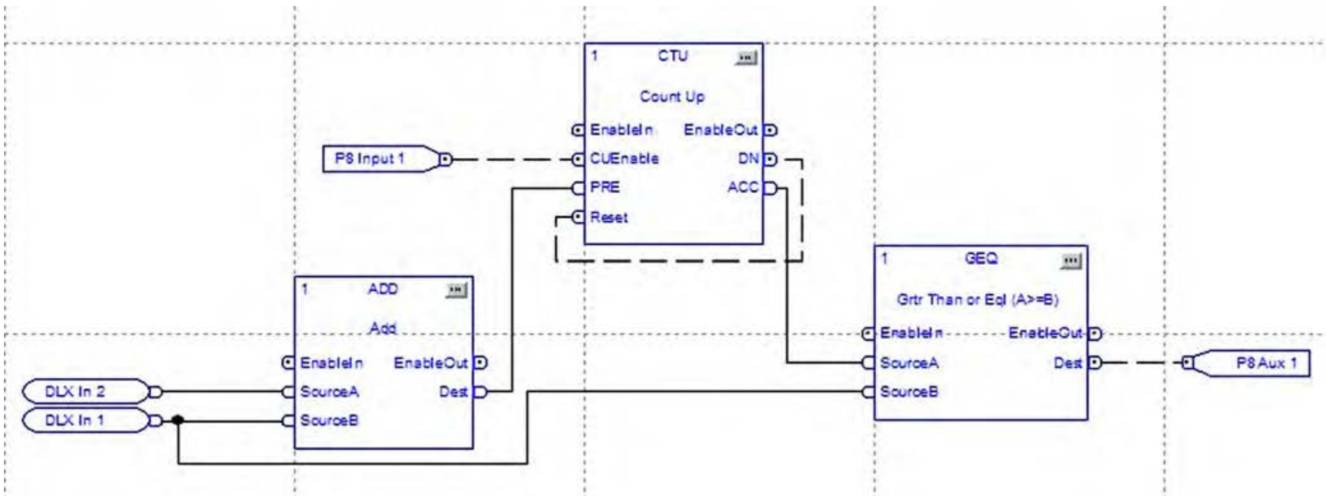
- When Part Present Sensor transitions to ON increment the parts counter
- If parts counter is greater than or equal to “DLX Input 1” then set the diverter actuator
- When the counter reaches “DLX Input 1” + “DLX Input 2” reset the counter.

Parameter Configuration

The following parameters are configured for this example:

Port Parameter No.	Parameter	Value	Description
335	DLX Input 1	5	Send 5 boxes down conveyer “A”
336	DLX Input 2	5	Send 5 boxes down conveyer “B”
8.6 Port #8 Parameter #6	Aux 1 Config	Device Logix	Auxiliary #1 is used to control the Diverter. In order for Device Logix to control the Auxiliary it must be configured to “Device Logix”.

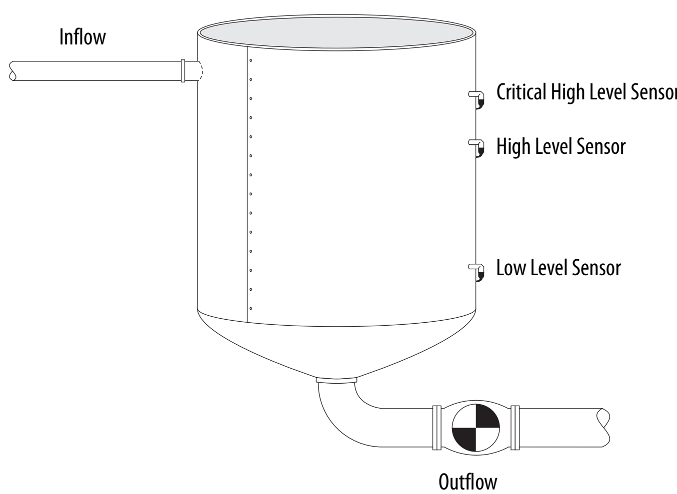
Figure 100 - Function Block Programming



Example 3: Wet Well Operation

This example demonstrates how basic control logic can be used for motor control. It is assumed that a Digital I/O (150-SM4) option module is installed in Port #8.

Figure 101 - Wet Well



The application consists of the following discrete I/O:

Type	Location of I/O	Name	Description
Inputs	Port #8 Input #2	Critical High Level sensor	Indicates a critically high level. It is normally a backup to the High Level sensor and is also used to detect if the High Level sensor is faulty.
	Port #8 Input #3	High Level sensor	Indicates the well is at a high level and it is time to start pumping using the SMC-50.
	Port #8 Input #4	Low Level sensor	When OFF, it is used to indicate that the well is empty (as long as the High and Critical High Level sensors are also OFF). The SMC-50 stops operating (end of pumping cycle).
Outputs	Port #8 Aux #1	Sensor Failure pilot light	Indicates that there is a problem with either the High Level or Low Level sensors
	Port #8 Aux #2	Critical Level Pilot light	Indicates that the Critical Level Sensor is active.
	No External Wiring	Start	Start signal to the SMC-50.
	No External Wiring	Stop	Stop signal to the SMC-50.

Example logic requirements:

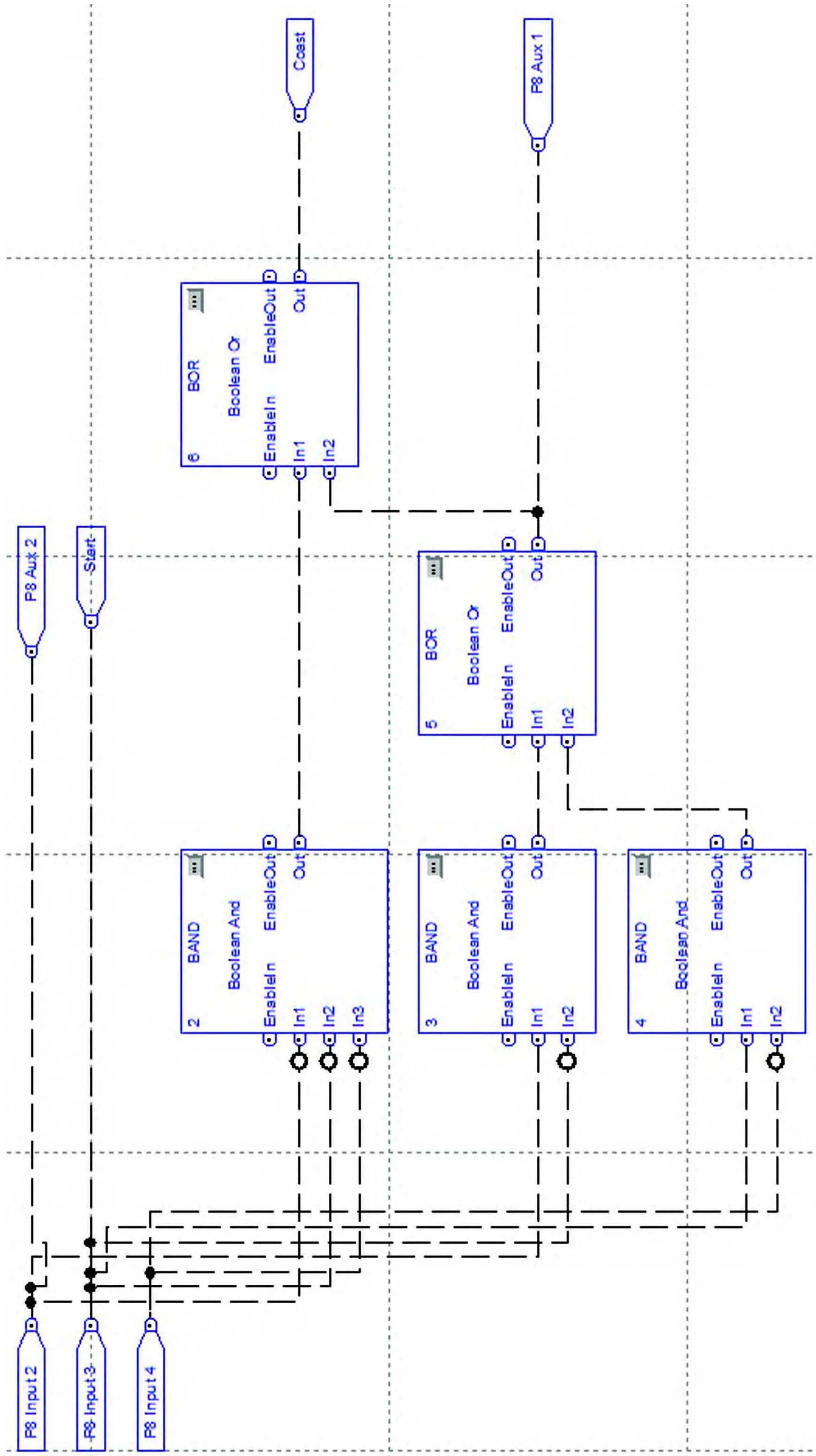
- Start the motor when the High Level Sensor is ON.
- Stop the motor when all the level sensors are OFF.
- Annunciate a Sensor Fault condition and Stop the SMC-50 when any of these conditions exist:
  - The Low Level sensor is OFF when either the High Level or Critical High Level sensors are ON
  - The High Level sensor is OFF when the Critical High Level sensor is ON
- Activate the Critical High Level Pilot when the Critical High Level sensor is active.
- Reset alarms / faults with a Reset push button input

Parameter Configuration

The following parameters are configured for this example.

Port Parameter No.	Parameter	Value	Description
0.148.14 Host Parameter #148 Bit #14	"Logic Mask"	Set bit #14	Allow DeviceLogix to control the motor.
8.6 Port #8 Parameter #6	"Aux 1 Config"	"Device Logix"	Auxiliary #1 is used to control the Sensor Failure pilot light. In order for DeviceLogix to control the Auxiliary it must be configured to "Device Logix".
8.10 Port #8 Parameter #10	"Aux 2 Config"	"Device Logix"	Auxiliary #2 is used to control the Critical Level pilot light. In order for DeviceLogix to control the Auxiliary it must be configured to "Device Logix".

Figure 102 - Function Block Programming



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In addition, we offer multiple support programs for installation, configuration, and troubleshooting. For more information, contact your local distributor or Rockwell Automation representative, or visit http://www.rockwellautomation.com/services/online-phone.

Installation Assistance

If you experience a problem within the first 24 hours of installation, review the information that is contained in this manual. You can contact Customer Support for initial help in getting your product up and running.

United States or Canada	1.440.646.3434
Outside United States or Canada	Use the Worldwide Locator at http://www.rockwellautomation.com/rockwellautomation/support/overview.page, or contact your local Rockwell Automation representative.

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Rockwell Automation tests all of its products to help ensure that they are fully operational when shipped from the manufacturing facility. However, if your product is not functioning and needs to be returned, follow these procedures.

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Outside United States	Please contact your local Rockwell Automation representative for the return procedure.

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